

FOLEY

ELECTRICAL CONTRACTORS

QCP-9
REV. 6
DATE: 11-7-83

DIABLO CANYON
NUCLEAR POWER PLANT
QUALITY CONTROL PROCEDURE
FOR
INSTALLATION AND INSPECTION
OF
STUD AND SHELL CONCRETE EXPANSION ANCHORS

APPROVED FOR CONSTRUCTION

THE
HOWARD P. FOLEY
COMPANY

P. O. BOX 327,
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Canadian Subsidiary:

EDMONTON, ALBERTA

ENGINEERING MANAGER

APPROVED CW. Needham DATE 10-28-83

QUALITY DIRECTOR

APPROVED 2 R. White DATE 10/28/83

PROJECT MANAGER

APPROVED [Signature] DATE 10-28-83

THE HOWARD P. FOLEY COMPANY

PG&E G.C.
QUALITY CONTROL

REVIEWED

WK Glenn

DATE 10-29-83

APPROVAL (AS NOTED)

- ☐ Approved as to Substance
- ☐ Subject to Notations Shown
- ☐ Not Approved
- ☐ Revised Drawings Required
- ☐ Furnish Reproducibles
- ☒ Approved for Constr.

Resident Engineer [Signature]

By [Signature] Date 10-28-83

PACIFIC GAS & ELECTRIC CO.
Diablo Canyon

CHANGES MADE TO QCP-9
INSTALLATION AND INSPECTION
OF
STUD AND SHELL CONCRETE EXPANSION ANCHORS

Revision 6

This procedure has been revised:

- 1) Added anchor bolt criteria from QCPE-9
- 2) Revised Form HPF/ABIR
- 3) Expanded Table 5
- 4) Deleted Form C-51
- 5) Incorporated prior PCN



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1. SCOPE

This procedure establishes the requirements, responsibilities, and method for the installation and documentation of stud, wedge, and shell-type concrete expansion anchors.

2. REFERENCES

Pacific Gas and Electric Company Specifications as assigned to The Howard P. Foley Company.

Pacific Gas and Electric Company Drawing 054162

The Howard P. Foley Company Quality Assurance Manual

The Howard P. Foley Company Quality Control Procedures and other Quality Instructions as applicable.

3. RESPONSIBILITIES

3.1 The Project Manager shall be responsible for employing all measures necessary to accomplish the work in accordance with the requirements of the contract documents and this procedure.

3.2 The Engineering Manager is responsible for the development of this procedure to ensure that the appropriate measures are established to comply with the contract specifications and drawing requirements.

3.3 The Production Superintendent shall be responsible for accomplishing all installations as required by the design documents and this procedure.

3.3.1 It shall be the responsibility of the Production Superintendent to ensure Production forces under his supervision are kept informed of and are working to the latest requirements specified in the Quality Procedure.

3.4 The Quality Director shall be responsible for inspection and documentation in accordance with Quality procedures, guidelines, and methods as approved by Pacific Gas and Electric Company.



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4. METHOD

4.1 General

4.1.1 Anchors shall be installed in accordance with applicable PG&E approved drawings as to size, location, and spacing. Tools and tightening procedures for installation of anchors shall be according to manufacturer's instructions. The following concrete expansion anchors are authorized for work:

SHELL ANCHORS: PHILLIPS SELF-DRILLING, PHILLIPS NON-DRILLING, DIAMOND, HILTI HDI, RAWL SABER-TOOTH.

STUD ANCHORS: PHILLIPS WEDGE, PHILLIPS SLEEVE, HILTI KWIK-BOLT, PARABOLT, WEJ-IT ANKR-TITE, PHILLIPS STUD.

4.1.1.1 Phillips stud-type anchors larger than 3/4 inch diameter shall not be used.

4.1.1.2 WEJ-IT (original style, with spade-shape wedges) may be used with written direction from PG&E.

4.1.1.3 Phillips drop-in anchors (MS and RM-series) may only be used on hollow metal door installations, instrumentation devices, and tubing supports.

