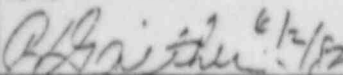
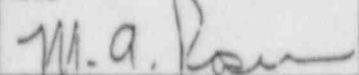
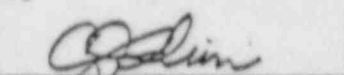
	PALO VERDE NUCLEAR GENERATING STATION		WPP <input type="checkbox"/>	QCI <input type="checkbox"/>
	TITLE -		NO. 256.0	REV. 5
	INSULATION RESISTANCE AND HI-POT TESTING		PAGE 1	OF 10
	WORK PLAN PROCEDURE/QUALITY CONTROL INSTRUCTION		ISSUED 9/28/79	
			REVISED 6/2/82	
PGAE	PGCE	PFE		
				

1.0 PURPOSE

1.1 This procedure establishes methods for insulation resistance testing Class IE and Non-Class IE electrical equipment and cable identified as follows:

1.1.1 High potential testing of medium voltage systems including cable and equipment specified by Project Engineering.

1.1.2 Insulation resistance testing (meggering) of electrical cable and equipment and preparatory testing of medium voltage systems prior to high potential testing.

NOTE: Megger testing of all 15KV, 5KV, and 600 volt power cables, bus duct, switchgear, load centers, motor control centers, power distribution panels, and rotating equipment prior to systems turnover shall be performed by Startup.

2.0 DEFINITIONS

2.1 Abbreviations, terms, and definitions most commonly used in this procedure are contained in WPP/QCI No. 1.0.

3.0 REFERENCES

3.1 EE580 Cable and Raceway Manual.

3.2 Associated Research Hi-Pot Testing Manual for DC Hi-Pot Tester, Model No. 5321.


3.3 IEEE Standard 43-1974. IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machines.

3.4 IEEE Standard 62-1958. Recommended Guide for Making Dielectric Measurements in the Field.

3.5 WPP/QCI No. 5.0, "Nonconforming Materials, Parts and Components".

3.6 Specification No. 13-EM-306, "Installation Specification for Cable Splicing Termination and Supports", (Section 15).

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3.0 REFERENCES (con't)

- 3.7 IEEE-STD-336-1971, "Installation, inspection, and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Station".
- 3.8 KIP 004-G "Construction In-Service Tagging Procedure".
- 3.9 KIP 041-E, "Certification Testing of High Voltage Rubber Gloves and Safety Blankets".

4.0 QUALITY CONTROL REQUIREMENTS

- 4.1 The Termination Engineer (TE) shall provide technical guidance and surveillance for testing of all Quality Class "Q", "R", and "S" cables and motors. The Area Field Engineer (AFE) shall provide technical guidance and surveillance for testing of all Quality Class "Q", "R", and "S" equipment as required.


NOTE: Where TE is identified in this procedure it shall be taken to mean TE or AFE as applicable.

- 4.2 The TE shall witness the testing and record test results on the cable/equipment test records. (Exhibit 256.0-1 and 256.0-2).
- 4.3 The QCE shall verify the test on Quality Class "Q" and associated cables and equipment.
- 4.4 The TE shall notify the responsible QCE at least one (1) hour prior to testing to ensure QC participation.

5.0 GENERAL

- 5.1 The following relation defines voltage level, voltage rating and service level:

<u>Voltage Level</u>	<u>Rating</u>	<u>Service Level</u>
Low	600V	480 V
Medium	5KV	4.16KV
Medium	15KV	13.8KV

	PALO VERDE NUCLEAR GENERATING STATION		WPP/P <input type="checkbox"/>	QCI <input type="checkbox"/>
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5.0 GENERAL (con't)

- 5.2 Bechtel safety procedures shall be followed for all tests to protect employees and equipment from harm.
- 5.3 Test equipment shall be in good operating condition, clean (free of dirt, dust, moisture, and all other contaminants) and be within calibration limits.
- 5.4 The TE shall be familiar with the manufacturer's detailed instructions, furnished with the particular test equipment to be used.


NOTE: These instructions contain directions for connecting and operating the test equipment and also include valuable information on making insulation tests on various types of installation.

- 5.5 Electrical terminations are inspected in accordance with WPP/QCI No. 255.0. Record of that inspection status is maintained on the EE580 cable termination card.
- 5.6 Requirements for protective maintenance of motors are covered in WP/P No. 28.0.
- 5.7 Megger readings shall be recorded upon stabilization of resistance value.
- 5.8 When megger testing cables, a separate "Component Megger Test Data Record" shall be used for each cable schema number.

6.0 INSULATION RESISTANCE TEST

6.1 General

- 6.1.1 Determine the type of megger test to be performed as per paragraph 6.2 and 6.3.
- 6.1.2 Visually verify that the enclosure or frame is solidly grounded to the station ground system.


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6.0 INSULATION RESISTANCE TEST (con't)

- 6.1.3 Select a megger with the proper DC output voltage.
- 6.1.4 Make circuit or component to be tested safe by opening supply breaker, lifting leads, etc., and clearance tagging as required by Reference 3.8.
- 6.1.5 Discharge equipment to be meggered to station ground prior to performing insulation resistance test.
- 6.1.6 Repeat steps 6.1.1 through 6.1.5 as required prior to each megger test.

6.2 Equipment Meggering

- 6.2.1 Megger equipment as follows:
 - 6.2.1.1 Equipment rated 600 and below shall be tested at 1000 volts.
 - 6.2.1.2 Equipment rated above 600 volts shall be tested at 2500 volt or 3000 VDC depending upon availability of type of megger.
- 6.2.2 Connect megger in accordance with megger manufacturer's instruction manual.
- 6.2.3 Record megger readings on Exhibit 256.0-2 per the instructions contained in Appendix II. If cables are connected, record cable readings on Exhibit 256.0-2 per the instructions contained in Appendix II. Indicate in the remarks section of the form that the cable is terminated to equipment.
 - 6.2.3.1 Upon completion of each test, ground component or circuit that was meggered to discharge any accumulated charge.
 - 6.2.3.2 Repeat previous steps, as required, to megger each phase.
 - 6.2.3.3 The meggering results for rotating equipment should be equal to or greater than the megohm value computed by formula:

	PALO VERDE NUCLEAR GENERATING STATION TITLE - INSULATION RESISTANCE AND HI-POT TESTING	WPP/QCI <input checked="" type="checkbox"/>
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6.0 INSULATION RESISTANCE TEST (con't)

$$R_m = (kV+1) \times 100$$

R_m = minimum acceptable insulation, resistance in megohms.

kV = rated RMS kilovolts.

NOTE: Megger reading for motors shall be recorded when test voltage has been applied for one (1) minute in accordance with reference 3.3.

6.2.3.4 For equipment other than motors, the minimum value shall be in accordance with Table I.

6.2.3.5 If megohm reading is less than the formula, controlled heat shall be applied for dry-out operation before remeggering.

NOTE: Refer to equipment manufacturer's technical information for temperature correction factor(s) and drying-out procedures.


6.2.3.6 In the event of failure, remove all visible surface dust and moisture from the equipment being tested (cable jackets excluded). Wipe with lint-free cloth or blow off with dry air. Do not degrade insulation by direct air impingement.

6.2.3.7 Retest the component. In the event a component cannot be made to pass resistance test, a NCR shall be prepared in accordance with WPP/QCI No. 5.0.

6.2.3.8 Each winding of rotating equipment shall be checked for continuity prior to megger test.

6.3 Cable Meggering

6.3.1 All cables shall be checked for continuity prior to meggering and recorded on the "Component Megger Test Data Record".

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6.0 INSULATION RESISTANCE TEST (con't)

6.3.2 All power cable/conductors shall be meggered phase-to-ground, and phase to phase. Power circuits of individual cables per phase shall be meggered only phase to ground. If power cables are meggered when connected to equipment, all associated control circuitry must be isolated to prevent damage by possible voltage transients.

6.3.3 It is not recommended, in general, to unnecessarily isolate a cable from an installation by breaking splices or removing taped terminals for the purpose of testing unless there is sufficient doubt about the serviceability of the cable.

6.3.4 Restore terminations, cable support, etc., to as found condition if disturbed for megger checking.

6.3.5 For power cables/conductors not connected to equipment loads, the following meggering requirements apply:

6.3.5.1 Power circuit cables/conductors rated 600 volts shall be meggered at 1000 volts.


6.3.5.2 Power circuit cables/conductors rated over 600 volts shall be meggered 2500 or 3000 volts.

6.3.5.3 Power cables of 125 VDC shall be meggered at 1000 VDC.

6.4 A value of 100 megohm is considered acceptable for all cables. Any cable reading below this value will be compared to manufacturer's specification. If value is less than manufacturer's recommendation, the cable shall be rejected.

NOTE: If cables are connected to equipment, minimum megger criteria as per paragraph 6.2.3.3 shall apply.


6.5 A polarization index test shall be performed on 4.16KV and 13.8KV rotating equipment to appraise insulation dryness and fitness for an over-voltage test. Read the resistance at 1 minute and 10 minutes. The ratio of 10 minute reading to 1 minute reading is the polarization index. The polarization index must be at least ≥ 1.5 for Class A insulation and ≥ 2.0 for Class B, F, and H insulation, to proceed with DC over-voltage test.

	PALO VERDE NUCLEAR GENERATING STATION	W/P/R <input type="checkbox"/>	DCI <input type="checkbox"/>
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7.0 DC HIGH POTENTIAL TEST

7.1 Due to the danger involved with hi-potential testing the following additional safety procedures shall be followed:


- 7.1.1 An insulation resistance test shall be performed prior to hi-pot testing any insulation. Do not conduct a DC hi-pot test if the insulation resistance is below R min. as described in Section 6.0.
- 7.1.2 The TE shall visually verify that barrier tape (yellow with black stripes) and danger signs are installed at a safe distance around the test area, (e.g., at each end of cables and at equipment under test).
- 7.1.3 A Safety Observer shall be stationed at cable end opposite from the test set.
- NOTE: The Safety Observer and Test Equipment Operator shall be in constant communication.
- 7.1.4 The TE shall visually verify rubber gloves and a hot stick are present. The rubber gloves shall be within certification limits and an air test shall be performed in accordance with Reference 3.9.
- 7.1.5 The high voltage leads shall be spaced a minimum of four inches (4") plus one inch (1") from grounded surfaces for each 10KV increment of test voltage. Where this distance cannot be achieved the leads shall be insulated with polyethylene or other insulating material.
- 7.1.6 To prevent any breeze from affecting the hi-potting process/results, whenever necessary a wind barricade shall be erected around the work area and/or polyethylene bags tied over the end of the cable.
- 7.1.7 Corona currents can not be prevented from reaching ground or microammeter by grounding the bypass switch. The correct method of stopping the corona current is the usage of a corona guard/corona shield.
- 7.1.8 The motor phase leads shall be shorted to each other prior to hi-potting.
- 7.1.9 On rotating equipment which have RTD's, the RTD leads shall be disconnected, shorted and grounded.

	PALO VERDE NUCLEAR GENERATING STATION		WP/P <input checked="" type="checkbox"/>	OCI <input checked="" type="checkbox"/>
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7.0 DC HIGH POTENTIAL TEST (con't)

7.2 Test Procedures

- 7.2.1 The DC high potential tests shall be conducted in accordance with the instructions in Spec. 13-EM-306.
- 7.2.2 The TE shall be familiar with the operation of the hi-pot test set and procedures of DC hi-pot testing.
- 7.2.3 The TE shall visually verify that the test set and grounding are properly connected prior to start of test.
- 7.2.4 The TE shall complete the testing and record the results on the appropriate data sheets.
- 7.2.5 If during the test, the leakage current continues to increase without any increase in applied voltage, it may be an indication of failing insulation. In all such cases the test should be terminated. The TE shall determine if the component shall be tested to destruction.
- 7.2.6 If during the test, a test set circuit breaker trips due to sudden increase in current, it is an indication of probable failure in the cable. A failure can be verified by the inability to sustain the test voltage.
- 7.2.7 Upon completion of the over-voltage test on cables, the applied voltage shall be reduced to zero and the DC set turned off. On long lengths of cable, the time required to bleed off this charge may be from two (2) to five (5) minutes. After the voltage has decayed to less than 10KV DC on the test set indicating voltmeter, apply the DC set ground hook stick to the DC test set high voltage output bushing or cable. Then ground the cable conductor with #16 or larger copper wire and leave the cable grounded for at least four (4) times the elapsed time of the applied test voltage. For example, if the total elapsed time from the initially applied voltage is fifteen (15) minutes the cable should be grounded for at least one (1) hour.
- 7.2.8 The rate of rise for the DC hi-pot test voltage shall be gradual and shall be applied between the conductor or conductors and the metallic sheath or shield. The

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7.0 DC HIGH POTENTIAL TEST (con't)

7.2.8 initially applied DC voltage shall not be greater than 20KV. The rate of increase from the applied voltage to the specified test voltage shall be approximately uniform and shall not be over one-hundred percent (100%) in ten (10) seconds nor less than one-hundred percent (100%) in sixty (60) seconds, per step of voltage.

7.2.9 The voltage should be raised at a slow enough rate to avoid having the microammeter pointer go off scale.

8.0 ACCEPTANCE CRITERIA




8.1 If the leakage current does not become excessive (e.g. decays to a lower stabilized value), the cable is accepted. Failure is indicated by a gradual or abrupt increase in current sufficient to trip the breaker of the test equipment or by an increase in current without increase in applied voltage.

9.0 INSPECTION REQUIREMENTS

- 9.1 At the completion of a test, the TE shall record the test results and shall sign and date in the space provided.
- 9.2 The QCE for Quality Class "Q" shall witness the test and review the test data and upon verification and acceptance of data shall stamp and date the record in the space provided.
- 9.3 The TE or QCE as applicable shall prepare a NCR for the equipment or cable that failed the test. (Ref. WPP/QCI No. 5.0).

10.0 TEST DOCUMENTS

- 10.1 The test results shall be recorded on the appropriate documents.
- 10.2 Forms are to be completed by the appropriate engineer.
- 10.3 Forms for test values (Exhibits 256.0-1 through 256.0-2) may be used to record values. Where the results are documented on IR's or CIP's, these forms are not required.

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11.0 DOCUMENTATION

- 11.1 The TE shall transmit Quality Class "R" and "S" test records, (Exhibit 256.0-1 and 256.0-2) to the LDPE. The LDPE shall file the test record in the Electrical Department files.
- 11.2 The responsible LDQCE shall forward the completed Quality Class "Q" and associated class test records (Exhibit 256.0-1 and 256.0-2) to DCC for file.

12.0 ATTACHMENTS

- 12.1 Exhibit 256.0-1 (Rev. 1) "Electrical High Potential Test Record".
- 12.2 Exhibit 256.0-2 (Rev. 2) "Component Megger Test Data Record".
- 12.3 Exhibit 256.0-3 (Rev. 0) Table I, "Insulation Resistance Acceptance Criteria".
- 12.4 Appendix I Instructions for the preparation of the "Electrical High Potential Test Record".
- 12.5 Appendix II Instructions for the preparation of the "Component Megger Test Data Record".

13.0 INCORPORATED PCN'S

- 13.1 Revision 5 to WPP/QCI is a major revision requested by Electrical/FE.
- 13.2 Revision 3 to Appendix II is revised per Electrical/FE request.



REV. 1

PALO VERDE NUCLEAR GENERATING STATION UNITS 1, 2 & 3
ELECTRICAL HIGH POTENTIAL TEST RECORD
JDE NO. 10407

1. S-EST

OF

WH-1001
NO. 256.0

2. UNIT NO. 3. SCHEME NO. 4. CABLE CODE

5. DRAWING NO. REV. NO. 6. NAME OF EQUIPMENT & SERIAL NO. 7. QUALITY CLASS -

8. WEDDER PRE-TEST

TEST DATA

TEST EQUIPMENT NO. CALIBRATION DUE DATE TEST VOLTAGE RESISTANCE ACCEPTANCE

HIGH POTENTIAL TEST

9. CURRENT VS VOLTAGE					10. CURRENT VS TIME				
TEST EQUIPMENT NO.		CALIBRATION DUE DATE			TEST EQUIPMENT NO.		CALIBRATION DUE DATE		
TEST VOLTAGE MAXIMUM		WEATHER			TEST VOLTAGE MAXIMUM		WEATHER		
TEST VOLTS	CURRENT			TIME MINUTES	CURRENT				
	AC	DC	Ω		AC	DC	Ω		
				1/2					
				1					
				2					
				3					
				4					
				5					
				10					
				15					

11. FAILURES:

12. REMARKS:

13. ACCEPTED BY

14. ACCEPTED/HOLD BY

TECHN/DATE

OCC/DATE

FORM 10407 (10/67) 1/98

FORM 256.0-1

TABLE 1


INSULATION RESISTANCE ACCEPTANCE CRITERIA

<u>EQUIPMENT</u>	<u>VOLTAGE RATING</u>	<u>DC-MEGGER VOLTAGE</u>	<u>RESISTANCE Min. at 40°c</u>
Switchgear	15 kv	2.5/3 kv	1600 Megs
Switchgear	5 kv	2.5/3 kv	1600 Megs
Load Center	600 v	1 kv	100 Megs
Bus Duct	15 kv	2.5/2 kv	1600 Megs
Bus Duct	5 kv	2.5/3 kv	1600 Megs
Bus Duct	60 v	1 kv	100 Megs
MCC	600 v	1 kv	100 Megs

<u>POWER CABLE</u>	<u>VOLTAGE RATING</u>	<u>DC-MEGGER VOLTAGE</u>	<u>RESISTANCE Min. at 40°c</u>
13.8 kv	15 kv	2.5/3 kv	100 Megohms
4.16 kv	5 kv	2.5/3 kv	100 Megohms
480 v	600 kv	1 kv	100 Megohms

NOTE:

Meggering of all medium power cables and buses shall be performed prior to system turnover. A megger test of the insulation resistance between each phase and ground, and between phases shall be made. The minimum insulation resistance shall be as indicated in table 1 or per the manufacturer's requirements. If the resistance readings are below acceptable limits the results shall be documented in accordance with WPP/QCI 5.0.

	PALO VERDE NUCLEAR GENERATING STATION TITLE - INSULATION RESISTANCE AND HI-POT TESTING APPENDIX I	WP/P <input type="checkbox"/> <input checked="" type="checkbox"/> QCI <input checked="" type="checkbox"/>
		Appendix NO. 1 256.0 REV 3
		PAGE 1 OF 3

A. PURPOSE

1. To provide instructions for the preparation of the "Electrical High Potential Test Record", (Exhibit 256.0-1).

B. GENERAL


1. Enter N/A for entries that are not applicable.

C. TE ENTRY INSTRUCTIONS

1. Entry No.

Information Required

1. Enter sheet number and number of sheets.
2. Enter unit number.
3. Enter scheme number.
4. Enter applicable cable code.
5. Enter drawing number and revision number.
6. Enter name of equipment and serial number if applicable.
7. Enter quality class.
8. Enter the megger pre-test data. Test equipment number (megger ID number), calibration due date and test voltage. The TE shall sign/initial and date acceptance of resistance, per Section 6.0 of this procedure.
9. Enter test set ID number and calibration due date. Enter maximum test voltage to be used. Enter weather condition (e.g. dry, stormy, damp, humid, etc.). Enter values of test voltage steps to be used and the current values for each phase.

	TITLE - INSULATION RESISTANCE AND HI-POT TESTING APPENDIX I	PALO VERDE NUCLEAR GENERATING STATION	
		WPP/P <input checked="" type="checkbox"/>	OCI <input checked="" type="checkbox"/>
		Appendix	
		NO. 256.0	REV 7
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C. TE ENTRY INSTRUCTIONS (con't)

1. Entry No.

Information Required

10. Enter test number ID number and calibration due date. Enter the test voltage. Enter weather condition (e.g. dry, wet, damp, humid, etc.). Enter the current phase at time increments as listed on the form.

NOTE: When equipment used for current versus voltage and current versus time tests is the same, equipment entries used for Entry No. 9 are sufficient and the boxes for Item No. 10 may be left blank.

11. Enter failures as applicable including NCR number(s).

12. Enter remarks as appropriate.

NOTE: The polarization index shall be entered in the remarks section when applicable.


13. TE shall initial/sign and date acceptance of test. In the event the equipment fails the hi-pot test, initiate a NCR per WPP/QCI No. 5.0.

14. QCE shall stamp and date acceptance of test. If the equipment fails the hi-pot tests, initiate a NCR per WPP/QCI No. 5.0.

NOTE: For Quality Class "Q" requirements, the QCE shall place a "hold stamp" pending correction of failure.


D. DOCUMENTATION

1. The Electrical LDOCE shall forward the completed Quality Class "Q" and associated class test records to DCC for file.
2. The TE shall forward the test records for Quality Class "R" and "S" to the LDFE for file in the Electrical Department.

	PALO VERDE NUCLEAR GENERATING STATION		W/P/P <input checked="" type="checkbox"/>	QC1 <input checked="" type="checkbox"/>
	TITLE -	INSULATION RESISTANCE AND HI-POT TESTING APPENDIX I	APPENDIX	
			NO. 256.0	REV 3
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E. INCORPORATED PCN'S

1. Revision 3 to Appendix I incorporated PCN No. 4.

	PALO VERDE NUCLEAR GENERATING STATION	WPP <input type="checkbox"/>	QCI <input type="checkbox"/>
	TITLE -	INSULATION RESISTANCE AND HI-POT TESTING	
	APPENDIX II	NO. Appendix 256.0 REV 3	
		PAGE 1	OF 2

A. PURPOSE

1. To provide instructions for the preparation of the "Component Megger Data Test Record", (Exhibit 256.0-2).

B. GENERAL

1. Enter N/A for entries that are not applicable.
2. When megger testing of cables, a separate "Component Megger Test Data Record" shall be used for each cable scheme number.

C. TE ENTRY INSTRUCTIONS

- | 1. <u>Entry No.</u> | <u>Information Required</u> |
|---------------------|---|
| 1. | Enter sheet number. |
| 2. | Enter name of equipment. |
| 3. | Enter equipment tag number or cable scheme number. |
| 4. | Enter unit number. |
| 5. | Enter the from/to location of the scheme number if applicable. |
| 6. | Enter test voltage. |
| 7. | Enter continuity per phase. |
| 8. | Enter the megger resistance value for each phase to ground and each phase to phase and polarity index when applicable. |
| 9. | The TE shall initial and date acceptance of insulation resistance test or initiate a NCR if the cable(s) fails per WPP/QCI No. 5.0. |
| 10. | QCE shall stamp and date verifying insulation resistance is acceptable or initiate a NCR if the cable(s) fails per WPP/QCI No. 5.0. |



TITLE -

INSULATION RESISTANCE AND
HI-POT TESTING
APPENDIX IIWP/P ☐CCI ☐NO. Appendix REV
256.0 3

PAGE 2 OF 2


C. TE ENTRY INSTRUCTIONS (con't)1. Entry No. Information Required

NOTE: For Quality Class "Q" and associated cables, the QCE shall place a "hold stamp" pending correction of failure.

11. Enter applicable megger number and calibration due date.
12. Indicate if disconnected to perform test.
13. Indicate reconnected after test.
14. Enter torque wrench number.
15. Enter torque wrench calibration due date.
16. Enter torque value.
17. Remarks. Enter if cable is terminated to equipment.

D. DOCUMENTATION

1. The Electrical LDQCE shall forward the completed Quality Class "Q" and associated class test data to DCC for file.
2. The TE shall forward the test data for Quality Class "R" and "S" to the LDFE for file in the Electrical Department.

	PALO VERDE NUCLEAR GENERATING STATION TITLE - INSULATION RESISTANCE AND HI-POT TESTING APPENDIX II	WPP	QCI
		NO. Appendix 256.0	REV 3
		PAGE 1	OF 2

A. PURPOSE


1. To provide instructions for the preparation of the "Component Megger Data Test Record", (Exhibit 256.0-2).

B. GENERAL

1. Enter N/A for entries that are not applicable.
2. When megger testing of cables, a separate "Component Megger Test Data Record" shall be used for each cable scheme number.

C. TE ENTRY INSTRUCTIONS

- | 1. <u>Entry No.</u> | <u>Information Required</u> |
|---------------------|---|
| 1. | Enter sheet number. |
| 2. | Enter name of equipment. |
| 3. | Enter equipment tag number or cable scheme number. |
| 4. | Enter unit number. |
| 5. | Enter the from/to location of the scheme number if applicable. |
| 6. | Enter test voltage. |
| 7. | Enter continuity per phase. |
| 8. | Enter the megger resistance value for each phase to ground and each phase to phase and polarity index when applicable. |
| 9. | The TE shall initial and date acceptance of insulation resistance test or initiate a NCR if the cable(s) fails per WPP/QCI No. 5.0. |
| 10. | QCE shall stamp and date verifying insulation resistance is acceptable or initiate a NCR if the cable(s) fails per WPP/QCI No. 5.0. |

	PALO VERDE NUCLEAR GENERATING STATION		WP/P <input type="checkbox"/>	QC1 <input type="checkbox"/>
	TITLE -	INSULATION RESISTANCE AND HI-POT TESTING APPENDIX II		NO. Appendix REV 256.0
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C. TE ENTRY INSTRUCTIONS (con't)


1. Entry No. Information Required

NOTE: For Quality Class "Q" and associated cables, the QCE shall place a "hold stamp" pending correction of failure.

11. Enter applicable megger number and calibration due date.
12. Indicate if disconnected to perform test.
13. Indicate reconnected after test.
14. Enter torque wrench number.
15. Enter torque wrench calibration due date.
16. Enter torque value.
17. Remarks. Enter if cable is terminated to equipment.


D. DOCUMENTATION

1. The Electrical LDQCE shall forward the completed Quality Class "Q" and associated class test data to DCC for file.
2. The TE shall forward the test data for Quality Class "R" and "S" to the LDPE for file in the Electrical Department.

	TITLE - LO VERDE NUCLEAR GENERATING STATION INSULATION RESISTANCE AND HI-POT TESTING APPENDIX I	WP/P <input type="checkbox"/>	QC1 <input type="checkbox"/>
		NO. 256.0	REV 3
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E. INCORPORATED PCN'S

1. Revision 3 to Appendix I incorporated PCN No. 4.

	TITLE - INSULATION RESISTANCE AND HI-POT TESTING APPENDIX I	WP/P <input checked="" type="checkbox"/>	DCI <input checked="" type="checkbox"/>
		NC. 1 256.0	REV 3
		PAGE 1	OF 3

A. PURPOSE

1. To provide instructions for the preparation of the "Electrical High Potential Test Record", (Exhibit 256.0-1).

B. GENERAL


1. Enter N/A for entries that are not applicable.

C. TE ENTRY INSTRUCTIONS

1. Entry No.

Information Required

1. Enter sheet number and number of sheets.
2. Enter unit number.
3. Enter scheme number.
4. Enter applicable cable code.
5. Enter drawing number and revision number.
6. Enter name of equipment and serial number if applicable.
7. Enter quality class.
8. Enter the megger pre-test data. Test equipment number (megger ID number), calibration due date and test voltage. The TE shall sign/initial and date acceptance of resistance, per Section 6.0 of this procedure.
9. Enter test set ID number and calibration due date. Enter maximum test voltage to be used. Enter weather condition (e.g. dry, stormy, damp, humid, etc.). Enter values of test voltage steps to be used and the current values for each phase.

	TITLE - INSULATION RESISTANCE AND HI-POT TESTING APPENDIX I	WPP/QCI <input type="checkbox"/>	
		NO. 256.0 REV 3	
		PAGE 2 OF 3	
		QCI <input type="checkbox"/>	

C. TE ENTRY INSTRUCTIONS (con't)

1. Entry No.

Information Required

10. Enter test number ID number and calibration due date. Enter the test voltage. Enter weather condition (e.g. dry, wet, damp, humid, etc.). Enter the current phase at time increments as listed on the form.

NOTE: When equipment used for current versus voltage and current versus time tests is the same, equipment entries used for Entry No. 9 are sufficient and the boxes for Item No. 10 may be left blank.

11. Enter failures as applicable including NCR number(s).

12. Enter remarks as appropriate.

NOTE: The polarization index shall be entered in the remarks section when applicable.

13. TE shall initial/sign and date acceptance of test. In the event the equipment fails the hi-pot test, initiate a NCR per WPP/QCI No. 5.0.

14. QCE shall stamp and date acceptance of test. If the equipment fails the hi-pot tests, initiate a NCR per WPP/QCI No. 5.0.

NOTE: For Quality Class "Q" requirements, the QCE shall place a "hold stamp" pending correction of failure.

D. DOCUMENTATION

1. The Electrical LDQCE shall forward the completed Quality Class "Q" and associated class test records to DOC for file.
2. The TE shall forward the test records for Quality Class "R" and "S" to the LDFE for file in the Electrical Department.

TABLE 1

INSULATION RESISTANCE ACCEPTANCE CRITERIA

<u>EQUIPMENT</u>	<u>VOLTAGE RATING</u>	<u>DC-MEGGER VOLTAGE</u>	<u>RESISTANCE Min at 40°C</u>
Switchgear	15 kv	2.5/3 kv	1600 Megs
Switchgear	5 kv	2.5/3 kv	1600 Megs
Load Center	600 v	1 kv	100 Megs
Bus Duct	15 kv	2.5/3 kv	1600 Megs
Bus Tract	5 kv	2.5/3 kv	1600 Megs
Bus Tract	60 v	1 kv	100 Megs
MCC	600 v	1 kv	100 Megs

<u>TOWER CABLE</u>	<u>VOLTAGE RATING</u>	<u>DC-MEGGER VOLTAGE</u>	<u>RESISTANCE Min at 40°C</u>
13.8 kv	15 kv	2.5/3 kv	100 Megohms
4.16 kv	5 kv	2.5/3 kv	100 Megohms
480 v	600 kv	1 kv	100 Megohms

NOTE:

Meggering of all medium power cables and buses shall be performed prior to system turnover. A megger test of the insulation resistance between each phase and ground, and between phases shall be made. The minimum insulation resistance shall be as indicated in table 1 or per the manufacturer's requirements. If the resistance readings are below acceptable limits the results shall be documented in accordance with WPP/QCI 5.0.



PALE VERDE NUCLEAR GENERATING STATION UNITS 1, 2 & 3
ELECTRICAL HIGH-POTENTIAL TEST RECORD
JOB NO. 11607

1. SHEET

OF

FORM 1001
NO. 256.0-1

REV. 1

2. UNIT NO. 3. SCHEMATIC NO.

4. SAFETY CODE

5. DRAWING NO.

REV. NO. 6. NAME OF EQUIPMENT & SERIAL NO.

7. QUALITY
CLASS

8. ADDRESS PRE-TEST

TEST DATA

TEST EQUIPMENT NO.

CALIBRATION DUE DATE

TEST VOLTAGE

RESISTANCE ACCEPTANCE

HIGH POTENTIAL TEST

9. CURRENT VS VOLTAGE

10. CURRENT VS TIME

TEST EQUIPMENT NO.

CALIBRATION DUE DATE

TEST EQUIPMENT NO.

CALIBRATION DUE DATE

TEST VOLTAGE MAXIMUM

WEATHER

TEST VOLTAGE MAXIMUM

WEATHER

TEST VOLTS

CURRENT

TIME
MINUTES

CURRENT

AC

DC

HF

AC

DC

HF

1/2

1

2

3

4

5

10

15

11. FAILURES:

12. REMARKS:

13. ACCEPTED BY


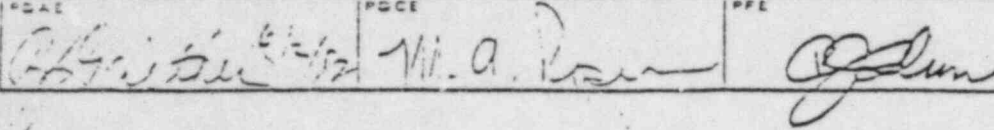
14. ACCEPTED/HOLD BY

DATE

DATE

TEST SUBJECT: 11607

FORM 1001 256.0-1

	TITLE -	INSULATION RESISTANCE AND HI-POT TESTING	WPIR <input type="checkbox"/>	QCI <input type="checkbox"/>
			NO. 256.0	REV 5
			PAGE 1	OF 10
			ISSUED 9/28/79	
			REVISED 6/2/82	
WORK PLAN PROCEDURE QUALITY CONTROL INSTRUCTION				
PDAE	PDCE	PFE		
				

1.0 PURPOSE

1.1 This procedure establishes methods for insulation resistance testing Class IE and Non-Class IE electrical equipment and cable identified as follows:

- 1.1.1 High potential testing of medium voltage systems including cable and equipment specified by Project Engineering.
- 1.1.2 Insulation resistance testing (meggering) of electrical cable and equipment and preparatory testing of medium voltage systems prior to high potential testing.


NOTE: Megger testing of all 15KV, 5KV, and 600 volt power cables, bus duct, switchgear, load centers, motor control centers, power distribution panels, and rotating equipment prior to systems turnover shall be performed by Startup.

2.0 DEFINITIONS

2.1 Abbreviations, terms, and definitions most commonly used in this procedure are contained in WPP/QCI No. 1.0.

3.0 REFERENCES

- 3.1 EE580 Cable and Raceway Manual.
- 3.2 Associated Research Hi-Pot Testing Manual for DC Hi-Pot Tester, Model No. 5321.
- 3.3 IEEE Standard 43-1974. IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machines.
- 3.4 IEEE Standard 62-1958. Recommended Guide for Making Dielectric Measurements in the Field.
- 3.5 WPP/QCI No. 5.0, "Nonconforming Materials, Parts and Components".
- 3.6 Specification No. 13-EM-306, "Installation Specification for Cable Splicing Termination and Supports", (Section 15).

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	TITLE -		NO. 256.0	REV 1
	INSULATION RESISTNACE AND HI-POT TESTING		PAGE 2	OF 10

3.0 REFERENCES (con't)

- 3.7 IEEE-STD-336-1971, "Installation, inspection, and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Station".
- 3.8 NIP 004-G "Construction In-Service Tagging Procedure".
- 3.9 NIP 041-E, "Certification Testing of High Voltage Rubber Gloves and Safety Blankets".

4.0 QUALITY CONTROL REQUIREMENTS

- 4.1 The Termination Engineer (TE) shall provide technical guidance and surveillance for testing of all Quality Class "Q", "R", and "S" cables and motors. The Area Field Engineer (AFE) shall provide technical guidance and surveillance for testing of all Quality Class "Q", "R", and "S" equipment as required.


NOTE: Where TE is identified in this procedure it shall be taken to mean TE or AFE as applicable.

- 4.2 The TE shall witness the testing and record test results on the cable/equipment test records. (Exhibit 256.0-1 and 256.0-2).
- 4.3 The QCE shall verify the test on Quality Class "Q" and associated cables and equipment.
- 4.4 The TE shall notify the responsible QCE at least one (1) hour prior to testing to ensure QC participation.

5.0 GENERAL

- 5.1 The following relation defines voltage level, voltage rating and service level:

<u>Voltage Level</u>	<u>Rating</u>	<u>Service Level</u>
Low	600V	480 V
Medium	5KV	4.16KV
Medium	15KV	13.8KV

	PALO VERDE NUCLEAR GENERATING STATION		WPP/P <input type="checkbox"/>	QCI <input type="checkbox"/>
	TITLE -		NO. 255.0	REV. 1
	INSULATION RESISTANCE AND HI-POT TESTING		PAGE 3	OF 10

5.0 GENERAL (con't)

- 5.2 Each safety procedure shall be followed for all tests to protect employees and equipment from harm.
- 5.3 Test equipment shall be in good operating condition, clean (free of dirt, dust, moisture, and all other contaminants) and be within calibration limits.
- 5.4 The TE shall be familiar with the manufacturer's detailed instructions, furnished with the particular test equipment to be used.


NOTE: These instructions contain directions for connecting and operating the test equipment and also include valuable information on making insulation tests on various types of installation.

- 5.5 Electrical terminations are inspected in accordance with WPP/QCI No. 255.0. Record of that inspection status is maintained on the EE580 cable termination card.
- 5.6 Requirements for protective maintenance of motors are covered in WPP/P No. 28.0.
- 5.7 Megger readings shall be recorded upon stabilization of resistance value.
- 5.8 When megger testing cables, a separate "Component Megger Test Data Record" shall be used for each cable scheme number.

6.0 INSULATION RESISTANCE TEST

6.1 -General

- 6.1.1 Determine the type of megger test to be performed as per paragraph 6.2 and 6.3.
- 6.1.2 Visually verify that the enclosure or frame is solidly grounded to the station ground system.


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6.0 INSULATION RESISTANCE TEST (con't)

- 6.1.3 Select a megger with the proper DC output voltage.
- 6.1.4 Make circuit or component to be tested safe by opening supply breaker, lifting leads, etc., and clearance tagging as required by Reference 3.8.
- 6.1.5 Discharge equipment to be meggered to station ground prior to performing insulation resistance test.
- 6.1.6 Repeat steps 6.1.1 through 6.1.5 as required prior to each megger test.

6.2 Equipment Meggering

- 6.2.1 Megger equipment as follows:
 - 6.2.1.1 Equipment rated 600 and below shall be tested at 1000 volts.
 - 6.2.1.2 Equipment rated above 600 volts shall be tested at 2500 volt or 3000 VDC depending upon availability of type of megger.
- 6.2.2 Connect megger in accordance with megger manufacturer's instruction manual.
- 6.2.3 Record megger readings on Exhibit 256.0-2 per the instructions contained in Appendix II. If cables are connected, record cable readings on Exhibit 256.0-2 per the instructions contained in Appendix II. Indicate in the remarks section of the form that the cable is terminated to equipment.
 - 6.2.3.1 Upon completion of each test, ground component or circuit that was meggered to discharge any accumulated charge.
 - 6.2.3.2 Repeat previous steps, as required, to megger each phase.
 - 6.2.3.3 The meggering results for rotating equipment should be equal to or greater than the megohm value computed by formula:

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6.0 INSULATION RESISTANCE TEST (con't)

$$R_m = (kV+1) \times 100$$

R_m = minimum acceptable insulation, resistance in megohms.

kV = rated RMS kilovolts.

NOTE: Megger reading for motors shall be recorded when test voltage has been applied for one (1) minute in accordance with reference 3.3.

6.2.3.4 For equipment other than motors, the minimum value shall be in accordance with Table I.

6.2.3.5 If megohm reading is less than the formula, controlled heat shall be applied for dry-out operation before remeggering.

NOTE: Refer to equipment manufacturer's technical information for temperature correction factor(s) and drying-out procedures.


6.2.3.6 In the event of failure, remove all visible surface dust and moisture from the equipment being tested (cable jackets excluded). Wipe with lint-free cloth or blow off with dry air. Do not degrade insulation by direct air impingement.

6.2.3.7 Retest the component. In the event a component cannot be made to pass resistance test, a NCR shall be prepared in accordance with WPP/QCI No. 5.0.

6.2.3.8 Each winding of rotating equipment shall be checked for continuity prior to megger test.

6.3 Cable Meggering

6.3.1 All cables shall be checked for continuity prior to meggering and recorded on the "Component Megger Test Data Record".

	PALO VERDE NUCLEAR GENERATING STATION TITLE - INSULATION RESISTANCE AND HI-POT TESTING	W.P.R. <input type="checkbox"/> GCI <input type="checkbox"/> NO. <input type="checkbox"/> REV <input type="checkbox"/> PAGE 2 OF 10
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6.0 INSULATION RESISTANCE TEST (con't)

6.3.2 All power cable/conductors shall be meggered phase-to-ground, and phase to phase. Power circuits of individual cables per phase shall be meggered only phase to ground. If power cables are meggered when connected to equipment, all associated control circuitry must be isolated to prevent damage by possible voltage transients.

6.3.3 It is not recommended, in general, to unnecessarily isolate a cable from an installation by breaking splices or removing taped terminals for the purpose of testing unless there is sufficient doubt about the serviceability of the cable.

6.3.4 Restore terminations, cable support, etc., to as found condition if disturbed for megger checking.

6.3.5 For power cables/conductors not connected to equipment loads, the following meggering requirements apply:

6.3.5.1 Power circuits cables/conductors rated 600 volts shall be meggered at 1000 volts.


6.3.5.2 Power circuit cables/conductors rated over 600 volts shall be meggered 2500 or 3000 volts.

6.3.5.3 Power cables of 125 VDC shall be meggered at 1000 VDC.

6.4 A value of 100 megohm is considered acceptable for all cables. Any cable reading below this value will be compared to manufacturer's specification. If value is less than manufacturer's recommendation, the cable shall be rejected.

NOTE: If cables are connected to equipment, minimum megger criteria as per paragraph 6.2.3.3 shall apply.

6.5 A polarization index test shall be performed on 4.16KV and 13.8KV rotating equipment to appraise insulation dryness and fitness for an over-voltage test. Read the resistance at 1 minute and 10 minutes. The ratio of 10 minute reading to 1 minute reading is the polarization index. The polarization index must be at least ≥ 1.5 for Class A insulation and ≥ 2.0 for Class B, F, and H insulation, to proceed with DC over-voltage test.

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7.0 DC HIGH POTENTIAL TEST

7.1 Due to the danger involved with hi-potential testing the following additional safety procedures shall be followed:

7.1.1 An insulation resistance test shall be performed prior to hi-pot testing any insulation. Do not conduct a DC hi-pot test if the insulation resistance is below R min. as described in Section 6.0.

7.1.2 The TE shall visually verify that barrier tape (yellow with black stripes) and danger signs are installed at a safe distance around the test area, (e.g., at each end of cables and at equipment under test).

7.1.3 A Safety Observer shall be stationed at cable end opposite from the test set.

NOTE: The Safety Observer and Test Equipment Operator shall be in constant communication.

7.1.4 The TE shall visually verify rubber gloves and a hot stick are present. The rubber gloves shall be within certification limits and an air test shall be performed in accordance with Reference 3.9.


7.1.5 The high voltage leads shall be spaced a minimum of four inches (4") plus one inch (1") from grounded surfaces for each 10KV increment of test voltage. Where this distance cannot be achieved the leads shall be insulated with polyethylene or other insulating material.

7.1.6 To prevent any breeze from affecting the hi-potting process/results, whenever necessary a wind barricade shall be erected around the work area and/or polyethylene bags tied over the end of the cable.

7.1.7 Corona currents can not be prevented from reaching ground or microammeter by grounding the bypass switch. The correct method of stopping the corona current is the usage of a corona guard/corona shield.

7.1.8 The motor phase leads shall be shorted to each other prior to hi-potting.


7.1.9 On rotating equipment which have RTD's, the RTD leads shall be disconnected, shorted and grounded.

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7.0 DC HIGH POTENTIAL TEST (CON'T)

7.2 Test Procedures

- 7.2.1 The DC high potential tests shall be conducted in accordance with the instructions in Spec. 13-EM-306.
- 7.2.2 The TE shall be familiar with the operation of the hi-pot test set and procedures of DC hi-pot testing.
- 7.2.3 The TE shall visually verify that the test set and grounding are properly connected prior to start of test.
- 7.2.4 The TE shall complete the testing and record the results on the appropriate data sheets.
- 7.2.5 If during the test, the leakage current continues to increase without any increase in applied voltage, it may be an indication of failing insulation. In all such cases the test should be terminated. The TE shall determine if the component shall be tested to destruction.
- 7.2.6 If during the test, a test set circuit breaker trips due to sudden increase in current, it is an indication of probable failure in the cable. A failure can be verified by the inability to sustain the test voltage.
- 7.2.7 Upon completion of the over-voltage test on cables, the applied voltage shall be reduced to zero and the DC set turned off. On long lengths of cable, the time required to bleed off this charge may be from two (2) to five (5) minutes. After the voltage has decayed to less than 10KV DC on the test set indicating voltmeter, apply the DC set ground hook stick to the DC test set high voltage output bushing or cable. Then ground the cable conductor with #16 or larger copper wire and leave the cable grounded for at least four (4) times the elapsed time of the applied test voltage. For example, if the total elapsed time from the initially applied voltage is fifteen (15) minutes the cable should be grounded for at least one (1) hour.
- 7.2.8 The rate of rise for the DC hi-pot test voltage shall be gradual and shall be applied between the conductor or conductors and the metallic sheath or shield. The

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		C		

7.0 DC HIGH POTENTIAL TEST (con't)

- 7.2.8 initially applied DC voltage shall not be greater than 20KV. The rate of increase from the applied voltage to the specified test voltage shall be approximately uniform and shall not be over one-hundred percent (100%) in ten (10) seconds nor less than one-hundred percent (100%) in sixty (60) seconds, per step of voltage.
- (con't)
- 7.2.9 The voltage should be raised at a slow enough rate to avoid having the microammeter pointer go off scale.

8.0 ACCEPTANCE CRITERIA


- 8.1 If the leakage current does not become excessive (e.g. decays to a lower stabilized value), the cable is accepted. Failure is indicated by a gradual or abrupt increase in current sufficient to trip the breaker of the test equipment or by an increase in current without increase in applied voltage.

9.0 INSPECTION REQUIREMENTS

- 9.1 At the completion of a test, the TE shall record the test results and shall sign and date in the space provided.
- 9.2 The QCE for Quality Class "Q" shall witness the test and review the test data and upon verification and acceptance of data shall stamp and date the record in the space provided.
- 9.3 The TE or QCE as applicable shall prepare a NCR for the equipment or cable that failed the test. (Ref. WPP/QCI No. 5.0).

10.0 TEST DOCUMENTS

- 10.1 The test results shall be recorded on the appropriate documents.
- 10.2 Forms are to be completed by the appropriate engineer.
- 10.3 Forms for test values (Exhibits 256.0-1 through 256.0-2) may be used to record values. Where the results are documented on IR's or CIP's, these forms are not required.

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	TITLE -	INSULATION RESISTANCE AND HI-POT TESTING		NO. 256.0 REV
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11.0 DOCUMENTATION

- 11.1 The TE shall transmit Quality Class "R" and "S" test records, (Exhibit 256.0-1 and 256.0-2) to the LDFE. The LDFE shall file the test record in the Electrical Department files.
- 11.2 The responsible LDQCE shall forward the completed Quality Class "Q" and associated class test records (Exhibit 256.0-1 and 256.0-2) to DCC for file.

