



Study Guide for Supervising Test Technician

Test Number's: 2884 & 4784

Human Resources
Performance Assessment Services
Southern California Edison
An Edison International Company

REV031711

Introduction

The **Supervising Test Technician** selection process includes a job knowledge and performance test. The job knowledge test is designed to cover the major knowledge necessary to perform the job while the performance test is designed to measure critical tasks of the **Supervising Test Technician** position. This Study Guide contains strategies to use for taking tests and a study outline, which includes knowledge categories, major job activities, study references, and example questions.

Test Scheduling

Your supervisor will schedule you for testing through Test Administration, Staffing and Assessment Services. If you are unsuccessful in passing the tests on your first attempt, you may re-take the tests, with supervisor's approval, after 30 days. Subsequent re-tests are every 90 days. After you pass the tests, your results are valid for a period of three years unless the testing requirements are revised or there are major revisions made to the test.

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 cellular/mobile phones, pagers or other electronic equipment will NOT be allowed in the testing area.

All questions on the job knowledge test are multiple-choice or hot spot questions. Multiple choice questions have four possible answers. Hot spot questions have a picture, and you must click the correct spot on the picture to answer the question. All knowledge tests will be taken on the computer. For more information on this, please see the next section of this study guide on *Computer Based Testing*.

The knowledge test has a three hour time limit. The performance test is administered over a two day time period. For the knowledge test, a non-programmable scientific calculator will be provided for you. The calculator provided during the test session will be one of these models:

- Casio fx-250HC,
- Texas Instruments TI-30XA,
- 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.

Study Guide Feedback

At the end of this Guide you have been provided with a Study 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.

Computer Based Testing

Taking an SCE knowledge test on the computer is simple. You do not need any computer experience or typing skills. You will only use the keyboard to enter your candidate ID and password. You'll answer all questions by pressing a single button on the mouse.

Log in Screen

You will be seated at a testing station. When you are seated, the computer will prompt you to enter the candidate ID and password you received in your invitation e-mail. You **MUST** have your candidate ID and password or you will be unable to take the test. Once you have confirmed your identity by entering this information, you will see a list of tests available to you.

Sample/Tutorial

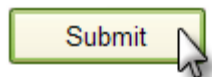
Before you start your actual test, a Sample/Tutorial Test is provided to help you become familiar with the computer and the mouse. From the list of exams that appear when you complete the log in, you will select Sample/Tutorial. You will have up to 10 minutes to take the Sample/Tutorial Test. The time you spend on this Sample Test does **NOT** count toward your examination time. Sample questions are included so that you may practice answering questions. In the Sample/Tutorial Test, you will get feedback on your answers. You will not receive feedback on your actual test.

Example

During the test, you may see several different types of items. Many of the questions will be multiple choice items. A few items will be pictures, where you'll have to click the spot on the picture that answers the question. Those picture questions are known as "Hot Spot" questions. More information on each type is below.

Overall Test Information

- When you begin the test, you can see the total time allowed for completion displayed at the top of the screen. You can scroll up to see that information at any time during the test.
- You can change your answers at any time during the test until the time runs out, or you click the "Submit" button. Once you click Submit, you can not change your answers.




Multiple Choice Questions

To answer each multiple choice question, you should move the mouse pointer over the circle (radio button) next to the answer of your choice, and click the left mouse button.

A sample is shown below:

1. In order to answer each question, first read the question and determine the response that best answers the question. Put the mouse pointer directly over the circle corresponding to that response.

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Time remaining:

Sample

Please select the best answer for each question below. If you have any comments, please record them on the Test Comments form given to you by the Test Administrator. Good luck!

1 of 13

Two resistors of 20 ohms each are connected in series. The total resistance of the circuit is _____ ohms.


a. 10
 b. 20
 c. 30
 d. 40

2. While the pointer is over the circle corresponding to the best answer, click the left mouse button.



Click the left button when the pointer icon is over your answer choice.

