

# **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. Consult the following link and click on Computer Based Testing for more information: All questions on this test are multiple-choice format and have four possible answers. All knowledge tests will be taken on the computer. Consult the following link and click on Computer Based Testing.

**The test has a three hour time limit. A non-programmable scientific calculator will be provided for you to use during the test. The calculator provided during the test session will be: Texas Instruments TI-36X**

**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.

## INFORMATION 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**

The **2178 Instrument Control and Electrician (ICE) Test** contains multiple-choice questions and may also contain hot spot questions. The purpose of this section is to help you to identify some special features of a multiple-choice test and to suggest techniques for you to use when taking one.

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.

## **INSTRUMENT THEORY AND PRACTICE (9 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 OF ITEMS)**

Includes knowledge of basic electronic theory, circuitry, electronic symbols, solid state theory, diodes, transistors, and AC/DC voltage regulators. 2

## **TEST EQUIPMENT (15 OF 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 OF 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 4<sup>th</sup> ed, by F, Kirk, T Weedon, P Kirk (2005).

Measurement and Control Basics, 3<sup>rd</sup> Edition, by T.A. Hughes.

### **SAFETY**

2011 National Electric Code.

Federal OSHA Standards, 29CFR, Sections 1910.137, 1910.331 to 1910.335, &1926.957.

[www.OSHA.gov.us](http://www.OSHA.gov.us).

### **ELECTRONICS**

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

Electricity One-Seven, 3<sup>rd</sup> Edition, by Harry Mileaf.

### **TEST EQUIPMENT**

Electricity One-Seven, 3<sup>rd</sup> Edition, by Harry Mileaf.

Measurement and Control Basics, 3<sup>rd</sup> Edition, by T.A. Hughes.

Instrumentation 4<sup>th</sup> ed, by F, Kirk, T Weedon, P Kirk (2005).

2011 National Electric Code.

### **PHYSICS AND CHEMISTRY**

Electricity One-Seven, 3<sup>rd</sup> Edition, by Harry Mileaf.

Instrumentation 4<sup>th</sup> ed, by F, Kirk, T Weedon, P Kirk (2005).

## **INSTRUMENT/ELECTRICAL MAINTENANCE AND INSTALLATION**

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

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Instrumentation 4<sup>th</sup> ed, by F, Kirk, T Weedon, P Kirk (2005).

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

<http://www.csanyigroup.com/download/knowledge/ansi-ieee-device-numbers>

## **MATH**

Math The Easy Way, 3<sup>rd</sup> Edition, by Prindle & Prindle.

Trigonometry The Easy Way, 3<sup>rd</sup> Edition, by Douglas Downing.

## **CONTROLS/PROGRAMMING**

Programmable Logic Controllers, by W. Bolton.

Instrumentation 4<sup>th</sup> ed, by F, Kirk, T Weedon, P Kirk (2005).





## **STUDY GUIDE FEEDBACK**

Please use this page to notify us of any changes in policies, procedures, or materials affecting this guide. Once completed, return to:

Southern California Edison  
Human Resources - Talent & Assessment Programs  
G.O. 5, 1st Floor  
1515 Walnut Grove Ave.  
Rosemead, CA 91770

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COMMENTS SECTION: