

# Administration of Apprenticeship Agreements & Schedule of Training Hours & Courses

6100 Neil Road Reno, Nevada 89511

**2026 REVISED DRAFT –  
NOT YET APPROVED**

*Sierra Pacific Power Company  
(d/b/a NV Energy)*

## ***Foreword***

The material contained in these standards has been developed jointly by representatives of Sierra Pacific Power Company d/b/a NV Energy ("Company") and the International Brotherhood of Electrical Workers Local 1245 ("Union") in accordance with contractual provisions of a Collective Bargaining Agreement (CBA-1245) between the two parties.

The following outline of training programs, courses, and study requirements, shall constitute an obligation on the part of the Company to provide on-the-job training, study courses as outlined and to keep records thereof for all employees assigned to the classification of apprenticeship and shall constitute an obligation on the part of the employees so assigned to participate in the training program and in the keeping of records of progress as herein outlined.

It is not the intent of either party to set standards that conflict with any State or Federal law or regulation. Should any such conflict arise, the law will supersede these standards.

The Joint Apprenticeship Training Committee (JATC-1245) has dedicated its time to develop an efficient program of apprenticeship to ensure that the apprentice of today, through a systematic program of on-the-job training and related classroom instruction, become a qualified well-rounded journeyman employee of tomorrow.

All actions taken by the JATC-1245 shall be in the best interest of the apprentice, management, labor, and the public.

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## SECTION I: DEFINITIONS

1. Apprentice:  
A person who has entered into a written Apprenticeship Agreement providing for employment and training under the terms and conditions of these Standards.
2. Apprenticeship Agreement:  
This term, which is synonymous with the word “indenture” as sometimes used, means the written document between the apprentice and the Joint Apprenticeship Training Committee (JATC-1245) stating the responsibilities and obligations of the parties in connection with the apprentice’s employment and training under these standards.
3. Collective Bargaining Agreement:  
Refers to the agreement entered into by the Company and International Brotherhood of Electrical Workers (IBEW) Local 1245 that provides for employer-sponsored training. May be referred to as “CBA” or “CBA-1245.”
4. Company:  
For the purposes of this agreement, it means Sierra Pacific Power Company d/b/a NV Energy. Note this agreement is for the entity bound by the Collective Bargaining Agreement between IBEW Local 1245 and NV Energy (Northern Nevada service territory). May also be referred to as the “Employer.”
5. Joint Apprenticeship Training Committee (JATC-1245):  
The Committee responsible for operating the programs described in these standards; hereinafter referred to as the “Apprenticeship Committee,” “Committee,” “JATC,” or “JATC-1245.” Only one Committee will have jurisdiction over each apprentice.
6. Journeyman:  
A qualified craft worker in the skilled trade classification covered in these Standards.
7. Project Administrator:  
The Company shall appoint a Project Administrator to oversee the Joint Apprenticeship Training Committee. May also be referred to as the “Committee Chairperson” or “Chairperson.” The Project Administrator shall serve as the JATC-1245 Chairperson.
8. Registration Agency:  
Shall mean the Nevada State Apprenticeship Council (NSAC).
9. Standards:  
Shall mean this entire document, including supplementary agreements and attachments.
10. Supplementary Training:  
This includes, but is not limited to, home study and classroom training.

11. Union:

For the purposes of this agreement, it means International Brotherhood of Electrical Workers (IBEW) Local Union 1245. May also be referred to as the "IBEW Local 1245," "IBEW 1245," "Local 1245" or "Union."

*Savings Clause: As used in this agreement, pronouns imparting the masculine gender shall be considered applicable to both sexes.*

## **SECTION II: APPRENTICESHIP COMMITTEE (JATC-1245)**

### ***Scope and Authority***

- A. The Union and Company shall establish a Committee, known as the Joint Apprenticeship Training Committee (JATC-1245), to select, review, and address apprenticeship matters including the administration of apprenticeship training and concerns.
- B. At a minimum, the Committee shall be comprised of four (4) members appointed by the Company and four (4) members appointed by the Union. Each apprenticeship discipline shall have two (2) voting members, comprised of one Company appointed representative and one Union appointed representative. The Committee may include, but not be limited to, a non-voting Human Resources Representatives, a Chairman, and the Union Business Representative, and a Secretary, etc. A Company appointee shall be the Committee Chairman and the secretary will be selected by the Union Representatives from the voting or non-voting Committee members. The Committee members shall serve from the date of their appointment until their successors are duly selected. The Human Resources Representative, Union Representative and Chairman will review appointments every two (2) years and will make adjustments to appointments as needed.
- C. All Committee members will have an equal vote. In the event of a tie vote situation, the IBEW Business Representative and Chairperson shall meet and confer. Following the meeting, the Committee Chairperson, who is normally a non-voting member, will have the tie-breaking vote.
- D. The Committee members shall serve from the date of their appointment until their successors are duly selected.
- E. The JATC-1245 shall have the responsibility of selecting apprentices, developing new apprenticeship programs, overseeing and amending existing apprenticeship programs, and investigating problems related to such areas as entrance requirements, standards of progress, methods of testing and scoring, apprenticeship working conditions, and procedures for removal or freezing when apprentices fail to meet established requirements.
- F. In case of failure on the part of any apprentice to fulfill the obligations of the apprenticeship, the Committee shall have the authority to extend or revoke his/her Apprenticeship Agreement. If an Apprenticeship Agreement is revoked, the Committee will follow the guidelines established by the Nevada State Apprenticeship Council (NSAC) or as otherwise required by statute.
- G. The apprentice agrees to abide by decisions made by the JATC-1245, but retains the right of appeal to the Nevada State Apprenticeship Council (NSAC) as outlined in statute.
- H. The JATC-1245 is authorized to extend the term of apprenticeship no more than six (6) months (cumulatively) over the scheduled term of the apprenticeship.

## ***Procedures***

- A. Committee meetings shall be held once a month or as designated by the Committee Chairperson. The Chairperson will be responsible for an agenda of and presiding over scheduled meetings. The Secretary shall record the minutes of each meeting and distribute them to JATC-1245 members. The Chairperson, or their designee, shall be responsible for apprentice files, the registration of apprenticeship agreements, and all other records and reports of the Committee.
- B. A quorum shall consist of at least five (5) of the appointed voting members, at least two (2) members appointed by the Company and two (2) members appointed by the Union.
  - o A majority of those members constituting the quorum must vote in favor of any affirmative action of the Committee, unless otherwise required by applicable law.
- C. In the event of an extended absence of an appointed JATC member, and with JATC approval, a temporary JATC member may be appointed by the Company and/or the Union for the purpose of achieving a quorum.

## ***Duties***

- A. To conduct surveys and studies to determine industry training needs and skill requirements and to develop other data essential to establishing adequate and effective plans and programs of training.
- B. To periodically review these standards and keep them consistent with industry, national and state standards.
- C. To indenture, under a written agreement, all apprentices accepted for training under the provisions of these standards.
- D. To determine the kind and amount of on-the-job training and experience to be required of apprentices and to arrange for such experience and training.
- E. To determine the kind and amount of supplemental instruction to be required of apprentices and to arrange for such instruction to be provided.
- F. To ensure adequate and safe equipment and facilities, as well as provisions for training in safety and related instruction.
- G. To ensure each apprentice learns from qualified training personnel and has adequate supervision to perform tasks.
- H. To establish a system of records, reports, and examinations that will provide means of determining the progress and conduct of each apprentice in both the on-the-job training and related instruction requirements throughout their apprenticeship.
- I. To determine when apprentices have satisfactorily met all requirements of their apprenticeship, to recommend their acceptance as Journeymen, and to obtain and award an appropriate "Certificate of Completion of Apprenticeship."
- J. To register all apprenticeship agreements with the Registration Agency and notify the Registration Agency of all cancellations and completions of apprenticeship in compliance with statute.
- K. To uniformly apply regulations concerning apprentices, including those which govern equality of wages, periodic advancement, promotion, assignment of work, the performance of a job, rotation among all of the different types of work involved in the trade, imposition of penalties or other disciplinary action, and all other administrative aspects of the program of apprenticeship without discrimination because of race, color,

religion or belief, sex, sexual orientation, gender identify or expression, age, marital status, covered veteran status, physical or mental disability, national origin, or ancestry.

### **SECTION III: DEFINITION OF APPRENTICESHIP**

Under this agreement, an apprentice is defined as a person who meets the “Qualification for Apprentices” as set forth in Section IV, and who:

- A. As their principal occupation, is engaged in learning and assisting in the particular craft.
- B. Has entered into a written apprenticeship agreement with the Company which subscribes to the craft standards contained in the individual apprenticeship program agreement. The apprentice is required to participate in an approved program of training in manual skills and related general and technical subjects as prescribed by the minimum requirements of the apprenticeship agreement.

### **SECTION IV: QUALIFICATION OF APPRENTICES**

- A. Must be at least 18 years of age.
- B. Must have a high school diploma or equivalency (HSE).
- C. Must have a valid driver’s license at the time of selection.
- D. Must be physically able to perform all work of the trade with or without reasonable accommodation.
- E. Apprentices shall be recruited and selected in accordance with the current CBA-1245 provisions and applicable Letter(s) of Agreement.
  - In order to be awarded an apprenticeship, an internal applicant must successfully complete education and/or training requirements as determined by the JATC-1245. (see *Attachment #1*)
  - Any person from outside the Company who is being considered to fill an apprenticeship vacancy will have to meet the same pre-qualification standards as an internal applicant.
- F. A Journeyman, regardless of his/her present classification, will not be permitted to bid back into an apprenticeship they have successfully completed.
- G. If an employee’s apprenticeship is terminated by the Committee or the apprentice voluntarily quits an apprenticeship, the employee must wait one (1) year before he/she will be considered for placement in any apprenticeship program. Any such application will be subject to review and approval by the JATC-1245.
- H. The recruitment, employment, and training of apprentices shall be without discrimination because of race, color, age, marital status, covered veteran status, religion or belief, national origin, ancestry, physical or mental disability, sex, sexual orientation, gender identity or expression, or any other basis made unlawful by any applicable law, ordinance, or regulation. The Company will take affirmative action to provide equal opportunity in apprenticeships and will operate the apprenticeship program as required under Title 29 of the Code of Federal Regulations, Part 30, and the most current Nevada EEO plan.

## **SECTION V: RESPONSIBILITIES OF APPRENTICES**

The Joint Apprenticeship Training Committee (JATC-1245) impresses upon all apprentices that in signing the Apprentice Agreement they have voluntarily agreed to abide by the provisions of these standards. Each apprentice is informed of the following responsibilities and obligations under the apprenticeship system:

- A. To respect the property of the Company and abide by the working rules and regulations of the employer and the Registration Agency.
- B. To attend and satisfactorily complete the required supplementary training.
- C. To develop safe working habits and conduct themselves in their work in such a manner as to assure their own safety as well as that of their fellow workers.
- D. Under normal circumstances, the apprentice will be expected to complete the apprenticeship program in the prescribed manner. If an apprentice decides he does not want to complete the apprenticeship, the Company may reassign the employee in accordance with the CBA-1245.
- E. Upon satisfactory completion of the requirements of the apprenticeship program, the apprentice will be reclassified to Journeyman in accordance with the CBA-1245.

## **SECTION VI: TERMS OF APPRENTICESHIP**

- A. The Company's apprenticeship programs will be operated in accordance with the rules and regulations set forth by the Nevada State Apprentices Council and applicable statute.
- B. The Company shall provide adequate and safe equipment and facilities for the training of apprentices in accordance with departmental and Company safe work practices and the CBA-1245.
- C. All apprentices shall be paid progressively increasing, reasonable schedule of wages in accordance with the CBA-1245, federal, and state laws.
- D. The workday, workweek, and working conditions shall be the same for the apprentices as the Journeymen, with the exception of overtime.
- E. The term of apprenticeship shall be specified in the Apprentice Agreement-Approved Programs Schedule of Training Hours and Courses appendix. The length of the term shall depend on the craft involved. These hours are based on a forty-hour (40) workweek.
- F. The term of the apprenticeship shall be divided into six (6) month training periods and any time lost during a period, as determined by the JATC-1245, must be made up before an apprentice may advance to the next period or to the Journeymen classification. If an apprentice should suffer an injury resulting in short term disability or time that the apprentice is unable to physically perform the duties required in his/her apprenticeship, or if the apprentice otherwise becomes eligible for, requests, and is granted an approved Leave of Absence (such as leave under the Family and Medical Leave Act or FMLA), the lost time will be considered a temporary medical suspension ("medical freeze"). If the apprentice is subject to physical restrictions prescribed by a physician which deem the apprentice unable to physically perform the duties required in his/her apprenticeship, the apprentice may not participate in any physical work/training or classroom instruction while the restrictions are in place. If restrictions are such that an apprentice is deemed capable to perform "light duty" tasks and the Employer is able to accommodate such light duty work, the apprentice may participate in classroom



instruction. The apprentice will be given a medical freeze until such time that the employee is able to resume his/her duties. The exact duration of any freeze will be subject to the discretion and approval of the JATC-1245, and the apprentice will be required to keep the JATC-1245 informed of his/her status and to appear before the Committee upon request. A medical freeze is not subject to the provisions of Section II H of this agreement.

- G. The Committee will obtain from the Registration Agency and issue to the apprentice all applicable Certificates of Completion.
- H. With the approval of the JATC-1245, an apprentice who does not show reasonable and normal performance in on-the-job training or related supplemental training may be granted additional time. This time will be counted as extra time over and above the standard time requirements of the agreement and is subject to Section II F. of this agreement.
- I. Any apprentice found to have stolen, cheated, gained access to testing answers, testing questions, or testing reference materials may be immediately removed from the program and will not be allowed to re-enter the same program.
- J. All apprentices are expected to follow the Company's values and ethics. Each apprentice will be supplied with a copy of the Company's code of ethics. Failure to abide by these may be grounds for immediate removal from the program without the ability to re-enter any apprenticeship program in accordance with the CBA-1245.
- K. The JATC-1245 is authorized, with the approval of the Company, to extend the term of apprenticeship no more than six (6) months (cumulatively) over the scheduled term of the apprenticeship when the apprentice fails to successfully complete the requirement for the current six (6) month period or to attain Journeyman status.

## **SECTION VII: APPRENTICESHIP TRAINING STANDARDS**

- A. A "Schedule of Training Hours and Courses" will be developed for each apprenticeship program. This Standard will indicate the training time for each phase of training or work process.
- B. The training time indicated will be indicative, not restrictive, of the emphasis or amount of time that should be spent on each phase. It must be emphasized that the total time spent on any work phase during any one-progression period may vary with the individual, workload, and amount of related instruction. The assignment of work phases to progression periods may be varied, but the minimum assignments should be met during the term of the apprenticeship.
- C. Each apprenticeship training standard shall contain the following information:
  - 1. The trade or craft involved;
  - 2. The processes in the trade or craft in which the apprentice shall be given work experience and the approximate amount of hours to be spent on each process;
  - 3. The number of hours to be spent in related or supplementary instruction which will total at least 144 hours per year;
    - If instruction is given during normal working hours, the apprentice will be paid pursuant to the contract rate.
    - If instruction, home study work or exams take place outside of regular working hours, the apprentice will not be paid.
  - 4. Minimum standards for progression.

Each new apprentice will receive a copy of and acknowledge reading and receipt of the “Administration of Apprenticeship Supplementary Agreement and Schedule of Training Hours and Courses”.

- D. The Company will register the “Administration of Apprenticeship Programs Supplementary Agreement” and the “Schedule of Training Hours and Courses” for each trade, with the Registration Agency. Modifications, amendments, and revisions will also be submitted to the Registration Agency for approval. This is done after obtaining approval from the Committee, Company, and the Union. Cancellation and de-registration of programs are subject to the provisions of NRS/NAC Chapter 610.

## **SECTION VIII: RATIO OF APPRENTICES TO JOURNEYMAN**

Whenever more Journeymen are employed, additional apprentices may be employed. The ratio of apprentice to Journeymen will not exceed one (1) apprentice to one (1) Journeyman.

## **SECTION IX: APPRENTICE PREVIOUS EXPERIENCE**

- A. Applicants who have been employed in a related trade or craft as an apprentice or have completed previous training programs in a related field may be granted advanced standing not to exceed one (1) six (6) month training period upon the recommendation of their Supervisor and approval of the JATC-1245. The department sponsoring the advancement shall furnish evidence of proficiency to the JATC-1245.
- B. Returning Reservists and National Guard members have thirty (30) days to submit documentation of related training or classroom training they received while on active duty. The JATC-1245 may, at its sole discretion, extend this period of time if the reason for the delay is due to difficulty acquiring the necessary documentation from the Department of Defense.
- Upon evaluation, the JATC-1245 may grant all or part of the request for additional credit.
- C. An applicant approved for an advanced standing shall be paid the appropriate wage of the training period to which they are advanced. If the advanced standing is granted, it will be for wages only. The time limits outlined in the Apprenticeship Agreement will be adhered to, and the completion date (“top out date”) for the apprentice will remain the same.
- D. The term of the apprenticeship shall not be less than 2,000 hours of work experience, or otherwise required by statute.

## **SECTION X: APPRENTICE PROBATIONARY PERIOD**

- A. The first six (6) months of the term of the apprenticeship shall be a probationary period. Either party without stated cause can cancel Apprenticeship Agreements during the probationary period without the formality of a hearing.
- B. After the probationary period (first six (6) months), the Apprenticeship Agreement may be cancelled at the request of the apprentice, or suspended or terminated by the JATC-1245 with a formal hearing.
- C. If an apprentice or the JATC-1245, determines the apprentice does not want to complete the apprenticeship, the Company is not required to reassign the employee unless it is in accordance with the CBA-1245.

- D. The Company shall notify the Registration Agency of all apprentice terminations including temporary layoff caused by reduction in workload or other unforeseen conditions.
- E. Individuals whose apprenticeship has been terminated by the JATC-1245 will be given written notice of their rights of appeal in accordance with statute.

## **SECTION XI: ADJUSTMENT OF DIFFERENCES**

- A. The Company and the apprentice shall have the right and privilege of appeal to the JATC-1245 in the event of dispute or controversy arising over interpretations of the provisions of this document. The JATC-1245 shall hear all affected parties and make such adjustments as it considers necessary. Persons wishing the JATC-1245 to hear such matters should make a request in writing to the JATC-1245 Chairperson five (5) business days prior to the regular scheduled JATC-1245 meeting, to have the request placed on the regular meeting agenda.
- B. Either of the parties may appeal the decision of the JATC-1245. Appeals will be directed to the Nevada State Apprenticeship Council (NSAC) in accordance with the guidelines and timeframes outlined in the Nevada Revised Statutes.

## **SECTION XII: APPRENTICE DISCIPLINARY ACTION**

- A. The JATC-1245 retains authority to discipline an apprentice who fails to comply with the Apprenticeship Agreement or rules and instructions of the JATC-1245.
- B. The JATC-1245 shall notify the apprentice to appear before the Committee for a hearing before such disciplinary action shall be invoked. Additional parties with firsthand knowledge of the issue to be heard may also be notified and requested to attend by the JATC-1245. Should the apprentice fail to appear before the Committee, disciplinary action may be invoked without a hearing.
- C. An apprentice who does not show acceptable performance in on-the-job training or related supplementary training may be granted additional time to show improved performance in accordance with Section II H. of this agreement. This extension ("freeze") time will be added to the standard apprenticeship time requirements and shall extend the term of his apprenticeship by that of the freeze.
- D. Failure to meet class attendance obligations is cause for disciplinary action by the Company and JATC-1245. Therefore, if apprentices are unable to attend training sessions due to illness or other just cause, they shall be expected to obtain an official excuse from the appropriate individual prior to class and will be responsible to arrange a time for a make-up class. Apprentices should not accept overtime work which could jeopardize their scheduled classes.
- E. Any apprentice found to have cheated in any manner may be immediately removed from the program and will not be allowed to re-enter the same program.
- F. Some of the reasons considered as just cause for disciplinary action include, but are not limited to, the following:
  - 1. Failure to meet related class attendance and progress requirements;
  - 2. Lack of interest, application to, or satisfactory progress in the work and/or on-the-job training;
  - 3. Failure to properly prepare and submit required reports;
  - 4. Undesirable conduct;
  - 5. Failure to demonstrate safe work habits; or
  - 6. Lack of respect for Company property.

### **SECTION XIII: APPRENTICE PROGRESS EVALUATION & REPORTING**

- A. The Company will establish a system of individual records, reports and examinations that will provide a means of recording the progress and conduct of each apprentice in both on-the-job training and supplementary training.
- B. Record of Training Hours:
  - 1. Each apprentice will complete a monthly record of training hours. The hours worked will be recorded and a new card, indicating the cumulative hours worked in each type of work, will be issued for each new month. This card will become part of the apprentice's permanent record.
  - 2. The training hour card will be filled out daily and turned in monthly.
  - 3. Apprentices will fill out their training hour cards as follows:
    - a. Each day enter hours worked in each category.
    - b. Obtain Foremen's/Journeyman approval for each day worked.
    - c. At the end of each month, give completed card to the Journeyman /Foreman and Supervisor who will add their own comments on the card.
  - 4. Foreman and/or Journeyman will fill out the apprentice's training hour card as follows:
    - a. Review and initial a card for each apprentice that worked on the crew each day.
    - b. At the end of the month, fill out the Foreman's remarks section; make any necessary comments about the apprentice's work performance.
  - 5. Supervisors will fill out the apprentice's training hour card as follows:
    - a. At the end of each month, review the training hour card with the Foreman/Journeyman.
    - b. Fill out the Supervisor's remarks section with a supervisory evaluation of the apprentice's progress.
    - c. Review the completed card with the apprentice.
    - d. Have the apprentice sign and make any comments on the completed card.
    - e. All training cards should be turned into the JATC-1245 by the Supervisor or designee and retained by the Company in accordance with records management standards.
    - f. Monthly evaluation cards will not be accepted without all signatures.

### **SECTION XIV: PROGRESSION & TESTING**

- A. To progress through the apprenticeship program, the apprentice will be required to pass tests for each step of the program. These tests may consist of written questions, electronic, or actual performance of specific work processes, or a combination of all, under test conditions. All progression tests and the manner in which they are scored will be evaluated and agreed to by the JATC-1245.
- B. Progression tests will be closed book, unless otherwise deemed necessary to be open book.
- C. A grade of 75% or above will be considered a passing grade on any test or performance of specific work processes.

- D. An apprentice who fails two (2) tests within the same six (6) month period will have his/her performance referred to the JATC-1245 to determine whether the apprentice should be disqualified from the program.
- E. In the event an apprentice has not passed the required tests for the current six (6) month training period, additional training time may be granted by the JATC-1245, in accordance with Section II F. of this agreement.  
During this period, the apprentice will not be permitted to do the work or receive the pay of the next higher wage step of his apprenticeship. Upon completion of this additional training period, the apprentice will be given another opportunity to pass the required test(s). An apprentice who fails a test cannot re-take the test before 30 calendar days from the date of their previous test unless approved by the JATC-1245 or at the request of the apprentice.
- F. To progress through the apprenticeship, the apprentice must show satisfactory performance in both on-the-job training and the supplementary training.
- G. The apprentice will be expected to exhibit knowledge of, and to perform in an efficient manner in all areas in which the apprentice has been trained.

#### **Final Exam ("Top Out Test")**

- A. All apprentices are required to take and pass a final exam ("top out test") by the end of the last month of which they are indentured.
- B. This exam will consist of multiple tests including written and demonstrated work processes.
- C. The tests will be administered and graded by the Trainer, Supervisor or designee, or a panel of Journeyman from the trade.
- D. An apprentice is required to achieve a minimum score of 75% on all final exams to pass.
- E. A failing grade on any portion of the final exam will require the apprentice to be placed in a three (3) month hold ("freeze") in which he can re-take the final exam. The apprentice will be provided this extension as long as the apprentice has not reached the maximum amount of extensions allowed by the JATC-1245 per Section II F. of this agreement.
- F. A failing grade on the re-test will result in the apprentice being removed from the apprenticeship program.

### **SECTION XV: SUPPLEMENTAL TRAINING & RELATED INSTRUCTION**

- A. All apprentices shall receive instruction and experience in areas of the craft in order to develop a practical, all-around journeyman level of skill and proficiency.
- B. Related classroom instruction, as agreed to by the JATC-1245, may be given to the apprentice during regular working hours or after working hours on the apprentice's own time.
- C. Each apprentice shall pursue related supplemental studies for at least 144 hours per year. This training shall be approved by the JATC-1245 and may be on the apprentice's own time and without pay from the Company.
- D. If instruction is given during normal working hours, the apprentice will be paid pursuant to the contract rate. If instruction or home study work or exams take place outside of regular working hours, the apprentice will not be paid.

## **SECTION XVI: ON-THE-JOB TRAINING & EXPERIENCE**

Under the supervision of a qualified Journeyman in the same classification/line of progression, each apprentice shall be given such practical experience and training in the various branches and job processes of the trade as is necessary to develop proficiency. Only hours actually worked on-the-job will be credited toward the term of apprenticeship.

## **SECTION XVII: APPRENTICE EXAMINATION AND COUNSEL**

- A. Apprentices may be called before the JATC-1245 at anytime for examination or consultation regarding their apprenticeship.
- B. Examination and review of the apprentice's progress and conduct, both on-the-job and in the related instruction will be conducted by or under the direction of the JATC-1245.
- C. Apprentices not showing satisfactory progress may be held in their current step at any time during their apprenticeship. The apprentice may be subject to any corrective action deemed necessary by the JATC-1245.
- D. The JATC-1245 may suspend or freeze an apprentice before advancing him to the next step or to Journeyman status.

## **SECTION XVIII: REVISION OF STANDARDS**

The action of the JATC-1245 and approval of the sponsoring parties may revise these Standards at any time. Copies of any revisions must be registered and approved by the Registration Agency before becoming effective. Revision of these standards shall not alter apprenticeship agreements already in effect without consent of all parties to the agreement. As used in these standards, the masculine, feminine or neutral gender, and the singular or plural number, shall each be deemed to include the others whenever the context so indicates. No section of these standards shall be in conflict with the CBA-1245, and terms of the current working agreement shall supersede any section or sections of these standards, but must meet the minimum requirement of N.R.S. 610, Apprenticeship Councils Rules and Regulations Part 29 CFR 29 and Part 29 CFR 30.

## **SECTION XIX: CANCELLATION/DE-REGISTRATION OF STANDARDS**

De-registration of a program may be effected upon the voluntary action of the JATC-1245 by request for cancellation of the registration, or upon reasonable cause by the Registration Agency instituting formal de-registration procedures in accordance with statute including the provisions of Part 29 CFR 30 E.E.O. Upon de-registration or voluntary cancellation of the program, the Company will inform each apprentice, within fifteen (15) days of de-registration or cancellation and the effect of such action.

## **SECTION XX: TRANSFER OF TRAINING OBLIGATION**

If the Company is unable to fulfill its training obligation (due to lack of work or failure to conform to these Standards), or upon request of the apprentice, the JATC-1245 may transfer an apprentice, with his/her consent, to another employer under the same or similar program to provide continuous employment and to assure the apprentice a more complete on-the-job learning experience in all aspects of the occupation.



**SECTION XXI: TERMS OF AGREEMENT**

This Supplemental Agreement became effective on the 28<sup>th</sup> day of January, 2026.

**JOINT APPRENTICE TRAINING COMMITTEE APPROVAL:**

|  |   |
|--|---|
| <br>_____ | <br>_____ |
| <br>_____ | <br>_____ |
| <br>_____ | <br>_____ |
| <br>_____ | <br>_____ |
| <br>_____ | <br>_____ |

**APPROVED AND ACCEPTED BY THE COMPANY & UNION:**

 1/28/26  
\_\_\_\_\_  
Labor Relations Manager  
NV Energy

 1/28/2026  
\_\_\_\_\_  
Business Representative  
IBEW Local 1245

## ATTACHMENT 1

The Company is committed to employ, in its best judgment, the best qualified candidates for approved positions while engaging in recruitment and selection practices that are in compliance with all applicable federal and state laws. It is the policy of Company to provide equal employment opportunity to all applicants.

Individuals interested in an apprenticeship, may submit an employment application when a vacancy is posted. Apprenticeship awards are awarded first as outlined by the NV Energy/IBEW Local 1245 Collective Bargaining Agreement and then, should the number of qualified candidates not fill the vacancy need, by consideration of qualified non-Local 1245 represented personal (both internal employees and external candidates).

### Internal NV Energy Local 1245 Applicants

Applicants to be accepted for apprenticeship must meet the following requirements and comply with all requirements in statute:

1. Any employee interested in applying to a posted apprenticeship in the future will need to successfully satisfy the pre-qualification testing requirements outlined below for the desired program.
2. Selection of internal applicants will be governed by the CBA-1245
  - a. It is the policy of the Company to post vacancies internally for ten (10) calendar days.
  - b. Pre-Qualification Testing  
The Company utilizes the ACT Work Keys exams in order to establish pre-qualification criteria as outlined below. ACT Work Keys assessments have been used for more than two decades to measure essential workplace skills and build career pathways.

| Apprenticeship                         | WorkKeys<br>Applied<br>Mathematics | WorkKeys<br>Applied<br>Technology | WorkKeys<br>Locating<br>Information | WorkKeys<br>Reading for<br>Information | WorkKeys<br>Workplace<br>Observations |
|--|------------------------------------|-----------------------------------|-------------------------------------|--|---------------------------------------|
| Customer Serviceman                    | 5                                  | 4                                 | 4                                   | 5                                      | 2                                     |
| Fitter                                 | 5                                  | 4                                 | 4                                   | 5                                      | 2                                     |
| Fitter/Welder                          | 5                                  | 4                                 | 4                                   | 5                                      | 2                                     |
| Gas Pressure Operator                  | 5                                  | 4                                 | 4                                   | 5                                      | 2                                     |
| Lineman                                | 5                                  | 4                                 | 4                                   | 5                                      | 2                                     |
| Meter Technician                       | 5                                  | 4                                 | 4                                   | 5                                      | 2                                     |
| Substation Electrician                 | 5                                  | 4                                 | 4                                   | 5                                      | 2                                     |
| Communications (Telecom)<br>Technician | 5                                  | 4                                 | 4                                   | 5                                      | 2                                     |

The JATC-1245 reserves the right to modify the pre-qualification testing criteria to enforce its duty to the Apprenticeship Programs.

- c. The JATC-1245 may also choose to review:
  - i. Applicable Driver's License
    1. If the selected applicant does not have the required driving licenses upon hire, the candidate will have thirty (30) days in which to acquire it or shall be removed from the apprenticeship. (Some apprenticeships may require a commercial driver's license CDL.)



2. If the applicant loses his/her license during their apprenticeship and is unable to perform his/her work duties, he/she may receive disciplinary action up to and including discharge from the program.
- ii. If the program's job duties require a current drug test on record; the applicant shall be scheduled for one prior to being awarded the position.
- iii. Upon accepting the apprenticeship, the employee may be scheduled for a physical exam. This will be scheduled if the successful candidate is not currently in a job with comparable physical requirements. The doctor will be provided with the essential job functions and demands. The purpose of the physical is to determine if the employee is physically capable of performing the essential functions of the apprenticeship.
  1. An exam will be given by one of the company-selected doctors or an applicant may go to his/her own doctor.
    - a. If an applicant goes to his/her own doctor, the Company will reimburse the standard fee that would have been paid to the Company doctor to do the exam. The applicant will pay the remainder.
    - b. The results of this physical may also be used to satisfy the DOT requirements for their driver's qualification

### **Non-NV Energy Local 1245 Candidates**

Any person who is being considered to fill an apprenticeship vacancy will have to meet the same pre-qualification standards as an internal employee as outlined above.

Applicants will be required to meet all pre-qualification testing, skills demonstration, interview along with completing the required NV Energy pre-employment qualification requirements such as pre-employment background check, post-offer drug test, etc.

To learn more about the Work Keys pre-qualification testing, visit <https://www.act.org/products/workforce-act-workkeys/>. Locally, the Work Keys Test Battery is administered by:

#### **Northern Nevada Area:**

Truckee Meadows Community College (TMCC) Testing Center located at 5270 Neil Road, Suite 319 Reno, Nevada. To schedule the Work Keys exams, contact the TMCC Testing Center directly at (775) 673-8241.

#### **Southern Nevada Area:**

College of Southern Nevada (CSN) Division of Workforce & Economic Development located at 2409 Las Verdes Street Las Vegas, Nevada. To schedule the Work Keys exams, contact CSN directly at (702) 651-4109.

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**Approved Apprenticeship Programs  
Schedule of Training Hours and Courses**

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**Communications Technician**  
**Program Duration: 4 Years (48 Months)**

Revision Date: 5/23/24

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**A. GENERAL**

The following outline of training programs, courses and study requirements shall constitute an obligation on the part of the Company to provide job training, study materials and courses as outlined, and to keep records thereon, for all apprentices assigned to the classification of Apprentice Communications Technician and shall constitute an obligation on the part of the employees so assigned to participate in the training programs and in the keeping of records of progress as herein outlined.