3. The answer you selected should now have a green dot in the circle. If you need to select an alternate answer, simply move the pointer over that circle, and click again.

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Time remaining:

Sample

Please select the best answer for each question below. If you have any comments, please record them on the Test Comments form given to you by the Test Administrator. Good luck!

1 of 13

Two resistors of 20 ohms each are connected in series. The total resistance of the circuit is _____ ohms.

a. 10
 b. 20
 c. 30
 d. 40

Hot Spot Questions

To answer each Hot Spot question, you should move the mouse pointer over the part of the image that best answers the question, and click the left mouse button. You will see a pointer appear in that spot. If you want to change your answer, simply move the mouse pointer to a new area on the picture and click again. The pointer will move to the new spot.

A sample is shown below:

1. In order to answer each question, first read the question and determine the place on the image that best answers the question. The pointer that will indicate your answer can always be seen in the bottom left of the image. It looks like this:




Put the mouse pointer directly over the spot on the image you want to select, and click the left mouse button.

1 of 8

On the screen below, where would you click to find out how much vacation time you have left?

About Me







Welcome to the "About Me" section

"About Me" has information about your benefits, programs that help you in your work and/or home life and more. Click on the links below to access the various areas.

Pointer starts out at the bottom left of the image.

About Me Map

 Overview An Overview of what's contained in this section of the Portal	 Career & Jobs Find out about career information and opportunities at Edison International.
 Pay Find information about base pay, job descriptions, Results Sharing, and recognition awards here.	 Time & Attendance Use this section to complete and submit your timesheet for approval, or to view your time-off balances and time


Place the mouse pointer on the spot you want to select, then click on the left button.

2. The pointer will move from the bottom left of the image and appear over the spot you selected.

1 of 8

On the screen below, where would you click to find out how much vacation time you have left?





About Me



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The pointer now appears over the correct answer.

3. To change your answer, simply move the mouse pointer to the new spot, and click again. The pointer graphic will move to the new spot you've selected. In order for your answer to be considered be correct, the center of the pointer (•) must be over the correct spot on the graphic.

Test Taking Strategies

Introduction

The **2884 Supervising Test Technician** knowledge 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.

Technique	Remarks
<i>Be confident</i>	<ul style="list-style-type: none"> - 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.
<i>Be punctual</i>	<ul style="list-style-type: none"> - Arrive early enough to feel relaxed and comfortable before the test begins.
<i>Concentrate</i>	<ul style="list-style-type: none"> - 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.
<i>Budget your times</i>	<ul style="list-style-type: none"> - Pace yourself carefully to ensure that you will have enough time to complete all items and review your answers.
<i>Read critically</i>	<ul style="list-style-type: none"> - 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.
<i>Make educated guesses</i>	<ul style="list-style-type: none"> - 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, be sure to erase your previous answer completely. On the 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.
 - Make sure each answer bubble is completely filled in. Erase any stray marks on your answer sheet. When testing on the computer, make sure each multiple choice question has a green 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 for the Knowledge Test

Below are the major job knowledge areas (topics) covered on the **2884 Supervising Test Technician** knowledge 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 **2884 Supervising Test Technician** knowledge test remains relevant to successful performance of the job.

There are a total of 95 items on the **2884 Supervising Test Technician** knowledge test and the passing score is 76%. This score was determined during the test validation process.

A. Electrical, Electronic, Mechanical Theory, and Mathematics (14 items)

Knowledge of advanced electrical and electronic theory (AC/DC theory, proper electrical wiring techniques, digital electronics, advanced phasors, and RX diagrams, etc). Knowledge of applied mechanical theory as in the knowledge of basic mechanical aptitude. Also knowledge of algebra, trigonometry, and phasoring.