4.1.1.3.1 Phillips drop-in MS-34 shall not be used (ref. NCR 8802-647).

4.1.1.4 Anchors shall not be used in concrete block walls without specific instructions from PG&E.

4.1.2 Stud-type anchors shall be permanently marked on the head with a letter or number (identifying their overall length) for traceability of embedment after installation (ref. Table 1 or 2).

4.1.2.1 Proper tools, methods, and care shall be used in setting bolts to avoid disfiguring the bolt identification marking.



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4.1.3 Prior to drilling anchor-bolt holes that have a depth greater than six inches, an approval to drill shall be obtained from PG&E on a C-51 form.

4.1.4 On all steel anchors used outdoors, apply no-oxide or silicone grease to the stud-bolt threads and to the nut after installation.

4.2 Installation

4.2.1 If a hole cannot be drilled to the correct depth (i.e., if reinforcing steel is encountered while drilling) a new hole shall be drilled. Reinforcing steel shall not be cut without specific written authorization from PG&E.

4.2.1.1 Each hole drilled for a concrete anchor shall have a minimum of 1/2 inch solid concrete between its edge and the nearest unused hole, anchor, embedded structural member, embedded weld plate or embedded unistrut. If an unused hole is within 4.5 nominal diameters of an expanded anchor (center-to-center) the unused hole shall be filled with grout or an expanded anchor.

4.2.1.2 If embedded unistrut is loaded, a 12-diameter spacing shall be maintained. If this spacing can not be maintained, the responsible PG&E Engineer shall be notified.

4.2.2 Edge of anchor to edge of concrete shall not be less than 6 anchor diameters, but in no case less than 3 inches.

4.2.2.1 An edge is where the concrete changes planes, such as a chamfered edge, corner or where the concrete meets an embedded item other than structural members or weld plates.

4.2.2.2 If edge of concrete is chamfered, edge distance shall be measured from nearest edge of chamfer (reference Drawing 054162, Para. B.2.7).

4.2.3 Center-to-center anchor spacing shall not be less than 12 times the nominal diameter of the anchor (e.g., a 1/2-inch Phillips Red Head, spacing is 6 inches) unless otherwise directed in writing by PG&E.

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4.2.4 Anchor holes shall be drilled in the surface as close as possible to perpendicular. Holes can not be accepted if they have a deviation (angle of incidence) greater than 5 degrees.

4.2.4.1 If the angle of incidence (bolt-to-concrete) is greater than 5 degrees but less than or equal to 15 degrees ($5 < \leq 15$), a HOLD/REJ Tag # shall be placed in the "Angle of Incidence" block of ABIR (Exhibit 1) and the actual angle of incidence recorded in the "Actual Angle of Incidence" block.

4.2.4.2 PG&E shall disposition all anchor bolt discrepancies where the angle of incidence is greater than 5 degrees and less than or equal to 15 degrees.

4.2.4.3 All anchor bolts with an angle of incidence greater than 15 degrees will be rejected and dispositioned by HPF Engineering.

4.2.5 Hex nuts on new anchor bolt installations shall be a minimum of one full thread past the end of the bolt (reference 050029, Misc. Note 27).

4.2.6 Holes for expansion anchors shall be drilled to the correct depth using tools and equipment suitable to the job. A depth gauge shall be used on the equipment to ensure correct hole depth.

4.2.6.1 Embedment length is exclusive of any grout pad or overlay.

4.2.7 A hole with the same diameter as the outside diameter of the shell of a shell-type anchor or shank of a stud-type shall be drilled.

4.2.7.1 For Phillips flush anchors, reference Table 3 of this procedure.

4.2.7.2 For drop-in anchors, reference Table 4 of this procedure.

4.2.8 Drilled anchor holes shall be cleaned of all debris prior to installation of the anchor.

4.2.9 Minimum embedment for shell (flush) anchors shall be equal to the length of the shell.

4.2.10 Shell (flush) anchors shall be set using the proper setting tools for the size and type of anchor being set.

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4.2.11 Shell (flush) anchors shall be set using the proper setting tools for the size and type of anchor being set.

4.2.12 Minimum embedment for stud anchors shall be determined in Table 5 of this procedure or as directed by PG&E.

4.2.13 Drive wedge type anchors into the hole to the proper embedment. With the fixture snug, tighten the nut to a finger tight condition. Tighten the nut from the finger tight condition to set the anchor.

4.2.14 Drive stud type anchors to the bottom of the hole drilled to the proper embedment depth. Expand anchor with the proper tools (reference Para. 4.1.2.1).

4.2.15 Where applicable, concrete anchor connection to surface may be replaced with the following:

- a) Bolted connection to embedded unistrut (size of bolt to be same as anchor)
- b) Thru-bolts to Class-1 concrete block walls (see Detail S-68)
- c) Stud welded to Containment steel liner (stud to be same as anchor) per the requirements of Drawing 055030, Note 9, 29, and QCP-5A.



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5. DOCUMENTATION

5.1 100 percent of all anchors on each installation shall be inspected for the "Attributes" listed on Form HPF/ABIR (Exhibit 1).

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5.1.1 Each Attribute shall be carefully checked for compliance to the applicable requirements, details, etc. Inspectors initial the corresponding box in the "ACPT" column if the Attribute is acceptable. If the Attribute is not applicable (N/A), draw a diagonal line through the "ACPT" box and write N/A on one side of the line and initial the other side. If the Attribute is discrepant/rejected, place a letter in the Hold/Rejected Tag # column (reference QCPE-9, Para. 5.5.10) and describe the discrepancy in the "Discrepancy Description" section.

5.2 All documentation generated through the implementation of this procedure shall be maintained in a readily retrievable manner as part of the Quality Control Records System.



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TABLE 1

STUD LENGTH IDENTIFICATION

(Excluding Hilti Stud Anchors)

OVERALL LENGTH	LETTER
1 1/2"	A
1 3/4"	B
2"	C
2 1/4"	D
2 1/2"	F
2 3/4"	G
3"	H
3 1/4"	J
3 1/2"	K
3 3/4"	L
4"	M
4 1/2"	N
4 3/4"	P
5"	Q
5 1/2"	R
6"	S
7"	T
8"	U
8 1/2"	V
9"	W
10"	X
11"	Y
12"	Z

OVERALL LENGTH	NUMBER
6 1/4"	1
4 1/4"	2
1 5/8"	3
2 1/8"	4
3 3/8"	5
5 1/4"	6

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Note: For Hilti Stud Anchor Identification see Table 2.

Table 2

HILTI

STUD LENGTH IDENTIFICATION

NOTE: All Hilti Stud Anchors received shall also have a punch mark placed next to the stamp to distinguish between Hilti manufactured anchors and other manufacturer's anchors.

ANCHOR DIAMETER	MANUFACTURER'S STAMP	LENGTH OF ANCHOR (INCHES)
1/4 inch	A	1 5/8
1/4 inch	B	2 1/4
1/4 inch	D	3
3/8 inch	B	2 1/8
3/8 inch	C	2 3/4
3/8 inch	E	3 1/2
3/8 inch	H	5
1/2 inch	C	2 3/4
1/2 inch	E	3 3/4
1/2 inch	I	5 1/2
1/2 inch	L	7
5/8 inch	E	3 1/2
5/8 inch	G	4 1/2
5/8 inch	J	6
5/8 inch	O	8 1/2
3/4 inch	F	4 1/4
3/4 inch	I	5 1/2
3/4 inch	L	7
3/4 inch	O	8 1/2
3/4 inch	R	10
1 inch	J	6
1 inch	P	9
1 inch	T	12
1 1/4 inch	P	9
1 1/4 inch	T	12

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TABLE 3

DRILLING DETAILS
PHILLIPS FLUSH TYPE ANCHORS

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<u>TYPE</u>	<u>DRILL SIZE</u>	<u>MINIMUM EMB.</u>
J-12	11/16"	2-1/16"
J-58	27/32"	2-9/16"
J-34	1"	3-3/16"

TABLE 4

DRILLING DETAILS
PHILLIPS DROP-IN ANCHORS

(Reference Paragraph 4.1.1.3)