The Company will furnish a copy of the Supplementary Agreement for Administration of Apprenticeship Programs and this Schedule of Training Hours and Courses to all employees assigned to the classification of Apprentice Communications Technicians subsequent to the date of this Supplementary Agreement. The Apprentice Communications Technician Training Program will consist of two basic parts.

- a. On-the-job training will be provided wherein the employee should learn the practical skills necessary for journeyman status.
- b. Supplementary classroom and home study training should provide the employee with basic knowledge of electronics and telecommunication theory as well as a better understanding of the diverse types of technical skills, equipment, software, and procedures with which he/she will be working.

**B. JOB TRAINING PROGRAM**

Work Assignments: Journeymen are responsible for the on-the-job training and Supervision is responsible for the proper rotation of the apprentice's work assignments for him/her to get training in all phases of the craft. The responsibility for evaluating and documenting the work of the apprentice rests with the immediate journeyman and foreman.

Each apprentice shall be assigned work that will provide him/her experience in all phases of a Communications Technician to include all aspects installation, construction, and maintenance.

During all phases of the apprentice training programs, instruction of proper safety procedures and practices will be provided.

**C. JOB STANDARDS**

Minimum Requirements: To provide each apprentice with at least a minimum amount of experience on each of the various types of systems and equipment, upon which the apprentice may be required to work as a Journeyman, he/she should be assigned work and given instructions in amounts meeting or exceeding those shown in the OJT hours tabulation.

#### D. SAFETY

In conjunction with the performance of work assignments, instruction on the following safety practices will be included with the on-the-job and classroom training:

- Care and use of personal tools
- Care and use of crew tools and equipment
- Proper operation of bucket truck, UTV, trailers and Snow Cats
- Vehicle operation on and off road
- Care and use of protective equipment
- Basic first aid and CPR
- Tailboard briefings

Apprentices should be encouraged to discuss their problems with the foremen and supervisor. Foremen and supervisor will assist and encourage the apprentice in their work.

#### E. TESTING

Grading of tests shall be done by the instructor, general foreman, or supervisor. The apprentice shall be notified of grades received from lesson tests. Lesson tests Determine the apprentice's progress in the Supplementary Study Course and shall be given upon completion of each lesson of the course and shall be prescribed for the course or as approved by the supervisor or general foreman and the record of grades shall be made a part of the apprentice's record.

In an effort for an apprentice to top out, the following guidelines may be used. The apprentice will be given a final test and practical application before topping out. This written test and practical application test will be administered within his/her last six months and may be administered no earlier than 90 days prior to his/her completion date.

#### F. ON-THE-JOB-TRAINING (OJT) HOURS

The following is an outline of the subjects to be covered in the on-the-job training, supplementary training and classroom, and home study program:

| <u>Process</u>                              | <u>Hours</u>       |
|---|--------------------|
| <b><i>I. Telecom Auxiliary Systems</i></b>  |                    |
| Power and DC Distribution Systems           | 400                |
| Uninterrupted Power Supply System           | 40                 |
| Generator Backup System                     | 100                |
| Telecom Alarm System                        | 280                |
| Timing Systems                              | 100                |
| HVAC Equipment                              | 40                 |
| Wire and Fiber Management                   | 260                |
| Testing Equipment, Systems, and Software    | 200                |
| <b><i>Total</i></b>                         | <b><i>1420</i></b> |
| <b><i>II. Energy Management Systems</i></b> |                    |
| SCADA System Components                     | 240                |
| Communications Front End Processor / Modems | 240                |
| SCADA Remote Terminal Units                 | 640                |

|  |                    |
|--|--------------------|
| Interface with Line and Meter Equipment IEDs | 320                |
| Protocols / Analyzers                        | 160                |
| Management Software                          | 120                |
| <b><u>Total</u></b>                          | <b><u>1720</u></b> |

### ***III. Telephone Systems***

|                     |                   |
|---------------------|-------------------|
| VOIP System         | 140               |
| T1 Systems          | 220               |
| DSO Circuits        | 220               |
| <b><u>Total</u></b> | <b><u>580</u></b> |

### ***IV. Relay and Protection Systems***

|                                     |                   |
|-------------------------------------|-------------------|
| RAS Schemes                         | 80                |
| Relay Protection                    | 240               |
| Power Line Carrier / Tone Equipment | 180               |
| Mirrored Bits Equipment             | 40                |
| Direct/Permissive                   | 80                |
| <b><u>Total</u></b>                 | <b><u>620</u></b> |

### ***V. Land Mobile Radio Systems***

|                         |                   |
|-------------------------|-------------------|
| Consoles                | 80                |
| Subscriber Units        | 180               |
| Programming             | 180               |
| Database Management     | 120               |
| IMC                     | 160               |
| LMR Base Site Equipment | 240               |
| <b><u>Total</u></b>     | <b><u>960</u></b> |

### ***VI. Transport Systems***

|                                 |                    |
|---------------------------------|--------------------|
| Microwave Radio                 | 600                |
| Multiplexers                    | 600                |
| DACS                            | 200                |
| Optical Fiber Transport Systems | 540                |
| Networking                      | 420                |
| MAS Radio                       | 220                |
| <b><u>Total</u></b>             | <b><u>2580</u></b> |

### ***VII. Safety***

|                                     |                   |
|-------------------------------------|-------------------|
| <u>Safety Training and Meetings</u> | <u>60</u>         |
| <u>Vehicle Operation</u>            | <u>60</u>         |
| <b><u>Total</u></b>                 | <b><u>120</u></b> |

**Total Program Hours 8,000**

G. OJT HOURS SUMMARY:

- Telecom Auxiliary Systems (Total 1420 Hours)
  - Power and DC Distribution Systems (400 Hours)
    - Installation and maintenance of DC controller and rectifiers
    - Installation and maintenance of telecom battery plants
    - Installation and maintenance of AC / DC distribution
      - Fuse Panel
      - Cabling
      - Breakers and Fuses
    - Installation and maintenance AC / DC Inverters and Converters
    - Installation of grounding equipment and standards
  - Uninterrupted Power Supply System (40 Hours)
  - Generator Backup Systems (100 Hours)
    - Generator operation and maintenance
    - Transfer switch operation and maintenance
    - Fuel Supplies and sensors
  - Telecom Alarm Systems (280 Hours)
    - Alarm management system and configuration
    - Remote unit installation, configuration, and maintenance
    - Remote sensors installation
    - Remote management and verification
  - Synchronization and Timing Systems (100 Hours)
    - Installation, configuration and maintenance of GPS antenna and timing sources
    - Installation, configuration, and maintenance of Building Integrated Timing Systems (BITS Clock)
  - HVAC Equipment (40 Hours)
    - Operation of thermostat and alarming
    - General maintenance
  - Wire and Fiber Management (260 Hours)
    - Basic telecom wiring standards and color codes
    - Terminal Block installation and maintenance
      - 66 / 110 Punch
      - Wire wrap
      - Network management termination panels
    - Fabrication and installation of Amphenol connectors
    - Installation and maintenance of fiber optic patch panels
    - Installation and maintenance of fiber optic patch cables
    - Fabricate, install and maintain fiber optic jumpers
  - Testing Equipment, Systems, and Software (200 Hours)
    - Test Equipment operation
      - OTDR, OLTS, and fiber optical scoping and testing
      - DS3, DS1, and DS0 Testing / VF Testing
      - Network Testing equipment
      - Spectrum Analyzer, Power Meters, RF Meters
  - Software
    - NMNS management

- Equipment interface with terminal emulation
  - Remote management
- Energy Management Systems (Total 1720 Hours)
  - SCADA System Components (240 Hours)
  - Communications Front End Processor (240 Hours)
    - FEP
    - Modem installation, configuration, and maintenance
  - SCADA Remote Terminal Units (640 Hours)
    - Installation, configuration, and maintenance of legacy and current RTUs
    - Configuration management
    - CIP requirements
  - Interface with Line and Meter Equipment / IEDs (320 Hours)
    - Interface with RTU and communication with Metering equipment
    - Configuration, installation, and maintenance for communication to reclosers, motor operators, and TGB Devices.
  - Protocols / Analyzers (160 Hours)
    - Knowledge and programming of protocols such as DNP, Harris, Telegyr, Conitel, and Modbus
    - Ability to utilize protocol analyzers in the troubleshooting and verification of data streams from RTU devices.
  - Management Software (120 Hours)
- Telephone Systems (Total 580 Hours)
  - VOIP System (140 Hours)
    - Programming, installation, and repair of VOIP phone system
  - T1 Systems (220 Hours)
    - Installation, configuration, and troubleshoot of T1 Channel Banks, Multiplexers, and equipment
    - Install, Wire and test using DSX jack fields intrusive and nonintrusive
  - DS0 Circuits (220 Hours)
    - Wiring and Testing
    - VF jack fields
- Relays and Protection Systems (Total 620 Hours)
  - RAS Schemes (80 Hours)
  - Relay Protection (240 Hours)
    - Installation, testing and maintenance of protection circuits
      - Direct fiber / Media Converters
      - Serial
      - C37.94
    - PRC-005-06 compliance testing
  - Power Line Carrier / Tone Equipment (180 Hours)
    - Installation, testing and maintenance on PLCE and Tones 9745, Type 40, TA 1 / 3
  - Mirrored Bits Equipment (40 Hours)
  - Directive / Permissive (80 Hours)

- Land Mobile Radio Systems (Total 960 Hours)
  - Consoles (80 hours)
    - Console configuration, updating and maintenance
  - Subscriber Units (180 Hours)
    - Installation, configuration, and maintenance of mobile radio in vehicles
    - Installation, configuration, and maintenance of hand-held radios
  - Programming (180 Hours)
    - EDACS
    - P25
  - Database Management (120 Hours)
  - IMC (160 Hours)
  - LMR Base Site Equipment (240 Hours)
    - EDACS and P25 system operation, configuration, and maintenance
    - Auxiliary support equipment
- Transport Systems (Total 2580 Hours)
  - Microwave Radio (600 Hours)
    - Installation, configuration, and maintenance of digital radio systems
    - Antenna support structures and transmission medium knowledge, installation, and maintenance
    - Dehydrator Systems installation and maintenance
  - Multiplexer (600 Hours)
    - Installation, configuration, and maintenance of multiplexers
  - DACS (200 Hours)
    - Configuration and maintenance of digital cross connect system
  - Optical Fiber Transport Systems (540 Hours)
  - Networking (420 Hours)
    - MPLS router installation, configuration, and maintenance
    - Assist IT / OT on network switch installations
    - Network cabling fabrication and testing
  - MAS Radio Systems (220 Hours)
- Safety (Total 120 Hours)
  - Safety Training and Meeting (60 Hours)
    - Personal protective equipment
    - Safe operational distances
    - Substation training
    - Tailboards / Safety Manual
    - MSHA
    - Ladder
    - Tools
  - Vehicle Operation (60 Hours)
    - UTV
    - Trailers
    - Snow Cats
    - On and off-road driving



## H. TRAINING PLAN OUTLINE

Upon start as a Telecom Apprentice, the apprentice will be assigned substation training and complete all safety required courses on NVE Learning Management system. The apprentice will be provided all personal protective equipment and scheduled for MSHA training. Apprentice will be introduced to all safety requirements and pre-job brief / tailboard documentation. The apprentice will be required to attain his/her FCC license and will be sent to a one-week course during the apprenticeship. On a seniority basis, the apprentice can volunteer to attain a commercial driver's license depending on department needs.

Throughout the program, the apprentice will be assigned to different foremen and journeymen to provide adequate on-the-job training and classroom time to prepare him/her to become a journeyman. Additionally, the apprentice will be assigned NVE Learning Management System (LMS) courses that are relevant to their education and skill development. The Telecom Apprentice Training will build off fundamentals and telecommunication basics and apply those skills to the more complex tasks.

The apprentice will spend his/her first year progressing through Safety, Telecom Auxiliary Systems and Telephone Systems to provide the general skills for telecommunication, safety procedures and area familiarity. The second year will advance to Relay and Protection Systems and start into the Transport Systems. The third year will complete the Transport Systems and start Energy Management Systems. The fourth year will finish Energy Management Systems and focus on Land Mobile Radio Systems. Due to the nature of Telecom Operations work and vast operational area, the apprentice will be introduced and track hours across several of the processes during a progression period.

## I. STEP PROGRESSION

Classroom room training and progression testing will focus on the outlined training plan:

### Step 1 (Six Months)

- Safety
- Telecom Auxiliary Systems
  - Wire and Fiber Management
  - Testing Equipment, Systems, and Software
  - HVAC Equipment
  - Uninterrupted Power Supply System
- Telephone Systems
  - T1 Systems
  - DSO Circuits

### Step 2 (1 Year)

- Telecom Auxiliary Systems
  - Power and DC Distribution Systems
  - Telecom Alarm System
  - Generator Backup System
  - Timing Systems
- Telephone Systems
  - VOIP System

**Step 3 (1.5 Years)**

- Relay and Protection Systems
  - RAS Schemes
  - Relay Protection
  - Power Line Carrier / Tone Equipment
  - Mirrored Bits Equipment
  - Direct/Permissive
- Transport Systems
  - DACS
  - MAS Radio

**Step 4 (2 Years)**

- Transport Systems
  - Microwave Radio
  - Networking

**Step 5 (2.5 Years)**

- Transport Systems
  - Multiplexers
  - Optical Fiber Systems

**Step 6 (3 Years)**

- Transport Systems
  - Optical Fiber Systems
- Energy Management Systems
  - SCADA System Components
  - Communications Front End Processor / Modems
  - SCADA Remote Terminal Units

**Step 7 (3.5 Years)**

- Energy Management Systems
  - SCADA Remote Terminal Units
- Land Mobile Radio Systems
  - Consoles
  - Subscriber Units
  - Programming
  - Database Management
  - IMC
  - LMR Base Site Equipment

**Step 8 (4 Years)**

- Process reviews
  - Telecom Auxiliary Systems
  - Energy Management Systems
  - Telephone Systems
  - Relay and Protection Systems
  - Land Mobile Radio Systems
  - Transport Systems
- Top Out Testing

## J. SUPPLEMENTAL TRAINING

### **Supplemental Training Program Outline Supplemental Training Module Approximation Summaries**

1. Learning Strategies 5 hours  
Penn Foster Lesson # 147008 Penn Foster Exam # 14700803
  - Features of the program
  - How to get help during studies
  - The program study materials and how they are obtained
  - Access to Penn Foster Web Site
  - Types of learners
  - How to establish a study schedule, organize materials, and choose appropriate study locations
  - The SQ3R study method
  - Proper procedure for building working vocabulary
  - Proper procedure for preparing and taking examinations
2. Jobs, Companies, and the Economy-Basic 5 hours  
Penn Foster Lesson # 186034 Penn Foster Exam # 18603400
  - Conclude how the economy affects consumers and employees
  - Explain the concept of competition and how a business must react to market demands
  - Evaluate how government policies affect the amount of saving and investing within an economy
  - Defend the use of a flexible and empowered workforce in making a business more competitive
  - Explain various economic measuring tools such as the inflation rate, the unemployment rate, and the GDP
  - Appraise the current status of American labor in general and the status of American labor unions in particular
  - Recognize how an employee or employer must compete in an increasingly international marketplace
3. Quality Concepts: Tools and Applications 5 hours  
Penn Foster Lesson # 186036 Penn Foster Exam # 18603600
  - How job roles change as a company evolves in its quality-consciousness
  - Several ways in which you can support TQM
  - Approaches, practices, and skills associated with positive organizational changes
  - The “change process” at the company level vs. “manufacturing processes” that require improvement
  - Major causes of process variation and examples of how they may affect the employee
  - Why and how the reduction of variability is a key factor in process improvement
  - Why and how quality and process improvement depend on data- driven decision making
  - Seven quality tools and how to use them
4. Trades Safety Getting Started 5 hours  
Penn Foster Lesson # 186001 Penn Foster Exam # 18600100
  - Physical hazards associated with chemicals and how to avoid those hazards
  - Electrical shock hazards

- Steps in a lock-out and tag procedure
  - Importance of machine guarding and identifying types of machine guards
  - Four classes of fire and how to extinguish each of them
  - Proper technique used to lift a heavy load
  - How to avoid hand injuries when using hand tools and power tools
  - Some of the hazards involved in welding and hot cutting operations and how to prevent them
  - How job analysis and the science of ergonomics are used to improve the workplace
  - Types of personal protective equipment (PPE) and the importance of using PPE
5.     Materials-Handling Safety 5 hours  
Penn Foster Lesson # 186006     Penn Foster Exam # 18600600
- Recognizing the hazards associated with handling materials
  - Types of injuries that can be caused by such hazards
  - Understanding how to effectively use safe material-handling practices
  - Knowing how to avoid physical injury when handling loads
  - Knowing and following the rules for safe operation of powered industrial material-handling equipment
  - Understanding and respecting the limits and restrictions placed on powered material-handling mechanisms
6.     Introduction to Telecommunications 10 hours  
Penn Foster Lesson # 387001     Penn Foster Exam # 38700100
- Everyday applications of telecommunications
  - Differences between analog and digital signals
  - Mediums that are used to carry data communications
  - Bandwidth characteristics in a telecommunications link
  - Basic differences between active and passive communications satellites
  - Testing instruments used by telecommunications technicians
  - Potential employers of telecommunications technicians
  - Common electrical shock hazards
  - Steps in a lockout and tag procedure
  - Types and importance of personal protective equipment (PPE)
7.     Nature of Electricity 5 hours  
Penn Foster Lesson # 086001     Penn Foster Exam # 08600101
- Operation of a simple circuit
  - Conductors, insulators, and resistors
  - Electrical charge forces
  - Dangers and benefits of static electricity
  - Volts, amperes, and ohms
  - Common notations and prefixes used to identify electrical and electronic values
  - Types of resistors
  - Electrical symbols used in schematic diagrams
  - Series and parallel circuits
8.     Working Safely with Electricity 10     hours  
Penn Foster Lesson # 4400     Penn Foster Exam # 44008
- Listing the major electrical classifications and describe the
  - job functions associated with each

- Influence of the National Electric Code on manufacturers, installers, and users of electrical equipment
  - Safe work habits that lessen the chances of serious electric shock by avoiding those conductive paths most dangerous to the human body
  - Safety equipment required to be worn when installing or repairing electrical equipment
9. Electrician's Tools 10 hours  
Penn Foster Lesson # 006026 Penn Foster Exam # 602600
- Explaining how various hand tools are used by an electrician
  - Discussing the safe use of hand tools and power tools
  - Performing basic calculations and measurement conversions using the metric system
  - Using Ohm's law to explain the relationship between current, voltage, and resistance in a circuit
  - Explaining how electrical measuring instruments are used to measure current, voltage, and resistance
  - Defining many of the basic electrical terms that electricians use everyday
  - Identifying the basic symbols used in electrical schematic drawings
10. Linear Distance and Measurement 5 hours  
Penn Foster Lesson # 186021 Penn Foster Exam # 18602101
- Measurement using both English and metric units of length
  - Calculating the perimeters of rectangles, squares, and triangles
  - Calculating the areas of objects such as rooms or machine bases
  - Calculating the circumference of circular objects such as pipes or tanks
  - Measuring distances using rigid and flexible rules, thickness gauges, and screw pitch gauges
  - Making precise measurements using vernier calipers and micrometers
11. Electrical Drawings and Circuits 8 hours  
Penn Foster Lesson # 186044 Penn Foster Exam # 18604400
- Identifying electrical construction drawings, schematics, and wiring diagrams
  - Interpreting various electrical symbols
  - Reading standard abbreviations used in electrical diagrams
  - Block diagrams, schematic diagrams, and wiring diagrams
  - Closed circuits, open circuits, grounded circuits, and short circuits
12. Reading Electrical Schematic Diagrams 10 hours  
Penn Foster Lesson # 006022 Penn Foster Exam # 00602202
- Standard electrical symbols and their meanings
  - Parts of a schematic diagram
  - Flow of electrical current through devices
  - Interpreting electrical drawings, block diagrams, wiring diagrams, and electrical schematic diagrams
  - Characteristics of switched circuits
  - Ladder diagrams and their functions
13. Problem Solving and Troubleshooting 10 hours  
Penn Foster Lesson # 186073 Penn Foster Exam # 18607300
- Problem solving, trouble shooting, and critical thinking
  - Applying logic to solving problems and troubleshooting systems

- Tools used for problem solving and troubleshooting
  - Tools and measurement devices that help in troubleshooting common industrial systems
  - Collecting information related to problem solving
  - Improving personal meta-cognitive abilities to analyze complex systems
14. Fractions, Percentages, Proportions, and Angles 5 hours  
Penn Foster Lesson # 186010 Penn Foster Exam # 18601000
- Defining the following terms: fraction, proper fraction, lowest common denominator, percent, ratio, and proportion
  - Adding, subtracting, multiplying, and dividing fractions
  - Changing fractions to decimals and decimals to fractions
  - Solving problems involving percentages
  - Working with ratios and equivalent ratios
  - Solving proportion problems
  - Using a protractor to measure angles
  - Laying out templates for checking angles
  - Using a calculator to solve percent problems, to convert fractions to decimals, and to calculate missing terms in proportions
15. Formulas 5 hours  
Penn Foster Lesson # 186012 Penn Foster Exam # 18601200
- Explaining the use of variables in formulas
  - Preparing and using formulas to solve problems
  - Using formulas to calculate the perimeter of a triangle and a rectangle, and the areas of a triangle, a rectangle, and a circle
  - Using formulas to calculate the distance, current in a circuit, and the volume of a pyramid and a sphere
  - Using a calculator to find square roots and solve formulas
  - Substituting given numerical values for letters in a formula and finding the unknown quantity
  - Transforming and solving equations and formulas
16. Circuit Analysis and Ohm's Law 5 hours  
Penn Foster Lesson # 086002 Penn Foster Exam # 086200200
- Total resistance in series, parallel, and series-parallel circuits
  - Using Ohm's law to calculate the amount of current, voltage, or resistance in circuits
  - Calculating the amount of power supplied and dissipated in a DC circuit
  - Reading current, voltage, and resistance with a meter
17. Basic Test Equipment 5 hours  
Penn Foster Lesson # 086025 Penn Foster Exam # 08602500
- Identifying the schematic symbols used to represent various reactive devices
  - Relationships between voltage, current, and resistance in a circuit
  - Measuring voltage, current, and resistance with a multimeter
  - Features of analog and digital VOMs
  - Using analog and digital VOMs to measure voltage, resistance, and current in a circuit
  - Safety precautions when using a multimeter
18. Troubleshooting with Volt-Ohm Milliamp Meters (VOMs) 5 hours

- Penn Foster Lesson # 086026    Penn Foster Exam # 08602600
- Safe practices when troubleshooting with a VOM
  - Continuity Testing
  - Short Circuit Testing
  - Resistance Testing on Electronic Components
  - Current Measurements
  - Measuring input and output voltages of DC power supplies
  - Measuring voltages on disconnect switches, circuit breakers, contactors, and transformers
  - Voltage tests on circuit boards, PLC systems and motor circuits
19.    Using Basic Oscilloscopes    5 hours
- Penn Foster Lesson # 086027    Penn Foster Exam # 08602701
- Oscilloscope controls and operation
  - Performing low-voltage measurements on circuit boards
  - Measuring the voltage output of a power supply and AC ripple
  - Measurements in SCR and TRIAC circuits
  - Testing AC and DC servo motor and heater controller circuits
  - Basic oscilloscope measurements on digital circuits
20.    Component Testers    6 hours
- Penn Foster Lesson # 086062    Penn Foster Exam # 08606200
- Identifying the type of component tester used in connection with resistors, capacitors, and inductors
  - Calculating turns ratio
  - Correct connection schemes for testing diodes, SCRs, and transistors
21.    Digital Test Equipment    6 hours
- Penn Foster Lesson # 086063    Penn Foster Exam # 08606300
- Converting between decimal, binary, octal, and hexadecimal numbering systems
  - Logic gate applications
  - Flip-flop storage applications
  - Using logic probes and IC logic clips
  - Troubleshooting digital systems using oscilloscopes and logic analyzers
22.    Industrial Computer Networks    6 hours
- Penn Foster Lesson # 08606900    Penn Foster Exam # 08606900
- Methods of communications within networks
  - Configurations of various types of industrial network systems
  - Types of network cables
  - Network protocols
  - Troubleshooting methods for networks
23.    Communication Cabling Systems    5 hours
- Penn Foster Lesson # 086801    Penn Foster Exam # 08680100
- Precursor Technologies of Telecommunications
  - Evolution of Telecommunications Wiring
  - Planning Wiring Installations
  - Computer Network Standards
  - UTP cabling connections and terminations

24. Copper Wiring for Telephone, Video, and Network Systems 5 hours  
Penn Foster Lesson # 086802 Penn Foster Exam # 08680200
- Basic methods of installing telephone, video and network cabling
  - Planning a cable installation
  - Factors affecting the quality of a cable installation
  - Media types for telephone, video and network cabling
  - Installation techniques
  - Workplace security and safety
25. Terminating and Testing Communication Wiring 5 hours  
Penn Foster Lesson # 086083 Penn Foster Exam # 08680300
- Advantages and disadvantages of wireless networking
  - Selecting and Installing wireless access points
  - Basic cable testing tools
26. Working with Fiber Optics 5 hours  
Penn Foster Lesson # 086084 Penn Foster Exam # 08608400
- Fundamental principles of fiber optic transmission
  - Different types of fiber-optic cabling
  - Common types of optical fiber connections, terminations, and splices
  - Pulling, cleaving, connecting, and polishing optical fiber cables
  - Types and methods of fiber-optic testing
27. Introduction to Algebra 5 hours  
Penn Foster Lesson # 186013 Penn Foster Exam # 18601300
- Explain the difference between positive and negative numbers and their uses
  - Performing basic arithmetic operations with signed numbers
  - Raising a number to any power
  - Using the order of operations for solving problems involving multiple operations
  - Defining the following words: term, constant, coefficient, exponent, monomial, trinomial, and polynomial
  - Identifying and combining like terms in an expression
  - Performing basic arithmetic operations with signed terms
  - Multiplying and dividing terms containing exponents
  - Removing parentheses from an expression and simplifying the expression
28. Algebra: Factoring 6 hours  
Penn Foster Lesson # X0202 Penn Foster Exam # Omit
- Finding prime factors of certain binomials and trinomials
  - Factoring a given trinomial
  - Using the Factor Theorem to factor a given polynomial
  - Using factoring to find the roots of an equation
  - Dividing one polynomial by another polynomial of lower degree
  - Finding the lowest common multiple of several polynomials
29. Algebra: Addition and Subtraction of Fractions 6 hours  
Penn Foster Lesson # X0203 Penn Foster Exam # Omit
- Recognizing equivalent algebraic fractions
  - Performing additions and subtractions involving algebraic fractions
  - Finding the least common denominator for a group of algebraic fractions
  - Reducing an algebraic fraction to its lowest terms



30. Algebra: Multiplication and Division of Fractions 6 hours  
Penn Foster Lesson # X0204 Penn Foster Exam # Omit
- Performing multiplications and division involving algebraic fractions
  - Solving equations involving fractions and decimals
  - Simplifying complex fractions
31. Algebra: Monomials/Polynomials 6 hours  
Penn Foster Lesson # X0201 Penn Foster Exam # Omit
- Removing grouping symbols from algebraic expressions, dividing by a monomial when indicated
  - Multiplying binomials by monomials, trinomials, and other binomials
  - Calculating the square root and the third power of given monomials
  - Finding special products involving binomials
  - Dividing one polynomial by another polynomial of lower degree
32. Algebra: Linear Equations 6 hours  
Penn Foster Lesson # X0205 Penn Foster Exam # Omit
- Recognizing the graph of a linear equation, given the graph or a set of points
  - Recognizing equations expressing mixture problems and other word problems
  - Solving number problems, digit problems, and age problems.
33. Algebra: Quadratic Equations 6 hours  
Penn Foster Lesson # X0208 Penn Foster Exam # Omit
- Recognizing the graphical solution of two equations
  - Solving and recognizing steps in the solution of systems of quadratic equations and a system of a quadratic and a linear equation
  - Solving fourth degree polynomial equations in quadratic form
  - Using the quadratic formula to solve a quadratic equation, calculating the discriminant of a quadratic equation, and pointing out what can be known from a given discriminant
  - Writing a quadratic equation which has given roots
  - Solving word problems involving quadratic equations
34. Algebra: Exponents 6 hours  
Penn Foster Lesson # X0209 Penn Foster Exam # Omit
- Demonstrating an understanding of the meaning of a fractional exponent
  - Applying the rules for positive and negative exponents in multiplication, division, and raising to powers
  - Use radicals to convert fractional exponents, and use fractional exponents to convert radicals
  - Writing a given number in standard form
35. Algebra: Radicals and Imaginary Numbers 6 hours  
Penn Foster Lesson # X0210 Penn Foster Exam # Omit
- Simplifying several radicals and then add like terms
  - Rationalizing the denominator of a fraction and eliminate an imaginary number from the denominator of a fraction
  - Solving an equation containing several square roots
  - Multiplying, dividing, and raising to powers terms containing radicals
36. Applied Geometry 6 hours  
Penn Foster Lesson # X0211 Penn Foster Exam # Omit

- Recognizing characteristics of angles and closed plane figures
  - Distinguishing between common geometric solids
  - Applying the Pythagorean theorem
  - Calculating the perimeter and area of a polygon, circle, and ellipse
  - Applying the formula for area and volume of geometric solids
37. Practical Trigonometry 6 hours  
Penn Foster Lesson # X0212 Penn Foster Exam # Omit
- Defining trigonometric functions
  - Using trigonometric tables and applying interpolation
  - Solving right triangles
  - Applying the laws of sines and cosines in solving oblique triangles
38. Electronics Hardware 6 hours  
Penn Foster Lesson # 086040 Penn Foster Exam # 08604000
- Connector and terminal types and their applications
  - Wire and Cable types and applications
  - Wire resistance
  - Wire resistance variables
  - Soldering equipment and materials selection
  - Soldering techniques for PC board and SMT applications
  - Special handling techniques for SMT components
39. Basic Electronic Components and Schematic Symbols 10 hours  
Penn Foster Lesson # 2020 Penn Foster Exam # 2020-4 Ed.2
- Electrical quantities
  - Common electronic components
  - Vacuum tubes and related devices
  - Semiconductor devices
40. Conductors, Insulators, and Batteries 5 hours  
Penn Foster Lesson # 086005 Penn Foster Exam # 08600500
- Conductivity and types of conductors
  - American Wire Gauge standards
  - Applications in sizing conductors
  - Insulating materials and temperature ratings
  - Dry cells and storage batteries
  - Battery arrangements
  - Storage battery safety precautions
  - Storage battery maintenance
  - Storage battery testing
  - Special types of batteries – NiCad, lithium, and others
41. Capacitors and Inductors 5 hours  
Penn Foster Lesson # 086003 Penn Foster Exam # 08600300
- Capacitor and Inductors definition
  - Capacitor and Inductor principles
  - Capacitor and Inductor types and ratings
  - Capacitors and Inductors in series and parallel
  - RC and RL time constants
  - Capacitor and Inductor applications

42. Magnetism and Electromagnetism 5 hours  
Penn Foster Lesson # 086004 Penn Foster Exam # 08600400
- Magnetic poles
  - Magnetic and nonmagnetic materials
  - Induction magnetization
  - Simple, compound, and closed magnetic circuits
  - Magnetic lines of force around an energized conductor
  - Right-hand rule for solenoid poles
  - Electromagnetic relays, buzzers, and stepping switches
  - DC motor operation
  - Electromagnetic induction in generators and motors
43. Alternating Current 5 hours  
Penn Foster Lesson # 086007 Penn Foster Exam # 08600701
- AC voltage waveforms
  - AC cycle terms
  - AC cycle time period
  - AC cycle characteristic values
  - Phase angles in reactive circuits
  - 220 VAC, single-phase circuit operation
  - Multiphase waveforms
  - Power factor meters
  - Delta and wye three phase circuit connections
44. Alternating Current Circuit-Principles 5 hours  
Penn Foster Lesson # 086008 Penn Foster Exam # 08600800
- Electric circuit characteristics
  - Circuit load applications
  - Electrical components in series and parallel
  - Load control from multiple locations
  - Three-wire circuits
  - Current in delta and wye connected circuits
  - Line to line and line to neutral voltage in Y-connected circuits
45. Inductors in AC Circuits 5 hours  
Penn Foster Lesson # 086009 Penn Foster Exam # 08600900
- Inductor operation in AC and DC circuits
  - Inductive reactance and impedance
  - AC frequency and inductive reactance
  - Ohm's law applied to inductors
  - Series RL circuit impedance
  - Parallel RL circuit impedance
46. Capacitors in AC Circuits 5 hours  
Penn Foster Lesson # 086010 Penn Foster Exam # 08601000
- Series and parallel connected capacitance values
  - Capacitive reactance
  - Ohm's law applied to capacitors
  - Impedance in a series RC circuit
  - Impedance in a parallel RC circuit
  - AC frequency and capacitive reactance
  - Resonant RLC circuits

47. Transformers 5 hours  
Penn Foster Lesson # 086011 Penn Foster Exam # 08601101
- Transformer construction
  - Transformer characteristics
  - Transformers in 3-phase circuits
  - Transformer types
48. Reactance and Impedance 5 hours  
Penn Foster Lesson # 086037 Penn Foster Exam # 08603700
- Resistors, capacitors, and inductors in DC circuits
  - Timing circuits
  - Calculating reactance in circuits with capacitors and inductors
  - Impedance of series RLC circuits
  - Voltage-current phase angles in RC, RL and RLC circuits
49. Resonant Circuits 5 hours  
Penn Foster Lesson # 086038 Penn Foster Exam # 08603800
- Time domain and frequency domain displays
  - Necessary conditions for series and parallel resonance circuits
  - Resonant frequency of an LC circuit
  - Quality factor Q
  - Q and bandwidth relationships
  - Tuned circuit applications in radios
  - Distributed components
50. Applications and Troubleshooting of Resonant Circuits 5 hours  
Penn Foster Lesson # 086039 Penn Foster Exam # 08603900
- Estimating voltages in troubleshooting AC and DC circuits
  - Impedance matching considerations
  - AC circuit filters
  - Power supply filter designs
  - AC filter characteristic curve
  - Resonant circuits in waveguides and transmission lines
  - Transmission line applications
51. Oscillators 6 hours  
Penn Foster Lesson # 086043 Penn Foster Exam # 08604300
- Types of oscillator circuits
  - Flywheel effect
  - Basic oscillator circuits
  - Complex RLC tuned circuits
  - Oscillators with LC feedback circuits
  - Oscillators with RC feedback circuits
  - Oscillator circuits applications
  - Frequency synthesizers
52. Modulation and Detection Circuits 6 hours  
Penn Foster Lesson # 086044 Penn Foster Exam # 08604401
- Forms of modulation
  - Degree of amplitude and frequency modulation

- Two signal mixing
  - Bandwidth of AM and FM signals
  - Pulse code modulation
  - Phase-locked loops
  - Types of modulation circuits and components
  - Types of pulse modulation
53. Learning to Solder and Desolder 3 hours  
Penn Foster Lesson # 087042 Penn Foster Exam # 08704200
- Tools and materials used in soldering
  - Making good solder connections
  - Soldering practices
  - Desoldering connections
  - Desoldering practices
54. Computer Applications in Telecommunications 10 hours  
Penn Foster Lesson # 387011 Penn Foster Exam # 38701100
- Four basic computer parts
  - Decimal to binary and binary to decimal conversion
  - Seven basic logic gates with Boolean expressions
  - Converting text, pictures, and audio to binary code
  - Data compression techniques
  - Data encryption techniques
55. Electronics Drawings 8 hours  
Penn Foster Lesson # 186045 Penn Foster Exam # 18604500
- Identifying the various electronics symbols used on drawings
  - Explaining the various types of drawings used in the electronics field
56. Understanding and Using Electronic Diagrams 10 hours  
Penn Foster Lesson # 2021 Penn Foster Exam # 2021-1d.2
- Fundamentals of electronic circuits
  - Vacuum tubes and transistors as circuit elements
  - Relays and switches as circuit elements
  - Electronic diagrams in preventive and corrective maintenance
  - Identifying electronic components
57. Basic Semiconductor Components: Diodes 6 hours  
Penn Foster Lesson # 086019 Penn Foster Exam # 08601900
- How diodes work
  - Type and function of diodes
  - Diode applications
  - Diode characteristics
  - Diodes in electronic circuits
  - Diode replacement selection
58. Rectification and Basic Electronic Devices 5 hours  
Penn Foster Lesson # 086014 Penn Foster Exam # 08601400
- Diodes and rectification
  - PN junction biasing

- Transistors and amplifiers
  - Transistor input and output circuits
  - Rectifier outputs with and without filters
  - Reversing DC output voltage polarity on rectifier schematics
  - Calculating rectifier circuit ripple frequency
  - Triode tubes and amplifiers
59. Rectifiers and Power Supplies 6 hours  
Penn Foster Lesson # 086041 Penn Foster Exam # 08604100
- Types of electronic rectifiers
  - Types of rectifier connections
  - Nonlinear component voltages and currents
  - Power supply filters
  - Voltage dividers in power supplies
  - Calculating voltage divider component values
  - Voltage-regulating devices and circuits
  - Voltage and current regulation in power supplies
60. Basic Semiconductor Components: Transistors 6 hours  
Penn Foster Lesson # 086020 Penn Foster Exam # 08602000
- How transistors work
  - Transistor characteristics
  - Basic amplifier configurations
  - Linear and non-linear amplification
  - Junction Field-Effect Transistors
  - Metal Oxide Semiconductor Field-Effect Transistors
  - Transistors and static charges
  - Troubleshooting circuits with amplifications circuits
61. Amplifiers 6 hours  
Penn Foster Lesson # 086042 Penn Foster Exam # 08604200
- Classes of transistor amplifiers
  - Calculating amplifier dB gain
  - Types of transistor amplifier circuits
  - Methods used to bias amplifiers
  - Simple troubleshooting operations on amplifiers
  - Distortion introduced by amplifiers
62. Switching Devices 6 hours  
Penn Foster Lesson # 086021 Penn Foster Exam # 08602101
- Various switch types
  - Basic relay ladder logic diagrams
  - Diodes used as switches
  - Problems with diode switching
  - Rapid electronic switching
  - Mechanical switches vs. rapid electronic switches
63. Electronic Sensors 6 hours  
Penn Foster Lesson # 086022 Penn Foster Exam # 08602200
- Thermoelectric effects
  - Bridge circuits in electronic instrumentation

- Nonlinear resistors in circuits
  - Protection devices for circuits
  - Stress and strain
64. Optoelectronic and Fiber-Optic Components 6 hours  
Penn Foster Lesson # 086024 Penn Foster Exam # 08602400
- Electronics and optics
  - Modern theories of light
  - Theory of light communication
  - Theory and application of barcodes
  - Using infrared light in security and video systems
  - Electron microscopes vs. optical microscopes
  - Fluorescent and other lighting sources
65. Switching Circuits 6 hours  
Penn Foster Lesson # 086054 Penn Foster Exam # 08605400
- Output conditions for various gate circuits
  - Application of transistors in gate circuits
  - Operation of multi-vibrators and flip-flops
  - Various logic families
  - Application of Boolean algebra in logic circuitry
66. Logic Circuits 6 hours  
Penn Foster Lesson # 086055 Penn Foster Exam # 08605500
- Binary vs. other numbering systems
  - Truth tables
  - Encoders, decoders, and converter circuits
  - Adders, subtracters, and comparators
67. Gating and Counting Circuits 6 hours  
Penn Foster Lesson # 086056 Penn Foster Exam # 08605600
- Arithmetic logic gates
  - Half-adder and full-adder circuits
  - Use of half-adder circuits
  - Decade and binary counters
  - Modulus of a counter
68. Pulse and Digital Circuits 6 hours  
Penn Foster Lesson # 086057 Penn Foster Exam # 08605700
- Characteristics of electronic pulses
  - Time constants in pulse-forming circuits
  - Waveforms for integrating and differentiating circuits using pulse inputs
69. Electronic Devices and Amplification 6 hours  
Penn Foster Lesson # 086045 Penn Foster Exam # 08604500
- Passive and active devices
  - Voltage, current, and impedance relationships in transformers
  - Amplifier gain calculations
  - Converting voltage and power gains to decibels
  - Impedance-matching pad calculations
  - Interfacing single-ended amplifiers to balanced lines, sources, and loads
  - Amplifying device characteristics and applications

70. Audio and RF Circuits 6 hours  
Penn Foster Lesson # 086046 Penn Foster Exam # 08604600
- Measuring sound intensity
  - AM vs. FM transmission
  - Narrow-band FM in industrial applications
  - Coaxial cable vs. copper wire transmission mediums
  - Tone frequencies used in control systems
  - Pushbutton dialing in industrial applications
  - Common-emitter amplifiers
71. Oscillators, Feedback, and Waveforms 6 hours  
Penn Foster Lesson # 086047 Penn Foster Exam # 08604700
- Oscillator operating principles
  - Basic types of oscillators
  - Oscillator feedback techniques
  - Creating various waveforms
  - Phase-locked loop in frequency synthesizers
  - Square wave generation utilizing 555 IC circuit timer/oscillator
72. Electronic Power Supply Systems 6 hours  
Penn Foster Lesson # 086048 Penn Foster Exam # 08604800
- Function of rectifiers
  - Half-wave and full-wave rectifier principles
  - Rectifier circuit output voltages
  - Percent of voltage regulation in a power supply
  - Function of filters and bleeder resistors in power supplies
  - Purpose of a voltage-divider network in a power supply
  - Electronic voltage regulators
  - Common industrial power supplies
73. Industrial Amplification Systems 6 hours  
Penn Foster Lesson # 086058 Penn Foster Exam # 08605800
- Power amplifiers vs. voltage amplifiers
  - Calculating dB gain
  - Characteristics of VMOS, BiFET, Darlington, push-pull, and complementary amplifiers
  - Operational amplifier analysis
  - Amplifier induced noise and distortion
74. Servo and Control Systems 6 hours  
Penn Foster Lesson # 086059 Penn Foster Exam # 08605900
- Functions and components of a servo system
  - Operation of servo systems
  - Applications for servo systems
  - Electronic circuits in servo applications
  - Servo system gain calculations
75. Pulse and Logic Circuits 6 hours  
Penn Foster Lesson # 086060 Penn Foster Exam # 08606000
- Digital vs. analog circuits
  - Slow-speed vs. fast-speed digital circuits



- Binary principles in electronic circuits
  - Types of logic gates
  - Latch and flip-flop circuits
  - Serial and parallel inputs/outputs
76. Introduction to Telecommunications Technology 5 hours  
Penn Foster Lesson #    Penn Foster Exam # 38781900
- Basic communication system components
  - Effect of electrical noise on receivers
  - Thermal noise generated by resistors
  - Amplifier signal-to-noise ratios and noise figures
  - Noise measurement techniques
  - Information, bandwidth, and propagation speed relationships
  - Fourier analysis of non-sinusoidal repetitive waveforms
  - RLC circuit analysis
  - LC and crystal oscillators
77. Amplitude Modulation: Transmission 5 hours  
Penn Foster Lesson #    Penn Foster Exam # 38782000
- Process of modulation
  - AM waveforms and modulation indexes
  - Sideband vs. side frequency
  - Power, voltage, and current calculations in AM systems
  - Basic AM circuits
  - High and low level modulation systems
  - AM transmitter test and maintenance equipment
78. Amplitude Modulation: Reception 5 hours  
Penn Foster Lesson #                      Penn Foster Exam # 38782100
- Receiver selectivity and sensitivity
  - AM receiver diode detectors
  - TRF and superheterodyne receivers
  - Image frequencies and how to suppress them
  - RF and IF amplifiers
  - Implementing Automatic Gain Control
  - Analysis of AM receiver systems
  - Analysis AM receiver stages
79. Single-Sideband Communications 5 hours  
Penn Foster Lesson #    Penn Foster Exam # 38782200
- Single sideband generation
  - Types of SSB and advantages over AM
  - SSB circuits and filters
  - SSB filter designs
  - Demodulation of SSB systems
  - SSB transmitter/receiver block diagrams
  - Frequency processing in SSB receivers
80. Frequency Modulation: Transmission 5 hours  
Penn Foster Lesson # 387905    Penn Foster Exam # 38790500
- Categories of angle modulation
  - Capacitor microphone principles

- FM signal modulation index, sidebands, and power
  - FM noise suppression, capture effect , and pre-emphasis
  - Generating FM signals
  - FM signal generation using phase locked-loop
  - Multiplexing techniques for FM stereo systems
81. Frequency Modulation: Reception 5 hours  
Penn Foster Lesson # Penn Foster Exam # 38782400
- FM vs. AM receivers
  - Slope detector schematics
  - FM discriminator techniques and circuits
  - Utilizing PLL as an FM discriminator
  - Block diagrams for stereo broadcast band receivers
  - LIC applications in stereo decoders
  - FM receiver schematics
82. Telephone Technology 5 hours  
Penn Foster Lesson # 387024 Penn Foster Exam # 38702400
- Components and functions of conventional and electronic telephones and facsimile machines
  - Modem modulation techniques
  - Components and signals of the local loop
  - Telephone system switching mechanisms and hierarchies
  - Telephony multiplexing techniques
  - Cellular and pager systems
83. Communications Techniques 5 hours  
Penn Foster Lesson # Penn Foster Exam # 38782500
- Double conversion and up-conversion
  - Delayed AGC and auxiliary AGC
  - High quality receivers vs. basic receivers
  - Relationships between noise, receiver sensitivity, dynamic range, and 3rd order intercept
  - Troubleshooting receivers with excessive IMD
  - Frequency synthesizers
  - DDS systems vs. analog synthesizers
84. Digital Comm.: Coding Techniques and Transmission 5 hours  
Penn Foster Lesson # Penn Foster Exam # 38782600
- Digital transmission bit error rates
  - ASCII, EBCDIC, Baudot, and Gray codes
  - PCM system operation
  - PCM system quantization processes
  - PCM vs. delta modulation
  - Error detection and correction techniques
85. Network Communications 5 hours  
Penn Foster Lesson # 387906 Penn Foster Exam # 38790600
- Telephone network terminology and operation
  - Cellular phone systems

- Telephone circuit characteristics
  - UART principles of operation
  - Modem principles of operation
  - Network topologies
  - Network protocols
  - Ethernet principles of operation
  - Cellular and PCS phone system operations
86. Transmission Lines 8 hours  
Penn Foster Lesson # Penn Foster Exam # 38781000
- Physical characteristics of standard transmission lines
  - Calculating characteristic impedance, delay factor, and velocity of propagation
  - Wave propagation and reflection analysis
  - Matching loads to transmission lines using a Smith Chart
  - Simulating discrete circuitry using short line sections
  - Troubleshooting line problems using a TDR
87. Wave Propagation and Antennas 8 hours  
Penn Foster Lesson # Penn Foster Exam # 38781100
- Characteristics of electromagnetic waves and isotropic point sources
  - Processes of wave reflection, refraction, and diffraction
  - Ground and space wave propagation and ghosting phenomena
  - Effect of antenna height on effective radio horizon
  - Atmospheric effects upon sky-wave propagation
  - Skip zone and critical angle influences on sky-wave propagation
  - Important aspects of satellite communications
  - SATCOM power budget analysis
  - Hertz antenna development
  - Properties of antenna reciprocity and polarization
  - Antenna performance factors and characteristics
88. Waveguides and Radar 8 hours  
Penn Foster Lesson # Penn Foster Exam # 38781200
- Considerations for ending signals via transmission lines, antennas, and waveguides
  - Basic modes of operation for rectangular waveguides
  - Calculating cutoff wavelength for dominant mode of operation
  - Effects of wavelength and velocity upon waveguide propagation
  - Various types of waveguides
  - Methods of coupling energy into and out of waveguides and cavity resonators
  - Basic components and characteristics of a radar system
  - Doppler radar system capabilities
  - Microstrip and stripline characteristic impedance calculation
89. Microwaves and Lasers 8 hours  
Penn Foster Lesson # 086E03 Penn Foster Exam # 38781300
- Common microwave antenna types
  - Parabolic antenna gain and beamwidth calculations
  - TWT and magnetron microwave tube operation
  - Common microwave semiconductor devices
  - Basic operation and uses of ferrites
  - Operation of parametric and maser low-noise amplifiers

- Basic laser theory of operation
90. Fiber Optics Background Information 5 hours  
Penn Foster Lesson # 086950 Penn Foster Exam # 08695002
- Major components of a fiber optic link
  - Electronics and fiber optics
  - Fiber optics in networks
  - Fiber optics vs. traditional transmission media
91. Characteristics of Fiber Optics 5 hours  
Penn Foster Lesson # 086951 Penn Foster Exam # 08695102
- Types of fiber
  - Dispersion in optical fiber
  - Core diameter vs. performance
  - Optical fiber applications
  - Mode field diameter in single-mode fiber
  - Single-mode fiber profiles
92. Sending and Receiving over Fiber 5 hours  
Penn Foster Lesson # 086952 Penn Foster Exam # 08695202
- Structure of the atom
  - Semiconductor properties
  - Electro-optic device principles of operation
  - LEDs in fiber optic systems
  - Lasers in fiber optic systems
  - Fiber optic system output patterns
  - Light velocity of propagation
  - DFB laser characteristics
  - VCSEL characteristics
93. Fiber Optics Interconnections 5 hours  
Penn Foster Lesson # 086953 Penn Foster Exam # 08695302
- Optical fiber termination and splicing technology
  - Common causes of fiber optic link failures
  - Fiber alignment techniques
  - Techniques used to terminate optical fiber
94. Fiber Optics Systems 5 hours  
Penn Foster Lesson # 086954 Penn Foster Exam # 08695402
- Optical link power budgets
  - Bandwidth/rise-time requirements in optical fiber links
95. Fiber Optics Final 5 hours  
Penn Foster Lesson # 086956 Penn Foster Exam # 08695602
- Final exam covering fiber optics system hardware and cable
96. Troubleshooting Industrial Computer Systems and Software 6 hours  
Penn Foster Lesson # 086068 Penn Foster Exam # 08606800
- Principal parts and types of memory found on a computer motherboard
  - Power supply components and ratings

- Locate the main power supply fuse and identify the type of power supply by its connectors
  - Various types of computer drive systems and their cables
  - Repair and troubleshooting procedures for computer hardware and software problems
  - Optical and RF identification systems-operation and troubleshooting
  - Purpose of vision system hardware and software and the troubleshooting for them
97. Number and Logic Systems 10 hours  
Penn Foster Lesson # 086813 Penn Foster Exam #086918002
- Decimal to binary and binary to decimal conversion
  - Binary to octal and octal to binary conversion
  - Binary to hexadecimal and hexadecimal to binary conversion
  - Decimal to BCD and BCD to decimal conversion
  - Boolean Algebra with OR Gate Application 10 hours Penn Foster Lesson # 086814 Penn Foster Exam # 086918102
  - Reducing Boolean expressions using a Karnaugh map
  - Identifying and using DeMorgan's theorems
  - Writing truth tables for exclusive-OR gates
98. Adders and Collection Gates 10 hours  
Penn Foster Lesson # 086815 Penn Foster Exam # 086918202
- Defining half adders and full adders and drawing block diagrams and truth tables
  - Programming GAL devices
  - Identifying and calculating fan-out and noise margins
  - Using open-collector gates in applications
99. Flip-Flops and Shift Registers 10 hours  
Penn Foster Lesson # 086816 Penn Foster Exam # 086918302
- Types of flip-flops (S-R, master-slave, JK and D)
  - Application of latches in control circuits
  - Configuration of typical IC flip-flops
  - Application of flip-flops in shift registers for serial communication devices
  - ASCII code and RS-232 standards
100. Counting and Timing Circuits and D/A and A/D Conversion 10 hours  
Penn Foster Lesson # 086817 Penn Foster Exam # 086918402
- Understanding and explaining the operation of a variety of binary counters
  - Applications of synchronous and asynchronous counters in frequency dividing
  - Generation and application of clock pulses in computers and digital electronic equipment
101. Digital Electronic Applications 10 hours  
Penn Foster Lesson # 086818 Penn Foster Exam # 086918502
- Operation and function of decoders, multiplexers, and de-multiplexers
  - Operation and application of LEDs and other digital displays
  - Operation and application of gates and other devices with tri-state outputs
  - Using digital outputs to drive high-current transistor interfaces
  - Devices that isolate circuits from each other
  - Applications of various types of memory
  - Basic concepts and structures of microcomputers and microcontrollers

| Supplemental Training Hours |     |
|-----------------------------|-----|
| Year 1                      | 161 |
| Year 2                      | 148 |
| Year 3                      | 144 |
| Year 4                      | 178 |
| Total Hours                 | 631 |

#### K. WAGES

Wage Schedule for Apprentice Communications Technician – See Collective Bargaining Agreement, but should be reflective of prorated portions of the Journeyman wage as outlined in the Parties' Letter of Agreement dated August 31, 2023 (LOA 23-07). The current Journeyman wage scale is outlined in the Collective Bargaining Agreement.

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**Customer Serviceman (Gas)**  
**Program Duration: 2.5 Years (30 Months)**  
Revision Date: 5/23/24

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**A. GENERAL**

The following outline of training programs, courses and study requirements shall constitute an obligation on the part of the Company to provide job training, study materials and study courses as outlined, and to keep records thereon, for all apprentices assigned to the classification of Apprentice Customer Serviceman and shall constitute an obligation on the part of the employees so assigned to participate in the training programs and in the keeping of records of progress as herein outlined.

The Company will furnish a copy of the Supplementary Agreement for Administration of Apprenticeship Programs and this Schedule of Training Hours and Courses to all employees assigned to the classification of Apprentice Customer Serviceman subsequent to the date of this Supplementary Agreement. The Apprentice Customer Serviceman Training Program will consist of two basic parts.

- a. On-the-job training will be provided wherein the employee should learn the practical skills necessary for journeyman status.
- b. Supplementary classroom and home study training should provide the employee with basic knowledge of gas as well as a better understanding of the various types of equipment and procedures with which he/she will be working.

**B. JOB TRAINING PROGRAM**

Work Assignments: Journeymen are responsible for the on-the-job training and Supervision is responsible for the proper rotation of the apprentice's work assignments in order for him/her to get training in all phases of the craft. The responsibility for evaluating the work of the apprentice rests with the immediate Journeyman.

Each apprentice shall be assigned work that will provide him/her experience in all phases of Customer Serviceman field work and emergency response.

During all phases of the apprentice training programs, instruction of proper safety procedures and practices will be provided.

**C. JOB STANDARDS**

Minimum Requirements: In order to provide each apprentice with at least a minimum amount of experience on each of the various types of equipment, upon which the apprentice may be required to work as a Journeyman, he/she should be assigned work and given instructions in amounts meeting or exceeding those shown in the following tabulation:

The following is an outline of the subjects to be covered in the supplementary classroom and home study training:

| <u>Process</u>  | <u>Hours</u> |
|---|--------------|
| Meter Sets  | 1,150        |
| Meter Exchanges                                       | 900          |
| Gas Meter Turn-On                                     | 900          |
| Leak Investigations                                   | 600          |
| Carbon Monoxide Investigation                         | 200          |
| Read/Turn – Off Meter                                 | 100          |
| Smart Meter Module Install/Inspection                 | 250          |
| Other Gas – Revenue Protection, Dial/Lens Replacement | 214          |
| Corrosion Control - Coating inspection/repair         | 100          |
| Customer Hi/Low Pressure Problems                     | 100          |
| <i>Safety</i>   |              |
| Safety / Training                                     | 160          |
| <i>Equipment and Tools</i>                            |              |
| Meter Valve Change-Out Tool                           | 24           |
| Locators  | 30           |
| Combustible Gas Indicator (CGI)                       | 50           |
| Grunsky Bag/Meter Bypass Tool                         | 70           |
| <i>Miscellaneous</i>                                  |              |
| Company Standards                                     | 40           |
| Complete Operator Qualification Evaluations           | 32           |
| Gas Meter Shop  | 32           |
| Ride Along with Gas Pressure Operator/ Leak Surveyor  | 24           |
| Gas Operations Crew Ride Along                        | 24           |
| Total OJT Hours Recommended                           | 5,000        |

### ***First 6 Months***

#### **NGT 1001 3.75 Hours**

Identifying Procedures/Processes Basic to Producing, Transporting, and Distributing Natural Gas  
COURSE DESCRIPTION:

This course presents the major components of a natural gas system from well head to burner. The action that each component has on the gas stream is presented in the context of the total system. Key terms and definitions are reviewed and applied to conditions common to the utilization of natural gas.

#### **NGT 1002 3.75 Hours**

Identifying Basic Properties of Fuel Gases COURSE DESCRIPTION:

This course relates to the chemical and physical properties of fuel gases basic to their unique characteristics. The physical properties of natural gas are discussed in relation to how it reacts to



pressure and/or temperature changes and the condition under which fuel gas is measured to the customer. The chemical properties are discussed in relation to their value as a source of heat. Units of measurement for natural gas are defined.

### **Properties of Gas 7.25 Hours**

American Gas Association – Fundamentals of Gas Combustion – Chapters 1 & 2 COURSE DESCRIPTION:

These chapters deal with the history, use, and development of fuel gas, properties and general characteristics of gasses, chemical composition of fuel gasses, natural gasses, liquefied petroleum gasses, manufactured and mixed gasses, odorant added to gas, specific gravity, and heating value.

### **NGT 1004 22.5 Hours**

Measuring and Regulating Natural Gas in a Distribution System COURSE DESCRIPTION:

This course reviews the principles of operation for direct volume measurement meters and rate-of-flow (inferential) type meters. The operating principles of service regulators are outlined and discussed. Emphasis is placed on the correct reading of dial type meter faces. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **Customer Service 7.25 Hours**

American Gas Association Fundamentals of Customer Service COURSE DESCRIPTION:

During this session the apprentice will be taught how to read a basic gas meter. Customer Service will be dealt with and the following topics discussed: preparing for a day's work; at the customer's premises; telephone contacts; customer visits to company offices and writing to customers.

### **NGT 1005 7.5 Hours**

Performing Calculations Basic to Gas Distribution and Service COURSE DESCRIPTION:

This course begins with instruction on the use of a calculator when working with dimensions given in decimal fractions. Basic calculations are performed for area and volume measurements. Practice problems include calculating the relationship between gas and heating measurements, calculating gas flow using meter index, and free air space. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **NGT 1003 11.25 Hours**

Adjusting Gas Burners for Proper Combustion of Natural Gas COURSE DESCRIPTION:

This course presents the science of gas burner design and factors affecting the proper combustion of fuel gas. Techniques used to measure gas input rates, gas flow and pressure are presented. Practice in troubleshooting causes of improper combustion is required. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **Combustion of Gas 7.25 Hours**

Fundamentals of Gas Combustion by American Gas Association- Chapter 3 COURSE DESCRIPTION:

This chapter covers the following subjects: the meaning of combustion, requirements for combustion, basic chemistry for combustion, controlled combustion, explosive combustion, limits of flammability, burning speed, complete combustion, incomplete combustion (causes and effects), carbon monoxide and testing for carbon monoxide.

**Fundamentals of Gas Controls 7.25 Hours**

American Gas Association – Chapter 1-4 COURSE DESCRIPTION:

These chapters cover the following subjects: controls and their functions, manual control of gas appliances, physical principles used in controls.

**Fundamentals of Gas Controls 7.25 Hours**

American Gas Association – Chapter 5 & 6 COURSE DESCRIPTION:

These chapters cover sensing devices and actuation of controls.

**Fundamentals of Gas Controls 7.25 Hours**

American Gas Association – Chapter 7 & 8 COURSE DESCRIPTION:

These chapters cover automatic controls, thermostats, automatic gas valves, limit controls, gas pressure regulators, combination controls, accessories, and miscellaneous controls and ignition systems, automatic pilots, oxygen-depletion sensing, pilot relight systems and intermittent ignition devices.

**Fundamentals of Gas Controls 7.25 Hours**

American Gas Association – Chapter 9 & 10 COURSE DESCRIPTION:

These chapters deal with the following topics: application to appliances; ranges, automatic water heaters, central heating systems, in-space heating appliances, clothes dryers, refrigerators, incinerators, air conditioners, and special considerations for maintenance and repair of controls; preventative maintenance.

*First Six Months Total Hours: 99.5*

**Second 6 Months****NGT 1601 18.75 Hours**

Identifying Procedures to Consider When Establishing a Gas Service COURSE DESCRIPTION:

This course presents the methods typically used when establishing a gas service. Topics include checking gas piping from the main to the customer's piping, checking gas piping inside buildings and checking gas operated equipment in service. Related skills performance is taught and documented by simulation or at a work site.

**NGT 1701 11.25 Hours**

Placing Gas Operated Appliances into Operation COURSE DESCRIPTION:

This course presents procedures for checking natural gas appliance systems to ensure proper installation and safe operation. Procedures for appliance checks include water heaters, central heating, space heating, cooking appliances and clothes dryers. Pre-lighting and operation check on gas fired equipment after light-up is emphasized.

Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**Water Heating Appliances 7.25 Hours**

Fundamentals of Gas Appliances – American Gas Association Chapter 3 COURSE DESCRIPTION:

This chapter covers the following topics: water heating appliances, storage heaters and instantaneous water heaters, and swimming pool heaters.

### **Introduction and Cooking Appliances 6.75 Hours**

Fundamentals of Gas Appliances – American Gas Association Chapters 1 & 2 COURSE

#### **DESCRIPTION:**

These chapters deal with the following topics: use of heat, use of gas, different kinds of fuel, appliance standards and cooking appliances, domestic cooking and commercial cooking appliances.

### **Space Heating 6.75 Hours**

Fundamentals of Gas Appliances – American Gas Association Chapter 4 COURSE DESCRIPTION:

This chapter discusses the following topics dealing with space heating: room heaters, floor furnaces, wall furnaces, direct vent heaters, central heating equipment, conversion burners, unit heaters, duct heaters, direct-fired make-up air heaters, infrared heaters, construction heaters.

### **Clothes Dryers, Incinerators, Gas Air Conditioning, Misc. Appliances 6.75 Hours**

Fundamentals of Gas Appliances – American Gas Association Chapters 5 - 8 COURSE

#### **DESCRIPTION:**

These chapters discuss and explain clothes dryers, incinerators, domestic incinerators, commercial incinerators, and special purpose incinerators; gas air conditioning and refrigeration; the absorption cycle, gas refrigerators; miscellaneous appliances; outdoor gas grills, decorative appliances, gas lights, recreational vehicle and mobile home appliances, fuel cells.

### **NGT 1702 11.25 Hours**

Inspecting and Servicing Gas Operated Equipment to Ensure Proper Venting and Ventilation Air

#### **COURSE DESCRIPTION:**

This course presents the theory and operation of natural draft venting and ventilation air systems. Focus is placed on the standards that are listed in the National Fuel Gas Code ANSI Z223.1 (NFPA #54). Inspection of gas operated equipment to ensure proper ventilation is emphasized. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **Fundamentals of Gas Appliance Venting and Ventilation 6.75 Hours**

American Gas Association COURSE DESCRIPTION:

This section covers the history of venting and ventilation, the purpose of gas appliance venting and ventilation, basic theory of venting system operation, types of gas vents, venting systems, code requirements for venting, vent sizing and design, air for combustion and ventilation, installation of vents, venting high efficiency gas appliances and troubleshooting.

### **NGT 1703 18.75 Hours**

Venting High Efficiency Gas Operated Equipment Proper Venting and Ventilation Air COURSE

#### **DESCRIPTION:**

Venting requirements for Categories I through IV gas operated appliances are presented based on their unique designs. The features and benefits of high efficiency gas operated equipment are identified. Practice in the sizing of vents for fan assisted appliances is provided. Practice in inspecting venting systems is required. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **NGT 1006 11.25 Hours**

Maintaining Records and Filing Reports of Compliance COURSE DESCRIPTION:

This course focuses on accuracy and complete information in field reports which document company-wide summary reports. Practice on company map reading, sketching of piping installations and

above-ground piping facilities is emphasized. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1603 6.75 Hours**

Installing and Maintaining Domestic Gas Meters and Regulator Sets and Service Lines COURSE DESCRIPTION:

This course presents U.S. Department of Transportation (D.O.T.) standards and industry recognized procedures for installing domestic gas service lines, and meter and regulator sets. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

*Second Six Months Total Hours: 112.25*

***Third 6 Months***

**NGT 1101 6.75 Hours**

Controlling/Preventing Fires Fueled by Natural Gas COURSE DESCRIPTION:

Factors are identified relating to extinguishing fires fueled by natural gas. Emphasis is placed on ways to prevent natural gas fires by eliminating ignition sources. Various classifications of fire extinguishing agents and their intended use are presented.

Techniques used to extinguish natural gas fires are demonstrated on a fire ground and practiced by the participants in the course. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1102 18.75 Hours**

Maintaining a Safe Working Environment COURSE DESCRIPTION:

This course is an overview of safety practices that prevent personal injury as well as property damage at the worksite. Proper use of major equipment is stressed.

Hazards resulting from escaping gas are emphasized. Also, the basis for the drug testing and alcohol misuse program is explained. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1103 15 Hours**

Prevent Accidental Ignition COURSE DESCRIPTION:

This course presents safety practices and procedures used to prevent accidental ignition of natural gas. Areas of emphasis are electrical arcing, welding, cutting, and other hot work, isolating pipeline segments, and isolating gas-handling facilities.

**NGT 1104 11.25 Hours**

Identifying the Fundamental Guidelines for Traffic Control in Work Zones COURSE DESCRIPTION:

This course presents the basic standard for traffic control as described in the manual on Uniform Traffic Control Devices, Part VI According to the U.S. Department of Transportation.