12.0 ATTACHMENTS

- 12.1 Exhibit 256.0-1 (Rev. 1) "Electrical High Potential Test Record".
- 12.2 Exhibit 256.0-2 (Rev. 2) "Component Megger Test Data Record".
- 12.3 Exhibit 256.0-3 (Rev. 0) Table I, "Insulation Resistance Acceptance Criteria".
- 12.4 Appendix I Instructions for the preparation of the "Electrical High Potential Test Record".
- 12.5 Appendix II Instructions for the preparation of the "Component Megger Test Data Record".

13.0 INCORPORATED PCN'S

- 13.1 Revision 5 to WPP/QCI is a major revision requested by Electrical/FE.
- 13.2 Revision 3 to Appendix II is revised per Electrical/FE request.

D.4.2.5 Conduit end fire seals shall be rated for 3 hours exposure.

D.4.2.6 Fire resistant seismic gap seals shall be rated for 3 hour exposure and shall be designed for a maximum horizontal movement of 1-1/2 inch and a maximum vertical movement of 1-1/4 inch. Drawing 13-A-ZYD 405 illustrates the typical details for fire rated seismic gap seals. Alternate design solutions will be considered if accompanied by descriptive literature and detailed information to allow for review of the proposed seal design by the Contractor.

X
D.4.2.7 Moisture seals for electrical cabinets shall be as shown on the detail drawings and shall be installed at the locations shown on attachment D-1 and shall be capable of preventing water penetration into the electrical cabinets in the event of discharge of sprinkler systems.

D.4.2.8 Vertical cable tray runs shall be protected by fire break barriers capable of preventing fire propagation for a minimum of 1 hour. The barriers shall be provided at 20 foot intervals, or less as directed by the Contractor. The Subcontractor shall submit for Contractor's acceptance the proposed ANI approved cable tray fire barrier design. A fire barrier seal on a vertical cable tray run penetrating a fire rated floor, shall be acceptable as a cable tray fire barrier.

D.4.2.9 Boot seals shall be constructed of silicone impregnated glass fiber, or an accepted equal flexible material suitable for operating at temperatures of 0°F to 600°F and able to accomodate pipe movement of zero to 3 inch in any direction without loss of sealing capabilities. Dielectric gel or ceramic fiber materials shall be used in conjunction with boots as a fire barrier.

D.4.2.10 Radiation and/or fire seals shall be constructed of high-density leaded elastomer having a density of 147 to 160 lb/ft³ and shall fill the whole thickness of the penetrated fire barrier.

D.4.2.11 Annular spaces of 1/2" or less may be filled with silicone caulk to a depth required to provide 3 hour fire rating.

D.4.2.12 When required, seals shall be able to withstand the differential air or water pressure specified in the Penetration Seal Schedules.

D.5 MATERIALS

D.5.1 General

D.5.1.1 Materials are specified herein by manufacturer's name and number in order to establish standards of quality and performance. Alternate materials from other manufacturers may be substituted, with prior acceptance by the Contractor, provided the request for substitution is accompanied by technical data as may be reasonably required to allow the Contractor to verify the quality and acceptability of the proposed item.

D.5.1.2 All materials shall conform to applicable requirements of standards listed in D.2 and to physical requirement specified in D.5.2.

Location		Penetrating Member			Penetration Seal Size		Remarks
Building	Electrical Cabinet Tag Number	Quantity	Designation (Last 7 digits)	Size W D	Length	Width	
Control	E-PBA-S03	1	IAATSVD	9" 4"	11"	6"	40.00
		1	IAATRVE	9" 4"	11"	6"	40.00
		1	IAATSVF	9" 4"	11"	6"	40.00
		1	IAATRVG	9" 4"	11"	6"	40.00
		1	IAATSVH	9" 4"	11"	6"	40.00
		1	IAATRVJ	9" 4"	11"	6"	40.00
		1	IAATSVK	9" 4"	11"	6"	40.00
		1	IAATRVC	9" 4"	11"	6"	40.00
		1	IAATSVM	9" 4"	11"	6"	40.00
		1	IAATRVN	9" 4"	11"	6"	40.00
		1	IAATSVQ	9" 4"	11"	6"	40.00
		1	IAATSVR	9" 4"	11"	6"	40.00
		1	IAATSVS	9" 4"	11"	6"	40.00
		1	IAATSVT	9" 4"	11"	6"	40.00
		1	IAATRVH	9" 4"	11"	6"	40.00
		1	IAATSVV	9" 4"	11"	6"	40.00
		1	IAATRVC	9" 4"	11"	6"	40.00
		1	IAATCVF	9" 4"	11"	6"	40.00
		1	IAATDAG	12" 4"	14"	6"	51.00
	1-ZAJ-E01	1	IAATTVA	12" 6"	14"	8"	68.00
		1	IAATXVA	12" 4"	14"	6"	51.00
	E-PNA-D25	1	IAATKHK	12" 4"	14"	6"	51.00

Location		Penetrating Member			Penetration Seal Size		Remarks
Building	Electrical Cabinet Tag Number	Quantity	Designation (Last 7 digits)	Size W D	Length	Width	
Control	E-PBB-504	1	IBBTRVQ	9" 4"	11"	6"	40.00
		1	IBBTRVR	9" 4"	11"	6"	40.00
		1	IBBTSVS	9" 4"	11"	6"	40.00
		1	IBBTRVT	9" 4"	11"	6"	40.00
		1	IBBTRVU	9" 4"	11"	6"	40.00
		1	IBBTDAB	12" 4"	14"	6"	51.00
		1	IBBTCAC	12" 4"	14"	6"	51.00
		1	IBBTDAC	12" 4"	14"	6"	51.00
		1	IBBTCAD	12" 4"	14"	6"	51.00
	E-PGB-L34	1	IBBTRVG	9" 4"	11"	6"	40.00
		1	IBBTSVH	9" 4"	11"	6"	40.00
		1	IBBTRVQ	9" 4"	11"	6"	40.00
		1	IBBTSVR	9" 4"	11"	6"	40.00
		1	IBBTSVB	9" 4"	11"	6"	40.00
	E-PGB-L32	1	IBBTRVC	9" 4"	11"	6"	40.00
		1	IBBTSVD	9" 4"	11"	6"	40.00
		1	IBBTRVE	9" 4"	11"	6"	40.00
		1	IBBTSVF	9" 4"	11"	6"	40.00
		1	IBBTRVN	9" 9"	11"	6"	40.00
	E-PGB-L36	1	IBBTSVP	9" 9"	11"	6"	40.00
		1	IBBTRVQ	9" 9"	11"	6"	40.00
		1	IBBTSVR	9" 9"	11"	6"	40.00
		1	IBBTKBE	12" 4"	14"	6"	51.00
		1	IBBTTBF	12" 4"	14"	6"	51.00
		1	IBBTTBE	12" 4"	14"	6"	51.00

ELECTRICAL CABINET MOISTURE SEAL SCHEDULE

Page 3 of 10

Location		Penetrating Member				Penetration Seal Size		Remarks
Building	Electrical Cabinet Tag Number	Quantity	Designation (Last 7 digits)	Size		Length	Width	
				W	D			
Control	E-PKA-M41	1	1AATTBE	12"	4"	14"	6"	51.00
		1	1AATKBE	12"	4"	14"	6"	51.00
		1	1AATKBF	12"	4"	14"	6"	51.00
		1	1AATKBG	14"	4"	14"	6"	51.00
	E-PHB-M32	1	1BBTTCA	24"	4"	26"	6"	95.00
		1	1BBTKCA	24"	4"	26"	6"	95.00
		1	1BBTKCB	24"	4"	26"	6"	95.00
	E-PNO-D28	1	1BDTASL	12"	4"	14"	6"	51.00
	E-PKD-M44	1	1BDTSAK	12"	4"	14"	6"	51.00
		1	1BDTSAH	12"	4"	14"	6"	51.00
		1	1BDTSAJ	12"	4"	14"	6"	51.00
		1	1BDTKAA	6"	4"	8"	6"	29.00
	E-PBB-S04	1	1BBTRVB	9"	4"	11"	6"	40.00
		1	1BBTSBC	9"	4"	11"	6"	40.00
		1	1BBTRVD	9"	4"	11"	6"	40.00
		1	1BBTSVE	9"	4"	11"	6"	40.00
		1	1BBTRVF	9"	4"	11"	6"	40.00
		1	1BBTSBG	9"	4"	11"	6"	40.00
		1	1BBTRVH	9"	4"	11"	6"	40.00
		1	1BBTSVJ	9"	4"	11"	6"	40.00
		1	1BBTRVK	9"	4"	11"	6"	40.00
		1	1BBTSVL	9"	4"	11"	6"	40.00
		1	1BBTRVM	9"	4"	11"	6"	40.00
		1	1BBTSVN	9"	4"	11"	6"	40.00
		1	1BBTRVP	9"	4"	11"	6"	40.00

D-1-3

S-1-20

13-A-208

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PRICE SCHEDULE (Continued)

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	EXTENSION
F.	1 each	A-W-NRN-S02 in accordance with drawing SK-E-115	Each	\$ 174,679.00
G.	1 each	One set of accessories for electrical maintenance shop listed in 4.13.2	Each	4,425.00
2.	1 lot	13.8-kV, 1000 MVA, indoor metal-clad switchgear consisting of the following:		
A.	1 each	1-E-NAN-S01 in accordance with drawing 13-E-NAA-001 and one set of accessories listed in 4.13.2	Each	357,599.00
B.	1 each	1-E-NAN-S02 in accordance with drawing 13-E-NAA-002	Each	330,255.00
3.	1 lot	4.16-kV, 250 MVA, outdoor, walk-in type, weatherproof metal-clad switchgear consisting of the following:		
A.	1 each	A-E-NBN-S05 in accordance with drawing AO-E-NBA-001 and one set of accessories listed in 4.14.2	Each	78,241.00
B.	1 each	A-E-NBN-S06 in accordance with drawing AO-E-NBA-001	Each	69,217.00
C.	1 each	One spare set of 250 MVA switchgear accessories for electrical maintenance shop listed in 4.14.2	Each	2,135.00
4.	1 lot	4.16-kV, 350 MVA, indoor metal-clad switchgear consisting of the following:		
A.	1 each	1-E-NBN-S01 in accordance with drawing 13-E-NBA-001 and one set of accessories listed in 4.14.2	Each	203,207.00
B.	1 each	1-E-NBN-S02 in accordance with drawing 13-E-NBA-002	Each	145,935.00
5.	1 lot	4.16-kV, 250 MVA, Class IE, indoor metal-clad switchgear consisting of the following:		
A.	1 each	1-E-PEA-S03 in accordance with drawing 13-E-PEA-001 and one set of accessories listed in 4.14.2	Each	172,125.00

E SCHEDULE (Continued)

<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>UNIT PRICE</u>	<u>EXTENSION</u>
1 each	1-E-PBB-S04 in accordance with drawing 13-E-PBA-002 and one set of accessories listed in 4.14.2	Each	\$ 172,125.00
1 lot	13.8-kV, 1000 MVA, outdoor, walk-in type, weatherproof metal-clad switchgear consisting of the following:		
1 each	2-E-NAN-S05 in accordance with drawing 02-E-NAA-002	Each	115,063.00
1 each	2-E-NAN-S06 in accordance with drawing 02-E-NAA-002 and one set of accessories listed in 4.13.2	Each	146,114.00
1 each	2-E-NAN-S03 in accordance with drawing 13-E-NAA-003 and one set of accessories listed in 4.13.2	Each	107,061.00
1 each	2-E-NAN-S04 in accordance with drawing 13-E-NAA-003	Each	100,600.00
1 lot	13.8-kV, 1000 MVA, indoor metal-clad switchgear consisting of the following:		
1 each	2-E-NAN-S01 in accordance with drawing 13-E-NAA-001 and one set of accessories listed in 4.13.2	Each	332,986.00
1 each	2-E-NAN-S02 in accordance with drawing 13-E-NAA-002	Each	330,255.00
1 lot	4.16-kV, 350 MVA, indoor metal-clad switchgear consisting of the following:		
1 each	2-E-NBN-S01 in accordance with drawing 13-E-NBA-001 and one set of accessories listed in 4.14.2	Each	189,300.00
1 each	2-E-NBN-S02 in accordance with drawing 13-E-NBA-002	Each	145,935.00
1 each	One spare set of 350 MVA switchgear accessories listed in 4.14.2 for electrical maintenance shop.	Each	3,435.00