References for Electrical, Electronic, Mechanical Theory, and Mathematics:

- ✓ Engineering Standards (ECS)
- ✓ AC Theory
- ✓ Phasor Analysis Manual
- ✓ Basic Electricity 1-7 (book)
- ✓ Protective Relaying Theory and Applications Book
- ✓ Transformer Theory Manual
- ✓ Ground Systems Manual
- ✓ Carrier Manual
- ✓ Potential Transformers Manual

B. Test Methods and Instruments (35 items)

Knowledge of types and applications of various test methods to install, test, maintain, and repair station equipment. Test methods include, but not limited to, primary push, impedance test, wire checking, relay testing, in-service testing, and dynamic relay testing. Knowledge of types and applications of high voltage test equipment, relay test equipment, megger, TTR, resistance bridge, oscilloscope, multimeters, power analyzer, frequency selectable voltmeter, signal generators. Knowledge of SCE policies, procedures, and standards (Division Orders, SOBs, SSIs, etc); knowledge of administrative procedures necessary for weekly/monthly/annual SCE inspection and maintenance; to complete monthly reports; to record maintenance, test, and operations events; to order supplies.

References for Test Methods and Instruments:

- ✓ Carrier Manual
- ✓ Current Transformers Manual
- ✓ Bus Differential Manual
- ✓ Bank Differential Manual
- ✓ Metering Manual
- ✓ Transformer Theory Manual
- ✓ Carrier Manual
- ✓ Doble Power Factor Training Manual
- ✓ Substation Division Order 40.40
- ✓ Substation Division Order
- ✓ Substation Division Orders 50.20

C. Station Equipment (13 items)

Knowledge of types and applications of recorders, metering and control equipment, instrumentation and alarms, instrument transformers, DC Systems, and circuit breakers, transformer and tap changers, voltage regulators, capacitor banks, reactors and synchronous condensers. Also knowledge of electromechanical and solid-state equivalent and microprocessor based relay testing and calibration.

References for Station Equipment:

- ✓ Engineering Standards (ECS)
- ✓ Doble Power Factor Training Manual
- ✓ Carrier Manual
- ✓ Substation Division Orders
- ✓ System Operating Bulletins
- ✓ SOB 1014
- ✓ SOB 1018
- ✓ SOB 1029
- ✓ HCB Manual
- ✓ Distance Relay Manual
- ✓ Regulator Manual

D. Engineering Standards (12 items)

Knowledge and understanding of drafting and engineering standards. These include SCE substation and facilities, types and construction of substation equipment, SCE voltage classification systems, types and applications of schematics and design, drafting methods and symbols.

References for Engineering Standards:

- ✓ Engineering Standards (ECS)
- ✓ System Operating Bulletins
- ✓ Relay Instruction Bulletins
- ✓ SAS Engineering Standards

E. System Operations and Move Programs (5 items)

Knowledge of types and applications of proper switching techniques including the ability to verify proper isolation and grounding of electric equipment; types and applications of clearances, tags, warning blocks, intercompany clearances, and switching orders. Knowledge of procedures and requirements for submitting switching/clearance requests, paralleling station transformers, and performing pre/post-switching techniques. Also general knowledge and understanding of Transmission Substation Operations.

References for Systems Operations and Move Programs:

- ✓ Accident & Prevention Manual (APM)
- ✓ Engineering Standards
- ✓ Operators Manual
- ✓ System Operating Bulletins
- ✓ Substation Division Orders
- ✓ SSI (Standard Station Instructions)

F. Safety Procedures (9 items)

Knowledge of and ability to apply SCE safety procedures and requirements (Accident Prevention Manual) and CAL OSHA requirements. Knowledge and application of safe operation of tools, equipment, and procedures to include grounding requirements, personal protective equipment, procedures for confined space entry, climbing, working in proximity to energized equipment, live line tools, voltage testers, barricades and warnings and practices of emergency communications. Also knowledge of procedures and requirements for first aid and CPR.