**NGT 1501 7.25 Hours**

Detecting the Presence and Measuring the Percent of Gas in a Gas-in-Air Mixture COURSE DESCRIPTION:

This course focuses on the principles of operations and application of combustible gas indicators. Covered is the application CGIs equipped with catalytic and thermal conductor sensors, semiconductor sensors and flame ionization sensors.

**NGT 1502 11.25 Hours**

Investigating Reported Gas Leaks and Odors in Buildings COURSE DESCRIPTION:

This course provides information and practice on the techniques of gas pipeline patrolling and leakage survey. The proper use of gas detectors and line locators are emphasized and practiced in the field. Accepted methods of leak survey are presented with emphasis on field practices. Hazards and symptoms of the presence of gas in the atmosphere are identified and safety precautions emphasized. Field practice doing patrol and leakage surveys is required.

**NGT 1504 11.25 Hours**

Investigating and Pinpointing Underground Natural Gas Leaks COURSE DESCRIPTION:

This course presents the theory and practice for using proper techniques and procedures when investigating and pinpointing natural gas leaks.

**NGT 1251 15 Hours**

Maintaining Compliance with the National Fuel Gas Code NFPA 54 COURSE DESCRIPTION:

This course presents information contained in the National Fuel Gas Code ANSI Z223.1. This code is a safety code that applies to the installation of fuel gas piping systems. The interpretation and application of this code in situations common to the natural gas industry is emphasized. Exercises involving the application of code references are a major part of the course.

**NGT 1301 15 Hours**

Maintaining Compliance with 49 Code of Federal Regulations (CFR), Part 192 COURSE DESCRIPTION:

This course is a survey of the criteria for the installation, maintenance and inspection of gas pipelines up to the outlet of the customer's meter. Key terms and definitions are reviewed and applied to issues common to the installation, maintenance and inspection of gas transportation pipelines. Emphasis is given to the identification of content contained in each subpart of 49 CFR. 192 identifying general provisions of the regulations. Identifying selected requirement basis to the operations of natural gas distribution systems.

**NGT 1404 11.25 Hours**

Communicating Potential Hazards in the Workplace COURSE DESCRIPTION:

A study of health related and explosive hazards associated with the natural gas industry are examined. The use of material safety data sheets (MSDS) is emphasized to protect persons against toxic chemical and hazardous materials.

**NGT 1506 3.75 Hours**

Investigating for Carbon Monoxide COURSE DESCRIPTION:

This course provides information and practice on the techniques of gas pipeline patrolling and leakage survey. The proper use of gas detectors and line locators are emphasized and practiced in the field. Accepted methods of leak survey are presented with emphasis on field practices. Hazards

and symptoms of the presence of gas in the atmosphere are identified and safety precautions emphasized. Field practice doing patrol and leakage surveys is required.

*Third Six Months Total Hours: 126.5*

#### ***Fourth 6 Months***

##### **NGT 2051 11.25 Hours**

Identifying Processes and Procedures Basic to Corrosion Control COURSE DESCRIPTION:

This course presents the electrochemical process that causes corrosion on buried metals, and the conditions that support this process. Methods used to control the corrosion process are described and illustrated. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

##### **NGT 1602 4.75 Hours**

Monitoring Odorant Levels COURSE DESCRIPTION:

This course presents the federal standards for proper odorant levels. Operating instruction for an odorometer and odorator are discussed. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

##### **NGT 2003 3.75 Hours**

Identifying Techniques Common to Purging Natural Gas Distribution Pipelines COURSE DESCRIPTION:

This course presents the theory and techniques common to purging natural gas lines. Topics include the isolation of equipment during the purging operation and procedures for purging air or gas from a section of pipeline. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

##### **NGT 1704 3.75 Hours**

Identifying Electrical Concepts Basic to Appliance Service COURSE DESCRIPTION:

This course presents the basics for troubleshooting electrical control circuits in gas operated appliances. Circuit components and their function in an electrical circuit are identified. The reading of electrical circuit diagram (ladder diagram) is practiced and their physical arrangements in the appliance are identified. Troubleshooting techniques are emphasized. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

##### **Historical Background of Electricity 3.75 Hours**

Fundamentals of Electricity – American Gas Association Chapters 1 - 3 COURSE DESCRIPTION:

This class will provide the apprentice with a basic historical background about the discovery of electricity and how it is used to improve everyday life.

##### **Electrical Relationships 3.75 Hours**

Fundamentals of Electricity – American Gas Association Chapters 4 - 6 COURSE DESCRIPTION:

This class will provide the apprentice with a basic background about Ohm's Law, Watt's Law and various circuits.

**Electrical Relationships 3.75 Hours**

Fundamentals of Electricity – American Gas Association Chapters 7 - 10 COURSE DESCRIPTION:  
This class will provide the apprentice with a basic background about Circuit Diagrams and Test Equipment.

**Gas Burners, Design, and Operation 3.75 Hours**

Fundamentals of Gas Combustion by American Gas Association – Chapter 4 COURSE DESCRIPTION:

This chapter deals with luminous or yellow flame burners, blue flame burners, primary air, secondary air, excess air, flame appearance and stability, lifting burner flames, flashback, yellow tipping of flames, effects of combustion air flow rates on appliance efficiency, control of combustion air flow, calculation of excess air percentage, impingement of burner flames on cool surfaces, typical appliance burners, gas orifice, air shutter, venturi throat mixing, tube, burner head, burner ports, operations of burners, atmospheric burners, power burners, force and induced draft burners, premixing and pressure power burners, appliance burner designs, drilled port burners, slotted port burners, ribbon port burners, single port or monoport burners, infrared radiant burners, jet burners, impingement target burners, pilot burners, primary aerated pilot burners, non-primary aerated pilot burners.

**Burner Orifices 3.75 Hours**

Fundamentals of Gas Combustion by American Gas Association – Chapter 5 COURSE DESCRIPTION:

This chapter illustrates the types of orifices; fixed, adjustable, universal, office discharge; coefficient, measuring gas input rates, measuring gas flow, measuring gas pressure, sizing for orifices for desired gas flow rates, sizing inputs by flame spread method and compensation for altitude on setting inputs.

**Burner Problems 3.75 Hours**

Fundamentals of Gas Combustion – American Gas Association Chapter 7 COURSE DESCRIPTION:  
This chapter discusses burner problems, lifting flames, flashback, extinction pop, yellow tipping, fluctuating flames, unstable or wavering flames, floating flames, flame rollout, gas odor at primary air openings and corrosion of appliances.

*Fourth Six Months Hours: 46*

***Fifth 6 Months*****High Efficiency Appliances 6.75 Hours**

Fundamentals of Gas Appliances – American Gas Association Chapter 9 COURSE DESCRIPTION:  
This chapter deals with high efficiency appliances categorization, vent materials, and condensate disposal.

**Customer Serviceman Procedures Manual Chapters 1-6 3.75 Hours**

COURSE DESCRIPTION:

This class will utilize the customer serviceman procedures manual and will discuss the subjects in chapters 1 – 6.

### **Customer Serviceman Procedures Manual Chapters 7-12 3.75 Hours**

#### **COURSE DESCRIPTION:**

This class will utilize the customer serviceman procedures manual and will discuss the subjects in chapters 7 – 12.

### **Customer Serviceman Procedures Manual Chapters 13-21 3.75 Hours**

#### **COURSE DESCRIPTION:**

This class will utilize the customer serviceman procedures manual and will discuss the subjects in chapters 13 – 21.

### **NGT 2053 11.25 Hours**

#### **Monitoring/Testing Corrosion Control Systems COURSE DESCRIPTION:**

This course presents factors basic to monitoring/testing cathodically protected pipelines, testing procedures for pipe-to-soil surveys, testing for shorted insulating joints, shorted casings, and evidence of atmospheric corrosion. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **NGT 2054 11.25 Hours**

#### **Monitoring Corrosion Control Methods Used on Buried Metal Pipelines COURSE DESCRIPTION:**

This course presents information and techniques for monitoring corrosion control methods. The focus is on the application of techniques used to monitor corrosion control methods in the field. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **NGT 2305 11.25 Hours**

#### **Regulating Gas Pressure in Piping Systems with Self Operating Regulators COURSE DESCRIPTION:**

This course presents the concepts and principals basic to the operation of pressure regulator installations. The content focuses on the operating characteristics of self- operating pressure regulator installations. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **NGT 2402 11.25 Hours**

#### **Controlling Gas Pressure with Pilot Loaded Regulators COURSE DESCRIPTION:**

This course presents the concepts and principals basic to the operation of pressure regulator installations. The content focuses on the operating characteristics of pilot loaded regulators.

### **NGT 2403 11.25 Hours**

#### **Inspect and Test Pressure Limit Stations, Relief Devises and Pressure Regulating Stations COURSE DESCRIPTION:**

This course presents the concepts and principals basic to operating pressure limiting and regulating stations. Procedures for inspecting and testing above ground structures are reviewed. Relief valve testing is demonstrated.

### **Standards Volume 15, Section 6 (NV Energy) 4 Hours**

#### **COURSE DESCRIPTION:**

This class will discuss and review NV Energy's' Volume 15, Section 6. Areas that will be discussed are gas-metering guidelines, gas metering locations, gas meter capacity table, gas service capacity table, gas meter guard post detail, and mobile home service requirements.



## **Operations and Maintenance Manual 16 Hours Sections A-M (excluding K) (NV Energy)**

### **COURSE DESCRIPTION:**

This class will discuss and review NV Energy's Gas Operations and Maintenance Manual, Sections A-M (excluding K). Areas that will be discussed include reporting safety-related conditions, petroleum gas systems, conversion to service, material and manufacturing requirements, pipe design, pipeline component design, welding steel pipelines, joining non-steel pipelines, general construction, meter and service facilities, corrosion control, test requirements, operations and maintenance.

*Fifth Six Months Total Hours: 94.25*

### **Approximate Total Program Hours: 478.5**

Note: The Lab Hours for the above Modules will be accomplished as the Process OJT hours are completed and through Classroom training.

Subsequent edition/volume changes of textbooks are approved for use through the discretion of the program.

### **Wages**

Wage Schedule for Apprentice Communications Technician – See Collective Bargaining Agreement, but should be reflective of prorated portions of the Journeyman wage as outlined in the Parties' Letter of Agreement dated August 31, 2023 (LOA 23-07). The current Journeyman wage scale is outlined in the Collective Bargaining Agreement.

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**Substation Electrician**  
**Program Duration: 4 Years (48 Months)**  
Revision Date: 2/22/24

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The following is an outline of the subjects to be covered in the supplementary classroom and home study training:

| <u>Process</u>                     | <u>Hours</u> |
|------------------------------------|--------------|
| Breakers                           | 840          |
| Transformers                       | 850          |
| Regulators/LTC                     | 300          |
| Relays                             | 40           |
| Batteries                          | 100          |
| Motor Operators                    | 50           |
| Transformer Shop                   | 40           |
| Misc. Repair & Maintenance         | 740          |
| Training                           | 250          |
| Maintenance/Repair                 | Total 3210   |
| General                            | 600          |
| Breakers                           | 1000         |
| Transformers                       | 800          |
| Regulators/LTC                     | 150          |
| Switches                           | 640          |
| Wiring                             | 1200         |
| Misc. Construction                 | 400          |
| Construction                       | Total 4790   |
| Classroom Training & Home Study    | 800          |
| Total OJT Hours Recommended: 8,000 |              |

**Step 1 (Months 1 thru 6)**  
**Safety, Training, Math, Prints & Tools**  
**Total Hours for Step 1 = 96**

| Topic                               | Material   | Hours |
|-------------------------------------|--|-------|
| Safety, Training, and Print Reading | NJATC Substation course year 1, Level 1, corresponding NJATC material;<br>NVE Safety Manual;<br>NVE one-line prints, switching diagrams<br>Apprentice expectations form List of tools<br>IBEW 1245 contract<br>Joint apprentice agreement contract | 32    |

**Lesson:**

- Review Apprentice expectations and list of tools
- Introduction to IBEW 1245 contract
- Introduction and review of the Joint Apprentice agreement contract
- Review applicable sections on the NV Energy Safety Manual
- Substation Entry Training Class
- Generation tour (origin of power in our system)
- Transmission and Distribution system voltages, basic electricity (Ohm's Law)
- Substation specific tools and materials
- Introduction to substation equipment, components and basic function
- Identify equipment and very basic relaying/protection and ANSI device numbers

| Topic                   | Material   | Hours |
|-------------------------|--|-------|
| Mathematics chapter 1-4 | Building a Foundation in Mathematics, NJATC courses, and books | 16    |

**Lesson:**

- Chapter 1 – Whole Numbers
- Chapter 2 – Fractions
- Chapter 3 – Decimals
- Chapter 4 – Integers

| Topic                   | Material   | Hours |
|-------------------------|--|-------|
| Mathematics chapter 5-7 | Building a Foundation in Mathematics, NJATC courses, and books | 16    |

**Lesson:**

- Chapter 5 – Rational Numbers
- Chapter 6 – Exponents
- Chapter 7 – Logarithms

| Topic                    | Material   | Hours |
|--------------------------|--|-------|
| Mathematics chapter 8-10 | Building a Foundation in Mathematics, NJATC courses, and books | 16    |

**Lesson:**

- Chapter 8 – Units and Measurements
- Chapter 9 – Algebra Essentials
- Chapter 10 – Equations, Formulas, and Inequalities

| Topic  | Material  | Hours |
|--|---|-------|
| Step One Progression Test Inspect tool bag that they have purchased full tool list | Syllabus all materials gone over in months 1-5 (safety, one lines, basic utility, math 1-10), List of tools | 16    |

**Lesson:**

- Review and preparation for progression test
- Tool bag inspection

**Step 2 (Months 7 thru 12)**  
**Math, Knot Tying/Rigging & Conduit Bending**  
**Total Hours for Step 2 = 96**

| Topic                     | Material   | Hours |
|---------------------------|--|-------|
| Mathematics chapter 11-13 | Building a Foundation in Mathematics, NJATC courses, and books | 16    |

**Lesson:**

- Chapter 11 – Ratios, Rates, and Proportions
- Chapter 12 – Percents
- Chapter 13 – The Cartesian Plane

| Topic                     | Material   | Hours |
|---------------------------|--|-------|
| Mathematics chapter 14-16 | Building a Foundation in Mathematics, NJATC courses, and books | 16    |

**Lesson:**

- Chapter 14 – Systems of Equations
- Chapter 15 – Plane Geometry
- Chapter 16 – Solid Geometry

| Topic                     | Material   | Hours |
|---------------------------|--|-------|
| Mathematics chapter 17-20 | Building a Foundation in Mathematics, NJATC courses, and books | 16    |

**Lesson:**

- Chapter 17 – Trigonometry
- Chapter 18 – Vectors
- Chapter 19 – Binary, Octal, and Hexadecimal Numbers
- Chapter 20 – Boolean Algebra Fundamentals

| Topic                  | Material  | Hours |
|------------------------|---|-------|
| Knot Tying and Rigging | Rigging and Lifting Principles<br>NJATC course, books<br>IBEW – Knot Tying and Rigging Workshop | 16    |

**Lesson:**

- Hands on workshop and practicing knot tying

| Topic           | Material                      | Hours |
|-----------------|-------------------------------|-------|
| Conduit Bending | NJATC course, books, workshop | 16    |

**Lesson:**

- Hands on workshop and practicing conduit bending.

| Topic                     | Material  | Hours |
|---------------------------|---|-------|
| Step Two Progression Test | Syllabus all materials gone over in months 7-11 (Math 11-20, Knot tying rigging, Conduit Bending) | 16    |

**Lesson:**

- Review and preparation progression test

**Step 3 (Months 13 thru 18)  
DC Theory, Batteries Total  
Hours Step 3 = 96**

| Topic         | Material  | Hours |
|---------------|---|-------|
| Print Reading | Three-line diagrams, Wiring diagrams, ANSI device numbers, NVE standards, breaker schematic | 8     |

**Lesson:**

- In-depth print reading, review NVE standards, complex prints.

| Topic               | Material  | Hours |
|---------------------|---|-------|
| DC Theory Level 1-2 | DC theory courses 1 and 2 with textbook and corresponding NJATC Blended Learning Courses/Material | 8     |

**Lesson:**

- Electrical Energy Sources
- Electrical Switches
- DC Series Circuits
- Test Instruments

| Topic             | Material  | Hours |
|-------------------|---|-------|
| DC Theory Level 3 | DC theory courses 3 with textbook and corresponding NJATC Blended Learning Courses/Material | 16    |

**Lesson:**

- How Current Reacts in DC Parallel Circuits – Ch. 5
- Understanding Resistance in DC Parallel Circuits – Ch. 5
- Working with Ratios and Proportion
- How Voltage Functions in DC Parallel Circuits – Ch. 5
- How to Calculate Power in DC Parallel Circuits – Ch. 5

| Topic             | Material  | Hours |
|-------------------|---|-------|
| DC Theory Level 4 | DC theory courses 4 with textbook and corresponding NJATC Blended Learning Courses/Material | 16    |

**Lesson:**

- Understanding Resistance in DC Combination Circuits – Ch. 6
- How Current Reacts in DC Combination Circuits – Ch. 6
- How Voltage Functions in DC Combination Circuits – Ch. 6
- How to Calculate Power in DC Combination Circuits – Ch. 6
- How Voltage and Current Dividers Work – Ch. 7
- The Design and Operation of the 3-Wire, Single-Phase System

| Topic             | Material  | Hours |
|-------------------|---|-------|
| DC Theory Level 5 | DC theory courses 5 with textbook and corresponding NJATC Blended Learning Courses/Material | 16    |

**Lesson:**

- Applying the Principle of Superposition to Circuit Calculations – Ch. 7
- Kirchhoff's Laws – Ch. 7
- Thevenin's and Norton's Theorems – Ch. 7

- Understanding Principles of Magnetism – Ch. 8
- Understanding the Principles of Electromagnetism – Ch. 9
- DC Generators and Motors – Ch. 10

| Topic              | Material   | Hours |
|--------------------|--|-------|
| Substation Battery | Troubleshooting, setting up battery alarms, using test equipment, circuit board training | 16    |

### **Lesson:**

**Substation DC Control System Overview** – Defines a battery and describes its purpose in a typical substation. Identifies the main components of a substation DC control system. Describes a basic DC control system arrangement. Describes the principles of operation for a typical DC control system.

**Cell Components and Electrochemical Action** – Lists the basic components of a lead-acid cell. Describes the electrochemical action in a cell that is charging, and a cell that is discharging. Identifies specific physical indications of problems in a cell and explains their causes.

**Cell and Battery Ratings** – Describes the voltage rating for a typical cell at full charge and at full discharge. Identifies the voltage for a given fully charged battery. Explains a cell's capacity rating. Identifies the capacity rating for a given fully charged battery. Defines specific gravity and identifies the specific gravity for a typical fully charged cell. Briefly describes the relationship of cell capacity, voltage, and specific gravity during discharge and during recharge.

**Battery Inspection** – Lists the protective equipment and safety precautions typically associated with working on substation batteries. Describes typical visual battery inspection checks. Explains why it is important to keep good battery maintenance records. Describes a typical station battery report form.

**Charger Functions and Components** – Describes the functions of a typical substation battery charger. Lists the common components of battery chargers and describe the function of each.

**DC Control System** – Describes the layout of a typical DC control system. Describes the principles of how a DC control system works.

**Freshening Charge** – Defines freshening charge and describes the basic steps for applying a freshening charge. Explains when a freshening charge is applied to a battery.

**Float and Equalizing Charges** – Defines float charge and equalizing charge. Explains when each of the two charges is applied to a battery. Describes the basic steps for applying each of the two charges.

**Charger Inspection and Adjustment** – Describes common charger inspection and adjustment steps

| Topic                     | Material   | Hours |
|---------------------------|--|-------|
| Step Two Progression Test | Syllabus all materials gone over in months 13-17 (All of DC and batteries, workshop) | 16    |

**Lesson:**

- Review and preparation for progression test.

**Step 4 (Months 19 thru 24)****AC Theory****Total Hours Step 4 = 96**

| Topic         | Material  | Hours |
|---------------|---|-------|
| DC schematics | Breaker schematics, Transformer schematics, Protection schematics | 16    |

**Lesson:**

- Understanding NV Energy control print for substation apparatus

| Topic             | Material  | Hours |
|-------------------|---|-------|
| AC Theory Level 1 | AC theory courses 1 chapters 3-6, 8, 9 in the textbook and workbook | 16    |

**Lesson:**

- Understanding Inductance and How It Affects a Circuit – Ch. 3 and 4
- Working with Inductors that are in Series and/or Parallel – Ch. 4 and 8
- Becoming Familiar with Inductive Reactance – Ch. 3
- Understanding Capacitance and How it Affects a Circuit – Ch. 5
- Understanding and Working Safely with Capacitors – Ch. 5
- Working with Capacitors that are in Series and/or Parallel – Ch. 6 and 9
- Becoming Familiar with Capacitive Reactance – Ch. 5

| Topic             | Material  | Hours |
|-------------------|---|-------|
| AC Theory Level 2 | AC theory courses 1 chapters 3-6, 8, 9 in the textbook and workbook | 16    |

**Lesson:**

- Comprehending the Parameters of Series RL Circuits – Ch. 4
- Comprehending the Parameters of RC Circuits – Ch. 6
- Comprehending and Analyzing Series RLC Circuits – Ch. 7
- Understanding and Working with Parallel RL Circuits – Ch. 8
- Understanding and Working with Parallel RC Circuits – Ch. 9
- Comprehending and Analyzing Parallel RLC Circuits – Ch. 10
- Identifying and Working with LC Circuits – Ch. 7 and 10
- Comparing Series and Parallel RLC Circuits – Ch. 7 and 10
- Analyzing and Working with Combination RLC Circuits – Ch. 11



| Topic             | Material   | Hours |
|-------------------|--|-------|
| AC Theory Level 3 | AC theory courses 3 Repeat chapters 7, 10, Chapter 11, different book "test instruments and applications, Chapters 1-2, 13 textbook and workbook | 16    |

**Lesson:**

- Power Factor – Ch. 11
- Power Factor Correction – Ch. 11
- General Use Test Instruments – Test Instruments and Applications Textbook Ch. 2
- Introduction to Generators – Ch. 1 and 2
- Understanding How the DC Generator Works – Ch. 13
- Understanding the Design and Function of AC Generators – Ch. 13

| • Topic              | Material  | Hours |
|----------------------|---|-------|
| AC Theory chapter 14 | AC theory chapter 14 with textbook and workbook | 16    |

**Lesson:**

- AC Theory -Ch 14

| Topic                     | Material  | Hours |
|---------------------------|---|-------|
| Step Two Progression Test | Syllabus all materials gone over in months 7-11 (Math 11-20, Knot tying rigging, Conduit Bending) | 16    |

**Lesson:**

- Review and preparation for top out test.

**Lesson:**

**Using a Voltage Tester** – States the main purpose of a voltage tester. Names the parts of a voltage tester and explains how a voltage tester works. Lists the steps required to check out a voltage tester and explains why it is necessary to check out a voltage tester before each use. Shows how to use a voltage tester.

**Meter Principles** – Lists the two general ways in which meters are classified. Describes the functions of a multimeter, a clamp-on ammeter, and a megohmmeter. Explains how a permanent magnet moving coil (PMMC) meter movement works. Shows how a current measuring device can also be used to measure voltage and resistance.

**Using a Multimeter, Part 1** – Identifies the switches, jacks, and scales on a typical multimeter. Demonstrates how to measure resistance and DC voltage using a multimeter.

**Using a Multimeter, Part 2** – Demonstrates how a multimeter is used to measure DC current and AC voltage.

**Using a Clamp-On Ammeter** – Identifies the parts and features of a clamp-on ammeter. Explains how the scales on a clamp-on ammeter are read. Demonstrates how to use a clamp-on ammeter to measure current.

**Using a Megohmmeter** – Demonstrates how to operate a megohmmeter. Identifies some of the factors that affect how much resistance insulation has.

**Lesson:**

**Introduction to Circuit Breakers** – Describes the main functions of a circuit breaker. Explains why arcs must be extinguished quickly. Describes the role of each of the following factors in extinguishing an arc in a circuit breaker: speed, distance, cooling, dielectric strength, zero current. Identifies four mediums commonly used in circuit breakers to help extinguish arcs.

**Air-Magnetic and Air-Blast Circuit Breakers** – Identifies the main arc extinguishing features of a typical air-magnetic circuit breaker. Explains how the arc extinguishing features in an air-magnetic circuit breaker work to extinguish arcs. Identifies the main arc extinguishing features of a typical air-blast circuit breaker. Describes how the arc extinguishing features in an air-blast circuit breaker work to extinguish arcs.

**Oil and Vacuum Circuit Breakers** – Identifies the main arc extinguishing features of a typical oil circuit breaker. Explains how the arc extinguishing features in an oil circuit breaker work to extinguish arcs. Identifies the main arc extinguishing features of a typical vacuum circuit breaker. Shows how the arc extinguishing features in a vacuum circuit breaker work to extinguish arcs.

**Gas-Blast and Gas-Puffer Breakers** – Identifies the main arc extinguishing features of a typical gas-blast circuit breaker. Explains how the arc extinguishing features in a gas-blast circuit breaker work to extinguish arcs. Identifies the main arc extinguishing features of a typical gas-puffer circuit breaker. Shows how the arc extinguishing features in a gas-puffer circuit breaker work to extinguish arcs.

**Solenoid and Motor/Spring Operating Mechanisms** – Identifies the main features of a typical solenoid circuit breaker operating mechanism. Explains how a solenoid operating mechanism works to operate a breaker. Identifies the main features of a typical motor/spring circuit breaker operating mechanism. Shows how a motor/spring operating mechanism works to operate a breaker.

**Pneumatic and Hydraulic Operating Mechanisms** – Identifies the main features of a typical pneumatic circuit breaker operating mechanism. Explains how a pneumatic operating mechanism works to operate a breaker. Identifies the main features of a typical hydraulic circuit breaker operating mechanism. Shows how a hydraulic operating mechanism works to operate a breaker.

**Lesson:**

**General Circuit Breaker Maintenance** – Describes routine circuit breaker status checks. Describes the purpose of isolating a breaker from its operating mechanism. Shows how to service circuit breaker components.

**Operating Mechanism Maintenance, Part 1** – Describes general maintenance checks for circuit breaker operating mechanisms. Describes maintenance checks for solenoid and motor/spring operating mechanisms.

**Operating Mechanism Maintenance, Part 2** – Describes maintenance checks for pneumatic and hydraulic operating mechanisms.

**Air-Magnetic and Vacuum Breaker Maintenance** – Describes maintenance tasks that apply specifically to air-magnetic breakers. Describes maintenance tasks that apply to vacuum breakers.

**Oil Circuit Breaker Maintenance** – Describes maintenance tasks specific to oil circuit breakers.

**Gas-Blast and Air-Blast Breaker Maintenance** – Describes maintenance tasks that apply specifically to gas-blast breakers. Describes maintenance tasks that apply to air- blast breakers.

**Properties of SF6** – Describes the physical characteristics of SF6. Describes the effects of heat and moisture on SF6. Describes the potential hazards associated with SF6 and its decomposition products.

**Personal Protection** – Describes methods for minimizing the creation of SF6 decomposition products. Describes equipment that may protect personnel from exposure to SF6 and its decomposition products. Describes the treatment recommended for personnel exposed to SF6 or its decomposition products.

**Handling SF6 Gas and its Decomposition Products** – Describes the generally recommended procedures for removing SF6 gas and solid decomposition products from gas-insulated equipment during routine maintenance or access. Describes generally recommended procedures for removing SF6 gas and solid decomposition products after a fault.

| Topic   | Material  | Hours |
|---|---|-------|
| Circuit breakers print reading, ANSI device numbers | NV Energy Manufacturer's Schematics, Wiring Diagrams, Nameplates, and Assembly Drawings | 16    |

**Lesson:**

- Students will be instructed on how to read NV Energy manufacture's schematics, wiring diagrams, nameplates and assembly drawings. Students will also review ANSI device numbers.

| Topic     | Material                         | Hours |
|-----------|----------------------------------|-------|
| Reclosers | Manufacturer's Instruction Books | 16    |

**Lesson:**

- Students will be instructed on the operation of reclosers and their controls. Recloser classes will include all types of reclosers and controls used at NV Energy (North). Manufacturers' manuals and videos will be utilized for this training

| Topic | Material | Hours |
|-------|----------|-------|
|-------|----------|-------|

|                                |                                 |    |
|--------------------------------|---------------------------------|----|
| Circuit breaker test equipment | Manufacture's Instruction Books | 16 |
|--------------------------------|---------------------------------|----|

**Lesson:**

- Students will learn the function and use of various circuit breaker test equipment. This will include motion analyzers, contact resistance meters, oil testers, trip profile testers, dew point testers.

| Topic                  | Material  | Hours |
|------------------------|---|-------|
| Knot Tying and Rigging | Rigging and Lift Principles NJATC Textbook and Workbook<br>IBEW –Knot Tying and Rigging | 16    |

**Lesson:**

- The student is introduced to the fundamental concepts involved in preparing and lifting loads and how to properly tie common knots used in the electrical trades.

| Topic                      | Material                           | Hours |
|----------------------------|------------------------------------|-------|
| Step Four Progression Test | All materials used in months 19-24 | 5     |

**Lesson:**

- Preparation for Step 4 progression test.

**Step 5 (Months 25 thru 30)**  
**Transformers, voltage regulators**  
**Total Hours Step 5 = 96**

| Topic                 | Material                                 | Hours |
|-----------------------|--|-------|
| Transformers, Level 1 | NJATC course, textbook Chapters 1-2, 4-6 | 16    |

**Lesson:**

- Magnetism and Electromagnetism – Ch. 1
- Transformers Operation Principles – Ch. 2
- Transformer Connections – Ch. 4
- Real World Transformer Connections – Ch. 4
- Harmonics – Ch. 5
- Power Generation and Distribution – Ch. 6

| Topic   | Material                            | Hours |
|---|-------------------------------------|-------|
| Transformers, Level 2, Doble DTA training, TTR, the Baron | NJATC course, textbook Chapters 7-8 | 16    |

**Lesson:**

- Reactors and Isolation Transformers – Ch. 7
- Autotransformers – Ch. 8
- Buck-Boost Transformers – Ch. 9
- Understanding Transformer Overcurrent Protection – Ch. 10
- Transformer Overcurrent Protection with Associated Tap Rules – Ch. 10
- Field Class training on Surge arrestors and SFRA

| Topic                 | Material                                 | Hours |
|-----------------------|--|-------|
| Transformers, Level 3 | NJATC course, textbook Chapters 3, 10-12 | 16    |

**Lesson:**

- Electrical Safety – Ch. 3
- Special Transformers – Ch. 10
- Special Connections – Ch. 11
- Selection and Installation – Ch. 12
- Maintenance and Troubleshooting – Ch. 13

| Topic               | Material  | Hours |
|---------------------|---|-------|
| Regulators and LTCs | Siemens and Cooper, Reinhausen, Manufacturer drawings, factory rep, Hands-on training | 16    |

**Lesson:**

- Review drawings, regulator theory, regulator troubleshooting and repairs/maintenance. Regulator operation. Regulator controllers and settings. Review switching procedures.

**Lesson:**

**Voltage Regulator Operation, Part 1** – Describes the function of a voltage regulator. Identifies the main components that enable an induction voltage regulator to adjust voltage.

**Voltage Regulator Operation, Part 2** – Describes how a step voltage regulator adjusts voltage.

**Voltage Regulator Control, Part 1** – Describes the function of a voltage detector and explains how it works. Describes the function of a line drop compensator and explains how it works.

**Voltage Regulator Control, Part 2** – Describes the function of these components of a voltage regulator: time delay, limit switches, voltage reduction control, and first-house voltage protector.

**Field Inspection** – Describes common inspection steps typically performed on a voltage regulator.

| Topic                     | Material  | Hours |
|---------------------------|---|-------|
| Transformer Print Reading | NVE manufacturer schematics, wiring diagrams, nameplates, and assembly drawings (need more material), schematics LTC and Regulators | 16    |

### **Lesson: Review Transformer and LTC prints**

**Tap Changers** – Explains what a tap changer is. States the function of a no-load tap changer and briefly describes how a typical no-load tap changer works. States the function of a load tap changer and briefly describes how a typical load tap changer works.

**Tap Changer Maintenance** – Identifies the steps for de-energizing, isolating, and grounding a power transformer. Lists the items typically included in a maintenance check of the physical condition of a load tap changer. Lists the items typically included in a maintenance check of the mechanical operation of a load tap changer. Lists the items typically included in a maintenance check of the electrical operation of a load tap changer.

| Topic                     | Material   | Hours |
|---------------------------|--|-------|
| Step Two Progression Test | Syllabus all materials gone over in months 25-29 (All of transformers, drawings, ANSI device numbers, standards) | 16    |

#### **Lesson:**

- Review and preparation for progression test.