PALO VERDE NUCLEAR GENERATING STATION UNITS 1, 2 & 3

CONCRETE DRILLING REQUEST

JOB NO. 10407

PAGE OF

WPP DCI
NO 270

(THIS FORM TO BE USED ONLY WHEN DRILLING WITH EQUIPMENT CAPABLE OF CUTTING REBAR)

1. REQUEST NO. 10-765 DATE 7/3/812. INITIATING DISCIPLINE CIVIL3. INITIATING AFE Ron P. Martin EXT. 21204. DATE DRILLING REQUIRED: 7/3/81 BY BECHTEL ☐

5. LOCATION (BLDG., ELEV., DISTANCE FROM COLUMN LINES (ETC.))

UNIT #1 MSSS BASEMENT (ELEV. 90'-6")6. REFERENCE DWGS., FCR, NCR: 13-2-203-705 13-2-203-706

7. DESCRIPTION (SIZE, DEPTH, AND QUANTITY OF HOLES)

1/2" EXPLORATORY HOLES TO FIND - conduitsEMBEDDED IN 100 SLAB WITHIN 6" TIMETHROUGH CONCRETE WPA8. INTER-DISCIPLINE REVIEW OF PROPOSED HOLES FOR
CONFLICT WITH EMBEDDED ITEMS

CIVIL BY/DATE	ELECT. BY/DATE	PIPING BY/DATE	OTHER BY/DATE	SURVEY BY/DATE
<u>RP</u> <u>2/29/80</u>	<u>WPA</u> <u>6/2/81</u>	<u>N/A</u> <u>EG</u> <u>6/30/81</u>	<u>N/A</u> <u>RP</u> <u>6/29/81</u>	<u>N/A</u> <u>RP</u> <u>6/29/81</u>

(NOT REQUIRED FOR HOLES 5" & LESS IN DEPTH)

NOTE: PRIOR TO APPROVAL OF REQUEST
THE HOLE MUST BE LAID OUT ON THE
CONCRETE MEMBER AND AN OUTLINE
OF THE ATTACHMENT MUST BE SHOWN

9. LOCATION TOLERANCES FOR DRILLING:

within marked envelope on ceiling of
MSSS basement (ELEV. 90'-6")N/A REBAR IS TO BE CUT10. REMARKS: There are three conduits; Bottom
section of conduit gives approx 11" clearance
to concrete soffit.N/A REBAR IS TO BE CUT

CHECK APPROPRIATE RESPONSE

11. ARE PROPOSED HOLES LOCATED IN A
RESTRICTED ZONE?YES ☐ NO ☒12. HAS ENGINEERING APPROVAL BEEN
OBTAINED TO CUT REBAR?YES ☐ NO ☒

LIST FCR'S

N/A13. RESPONSIBLE CODE
NAME R. P. Martin EXT. 228614. DRILLING COMPLETION DATE: 7/29/81



PALO VERDE NUCLEAR GENERATING STATION UNITS 1, 2 & 3
CONCRETE DRILLING REQUEST
JOB NO. 10407

PAGE OF
WPP/OCF
NO 270

REV. 0

(THIS FORM TO BE USED ONLY WHEN DRILLING WITH EQUIPMENT CAPABLE OF CUTTING REBAR)

1. REQUEST NO. 10-174 DATE 7/30/81 9. LOCATION TOLERANCES FOR DRILLING:
±6" more entire pattern
±2" more bolt hole off pattern

2. INITIATING DISCIPLINE CIVIL

3. INITIATING AFE RP Martin (RP) EXT. 2609
BY DECHTEL ☐
BY SUB. CONTR. ☒

4. DATE DRILLING REQUIRED: 7/31/81

5. LOCATION: (BLDG., ELEV., DISTANCE FROM COLUMN LINES (ETC.))
UNIT #1, MESS, EL 96'-6", 89' E 1/2 CONT, 2'-8" & 8'-6" N E MESS

6. REFERENCE DWGS., FCR, NCR: 13-C-265-706 R2
13-C-265-705 R11

10. REMARKS: 4 buried 4" conduits in slab
running North/South approx 11" from
bottom of slab - Do Not Cut GROUND

7. DESCRIPTION (SIZE, DEPTH, AND QUANTITY OF HOLES):
8 holes - 1 3/4" φ, 33" Deep (Oral splicing)

8. INTER-DISCIPLINE REVIEW OF PROPOSED HOLES FOR
CONFLICT WITH EMBEDDED ITEMS

CIVIL BY/DATE	ELECT. BY/DATE	PIPING BY/DATE	OTHER BY/DATE	SURVEY BY/DATE
(RP) 7/24/81	RP 7/2/81	N/A E/S 7/27/81	N/A (RP) 7/24/81	7/27/81 LSC.

(NOT REQUIRED FOR HOLES 5" & LESS IN DEPTH)

NOTE: PRIOR TO APPROVAL OF REQUEST
THE HOLE MUST BE LAID OUT ON THE
CONCRETE MEMBER AND AN OUTLINE
OF THE ATTACHMENT MUST BE SHOWN.

CHECK APPROPRIATE RESPONSE:

11. ARE PROPOSED HOLES LOCATED IN A
RESTRICTED ZONE? YES ☐ NO ☒


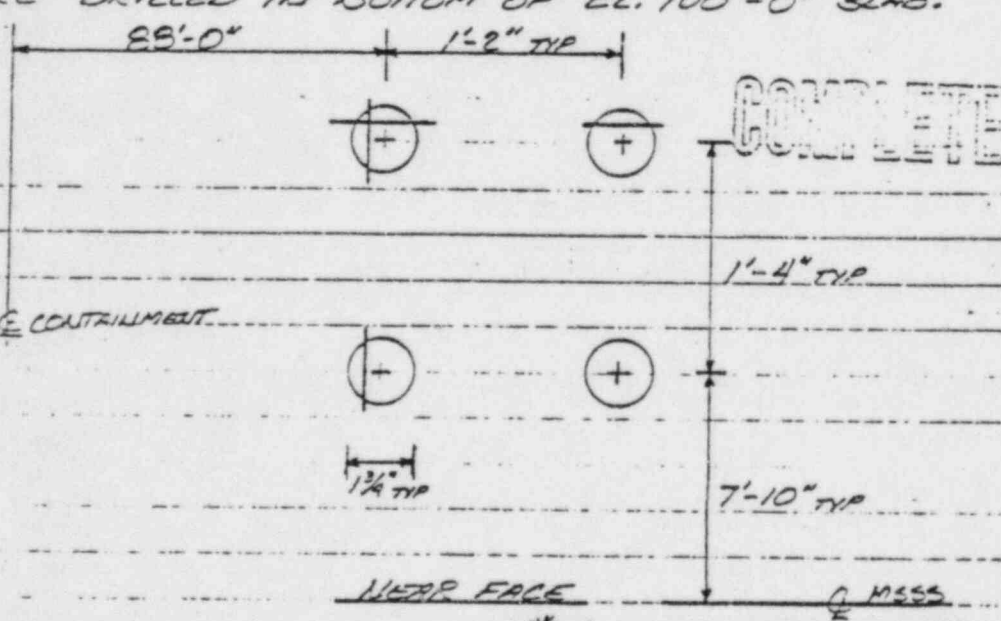
12. HAS ENGINEERING APPROVAL BEEN
OBTAINED TO CUT REBAR? YES ☒ NO ☐

LIST FCR'S 26,774-C

13. RESPONSIBLE SODPFE
NAME: Paul B. B... EX: 2286

14. DRILLING COMPLETION DATE: 8/5/81

MOC 170998

PALO VERDE NUCLEAR GENERATING STATION		1. PAGE <u>1</u> OF <u>1</u>	2. NO. <u>26.774-C</u>	13A. DCN NO. <u>N/A</u>
 FIELD CHANGE REQUEST JOB NO. 10407		QUALITY CLASS <u>Q</u>	3. MO DAY YR DATE <u>10/13/81</u>	13B. SCN NO. <u>N/A</u>
4. REF DWG OR SPEC <u>13-C-ZCS-706</u>		REV <u>2</u>	5. TITLE <u>MISS B.D.G., PLAN @ EL. 96'-6"</u>	
6. DESIGN ORIGIN: <input checked="" type="checkbox"/> ENGINEERING <input type="checkbox"/> SUPPLIER (IDENTIFY BY NAME)		7. <input checked="" type="checkbox"/> UNIT 1 <input type="checkbox"/> UNIT 2 <input type="checkbox"/> UNIT 3 <input type="checkbox"/> COMMON		
8. EXISTING CONDITION <u>"AS BUILT INFORMATION, REINFORCING BARS CUT BY FIELD."</u>				
9. CHANGE REQUEST/SKETCH <u>"AS BUILT INFORMATION. REINFORCING BARS CUT BY FIELD IN ACCORDANCE WITH SPEC 13-CM-378. HOLES ARE DRILLED IN BOTTOM OF EL. 100'-0" SLAB."</u>  <p>RECEIVED OCT 28 1981 CONSTRUCTION EVNGS</p> <p>* ALL BARS CUT ARE #11. LOOKING @ BOTTOM OF EL. 100'-0" SLAB</p>				
10. REVIEWED BY: <u>Sand Butler</u> DISCIPLINE FIELD ENGINEER DATE <u>10-14-81</u>		11. PREPARED BY: <u>B. Paul Beck</u> 11. APPROVAL OF FIELD DISPOSITION: <u>[Signature]</u> PROJECT FIELD ENGINEER DATE <u>10/14/81</u>		
13. BECHTEL ENGINEERING <input checked="" type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED <u>[Signature]</u> GROUP SUPERVISOR DATE <u>10/23/81</u>		NUCLEAR GROUP SUPERVISOR (IF REQUIRED): <u>N/A</u> DATE		
<u>[Signature]</u> PROJECT ENGINEER DATE <u>10/26/81</u>		PGAE (10-LISTED P&I AND SINGLE LINE DWGS) (QUALITY CLASS Q AND R SPECS) <u>N/A</u> DATE		
REMARKS				
DISTRIBUTION: ORIGINAL - PRINT COORDINATOR; COPIES TO - CLIENT, SURVEY, DISCIPLINE, AND RESIDENT ENGINEER				
ADDITIONAL DISTRIBUTION: <input type="checkbox"/> PROJECT PROCUREMENT MANAGER <input type="checkbox"/> COST TREND ENGINEER				