References for Safety Procedures:

- ✓ Operators Manual
- ✓ Accident Prevention Manual (APM)
- ✓ Accident Prevention Manual (APM) Rule 709c
- ✓ Potential Transformers Manual
- ✓ Carrier Manual
- ✓ Substation Division Order 10.10
- ✓ Substation Division Order 50.20

G. Computer Knowledge (7 items)

Basic knowledge of computer hardware and software such as PROTEST, SEL, and Windows-based relay-interface programs.

References for Computer Knowledge:

- ✓ SAS Installation Manual
- ✓ SAS Portal Page
- ✓ SEL Manual
- ✓ Protest Manual

Sample Questions for the Job Knowledge Test

The following are samples of the type of questions, arranged by knowledge area that you will encounter in the knowledge test. An answer page follows the questions.

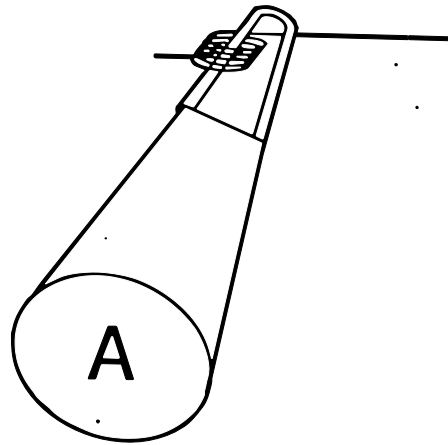
- 1) Given a three phase 66/16KV 28MVA transformer, what is the full load line current on the secondary?
 - a) 245 amps
 - b) 1010 amps
 - c) 583 amps
 - d) 424 amps

- 2) When submitting an outage for a 66kV ISO line, the correct lead time is:
 - a) 24 hours
 - b) 48 hours
 - c) 72 hours
 - d) 96 hours

- 3) What is the division order that gives the relay routine interval for different relays?
 - a) DO 50.10
 - b) DO 50.20
 - c) DO 60.20
 - d) DO 80.10

- 4) Using Protest, what macro would you use to test the Mho circle of a distance relay?
 - a) LRAMPI
 - b) TIMEI
 - c) TIMEV
 - d) ZPXBOI

- 5) A clamp-on ammeter is connected as shown below and reads 10 amps. What is the current in the conductor?

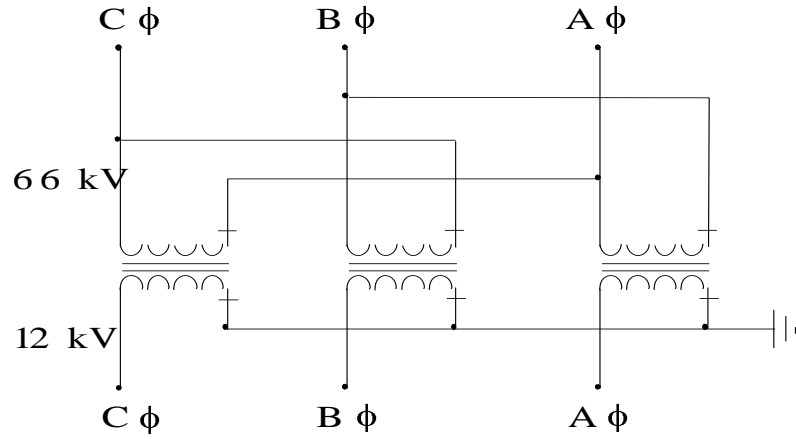


Note: 6 turns

- a) 1.67A
b) 3.33A
c) 5.00A
d) 15.00A
- 6) Three single-phase 5000 KVA transformers are connected in a bank delta-delta. One unit fails, is cut in the clear, and the load is picked up. What is the capacity of the remaining two units?
- a) 5,770 KVA
b) 6,250 KVA
c) 8,655 KVA
d) 10,000 KVA

7). Phasor the 66/12 kV three-phase transformer bank. The 12 kV phase-to-neutral is:

- a) in phase with the 66kV phase-to-neutral
- b) 180° out-of-phase with the 66 kV phase-to-neutral
- c) leading the 66 kV phase-to-neutral by 30°
- d) lagging the 66 kV phase-to-neutral by 30°



Note: Edison A-C-B Rotation

8). What kind of software would you use to run a dole test set?

- a) Protest
- b) Hyperlink
- c) ASE2000
- d) 5020

Answers to Sample Questions for the Job Knowledge Test

1) B

2) C

3) B

4) D

5) A

6) C

7) D

8) A

Performance Test

Below are the major job (topics) covered on the 4784 Supervising Test Technician performance test.

A. Electrical, Electronic, Mechanical Theory, and Mathematics

Knowledge of advanced electrical and electronic theory (AC/DC theory, proper electrical wiring techniques, digital electronics, advanced phasors, and RX diagrams, etc). Knowledge of applied mechanical theory as in the knowledge of basic mechanical aptitude. Also knowledge of algebra, trigonometry, and phasoring.

B. Test Instruments

Knowledge of types and applications of high voltage test equipment, relay test equipment, megger, TTR, resistance bridge, oscilloscope, multimeters, power analyzer, frequency selectable voltmeter, signal generators.

C. Station Equipment

Knowledge of types and applications of recorders, metering and control equipment, instrumentation and alarms, instrument transformers, DC Systems, and circuit breakers, transformer and tap changers, voltage regulators, capacitor banks, reactors and synchronous condensers. Also knowledge of electromechanical and solid-state equivalent and microprocessor based relay testing and calibration.

D. Test Methods

Knowledge of types and applications of various test methods to install, test, maintain, and repair station equipment. Test methods include, but not limited to, primary push, impedance test, wire checking, relay testing, in-service testing, and dynamic relay testing.

E. Hand Tools

Knowledge of types and application of hand tools.

F. Safety Procedures

Knowledge of and ability to apply SCE safety procedures and requirements (Accident Prevention Manual) and CAL OSHA requirements. Knowledge and application of safe operation of tools, equipment, and procedures to include grounding requirements, personal protective equipment, procedures for confined space entry, climbing, working in proximity to energized equipment, live line tools, voltage testers, barricades and warnings and practices of emergency communications. Also knowledge of procedures and requirements for first aid and CPR.

G. Administrative Knowledge

Knowledge of SCE policies, procedures, and standards (Division Orders, SOBs, SSIs, etc); knowledge of administrative procedures necessary for weekly/monthly/annual SCE inspection and maintenance; to complete monthly reports; to record maintenance, test, and operations events; to order supplies.

H. Computer Knowledge

Basic knowledge of computer hardware and software such as MS Office, Windows, PROTEST, ATS LAN, ABB WIN-ECP, and Windows-based relay-interface programs.

I. System Operations & Move Programs

Knowledge of types and applications of proper switching techniques including the ability to verify proper isolation and grounding of electric equipment; types and applications of clearances, tags, warning blocks, intercompany clearances, and switching orders. Knowledge of procedures and requirements for submitting switching/clearance requests, paralleling station transformers, and performing pre/post-switching techniques. Also general knowledge and understanding of Transmission Substation Operations.

Sample Performance Test

The following are samples of the type of tasks that you will encounter in the performance test.

Perform each of the following tasks and provide documentation required for performing each task.

- 1) Develop an outage request for a subtransmission operating bus outage for relay routine, including trip test.
- 2) Perform all required tests to put a 66/12kV Transformer in service.
- 3) Perform all required tests to replace a 220 kV circuit breaker.
- 4) Prepare all test plans and documentation to routine a 66kV distance relay.
- 5) Prepare all test plans and documentation to routine a 66/12kV Bank position.

Major Job Activity Groups

Below are the major job activity groups that are covered on the tests.