#### **Lesson:**

**Transformer Principles** – Lists the main parts of a transformer. Explains how a transformer fulfills the three requirements for electromagnetic induction.  
Describes the relationships between primary and secondary voltages and transformer turns ratio.

**Power Transformers, Current Transformers, and Potential Transformers** – Covers how to recognize and identify: power transformers, current transformers, and potential transformers.

**Power Transformer Cooling Systems, Part 1** – Describes the purpose of power transformer cooling systems. Identifies a self-cooled power transformer and describes how the cooling system works. Identifies a self-cooled/forced-air-cooled power transformer and describes how the cooling system works.

**Lesson: Power Transformer Cooling Systems, Part 2** – Identifies a forced-oil/forced- air-cooled power transformer and describes how the cooling system works. Describes the functions of temperature gauges and level gauges on a power transformer.

**Power Transformer Sealing Systems, Part 1** – States the purpose of a power transformer sealing system. Identifies a gas-sealed power transformer and describes how the sealing system works. Identifies a conservator-type sealed power transformer and describes how the sealing system works.

**Power Transformer Sealing Systems, Part 2** – Identifies a conservator-type sealed power transformer that has an air bag in the conservator and describes how the sealing system works. Identifies a gas/oil-sealed power transformer and describes how the sealing system works.

**Visual Inspection** – Lists the typical items checked during an inspection of a transformer's exterior condition, sealing system, and cooling system.

**Gas and Oil Testing** – Shows how to test: the gas in a power transformer for combustible gas, the gas in a power transformer for oxygen, and the insulating strength of the oil in a power transformer.

**Tap Changers** – Explains what a tap changer is. States the function of a no-load tap changer and briefly describes how a typical no-load tap changer works. States the function of a load tap changer and briefly describes how a typical load tap changer works.

**Tap Changer Maintenance** – Identifies the steps for de-energizing, isolating, and grounding a power transformer. Lists the items typically included in a maintenance check of the physical condition of a load tap changer. Lists the items typically included in a maintenance check of the mechanical operation of a load tap changer. Lists the items typically included in a maintenance check of the electrical operation of a load tap changer.

**Turns Ratio Test** – Explains how to test a transformer's turns ratio.

**Insulation Resistance Test** – Explains how to test a transformer's insulation resistance.

**Lesson:**

**Voltage Regulator Operation, Part 1** – Describes the function of a voltage regulator. Identifies the main components that enable an induction voltage regulator to adjust voltage.

**Voltage Regulator Operation, Part 2** – Describes how a step voltage regulator adjusts voltage.

**Voltage Regulator Control, Part 1** – Describes the function of a voltage detector and explains how it works. Describes the function of a line drop compensator and explains how it works.

**Voltage Regulator Control, Part 2** – Describes the function of these components of a voltage regulator: time delay, limit switches, voltage reduction control, and first-house voltage protector.

**Field Inspection** – Describes common inspection steps typically performed on a voltage regulator.

**Field Control Checks** – Describes control checks for a voltage regulator with solid- state control.

**Regulator Replacement** – Describes how to safely remove a voltage regulator from service, and how to safely put a voltage regulator back into service.

**Step 6 (Months 31 thru 36)**  
**Capacitors, Reactors,**  
**Breakers & Reclosers**  
**Total Hours for Step 6 = 96**

| Topic                   | Material   | Hours |
|-------------------------|--|-------|
| Capacitors and Reactors | Eaton, hands on, manufacturer training, drain a capacitor and cut it open, grounding capacitors, storing capacitors, safety, Chapter 5 from the AC theory, check NJATC courses | 16    |

**Lesson:**

**Function of Capacitors and Reactors** – Defines the following terms: working power, non-working power, capacitive power, inductive power, power factor, unity power factor. Describes

how the relationship between working and non-working power determines the efficiency of the power produced in a T&D system. Explains how capacitor banks and shunt reactors are used to improve power factor.

**Clearing Capacitor Banks** – Describes how to safely de-energize, isolate, and test a substation capacitor bank. Describes how to safely ground a substation capacitor bank using portable grounds. Describes how to safely ground a substation capacitor bank that is equipped with switches.

**Capacitor Bank Maintenance** – Describes maintenance tasks commonly performed on substation capacitor banks. Identifies common problems to look for when inspecting substation capacitor banks. Describes how to safely remove individual capacitors and capacitor fuses. Describes special precautions required when handling capacitors containing PCBs.

**Capacitor Resistor and Insulator Testing** – Describes how to test the integrity of the internal resistance of a substation capacitor. Describes how to test the integrity of the insulators of a substation capacitor.

**Capacitor Capacitance Testing** – Describes several methods for checking the capacitance of substation capacitors. Describes how to check the balance of a substation capacitor bank.

**Shunt Reactors** – Identifies and describes two basic types of substation shunt reactors. Identifies common problems to look for when visually inspecting a substation oil- insulated shunt reactor and an air-core shunt reactor. Describes how to safely de- energize, isolate, test, and ground a substation shunt reactor. Describes how to test the insulation resistance of a substation shunt reactor.

**Series Reactors** – States the function of a substation series reactor and describes how a series reactor operates. Shows how to safely de-energize, isolate, test, and ground a substation series reactor. Identifies common problems to look for when visually inspecting a substation series reactor.

| Topic                                     | Material   | Hours |
|---|--|-------|
| Introduction to breakers and Air Breakers | Manufacturer books, Air breaker schematics, Hands on training, Testing | 8     |

***Lesson: Review safety and switching procedures for air breakers. Maintenance procedures and troubleshooting.***

**Introduction to Circuit Breakers** – Describes the main functions of a circuit breaker. Explains why arcs must be extinguished quickly. Describes the role of each of the following factors in extinguishing an arc in a circuit breaker: speed, distance, cooling, dielectric strength, zero current. Identifies four mediums commonly used in circuit breakers to help extinguish arcs.

**Air-Magnetic and Air-Blast Circuit Breakers** – Identifies the main arc extinguishing features of a typical air-magnetic circuit breaker. Explains how the arc extinguishing features in an air-magnetic circuit breaker work to extinguish arcs. Identifies the main arc extinguishing features of a typical air-blast circuit breaker. Describes how the arc extinguishing features in an air-blast circuit breaker work to extinguish arcs.

| Topic | Material | Hours |
|-------|----------|-------|
|-------|----------|-------|



|                 |  |    |
|-----------------|--|----|
| Vacuum Breakers | Hands on training RMAG, Hands on training metal clad vacuum breaker, Testing | 16 |
|-----------------|--|----|

**Lesson: Maintenance and testing procedures for Vacuum breakers. Install and Troubleshooting.**

**Oil and Vacuum Circuit Breakers** – Identifies the main arc extinguishing features of a typical oil circuit breaker. Explains how the arc extinguishing features in an oil circuit breaker work to extinguish arcs. Identifies the main arc extinguishing features of a typical vacuum circuit breaker. Shows how the arc extinguishing features in a vacuum circuit breaker work to extinguish arcs.

| Topic        | Material   | Hours |
|--------------|--|-------|
| Oil Breakers | Manufacturer books, Oil breaker schematics, Hands on training, Testing | 8     |

**Lesson:** Maintenance and testing procedures for Oil breakers. Troubleshooting

**Oil and Vacuum Circuit Breakers** – Identifies the main arc extinguishing features of a typical oil circuit breaker. Explains how the arc extinguishing features in an oil circuit breaker work to extinguish arcs. Identifies the main arc extinguishing features of a typical vacuum circuit breaker. Shows how the arc extinguishing features in a vacuum circuit breaker work to extinguish arcs.

| Topic                          | Material  |    |
|--------------------------------|---|----|
| Gas Breakers Circuit Switchers | Manufacturer books, Gas breaker schematics, Hands on training | 24 |

**Lesson: Maintenance and testing procedures for Gas breakers, review SF6 handling procedures, review safety procedures for handling faulted breakers and special procedures for faulted SF6 gas. Install procedures and troubleshooting. Gas-Blast and Gas-Puffer Breakers** – Identifies the main arc extinguishing features of a typical gas-blast circuit breaker. Explains how the arc extinguishing features in a gas- blast circuit breaker work to extinguish arcs. Identifies the main arc extinguishing features of a typical gas-puffer circuit breaker. Shows how the arc extinguishing features in a gas-puffer circuit breaker work to extinguish arcs.

- Understanding circuit switchers: their use, functions, maintenance and installation practices.

| Topic     | Material                              | Hours |
|-----------|---------------------------------------|-------|
| Reclosers | Manufacturer books, Hands on training | 8     |

**Lesson:**

- Recloser types and recloser controller types. Review testing procedures.

| Topic | Material | Hours |
|-------|----------|-------|
|-------|----------|-------|

|                           |   |    |
|---------------------------|---|----|
| Step Six Progression Test | Syllabus all materials gone over in months 31-35 (All of breakers, reclosers, capacitors, schematics) | 16 |
|---------------------------|---|----|

**Lesson:**

- Review and prepare for progression test.

**Step 7 (Months 37 thru 42)  
Current Transformers, Potential  
Transformers, System Protection,  
Relays & Switching Procedures Total  
Hours for Step 7 = 96**

| Topic   | Material   | Hours |
|---|--|-------|
| Current Transformers and Potential Transformers | NVE Prints, hands-on training, manufacturer drawings | 8     |

**Lesson:**

**CT Application and Construction** – States the functions of a current transformer. Describes common current transformer applications in a substation. Describes the construction of common substation current transformers.

**CT Accuracy Class and Operation** – Explains the meanings of CT accuracy class ratings. Describes the basic operation of a current transformer. Explains saturation in a CT core. Describes a CT's turns ratio and current ratio as they relate to the CT's current and voltage output.

**Polarity Testing: DC Kick Method** – Explains why the polarity of a current transformer is checked. Describes the DC kick method of checking the polarity of a current transformer.

**Polarity Testing: Current Method** – Describes the current method of checking the polarity of a current transformer.

**Demagnetizing a Current Transformer** – Explains why it may be necessary to demagnetize a current transformer. Describes the basic steps for demagnetizing a current transformer.

**Ratio Testing: Current Method** – States the purpose of current transformer ratio testing. Describes the current method of checking the ratio of a current transformer.

**Ratio Testing: Voltage Method** – Describes the voltage method of checking the full winding ratio of a CT. Describes the voltage method of checking the tapped winding ratios of a CT.

**Insulation Resistance Testing** – Explains the purpose of testing current transformer insulation resistance. Describes the basic steps for testing the insulation resistance of a current transformer. Describes how to correct insulation resistance readings for temperature.

| Topic                            | Material   | Hours |
|----------------------------------|--|-------|
| System Protection and Monitoring | NVE Prints, hands-on training, manufacturer drawings | 8     |

## **Lesson:**

**Elements of System Protection and monitoring equipment Introduction** – Explains in general terms how system grounds, arresters, and fuses protect a T&D system. Briefly describes three types of monitoring and control equipment used in T&D systems.

**System Grounds** – Describes factors that affect the resistance of earth to current flow. Describes one method for installing a ground rod. Describes how substations, distribution systems, and transmission systems are typically grounded.

**Arresters** – Explains the principles of arrester operation. Describes the basic operation of a valve type arrester, a pellet type arrester, and an expulsion type arrester. Describes one method for replacing a damaged arrester.

**Fuses and Fuse Cutouts** – Describes the operation of an open-type fuse cutout and a door-type fuse cutout. Describes the operation of a fuse link. Explains how fuses are rated. Describes one method for replacing a fuse link in an open-type fuse cutout.

| Topic             | Material   | Hours |
|-------------------|--|-------|
| Control Equipment | NVE Prints, hands-on training, manufacturer drawings | 8     |

## **Lesson: Elements of substation control equipment**

**Monitoring and Control Systems** – Describes the functions of a monitoring and control system. Describes some of the important features offered by most monitoring and control systems. Explains the functions of the major components in a SCADA

**Distribution Automation and Load Management** – Describes the functions of a distribution automation system and a load management system. Describes some of the important features offered by most distribution automation systems and load management systems. Explains in general terms how most distribution automation systems and load management systems operate. Describes the functions of the controllers in a distribution automation system and a load management system.

**Control Functions, Modes, and Equipment** – States two basic reasons why control is needed in a substation. Describes how control is provided. Identifies the equipment typically used to provide control.

**Voltage Control** – States why it is necessary to control voltage. Describes how a simple voltage control system works.

**Distribution Feeder Fault Control** – States why it is necessary to control the effects of faults. Describes how the effects of distribution feeder faults can be controlled using an overcurrent relay protective system and a feeder reclosing relay control system.

**Transmission and Sub-Transmission Feeder Fault Control** – Describes how the effects of feeder faults can be controlled using an impedance relay protective system. Identifies the difference between controlling the effects of feeder faults with an impedance system and controlling the effects of feeder faults with an overcurrent system.

**Station Fault Control** – Describes how the effects of station faults can be controlled using a differential relay system. Identifies the differences between controlling the effects of station faults with a differential system and controlling the effects of station faults with an overcurrent protective system.

**Source Circuit Fault Control** – Describes how the effects of source circuit faults can be controlled using a directional relay protective system. Describes how the effects of opens on a source circuit can be controlled using a voltage relay protective system.  
Describes how the duration of a source circuit outage can be minimized by an auto closing relay protective system.

**Routine Checks of Control Equipment** – Lists items typically checked during a routine inspection of substation control equipment. Identifies what various fault indications mean.

| Topic  | Material  | Hours |
|--------|---|-------|
| Relays | NVE Prints, hands-on training, manufacturer drawings, Online course from Iowa State University (Homework) | 24    |

**Lesson:**

- Overcurrent
- Directional
- Differential
- Distance
- Breaker Fail
- Comm Schemes
- CO Relay
- KD Relay
- SEL-351S (Breaker Fail)
- SEL-311C

| Topic   | Material                    | Hours |
|---------|-----------------------------|-------|
| Telecom | SCADA, com aided protection | 8     |

**Lesson: Basics of Telecom Equipment, protection and system communication**

| Topic                 | Material                       | Hours |
|-----------------------|--------------------------------|-------|
| Protection Schematics | NVE Prints, hands-on training, | 24    |

***Lesson: In-depth lesson into reading and interpreting NVE protection schematics***

| Topic                       | Material  | Hours |
|-----------------------------|---|-------|
| Step Seven Progression Test | Syllabus all materials gone over in months 31-35 (All of breakers, reclosers, capacitors, schematics) | 16    |

***Lesson: Preparation for progression test***

**Step 8 (Months 43 thru 48)  
Cross training with System  
Protection, System Control,  
Troublemens Preparation for Top  
Out Test**

**Approximate Total Program Hours 1,005**

**Wages**

Wage Schedule for Apprentice Communications Technician – See Collective Bargaining Agreement, but should be reflective of prorated portions of the Journeyman wage as outlined in the Parties' Letter of Agreement dated August 31, 2023 (LOA 23-07). The current Journeyman wage scale is outlined in the Collective Bargaining Agreement.

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**Fitter**  
**Program Duration: 2 Years (24 Months)**

Revision Date:

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The following is an outline of the subjects to be covered in the supplementary classroom and home study training:

| <u>Process</u>  | <u>Hours</u> |
|---|--------------|
| <i>Gas</i>  |              |
| Valve Maintenance/Leak Repair   | 160          |
| Main-Installation/Replacement   | 822          |
| Main-Leak Repair and Maintenance  | 500          |
| Main-Misc. Pipe Fittings (heat fusion/mechanical)   | 175          |
| Service Installation/Replacement (insertion)  | 750          |
| Service-Leak Repair and Maintenance   | 500          |
| Service-Misc. Pipe Fittings (heat fusion/mechanical)  | 225          |
| Corrosion Control (installing anodes, test stations,<br>pipe jeeeping, coating inspection/repair) | 38           |
| <i>Total</i>  | <i>3,170</i> |
| <i>Equipment and Tools</i>  |              |
| Truck and Equipment   | 50           |
| Tapping Machines  | 100          |
| Stop-Off Machines   | 100          |
| Locators  | 50           |
| Hand Tools  | 50           |
| Combustible Gas Indicator (CGI)   | 40           |
| Potentiometer   | 24           |
| Welding Preparation (includes grinding and cutting torch)   | 12           |
| <i>Total</i>  | <i>426</i>   |
| <i>Miscellaneous</i>  |              |
| Traffic Control   | 80           |
| First Aid and Safety  | 80           |
| Company Standards   | 24           |
| Completing Documentation for Gas Facilities   | 70           |
| Complete Operator Qualification Evaluations   | 70           |
| 49 CFR Parts 191 & 192  | 40           |
| Ride Along with Serviceman  | 16           |
| Ride Along with Gas Pressure Operator/ Leak Surveyor  | 8            |
| Ride Along with Inspector   | 16           |
| <i>Total</i>  | <i>404</i>   |
| Total OJT Hours Recommended   | 4,000        |

***First Six Months:***

- Identifying Procedures/Processes Basic to Producing, Transporting, and Distributing Natural Gas.
- Identifying Basic Properties of Fuel Gases.
- Controlling/Preventing Fires Fueled by Natural Gas.
- Maintaining a Safe Working Environment.
- Prevent Accidental Ignition.
- Identifying the Fundamental Guidelines for Traffic Control in Work Zones.
- Maintaining Records and Filing Reports of Compliance.
- Performing Calculations Basic to Gas Distribution and Service.
- Join Plastic Pipe with Heat Fusion.
- Join Plastic Pipe with Mechanical Fittings.
- Making Field Repairs in Natural Gas Pipelines.
- Inspecting the Installation of Pipelines.

***Second Six Months:***

- Joining Copper Pipe for Gas Distribution.
- Installing Mains and Gas Service Lines.
- Maintaining a Safe Working Environment While Excavating (Competent Person).
- Communicating Potential Hazards in the Workplace.
- Detecting the Presence and Measuring the Percent of Gas in a Gas-in-Air Mixture.
- Locating and Marking Underground Pipeline Facilities.
- Investigating and Pinpointing Underground Natural Gas Leaks.
- Investigating Reported Gas Leaks and Odors in Buildings.
- Perform Patrol and Leakage Surveys on Gas Pipeline Facilities.
- Investigating for Carbon Monoxide.
- Maintaining Compliance with 49 Code of Federal Regulations (CFR), Part 192.
- Volume 15, Section 5.
- Volume 15, Section 6.

***Third Six Months:***

- Operations & Maintenance (O&M) Manual, Sections A-M Excluding K.
- Identifying Safety Requirements for Working in Confined Spaces and Controlling Hazardous Energy.
- Operating Tractors/Loaders/Backhoes Safely.
- Maintaining Line Valves in Gas Transmission/Distribution Piping.
- Identifying Techniques Common to Purging Natural Gas Distribution Pipelines.
- Abandoning/Deactivating Gas Pipeline Facilities.
- Tapping/Stopping Pipelines Under Pressure.
- Inspecting Pipe Welds.
- Cutting Steel using Oxyacetylene Hand Held Cutting Torch.
- Identifying Processes, Materials, and Terms Basic to Welding.
- Performing Tie-In/Bypass Operations.

**Fourth Six Months:**

- Identifying Factors to Consider when Maintaining Overpressure Protection Using Pressure Relief Valves.
- Repair/Protect Cast Iron Pipe.
- Identifying Techniques Common to Pipeline Pigging.
- Identifying Processes and Procedures Basic to Corrosion Control.
- Installing Cathodic Protection Systems.
- Monitoring/Testing Corrosion Control Systems.
- Monitoring Corrosion Control Methods Used on Buried Metal Pipelines.
- Measuring and Regulating Natural Gas in a Distribution System.
- Adjusting Gas Burners for Proper Combustion of Natural Gas.

**Monthly Work Processes****Month 1****NGT 1001 -- ITS Module GDS 1.1**

3.75 Hours Home Study and Classroom

Identifying Procedures/Processes Basic to Producing, Transporting, and Distributing Natural Gas

**COURSE DESCRIPTION:**

This course presents the major components of a natural gas system from well head to burner. The action that each component has on the gas stream is presented in the context of the total system. Key terms and definitions are reviewed and applied to conditions common to the utilization of natural gas.

**NGT 1002 -- ITS Module GDS 1.2**

3.75 Hours Home Study and Classroom

Identifying Basic Properties of Fuel Gases

**COURSE DESCRIPTION:**

This course relates to the chemical and physical properties of fuel gases basic to their unique characteristics. The physical properties of natural gas are discussed in relation to how it reacts to pressure and/or temperature changes and the condition under which fuel gas is measured to the customer. The chemical properties are discussed in relation to their value as a source of heat. Units of measurement for natural gas are defined.

**NGT 1101 -- ITS Module GDS 1.6**

3.75 Hours Home Study and Classroom – 30 Hours Lab

Controlling/Preventing Fires Fueled by Natural Gas

**COURSE DESCRIPTION:**

Factors are identified relating to extinguishing fires fueled by natural gas. Emphasis is placed on ways to prevent natural gas fires by eliminating ignition sources. Various classifications of fire extinguishing agents and their intended use are presented. Techniques used to extinguish natural gas fires are demonstrated on a fire ground and practiced by the participants in the course. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.



## ***Month 2***

### **NGT 1102 -- ITS Module GDS 1.8**

3.75 Hours Home Study and Classroom – 15 Hours Lab

Maintaining a Safe Working Environment

#### **COURSE DESCRIPTION:**

This course is an overview of safety practices that prevent personal injury as well as property damage at the worksite. Proper use of major equipment is stressed. Hazards resulting from escaping gas are emphasized. Also, the basis for the drug testing and alcohol misuse program is explained. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **NGT 1103 -- ITS Module GDS 1.11 (OQ M-7)**

7.5 Hours Home Study and Classroom – 7.5 Hours Lab

Prevent Accidental Ignition

#### **COURSE DESCRIPTION:**

This course presents safety practices and procedures used to prevent accidental ignition of natural gas. Areas of emphasis are electrical arcing, welding, cutting, and other hot work, isolating pipeline segments, and isolating gas-handling facilities.

## ***Month 3***

### **NGT 1104 -- ITS Module GDS 10.3**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Identifying the Fundamental Guidelines for Traffic Control in Work Zones

#### **COURSE DESCRIPTION:**

This course presents the basic standard for traffic control as described in the manual on Uniform Traffic Control Devices, Part VI According to the U.S. Department of Transportation.

### **NGT 1006 -- ITS Module GDS 1.7**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Maintaining Records and Filing Reports of Compliance

#### **COURSE DESCRIPTION:**

This course focuses on accuracy and complete information on field reports which document company- wide summary reports. Practice in company map reading, sketching of piping installations and above ground piping facilities is emphasized. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### ***Month 4***

#### **NGT 1005 -- ITS Module GDS 1.5**

7.5 Hours Home Study and Classroom

Performing Calculations Basic to Gas Distribution and Service

##### **COURSE DESCRIPTION:**

This course begins with instruction on the use of a calculator when working with dimensions given in decimal fractions. Basic calculations are performed for area and volume measurements. Practice problems include calculating the relationship between gas and heating measurements, calculating gas flow using meter index, and free air apace. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### ***Month 5***

#### **NGT 1804 -- ITS Module GDS 4.11 (OQ F-1)**

7.5 Hours Home Study and Classroom

Join Plastic Pipe with Heat Fusion

##### **COURSE DESCRIPTION:**

This course presents the theory of heat fusing polyethylene pipe and the specification and conditions required to produce an acceptable joint. Meets D.O.T. operator qualification for ITS covered task F-1, Join Plastic Pipe with Heat Fusion. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

#### **NGT 1803 -- ITS Module GDS 4.10 (OQ F-2)**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Join Plastic Pipe with Mechanical Fittings

##### **COURSE DESCRIPTION:**

This course presents the theory and practice of joining plastic pipe with mechanical fittings; referencing the fitting manufacturer's installation procedures when installing mechanical fittings is emphasized. Controlling static charges on plastic pipe is discussed and methods of controlling static charges are demonstrated. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### ***Month 6***

#### **NGT 1801 -- ITS Module GDS 4.5 (OQ M-8)**

3.75 Hours Home Study and Classroom – 15 Hours Lab

Making Field Repairs on Natural Gas Pipelines

##### **COURSE DESCRIPTION:**

This course presents common methods and installation practices used to make field repairs on gas piping facilities. Emphasis is placed on D.O.T. standards according to 49 CFR 192. Meets operator qualification for ITS covered task M-8, Make Field Repairs on Gas Pipelines. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1802 -- ITS Module GDS 4.6**

7.5 Hours Home Study and Classroom

Inspecting the Installation of Pipelines

**COURSE DESCRIPTION:**

Beginning with examining the preparation of the pipeline right-of-way and continuing through the completion of the construction operation, this course presents the major phases of the inspection process. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

*First Six Months Total Hours: 150*

***Month 7*****NGT 1806 -- ITS Module GDS 4.16 (OQ F-3)**

3.75 Hours Home Study and Classroom

Joining Copper Pipe for Gas Distribution

**COURSE DESCRIPTION:**

This course presents the materials and techniques for joining copper pipe/tubing. Joining methods include flared connection, soldered connection, silver brazed and "swag-lock" fittings. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1805 -- ITS Module GDS 4.13**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Installing Mains and Gas Service Lines

**COURSE DESCRIPTION:**

This course presents installation practices basic to installing gas mains and service lines. Topics include safety, installation standards, and line marking in accordance with D.O.T. 49 CFR, Part 102. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1401 -- ITS Module GDS 10.4**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Maintaining a Safe Working Environment While Excavating (Competent Person)

**COURSE DESCRIPTION:**

The content of this course focuses on the requirements for earth excavation and protection system according to OSHA 29 CFR Part 1026. The use of tables and specifications to design shoring protective systems are applied to typical excavations.

***Month 8*****NGT 1404 -- ITS Module GDS 10.7**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Communicating Potential Hazards in the Workplace

**COURSE DESCRIPTION:**

A study of health-related and explosive hazards associated with the natural gas industry are examined. The use of material safety data sheets (MSDS) is emphasized to protect persons against toxic chemical and hazardous materials.

**NGT 1501 -- ITS Module GDS 2.1**

7.25 Hours Home Study and Classroom

Detecting the Presence and Measuring the Percent of Gas  
in a Gas-in-Air Mixture

**COURSE DESCRIPTION:**

This course focuses on the principles of operations and application of combustible gas indicators. Covered is the application CGIs equipped with catalytic and thermal conductor sensors, semi-conductor sensors and flame ionization sensors.

***Month 9*****NGT 1503 -- ITS Module GDS 2.3 (OQ M-2)**

3.75 Hours Home Study and Classroom – 7.5 Hours lab

Locating and Marking Underground Pipeline Facilities

**COURSE DESCRIPTION:**

This course presents techniques and procedures basic to locating and marking pipeline facilities. Line locating will be included in the lab exercise.

**NGT 1504 -- ITS Module GDS 2.4**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Investigating and Pinpointing Underground Natural Gas Leaks

**COURSE DESCRIPTION:**

This course presents the theory and practice for using proper techniques and procedures when investigating and pinpointing natural gas leaks.

**NGT 1502 -- ITS Module GDS 2.2**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Investigating Reported Gas Leaks and Odors in Buildings

**COURSE DESCRIPTION:**

This course provides information and practice for investigating reported gas leaks and odors in buildings and how to check for carbon monoxide.

***Month 10*****NGT 1505 -- ITS Module GDS 2.5 (OQ M-1)**

7.5 Hours Home Study and Classroom – 7.5 Hours Home Study and Classroom

Perform Patrol and Leakage Surveys on Gas Pipeline Facilities

**COURSE DESCRIPTION:**

This course provides information and practice in patrol and leakage surveys in pipeline distribution and transmission facilities.

**NGT 1506 -- ITS Module GDS 2.6**

3.75 Hours Home Study and Classroom

Investigating for Carbon Monoxide

**COURSE DESCRIPTION:**

This course provides information and practice for investigating carbon monoxide contamination.

### ***Month 11***

#### **NGT 1301 -- ITS Module GDS 10.2**

15 Hours Home Study and Classroom

Maintaining Compliance with 49 Code of Federal Regulations (CFR), Part 192

##### **COURSE DESCRIPTION:**

This course is a survey of the criteria for the installation, maintenance and inspection of gas pipelines up to the outlet of the customer's meter. Key terms and definitions are reviewed and applied to issues common to the installation, maintenance and inspection of gas transportation pipelines. Emphasis is given to the identification of content contained in each subpart of 49 CFR. Identifying general provisions of the regulations. Identifying selected requirement basis to the operations of natural gas distribution systems.

### ***Month 12***

#### **Standards Volume 15, Section 5 (NV Energy.)**

4 hours Home Study and Classroom

##### **COURSE DESCRIPTION:**

This class will discuss and review NV Energy's Volume 15, Section 5. This volume deals with material standards, trench standards, gas services, gas mains, gas assemblies, gas fittings and shop fabrications.

#### **Standards Volume 15, Section 6 (NV Energy.)**

4 hours Home Study and Classroom

##### **COURSE DESCRIPTION:**

This class will discuss and review NV Energy's Volume 15, Section 6. areas that will be discussed are gas-metering guidelines, gas-metering locations, gas meter capacity table, gas service capacity table, Gas meter guard post detail, and mobile home service requirements.

*Second Six Months Total Hours: 120.25*

### ***Month 13***

#### **Operations and Maintenance Manual, Sections A-M (excluding K) (NV Energy)**

16 hours Home Study and Classroom

##### **COURSE DESCRIPTION:**

This class will discuss and review NV Energy's Gas Operations and Maintenance Manual, Sections A-M (excluding K). Areas that will be discussed include reporting safety related conditions, petroleum gas systems, conversion to service, material and manufacturing requirements, pipe design, pipeline component design, welding steel pipelines, joining non-steel pipelines, general construction, meter and service facilities, corrosion control, test requirements, operations and maintenance.

## ***Month 14***

### **NGT 1403 -- ITS Module GDS 10.6**

3.75 Hours Home Study and Classroom – 15 Hours Lab

Identifying Safety Requirements for

Working in Confined Spaces and Controlling Hazardous Energy

#### **COURSE DESCRIPTION:**

Confined spaces are defined and classified. Atmospheric monitoring and entry procedures into confined spaces are included in the course. Controlling hazardous energy with the lock-out/tag-out method is emphasized.

### **NGT 1402 -- ITS Module GDS 10.5**

3.75 Hours Home Study and Classroom – 30 Hours Lab

Operating Tractors/Loaders/Backhoes Safely

#### **COURSE DESCRIPTION:**

This course presents an overview of the operation of a tractor/loader/backhoe. Operating safety precautions and equipment maintenance is emphasized. Techniques on the proper control of the tractor/loader/backhoe are discussed and demonstrated. Operating skills are developed as a part of his/her laboratory experience.

## ***Month 15***

### **NGT 1901 -- ITS Module GDS 3.10 (OQ M-5)**

7.5 Hours Home Study and Classroom

Maintaining Line Valves in Gas Transmission/Distribution Piping

#### **COURSE DESCRIPTION:**

This course presents the basic design characteristics and maintenance procedures for pipeline valves. The valve types included are plug, ball and gate. The proper use and care of high-pressure grease guns is explained. This course meets operator qualification as required by D.O.T. 49 CFR Part 192.745. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **NGT 2003 -- ITS Module GDS 4.9**

3.75 Hours Home Study and Classroom – 15 Hours Lab

Identifying Techniques Common to Purging Natural Gas Distribution Pipelines

#### **COURSE DESCRIPTION:**

This course presents the factors affecting the mechanical nature of displacing one gas with another gas by purging. Principles concerning the formation, analysis and control of gas mixtures is emphasized. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

## ***Month 16***

### **NGT 1903 -- ITS Module GDS 4.14 (OQ M-10)**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Abandoning/Deactivating Gas Pipeline Facilities

#### **COURSE DESCRIPTION:**

This course Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **NGT 2001 -- ITS Module GDS 4.7 (OQ L-1)**

3.75 Hours Home Study and Classroom – 15 Hours Lab

Tapping/Stopping Pipelines Under Pressure

#### **COURSE DESCRIPTION:**

This course presents the techniques used to safely tap pipelines under pressure. Tapping and stopping procedures are limited to 2" pipe or less. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

## ***Month 17***

### **NGT 1905 -- ITS Module GDS 10.10**

7.5 Hours Home Study and Classroom – 15 Hour Lab

Inspecting Pipe Welds

#### **COURSE DESCRIPTION:**

This course presents the duties and responsibilities basic to the practice of inspecting pipe welds. Emphasis is given to the identification and evaluation of weld defects. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### **P/SW 1.3**

3 Hours Home Study and Classroom

Cutting Steel Using an Oxyacetylene Hand-Held Cutting Torch

#### **COURSE DESCRIPTION:**

This course is designed to provide information basic to setting up oxyacetylene welding equipment for the purpose of cutting steel using an oxyacetylene hand-held cutting torch. Complying with basic rules for oxyacetylene gas welding and cutting safety is emphasized.

## ***Month 18***

### **P/SW – 1.1**

Identifying Processes, Materials and Terms Basic to Welding

3 Hours Home Study and Classroom

#### **COURSE DESCRIPTION:**

This course presents an overview of four commonly used welding processes: Oxyacetylene welding (OAW), shielded metal arc welding (SMAW), gas tungsten arc welding (GTAW) and gas metal arc welding (GMAW). The course also includes information about standard steel shapes and ordering information.

**NGT 2004 -- ITS Module GDS 4.12**

3.75 Hours Home Study and Classroom – 15 Hours Lab

Performing Tie-In/Bypass Operations

**COURSE DESCRIPTION:**

This course presents procedures for performing tie-in/bypass operations. Emphasis is placed on factors that relate to personal safety and properly following procedures. The course includes tapping and stopping of pipelines. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

*Third Six Months Total Hours: 172*

***Month 19*****NGT 1902 -- ITS Module GDS 3.11**

7.5 Hours Home Study and Classroom

Identifying Factors to Consider when Maintaining  
Overpressure Protection Using Pressure Relief Valves

**COURSE DESCRIPTION:**

This course presents the components and operating characteristics of typical pressure relief valve installations. The focus of the discussions is primarily on spring operated and pilot operated pressure relief valves. Emphasis is placed on factors to consider when installing pressure relief valves. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1904 -- ITS Module GDS 4.15 (OQ M-9)**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Repair/Protect Cast Iron Pipe

**COURSE DESCRIPTION:**

This course presents the materials and procedures for repairing cast iron pipe. The protection of cast iron pipe while excavating is emphasized. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

***Month 20*****NGT 2002 -- ITS Module GDS 4.8**

3.75 Hours Home Study and Classroom – 15 Hours Lab

Identifying Techniques Common to Pipeline Pigging

**COURSE DESCRIPTION:**

This course presents the techniques factors basic to pigging pipelines. Emphasis is placed on the mechanics of pigging including safety precautions to consider. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2051 -- ITS Module LCC 1.1**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Identifying Processes and Procedures Basic to Corrosion Control



#### **COURSE DESCRIPTION:**

This course presents the electrochemical process that causes corrosion on buried metals, and the conditions that support this process. Methods used to control the corrosion process are described and illustrated. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### ***Month 21***

#### **NGT 2052 -- ITS Module LCC 1.2**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Installing Cathodic Protection Systems

#### **COURSE DESCRIPTION:**

This course presents construction procedures associated with pipeline corrosion control. Installation procedures for test pints, cased installation, insulated joints, galvanic anodes and rectifiers. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

#### **NGT 2053 -- ITS Module LCC 1.3**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Monitoring/Testing Corrosion Control Systems

#### **COURSE DESCRIPTION:**

This course presents factors basic to monitoring/testing cathodically protected pipelines. Testing procedures for pipe-to-soil surveys, testing for shorted insulating joints, shorted casings, and evidence of atmospheric corrosion. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### ***Month 22***

#### **NGT 2054 -- ITS Module LCC 1.4 (OQ I-1)**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Monitoring Corrosion Control Methods Used on Buried Metal Pipelines

#### **COURSE DESCRIPTION:**

This course presents information and techniques for monitoring corrosion control methods. The focus is on the application of techniques used to monitor corrosion control methods in the field. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

#### **NGT 1004 -- ITS Module GDS 1.4**

7.5 Hours Home Study and Classroom – 15 Hours Lab

Measuring and Regulating Natural Gas in a Distribution System

#### **COURSE DESCRIPTION:**

This course reviews the principles of operation for direct volume measurement meters and rate-of-flow (inferential) type meters. The operating principles of service regulators are outlined and discussed. Emphasis is placed on the correct reading of dial type meter faces. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

### ***Month 23***

#### **NGT 1003 -- ITS Module GDS 1.3**

3.75 Hours Home Study and Classroom – 7.5 Hours Lab

Adjusting Gas Burners for Proper Combustion of Natural Gas

#### **COURSE DESCRIPTION:**

This course presents the science of gas burner design and factors affecting the proper combustion of fuel gas. Techniques used to measure gas input rates, gas flow and pressure are presented. Practice in troubleshooting causes of improper combustion is required. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

*Fourth Six Months Total Hours: 116.25*

**Approximate Total Program Hours 558.50**

Note: The Lab Hours for the above Modules will be accomplished as the Process OJT hours are completed and through Classroom training.

Subsequent edition/volume changes of textbooks are approved for use through the discretion of the program.

### **Wages**

Wage Schedule for Apprentice Communications Technician – See Collective Bargaining Agreement, but should be reflective of prorated portions of the Journeyman wage as outlined in the Parties' Letter of Agreement dated August 31, 2023 (LOA 23-07). The current Journeyman wage scale is outlined in the Collective Bargaining Agreement.

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**Fitter/Welder**  
**Program Duration: 2 Years (24 Months)**

Revision Date: \_\_/\_\_/\_\_

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The following is an outline of the subjects to be covered in the supplementary classroom and home study training:

| <u>Process</u>  | <u>Hours</u> |
|---|--------------|
| Cutting Torch   | 100          |
| Cutting Machines  | 30           |
| Gas Welding of: ¾", 1", 1 ¼"  | 200          |
| Pipe and Fittings   |              |
| Gas Welding of 2" Pipe  | 400          |
| Arc Welding of ¾" , 1", 1 ¼"  | 200          |
| Pipe and Fittings   |              |
| Arc Welding of 2" Pipe and Above  | 400          |
| Arc Welding of 2" and above Fittings (elbow, tee's, reducers & valves)          | 400          |
| Arc Welding of 2" and above Fittings (half pots, full pots, and full stop-offs) | 400          |
| Arc Welding of Patches on Live Gas Mains (with Blowing Gas)                     | 200          |
| Arc Welding of Patches of Live Water Mains (with Leaking Water)                 | 100          |
| Layout of Offsets   | 20           |
| Layout of Metersets   | 20           |
| Pipe Preparation  | 20           |
| Certification Tests Preparations  | 430          |
| Welding in Water  | 20           |
| Cutting with Electric Arc   | 10           |
| Welding with Mirrors  | 20           |
| Welding in a Confined Space   | 20           |
| Welding with Limited Space  | 20           |
| Structural Welding  | 400          |
| Welding Pressurized Pipe  | 400          |
| Marking-Up Pups for Tapping Valves  | 20           |
| 2" Horizontal Taps  | 20           |
| 2" Half Fitting Taps and Stop-Offs  | 20           |
| 2" Split Pot and Stop Offs  | 20           |
| 2" Bottom-Out With Offset   | 20           |
| 2" Bottom-Out with By-Pass (through machines)                                   | 20           |
| 2" Stop-Off with By-Pass (around machines)                                      | 20           |
| Maintenance of 2" Tapping Machines and Related Equipment                        | 50           |
| Total OJT Hours Recommended   | 4,000        |

The following is an outline on the subjects to be covered in the supplementary classroom and home study training.

***First Six Months:***

- Health Risks of Welding
- Safety Equipment, Protective Clothing
- Oxy-Acetylene Safety
- Oxy-Acetylene Welding
- Oxy-Acetylene Cutting

***Second Six Months:***

- Welding Safety
- Introduction to Arc Welding
- Introduction to Basic Shop Metallurgy
- Lessons in Arc Welding

***Third Six Months:***

- Advanced Theory in Arc Welding
- Advanced Shop Drawings

***Fourth Six Months:***

- API 1194
- DOT 192
- NV Energy O&M Procedures

***First Six Months***

**Health Risks of Welding**

8 hours

(Film and Discussion with Hazmat Specialist – Safety Department  
Industrial Training Systems ITS)

Personal Safety and Proper Attitude

The apprentice will have a knowledge of the risks and hazards associated with the welding occupation.

**Safety Equipment, Protective Clothing**

16 hours

(Film, Discussion and Home Study – ITS Video #250-02 Safe Use of Equipment-Skills Education Series Video – Welding Safety and the James F. Lincoln Arc Welding Foundation Manual – Principles of Industrial Welding)

The apprentice will have a working knowledge of the personal safety equipment needed and required to perform the various jobs in the welding field. Proper maintenance of welding equipment will be demonstrated.

**Oxy-Acetylene Safety**

16 hours

(Video, discussion and home study – NUS Maintenance Training Video Gas Welding – Lincoln Arc Welding Foundation Manual Principles of Industrial Welding)

This Unit introduces the concepts and steps of gas welding. The purpose of gas welding, welding equipment components and their use, regulator and torch adjustments, and safety during gas welding and cutting.

### **Oxy-Acetylene Welding**

16 hours

(Video, discussion and home study – NUS Maintenance Training Video Gas Welding - Lincoln Arc Welding Foundation Manual – Principles of Industrial Welding)

This unit introduces the concepts and steps of gas welding. The purpose of gas welding, welding equipment components and their use, regulator and torch adjustments, and safety during gas welding and cutting.

### **Oxy-Acetylene Cutting**

16 hours

(Home study and discussion. Lincoln Arc Welding Foundation Manuals – Arc Welding Instructions for the Beginners and Principles of Industrial Welding)

This lesson will enable the apprentice to master the fundamentals of the cutting process with the combination torch. They will learn plate cutting, pipe cutting, the safe operation and maintenance of the equipment.

*TOTAL HOURS FIRST SIX MONTHS* 72 hours

## ***Second Six Months***

### **Welding Safety**

4 hours

(Video, discussion and home study – Lincoln Arc Welding Foundation Video – Welding Safely the way the Pros Do It and Manual – The Procedure Handbook of Arc Welding)

This lesson covers the safety measures used in the personal protection of the welder when using the arc process. It also covers the steps taken to protect the welder's co-workers.

### **Introduction to Arc Welding**

16 hours

(Video, discussion and home study – NUS Maintenance Training Video Arc Welding and – Lincoln Arc Welding Foundation Manuals - Arc Welding Instructions for the Beginner, New Lessons in Arc Welding and the Procedures Handbook of Arc Welding)

This lesson will introduce the apprentice to the why and how of arc welding. Apprentice will be shown how to identify welding equipment, assemble these components for use and adjust current flow.

### **Introduction to Basic Shop Metallurgy**

40 hours

(Video, discussion and home study – NUS Maintenance Training Video –

Practical Shop Metallurgy and Lincoln Arc Welding Foundation Manual Metals and How to Weld Them)

This unit presents the concepts associated with shop metallurgy.

Apprentices are shown how to identify metals and their properties. This unit also demonstrates several types of heat-treating processes and teaches apprentices how to identify causes of metal failure.

### **Lessons in Arc Welding**

40 hours

(Home study and discussion. Lincoln Arc Welding Foundation Manuals – The procedure Handbook of Arc Welding, New Lessons in Arc Welding and Principles of Industrial Welding).

This lesson teaches the theory and process of the electrode, striking an arc, polarity, arc blow, different positions of the weld, types of beads, different types of joints and a introduction to welding symbols.

*TOTAL HOURS SECOND SIX MONTHS 100 hours*

### ***Third Six Months***

#### **Advanced Theory in Arc Welding**

50 hours

(Home study and discussion – Lincoln Arc Welding Foundation Manuals; – Principles of Industrial Welding and the Procedure Handbook of Arc Welding)

During this section, the apprentice will gain a practical understanding of the problems encountered in the welding process and how to avoid or repair them. It will also teach the procedure in selecting the right welding process for any type of situation. It will also examine the different types and sizes of electrodes. The lesson will also include the information needed to select the correct materials for a particular application and types of fittings, pipe and steel.

#### **Advanced Shop Drawings**

22 hours

(Home Study, discussion – Lincoln Arc Welding Foundation Manuals – How to Read Shop Drawings)

This lesson addresses, in more detail, the skill of reading blueprints, shop drawings and welding symbols.

*TOTAL HOURS THIRD SIX MONTHS 72 hours*

### ***Fourth Six Months***

#### **API 1104**

25 hours

(Discussion and home study –American Petroleum Manual 1104)

The apprentice will learn to understand the contents of this regulation and what will govern their decision on a specific type of weld.

#### **DOT 192**

20 hours

(Home study and discussion. Department of Transportation Manual – Section 192)

The apprentice will be familiarized with the regulations that pertain to the

welding sections.

**NV Energy O&M Procedures**

30 hours

(Home study and discussion. NVE Operations and Maintenance Procedure Manual)

The apprentice will understand the procedures in the welding of poplins and their components, set forth by the Company.

TOTAL HOURS FOURTH SIX MONTHS

75 hours

**Approximate Total Program Hours 319**

Subsequent edition/volume changes of textbooks are approved for use through the discretion of the program.

**Wages**

Wage Schedule for Apprentice Communications Technician – See Collective Bargaining Agreement, but should be reflective of prorated portions of the Journeyman wage as outlined in the Parties' Letter of Agreement dated August 31, 2023 (LOA 23-07). The current Journeyman wage scale is outlined in the Collective Bargaining Agreement.

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**Gas Pressure Operator**  
**Program Duration: 2.5 Years (30 Months)**  
(Revision Date: 2/22/24)

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The following is an outline of the subjects to be covered in the supplementary classroom and home study training:

| <u>Process</u>   | <u>Hours</u> |
|--|--------------|
| <i>Leak Survey:</i>  |              |
| Leak Survey and Atmospheric Corrosion                          | 1,200        |
| Transmission Line  | 40           |
| Emergency Assistance and Leak Investigation                    | 260          |
| <i>Total</i>   | <i>1,500</i> |
| <br><i>Equipment and Tools:</i>                                |              |
| Leak Detection Equipment Calibration and Maintenance           | 20           |
| Pressure Equipment Calibration, Maintenance, and Testing       | 45           |
| Hand and Power Tools   | 25           |
| <i>Total</i>   | <i>90</i>    |
| <br><i>System Operations:</i>                                  |              |
| Load Forecasting and System Usage Determination                | 800          |
| System Monitoring (SCADA Alarms, PI)                           | 200          |
| CP Survey  | 240          |
| City Gate/Regulator Station Inspection, Maintenance, Spin Test | 1,060        |
| System Patrolling and Pipeline Marker Inspection               | 320          |
| Operator Qualification   | 200          |
| Odorant Testing and Injection                                  | 200          |
| Valve Maintenance  | 50           |
| <i>Total</i>   | <i>3,070</i> |
| <br>Miscellaneous (Safety Meeting/Training)                    | 200          |
| Gas Operations Crew Ride Along                                 | 20           |
| Gas Serviceman Ride Along                                      | 40           |
| Gas Meter Shop   | 80           |
| <i>Total</i>   | <i>340</i>   |

Total OJT Hours Recommended 5,000



***First Six Months: Approximately 134.75 Hours***

- Identifying Procedures/Processes Basic to Producing, Transporting, and Distributing Natural Gas
- Identifying Basic Properties of Fuel Gases
- Controlling/Preventing Fires Fueled by Natural Gas
- Maintaining a Safe Working Environment
- Preventing Accidental Ignition
- Identifying the Fundamental Guidelines for Traffic Control in Work Zones
- Maintaining Records and Filing Reports of Compliance
- Performing Calculations Basic to Gas Distribution and Service
- Maintaining A Safe Working Environment While Excavating (Competent Person)
- Communicating Potential Hazards in the Workplace
- Detecting the Presence and Measuring the Percent of Gas in a Gas-in-Air Mixture

***Second Six Months: Approximately 142.5 Hours***

- Investigating Reported Gas Leaks and Odors In Buildings
- Investigating and Pinpointing Underground Natural Gas Leaks
- Performing Patrol and Leakage Surveys on Gas Pipeline Facilities
- Locating and Marking Underground Pipeline Facilities
- Monitoring Odorant Levels
- Establishing and Maintaining Proper Odorant Levels in Natural Gas Systems
- Identifying Principals and Practices Basic to Gas Measurement
- Identifying Techniques Common to Purging Natural Gas Distribution Pipelines
- Identifying Techniques Common to Purging Natural Gas Distribution Pipelines
- Regulating Gas Pressure in Piping Systems with Self-Operating Regulators
- Controlling Gas Pressure with Pilot Loaded Regulators
- Inspecting and Testing Pressure Limit Stations, Relief Devices and Pressure Regulating Stations

***Third Six Months: Approximately 137.5 Hours***

- Inspecting and Maintaining Pressure Relief Valve Installations
- Identifying Factors to Consider when Maintaining Overpressure Protection Using Pressure Relief Valves
- Changing and Interpreting Recording Charts
- Reading Multiple Range Pressure Recording Charts
- Maintaining Line Valves in Gas Transmission/Distribution Piping
- Maintaining Line Valves in Gas Transmission/Distribution Piping
- Investigating for Carbon Monoxide
- Identifying Safety Requirements for Working in Confined Spaces and Controlling Hazardous Energy
- Measuring and Regulating Natural Gas in a Distribution System
- Identifying Components and Operating Characteristics of Orifice Meter Settings
- Identifying Components and Operating Characteristics of Turbine Meter Settings

***Fourth Six Months: Approximately 100.5 Hours***

- Identifying Components and Operating Characteristics of Diaphragm Meter Settings
- Identifying Components and Operating Characteristics of Rotary Meter Settings
- Testing the Dew Point of Gas
- Proper Use and Maintenance of Differential Pressure Recorders to Ensure Accuracy
- Operating and Maintaining Pipeline Heaters
- Identifying Processes and Procedures Basic to Corrosion Control
- Installing Cathodic Protection Systems
- Monitoring/Testing Corrosion Control Systems
- Monitoring Corrosion Control Methods Used on Buried Metal Pipelines
- Operating and Maintaining Mercury Instruments, Gauges and Indexes

***Fifth Six Months: Approximately 181 Hours***

- Maintaining Compliance with 49 Code of Federal Regulations (CFR), Part 192
- Operations and Maintenance Manual Sections A-M excluding K
- Operator Qualification Evaluations

**Approximate Total Program Hours 696.25**

***First Six Months******Training Titles and Descriptions:*****NGT 1001 -- 3.75 Hours**

Identifying Procedures/Processes Basic to Producing, Transporting, and Distributing Natural Gas

**COURSE DESCRIPTION:**

This course presents the major components of a natural gas system from well head to burner. The action that each component has on the gas stream is presented in the context of the total system. Key terms and definitions are reviewed and applied to conditions common to the utilization of natural gas.

**NGT 1002 -- 3.75 Hours**

Identifying Basic Properties of Fuel Gases

**COURSE DESCRIPTION:**

This course relates to the chemical and physical properties of fuel gases basic to their unique characteristics. The physical properties of natural gas are discussed in relation to how it reacts to pressure and/or temperature changes and the condition under which fuel gas is measured to the customer. The chemical properties are discussed in relation to their value as a source of heat. Units of measurement for natural gas are defined.

**NGT 1101 -- 33.75 Hours**

Controlling/Preventing Fires Fueled by Natural Gas

**COURSE DESCRIPTION:**

Factors are identified relating to extinguishing fires fueled by natural gas. Emphasis is placed on ways to prevent natural gas fires by eliminating ignition sources. Various classifications of fire extinguishing agents and their intended use are presented.

Techniques used to extinguish natural gas fires are demonstrated on a fire ground and practiced by the participants in the course. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1102 -- 18.75 Hours**

Maintaining a Safe Working Environment

**COURSE DESCRIPTION:**

This course is an overview of safety practices that prevent personal injury as well as property damage at the worksite. Proper use of major equipment is stressed. Hazards resulting from escaping gas are emphasized. Also, the basis for the drug testing and alcohol misuse program is explained. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1103 (OQ M-7) -- 15 Hours**

Prevent Accidental Ignition

**COURSE DESCRIPTION:**

This course presents safety practices and procedures used to prevent accidental ignition of natural gas. Areas of emphasis are electrical arcing, welding, cutting, and other hot work, isolating pipeline segments, and isolating gas-handling facilities.

**NGT 1104 -- 11.25 Hours**

Identifying the Fundamental Guidelines for Traffic Control in Work Zones

**COURSE DESCRIPTION:**

This course presents the basic standard for traffic control as described in the manual on Uniform Traffic Control Devices, Part VI According to the U.S. Department of Transportation.

**NGT 1006 -- 11.25 Hours**

Maintaining Records and Filing Reports of Compliance

**COURSE DESCRIPTION:**

This course focuses on accuracy and complete information on field reports which document company wide summary reports. Practice in company map reading, sketching of piping installations and above ground piping facilities is emphasized. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1005 -- 7.5 Hours**

Performing Calculations Basic to Gas Distribution and Service

**COURSE DESCRIPTION:**

This course begins with instruction on the use of a calculator when working with dimensions given in decimal fractions. Basic calculations are performed for area and volume measurements. Practice problems include calculating the relationship between gas and heating measurements, calculating gas flow using meter index, and free air apace. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1401 -- 11.25 Hours**

Maintaining a Safe Working Environment While Excavating (Competent Person)

**COURSE DESCRIPTION:**

The content of this course focuses on the requirements for earth excavation and protection system according to OSHA 29 CFR Part 1026. The use of tables and specifications to design shoring protective systems is applied to typical excavations.

**NGT 1404 -- 11.25 Hours**

Communicating Potential Hazards in the Workplace

**COURSE DESCRIPTION:**

A study of health related and explosive hazards associated with the natural gas industry are examined. The use of material safety data sheets (MSDS) is emphasized to protect persons against toxic chemical and hazardous materials.

**NGT 1501 -- 7.25 Hours**

Detecting the Presence and Measuring the Percent of Gas in a Gas-in-Air Mixture

**COURSE DESCRIPTION:**

This course focuses on the principles of operations and application of combustible gas indicators. Covered is the application of CGIs equipped with catalytic and thermal conductor sensors, semi-conductor sensors and flame ionization sensors.

First Six Month Total Hours: 134.75

***Second Six Months*****NGT 1502 -- 11.25 Hours**

Investigating Reported Gas Leaks and Odors In Buildings

**COURSE DESCRIPTION:**

This course provides information and practice on the techniques of gas pipeline patrolling and leakage survey. The proper use of gas detectors and line locators are emphasized and practiced in the field. Accepted methods of leak survey are presented with emphasis on field practices. Hazards and symptoms of the presence of gas in the atmosphere are identified and safety precautions emphasized. Field practice doing patrol and leakage surveys is required.

**NGT 1504 -- 11.25 Hours**

Investigating and Pinpointing Underground Natural Gas Leaks

**COURSE DESCRIPTION:**

This course presents the theory and practice for using proper techniques and procedures when investigating and pinpointing natural gas leaks.

**NGT 1505 (OQ M-1) -- 15 Hours**

Perform Patrol and Leakage Surveys on Gas Pipeline Facilities

**COURSE DESCRIPTION:**

This course provides information and practice on the techniques of gas pipeline patrolling and leakage survey. The proper use of gas detectors and line locators are emphasized and practiced in the field. Accepted methods of leak survey are presented

with emphasis on field practices. Hazards and symptoms of the presence of gas in the atmosphere are identified and safety precautions emphasized. Field practice doing patrol and leakage surveys is required.

**NGT 1503 (OQ M-2) -- 11.25 Hours**

Locating and Marking Underground Pipeline Facilities

**COURSE DESCRIPTION:**

This course presents techniques and procedures basic to locating and marking pipeline facilities. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1602 -- 4.75 Hours**

Monitoring Odorant Levels

**COURSE DESCRIPTION:**

This course presents the federal standards for proper odorant levels. Operating instruction for an odorometer and odorator are discussed. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2204 -- 11 Hours**

Establishing and Maintaining Proper Odorant Levels in Natural Gas Systems

**COURSE DESCRIPTION:**

This course presents the industry standards and devices used to introduce odorants into a natural gas system. Emphasis is placed on testing for odorant levels and the proper handling of odorant.

**NGT 2201 -- 7.5 Hours**

Identifying Principals and Practices Basic to Gas Measurement

**COURSE DESCRIPTION:**

This course presents concepts and principals basic to gas measurement. The effect of gas pressure and temperature on gas measurement is demonstrated using mathematical calculations based on gas laws. An overview of the operating principals of diaphragm, rotary and turbine meters used to measure gas is presented.

**NGT 1604 -- 18.75 Hours**

Identifying Techniques Common to Purging Natural Gas Distribution Pipelines

**COURSE DESCRIPTION:**

This course presents the factors affecting the mechanical nature of displacing one gas with another gas by purging. Principles concerning the formation, analysis and control of gas mixtures is emphasized. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2003 -- 18.75 Hours**

Identifying Techniques Common to Purging Natural Gas Distribution Pipelines

**COURSE DESCRIPTION:**

This course presents the factors affecting the mechanical nature of displacing one gas with another gas by purging. Principles concerning the formation, analysis and control of gas mixtures is emphasized. Related skill performance is verified and documented

by laboratory simulation exercises and/or on the job training.

**NGT 2305 -- 11 Hours**

Regulating Gas Pressure in Piping Systems with Self-Operating Regulators

**COURSE DESCRIPTION:**

This course presents concepts and principals basic to the operation of pressure regulator installations. The content focuses on the operating characteristics of self-operating pressure regulator installations. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2402 -- 11 Hours**

Controlling Gas Pressure with Pilot Loaded Regulators

**COURSE DESCRIPTION:**

This course presents concepts and principals basic to the operation of pressure regulator installations. The content focuses on the operating characteristics of pilot loaded regulators. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2403 -- 11 Hours**

Inspect and Test Pressure Limit Stations, Relief Devices and Pressure Regulating Stations

**COURSE DESCRIPTION:**

This course presents concepts and principals basic to operating pressure limiting and regulating stations. Procedures for inspecting and testing above ground structures are reviewed. Relief valve testing is demonstrated. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

*Second Six Month Total Hours: 142.5*

***Third Six Months***

**NGT 2401 -- 11 Hours**

Inspecting and Maintaining Pressure Relief Valve Installations

**COURSE DESCRIPTION:**

This course presents the purpose and operating characteristics of pressure relief valves. Content focuses on inspecting, testing and maintenance of relief valve installations. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1902 -- 7.5 Hours**

Identifying Factors to Consider when Maintaining Overpressure Protection Using Pressure Relief Valves

**COURSE DESCRIPTION:**

This course presents the components and operating characteristics of typical pressure relief valve installations. The focus of the discussions is primarily on spring operated and pilot operated pressure relief valves. Emphasis is placed on factors to consider when installing pressure relief valves. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2306 -- 11 Hours**

Changing and Interpreting Recording Charts

**COURSE DESCRIPTION:**

This course presents the basic technology used to transfer information to a recording chart. Emphasis is on: accurately reading and interpreting an index, change an orifice chart, change a meter driven chart, change a clock driven chart and interpret pressure charts. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2406 -- 11 Hours**

Reading Multiple Range Pressure Recording Charts

**COURSE DESCRIPTION:**

This course presents concepts and principals basic to reading multiple range pressure recording charts. Emphasis is placed on the correct reading of pressure charts and recording pertinent information.

**NGT 1901 (OQ M-5) -- 7.5 Hours**

Maintaining Line Valves in Gas Transmission/Distribution Piping

**COURSE DESCRIPTION:**

This course presents the basic design characteristics and maintenance procedures for pipeline valves. The valve types included are plug, ball and gate. The proper use and care of high-pressure grease guns is explained. This course meets operator qualification as required by D.O.T. 49 CFR Part 192.745. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2202 -- 22.5 Hours**

Maintain Line Valves in Gas Transmission/Distribution Piping

**COURSE DESCRIPTION:**

This course presents the basic operating principles and maintenance schedules of gas control flow valves. The proper use and handling of high pressure grease guns is demonstrated. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 1506 -- 3.75 Hours**

Investigating for Carbon Monoxide

**COURSE DESCRIPTION:**

This course provides information and practice on the techniques of gas pipeline patrolling and leakage survey. The proper use of gas detectors and line locators are emphasized and practiced in the field. Accepted methods of leak survey are presented with emphasis on field practices. Hazards and symptoms of the presence of gas in the atmosphere are identified and safety precautions emphasized. Field practice doing patrol and leakage surveys is required.

**NGT 1403 -- 18.75 Hours**

Identifying Safety Requirements for Working in Confined Spaces and Controlling Hazardous Energy

**COURSE DESCRIPTION:**

Confined spaces are defined and classified. Atmospheric monitoring and entry

procedures into confined spaces are included in the course. Controlling hazardous energy with the lock-out/tag-out method is emphasized.

**NGT 1004 -- 22.5 Hours**

Measuring and Regulating Natural Gas in a Distribution System

**COURSE DESCRIPTION:**

This course reviews the principles of operation for direct volume measurement meters and rate-of-flow (inferential) type meters. The operating principles of service regulators are outlined and discussed. Emphasis is placed on the correct reading of dial type meter faces. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2301 -- 11 Hours**

Identifying Components and Operating Characteristics of Orifice Meter Settings

**COURSE DESCRIPTION:**

This course presents the operating principals of orifice meters. Emphasis is placed on the identification of the meter components and their function in the measurement process.

**NGT 2302 -- 11 Hours**

Identifying Components and Operating Characteristics of Turbine Meter Settings

**COURSE DESCRIPTION:**

This course presents the operating principals of turbine type meters. Emphasis is placed on the identification of the meter components and their function in the measurement process.

*Third Six Months Hours: 137.5*

***Fourth Six Months***

**NGT 2303 -- 11 Hours**

Identifying Components and Operating Characteristics of Diaphragm Meter Settings

**COURSE DESCRIPTION:**

This course presents the operating principals of diaphragm type meters. Emphasis is placed on the identification of the meter components and their function in the measurement process.

**NGT 2304 -- 11 Hours**

Identifying Components and Operating Characteristics of Rotary Meter Settings

**COURSE DESCRIPTION:**

This course presents the operating principals of rotary type meters. Emphasis is placed on the identification of the meter components and their function in the measurement process.



**NGT 2205 -- 11 Hours**

Testing the Dew Point of Gas

**COURSE DESCRIPTION:**

This course covers the theory and practice used to test the dew point of a gas. Methods used to test moisture in gas are discussed. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2404 -- 7.5 Hours**

Proper Use and Maintenance of Differential Pressure Recorders to Ensure Accuracy

**COURSE DESCRIPTION:**

This course presents information and procedures for maintaining and calibrating differential pressure recorders. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2203 -- 7.5 Hours**

Operating and Maintaining Pipeline Heaters

**COURSE DESCRIPTION:**

This course presents the design features and operation characteristics of catalytic type indirect and water bath type pipeline heaters. The operation, maintenance and troubleshooting procedures for pipeline heaters are explained.

**NGT 2051 -- 11.25 Hours**

Identifying Processes and Procedures Basic to Corrosion Control

**COURSE DESCRIPTION:**

This course presents the electrochemical process that causes corrosion on buried metals, and the conditions that support this process. Methods used to control the corrosion process are described and illustrated. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2052 -- 11.25 Hours**

Installing Cathodic Protection Systems

**COURSE DESCRIPTION:**

This course presents construction procedures associated with pipeline corrosion control. Installation procedures for test pints, cased installation, insulated joints, galvanic anodes and rectifiers. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2053 -- 11.25 Hours**

Monitoring/Testing Corrosion Control Systems

**COURSE DESCRIPTION:**

This course presents factors basic to monitoring/testing cathodically protected pipelines, testing procedures for pipe-to-soil surveys, testing for shorted insulating joints, shorted casings, and evidence of atmospheric corrosion. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2054 (OQ I-1) -- 11.25 Hours**

Monitoring Corrosion Control Methods Used on Buried Metal Pipelines

**COURSE DESCRIPTION:**

This course presents information and techniques for monitoring corrosion control methods. The focus is on the application of techniques used to monitor corrosion control methods in the field. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

**NGT 2405 -- 7.5 Hours**

Operating and Maintaining Mercury Instruments, Gauges and Indexes

**COURSE DESCRIPTION:**

This course presents the fundamental operating and maintenance procedures for Mercury instruments, gauges and indexes. Training is focused on maintaining Mercury gauges and volume recorders. Related skill performance is verified and documented by laboratory simulation exercises and/or on the job training.

*Fourth Six Months Total Hours: 100.5*

***Fifth Six Months***

**NGT 1301 -- 15 Hours**

Maintaining Compliance with 49 Code of Federal Regulations (CFR), Part 192

**COURSE DESCRIPTION:**

This course is a survey of the criteria for the installation, maintenance and inspection of gas pipelines up to the outlet of the customer's meter. Key terms and definitions are reviewed and applied to issues common to the installation, maintenance and inspection of gas transportation pipelines. Emphasis is given to the identification of content contained in each subpart of 49 CFR. Identifying general provisions of the regulations. Identifying selected requirement basis to the operations of natural gas distribution systems.

**Operations and Maintenance Manual Sections A-M (excluding K) (NV Energy) -- 16 Hours**

**COURSE DESCRIPTION:**

This class will discuss and review NV Energy's Gas Operations and Maintenance Manual, sections A-M (excluding K). Areas that will be discussed include reporting safety related conditions, petroleum gas systems, conversion to service, material and manufacturing requirements, pipe design, pipeline component design, welding steel pipelines, joining non-steel pipelines, general construction, meter and service facilities, corrosion control, test requirements, operations and maintenance

**Operator Qualification CBT Evaluation Completion (NV Energy) -- 150 Hours**

**COURSE DESCRIPTION:**

Complete approximately 28 Written and 7 Performance evaluations for "Operator Qualification Covered Tasks" associated with the Gas Pressure Operator Job to fulfill the requirements of 49 CFR 192 Subpart "N".

*Fifth Six Months Total Hours: 181*

### **Approximate Total Program Hours 696.25**

Subsequent edition/volume changes of textbooks are approved for use through the discretion of the program.

### **Wages**

Wage Schedule for Apprentice Communications Technician – See Collective Bargaining Agreement, but should be reflective of prorated portions of the Journeyman wage as outlined in the Parties' Letter of Agreement dated August 31, 2023 (LOA 23-07). The current Journeyman wage scale is outlined in the Collective Bargaining Agreement.

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**Lineman**  
**Program Duration: 4 Years (48 Months)**  
(Revision Date: 2/22/24)

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The following is an outline of the subjects to be covered in the supplementary classroom and home study training:

| <u>Process</u>   | <u>Hours</u> |
|--|--------------|
| <i>Overhead</i>  |              |
| Framing, installation and removal of poles, arms<br>guys, fixtures, conductors | 1380         |
| Repairing fixtures and conductors  | 700          |
| Stringing and sagging conductors   | 380          |
| Install pole mounted switches, cutouts, and special devices                    | 340          |
| OH transformers – install and connect  | 280          |
| OH services – install and connect  | 180          |
| Live line work – hot stick   | 300          |
| Live line work - rubber goods  | 200          |
| Transmission work experience   | 490          |
| <b>Total Overhead Hours</b>  | <b>4,250</b> |

| <u>Process</u>   | <u>Hours</u> |
|--|--------------|
| <i>Underground</i>                                       |              |
| UG primary cable – installing, splicing, and terminating | 1,250        |
| UG switches – installing or repairing                    | 200          |
| UG transformers – install and connect                    | 350          |
| UG services – install and connect                        | 200          |
| Hot stick primary – switching, phasing, sensing, etc.    | 120          |
| Rubber glove – 600V and below                            | 120          |
| <b>Total Underground Hours</b>                           | <b>2,240</b> |

Process*Safety*

|   |           |
|---|-----------|
| Safety meetings, safety rule book, CPR, and first aid | 48        |
| Pole top and vault rescue                             | 12        |
| <b>Total Safety Hours</b>                             | <b>60</b> |

Process*General*

|   |              |
|---|--------------|
| Use and operation of line trucks and aerial lift equipment  | 320          |
| Company standards (OH & UG line construction)               | 40           |
| Install and repair street lighting                          | 5            |
| Use of voltmeters, phase sequence indicators                | 5            |
| Field switching (procedures and clearances)                 | 120          |
| System control rotation                                     | 40           |
| Electric meter operations rotation                          | 10           |
| Substation, system protection and transformer shop rotation | 150          |
| Installation of substructures (with Inspector)              | 40           |
| Troubleshooting & trouble rotation                          | 120          |
| Supplementary training                                      | 600          |
| <b>Total General Hours</b>                                  | <b>1,450</b> |

**Total OJT Hours Recommended                      8,000**

***First Six Months (0 months to 6 months)***

Apprentice will receive orientation of their on-the-job (OJT) card completion and submission along with how to properly complete his/her timecard.

Apprentice should be assigned to an overhead crew and should be allowed to climb as much as possible. It is the responsibility of foreman to ensure apprentice receives this experience. Apprentice will be restricted to all types of line work on de-energized equipment, working with or under the direct supervision of company foreman or company journeyman, excluding contracted employees.

Apprentice may be rotated among overhead and underground crews to gain a varied experience.

Apprentice will be required to attend a one-day class to study effective listening skills and field ambassador training.

Apprentice will be required to attend a five-day class to study basic electricity, secondary and metering. Apprentice will be required to pass a test demonstrating knowledge learned in the course.

***Second Six Months (6 months to 1 Year)***

Working with or under the direction of a company foreman or company journeyman, excluding contracted employees, apprentice will perform all types of line work on de-energized equipment and on energized lines and equipment not to exceed 600 volts (hot secondary).

Apprentice will be required to attend a five-day basic transformer class. Apprentice will be required to successfully complete a written test at the end of class.

***Third Six Months (1 Year to 1.5 Years)***

Working with or under the direction of a company foreman or company journeyman, excluding contracted employees apprentice will perform all types of line work on de-energized equipment and on energized lines and equipment not to exceed 600 volts (hot secondary).

Apprentice will be required to attend a 10-day advanced transformer class. Apprentice will be required to successfully complete a test demonstrating knowledge learned in the course.

Apprentice will attend a two-day class on construction standards, how to read work orders, how to check materials and mapping. Apprentice will be required to successfully complete a test demonstrating knowledge learned in the course.

Apprentice will be required to attend a fifteen-day hot stick / rubber gloving class and will be required to successfully complete a test demonstrating knowledge learned in the course.

***Fourth Six Months (1.5 Years to 2 Years)***

Apprentice may begin to work on energized primary lines based upon a written recommendation from his/her foreman, supervisor and after having successfully passed a proficiency evaluation. This evaluation will cover only those areas apprentice has been exposed to, had classes on or is covered in the home study coursework. Apprentice should be assigned to work with a company journeyman and/or company foreman, excluding contracted employees, on all types of overhead and underground line work. This shall include as much hot line work as possible, in accordance with company safety rules. Apprentice will become proficient in the use of live line tools, rubber goods and all personal protective equipment (hot primary).

Based upon apprentice's ability, he/she may begin hot primary work at any time during this fourth step. However, if apprentice's ability has not reached this level by the end of fourth step, apprentice will be frozen until able to do so. The freeze shall be in accordance with the Apprenticeship Agreement (Section II F.).

***Fifth Six Months (2 Years to 2.5 Years)***

Apprentice will be required to attend a five-day class on transmission line maintenance and equipment. Transmission rotations will be scheduled throughout their apprenticeship and shall be completed by the eighth step. The time with the transmission crew is to be coordinated with leadership to ensure the work being done is of a learning nature and will be of a benefit to the apprentice.

Apprentice will be required to attend a five-day switching class. Apprentice will be required to successfully complete a test demonstrating knowledge learned in the course.

Apprentice will be permitted to be scheduled to work with inspector, troubleman, system control, substation, system protection, transformer shop and electric meter operations. The hours for each group to be completed by eighth step.

***Sixth Six Months (2.5 Years to 3 Years)***

Apprentice will be required to attend a 5-day review class on transformers, hot sticks, and related equipment. Apprentice will be required to complete a hands-on demonstrated test.

***Seventh Six Months (3 Years to 3.5 Years)***

Apprentice will be required to attend a three-day grounding and bonding class.

Apprentice will be required to attend a five-day overhead procedures class.

Apprentice will be required to attend a three-day underground operating procedures class.

***Eighth Six Months (3.5 Years to 4 Years)***

Apprentice will be required to attend a five-day journeyman top out prep test class. This class will help prepare apprentice for their one-day journeyman top out test. During the last six months of the apprenticeship no additional formal curriculum is required. This timeframe will be used to reinforce hours, demonstrate on the job skills and prepare for journeyman status.

During apprentice's last six months, he/she will be given the responsibility of job planning and leading the crew through completion of the job. This will be scheduled and coordinated by supervisor and will be evaluated by foreman and supervisor.

By the end of the eighth month, the apprentice will have completed 490 hours with transmission, 40 hours with inspection, 120 hours with troubleman, 40 hours with system control, and 150 hours with substation, system protection and transformer shop, and 10 hours with electric meter operations.

***General***

In conjunction with the performance of work assignments, instruction on the following safety practices will be included with the on-the-job and classroom training:

- Care and use of personal tools
- Care and use of crew tools and equipment, proper operation of aerial and line trucks
- Field switching and line clearance
- Clearing and grounding of lines and equipment
- Care and use of hot line tools
- Care and use of protective equipment, rubber goods, etc.
- Pole top and vault rescue
- Company electric construction standards
- Basic first aid and CPR
- Tailboard briefings
- Climbing instructions and practice

Apprentices should be encouraged to discuss their problems with their foremen, supervisors and instructors. Foremen, supervisors and instructors will assist and encourage apprentice in their work.



### ***Supplementary Classroom Training***

There will be two kinds of supplementary training provided: (1) a supplementary study course to take place on the apprentice's own time, and (2) a supplementary training course on company time. Supplementary study and training will be in an amount at least equal to 600 hours.

1. Supplementary Study Course –

Shall be that course known as the “Electrical Apprenticeship Training: Outside”, developed by the IBEW – NECA, as amended by agreement between union and company members of the JATC-1245.

A copy of the “Electrical Apprenticeship Training: Outside” and the reference textbooks needed will be supplied by the company to each apprentice assigned to the apprentice lineman classification at no cost to the apprentice, but with the requirement that the books supplied shall remain the property of company until the apprenticeship is successfully completed. At that time, the books will become the property of the apprentice.

Company will provide a classroom and instructor to meet with the apprentice and provide instruction and review for the course on a scheduled basis, such schedule to prove those classes will be held for up to six (6) hours, meeting once per month.

Apprentice shall study prepared lesson units and complete checkup questions on his/her own time; however, apprentice may be given the unit test bi-monthly. If the apprentice does not show up to class with lesson units completed or pass test, his/her progress may be reviewed by JATC-1245 who will recommend freezing the apprentice pursuant to Apprenticeship Agreement (Section II F.). Additionally, apprentice may be restricted from attending monthly class if not fully prepared and would require scheduling make-up class later.

Apprentice records, progress records and records of examination grade will be made by instructor. Records shall be kept on file in the training department. Records shall be available to the apprentice, instructors, union's business representative and to the members of the JATC-1245. All permanent apprenticeship records shall be forwarded in accordance with apprenticeship agreement and JATC-1245 procedures.

2. Supplementary Training Course –

Training department will be responsible for coordinating and ensure scheduling of specified training in conjunction with supervisors. Training shall consist of either classroom training or “in-the-field” training on such subjects as climbing, use and care of hot line tools, rigging, basic electric theory, safety, first aid, pole top and vault rescue, CPR, care and inspection of tools and equipment, use and care of personal protective equipment, transformer hookups, reading and understanding mapping, basic metering, switching procedures, overhead procedures, underground procedures, etc., and shall be made available to the apprentice on a scheduled basis of not less than ten work days per year with qualified instructors provided by the company.

Apprentice records, progress records and records of examination grade will be made by instructor. Records shall be kept on file in the training department. Records shall be available to the apprentice, instructors, union's business representative and to the members of the JATC-1245. All permanent apprenticeship records shall be forwarded in accordance with apprenticeship agreement and JATC-1245 procedures.

### ***Tests***

Grading of tests shall be done by the instructor. The apprentice shall be notified of grades earned. Lesson tests determine the apprentice's progress in the supplementary study course and shall be given upon completion of each lesson of the course and shall be prescribed for the course or as approved by the training department. The grades shall be made a part of the apprentice's record.

In an effort for an apprentice to top out, the following guidelines may be used; apprentice will be given a final test before topping out, a written and demonstrated skills test will be the company's journeyman lineman test or its equivalent, and written test will be administered within apprentices last month prior to his/her completion date.

### ***Learning References***

The apprentice will be instructed on the lessons contained in the IBEW - NECA Program. As part of the lessons, the following reference and study materials will be used to supplement the required lessons.

Building a Foundation in Mathematics  
2nd ED. By NJATC/Delmar Cengage Learning

Promoting a Culture of Safety in the Electrical Industry  
By NJATC

Underground Distribution  
2nd ED. By NJATC/ Alexander Publishing

The Lineworkers Rigging Handbook  
2nd ED. By NJATC/ Alexander Publishing

The Guidebook for Linemen and Cablemen  
By Wayne Van Soelen

D.C. Theory  
2nd ED. By NJATC/Delmar Cengage Learning

Transformation for Lineworkers  
2nd ED. By NJATC/Delmar Cengage Learning

Test Instruments  
By Glen Mazur

Terminations & Splicing Theory- Practice  
4th ED. By NJATC Special Printing

Flaggers Certification Handbook  
2005 ED. By Evergreen Safety Council

Distribution Volume I; Transformer Theory for Line People  
1983 ED. By Robert A. Billing/NJATC Special Printing

A.C. Theory  
3rd ED. By NJATC/Delmar Cengage Learning

Substation Construction Guidelines  
1st ED. By NJATC/ Alexander Publishing

Personal Protective Grounding for Worker Safety  
By NJATC

Live Line Work Practices  
2nd ED. By Alexander Publishing

"Hot Sticks" A Manual on High Voltage Line Maintenance  
Rev. 9/95 By A.B. Chance

Distribution Volume II; Capacitors, Regulators, Circuit Protection  
1987 ED. By Robert A. Billing/NJATC Special Printing

Reference Guide to Fiber Optics  
2009, 2013 ED. By NJATC & FOA

Subsequent edition/volume changes of textbooks are approved for use through the discretion of the program.

**First Year Lineman Apprentice  
First Six Months**

**Outside 1<sup>st</sup> Year, Level I – ProTech Skills Institute** **30 hours**

This course begins with a lesson that instructs the student on how to study the course and gives helpful pointers on negotiating the course materials. The next lessons present the responsibilities of the apprentice and the advantages of an IBEW/NECA apprenticeship. Other lessons teach the student about safety and hazard awareness and how to identify and care for basic tools of the trade. An introduction to OSHA is given and then the last lessons cover topics such as fall protection, climber cutouts, climbing poles, and pole top and bucket rescues.

**National Electrical AJATC Course Test 1-1** **2 hours**

**Outside 1<sup>st</sup> Year, Level II – ProTech Skills Institute** **30 hours**

This course covers a wide variety of topics. Students learn about how to avoid sexual harassment and the dangers of drug use. They also gain a thorough understanding of the history of the IBEW and NECA. Lessons cover the care and use of rubber gloves and protective line devices. The apprentice will learn how to work in a confined space and how to work with powered equipment, wood poles, and energized circuits. Safety topics and hand signals will also be covered.

**National Electrical AJATC Course Test 1-2** **2 hours**

**Outside 1<sup>st</sup> Year, Level III – ProTech Skills** **30 hours**

The course opens with an introduction to whole numbers, fractions, decimals, and percentages. Lessons then transition to electron theory and electrical units. The apprentice also learns about ropes, knots, hitches and splices, ladders, powered equipment safety pertaining to underground, and digger derricks. The last lessons cover hazard communication and personal protective equipment.

**National Electrical AJATC Course Test 1-3** **2 hours**

**6 Month Progression Written & Skills Test** **8 hours**

**Effective Listening – NV Energy** **4 hours**

At the end of this course, apprentice's listening skills should have improved. This will assist the apprentice to be more effective on the job and will assist him in taking directions from the journeyman. The course is designed to help apprentice assess his/her personal listening habits and skills, identify difficult listening events in his/her job, and develop specific strategies for improved listening.

**Field Ambassador – NV Energy****4 hours**

At the end of this class, apprentice will be able to convert difficult customer situations into positive experiences. This course covers customer relationship models, handling mistakes, handling requests, and responding to angry or upset customers.

**Basic Electricity, Secondary and Metering – NV Energy****40 hours**

In this class the apprentice will understand basic electricity, secondary and metering. This class utilizes lecture room, videos, and hands-on implementation.

***Total Hours Year 1 First Six Months:152***

**First Year Lineman Apprentice  
Second Six Months**

**Outside 1<sup>st</sup> Year, Level IV – ProTech Skills** **30 hours**

To be successful in this industry, an outside technician must be knowledgeable about mathematics and Ohm's Law. This course covers solving basic algebraic equations and solving power calculations. Students will learn about resistance, current, voltage and power in series circuits. Lessons explore the use and operation of blocks, slings, and chokers as well as various rigging tools and equipment. Guy types, anchors, line conductors, crossarms, and insulators also are covered.

**National Electrical AJATC Course Test 1-4** **2 hours**

**Outside 1<sup>st</sup> Year, Level V – ProTech Skills** **30 hours**

To be successful in this industry, an Outside technician must be knowledgeable about mathematics and Ohm's Law. This course covers solving basic algebraic equations and solving power calculations. Students will learn about resistance, current, voltage and power in series circuits. Lessons explore the use and operation of blocks, slings, and chokers as well as various rigging tools and equipment. Guy types, anchors, line conductors, crossarms, and insulators also are covered.

**National Electrical AJATC Course Test 1-5** **2 hours**

**Outside 1<sup>st</sup> Year, Level VI – ProTech Skills** **30 hours**

This course begins with lessons on resistance, current, voltage, and power in combination circuits. The student will then learn about two-way radios, underground systems, and excavation and shoring. Laying conduit and pulling cable are covered. The next lessons touch on manholes, underground systems, basket, aerial lifts, and platforms. The course closes with discussions on grounding and protective grounds, taking a line out of service, and lockout/tagout applications.

**National Electrical AJATC Course Test 1-6** **2 hours**

**National Electrical AJATC Course 1<sup>st</sup> Year Final Examination** **2 hours**

**12 Month Progression Written & Skills Test** **8 hours**

**Basic Transformer Class** **40 hours**

Apprentice will have a basic understanding of single-phase transformers. This class utilizes lecture room, videos, and hands-on implementation.

***Total Hours 2nd Six Months:146***

**Second Year Lineman Apprentice**  
***Third Six Months***

**Outside 2<sup>nd</sup> Year, Level I – ProTech Skills Institute** **30 hours**

The course opens with lessons that cover organizational topics such as the national program, the IBEW constitution, parliamentary procedure and how it works, and understanding local union bylaws. It then covers professional personal conduct, absenteeism, working outdoors, and emergency response. The course closes with lessons on reviewing the applications of DC theory, fundamentals of alternating current, understanding how the DC generator works, and understanding the design and function of AC generators.

**National Electrical AJATC Course Test 2-1** **2 hours**

**Outside 2<sup>nd</sup> Year, Level II – ProTech Skills Institute** **30 hours**

Level II focuses primarily on transformers. It opens with lessons on test instruments, and then covers transformer construction, characteristics, operation, polarity, tap changers, installation, load checks, and protection. The last lesson in the course will teach students about vectors.

**National Electrical AJATC Course Test 2-2** **2 hours**

**Outside 2<sup>nd</sup> Year, Level III – ProTech Skills Institute** **30 hours**

Successful qualified electrical workers must possess a strong knowledge of math. Level III opens with the student covering working with prefixes and powers of 10, the customary and metric systems of measurements, the circle, area and volume, and measuring and drawing angles. It then transitions to blueprint fundamentals, electrical drawings and diagrams, and civil drawings. It closes with lessons on staking sheets and stakes and measuring and leveling devices.

**National Electrical AJATC Course Test 2-3** **2 hours**

**18 Month Progression Written & Skills Test** **8 hours**

**Advanced Transformer Class** **80 hours**

Apprentice will be instructed on three-phase wye, delta, bank and vector transformer connections.

**Mapping, Work Orders & Standards Class** **16 hours**

Apprentice will understand of how to interpret mapping, read work orders, and understand construction standards.

**Hot stick / Rubber Gloving Class** **120 hours**

Apprentice will understand the use of live line tools, rubber goods, and personal protective equipment.

***Total Hours 3rd Six Months Hours: 320***

**Second Year Lineman Apprentice**  
***Fourth Six Months***

**Outside 2<sup>nd</sup> Year, Level IV – ProTech Skills Institute** **30 hours**

Level IV opens with introduction to inductance and continues with lessons on voltage drop, metering, overvoltage protection, fault indicator, tower footings, tower erection, joining high-line conductors, and sagging conductors. The course also covers dampers, hold down weights, and armor rods, phasing and tying in circuits, overload capabilities of electrical equipment, phase sequence, back-feed, and locating faults and restoring service.

**National Electrical AJATC Course Test 2-4** **2 hours**

**Outside 2<sup>nd</sup> Year, Level V – ProTech Skills Institute** **30 hours**

Cabling splicing is the main focus of Level V. Topics covered include safety, materials and tools, preparation, terminations, elbows, grounding cables, pulling, insulation testing, and manufacturers' kits. Students will learn how to use a megohmmeter and gain experience in cable fault locating, underground troubleshooting, and confined spaces.

**National Electrical AJATC Course Test 2-5** **2 hours**

**Outside 2<sup>nd</sup> Year, Level VI – ProTech Skills Institute** **30 hours**

Crane and traffic signal practices are covered in the course. Crane topics include mobile cranes, boom capacities and load charts, rigging vectors, and lifting and digging operations. After gaining an overview of the traffic signal industry, students will focus on flagging, signs, and barricades, traffic control devices, hardware, and equipment. The course closes with lessons on caissons, basic signal blueprints, cabinets, and phasing and traffic flow.

**National Electrical AJATC Course Test 2-6** **2 hours**

**National Electrical AJATC Course 2<sup>nd</sup> Year Final Examination** **2 hours**

**24 Month Progression Written & Skills Test** **8 hours**

***Total Hours 4th Six Months Hours: 106***



**Third Year Lineman Apprentice**  
***Fifth Six Months***

**Outside 3<sup>rd</sup> Year, Level I – ProTech Skills Institute** **30 hours**

Level I opens with lessons on taking pride in the industry, an introduction to the COMET program, and productivity. Students will then learn about distribution circuits, alternating current, inductance and capacitors. The course closes with lessons on transformers—3-phase voltages and connections and single-phase connections. Students also will learn about troubleshooting 3-phase banks.

**National Electrical AJATC Course Test 3-1** **2 hours**

**Outside 3<sup>rd</sup> Year, Level II – ProTech Skills Institute** **30 hours**

Level II starts with a lesson on labor-management relations but is primarily about personal protective grounding. Topics covered include body currents, basic electric circuits, grounding history, equipotential zone grounding, equipment selection, installation of grounds and step and touch potential. Including lessons on induced voltage and multiple grounds, truck grounding, underground distribution grounding, and grounding in substations. The last two lessons are on testing ground resistance and lightning protection.

**National Electrical AJATC Course Test 3-2** **2 hours**

**Outside 3<sup>rd</sup> Year, Level III – ProTech Skills Institute** **30 hours**

Level III focuses on live-line tools and work practices. The beginning of the course covers applying rubber protective devices and the identification and care of tools. The next lessons are on maintenance with hot sticks. The students then will learn about insulator and crossarm changes, helicopter timber changes, and special practices. The course closes with lessons on primary and single-phase revenue metering.

**National Electrical AJATC Course Test 3-3** **2 hours**

**30 Month Progression Written & Skills Test** **8 hours**

**Transmission Lines Class** **40 hours**

Apprentice will gain working knowledge of the transmission line maintenance and equipment.

**Switching Class** **40 hours**

Apprentice will have an understanding and working knowledge of the routine substation and overhead line switching tasks and how they are carried out in a safe consistent manner. Areas that will be addressed in this class are the scope and definitions, tagging rules, substation switching procedures, and overhead line switching procedures.

***Total Hours Fifth Six Months Hours: 184***

**Third Year Lineman Apprentice  
Sixth Six Months**

**Outside 3<sup>rd</sup> Year, Level IV – ProTech Skills Institute 30 hours**

Level IV covers substation construction. Instruction includes safety procedures, federal regulations, print reading, making connections, and function and types of stations. The student will then move on to spill prevention, containment, and countermeasure plans. The remaining lessons cover foundations, installing grout, underground power cables, grounding grids, steel superstructure assembly, and installing insulators, control cables, and devices.

**National Electrical AJATC Course Test 3-4 2 hours**

**Outside 3<sup>rd</sup> Year, Level V – ProTech Skills Institute 30 hours**

Level V continues the study of substations. Lessons cover equipment identification, oil circuit breakers, batteries, oil care and filtering, and air switches. Other topics included in this course are fuse principles, reclosers and sectionalizers, fault current, voltage regulations, tap changing, and capacitors. The course closes with lessons on power factor and power harmonics.

**National Electrical AJATC Course Test 3-5 2 hours**

**Outside 3<sup>rd</sup> Year, Level VI – ProTech Skills Institute 30 hours**

Level VI prepares the student for life after class. Topics include the economics of unemployment, motivation and the National Electrical Benefit Fund. Fiber optics, alternative energy sources and high voltage lines are also covered. The course ends with lessons on foremanship and journeyman responsibilities.

**National Electrical AJATC Course Test 3-6 2 hours**

**National Electrical AJATC Course 3<sup>rd</sup> Year Final Examination 2 hours**

**36 Month Progression Written & Skills Test 8 hours**

**Transformer/Hot Stick Review Class 40 hours**

This class reemphasizes the use of hot sticks in the field and the theory and workings of transformers. This is a hands-on class designed to answer and address questions and situations an apprentice may have faced during on-the-job training.

**Total Hours Sixth Six Months Hours: 146**

**Fourth Year Apprentice  
Seventh Six Months**

**42 Month Progression Written & Skills Test** **8 hours**

**Grounding & Bonding Class** **24 hours**

Apprentice will learn theory and practices of proper grounding and bonding.

**Overhead Procedures Class** **40 hours**

Apprentice will learn through a hands-on approach about switching procedures and practices in the field. Apprentice will become familiar with tools and equipment found in their overhead work such as capacitor banks, regulator banks, transformer banks, and line reclosers. They will learn how to handle the mental and physical process of switching in the field, how to write switching procedures, and the proper use of the apparatus and tools.

**Underground Operating Procedures** **24 hours**

Apprentice will review operating procedures, troubleshoot a metering board, make up splices and termination, and become familiar with various cable testing devices.

***Total 7th Six Month Hours: 96***

**Fourth Year Apprentice  
Eighth Six Months**

**Prep Test Class** **40 hours**

Apprentice will attend a five-day prep test class. This class will get them prepared to take their journeyman top out test. During these last six months the hours will be watched to make sure that the apprentice isn't missing any hours.

**Top Out Test** **8 hours**

In the last month, Apprentice will take their top out test. Refer to Section XIV Progression & Testing "Final Exam (Top Out Test)" for applicable provisions.

***Total 8th Six Month Hours: 48***

**Approximate Total Program Hours: 1,198**

**Wages**

Wage Schedule for Apprentice Communications Technician – See Collective Bargaining Agreement, but should be reflective of prorated portions of the Journeyman wage as outlined in the Parties' Letter of Agreement dated August 31, 2023 (LOA 23-07). The current Journeyman wage scale is outlined in the Collective Bargaining Agreement.

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**Meter Technician**  
**Program Duration: 4 Years (48 Months)**  
(Revision date: 2/22/24)

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The following is an outline of the subjects to be covered in the supplementary classroom and home study training:

| <u>Process</u>                    | <u>Hours</u> |
|-----------------------------------|--------------|
| Meter Shop Safety                 | 100          |
| Single Phase Shop Testing         | 400          |
| Poly Phase Shop Testing           | 600          |
| Wiring New Meter Sets             |              |
| - Secondary                       | 1600         |
| - Primary                         | 240          |
| Field Testing                     |              |
| - Mainlines                       | 1600         |
| - In Service Checks               | 560          |
| Field Inspections                 |              |
| - Solar and Battery Installations | 1600         |
| - Troubleshooting/Exchanges       | 980          |
| Meter Dispatching                 | 40           |
| Trade Schools                     | 120          |
| Cross Training                    |              |
| - Billing                         | 20           |
| - Trouble Dispatch                | 20           |
| - Lines                           | 40           |
| - Telecommunications              | 40           |
| - Substation                      | 40           |
| Total OJT Hours Recommended       | 8000         |

***Course Plan***

***First Six Months***

Familiarize candidates by reviewing math courses that are focused on algebra, geometry, trigonometry, and expose candidates to basic electric safety practices.

### ***Second Six Months***

Acquaint candidates with D/C electrical principles, A/C circuitry and electromagnetism, both of which are essential for the successful operation of induction meters used mainly on residential and some commercial/industrial customers. Additional training will be provided in proper dealings with customers so they can present a good image of the Company to the public. Energy diversion classes are taught to arm the apprentice with the ability to help curtail power theft.

### ***Third Six Months***

Familiarization with electronic components and electronic measurements is emphasized. Self-contained metering and their proper installation are also taught during this period. Candidates are given an introductory course into computer hardware and how to use common computer applications, including meter programming software.

### ***Fourth Six Months***

Transformers and instrument transformers that are used to supply power to commercial/industrial customers and facilitate metering of this power are introduced. Reading and understanding schematics as presented on blueprints and one-line diagrams is also given special attention.

### ***Fifth Six Months***

The apprentice will review substations, local distribution, and underground power systems. Electrical parameters and quantities measured in a power system are also introduced.

### ***Sixth Six Months***

Polyphase systems, polyphase metering, and demand metering are discussed during this term.

### ***Seventh Six Month***

Specialized metering such as reactive, Q, V2H, and other metering quantities are treated in some detail. Mechanical and solid-state relaying transducers, and solid-state power supplies are studied. This will equip candidates with the knowledge of how load management and conservation information is provided to commercial/residential customers and to SCADA systems.

### ***Eighth Six Months***

Advanced metering is introduced to candidates to prepare them to perform independently in the shop and in the field. This includes totalizing meters, all solid-state meters, multi-tariff meters, electronic recorders, and other specialized instruments. During this period, candidates are expected to get the formal hands-on training through direct supervision and assisting meter technicians in the field.

The following is an outline of the subjects to be covered in the supplementary classroom and home study training:

### ***Supplementary Classroom Training***

#### ***First Six Months***

Safety in Meter Work (NUS) Safety in  
Sub/Switch Yards (NUS)  
Fractions, Percents, Proportions, Angles (ICS)  
Formulas (ICS)  
Introduction to Algebra (ICS)  
Monomials and Polynomials  
Algebra Factoring (ICS)  
Addition and Subtraction of Fractions (ICS)  
Multiplication and Division of Fractions (ICS) Linear  
Equations (ICS)  
Exponents (ICS) Applied  
Geometry (ICS)  
Practical Trigonometry (ICS)

#### ***Second Six Months***

Nature of Electricity (ICS)  
Circuit Analysis and Ohms Law (ICS)  
Capacitors and Inductors (ICS) Magnetism  
and Electromagnetism (ICS)  
Conductors, Insulators, and Batteries (ICS) DC  
Motors and Generator Theory (ICS) Alternating  
Current (ICS)  
Alternating Current Circuits (ICS) Inductors  
in AC Circuits (ICS) Capacitors in AC  
Circuits (ICS) Transformers (ICS)  
Alternators (ICS)  
Rectification and Basic Electronic Devices (ICS)  
Electrical Energy Distribution (ICS)  
Introduction to Metering (NUS)  
Customer Relations & High Bill Complaints (NUS)

#### ***Third Six Months***

Register Ratios and Constants  
Single Phase Metering I (Northwest Meter School) Introduction  
to PC's Series (online)  
Installation Checks and Inspections (NUS) Electrical  
Measuring Instruments A, B, C (ICS) Energy Diversion  
1 & 2 (NUS)

***Fourth Six Months***

Using Electrical Test Equipment (NUS) Reading  
Electrical Schematic Diagrams (ICS) Electrical  
Blueprint Reading (ICS)  
Solid State Fundamentals Chapters 1 – 6  
Transformers (ICS)  
Transformer Operation (ICS)  
Instrument Transformers (ICS)

***Fifth Six Months***

Electric Meters and Associated Devices (NUS)  
Polyphase Metering II (Northwest Meter School)  
Electric Power Measurements A & B (ICS)  
Telemetry (ICS)  
Local Distribution of Electrical Power (ICS)  
Underground Power Systems (ICS) Switchgear  
(ICS)  
Electrical Power Substations A & B (ICS)

***Sixth Six Months***

Intro to Information Systems (TMCC) Relays  
I (NUS)  
Demand Metering Concepts and Applications (NUS)  
Conservation and Load Management  
Polyphase System 1 & 2 (NUS)  
Polyphase Transformer Rated Applications (NUS) Polyphase  
Transformer Rated Meter Testing (NUS) Principles of Accuracy  
Testing (NUS)

***Seventh Six Months***

NEC Articles 90 – 285 (Mike Holt DVDs) Electronic  
Metering III (Northwest Electric School) NEC Articles  
250 (Mike Holt DVDs)  
NEC Articles 300 – 460 (Mike Holt DVDs)  
Demand Metering Concepts (NUS)  
Testing and Calibrating Demand Meters (NUS) “Q”  
Metering Concepts and Testing (NUS) Reactive  
Meter Testing (NUS)  
Solid State Meters And Associated Devices (NUS)

***Eighth Six Months***

Testing Totalizing Techniques (NUS)  
Totalizing  
Metering Standards Review

## ***First Six Months:***

### **Month 1:**

#### **Meter Safety**

#### **Safety in Meter Work**

6 hours

#### **NUS Course + Test**

This course points out some safety concerns associated with meter work and explains how safety hazards can be minimized. The unit examines single-phase and polyphase self-contained meter installations and points out where high fault current may be present. Also covered are safety practices relating to meter installations or exchanges, personal protective equipment and physical hazards.

#### **Safety in Sub/Switch Yards**

6 hours

#### **NUS Course + Test**

This unit describes electrical, chemical, and personal hazards that may be encountered, instructs trainees on how to recognize hazards and unsafe practices on the job, and presents a general procedure for responding to imminent dangers and accidents.