13-C-ZCS-706

STATUS: HT CK D12

VENDOR: 11P0

E-24

PALO VERDE NUCLEAR GENERATING STATION

NONCONFORMANCE REPORT

NO EC-1361

PAGE 1 OF 1

1. UNIT <u>1</u>	2. MO DAY YR <u>9</u> <u>4</u> <u>81</u>	3. DRAWING/PART NO. <u>13-E-ZCC-045</u>	4. ITEM DESCRIPTION <u>CONDUIT 1 E-Z-C-E ARK1A</u>	5. ITEM LOCATION <u>100' SLAB 100' EL.</u> <u>MAIN STAIR BLOB. NORTH CELL</u>
6. Q CLASS <u>R</u>	7. STARTUP SYSTEM NO. <u>YB</u>	8. SERIAL NO. <u>N/A</u>	9. CONTRACTOR/SUPPLIER <u>Bechtel</u>	10. P.O. OR SPEC NO. <u>N/A</u>
11. ASME AUTHORIZED INSPECTION REQ'D. <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		12. DESCRIPTION LIST IN ORDER: NO. PCS., DWG./SPEC REQMT., PRESENT CONDITION		
13. REPORTED BY: <u>Richard Shaver</u>		14. ASSUMED CAUSE OF DISCREPANCY <u>CONSTRUCTION ERROR</u>		
15. INSPECTION/VALIDATION/REVIEW DATE <u>9/1/81</u>		16. FIELD ENGR DECISION <u>Repair</u>		
17. FIELD RECOMMENDED DISPOSITION <input checked="" type="checkbox"/> FIELD RECOMMENDED <input type="checkbox"/> ENGINEER DISPOSITION REQ'D		18. DISPOSITION CONCURRENCE <u>mt</u>		
19. ACCEPTANCE OF REWORK/REPAIR <u>QC ENGR J. E. Shaver</u>		19. DISPOSITION CONCURRENCE <u>mt</u>		
20. AUTHORITY <u>QC ENGR J. E. Shaver</u>		20. AUTHORITY <u>QC ENGR J. E. Shaver</u>		
21. DATE <u>9/1/81</u>		21. DATE <u>9/1/81</u>		
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100. SIGNATURE <u>J. E. Shaver</u>		100. SIGNATURE <u>J. E. Shaver</u>		

DAILY REPORT

BECHTEL Power Corporation

S/C NUMBER 10407-FSC-99

PAGE 1 OF 2

REPORT NO. 000205

JOB NAME Palo Verde Nuclear Generating Station

SHIFT Day DATE 7/30/81

SUBCONTRACTOR Concrete Coring Company

WEATHER Clear

S/C REPRESENTATIVE Larry Murray

CATEGORY Core drilling

SUBCONTRACT FORCES	NON-MAN.		MANUAL		LIST OF MAJOR EQUIPMENT	HRS
	NO	MH	NO	MH		
1. CRIP			10-00	4	1. CRIP	8
2. FILTER			10-05	12	2. FILTER	12
3. ...			10-01	1	3. ...	1

DESCRIPTION OF WORK PERFORMED TODAY:

[illegible]

Comments

WORK PERFORMED TODAY ON: (EWO, AMENDMENT, ETC.)

[illegible]

REVIEWED BY: T. H. Roseth 8-5-81

REPORTED BY: M. Paul L. L.

CONCRETE CORING COMPANY

JOB TICKET
NUMBER

PH325782

CUSTOMER DELIVERY COPY

BILL TO

JOB ADDRESS

MAP PG. NO.

WORK TO BE DONE

SALESMAN

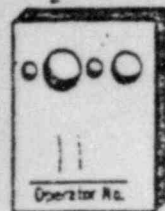
NEAREST CROSS STREET

OTHER MEN ON JOB SAME DAY

DATE

7/22/01

THANK
YOU



QUANTITY	DESCRIPTION	PRICE	AMOUNT
1	2 174' X 22' Deep in Concrete Wall		
2	174' X 22' (10' X 22' Bored)		
3	174' X 22' (10' X 22' Bored)		
4	174' X 22' (10' X 22' Bored)		
5			
6			
7			
8	100' HARDER		
9			
10			
11			
12			
13			
14			

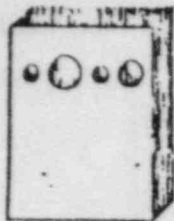
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28

X H. Paul
ACKNOWLEDGED

COMPANY

- ☐ TRUCK POWER USED FOR OUR CONVENIENCE
- ☐ TRUCK WATER USED FOR OUR CONVENIENCE
- ☐ OVERTIME WORKED FOR OUR CONVENIENCE

P.O. NO. _____
JOB NO. _____
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CONCRETE CORING COMPANY

PHOENIX

3831 E. ILLINI STREET, PHOENIX, ARIZONA 85040 - (602) 268-1439

Offices in: Los Angeles Orange County Phoenix Miami
Dallas Denver Houston Honolulu Seattle San Diego

INVOICE NO.
PH123042

B
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BECHTEL POWER CORPORATION
P.O. Box 49
Palo Verde, Arizona 85343
ATTN: Accounts Payable

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PVNGS
Palo Verde, Arizona

Customer Purchase Order Number			Customer Job Number	Billing Date	Salesman
10407-FSC-99				7-31-81	Murray
4	PH325702	7-29-81	CORE DRILLING		432.00
11	PH325781	7-29-81	CORE DRILLING		432.00
32	PH320840	7-29-81	CORE DRILLING		432.00
11	PH325782	7-30-81	CORE DRILLING		432.00
32	PH320841	7-30-81	CORE DRILLING		516.00 480.00
11	PH325783	7-31-81	CORE DRILLING		564.00 504.00
32	PH320842	7-31-81	CORE DRILLING		432.00
TOTAL					3240.00 3,144.00
					2160.00

NET 30 DAYS Payment is due upon presentation of invoice. If any invoice is not paid in full
10 days after its billing date, the Customer hereby agrees to pay interest at the rate of 10% per annum upon
the unpaid balance of the invoice, if at all, as soon as it is received by the Company.

WET Concrete Cutting Industries, Inc.

ORIGINAL INVOICE

PLEASE PAY

DAILY REPORT

BECHTEL Power Corporation

S/C NUMBER 10407-FSC-99

PAGE 1 OF 3

REPORT NO. 000206

JOB NAME Palo Verde Nuclear Generating Station

SHIFT Day DATE 7/9/81

SUBCONTRACTOR Concrete Coring Company

WEATHER Clear

S/C REPRESENTATIVE Larry Murray

CATEGORY Core drilling

SUBCONTRACT FORCES	NON-MAN.		MANUAL		LIST OF MAJOR EQUIPMENT	HRS
	NO	MH	NO	MH		
1430P			1000	014	CATERPILLAR	014
1430P			1005	0		0
1430P			1005	0		0

DESCRIPTION OF WORK PERFORMED TODAY:

[illegible]

Comments

WORK PERFORMED TODAY ON: (EWO, AMENDMENT, ETC.)

[illegible]

REVIEWED BY:

REPORTED BY

CONCRETE CORING COMPANY

JOB TICKET
NUMBER

PH 325783

CUSTOMER DELIVERY COPY

Revised
BILL TO
JOB ADDRESS
CITY
DALLAS
MAP PG. NO.
C/O
WORK TO BE DONE

DATE 7/1/71
SALESMAN
NEAREST CROSS STREET
OTHER MEN ON JOB SAME DAY

THANK
YOU

	DESCRIPTION	PRICE	AMOUNT
5	1 1/2" X 22" Deep IN CONCRETE - WALL		
	1" Line 424 - 1/2" DIA - 1/2" DIA - 1/2" DIA		1/32
	1/2" DIA 1/2" DIA		
	Request # R-174		
	1/2" DIA 1/2" DIA		
4X	3 X 8" Deep IN BLOCK WALL		
	Chem. TREAT BLDG. 1/2" DIA		
	Request # R-167	81 5/8	39 1/2
12	1" X 8" Deep IN CONCRETE - WALL		
	SULFURIC ACID TANK U-I	66 1/4	
	Request 1P-170		
	1" HP DIA - 1/2" DIA		

O. NO.

B. NO.

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☐ TRUCK WATER USED FOR OUR CONVENIENCE
☐ OVERTIME WORKED FOR OUR CONVENIENCE

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INVOICE NO
PH12315

PH12315
3801 E. ILLINOIS STREET, PHOENIX, ARIZONA 85040 - (602) 268-1439
Branches: Los Angeles Orange County Dallas Miami
Dallas Denver Houston Kansas City San Diego

BECHTEL POWER CORPORATION
P.O. Box 49
Palo Verde, Arizona 85343
ATTN: Accounts Payable

ADDRESS

PVNGS
Palo Verde, Arizona

Invoice Order Number		Customer Job Number	Billing Date	Salesman
10407-FSC-99			8-13-81	Murray
PH325702	7-29-81	CORE DRILLING		432.00 ✓
PH325781	7-29-81	CORE DRILLING		432.00 ✓
PH320840	7-29-81	CORE DRILLING		432.00 ✓
PH325782	7-30-81	CORE DRILLING		432.00 ✓
PH320841	7-30-81	CORE DRILLING		696.00 ✓
PH325783	7-31-81	CORE DRILLING		828.00 ✓
PH320842	7-31-81	CORE DRILLING		432.00 ✓
			TOTAL	3684.00 ✓
				1524

NET 30 DAYS Payment is due upon presentation of invoice. If any invoice is not paid in full 30 days after its billing date, the Customer hereby agrees to pay interest at the rate of 10% per annum upon said portion of the invoice. If action or suit is brought by Concrete Coring Company to collect any amount owing under this bill, Customer agrees to pay all costs of collection including reasonable attorney's fees.

1971 Concrete Coring Industries, Inc.
ORIGINAL INVOICE

PLEASE PAY
LAST AMOUNT IN
THIS COLUMN

DAILY REPORT

BECHTEL Power Corporation

S/C NUMBER 10407-FSC-99

PAGE 1 OF 2

REPORT NO. 000207

JOB NAME Palo Verde Nuclear Generating Station

SHIFT DAY DATE 8/9/81

SUBCONTRACTOR Concrete Coring Company

WEATHER Clear

S/C REPRESENTATIVE Larry Murray

CATEGORY Core drilling

SUBCONTRACT FORCES	NON-MAN.		MANUAL		LIST OF MAJOR EQUIPMENT	HRS
	NO	MH	NO	MH		
LFBR			CO-06	8	CARDILL	8
"			PP33	8	"	8

DESCRIPTION OF WORK PERFORMED TODAY:

[illegible]

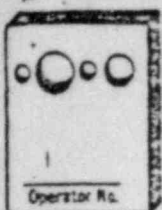
Comments

WORK PERFORMED TODAY ON: (EWO, AMENDMENT, ETC.)

[illegible]

REVIEWED BY: T. H. Roscoe 8-5-81

REPORTED BY: W. F. [Signature]



CONCRETE CORING COMPANY

JOB TICKET
NUMBER

PH325784

CUSTOMER DELIVERY COPY

BILL TO

JOB ADDRESS

MAP PG. NO.

WORK TO BE DONE

CITY

MAN TO CONTACT

SALESMAN

NEAREST CROSS STREET

OTHER MEN ON JOB SAME DAY

DATE

THANK
YOU

QUANTITY	DESCRIPTION	PRICE	AMOUNT
1	2	1 1/4" X 22' DEEP IN CONCRETE CEILING	
2		WALL PUNCH 11" DIAMETER	
3		REINFORCEMENT - T	
4		REINFORCEMENT - 1/2" X 12'	
5			
6	2	1" X 5' DEEP IN CONCRETE WALL	
7		SPRAY FOAM U-I	
8		REINFORCEMENT - 1/2" X 17'	
9			
10			
11			
12			
13			
14			

015/81
12/12
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P.O. NO. _____

JOB NO. _____

X

ACKNOWLEDGED

COMPANY

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☐ TRUCK WATER USED FOR OUR CONVENIENCE
☐ OVERTIME WORKED FOR OUR CONVENIENCE

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CONCRETE CORING COMPANY

PHOENIX

3831 E. ILLINI STREET, PHOENIX, ARIZONA 85040 - (602) 268-1439

Offices in: Los Angeles Orange County Phoenix Miami
Dallas Denver Houston Honolulu Seattle San Diego

INVOICE NO.
PH123093

B
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BECHTEL POWER CORPORATION
P.O. Box 49
Palo Verde, Arizona 85343
ATTN: Accounts Payable

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PVNGS
Palo Verde, Arizona

Customer Purchase Order Number			Customer Job Number	Billing Date	Salesman
10407 FSC-99				8-5-81	Murray
11	PH325784	8-3-81	CORE DRILLING		432.00 /
30	PH325663	8-3-81	STAND-BY		131.00 /
11	PH325785	8-4-81	CORE DRILLING		432.00 /
30	PH325664	8-4-81	CORE DRILLING		432.00 /
TOTAL					1427.00 /

TERMS NET 30 DAYS Payment is due upon presentation of invoice. If any invoice is not paid in full within 30 days after its billing date, the Customer hereby agrees to pay interest at the rate of 10% per annum upon

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PLEASE PAY

INTERVIEW OF PHILIP A. AGUAYO

323
JUN 17 1982

Case No.: 5-82-009

Transcript of tape
recorded interview of: Philip A. AGUAYO

Date of Interview: June 17, 1982

Interviewers: Eugene J. POWER and Owen C. SHACKLETON Jr.,
Investigators assigned to Region V, U.S.
Nuclear Regulatory Commission

Purpose of Interview: To obtain AGUAYO's responses to allegations
made by Robert D. GUNDERSON Jr., electrician,
who formerly worked on Unit-1, PVNGS, in one
of the electrical termination crews with
AGUAYO

Location of Interview: Bechtel Management trailer at Unit-1, PVNGS

Conditions of Interview: Interview was conducted with AGUAYO
under oath

Dupe 8505240073

S-55

INTERVIEW WITH AGUAYO

SHACKLETON: This is an interview of Mr. Philip A. AGUAYO. Mr. AGUAYO is an electrician working for the Bechtel Power Corporation at Unit #1 at Palo Verde Nuclear Generating Station. Present to conduct this interview from the Nuclear Regulatory Commission is E. J. POWER and O. C. SHACKLETON, investigators from Region V. Mr. AGUAYO, do we have your permission to log this interview on tape?

AGUAYO: Yes, sir.

SHACKLETON: And, as I understand it Phil, you would like to have a copy of the, uh, transcript from this tape, is that correct?

AGUAYO: Yes, sir.

SHACKLETON: O.K. The Commission will furnish it to you and I'll mail it to your home and be patient with us in time; it will be a few weeks.

AGUAYO: O.K.

SHACKLETON: O.K. Phil, what I want to do is go through this list of allegations and find out whether or not you had any similar experience or know anything about them or can enlighten us in any way.

POWER: Yeah ... before you get started ... how long have you been on high-voltage termination?

AGUAYO: Oh, since September. When I turned out of the apprenticeship, they asked me if I wanted ...

POWER: ... wanted to go ...

AGUAYO: Yeah.

POWER: O.K. So, September '81 to date?

AGUAYO: Yeah. First of September of some time ...

SHACKLETON: High-voltage since September 1981.

AGUAYO: O.K.

7(A)

SHACKLETON: O.K. Now, see you've been here since, uh, only 1-1/2 years, uh, you'll cover a period of time ... the next issue is on improper installation of high voltage termination and what I'm talking about here is the use of some of these materials you guys use to make the terminations like Scotchfill, and I understand that approximately a year ago, two years ago, they were using this material on some of the terminations and found that it bled because of the intense desert heat out here, and so they've used another material. They use 130-C. It's a wrap. Is that what you're using now?

AGUAYO: Oh, I don't ... I really don't ... see, we have all these little specs on different motors and different areas, and when they give you a card like on the motor over here, you check out your specs, you know, 'cause you, you use different things and sometimes, you know, like a year ago or something and you'd be using such and such and if they'd say no, no we're not using that no more, we're using this, so uh ...

POWER: So, whatever the current specs are, yeah.

AGUAYO: ... and then we're updating them so that is, that isn't good enough, we're gonna use this now. - -

POWER: Yeah. O.K.

SHACKLETON: Phil, the next issue is concerned by some people where you do terminations like onto an electrical motor, have you done any of those?

AGUAYO: Right.

SHACKLETON: And I'm talking primarily about safety class motor, not, uh, smaller ones but the larger motors that are involved in Class Q systems where you may have on the peckerhead a one-lug bolt connection off the motor and on your field cable you've got a two-bolt lug. Do you follow me allright?

AGUAYO: Yeah.

SHACKLETON: When you ...

AGUAYO: Two-bolt.

SHACKLETON: ... when you go to connect them, have you done any of those?

AGUAYO: Uh, if I remember correctly, everything I've done they match right up.

SHACKLETON: So you've never had a two to a one?

AGUAYO: No, I don't think you can do that.

SHACKLETON: O.K.

AGUAYO: I'm pretty sure they came out and said we couldn't use that.

SHACKLETON: The next issue is getting your opinion and observations on your QC inspectors that work with you people to inspect your work. From your observations, do ... are ... do they do an adequate job?

AGUAYO: More than adequate. See, if you make a mistake, they're going to find out about it.

SHACKLETON: Do you feel that they, they are well enough trained that they know what they're doing? Do you feel satisfied?

AGUAYO: Right. They do a real good job.

SHACKLETON: Good. Now the other part of that is that we've had an allegation that some of these people are intimidated by foremen and superintendents in construction to where they're, they're afraid to enforce what they think they should do, like hang a red tag and then have a foreman come along and tell them to take the damn thing off and

the guy does it because he's intimidated by it. Have you ever observed or know of that to take place?

AGUAYO: Never. They're king pin out here, you know, they're (unintelligible) main man.

SHACKLETON: Do you feel then, that QC operates freely as quality control without being subject to construction?

AGUAYO: Right. Yes, I do.

SHACKLETON: Have you done any high pot testing?

AGUAYO: I actually have, I've been foreman on it, but as far as hooking up all the things, I haven't.

SHACKLETON: Have you ever heard or observed excessive high potting on the cable? We understand, again as I explain to you, Gene and I are not electricians or electrical engineers, but we understand from the alleg ... from the allegor that Anaconda, in their specs for their cable, states they can only high pot test it once. If you do it over once that ...

(end of tape)

SHACKLETON: Phil, have you ever worked on, uh, the installation where you, you have conduit that comes down to a metal cabinet where you terminate maybe some kind of a control cabinet, when you're using conduit and you have O-rings where you got a fitting that, that has threads and it tightens down so that you have water-tight integrity?

AGUAYO: Uh, I'd imagine so, 'cause they're all over out there.

SHACKLETON: Yeah. Have you ever worked on them yourself?

AGUAYO: I would say yes, I mean, I don't know ...

SHACKLETON: Have you always, can you recall, have you always had O-rings available when you needed them?

AGUAYO: Well, we don't install them, but the guys that run the pipe do.

SHACKLETON: Yeah, O.K. So you've never done it yourself.

AGUAYO: Well, I, I've ran pipe out here before ...

SHACKLETON: Yeah.

AGUAYO: ... and I have intalled them.

SHACKLETON: Well, the allegation was that there was a period of time here for about six months in which Bechtel didn't have O-rings available and the men were told to go ahead and do the piping without them, which they did.

AGUAYO: Every time I was on piping we always had them available.

SHACKLETON: The last area, Phil, I want to talk to you about has nothing to do with electrical, but it's a problem that we face in the country today and in many walks of life and many places and that's the use of controlled drugs on the site and we've been given information relating to the use of and sale on this site of marijuana, hashish, amphetamines, uh, cocaine. Have you observed or know of this type of traffic on the site?

AGUAYO: I've heard of it, you know, but uh ...

SHACKLETON: Is there any particular areas in the plant where a lot of pot has been smoked?

AGUAYO: The only place I would say about that would be out in the parking lot. You know, like prior about three years ago, you know, when the thing was going big you had a lot of people out there smoking pot. You could smell it, you know.

SHACKLETON: Uh-huh.

AGUAYO: ... that's one thing ... I've never been around anybody that's done that 'cause I wouldn't even work with somebody like that, you know, it can endanger you and endanger somebody else.

SHACKLETON: Well, that's a real concern that we have, for the ... everybody, the public in particularly. All they have to know is that we've got a drug problem out here in addition to all the other allegations and we're interested in, in curtailing it, getting it out of here because not only drugs, but alcohol. If a guy is inebriated, uh, he could hurt somebody, hurt himself and he isn't going to do his work very well. And if he's working on safety-related work, uh, no one wants that, no one would want a surgeon or a dentist to be crooked when they're at work now.

AGUAYO: That's true.

SHACKLETON: O.K. I ... the only other question I have, Phil. Is there anything that you've observed here at the plant that

you feel that the Nuclear Regulatory Commission should give it some special attention?

AGUAYO: The only thing I'd like to see, like when they get Unit 1 going, some monitors out there. You know, I don't know how they're going to do it once they get Unit 1 on the line, but ...

SHACKLETON: They put monitors all over the countryside.

AGUAYO: ... for my own safety, you know, I'd like to have a monitor available whenever I wanted to walk around here.

SHACKLETON: They have, they have monitors all around for miles ...

AGUAYO: But let me ...

SHACKLETON: ... and, and on zones, it's all zoned off. And they have, they have monitors on all the, uh ...

POWER: As far out as ten miles from the site.

SHACKLETON: Yeah.

POWER: ... they go out quite a distance ... I bet ... we've got different people in our region (unintelligible).

SHACKLETON: We're not health physicists ... they're health physicists ...

POWER: Yes, I'm not a health physicist, I'm a physical security investigator type, and we've got engineers, nuclear engineers, mechanical and all that, whatever ... anyway,

the health physics side of the house does do that, uh, start-up takes a long time, uh, they really couldn't have a problem, they could have, I, I'm not trying to belittle the situation. It could be serious, but because of the tests that they go through, they have a gradual, what is called a power ascension. They're ... it's like turning on a water faucet, you turn it on a little bit and there's going to be a little drip. Well, if you were working in the area and it's a little drip you can't get wet, O.K. and then they start turning it on a little more, they go 10%, 20%, 50%, and then they are allowed to go up accordingly so far. Now this goes over a period of at least a minimum of probably six months to a year before they ever reach a point where they start producing power to sell and during this period of time they have to meet certain criteria, in all the testing so it is a controlled situation, it is well tested. But when you have a question, yeah, make sure you ask anytime and don't forget they're ... there's three NRC onsite all the time, right now. They're three engineers. Two of which are start-up engineers, that's where their deal is and they might, if you've got a question or concern, you know, please ask them ...

AGUAYO: I would like to know before they start Unit 1 or anything ...

SHACKLETON: They have ... they're required to ...

AGUAYO: I would like to be informed about what they are going to be having out here.

POWER: Yeah.

AGUAYO: Cause, you know, I, you know, you're supposed to work safely, you know, I'm kinda ...

SHACKLETON: Uh, most everybody is. That's why we're here.

POWER: Maybe somebody else will say ... Well, maybe they, well, they believe an electrical installation is improper and if somebody has a question and they get to the NRC, I guarantee you somebody is going to come and look at it and make that determination. Now whether or not you believe the NRC that's another problem, but I guarantee you we will get the best that we have available that we can get to go to the 9th degree to determine whether or not it's a valid concern, you know, the allegation is true, if correctable, change or correct it or we'll, um, shut it down, it's that simple ...

SHACKLETON: Not only that, we have a very expensive mobile laboratory and they have come here periodically and run tests on, on the systems in the plant and make sure that ...

POWER: ... see if they relate to ...

SHACKLETON: ... that that they're at proper levels and so on. There's a lot of checks and it's all available to the public to, to know about.

AGUAYO: Yeah.

SHACKLETON: Is there any thing further you ...

POWER: Yeah, I got one before you get going.

AGUAYO: No, that's about ...

POWER: ... Uh, are you aware of or have knowledge of any situation where, in drilling cores, they have damaged conduit in concrete walls? Have you ever heard anything of this nature?

AGUAYO: Damaged your concrete?

POWER: Yeah. While they're drilling core samples, you know, they get conduit in the process and damage it.

AGUAYO: Oh. No, I never heard of anything like that.

SHACKLETON: O.K. We'll terminate, uh, this interview at this time and it's approximately ten minutes after three.

(end of tape)