Activity I: System equipment testing, inspection, and repair

Description:

Tests, inspects, repairs and adjusts relays, electrical, electronic, and digital instrumentation, local controllers, and associated devices for protection, control, and indication of all assigned system equipment.

Tasks:

- Sets up and operates measuring and test equipment such as volt-ohmmeter, meters and oscilloscopes in order to conduct tests on relays (for example - carrier equipment)
- Operates and repairs/adjusts recorders such as DFRs, CDA, CDV and metering
- Operates a power analyzer in order to conduct in service testing and troubleshooting
- Operates metering and control equipment using software in order to test and calibrate monitoring and control equipment such as RTU, SCADA, PLC
- Performs testing on alarms in accordance with SCE procedures and adjusts and calibrates the alarms settings
- Installs, tests and calibrates various electromechanical and solid-state equivalent relays such as bus differential, distance/impedance, reclosing, non-directional and directional overcurrent relays
- Installs, tests, calibrates, and program various microprocessor-based relays such as SEL, ABB, GE, and GEC
- Uses software programs utilized in testing, inspecting, repairing and adjusting assigned system equipment

Activity II: Electrical Apparatus Testing and Troubleshooting

Description:

Tests, inspects and calibrate synchronous machines, motors, transformers, voltage regulators, instrument transformers, circuit breakers, cables, capacitors, and static VAR compensators and other electrical apparatus. Determines, diagnoses, and isolates electrical trouble and detects electrical faults in equipment and makes or recommends necessary repairs.

Tasks:

- Initiates and interprets testing on instrument transformers such as current and potential transformers, and CCVTs
- Initiates and interprets testing on circuit breakers
- Initiates and interprets testing on power transformers
- Initiates and interprets testing on LTCs
- Initiates and interprets testing on voltage regulators
- Initiates and interprets testing on reactors
- Initiates and interprets testing on synchronous condensers
- Initiates and interprets testing on capacitor banks
- Initiates and interprets testing on and capacitor bank controls

- Initiates and interprets testing on underground cable
- Operates on DC systems in order to operate battery chargers, measure battery voltages, and locate battery grounds
- Troubleshoots electrical equipment

Activity III: Supervisory and Administrative Responsibilities

Description:

Plans, programs, lays out job activities, and coordinates work with other electrical workers. Performs administrative-related activities such as reporting, ordering supplies, recording daily logs, etc.

Tasks:

- Coordinates work schedules with other electrical workers
- Submit reports, order materials, etc.
- Uses basic project management skills to prioritize and lay out job activities for other personnel
- Communicates with and provides direction to assigned craft personnel
- Instructs and trains test technicians in job duties
- Completes daily/weekly/monthly/annual inspection and maintenance reports
- Performs truck and shop inventory
- Maintains accurate records on assigned equipment
- Maintains electrical drawings and required documentation; performs field design modifications as required

Activity IV: Switching

Description:

Performs switching in order to verify proper isolation and grounding of electric equipment.

Tasks:

- Operates switches and disconnects
- Performs pre/post-switching
- Prepares and submit equipment outage requests
- Identify clearance, boundaries, and hazards
- Checks switching programs for errors and omissions
- Inspect equipment to be operated
- Records megawatt, amp, and volt readings before and after switching
- Isolate, test for no voltage and ground electrical equipment and verify proper isolation and grounding.

Activity V: System Operations Program Review

Description:

Provide feedback and input to Operations (GCC, TSO, SOS, outage coordinators) on move programs and switching programs to ensure proper switching to complete required tests

Tasks:

- Review move and switching program in order to identify omissions in the programs
- Reports back their input to related parties
- Ensures their own scope of work is incorporated into program and can safely be accomplished within the scope of the program

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 - Performance Assessment Services
G.O. 4, Ground Floor
8631 Rush St.
Rosemead, CA 91770

Test Name: 2884 Supervising Test Technician Test

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