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<u>TYPE</u>	<u>DRILL SIZE</u>	<u>MINIMUM EMB.</u>
MS-14	3/8"	1"
MS-38	1/2"	1-3/8"
MS-12	5/8"	1-3/4"
MS-58	3/4"	2-1/4"
RM-14	3/8"	1"
RM-38	1/2"	1-9/16"
RM-12	5/8"	2"
RM-58	7/8"	2-1/2"
RM-34	1"	3-3/16"

TABLE 5
MINIMUM ANCHOR EMBEDMENTS

NOMINAL DIAMETER (Inches)	MINIMUM EMBEDMENT (Inches)	
	HILTI/PHILLIPS WEDGE	PHILLIPS STUD
1/4	1-1/8	1-5/8
3/8	1-3/4	1-7/8
1/2	2-1/4	2-1/4
5/8	2-7/8	2-7/8
3/4	3-3/8	3-3/8
7/8	4	
1	4-1/2	
1-1/4	5-5/8	

SUPPORT DWG./DETAIL # REV

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ANCHOR BOLT TYPE UNIT SIZE

SUPPORT I.D. #

TOTAL ANCHOR BOLTS

ANCHOR BOLTS CHECKED

ANCHOR BOLT INSPECTION REPORT

ATTRIBUTE	ACPT	HOLD/ REJ. TAG #	ATTRIBUTE		HOLD/ REJ. TAG #
I.D. MARKING Ref 4.1.2			TIGHTNESS Ref 4.2.13 Ref 4.2.14		
SPACING Ref 4.2.3					
EMBEDMENT Ref 4.2.12			ABANDONED HOLES PATCHED Ref 4.2.1		
OUTSIDE WEATHER REQ. Ref 4.1.4			FLUSH SHELL TYPE ANCHOR RECESSED LESS THAN 1/4 OF NORMAL DIAMETER		
PLACEMENT Ref 4.2.1.1 Ref 4.2.2					
ANGLE OF INCIDENCE $\leq 5^\circ$ Ref 4.2.4			AUTHORIZATION TO DRILL OR CHIP CONCRETE (PG&E C-51) Ref 4.1.3		
ACTUAL ANGLE OF INCIDENCE $> 5^\circ \leq 15^\circ$ Ref 4.2.4.1					
HOLD/REJ TAG #	DISCREPANCY DESCRIPTION		CORRECTIVE ACTION TAKEN		O.C. ACCEPT & DATE

REMARKS:

Q.C. ACCEPTANCE

DATE

CLERICAL

HPF/ABIR 11-7-83

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PCN-1

4.2.11 Delete

4.2.12 Minimum embedment for stud anchors shall be determined in Table 5 of this procedure or as directed by PG&E.

PCN-1

4.2.13 Drive wedge type anchors into the hole to the proper embedment. With the fixture snug, tighten the nut to a finger tight condition. Turn the nut 3 or 4 turns from the finger tight condition to set the anchor.

PCN-1

4.2.14 Drive stud type anchors to the bottom of the hole drilled to the proper embedment depth. Expand anchor with the proper tools (reference Para. 4.1.2.1). With the fixture snug, tighten the nut to verify the anchor is set.

PCN-1

4.2.14.1 Anchors shall not turn in the hole or slip more than 10 percent when the bolt is tightened. If the above occurs, the following corrective actions shall be taken:

- a) Remove bolt or nut, reset anchor, and repeat tightening
- b) Remove anchor, substitute larger diameter or longer anchor
- c) Drill new hole and install a new anchor which satisfies the requirements of this procedure.

4.2.15 Where applicable, concrete anchor connection to surface may be replaced with the following:

- a) Bolted connection to embedded unistrut (size of bolt to be same as anchor)
- b) Thru-bolts to Class-1 concrete block walls (see Detail S-68)
- c) Stud welded to Containment steel liner (stud to be same as anchor) per the requirements of Drawing 050030, Note 9, 29, and QCP-5A.

5. DOCUMENTATION

5.1 100 percent of all anchors on each installation shall be inspected for the "Attributes" listed on Form HPF/ABIR (Exhibit 1).

FOR INFORMATION ONLY



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TO: ALL O.C. INSPECTORS *Dick*
FROM: Rick Wilson, Quality Director
DATE: December 16, 1983
RE: QCP-9 "Installation and Inspection of Stud and Shell Concrete Anchors"

There has been some confusion regarding the inspection requirements required per QCP-9 6. The following is a clarification of those paragraphs which are causing concern.

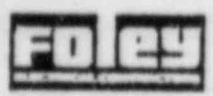
Paragraph 4.2.1 - "If a hole cannot be drilled to the correct depth (i.e. if reinforcing steel is encountered while drilling) a new hole shall be drilled. Reinforcing steel shall not be cut without specific written authorization from P.G. & E." The intent of this paragraph is to give clear direction to the craftsman of what to do when encountering rebar during drilling. It is not a hold point for Q.C. inspection.

Paragraph 4.2.4 - "Anchor holes shall be drilled in the surface as close as possible to perpendicular. Holes cannot be accepted if they have a deviation (angle of incidence) greater than 5 degrees." The intent of this paragraph is to give clear direction to the craftsman as to what will be an acceptable angle of incidence. This angle will be inspected by Q.C. after installation of the anchor by measurement of the angle of the anchor. See paragraph 4.2.7.

Paragraph 4.2.6 - "Holes for expansion anchors shall be drilled to the correct depth using tools and equipment suitable to the job. A depth gauge shall be used on the equipment to ensure correct hole depth." The intent of this paragraph is to give the craftsman direction and tools to be used to ensure proper depth of the hole.

Paragraph 4.2.8 - "Drilled anchor holes shall be cleaned of all debris prior to installation of the anchor." Intent of this paragraph is to give draft direction as to cleaning prior to installation of the anchor.

Paragraph 1.1 - States that "All of all anchors on each installation shall be inspected under the 'Attributes' listed in 1.1.1.1. The intent is that these attributes are to be inspected and documented after the installation of the anchor in place.



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SUPPORT DWG./DETAIL # _____ SUPPORT I.D. # _____		<div style="background-color: black; color: white; padding: 5px; font-weight: bold; font-size: 1.2em;"> Foley </div> <div style="background-color: black; color: white; padding: 2px; font-weight: bold; font-size: 0.8em;"> ELECTRICAL CONTRACTORS </div>		<div style="display: flex; justify-content: space-between;"> <div> ANCHOR BOLT INSPECTION REPORT </div> <div style="text-align: right;"> UNIT _____ ANCHOR BOLT TYPE _____ TOTAL ANCHOR BOLTS _____ ANCHOR BOLTS CHECKED _____ </div> </div>	
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ATTRIBUTE	ACPT	HOLD/ REJ. TAG #	ATTRIBUTE	ACPT	HOLD/ REJ. TAG #
I.D. MARKING Ref 4.1.2			TIGHTNESS Ref 4.2.13 Ref 4.2.14		
SPACING Ref 4.2.3			ABANDONED HOLES PATCHED Ref 4.2.1.1		
EMBEDMENT Ref 4.2.12					
OUTSIDE WEATHER REQ. Ref 4.1.4			FLUSH SHELL TYPE ANCHOR RECESSED LESS THAN 1/4 OF NORMAL DIAMETER		
PLACEMENT Ref 4.2.1.1 Ref 4.2.2					
ANGLE OF INCIDENCE $\leq 5^\circ$ Ref 4.2.4			AUTHORIZATION TO DRILL OR CHIP CONCRETE (PG&E C-51) Ref 4.1.3		
ACTUAL ANGLE OF INCIDENCE $> 5^\circ \leq 15^\circ$ Ref 4.2.4.1					

HOLD/REJ TAG #	DISCREPANCY DESCRIPTION	CORRECTIVE ACTION TAKEN	O.C. ACCEPT & DATE

REMARKS: _____

Q.C. ACCEPTANCE _____

DATE _____

CLERICAL _____

HPP/ABIR 11-7-83