#### **Basic Industrial Math Fractions, Percents, Proportions, Angles**

5 hours

#### **ICS 186305**

The apprentice will understand the terms: fraction, proper fraction, improper fraction, lowest common denominator, percent, ratio, and proportion, how to add, subtract, multiply, and divide fractions and decimals, how to change fractions to decimals and decimals to fractions, how to solve problems involving percent, how to use a protractor to measure angles, how to layout templates for checking angles and how to use a calculator to solve percent problems and to convert fractions to decimals.

### **Month 2:**

#### **Basic Industrial Math (continued)Formulas**

5 hours

#### **ICS 186307**

At the end of this unit the apprentice will understand the use of letters in formulas, how to prepare and use formulas to solve problems, how to use formulas to calculate the perimeter of a triangle and rectangle, distance, area of a triangle, rectangle, and circle, volume of a pyramid, current in a circuit, and volume of a sphere, how to use a calculator to find square root and solve formulas, how to transform and solve an equation, how to perform basic arithmetic operations with signed terms and how to substitute given numerical values for letters in a formula and find the unknown quantity.

#### **Introduction to Algebra**

5 hours

#### **ICS 186308**

This unit will teach the apprentice the definition of the terms: term, constant, coefficient, exponent, monomial, trinomial, and polynomial, how to identify and combine like terms in an expression, how to multiply and divide terms containing exponents, how to remove parentheses from an expression and simplify the expression and how to perform basic arithmetic operations with signed terms.



**Month 3:**

Algebra (continued)

Monomials and Polynomials

6 hours

ICS X0201

This unit will teach the apprentice to remove grouping symbols from algebraic expressions, multiply binomials, and divide on polynomial by another polynomial of lower degree.

Factoring

6 hours

ICS X0202

This unit will teach the apprentice to find the prime factors of certain binomials and trinomials, to factor a given trinomial, to use the Factor Theorem to factor a given polynomial, to use factoring to find the roots of an equation, to divide one polynomial by another polynomial of lower degree and how to find the lowest common multiple of several polynomials.

**Month 4:**

Algebra (continued)

Addition and Subtraction of Fractions

6 hours

ICS X0203

The apprentice will learn to recognize equivalent algebraic fractions, how to perform additions and subtractions involving algebraic fractions, how to reduce an algebraic fraction to its lowest terms and how to find the least common denominator for a group of algebraic fractions.

Multiplication and Division of Fractions

6 hours

ICS X0204

At the end of this unit the apprentice will be able to perform multiplications and divisions involving algebraic fractions, reduce an algebraic fraction to its lowest terms, find the least common denominator for a group of algebraic fractions, solve equations involving fractions or decimals and simplify complex fractions.

Progress Exam ICS

X0221

Covers courses X0201, X0202, X0203, and X0204.

**Month 5:**

Algebra (continued)

Linear Equations

6 hours

ICS X0205

In this unit the apprentice will learn to recognize equations expressing mixture problems and other word problems, to solve number problems, digit problems, and age problems and how to recognize the graph of a linear equation, given the graph or a set of points.

Progress Exam ICS

X0222

Covers course X0205.

Excludes courses X0206, X0207, and X0208.

Exponents 6 hours  
ICS X0209

At the end of this unit the apprentice will be able to demonstrate an understanding of the meaning of a fractional exponent, apply the rules for positive and negative exponents in multiplication, division, and raising to powers, use radicals to convert fractional exponents and use fractional exponents to convert radicals and write a given number in standard form.

Progress Exam ICS  
X0223  
Covers course X0209.  
Excludes course X0210.

**Month 6:**

Applied Geometry 6 hours  
ICS 186085

At the end of this unit the apprentice will be able to recognize characteristics of angles and closed plane figures, to distinguish between common geometric solids, to apply the Pythagorean Theorem, to calculate perimeters and areas of a polygon, circle, and ellipse and to apply the formula for area and volume of geometric solids.

Practical Trigonometry 6 hours  
ICS 186086

This unit will teach the apprentice how to define trigonometric functions, how to use trigonometric tables and apply interpolation, how to solve right triangles and how to apply the laws of sines and cosines in solving oblique triangles.

Progress Exam ICS  
X0220  
Covers courses 186085 and 186086.

*Total Hours First Six Months: 75*

***Second Six Months***

**Month 7:**

DC Principles  
Nature of Electricity 5 hours  
ICS 086112

At the end of this unit the apprentice will understand the operation of a simple circuit, the terms: conductor, insulator, and resistor, understand that unlike charges attract and like charges repel, the dangers and benefits of static electricity, the terms volt, ampere, and ohm, common notations and prefixes used to identify electrical and electronic values, carbon resistors, potentiometers, and rheostats, and explain how they work and how to identify the common electrical symbols used in schematic diagrams.

Circuit Analysis and Ohms Law  
ICS 086113

5 hours

At the end of this unit the apprentice will understand total resistance in series, parallel, and series-parallel circuits, how to use Ohm's law to calculate the current, voltage, or resistance in circuits and how to calculate the amount of power supplied and dissipated in a DC circuit and the steps for finding current, voltage, and resistance with a digital or analog meter.

Capacitors and Inductors  
ICS 086114

5 hours

At the end of this course apprentices will understand how capacitors hold a charge, describe common type of capacitors, calculate total capacitance of circuit containing capacitors in series or parallel, explain how inductors are constructed, describe how inductors regulate the flow of current, and calculate the total inductance of series or parallel connected inductors.

**Month 8:**

DC Principles (continued)  
Magnetism and Electromagnetism  
ICS 086115

5 hours

At the end of this unit the apprentice will understand the north and south poles of permanent magnets and electromagnets, magnetic and nonmagnetic materials, how to magnetize a piece of steel by induction, the difference between simple, compound, and closed magnetic circuits, the direction of magnetic lines of force around a conductor (if the direction of current is known), how to use the right-hand rule to locate the poles of a solenoid, the operation of simple electromagnetic relays, buzzers, and stepping switches and how a DC motor operates.

Conductors, Insulators and Batteries  
ICS 086116

5 hours

This unit will teach the apprentice the various types of conductors and discuss their conductivity, the American Wire Gage System of sizing copper conductors, the size of conductor needed for an application, the various types of insulating materials and their temperature ratings, the difference between a dry cell and a storage battery, how to connect cells together to obtain more voltage, more current, or more of both voltage and current, the proper safety precautions used when working with storage batteries, how to properly clean and care for storage batteries, and the instruments used for testing storage batteries.

DC Motors and Generator Theory  
ICS 086117

5 hours

In this unit the apprentice will learn to identify a series-, shunt-, and compound-wound motor and discuss their application, how a permanent-magnet and stepper motor operate, the steps to reversing a DC motor's direction, how the speed of a DC motor can be controlled, the basic principle for generating a direct current, the factors that affect the strength of the induced voltage, the purpose of a commutator and brush assembly, the difference between the field connections of series-, shunt-, and compound-wound machines, the reason for shifting brushes, the use of commutating poles and compensating windings for better generator operation.

**Month 9:**

## AC Principles

## Alternating Current

5 hours

## ICS 086118

This unit will teach the apprentice to draw a graph of an AC voltage and describe how AC voltage is created, explains AC cycle terms: "alternation," "peak," "positive," and "negative", the time period of an AC voltage as expressed in degrees, the characteristic values of an AC cycle and describe the relationship between the values, phase angle and describe how it relates to reactive circuits, how to calculate power for single-phase and three-phase circuits, how a 220 VAC single-phase circuit operates, the phase relationship of three-phase wave forms, how to determine real power by reading a power factor meter and delta and wye three-phase circuit connections.

## Alternating Current Circuits

5 hours

## ICS 086119

At the end of this unit the apprentice will be able to identify electric circuits in terms of their circuit characteristics, list several circuit characteristics that are used to describe a circuit for a particular load application, connect electrical components in series and parallel circuits, control loads from one or two switch points, understand how delta-and wye-connected three phase circuits are different and understand how grounding a circuit increases its safety.

## Inductors in AC Circuits

5 hours

## ICS 086120

In this unit the apprentice will learn how an inductor is made and how it operates in a DC and AC circuit, inductive reactance and impedance, and how AC frequency affects inductance. How to use Ohm's law in an AC circuit that includes an inductor, how to calculate the impedance of a series RL circuit and how to calculate the impedance of a parallel RL circuit.

**Month 10:**

## AC Principles (continued)

## Capacitors in AC Circuits

5 hours

## ICS 086121

At the end of this unit the apprentice will understand how a capacitor stores a charge and how series connected and parallel connected capacitance values are calculated, capacitive reactance and using Ohm's Law in AC circuits that contain a capacitor, how to calculate the impedance of a series RC circuit and how changing the frequency of an AC signal changes capacitive reactance.

## Transformers

5 hours

## ICS 086122

This unit will explain what the main components of a transformer are, how mutual inductance makes it possible to change an AC voltage from one value to another when using a transformer, how to determine the turns ratio of a transformer when the primary and secondary voltages are known, how to calculate primary or secondary voltages or current when either one of these and the turns ratio are known, why transformers are laminated, how to connect three single-phase transformers for three phase operation, how to calculate

line current (if phase current is known) in delta-connected transformers and the operating principles of an auto transformer.

**Month 11:**

AC Principles (continued)

Alternators

5 hours

ICS 086123

At the end of this unit the apprentice will understand how single- and three-phase alternators operate, list and describe the major components of an alternator, discuss alternator ratings in terms of power, voltage, speed and temperature, state the steps required for starting, stopping and operating alternators.

Rectification and Basic Electronic Devices

5 hours

ICS 086125

At the end of this unit the apprentice will understand how diodes are used as rectifiers, the basic operation of a diode and a triode electron tube, how to connect a PN junction for forward and reverse bias, how a transistor operates as an amplifier, recognize transistor input and output circuits, rectifier circuits with and without filter circuits, the operation of an SCR and a triac and how to calculate the ripple frequency of a half-wave and full-wave single-phase and three-phase rectifier.

Electrical Energy Distribution

5 hours

ICS 086124

This unit will explain the difference between feeder and branch circuits, describe the different types of systems available for distributing power within a plant, teach the apprentice to recognize and identify utilization equipment, discuss the use of transformers in energy distribution, identify by name and describe the uses of various types of raceways, teach the apprentice how to distinguish between panel boards and switchboards, describe the electrical system of a power utility and describe how electricity is generated at a power station or utility.

Rectification and Basic Electronic Devices

5 hours

ICS 086125

This unit will explain how diodes are used as rectifiers, discuss the basic operation of a diode and a triode electron tube, how to connect a PN junction for forward and reverse bias, explain how a transistor operates as an amplifier, recognize transistor input and output circuits, compare rectifier circuits with and without filter circuits, describe the operation of an SCR and a triac, and calculate the ripple frequency of a half-wave and full-wave single phase and three-phase rectifier.

**Month 12:**

Introduction to Metering

6 hours

NUS Course + Test

This unit teaches the apprentice basic concepts of metering by identifying several early types of electro-mechanical watt-hour meters and the basic parts and describe the operating principles of a modern electro-mechanical watt-hour meter. The unit discusses self-contained meter application by explaining the difference between self-contained meters and transformer-rated meters, listing and explaining some of the information typically found on watt-hour meter nameplates and identifying the characteristics of a typical three-phase delta service and a typical three-phase wye service. Transformer-rated meter application is explained by how an instrument transformer is connected to a transformer-rated meter, identifies the two main classifications of instrument transformers and states the function of a test switch. Meter Testing is discussed including the basic steps for conducting a comparison test on a single-phase watt-hour meter, and the function of a standard and describe how a standard is used to conduct accuracy tests. Meterman responsibilities are reviewed with some of the tasks and responsibilities commonly associated with being a meterman, identifying some typical installation checks performed by meterman and explains how they are done, and identifying several forms of power theft.

Customer Relations &amp; High Bill Complaints

6 hours

NUS Course + Test

The apprentice will learn ways in which a meter technician can achieve a proper on-the-job appearance, some of the ways that a meter technician can help ensure a proper level of job preparedness, what job awareness is and why it is important for meter technicians, what is a proper attitude for a meter technician, why it is important to be knowledgeable about the causes of high electrical bills, explain how to use the watt-load check method to determine if a meter reading is accurate, describe a procedure for troubleshooting a high bill complaint at a single-phase residential meter installation.

*Total Hours Second Six Months: 87****Third Six Months*****Month 13:**

Register Ratios and Constants

6 hours

Course + Test

Deals with the many ratios and constants that are essential in interpreting meter reads, setting the pulse output of meters, and determining the pulse value of pulses stored in solid-state recorders or passed on to computerized load management systems. Solid-state meters can display reads in primary terms – determinants of the transformer factors needed by solid-state meters to display reads in primary terms are discussed.

## Single Phase Metering - Group I

30 hours

Northwest Electric Meter School (September)

This class is taught off site. The topics covered include: metering math, basic electricity, single phase meter components, meter constants and ratios, loads and meter applications, supplier display, current diversion, instrument transformer basics, phantom load boxes, test jacks and standards, safety, automatic meter reading, single phase meter testing, effects of harmonics on customer equipment, interpreting measurements. This class will involve classroom as well as lab.

## Month 14 & 15:

Introduction to PCs Series

35 hours

<http://www.e-learningcenter.com>

This online class is composed of ten lessons. These are as follows: *Introducing the PC*; during this lesson the apprentice will be introduced to basic computer concepts and instructs apprentices on how to start the PC. *Using Your PC* teaches apprentices how to navigate within the windows operating system and use the drives in a PC. *Working with Folders and Files* teaches the apprentices the concepts of folders and files and explains how they are used within the windows operating system. *Inside your PC* explains the components within a PC and how they are used. *Basic Peripherals* describes the function and uses of typical peripherals that are used with PCs. *Other Peripheral* describes the functions and uses of other peripherals available for a PC including modems, sound cards, scanners, digital camera, and external disk drives and explains how to install these peripherals. *Understanding Software* introduces apprentices to typical software available for PCs and how to install and update the software, *Introducing the Internet* introduces apprentices to the internet and explains how to use a Web browser and e-mail. *Troubleshooting and Tips* provides the apprentice with information on how to protect data on their computer and overcome potential problems in addition to offering tips on how to maximize the efficient of their PC.

## Month 16:

Installation Checks and Inspections

6 hours

NUS Course + Test

This unit discusses general non-electrical checks and inspections that can be made to a meter installation, non-electrical checks and inspections that can be made inside a transformer cabinet and inside a meter box, how voltage checks may be made on a polyphase, transformer-rated meter installation, how circuit continuity checks may be made on a polyphase, transformer-rated meter installation, how circuit continuity can be checked on a meter installation that has a connected customer load, how a phase check can be performed on a polyphase, transformer-rated meter installation, and how the accuracy and balance of a meter in a polyphase, transformer-rated meter installation can be checked.

Electrical Measuring Instruments

10 hours

ICS 4146 A

The apprentice will learn principles of electrical measurements, instrument movements, measuring current, measuring voltage, measuring power, measuring resistance and frequency and instrument errors and faults.

**Month 17:**

Electrical Measuring Instruments

10 hours

ICS 4146 B

In the second part of this lesson, the apprentice will learn about bridge measurements; DC bridge measurements; AC bridge measurements; calibration of instruments and telemetering.

Electrical Measuring Instruments

10 hours

ICS 4146 C

In this final section the apprentice will learn about multimeters, volt-ohm multiammeters, vacuum-tube voltmeters, transistor volt-ohm-milliammeters, field effect transistor volt-ohm-milliammeters, digital meters and oscilloscopes.

**Month 18:**

Energy Diversion

12 hours

NUS 1 &amp; 2 Course + Test

This course will examine some common methods that have been used to divert energy and show how energy diversion can be minimized or prevented. Apprentices first will look at energy diversion on single-phase residential customers and then focus on diversion on polyphase self-contained and instrument-rated installations.

*Total Hours Third Six Months: 119*

***Fourth Six Months*****Month 19:**

Using Electrical Test Equipment

6 hours

NUS Course + Test

This unit teaches the purpose and operation of voltage tests, multimeter, clamp-on ammeters, and megohmmeters. The unit demonstrates how electrical test equipment is used to measure current, voltage, and resistance and give appropriate safety precautions.

Reading Electrical Schematic Diagrams

10 hours

ICS 006022

This lesson will teach the apprentice about electrical diagrams; meaning of schematic diagrams; schematic diagrams of basic electric equipment and connections, such as types of circuits; sources of DC power; sources of AC power; transformers; rectifiers; motors; measuring devices; protection and control devices. Also discussed are schematic diagrams of lighting circuits and various types of motor control circuits; typical schematics used in generating systems, transmission systems, and distribution systems.

**Month 20:**

Electrical Blueprint Reading

10 hours

ICS 006036

In this study unit, the apprentice will learn to read several different types of electrical blueprints. The general principles for preparing blueprints will be covered. The skills the apprentice learns can be applied to reading blueprints for residential, commercial, manufacturing, and electric utility projects. When apprentices complete this study unit they



will be able to: explain how blueprints are prepared, discuss how and why blueprints are copies of original drawings, read and understand the information presented on blueprints, be able to identify the different methods of presenting information, understand and interpret common symbols and abbreviations used on electrical blueprints and trace a wiring diagram and understand it.

**Month 21:**

|                          |         |
|--------------------------|---------|
| Solid State Fundamentals | 9 hours |
| Chapter 1                |         |
| Chapter 2                |         |
| Chapter 3                |         |

**Month 22:**

|                          |         |
|--------------------------|---------|
| Solid State Fundamentals | 9 hours |
| Course + Test            |         |
| Chapter 4                |         |
| Chapter 5                |         |
| Chapter 6                |         |

**Month 23:**

|              |          |
|--------------|----------|
| Transformers | 10 hours |
| ICS 4040     |          |

In this unit the apprentice will learn essential transformer properties; operation under load and without load; losses; voltage regulation; rating; types of core and windings; insulation; bushings; tap changers; polarity; single-phase and polyphase transformers; delta, star, open-delta, and scott connections; special transformers, autotransformers, reactors, step-voltage regulators; instrument transformers; maintenance of transformers; design of small low-voltage transformers.

|                       |          |
|-----------------------|----------|
| Transformer Operation | 10 hours |
| ICS 4041              |          |

In this unit the apprentice will learn calculations pertaining to transformer operation; phasor diagrams; equivalent circuits; losses; efficiency; three-phase transformer connections; harmonic currents and voltages; parallel operation of transformers; phase transformation; regulation of voltage with tap changers and separate units; and operation of autotransformers and three-winding transformers; testing of transformers.

**Month 24:**

Instrument Transformers  
ICS 6793

10 hours

In this unit the apprentice will learn fundamentals of current and potential transformers; types of instrument transformers; instrument transformer construction standards, such as ratings and insulation classes; instrument transformer performance standards as to burden, accuracy, and correction factors; practical application of instrument transformers with regard to grounding, rating, connections, and burden; and polarity and accuracy testing of instrument transformers utilizing various methods and procedures.

*Total Hours Fourth Six Months: 74*

***Fifth Six Months*****Month 25:**

Electric Meters and Associated Devices  
NUS Course + Test

6 hours

This unit examines some of the electronic devices used in or in conjunction with electric metering. These devices are explained and their functions demonstrated.

Polyphase Metering

30 hours

Northwest Meter School Group II (September)

This class is taught offsite. The topics covered include: Operation of three-phase meters, meters in three-phase circuits, graphic and phasor analysis, introduction to three-phase meter, instrument transformer basics, "B" system vector, electronic demand, reactive, KVA metering, system vector, introduction to pulse metering, verification of meter connection, and distribution transformer connections, This class will also have labs covering reactive meters, testing watt-hour meter, and three phase metering.

**Month 26:**

Electric Power Measurements  
ICS 4019 A & B

20 hours

Part 1 discusses: principles of electrical measurements; instrument movements; measuring current; measuring voltage; measuring power, measuring resistance and frequency; and instrument errors and faults.

Part 2 discusses: bridge measurements; DC bridge measurements; AC bridge measurements; calibration of instruments; and telemetering.

**Month 27:**

Telemetering  
ICS 4048

10 hours

This unit discusses: definition and classification of telemetering; analog telemetering systems; frequency telemetering system; impulse duration telemetering system; digital telemetering system; transmission of data signals; telemetering channels; computations in telemetering; telemetering for automatic control; and electric-power-system control.

**Month 28:**

Local Distribution of Electrical Power  
ICS 006038

10 hours

In this study unit, apprentices take a tour of the distribution of electrical energy, starting with the various methods of generation, through transmission systems, into the rural and urban substations, and ending at the customer's service entrance. When apprentices complete this study unit, they will be able to: identify the three classes of power demands and the trends associated with them, identify the various methods used in the production of electricity, understand the generation, transmission, subtransmission, distribution, and secondary voltage levels, understand the conductors used in primary distribution systems, the components used in the protection of primary distribution systems, the clearance requirements associated with secondary distribution, methods of metering consumer usage of electricity, and NEC minimum requirements associated with installing services.

**Month 29:**

Underground Power Systems  
ICS 008639

10 hours

This study unit examines methods and equipment associated with the underground primary transmission and distribution, and the secondary distribution, of electricity to the customer. When apprentices complete this study unit, they will be able to: understand some advantages and disadvantages of underground electrical installations, identify, cables, ducts, enclosures, and equipment used in underground primary systems, understand some of the requirements and methods used in the installation of underground secondary electrical service and understand some of the methods used in the secondary distribution of power in high rise buildings.

**Month 30:**

Switchgear  
ICS 086092

10 hours

In this lesson the apprentice will learn about switchgear and the power system; flow of power; protection of the power system; overlapping protective zones; differential protection schemes; automatic and manual control of generating stations; minimum protection for generators and transformers; protection of distribution systems; circuit breaker ratings and designs; operation of circuit breakers; interruption of AC and DC circuits; AC reclosing service; station-type cubicle switchgear; metal-clad switchgear; low-voltage metal-enclosed switchgear; supervisory and control switchboards; and switchgear devices.

Electric Power Substations  
ICS 6590A

10 hours

This unit focuses on the types, purpose, location, and rating of transmission and subtransmission substations, protection of substations, switching systems, switchgear ratings, types of circuit breakers, disconnecting switches, transformation in substations, voltage control in substations, control and operation of substations, and construction of substations.

Electric Power Substations  
ICS 6590B

10 hours

This unit focuses on the distribution systems and arrangement of primary and secondary feeders, subtransmission-supply arrangement, high-voltage and low-voltage structures, transformers, voltage-control equipment, metering devices, control instruments, and protective relays, rural substations, industrial substations, direct-current substations, and types of rectifiers used in substations.

*Total Hours Fifth Six Months: 116*

***Sixth Six Months***

**Month 31:**

Intro to Information Systems  
IS 101 TMCC

44 hours

This course presents the apprentice an introduction to computer terminology, hardware and application programs for management information systems. Students are introduced to business, industry and education applications of popular software using spreadsheets, word processors, and data bases. "Hands on" experience is provided through student use of open lab

Relays 1

6 hours

NUS Course + Test

This course presents the basic theory of protective relays, a description of commonly used types of relays, and a brief explanation of how these relays are used. Additional details and examples of the applications of directional and non-directional relays are provided.

Demand Metering Concepts and Applications

6 hours

NUS Course + Test

This unit focuses on the need for demand metering and on basic demand metering concepts. Examples of mechanical, thermal, and solid-state types of demand registers are examined and explained.

**Month 32:**

Conservation and Load Management  
SPPC Course + Test

6 hours

Defines what conservation and load management are and the purpose of their implementation. Typical conservation and load management programs briefly describes with special emphasis on how they relate to electric metering. This includes the following:

- a) Time-of-use metering.
- b) Real-time billing and peak indication alarms.
- c) Automated load management systems.
- d) Other conservation programs.

**Month 33:**

Polyphase Systems 1

6 hours

NUS Course + Test

In this unit the apprentice will learn about polyphase systems, primary and secondary delta connections, primary and secondary wye connections and polyphase banks.

Polyphase Systems 2

6 hours

NUS Course + Test

The second part of this unit discusses when and where various meters should be used. Blondel's theorem will be used to show how a polyphase system is accurately metered. The power measured in both balanced and unbalanced polyphase circuits will be examined.

**Month 34:**

Polyphase Transformer Rated Application

6 hours

NUS Course + Test

Apprentices examine transformer-rated installations and learn when and why instrument transformers are used. Apprentices also examine transformer basic, polyphase connections, and the most common polyphase transformer-rated installations. Installation procedures are discussed as well as the sizing and proper selection of CTs and VTs.

**Month 35:**

Polyphase Transformer Rated Meter Testing

6 hours

NUS Course + Test

This unit shows how to test three and four-wire polyphase transformer-rated meters. Close attention will be given to verifying correct disk rotation and matching current and voltage phases before testing. Calibration of typical three and four-wire polyphase transformer-rated meters will be demonstrated.

**Month 36:**

Principles of Accuracy Testing

6 hours

NUS Course + Test

This unit will present the apprentice with the basic theory of watthour meter accuracy testing. Apprentices will be introduced to typical test equipment and how that test equipment is connected to simulate in-service operating conditions for accuracy testing. In addition, apprentices are shown how to interpret test results. Finally, apprentices are shown test connection diagrams for some typical watthour meters. The areas to be discussed will include principles of meter operation, meter in-service connections, test equipment, test connections and comparisons, and test connection diagrams.

*Total Hours Sixth Six Months: 92*

## ***Seventh Six Months***

### **Month 37:**

NEC Articles 90-285 (excl. 250)

8 hours

General Requirements

Mike Holt DVD Course + Test

The two DVDs cover electrical installations such as splices, terminals, working space, interruption rating, mechanical execution of work access, and guarding. Also the use and identification of the grounded (neutral) conductor and branch circuits, such as current rating, location of receptacles, switches and lights, branch circuits, feeders, outside wiring services, conductor sizing and protection, equipment and disconnecting means, overcurrent protection general rules, location, and enclosures.

Electronic Metering Group III

30 hours

Northwest Electric Metering School (September)

This class is taught off site. The topics covered include: design feature of solid state meters, electronic meter calculations, phasors, field test instruments, computer hardware, primary metering, current diversion, basic programming concepts, testing solid state metering, safety, and installation planning. There will also be labs dealing with phase angle metering and application of electronic metering programs lab.

### **Month 38:**

NEC Article 250

9 hours

Grounding and Bonding

Mike Holt DVD Course + Test

The two DVDs will cover the purpose of grounding vs. circuit grounding, location of grounding connection, and enclosure grounding.

Self-Contained Polyphase Meter Testing

6 hours

NUS Course + Test

This unit demonstrates accuracy tests on a three stator self-contained polyphase meter and a two-and-a-half stator (split element) self-contained polyphase meter in the field. At the end of this unit the apprentice will understand accuracy tests typically performed on a self-contained, polyphase meter, the basic test equipment used for testing a self-contained, polyphase meter, how a self-contained, polyphase meter and the appropriate test equipment are connected to perform each type of accuracy test. The unit also explains basic preparations for testing a polyphase meter, how series element tests may be performed on a three-phase, four-wire, three-stator meter, how individual element tests may be performed on a three-phase, four-wire, three-stator meter, the basic layout of a three-phase, four-wire, two-and-a-half-stator meter (text only), how series element tests may be performed on a three-phase, four-wire, two-and-a-half- stator meter (text only, how individual element tests may be performed on a three- phase, four-wire, two-and-a-half-stator meter (text only). In addition the apprentice will learn preliminary steps that are often taken before adjustments are made to a polyphase meter and how adjustments can be made to a three-phase, four-wire, three- stator meter.

**Month 39:**

NEC Articles 300-392

8 hours

Wiring Methods

Mike Holt DVD Course + Test

The two DVDs will cover wiring methods, temporary wiring, conductor properties such as circular mils, insulation, ampacity and overcurrent protection, and Articles which contain the specific requirements for the installation of cables. Also covered are raceways, outlet boxes, and other enclosures such as cabinets, cutout boxes, switch-boards, and panelboards.

NEC Articles 400 - 460

3 hours

Equipment for General Use Mike

Holt DVD Course + Test

The DVD explains the general NEC rules that apply to appliances, electric space heating, motors, air-conditioning and transformers such as disconnects, conductor sizing, overcurrent, and overload sizing.

**Month 40:**

Demand Metering Concepts

6 hours

NUS Course + Test

This unit focuses on the need for demand metering and on basic demand metering concepts. Examples of mechanical, thermal, and solid state types of demand registers are examined and explained.

Testing and Calibrating Demand Meters

6 hours

NUS Course + Test

This unit will demonstrate a method of performing accuracy tests on kilowatt-hour meters equipped with various types of demand registers. Accuracy testing of single-phase and polyphase meters will be shown with emphasis on demand register test procedures.

**Month 41:**

"Q" Metering Concepts and Testing

6 hours

NUS Course + Test

This unit examines the concepts and theories of Q meters including how they work and how they are tested. Tests are shown in detail including connections and calibration techniques.

Reactive Meter Testing

6 hours

NUS Course + Test

This unit demonstrates accuracy testing on typical three and four wire reactive meter installations. Test procedures for three and four wire reactive meter installations are shown.

**Month 42:**

Solid State Meters and Associated Devices

6 hours

NUS Course + Test

This unit examines many of the solid-state devices used in, or in conjunction with, electric metering. The devices are identified and described and their functions demonstrated. In addition, an example of a totally solid-state metering system is presented and its associated components identified.

*Total Hours Seventh Six Months: 94*

***Eighth Six Months***

**Month 43:**

Testing Totalizing Techniques

6 hours

NUS Course + Test

This unit examines the principles of operation of four-element and six-element electromechanical totalizing meters. Test equipment connections for accuracy tests on both types of meters and test procedures are covered.

**Month 44:**

Totalizing

6 hours

Internally Developed

Describes totalized billing and explains the benefits of its implementation and the class of customers that this billing method applies to. The three most common totalizing methods are described together with the reason for determining which method to select. This class also describes the most common hardware and software used in totalized billing.

**Month 45-46:**

Metering Standards

30 hours

Regional Standards – North

Volume 2

**Month 47-48:**

Review

32 hours

*Total Hours Eighth Six Months: 74*

***First Six Months*****075 hrs**

- Safety 012 hrs
- Algebra 051 hrs
- Geometry 006 hrs
- Trigonometry 006 hrs

***Second Six Months*****087 hrs**

- Basic Electricity 075 hrs
- Introduction to Metering 006 hrs
- Customer Relations and High Bill 006 hrs

*1<sup>st</sup> Year Total: 162 hours*



**Third Six Months** **119 hrs**

- Single Phase Metering 036 hrs
- Computers 035 hrs
- Installation Checks and Inspections 006 hrs
- Electrical Measuring Instruments 030 hrs
- Energy Diversion 012 hrs

**Fourth Six Months** **074 hrs**

- Using Electrical Test Equipment 006 hrs
- Reading Electrical Schematic Diagrams 010 hrs
- Reading Electrical Blueprints 010 hrs
- Solid State Fundamentals 018 hrs
- Transformers 010 hrs
- Transformer Operation 010 hrs
- Instrument Transformers 010 hrs

*2nd Year Total 193 hours*

**Fifth Six Months** **116 hrs**

- Electrical Meters and Associated Devices 006 hrs
- Poly Phase Metering 030 hrs
- Electric Power Measurements 020 hrs
- Telemetry 010 hrs
- Local Distribution of Electrical Power 010 hrs
- Underground Power Systems 010 hrs
- Switchgear 010 hrs
- Electric Power Substation 020 hrs

**Sixth Six Months** **092 hrs**

- Introduction to Computer Applications 044 hrs
- Relays I 006 hrs
- Demand Metering Concepts and Applications 006 hrs
- Conservation and Load Management 006 hrs
- Polyphase Systems I & II 012 hrs
- Polyphase Transformer Rated Application 006 hrs
- Polyphase Transformer Rated Meter Testing 006 hrs
- Principles of Accuracy Testing 006 hrs

*3<sup>rd</sup> Year Total 208 hours*

**Seventh Six Months****094 hrs**

- NEC Articles 90 – 460 028 hrs
- Electronic Metering 030 hrs
- Self-Contained Polyphase Meter Testing 006 hrs
- Demand Metering Concepts 006 hrs
- Testing and Calibrating Demand Meters 006 hrs
- "Q" Metering Concepts and Testing 006 hrs
- Reactive Meter Testing 006 hrs
- Solid State Meters Associated Devices 006 hrs

**Eighth Six Months****074 hrs**

- Testing Totalizing Techniques 006 hrs
- Totalizing 006 hrs
- Metering Standards 030 hrs
- Review 032 hrs

*4<sup>th</sup> Year Total 168 hours*

**Approximate Total Program Hours 731 hours**

Subsequent edition/volume changes of textbooks are approved for use through the discretion of the program.

**Wages**

Wage Schedule for Apprentice Communications Technician – See Collective Bargaining Agreement, but should be reflective of prorated portions of the Journeyman wage as outlined in the Parties' Letter of Agreement dated August 31, 2023 (LOA 23-07). The current Journeyman wage scale is outlined in the Collective Bargaining Agreement.