

STUDY GUIDE INSTRUMENT CONTROL & ELECTRICIAN TECHNICIAN TEST

TEST #2178

INTRODUCTION

The **2178 Instrument Control and Electrician (ICE) Technician** Test is a job knowledge test designed to cover the major knowledge areas necessary to perform the job. This Guide contains strategies to use for taking tests and a study outline, which includes knowledge categories, major job activities, and study references.

TEST SESSION

It is important that you follow the directions of the Test Administrator exactly. If you have any questions about the testing session, be sure to ask the Test Administrator before the testing begins. During testing, you may NOT leave the room, talk, smoke, eat, or drink. Since some tests take several hours, you should consider these factors before the test begins.

All questions on this test are multiple-choice format and have four possible answers. All knowledge tests will be taken on the computer.

The test has a three hour time limit. A non-programmable scientific calculator will be provided for you to use during the test.

You will NOT be able to bring or use your own calculator during testing.

You will receive a Test Comment form so that you can make comments about test questions. Write any comments you have and turn it in with your test when you are done.

STUDY GUIDE FEEDBACK

At the end of this Guide you have been provided with an Information Guide Feedback page. If a procedure or policy has changed, making any part of this Guide incorrect, your feedback would be appreciated so that corrections can be made.

TEST TAKING STRATEGIES

INTRODUCTION

Your emotional and physical state during the test may determine whether you are prepared to do your best. The following list provides common sense techniques you can use before the test begins.

CONFIDENCE

If you feel confident about passing the test, you may lose some of your anxiety. Think of the test as a way of demonstrating how much you know, the skills you can apply, the problems you can solve, and your good judgment capabilities.

PUNCTUALITY

Arrive early enough to feel relaxed and comfortable before the test begins.

CONCENTRATION

Try to block out all distractions and concentrate only on the test. You will not only finish faster but you will reduce your chances of making careless mistakes. If possible, select a seat away from others who might be distracting. If lighting in the room is poor, sit under a light fixture. If the test room becomes noisy or there are other distractions or irregularities, mention them to the Test Administrator immediately.

BUDGET YOUR TIMES

Pace yourself carefully to ensure that you will have enough time to complete all items and review your answers.

READ CRITICALLY

Read all directions and questions carefully. Even though the first or second answer choice looks good, be sure to read all the choices before selecting your answer.

MAKE EDUCATED GUESSES

Make an educated guess if you do not know the answer or if you are unsure of it.

CHANGING ANSWERS

If you need to change an answer when testing on a computer, be sure that the new answer is selected instead of the old one.

RETURN TO DIFFICULT QUESTIONS

If particular questions seem difficult to understand, make a note of them, continue with the test and return to them later.

DOUBLE CHECK MATH CALCULATIONS

Use scratch paper to double check your mathematical calculations.

REVIEW

If time permits, review your answers. Do the questions you skipped previously. When testing on a computer, make sure each multiple choice question has a dot next to the correct answer.

Remember the techniques described in this section are only suggestions. You should follow the test taking methods that work best for you.

JOB KNOWLEDGE CATEGORIES AND STUDY REFERENCES

Below are the major job knowledge areas (topics) covered on the **2178 Instrument Control and Electrician (ICE) Technician Test** and the associated study references. Listed next to each knowledge category is the number of items on the exam that will measure that topic. You can use this information to guide your studying. Some exams also contain additional pretest items. Pretest items will appear just like all of the other items on your exam, but they will not affect your score. They are an essential part of ensuring the 2178 Instrument Control and Electrician test remains relevant to successful performance of the job.

There are a total of 86 items on the 2178 Instrument Control and Electrician Technician Test and the passing score is 70%.

ELECTRICAL THEORY AND PRACTICE (18 ITEMS)

Includes knowledge of AC and DC theory, Ohm's Law, series and parallel circuits, inductance, capacitance, three-phase power, AC and DC motors, and electrical terminology. Knowledge of power generation including generator excitation, standard electrical symbols, and abbreviations used in electrical drawings such as single lines, schematics, elementaries, and wiring diagrams. Knowledge of transformer theory, relay protection, switchgear, and motor control center. Ability to read and apply diagram information.

INSTRUMENT THEORY AND PRACTICE (8 ITEMS)

Includes knowledge of the types and methods of measurement and control of flow, pressure, level, and temperature. Knowledge of strategies of control dynamics, such as PID (Proportional, Integral and Derivative) loops. Knowledge of how to test, troubleshoot, repair, and maintain instrumentation equipment.

SAFETY (10 ITEMS)

Includes knowledge of electrical safety procedures and precautions as specified by Cal OSHA and the National Electric Code (NEC). Knowledge of how to install electrical, instrumentation, and control equipment following regulatory processes and safety standards and procedures. Knowledge of how to test, troubleshoot, repair, and maintain control equipment following safety processes and procedures. Knowledge of work authorization, including lock out tag out (LOTO). Knowledge of the use of high voltage safety equipment, hazardous material safety equipment, and personal protection equipment (PPE).

ELECTRONICS (7 ITEMS)

Includes knowledge of basic electronic theory, circuitry, electronic symbols, solid state theory, diodes, transistors, and AC/DC voltage regulators.

TEST EQUIPMENT (14 ITEMS)

Includes knowledge of the proper use of various test instruments, such as multimeters, meggers, ductors, oscilloscopes, handheld communicators, high voltage meters, ammeters, and manometers. Knowledge of the

purpose of the tests applied, why it is appropriate, and the accuracy requirements. Knowledge of test tolerances. Knowledge of test and calibration requirements and how to interpret test and calibration results.

PHYSICS AND CHEMISTRY (4 ITEMS)

Knowledge of applied physics, including fluids, gasses, dynamic forces of levers, pneumatics, and hydraulics. Knowledge of basic chemistry as it applies to chemical measurement and control used in water treatment. Knowledge of chemical and physical properties of instrumentation applications.

INSTRUMENT/ELECTRICAL MAINTENANCE AND INSTALLATION (17 ITEMS)

Includes knowledge of installation, maintenance, and repair of batteries. Knowledge of how to perform (install, repair, maintain) low voltage wiring. Knowledge of how to perform conduit installation based upon the National Electric Code (NEC). Knowledge of how to perform connection practices and how to install and repair communication wiring. Knowledge of the types and applications of hand tools used in the instrumentation field and of power tools (e.g., drill motors, conduit benders, etc.). Knowledge of standard installation practices of flow instrumentation, pressure instrumentation, level instrumentation, temperature sensors and transducers, final control elements (e.g., valves, dampers), and tubing installations. Knowledge of logical applications of troubleshooting instrument problems using electrical drawings and Piping & Instrument Diagrams (P&ID). Knowledge of logical applications of troubleshooting instrument problems using electrical drawings. Knowledge of variable frequency drive (VFDs). Knowledge of soft start motor controls.

MATH (4 ITEMS)

Includes knowledge of algebra, geometry, and trigonometry. Ability to apply mathematical formulas to job related problems.

CONTROLS/PROGRAMMING (4 ITEMS)

Includes knowledge of programmable logic controllers (PLC) and associated equipment, such as HMI screen, router, power supply, UPS, etc.

STUDY REFERENCES

ELECTRICAL THEORY AND PRACTICE

Electricity One-Seven, 3rd Edition, by Harry Mileaf.
Delmar Standard Textbook of Electricity, 4th Edition.

INSTRUMENT THEORY AND PRACTICE

Programmable Logic Controllers, by W. Bolton.
Instrumentation 4th ed, by F, Kirk, T Weedon, P Kirk (2005).
Measurement and Control Basics, 3rd Edition, by T.A. Hughes.

SAFETY

2011 National Electric Code.

Electrical Protective Equipment

<https://www.ecfr.gov/current/title-29/part-1910/section-1910.137>

Electrical Safety-Related Work Practices (General Industry)

1910.331 – Scope

<https://www.ecfr.gov/current/title-29/part-1910/section-1910.331>

1910.332 – Training

<https://www.ecfr.gov/current/title-29/part-1910/section-1910.332>

1910.333 – Selection and Use of Work Practices

<https://www.ecfr.gov/current/title-29/part-1910/section-1910.333>

1910.334 – Use of Equipment

<https://www.ecfr.gov/current/title-29/part-1910/section-1910.334>

1910.335 – Safeguards for Personnel Protection

<https://www.ecfr.gov/current/title-29/part-1910/section-1910.335>

Construction – Lines and Equipment Energized

<https://www.ecfr.gov/current/title-29/part-1926/section-1926.957>

ELECTRONICS

Electronics Principles, 8th Edition, by Albert P Malvino.
Electricity One-Seven, 3rd Edition, by Harry Mileaf.

TEST EQUIPMENT

Electricity One-Seven, 3rd Edition, by Harry Mileaf.

Measurement and Control Basics, 3rd Edition, by T.A. Hughes.

Instrumentation 4th ed, by F, Kirk, T Weedon, P Kirk (2005).

2011 National Electric Code.

PHYSICS AND CHEMISTRY

Electricity One-Seven, 3rd Edition, by Harry Mileaf.

Instrumentation 4th ed, by F, Kirk, T Weedon, P Kirk (2005).

INSTRUMENT/ELECTRICAL MAINTENANCE AND INSTALLATION

Electricity One-Seven, 3rd Edition, by Harry Mileaf.

Electronics Principles, 8th Edition, by Albert P Malvino.

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Instrumentation 4th ed, by F, Kirk, T Weedon, P Kirk (2005).

Soft Starter Bypass Technology in Smart Motor Controllers, by Bernhardt, William & Anderson, Richard, Rockwell Automation.

<https://electrical-engineering-portal.com/ansi-codes-device-designation-numbers>

MATH

Math The Easy Way, 3rd Edition, by Prindle & Prindle.

Trigonometry The Easy Way, 3rd Edition, by Douglas Downing.

CONTROLS/PROGRAMMING

Programmable Logic Controllers, by W. Bolton.

Instrumentation 4th ed, by F, Kirk, T Weedon, P Kirk (2005).



STUDY GUIDE FEEDBACK

Please email Southern California Edison's Corporate Testing to notify us of any changes in policies, procedures, or materials affecting this guide. Once completed, return to:

EdisonTesting@sce.com

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COMMENTS SECTION: