APPLICATION FOR HCAI PREAPPROVAL OF MANUFACTURER'S CERTIFICATION (OPM)

OFFICE USE ONLY

APPLICATION #: OPM-0542

HCAI Preapproval of Manufacturer's Certification (OPM)

Type: ☐ New ☒ Renewal/Update

Manufacturer Information

Manufacturer: nVent - Erico International Corporation

Manufacturer's Technical Representative: Ward Judson

Mailing Address: 34600 Solon Road, Solon, OH 44139

Telephone: (440) 528-3788 Email: Ward.Judson@nvent.com

Product Information

Product Name: nVent CADDY Seismic Bracing for MEP Systems

Product Type: Various Components & Supports for Seismic Bracing

Product Model Number: CSBQIKCL,CSBQG,CSBBRP,CSBMA,CSBBRS1, CSBBRS2,CSBBRS3,CSBU1, CSBU2, CSBUS1,CSBUS2, CSBUS1PA,CSBUS2PA,CSBS1, CSBS1A, CSBS2, CSBS3, CSBS4, CSBS5, CSB, CSBT

General Description: The product consists of support members for seismic bracing of MEP systems that include service pipe, conduit, cable tray, and round & rectangular gage ducts.

Applicant Information

Applicant Company Name: CYS Structural Engineers, Inc.

Contact Person: Dieter Siebald

Mailing Address: 2495 Natomas Park Drive, Suite 650, Sacramento, CA 95833

Telephone: (916) 920-2020 Email: dieters@cyseng.com

Title: Structural Engineer

Registered Design Professonal Preparing Engineering Recommendations

Company Name: CYS STRUCTURAL ENGINEERS, INC.

Name: Dieter Siebald California License Number: S4346

Mailing Address: 2495 Natomas Park Drive, Suite 650, Sacramento, CA 95833

Telephone: (916) 920-2020 Email: dieters@cyseng.com

HCAI Special Seismic Certification Preapproval (OSP)

☐ Special Seismic Certification is preapproved under OSP OSP Number:

Certification Method

Testing in accordance with: ☐ ICC-ES AC156 ☒ FM 1950-16

☐ Other(s) (Please Specify):

*Use of criteria other than those adopted by the California Building Standards Code, 2019 (CBSC 2019) for component supports and attachments are not permitted. For distribution system, interior partition wall, and suspended ceiling seismic bracings, test criteria other than those adopted in the CBSC 2019 may be used when approved by HCAI prior to testing.

☒ Analysis

☐ Experience Data

☐ Combination of Testing, Analysis, and/or Experience Data (Please Specify):

HCAI Approval

Date: 4/16/2022

Name: William Staehlin Title: Senior Structural Engineer

Condition of Approval (if applicable):

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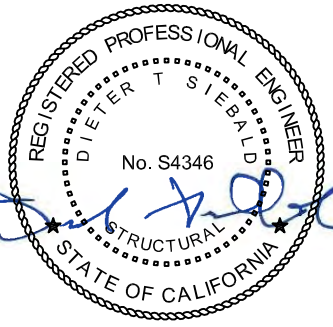

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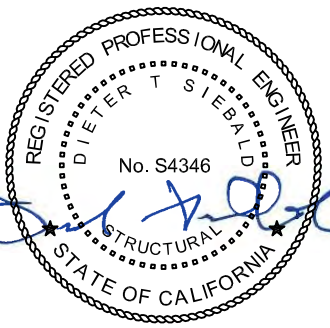

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SEISMIC BRACING FOR MEP SYSTEMS

CONDITIONS OF USE:

1. THIS HCAI PRE–APPROVAL OF MANUFACTURER'S CERTIFICATION (OPM) IS BASED ON THE CBC 2019. THE DEMAND (DESIGN FORCES) FOR USE W/ THIS OPM MUST BE BASED ON THE CBC 2019.
2. THIS PRE–APPROVAL IS FOR THE SEISMIC BRCG OF INTERIOR PIPES, CONDUITS, CABLE TRAYS AND DUCTS. IT DOES NOT ADDRESS OTHER LOADS SUCH AS, BUT NOT LIMITED TO, THOSE GENERATED BY THERMAL EXPANSION, PRESSURE, FLUID DYNAMICS, PIPE RUPTURE OR MOVEMENTS OF EQUIPMENT TO WHICH BRACE COMPONENTS ARE ATTACHED. IT DOES NOT ADDRESS COMPONENTS THAT CROSS SEISMIC SEPARATIONS OF BLDGS. NOR DOES IT ADDRESS COMPONENTS (OTHER THAN PIPE RISERS) ATTACHED TO PORTIONS OF THE STRUCTURE OR EQUIPMENT THAT WILL EXPERIENCE RELATIVE SEISMIC DISPLACEMENT. THE RANGE OF COMPONENT SIZES AND MATERIAL INCLUDED IN THE PRE–APPROVAL ARE AS FOLLOWS:
   A. SERVICE PIPE/CONDUIT DIAMETERS:
      - STEEL: SCHEDULE 10 UP TO 12 INCHES IN DIA (INCLUDES 0.188, REFER TO SECTION 500, FOOTNOTES g & h)
      - STEEL: SCHEDULE 40 UP TO 12 INCHES IN DIA
      - STEEL: SCHEDULE LW (i.e., SCHEDULE 7, REFER TO SECTION 500 TABLE, FOOTNOTE c) UP TO 6 INCHES IN DIA
      - CAST IRON: UP TO 12 INCHES IN DIA
      - COPPER: TYPE K & TYPE L UP TO 6 INCHES IN DIA
      - RIGID METALLIC CONDUIT (RMC): UP TO 4 INCHES IN DIA
      - INTERMEDIATE METALLIC CONDUIT (IMC): UP TO 4 INCHES IN DIA
      - ELECTRICAL METALLIC TUBING (EMT): UP TO 4 INCHES IN DIA
   B. BRACE PIPES:
      - STEEL: ASTM® A53 GR B, MIN NPS 1"ø TO MAX NPS 2"ø.
   C. TELESCOPIC BRACE ASSEMBLY FOR TRANSVERSE & VERT BRCG ONLY OF 1"ø TO 4"ø SERVICE PIPES.
   D. BRACE STRUTS:
      - STEEL: ASTM A653 SS GR 33 1⅝x1⅝x12 GA HOT–DIP GALV STRUT CHANNEL.
   E. BRACE TUBING: ELECTRICAL METALLIC TUBING (EMT)
   F. CABLE TRAYS: LADDER TYPE, ALL SIZES
   G. GALVANIZED DUCTS: ROUND DUCTS UP TO 84 INCHES IN DIA; RECTANGULAR DUCTS UP TO 120 INCHES IN WIDTH.
   H. THE SUBSTRATES INCLUDED IN THIS PRE–APPROVAL ARE AS FOLLOWS: CONC, CONC/MTL DECK, & STL.
3. THESE DRAWINGS ARE PREPARED FOR ERICO INTERNATIONAL CORPORATION, A DIVISION OF NVENT, SOLON, OHIO 44139.
4. THE CONTRACTOR AND THE INSPECTOR OF RECORD MUST OBTAIN A COPY OF THIS PRE–APPROVAL FROM THE HCAI PRE–APPROVAL PROGRAMS WEBSITE.
5. THIS PRE–APPROVAL IS FOR DESIGN AND SUPPORTS & ATTACHMENTS OF MEP SYSTEM SEISMIC SWAY BRACING ONLY.
6. THIS PRE–APPROVAL IS LIMITED TO INDOOR USE.
7. THE MAX ALLOWABLE S_{DS} FOR THIS PRE–APPROVAL IS LIMITED TO 2.5g.

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CONDITIONS OF USE

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SEISMIC BRACING FOR
MEP SYSTEMS

SCOPE:

1. THIS PRE–APPROVAL MAY BE USED FOR SEISMIC BRACING OF 1"ø TO 12"ø SERVICE (RUN) PIPES OR CONDUITS, OR CABLE TRAYS, OR RECTANGULAR & ROUND DUCTS.

2. IN ADDITION, THIS PRE–APPROVAL MAY BE USED FOR SEISMIC BRACE ATTACHMENTS TO THE UNDERSIDE OF CONC FLRS OR ROOF W/ OR WITHOUT MTL DECK, TO THE FACE OF CONC WALLS, TO WF STL BMS, TO OPEN WEB STL JOISTS, OR TO STL PURLINS (RESTRAINTS ONLY).

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CONSTRUCTION TOLERANCES:

1. CONSTRUCTION TOLERANCES MUST BE AS NOTED ON THE DRAWING ATTACHMENT DTLS AND SECTION 500.
2. CONSTRUCTION TOLERANCE FOR ANGLES OF ALL BRACES FROM HORIZ MUST BE LIMITED TO ±5 DEGREES.
3. CONSTRUCTION TOLERANCE FOR VERT SEISMIC BRACES FROM VERT MUST BE LIMITED TO ±5 DEGREES.

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HOW TO USE THIS PRE-APPROVAL:

1. THIS PRE-APPROVAL MAY BE USED FOR THE DESIGN OF SEISMIC SWAY BRCG OF MEP SYSTEMS EXCLUDING FIRE SPRINKLER PIPING. A CALIFORNIA LICENSED STRUCTURAL ENGINEER (CLSE) HAS DESIGNED THIS PRE-APPROVAL, ALONG W/ SUPPORTING CALCULATIONS. THEREFORE, THE PRE-APPROVED DTLS AND CALCULATIONS ARE NOT TO BE RE-REVIEWED BY REGIONAL STAFF. HOWEVER, EA MEP SYSTEM REQUIRES SUBMITTALS THAT MUST BE REVIEWED AND APPROVED BY HCAI.
2. AS W/ ALL PRE-APPROVED DTLS, SYSTEMS, ETC., PLANS (i.e. LAYOUT DRAWINGS) ARE STILL REQ SHOWING HOW AND WHERE THIS PRE-APPROVED SUPPORTS, ATTACHMENTS AND BRCG SYSTEM WILL BE APPLIED TO THE MEP SYSTEM ON A PROJECT SPECIFIC BASIS. THIS PROCESS IS NEEDED TO VERIFY THAT THE APPROPRIATE DTL HAS BEEN SELECTED AND APPLIED FOR EA CONDITION AND FOR THE ACTUAL SUBSTRATE THAT IT WILL BE CONNECTED/ATTACHED TO. FOR THE MEP SYSTEM, THESE PLANS MUST BE PREPARED, STAMPED & SIGNED BY A CALIFORNIA REGISTERED DESIGN PROFESSIONAL (CRDP). SEE 2019 CAC SECTION 7-115.
   A. THE CRDP REVIEWING THE BRACE SYSTEM IS RESPONSIBLE FOR THE ADEQUACY OF THE DESIGN AND APPLICATION OF THIS OPM.
   B. THE CRDP MUST ARRANGE AND DESIGN THE TRANSVERSE, LONGITUDINAL AND VERT SEISMIC BRACES SO THAT THERE IS A VERT SEISMIC BRACE NO MORE THAN 6" FROM EA TRANSVERSE AND EA LONGITUDINAL BRACE MEMBER. FOR VERT SEISMIC BRACES SEE SECTION 8. PLEASE NOTE THAT A TYP VERT SERVICE PIPE ROD HANGER IS NOT A VERT SEISMIC BRACE.
   C. THE CRDP MUST CHECK THE VERT SEISMIC BRACE ASSEMBLY FOR BOTH TENSION AND COMPRESSION LOADS AND DETERMINE WHETHER THE VERT SEISMIC BRACE ASSEMBLY OF THE BRCG SYSTEM REQUIRES COMPRESSION STIFFENERS OR OTHER STRENGTHENING. THE TENSION LOADS ON THE VERT SEISMIC BRACE ASSEMBLY MUST INCLUDE THE MAX TRIBUTARY DEAD LOAD, THE VERT COMPONENTS OF THE TRANSVERSE AND/OR LONGITUDINAL BRACES, AND THE TRIBUTARY VERT SEISMIC LOAD. COMPRESSION LOADS ON THE VERT SEISMIC BRACE ASSEMBLY MUST INCLUDE THE VERT COMPONENTS OF THE TRANSVERSE AND/OR LONGITUDINAL BRACES, AND THE TRIBUTARY VERT SEISMIC LOAD, BUT MUST NOT BE OFFSET BY TRIBUTARY DEAD LOADS UNLESS IT CAN BE VERIFIED THAT THE DEAD LOADS WILL, IN FACT, BE APPLIED TO THE VERT SEISMIC BRACE ASSEMBLY IN QUESTION.
   D. THE CRDP MUST ARRANGE THE ANCHORS TO ENSURE THAT THEY CAN BE INSTALLED IN ACCORDANCE W/ THE PRE-APPROVAL AND THAT THERE ARE NO SLAB EDGES, OPENINGS, OR OTHER ANCHORS NEAR ENOUGH TO THE ANCHORS TO REDUCE THEIR ALLOWABLE CAPACITIES. THE ALLOWABLE CAPACITIES INDICATED IN APPENDIX A OF THIS OPM ARE BASED ON A MIN DISTANCE TO EDGE OF CONC, AS SHOWN IN THE ALLOWABLE LOAD TABLE IN APPENDIX A AND APPLICABLE LOAD COMBINATIONS PER ASCE 7 SECTION 12.4 IN THE ANALYSIS. THE ALLOWABLE ANCHOR CAPACITIES ARE FOR USE IN THE INTERACTION EQUATION PER ACI 318-14 SECTION 17.6.
3. THIS PRE-APPROVAL RELIES ON A PRESCRIPTIVE COOKBOOK APPROACH. THE PRE-APPROVED DTLS HAVE TABLES AND CHARTS ASSOCIATED W/ THEM THAT MUST BE USED TO SELECT THE APPROPRIATE DTL FOR EA LOCATION THAT AN ANCHOR OR BRACE IS TO BE INSTALLED. THE APPLICATION OF THESE CRITERIA SHOULD NEVER BECOME THE RESPONSIBILITY OF THE INSPECTOR OF RECORDS (IOR), WHOSE RESPONSIBILITY IS TO INSPECT ONLY, NOT DESIGN.

SHEET TITLE: OVERVIEW
HOW TO USE THIS PRE-APPROVAL

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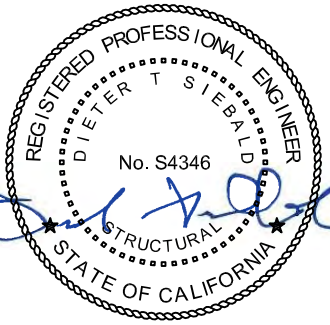
HOW TO USE THIS PRE-APPROVAL (CONTINUED):

4. THE STRUCTURAL ENGINEER OF RECORD (SEOR) MUST REVIEW AND FORWARD THE SUPPORTS, ATTACHMENTS AND BRCG PLANS FOR PLAN CHECK W/ A NOTATION INDICATING THAT THE PLANS HAVE BEEN REVIEWED AND THEY HAVE BEEN FOUND TO BE IN GENERAL CONFORMANCE W/ THE DESIGN OF THE PROJECT; SEE CAC SECTION 7-126. A "SHOP DRAWING STAMP" IS USUALLY ACCEPTABLE FOR COMPLIANCE W/ THIS REQUIREMENT.
5. THE REGIONAL STAFF, ON A PROJECT SPECIFIC BASIS, MUST REVIEW SUPPORTS, ATTACHMENTS AND BRCG DTLS AND SUPPORTING CALCULATIONS THAT ARE NOT PART OF THIS PRE-APPROVAL. REVIEW OF SUPPORTS, ATTACHMENTS AND BRCG DTLS OF THIS NATURE DO NOT CONSTITUTE A PRE-APPROVAL THAT MAY BE USED ON OTHER PROJECTS WITHOUT THE BENEFIT OF PLAN REVIEW AND APPROVAL.
6. LAYOUT DRAWINGS:
   A. LAYOUT DRAWINGS OF THE SUPPORT AND BRCG SYSTEMS PER THIS PRE-APPROVAL MUST BE SUBMITTED TO THE DISCIPLINE IN RESPONSIBLE CHARGE OF THE PROJECT FOR REVIEW TO VERIFY THAT THE DTLS ARE IN CONFORMANCE W/ ALL CODE REQUIREMENTS. THE LAYOUT DRAWINGS MUST BE IN ACCORDANCE W/ ASCE® 7-16 SECTION 13.6 (INCLUDING SUPPLEMENT #1 & CH 13 ERRATA) AS MODIFIED BY THE CBC 2019 SECTION 1617A.
      a) THE STRUCTURAL ENGINEER OF RECORD (SEOR) MUST VERIFY THAT THE SUPPORTING STRUCTURE IS ADEQUATE FOR THE LOADS IMPOSED ON IT BY THE SUPPORTS AND BRACES INSTALLED PER THE PRE-APPROVAL IN ADDITION TO ALL OTHER LOADS.
      b) THE SEOR WILL FORWARD THE SUPPORTS, ATTACHMENTS AND BRCG PLANS (INCLUDING APPROVED CHANGE ORDERS FOR SUPPLEMENTARY FRAMING WHERE REQ) TO THE DISCIPLINE IN RESPONSIBLE CHARGE W/ A NOTATION INDICATING THAT THE PLANS HAVE BEEN REVIEWED AND ARE IN GENERAL CONFORMANCE W/ THIS PRE-APPROVAL, THE DESIGN OF THE PROJECT (CAC 2019, SECTION 7-153).
      c) A "SHOP DRAWING STAMP" MAY BE USED TO INDICATE COMPLIANCE W/ THIS REQUIREMENT.
      d) THE CALIFORNIA REGISTERED DESIGN PROFESSIONAL (CRDP OTHER THAN SEOR) MAY PROVIDE THE SHOP DRAWING STAMP FOR SMALL INSTALLATIONS AT THE DISCRETION OF THE HCAI DISTRICT STRUCTURAL ENGINEER.
   B. THE SEOR MUST DESIGN ANY SUPPLEMENTARY FRAMING THAT IS NEEDED TO RESIST THE LOADS, MAINTAIN STABILITY AND/OR IS REQ FOR INSTALLATION OF THIS PRE-APPROVAL. THE SUPPLEMENTARY FRAMING MUST BE SUBMITTED TO HCAI AS AN "AMENDED CONSTRUCTION DOCUMENT" (ACD).
   C. THE LAYOUT DRAWINGS (W/ THE SHOP DRAWING STAMP) MUST BE SUBMITTED TO HCAI FOR REVIEW OF THE FOLLOWING:
      a) STRUCTURE SUPPORTING THE DISTRIBUTION SYSTEM HAS ADEQUATE CAPACITY.
      b) SEISMIC DESIGN FORCES (Fp) ARE IN ACCORDANCE W/ CBC 2019.
      c) VERIFY THAT THE SUBMITTAL IS WITHIN THE SCOPE OF HCAI PRE-APPROVAL OF MANUFACTURER'S CERTIFICATION (OPM):
         - SIZE AND DISTRIBUTION SYSTEM COMPONENTS
         - SPACING OF BRCG AND FLEX JOINTS, AND
         - SUBSTRATE FOR ATTACHMENTS

      FOR EXAMPLE PROBLEMS SHOWING CALCULATIONS OF ELEMENTS AND SELECTION OF ELEMENTS TO SATISFY THE DEMANDS FROM THE OPM, SEE SECTION 300.



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HOW TO USE THIS PRE-APPROVAL (CONTINUED):

6. LAYOUT DRAWINGS (CONTINUED):
   - D. THE LAYOUT DRAWINGS (W/ THE SHOP DRAWING STAMP) MUST BE KEPT ON THE JOB SITE AND CAN THEN BE USED FOR INSTALLATION OF THE SUPPORT AND BRCG. HCAI FIELD STAFF WILL REVIEW THE INSTALLATION.
   - E. A COPY OF THIS PRE-APPROVAL MUST BE ON THE JOB SITE PRIOR TO STARTING THE INSTALLATION OF HANGERS AND/OR BRACES. IT IS THE CONTRACTOR'S AND IOR'S RESPONSIBILITY TO OBTAIN COPIES OF HCAI PRE-APPROVALS FROM THE HCAI PRE-APPROVAL PROGRAMS WEBSITE.
   - F. COMPONENTS OF TWO OR MORE PRE-APPROVED BRCG SYSTEMS MUST NOT BE MIXED. ONLY THIS PRE-APPROVAL MAY BE USED FOR THE MEP SYSTEM. ANY SUBSTITUTION OF COMPONENT OF THIS PRE-APPROVAL MUST REQUIRE HCAI REVIEW AND APPROVAL.
7. IT IS THE RESPONSIBILITY OF THE CRDP DESIGNING THE BRACE SYSTEM, TO VERIFY THAT THE SYSTEM DESIGN IS IN CONFORMANCE W/ THE 2019 CBC SECTION 1617A AND W/ THE DTLS SHOWN IN THIS PRE-APPROVAL.

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NOTE:
PAGES 1.7 TO 1.9 NOT USED

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MECHANICAL & CAST–IN–PLACE ANCHOR REQUIREMENTS:

1. MECHANICAL & CAST–IN–PLACE ANCHORS:
   - A. ANCHORS INSTALLED IN NWC OR SLWC MUST BE PER ANCHOR TABLES PROVIDED IN THIS MECHANICAL & CAST–IN–PLACE ANCHOR REQUIREMENTS SECTION. INSTALLATION MUST COMPLY W/ SECTION 1617A.1.19 OF THE 2019 CBC. ANCHORS MUST HAVE CRACKED CONC COMPLIANCE IN ACCORDANCE W/ AC193 ACCEPTANCE CRITERIA FOR MECHANICAL ANCHORS IN CONC ELEMENTS. AN HCAI CHANGE ORDER IS REQ FOR ANY SUBSTITUTION OF A SPECIFIED ANCHOR.
   - B. INSTALLATION: INSTALL THE CONC ANCHORS PER THE PARAMETERS SET FORTH WITHIN THIS OPM & EVALUATION REPORT FOR THE SPECIFIC ANCHOR.
2. MECHANICAL ANCHORS ONLY:
   - A. JOB TESTING FOR MECHANICAL ANCHORS ONLY: FOR VERIFYING SATISFACTORY INSTALLATIONS WORKMANSHIP, PERFORM JOB SITE TESTING IN ACCORDANCE W/ INSTALLATION PARAMETERS TABLE PROVIDED ON THE FOLLOWING PAGES. TEST 50% OF THE INSTALLED ANCHORS. THE TEST LOAD MAY BE APPLIED BY ANY METHOD INCLUDING MFR'S TORQUE CRITERIA TESTING THAT WILL EFFECTIVELY MEASURE THE TENSION IN THE ANCHOR SUCH AS DIRECT PULL W/ A HYDRAULIC JACK OR CALIBRATED SPRING LOADING DEVICES. ALL TESTS MUST BE CONDUCTED BY AN APPROVED TESTING/INSPECTION AGENCY CONTRACTED BY THE FACILITY IN THE PRESENCE OF THE SPECIAL INSPECTOR AND THE INSPECTOR OF RECORD. IF ANY ANCHOR FAILS TESTING, TEST ALL ANCHORS OF THE SAME TYPE INSTALLED BY THE SAME TRADE AND NOT PREVIOUSLY TESTED UNTIL TWENTY (20) CONSECUTIVE ANCHORS PASS, THEN RESUME THE INITIAL TEST FREQUENCY. THE TEST MUST BE PERFORMED 24 HOURS OR MORE AFTER INSTALLATION. TESTING MAY BE DONE PRIOR TO SEISMIC BRACE INSTALLATION. ALSO REFER TO THE 2019 CBC SECTION 1910A.5, "TESTS FOR POST–INSTALLED ANCHORS IN CONCRETE".
   - B. FAILURE/ACCEPTANCE CRITERIA: THE FOLLOWING CRITERIA APPLY FOR THE ACCEPTANCE OF MECHANICAL ANCHORS ONLY:
     - HYDRAULIC RAM METHOD: APPLY AND HOLD TEST LOAD FOR A MIN OF 15 SECONDS. THE ANCHOR SHOULD HAVE NO OBSERVABLE MOVEMENT AT THE APPLICABLE TEST LOAD WHERE WASHERS ARE USED. FOR WEDGE TYPE ANCHORS, SUCH AS POWER–STUD+, A PRACTICAL WAY TO DETERMINE OBSERVABLE MOVEMENT IS THAT THE WASHER UNDER THE NUT BECOMES LOOSE.
     - TORQUE WRENCH METHOD: THE APPLICABLE TEST TORQUE MUST BE REACHED WITHIN THE FOLLOWING LIMITS: WEDGE TYPE: ONE–HALF (1/2) TURN OF THE NUT.

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MECHANICAL & CAST–IN–PLACE ANCHOR REQUIREMENTS (CONTINUED):

2. MECHANICAL ANCHORS ONLY:
   C. INSTALLATION PARAMETERS FOR MECHANICAL ANCHORS:

MFR	TYPE	ESR REPORT	ANCHOR DIAMETER (IN) d_a	NOMINAL EMBED (IN) h_{nom}	EFFECTIVE EMBED (IN) h_{ef}	MIN MEMBER THK[1] (IN) h_{min}	TORQUE (FT-LBS) T_{inst}
DEWALT / POWERS	Power-Stud+ SD1	ESR-2818	0.5	2.5	2	4	40
			0.5	3.75	3.25	6	40
			0.75	4	3.125	6	110
			0.75	5.625	4.75	10	110
	Power-Stud+ SD2	ESR-2502	0.5	2.5	2	4.5	40
			0.5	3.75	3.25	5.75	40
			0.75	4.5	3.75	7	110
			0.75	5.75	5	10	110
	Power-Stud+ SD4 (SS304)	ESR-2502	0.5	2.5	2	4	40
			0.75	4.5	3.75	6	110
	Power-Stud+ SD6 (SS316)	ESR-2502	0.5	2.5	2	4	40
			0.75	4.5	3.75	6	110
	Snake+	ESR-2272	0.375	1.63	1.1	4	8
			0.5	2.19	1.54	4	36
	Mini-Undercut+ (5/8" OD)	ESR-3912	0.375	0.75	0.75	2.5	5
	Hangermate+	ESR-3889	0.25	1.625	1.2	3.25	19
			0.25	2.5	1.94	4	25
HILTI	HDI-P TZ	ESR-4236	0.375	0.75	0.75	2.5	5
	Kwik Bolt TZ2	ESR-4266	0.5	2.5	2	4	50
			0.5	3.75	3.25	6	50
			0.75	4	3.25	5.5	110
			0.75	4.5	3.75	6	110
			0.75	5.5	4.75	8	110

FOR HILTI KWIK BOLT TZ2 SS TORQUE VALUES ARE AS FOLLOWS:

ANCHOR DIAMETER (IN) d_a	TORQUE (FT-LBS) T_{inst}
0.5	40
0.75	125

NOTE:
TABLE CONTINUED ON NEXT PAGE

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: OVERVIEW & GENERAL NOTES
MECHANICAL & CAST-IN-PLACE REQUIREMENTS (CONTINUED)

CYS STRUCTURAL ENGINEERS, INC.
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MECHANICAL & CAST–IN–PLACE ANCHOR REQUIREMENTS (CONTINUED):

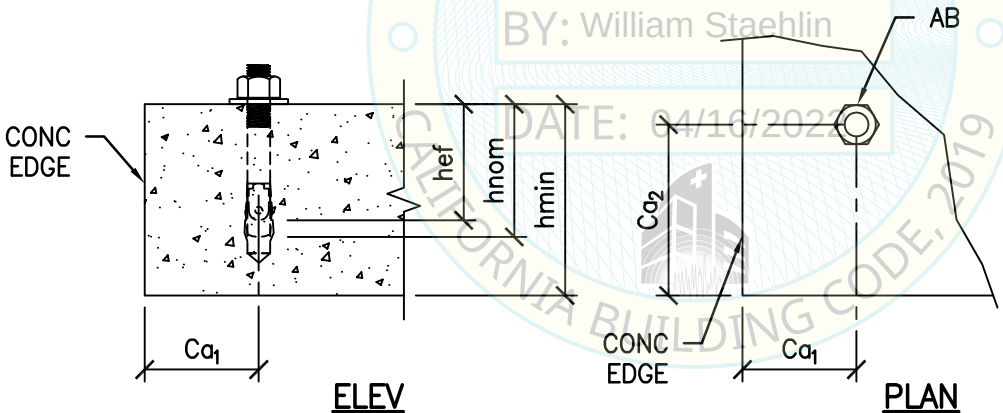
2. MECHANICAL ANCHORS ONLY:
   C. INSTALLATION PARAMETERS FOR MECHANICAL ANCHORS:

MFR	TYPE	ESR REPORT	ANCHOR DIAMETER (IN) d_a	NOMINAL EMBED (IN) h_{nom}	EFFECTIVE EMBED (IN) h_{ef}	MIN MEMBER THK[1] (IN) h_{min}	TORQUE (FT-LBS) T_{inst}
SIMPSON	Strong-Tie Strong-Bolt 2	ESR-3037	0.5	2.75	2.25	4	60
			0.5	3.875	3.375	5.5	60
			0.75	4.125	3.375	6.75	150
			0.75	5.75	5	8.75	150
	Strong-Tie Titen HD	ESR-2713	0.5	3.25	2.35	5	65
			0.5	4	2.99	6.25	65
			0.75	4	2.94	6	150
			0.75	5.5	4.22	8.75	150
			0.75	6.25	4.86	10	150

FOOTNOTES:

1. FOR CASE 1 (STL DECK SOFFIT), REFER TO DTLS IN SECTION 100 FOR MTL DECK & CONC FILL DIMS.
2. FOR MIN EDGE DISTANCE, REFER TO DTL BLW.
3. FOR LRFD CAPACITY, SEE APPENDIX "A".
4. FOR "KB–TZ2" & "HANGERMATE+", DECK STRENGTH MUST BE Fy= 50,000 PSI, MIN.

ANCHOR DIA	Ca_1 (MIN)	Ca_2 (MIN)
¼"	4"	6"
⅜"	6"	9"
½"	8"	12"
¾"	10"	15"



ELEV PLAN

MIN EDGE DISTANCE FOR ANCHORS

1. Ca_1 IS THE MIN CONC EDGE DISTANCE.
2. Ca_2 IS THE MIN CONC EDGE DISTANCE IN THE PERP DIRECTION.

SHEET TITLE: OVERVIEW & GENERAL NOTES
MECHANICAL & CAST-IN-PLACE REQUIREMENTS (CONTINUED)

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MECHANICAL & CAST–IN–PLACE ANCHOR REQUIREMENTS (CONTINUED):

2. MECHANICAL ANCHORS ONLY:
   D. THREE (3) CONDITIONS OF POST–INSTALLED ANCHORAGE TO CONC ARE SPECIFIED & PRESENTED IN THIS PRE–APPROVAL:

CASE 1: THE SEISMIC BRACE IS ATTACHED TO THE UNDERSIDE OF A SUSPENDED FLR OR ROOF OF A BLDG. IT IS ASSUMED THE FLRS & ROOF ARE BUILT OF MIN 3¼" NWC OR SLWC TOPPING (f'c= 3000 PSI MIN) OVER 20 GAGE MIN MTL DECK (Fy = 33,000 PSI, MIN UNO PER FOOTNOTE 4 IN INSTALLATION PARAMETERS FOR MECHANICAL ANCHORS TABLE ON PG 1.12. INSTALLATION IN THE SOFFIT OF MTL DECK MUST COMPLY W/ MIN REQUIREMENTS NOTED IN SECTION 100 OF THIS OPM.

CASE 2: THE SEISMIC BRACE IS ATTACHED TO THE UNDERSIDE OF A SUSPENDED FLR OR ROOF OF A BLDG. IT IS ASSUMED THE FLRS & ROOF ARE BUILT OF NORMAL WT REINFORCED CONC. (f'c = 3000 PSI, MIN). THK PER TABLE 2.C ON PGS 1.11 & 1.12.

CASE 3: THE SEISMIC BRACE IS ATTACHED TO A CONC WALL IN A BLDG. IT IS ASSUMED THE WALLS ARE BUILT OF NORMAL WT REINFORCED CONC (f'c= 3000 PSI, MIN). THK PER TABLE 2.C ON PGS 1.11 & 1.12.

SHEET TITLE: OVERVIEW & GENERAL NOTES
MECHANICAL & CAST-IN-PLACE REQUIREMENTS (CONTINUED)

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MECHANICAL & CAST–IN–PLACE ANCHOR REQUIREMENTS (CONTINUED):

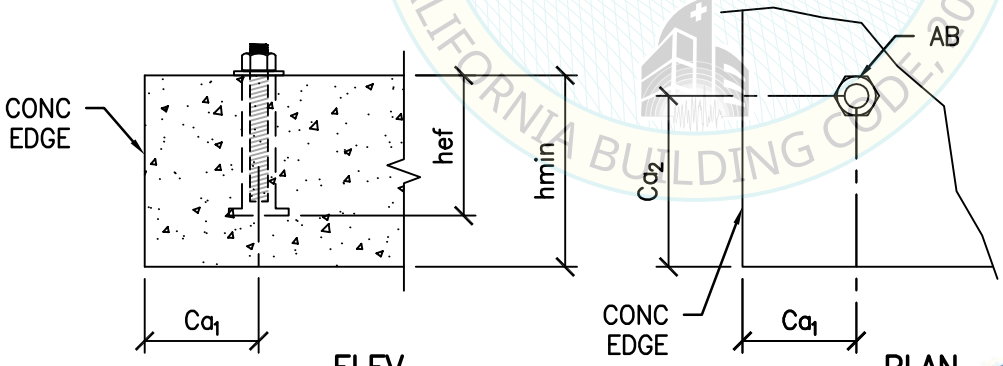
3. CAST–IN–PLACE ANCHORS ONLY:
   A. INSTALLATION PARAMETERS FOR CAST–IN–PLACE ANCHORS:

	TYPE	ESR REPORT	ANCHOR DIAMETER (IN) d_a	EFFECTIVE EMBED (IN) h_{ef}	BEARING AREA (IN^2) A_{brg}	MIN MEMBER THK[1] (IN) h_{min}
DEWALT / POWERS	Wood-Knocker II+ Insert	ESR-3657	0.7	1.75	1.2	3.5
			1	1.75	1.4	3.5
	Bang-It Deck Insert	ESR-3657	0.7	1.75	1.2	SEE NOTE 1
			1	1.75	1.4	
	DDI+ Deck Insert	ESR-3958	0.375	1.5	0.17	
			0.5	1.75	0.28	
			0.625	2	0.45	

FOOTNOTES:

1. FOR CASE 1 (STL DECK SOFFIT), REFER TO DTLS IN SECTION 100 FOR MTL DECK & CONC FILL DIMS.
2. FOR MIN EDGE DISTANCE, REFER TO DTL BLW.
3. FOR LRFD CAPACITY, SEE APPENDIX "A".
4. FOR "WOOD–KNOCKER II+" & "BANG–IT" DECK INSERTS PER ESR–3657, THE FOLLOWING LIMITATIONS MUST APPLY:
   A. ONLY ½", ⅝" & ¾" SINGLE THRD INSERTS ARE QUALIFIED PER THIS OPM. MULTI–THRD INSERTS ARE NOT ALLOWED.
   B. THRD ROD MUST CONFORM TO ASTM A36, ASTM F1554 GRADE A36, ASTM F1554 GR 105 OR ASTM A193 GR B7
5. FOR DDI+ INSERT DECK STRENGTH MUST BE Fy= 50 KSI, MIN

ANCHOR DIA	Ca_1 (MIN)	Ca_2 (MIN)
¼"	4"	6"
⅜"	6"	9"
½"	8"	12"
¾"	10"	15"



MIN EDGE DISTANCE FOR ANCHORS

1. Ca_1 IS THE MIN CONC EDGE DISTANCE.
2. Ca_2 IS THE MIN CONC EDGE DISTANCE IN THE PERP DIRECTION.

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SHEET TITLE: OVERVIEW & GENERAL NOTES
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MECHANICAL & CAST-IN-PLACE ANCHOR REQUIREMENTS (CONTINUED):

3B. TWO (2) CONDITIONS OF CAST-IN-PLACE (CIP) ANCHORAGE TO CONC IS SPECIFIED & PRESENTED IN THIS APPROVAL.

CASE 4: THE SEISMIC BRACE IS ATTACHED TO THE UNDERSIDE OF A SUSPENDED FLR OR ROOF OF A BLDG. IT IS ASSUMED THE FLRS & ROOF ARE BUILT OF MIN 3¼" NWC OR SLWC TOPPING (f'c= 3000 PSI MIN) OVER 20 GAGE MIN MTL DECK (Fy = 33,000 PSI, MIN UNO PER CAST-IN-PLACE ANCHOR TABLE FOOTNOTE 5 ON PG 1.14. INSTALLATION IN THE SOFFIT OF MTL DECK MUST COMPLY W/ MIN REQUIREMENTS NOTED IN SECTION 100 OF THIS OPM.

CASE 5: THE SEISMIC BRACE IS ATTACHED TO THE UNDERSIDE OF A SUSPENDED FLR OR ROOF OF A BLDG. IT IS ASSUMED THE FLRS & ROOF ARE BUILT OF MIN 4½" NORMAL WT REINFORCED CONC (f'c = 3000 PSI MIN).

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MECHANICAL & CAST-IN-PLACE REQUIREMENTS (CONTINUED)

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ABBREVIATIONS

@	AT
AB	ANCHOR BOLT
ABV	ABOVE
ACI®	AMERICAN CONCRETE INSTITUTE
AISC®	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ALT	ALTERNATE
ASCE®	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASME®	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASD	ALLOWABLE STRENGTH DESIGN
ASTM®	AMERICAN SOCIETY FOR TESTING & MATERIALS
BM	BEAM
BLDG	BUILDING
BLW	BELOW
BOTT	BOTTOM
BRCG	BRACING
BTW	BETWEEN
CAC	CALIFORNIA ADMINISTRATIVE CODE
CBC	CALIFORNIA BUILDING CODE
CG	CENTER OF GRAVITY
CIP	CAST-IN-PLACE
CLSE	CALIFORNIA LICENSED STRUCTURAL ENGINEER
℄	CENTERLINE
CONC	CONCRETE
CONN	CONNECTION
CRDP	CALIFORNIA REGISTERED DESIGN PROFESSIONAL
DIM	DIMENSION
DTL	DETAIL
DIA (ø)	DIAMETER
(E)	EXISTING CONDITION
EA	EACH
EE	EACH END
ELEV	ELEVATION
EMT	ELECTRICAL METALLIC TUBING
EQUIP	EQUIPMENT
f'c	SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE
FLG	FLANGE
FLR	FLOOR
FM®	FM APPROVALS (AKA FACTORY MUTUAL)
Fp	HORIZONTAL SEISMIC FORCE PER ASCE/SEI 7-16 SEISMIC FORCE REQUIREMENTS
Fvnet	VERTICAL FORCE RESULTANT FROM Fpw
Fpv	VERTICAL SEISMIC FORCE PER ASCE 7-16 SEISMIC FORCE REQUIREMENTS
Fy	SPECIFIED MINIMUM YIELD STRESS OF STEEL, KSI
GA	GAUGE
GR	GRADE
HCAI	DEPARTMENT OF HEALTH CARE ACCESS & INFORMATION
HORIZ	HORIZONTAL
IMC	INTERMEDIATE METAL CONDUIT
IN (")	INCH
INFO	INFORMATION
JST	JOIST
L	LENGTH
LBS	POUNDS
LONG	LONGITUDINAL
LRFD	LOAD & RESISTANCE FACTOR DESIGN
LWC	LIGHT WEIGHT CONCRETE
MAX	MAXIMUM
MEP	MECHANICAL, ELECTRICAL, PLUMBING
MFR	MANUFACTURER
MIN	MINIMUM
MTL	METAL
NA	NOT APPLICABLE
NO. (#)	NUMBER OR POUNDS
NWC	NORMAL WEIGHT CONCRETE
OPM	HCAI PRE-APPROVAL OF MANUFACTURER'S CERTIFICATION
PERP	PERPENDICULAR
PG	PAGE
PSI	POUNDS PER SQUARE INCH
R	RADIUS OF GYRATION
REINF	REINFORCING/REINFORCEMENT
REQ	REQUIRED
RMC	RIGID METAL CONDUIT
SCHED	SCHEDULE
SDS	SELF-DRILLING SCREW
SEOR	STRUCTURAL ENGINEER OF RECORD
SIM	SIMILAR
SLWC	SAND LIGHTWEIGHT CONCRETE
SMACNA	SHEET METAL AND AIR CONDITIONING CONTRACTOR'S NATIONAL ASSOCIATION
SMS	SHEET METAL SCREWS
STL	STEEL
STRUC	STRUCTURAL
T	ANCHORAGE TENSION REACTION DUE TO SEISMIC FORCE
T/C	TENSION OR COMPRESSION
THK	THICK/THICKNESS
THRD	THREAD/THREADED
TRAN	TRANSVERSE
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
V	ANCHORAGE SHEAR REACTION DUE TO SEISMIC FORCE
UL®	UNDERWRITERS' LABORATORIES
USD	ULTIMATE STRENGTH DESIGN
VERT	VERTICAL
W/	WITH
WF	WIDE FLANGE
Wp	WEIGHT OF INSULATED WATER-FILLED PIPE
WT	WEIGHT

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SHEET TITLE: OVERVIEW & GENERAL NOTES
ABBREVIATIONS

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TRADEMARK FOOTNOTES:

FOOTNOTES:

ACI IS A REGISTERED TRADEMARK OF THE AMERICAN CONCRETE INSTITUTE
AISC IS A REGISTERED TRADEMARK OF THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ASCE IS A REGISTERED TRADEMARK OF AMERICAN SOCIETY OF CIVIL ENGINEERS
ASME IS A REGISTERED TRADEMARK OF AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASTM IS A REGISTERED TRADEMARK OF AMERICAN SOCIETY FOR TESTING AND MATERIALS
CADDY, CADWELD, CRITEC, ERICO, ERIFLEX, ERITECH, AND LENTON ARE REGISTERED TRADEMARKS OF ERICO INTERNATIONAL CORPORATION
ELCO IS A REGISTERED TRADEMARK OF INFASTECH INTELLECTUAL PROPERTIES Pte, LTD.
FM IS A REGISTERED CERTIFICATION MARK OF FM APPROVALS LLC, LTD
POWER-STUD+, SNAKE+, MINI-UNDERCUT+, WOOD-KNOCKER, WOOD-KNOCKER II+ & HANGERMATE+ ARE REGISTERED TRADEMARKS OF DEWALT/POWERS FASTENERS, INC.
KWIK BOLT TZ & HDI-P TZ ARE REGISTERED TRADEMARKS OF HILTI, INC.
STRONG-BOLT 2 & TITEN HD ARE REGISTERED TRADEMAKRS OF SIMPSON STRONG-TIE COMPANY, INC.
TRUBOLT & TRUBOLT+ ARE REGISTERED TRADEMARKS OF ITW RED HEAD
UL IS A REGISTERED TRADEMARK OF UL, LLC.

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TRADEMARK FOOTNOTES

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SUPPORT AND ATTACHMENT MATERIAL STANDARDS:

SUPPORT	STANDARD	SUPPLEMENTARY SUPPORT & ATTACHMENT	STANDARD
CSB	ASTM A1011 GR 36	BRACE & PIPE CLAMPS	
		SCREW	HRS GR 1045
		NUT	HRS GR 1045
		CARRIAGE BOLT	ASTM A307
CSBBRP	ASTM A449 & A563, (PLATING) B633 & A123	CLAMP BRACKET	ASTM A36
		CASTING	ASTM A536
		HEX BOLT	ASTM A449
CSBBRS	ASTM A536, (PLATING) B633 & A123		
BRACE PIPE, 1", 1¼", 1½", 2"	ASTM A53 GR B		
THREADED ROD, ⅜", ½", ⅝", ¾"	ASTM A36		
		EXPANSION ANCHORS	REFER TO GENERAL NOTE 2
CSBMA	ASTM® A36, (PLATING) B633 & A123		
CSBQG	ASTM A449 & A563, (PLATING) B633 & A123	CLAMP BRACKET	ASTM A36
		CLAMPING BAR	ASTM A36
		FLANGE NUT	A563 GR B
		HEX BOLT	ASTM A449
CSBQIKCL	ASTM® A536, (PLATING) B633 & A123	CLAMP BRACKET	ASTM A36
		U-BOLT	ASTM A36
		FLANGE NUT	GB699
		SHEAR NUT	Y15P6
CSBS1, CSBS1A, CSBS2, CSBS3, CSBS4, CSBS5	ASTM A1018 HSLA-F GR 50	CLAMP MAIN BODY	
		CONE POINT SCREW	HRS GR 1045
		CARRIAGE BOLT	ASTM A307
		SERRATED FLANGE NUT	GR 5
		SHEAR OFF NUT	GR 5

FOR CONTINUATION, SEE FOLLOWING PAGE

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SHEET TITLE: OVERVIEW & GENERAL NOTES
COMPONENT MATERIAL STANDARDS

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SUPPORT AND ATTACHMENT MATERIAL STANDARDS (CONTINUED):

SUPPORT	STANDARD	SUPPLEMENTARY SUPPORT & ATTACHMENT	STANDARD
CSBT	ASTM A36	TELESCOPING PIPES SCH 10	Fy= 28 KSI
		RIVETS	GR C1006
		V-BOLT	ASTM A307
		5/16"ø SELF-TAPPING SCREW	ELCO ECC720
		STAMPING & CSBTB1	ASTM A36
		NUTS ON THRD ROD	Fy= 55 KSI
CSBU1 & CSBU2 BODY & BASE	ASTM A1011 GR 36	RIVET	CHS GR 1006
		CONE POINT SCREW	HRS GR 1045
CSBUS1 & CSBUS2	ASTM A1011 GR 36	BASE	ASTM A109
		RIVET	CHS GR 1006
		SHEAR BOLT	Y15
		STRUT NUT	SAE 1015-1020
CSBUS1PA & CSBUS2PA	ASTM A36	BASE	ASTM A36
		BOLT & NUT	ANSI 1218
		SHEAR BOLT	Y15
		STRUT NUT	SAE 1015-1020
ERICO TYPE A STRUT	ASTM A653 CS TYPE A: Fy= 25 KSI MIN		
UNISTRUT P1001	ASTM A653 GR 33		
UNISTRUT WOLF WASHER			
UNISTRUT P1010 SPRING NUT			
BRACE EMT	ANSI C 80.3 (NTC-105): UL 797		

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SUPPORT AND ATTACHMENT MATERIAL STANDARDS (CONTINUED):

SUPPORT	STANDARD	SUPPLEMENTARY SUPPORT & ATTACHMENT	STANDARD
320W	ASTM A109 NO.3 Fu= 55 KSI MIN		
325	ASTM A1011CS TYPE B, Fy= 30 KSI MIN		
328	ASTM A1011 GR 1010		
329	ASTM A570; (PLATING) ASTM B633		
CSBRS1	ASTM A1008 CS TYPE B Fy= 20 KSI MIN		
		HEX SCREW	GRADE 5
		HEX NUT	GRADE 5
CSBRS2, CSBRS3, CSBRS4, CSBRS5, CSBRS6	AISI 316 SS		
401	ASTM A1011 Fy= 30 KSI MIN; (PLATING) ASTM B633	TOP & BOTT	
		CROSS-BOLT	ASTM A307 GRADE A
		HEX NUT	ASTM A563 GRADE B
CSBR1	ASTM A1011 GR 36; (PLATING) B633	STAMPED BODY	
		CONE POINT SCREW	HRS GR 1045 Fy= 51.5 KSI MIN
		CARRIAGE BOLTS	GRADE 5
		SHEAR OFF NUT	HRS GR 1045 Fy= 56.6 KSI MIN
CSBR2	ASTM A1011 GR 36; (PLATING) B633	STAMPED BODY	
		SEAR BOLTS	HRS GR 1045
		CARRIAGE BOLTS	GRADE 5
		SHEAR OFF NUT	HRS GR 1045 Fy= 56.6 KSI MIN
		STRUT NUT	SAE 1015-1020
429	ASTM A1011 Fy= 30 KSI MIN; (PLATING) ASTM B633	CLAMP HALVES	
		HEX NUT	GB699
		MULTI-HEAD SCREW	TENSILE STRENGTH= 700 N/mm2
		O-RING	NATURAL RUBBER
		SPACER	POLYETHYLENE

FOR CONTINUATION, SEE FOLLOWING PAGE

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SUPPORT AND ATTACHMENT MATERIAL STANDARDS (CONTINUED):

SUPPORT	STANDARD	SUPPLEMENTARY SUPPORT & ATTACHMENT	STANDARD
CCC	ASTM A1011 Fy= 30 KSI MIN; (PLATING) ASTM B633	CLAMP MAIN BODY	
		CUSHION INSULATIOM	THERMOPLASTIC ELASTOMER, SHORE A 85-105
		ROUND HEAD SQ SHANK BOLT	ASTM A307 GRADE A
		NYLON LOCK NUT	ASTM A563 GRADE A
SCH-B	ASTM A109; (PLATING) ASTM A653	STAMPED CLAMPS	
		SCREW	ASTM A108 GR 1018
		SADDLE	ASTM A563 GRADE A
USC	ASTM A1011 Fy= 30 KSI MIN; (PLATING) ASTM B633	STAMPED CLAMPS	
		SCREW-BOLT	ASME B18.6.3
BC200000EG	HRS GR 1008		
EZR	ASTM A1011 Fy= 30 KSI MIN; (PLATING) ASTM B633	STAMPED CLAMPS	
		CARRIAGE BOLTS	ASTM A449
		SERRATED FLANGE HEX NUT	ASTM A563 GRADE B
ERICO STRUT NUT	SAE 1015-1020	STAMPED BODY	

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DESIGN PARAMETERS & BRACING GUIDELINES – PIPING & CONDUIT:

1. DESIGN AND INSTALLATION OF THE SEISMIC BRCG FOR PIPING & CONDUIT SYSTEMS MUST CONFORM TO ASCE/SEI 7–16 CHAPTER 13.
2. DTLS OF THE SUPPORT AND BRCG OF PIPING & CONDUIT SYSTEMS MUST COMPLY W/ THE 2019 CBC SECTION 1613A EARTHQUAKE LOADS & SECTION 1617A MODIFICATIONS TO ASCE 7.
3. THE CRDP MUST PROVIDE DTLS AND CALCULATIONS FOR THE SEISMIC BRCG AND THEIR SUPPORTS & ATTACHMENTS TO THE STRUCTURE. WHERE APPLICABLE, DTLS FOR THE SUPPORT AND BRCG MAY BE REFERRED TO THIS HCAI PRE–APPROVAL. ALL LAYOUT DRAWINGS OF THE PIPING OR CONDUIT SYSTEM MUST BE SUBMITTED TO HCAI FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.
4. THE CRDP MUST DETERMINE THE CONFIGURATION OF THE PIPING OR CONDUIT SYSTEM AND THE DEMAND LOADS ON ALL PIPING OR CONDUIT COMPONENTS, BRCG, AND SUPPORTS & ATTACHMENTS. THE CRDP MUST DETERMINE THE GOVERNING CAPACITY & WEAKEST LINK IN THE LOAD PATH FOR EACH DESIRED BRCG COMBINATION BASED ON THE CAPACITY OF THE INDIVIDUAL ELEMENTS BLW:
   A. THE ALLOWABLE HORIZ CAPACITY F_H OF THE BRACE COMPONENT ATTACHED TO THE SERVICE PIPE OR CONDUIT AS GIVEN IN SECTION 500 (BASED ON TESTING).
   B. THE ALLOWABLE AXIAL CAPACITY OF THE LATERAL BRACE OR BRANCH LINE RESTRAINT ROD AS GIVEN IN SECTION 400.
   C. THE ALLOWABLE HORIZ CAPACITY F_H OF THE BRACE COMPONENT ATTACHED TO THE STRUCTURE ARE GIVEN AT THE END OF THE TABLE IN SECTION 600 (BASED ON TESTING).
   D. THE CAPACITY OF THE ANCHORAGE TO CONC ARE GIVEN IN APPENDIX A. THE TENSION AND SHEAR VALUES WERE DETERMINED USING ACI® 318–14 AND LISTED ICC ESR REPORTS. THE CRDP MUST DETERMINE IF THE DEMAND LOADS EXCEED THE COMBINED FORCES CHECK PER ACI 318–14, SECTION 17.
5. THE DEAD LOADS OF INSULATED WATER FILLED PIPES MAY BE FOUND IN SECTION 200 & THE DEAD LOADS OF CABLE FILLED CONDUITS (PIPE) MAY BE FOUND IN SECTION 201.
6. SEISMIC BRCG MUST HAVE A MAX SPACING NOT EXCEEDING THAT SPECIFIED IN SECTIONS 200 & 201.
7. SEISMIC BRCG MUST BE LIMITED TO AN L/R RATIO AS SPECIFIED IN SECTION 400.
8. SEISMIC BRACE ANCHORAGE MUST BE AT LEAST 6" AWAY FROM ANY OTHER ANCHORAGE OR CONC EDGES UNO IN SECTION 1.
9. FOR EXAMPLES OF THE SEISMIC BRACE DESIGN PROCEDURE, SEE SECTIONS 300 & 301.
10. IT IS THE RESPONSIBILITY OF THE CRDP TO DETERMINE THE GOVERNING SEISMIC LOADS.

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DESIGN PARAMETERS & BRACING GUIDELINES – PIPING & CONDUIT (CONTINUED):

11. A RUN OF PIPE OR CONDUIT IS CONSIDERED A CONTINUOUS RUN IF THE MAX OFFSET IS LESS THAN 24". IF THE OFFSET IS 24" OR GREATER, EA STRAIGHT SEGMENT MUST BE TREATED AS AN INDEPENDENT RUN AND BRACED. REFER TO PARTIAL PLAN ON PG 1.103 PLEASE NOTE THAT RIGID GROOVED COUPLING LISTED FOR UL® STANDARD 213 MUST BE PERMITTED IN HORIZ RUN OF SERVICE PIPE. FLEXIBLE GROOVED COUPLING LISTED FOR UL STANDARD 213 MUST BE PERMITTED IN VERT RISERS (TO ACCOMMODATE DRIFT) AND OTHER LOCATION (e.g. SEISMIC SEPARATION, EQUIPMENT NOZZLE, ETC.) TO ACCOMMODATE SMALL MOVEMENT AND/OR ROTATION. NON–UL LISTED GROOVED COUPLINGS MUST NOT BE USED UNLESS APPROVED ON PROJECT SPECIFIC BASIS.
12. TRANSVERSE BRCG:
    A. TRANSVERSE BRCG IS TO PROTECT PIPING OR CONDUIT AGAINST MOVEMENT PERP TO THE RUN OF PIPE OR CONDUIT.
    B. TRANSVERSE BRCG MUST BE PROVIDED ON ALL PIPING OR CONDUIT W/ A DIA OF 2½" AND LARGER.
    C. MAX SPACING OF TRANSVERSE BRCG FOR PIPING OR CONDUIT MUST BE AS PROVIDED IN SECTION 200 OR 201. REFER TO PARTIAL PLAN ON PG 1.104.
    D. A TRANSVERSE BRACE PLACED ON THE PIPE OR CONDUIT RUN SECTION AT THE OPPOSITE SIDE OF AN ELBOW WITHIN 24" MAY ACT AS A LONGITUDINAL BRACE. THE TRANSVERSE BRACE ACTING AS A LONGITUDINAL BRACE MUST NOT HAVE THE TRIBUTARY LOAD GOING TO IT EXCEED THAT GOING TO A TYP TRANSVERSE BRACE. REFER TO PARTIAL PLAN ON PG 1.104.
    E. THE MIN REQ BRCG FOR RUNS LONGER THAN 5 FEET IS A TRANSVERSE BRACE AT EA END, AND A LONGITUDINAL BRACE AT ONE OF THOSE TWO POSITIONS. REFER TO PARTIAL PLAN ON PG 1.105.
    F. BRCG INSTALLED TO SMALLER PIPING OR CONDUIT MUST NOT BE USED TO BRACE LARGER PIPING OR CONDUIT.
13. LONGITUDINAL BRCG:
    A. LONGITUDINAL BRCG IS TO PROTECT PIPING OR CONDUIT AGAINST MOVEMENT PARALLEL TO THE RUN OF PIPE OR CONDUIT.
    B. MAX SPACING OF LONGITUDINAL BRCG FOR PIPING OR CONDUIT MUST NOT EXCEED 3 TIMES THE ALLOWABLE TRANSVERSE BRACE SPACING AS PROVIDED IN SECTION 200 OR 201. REFER TO PARTIAL PLAN ON PG 1.104.
    C. EA PIPE OR CONDUIT RUN MUST HAVE AT LEAST ONE LONGITUDINAL BRACE. ADDITIONAL LONGITUDINAL BRACES ARE REQ WHEN THE MAX LONGITUDINAL SPACING IS EXCEEDED. REFER TO PARTIAL PLANS ON PGS 1.103, 1.104 & 1.105.

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DESIGN PARAMETERS & BRACING GUIDELINES – PIPING & CONDUIT (CONTINUED):

14. VERT OFFSETS/RISERS:
    A. TOPS OF VERT OFFSETS/RISERS EXCEEDING 3 FEET IN LENGTH MUST BE PROVIDED W/ A FOUR–WAY BRACE. BRCG MUST BE LOCATED WITHIN 24" OF THE END OF THE VERT RUN. REFER TO PARTIAL ISOMETRIC A ON PG 1.106.
    B. PER 2019 CPC TABLE 313.3, DISTANCE BTW FOUR–WAY BRACES FOR RISERS MUST NOT EXCEED 25 FEET FOR STL PIPE, 10 FEET FOR COPPER PIPE, & 15 FEET FOR CAST IRON PIPE.
    C. THE VERT PIPING OR CONDUIT SYSTEM MUST BE SEISMICALLY BRACED AS IT PASSES THRU A FLR OR ROOF PENETRATION. THE SEISMIC BRACE SUPPORT MUST CONSIST OF A STRUT OR STL MEMBER ATTACHED TO THE CONC FLR OR STRU FLR FRMG MEMBERS. SUPPORTS & ATTACHMENTS FOR EACH RISER MUST BE DESIGNED FOR ALL GRAVITY, SEISMIC, & THERMAL LOADS. RELATIVE DISPLACEMENT BETWEEN FLOORS MUST BE CONSIDERED IN THE DESIGN & THE DESIGN IS SUBJECT TO APPROVAL BY HCAI. AS AN ALTERNATE, VERT PIPING OR CONDUIT SYSTEMS SUPPORTED AT EA FLR MUST BE CONSIDERED SEISMICALLY BRACED IF THE PENETRATION THROUGH EA FLR IS TIGHTLY PACKED W/ APPROVED FIRESTOPS, SATISFYING NFPA 13–16 SECTION 9.3.5.8.5 & THE FLR TO FLR SPACING DOES NOT EXCEED THE MAX BRACE SPACING SHOWN IN SECTION 200 OR 201.
15. WHEN CALCULATING HORIZ LOAD REQUIREMENTS, USE TABLES FROM SECTION 200 OR 201 TO CALCULATE THE WT OF INSULATED WATER FILLED PIPE OR CABLE FILLED CONDUIT.
16. FOR LATERAL SEISMIC BRACE AXIAL CAPACITY AND ALLOWABLE BRACE LENGTH, SEE TABLES IN SECTION 400.
17. DO NOT BRACE THE PIPING OR CONDUIT SYSTEM TO TWO DIFFERENT PARTS OF A BLDG WHICH MAY ACT DIFFERENTLY IN RESPONSE TO AN EARTHQUAKE (i.e., SEPARATED BY A SEISMIC JOINT). ANY SYSTEM THAT CROSSES A BLDG SEPARATION OR SEISMIC JOINT MUST BE DESIGNED TO ACCOMMODATE THE SEISMIC RELATIVE DISPLACEMENT PER ASCE/SEI 7–16, SECTION 13.3.2 OR AS SPECIFIED BY THE STRUCTURAL ENGINEER OF RECORD ON THE HCAI APPROVED CONSTRUCTION DOCUMENTS.

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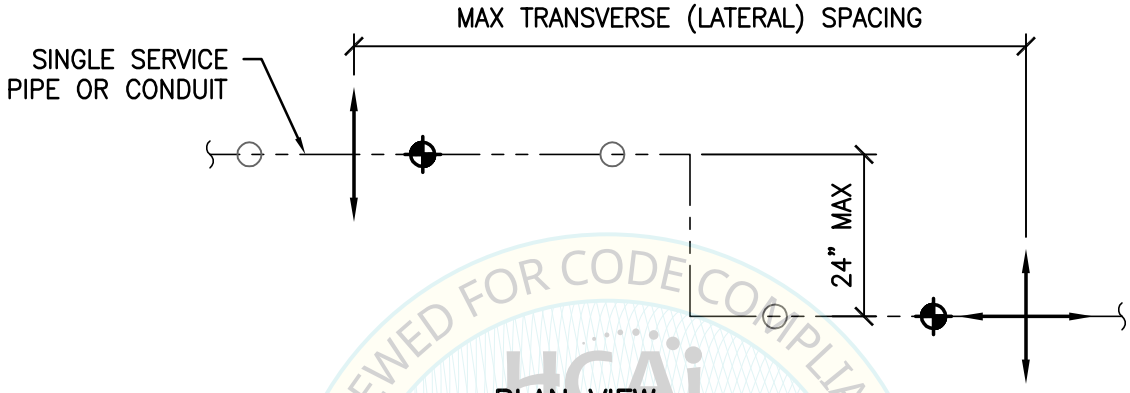

PLAN VIEW

LEGEND:

- TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 2 TO 10
- TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 2 TO 10
- VERT SEISMIC BRACE – MUST BE WITHIN 6" OF ALL TRANSVERSE AND LONGITUDINAL BRACES
- VERT PIPE OR CONDUIT HANGER (NOT PART OF OPM) SHOWN FOR REFERENCE ONLY

NOTES:

1. FOR LOCATION OF VERT SEISMIC BRACES, SEE SECTION 1 – HOW TO USE THIS PRE-APPROVAL.
2. A VERT PIPE OR CONDUIT HANGER IS NOT A VERT SEISMIC BRACE & IS NOT PART OF THIS OPM.

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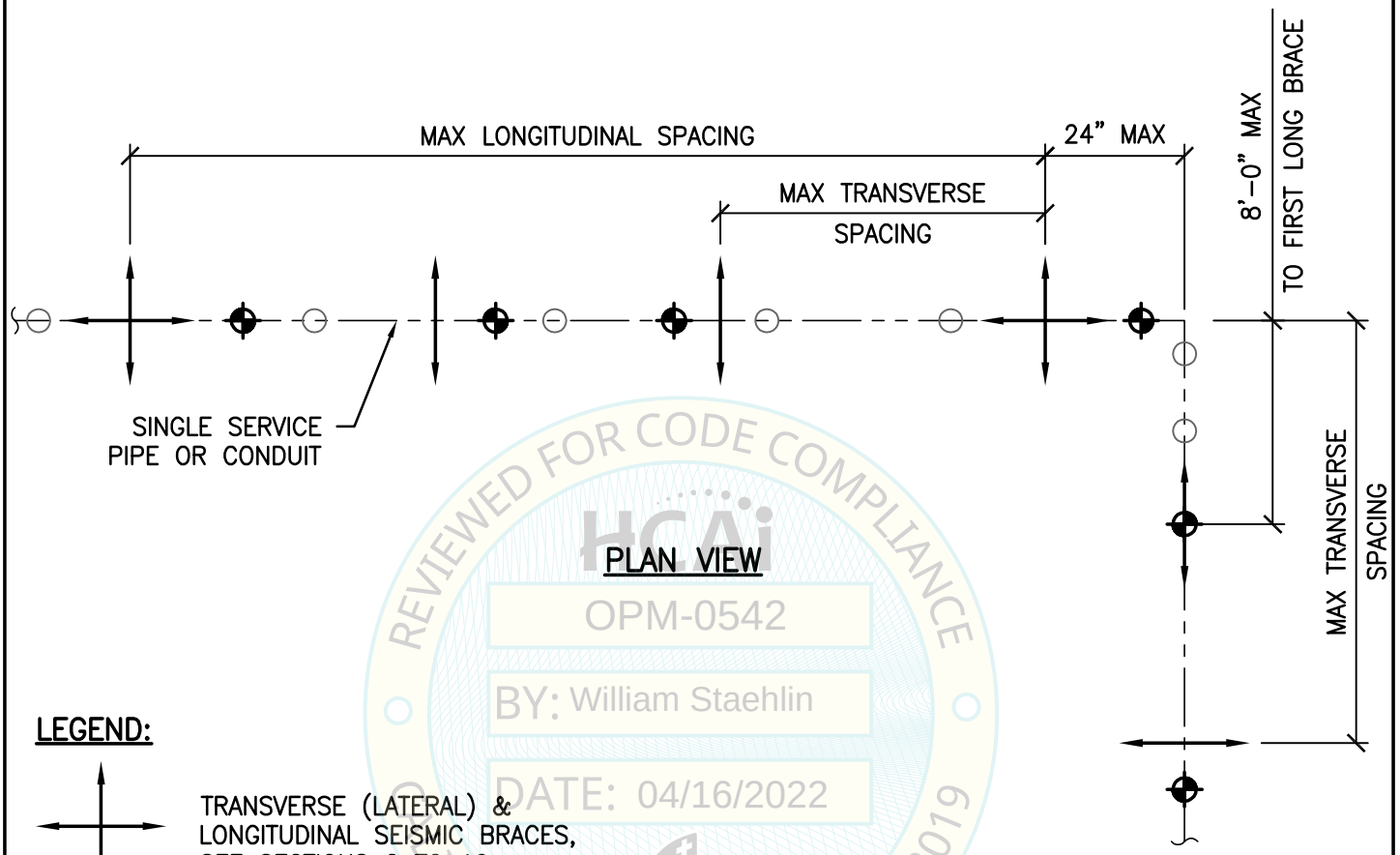

PLAN VIEW

LEGEND:

- TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 2 TO 10
- TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 2 TO 10
- VERT SEISMIC BRACE – MUST BE WITHIN 6" OF ALL TRANSVERSE AND LONGITUDINAL BRACES
- VERT PIPE OR CONDUIT HANGER (NOT PART OF OPM) SHOWN FOR REFERENCE ONLY

NOTES:

1. FOR LOCATION OF VERT SEISMIC BRACES, SEE SECTION 1 – HOW TO USE THIS PRE–APPROVAL.
2. A VERT PIPE OR CONDUIT HANGER IS NOT A VERT SEISMIC BRACE & IS NOT PART OF THIS OPM.

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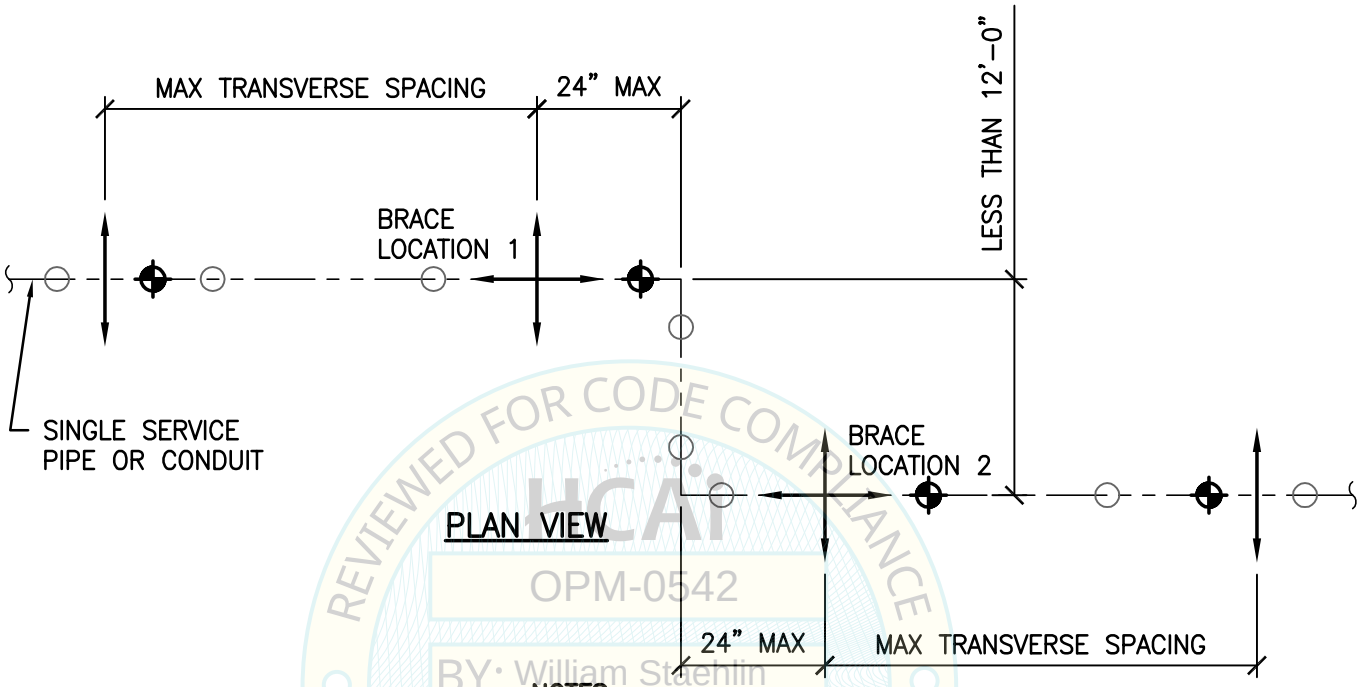

PLAN VIEW

LEGEND:

- TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 2 TO 10
- TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 2 TO 10
- VERT SEISMIC BRACE – MUST BE WITHIN 6" OF ALL TRANSVERSE AND LONGITUDINAL BRACES
- VERT PIPE OR CONDUIT HANGER (NOT PART OF OPM) SHOWN FOR REFERENCE ONLY

NOTES:

1. FOR LOCATION OF VERT SEISMIC BRACES, SEE SECTION 1 – HOW TO USE THIS PRE–APPROVAL.
2. AT LEAST ONE LONGITUDINAL BRACE IS REQ AT EA OF THE TWO CONTINOUS RUNS SHOWN. A LONGITUDINAL BRACE MUST BE LOCATED AT BOTH BRACE LOCATION 1 & BRACE LOCATION 2. THE MAX ALLOWABLE LONGITUDINAL BRACE SPACING MUST NOT BE EXCEEDED.
3. A VERT PIPE OR CONDUIT HANGER IS NOT A VERT SEISMIC BRACE & IS NOT PART OF THIS OPM.
4. NOTE THAT THE LONGITUDINAL BRACES LOCATED AT BRACE LOCATIONS 1&2 WILL ALSO ACT AS TRANSVERSE BRACES FOR THE SERVICE PIPE OR CONDUIT RUN LOCATED BTW THE TWO CONTINUOUS RUNS. ANY ADDITIONAL LOAD TO THE LONGITUDINAL BRACES MUST BE CONSIDERED IN THE BRACE EVALUATION.

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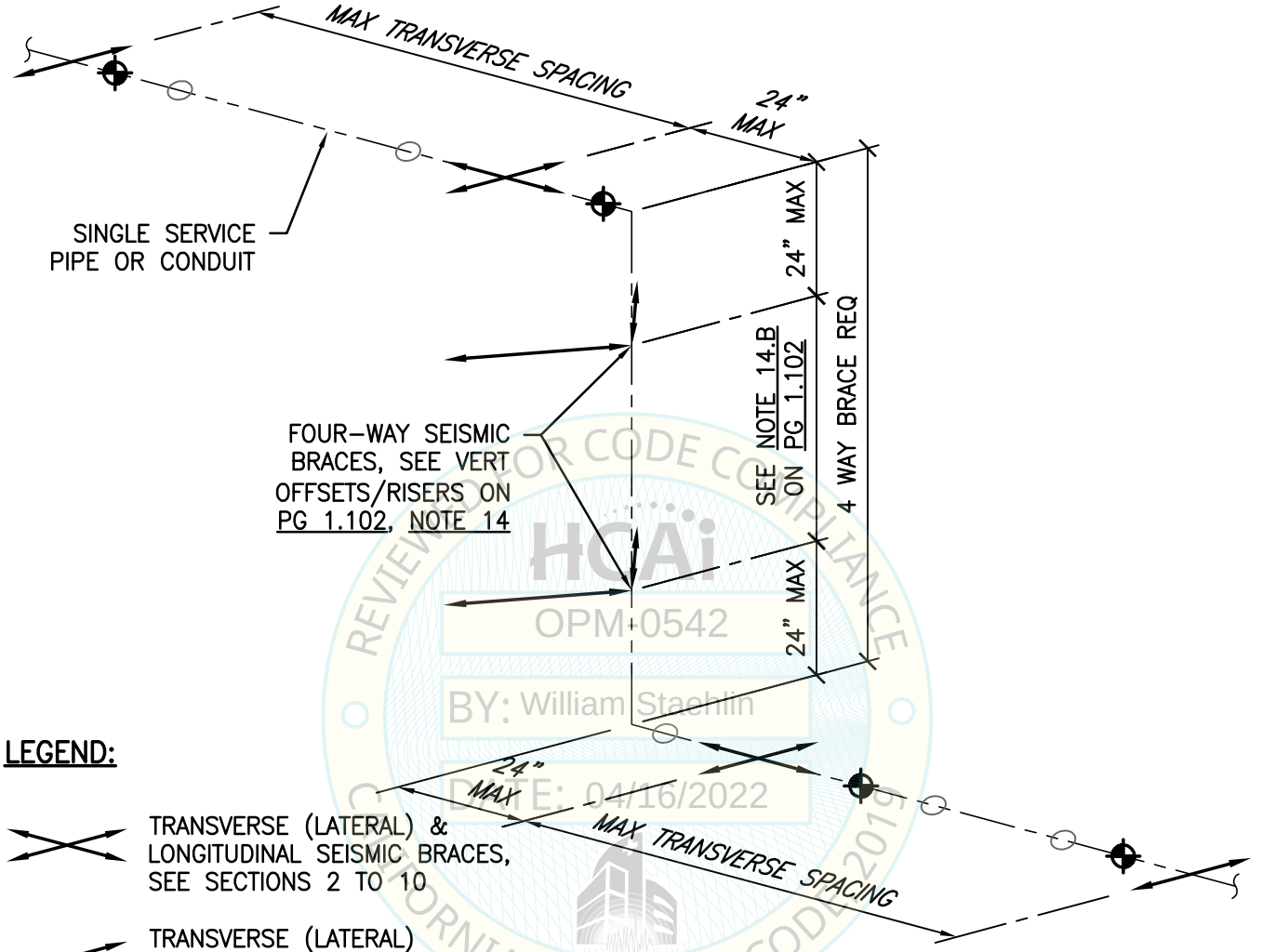

LEGEND:

TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 2 TO 10

TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 2 TO 10

FOUR-WAY RISER SEISMIC BRACES, SEE SECTION 9

VERT SEISMIC BRACE – MUST BE WITHIN 6" OF ALL TRANSVERSE AND LONGITUDINAL BRACES

VERT PIPE OR CONDUIT HANGER (NOT PART OF OPM) SHOWN FOR REFERENCE ONLY

NOTE:
FOR VERT RISERS AT FLOOR PENETRATIONS SEE NOTE 14 ON PG 1.102.

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DESIGN PARAMETERS & BRACING GUIDELINES – ELECTRICAL CABLE TRAYS:

1. DESIGN AND INSTALLATION OF THE SEISMIC BRCG FOR ELECTRICAL CABLE TRAY SYSTEMS MUST CONFORM TO ASCE/SEI 7-16 SECTION 13.
2. THE DTLS OF THE SUPPORT AND BRCG OF ELECTRICAL CABLE TRAY SYSTEMS MUST COMPLY W/ THE 2019 CBC SECTION 1613A EARTHQUAKE LOADS AND SECTION 1617A MODIFICATIONS TO ASCE 7.
3. THE CRDP MUST PROVIDE DTLS AND CALCULATIONS FOR THE SEISMIC BRCG AND THEIR SUPPORTS AND ATTACHMENTS TO THE STRUCTURE. WHERE APPLICABLE, DTLS FOR THE SUPPORT AND BRCG MAY BE REFERRED TO THIS HCAI PRE-APPROVAL. ALL LAYOUT DRAWINGS OF THE ELECTRICAL CABLE TRAY SYSTEM MUST BE SUBMITTED TO HCAI FOR REVIEW AND CABLE TRAY BRACE SPACING MUST BE APPROVED BY HCAI PRIOR TO INSTALLATION.
4. THE CRDP MUST DETERMINE THE CONFIGURATION OF THE ELECTRICAL CABLE TRAY SYSTEM AND THE DEMAND LOADS ON ALL ELECTRICAL CABLE TRAY COMPONENTS, BRCG, SUPPORTS AND ATTACHMENTS. THE CRDP MUST DETERMINE THE GOVERNING CAPACITY FOR EACH DESIRED BRCG COMBINATION BASED ON THE CAPACITY OF THE INDIVIDUAL ELEMENTS BLW:
   A. THE ALLOWABLE HORIZ CAPACITY F_H OF THE BRACE COMPONENT ATTACHED TO THE ELECTRICAL CABLE TRAY AS GIVEN IN SECTION 500 (BASED ON TESTING).
   B. THE ALLOWABLE AXIAL CAPACITY OF THE LATERAL BRACE OR BRANCH LINE RESTRAINT ROD AS GIVEN IN SECTION 400.
   C. THE ALLOWABLE HORIZ CAPACITY F_H OF THE BRACE COMPONENT ATTACHED TO THE STRUCTURE ARE GIVEN AT THE END OF THE TABLE IN SECTION 600 (BASED ON TESTING).
   D. THE CAPACITY OF THE SUPPORTS AND ATTACHMENTS TO CONC ARE GIVEN IN APPENDIX A. THE TENSION AND SHEAR VALUES WERE DETERMINED USING ACI® 318-14 AND LISTED ICC ESR REPORTS. THE CRDP MUST DETERMINE IF THE DEMAND LOADS EXCEED THE COMBINED FORCES CHECK PER ACI 318-14, SECTION 17.
   E. ECCENTRIC DISTRIBUTION MUST BE CONSIDERED WHEN DETERMINING THE VALUE USED IN DESIGN.
5. THE DEAD LOADS OF WIRE FILLED CABLE TRAYS MAY BE FOUND IN SECTION 202.
6. SEISMIC BRCG MUST HAVE A MAX SPACING NOT EXCEEDING THAT SPECIFIED IN THIS DESIGN PARAMETERS AND BRACING GUIDELINES SECTION FOR ELECTRICAL CABLE TRAYS AND SEISMIC BRCG RESTRAINTS MUST BE ATTACHED AT GENERAL SUPPORT LOCATIONS.
7. SEISMIC BRCG MUST BE LIMITED TO AN L/R RATIO AS SPECIFIED IN SECTION 400.
8. SEISMIC BRACE ANCHORAGE MUST BE AT LEAST 6" AWAY FROM ANY OTHER ANCHORAGE OR CONC EDGES UNO IN SECTION 1.
9. FOR EXAMPLES OF THE SEISMIC BRACE DESIGN PROCEDURE, SEE SECTION 302.
10. IT IS THE RESPONSIBILITY OF THE CRDP TO DETERMINE THE GOVERNING SEISMIC LOADS.

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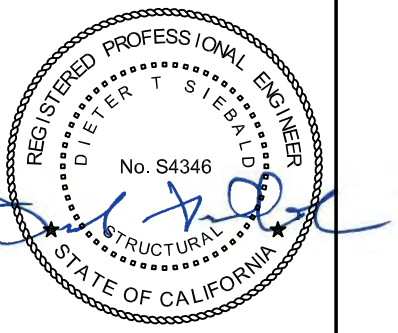
DESIGN PARAMETERS & BRACING GUIDELINES – ELECTRICAL CABLE TRAYS (CONTINUED):

11. A RUN OF ELECTRICAL CABLE TRAY IS CONSIDERED A CONTINUOUS RUN IF THE MAX OFFSET IS LESS THAN THE MAX DISTANCE ALLOWED BY THE MFR. IF THE OFFSET IS GREATER THAN THE MAX DISTANCE ALLOWED BY THE MFR, EA STRAIGHT SEGMENT MUST BE TREATED AS AN INDEPENDENT RUN AND BRACED. REFER TO PARTIAL PLAN ON PG 1.203. CABLE TRAY MUST BE SPLICED AS PER MFR.
12. TRANSVERSE BRCG:
    A. TRANSVERSE BRCG IS TO PROTECT ELECTRICAL CABLE TRAY AGAINST MOVEMENT PERP TO THE RUN OF ELECTRICAL CABLE TRAY. TRANSVERSE BRCG IS GOING TO BE LOCATED AT THE THREADED ROD SUPPORT WHICH NEEDS TO BE ADEQUATE FOR COMBINED GRAVITY & VERT SEISMIC LOADS.
    B. A TRANSVERSE BRACE PLACED ON THE ELECTRICAL CABLE TRAY RUN SECTION AT THE OPPOSITE SIDE OF AN ELBOW WITHIN THE MAX DISTANCE ALLOWED BY THE MFR MAY ACT AS A LONGITUDINAL BRACE. REFER TO PARTIAL PLAN ON PG 1.204.
    C. THE MIN REQ BRCG FOR RUNS LONGER THAN 5 FEET IS A TRANSVERSE BRACE AT EA END, AND A LONGITUDINAL BRACE AT ONE OF THOSE TWO POSITIONS. REFER TO PARTIAL PLAN ON PG 1.205.
    D. MULTIPLE COMPONENTS SUPPORTED BY TWO SINGLE HORIZ TRAPEZE STRUTS AS SHOWN ON PGS 16.1 THROUGH 16.3 MUST USE THE LEAST TRANSVERSE & LONGITUDINAL BRACE SPACING OF ALL THE COMPONENTS ATTACHED TO THE HORIZ TRAPEZE STRUTS.
    E. MAX ALLOWABLE SPACING OF TRANSVERSE BRCG FOR CABLE TRAY MUST NOT EXCEED THE MFR SPECIFICATIONS. REFER TO PARTIAL PLAN OF PG 1.204.
13. LONGITUDINAL BRCG:
    A. LONGITUDINAL BRCG IS TO PROTECT ELECTRICAL CABLE TRAY AGAINST MOVEMENT PARALLEL TO THE RUN OF ELECTRICAL CABLE TRAY. LONGITUDINAL BRCG IS GOING TO BE LOCATED AT THE THREADED ROD SUPPORT WHICH NEEDS TO BE ADEQUATE FOR COMBINED GRAVITY & VERT SEISMIC LOADS.
    B. EA ELECTRICAL CABLE TRAY RUN MUST HAVE AT LEAST ONE LONGITUDINAL BRACE. ADDITIONAL LONGITUDINAL BRACES ARE REQ WHEN THE MAX LONGITUDINAL SPACING IS EXCEEDED. REFER TO PARTIAL PLANS ON PGS 1.203, 1.204 & 1.205.
    C. MAX ALLOWABLE SPACING OF LONGITUDINAL BRCG FOR CABLE TRAY MUST NOT EXCEED THE MFR SPECIFICATIONS.
14. VERT OFFSETS/RISERS:
    A. TOPS OF VERT OFFSETS/RISERS EXCEEDING 3 FEET IN LENGTH MUST BE PROVIDED W/ A FOUR-WAY BRACE. BRCG MUST BE LOCATED WITHIN 24" OF THE END OF THE VERT RUN. REFER TO PARTIAL ISOMETRIC A ON PG 1.206. FOUR-WAY BRACING MUST BE DESIGNED BY THE DESIGN PROFESSIONAL. TRAPEZE TYPE SUPPORTS MAY BE USED. HOWEVER, CLIP ANGLES W/ SCREWS MUST BE USED TO ATTACH VERT CABLE TRAY TO THE HORIZ STRUT(S).
    B. DISTANCE BTW FOUR-WAY BRACES FOR RISERS MUST NOT EXCEED 10 FT & THOSE SPECIFIED BY THE MFR.
    C. VERT RISERS SUPPORTED AT A FLOOR MUST BE CONSIDERED SEISMICALLY BRACED AT THE FLR IF THE PENETRATION THROUGH THE FLR IS TIGHTLY PACKED WITH FIRE PROTECTION MATERIAL. FOR PENETRATIONS THROUGH FLR OPGS THAT ARE NOT TIGHTLY PACKED, SUPPORTS & ATTACHMENTS FOR EA RISER SHOWN IN DETAILS ON PG 13.4, MUST BE DESIGNED FOR ALL GRAVITY, SEISMIC, & THERMAL LOADS. RELATIVE DISPLACEMENT BTW FLRS MUST BE CONSIDERED IN THE DESIGN & THE DESIGN IS SUBJECT TO APPROVAL BY HCAI.



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15. WHEN CALCULATING HORIZ LOAD REQUIREMENTS, USE TABLES FROM SECTION 202 TO CALCULATE THE WT OF WIRE FILLED ELECTRICAL CABLE TRAY.
16. FOR LATERAL SEISMIC BRACE AXIAL CAPACITY AND ALLOWABLE BRACE LENGTH, SEE TABLES IN SECTION 400.
17. DO NOT BRACE THE ELECTRICAL CABLE TRAY SYSTEM TO TWO DIFFERENT PARTS OF A BLDG WHICH MAY ACT DIFFERENTLY IN RESPONSE TO AN EARTHQUAKE (i.e., SEPARATED BY A SEISMIC JOINT). ANY SYSTEM THAT CROSSES A BLDG SEPARATION OR SEISMIC JOINT MUST BE DESIGNED TO ACCOMMODATE THE SEISMIC RELATIVE DISPLACEMENT PER ASCE/SEI 7–16, SECTION 13.3.2 OR AS SPECIFIED BY THE STRUCTURAL ENGINEER OF RECORD ON THE HCAI APPROVED CONSTRUCTION DOCUMENTS.
18. CABLE TRAYS MUST BE POSITIVELY FASTENED TO THE SUPPORT AS DETAILED IN SECTION 13.

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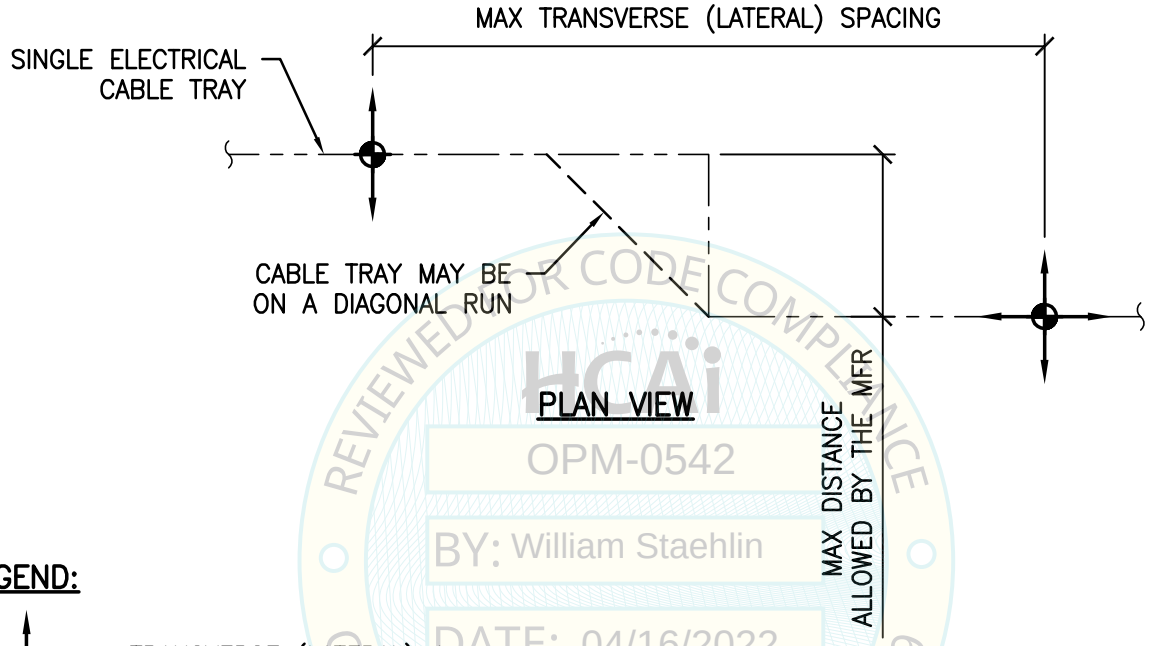

PLAN VIEW

LEGEND:

TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 13 & 16

TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 13 & 16

ELECTRICAL CABLE TRAY TRAPEZE SUPPORT W/ SEISMIC BRACES

NOTE:

1. CABLE TRAY TRANSVERSE & LONGITUDINAL BRACE SPCG MUST NOT EXCEED THOSE SPECIFIED BY THE MFR.

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No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: OVERVIEW & GENERAL NOTES
DESIGN PARAMETERS & BRACING GUIDELINES - ELECTRICAL CABLE TRAYS

CYS STRUCTURAL ENGINEERS, INC.
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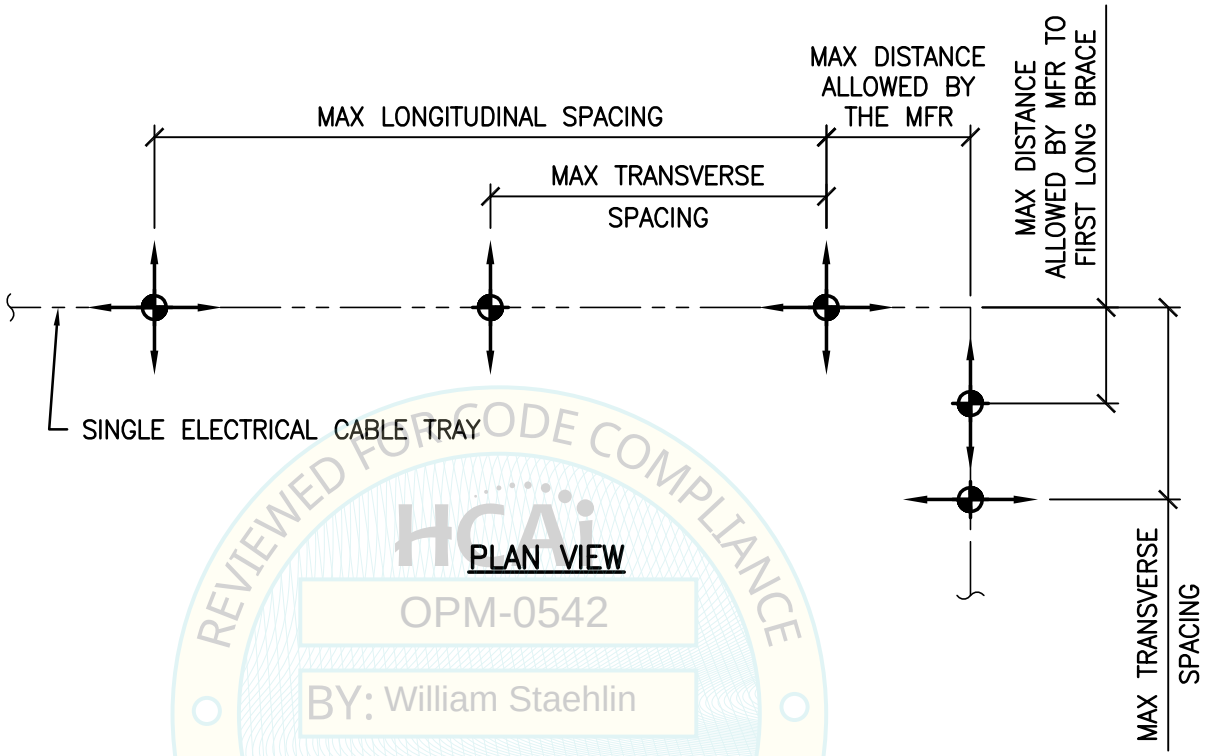
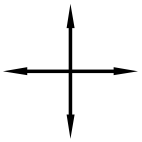
DESIGN PARAMETERS & BRACING GUIDELINES – ELECTRICAL CABLE TRAYS (CONTINUED):



PLAN VIEW

LEGEND:



TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 13 & 16

TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 13 & 16

ELECTRICAL CABLE TRAY TRAPEZE SUPPORT W/ SEISMIC BRACES

NOTE:

1. CABLE TRAY TRANSVERSE & LONGITUDINAL BRACE SPCG MUST NOT EXCEED THOSE SPECIFIED BY THE MFR.

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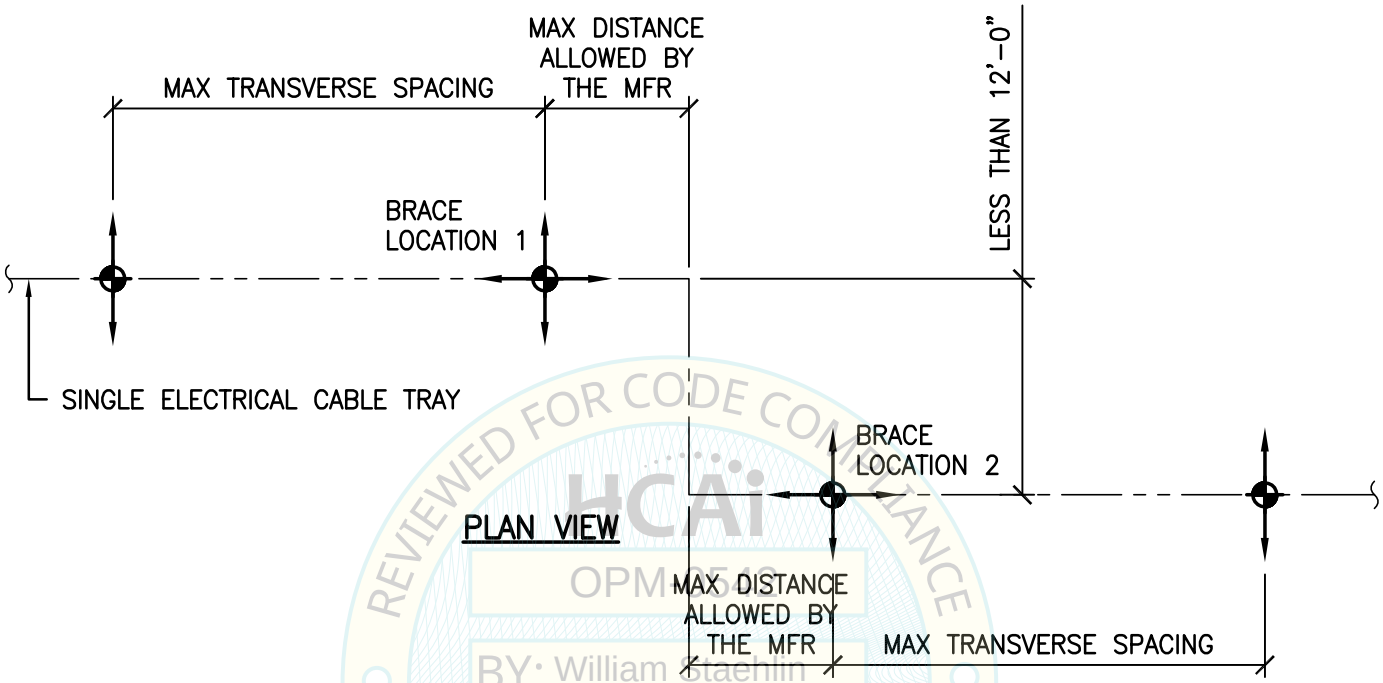
DESIGN PARAMETERS & BRACING GUIDELINES – ELECTRICAL CABLE TRAYS (CONTINUED):



PLAN VIEW

LEGEND:

TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 13 & 16

TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 13 & 16

ELECTRICAL CABLE TRAY TRAPEZE SUPPORT W/ SEISMIC BRACES

NOTES:

1. AT LEAST ONE LONGITUDINAL BRACE IS REQ. THE LONGITUDINAL BRACE MUST BE LOCATED AT EITHER BRACE LOCATION 1 OR BRACE LOCATION 2.
2. CABLE TRAY TRANSVERSE & LONGITUDINAL BRACE SPCG MUST NOT EXCEED THOSE SPECIFIED BY THE MFR.

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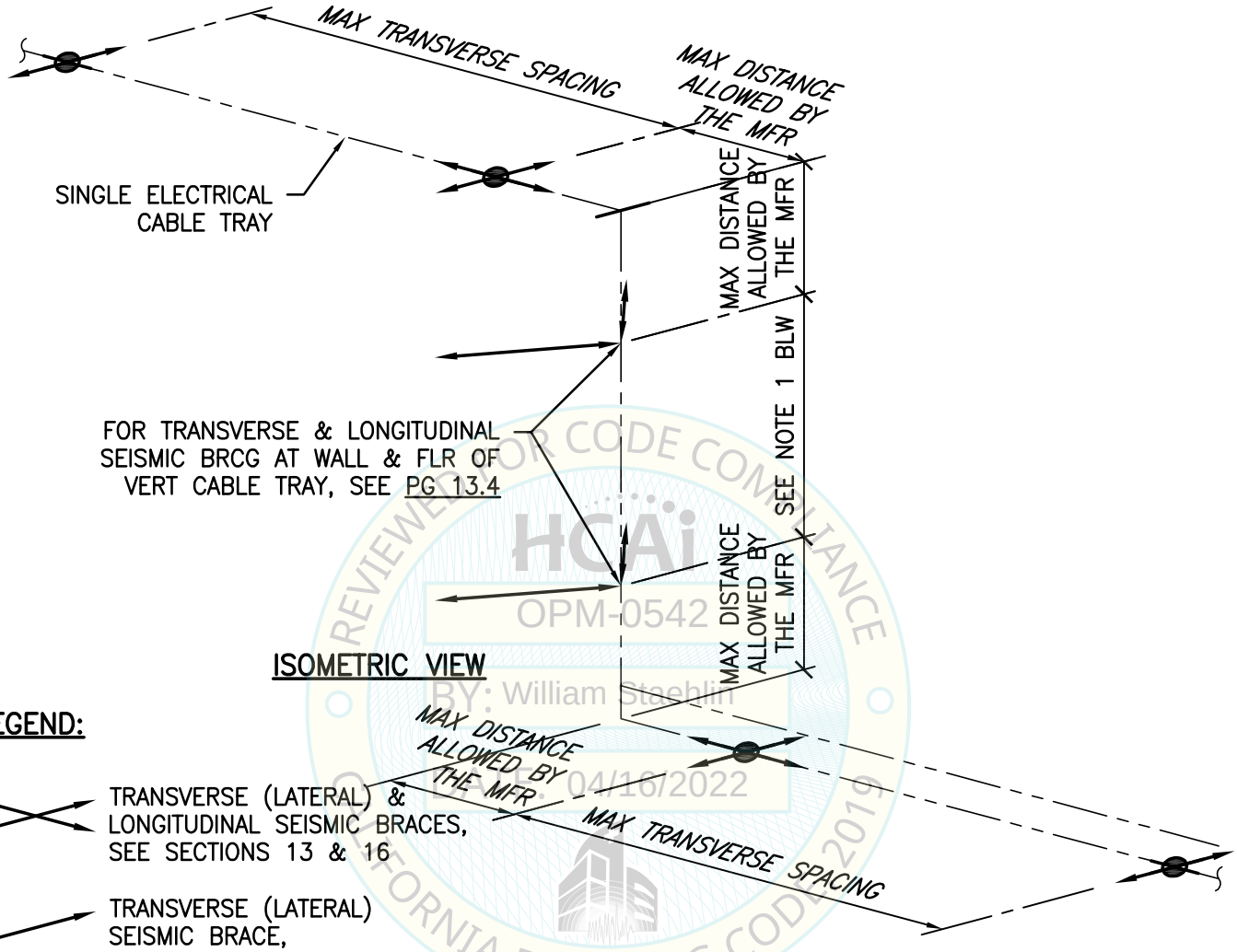
DESIGN PARAMETERS & BRACING GUIDELINES – ELECTRICAL CABLE TRAYS (CONTINUED):



ISOMETRIC VIEW

LEGEND:

TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 13 & 16

TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 13 & 16

ELECTRICAL CABLE TRAY TRAPEZE SUPPORT W/ SEISMIC BRACES

NOTES:

1. SPCG OF VERT RISERS MUST NOT EXCEED 10 FT & THOSE SPECIFIED BY THE MFR.
2. FOR VERT RISERS AT FLOOR PENETRATIONS SEE NOTE 14 ON PG 1.201.

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DESIGN PARAMETERS & BRACING GUIDELINES – RECTANGULAR & ROUND DUCTS:

1. DESIGN AND INSTALLATION OF THE SEISMIC BRCG FOR DUCTWORK SYSTEMS MUST CONFORM TO ASCE/SEI 7-16 SECTION 13 & 2019 CBC SECTION 1617.A.1.25.
2. THE SPACING AND DTLS OF THE SUPPORT AND BRCG OF DUCTWORK SYSTEMS MUST COMPLY W/ ASCE/SEI 7-16 SECTION 13.6 PER 2019 CBC SECTIONS 1601.1.4 & 1617A.1.18 APPLICABLE ONLY TO HCAI 1,2,4,5 & 1R DESIGNATED PROJECTS, DISTRIBUTED HVAC DUCTWORK AND FACTORY BUILT VENT DUCT WEIGHING 5 PLF OR LESS ARE EXEMPT FROM DESIGN FOR THE SEISMIC FORCES OF ASCE 7-16 §13.3., AND REMAINING DUCT SYSTEMS. DESIGN FOR THE SEISMIC FORCES AND RELATIVE DISPLACEMENTS SHALL NOT BE REQ FOR HVAC DUCTWORK & FACTORY BUILT VENT DUCT WHERE FLEXIBLE CONNECTIONS OR OTHER ASSEMBLIES ARE PROVIDED TO ACCOMMODATE THE RELATIVE DISPLACEMENT BTW THE DUCT SYSTEM & ASSOCIATED COMPONENTS, THE DUCT SYSTEM IS POSITIVELY ATTACHED TO THE STRUCTURE, AND WHERE ONE OF THE FOLLOWING APPLY:
   A. TRAPEZE ASSEMBLIES W/ ⅜" OR ½"ø ROD HANGERS NOT EXCEEDING 12" IN LENGTH FROM THE DUCT SUPPORT POINT TO THE CONNECTION AT THE SUPPORTING STRUCTURE ARE USED TO SUPPORT DUCT, AND THE TOTAL WT SUPPORTED BY ANY SINGLE TRAPEZE IS LESS THAN 10 PLF AND 100 LBS OR LESS; OR
   B. THE DUCT IS SUPPORTED BY INDIVIDUAL ROD HANGERS ⅜" OR ½"ø, AND EA HANGER IN THE DUCT RUN IS 12" OR LESS IN LENGTH FROM THE DUCT SUPPORT POINT TO THE CONNECTION AT THE SUPPORTING STRUCTURE, AND THE TOTAL WT SUPPORTED BY ANY SINGLE ROD IS 50 LBS OR LESS.
3. THE CRDP MUST PROVIDE DTLS AND CALCULATIONS FOR THE SEISMIC BRCG AND THEIR SUPPORTS AND ATTACHMENTS TO THE STRUCTURE. WHERE APPLICABLE, DTLS FOR THE SUPPORT AND BRCG MAY BE REFERRED TO THIS HCAI PRE-APPROVAL. ALL LAYOUT DRAWINGS OF THE DUCTWORK SYSTEM MUST BE SUBMITTED TO HCAI FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.
4. THE CRDP MUST DETERMINE THE CONFIGURATION OF THE DUCTWORK SYSTEM AND THE DEMAND LOADS ON ALL DUCTWORK COMPONENTS, BRCG, AND SUPPORTS AND ATTACHMENTS. THE CRDP MUST DETERMINE THE GOVERNING CAPACITY FOR EACH DESIRED BRCG COMBINATION BASED ON THE CAPACITY OF THE INDIVIDUAL ELEMENTS BLW:
   A. THE ALLOWABLE HORIZ CAPACITY F_H OF THE BRACE COMPONENT ATTACHED TO THE DUCTWORK AS GIVEN IN SECTION 500 (BASED ON TESTING).
   B. THE ALLOWABLE AXIAL CAPACITY OF THE LATERAL BRACE AS GIVEN IN SECTION 400.
   C. THE ALLOWABLE HORIZ CAPACITY F_H OF THE BRACE COMPONENT ATTACHED TO THE STRUCTURE ARE GIVEN AT THE END OF THE TABLE IN SECTION 600 (BASED ON TESTING).
   D. THE CAPACITY OF THE ANCHORAGE TO CONC ARE GIVEN IN APPENDIX A. THE TENSION AND SHEAR VALUES WERE DETERMINED USING ACI® 318-14 AND LISTED ICC ESR REPORTS. THE CRDP MUST DETERMINE IF THE DEMAND LOADS EXCEED THE COMBINED FORCES CHECK PER ACI 318-14, SECTION 17.
4. THE DEAD LOADS OF DUCTWORK MAY BE FOUND IN SECTION 202.
5. SEISMIC BRCG MUST HAVE A MAX SPACING NOT EXCEEDING THAT SPECIFIED IN THIS SECTION.
6. SEISMIC BRCG MUST BE LIMITED TO AN L/R RATIO AS SPECIFIED IN SECTION 400.
7. SEISMIC BRACE ANCHORAGE MUST BE AT LEAST 6" AWAY FROM ANY OTHER ANCHORAGE OR CONC EDGES UNO IN SECTION 1.
8. FOR AN EXAMPLE OF THE SEISMIC BRACE DESIGN PROCEDURE, SEE SECTION 302.
9. IT IS THE RESPONSIBILITY OF THE CRDP TO DETERMINE THE GOVERNING SEISMIC LOADS.

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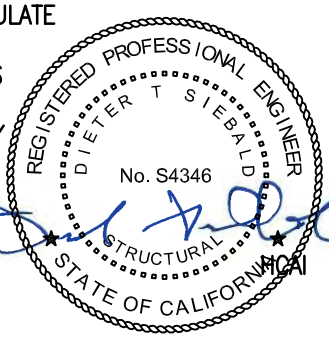
DESIGN PARAMETERS & BRACING GUIDELINES – RECTANGULAR & ROUND DUCTS (CONTINUED):

11. A RUN OF DUCTWORK IS CONSIDERED A CONTINUOUS RUN IF THE MAX OFFSET IS LESS THAN 24". IF THE OFFSET IS 24" OR GREATER, EA STRAIGHT SEGMENT MUST BE TREATED AS AN INDEPENDENT RUN AND BRACED. REFER TO PARTIAL PLAN ON PG 1.303.
12. TRANSVERSE BRCG:
    A. TRANSVERSE BRCG IS TO PROTECT DUCTWORK AGAINST MOVEMENT PERP TO THE RUN OF DUCTWORK.
    B. TRANSVERSE BRCG MUST BE PROVIDED ON ALL FEED AND CROSS DUCTS REGARDLESS OF SIZE. THE LAST LENGTH OF DUCTWORK AT THE END OF A FEED OR CROSS DUCT MUST BE PROVIDED W/ A TRANSVERSE BRACE.
    C. TRANSVERSE BRCG MAX SPACING FOR DUCTWORK CONFORMING TO SMACNA STANDARDS MUST BE 30 FT. REFER TO PARTIAL PLAN ON PG 1.304.
    D. A TRANSVERSE BRACE PLACED ON THE DUCTWORK RUN SECTION AT THE OPPOSITE SIDE OF AN ELBOW WITHIN 24" MAY ACT AS A LONGITUDINAL BRACE. REFER TO PARTIAL PLAN ON PG 1.304.
    E. THE MIN REQ BRCG FOR RUNS LONGER THAN 5 FEET IS A TRANSVERSE BRACE AT EA END, AND A LONGITUDINAL BRACE AT ONE OF THOSE TWO POSITIONS. REFER TO PARTIAL PLAN ON PG 1.302.
    F. BRCG INSTALLED TO SMALLER DUCTWORK MUST NOT BE USED TO BRACE LARGER DUCTWORK.
13. LONGITUDINAL BRCG:
    A. LONGITUDINAL BRCG IS TO PROTECT DUCTWORK AGAINST MOVEMENT PARALLEL TO THE RUN OF DUCTWORK.
    B. LONGITUDINAL BRCG MAX SPACING FOR DUCTWORK CONFORMING TO SMACNA STANDARDS MUST BE 60 FT. REFER TO PARTIAL PLAN ON PG 1.304.
    C. EA DUCTWORK RUN MUST HAVE AT LEAST ONE LONGITUDINAL BRACE. ADDITIONAL LONGITUDINAL BRACES ARE REQ WHEN THE MAX LONGITUDINAL SPACING IS EXCEEDED. REFER TO PARTIAL PLANS ON PGS 1.303, 1.304 & 1.305.
14. VERT OFFSETS/RISERS:
    A. TOPS OF VERT OFFSETS/RISERS EXCEEDING 3 FEET IN LENGTH MUST BE PROVIDED W/ A FOUR-WAY BRACE. BRCG MUST BE LOCATED WITHIN 24" OF THE END OF THE VERT RUN. REFER TO PARTIAL ISOMETRIC A ON PG 1.305. FOUR-WAY BRCG MUST BE DESIGNED BY THE DESIGN PROFESSIONAL. TRAPEZE TYPE SUPPORTS MAY BE USED. HOWEVER, CLIP ANGLES W/ SCREWS MUST BE USED TO ATTACH VERT DUCTS TO THE HORIZ STRUT(S).
    B. DISTANCE BTW FOUR-WAY BRACES FOR RISERS MUST NOT EXCEED 25 FEET.
    C. VERT DUCTWORK SYSTEMS SUPPORTED AT EA FLR SHALL CONSIDERED SEISMICALLY BRACED IF THE PENETRATION THROUGH EA FLR IS TIGHTLY PACKED AND THE FLR-TO-FLR SPACING IS NOT IN EXCESS OF 30 FEET.
    D. VERT DUCT RISERS IN AN OPEN SHAFT MUST BE ATTACHED TO STL SUPPORT WITH BOTH STL SUPPORTS AND CONNECTIONS SIZED TO ACCEPT THE COMBINED GRAVITY AND SEISMIC LOADS. THERMAL LOADS SHALL BE CONSIDERED, WHERE APPLICABLE. LATERAL SEISMIC RESTRAINT SPACING SHALL NOT EXCEED 30 FEET. SUPPORTS AND CONNECTIONS MUST BE ENGINEERED ON A JOB BY JOB BASIS SUBJECT TO APPROVAL BY THE ENFORCEMENT AGENCY. SEISMIC RELATIVE DISPLACEMENT BTW FLRS SHALL BE CONSIDERED IN THE DESIGN.
15. WHEN CALCULATING HORIZ LOAD REQUIREMENTS, USE TABLE FROM SECTION 202 TO CALCULATE THE WT OF DUCTWORK.
16. FOR LATERAL SEISMIC BRACE AXIAL CAPACITY AND ALLOWABLE BRACE LENGTH, SEE TABLES IN SECTION 400.
17. DO NOT BRACE THE DUCTWORK SYSTEM TO TWO DIFFERENT PARTS OF A BLDG WHICH MAY ACT DIFFERENTLY IN RESPONSE TO AN EARTHQUAKE (i.e., SEPARATED BY A SEISMIC JOINT). ANY SYSTEM THAT CROSSES A BLDG SEPARATION OR SEISMIC JOINT MUST BE DESIGNED TO ACCOMMODATE THE SEISMIC RELATIVE DISPLACEMENT PER ASCE/SEI 7-16, SECTION 13.3.2 OR AS SPECIFIED BY THE STRUCTURAL ENGINEER OF RECORD ON THE APPROVED CONSTRUCTION DOCUMENTS.



SHEET TITLE: OVERVIEW & GENERAL NOTES
DESIGN PARAMETERS & BRACING GUIDELINES - RECTANGULAR & ROUND DUCTS

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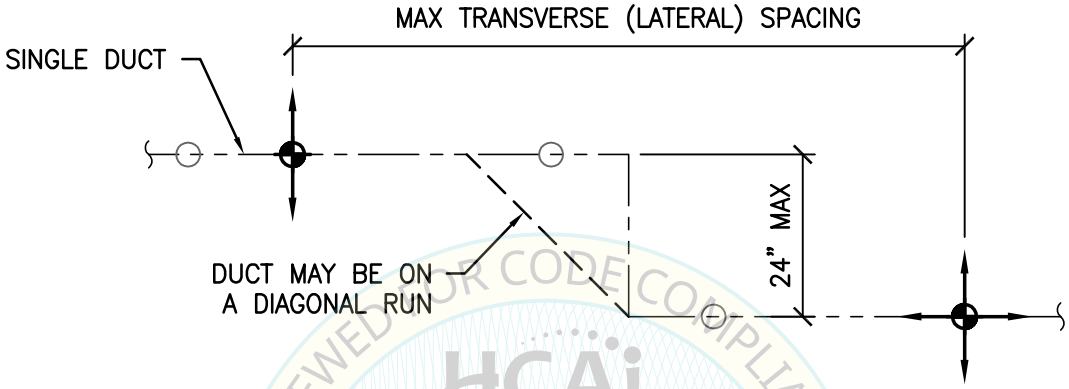
DESIGN PARAMETERS & BRACING GUIDELINES – RECTANGULAR & ROUND DUCTS (CONTINUED):



PLAN VIEW

LEGEND:

TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 14 & 15

TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 14 & 15

RECTANGULAR OR ROUND DUCT TRAPEZE SUPPORT W/ SEISMIC BRACE

RECTANGULAR OR ROUND DUCT TRAPEZE SUPPORT W/O SEISMIC BRACES (NOT PART OF OPM) SHOWN FOR REFERENCE ONLY

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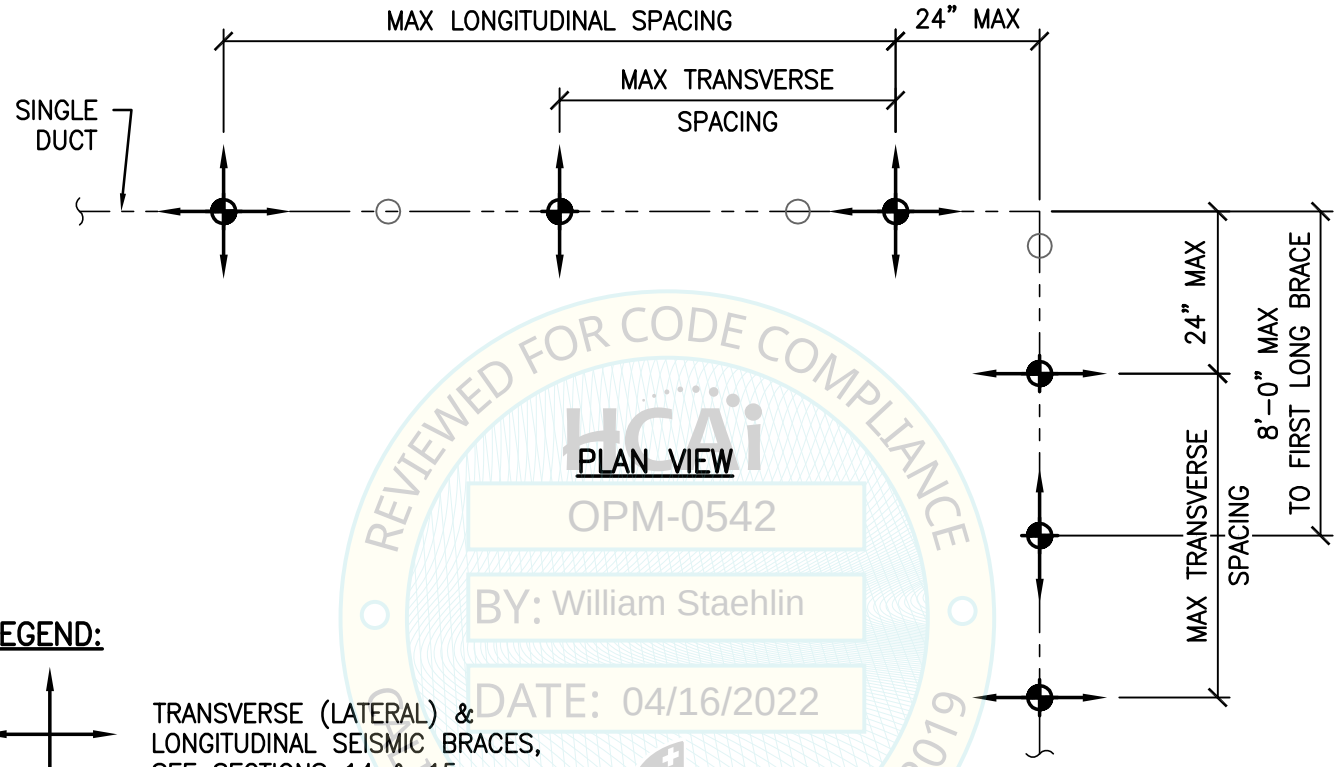
DESIGN PARAMETERS & BRACING GUIDELINES – RECTANGULAR & ROUND DUCTS (CONTINUED):



PLAN VIEW

LEGEND:

- TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 14 & 15
- TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 14 & 15
- RECTANGULAR OR ROUND DUCT TRAPEZE SUPPORT W/ SEISMIC BRACE
- RECTANGULAR OR ROUND DUCT TRAPEZE SUPPORT W/O SEISMIC BRACES (NOT PART OF OPM) SHOWN FOR REFERENCE ONLY

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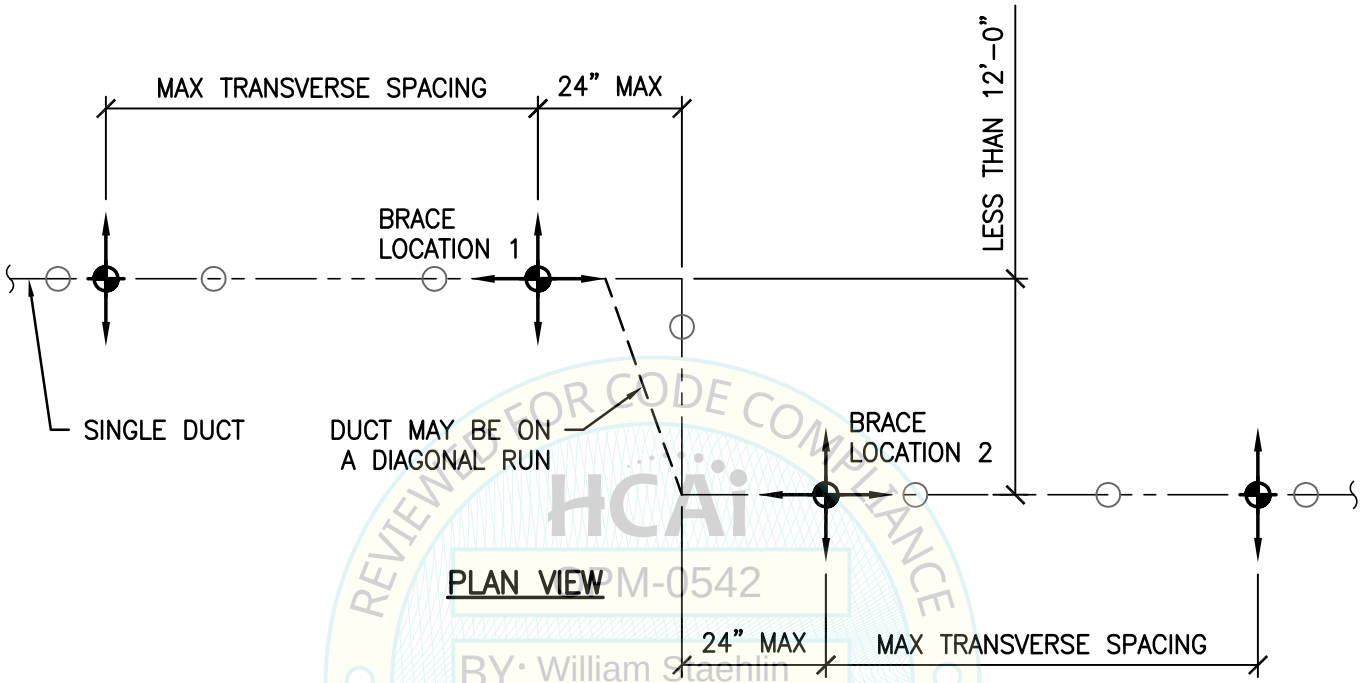
DESIGN PARAMETERS & BRACING GUIDELINES – RECTANGULAR & ROUND DUCTS (CONTINUED):



PLAN VIEW

LEGEND:

TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 14 & 15

TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 14 & 15

RECTANGULAR OR ROUND DUCT TRAPEZE SUPPORT W/ SEISMIC BRACE

RECTANGULAR OR ROUND DUCT TRAPEZE SUPPORT W/O SEISMIC BRACES (NOT PART OF OPM) SHOWN FOR REFERENCE ONLY

NOTE:

1. AT LEAST ONE LONGITUDINAL BRACE IS REQ. THE LONGITUDINAL BRACE MUST BE LOCATED AT EITHER BRACE LOCATION 1 OR BRACE LOCATION 2.

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SHEET TITLE: OVERVIEW & GENERAL NOTES
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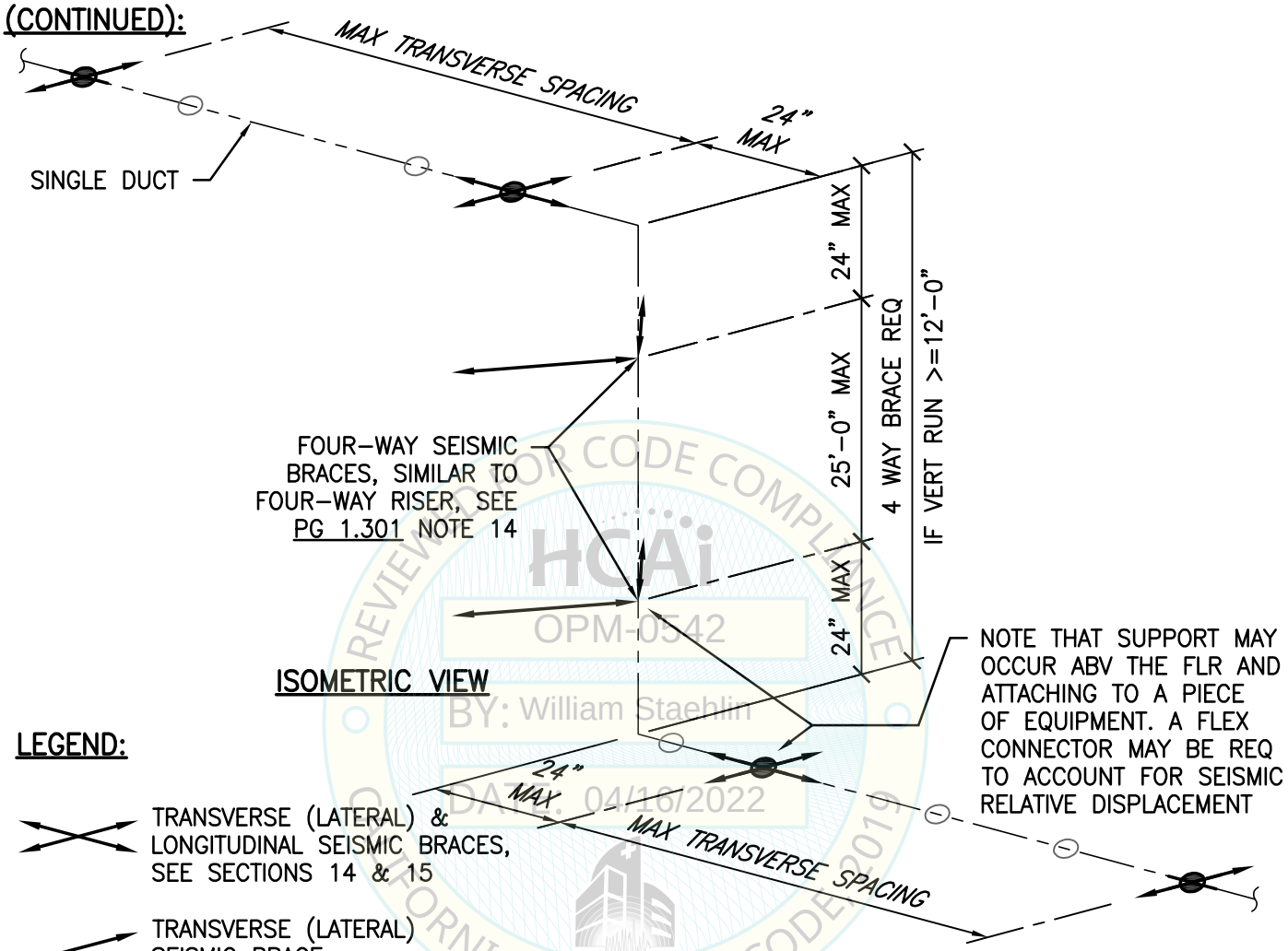
DESIGN PARAMETERS & BRACING GUIDELINES – RECTANGULAR & ROUND DUCTS (CONTINUED):



ISOMETRIC VIEW

LEGEND:

TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 14 & 15

TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTIONS 14 & 15

FOUR–WAY RISER SEISMIC BRACES, SEE SECTIONS 14 & 15

RECTANGULAR OR ROUND DUCT TRAPEZE SUPPORT W/ SEISMIC BRACE

RECTANGULAR OR ROUND DUCT TRAPEZE SUPPORT W/O SEISMIC BRACES (NOT PART OF OPM) SHOWN FOR REFERENCE ONLY

NOTE:
FOUR–WAY BRCG MUST NOT BE REQ WHERE RISERS PENETRATE INTERMEDIATE FLRS IN MULTI–STORY BLDGS WHERE THE CLEARANCE BTW FLRS DOES NOT EXCEED 12'–0", PROVIDED THE PENETRATION THROUGH THE FLR IS CONSIDERED SEISMICALLY BRACED PER NOTE 14 ON PG 1.301.

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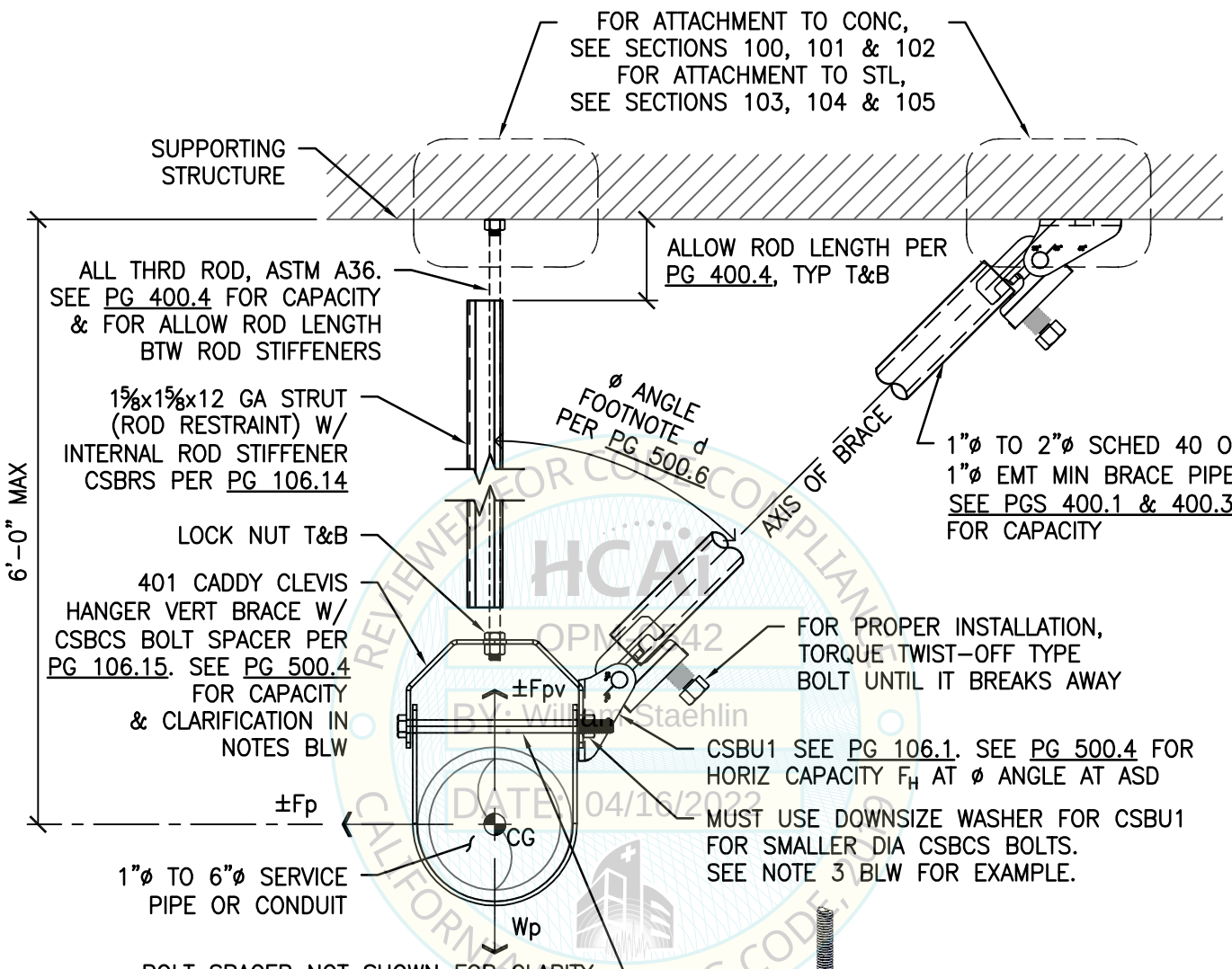
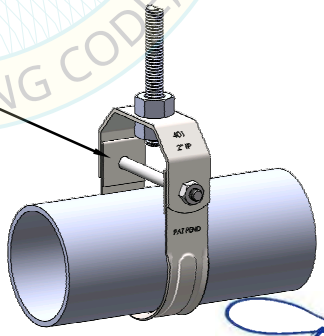
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. FOR 3" & 3½"ø PIPE & FOR 30 DEG–44 DEG USE CAPACITY FOR 4"ø PIPE.
2. FOR DIAMETERS NOT NOTED, USE CAPACITY FOR SMALLER DIA PIPE UNLESS CAPACITY FOR LARGER IS LESS.
3. FOR ¼" DIA CSBCS CLEVIS BOLT USE 2– 9/32"x1¼" STANDARD LOW CARBON STL FLAT FENDER WASHERS & TORQUE TO 10 FT–LBS. FOR ⅜" DIA BOLT USE 1– STANDARD ⅜" WASHER & TORQUE TO 25 FT–LBS. FOR ½" DIA BOLT NO WASHER IS REQ & TORQUE TO 50 FT–LBS.
4. IF CLEVIS HANGER IS USED AS A VERT BRACE HANGER WITHOUT A TRAN BRACE, IT IS CAPABLE TO RESIST DEAD & SEISMIC VERT LOADS ($W_P \pm F_{PV}$) OF 600 LBS AT ASD.
5. THE MAX TRAN BRACE SPACING &/OR MAX HANGER SPACING CALLED ON PG 200.3 MAY HAVE TO BE REDUCED BASED ON THE 600 LBS LIMIT.



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SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ CLEVIS HANGER TRANSVERSE (LATERAL) RIGID BRACING

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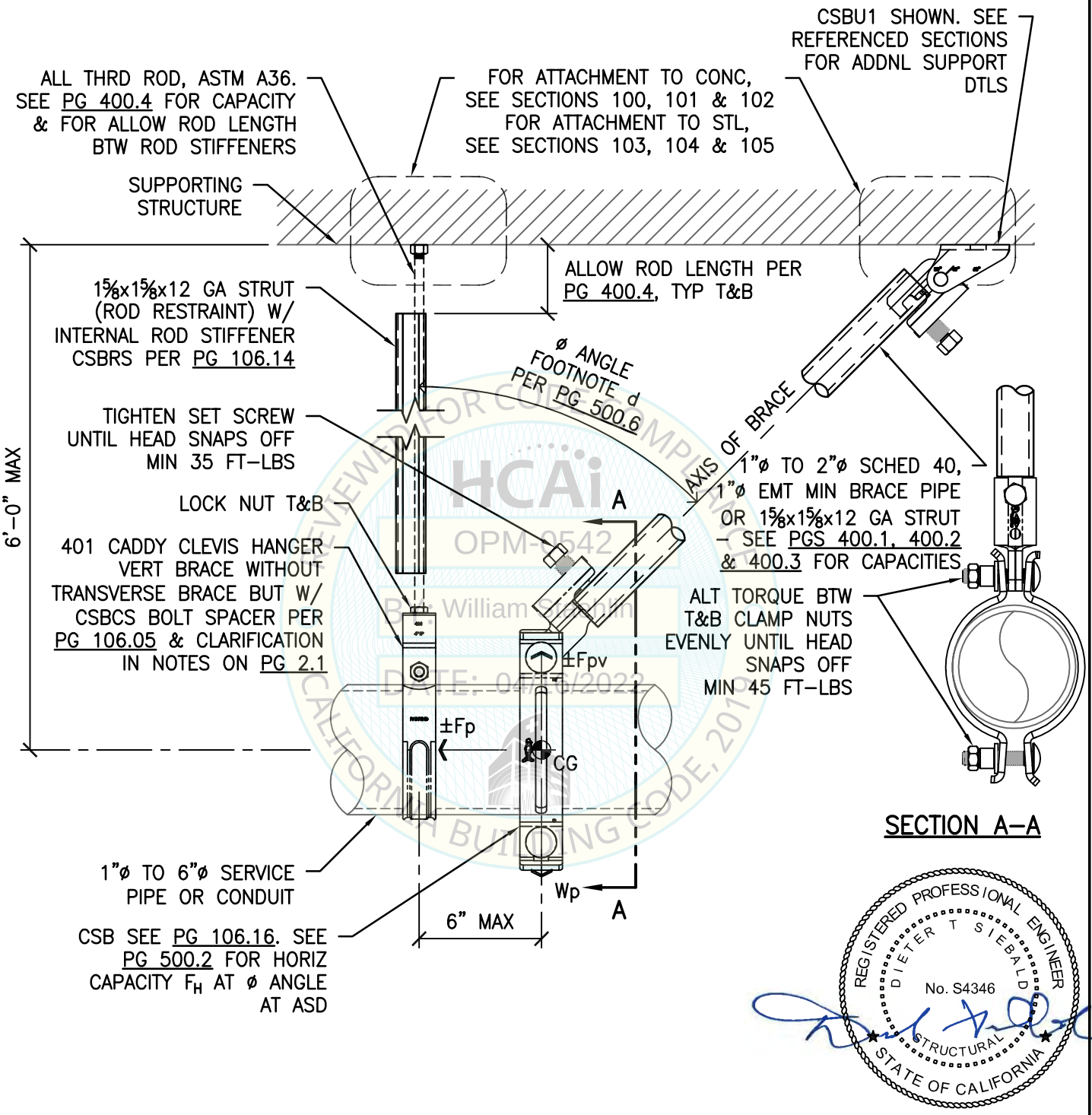
SEISMIC BRACING FOR MEP SYSTEMS



SECTION A–A

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
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SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ CLEVIS HANGER LONGITUDINAL RIGID BRACING

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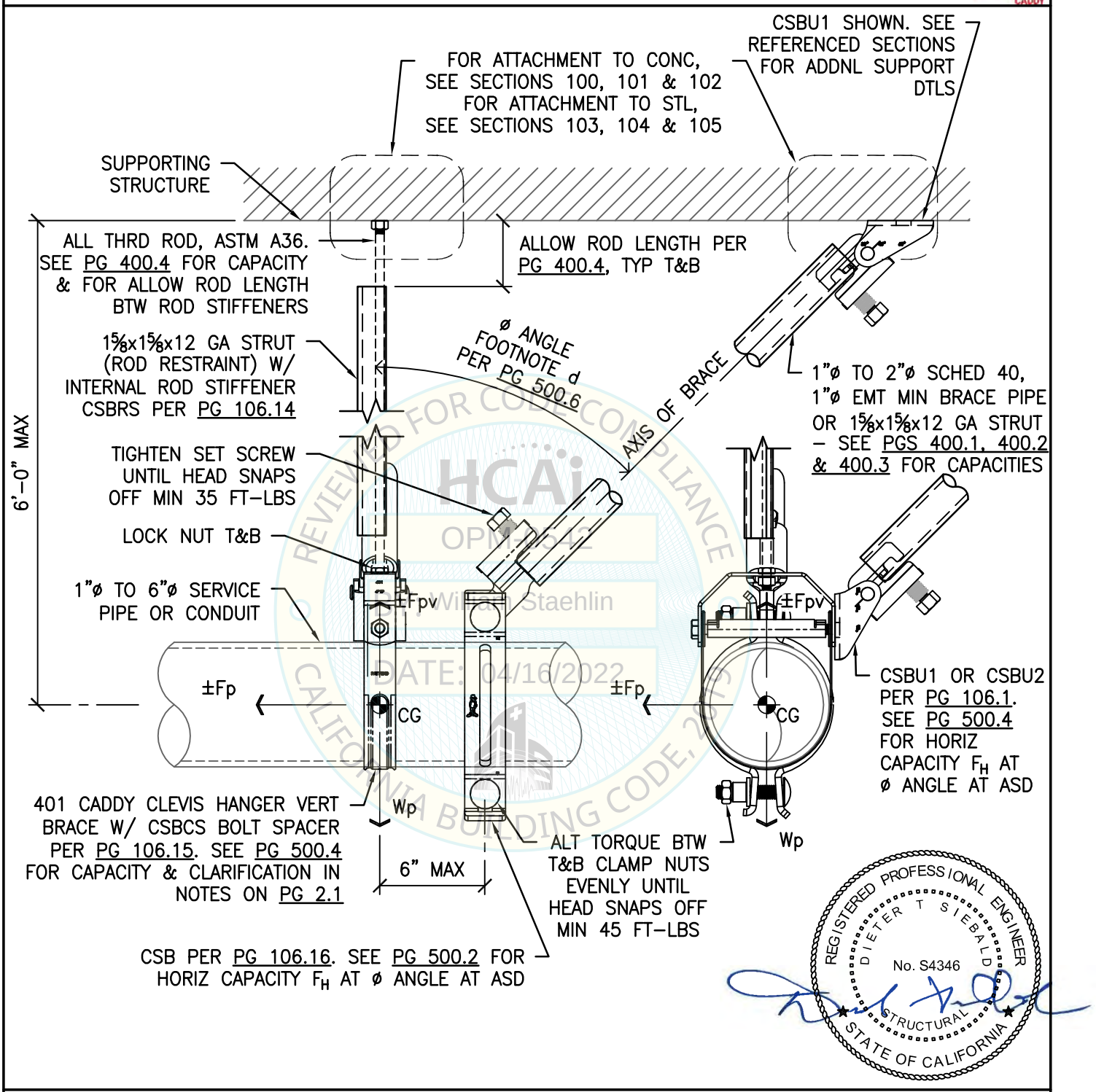
SEISMIC BRACING FOR MEP SYSTEMS



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SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ CLEVIS HANGER
TRANSVERSE (LATERAL) & LONGITUDINAL RIGID BRACING

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SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ PIPE CLAMP
TRANSVERSE (LATERAL) RIGID BRACING

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SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ PIPE CLAMP
TRANSVERSE (LATERAL) RIGID BRACING AT TOP OF PIPE CLAMP

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
www.cyseng.com

Job No:	21098
Date:	04/11/2022
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SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ PIPE CLAMP
LONGITUDINAL RIGID BRACING

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
www.cyseng.com

Job No:	21098
Date:	04/11/2022
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SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ PIPE CLAMP
LONGITUDINAL RIGID BRACING AT TOP OF PIPE CLAMP

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
www.cyseng.com

Job No:	21098
Date:	04/11/2022
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SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ PIPE CLAMP
TRANSVERSE (LATERAL) & LONGITUDINAL RIGID BRACING

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
www.cyseng.com

Job No:	21098
Date:	04/11/2022
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SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ PIPE CLAMP
TRANSVERSE & LONGITUDINAL RIGID BRACING AT TOP OF PIPE CLAMP

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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Job No:	21098
Date:	04/11/2022
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SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ WELDED STEEL ATTACHMENT
TRANSVERSE (LATERAL) RIGID BRACING

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
www.cyseng.com

Job No:	21098
Date:	04/11/2022
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SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ WELDED STEEL ATTACHMENT
LONGITUDINAL RIGID BRACING

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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Job No:	21098
Date:	04/11/2022
Page:	4.2 of .

SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ WELDED STEEL ATTACHMENT
TRANSVERSE (LATERAL) & LONGITUDINAL RIGID BRACING

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
www.cyseng.com

Job No:	21098
Date:	04/11/2022
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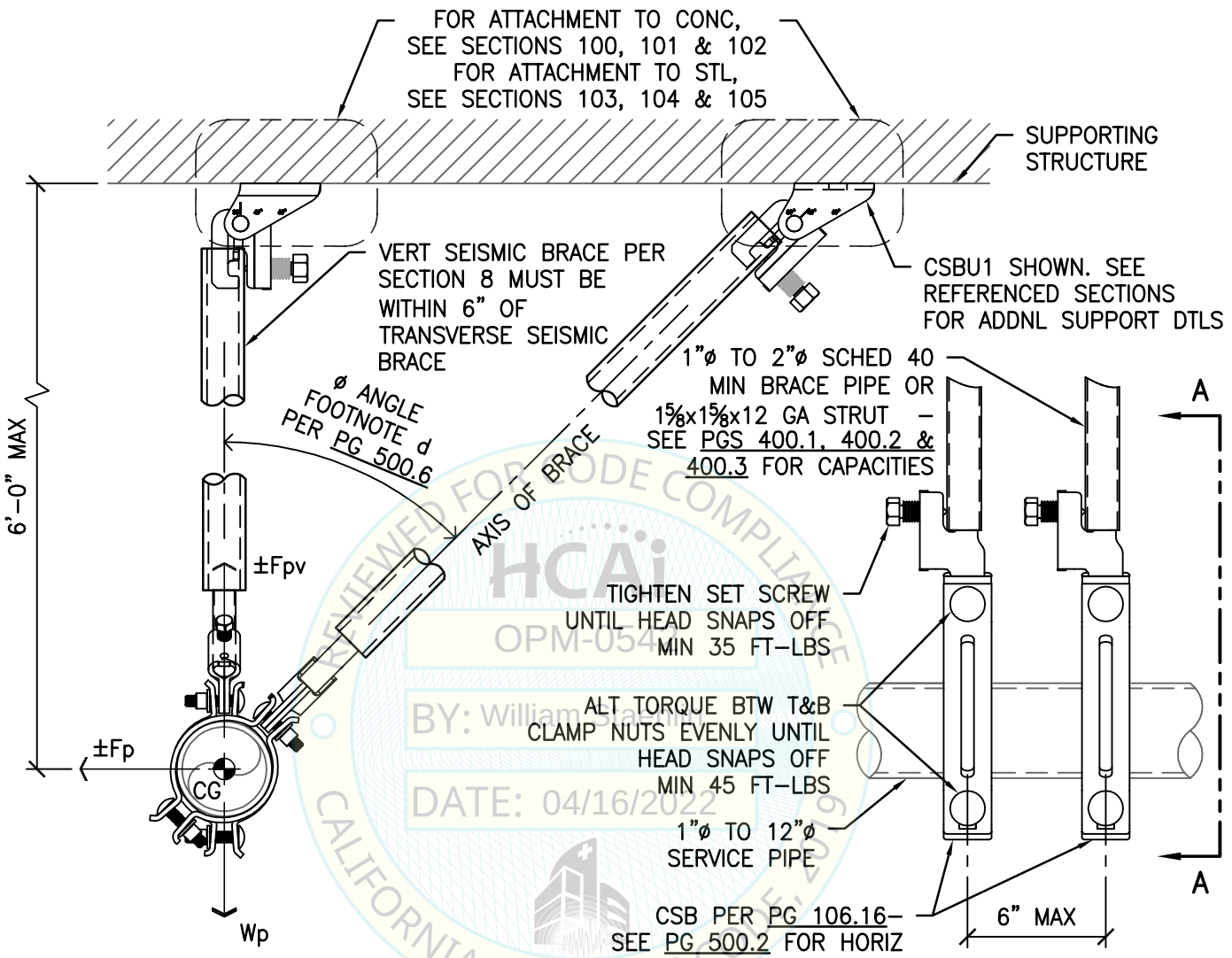
SEISMIC BRACING FOR MEP SYSTEMS



SHEET TITLE: SINGLE PIPE OR CONDUIT WITH LATERAL CONCENTRIC BRACES
CSB WITH BRACE PIPE FOR 1"Ø TO 12"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
www.cyseng.com

Job No:	21098
Date:	04/11/2022
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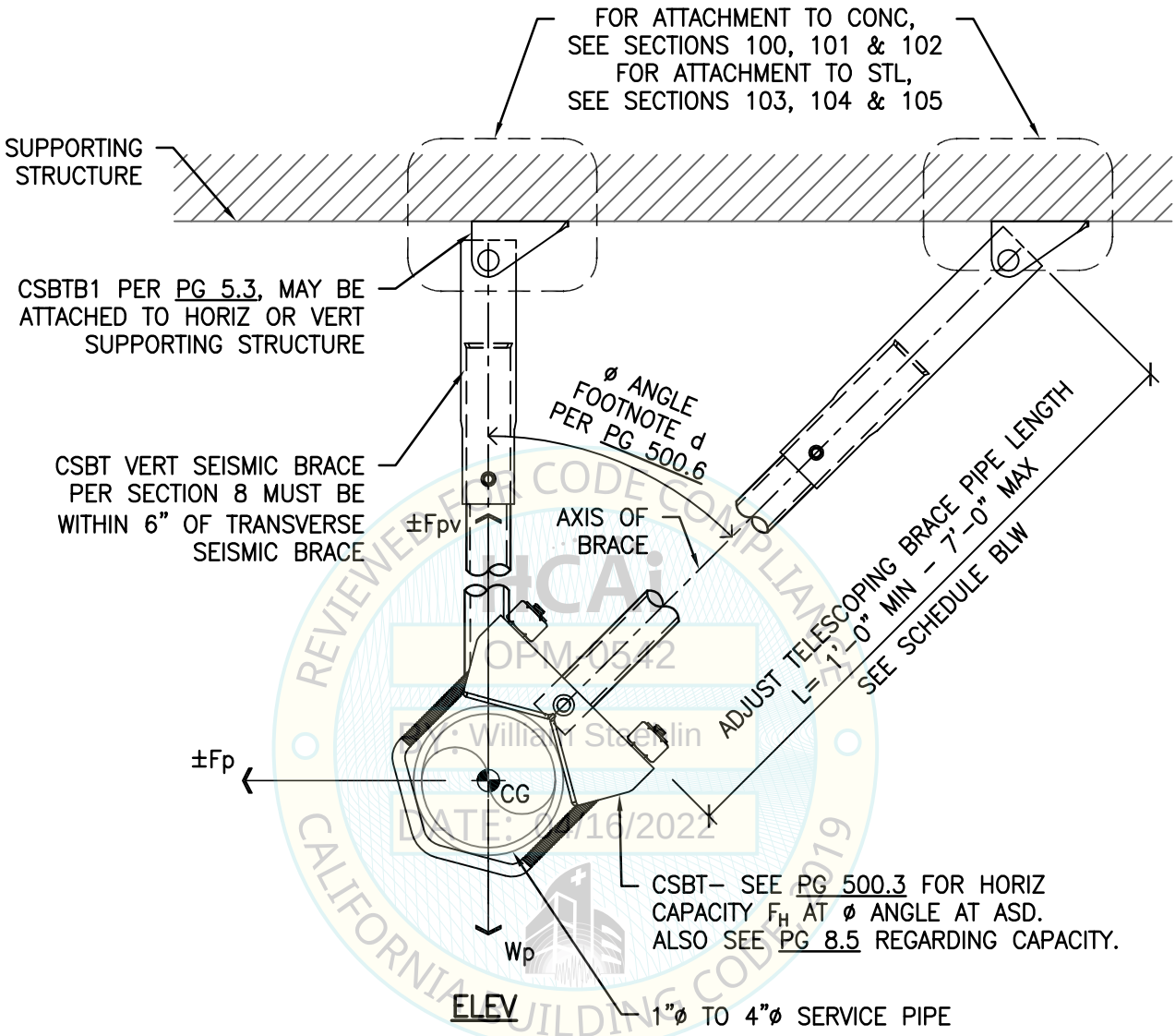
SEISMIC BRACING FOR MEP SYSTEMS



BRACE ASSEMBLY	"L" RANGE
CSBT1	1.0' TO <1.5'
CSBT2	1.5' TO <3.0'
CSBT3	3.0' TO <5.5'
CSBT4	5.5' TO <7.0'

NOTE:
SEE PG 5.3 FOR CSBT ASSEMBLY & INSTALLATION INSTRUCTIONS

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT WITH LATERAL CONCENTRIC BRACES
CSBT TELESCOPING ASSEMBLY FOR 1"Ø TO 4"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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Job No:	21098
Date:	04/11/2022
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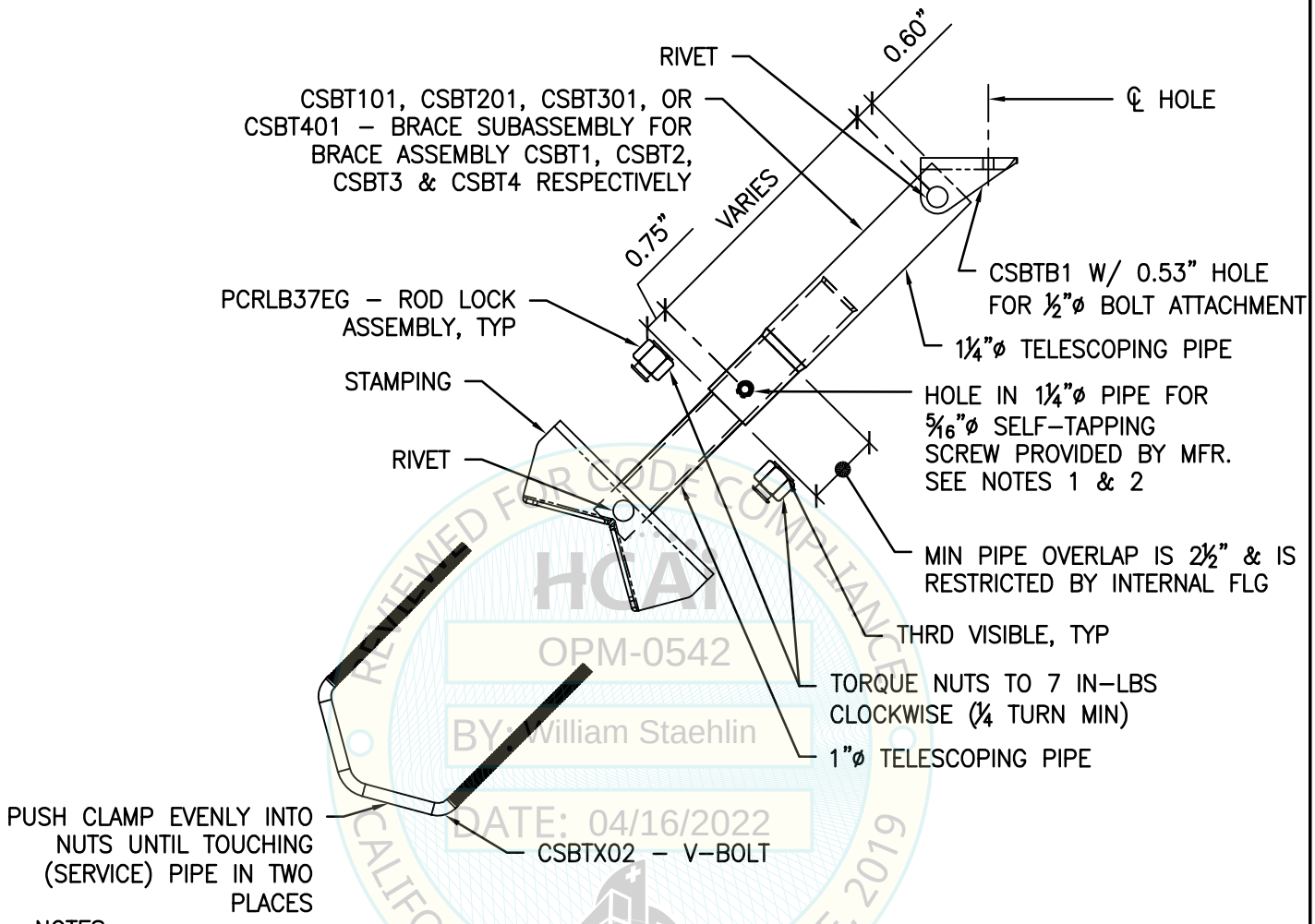
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. INSTALL W/ A STD SCREW GUN W/ A SIZE OF 5⁄16" (8mm) HEX HEAD TOOL AT RECOMMENDED 1010 RPM INSTALLATION SPEED. HEX HEAD SHOULD BE SEATED (NO THREAD VISIBLE)

2. STD SCREW GUN NEEDS CLUTCH SET OR A DEPTH SENSITIVE NOSEPIECE FOR CORRECT SEATING OF FASTENER. NOT FOLLOWING INSTRUCTION COULD RESULT IN SHEARING HEAD OFF OF FASTENER

3. SEE SECTION 500 FOR CAPACITY OF SHOWN ASSEMBLY WHEN ATTACHED TO SUPPORTING STRUCTURE ABV. FOR ATTACHMENT TO VERT SURFACES SUCH AS WALLS OR BMS, USE 475 LBS.

4. THE CSBT TELESCOPING ASSEMBLY IS A COMPLETE MANUFACTURED BRACE ASSEMBLY & IS REFERENCED AS SUCH IN THIS OPM.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT WITH LATERAL CONCENTRIC BRACES
CSBT WITH TELESCOPING ASSEMBLY FOR 1"Ø TO 4"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
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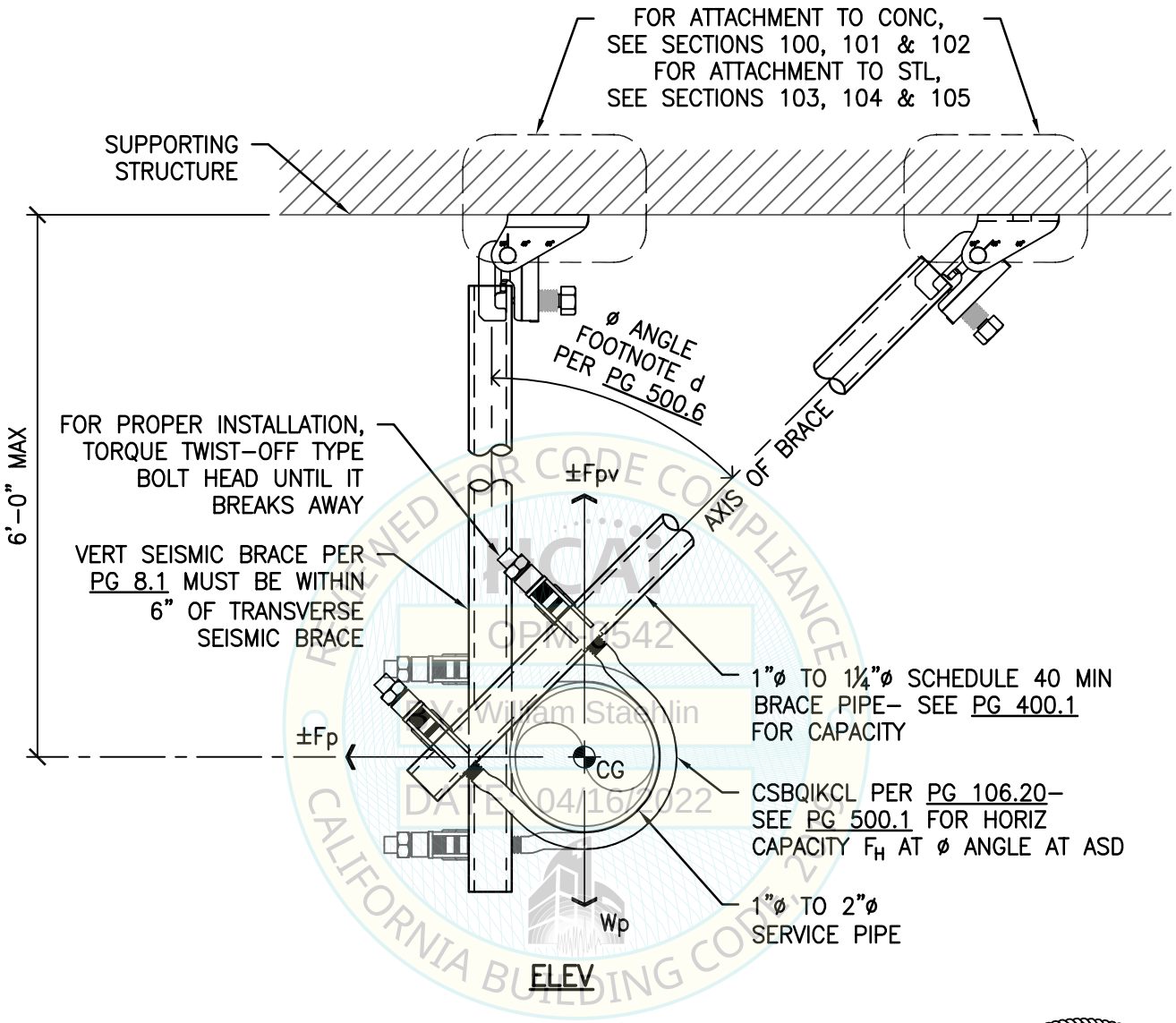
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE:SINGLE PIPE OR CONDUIT W/ LATERAL ECCENTRIC BRACES & RESTRAINT RODS CSBQIKCL WITH BRACE PIPE FOR 1"Ø TO 2"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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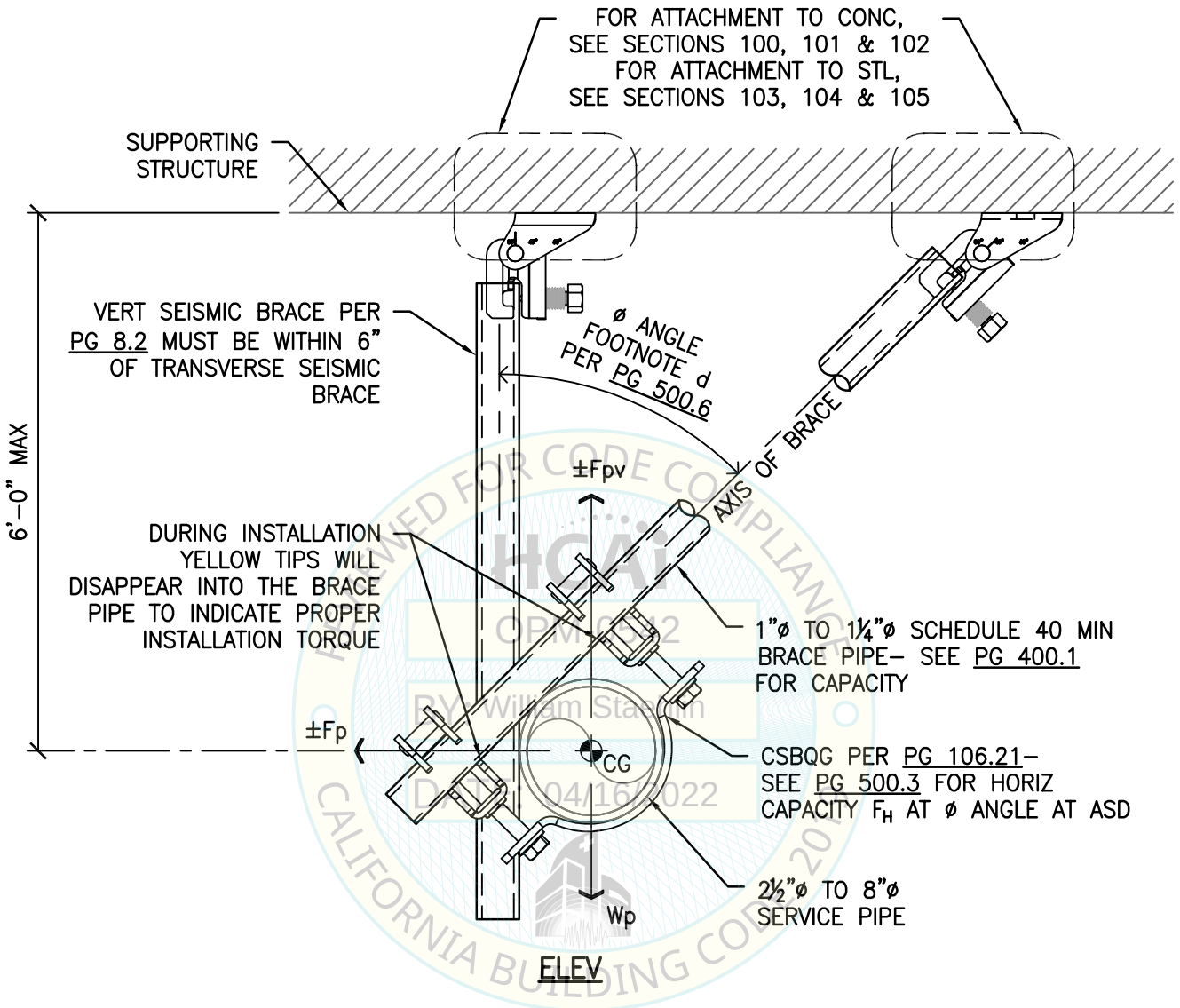
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT W/ LATERAL ECCENTRIC BRACES & RESTRAINT RODS CSBQG WITH BRACE PIPE FOR 2.5"Ø TO 8"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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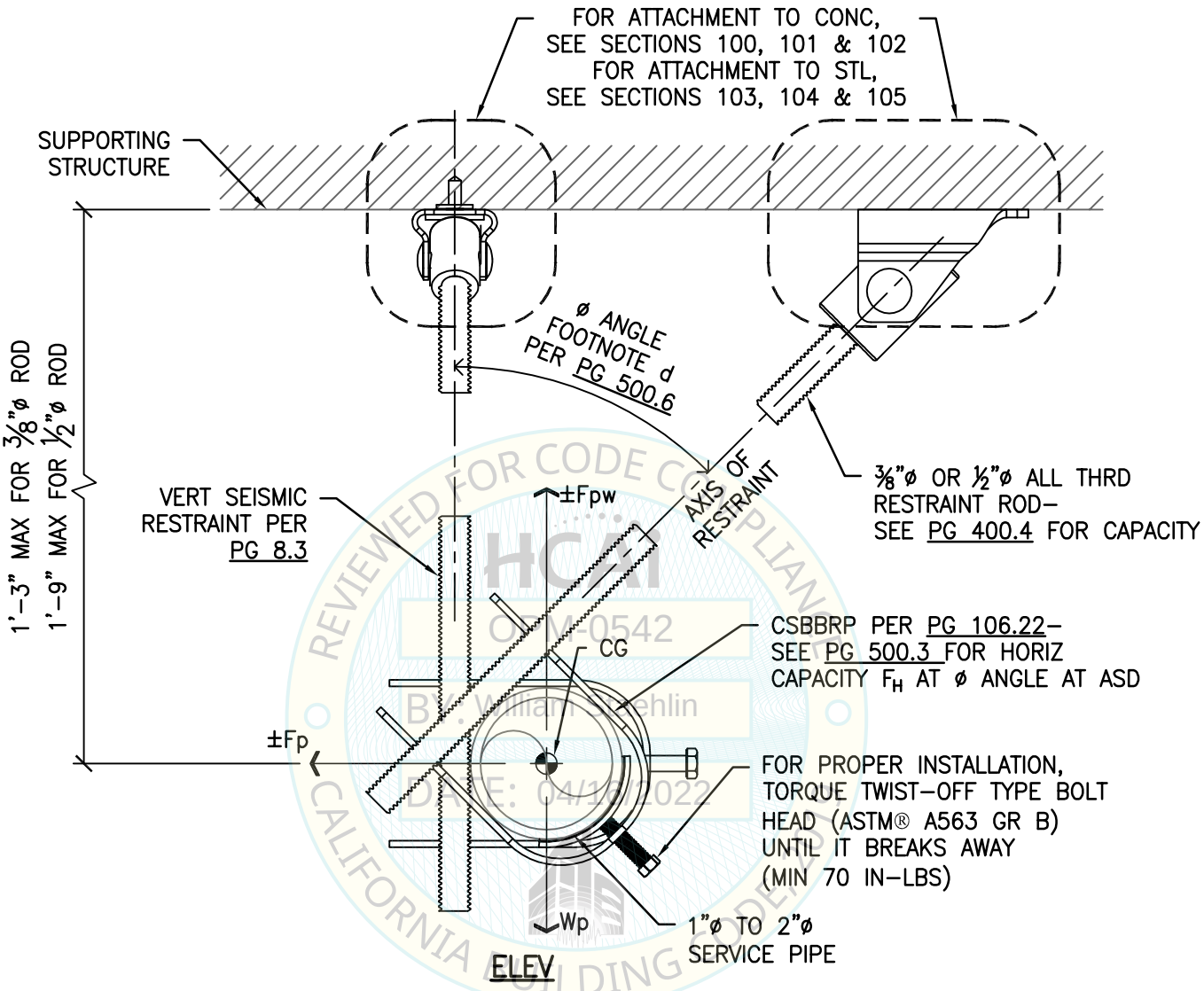
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT W/ LATERAL ECCENTRIC BRACES & RESTRAINT RODS CSBBRP WITH RESTRAINT ROD FOR 1"Ø TO 2"Ø SERVICE PIPES

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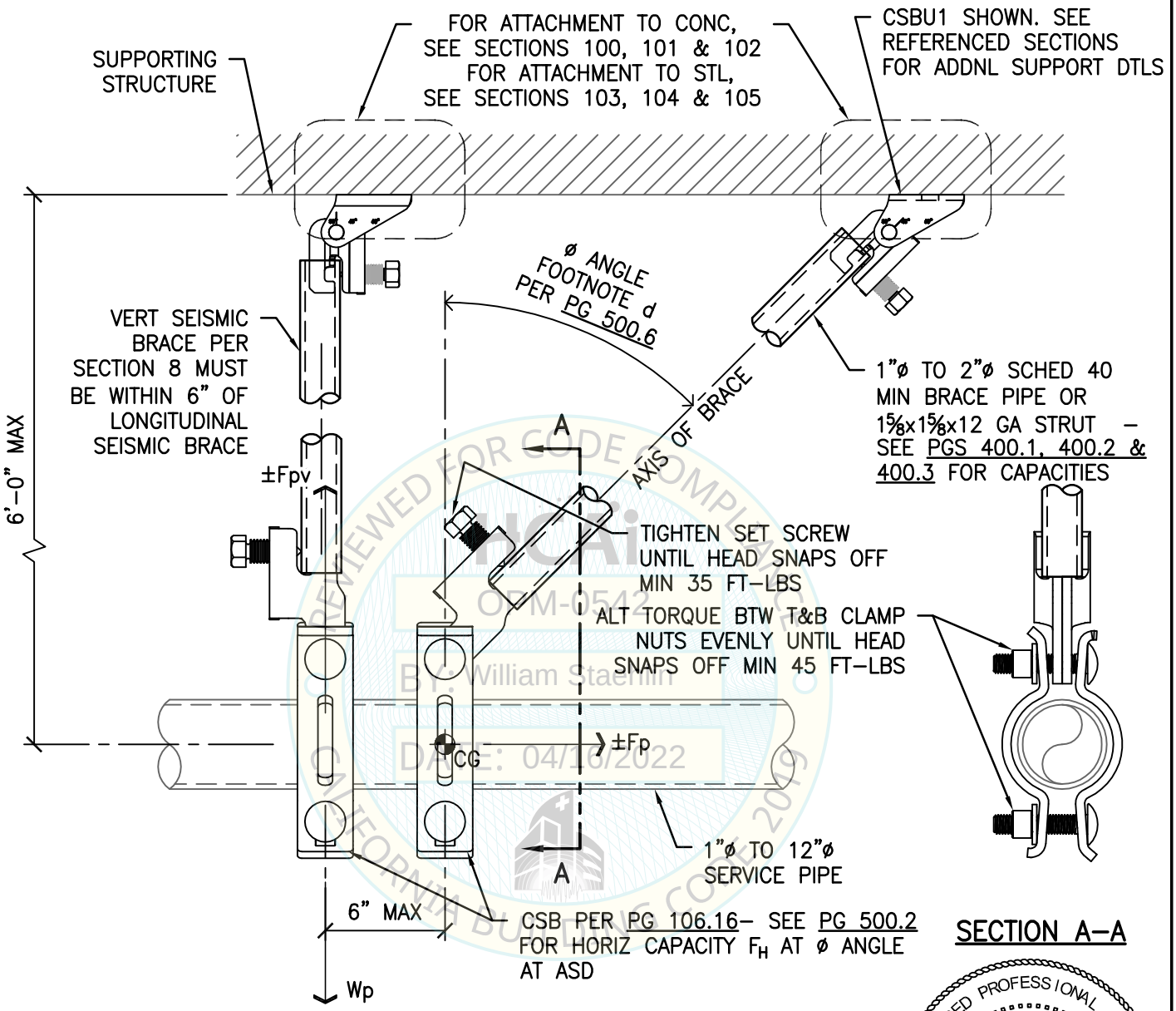
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR RIGID METAL CONDUIT WITH LONGITUDINAL BRACES
CSB WITH BRACE PIPE FOR 1"Ø TO 12"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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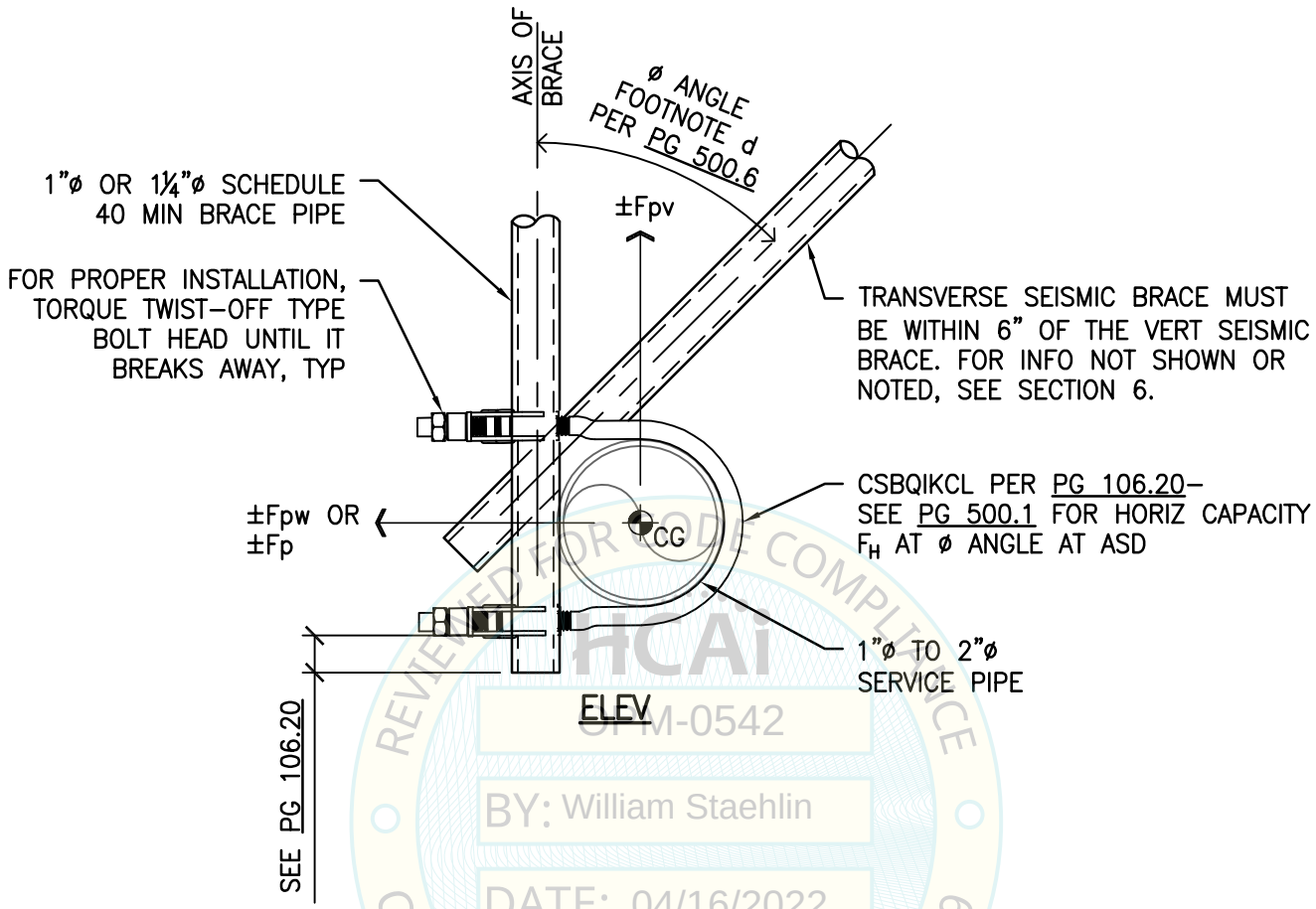
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. FOR ATTACHMENT TO CONC, SEE SECTIONS 100, 101 & 102. FOR ATTACHMENT TO STL, SEE SECTIONS 103, 104 & 105.
2. FOR CONSTRUCTION TOLERANCE, SEE SECTION 1.
3. USE ø=90° OF TRANSVERSE MODE (SEE SECTION 500) FOR AXIAL CAPACITY OF BRACE PIPE.
4. FOR BRACE PIPE AXIAL CAPACITY, SEE SECTION 400.
5. THIS VERT SEISMIC BRACE SHALL NOT BE USED AS A TYP SERVICE PIPE HANGER FOR LONG TERM GRAVITY LOADS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT WITH VERTICAL BRACES & RESTRAINT RODS CSBQIKCL WITH BRACE PIPE FOR 1"Ø TO 2"Ø SERVICE PIPES

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2495 NATOMAS PARK DRIVE, SUITE 650
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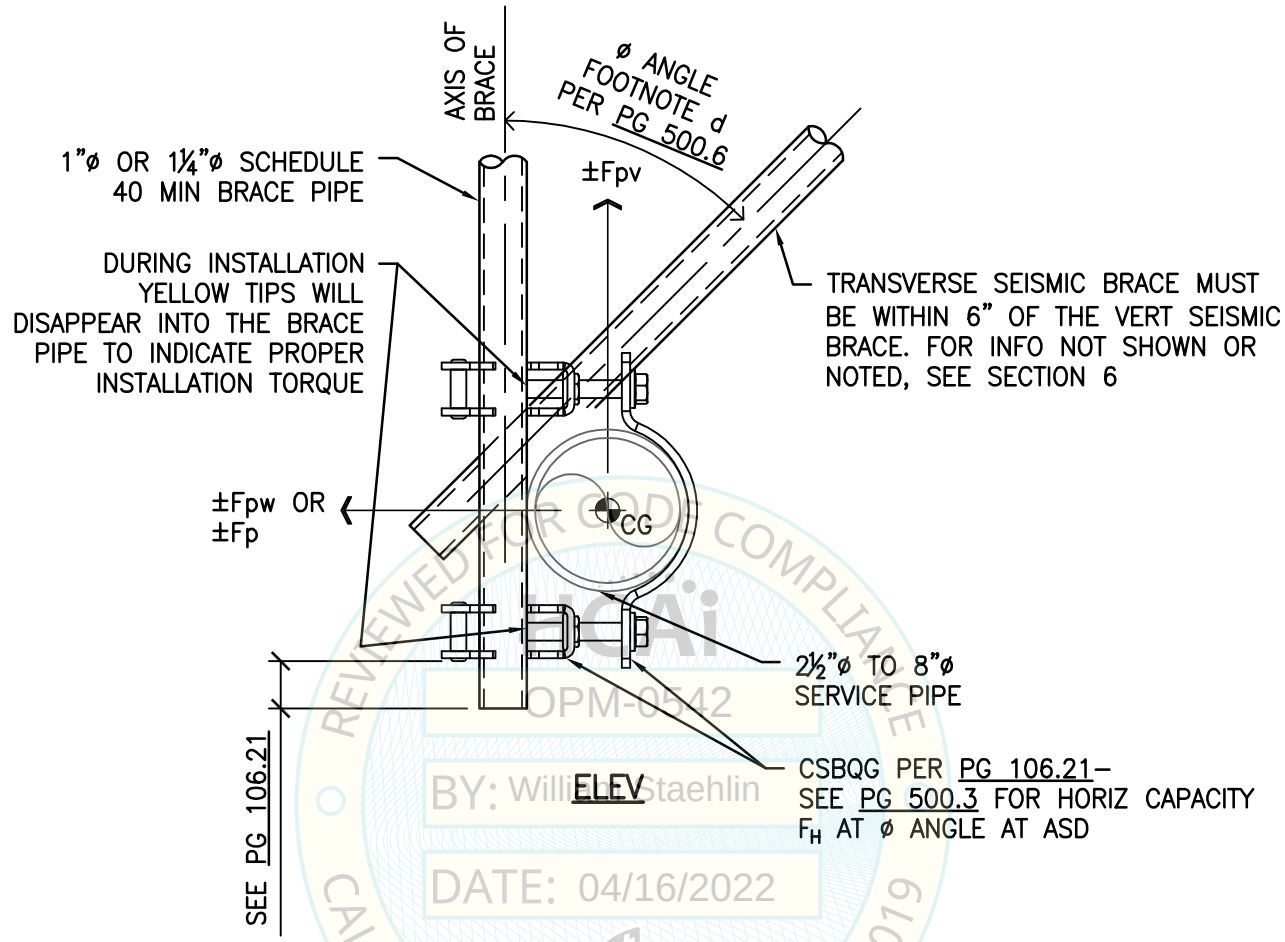
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. FOR ATTACHMENT TO CONC, SEE SECTIONS 100, 101 & 102. FOR ATTACHMENT TO STL, SEE SECTIONS 103, 104 & 105.
2. FOR CONSTRUCTION TOLERANCE, SEE SECTION 1.
3. USE ø=90° OF TRANSVERSE MODE (SEE SECTION 500) FOR AXIAL CAPACITY OF BRACE PIPE.
4. FOR BRACE PIPE AXIAL CAPACITY, SEE SECTION 400.
5. THIS VERT SEISMIC BRACE SHALL NOT BE USED AS A TYP SERVICE PIPE HANGER FOR LONG TERM GRAVITY LOADS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT WITH VERTICAL BRACES & RESTRAINT RODS
CSBQG WITH BRACE PIPE FOR 2.5"Ø TO 8"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
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SACRAMENTO, CA 95833
TEL (916) 920-2020
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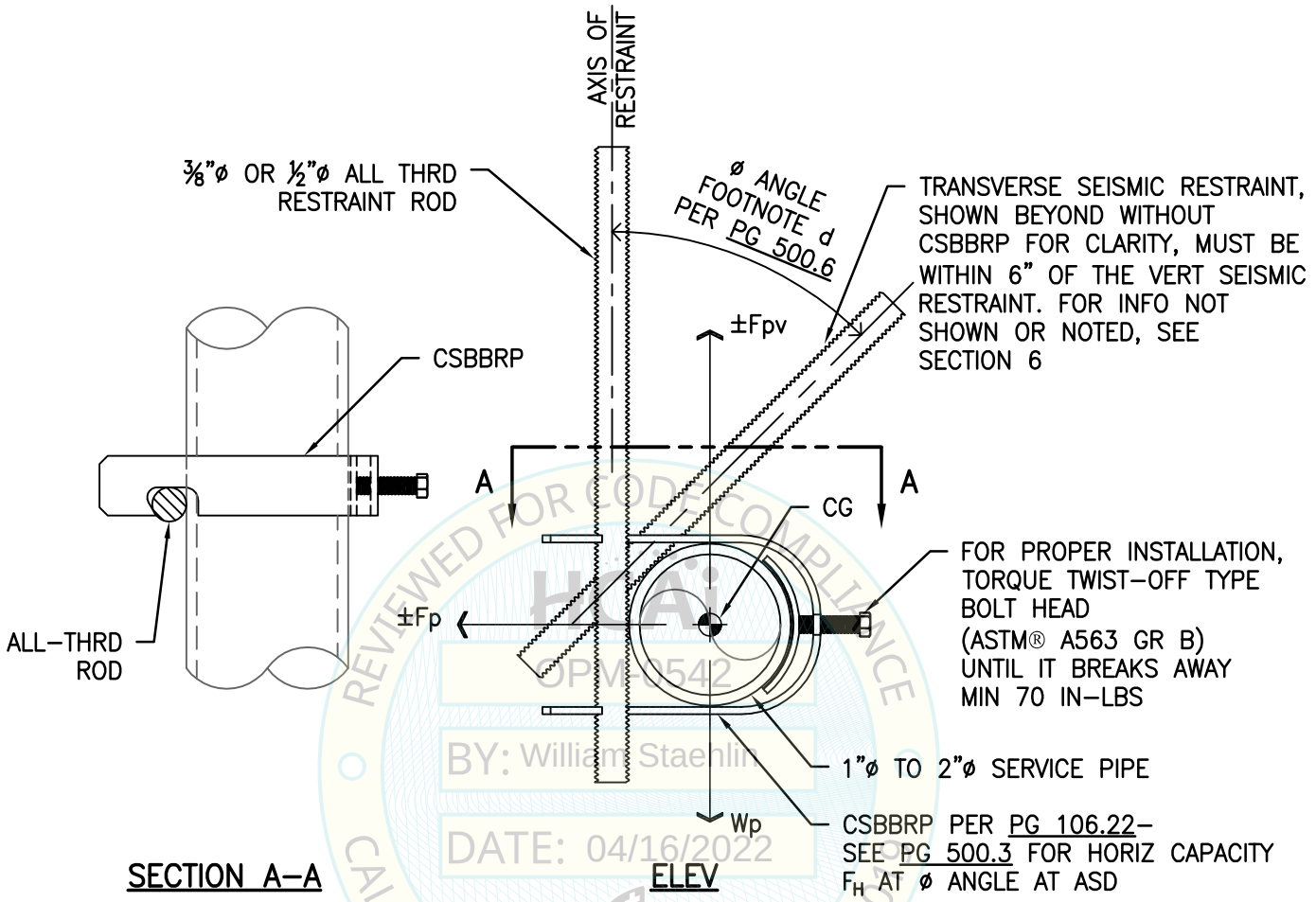
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. FOR ATTACHMENT TO CONC, SEE SECTIONS 100, 101 & 102. FOR ATTACHMENT TO STL, SEE SECTIONS 103, 104 & 105.
2. THE CSBBRP W/ RESTRAINT ROD IS A BRANCH LINE RESTRAINT DEVICE (NOT A BRACE).
3. FOR CONSTRUCTION TOLERANCE, SEE SECTION 1.
4. USE ø=90° OF TRANSVERSE MODE (SEE SECTION 500) FOR AXIAL CAPACITY OF COMPONENT.
5. FOR RESTRAINT ROD AXIAL CAPACITY, SEE SECTION 400.
6. THIS VERT SEISMIC RESTRAINT MAY ALSO BE USED AS A TYP SERVICE PIPE HANGER FOR LONG TERM GRAVITY LOADS, HOWEVER NOT IN COMBINATION AS A SEISMIC RESTRAINT AND GRAVITY HANGER.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT WITH VERTICAL BRACES & RESTRAINT RODS
CSBBRP WITH RESTRAINT ROD FOR 1"Ø TO 2"Ø SERVICE PIPES

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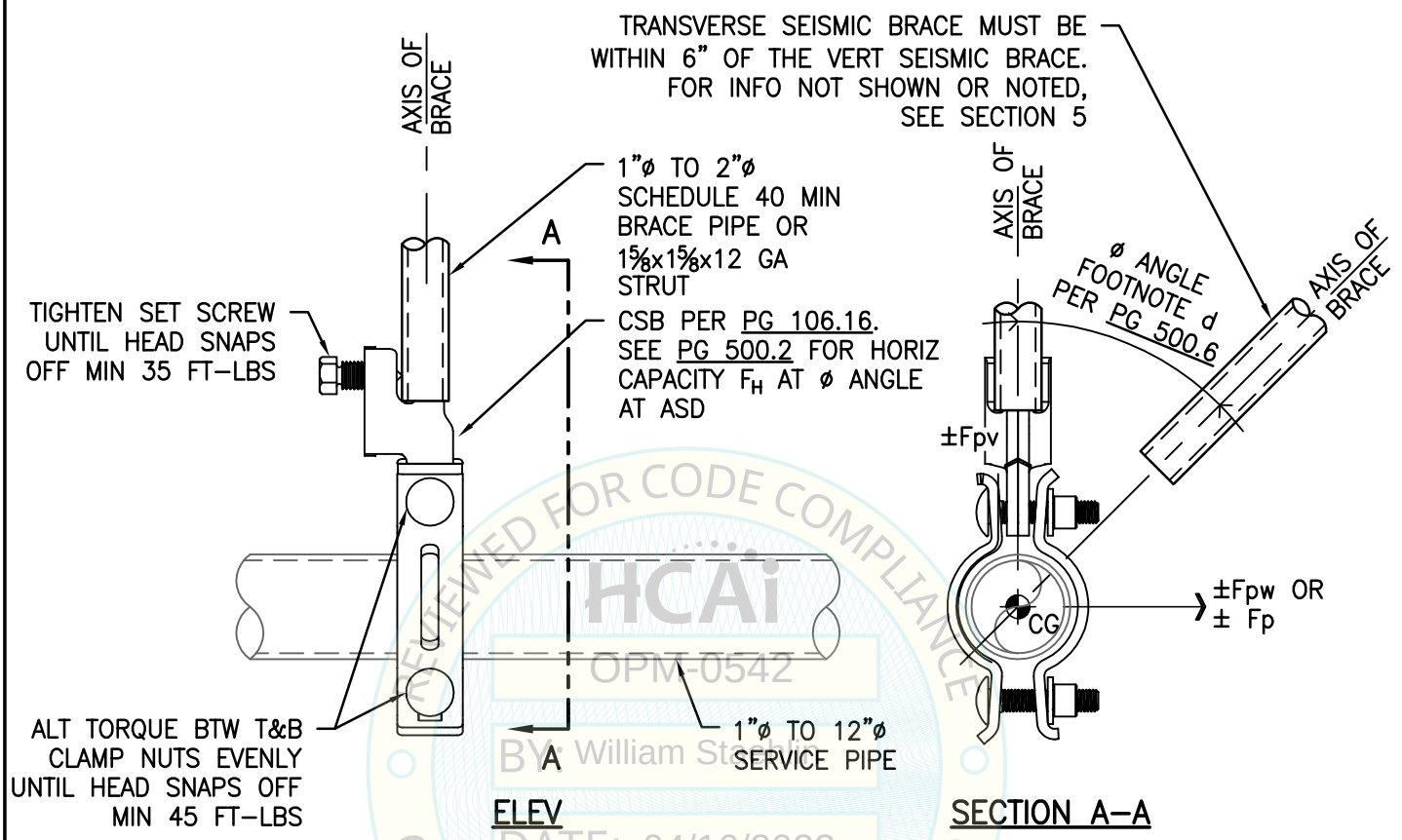
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. FOR ATTACHMENT TO CONC, SEE SECTIONS 100, 101 & 102. FOR ATTACHMENT TO STL, SEE SECTIONS 103, 104 & 105.
2. FOR CONSTRUCTION TOLERANCE, SEE SECTION 1.
3. USE ø=90° OF TRANSVERSE MODE (SEE SECTION 500) FOR AXIAL CAPACITY OF BRACE PIPE.
4. FOR BRACE PIPE & STRUT AXIAL CAPACITIES, SEE SECTION 400.
5. THIS VERT SEISMIC BRACE MAY ALSO BE USED AS A TYP SERVICE PIPE HANGER FOR LONG TERM GRAVITY LOADS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT WITH VERTICAL BRACES & RESTRAINT RODS
CSB WITH BRACE PIPE FOR 1"Ø TO 12"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
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Job No:	21098
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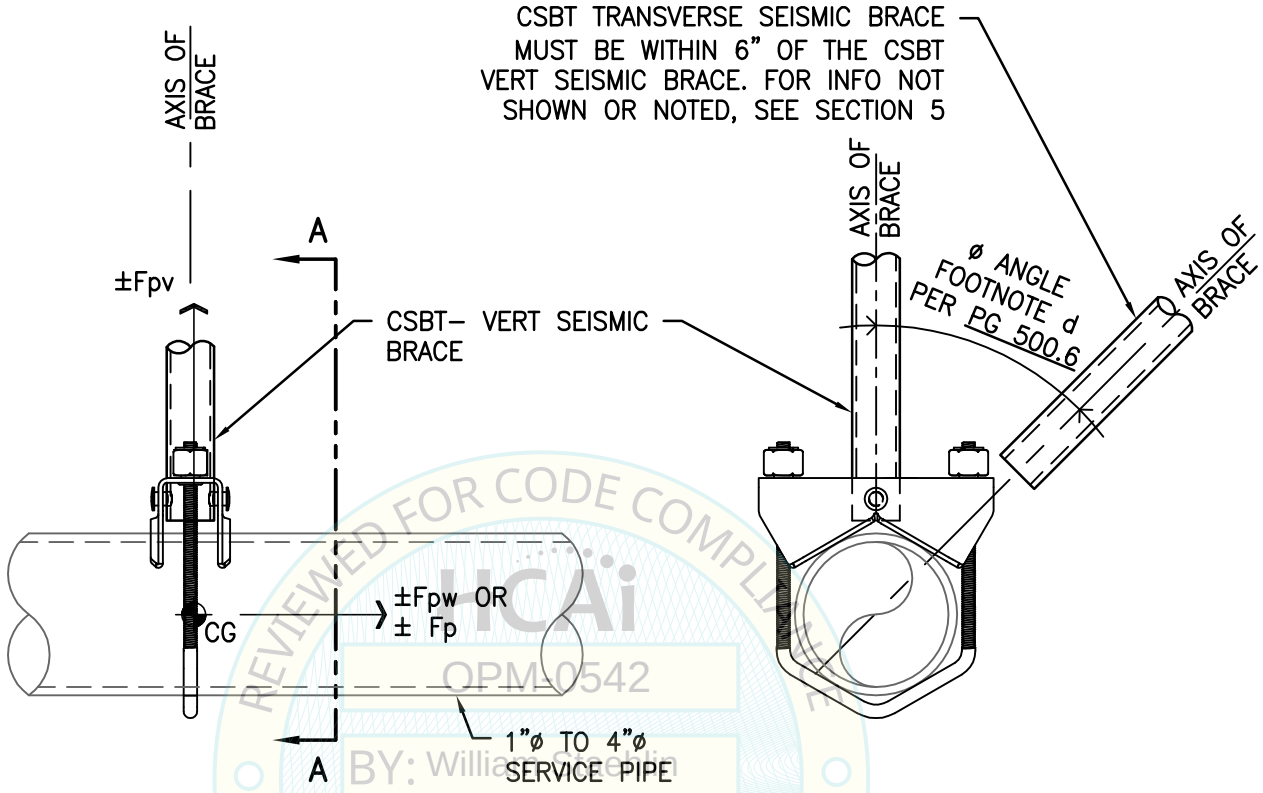
SEISMIC BRACING FOR MEP SYSTEMS



ELEV SECTION A–A

NOTES:

1. FOR ATTACHMENT TO CONC, SEE SECTIONS 100, 101 & 102. FOR ATTACHMENT TO STL, SEE SECTIONS 103, 104 & 105.
2. FOR CONSTRUCTION TOLERANCE, SEE SECTION 1.
3. THE CSBT WAS TESTED AS AN ASSEMBLY W/ THE BRACE PIPE, THE SERVICE PIPE ATTACHED COMPONENT & THE BLDG ATTACHED COMPONENT INCLUDED IN ONE TEST FOR THE FOUR LISTED BRACE PIPE ANGLES AS SHOWN ON PG 500.3. THERE IS NO NEED TO CHECK EA OF THE THREE BRACE ASSEMBLY COMPONENTS. THE PROVIDED VALUES ARE FOR THE ASSEMBLY.
4. THE CSBT TESCOPING BRACE PIPE ASSEMBLY COMPONENTS & INSTALLATION INSTRUCTIONS ARE SHOWN ON PG 5.3.
5. THIS VERT SEISMIC BRACE MAY ALSO BE USED AS A TYP SERVICE PIPE HANGER FOR LONG TERM GRAVITY LOADS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT WITH VERTICAL BRACES & RESTRAINT RODS
CSBT WITH TELESCOPING ASSEMBLY FOR 1"Ø TO 4"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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Job No:	21098
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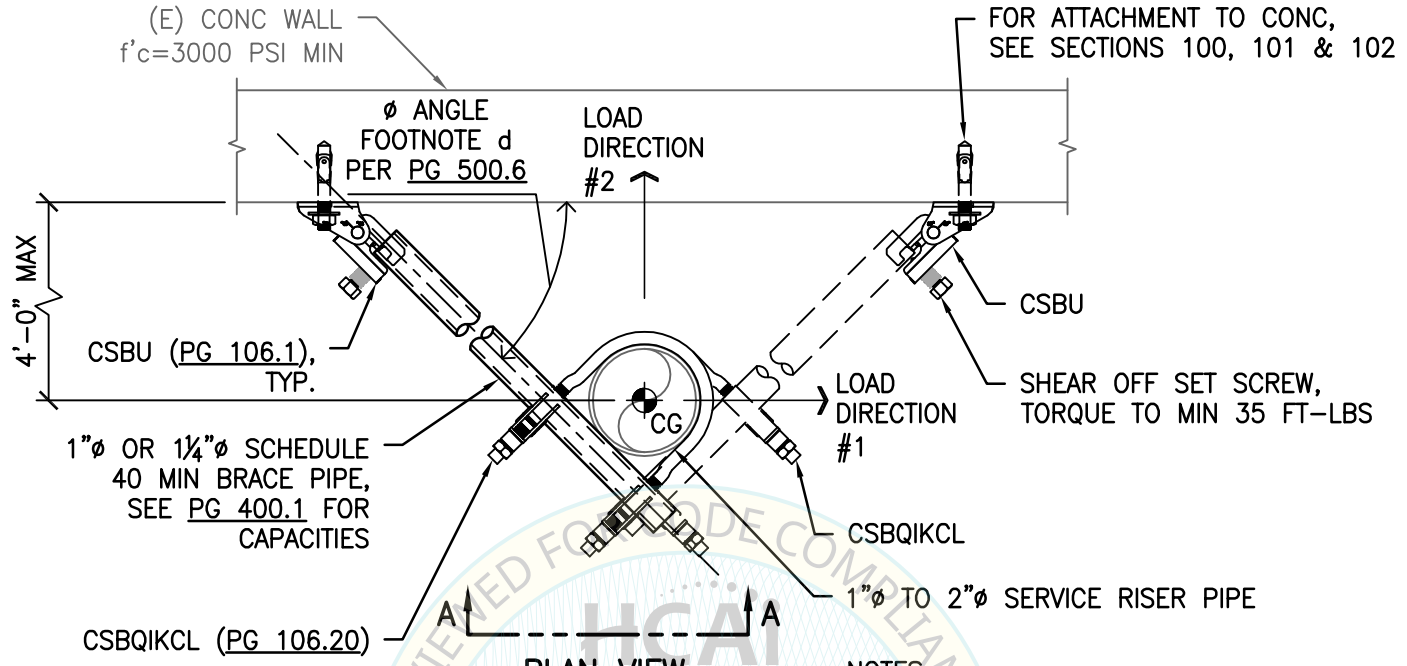
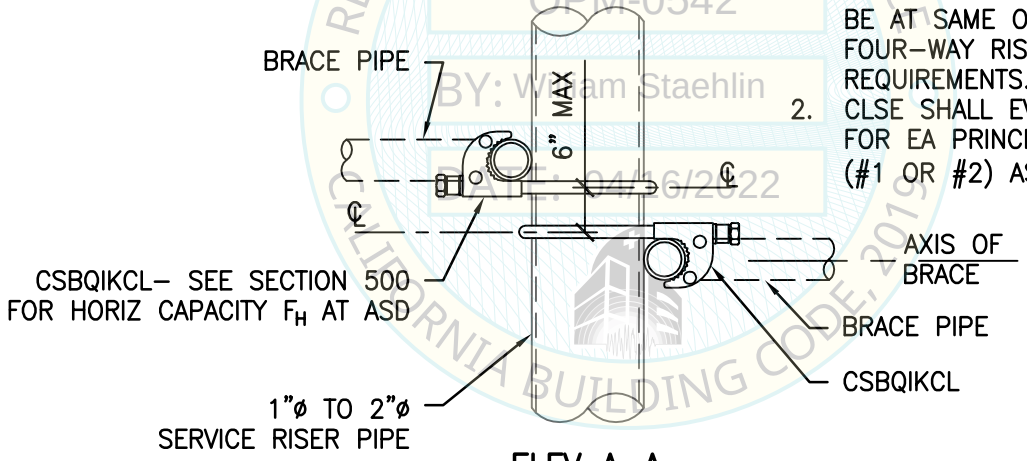
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. ONE PAIR OF BRACE PIPES NEED TO BE AT SAME OPP ANGLE TO SATISFY FOUR-WAY RISER BRCG REQUIREMENTS.
2. CLSE SHALL EVALUATE ±Fp OR ±Fpw FOR EA PRINCIPAL LOAD DIRECTION (#1 OR #2) AS SHOWN.



ELEV A-A

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT FOUR-WAY RISER SEISMIC BRACES CSBQIKCL WITH BRACE PIPES FOR 1"Ø TO 2"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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Job No:	21098
Date:	04/11/2022
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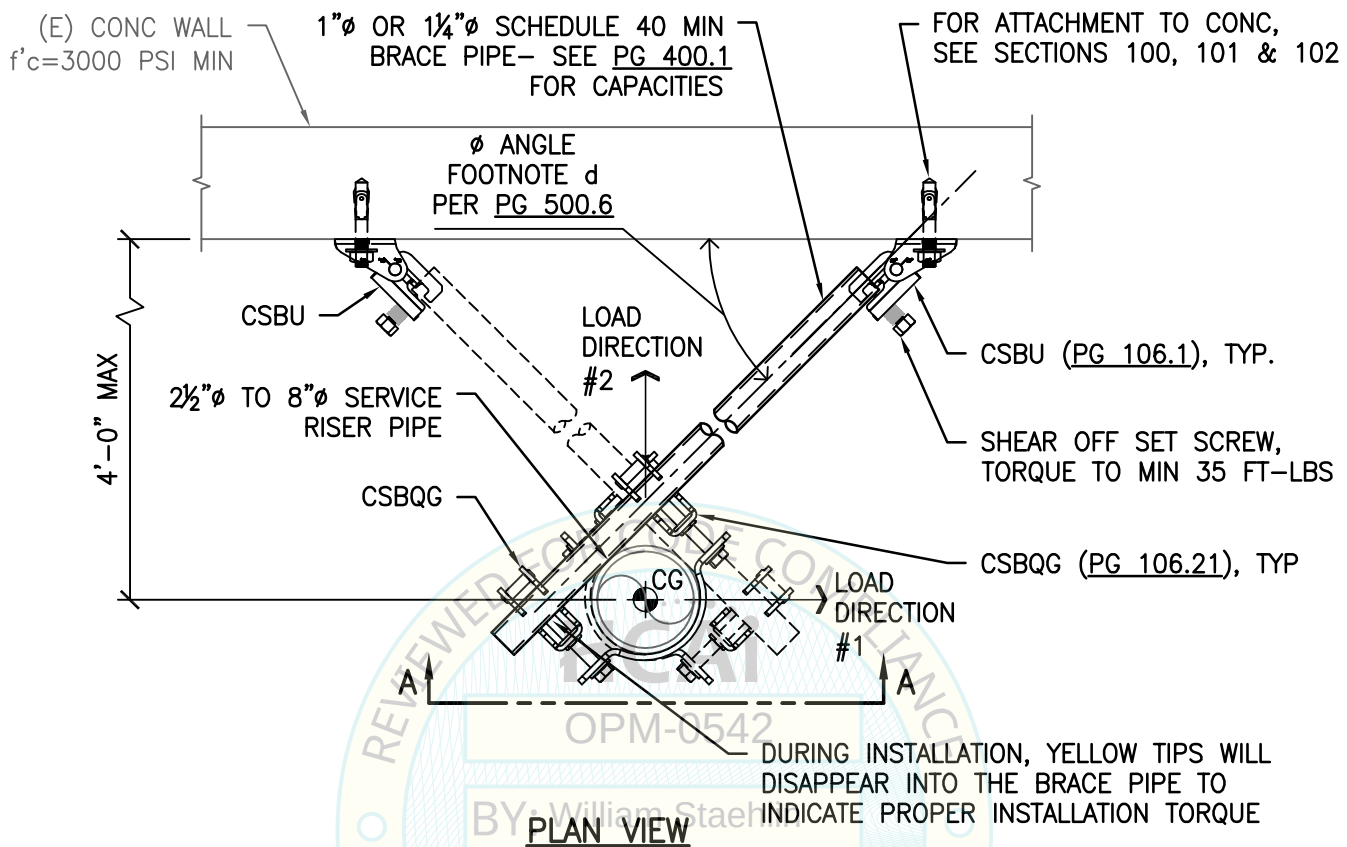
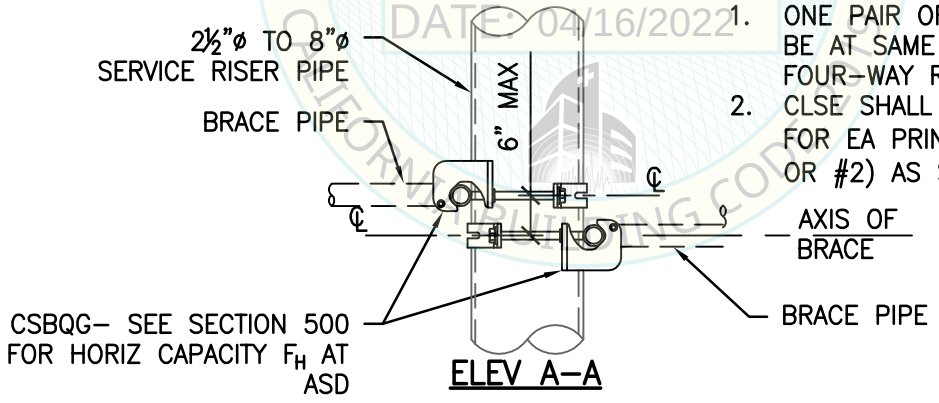
SEISMIC BRACING FOR MEP SYSTEMS



PLAN VIEW

NOTES:

1. ONE PAIR OF BRACE PIPES NEED TO BE AT SAME OPP ANGLE TO SATISFY FOUR–WAY RISER BRCG REQUIREMENTS.
2. CLSE SHALL EVALUATE ±Fp OR ±Fpw FOR EA PRINCIPAL LOAD DIRECTION (#1 OR #2) AS SHOWN.



ELEV A–A

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR RIGID METAL CONDUIT FOUR-WAY RISER SEISMIC BRACES CSBQG WITH BRACE PIPES FOR 2.5"Ø TO 8"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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TEL (916) 920-2020
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Job No:	21098
Date:	04/11/2022
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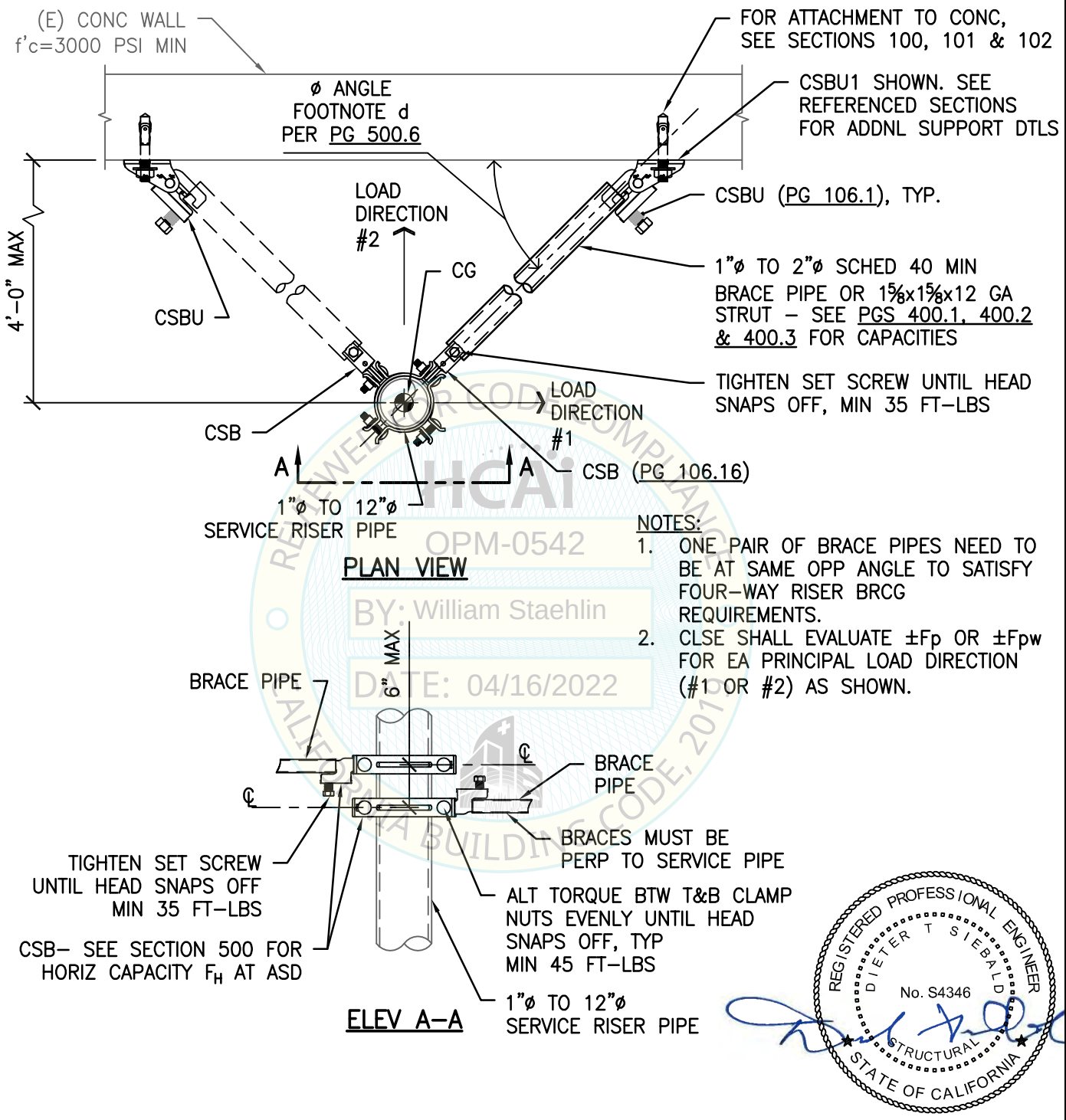
SEISMIC BRACING FOR MEP SYSTEMS



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DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT FOUR-WAY RISER SEISMIC BRACES
CSB WITH BRACE PIPES FOR 1"Ø TO 12"Ø SERVICE PIPES

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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TEL (916) 920-2020
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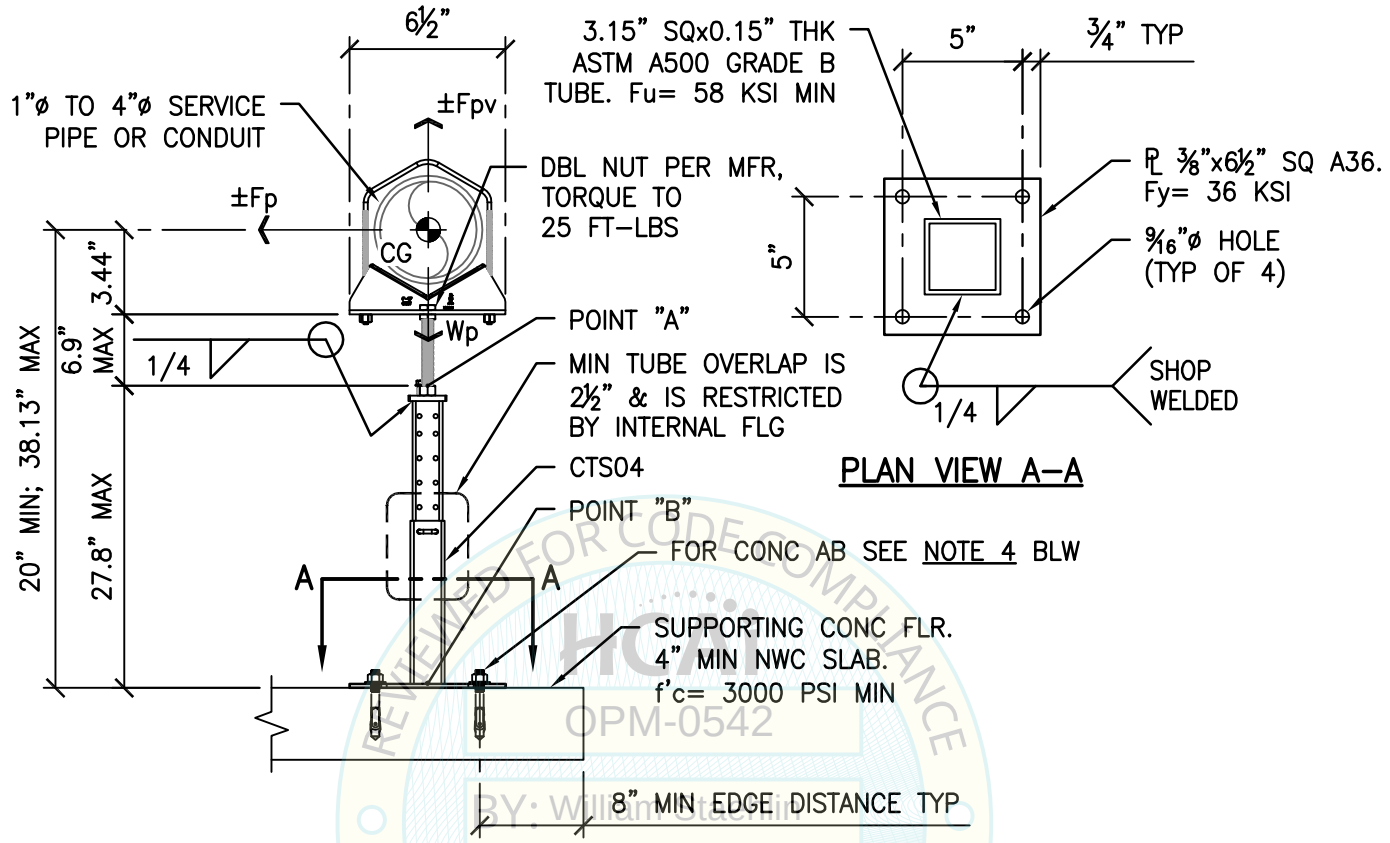
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. THE CTS04 TELESCOPING PIPE STAND IS A COMPLETE MANUFACTURED BRACE PIPE ASSEMBLY. FOR INSTALLATION INSTRUCTIONS, SEE PG 10.3.
2. THE CTS04 BRACE PIPE ASSEMBLY MAY BE USED W/ AN INVERTED CSB LONGITUDINAL BRACE. REFER TO SECTION 7.
3. MAX ALLOWABLE MOMENT FOR THRD ROD AT ASD IS 3000 IN–LBS (POINT "A"). MAX ALLOWABLE MOMENT FOR BASE PL, ANCHORS & TUBE STL AT ASD IS 5200 IN–LBS (POINT "B"). CONCURRENT MAX AXIAL COMPRESSION LOAD AT ASD IS 2000 LBS. Fp,max= 136 LBS AT ASD.
4. THE ALLOWABLE LOADS QUALIFY ½"ø x 2" MIN EMBED CONC AB FOR DEEPER SUPPORTING FLRS, A LARGER ANCHOR EMBEDMENT MAY BE USED. SEE SECTION 1 FOR CONC AB INSTALLATION REQUIREMENTS.
5. BASE PL MAY BE WELDED TO SUPPORTING STRUC STL BUT MUST BE DESIGNED ON A PROJECT SPECIFIC BASIS & MUST REQ SPECIFIC HCAI APPROVAL
6. SEE SECTION 200 FOR PIPE WEIGHTS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE PIPE OR CONDUIT INTERIOR TELESCOPING PIPE STAND CTS04

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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Date:	04/11/2022
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SHEET TITLE: SINGLE PIPE, EMT OR CONDUIT INTERIOR TELESCOPING PIPE STAND CTS10

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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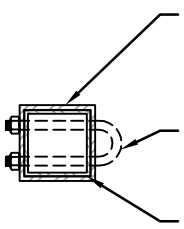
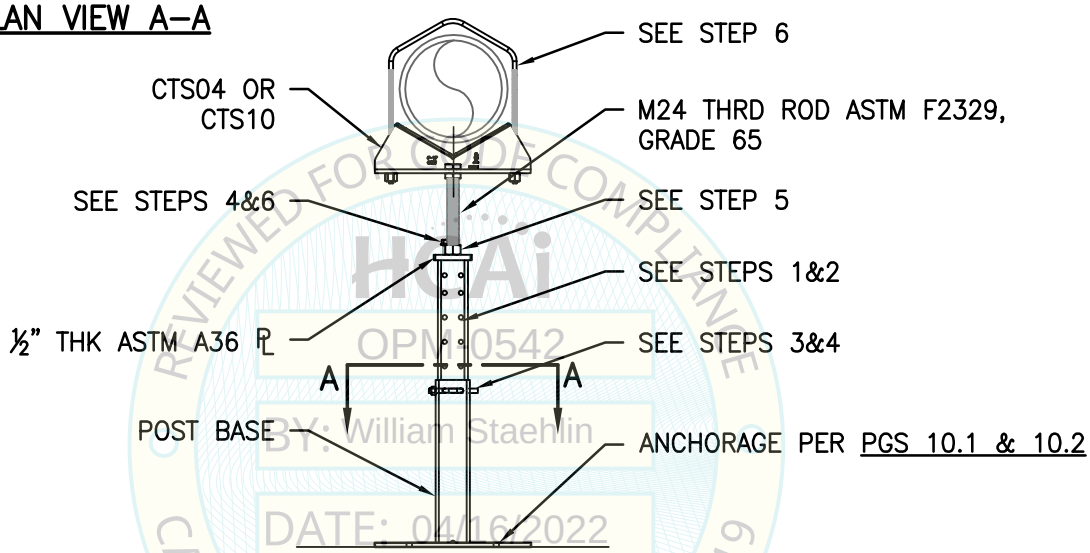


PLAN VIEW A-A



TELESCOPING PIPE STAND INSTALLATION INSTRUCTIONS:

STEP 1: INSERT POST ASSEMBLY.

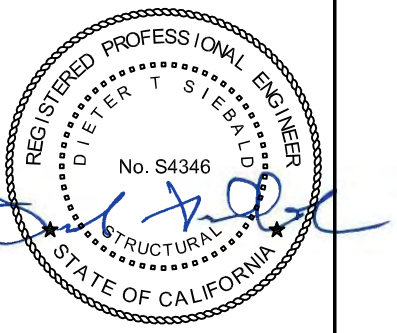
STEP 2: ADJUST HT OF POST ASSEMBLY.

STEP 3: INSERT U-BOLT (BY MFR) & TORQUE NUTS TO 35 FT-LBS.

STEP 4: REMOVE SET SCREW

STEP 5: ROTATE NUT ON LEVELING ROD.
AT FINAL POSITION, TORQUE TO 25 FT-LBS.

STEP 6: REPLACE SET SCREW & HAND TIGHTEN. SET SCREW SO THAT IT STOPS NUT ROTATION. PRESS V-BOLT AGAINST PIPE & TORQUE TO 7 FT-LBS.



SHEET TITLE: SINGLE PIPE OR CONDUIT TELESCOPING PIPE STAND
CTS04 & CTS10 POST BASE INSTALLATION INSTRUCTIONS

CYS STRUCTURAL ENGINEERS, INC.
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Date:	04/11/2022
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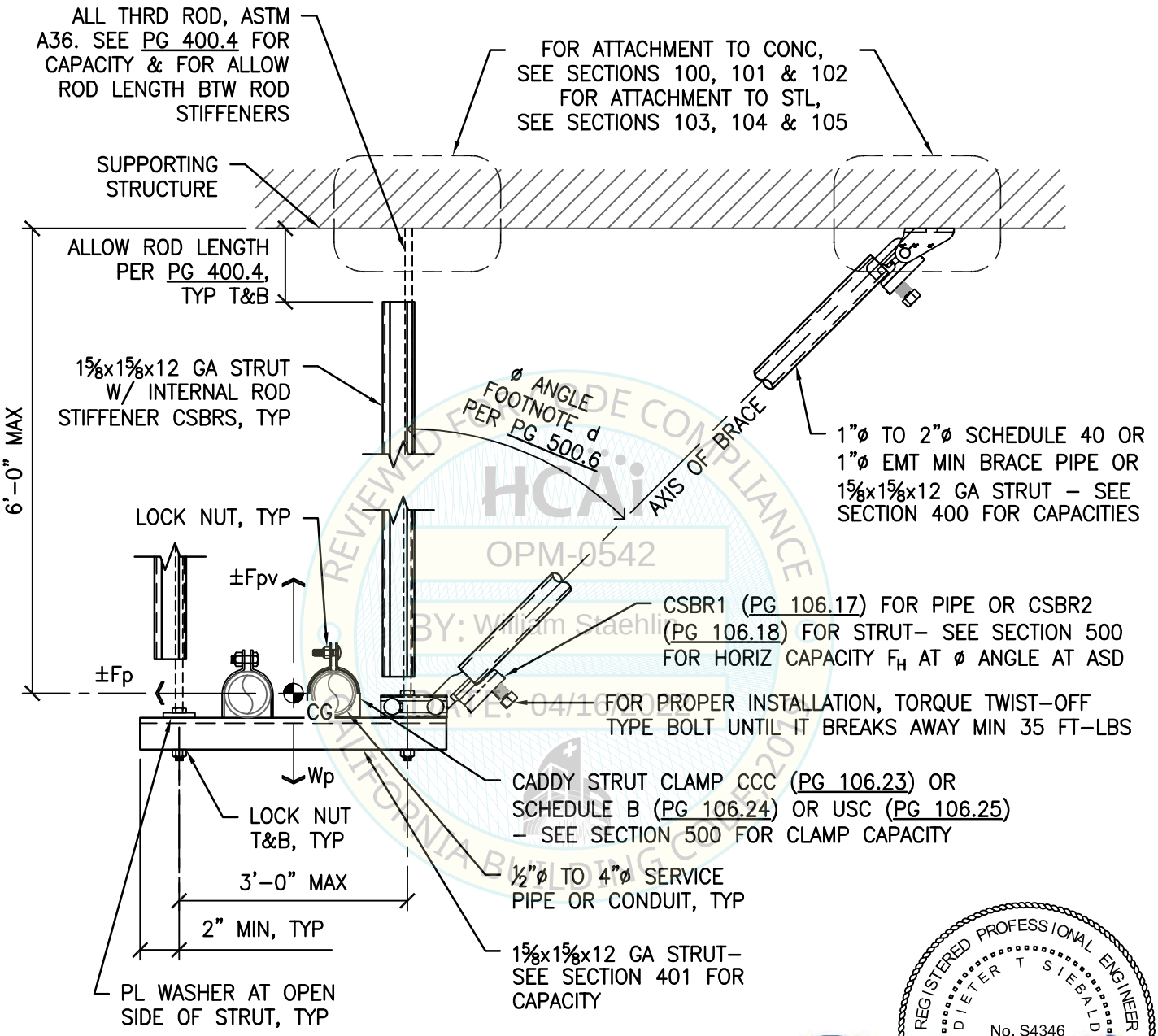
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: MULTIPLE PIPE OR CONDUIT SUPPORTED BY SINGLE HORIZONTAL TRAPEZE STRUT TRANSVERSE (LATERAL) RIGID BRACING

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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Date:	04/11/2022
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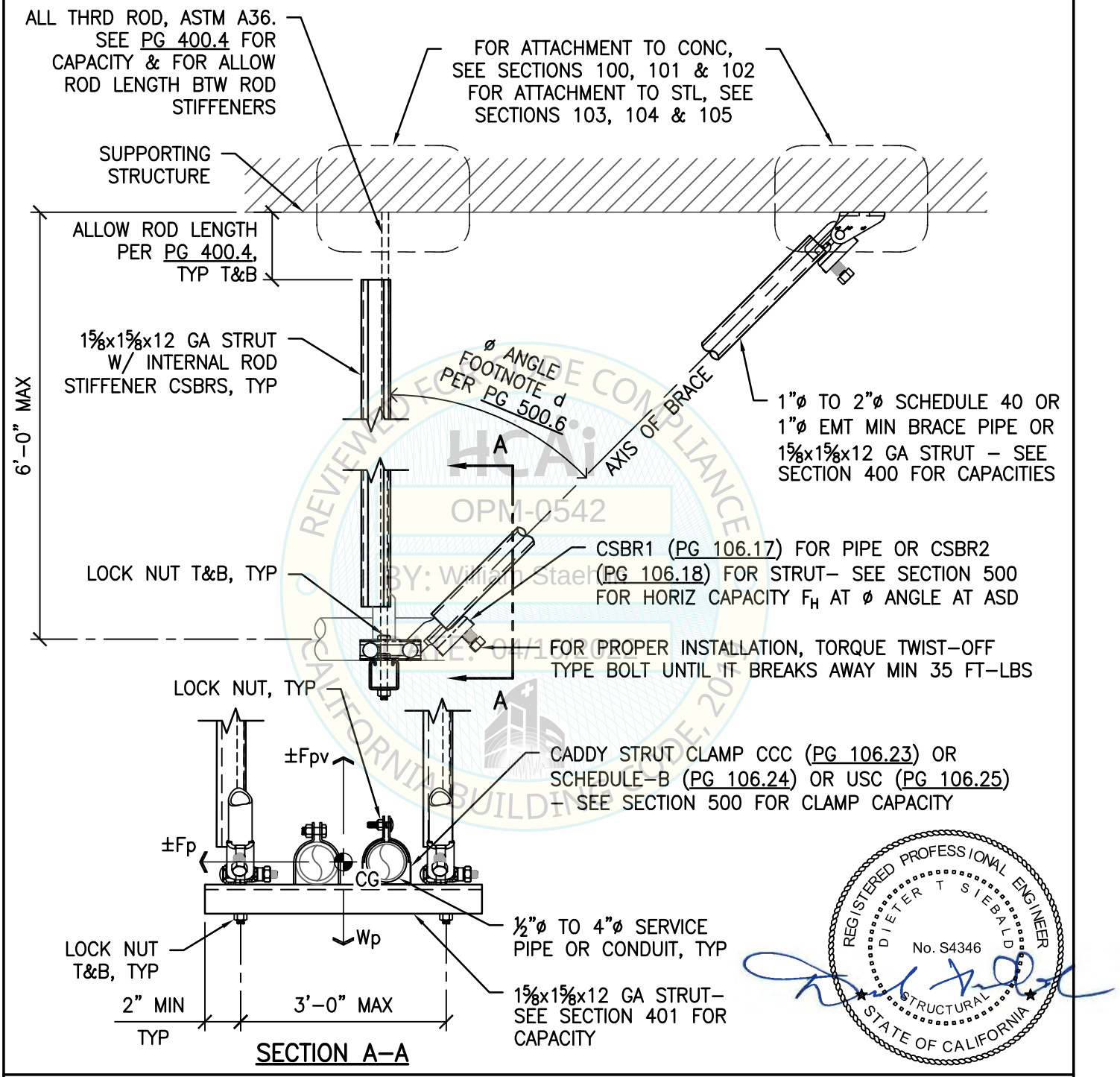
SEISMIC BRACING FOR MEP SYSTEMS



SECTION A–A

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: MULTIPLE PIPE OR CONDUIT SUPPORTED BY SINGLE HORIZONTAL TRAPEZE STRUT LONGITUDINAL RIGID BRACING

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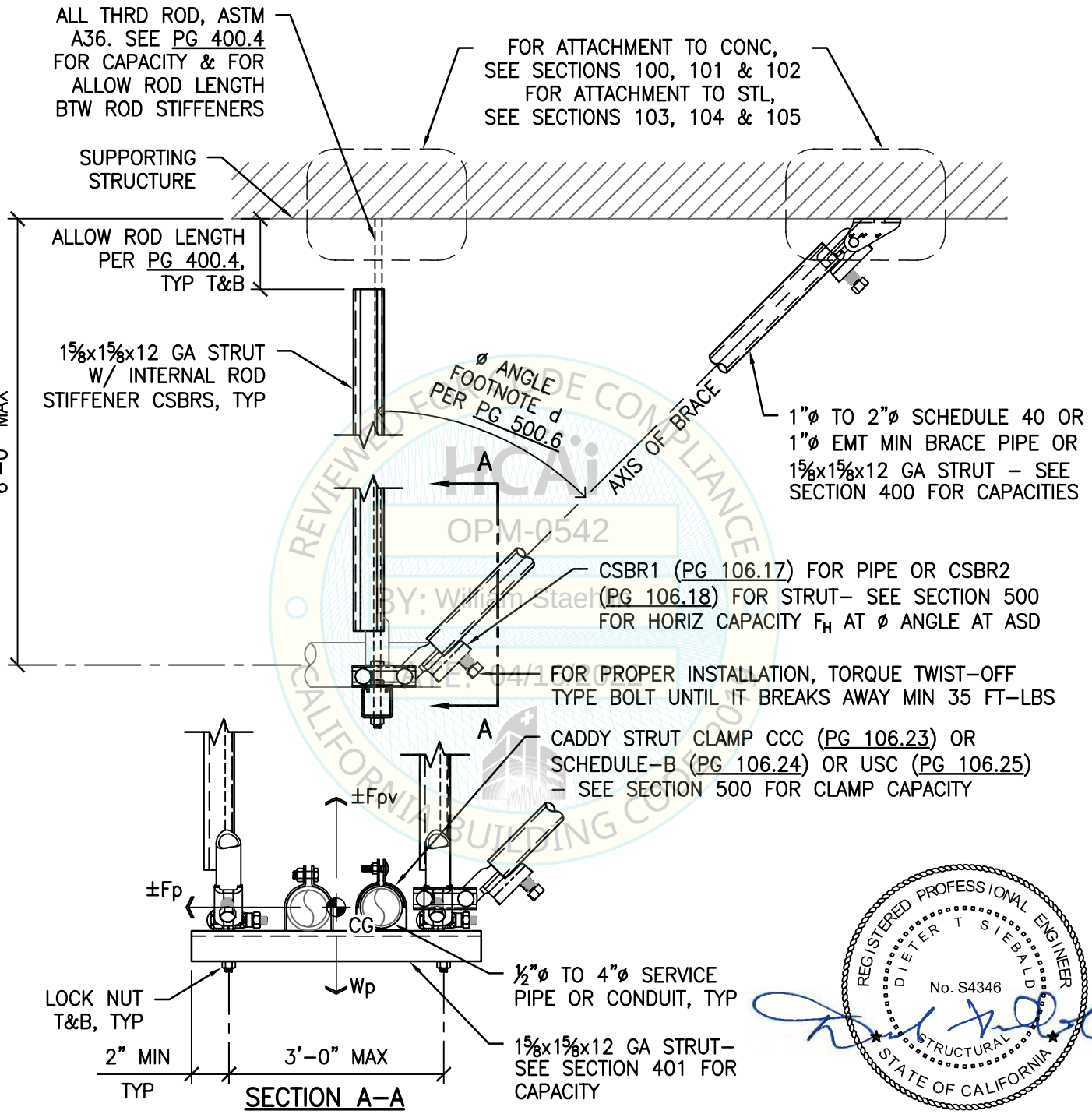
SEISMIC BRACING FOR MEP SYSTEMS



SECTION A–A

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: MULTIPLE PIPE OR CONDUIT SUPPORTED BY SINGLE HORIZONTAL TRAPEZE STRUT TRANSVERSE (LATERAL) & LONGITUDINAL RIGID BRACING

CYS STRUCTURAL ENGINEERS, INC.
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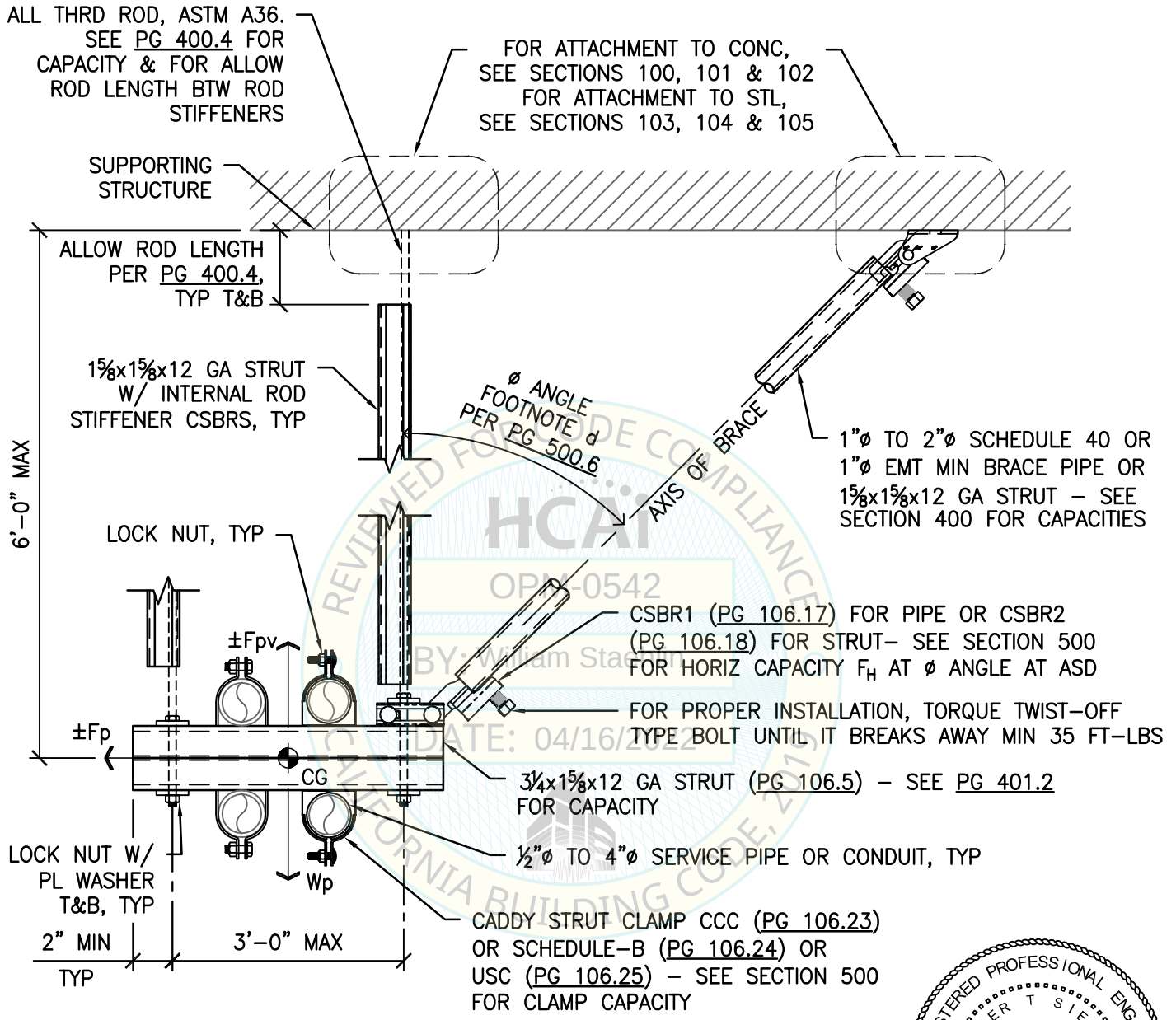
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: MULTIPLE PIPE OR CONDUIT SUPPORTED BY DOUBLE HORIZONTAL TRAPEZE STRUT TRANSVERSE (LATERAL) RIGID BRACING

CYS STRUCTURAL ENGINEERS, INC.
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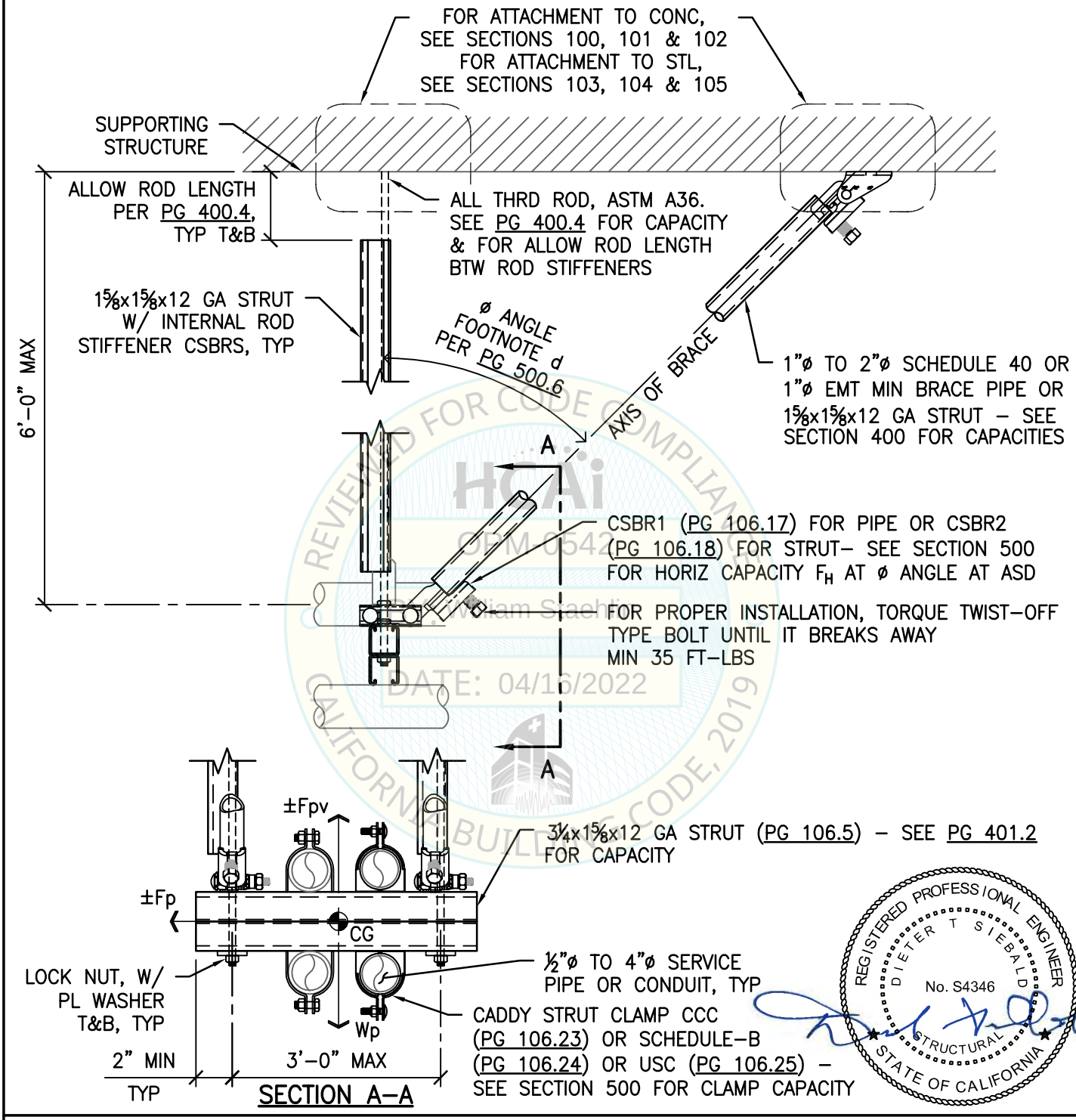
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: MULTIPLE PIPE OR CONDUIT SUPPORTED BY DOUBLE HORIZONTAL TRAPEZE STRUT LONGITUDINAL RIGID BRACING

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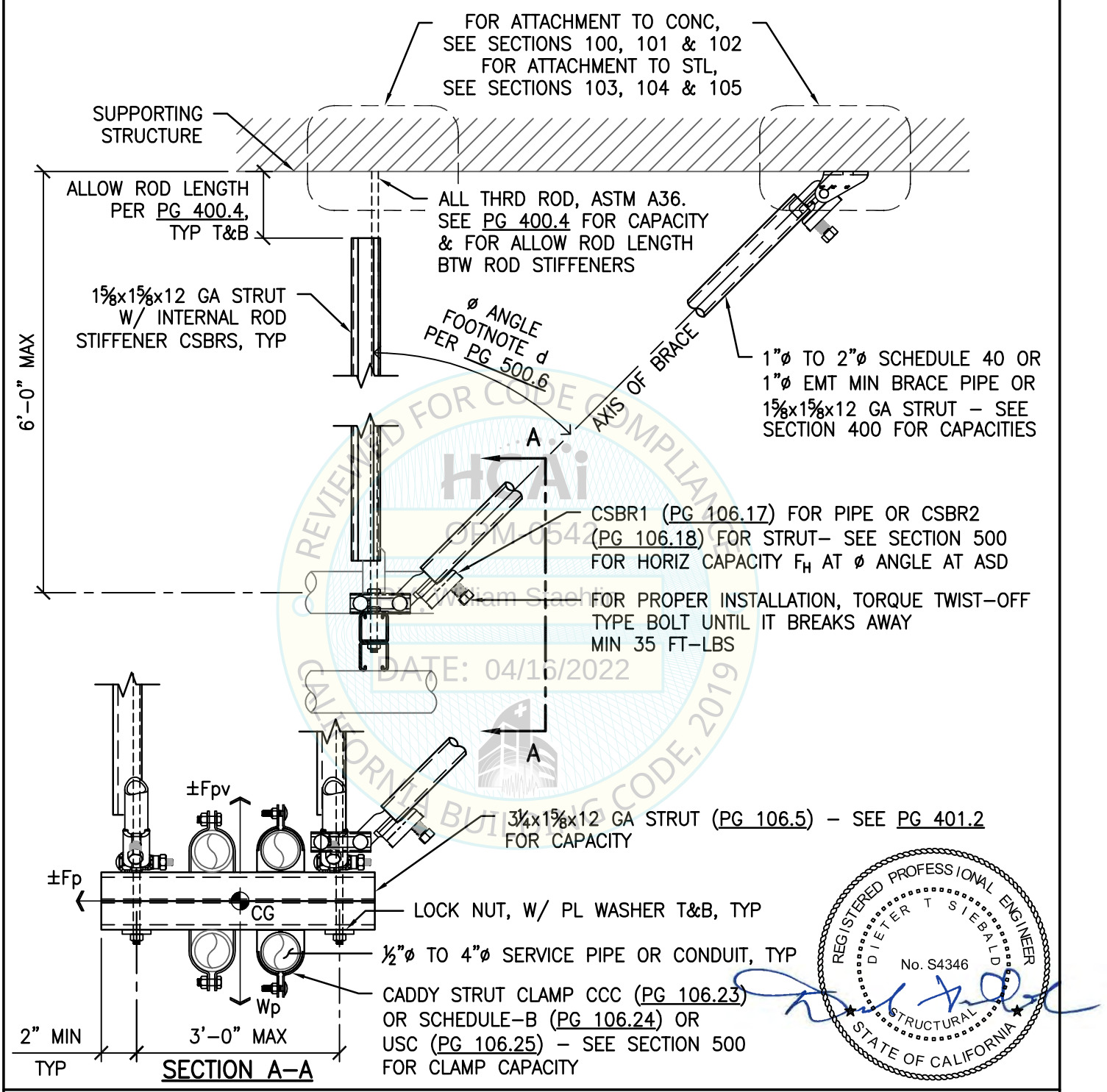
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: MULTIPLE PIPE OR CONDUIT SUPPORTED BY DOUBLE HORIZONTAL TRAPEZE STRUT TRANSVERSE (LATERAL) & LONGITUDINAL RIGID BRACING

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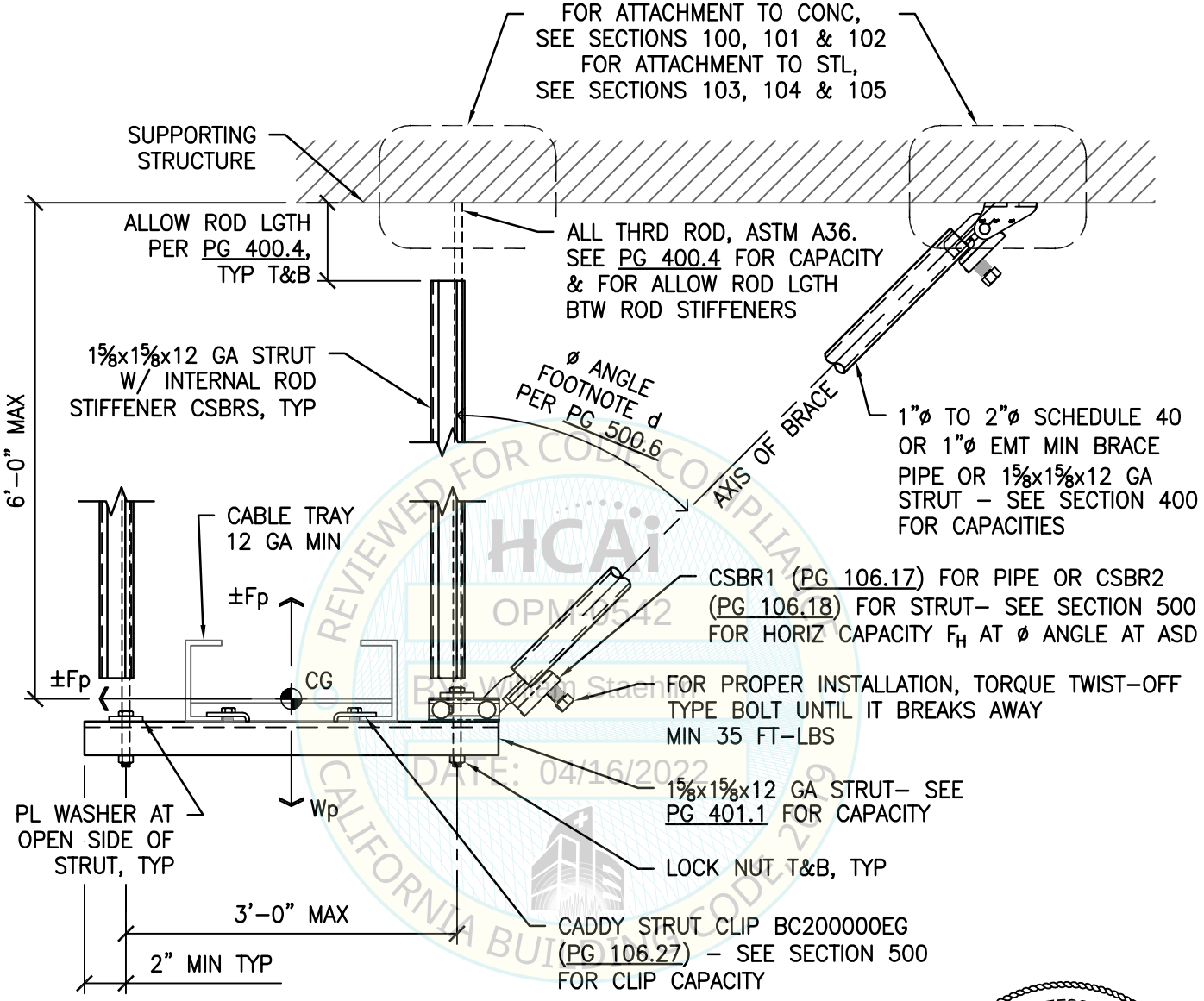
SEISMIC BRACING FOR MEP SYSTEMS



NOTE:
FOR CABLE TRAY REFER TO DESIGN PARAMETERS & BRCG GUIDELINES ON PGS 1.200 THRU 1.206.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE CABLE TRAY SUPPORTED BY SINGLE HORIZONTAL TRAPEZE STRUT TRANSVERSE (LATERAL) RIGID BRACING

CYS STRUCTURAL ENGINEERS, INC.
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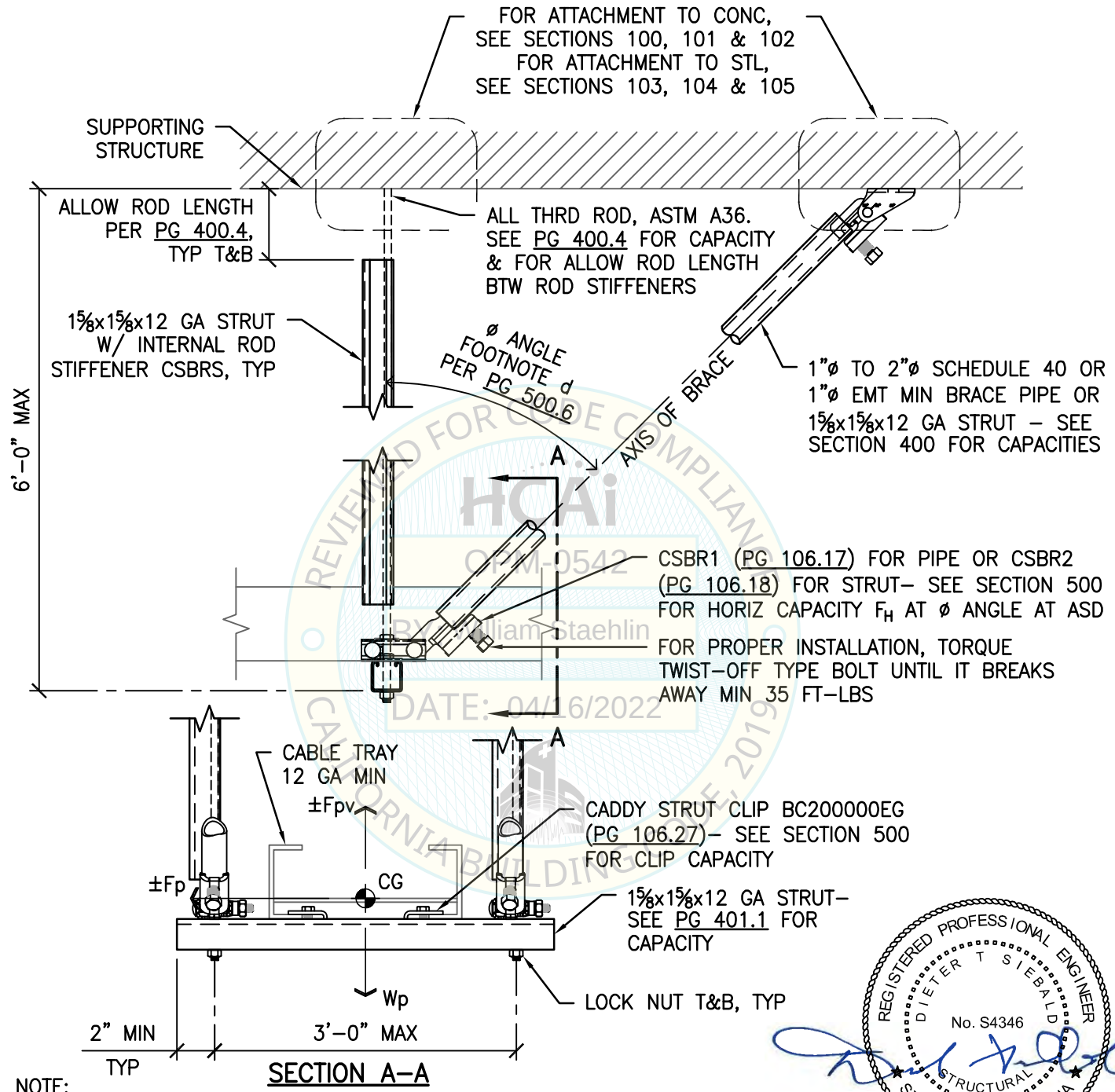
SEISMIC BRACING FOR MEP SYSTEMS



SECTION A–A

NOTE:
FOR CABLE TRAY REFER TO DESIGN PARAMETERS & BRCG GUIDELINES ON PGS 1.200 THRU 1.206.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE CABLE TRAY SUPPORTED BY SINGLE HORIZONTAL TRAPEZE STRUT LONGITUDINAL RIGID BRACING

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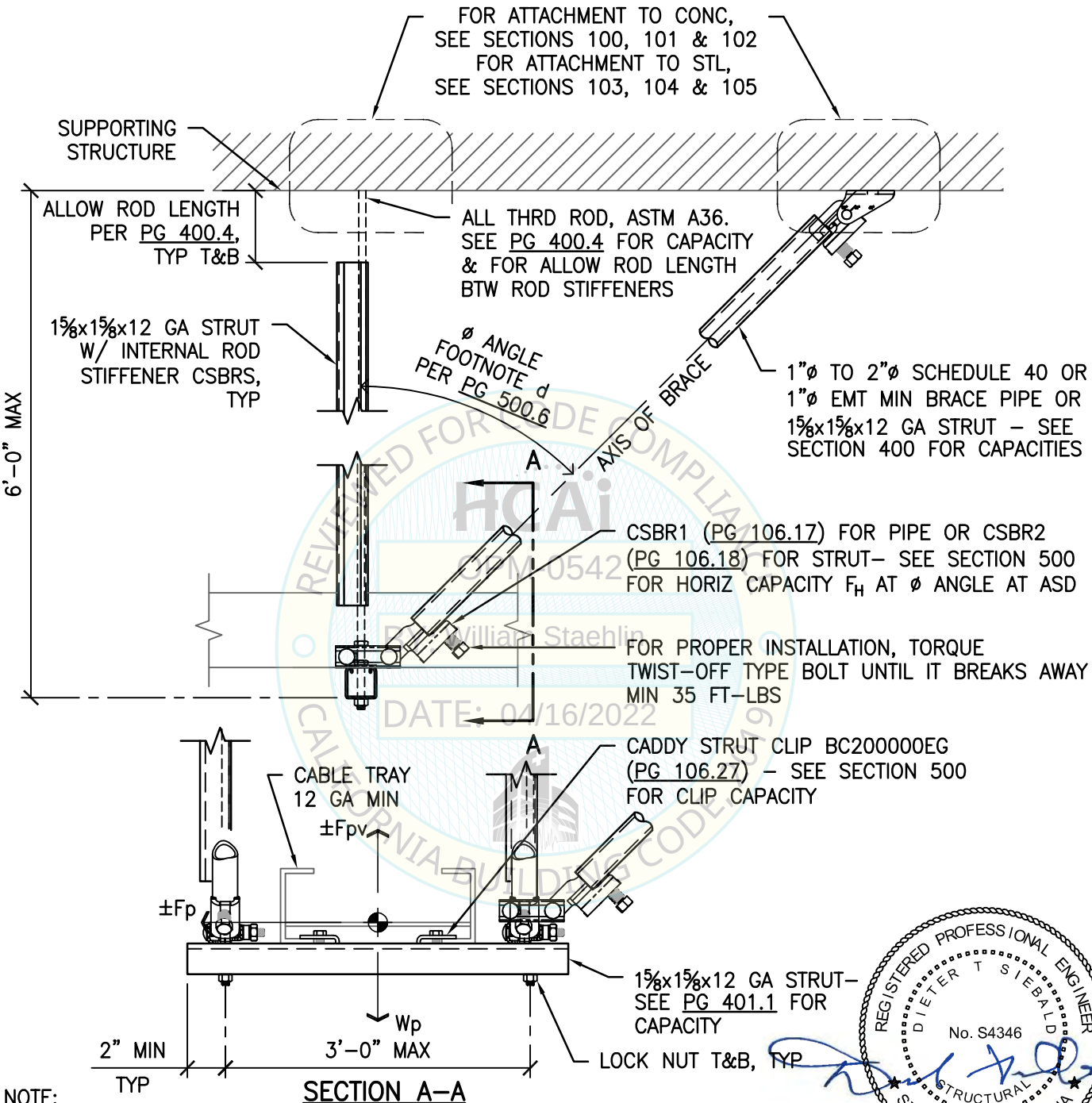
SEISMIC BRACING FOR MEP SYSTEMS



SECTION A–A

NOTE:
FOR CABLE TRAY REFER TO DESIGN PARAMETERS & BRCG GUIDELINES ON PGS 1.200 THRU 1.206.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE CABLE TRAY SUPPORTED BY SINGLE HORIZONTAL TRAPEZE STRUT TRANSVERSE (LATERAL) & LONGITUDINAL RIGID BRACING

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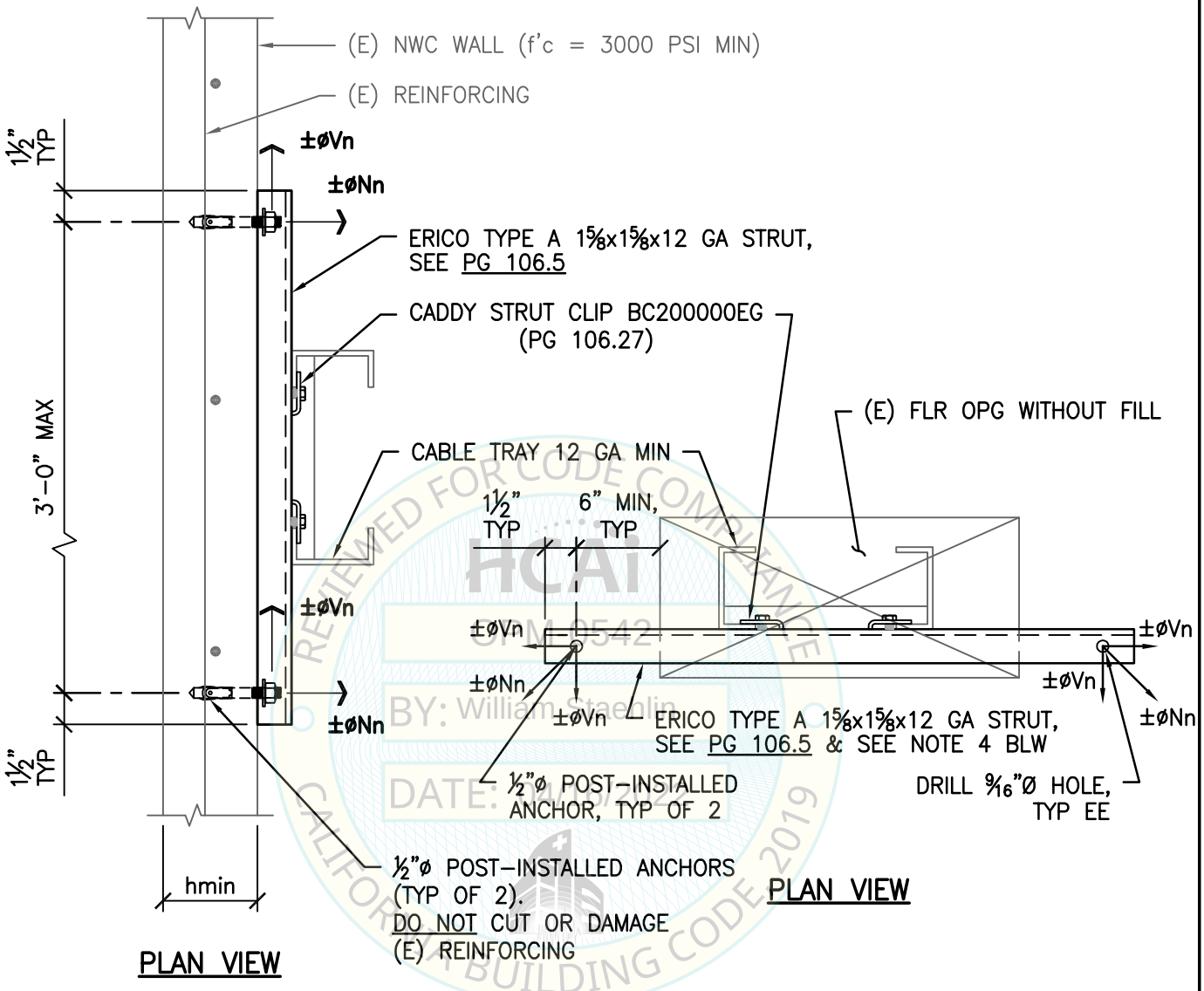
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. SEOR MUST VERIFY CAPACITY OF THE STRUT WHEN THE STRUT IS LONGER THAN 3'-3".

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE CABLE TRAY SUPPORTED BY SINGLE HORIZONTAL TRAPEZE STRUT TRANSVERSE (LATERAL) & LONGITUDINAL RIGID BRACING AT CONCRETE WALL & FLOOR

CYS STRUCTURAL ENGINEERS, INC.
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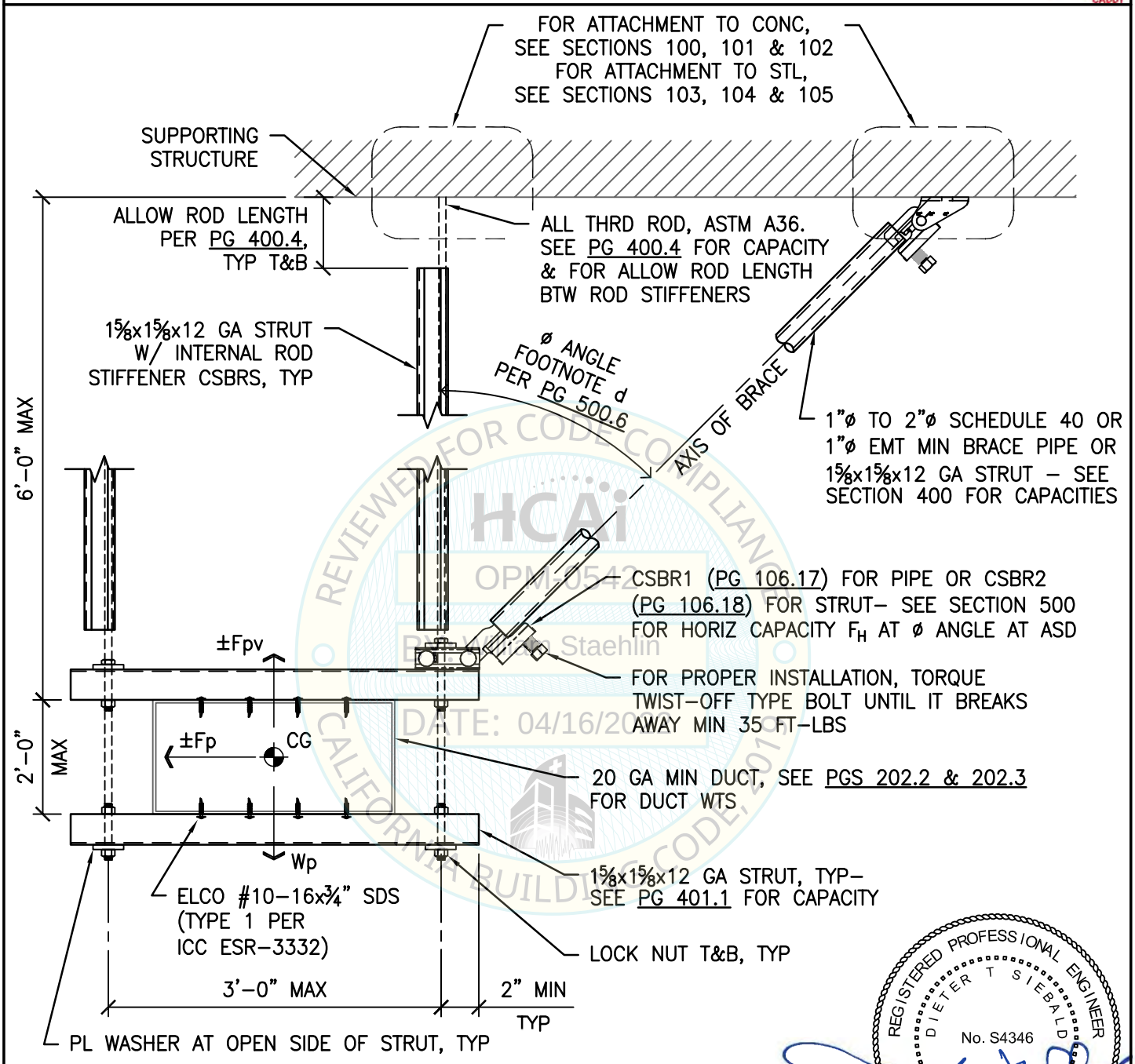
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE RECTANGULAR DUCT SUPPORTED BY TWO SINGLE HORIZONTAL TRAPEZE STRUTS TRANSVERSE (LATERAL) RIGID BRACING

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2495 NATOMAS PARK DRIVE, SUITE 650
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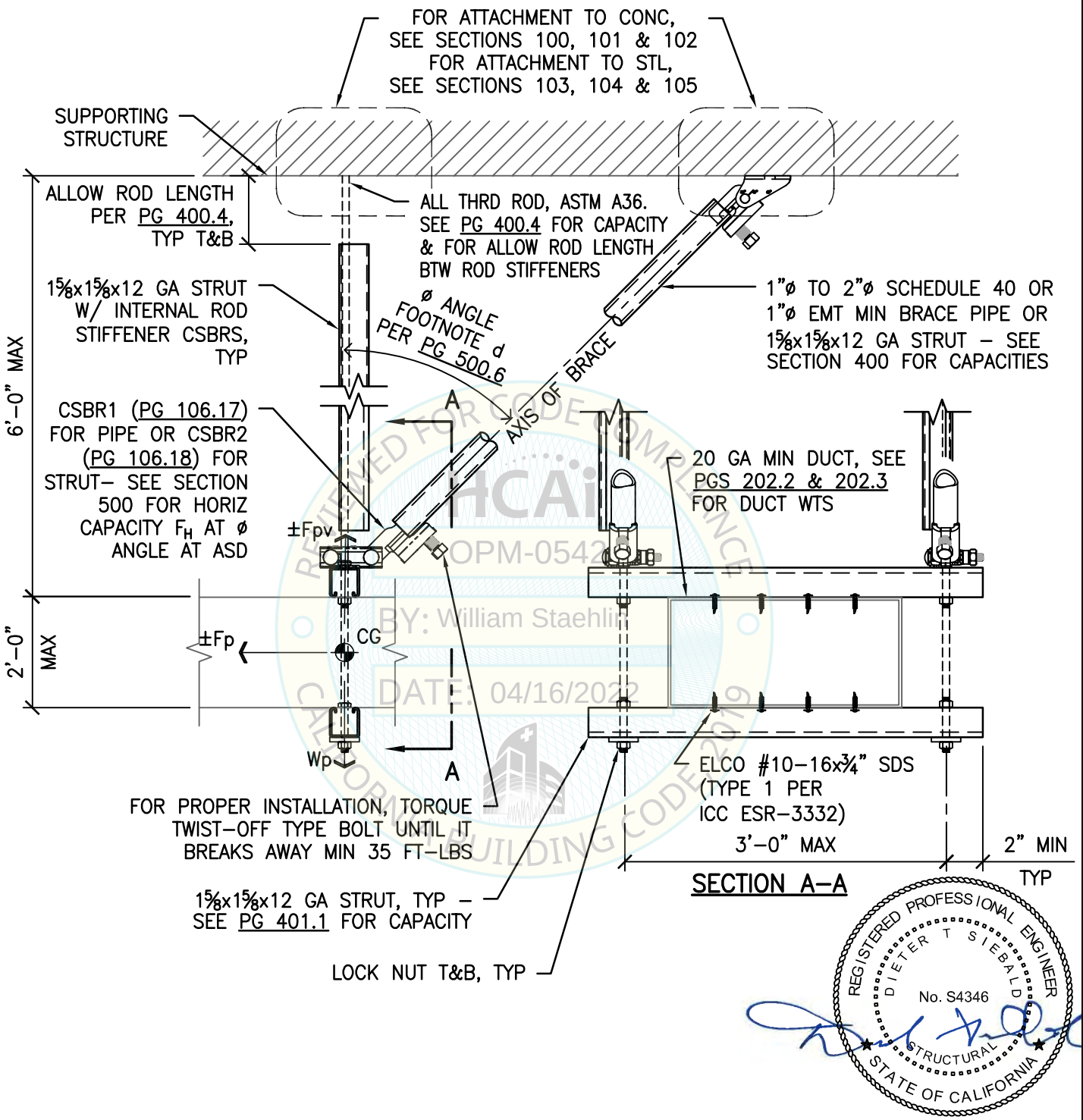
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE RECTANGULAR DUCT SUPPORTED BY TWO SINGLE HORIZONTAL TRAPEZE STRUTS LONGITUDINAL RIGID BRACING

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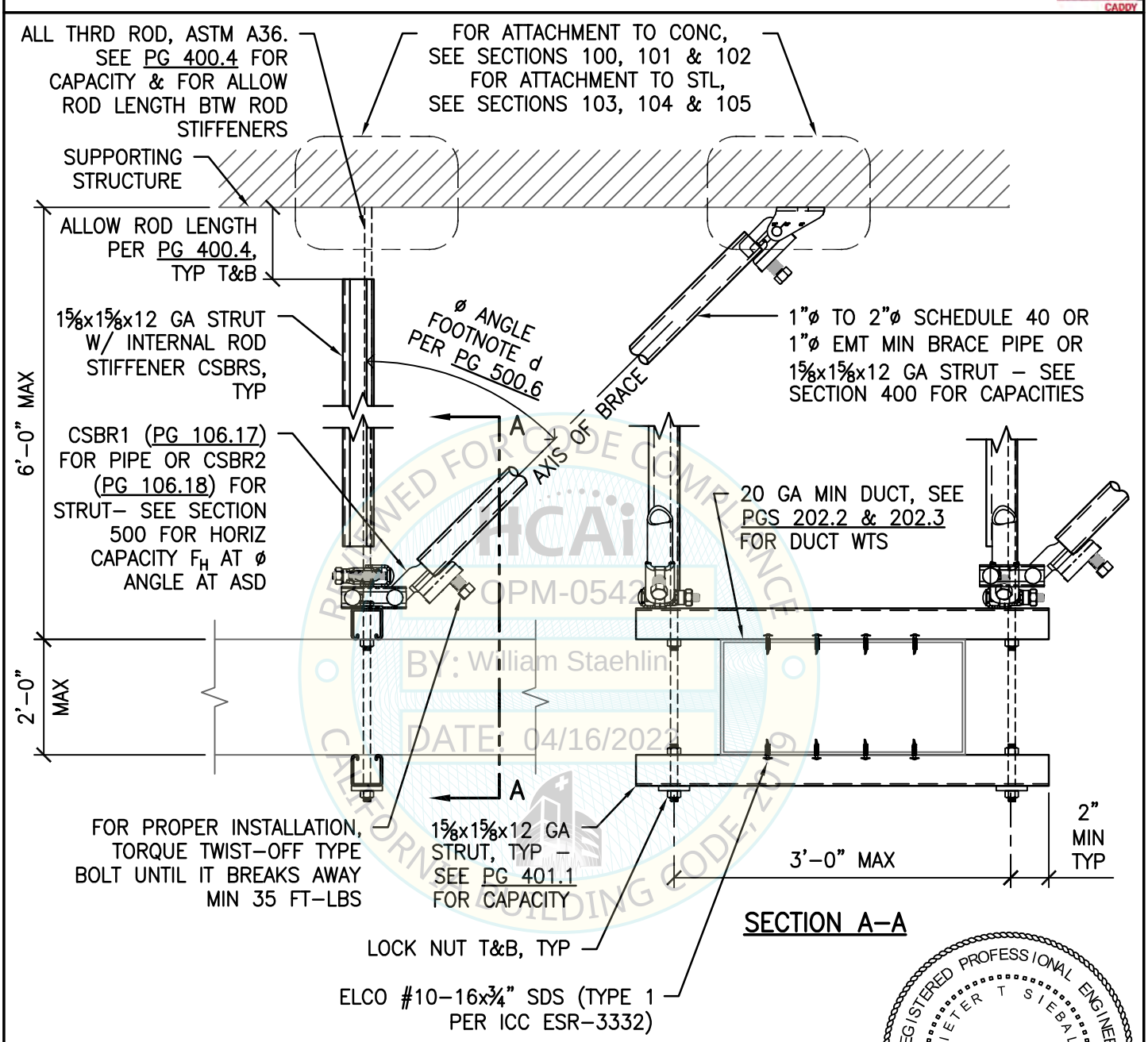
SEISMIC BRACING FOR MEP SYSTEMS



SECTION A–A

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE RECTANGULAR DUCT SUPPORTED BY TWO SINGLE HORIZONTAL TRAPEZE STRUTS TRANSVERSE (LATERAL) & LONGITUDINAL RIGID BRACING

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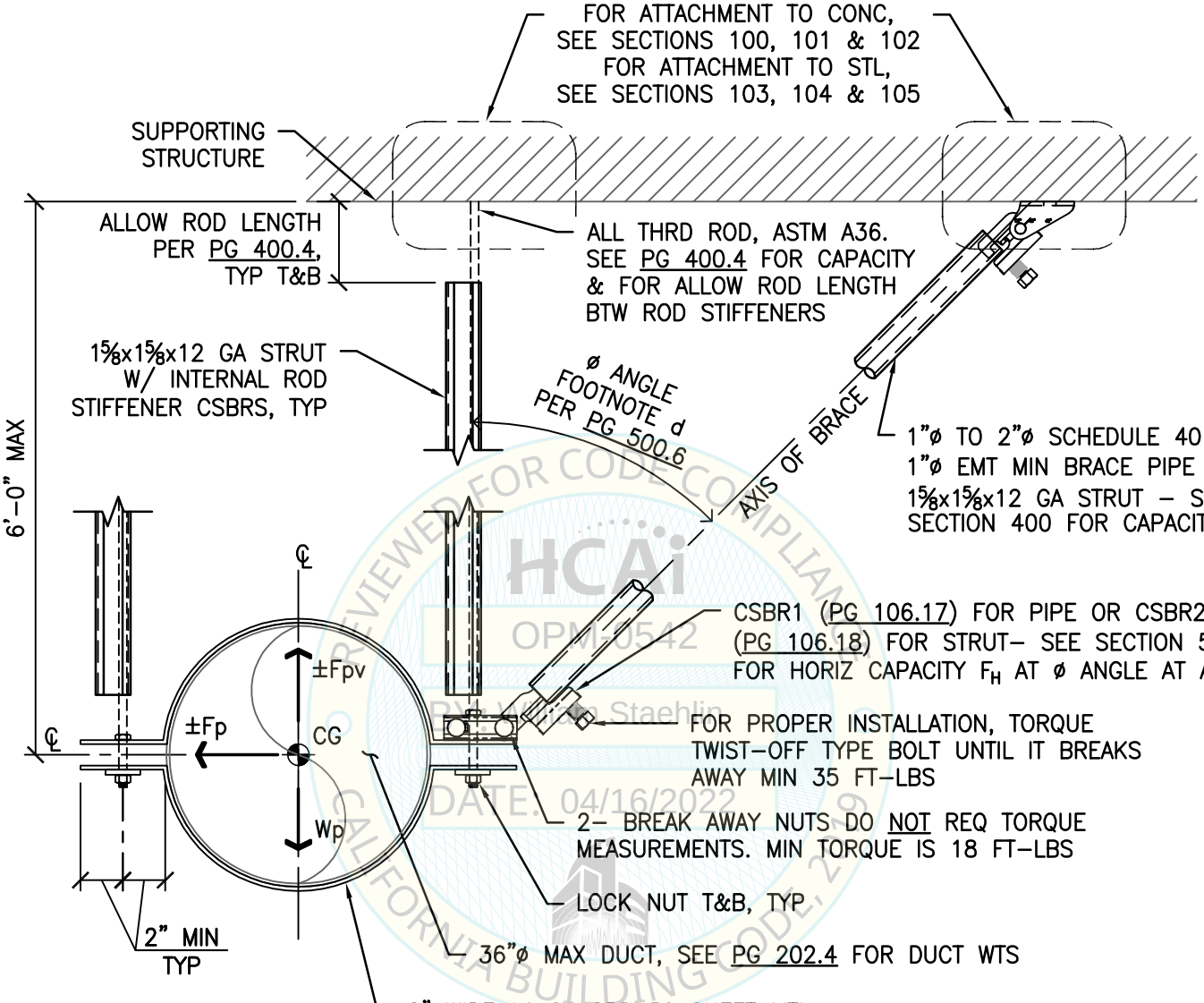
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE ROUND DUCT SUPPORTED BY SHEET METAL STRAPS
TRANSVERSE (LATERAL) RIGID BRACING

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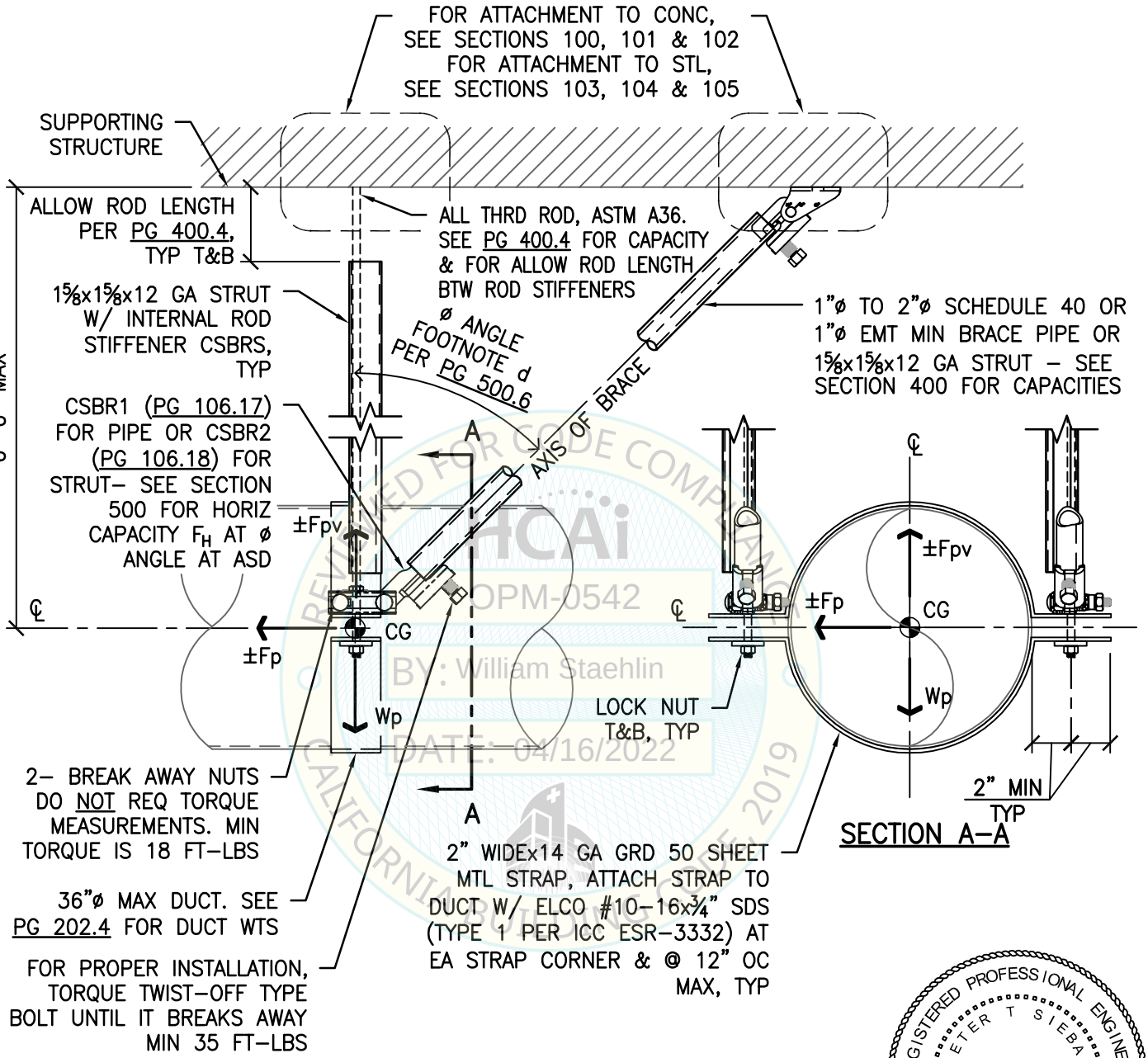
SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE ROUND DUCT SUPPORTED BY SHEET METAL STRAPS LONGITUDINAL RIGID BRACING

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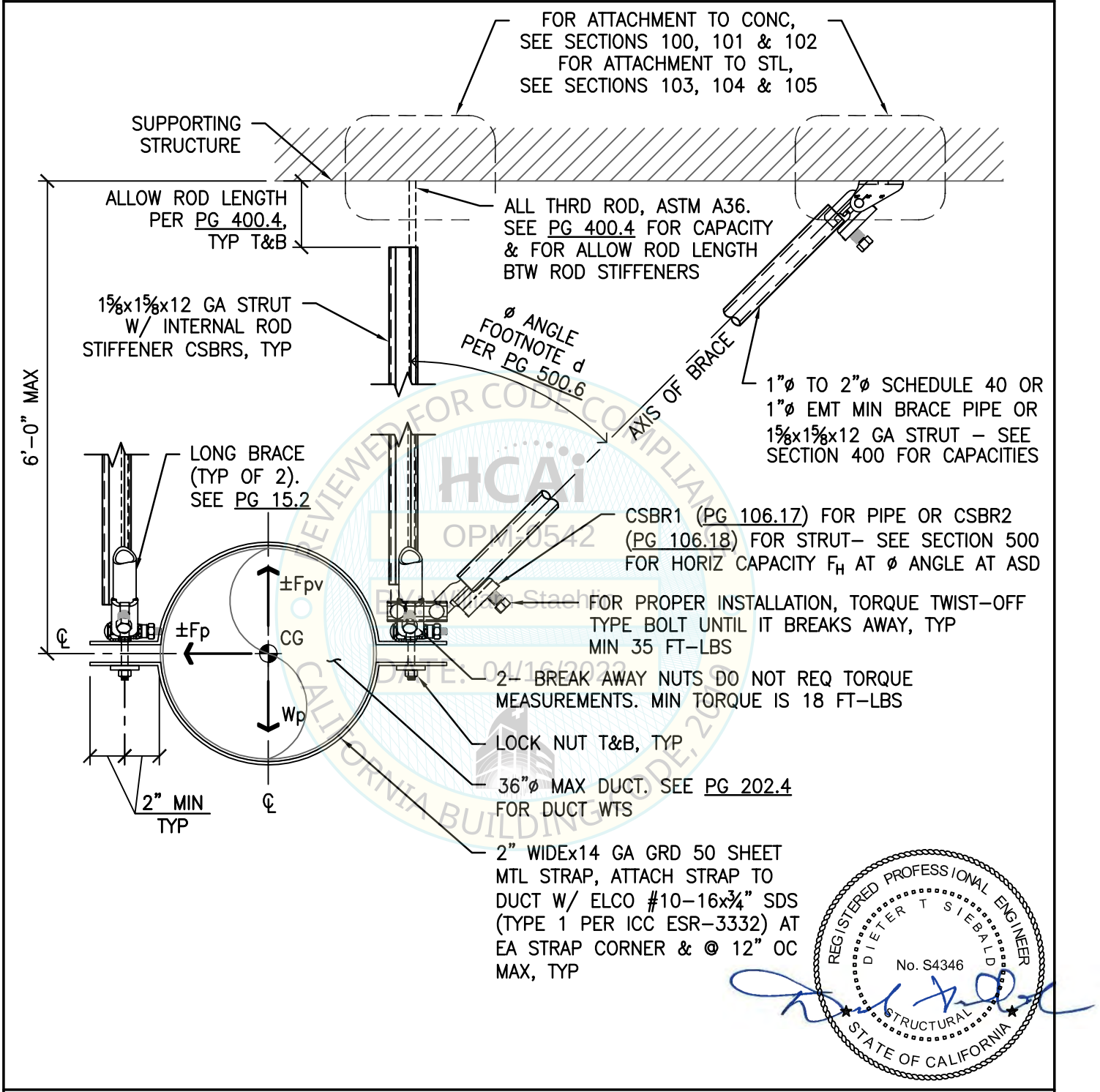
Page:	15.2 of .

SEISMIC BRACING FOR MEP SYSTEMS



REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE ROUND DUCT SUPPORTED BY SHEET METAL STRAPS
TRANSVERSE (LATERAL) & LONGITUDINAL RIGID BRACING

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2495 NATOMAS PARK DRIVE, SUITE 650
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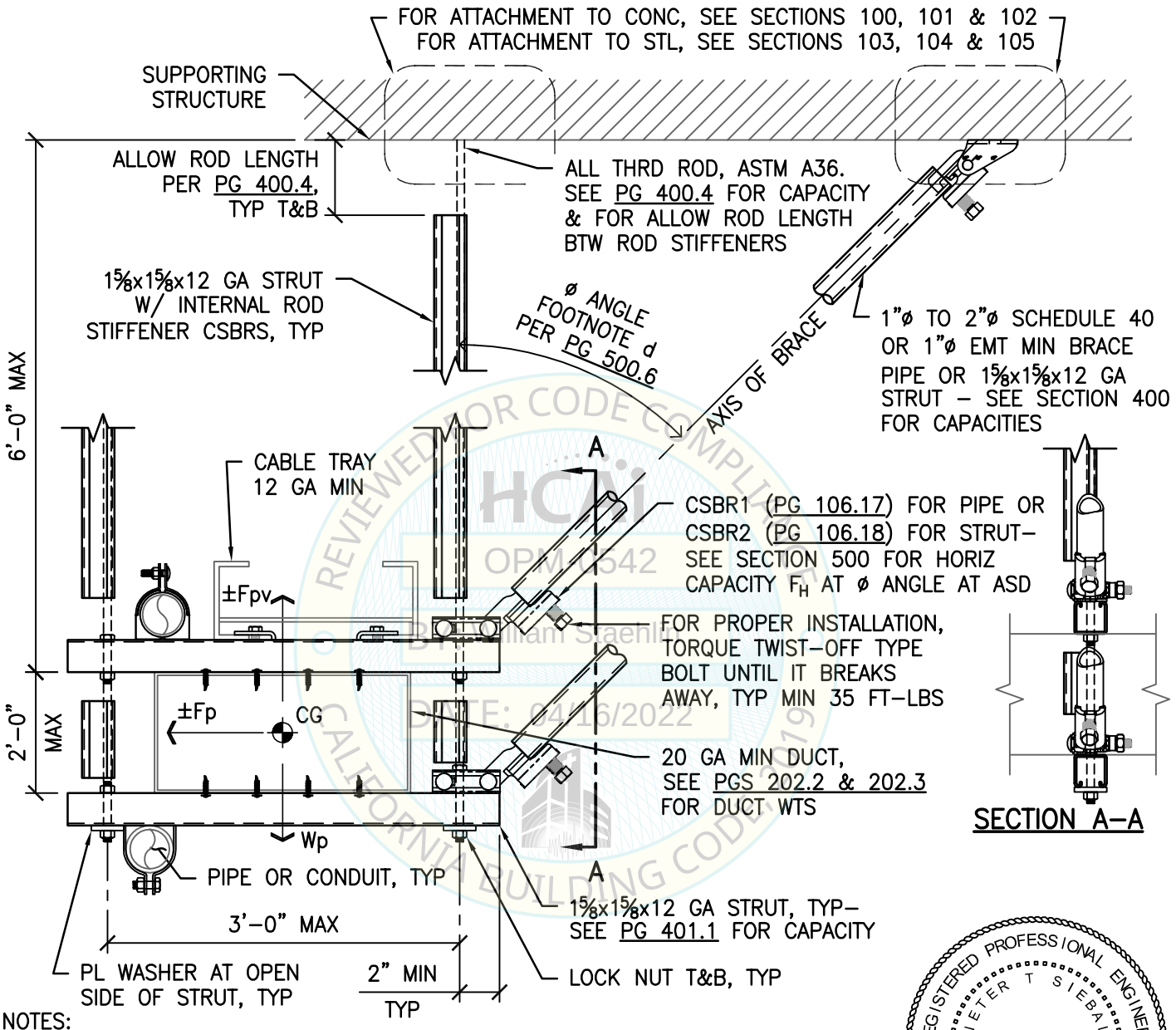
SEISMIC BRACING FOR
MEP SYSTEMS

TRANSVERSE (LATERAL) RIGID BRACING



NOTES:
1. FOR COMPONENT ATTACHMENTS TO STRUT, SEE PGS 11.1, 13.1 & 14.1.
2. DESIGN PROFESSIONAL MUST CALCULATE DESIGN VALUES FOR EACH TRAPEZE SUPPORT. SPACING BETWEEN BRACED TRAPEZE SUPPORTS MUST NOT EXCEED THE SMALLEST ALLOWABLE SPACING FOR ANY ONE SYSTEM COMPONENT ATTACHED TO THE SUPPORT.
3. DESIGN PROFESSIONAL MUST CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE Fp VALUE USED IN DESIGN.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: MULTIPLE PIPE OR CONDUIT OR SINGLE RECTANGULAR DUCT OR SINGLE CABLE TRAY SUPPORTED BY TWO SINGLE HORIZONTAL TRAPEZE STRUTS

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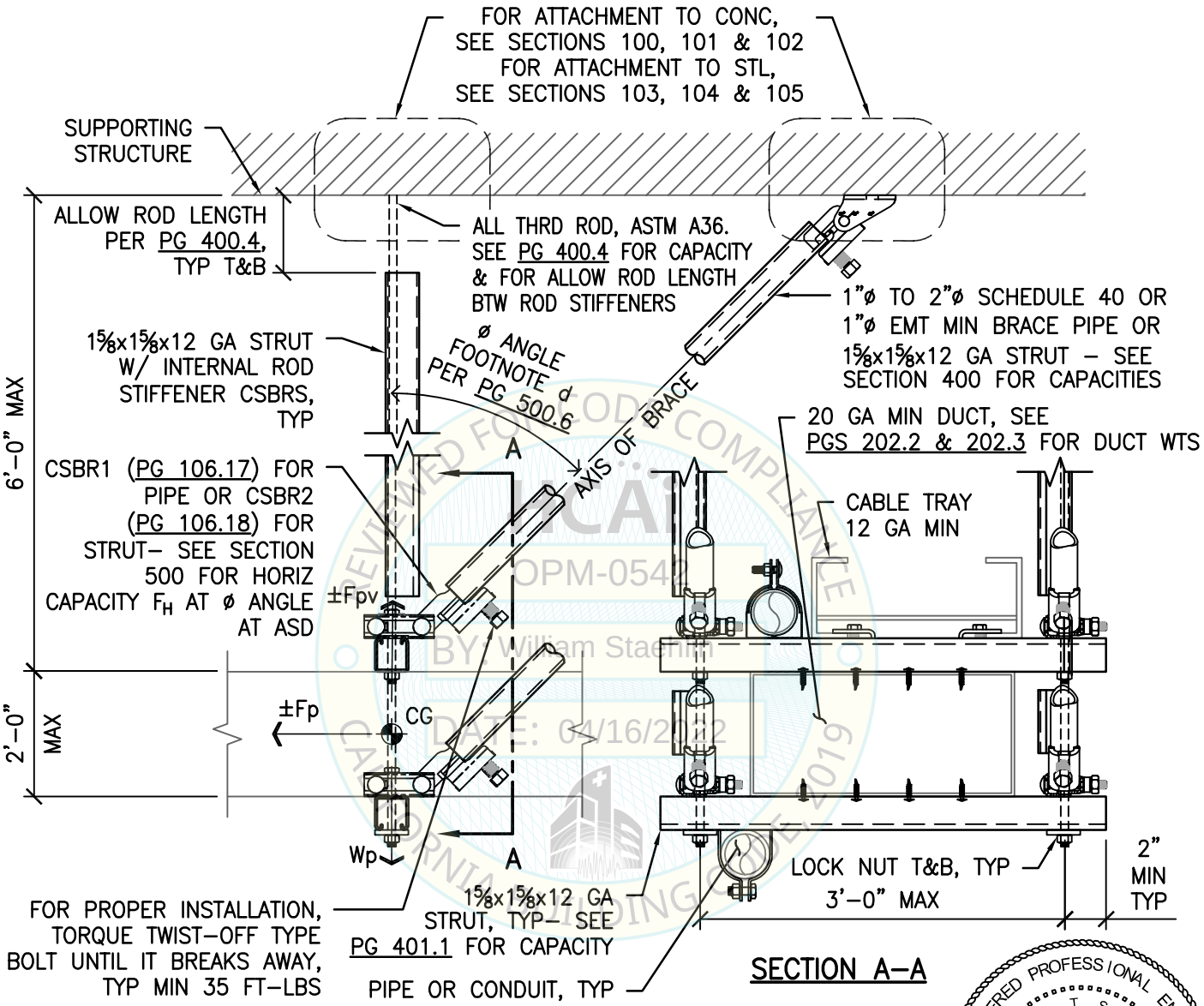
SEISMIC BRACING FOR MEP SYSTEMS

LONGITUDINAL RIGID BRACING



SECTION A–A

NOTES:

1. FOR COMPONENT ATTACHMENTS TO STRUT, SEE PGS 11.1, 13.1 & 14.1.
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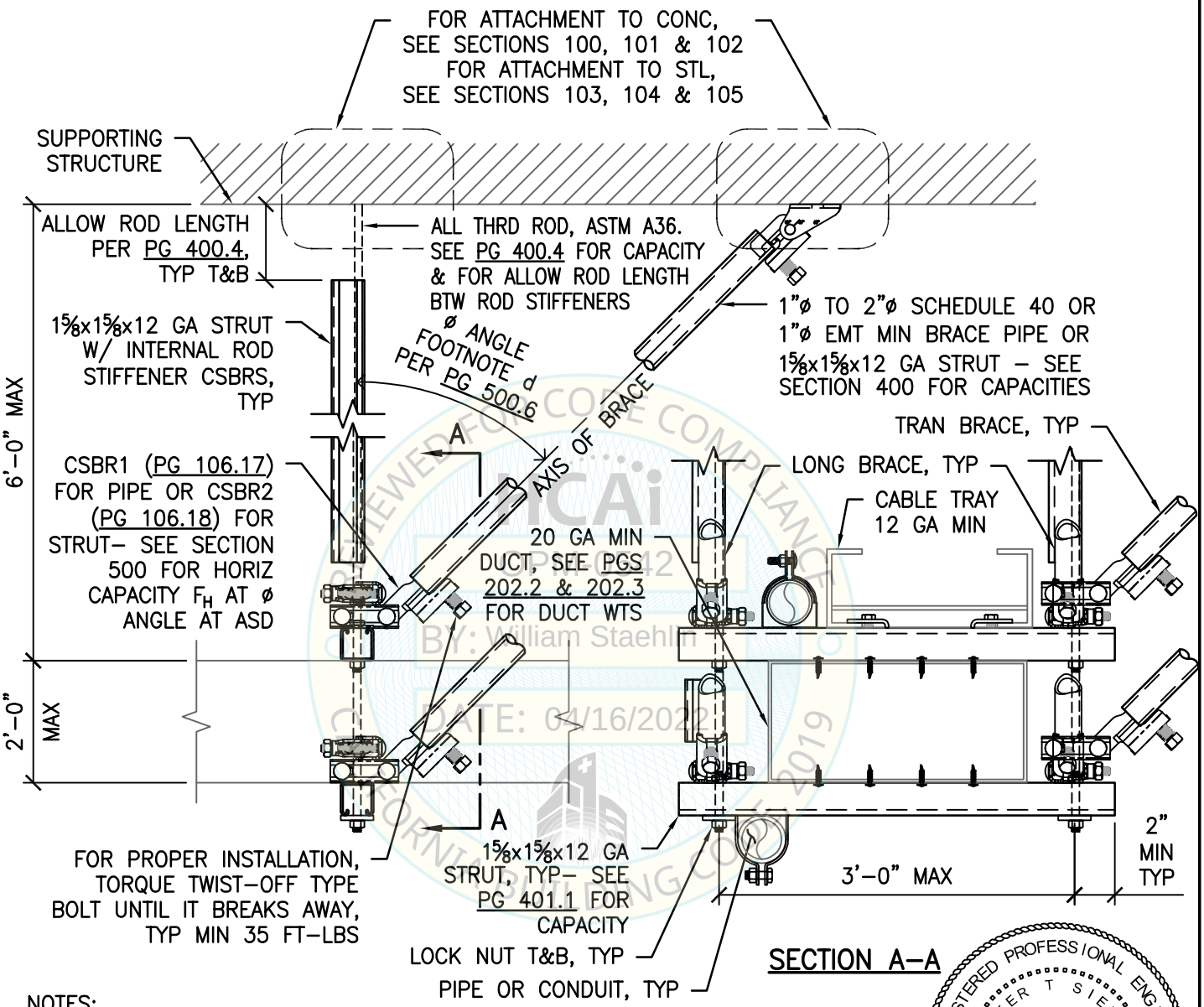
SEISMIC BRACING FOR
MEP SYSTEMS

TRANSVERSE (LATERAL) & LONGITUDINAL RIGID BRACING



SECTION A–A

NOTES:

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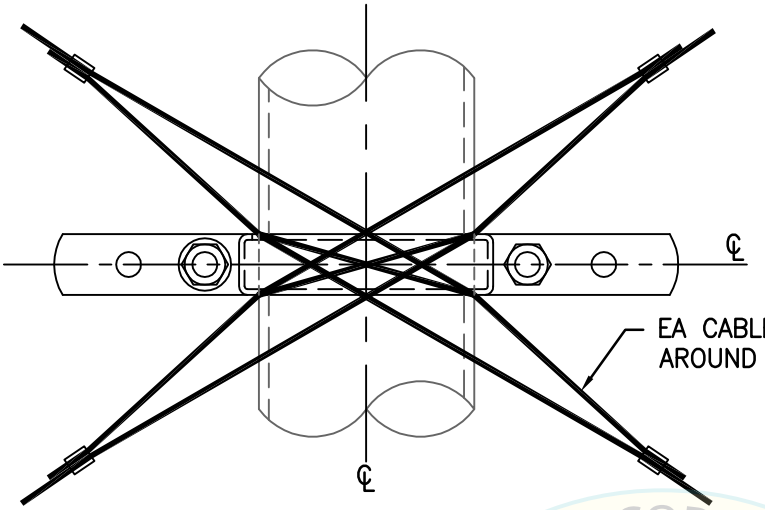
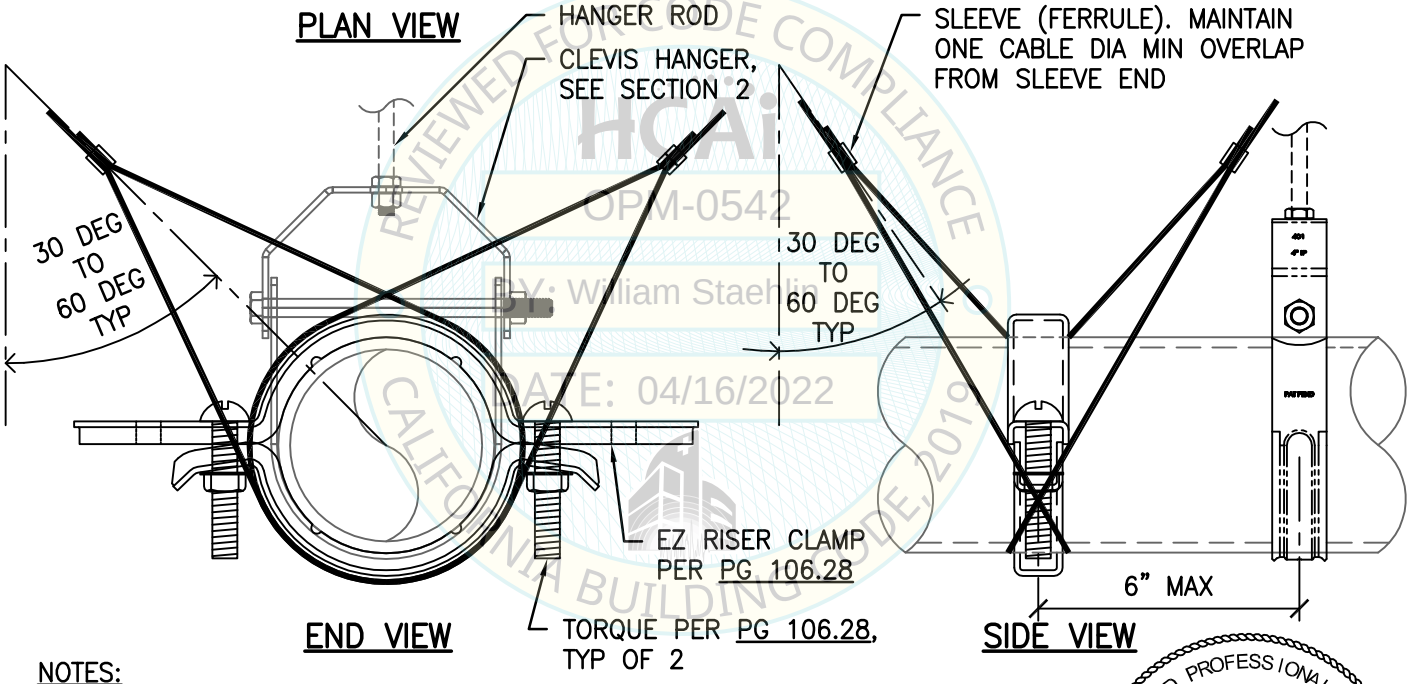
SEISMIC BRACING FOR MEP SYSTEMS



PLAN VIEW



END VIEW

SIDE VIEW

NOTES:

1. FOR CABLE & SLEEVE CAPACITY, SEE PG 400.5
2. THE SLEEVE HAS TO BE SWAGED BY USING A SWAGING TOOL SUPPLIED BY CADDY. REFER TO PG 400.5 INSTRUCTIONS FOR NUMBER OF SWAGES NEEDED PER CABLE SIZE.
3. FOR ATTACHMENT TO STRUCTURE, SEE PG 17.2.
4. MAX DIA OF SERVICE PIPE NOT TO EXCEED 6".
5. CABLE CONNS SHOWN ON PGS 17.1 TO 17.3 ARE NOT TO BE USED FOR GRAVITY CONNS OF EQUIP, DUCTWORK OR PIPING; TO BE USED FOR SEISMIC RESTRAINT ONLY.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ TENSION CABLE BRACING & COMPRESSION CLEVIS HANGER TRANSVERSE (LATERAL) & LONGITUDINAL BRACING

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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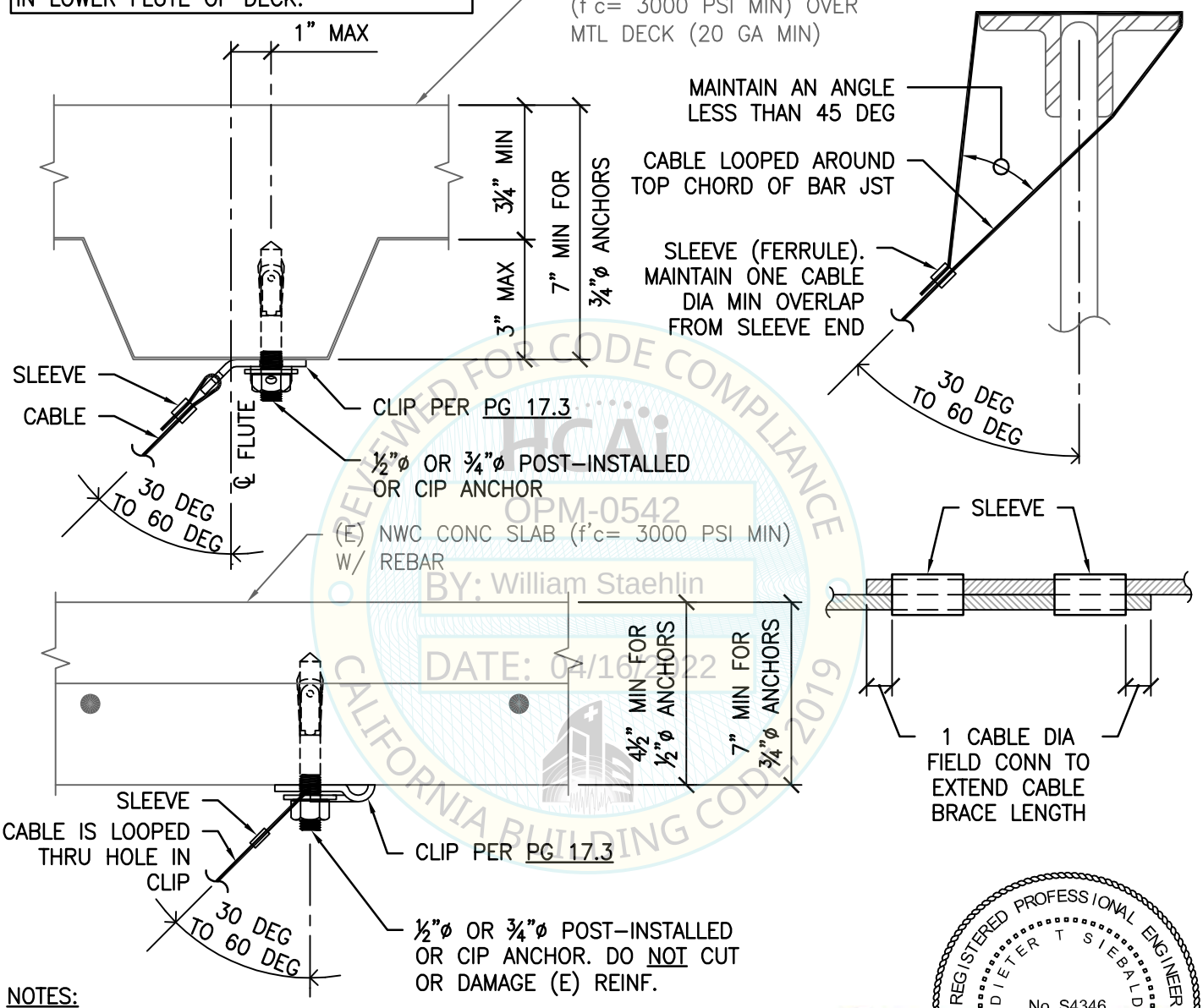
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ TENSION CABLE BRACING & COMPRESSION CLEVIS HANGER SUPPORT & ATTACHMENT DETAILS TO STRUCTURE

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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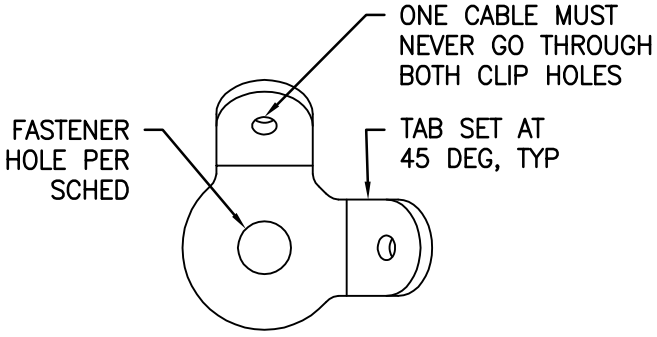
SEISMIC BRACING FOR MEP SYSTEMS

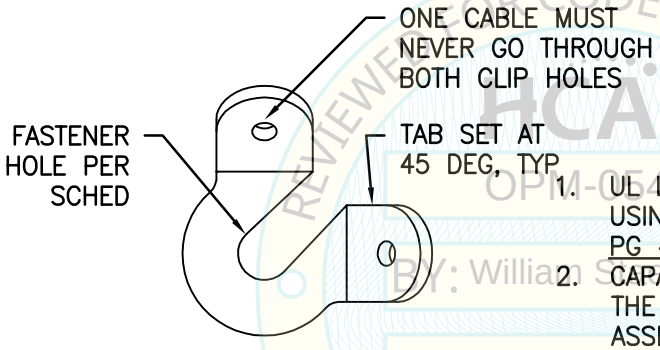
UNIVERSAL RESTRAINT CLIP



PART NO.	CABLE SIZE	HOLE DIA	UL LOAD RATING [1]
CSBURC38	3/32" – 3/16"	3/8"	1900 LBS
CSBURC12		1/2"	
CSBURC58		5/8"	

1. UL LOAD RATING OF THE CLIP IS BASED ON TESTING USING MAX CABLE SIZE. CABLE CAPACITY IS ON PG 400.5.
2. CAPACITY OF CLIP ALWAYS EXCEEDS THE CAPACITY OF THE CABLE. HOWEVER, FOR THE CABLE & CLIP ASSEMBLY ALWAYS USE THE LOWER VALUE OF THE CLIP OR CABLE.
3. CABLE BRCG CAN BE INSTALLED AT ANY BRACE ANGLE.

UNIVERSAL RESTRAINT CLIP RETROFIT

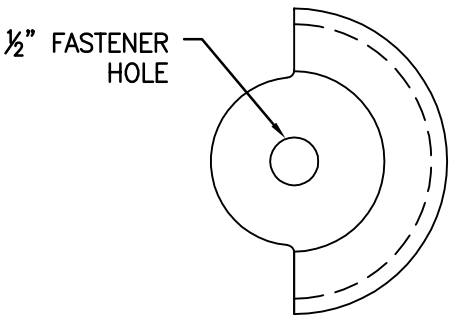


PART NO.	CABLE SIZE	HOLE DIA	UL LOAD RATING [1]
CSBURCR38	3/32" – 3/16"	3/8"	1900 LBS
CSBURCR12		1/2"	
CSBURCR58		5/8"	

1. UL LOAD RATING OF THE CLIP IS BASED ON TESTING USING MAX CABLE SIZE. CABLE CAPACITY IS ON PG 400.5.
2. CAPACITY OF CLIP ALWAYS EXCEEDS THE CAPACITY OF THE CABLE. HOWEVER, FOR THE CABLE & CLIP ASSEMBLY ALWAYS USE THE LOWER VALUE OF THE CLIP OR CABLE.
3. CABLE BRCG CAN BE INSTALLED AT ANY BRACE ANGLE.

NO PRY CLIP

PART NO.	CABLE SIZE	HOLE DIA	UL LOAD RATING[1]
CSBNPC12	3/32" – 3/16"	1/2"	1900 LBS



1. UL LOAD RATING OF THE CLIP IS BASED ON TESTING USING MAX CABLE SIZE. CABLE CAPACITY IS ON PG 400.5.
2. CAPACITY OF CLIP ALWAYS EXCEEDS THE CAPACITY OF THE CABLE. HOWEVER, FOR THE CABLE & CLIP ASSEMBLY ALWAYS USE THE LOWER VALUE OF THE CLIP OR CABLE.
3. CABLE BRCG CAN BE INSTALLED AT ANY BRACE ANGLE.

REGISTERED PROFESSIONAL ENGINEER
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STATE OF CALIFORNIA

SHEET TITLE: SINGLE HUNG PIPE OR CONDUIT W/ TENSION CABLE BRACING & COMPRESSION CLEVIS HANGER SEISMIC BRACE SUPPORT DETAILS

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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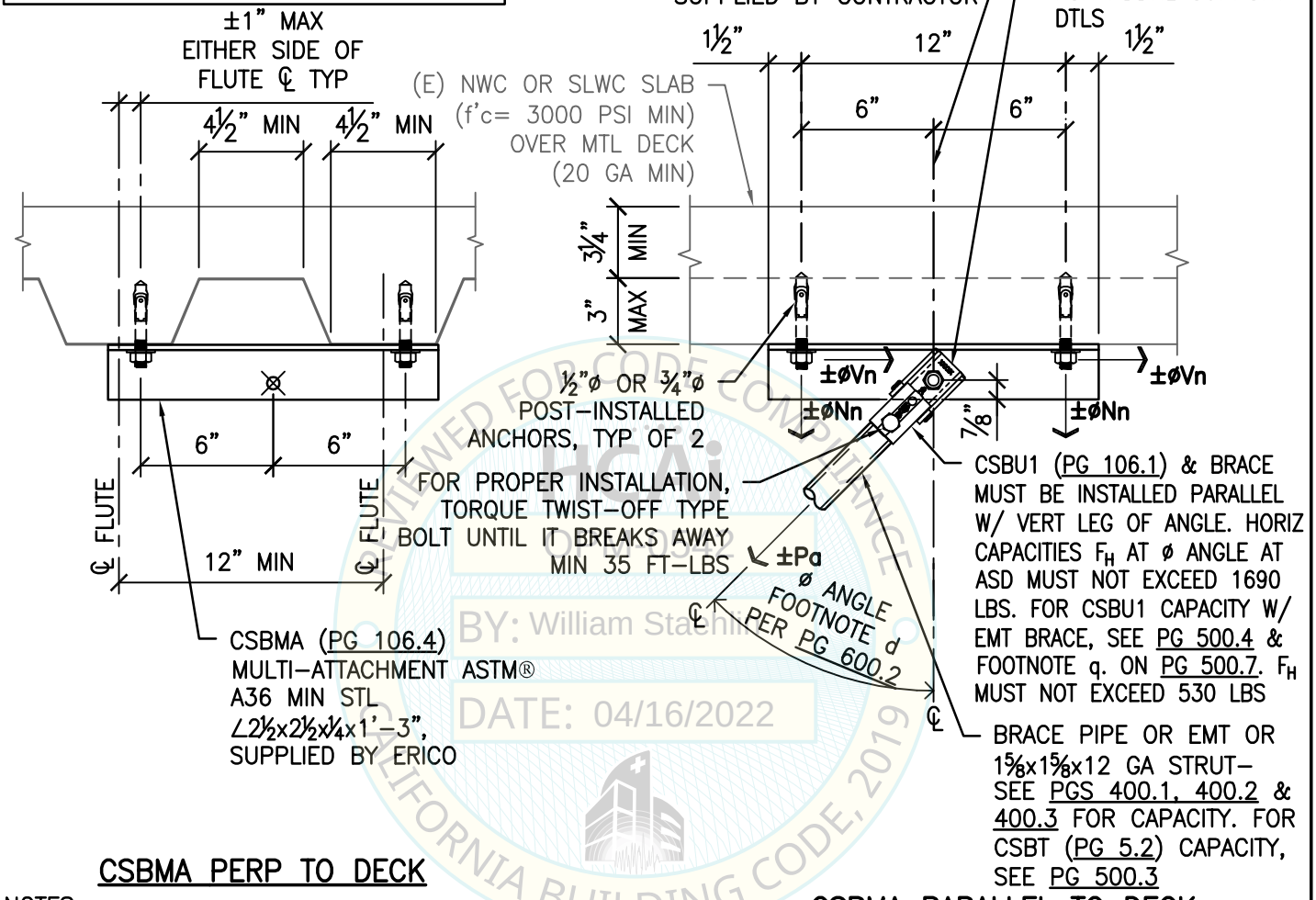
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



CSBMA PERP TO DECK

CSBMA PARALLEL TO DECK

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.
5. WHEN USING EMT BRACE, MUST HAVE ATTACHMENT QUALIFIED TO USE EMT AT BOTH ENDS OF EMT BRACE

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL
CSBMA POST INSTALLED ANCHORS W/ BRACE PIPE PARALLEL

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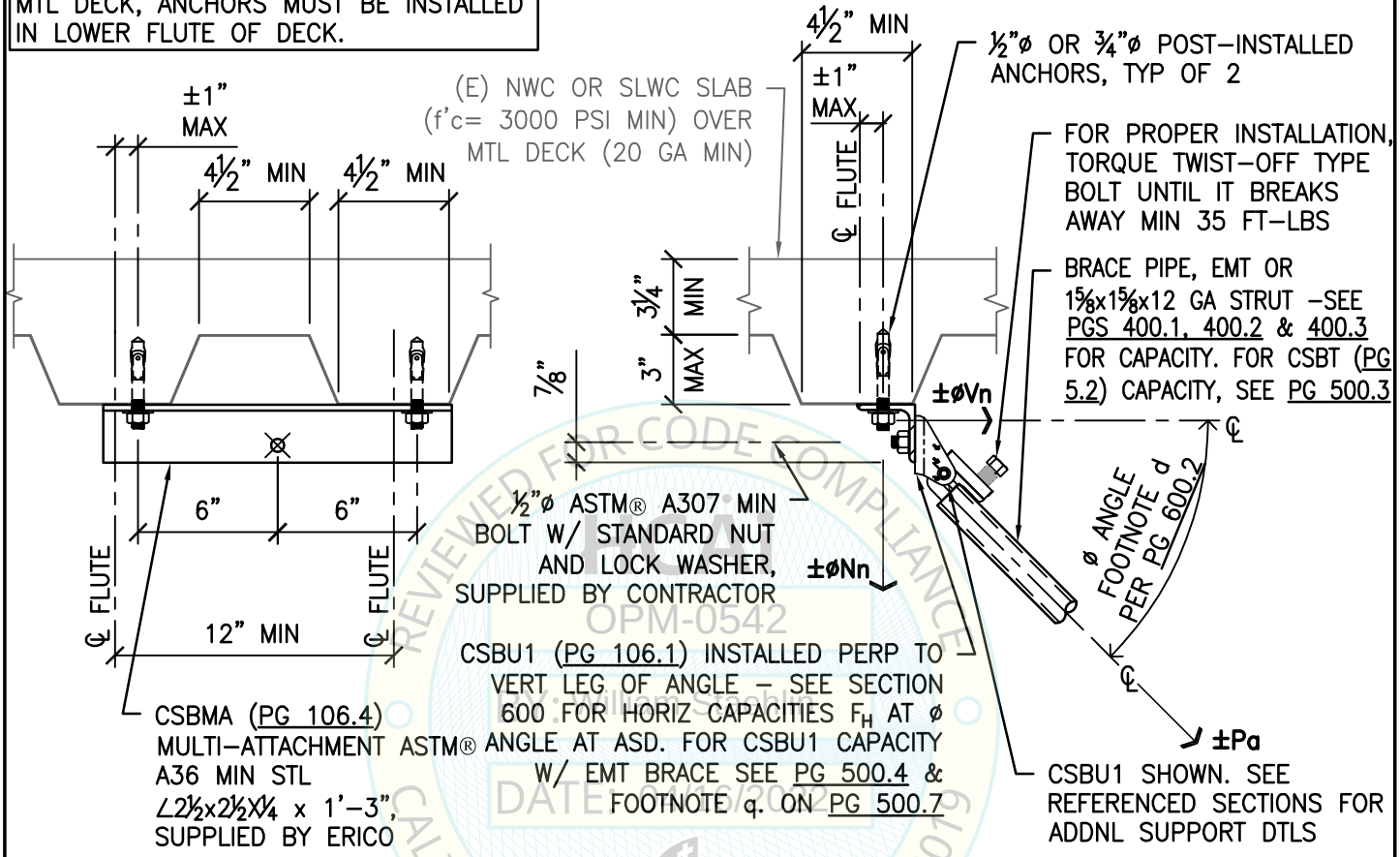
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



CSBMA PERP TO DECK

CSBMA PARALLEL TO DECK

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
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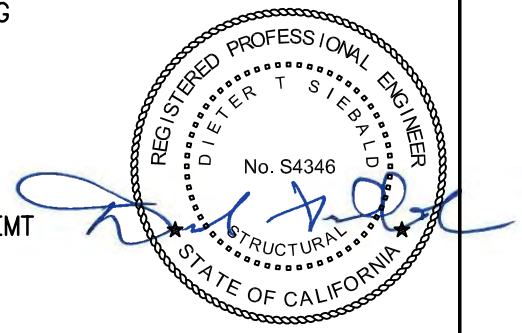

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL
CSBMA POST INSTALLED ANCHORS W/ BRACE PIPE PERPENDICULAR

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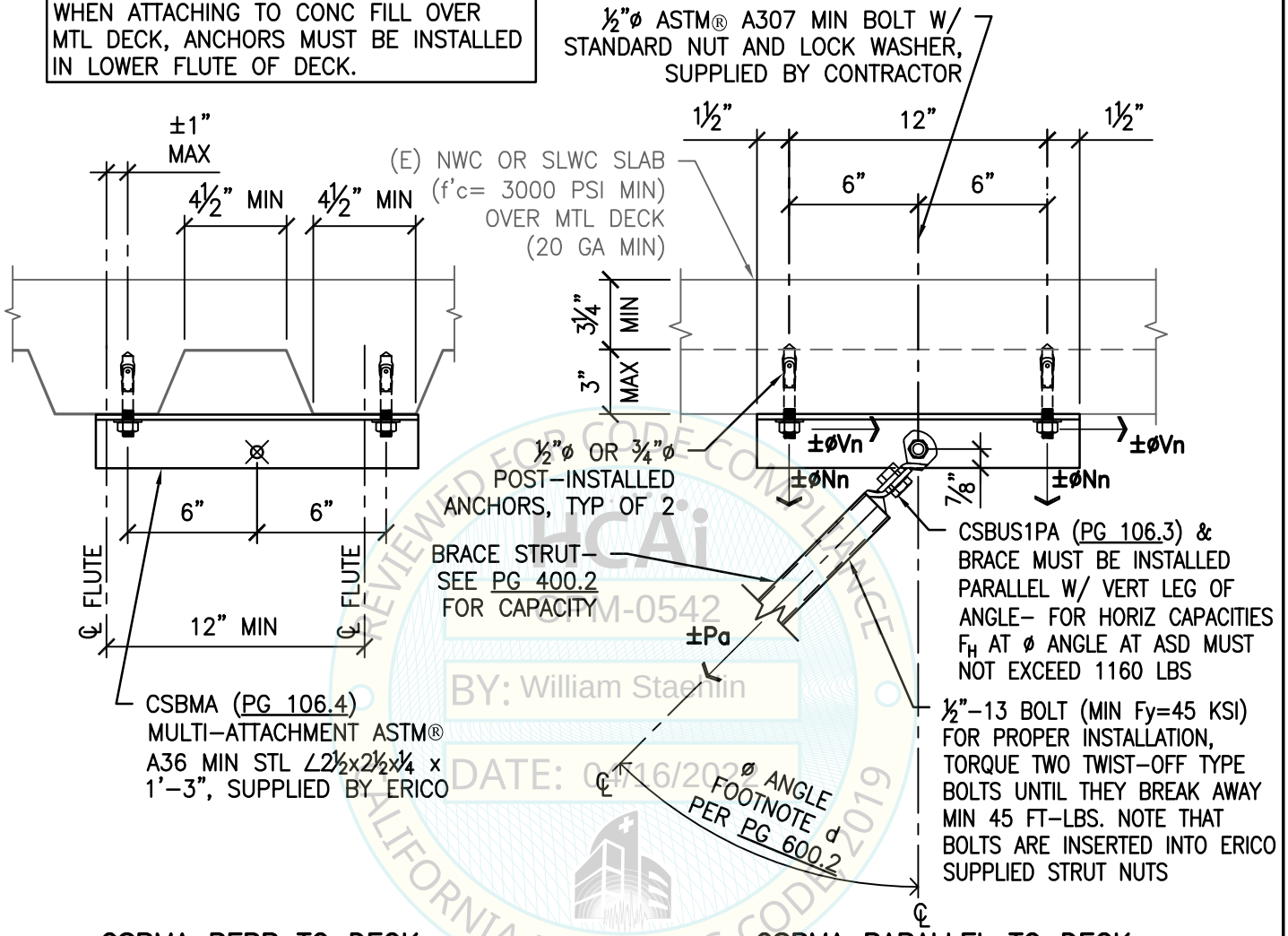
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



CSBMA PERP TO DECK

CSBMA PARALLEL TO DECK

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

REGISTERED PROFESSIONAL ENGINEER DIETER T SIEBALD No. S4346 STRUCTURAL STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL CSBMA POST INSTALLED ANCHORS W/ BRACE STRUT PARALLEL

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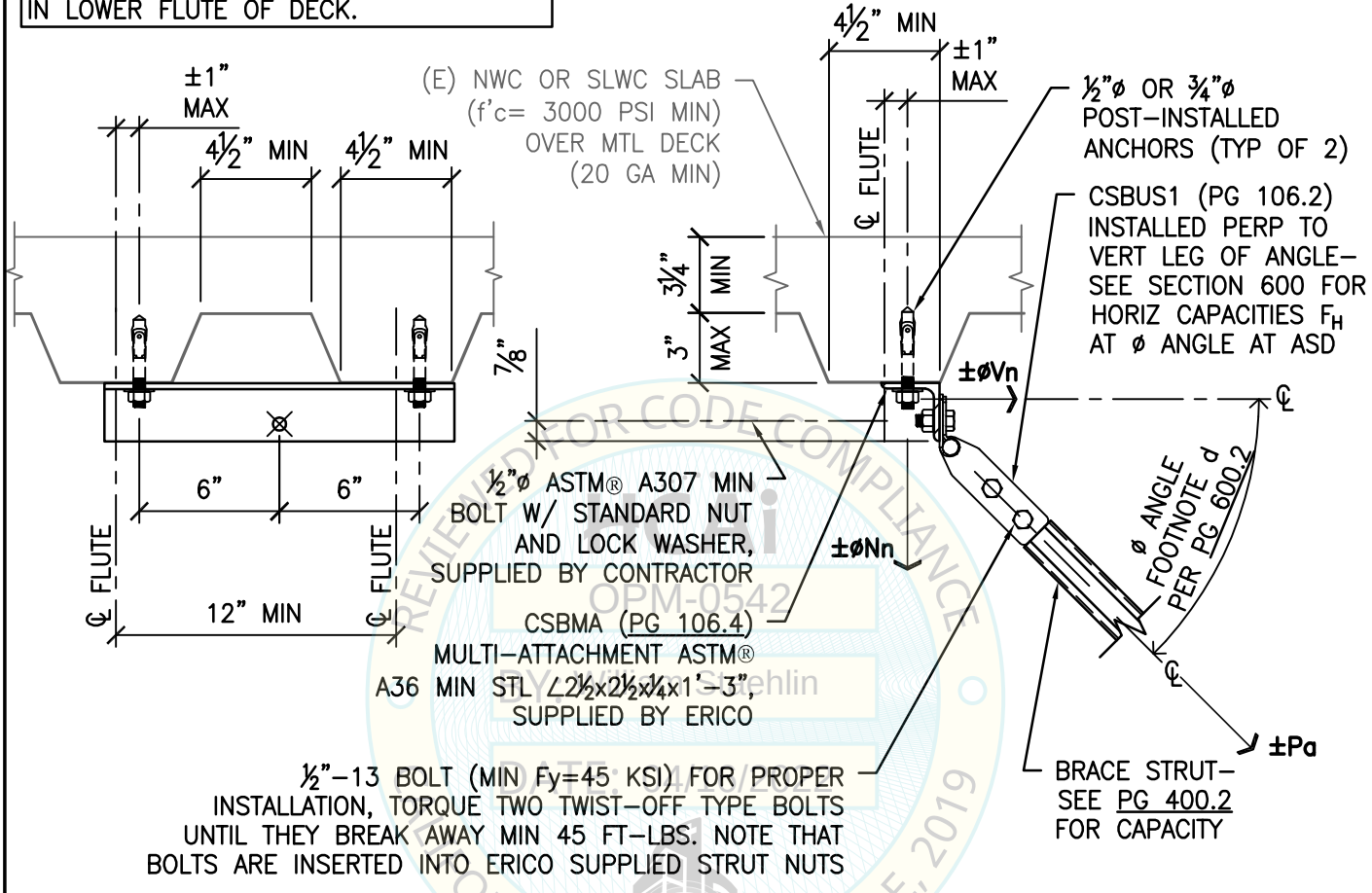
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



CSBMA PERP TO DECK **CSBMA PARALLEL TO DECK**

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL CSBMA POST INSTALLED ANCHORS W/ BRACE STRUT PERPENDICULAR

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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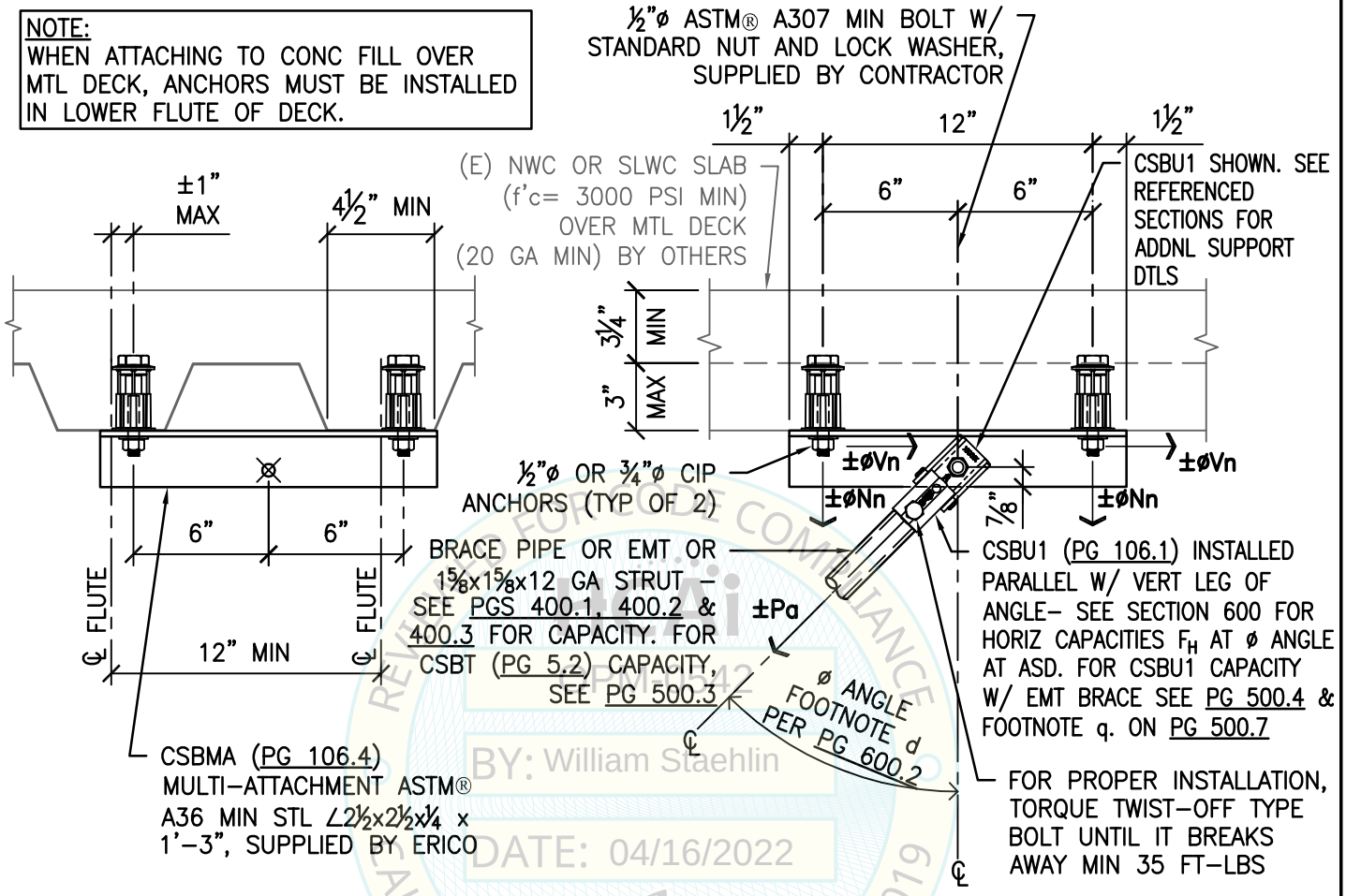
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



CSBMA PERP TO DECK

CSBMA PARALLEL TO DECK

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.
5. WHEN USING EMT BRACE, MUST HAVE ATTACHMENT QUALIFIED TO USE EMT AT BOTH ENDS OF EMT BRACE.

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL CSBMA CAST IN PLACE ANCHORS W/ BRACE PIPE PARALLEL

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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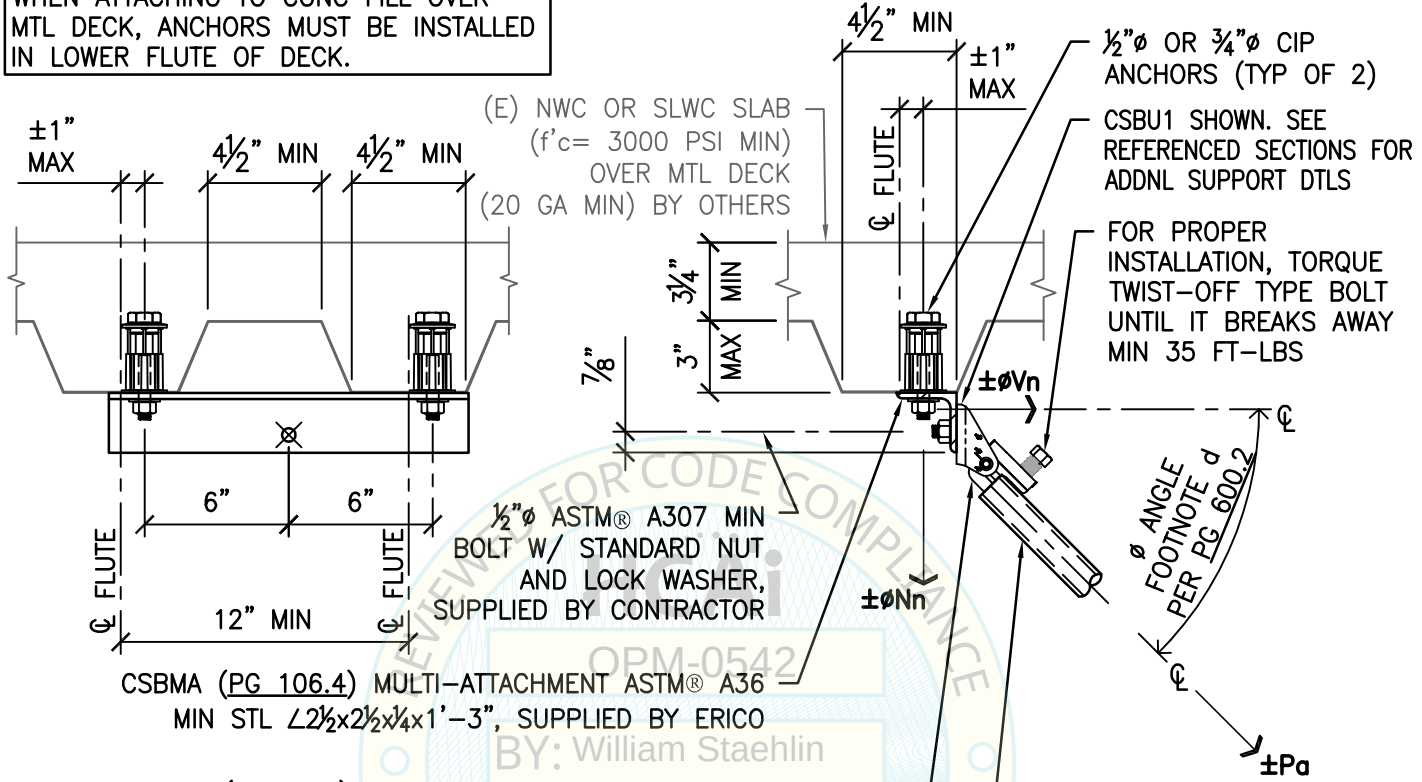
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



CSBMA PERP TO DECK

CSBMA PARALLEL TO DECK

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.
5. WHEN USING EMT BRACE, MUST HAVE ATTACHMENT QUALIFIED TO USE EMT AT BOTH ENDS OF EMT BRACE.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL CSBMA CAST IN PLACE ANCHORS W/ BRACE PIPE PERPENDICULAR

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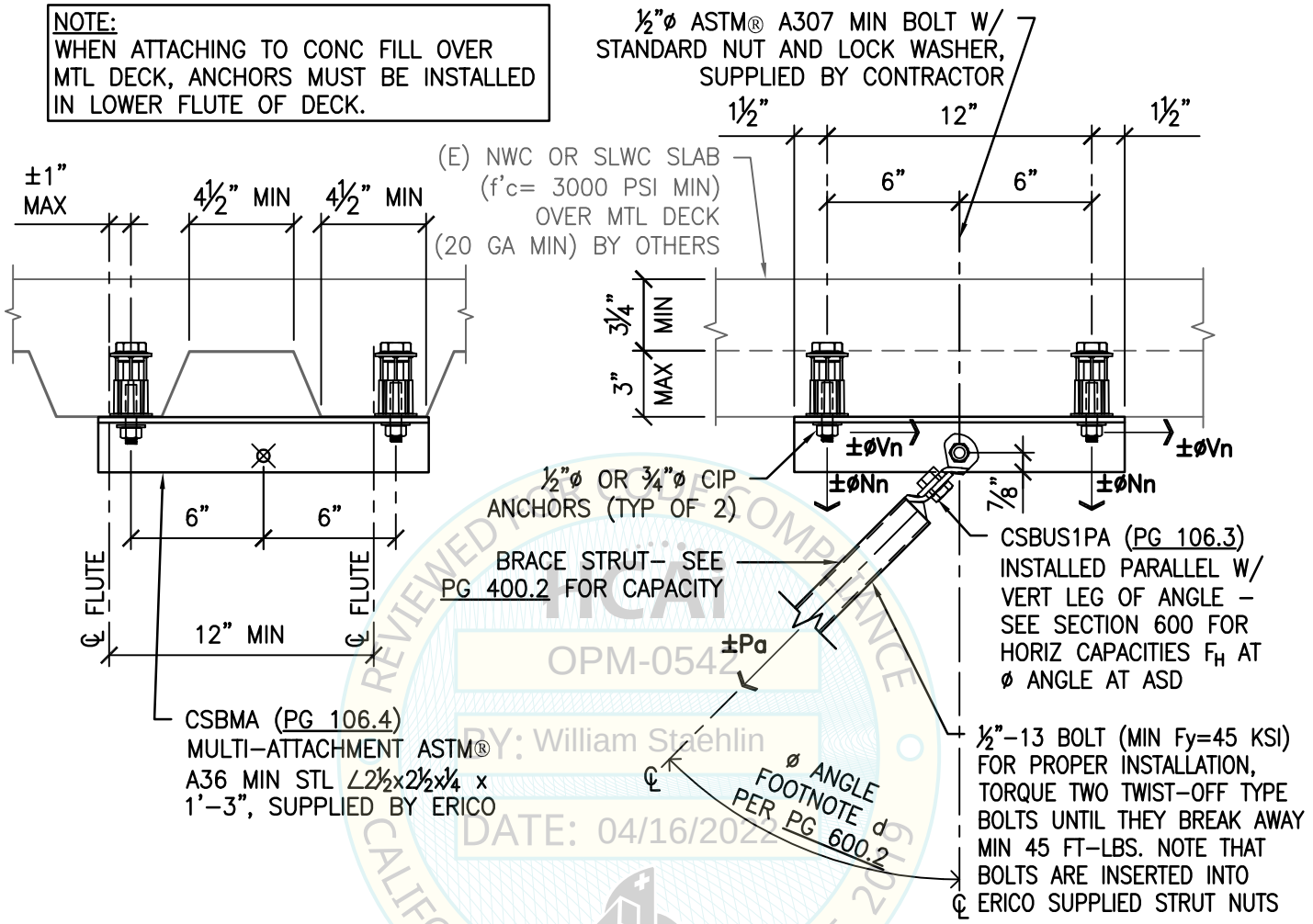
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



CSBMA PERP TO DECK **CSBMA PARALLEL TO DECK**

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL CSBMA CAST IN PLACE ANCHORS W/ BRACE STRUT PARALLEL

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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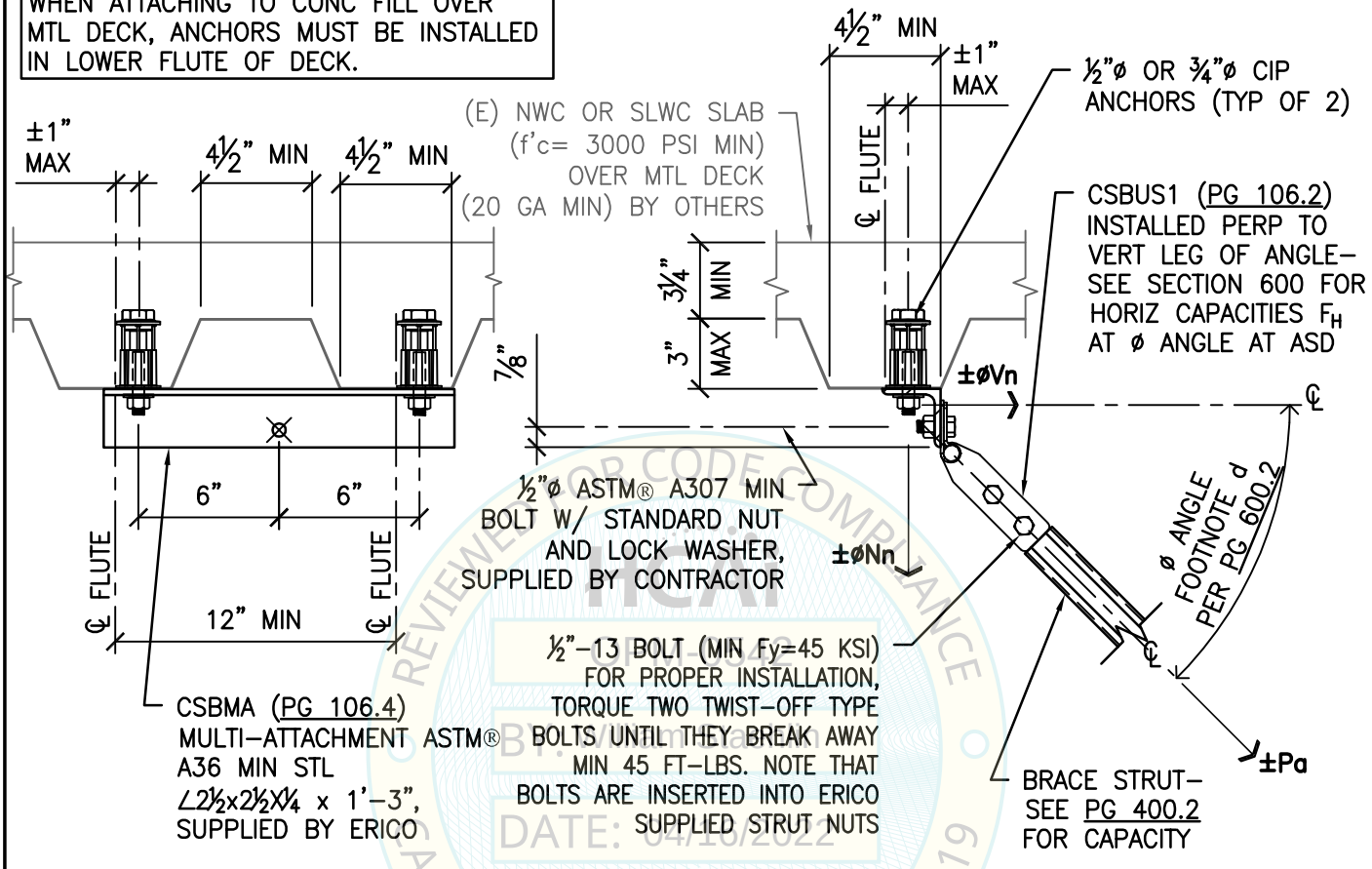
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



CSBMA PERP TO DECK **CSBMA PARALLEL TO DECK**

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL CSBMA CAST IN PLACE ANCHORS W/ BRACE STRUT PERPENDICULAR

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2495 NATOMAS PARK DRIVE, SUITE 650
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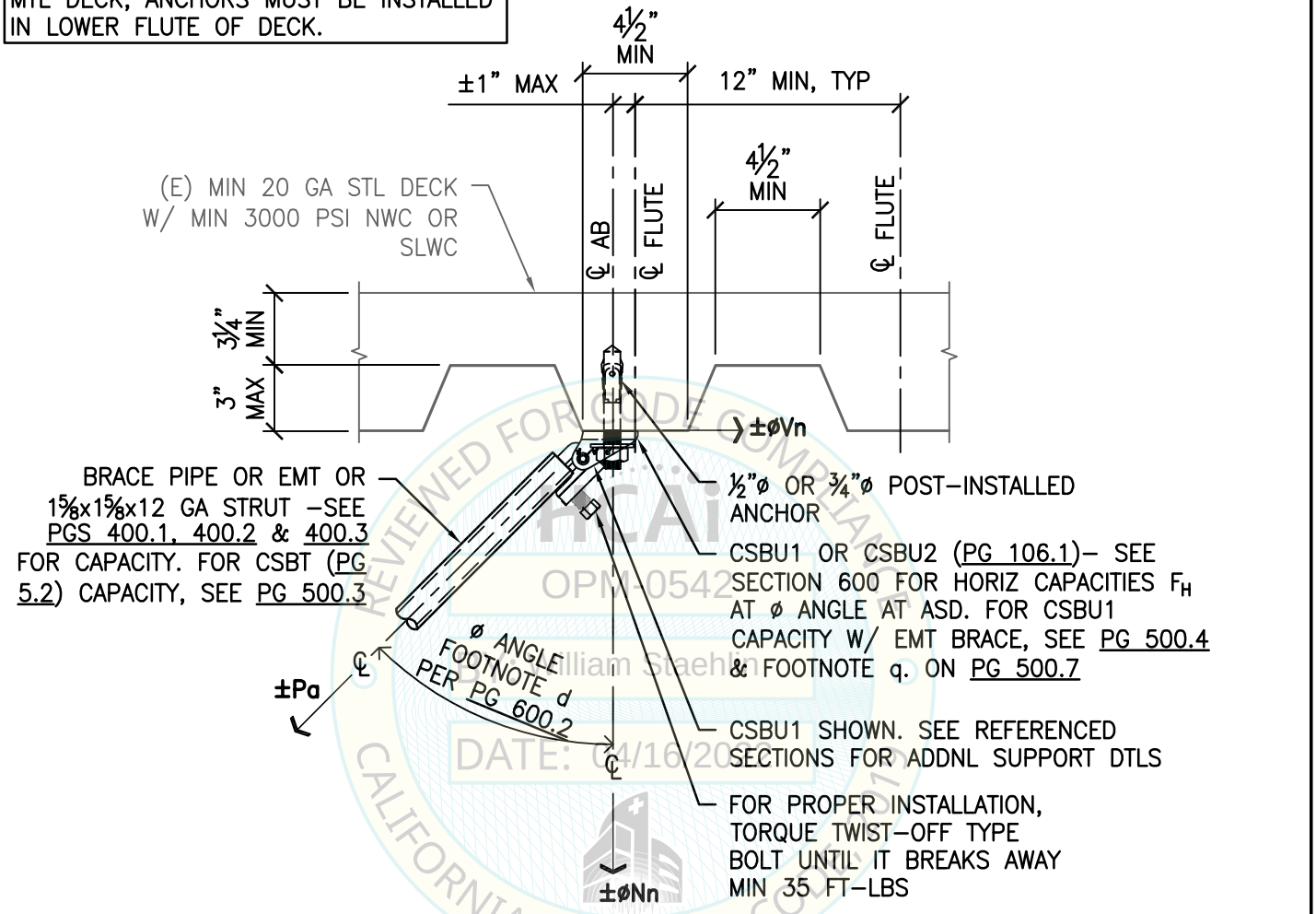
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.
4. EMT MUST NOT BE USED W/ CSBU2.
5. WHEN USING EMT BRACE, MUST HAVE ATTACHMENT QUALIFIED TO USE EMT AT BOTH ENDS OF EMT BRACE.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL CSBU POST INSTALLED ANCHOR W/ BRACE PIPE

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2495 NATOMAS PARK DRIVE, SUITE 650
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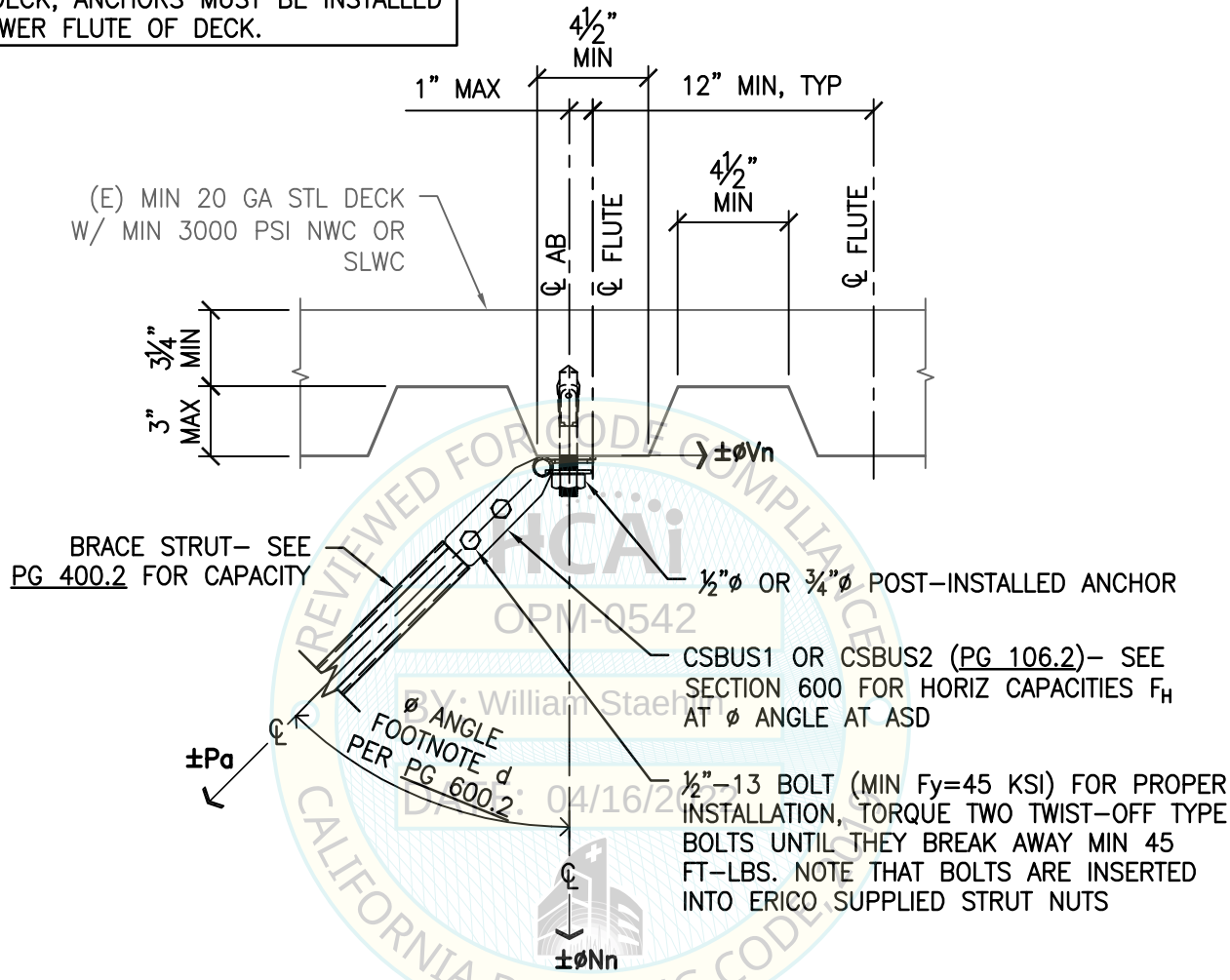
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



NOTES:

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2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL
CSBUS POST INSTALLED ANCHOR W/ BRACE STRUT

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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SEISMIC BRACING FOR MEP SYSTEMS

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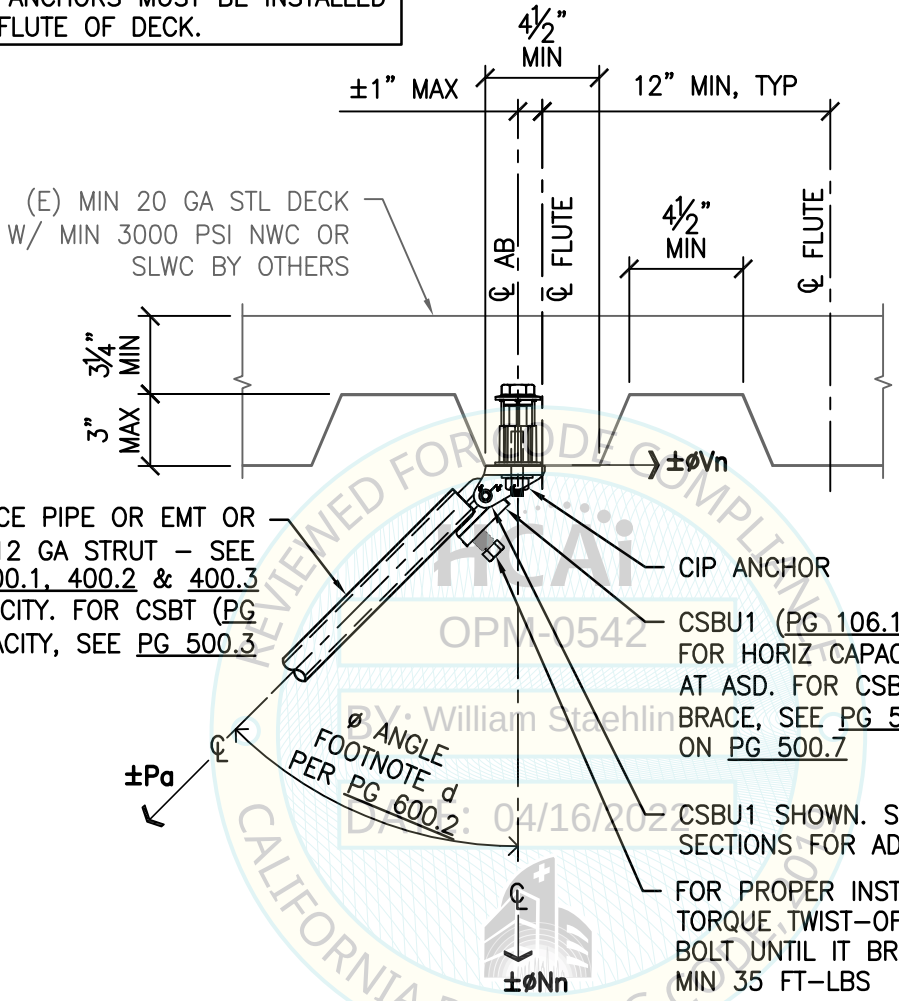

NOTES:

1. SPECIALTY INSERTS INSTALLED IN NWC MUST BE HEADED CAST–IN SPECIALTY INSERTS IN CRACKED CONC AS NOTED PER APPENDIX 'A', CASE 4 OF PG A5.
2. INSTALLATION MUST BE IN ACCORDANCE W/ THE REQUIREMENTS OF THE ICC–ES EVALUATION REPORT FOR THE SPECIFIED ANCHOR.
3. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
4. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
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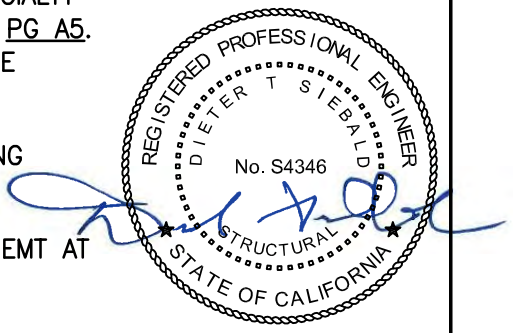

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL CSBU CAST IN PLACE ANCHOR W/ BRACE PIPE

CYS STRUCTURAL ENGINEERS, INC.
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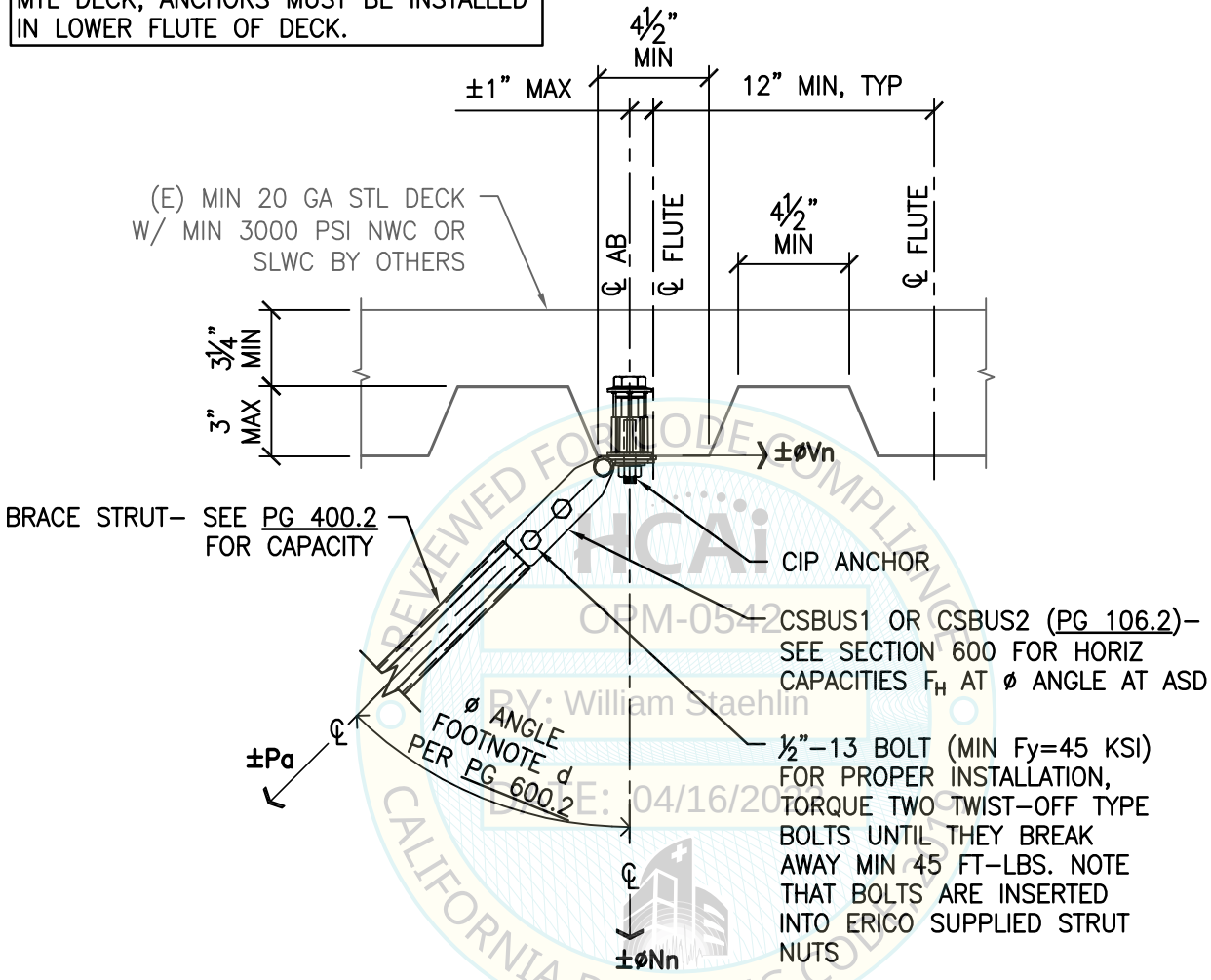
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



NOTES:

1. SPECIALTY INSERTS INSTALLED IN NWC MUST BE HEADED CAST–IN SPECIALTY INSERTS IN CRACKED CONC AS NOTED PER APPENDIX 'A', CASE 4 ON PG A5.
2. INSTALLATION MUST BE IN ACCORDANCE W/ THE REQUIREMENTS OF THE ICC–ES EVALUATION REPORT FOR THE SPECIFIED ANCHOR.
3. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
4. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
5. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.

REGISTERED PROFESSIONAL ENGINEER
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL CSBUS CAST IN PLACE ANCHOR W/ BRACE STRUT

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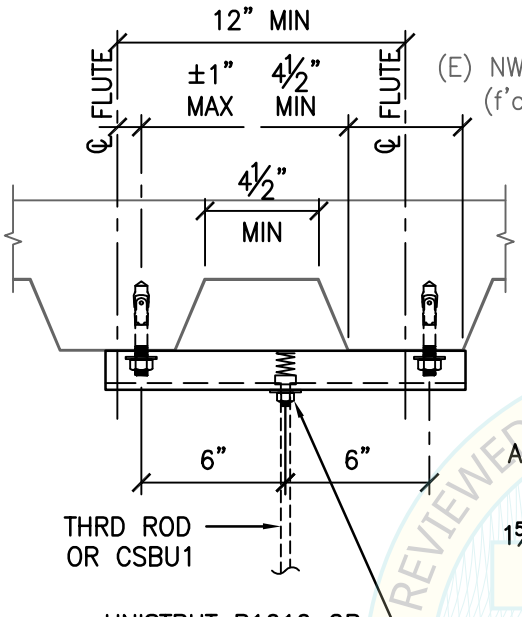
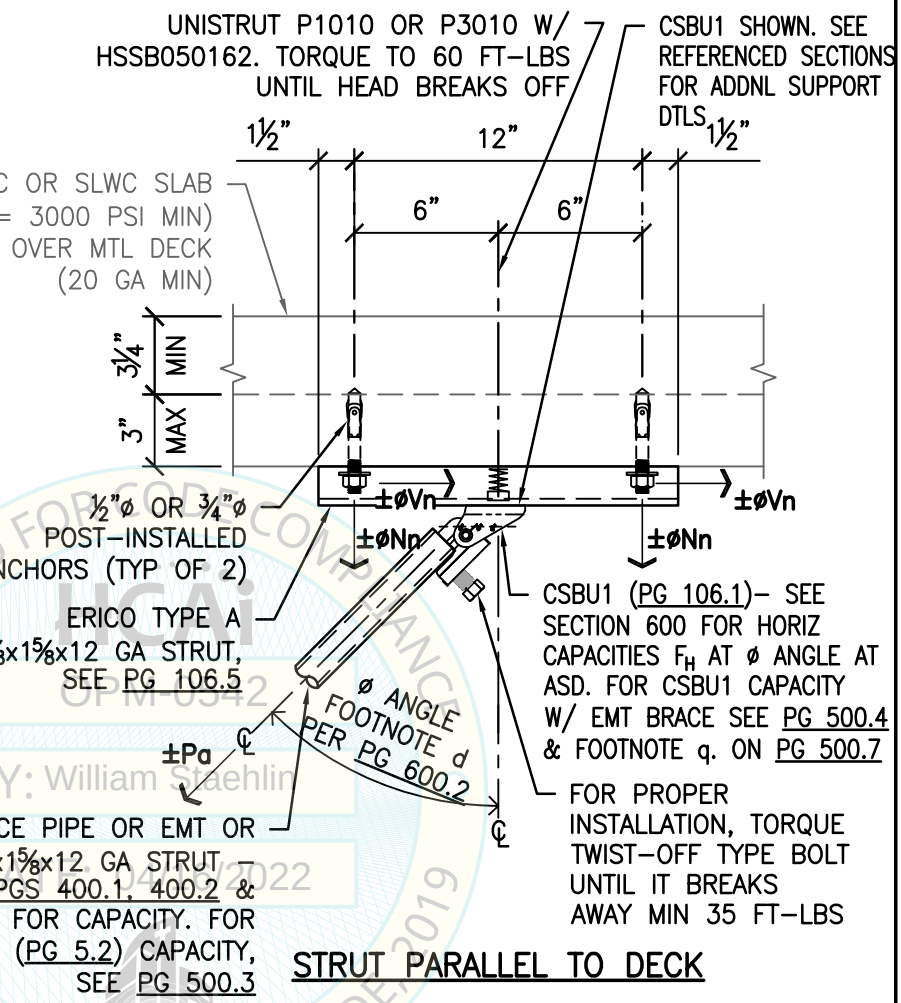
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



STRUT PERP TO DECK



STRUT PARALLEL TO DECK

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR STRUT. PLEASE NOTE THAT CAPACITY PROVIDED IS FOR THE WORST-CASE ANCHOR CONDITION & HIGHER VALUES MAY BE OBTAINED VIA THE SEOR.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. THE ALLOWABLE ASD SLIP LOAD & TENSION LOAD FOR THE UNISTRUT P1010 OR P3010 IS 1370 LBS & 2810 LBS RESPECTIVELY. THE ALLOWABLE LOAD PERP TO THE STRUT IS 1035 LBS.

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL STRUT POST INSTALLED ANCHORS W/ BRACE PIPE PARALLEL & VERTICAL ROD

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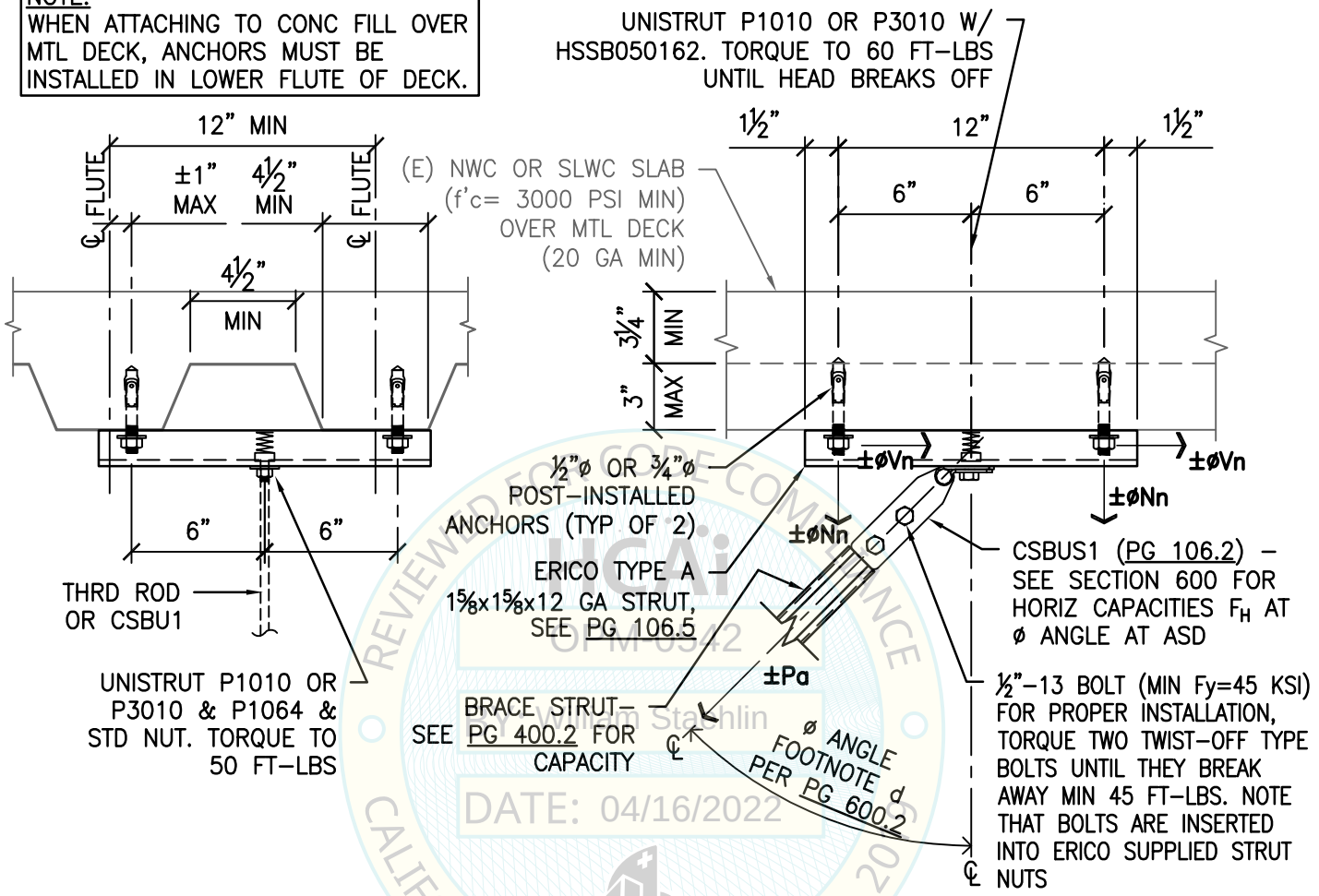
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



STRUT PERP TO DECK **STRUT PARALLEL TO DECK**

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR STRUT. PLEASE NOTE THAT CAPACITY PROVIDED IS FOR THE WORST-CASE ANCHOR CONDITION & HIGHER VALUES MAY BE OBTAINED VIA THE SEOR.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL STRUT POST INSTALLED ANCHORS W/ BRACE STRUT PARALLEL & VERTICAL ROD

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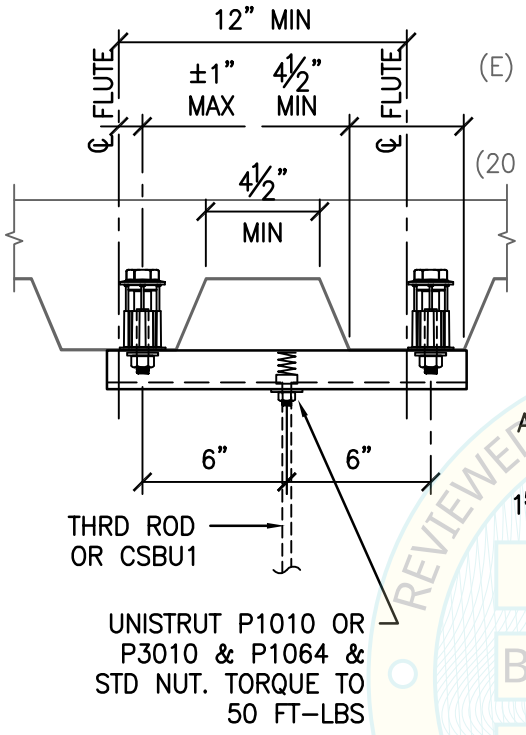
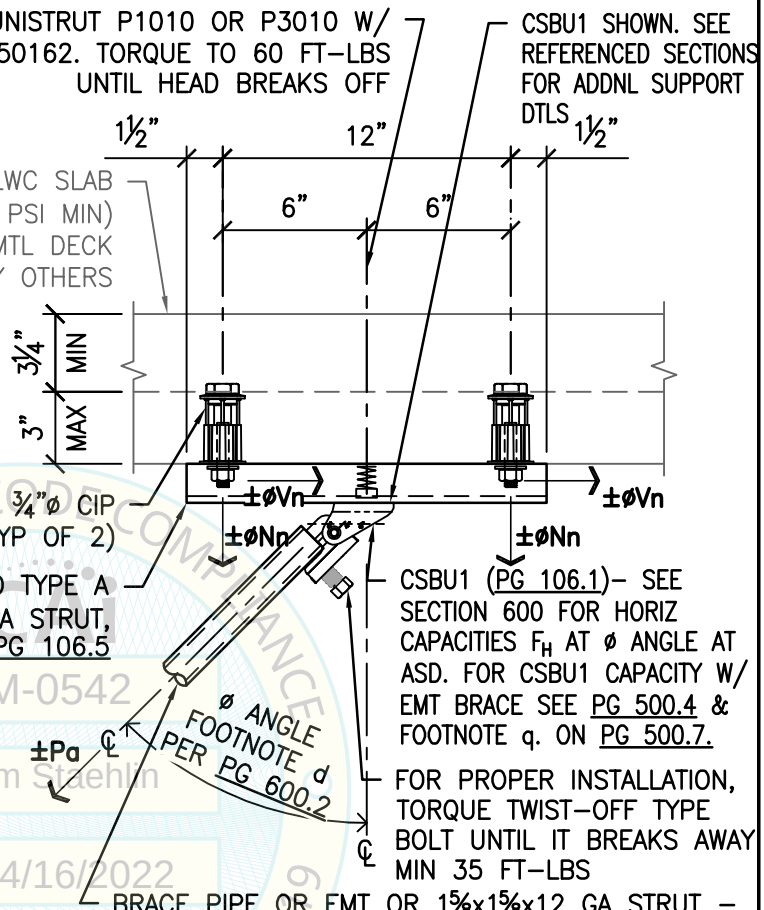
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



STRUT PERP TO DECK



STRUT PARALLEL TO DECK

NOTES:

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3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL STRUT CAST IN PLACE ANCHORS W/ BRACE PIPE PARALLEL & VERTICAL ROD

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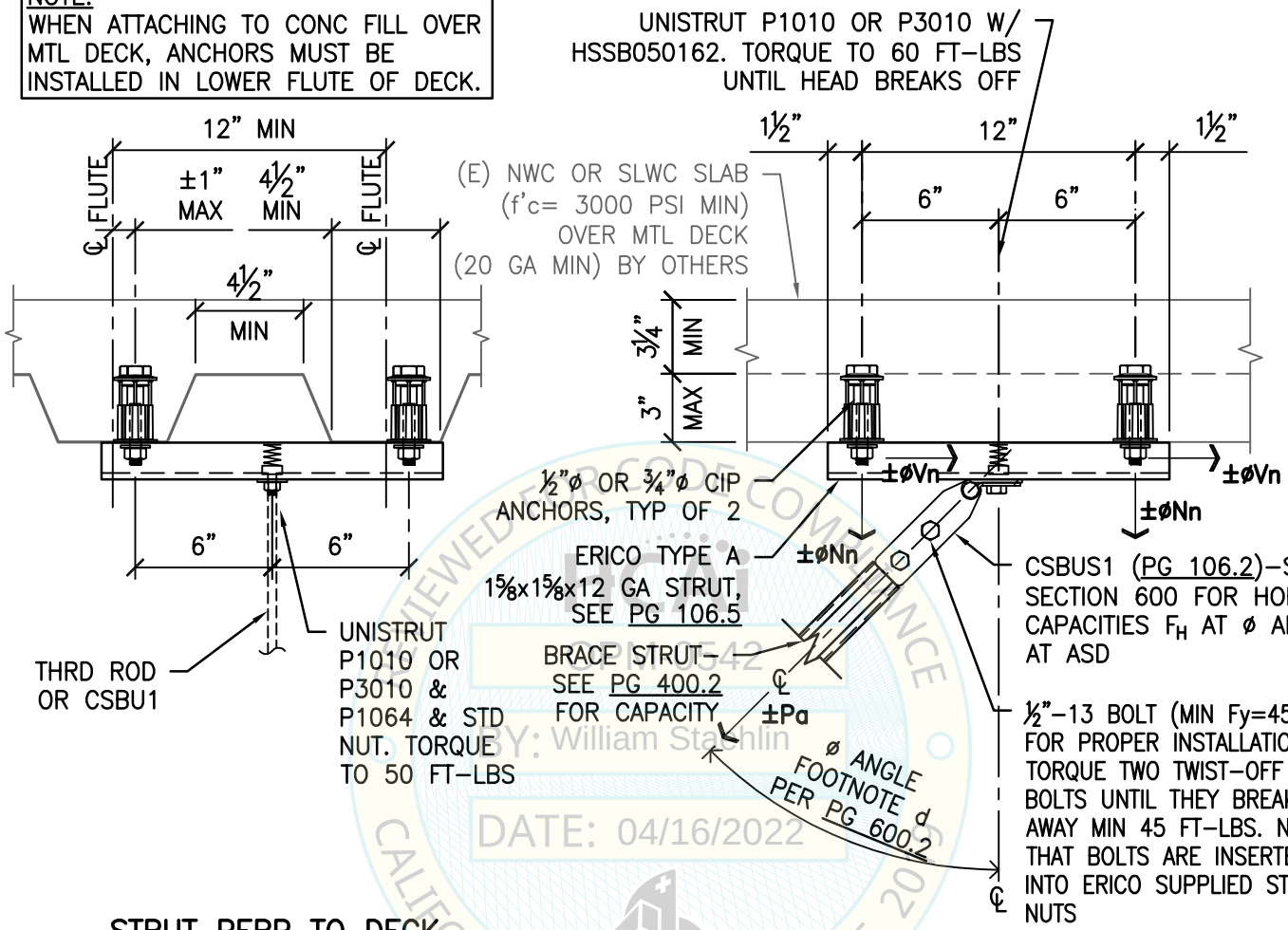
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



STRUT PERP TO DECK

STRUT PARALLEL TO DECK

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR STRUT. PLEASE NOTE THAT CAPACITY PROVIDED IS FOR THE WORST-CASE ANCHOR CONDITION & HIGHER VALUES MAY BE OBTAINED VIA THE SEOR.
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL STRUT CAST IN PLACE ANCHORS W/ BRACE STRUT PARALLEL

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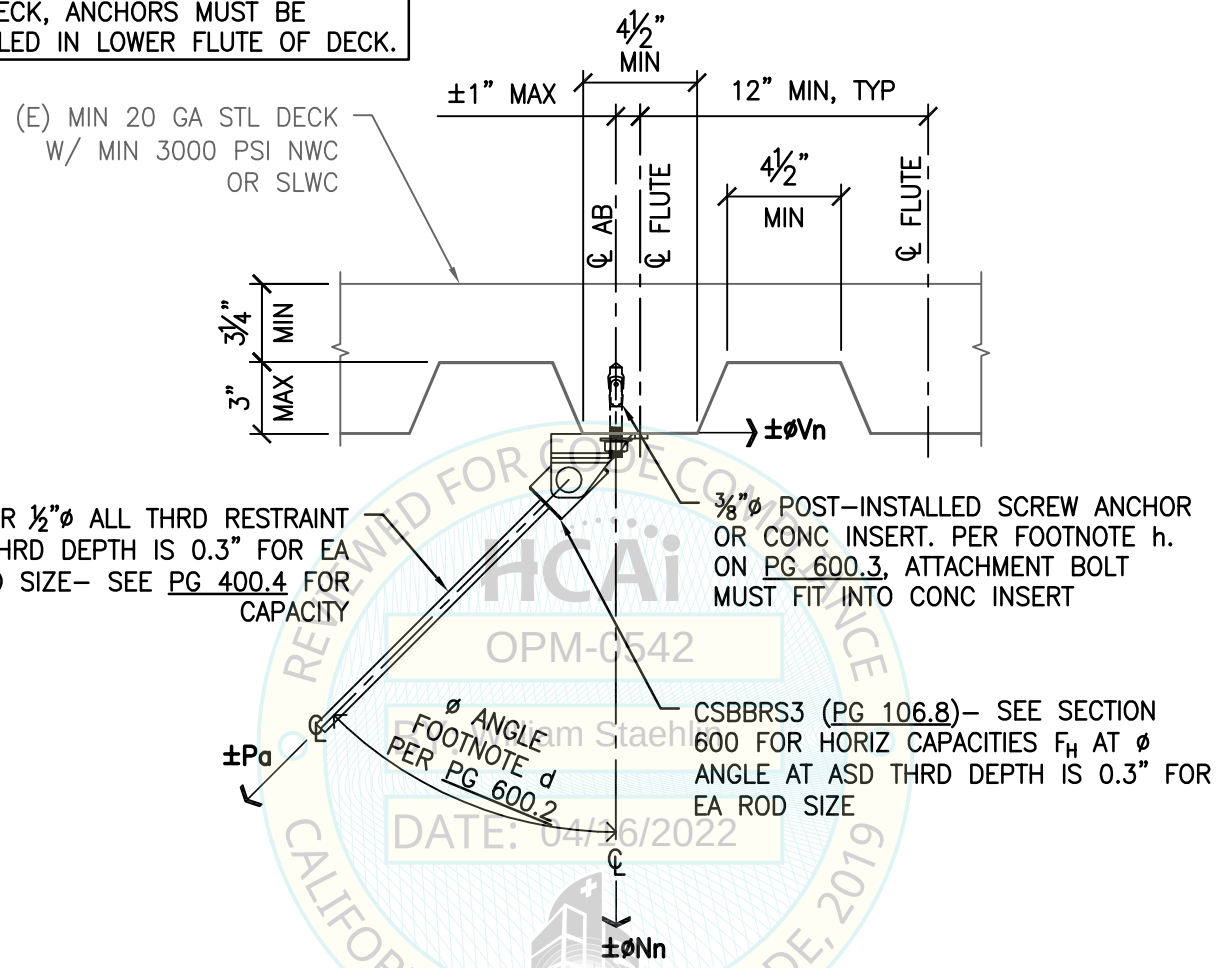
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
WHEN ATTACHING TO CONC FILL OVER MTL DECK, ANCHORS MUST BE INSTALLED IN LOWER FLUTE OF DECK.



NOTES:

1. SEE APPENDIX 'A' CASE 1, PG A1 FOR CONC ANCHORAGE CAPACITY FOR POST–INSTALLED DEWALT/POWERS SNAKE+ SCREW ANCHOR. SEE APPENDIX 'A' CASE 4, PG A5 FOR CONC ANCHORAGE CAPACITY OF CIP DEWALT/POWERS DDI+ DECK INSERT ANCHOR.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A' FOR THE ANCHORS IN NOTE 1.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.
4. THRD ROD MAY CONTROL THE CAPACITY OF THE RESTRAINT ASSEMBLY.

REGISTERED PROFESSIONAL ENGINEER
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STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF METAL DECK W/ CONCRETE FILL
CSBBRS3 POST INSTALLED ANCHOR OR CIP INSERT W/ RESTRAINT ROD

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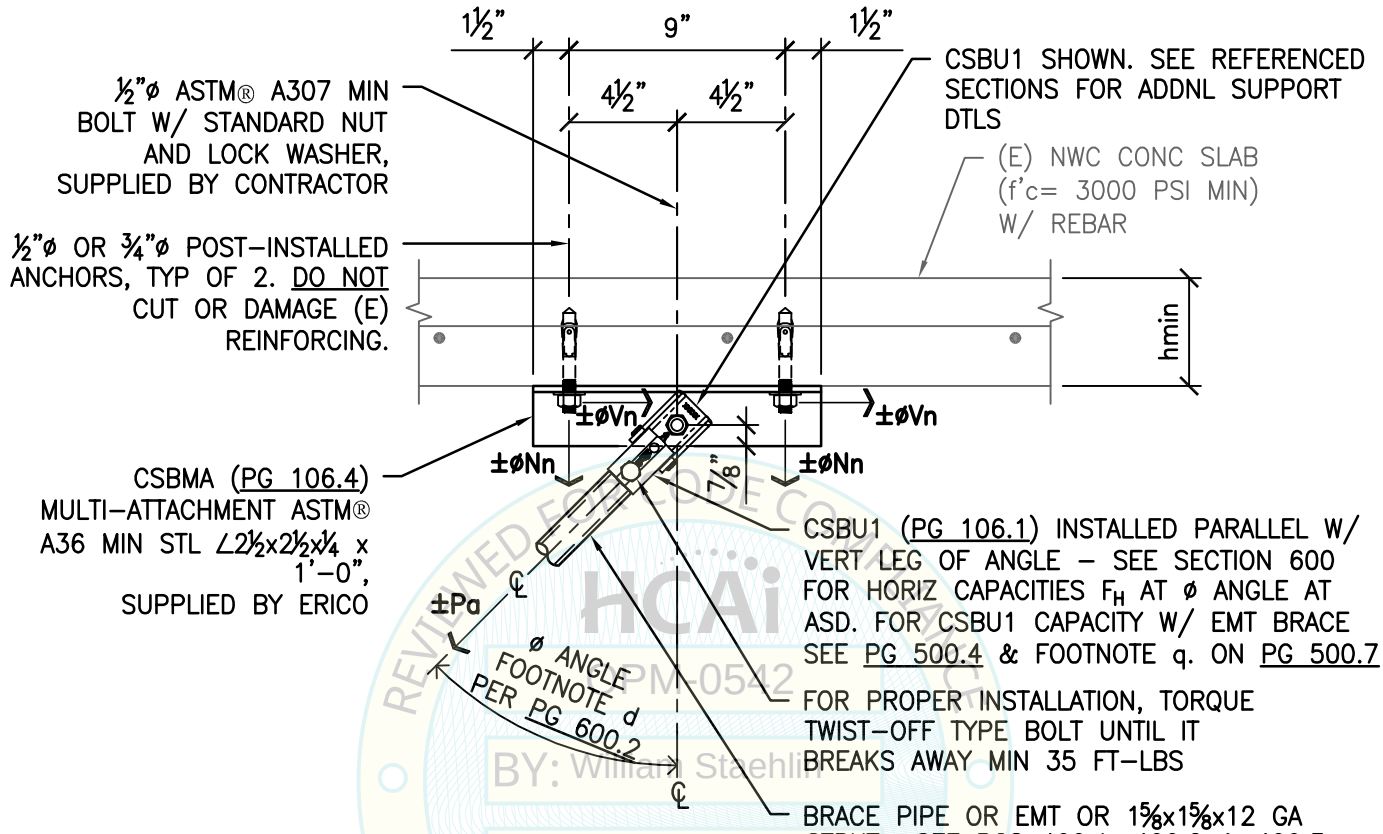
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

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3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

REGISTERED PROFESSIONAL ENGINEER DIETER T SIEBALD No. S4346 STRUCTURAL STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF CSBMA POST INSTALLED ANCHORS W/ BRACE PIPE PARALLEL

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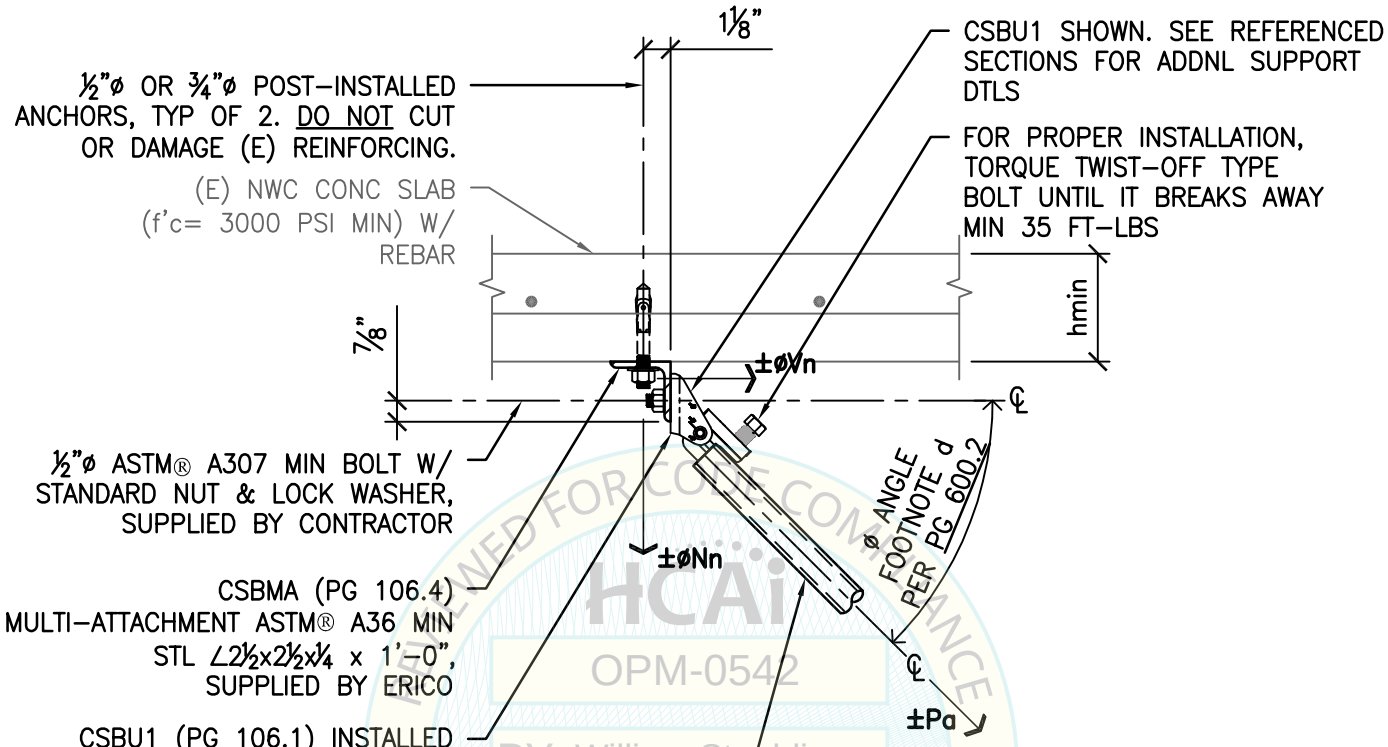
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

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3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
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STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF CSBMA POST INSTALLED ANCHORS W/ BRACE PIPE PERPENDICULAR

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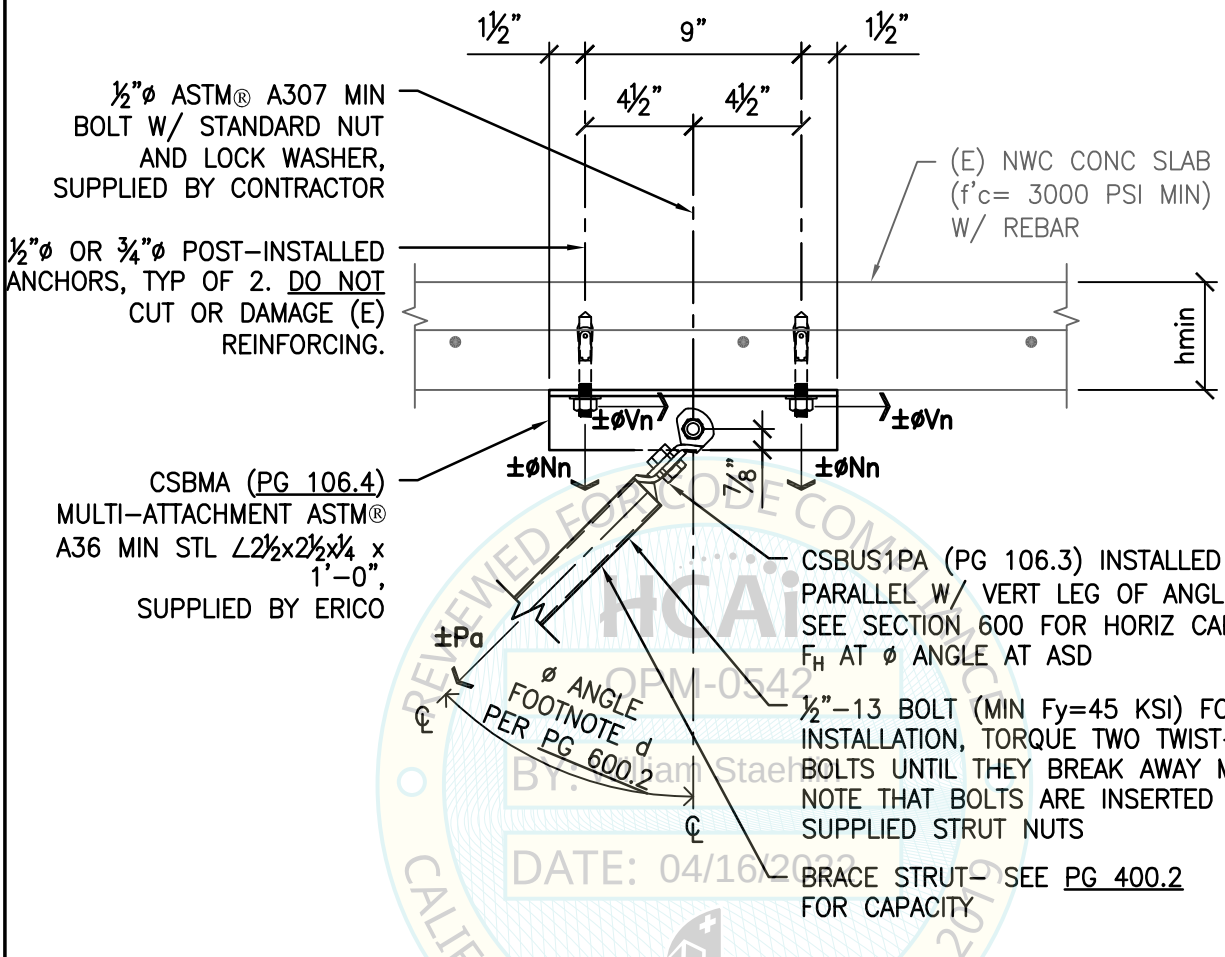
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

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3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
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STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF
CSBMA POST INSTALLED ANCHORS W/ BRACE STRUT PARALLEL

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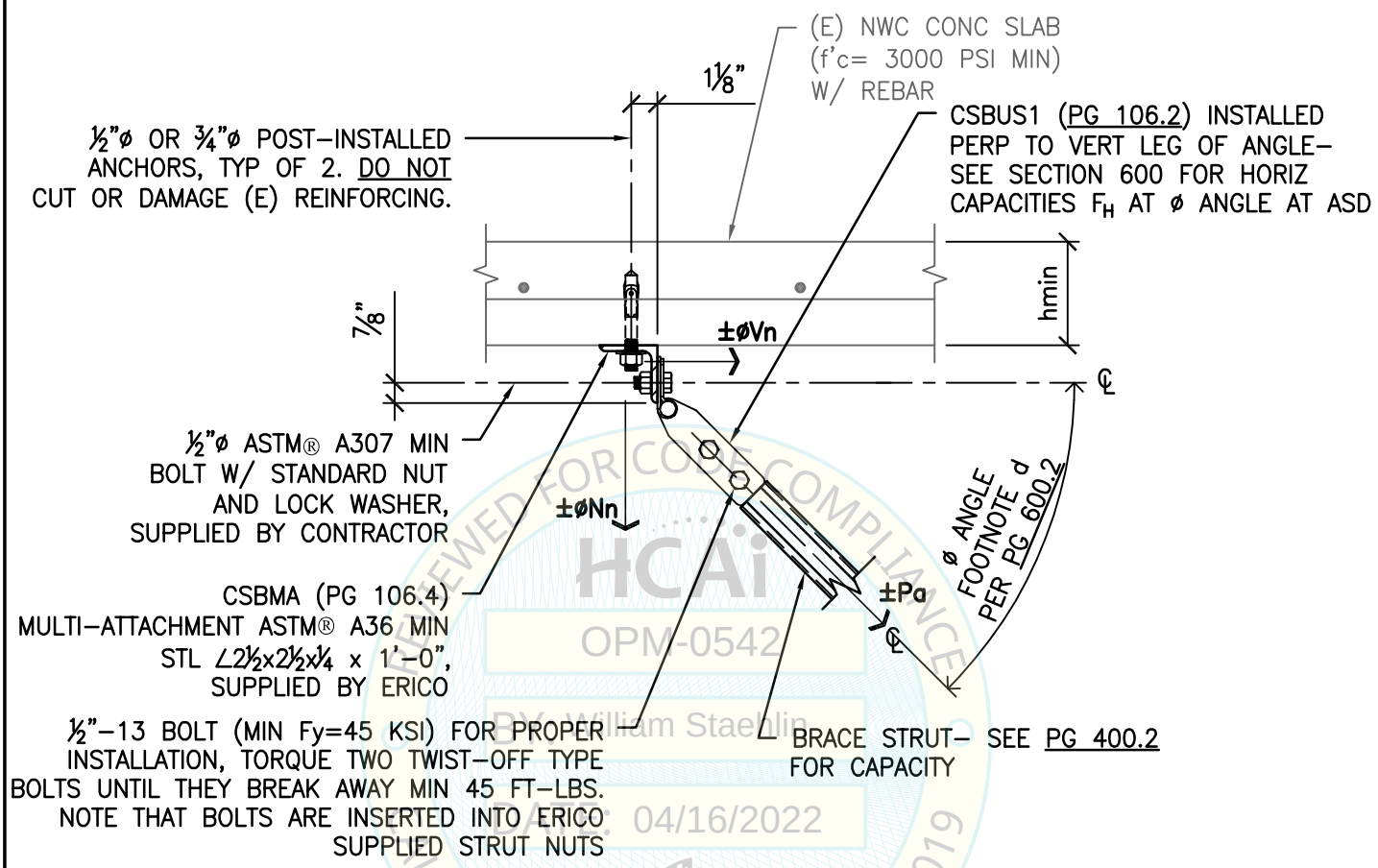
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

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SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF
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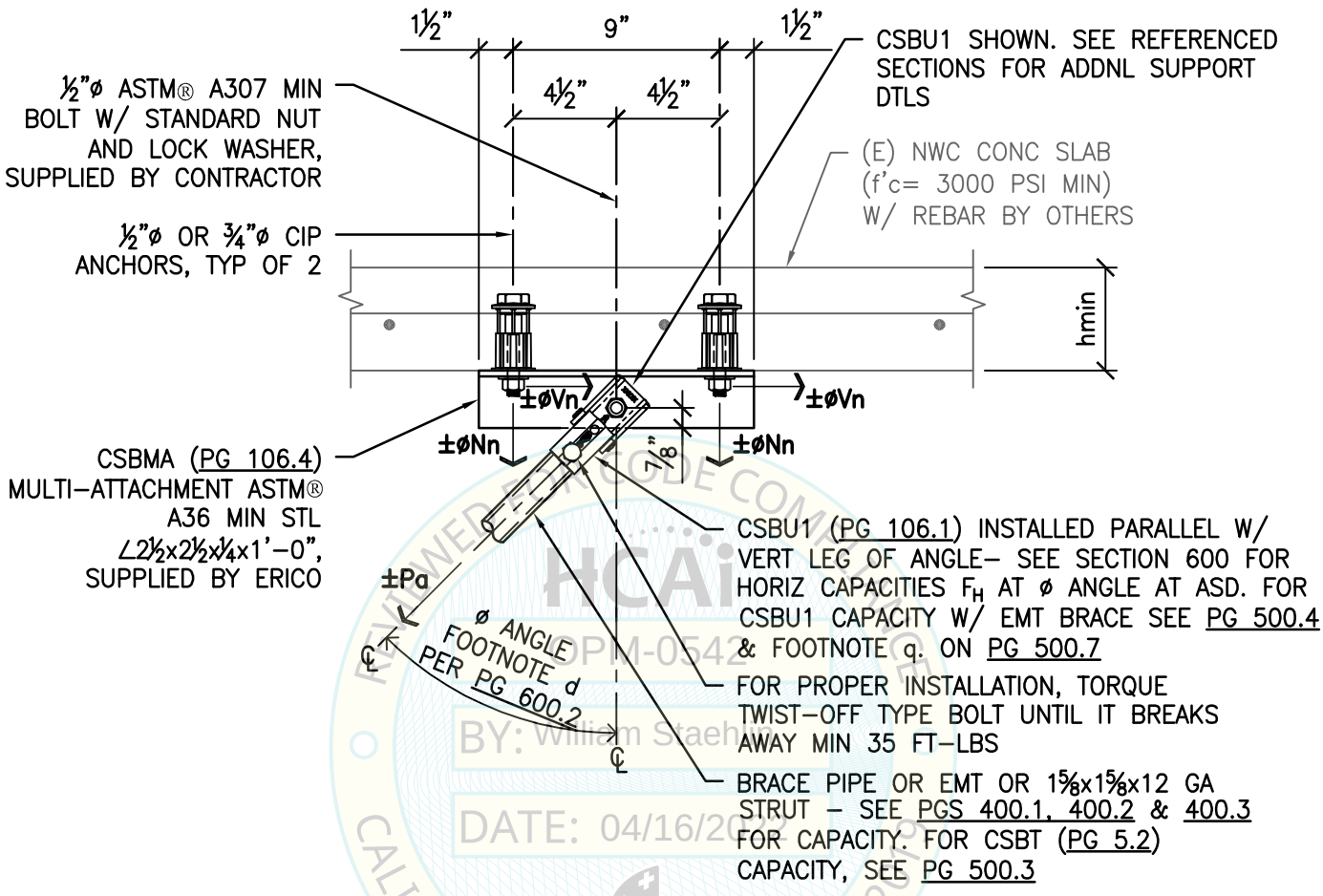
SEISMIC BRACING FOR MEP SYSTEMS



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4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

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STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF CSBMA CAST IN PLACE ANCHORS W/ BRACE PIPE PARALLEL

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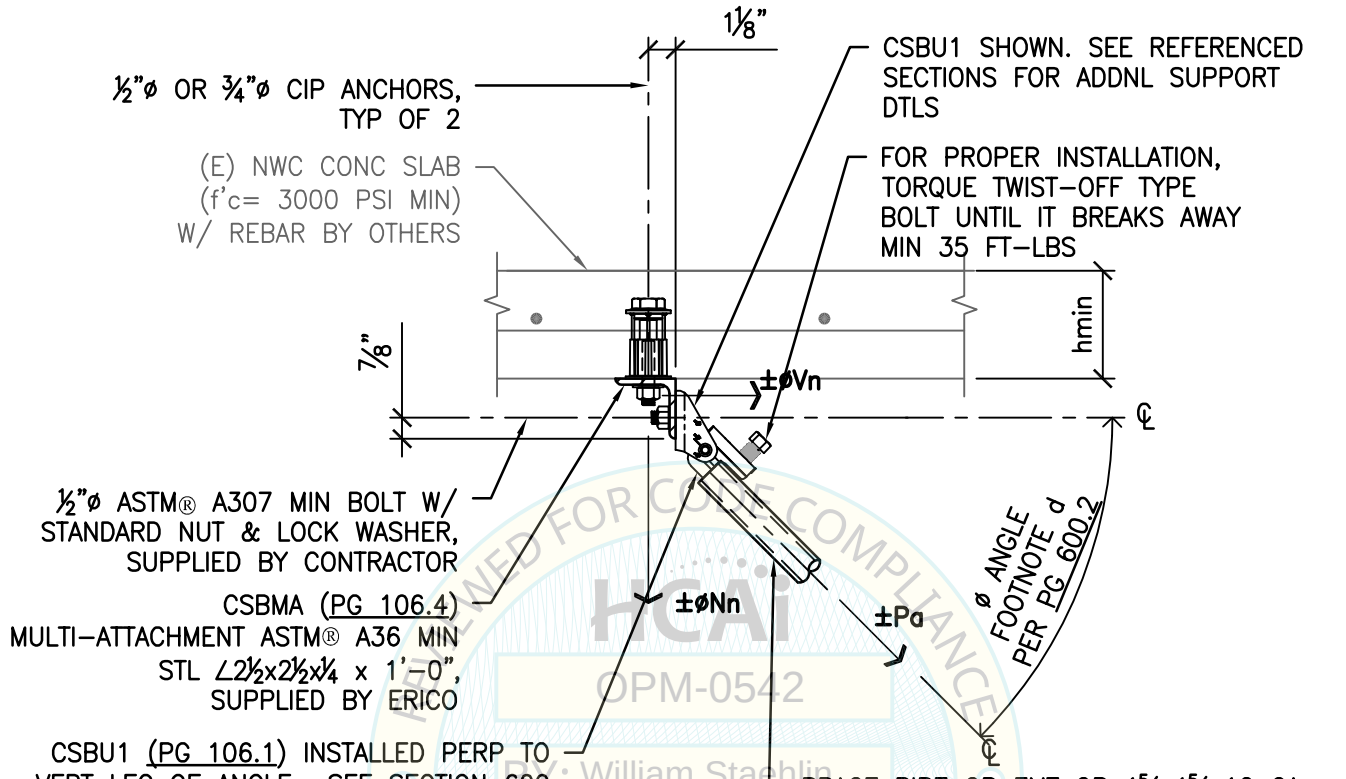
SEISMIC BRACING FOR MEP SYSTEMS



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4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

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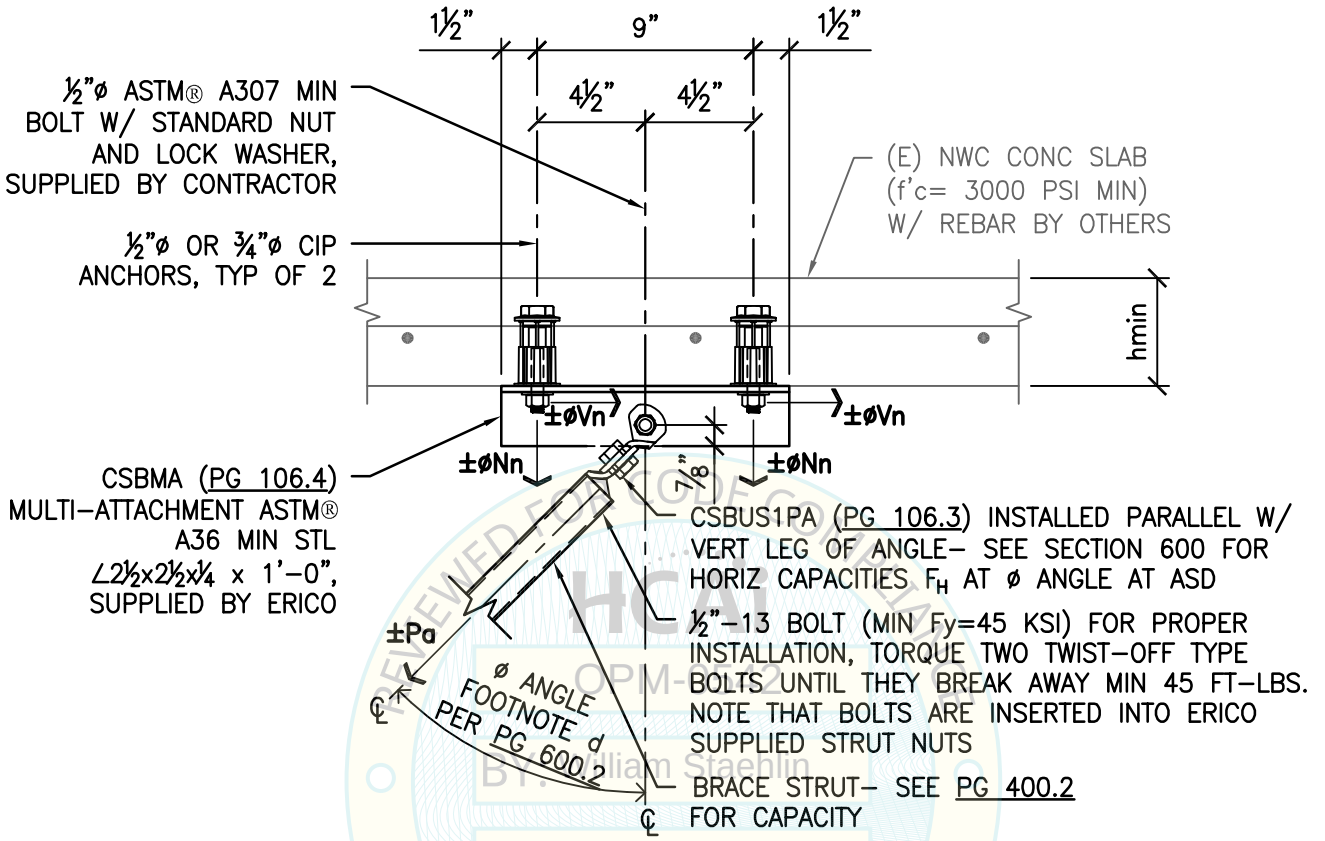
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

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3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

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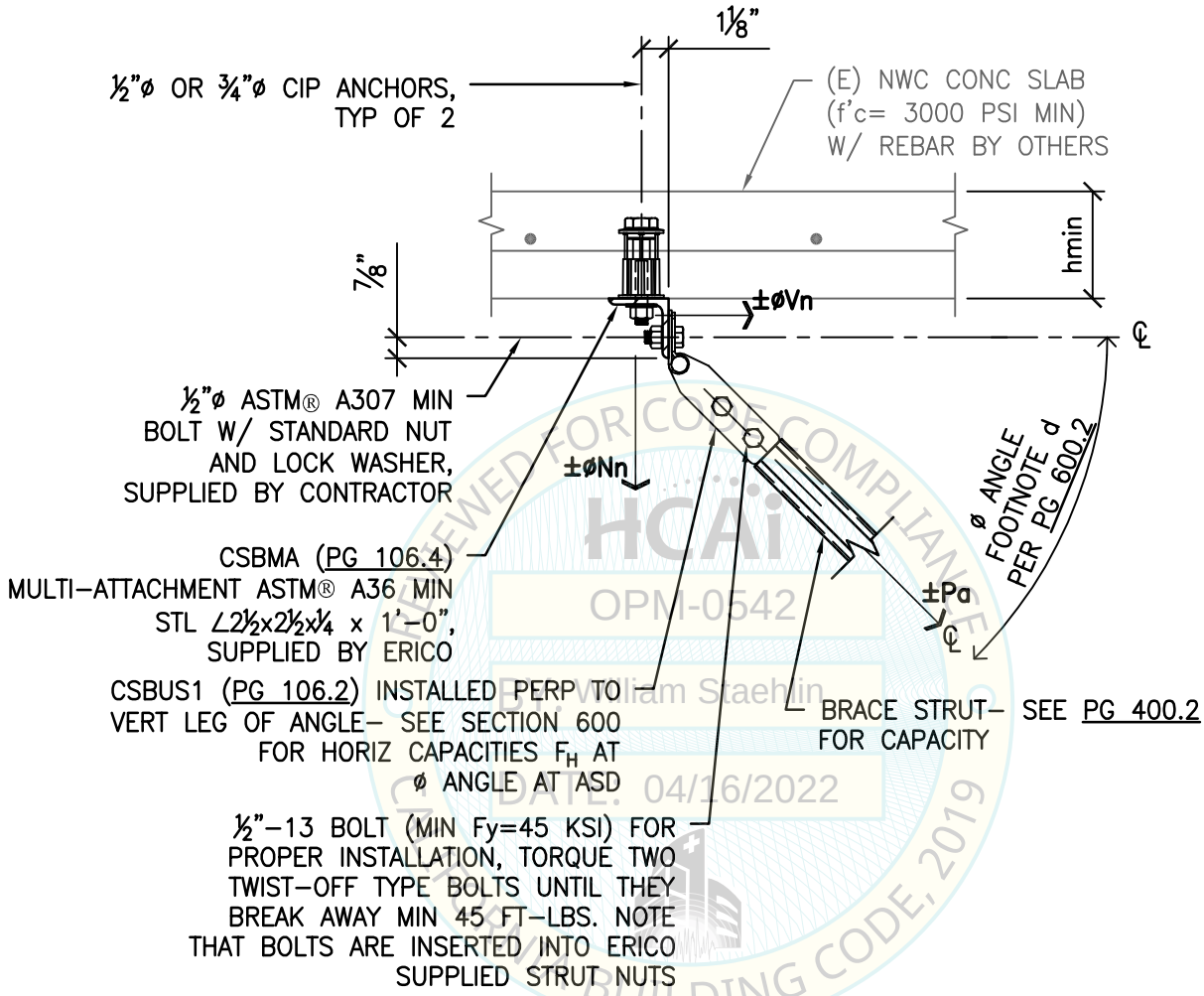
SEISMIC BRACING FOR MEP SYSTEMS



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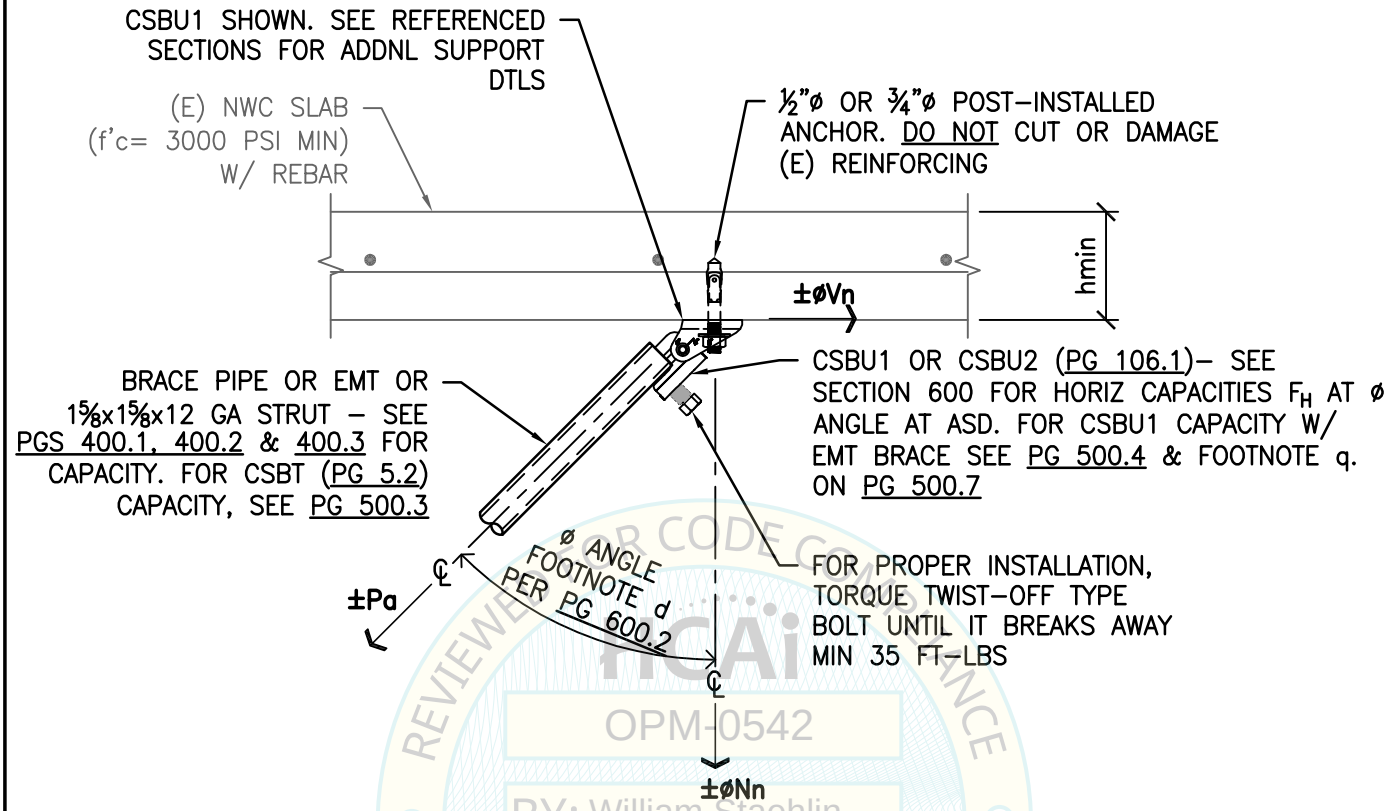
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. EMT MUST NOT BE USED W/ CSBU2.

REGISTERED PROFESSIONAL ENGINEER
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF
CSBU POST INSTALLED ANCHOR W/ BRACE PIPE

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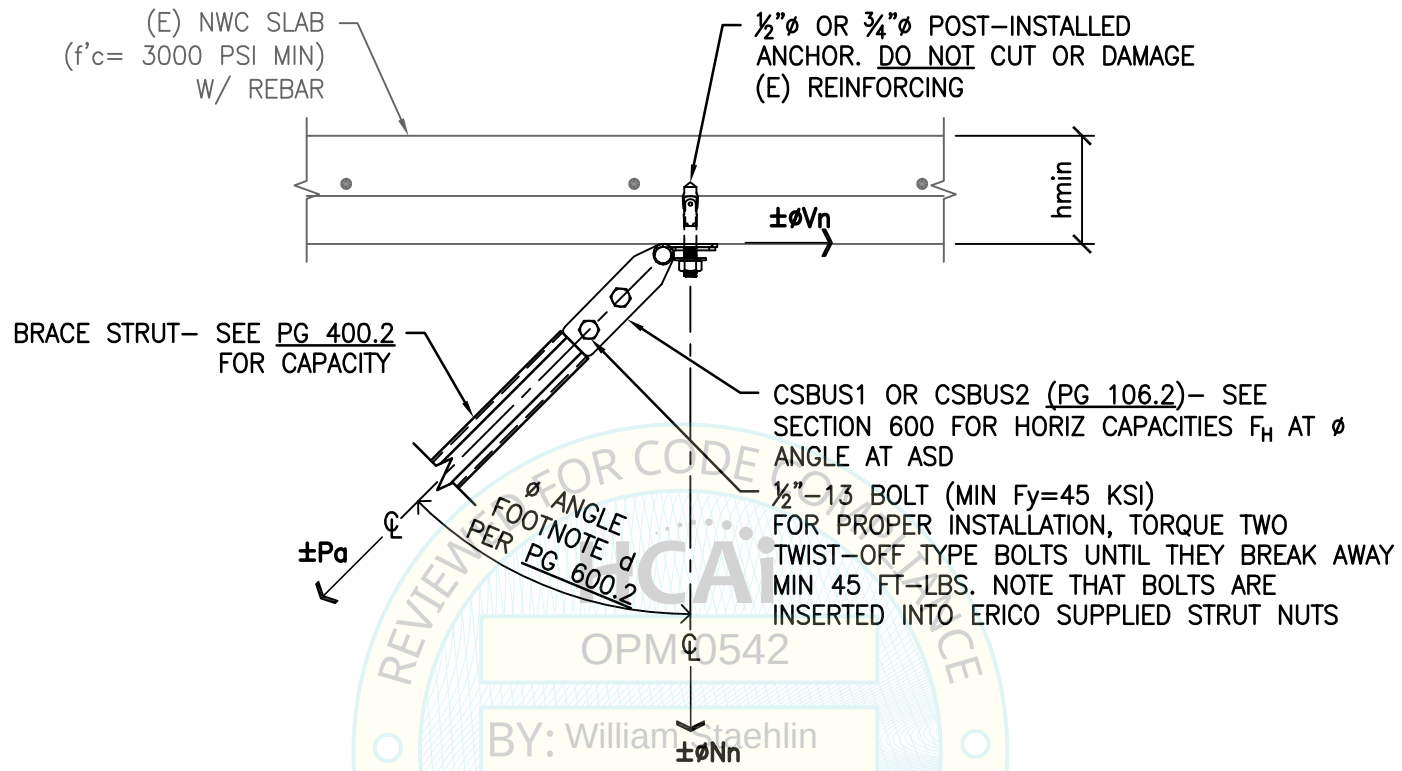
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

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REGISTERED PROFESSIONAL ENGINEER
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF
CSBU POST INSTALLED ANCHOR W/ BRACE STRUT

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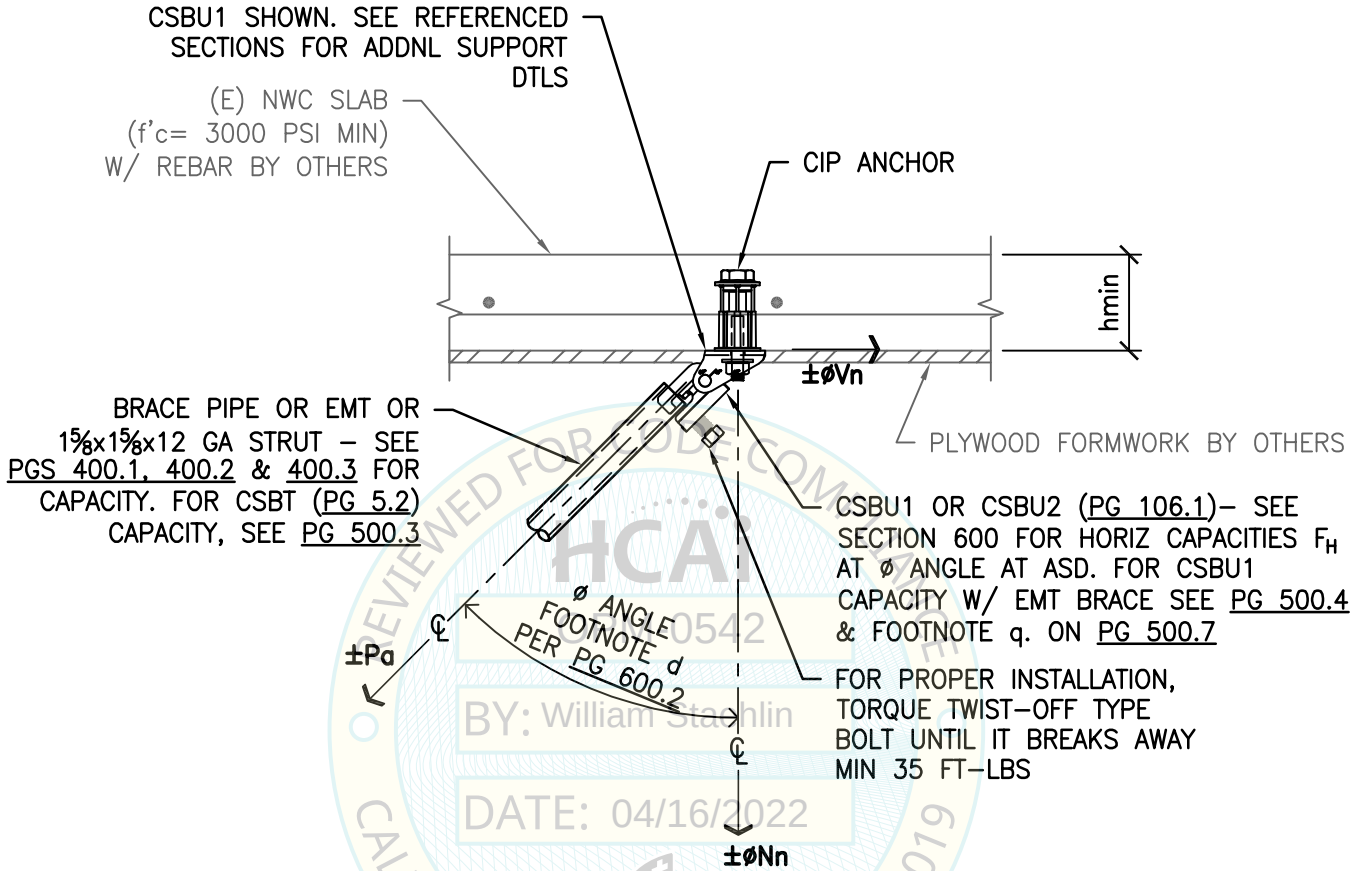
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SPECIALTY INSERTS INSTALLED IN NWC MUST BE HEADED CAST–IN SPECIALTY INSERTS IN CRACKED CONC AS NOTED IN APPENDIX 'A'.
2. INSTALLATION MUST BE IN ACCORDANCE W/ THE REQUIREMENTS OF THE ICC–ES EVALUATION REPORT FOR THE SPECIFIED ANCHOR.
3. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
4. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
5. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.
6. EMT MUST NOT BE USED W/ CSBU2.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF
CSBU CAST IN PLACE ANCHOR W/ BRACE PIPE

CYS STRUCTURAL ENGINEERS, INC.
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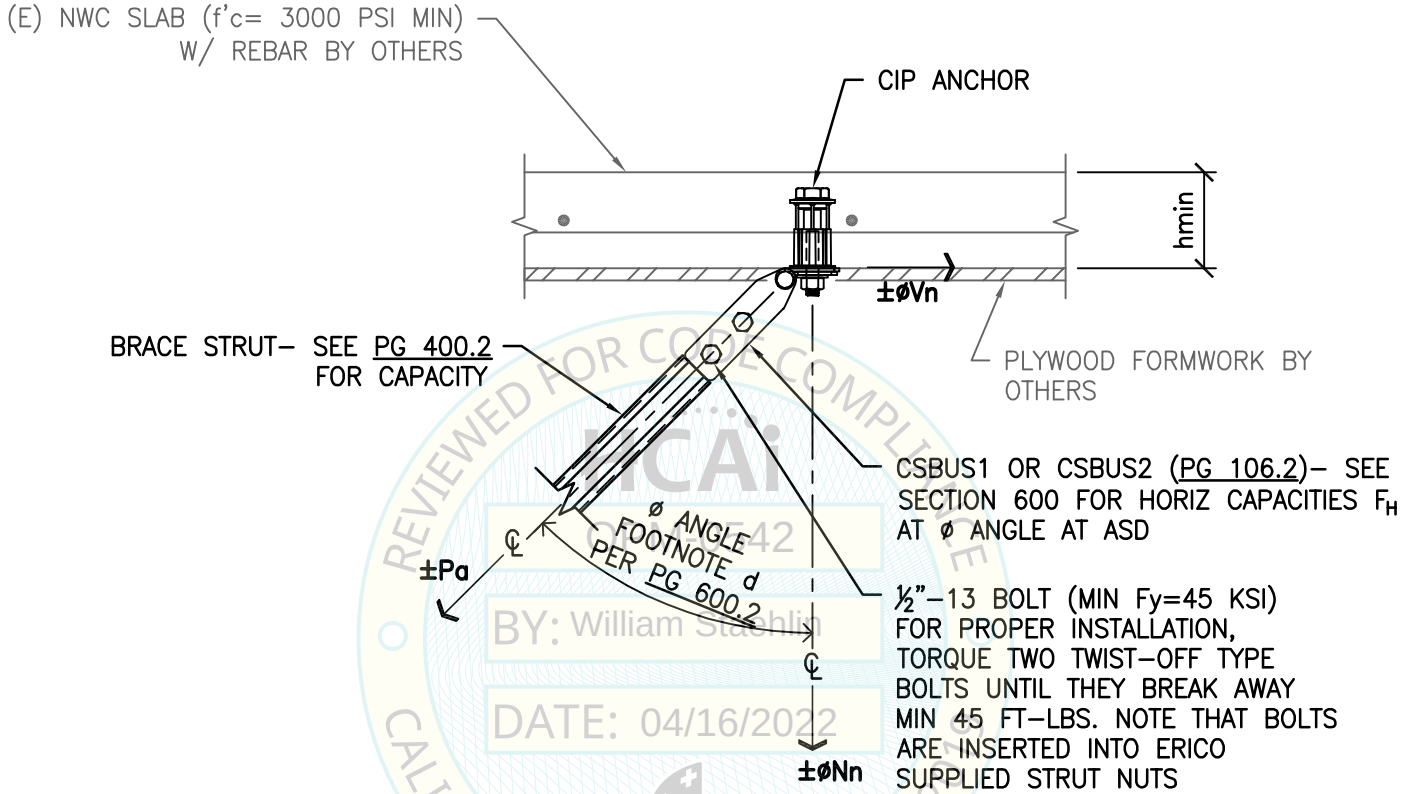
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SPECIALTY INSERTS INSTALLED IN NWC MUST BE HEADED CAST–IN SPECIALTY INSERTS IN CRACKED CONC AS NOTED IN APPENDIX 'A'.
2. INSTALLATION MUST BE IN ACCORDANCE W/ THE REQUIREMENTS OF THE ICC–ES EVALUATION REPORT FOR THE SPECIFIED ANCHOR.
3. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
4. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
5. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF CSBU CAST IN PLACE ANCHOR W/ BRACE STRUT

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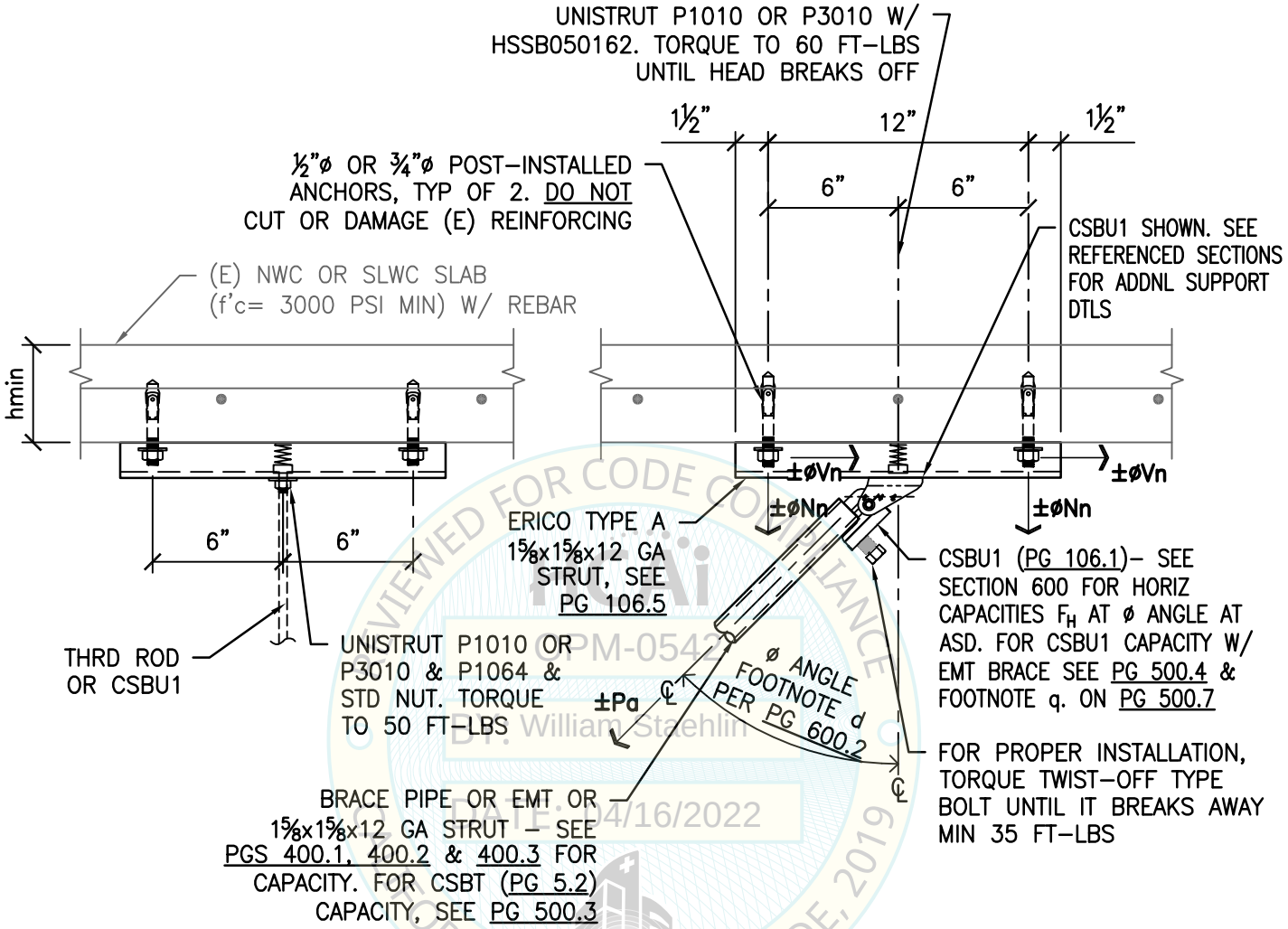
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. THE ALLOWABLE ASD SLIP LOAD & TENSION LOAD FOR THE UNISTRUT P1010 OR P3010 IS 1370 LBS & 2810 LBS RESPECTIVELY. THE ALLOWABLE LOAD PERP TO THE STRUT IS 1035 LBS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF STRUT POST INSTALLED ANCHORS W/ BRACE PIPE PARALLEL & VERTICAL ROD

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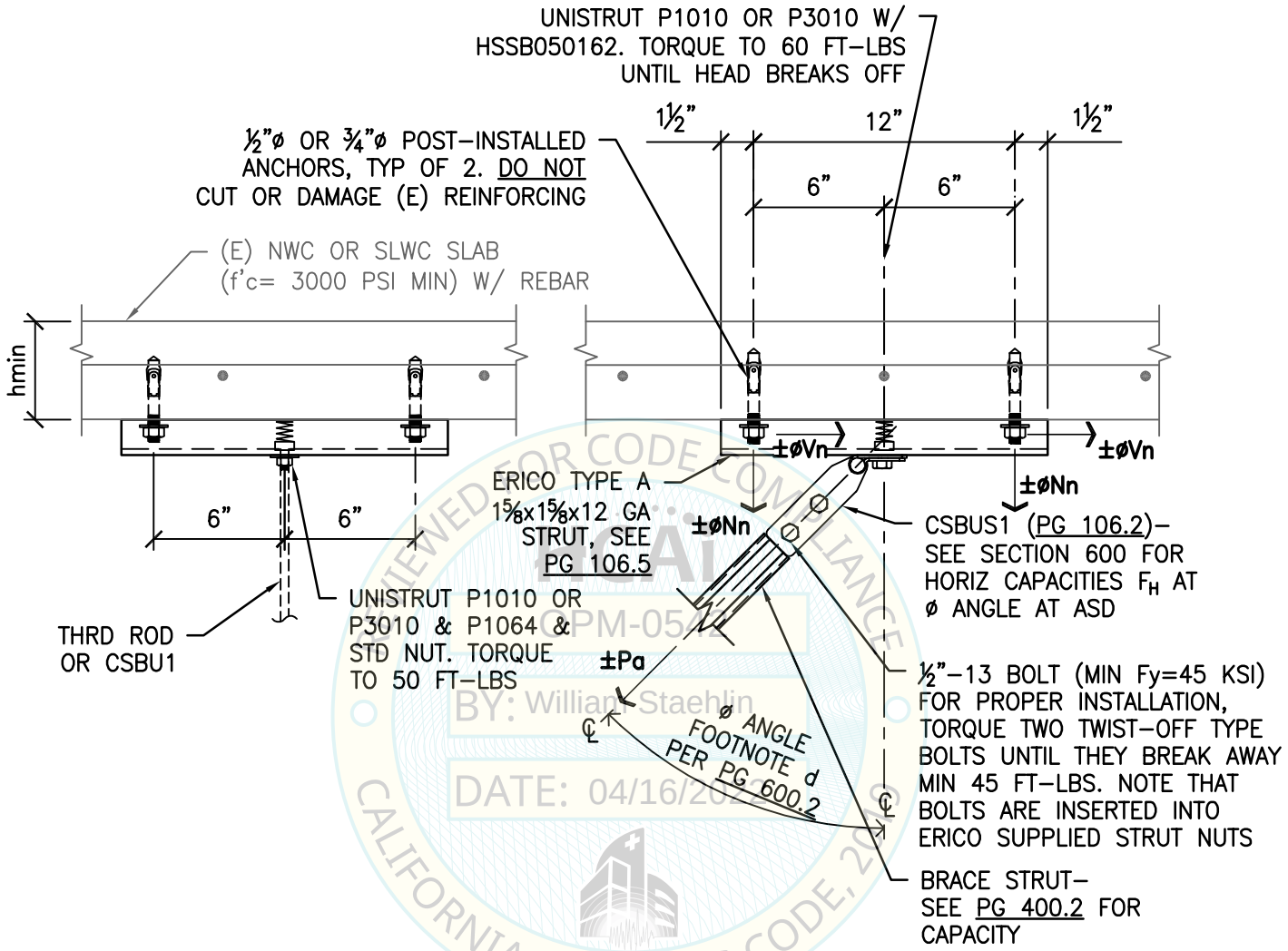
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. THE ALLOWABLE ASD SLIP LOAD & TENSION LOAD FOR THE UNISTRUT P1010 OR P3010 IS 1370 LBS & 2810 LBS RESPECTIVELY. THE ALLOWABLE LOAD PERP TO THE STRUT IS 1035 LBS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF STRUT POST INSTALLED ANCHORS W/ BRACE STRUT PARALLEL

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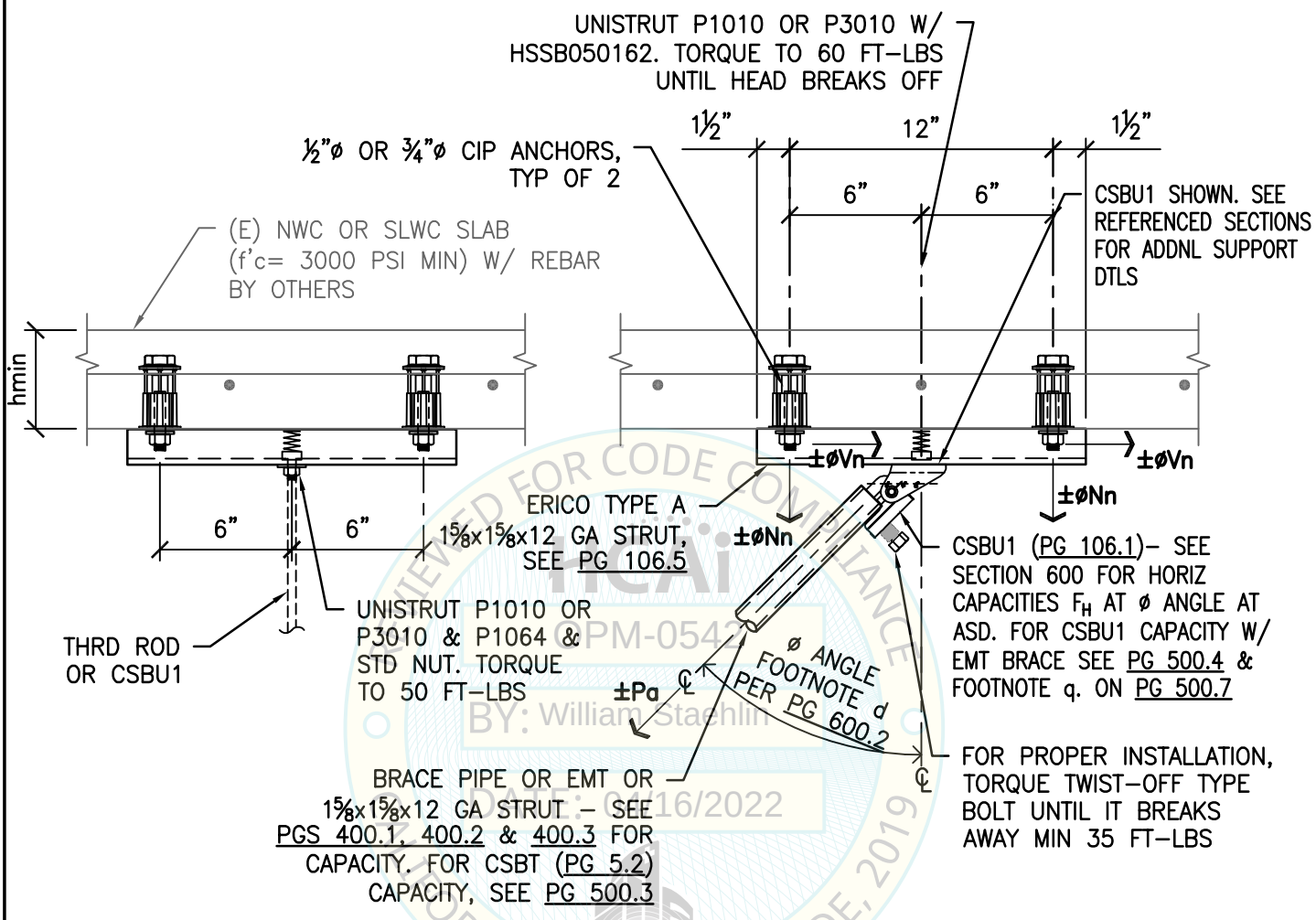
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. THE ALLOWABLE ASD SLIP LOAD & TENSION LOAD FOR THE UNISTRUT P1010 OR P3010 IS 1370 LBS & 2810 LBS RESPECTIVELY. THE ALLOWABLE LOAD PERP TO THE STRUT IS 1035 LBS.

REGISTERED PROFESSIONAL ENGINEER DIETER T SIEBALD No. S4346 STRUCTURAL STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF STRUT CAST IN PLACE ANCHORS W/ BRACE PIPE PARALLEL & VERTICAL ROD

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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TEL (916) 920-2020
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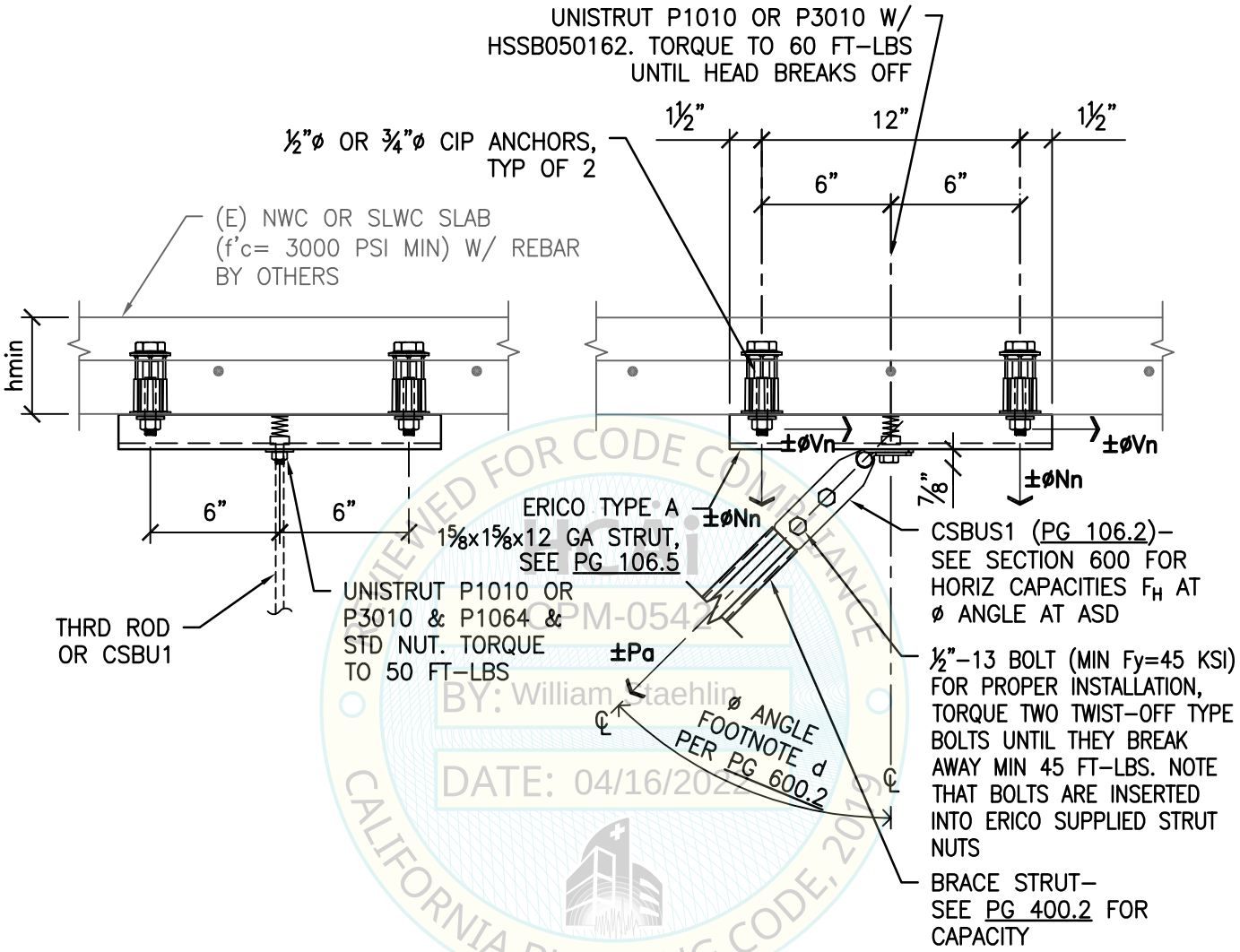
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. THE ALLOWABLE ASD SLIP LOAD & TENSION LOAD FOR THE UNISTRUT P1010 OR P3010 IS 1370 LBS & 2810 LBS RESPECTIVELY. THE ALLOWABLE LOAD PERP TO THE STRUT IS 1035 LBS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF STRUT CAST IN PLACE ANCHORS W/ BRACE STRUT PARALLEL & VERTICAL ROD

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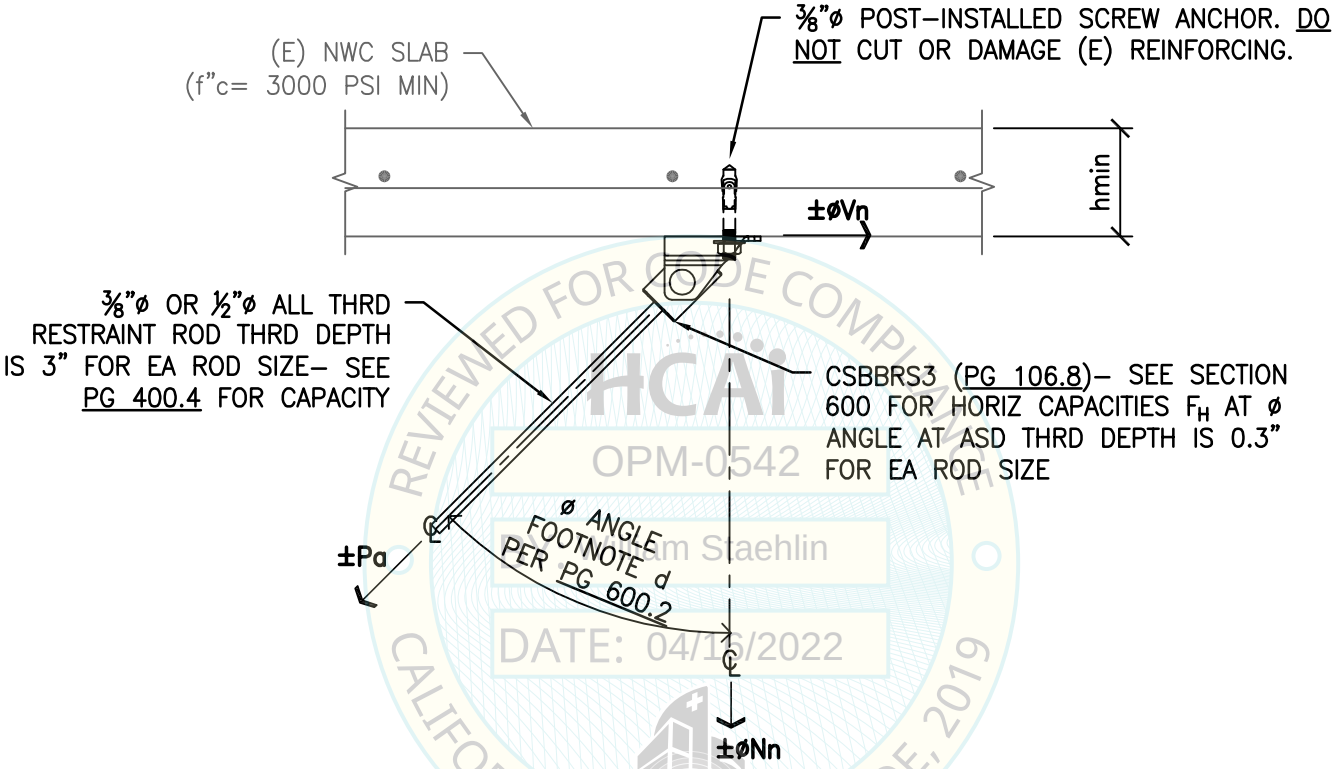
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE APPENDIX 'A' CASE 2, PG A3 FOR CONC ANCHORAGE CAPACITY FOR POST–INSTALLED DEWALT/POWERS SNAKE+ SCREW ANCHOR.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A' FOR THE ANCHOR IN NOTE 1.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.
4. THRD ROD MAY CONTROL THE CAPACITY OF THE RESTRAINT ASSEMBLY.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO UNDERSIDE OF CONCRETE FLOOR OR ROOF
CSBBRS3 POST INSTALLED ANCHOR W/ RESTRAINT ROD

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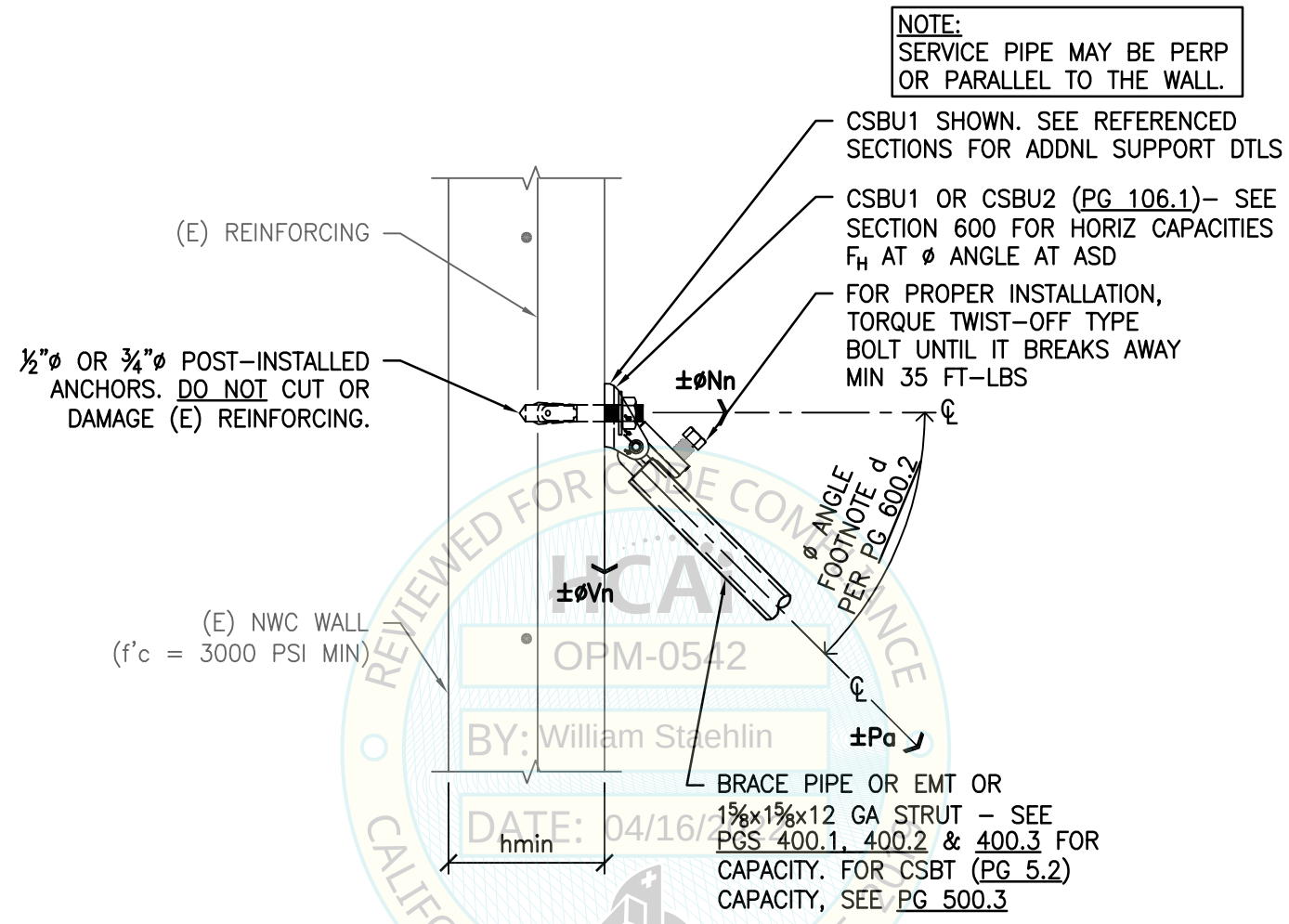
SEISMIC BRACING FOR MEP SYSTEMS



ELEV VIEW

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.
4. EMT MUST NOT BE USED W/ CSBU2.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
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STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO CONCRETE WALL
CSBU POST INSTALLED ANCHORS W/ BRACE PIPE

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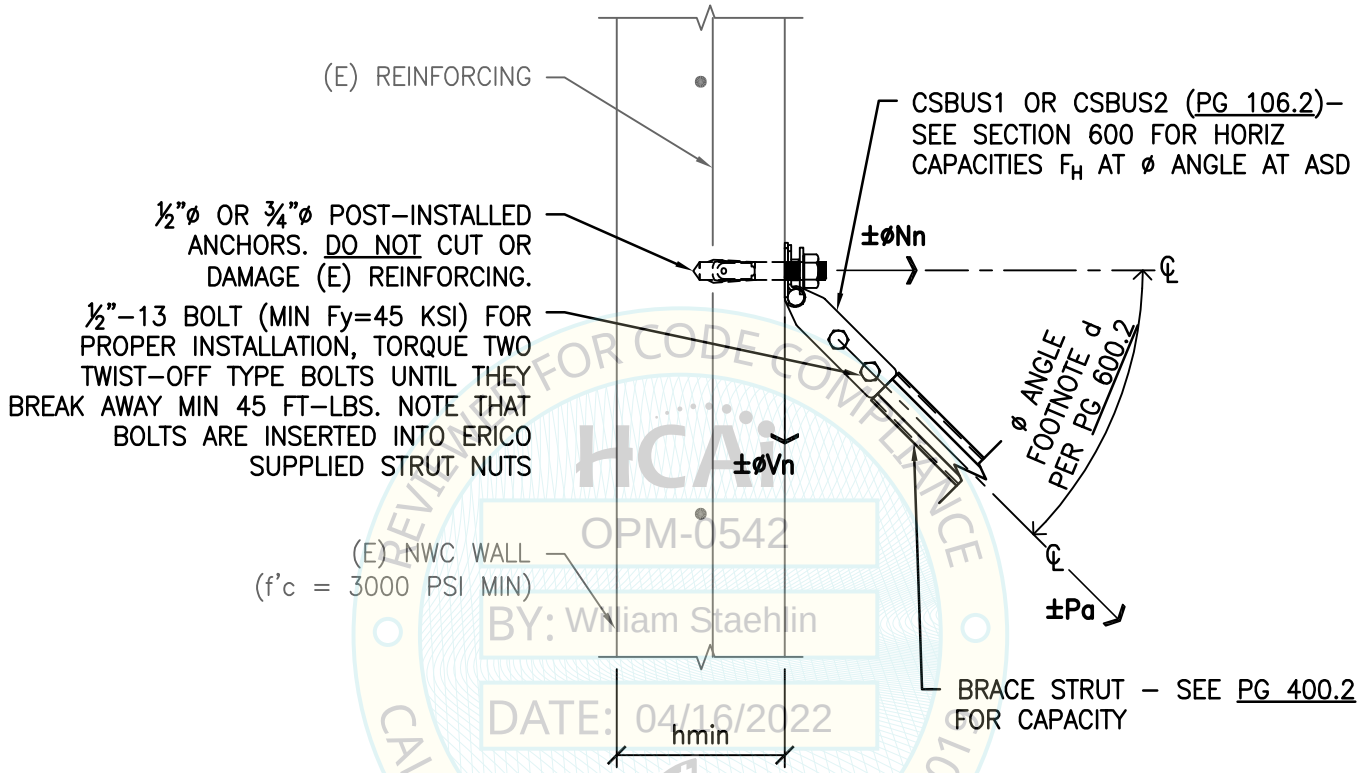
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
SERVICE PIPE MAY BE PERP OR PARALLEL TO THE WALL.



ELEV VIEW

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE–APPROVAL.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO CONCRETE WALL
CSBU POST INSTALLED ANCHORS W/ BRACE STRUT

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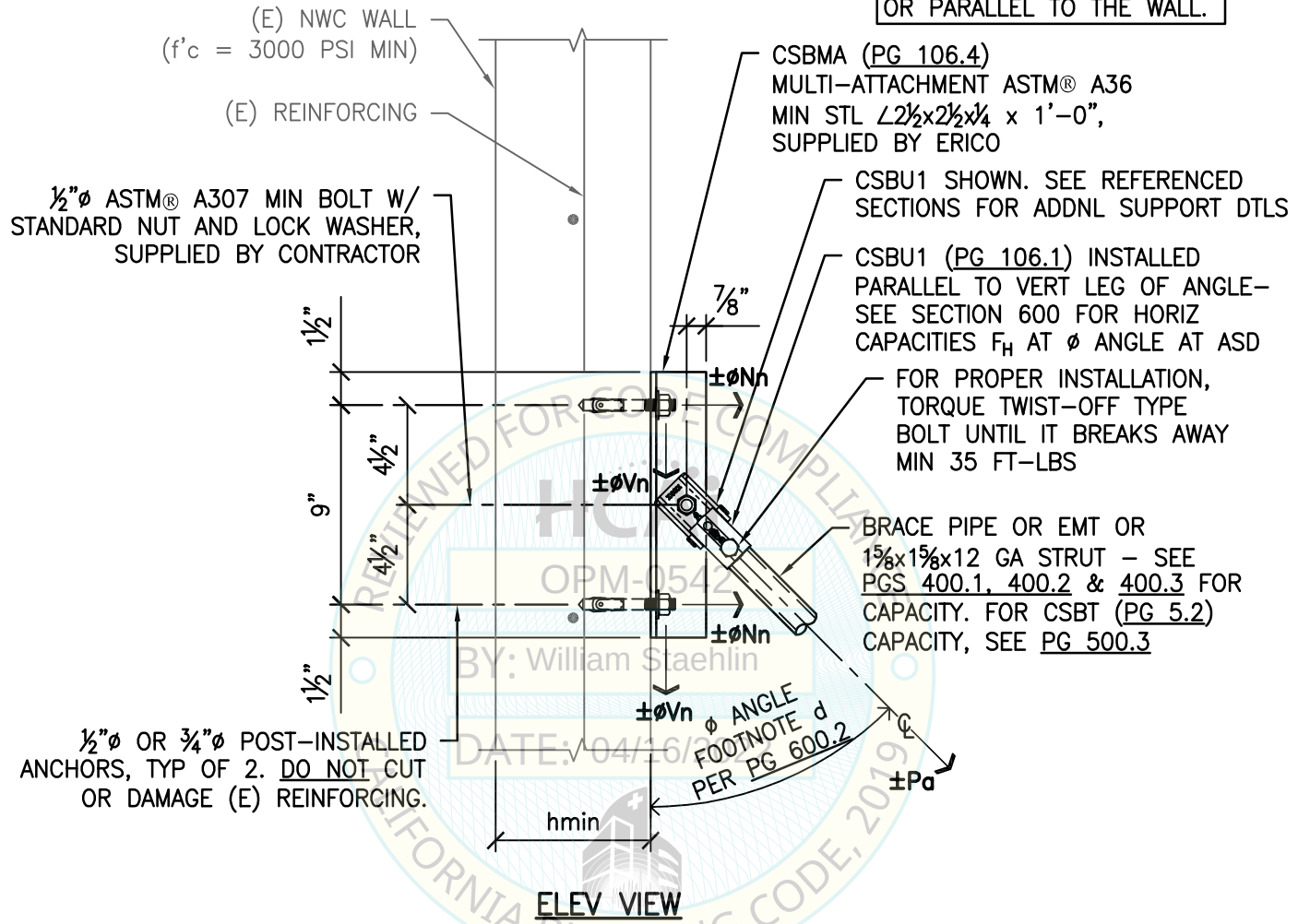
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
SERVICE PIPE MAY BE PERP OR PARALLEL TO THE WALL.



ELEV VIEW

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO CONCRETE WALL
CSBMA POST INSTALLED ANCHORS W/ BRACE PIPE

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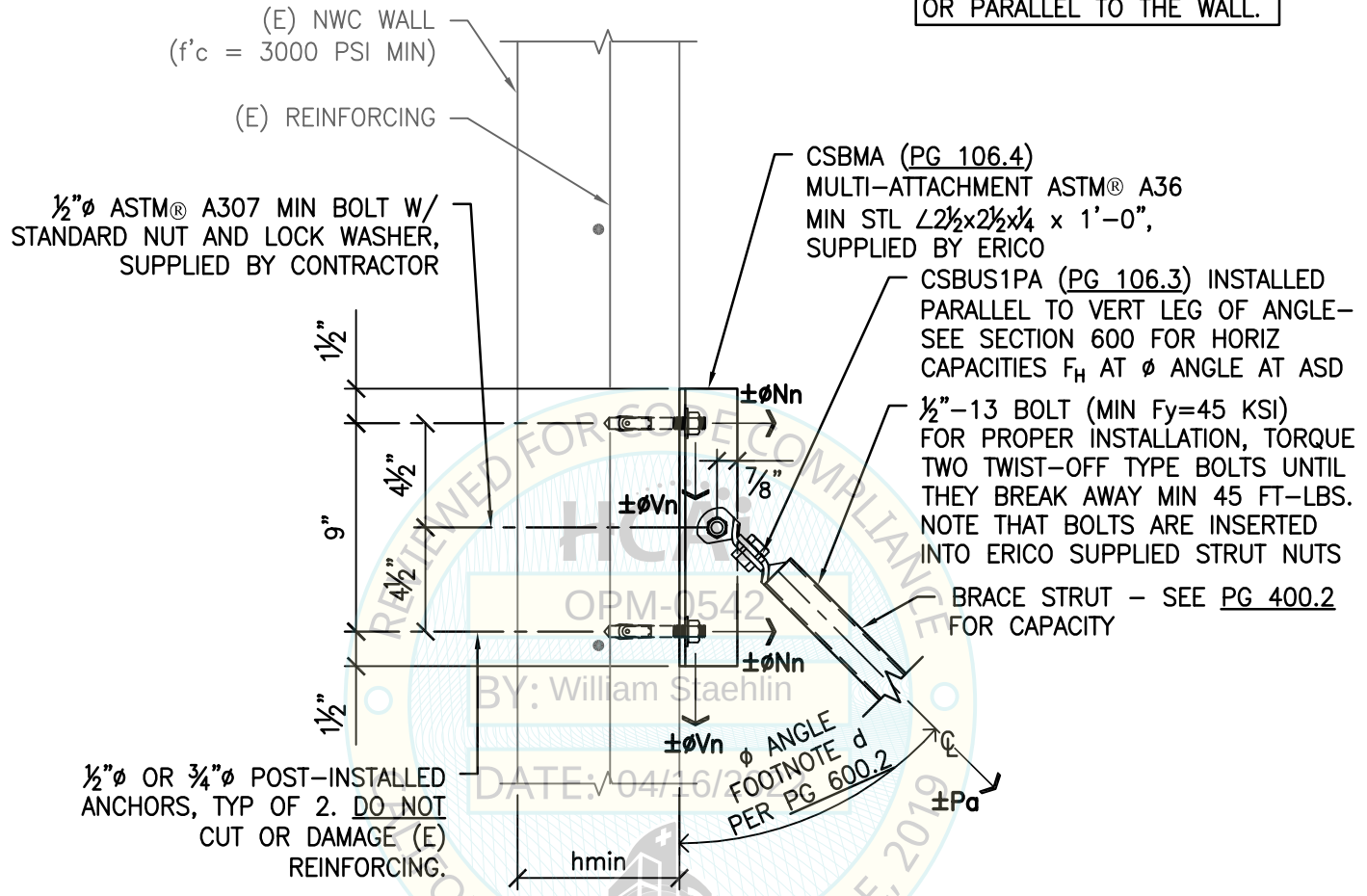
SEISMIC BRACING FOR MEP SYSTEMS

NOTE:
SERVICE PIPE MAY BE PERP OR PARALLEL TO THE WALL.



ELEV VIEW

NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. SEE PG 106.4 FOR ALLOWABLE CAPACITY OF THE CSBMA ANGLE.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO CONCRETE WALL
CSBMA POST INSTALLED ANCHORS W/ BRACE STRUT

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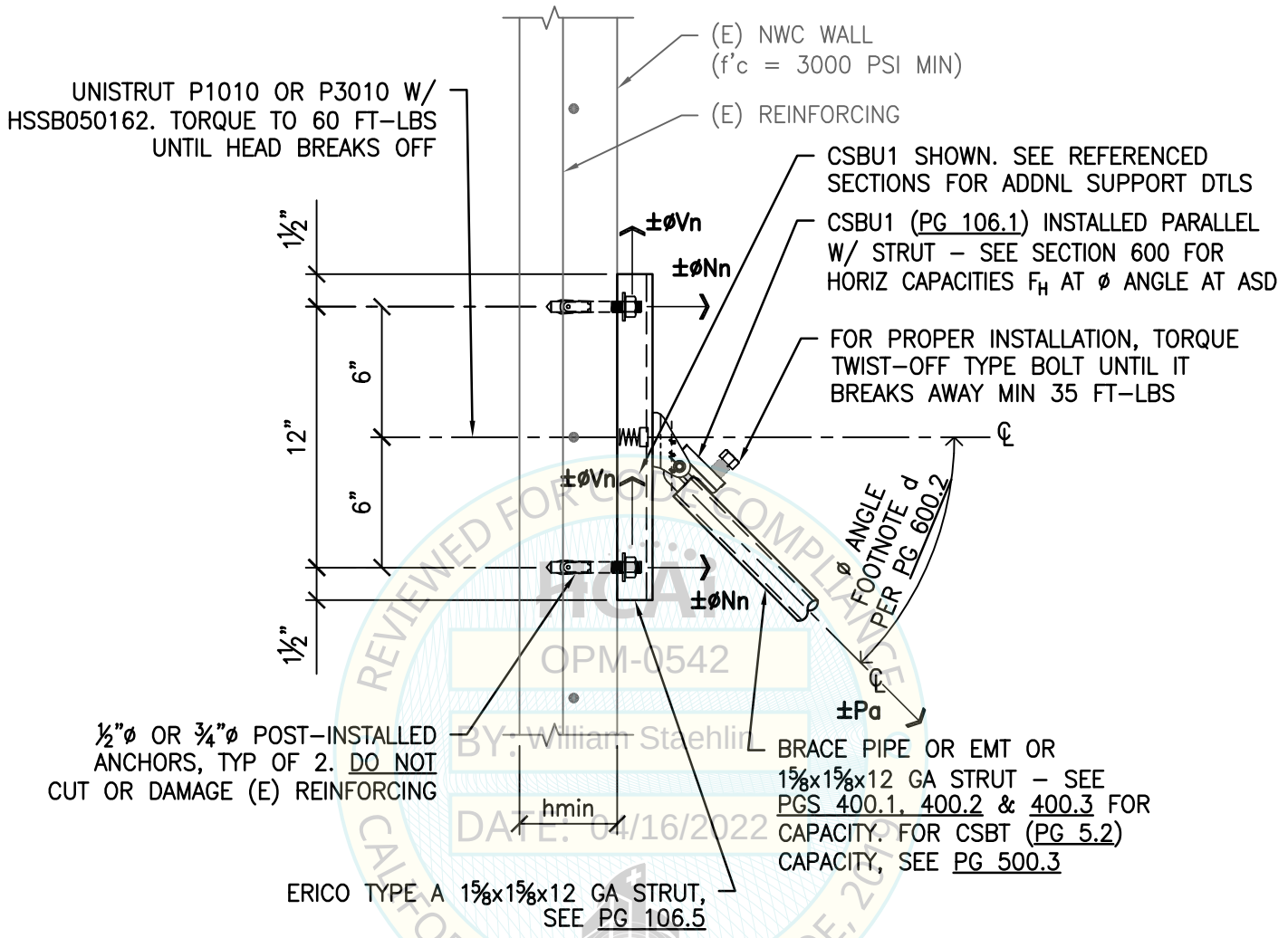
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. THE ALLOWABLE ASD SLIP LOAD & TENSION LOAD FOR THE UNISTRUT P1010 OR P3010 IS 1370 LBS & 2810 LBS RESPECTIVELY.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO CONCRETE WALL
STRUT POST INSTALLED ANCHORS W/ BRACE PIPE

CYS STRUCTURAL ENGINEERS, INC.
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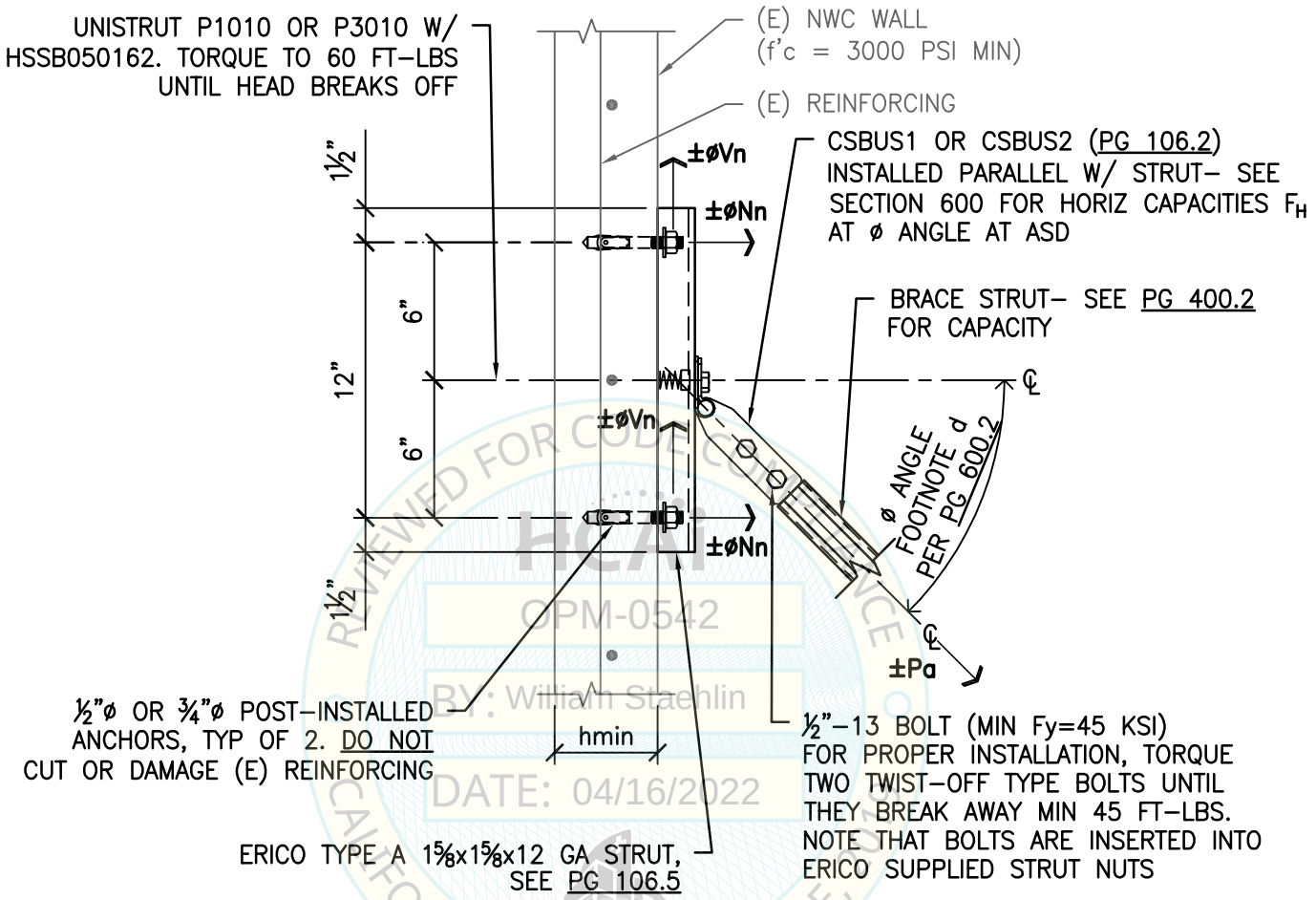
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE APPENDIX 'A' FOR CONC ANCHORAGE CAPACITY FOR ANCHORS.
2. SEOR MUST VERIFY LRFD DEMAND FORCES INCLUDE Ωo WHEN CHECKING CONC ANCHORAGE CAPACITY PROVIDED IN APPENDIX 'A'.
3. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
4. THE ALLOWABLE ASD SLIP LOAD & TENSION LOAD FOR THE UNISTRUT P1010 OR P3010 IS 1370 LBS & 2810 LBS RESPECTIVELY.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO CONCRETE WALL
STRUT POST INSTALLED ANCHORS W/ BRACE STRUT

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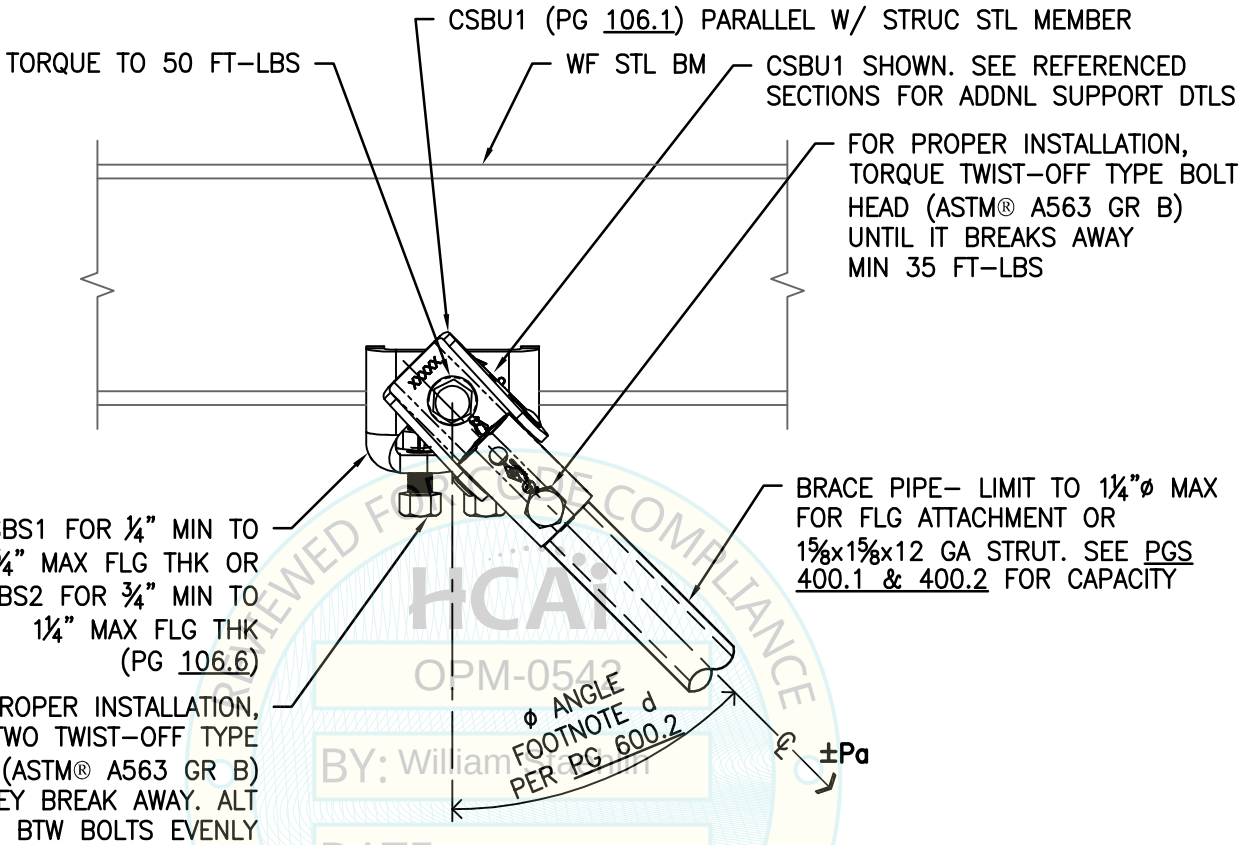
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1, CSBS1A, CSBS2 OR CSBU1 AT ASD W/ BRACE PIPE PARALLEL TO STRUC STL MEMBER (FOOTNOTE i. ON PG 600.3).
2. CSBS1A IS A PRE-ASSEMBLY OF CSBS1 & CSBU1.
3. PRE-ASSEMBLY CSBS1A CAN BE USED WHENEVER THE CSBS1 & CSBU1 ARE CALLED OUT.
4. THE CSBS1 OR CSBS2 DO NOT ROTATE. IT IS THE BRACE MEMBER THAT ROTATES.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBS1, CSBS1A & CSBS2 BOTTOM FLANGE W/ BRACE PIPE PARALLEL

CYS STRUCTURAL ENGINEERS, INC.
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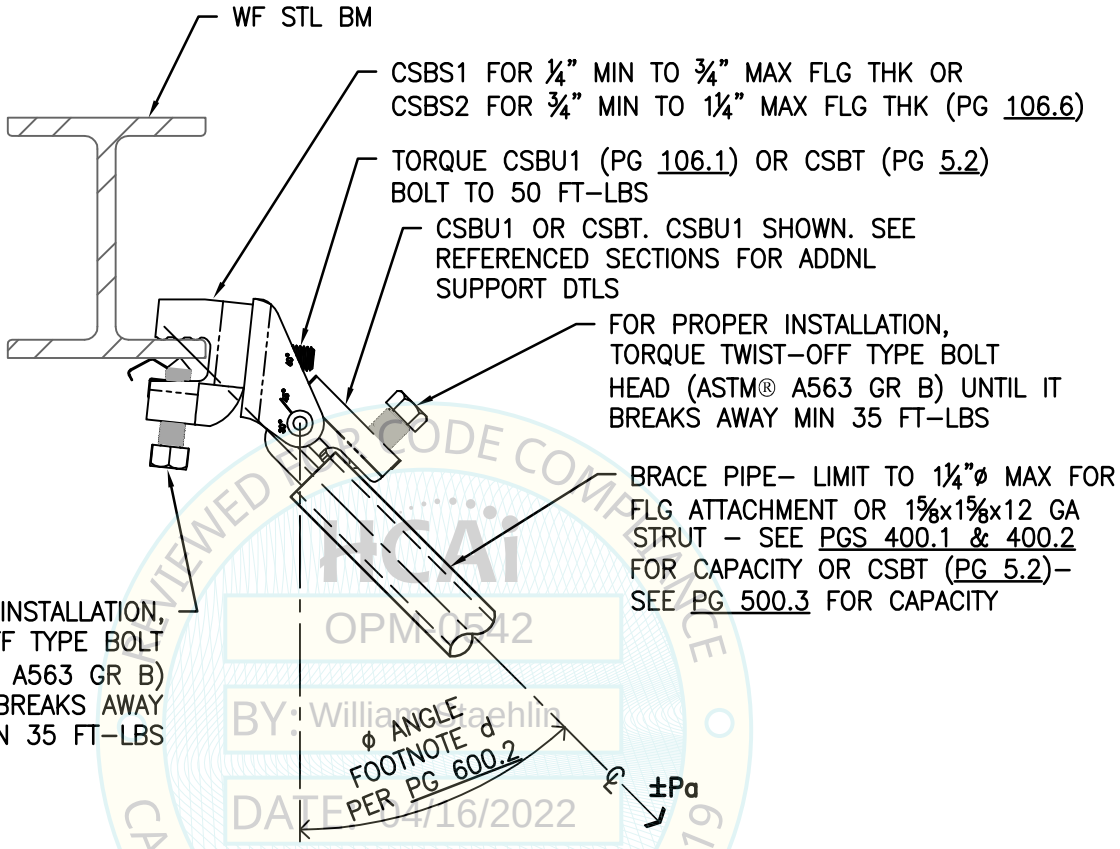
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1, CSBS1A, CSBS2, CSBU1 OR CSBT AT ASD W/ BRACE PIPE PERP TO STRUC STL MEMBER (FOOTNOTE j. ON PG 600.3).
2. CSBS1A IS A PRE–ASSEMBLY OF CSBS1 & CSBU1.
3. PRE–ASSEMBLY CSBS1A CAN BE USED WHENEVER THE CSBS1 & CSBU1 ARE CALLED OUT.
4. THE CSBS1 OR CSBS2 DO NOT ROTATE. IT IS THE BRACE MEMBER THAT ROTATES.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBS1, CSBS1A & CSBS2 BOTTOM FLANGE W/ BRACE PIPE PERPENDICULAR

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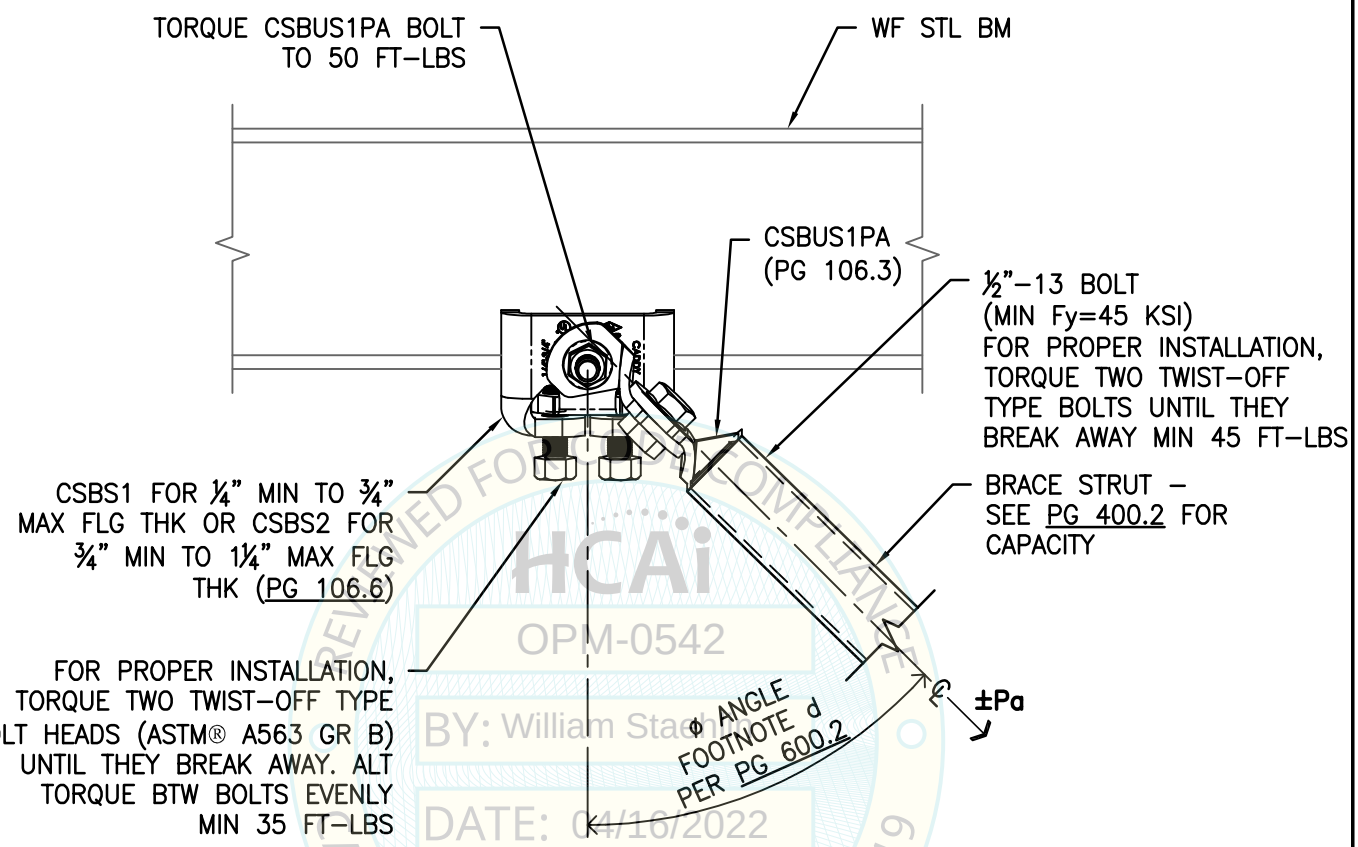
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ϕ ANGLE OF CSBS1, CSBS2 OR CSBUS1PA AT ASD W/ BRACE PIPE PARALLEL TO STRUC STL MEMBER (FOOTNOTE i. ON PG 600.3).
2. THE CSBS1 OR CSBS2 DO NOT ROTATE. IT IS THE BRACE MEMBER THAT ROTATES.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBS1 & CSBS2 BOTTOM FLANGE W/ BRACE STRUT PARALLEL

CYS STRUCTURAL ENGINEERS, INC.
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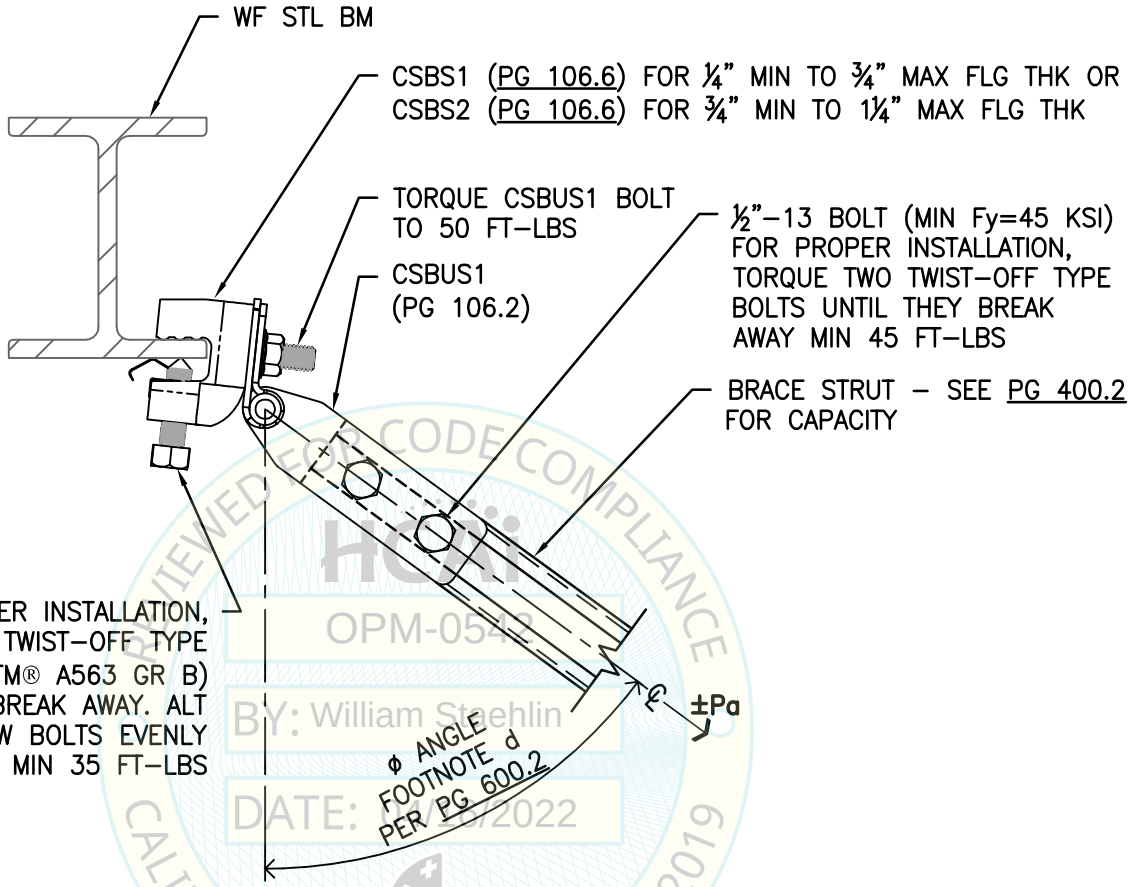
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:
1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ϕ ANGLE OF CSBS1, CSBS2 OR CSBUS1 AT ASD W/ BRACE PIPE PERP TO STRUC STL MEMBER (FOOTNOTE j. ON PG 600.3).
2. THE CSBS1 OR CSBS2 DO NOT ROTATE. IT IS THE BRACE MEMBER THAT ROTATES.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBS1 & CSBS2 BOTTOM FLANGE W/ BRACE STRUT PERPENDICULAR

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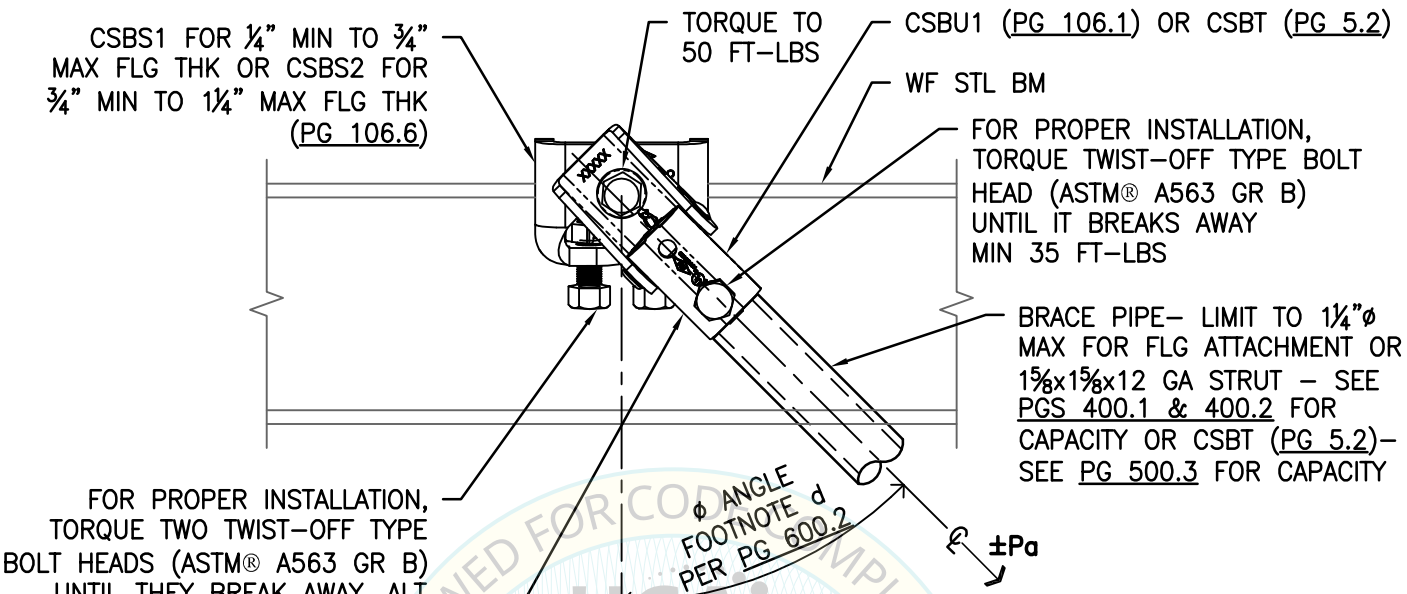
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:
1. SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1, CSBS1A, CSBS2, CSBU1 OR CSBT AT ASD.
2. CSBS1A IS A PRE–ASSEMBLY OF CSBS1 & CSBU1.
3. PRE–ASSEMBLY CSBS1A CAN BE USED WHENEVER THE CSBS1 & CSBU1 ARE CALLED OUT.
4. THE CSBS1 OR CSBS2 DO NOT ROTATE. IT IS THE BRACE MEMBER THAT ROTATES.

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DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBS1, CSBS1A & CSBS2 TOP FLANGE W/ BRACE PIPE PARALLEL

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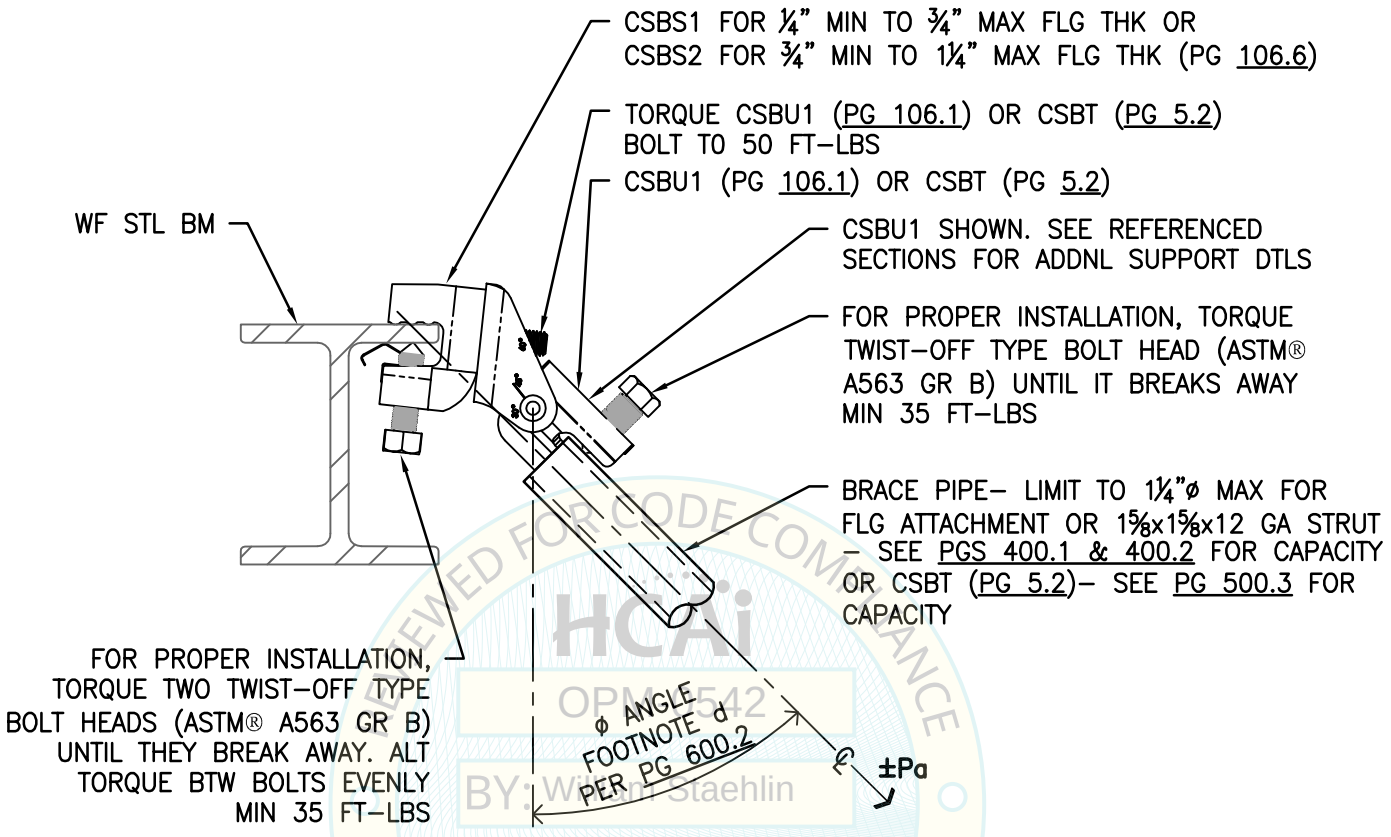
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:
1. SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1, CSBS1A, CSBS2, CSBU1 OR CSBT AT ASD.
2. CSBS1A (PG 106.6) IS A PRE–ASSEMBLY OF CSBS1 & CSBU1.
3. PRE–ASSEMBLY CSBS1A CAN BE USED WHENEVER THE CSBS1 & CSBU1 ARE CALLED OUT.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

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CSBS1, CSBS1A & CSBS2 TOP FLANGE W/ BRACE PIPE PERPENDICULAR

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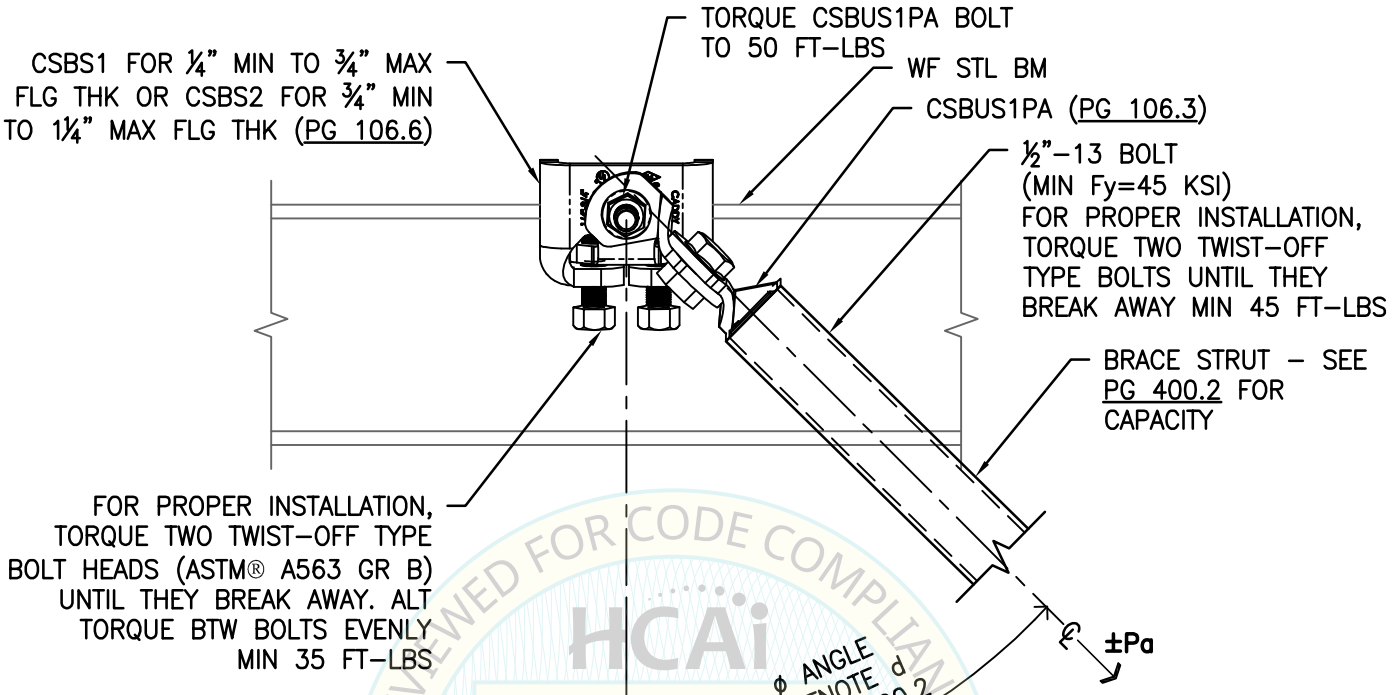
SEISMIC BRACING FOR MEP SYSTEMS



NOTE:
SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1, CSBS2 OR CSBUS1PA AT ASD.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
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STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBS1 & CSBS2 TOP FLANGE W/ BRACE STRUT PARALLEL

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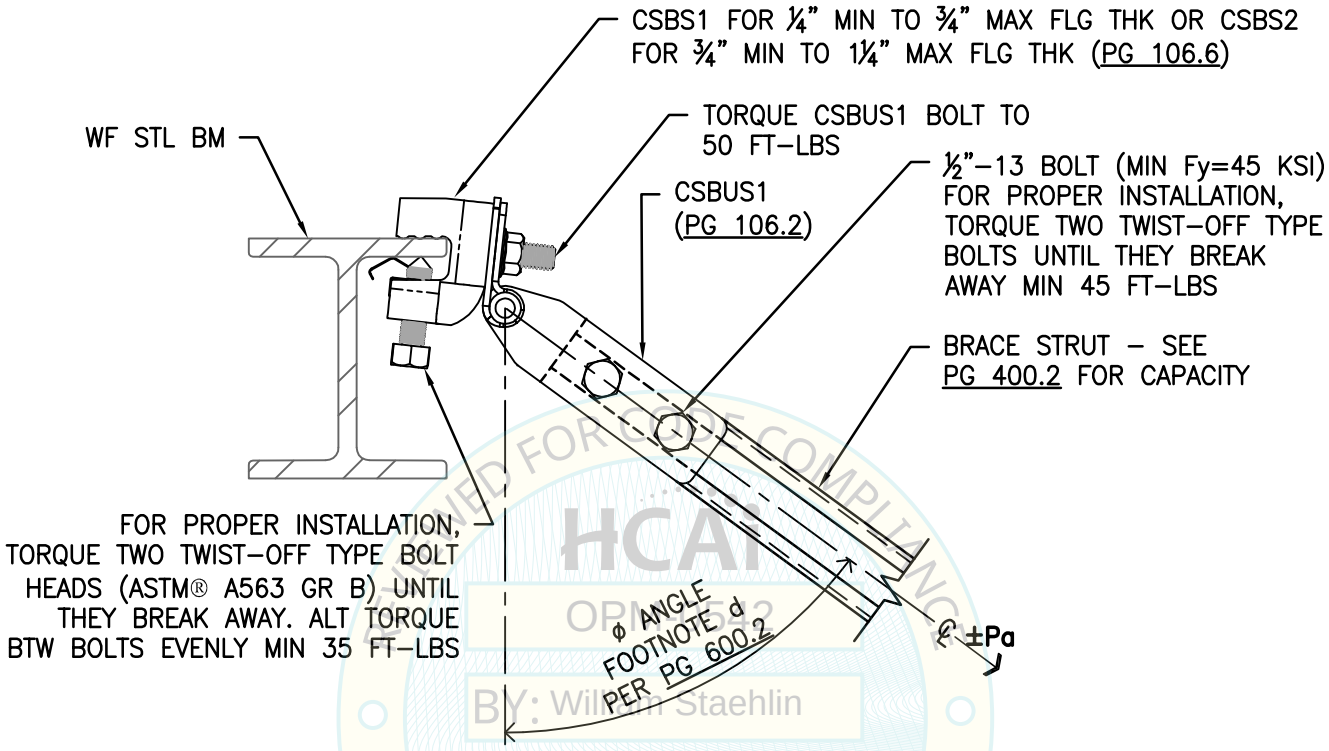
SEISMIC BRACING FOR MEP SYSTEMS



NOTE:
SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ϕ ANGLE OF CSBS1, CSBS2 OR CSBUS1 AT ASD.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBS1 & CSBS2 TOP FLANGE W/ BRACE STRUT PERPENDICULAR

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SEISMIC BRACING FOR MEP SYSTEMS

PART NO.	FLG THK	FLG WIDTH	THRD ROD
CSBS3	¼" TO ¾"	4" TO 8½"	12"
CSBS4	¼" TO ¾"	4" TO 14½"	17"
CSBS5	¾" TO 1¼"	4" TO 18"	21½"

FOR PROPER INSTALLATION, TORQUE TWO TWIST-OFF TYPE BOLT HEADS (ASTM® A563 GR B) UNTIL THEY BREAK AWAY. ALT TORQUE BTW BOLTS EVENLY MIN 35 FT-LBS

½-13 UNC-2Ax1.75" CARRIAGE BOLT & ½-13 UNC-2B SERRATED FLG NUT SUPPLIED BY ERICO® (ASTM A449, 25-34 HRC HARDNESS). TORQUE TO 50 FT-LBS

FOR PROPER INSTALLATION, TORQUE TWIST-OFF TYPE BOLT HEAD UNTIL IT BREAKS AWAY MIN 35 FT-LBS

BRACE PIPE OR 1⅝x1⅝x12 GA STRUT. SEE PGS 400.1 & 400.2 FOR CAPACITY OR CSBT (PG 5.2) SEE PG 500.3 FOR CAPACITY

CSBU1 SHOWN. SEE REFERENCED SECTIONS FOR ADDNL SUPPORT DTLS

(E) WF BM. SEE SEOR RESPONSIBILITIES IN SECTION 1

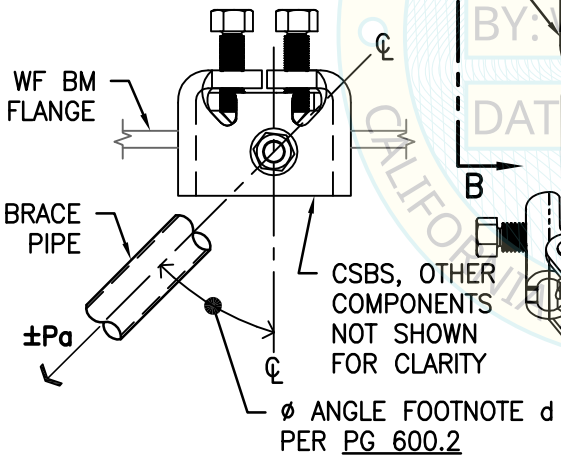
¼" THK FLG SHOE

SHEAR OFF NUT, TYP

⅜"-16 THRD ROD IS INTEGRAL TO THE CSBS, SEE SCHEDULE FOR LENGTH (TYP OF 2)

CSBS (PG 106.6)

ONLY CSBU1 (PG 106.1) OR CSBT (PG 5.2) FOR CSBS



SECTION VIEW B-B

PLAN VIEW A-A

NOTE:
SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS3, CSBS4, CSBS5, CSBU1 OR CSBT AT ASD.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBS3, CSBS4 & CSBS5 BOTTOM FLANGE W/ BRACE PIPE PARALLEL

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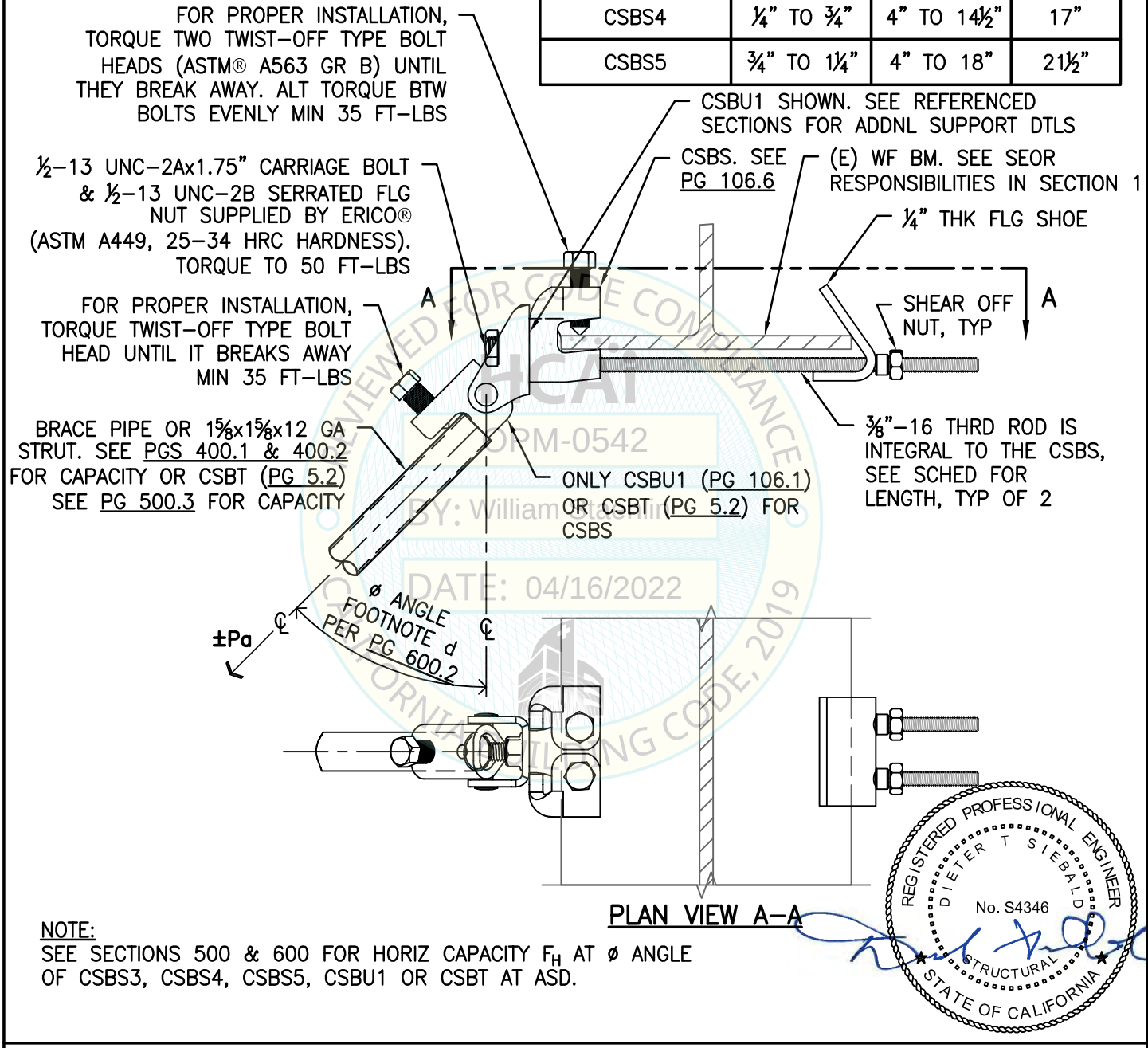
SEISMIC BRACING FOR MEP SYSTEMS

PART NO.	FLG THK	FLG WIDTH	THRD ROD
CSBS3	¼" TO ¾"	4" TO 8½"	12"
CSBS4	¼" TO ¾"	4" TO 14½"	17"
CSBS5	¾" TO 1¼"	4" TO 18"	21½"



NOTE:
SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS3, CSBS4, CSBS5, CSBU1 OR CSBT AT ASD.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBS3, CSBS4 & CSBS5 BOTTOM FLANGE W/ BRACE PIPE PERPENDICULAR

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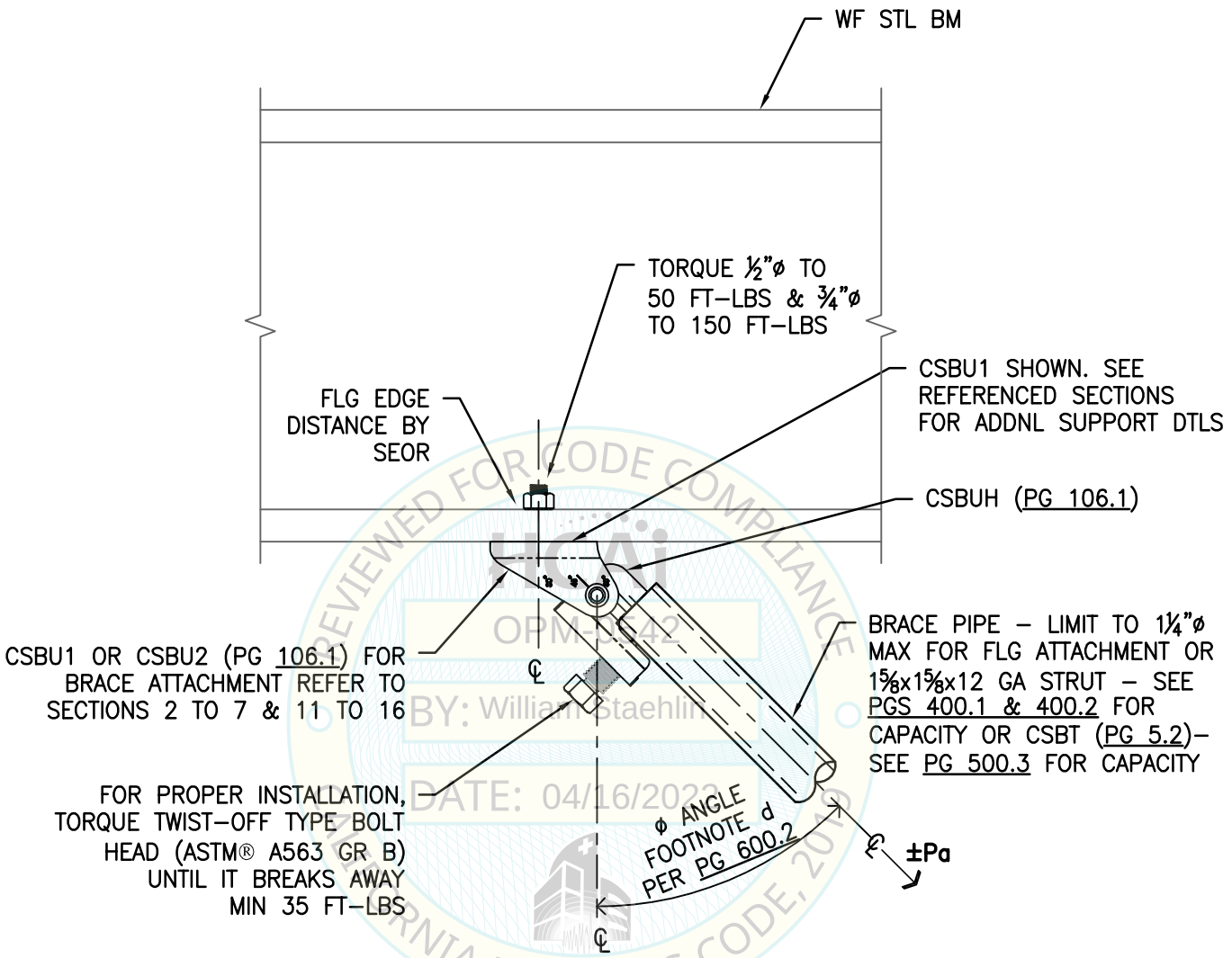
SEISMIC BRACING FOR MEP SYSTEMS



WARNING: ATTACHMENTS ARE NOT ALLOWED IN PROTECTED ZONES AS DEFINED IN AISC 341.

NOTE:
SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBU1, CSBU2 OR CSBT AT ASD.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBU BOTTOM FLANGE W/ BRACE PIPE PARALLEL

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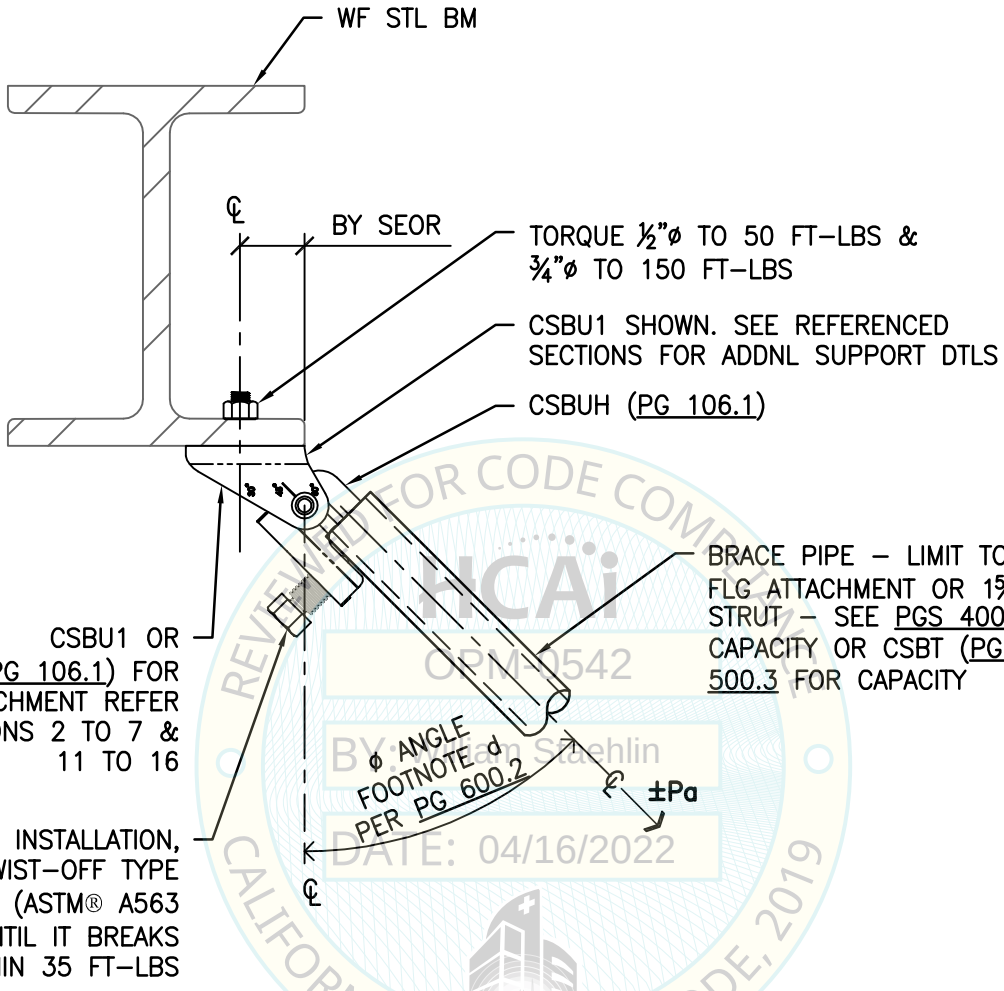
SEISMIC BRACING FOR MEP SYSTEMS



WARNING: ATTACHMENTS ARE NOT ALLOWED IN PROTECTED ZONES AS DEFINED IN AISC 341.

NOTE:
SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBU1, CSBU2 OR CSBT AT ASD.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
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STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBU BOTTOM FLANGE W/ BRACE PIPE PERPENDICULAR

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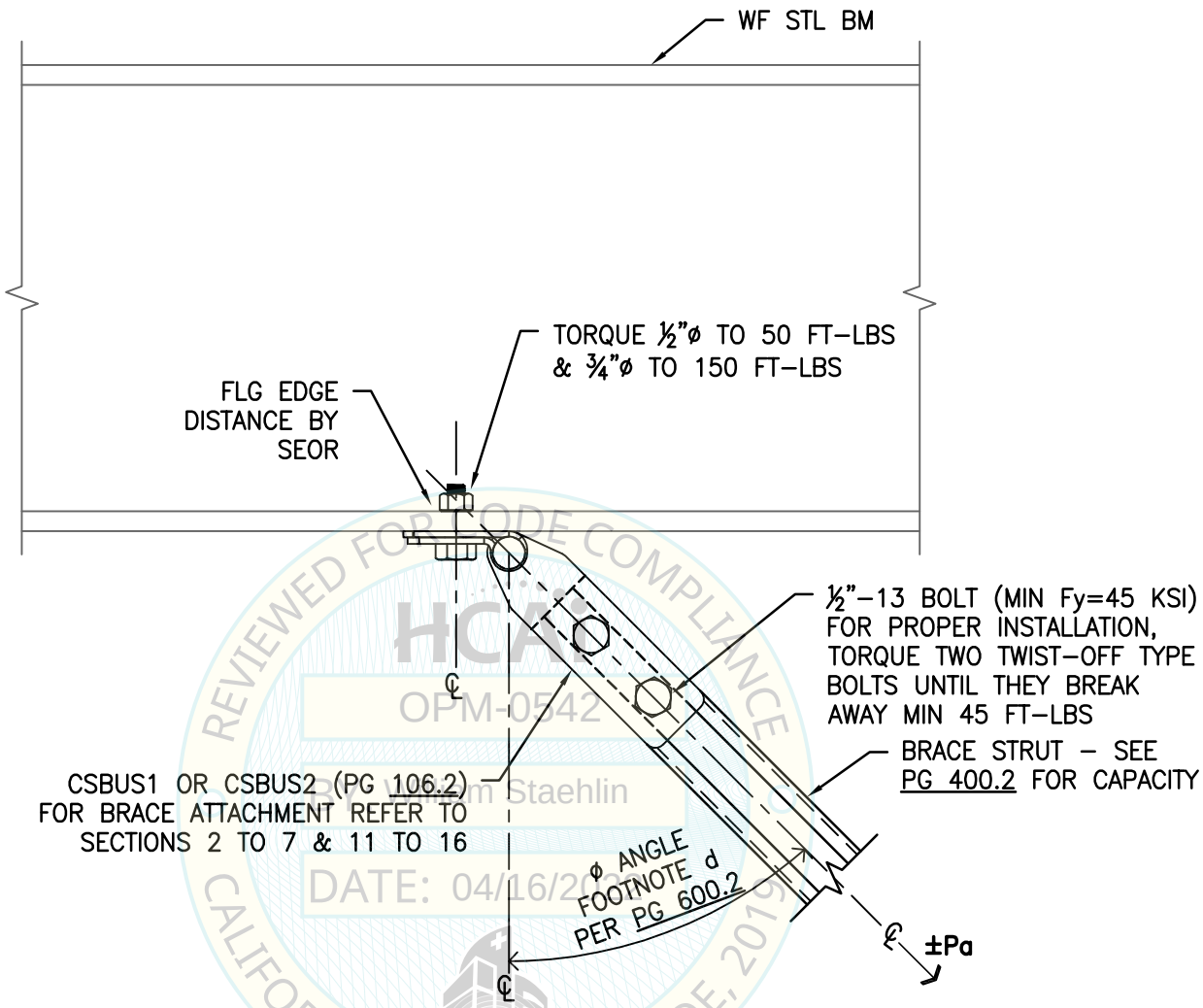
SEISMIC BRACING FOR MEP SYSTEMS



WARNING: ATTACHMENTS ARE NOT ALLOWED IN PROTECTED ZONES AS DEFINED IN AISC 341.

NOTE:
SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBUS1 OR CSBUS2 AT ASD.

REGISTERED PROFESSIONAL ENGINEER
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBU BOTTOM FLANGE W/ BRACE STRUT PARALLEL

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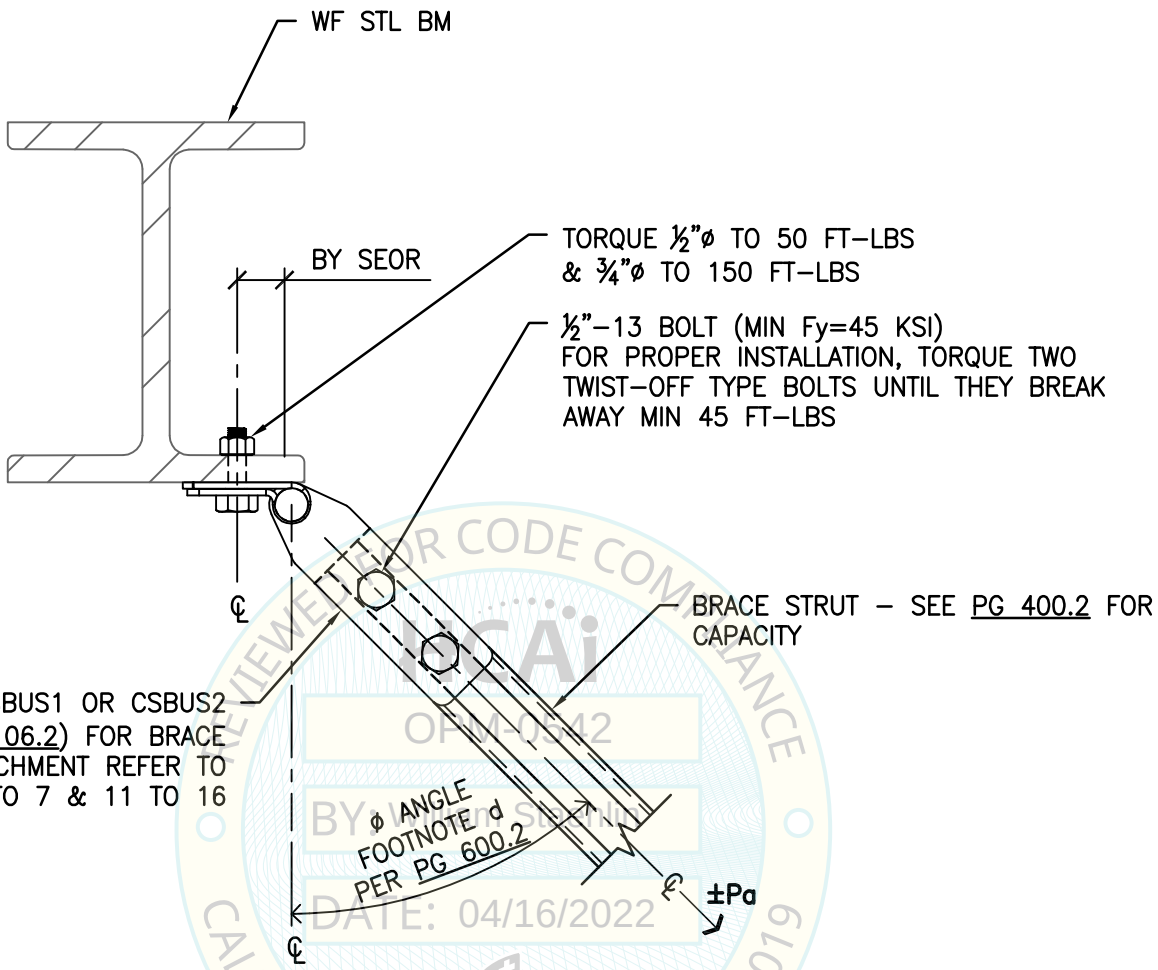
SEISMIC BRACING FOR MEP SYSTEMS



WARNING: ATTACHMENTS ARE NOT ALLOWED IN PROTECTED ZONES AS DEFINED IN AISC 341.

NOTE:
SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBUS1 OR CSBUS2 AT ASD.

REGISTERED PROFESSIONAL ENGINEER
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBU BOTTOM FLANGE W/ BRACE STRUT PERPENDICULAR

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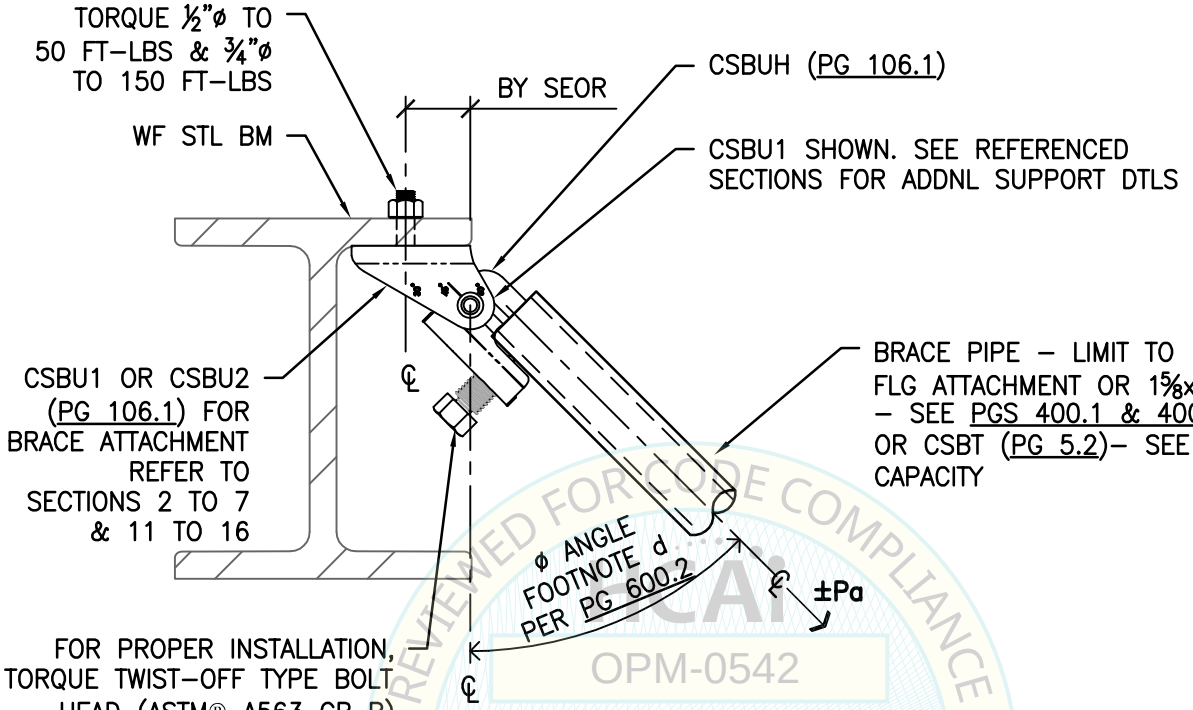
SEISMIC BRACING FOR MEP SYSTEMS



WARNING: ATTACHMENTS ARE NOT ALLOWED IN PROTECTED ZONES AS DEFINED IN AISC 341.

NOTE:
SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBU1, CSBU2 OR CSBT AT ASD.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBU TOP FLANGE W/ BRACE PIPE PERPENDICULAR

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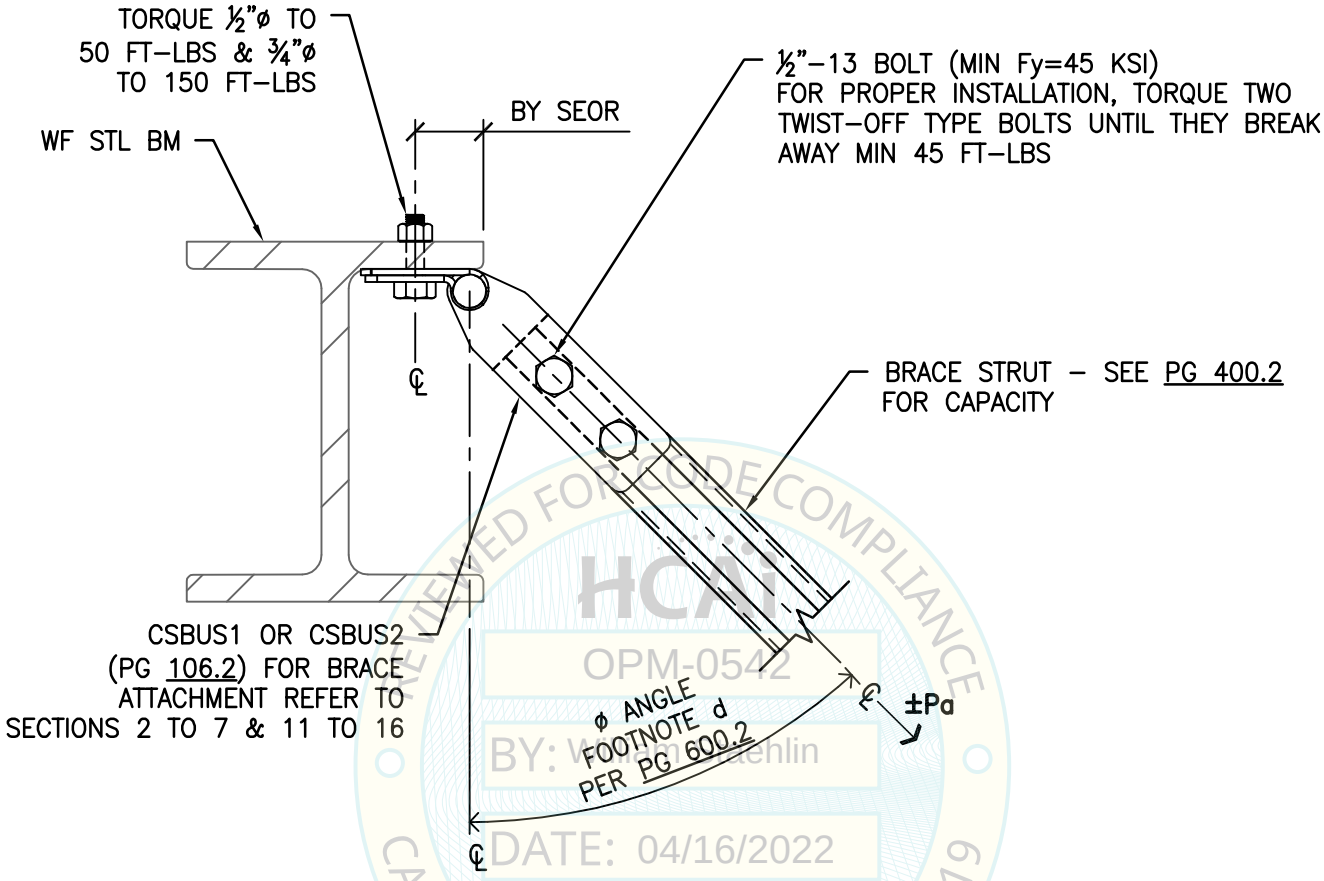
SEISMIC BRACING FOR MEP SYSTEMS



WARNING: ATTACHMENTS ARE NOT ALLOWED IN PROTECTED ZONES AS DEFINED IN AISC 341.

NOTE:
SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBUS1 OR CSBUS2 AT ASD.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBU TOP FLANGE W/ BRACE STRUT PERPENDICULAR

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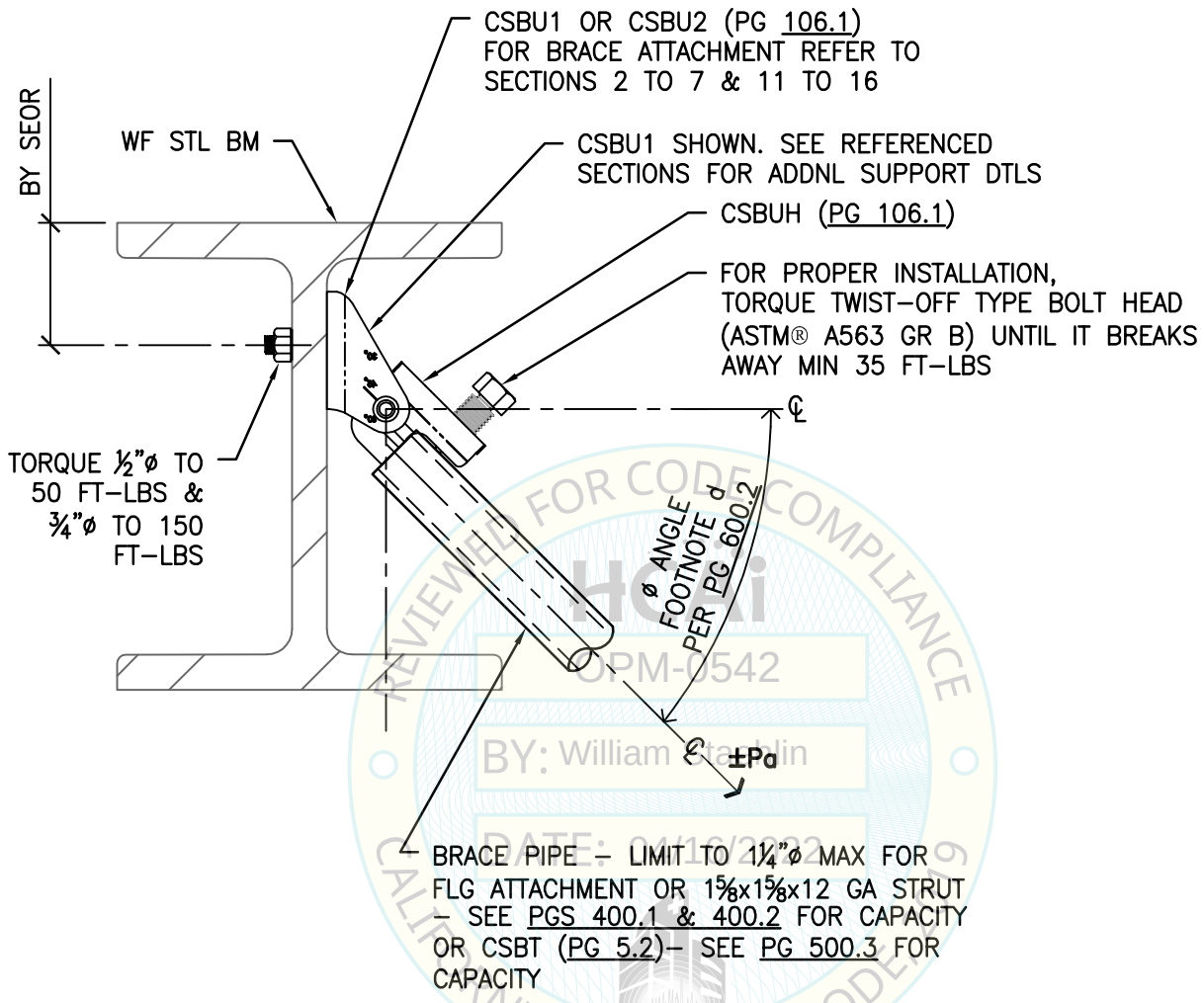
SEISMIC BRACING FOR MEP SYSTEMS



WARNING: ATTACHMENTS ARE NOT ALLOWED IN PROTECTED ZONES AS DEFINED IN AISC 341.

NOTE:
SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBU1, CSBU2 OR CSBT AT ASD.

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DIETER T SIEBALD
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBU TOP FLANGE W/ BRACE PIPE PERPENDICULAR

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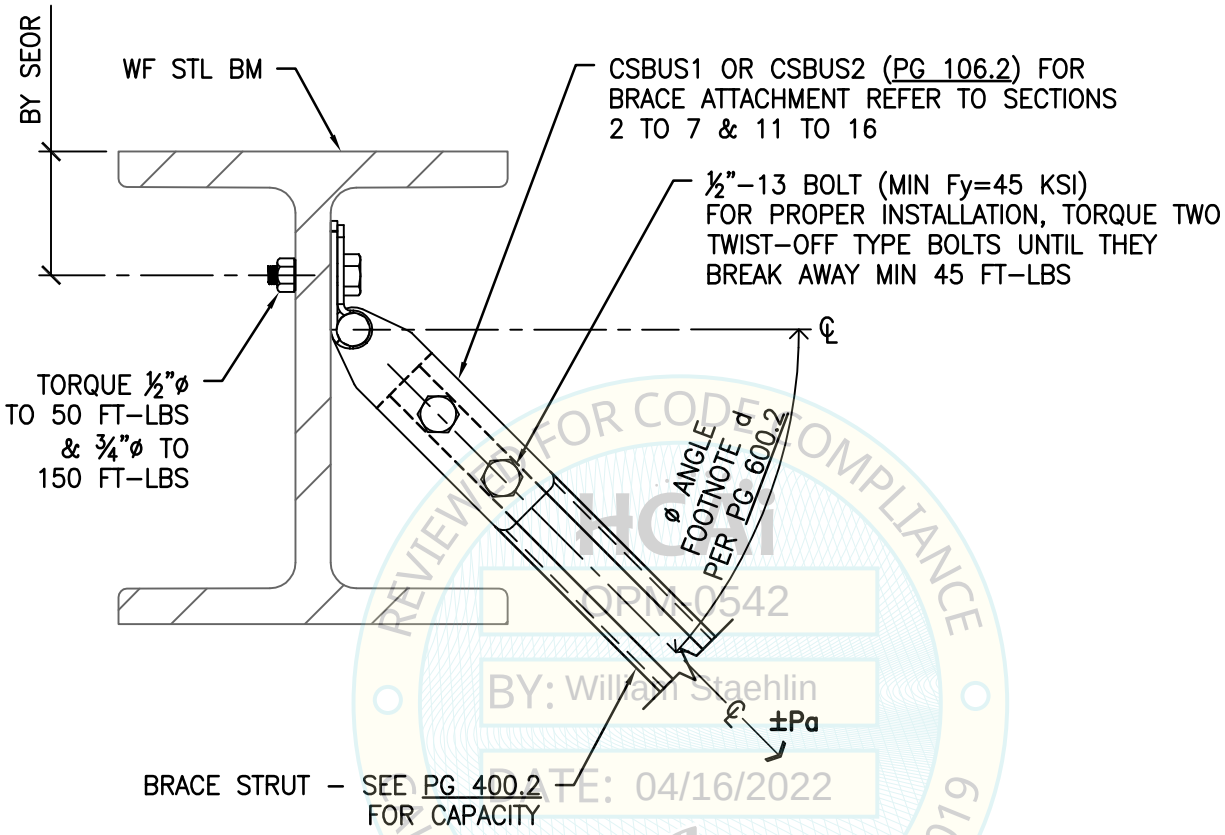
SEISMIC BRACING FOR MEP SYSTEMS



WARNING: ATTACHMENTS ARE NOT ALLOWED IN PROTECTED ZONES AS DEFINED IN AISC 341.

NOTE:
SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBUS1 OR CSBUS2 AT ASD.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBU TOP FLANGE W/ BRACE STRUT PERPENDICULAR

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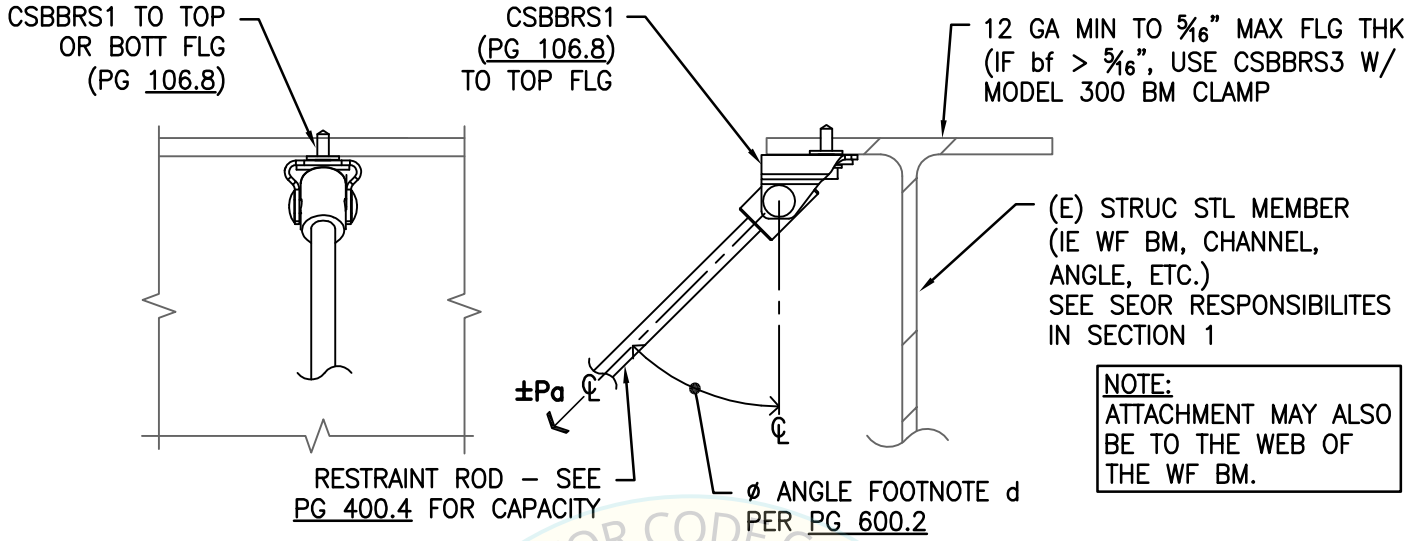
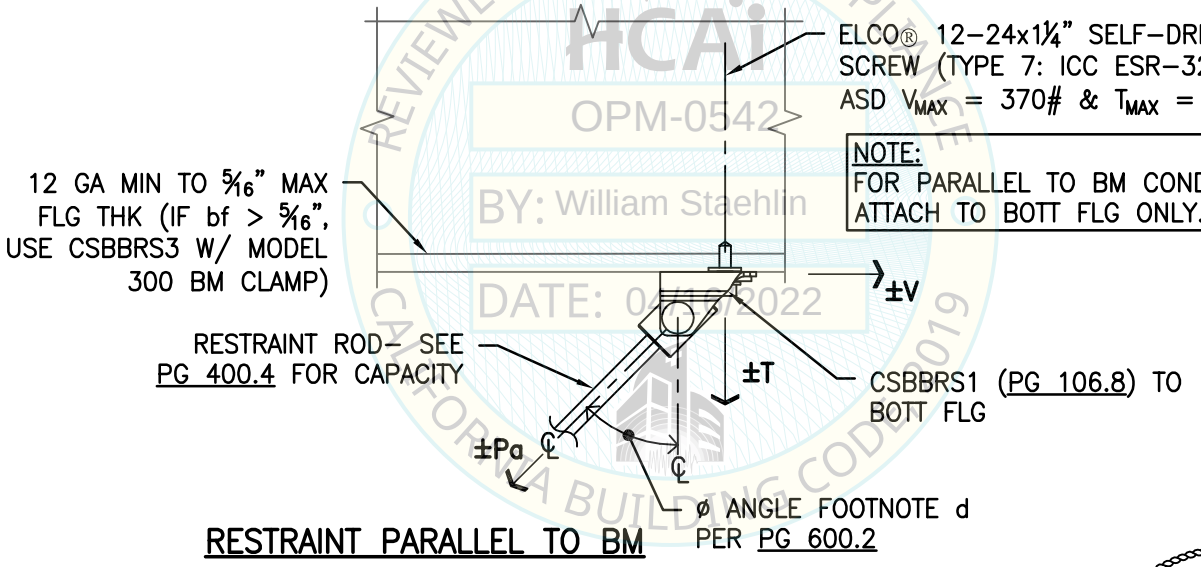
SEISMIC BRACING FOR MEP SYSTEMS



NOTE:
ATTACHMENT MAY ALSO BE TO THE WEB OF THE WF BM.

RESTRAINT PERP TO BM

RESTRAINT PERP TO BM



NOTE:
FOR PARALLEL TO BM CONDITION ATTACH TO BOTT FLG ONLY.

RESTRAINT PARALLEL TO BM

WARNING: ATTACHMENTS ARE NOT ALLOWED IN PROTECTED ZONES AS DEFINED IN AISC 341.

NOTES:
1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBBRS1 AT ASD.
2. THE RESTRAINT ROD MAY GOVERN THE CAPACITY OF THE RESTRAINT ASSEMBLY.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
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STRUCTURAL
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBBRS1 TOP OR BOTTOM FLANGE BEAMS W/ RESTRAINT ROD

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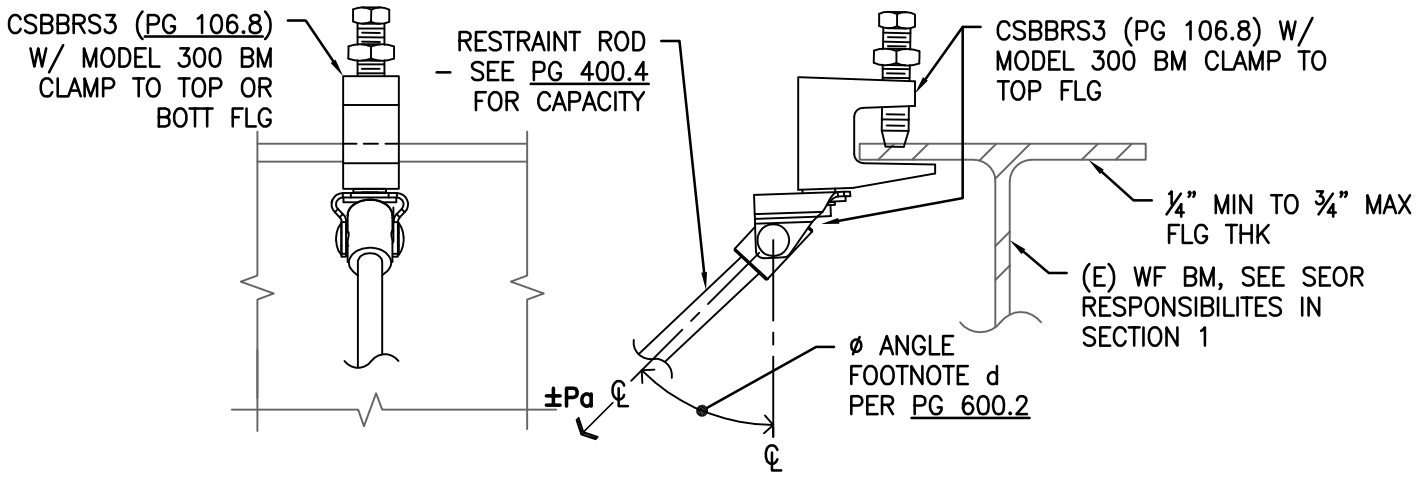
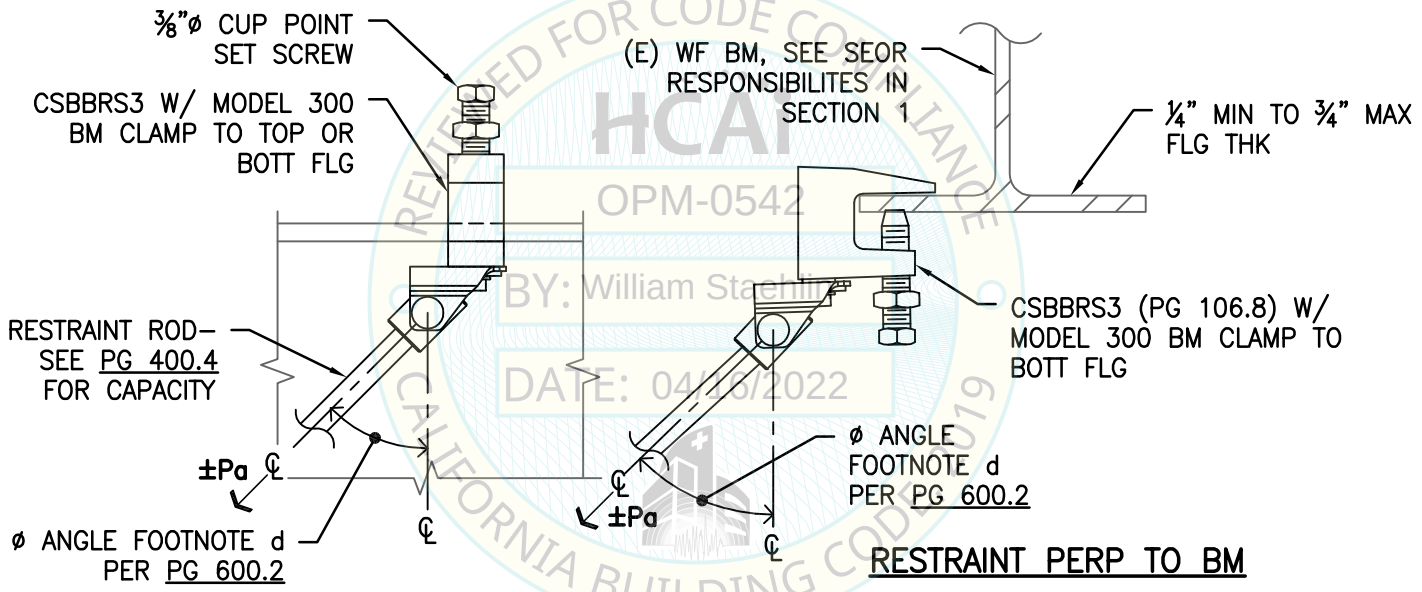
SEISMIC BRACING FOR MEP SYSTEMS





RESTRAINT PARALLEL TO BEAM

NOTES:

1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBBRS3 W/ MODEL 300 BM CLAMP AT ASD.
2. SET SCREW CAN BE EITHER UP OR DOWN ON TOP OR BOTT FLG.
3. THE RESTRAINT ROD MAY GOVERN THE CAPACITY OF THE RESTRAINT ASSEMBLY.
4. TORQUE SET SCREW TO 60 IN–LBS, TYP.

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBBRS3 W/ MODEL 300 BEAM CLAMP TO TOP OR BOTTOM FLANGE W/ RESTRAINT ROD

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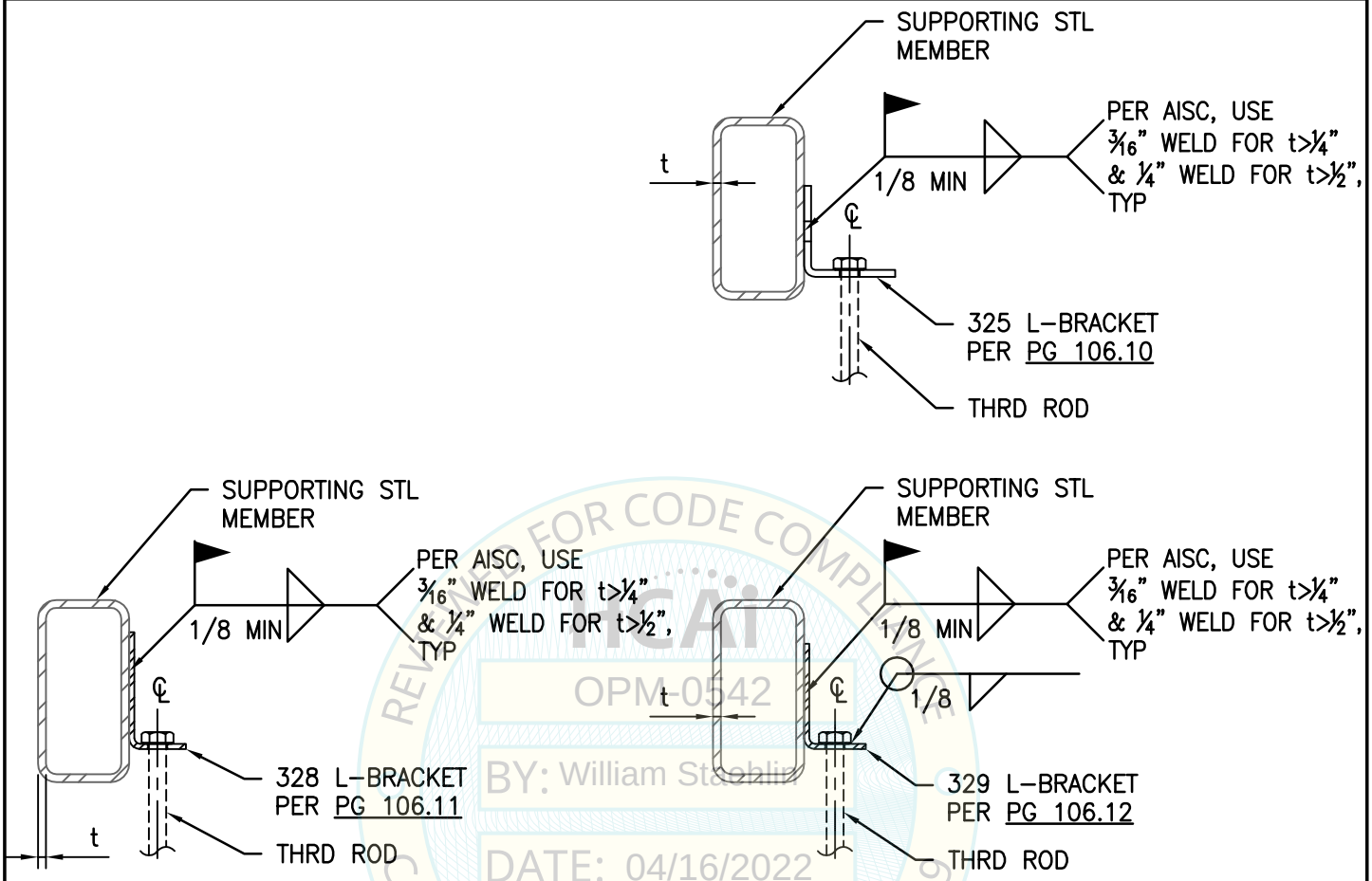
SEISMIC BRACING FOR MEP SYSTEMS



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STATE OF CALIFORNIA

NOTES:
1. SEE PGS 106.9 TO 106.13 FOR VERT LOAD CAPACITY.
2. SEOR TO CHECK CAPACITY OF SUPPORTING STRUC MEMBER.
3. THE THRD ROD MAY GOVERN THE CAPACITY, SEE PG 400.4.

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
U-BRACKETS & L-BRACKETS

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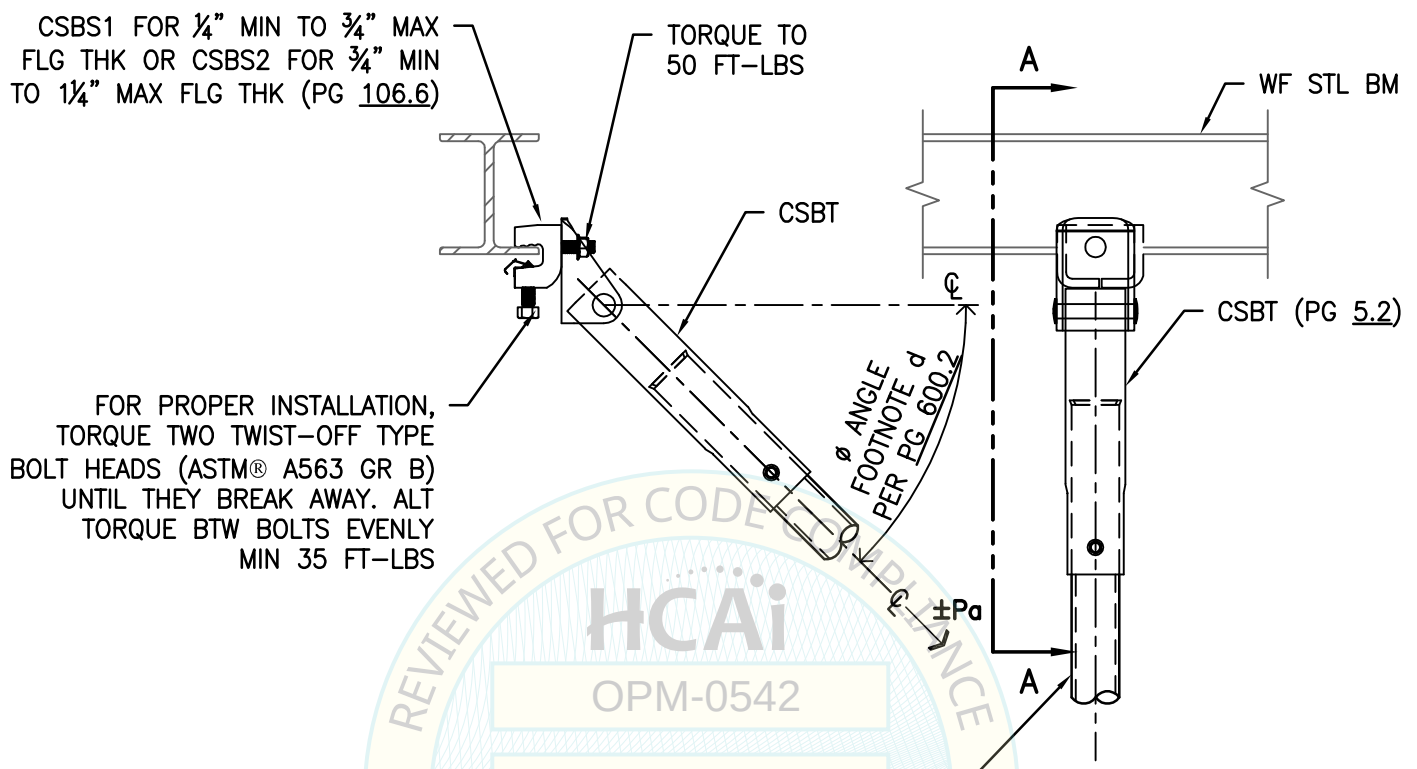
SEISMIC BRACING FOR MEP SYSTEMS



SECTION A-A BRACE PIPE- CSBT (PG 5.2)
SEE PG 500.3 FOR CAPACITY

NOTE:
1. SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1, CSBS2 OR CSBT AT ASD W/ CSBT BRACE PARALLEL TO STRUC STL MEMBER (FOOTNOTE i. ON PG 600.3).

REGISTERED PROFESSIONAL ENGINEER
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO WIDE FLANGE STEEL BEAMS
CSBS1 & CSBS2 BOTTOM FLANGE W/ CSBT BRACE PERPENDICULAR

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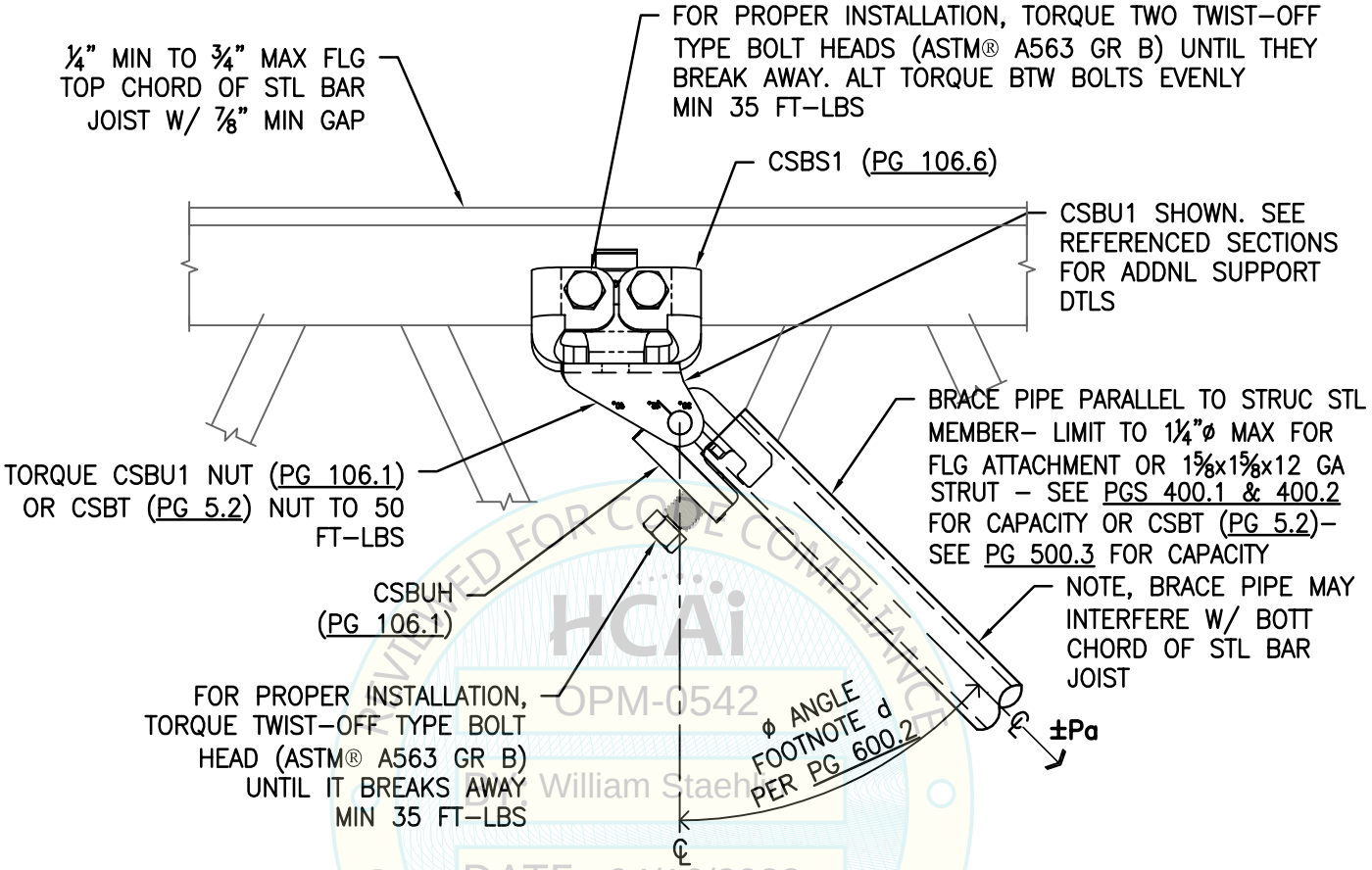
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:
1. SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1A OR CSBT AT ASD W/ BRACE PIPE PARALLEL TO STRUC STL MEMBER (FOOTNOTE i. ON PG 600.3).
2. CSBS1A IS A PRE–ASSEMBLY OF CSBS1 & CSBU1.
3. PRE–ASSEMBLY CSBS1A CAN BE USED WHENEVER THE CSBS1 & CSBU1 ARE CALLED OUT.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO TOP CHORD OF STEEL BAR JOISTS
CSBS1 TO VERTICAL LEG W/ BRACE PIPE PARALLEL

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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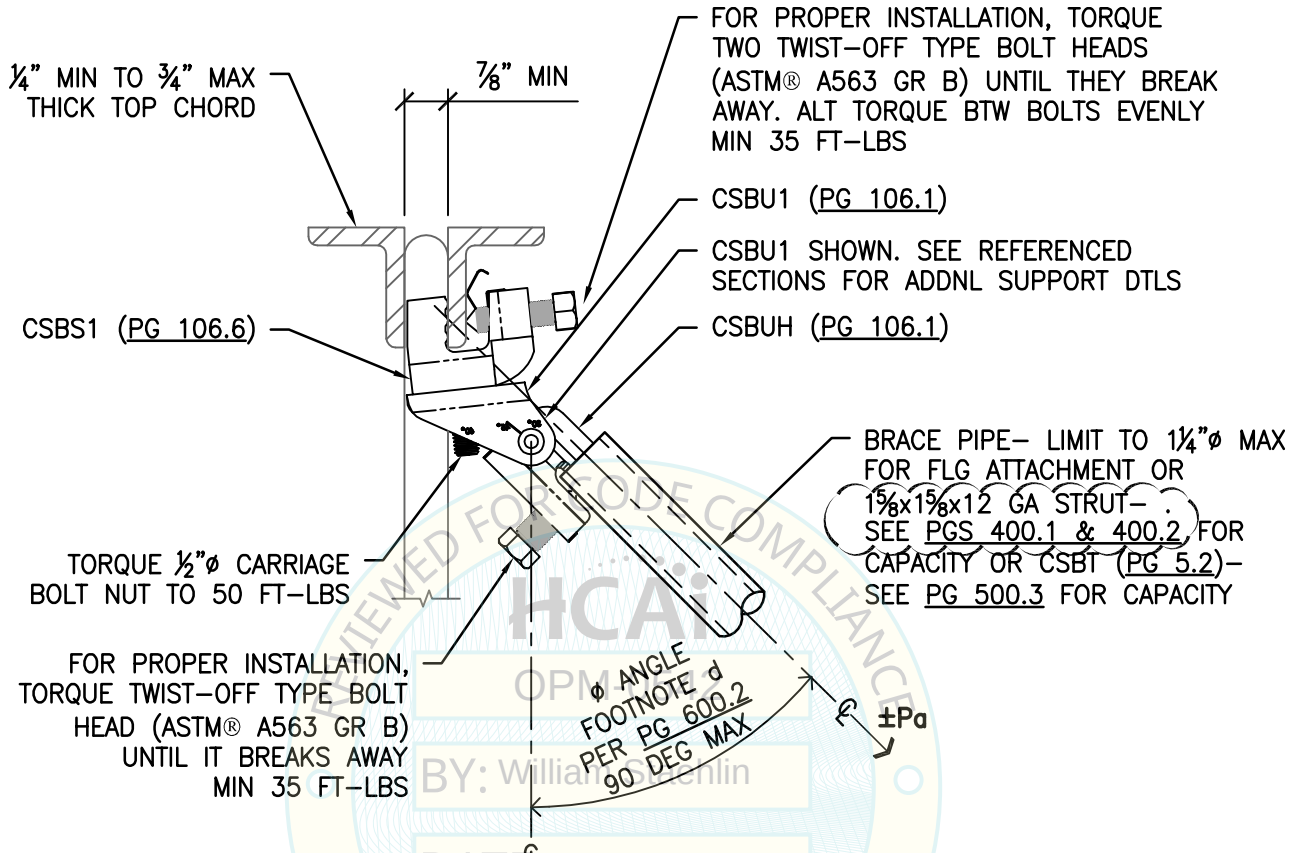
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1A OR CSBT AT ASD W/ BRACE PIPE PERP TO STRUC STL MEMBER (FOOTNOTE j. ON PG 600.3).
2. CSBS1A IS A PRE–ASSEMBLY OF CSBS1 & CSBU1.
3. PRE–ASSEMBLY CSBS1A CAN BE USED WHENEVER THE CSBS1 & CSBU1 ARE CALLED OUT.
4. NOTE THAT BOTT FLG MAY RESTRICT MOVEMENT OF BRACE TO STRAIGHT VERT.

REGISTERED PROFESSIONAL ENGINEER
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SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO TOP CHORD OF STEEL BAR JOISTS
CSBS1 TO VERTICAL LEG W/ BRACE PIPE PERPENDICULAR

CYS STRUCTURAL ENGINEERS, INC.
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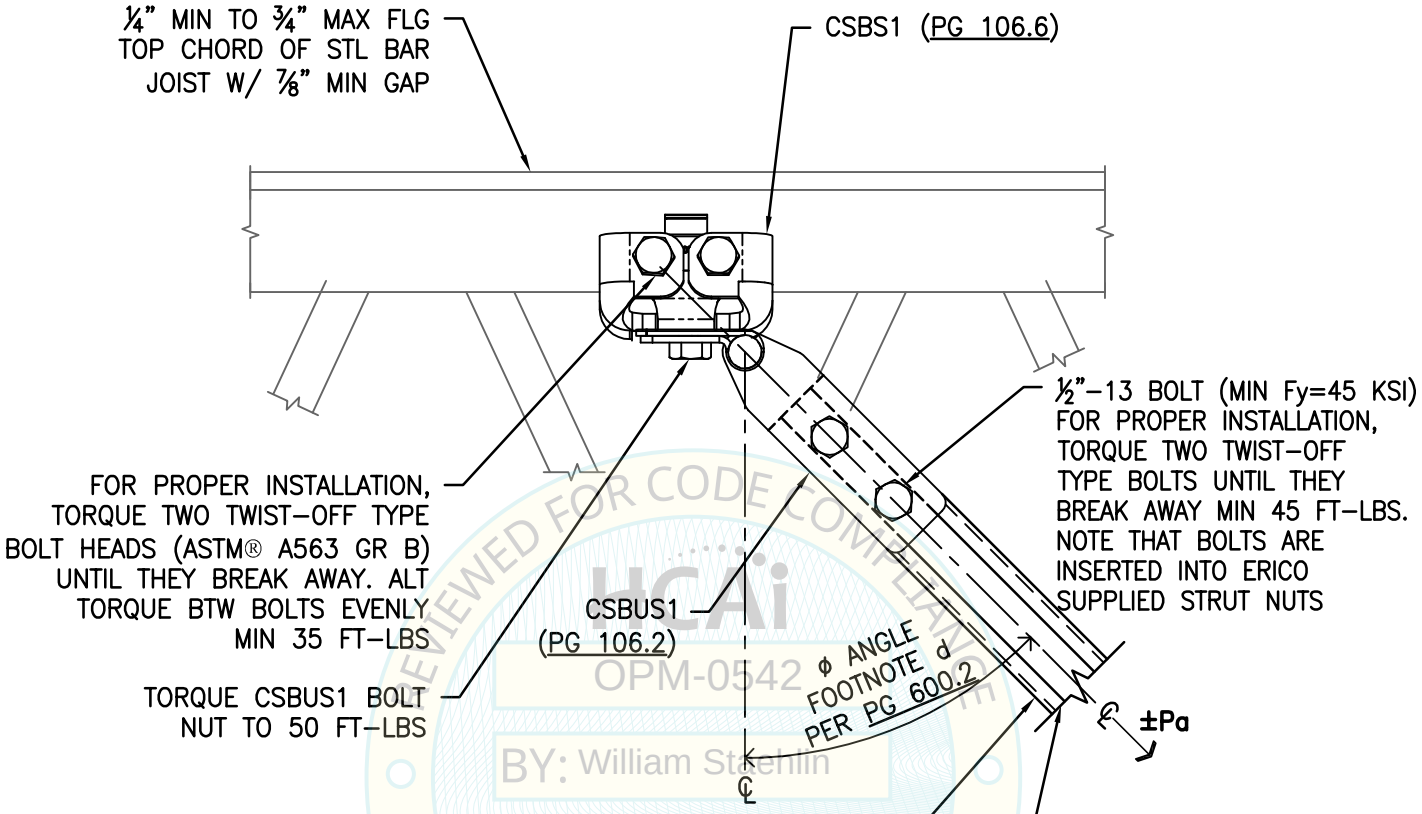
SEISMIC BRACING FOR MEP SYSTEMS



NOTE:
SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ϕ ANGLE OF CSBS1 OR CSBUS1 AT ASD W/ BRACE STRUT PARALLEL TO STRUC STL MEMBER (FOOTNOTE i. ON PG 600.3)

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CSBS1 TO VERTICAL LEG W/ BRACE STRUT PARALLEL

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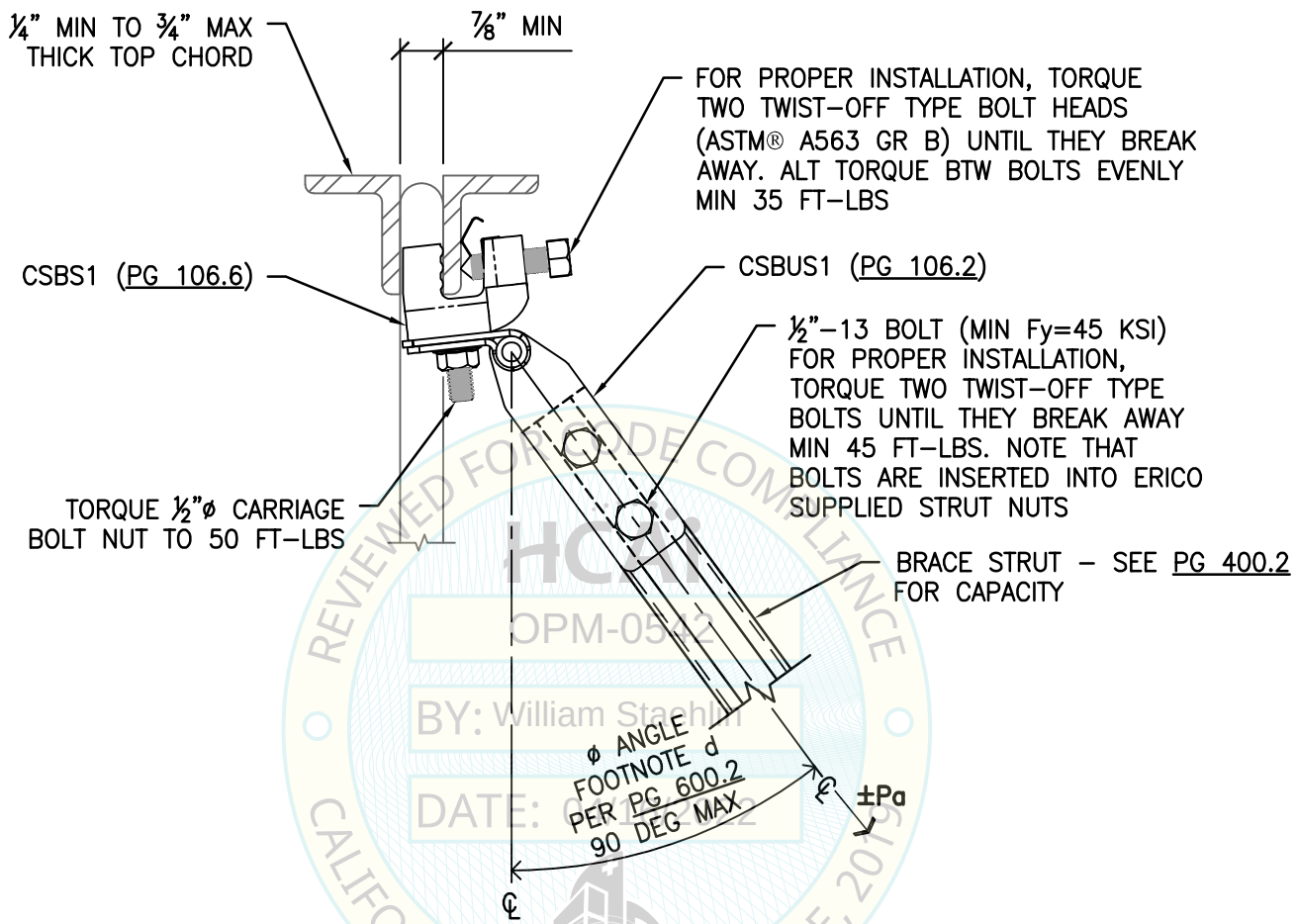
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBUS1 AT ASD W/ BRACE STRUT PERP TO STRUC STL MEMBER (FOOT NOTE j. ON PG 600.3).
2. NOTE THAT BOTT FLG MAY RESTRICT MOVEMENT TO STRAIGHT VERT.

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STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO TOP CHORD OF STEEL BAR JOISTS
CSBS1 TO VERTICAL LEG W/ BRACE STRUT PERPENDICULAR

CYS STRUCTURAL ENGINEERS, INC.
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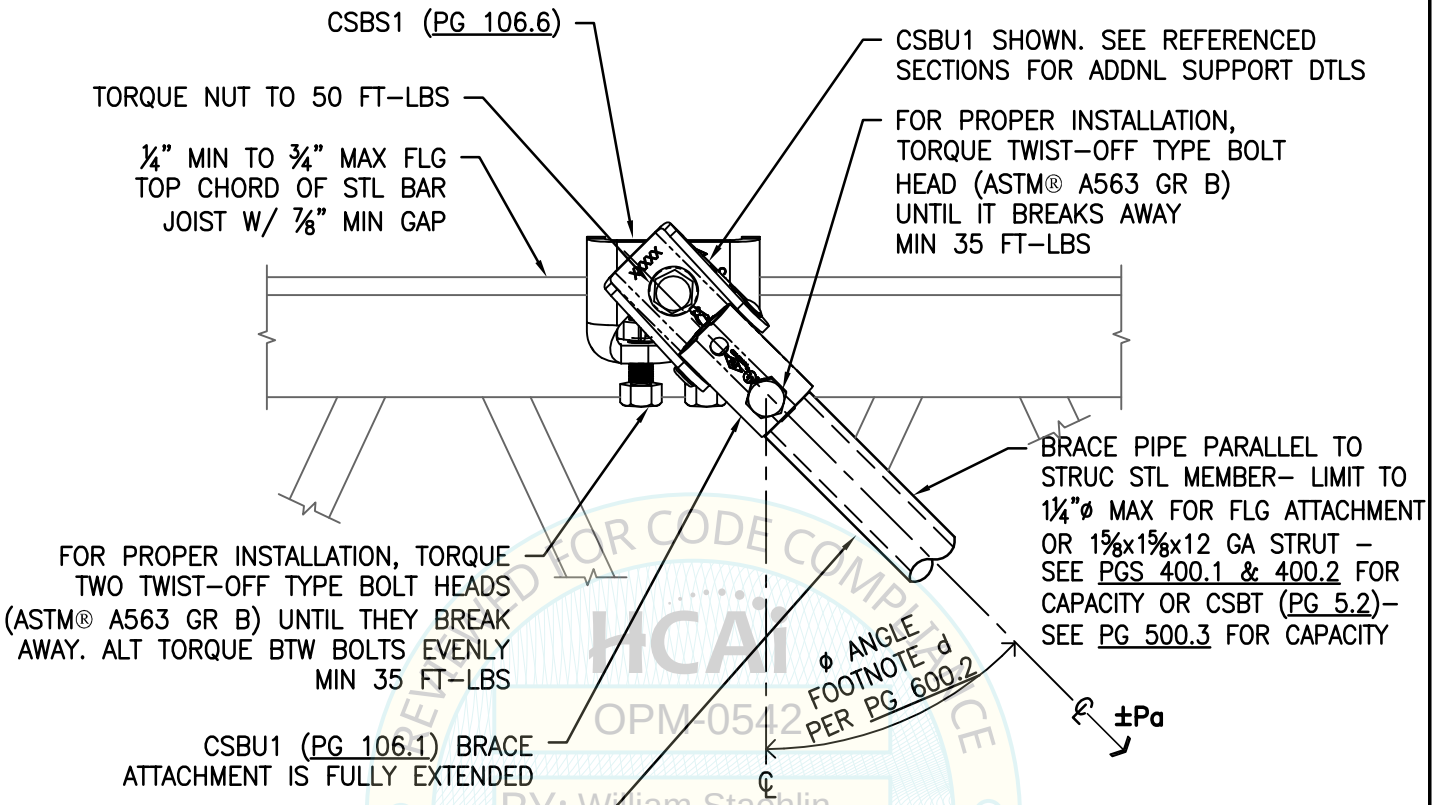
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1A OR CSBT AT ASD W/ BRACE PIPE PARALLEL TO STRUC STL MEMBER (FOOTNOTE i. ON PG 600.3).
2. CSBS1A IS A PRE-ASSEMBLY OF CSBS1 & CSBU1.
3. PRE-ASSEMBLY CSBS1A CAN BE USED WHENEVER THE CSBS1 & CSBU1 ARE CALLED OUT.

REGISTERED PROFESSIONAL ENGINEER
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STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO TOP CHORD OF STEEL BAR JOISTS
CSBS1 TO HORIZONTAL LEG W/ BRACE PIPE PARALLEL

CYS STRUCTURAL ENGINEERS, INC.
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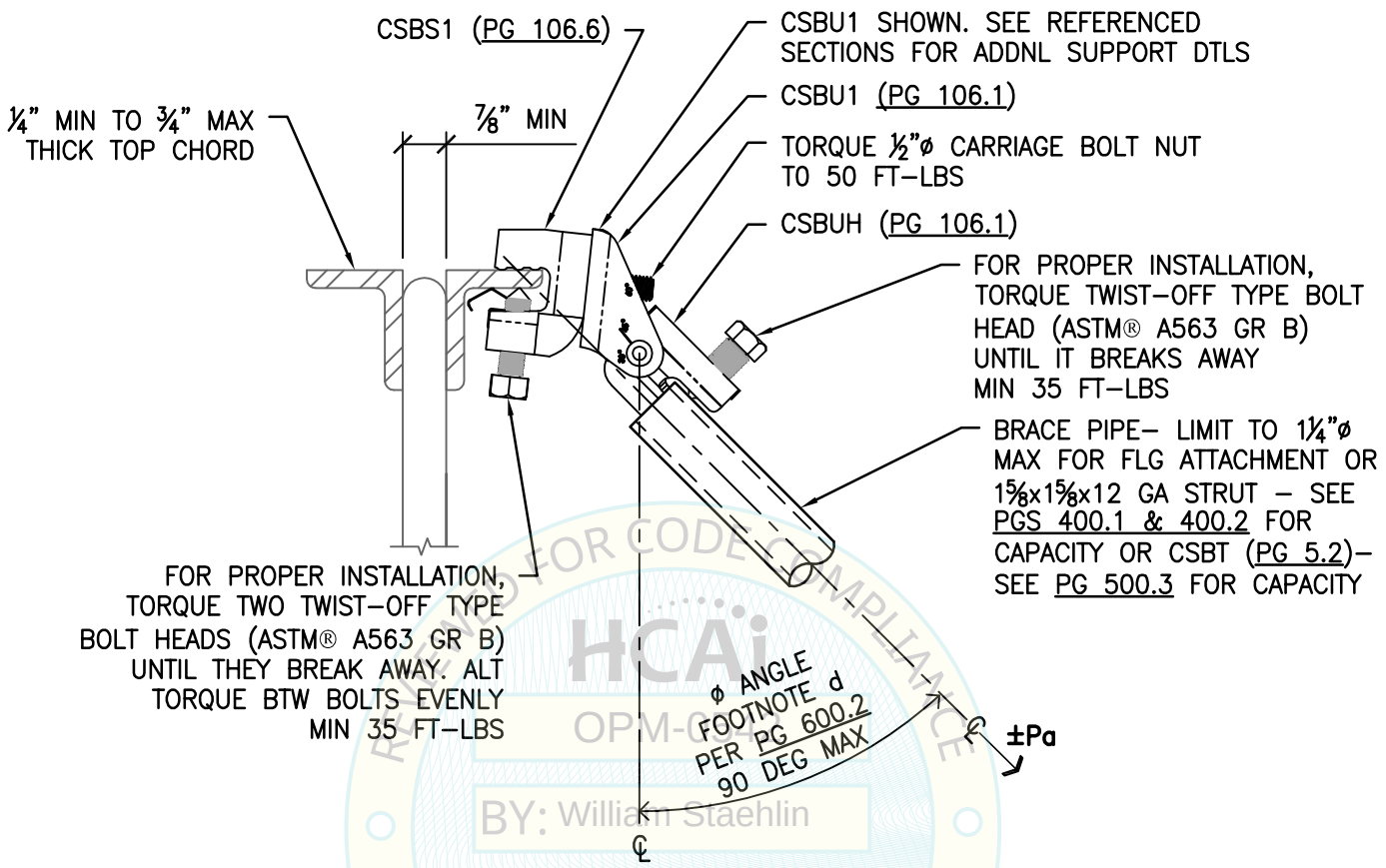
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE SECTIONS 500 & 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1A OR CSBT AT ASD W/ BRACE PIPE PERP TO STRUC STL MEMBER (FOOTNOTE j. ON PG 600.3).
2. CSBS1A IS A PRE-ASSEMBLY OF CSBS1 & CSBU1.
3. PRE-ASSEMBLY CSBS1A CAN BE USED WHENEVER THE CSBS1 & CSBU1 ARE CALLED OUT.
4. NOTE THAT BOTT FLG MAY RESTRICT MOVEMENT OF BRACE TO STRAIGHT VERT.

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DIETER T SIEBALD
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STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO TOP CHORD OF STEEL BAR JOISTS
CSBS1 TO HORIZONTAL LEG W/ BRACE PIPE PERPENDICULAR

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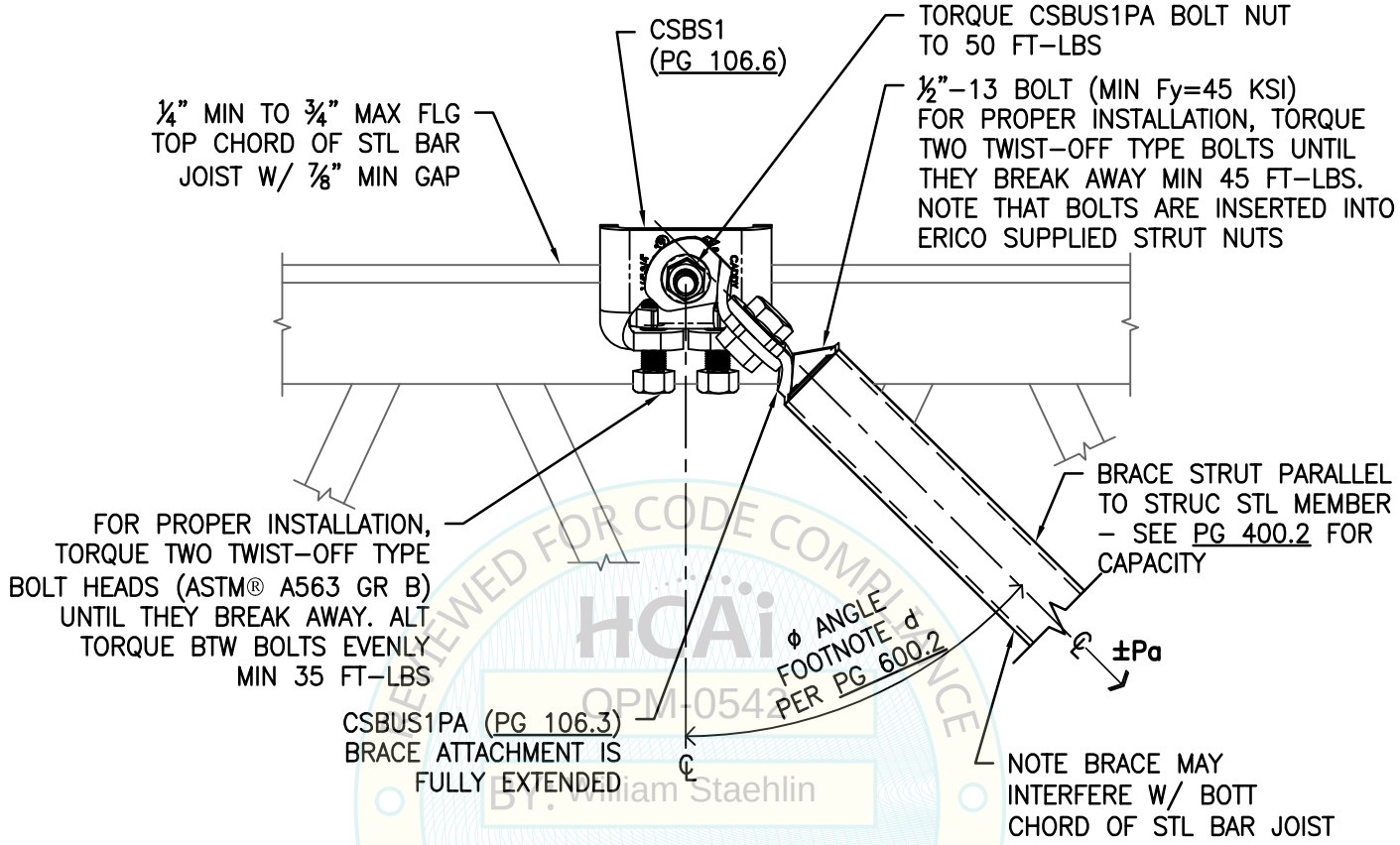
SEISMIC BRACING FOR MEP SYSTEMS



NOTE:
SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ϕ ANGLE OF CSBUS1PA AT ASD W/ BRACE STRUT PARALLEL TO STRUC STL MEMBER (FOOTNOTE i. ON PG 600.3).

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SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO TOP CHORD OF STEEL BAR JOISTS
CSBS1 TO HORIZONTAL LEG W/ BRACE STRUT PARALLEL

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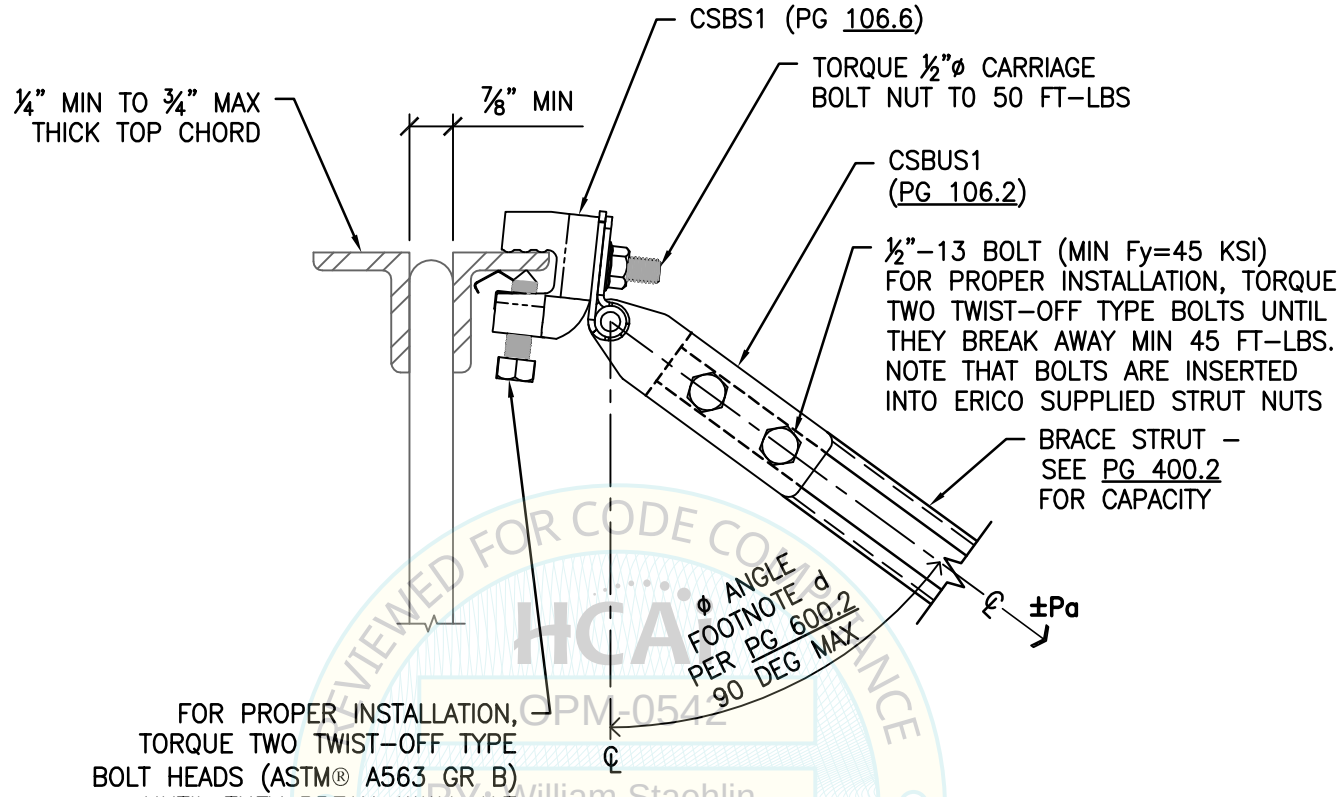
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1 AT ASD W/ BRACE STRUT PERP TO STRUC STL MEMBER (FOOTNOTE j. ON PG 600.3).
2. NOTE THAT BOTT FLG MAY RESTRICT MOVEMENT OF BRACE TO STRAIGHT VERT.

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DIETER T SIEBALD
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STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO TOP CHORD OF STEEL BAR JOISTS
CSBS1 TO HORIZONTAL LEG W/ BRACE STRUT PERPENDICULAR

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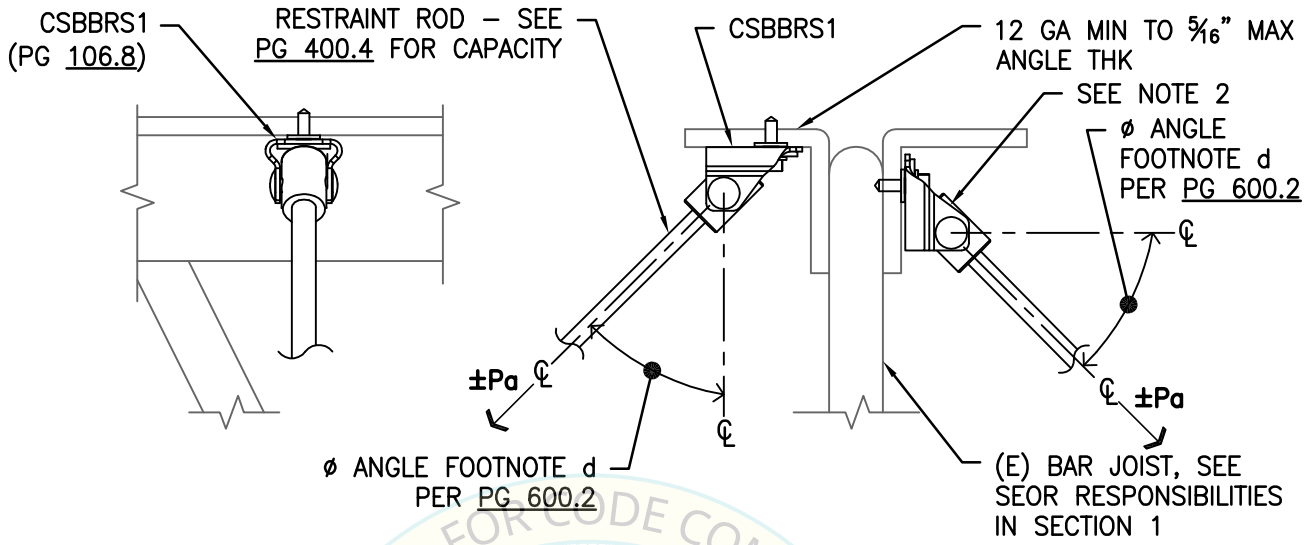
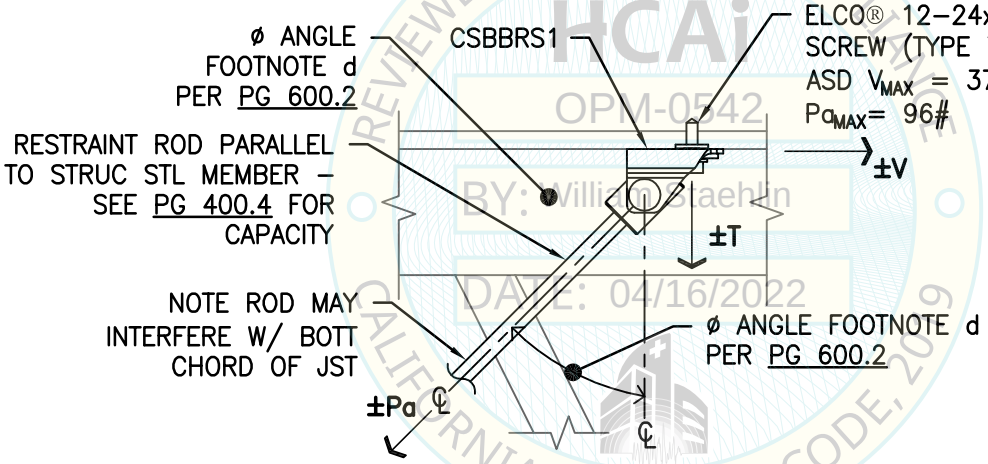
SEISMIC BRACING FOR MEP SYSTEMS



RESTRAINT PERP TO JOIST

RESTRAINT PERP TO JOIST



RESTRAINT PARALLEL TO JOIST

TOP FLG ATTACHMENT

NOTES:

1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBBRS1 AT ASD.
2. THE CSBBRS1 MAY ALSO ATTACH TO THE VERT LEG OF THE JOIST TOP CHORD. DO NOT SCREW INTO JOIST WEB MEMBERS.
3. THE RESTRAINT ROD MAY GOVERN THE CAPACITY OF THE RESTRAINT ASSEMBLY.

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DIETER T SIEBALD
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STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO TOP CHORD OF STEEL BAR JOISTS
CSBBRS1 TO HORIZONTAL LEG W/ RESTRAINT ROD PERPENDICULAR OR PARALLEL

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2495 NATOMAS PARK DRIVE, SUITE 650
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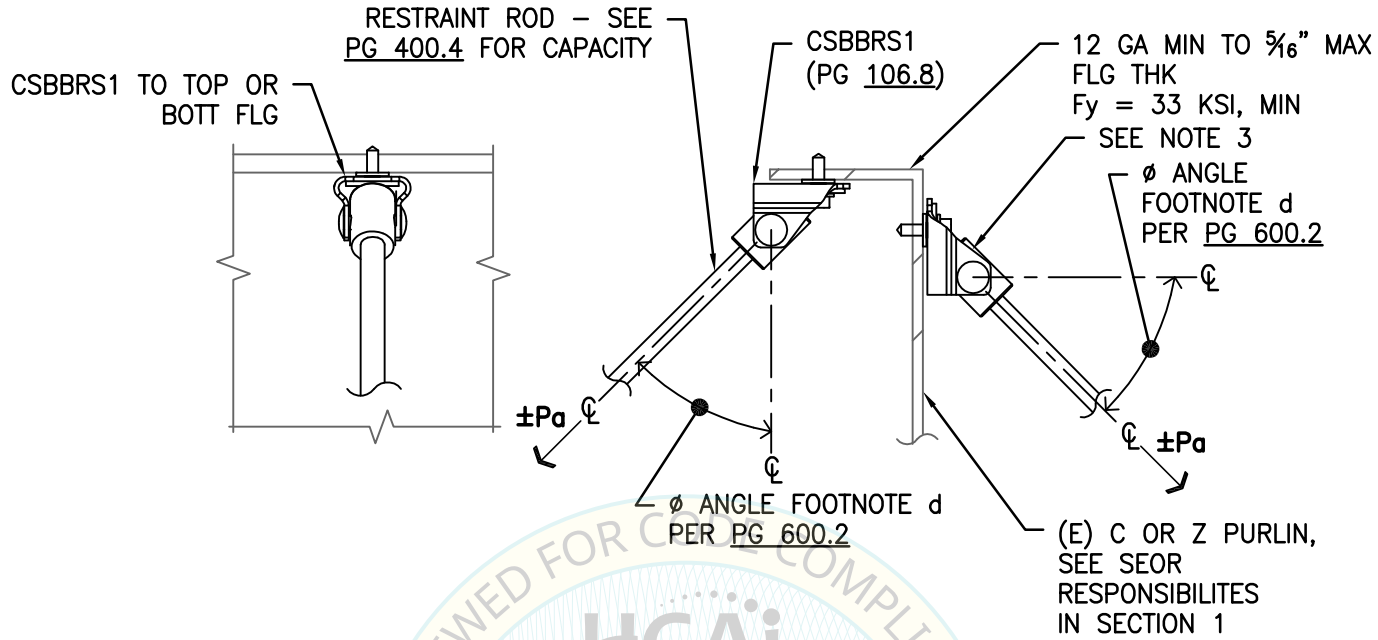
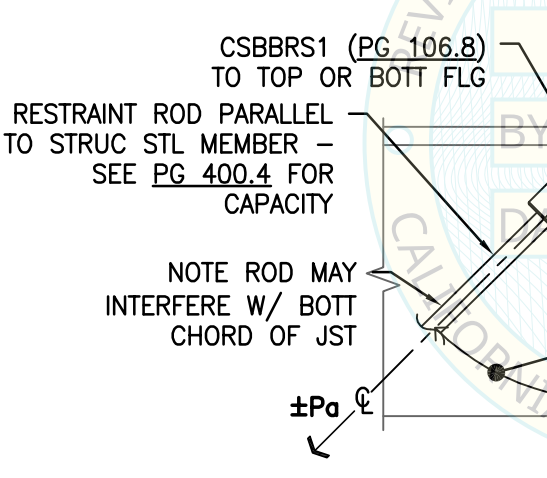
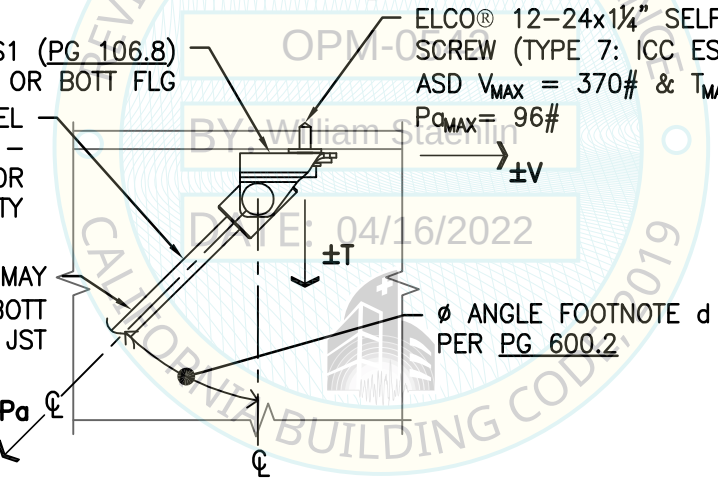
SEISMIC BRACING FOR MEP SYSTEMS



RESTRAINT PERP TO PURLIN



RESTRAINT PERP TO PURLIN



RESTRAINT PARALLEL TO PURLIN

NOTES:

1. SEE SECTION 600 FOR HORIZ CAPACITY F_H OF AT ø ANGLE CSBBRS1 AT ASD.
2. THE RESTRAINT ROD MAY GOVERN THE CAPACTY OF THE RESTRAINT ASSEMBLY.
3. ATTACHMENT MAY ALSO BE TO THE WEB OF THE PURLIN, WHICH IS SUGGESTED SO AS TO MINIMIZE TORSION.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SUPPORTS & ATTACHMENT DETAILS TO C OR Z PURLINS
CSBBRS1 TO HORIZONTAL FLANGE W/ RESTRAINT ROD PERPENDICULAR OR PARALLEL

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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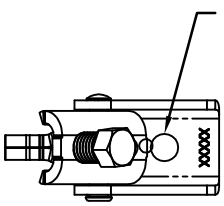
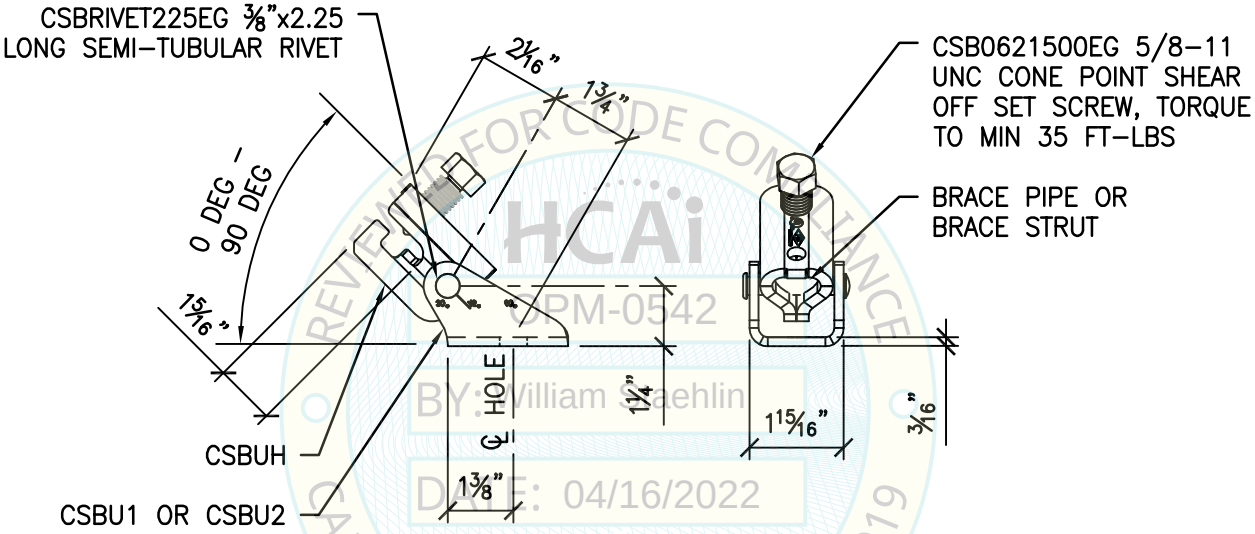
SEISMIC BRACING FOR MEP SYSTEMS



BOTT VIEW



SIDE VIEWS

NOTES:
1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBU1 & CSBU2 AT ASD.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
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STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSBU1 & CSBU2 FOR ½" & ¾" BOLTS

CYS STRUCTURAL ENGINEERS, INC.
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Date:	04/11/2022
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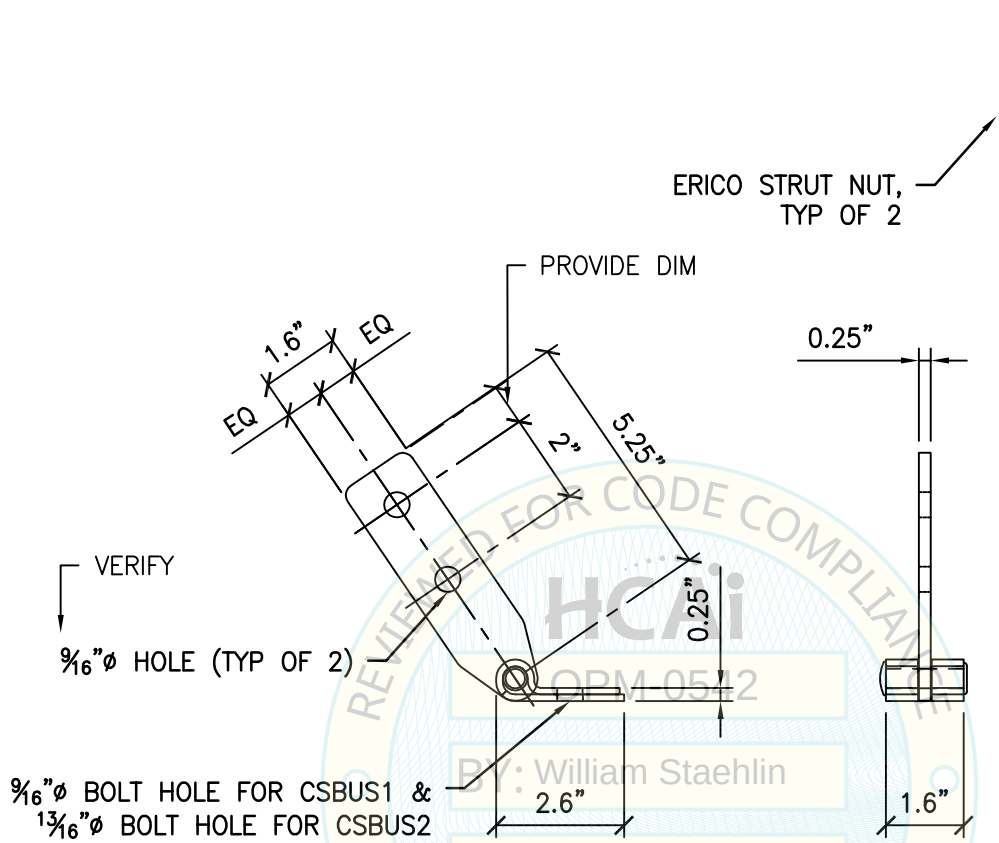
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBUS1 & CSBUS2 AT ASD.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. STRUT NUTS & SHEAR OFF BOLTS ARE SUPPLIED & PRE-ASSEMBLED BY ERICO & ARE INTEGRAL TO THE CSBUS1 & CSBUS2 PRODUCTS.
4. FOR ERICO STRUT NUT, SEE PG 106.29.

REGISTERED PROFESSIONAL ENGINEER
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STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSBUS1 & CSBUS2 FOR ½" & ¾" BOLTS

CYS STRUCTURAL ENGINEERS, INC.
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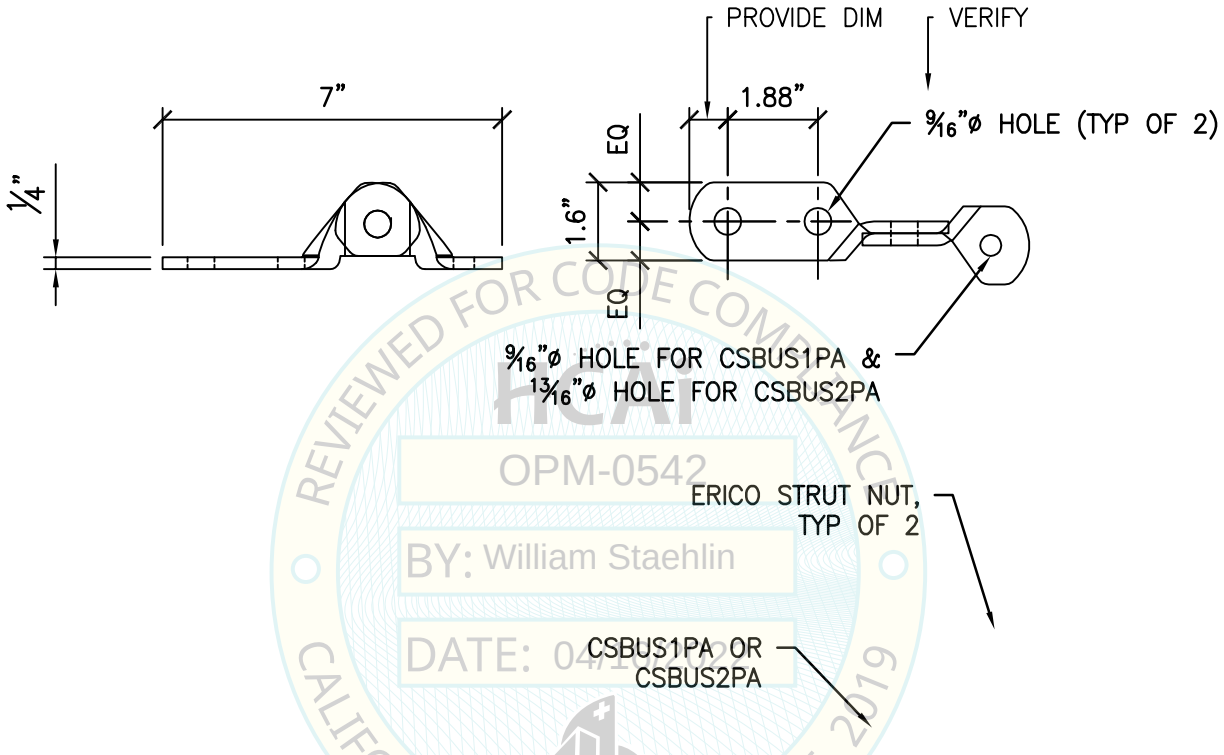
SEISMIC BRACING FOR MEP SYSTEMS



NOTES:

1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBUS1PA & CSBUS2PA AT ASD.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. STRUT NUTS & SHEAR OFF BOLTS ARE SUPPLIED & PRE-ASSEMBLED BY ERICO & ARE INTEGRAL TO THE CSBUS1 & CSBUS2 PRODUCTS.
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REGISTERED PROFESSIONAL ENGINEER
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STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSBUS1PA & CSBUS2PA FOR ½" & ¾" BOLTS

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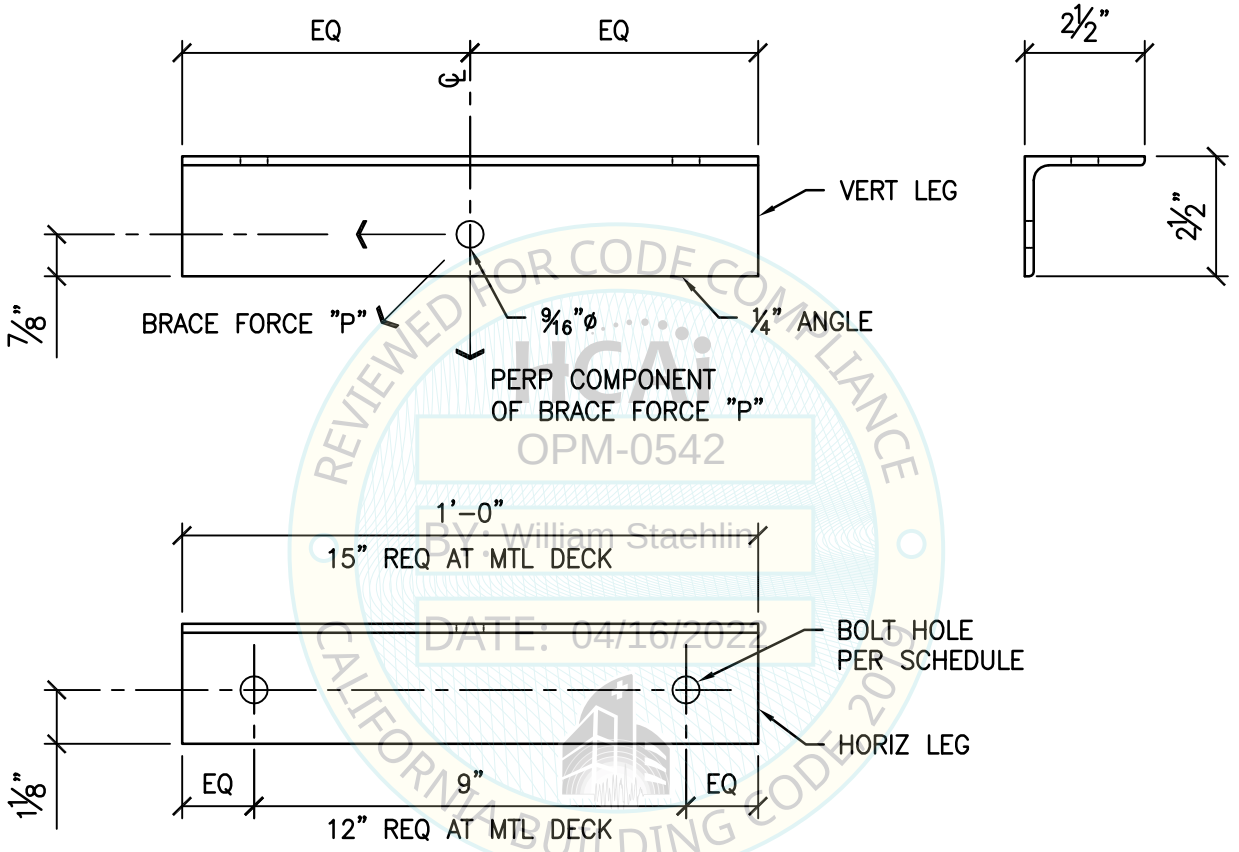
SEISMIC BRACING FOR MEP SYSTEMS

	BOLT HOLE DIA
CSBMA050050EG	9/16"
CSBMA050075EG	13/16"



NOTES:
1. THE ALLOWABLE PERP LOAD TO THE CSBMA IS 2400 LBS. THE BRACE FORCE "P" SHALL BE LIMITED SUCH THAT THE PERP COMPONENT OF BRACE FORCE "P" DOES NOT EXCEED 2400 LBS AT ASD
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. USE ¾"ø ANCHOR AT CSBMA050075EG

REGISTERED PROFESSIONAL ENGINEER
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STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSBMA FOR ½" & ¾" BOLTS

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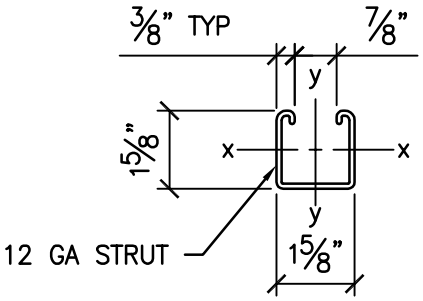
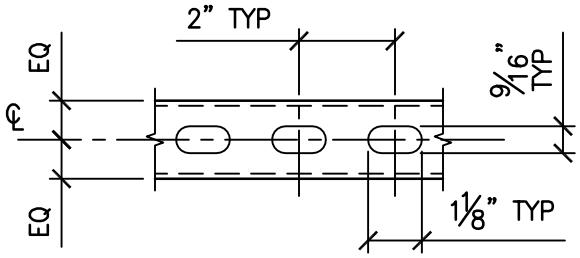
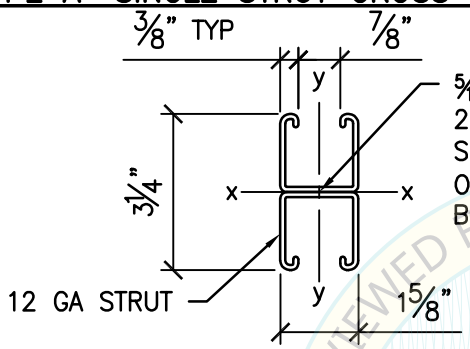
SEISMIC BRACING FOR MEP SYSTEMS



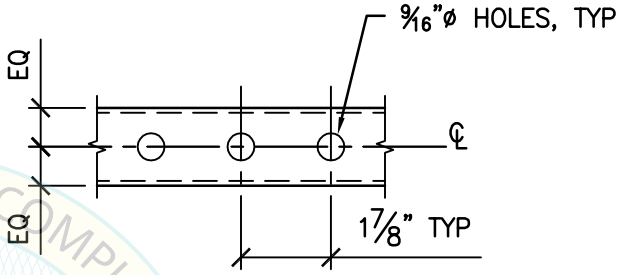
"TYPE A" SINGLE STRUT CROSS SECTION



STRUT BOTT VIEW W/ SLOTTED HOLES



UNISTRUT CROSS SECTION



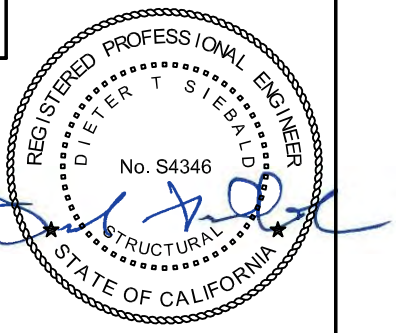
STRUT BOTT VIEW W/ STD SIZE PUNCHED HOLES

MIN STRUT SECTION PROPERTIES

STRUT MEMBER	WEIGHT (LBS/FT)	AREA (IN^2)	I_{xx} (IN^4)	S_{xx} (IN^3)	r_x (IN)	I_{yy} (IN^4)	S_{yy} (IN^3)	r_y (IN)
1 5/8x1 5/8x12 GA SINGLE STRUT, SOLID	1.879	0.533	0.182	0.199	0.574	0.234	0.289	0.651
1 5/8x1 5/8x12 GA SINGLE STRUT, HALF–SLOT	1.779	0.494	0.156	0.171	0.562	0.232	0.286	0.686
UNISTRUT P1001 1 5/8x3 1/4x12 GA STRUT, SOLID	3.780	1.110	0.928	0.571	0.915	0.471	0.580	0.651
UNISTRUT P1001T 1 5/8x3 1/4x12 GA STRUT, SLOTTED	3.680	0.992	0.927	0.571	0.968	0.468	0.576	0.687

NOTES:

1. SEE SECTIONS 400 & 401 FOR STRUT LGTH & AXIAL CAPACITY OR AXIAL W/ FLEXURAL CAPACITY.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.31 & ONWARDS.
3. RATED LOADS AT BOLTED CONNS SHOWN IN THIS OPM ARE NOT VALID AT HALF–SLOTTED HOLES IN THE STRUT CHANNEL. ALL BOLT HOLES MUST BE STD SIZE (BOLT SIZE + 1/16")



SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
STRUT CHANNEL

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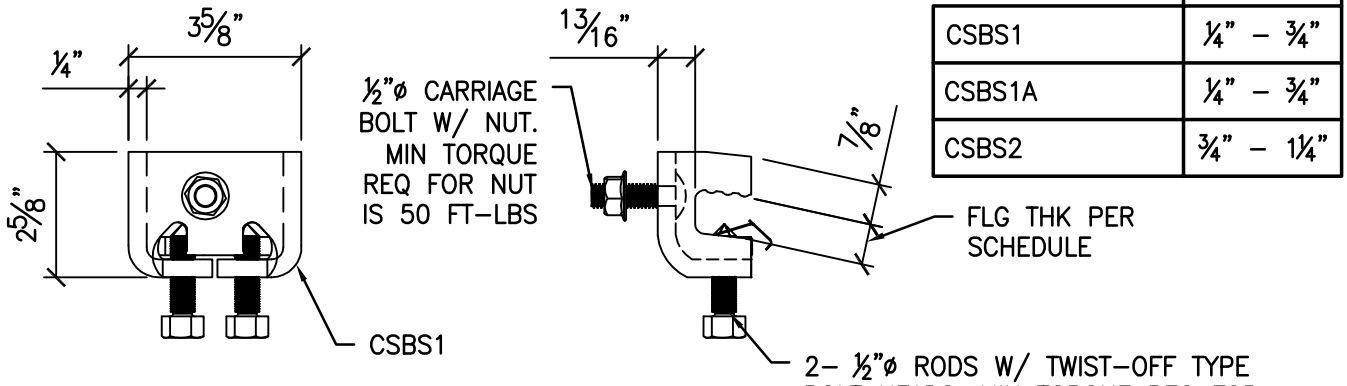
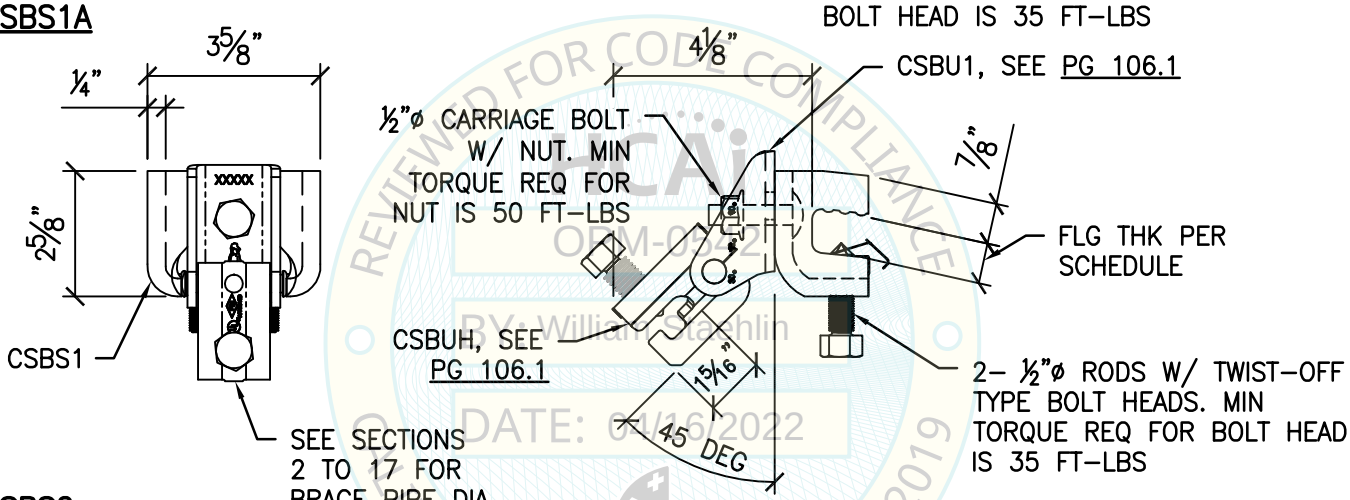
SEISMIC BRACING FOR MEP SYSTEMS

CSBS1

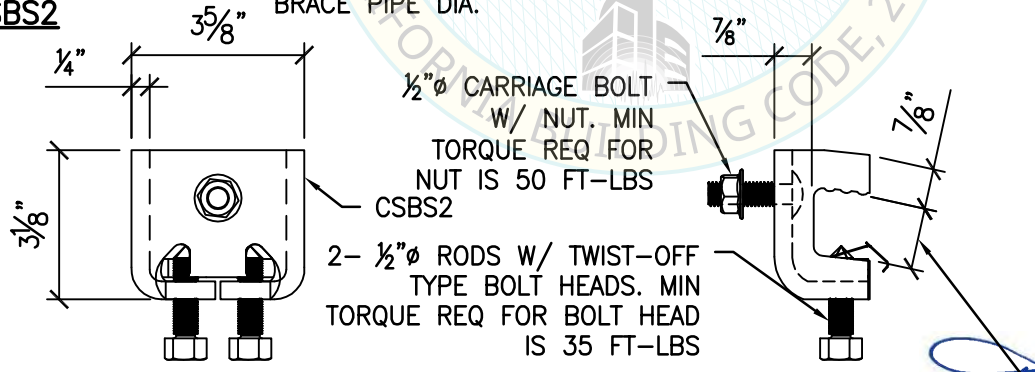
	FLG THK
CSBS1	¼" – ¾"
CSBS1A	¼" – ¾"
CSBS2	¾" – 1¼"



CSBS1A



CSBS2



NOTES:

1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS1, CSBS1A & CSBS2 AT ASD.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSBS1, CSBS1A & CSBS2

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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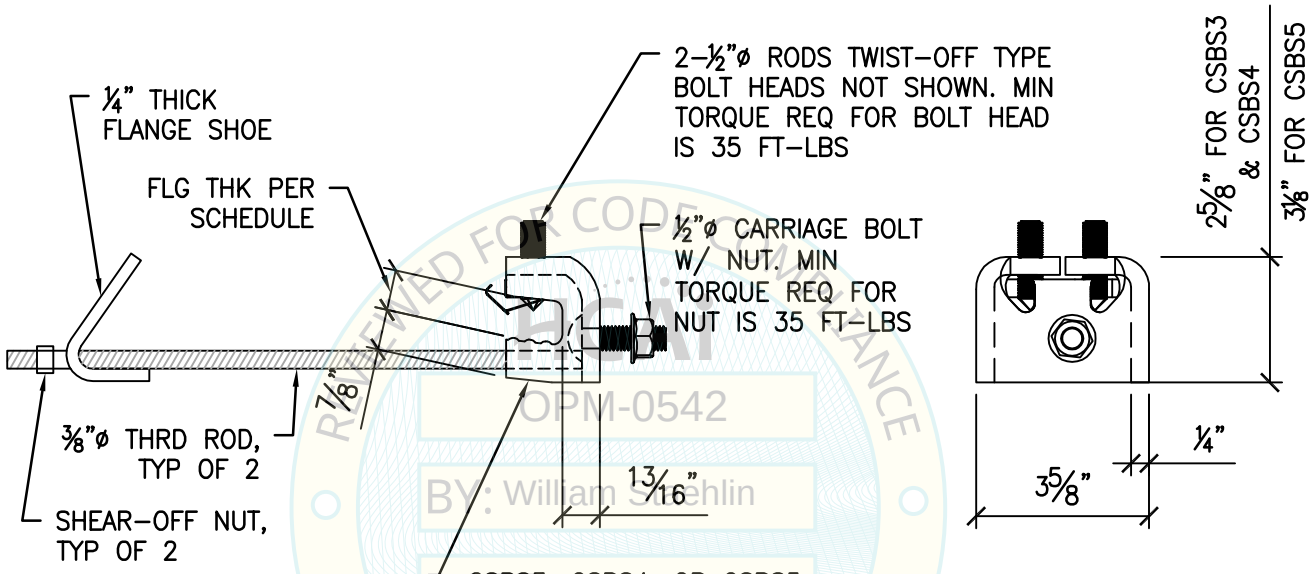
SEISMIC BRACING FOR MEP SYSTEMS

	FLG WIDTH	FLG THK
CSBS3	4" – 8½"	¼" – ¾"
CSBS4	4" – 14½"	¼" – ¾"
CSBS5	4" – 18"	¾" – 1¼"



NOTES:
1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBS3, CSBS4 & CSBS5 AT ASD.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSBS3, CSBS4 & CSBS5

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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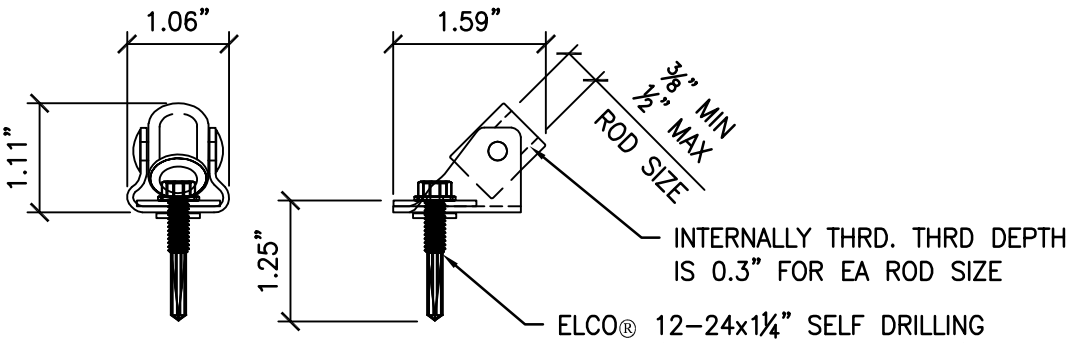
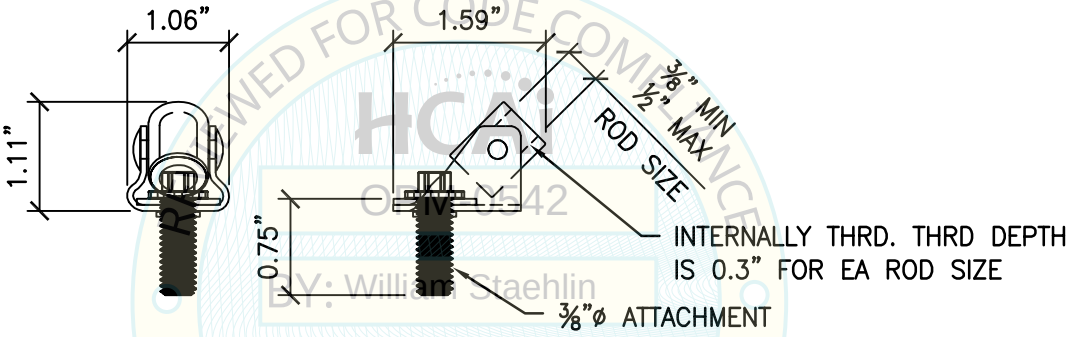
SEISMIC BRACING FOR MEP SYSTEMS



CSBBRS1



CSBBRS3

NOTES:
1. SEE SECTION 600 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBBRS1 & CSBBRS3 AT ASD.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSBBRS1 & CSBBRS3

CYS STRUCTURAL ENGINEERS, INC.
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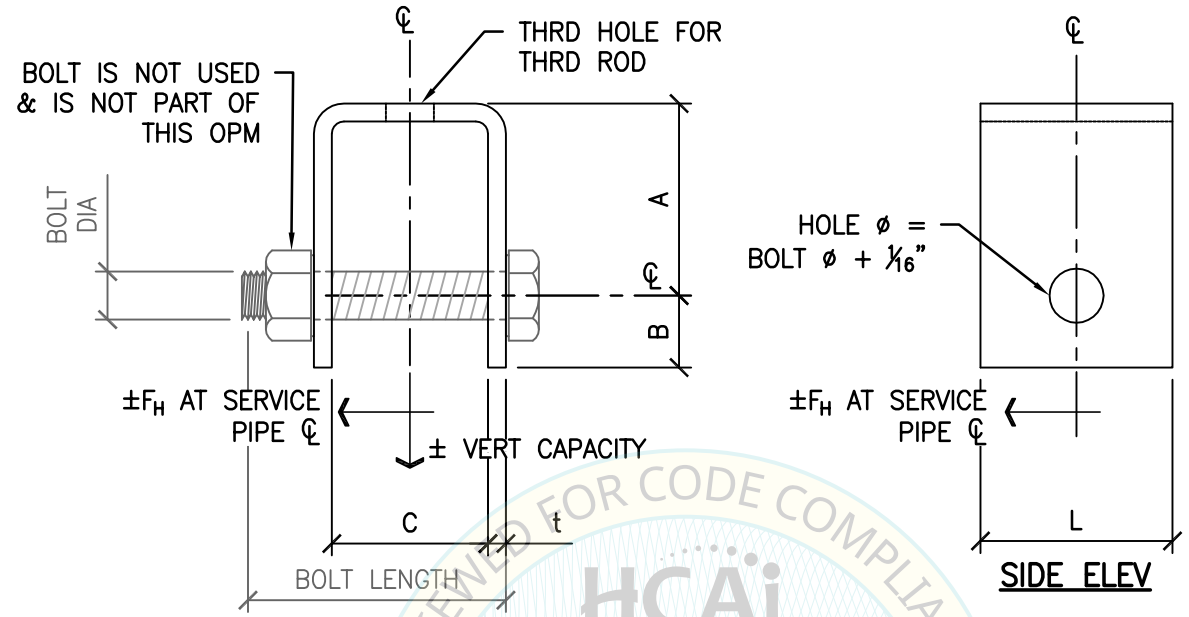
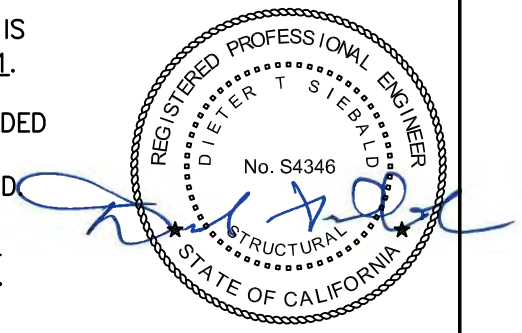
320W WELDED BEAM OR SERVICE PIPE ATTACHMENT



PART #	THRD ROD DIA	A	B	C	BOLT DIA	BOLT LENGTH	t	L	HORIZ CAPACITY F_H (LBS)	VERT CAPACITY (LBS)
320W0037PL	3/8"	2"	7/8"	1 9/16"	–	–	1/4"	2"	156	7764
320W0050PL	1/2"	2"	7/8"	1 5/8"	–	–	1/4"	2"	156	7764
320W0062PL	5/8"	2"	1"	1 5/8"	–	–	1/4"	2"	153	7767
320W0075PL	3/4"	2"	1 1/8"	1 7/8"	–	–	3/8"	2 1/2"	425	9475

NOTES:
1. 320W. WHEN WELDED TO SERVICE PIPES OR SUPPORTING STL MEMBER IS ONLY USED W/ 3/8" & 1/2"ø THRD RODS. SEE PGS 4.1 TO 4.3 & 103.21.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. F_H CAPACITY IS BASED ON THE CONDITION WHERE THE BRACKET IS WELDED TO THE SERVICE PIPE (SEE PG 4.1). F_H IS NOT APPLICABLE WHEN THE BRACKET IS WELDED TO SUPPORTING STL MEMBERS. CAPACITY IS AT ASD.
4. VERT CAPACITY IS BASED ON THE CONDITION WHERE THE BRACKET SUPPORTS VERT SEISMIC BRACES. CAPACITY IS AT ASD & IS THE TOTAL VERT LOAD THAT THE BRACKET CAN RESIST, INCLUDING BOTH W_p & F_{PV}.



SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
320W U-BRACKET

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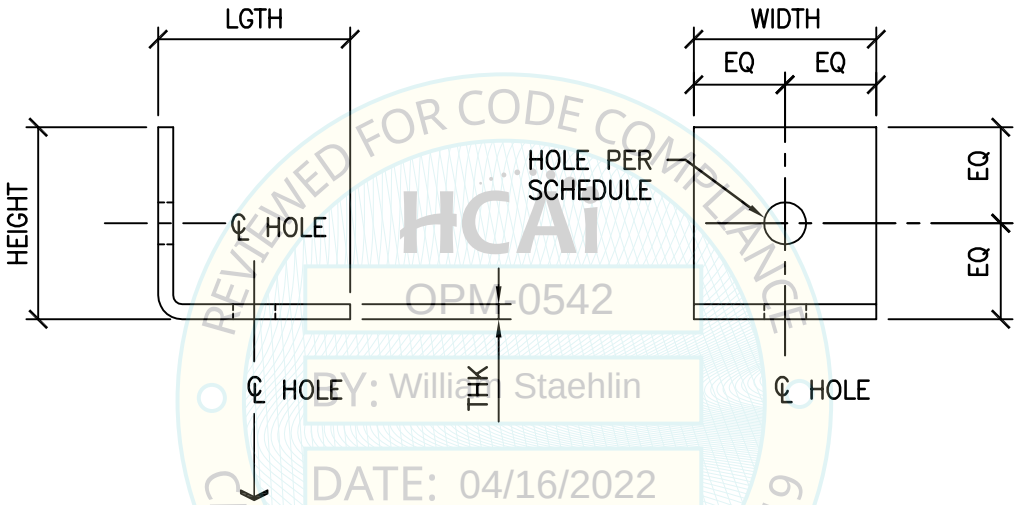
SEISMIC BRACING FOR
MEP SYSTEMS

325 STEEL SIDE BEAM ATTACHMENT

	HOLE SIZE	HEIGHT	LGTH	WIDTH	THK	BRACKET CAPACITY (LBS)
3250037EG	7/16"	2"	2"	1.9"	5/32"	210
3250050EG	9/16"	2"	2"	1.9"	5/32"	210
3250062EG	11/16"	2½"	2½"	2.5"	¼"	560
3250075EG	13/16"	3"	3"	3"	⅜"	1260



NOTES:
1. SEE SCHEDULE ABV FOR VERT CAPACITY AT SUPPORTING STRUCTURE FOR 325 L–BRACKET.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. CAPACITY IS AT ASD & IS THE TOTAL LOAD THAT THE BRACKET CAN RESIST, INCLUDING BOTH W_p & F_{PV}

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STRUCTURAL
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SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
325 L-BRACKET

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2495 NATOMAS PARK DRIVE, SUITE 650
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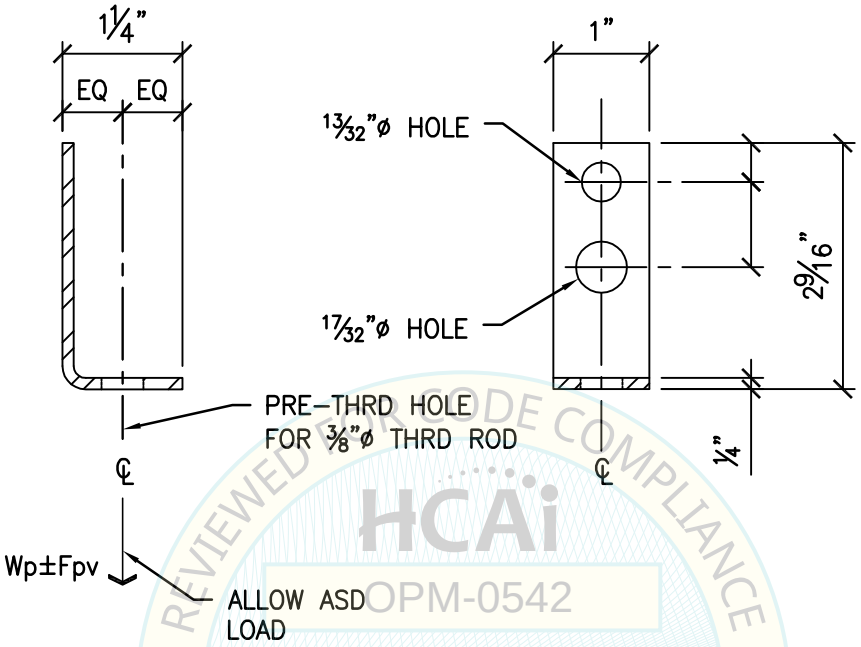
328 THREADED STEEL SIDE BEAM ATTACHMENT



NOTES:
1. SEE PG 400.4 FOR THRD ROD CAPACITY OF 328 L–BRACKET AT ASD.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. L–BRACKET CAPACITY INCLUDES BOTH Wp & Fpv & IS 146# AT ASD.

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No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
328 L-BRACKET

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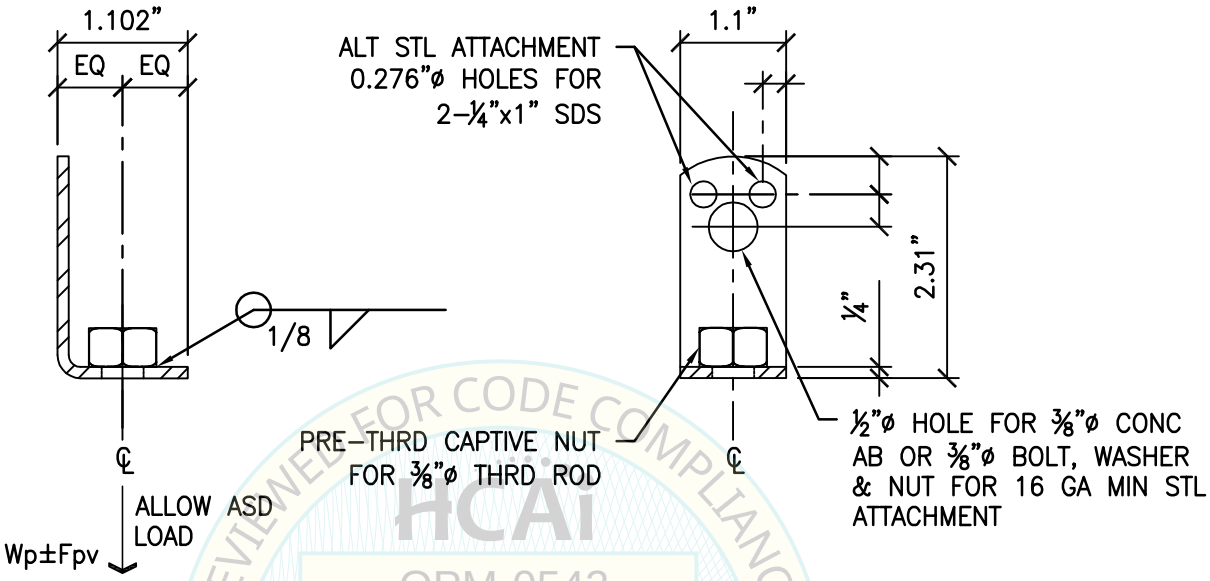
329 SIDE BEAM ATTACHMENT



NOTES:
1. SEE PG 400.4 FOR THRD ROD CAPACITY 329 L–BRACKET AT ASD.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. 329 L–BRACKET CAPACITY INCLUDES BOTH Wp & Fpv & IS 220# AT ASD.

REGISTERED PROFESSIONAL ENGINEER
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No. S4346
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SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
329 L-BRACKET

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NOT USED

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
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SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS

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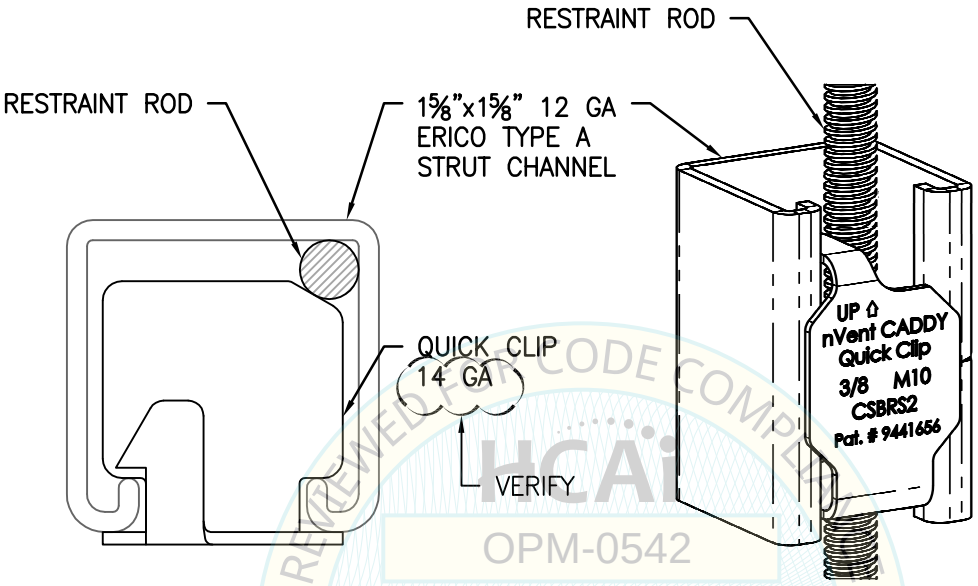
SEISMIC BRACING FOR
MEP SYSTEMS

NVENT CADDY QUICK CLIP ROD STIFFENER CSBRS (X)

	ROD DIA ø
CSBRS2	3/8"
CSBRS3	1/2"
CSBRS4	5/8"
CSBRS5	3/4"



PLAN VIEW ISOMETRIC VIEW

NOTES:
1. SEE PG 400.4 FOR ROD CAPACITY W/ OR WITHOUT STIFFENERS.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.

REGISTERED PROFESSIONAL ENGINEER
DIETER T SIEBALD
No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSBRS NVENT CADDY QUICK CLIP ROD STIFFENER

CYS STRUCTURAL ENGINEERS, INC.
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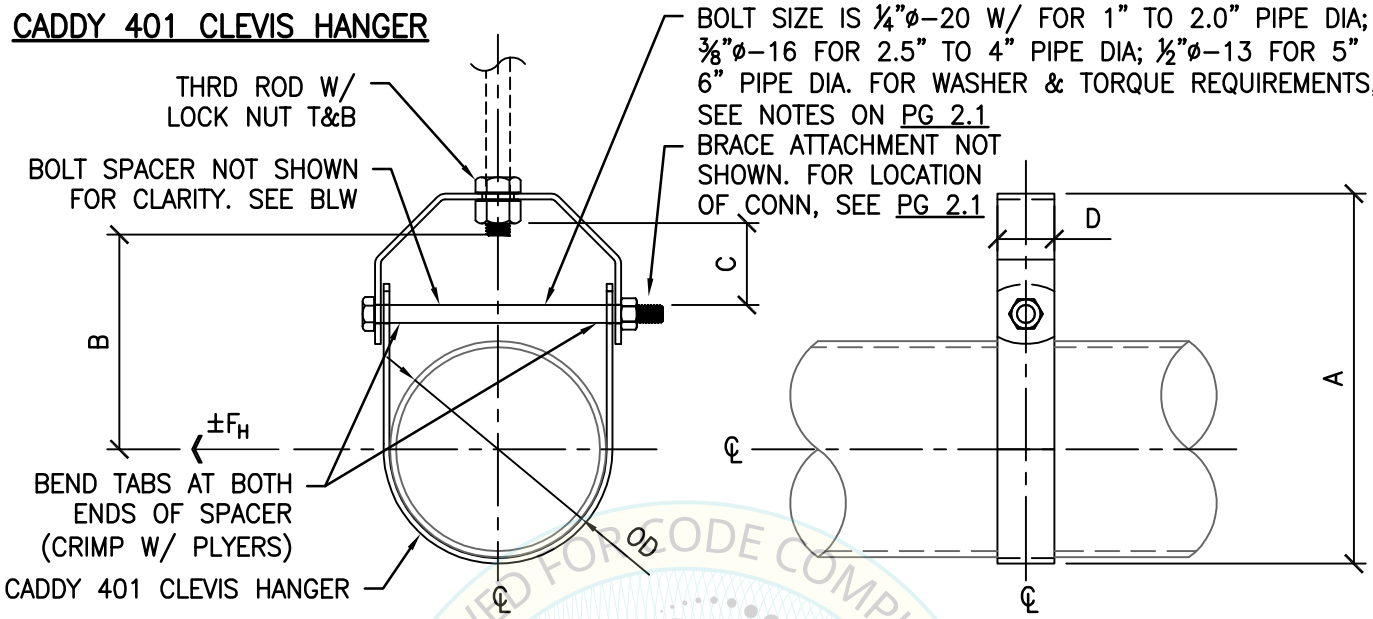
C:\Users\camachom\appdata\local\temp\AcPublish_19380\S1_Erico MEP.dwg Time:Apr11,2022-03:40pm Login:camachom Dimscale:8 LTScale:4

CADDY 401 CLEVIS HANGER

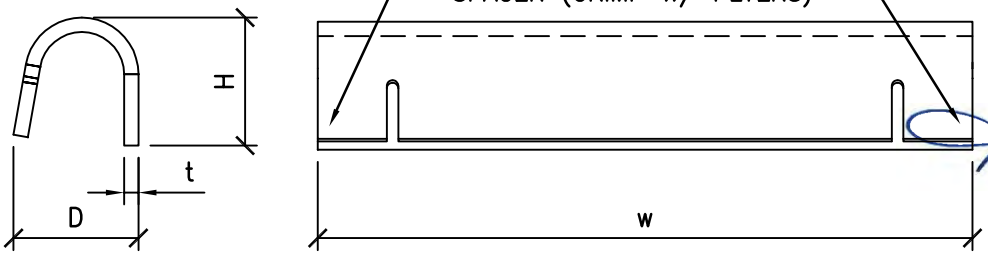


PART #	PIPE DIA (IN)	OD (IN)	ROD SIZE (IN)	A (IN)	B (IN)	C (IN)	D (IN)
4010100EG	1	1.315	⅜	2 13/16	1⅜	⅜	0.748
4010125EG	1¼	1.660	⅜	3⅛	1 9/16	⅜	0.948
4010150EG	1½	1.900	⅜	3 1/16	2 1/16	1 1/16	0.948
4010200EG	2	2.375	⅜	4 5/16	2½	⅞	0.948
4010250EG	2½	2.875	½	5 5/16	3 1/16	1	1.181
4010300EG	3	3.5	½	6 1/16	3½	1⅛	1.181
4010350EG	3½	4	½	6 13/16	4	1 5/16	1.181
4010400EG	4	4.5	⅝	7 7/16	4⅜	1⅜	1.181
4010500EG	5	5.563	⅝	9 1/16	5⅛	1⅝	1.181
4010600EG	6	6.625	¾	10 9/16	6	1⅞	1.496

BOLT SPACER PART #	PIPE DIA (IN)	W (IN)	H (IN)	t (IN)	D (IN)
CSBCS0100	1	1.21	0.51	0.075	0.51
CSBCS0125	1¼	1.55	0.51	0.075	0.51
CSBCS0150	1½	1.71	0.51	0.075	0.51
CSBCS0200	2	2.28	0.51	0.075	0.51
CSBCS0250	2½	2.78	0.67	0.075	0.65
CSBCS0300	3	3.41	0.67	0.075	0.65
CSBCS0350	3½	3.91	0.67	0.075	0.65
CSBCS0400	4	4.41	0.67	0.075	0.65
CSBCS0500	5	5.50	0.98	0.075	0.90
CSBCS0600	6	6.56	0.98	0.075	0.90

NOTES:
1. SEE SECTION 500 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CADDY 401 CLEVIS HANGER W/ CSBCS BOLT SPACER & CSBU1 BRACE ASSEMBLY.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.

CSBCS BOLT SPACER



SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CADDY 401 CLEVIS HANGER W/ CSBCS BOLT SPACER

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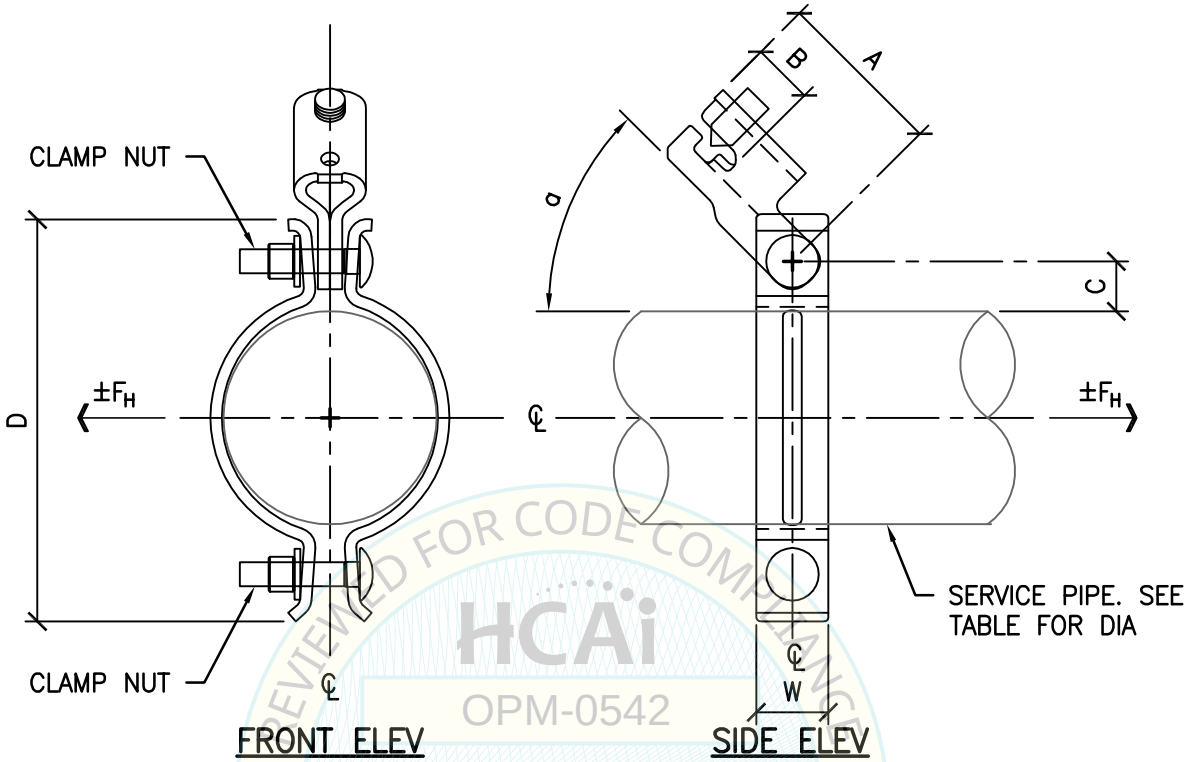
SEISMIC BRACING FOR MEP SYSTEMS

CSB



PART #	PIPE DIA (IN)	a	W (IN)	A (IN)	B (IN)	C (IN)	D (IN)
CSB0100	1	45	1½	3 9/16	1 5/16	5/8	5
CSB0125	1¼	45	1½	3 9/16	1 5/16	1 1/16	5½
CSB0150	1½	45	1½	3 9/16	1 5/16	¾	5⅜
CSB0200	2	45	1½	3 9/16	1 5/16	13/16	6
CSB0250	2½	45	1½	3 9/16	1 5/16	15/16	6¾
CSB0300	3	45	1½	3 9/16	1 5/16	1	7⅜
CSB0400	4	45	1½	3 9/16	1 5/16	1 1/16	8½
CSB0500	5	45	1½	3 9/16	1 5/16	1	10 1/16
CSB0600	6	45	1½	3 9/16	1 5/16	1⅛	10⅞
CSB0800	8	45	1½	3 9/16	1 5/16	1¼	13
CSB1000	10	45	1½	3 9/16	1 5/16	1⅜	15
CSB1200	12	45	1½	3 9/16	1 5/16	1⅜	16⅞

NOTES:
1. SEE SECTION 500 FOR HORIZ CAPACITY F_H AT ø ANGLE AT ASD OF CSB.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. LONGITUDINAL PIPE BRACE SHOWN. WHEN SERVING AS A TRANSVERSE BRACE, BRACE PIPE IS AT 90 DEG ANGLE TO RUN PIPE. AS AN ALTERNATE, A 1⅝x1⅝x12 GA STRUT BRACE MAY BE USED.

REGISTERED PROFESSIONAL ENGINEER DIETER T SIEBALD No. S4346 STRUCTURAL STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSB

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
SACRAMENTO, CA 95833
TEL (916) 920-2020
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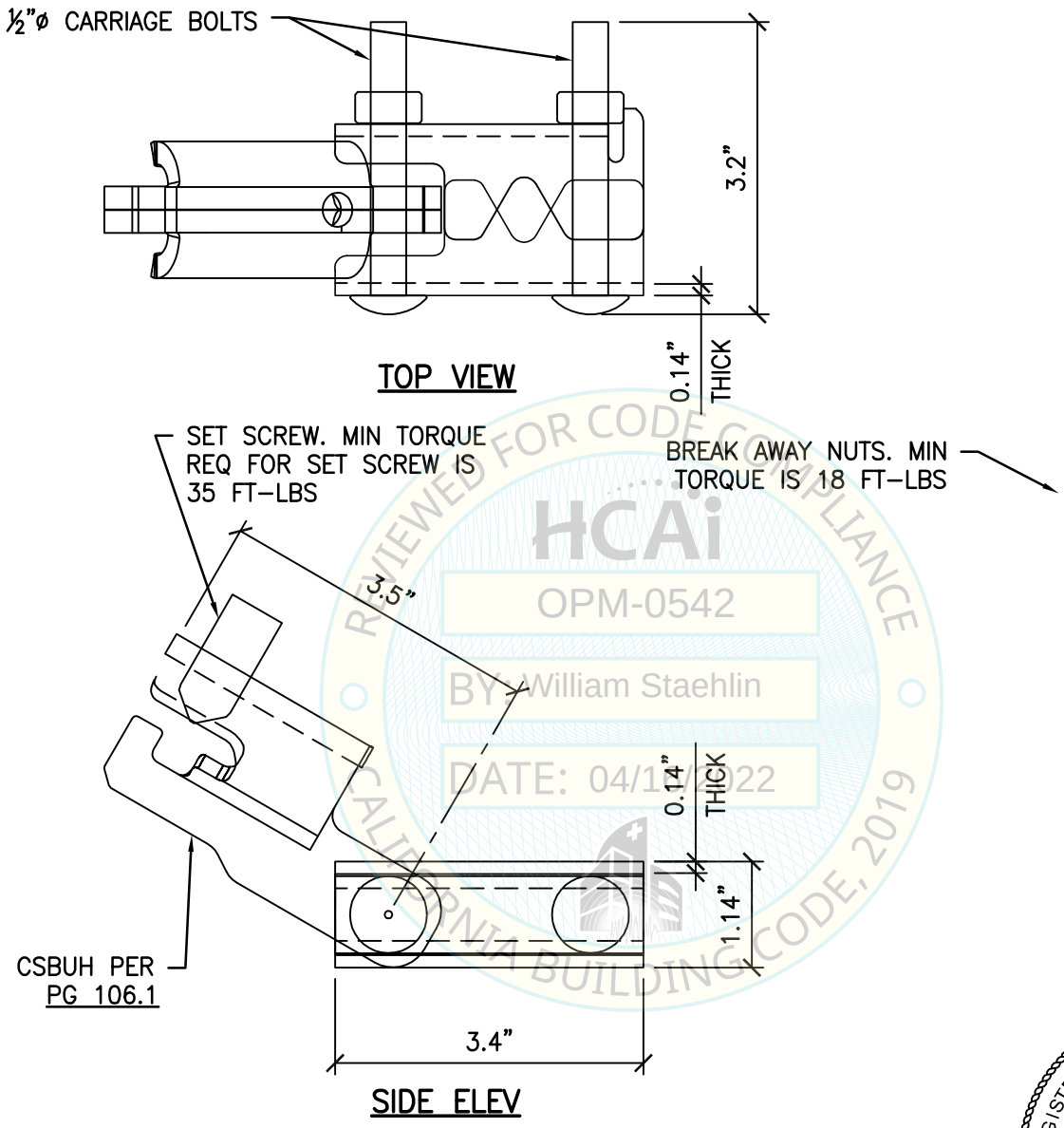
CSBR1 RETROFIT TRAPEZE ATTACHMENT



TOP VIEW

SIDE ELEV

NOTES:
1. SEE SECTION 500.4 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBR1.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.

REGISTERED PROFESSIONAL ENGINEER
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No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSBR1

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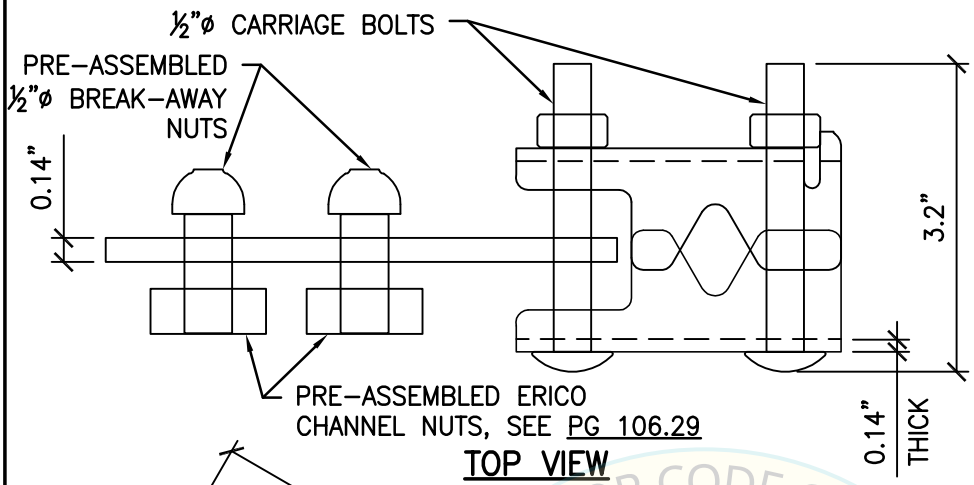
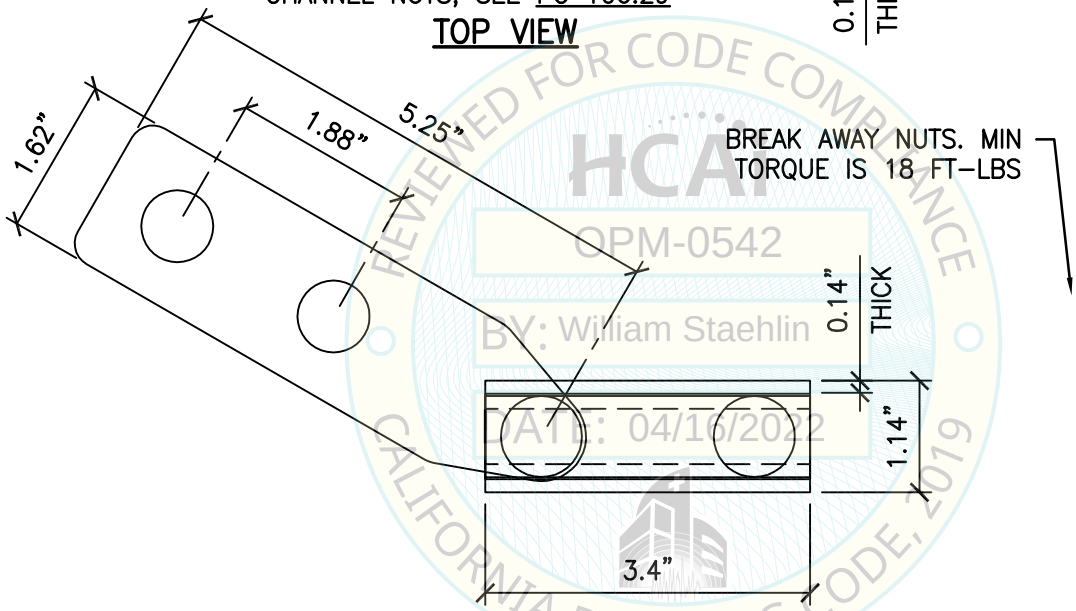
CSBR2 RETROFIT TRAPEZE ATTACHMENT



TOP VIEW



SIDE ELEV

NOTES:
1. SEE SECTION 500.4 FOR HORIZ CAPACITY F_H AT ø ANGLE OF CSBR2.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. STRUT NUTS & SHEAR OFF BOLTS ARE SUPPLIED & PRE-ASSEMBLED BY ERICO & ARE INTEGRAL TO THE CSBR2 PRODUCT.
4. FOR ERICO STRUT NUT, SEE PG 106.29.

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STRUCTURAL
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SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSBR2

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SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CADDY 429 PIPE CLAMP

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SACRAMENTO, CA 95833
TEL (916) 920-2020
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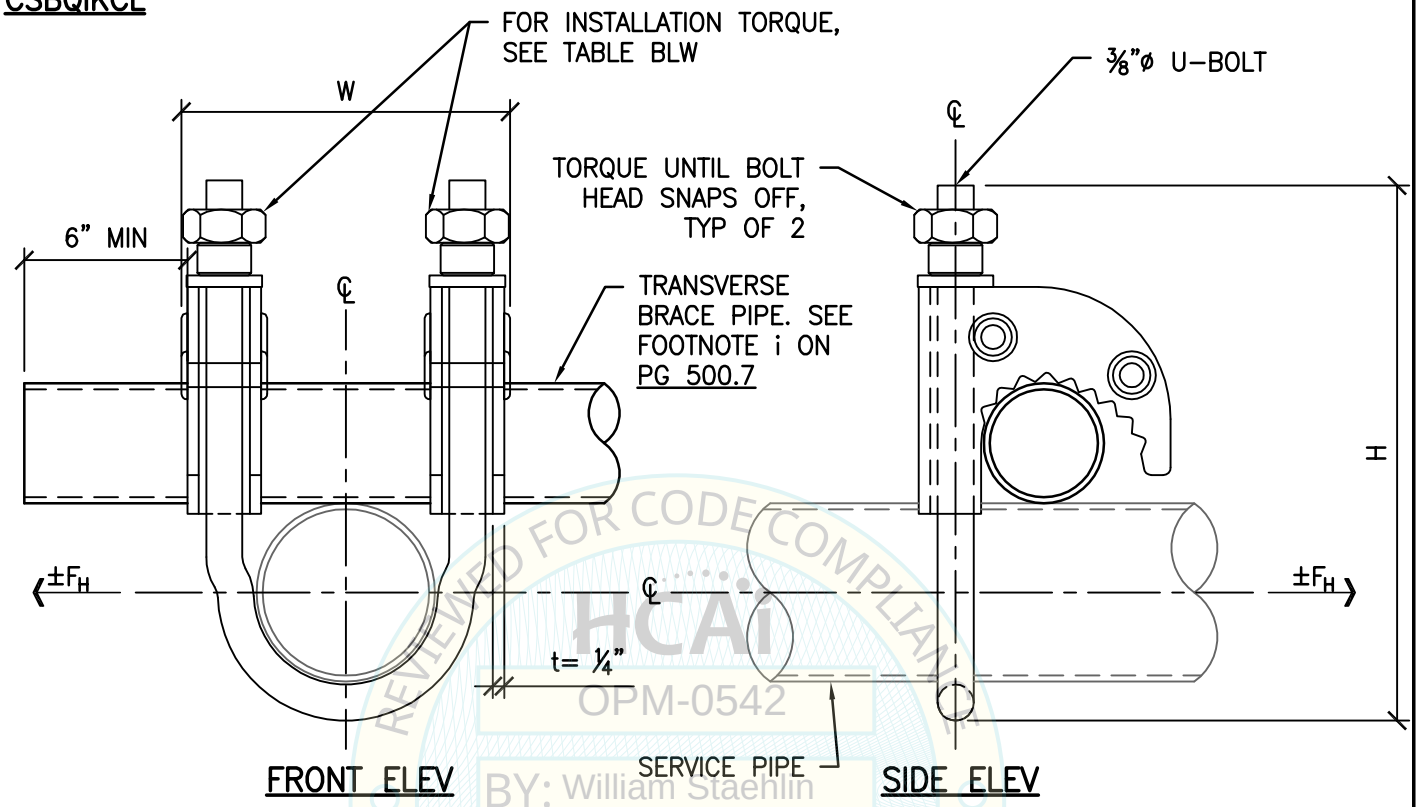
SEISMIC BRACING FOR MEP SYSTEMS

CSBQIKCL



PART #	SERVICE PIPE SIZE (IN)	H (IN)	W (IN)	INSTALL TORQUE (FT-LBS)
CSBQIKCL100EG	1	5 1/8	2 5/8	25
CSBQIKCL125EG	1 1/4	5 3/8	3	25
CSBQIKCL150EG	1 1/2	5 5/8	3 1/4	25
CSBQIKCL200EG	2	6 3/8	3 5/8	25

NOTES:
1. SEE PG 500.1 FOR HORIZ CAPACITY F_H AT ø ANGLE AT ASD OF CSBQIKCL.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. CSBQIKCL CAN ALSO BE USED AS FOUR-WAY RISER. SEE PG 9.1

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No. S4346
STRUCTURAL
STATE OF CALIFORNIA

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS CSBQIKCL

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SACRAMENTO, CA 95833
TEL (916) 920-2020
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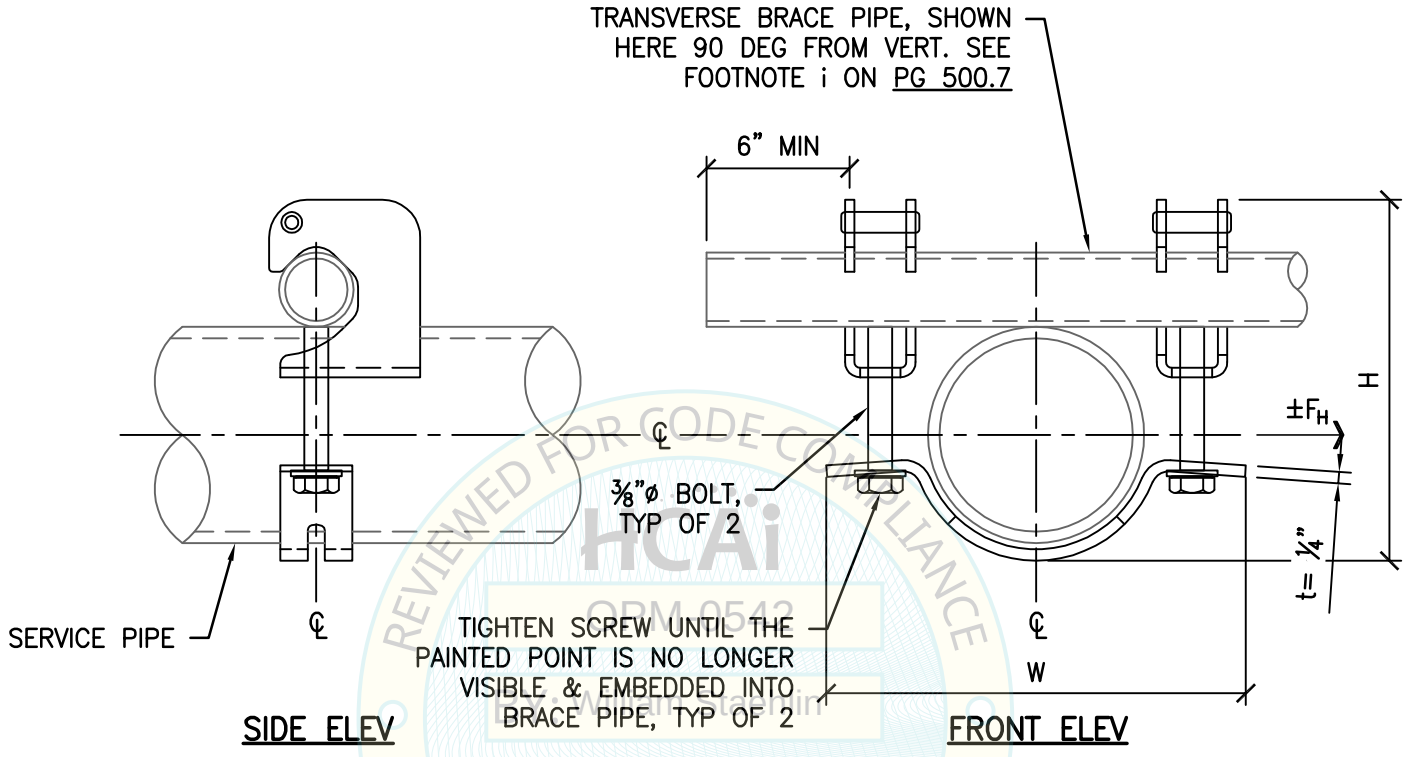
CSBQG



PART #	SERVICE PIPE SIZE (IN)	H (IN)	W (IN)
CSBQG250EG	2½	5⅞	6¾
CSBQG300EG	3	6½	7½
CSBQG400EG	4	7½	8¾
CSBQG600EG	6	9⅝	11¾
CSBQG800EG	8	11 13/16	13⅞

NOTES:
1. SEE PG 500.3 FOR HORIZ CAPACITY F_H AT ø ANGLE AT ASD OF CSBQG.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. CSBQG CAN ALSO BE USED AS FOUR-WAY RISER. SEE PG 9.2

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SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CSBQG

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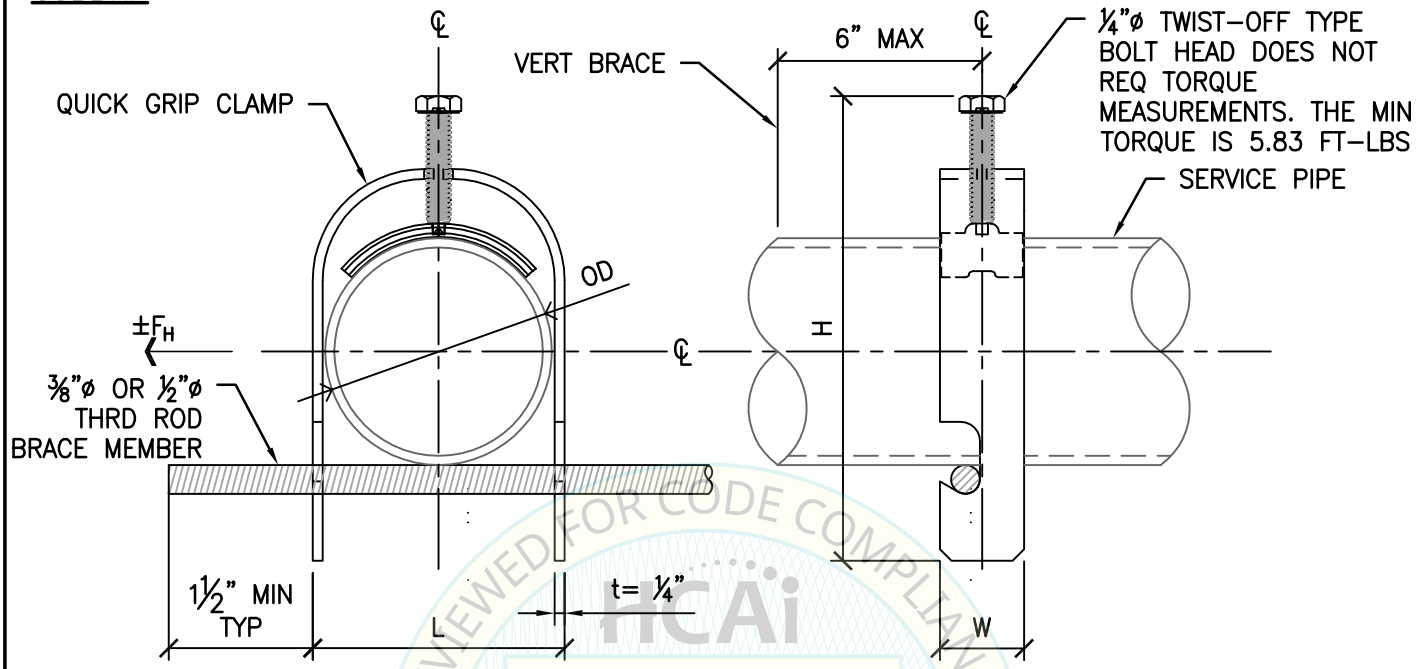
SEISMIC BRACING FOR MEP SYSTEMS

CSBBRP



PART #	SERVICE PIPE SIZE (IN)	OD (IN)	H (IN)	L (IN)	W (IN)
CSBBRP100EG	1	1.32	6.67	1.63	0.88
CSBBRP125EG	1¼	1.66	7.56	1.97	0.88
CSBBRP150EG	1½	1.90	8.20	2.21	0.88
CSBBRP200EG	2	2.38	9.45	2.69	0.88

NOTES:
1. SEE PG 500.3 FOR HORIZ CAPACITY F_H AT ø ANGLE OF AT ASD FOR CSBBRP.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.

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SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS CSBBRP

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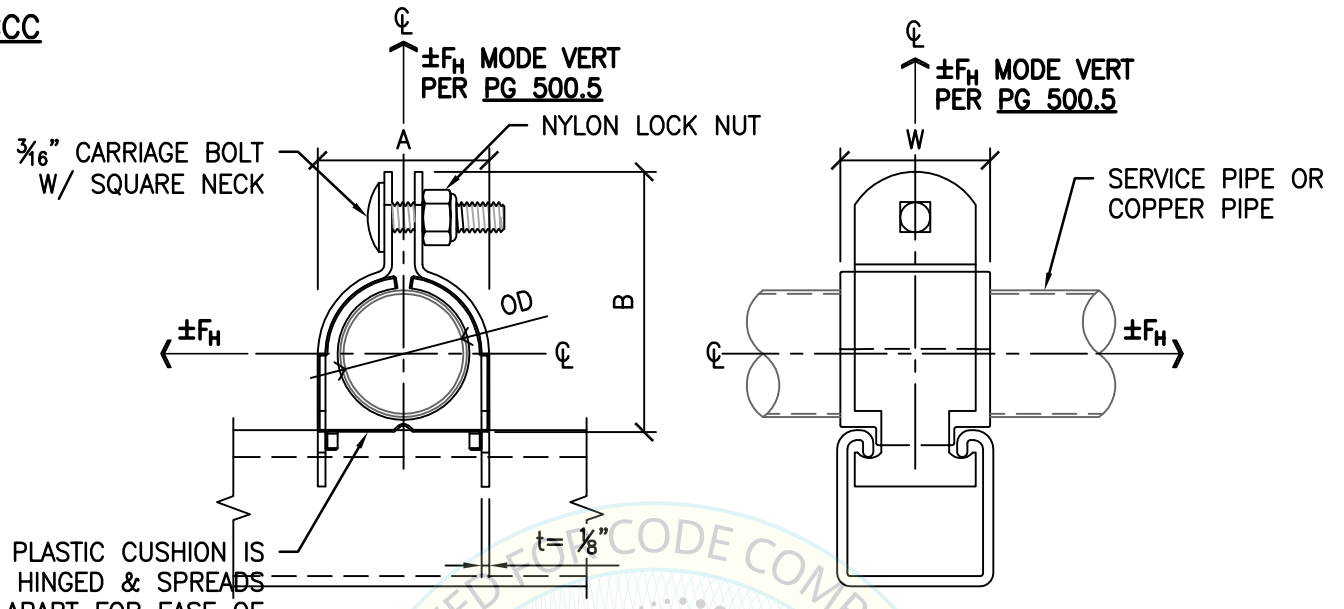
SEISMIC BRACING FOR MEP SYSTEMS

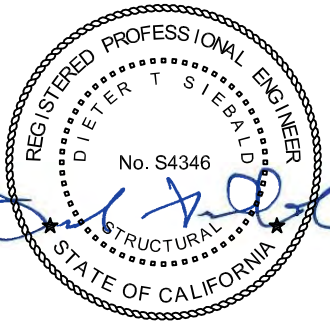
CCC



PART #	OD (IN)	COPPER TUBE SIZE (IN)	PIPE SIZE (IN)	W (IN)	A (IN)	B (IN)
CCC0062	5/8	1/2	3/8	1.562	0.995	1.64
CCC0075	3/4	5/8	–	1.562	1.120	1.77
CCC0087	7/8	3/4	1/2	1.562	1.245	1.89
CCC0100	1	–	3/4	1.562	1.370	2.02
CCC0112	1 1/8	1	–	1.562	1.535	2.46
CCC0125	1 1/4	–	1	1.562	1.660	2.58
CCC0137	1 3/8	1 1/4	–	1.562	1.785	2.71
CCC0150	1 1/2	–	1 1/4	1.562	1.910	2.84
CCC0162	1 5/8	1 1/2	1 1/4	1.562	2.035	2.96
CCC0187	1 7/8	–	1 1/2	1.562	2.325	3.21
CCC0212	2 1/8	2	–	1.562	2.700	3.58
CCC0237	2 3/8	–	2	1.562	2.950	3.84
CCC0262	2 5/8	2 1/2	–	1.562	3.200	4.08
CCC0312	3 1/8	3	–	1.562	3.700	4.58
CCC0412	4 1/8	4	–	1.562	4.825	5.95
CCC0450	4 1/2	–	4	1.562	5.200	6.32

NOTES:

1. SEE PG 500.5 FOR MODE T & MODE L HORIZ CAPACITY F_H & FOR MODE VERT CAPACITY F_H AT ø ANGLE OF 0° AT ASD OF CCC.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. FOR 5/8" & 3/4" COPPER TUBE SIZE & 3/8" & 3/4" PIPE SIZE, USE 1/2" PIPE SIZE CAPACITY SHOWN ON PG 500.5. FOR 1 1/4" & 1 1/2" COPPER TUBE SIZE, USE 1" CAPACITY SHOWN ON PG 500.5. FOR 3" & 2 1/2" COPPER TUBE SIZE, USE 2" CAPACITY SHOWN FOR L MODE & 4" CAPACITIES FOR VERT & T MODES ON PG 500.5.



SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
CCC

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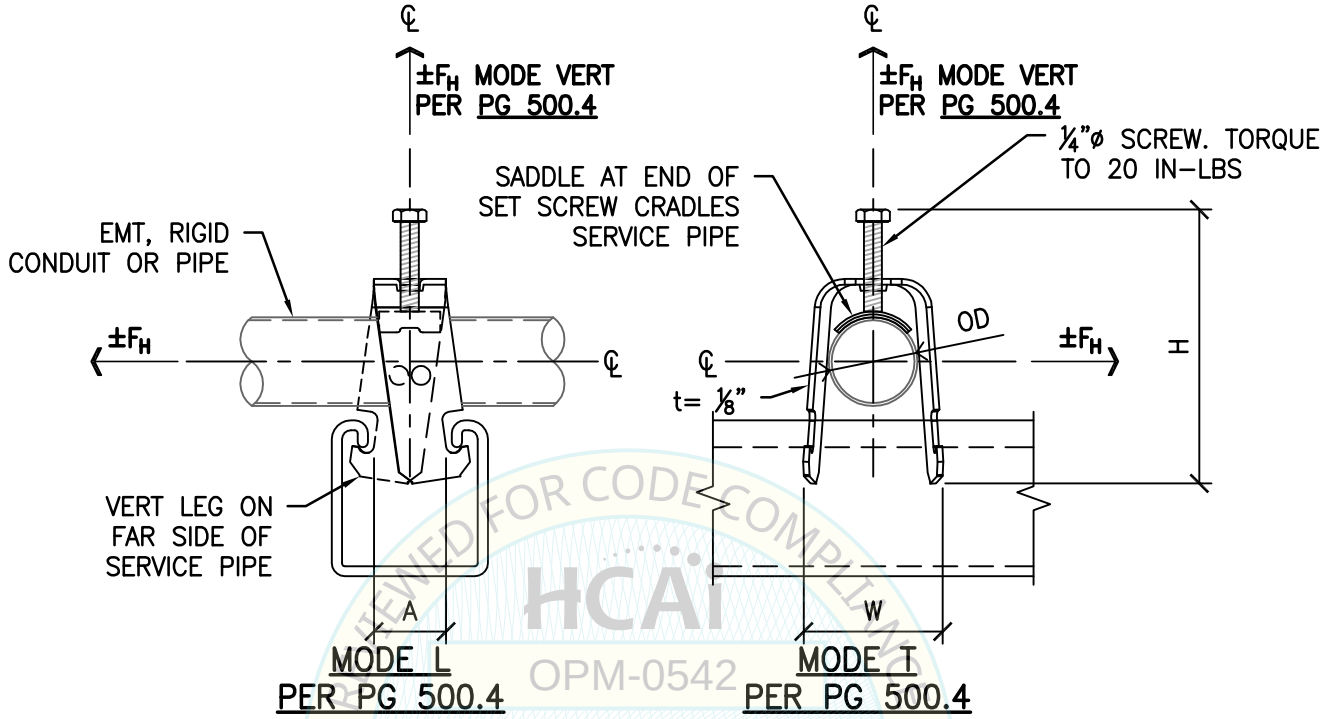
SEISMIC BRACING FOR MEP SYSTEMS

SCH–B



PART #	OD (IN)	EMT (IN)	RIGID CONDUIT OR PIPE SIZE (IN)	W (IN)	H (IN)	A (IN)
SCH12B	0.92	–	½	1.30	2.60	3½32
SCH16B	1.16	1	¾	1.50	2.70	3½32
SCH20B	1.51	1¼	1	1.90	3.00	3½32
SCH24B	1.74	1½	1¼	2.20	3.20	3½32
SCH32B	2.20	2	1½	2.20	3.20	3½32
SCH40B	2.38	–	2	3.00	4.00	3½32
SCH48B	2.88	2½	2½	3.00	4.00	3½32
SCH56B	3.50	3	3	3.00	4.00	3½32
SCH64B	4.00	3½	3½	3.00	4.00	3½32
SCH72B	4.50	4	4	3.00	4.00	3½32

NOTES:
1. SEE PG 500.4 FOR MODE T & MODE L HORIZ CAPACITY F_H & FOR MODE VERT CAPACITY F_H AT ø ANGLE OF 0° AT ASD OF SCH–B.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.

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SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
SCH-B

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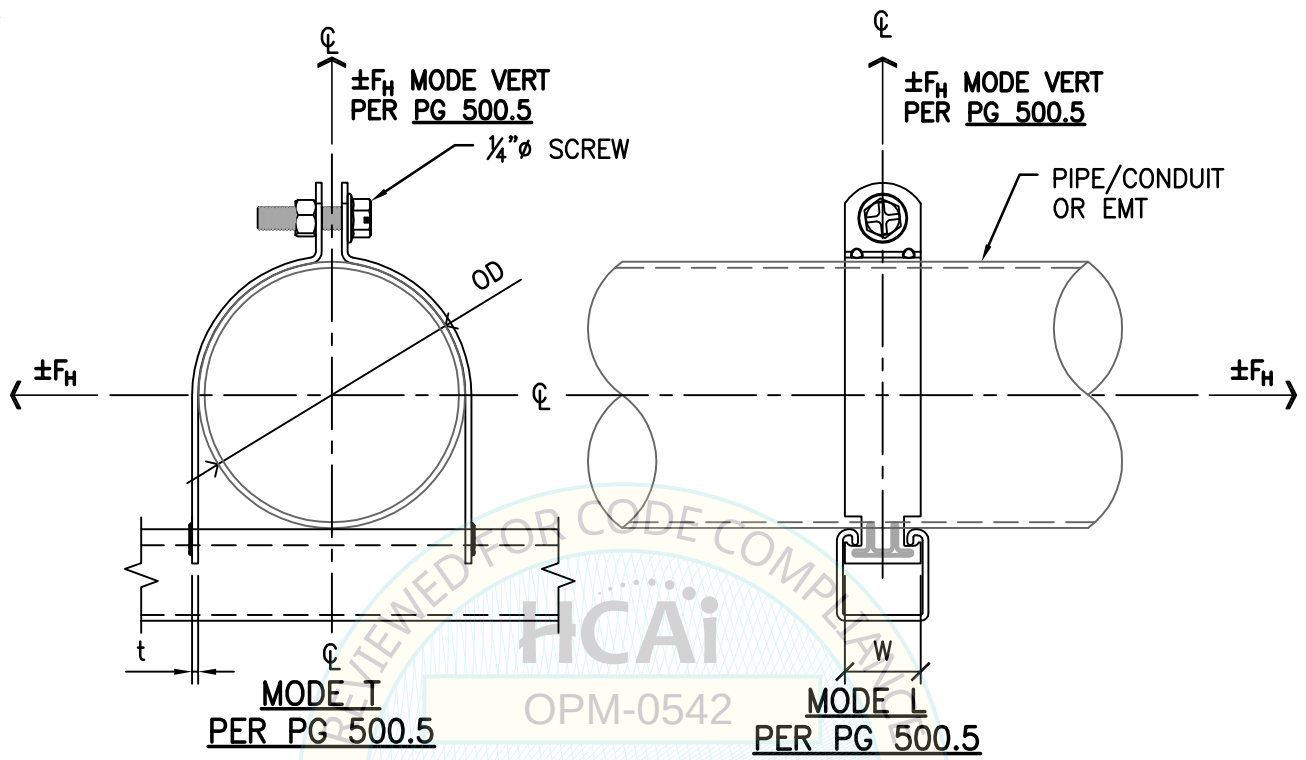
SEISMIC BRACING FOR MEP SYSTEMS

USC



NOTES:
1. SEE PG 500.5 FOR MODE T & MODE L HORIZ CAPACITY F_H & FOR MODE VERT CAPACITY F_H AT ø ANGLE OF 0° AT ASD OF USC.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. FOR PART NUMBERS & SERVICE PIPE DIA, ETC., SEE PG 106.26.

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
USC

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USC (CONTINUED)

PART #	OD (IN)	PIPE SIZE (IN)	EMT CONDUIT SIZE (IN)	W (IN)	t (IN)
USC021EG	0.81–0.84	½	–	1¼	16 GA
USC026EG	1.00–1.06	¾	–	1¼	16 GA
USC031EG	1.16–1.26	–	1	1¼	16 GA
USC033EG	1.29–1.32	1	–	1¼	16 GA
USC040EG	1.51–1.60	–	1¼	1¼	14 GA
USC042EG	1.63–1.67	1¼	–	1¼	14 GA
USC046EG	1.69–1.77	–	1½	1¼	14 GA
USC048EG	1.87–1.97	1½	–	1¼	14 GA
USC058EG	2.20–2.25	–	2	1¼	12 GA
USC060EG	2.34–2.45	2	–	1¼	12 GA
USC073EG	2.75–2.88	2½	2½	1¼	12 GA
USC086EG	3.31–3.50	3	3	1¼	12 GA
USC101EG	3.87–4.04	3½	3½	1¼	12 GA
USC113EG	4.37–4.54	4	4	1¼	12 GA

NOTE:
FOR ¾" PIPE SIZE, USE ½" PIPE SIZE CAPACITY SHOWN ON PG 500.3.
FOR 1¼" & 1½" PIPE SIZE OR EMT CONDUIT SIZE, USE 1" CAPACITY SHOWN ON PG 500.3. FOR 2½", 3" & 3½" PIPE SIZE OR EMT CONDUIT SIZE, USE 2" CAPACITY SHOWN ON PG 500.3.

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SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
USC (CONTINUED)

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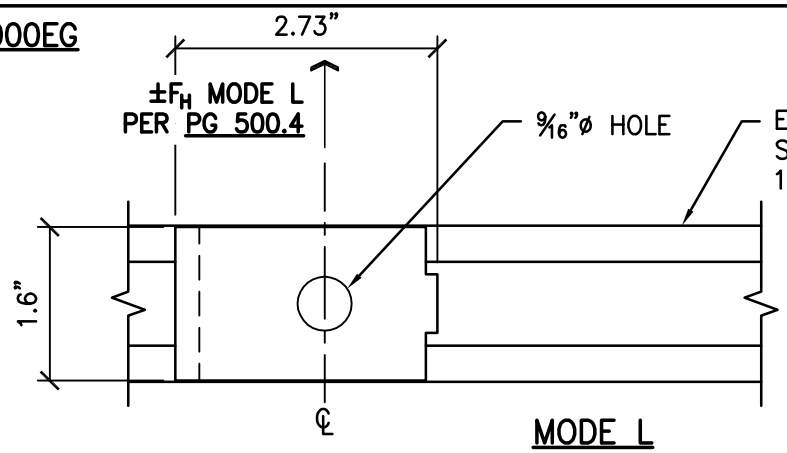
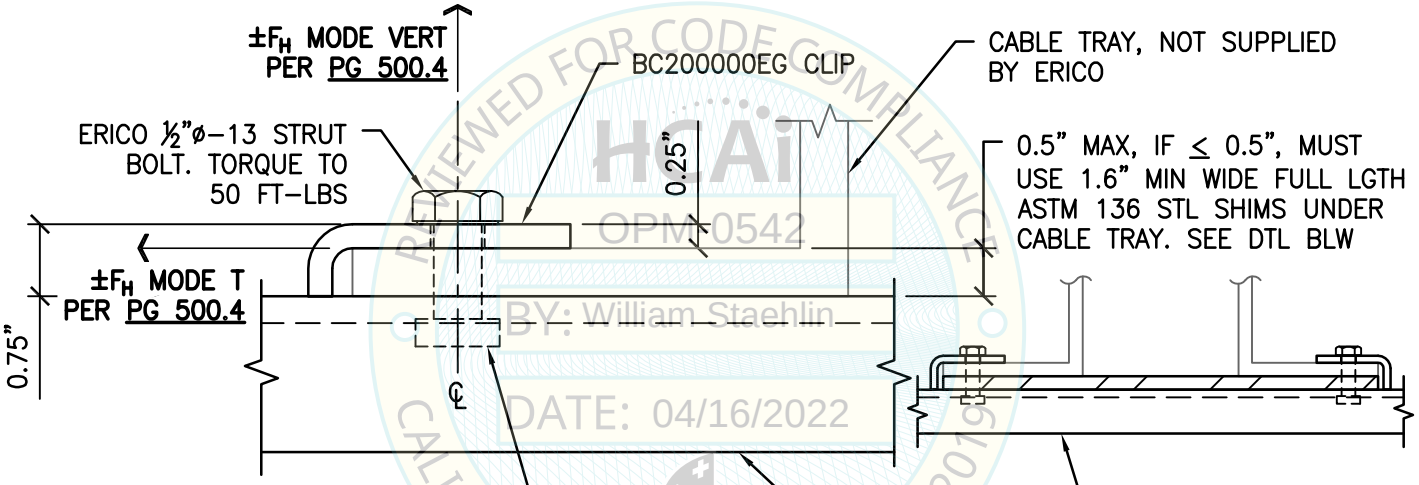
SEISMIC BRACING FOR MEP SYSTEMS

BC200000EG



MODE L
PER PG 500.6

TOP VIEW



MODE T
PER PG 500.6

SIDE ELEV

NOTES:
1. SEE PG 500.4 FOR MODE T & MODE L HORIZ CAPACITY F_H & FOR MODE VERT CAPACITY F_H AT ø ANGLE OF BRACE MEMBER AT ASD FOR BC200000EG.
2. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
3. INSTALLATION OF BC200000EG CLIP MUST ALWAYS BE IN PAIRS AT OPPOSITE SIDES OF THE CABLE TRAY.
4. FOR ERICO STRUT NUT SEE PG 106.29.
5. ERICO STRUT NUT WAS FM TESTED AS PART OF A BRACED ASSEMBLY.

SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
BC200000EG

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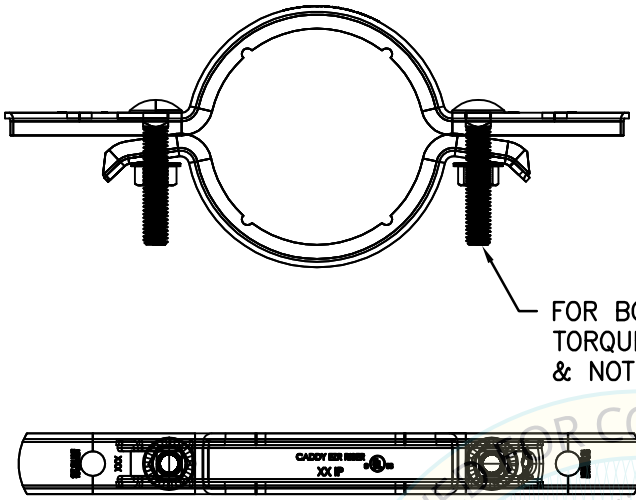
EZ RISER CLAMP



PART #	PIPE SIZE	OD (IN)	HOLE SIZE (IN)	BOLT DIA (IN)	A (IN)	B (IN)	C (IN)	STATIC LOAD (LBS)
EZR0050	½"	0.84	0.39	⅜–16	8½	5⅛	⅞	255
EZR0075	¾"	1.05	0.39	⅜–16	9	5⅜	⅞	255
EZR0100	1"	1.315	0.39	⅜–16	9	5⅝	⅞	255
EZR0125	1¼"	1.66	0.39	⅜–16	9½	6	⅞	255
EZR0150	1½"	1.9	0.39	⅜–16	9⅞	6¼	⅞	255
EZR0200	2"	2.375	0.39	⅜–16	10¼	7	1	255
EZR0250	2½"	2.875	0.39	⅜–16	11	7½	1	390
EZR0300	3"	3.5	0.39	⅜–16	11¾	8⅛	1	530
EZR0350	3½"	4	0.52	½–13	12⅝	9⅜	1¼	670
EZR0400	4"	4.5	0.52	½–13	13	10	1¼	810
EZR0500	5"	5.563	0.52	½–13	14½	11¾	1½	1160
EZR0600	6"	6.625	0.52	½–13	16	12¾	1½	1570

NOTES:

1. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
2. CLAMP IS FITTED FOR STL PIPE & MUST BE INSTALLED BLW A COUPLING OR SHEAR LUG, W/ BOLTS TORQUED TO RECOMMENDED VALUES.
3. USE OF A SOCKET OR DRIVER IS RECOMMENDED FOR INSTALLATION.
4. EZ RISER CLAMP IS ONLY INTENDED FOR USE W/ SECTION 17 NON–RIGID CABLE SUPPORTS & HOLDS THE CABLES IN PLACE.
5. INSTALL PER MFR'S INSTRUCTIONS & TORQUE ⅜" – 16 BOLTS TO 19 FT–LBS & ½"–13 BOLTS TO 50 FT–LBS.

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SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
EZ-RISER CLAMP

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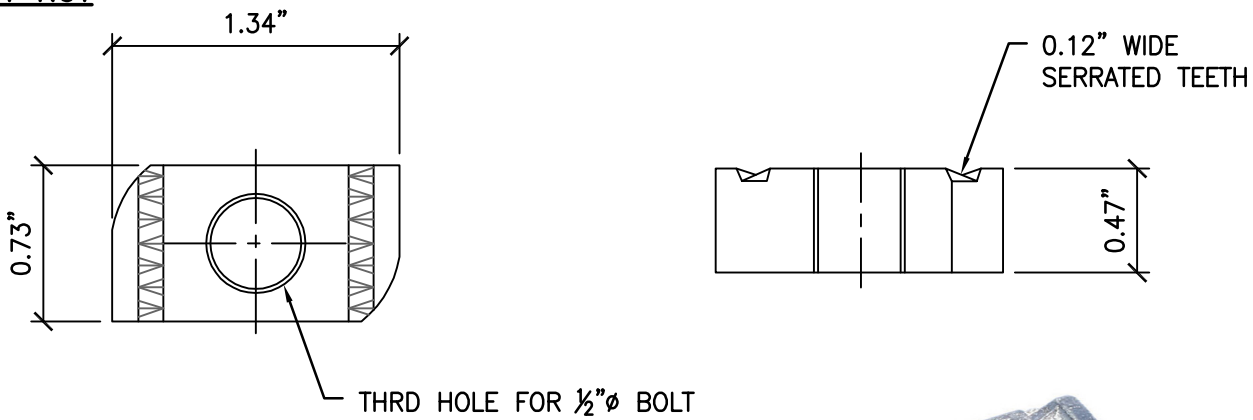
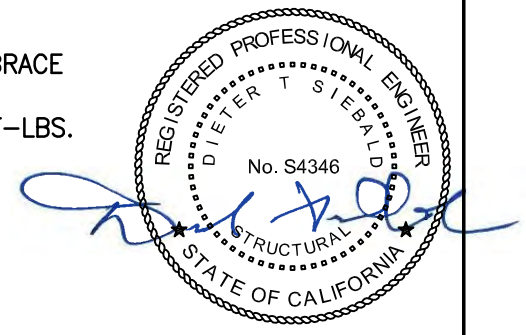
STRUT NUT



NOTES:
1. FOR MATERIAL STANDARDS, SEE SECTION 1, PG 1.30 & ONWARDS.
2. ERICO STRUT NUT IS ONLY USED IN THIS OPM FOR PRE-ASSEMBLED BRACE COMPONENTS THAT HAVE BEEN FM TESTED AS AN ASSEMBLY.
3. INSTALL PER MFR'S INSTRUCTIONS & TORQUE ½"ø-13 BOLTS TO 50 FT-LBS.



SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS
ERICO STRUT NUT

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PIPE TRANSVERSE BRACE SPACING TABLES

MAX LOAD TO EACH TRANSVERSE BRACE AT ASD LEVEL OF DESIGN

Schedule LW Steel Pipe (Light-Wall Schedule 7)

Fy = 30 ksi			Fy Reduction [7] = 0.9			Insulated Water-Filled Pipe Wt	L_v = Hanger Spacing[3]	Max Transverse Spacing per Seismic Design Force "F_p" (ft)[5][6]			
Pipe Size [1]	OD [1]	t_{nom} [1]	S [2]	r [4]	M_{cap}			0.5	0.75	1	1.25
								Corresp. Vert. Seismic Effect, "Ev"			
(in)	(in)	(in)	(in^3)	(in)	(ft-lb)	(plf)	(ft)	0.1	0.15	0.2	0.25
1 1/4	1.660	0.062	0.11	0.16	253	2.7	6	26	23	20	18
1 1/2	1.900	0.080	0.19	0.19	422	3.5	8	30	25	22	19
2	2.375	0.080	0.30	0.21	675	4.6	9	33	28	24	21
2 1/2	2.875	0.083	0.46	0.24	1040	6.2	10	36	30	26	23
3	3.500	0.092	0.76	0.28	1721	8.4	11	40	33	28	25
4	4.500	0.092	1.29	0.32	2891	12.5	12	43	35	30	27
6	6.625	0.115	3.51	0.43	7902	25.2	12	51	42	36	32

Hanger spacing is based on the minimum of the strength of the pipe, deflection of L/60 and deflection of 6in

1. STL PIPE DIM AS PROVIDED BY ERICO.
2. $S = [\pi (OD)^4 - (OD - 2*t_{design})^4]/32\ (OD)$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
3. MAX DISTANCE BTW HANGERS IS BASED ON SCHEDULE 10 HANGER SPACING IN TABLE 4 OF "ANSI/MSS SP-58-2018: PIPE HANGERS AND SUPPORTS – MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION AND INSTALLATION" (MSS SP-58-2009). THE CAPACITY OF THE SCHEDULE 7 PIPE IS COMPARED TO THE CAPACITY OF THE SCHEDULE 10 PIPES. THE SCHEDULE 7 HANGER SPACING CORRESPONDS TO THE SCHEDULE 10 PIPE THAT HAS A LOWER CAPACITY THAN THE SCHEDULE 7 PIPE. MAX DISTANCE IS NOT TO EXCEED 12FT PER 2019 CA PLUMBING CODE, TABLE 313.3.
4. $r = \text{sqrt}\ [(OD)^2 + (OD - 2*t_{design})^2]/4$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
5. PIPES MODELED AS PIN-PIN. THE FLEXURAL DEMAND EQUATION USED IS: $M = wL^2/8$. MAX TRANSVERSE SPACING INCLUDES EFFECTS OF BI-AXIAL BENDING FROM BOTH VERT & HORIZ LOADS. PER OSHPD, THE ALLOWABLE DEFLECTION IS LIMITED TO THE LESSER OF L/60 OR 6".
6. FOR SEISMIC DESIGN FORCE, "Fp" BTW TABULATED VALUES, LINEAR INTERPOLATION IS PERMITTED.
7. REFER TO ASCE 7-16, SECTION 13.6.7

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STATE OF CALIFORNIA

SHEET TITLE: PIPE TRANSVERSE BRACE SPACING TABLES
STEEL PIPE SCHEDULE LW (LIGHT-WALL SCHEDULE)

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PIPE TRANSVERSE BRACE SPACING TABLES

MAX LOAD TO EACH TRANSVERSE BRACE AT ASD LEVEL OF DESIGN

Schedule 10 Steel Pipe

ASTM A53, TYPE E, GRADE A

Fy = 30 ksi			Fy Reduction[7] = 0.9			Insulated Water-Filled Pipe Wt	L_v = Hanger Spacing[3]	Max Transverse Spacing per Seismic Design Force "F_p" (ft)[5],[6]			
								0.5	0.75	1	1.25
								Corresp. Vert. Seismic Effect, "Ev"			
Pipe[1] (in)	OD[1] (in)	t_{nom}[1] (in)	S[2] (in^3)	r[4] (in)	M_{cap} (ft-lb)	(plf)	(ft)	0.1	0.15	0.2	0.25
1	1.315	0.109	0.11	0.18	171	2.5	7	24	21	19	18
1 1/4	1.660	0.109	0.18	0.21	287	3.3	7	29	25	23	20
1 1/2	1.900	0.109	0.24	0.22	384	3.9	9	31	27	23	21
2	2.375	0.109	0.39	0.25	621	5.2	10	34	30	26	23
2 1/2	2.875	0.120	0.64	0.29	1013	7.1	11	38	33	28	25
3	3.500	0.120	0.98	0.32	1533	9.2	12	41	36	31	27
4	4.500	0.120	1.65	0.36	2589	13.6	12	46	38	33	30
5	5.563	0.134	2.83	0.43	4451	20.2	12	50	42	36	32
6	6.625	0.134	4.06	0.47	6381	26.3	12	53	44	38	34
8	8.625	0.188*	9.61	0.63	15107	41.1	12	63	56	48	43
10	10.75	0.188*	15.1	0.70	23753	57.9	12	67	59	51	45
12	12.75	0.330	36.4	1.01	57285	93.6	12	78	71	63	56

1. STL PIPE DIM AS PROVIDED BY ERICO.
2. $S = [\pi (OD)^4 - (OD - 2*t_{design})^4]/32\ (OD)$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
3. MAX DISTANCE BTW HANGERS PER TABLE 4 OF "ANSI/MSS SP-58-2018: PIPE HANGERS AND SUPPORTS – MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION AND INSTALLATION" (MSS SP-58-2009). MAX DISTANCE IS NOT TO EXCEED 12FT PER 2019 CA PLUMBING CODE, TABLE 313.3.
4. $r = \text{sqrt}\ [(OD)^2 + (OD - 2*t_{design})^2]/4$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
5. PIPES MODELED AS PIN-PIN. THE FLEXURAL DEMAND EQUATION USED IS: $M = wL^2/8$. MAX TRANSVERSE SPACING INCLUDES EFFECTS OF BI-AXIAL BENDING FROM BOTH VERT & HORIZ LOADS. PER OSHPD, THE ALLOWABLE DEFLECTION IS LIMITED TO THE LESSER OF L/60 OR 6".
6. FOR SEISMIC DESIGN FORCE, "Fp" BTW TABULATED VALUES, LINEAR INTERPOLATION IS PERMITTED.
7. REFER TO ASCE 7-16, SECTION 13.6.7

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SHEET TITLE: PIPE TRANSVERSE BRACE SPACING TABLES
STEEL PIPE SCHEDULE 10

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SEISMIC BRACING FOR
MEP SYSTEMS

PIPE TRANSVERSE BRACE SPACING TABLES

MAX LOAD TO EACH TRANSVERSE BRACE AT ASD LEVEL OF DESIGN

Schedule 40 Steel Pipe

ASTM A53, TYPE E, GRADE A

Fy = 30 ksi				Fy Reduction[7] = 0.9				Max Transverse Spacing per Seismic Design Force "F_p" (ft)[5],[6]			
Pipe[1]	OD[1]	t_{nom}[1]	S[2]	r[4]	M_{cap}	Insulated Water-Filled Pipe Wt	L_v = Hanger Spacing[3]	0.5	0.75	1	1.25
								Corresp. Vert. Seismic Effect, "Ev"			
(in)	(in)	(in)	(in^3)	(in)	(ft-lb)	(plf)	(ft)	0.1	0.15	0.2	0.25
1	1.315	0.133	0.13	0.20	331	2.8	7	24	21	19	18
1 1/4	1.660	0.140	0.22	0.23	583	3.8	7	29	25	23	21
1 1/2	1.900	0.145	0.31	0.25	809	4.5	9	32	28	25	22
2	2.375	0.154	0.53	0.29	1388	6.2	10	35	32	28	25
2 1/2	2.875	0.203	1.00	0.37	2637	9.1	11	40	36	32	28
3	3.500	0.216	1.62	0.42	4265	12.1	12	44	40	35	31
4	4.500	0.237	3.02	0.50	7936	18.3	12	49	44	40	35
5	5.563	0.258	5.12	0.58	13439	26.6	12	54	49	43	38
6	6.625	0.280	7.97	0.67	20927	34.8	12	59	53	47	42
8	8.625	0.322	15.8	0.82	41362	55.1	12	67	60	53	48
10	10.75	0.365	28.0	0.97	73531	74.7	12	74	67	62	55
12	12.75	0.406	44.1	1.12	115741	102.1	12	80	73	66	59

1. STL PIPE DIM AS PROVIDED BY ERICO.
2. $S= [\pi (OD)^4-(OD-2*t_{design})^4]/32\ (OD)$ WHERE t_{design} = 0.93 t_{nom} (PER AISC 360).
3. MAX DISTANCE BTW HANGERS PER TABLE 4 OF "ANSI/MSS SP-58-2018: PIPE HANGERS AND SUPPORTS – MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION AND INSTALLATION" (MSS SP-58-2009). MAX DISTANCE IS NOT TO EXCEED 12FT PER 2019 CA PLUMBING CODE, TABLE 313.3.
4. $r= \text{sqrt}\ [(OD)^2+(OD-2*t_{design})^2]/4$ WHERE t_{design} = 0.93 t_{nom} (PER AISC 360).
5. PIPES MODELED AS PIN-PIN. THE FLEXURAL DEMAND EQUATION USED IS: $M= wL^2/8$. MAX TRANSVERSE SPACING INCLUDES EFFECTS OF BI-AXIAL BENDING FROM BOTH VERT & HORIZ LOADS. PER OSHPD, THE ALLOWABLE DEFLECTION IS LIMITED TO THE LESSER OF L/60 OR 6".
6. FOR SEISMIC DESIGN FORCE, "Fp" BTW TABULATED VALUES, LINEAR INTERPOLATION IS PERMITTED.
7. REFER TO ASCE 7-16, SECTION 13.6.7

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SHEET TITLE: PIPE TRANSVERSE BRACE SPACING TABLES
STEEL PIPE SCHEDULE 40

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PIPE TRANSVERSE BRACE SPACING TABLES

MAX LOAD TO EACH TRANSVERSE BRACE AT ASD LEVEL OF DESIGN

Drawn Copper Tube: Type K Soldered. Fy = 30ksi

Fy = 30 ksi			Fy Reduction[6] = 0.9			Insulated Water-Filled Pipe Wt	L_v = Hanger Spacing[3]	Max Transverse Spacing per Seismic Design Force "F_p" (ft)[5]			
Pipe Size[1]	OD[1]	t_{nom}[1]	S[2]	r[4]	M_{cap}			0.5	0.75	1	1.25
								Corresp. Vert. Seismic Effect, "Ev"			
(in)	(in)	(in)	(in^3)	(in)	(ft-lb)	(plf)	(ft)	0.1	0.15	0.2	0.25
3/4	0.875	0.065	0.03	0.11	40	1.4	5	14	12	11	10
1	1.125	0.065	0.05	0.13	69	1.9	6	17	14	13	12
1 1/4	1.375	0.065	0.08	0.15	106	2.4	6	19	16	15	14
1 1/2	1.625	0.072	0.12	0.17	165	3.0	6	22	19	17	16
2	2.125	0.083	0.25	0.21	331	4.4	8	26	23	21	19
2 1/2	2.625	0.095	0.43	0.25	582	6.1	9	30	27	24	22
3	3.125	0.109	0.71	0.29	950	8.2	10	33	30	27	25
3 1/2	3.625	0.120	1.05	0.32	1414	10.5	10	36	32	30	27
4	4.125	0.134	1.52	0.37	2049	13.4	10	38	35	32	29
5	5.125	0.160	2.81	0.45	3789	20.4	10	42	38	36	32
6	6.125	0.192	4.82	0.53	6492	28.4	10	47	42	39	36
8	8.125	0.271	11.90	0.73	16034	49.6	10	55	50	46	44
10	10.125	0.338	23.05	0.91	31053	75.9	10	62	56	52	49
12	12.125	0.405	39.60	1.09	53357	107.4	10	68	61	57	54

1. COPPER PIPE DIM PER COPPER DEVELOPMENT ASSOCIATION, INC.
2. $S = [\pi (OD)^4 - (OD - 2*t_{design})^4]/32\ (OD)$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
3. MAX DISTANCE BTW HANGERS PER TABLE 4 OF "ANSI/MSS SP-58-2018: PIPE HANGERS AND SUPPORTS – MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION AND INSTALLATION" (MSS SP-58-2009). MAX DISTANCE IS NOT TO EXCEED 6'-0" FOR 1½" DIA PIPE & SMALLER AND MAX DISTANCE IS NOT TO EXCEED 10'-0" FOR 2" DIA PIPE OR LARGER PER CA PLUMBING CODE, TABLE 313.3.
4. $r = \text{sqrt}\ [(OD)^2 + (OD - 2 * t_{design})^2\ ]/4$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
5. PIPES MODELED AS PIN-PIN. THE FLEXURAL DEMAND EQUATION USED IS: $M = wL^2/8$. MAX TRANSVERSE SPACING INCLUDES EFFECTS OF BI-AXIAL BENDING FROM BOTH VERT & HORIZ LOADS. PER OSHPD, THE ALLOWABLE DEFLECTION IS LIMITED TO THE LESSER OF L/60 OR 6".
6. REFER TO ASCE 7-16, SECTION 13.6.7

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SHEET TITLE: PIPE TRANSVERSE BRACE SPACING TABLES
COPPER PIPE TYPE K DRAWN W/ SOLDERED JOINTS

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PIPE TRANSVERSE BRACE SPACING TABLES

MAX LOAD TO EACH TRANSVERSE BRACE AT ASD LEVEL OF DESIGN

Copper Tube: Type K Annealed. Fy = 9ksi

Fy = 9 ksi			Fy Reduction[6] = 0.9			Insulated Water-Filled Pipe Wt	L_v = Hanger Spacing[3]	Max Transverse Spacing per Seismic Design Force "F_p" (ft)[5]			
Pipe [1]	OD [1]	t_{nom} [1]	S [2]	r [4]	M_{cap}			0.5	0.75	1	1.25
								Corresp. Vert. Seismic Effect, "Ev"			
(in)	(in)	(in)	(in^3)	(in)	(ft-lb)	(plf)	(ft)	0.1	0.15	0.2	0.25
3/4	0.875	0.065	0.03	0.11	12	1.4	5	8	7	6	5
1	1.125	0.065	0.05	0.13	21	1.9	6	9	7	6	5
1 1/4	1.375	0.065	0.08	0.15	32	2.4	6	11	9	8	7
1 1/2	1.625	0.072	0.12	0.17	50	3.0	6	13	10	9	8
2	2.125	0.083	0.25	0.21	99	4.4	8	14	12	10	9
2 1/2	2.625	0.095	0.43	0.25	175	6.1	9	16	13	11	10
3 1/2	3.625	0.120	1.05	0.32	424	10.5	10	20	16	14	12
4	4.125	0.134	1.52	0.37	615	13.4	10	22	18	15	13
5	5.125	0.160	2.81	0.45	1137	20.4	10	25	20	18	16
6	6.125	0.192	4.82	0.53	1948	28.4	10	29	24	20	18
8	8.125	0.271	11.90	0.73	4810	49.6	10	36	29	25	22
10	10.125	0.338	23.05	0.91	9316	75.9	10	41	34	29	26
12	12.125	0.405	39.60	1.09	16007	107.4	10	46	37	32	29

1. COPPER PIPE DIM PER COPPER DEVELOPMENT ASSOCIATION, INC.
2. $S = [\pi (OD)^4 - (OD - 2*t_{design})^4]/32\ (OD)$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
3. MAX DISTANCE BTW HANGERS PER TABLE 4 OF "ANSI/MSS SP-58-2018: PIPE HANGERS AND SUPPORTS – MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION AND INSTALLATION" (MSS SP-58-2009). MAX DISTANCE IS NOT TO EXCEED 6'-0" FOR 1½" DIA PIPE & SMALLER AND MAX DISTANCE IS NOT TO EXCEED 10'-0" FOR 2" DIA PIPE OR LARGER PER CA PLUMBING CODE, TABLE 313.3.
4. $r = \text{sqrt}\ [(OD)^2 + (OD - 2 * t_{design})^2\ ]/4$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
5. PIPES MODELED AS PIN-PIN. THE FLEXURAL DEMAND EQUATION USED IS: $M = wL^2/8$. MAX TRANSVERSE SPACING INCLUDES EFFECTS OF BI-AXIAL BENDING FROM BOTH VERT & HORIZ LOADS. PER OSHPD, THE ALLOWABLE DEFLECTION IS LIMITED TO THE LESSER OF L/60 OR 6".
6. REFER TO ASCE 7-16, SECTION 13.6.7

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SHEET TITLE: PIPE TRANSVERSE BRACE SPACING TABLES
COPPER PIPE TYPE K ANNEALED

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PIPE TRANSVERSE BRACE SPACING TABLES

MAX LOAD TO EACH TRANSVERSE BRACE AT ASD LEVEL OF DESIGN

Drawn Copper Tube: Type L Soldered. Fy = 30ksi

Fy = 30 ksi			Fy Reduction[6] = 0.9			Insulated Water-Filled Pipe Wt	L_v = Hanger Spacing[3]	Max Transverse Spacing per Seismic Design Force "F_p" (ft)[5]			
Pipe [1]	OD [1]	t_{nom} [1]	S [2]	r [4]	M_{cap}			0.5	0.75	1	1.25
								Corresp. Vert. Seismic Effect, "Ev"			
(in)	(in)	(in)	(in^3)	(in)	(ft-lb)	(plf)	(ft)	0.1	0.15	0.2	0.25
3/4	0.875	0.045	0.02	0.10	9	1.3	5	13	11	10	9
1	1.125	0.050	0.04	0.12	16	1.7	6	16	14	12	11
1 1/4	1.375	0.055	0.07	0.13	27	2.2	6	18	16	14	13
1 1/2	1.625	0.060	0.10	0.15	42	2.8	6	21	18	16	15
2	2.125	0.070	0.21	0.19	85	4.1	8	26	22	20	19
2 1/2	2.625	0.080	0.37	0.23	149	5.7	9	30	26	23	21
3 1/2	3.625	0.100	0.89	0.30	359	9.8	10	35	32	29	26
4	4.125	0.110	1.27	0.33	513	12.4	10	37	34	31	28
5	5.125	0.125	2.24	0.40	905	18.6	10	41	37	34	30
6	6.125	0.140	3.60	0.46	1454	25.1	10	45	41	37	33
8	8.125	0.200	9.00	0.63	3638	43.7	10	53	48	44	40
10	10.125	0.250	17.47	0.79	7061	66.8	10	59	54	50	46
12	12.125	0.280	28.18	0.91	11392	91.9	10	65	58	54	50

1. COPPER PIPE DIM PER COPPER DEVELOPMENT ASSOCIATION, INC.
2. $S = [\pi (OD)^4 - (OD - 2*t_{design})^4]/32\ (OD)$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
3. MAX DISTANCE BTW HANGERS PER TABLE 4 OF "ANSI/MSS SP-58-2018: PIPE HANGERS AND SUPPORTS – MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION AND INSTALLATION" (MSS SP-58-2009). MAX DISTANCE IS NOT TO EXCEED 6'-0" FOR 1½" DIA PIPE & SMALLER AND MAX DISTANCE IS NOT TO EXCEED 10'-0" FOR 2" DIA PIPE OR LARGER PER CA PLUMBING CODE, TABLE 313.3.
4. $r = \text{sqrt}\ [(OD)^2 + (OD - 2 * t_{design})^2\ ]/4$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
5. PIPES MODELED AS PIN-PIN. THE FLEXURAL DEMAND EQUATION USED IS: $M = wL^2/8$. MAX TRANSVERSE SPACING INCLUDES EFFECTS OF BI-AXIAL BENDING FROM BOTH VERT & HORIZ LOADS. PER OSHPD, THE ALLOWABLE DEFLECTION IS LIMITED TO THE LESSER OF L/60 OR 6".
6. REFER TO ASCE 7-16, SECTION 13.6.7

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SHEET TITLE: PIPE TRANSVERSE BRACE SPACING TABLES
COPPER PIPE TYPE L DRAWN W/ SOLDERED JOINTS

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PIPE TRANSVERSE BRACE SPACING TABLES

MAX LOAD TO EACH TRANSVERSE BRACE AT ASD LEVEL OF DESIGN

Copper Tube: Type L Annealed. Fy = 9ksi

Fy =	9 ksi		Fy Reduction[6] =	0.9		Insulated Water-Filled Pipe Wt	L_v = Hanger Spacing[3]	Max Transverse Spacing per Seismic Design Force "F_p" (ft)[5]			
Pipe [1]	OD [1]	t_{nom} [1]	S [2]	r [4]	M_{cap}			0.5	0.75	1	1.25
								Corresp. Vert. Seismic Effect, "Ev"			
(in)	(in)	(in)	(in^3)	(in)	(ft-lb)	(plf)	(ft)	0.1	0.15	0.2	0.25
3/4	0.875	0.045	0.02	0.10	9	1.3	5	7	5	5	4
1	1.125	0.050	0.04	0.12	16	1.7	6	8	6	5	5
1 1/4	1.375	0.055	0.07	0.13	27	2.2	6	10	8	7	6
1 1/2	1.625	0.060	0.10	0.15	42	2.8	6	12	10	8	7
2	2.125	0.070	0.21	0.19	85	4.1	8	13	11	9	8
2 1/2	2.625	0.080	0.37	0.23	149	5.7	9	15	12	10	9
3	3.125	0.090	0.59	0.26	239	7.6	10	16	13	11	10
3 1/2	3.625	0.100	0.89	0.30	359	9.8	10	19	15	13	11
4	4.125	0.110	1.27	0.33	513	12.4	10	21	16	14	12
5	5.125	0.125	2.24	0.40	905	18.6	10	23	19	16	14
6	6.125	0.140	3.60	0.46	1454	25.1	10	26	21	18	16
8	8.125	0.200	9.00	0.63	3638	43.7	10	33	27	23	20
10	10.125	0.250	17.47	0.79	7061	66.8	10	38	31	26	24
12	12.125	0.280	28.18	0.91	11392	91.9	10	41	34	29	26

1. COPPER PIPE DIM PER COPPER DEVELOPMENT ASSOCIATION, INC.
2. $S = [\pi (OD)^4 - (OD - 2*t_{design})^4]/32\ (OD)$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
3. MAX DISTANCE BTW HANGERS PER TABLE 4 OF "ANSI/MSS SP-58-2018: PIPE HANGERS AND SUPPORTS – MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION AND INSTALLATION" (MSS SP-58-2009). MAX DISTANCE IS NOT TO EXCEED 6'-0" FOR 1½" DIA PIPE & SMALLER AND MAX DISTANCE IS NOT TO EXCEED 10'-0" FOR 2" DIA PIPE OR LARGER PER CA PLUMBING CODE, TABLE 313.3.
4. $r = \text{sqrt}\ [(OD)^2 + (OD - 2 * t_{design})^2\ ]/4$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
5. PIPES MODELED AS PIN-PIN. THE FLEXURAL DEMAND EQUATION USED IS: $M = wL^2/8$. MAX TRANSVERSE SPACING INCLUDES EFFECTS OF BI-AXIAL BENDING FROM BOTH VERT & HORIZ LOADS. PER OSHPD, THE ALLOWABLE DEFLECTION IS LIMITED TO THE LESSER OF L/60 OR 6".
6. REFER TO ASCE 7-16, SECTION 13.6.7

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SHEET TITLE: PIPE TRANSVERSE BRACE SPACING TABLES
COPPER PIPE TYPE L ANNEALED

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PIPE TRANSVERSE BRACE SPACING TABLES

MAX LOAD TO EACH TRANSVERSE BRACE AT ASD LEVEL OF DESIGN

Cast Iron Pipe. Fy = 17.85ksi

ASTM A808

Fy = 17.85 ksi			Fy Reduction[6] = 0.1								
Pipe Size	OD	t_{nom}	S [1]	r [3]	M_{cap}	Water-Filled Pipe Wt	L_v = Hanger Spacing[2]	Max Transverse Spacing per Seismic Design Force "F_p" (ft)[4]			
								0.5	0.75	1	1.25
								Corresp. Vert. Seismic Effect, "Ev"			
(in)	(in)	(in)	(in^3)	(in)	(ft-lb)	(plf)	(ft)	0.1	0.15	0.2	0.25
1 1/2	1.900	0.160	0.33	0.26	30	3.3	8	NP	NP	NP	NP
2	2.350	0.160	0.53	0.30	47	5.0	8	3	1	NP	NP
3	3.350	0.160	1.15	0.36	102	8.3	8	7	5	4	3
4	4.380	0.190	2.36	0.45	210	12.8	8	10	8	7	6
5	5.300	0.190	3.53	0.49	314	17.6	8	12	9	8	7
6	6.300	0.190	5.06	0.54	451	22.9	8	13	10	8	7
8	8.380	0.230	10.92	0.68	973	39.3	8	15	12	11	9
10	10.560	0.280	21.17	0.85	1886	59.8	8	19	15	13	11
12	12.500	0.280	30.01	0.92	2673	81.0	8	19	15	13	12

1. CAST IRON PIPE DIM PER ASTM A888.
2. $S = [\pi (OD)^4 - (OD - 2*t_{design})^4]/32\ (OD)$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
3. MAX DISTANCE BTW HANGERS PER TABLE 4 OF "ANSI/MSS SP-58-2018: PIPE HANGERS AND SUPPORTS – MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION AND INSTALLATION" (MSS SP-58-2009). MAX DISTANCE IS NOT TO EXCEED 6'-0" FOR 1½" DIA PIPE & SMALLER AND MAX DISTANCE IS NOT TO EXCEED 10'-0" FOR 2" DIA PIPE OR LARGER PER CA PLUMBING CODE, TABLE 313.3.
4. $r = \text{sqrt}\ [(OD)^2 + (OD - 2 * t_{design})^2\ ]/4$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
5. PIPES MODELED AS PIN-PIN. THE FLEXURAL DEMAND EQUATION USED IS: $M = wL^2/8$. MAX TRANSVERSE SPACING INCLUDES EFFECTS OF BI-AXIAL BENDING FROM BOTH VERT & HORIZ LOADS. PER OSHPD, THE ALLOWABLE DEFLECTION IS LIMITED TO THE LESSER OF L/60 OR 6".
6. REFER TO ASCE 7-16, SECTION 13.6.7

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SHEET TITLE: PIPE TRANSVERSE BRACE SPACING TABLES
CAST IRON PIPE - NO HUB

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ELECTRICAL CONDUIT TRANSVERSE BRACE SPACING TABLES

MAX LOAD TO EACH TRANSVERSE BRACE AT ASD LEVEL OF DESIGN

Rigid Metal Conduit (RMC)

Fy = 30 ksi				Fy Reduction[7] = 0.7		Cable-Filled Pipe Wt	L_v = Hanger Spacing[3]	Max Transverse Spacing per Seismic Design Force "F_p" (ft)[5]			
Pipe Size[1]	OD[1]	t_{nom}[1]	S[2]	r[4]	M_{cap}			0.5	0.75	1	1.25
								Corresp. Vert. Seismic Effect, "Ev"			
(in)	(in)	(in)	(in^3)	(in)	(ft-lb)	(plf)	(ft)	0.1	0.15	0.2	0.25
1/2	0.840	0.109	0.04	0.26	41	1.2	7	19	17	14	13
3/4	1.050	0.113	0.07	0.33	70	1.8	7	21	18	15	14
1	1.315	0.133	0.13	0.42	132	2.6	7	25	21	18	16
1 1/4	1.660	0.140	0.22	0.54	233	3.4	7	30	25	22	19
1 1/2	1.900	0.145	0.31	0.62	323	4.4	9	31	25	22	19
2	2.375	0.154	0.53	0.79	554	6.5	10	33	27	23	21
2 1/2	2.875	0.203	1.00	0.95	1053	9.9	11	37	30	26	23
3	3.500	0.216	1.62	1.16	1702	13.7	12	40	33	28	25
3 1/2	4.000	0.226	2.25	1.34	2361	17.4	13	42	34	29	26
4	4.500	0.237	3.02	1.51	3168	21.6	14	43	35	30	27

1. CONDUIT DIM PER WESTERN TUBE.
2. $S = [\pi (OD)^4 - (OD - 2*t_{design})^4]/32\ (OD)$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
3. MAX DISTANCE BTW HANGERS IS BASED ON STD WT STL PIPE HANGER SPACING IN TABLE 4 OF "ANSI/MSS SP-58-2018: PIPE HANGERS AND SUPPORTS - MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION AND INSTALLATION" (MSS SP-58-2009).
4. $r = \text{sqrt}\ [(OD)^2 + (OD - 2*t_{design})^2]/4$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
5. PIPES MODELED AS PIN-PIN. THE FLEXURAL DEMAND EQUATION USED IS: $M = wL^2/8$. MAX TRANSVERSE SPACING INCLUDES EFFECTS OF BI-AXIAL BENDING FROM BOTH VERT & HORIZ LOADS. PER OSHPD, THE ALLOWABLE DEFLECTION IS LIMITED TO THE LESSER OF L/60 OR 6".
6. FOR SEISMIC DESIGN FORCE, "Fp" BTW TABULATED VALUES, LINEAR INTERPOLATION IS PERMITTED.
7. REFER TO ASCE 7-16, SECTION 13.6.5.

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SHEET TITLE: ELECTRICAL CONDUIT TRANSVERSE BRACE SPACING TABLES
RIGID METAL CONDUIT (RMC)

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ELECTRICAL CONDUIT TRANSVERSE BRACE SPACING TABLES

MAX LOAD TO EACH TRANSVERSE BRACE AT ASD LEVEL OF DESIGN

Intermediate Metal Conduit (IMC)

Fy = 30 ksi			Fy Reduction[7] = 0.7			Cable-Filled Pipe Wt	L_v = Hanger Spacing[3]	Max Transverse Spacing per Seismic Design Force "F_p" (ft)[5]			
Pipe[1]	OD[1]	t_{nom}[1]	S[2]	r[4]	M_{cap}			0.5	0.75	1	1.25
								Corresp. Vert. Seismic Effect, "Ev"			
(in)	(in)	(in)	(in^3)	(in)	(ft-lb)	(plf)	(ft)	0.1	0.15	0.2	0.25
1/2	0.815	0.070	0.03	0.26	28	1.0	7	18	15	12	11
3/4	1.029	0.075	0.05	0.34	50	1.6	7	20	16	13	12
1	1.290	0.085	0.09	0.43	90	2.2	7	23	19	16	14
1 1/4	1.638	0.085	0.14	0.55	151	2.8	7	27	22	19	17
1 1/2	1.883	0.090	0.20	0.63	214	3.7	9	27	22	19	17
2	2.360	0.095	0.35	0.80	362	5.6	10	28	23	19	17
2 1/2	2.857	0.140	0.73	0.96	762	8.7	11	33	27	23	20
3	3.476	0.140	1.10	1.18	1156	11.9	12	35	28	24	21
3 1/2	3.971	0.140	1.46	1.36	1531	14.9	13	35	28	24	22
4	4.466	0.140*	1.87	1.53	1958	18.5	14	35	28	24	21

1. CONDUIT DIM PER WESTERN TUBE.
2. $S = [\pi (OD)^4 - (OD - 2*t_{design})^4]/32\ (OD)$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
3. MAX DISTANCE BTW HANGERS IS BASED ON STD WT STL PIPE HANGER SPACING IN TABLE 4 OF "ANSI/MSS SP-58-2018: PIPE HANGERS AND SUPPORTS - MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION AND INSTALLATION" (MSS SP-58-2009).
4. $r = \text{sqrt}\ [(OD)^2 + (OD - 2*t_{design})^2]/4$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
5. PIPES MODELED AS PIN-PIN. THE FLEXURAL DEMAND EQUATION USED IS: $M = wL^2/8$. MAX TRANSVERSE SPACING INCLUDES EFFECTS OF BI-AXIAL BENDING FROM BOTH VERT & HORIZ LOADS. PER OSHPD, THE ALLOWABLE DEFLECTION IS LIMITED TO THE LESSER OF L/60 OR 6".
6. FOR SEISMIC DESIGN FORCE, "Fp" BTW TABULATED VALUES, LINEAR INTERPOLATION IS PERMITTED.
7. REFER TO ASCE 7-16, SECTION 13.6.5.

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SHEET TITLE: ELECTRICAL CONDUIT TRANSVERSE BRACE SPACING TABLES
INTERMEDIATE METAL CONDUIT (IMC)

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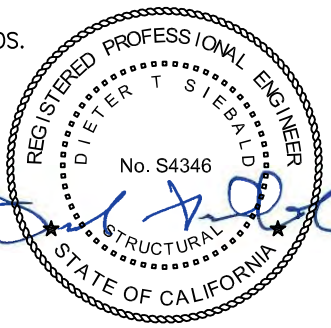
ELECTRICAL CONDUIT TRANSVERSE BRACE SPACING TABLES

MAX LOAD TO EACH TRANSVERSE BRACE AT ASD LEVEL OF DESIGN

Electrical Metal Tubing (EMT)

Fy = 30 ksi			Fy Reduction[7] = 0.7			Cable-Filled Pipe Wt	L_v = Hanger Spacing[3]	Max Transverse Spacing per Seismic Design Force "F_p" (ft)[5]			
Pipe[1]	OD[1]	t_{nom}[1]	S[2]	r[4]	M_{cap}			0.5	0.75	1	1.25
								Corresp. Vert. Seismic Effect, "Ev"			
(in)	(in)	(in)	(in^3)	(in)	(ft-lb)	(plf)	(ft)	0.1	0.15	0.2	0.25
1/2	0.706	0.042	0.01	0.24	14	0.7	7	14	11	10	8
3/4	0.992	0.049	0.03	0.33	32	1.2	7	18	14	12	11
1	1.163	0.057	0.05	0.39	51	1.7	7	19	15	13	12
1 1/4	1.520	0.070	0.10	0.51	109	2.2	7	26	21	18	16
1 1/2	1.740	0.065	0.13	0.59	136	2.9	9	23	19	16	14
2	2.197	0.065	0.21	0.75	221	4.5	10	23	19	16	14
2 1/2	2.875	0.072	0.41	0.99	425	6.5	11	28	22	19	17
3	3.500	0.072	0.61	1.21	637	9.1	12	28	22	19	17
3 1/2	3.834	0.083	0.84	1.33	879	12.1	13	28	22	19	17
4	4.500	0.083	1.2	1.56	1222	15.4	14	28	23	19	17

1. CONDUIT DIM PER WESTERN TUBE.
2. $S = [\pi (OD)^4 - (OD - 2*t_{design})^4]/32\ (OD)$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
3. MAX DISTANCE BTW HANGERS IS BASED ON STD WT STL PIPE HANGER SPACING IN TABLE 4 OF "ANSI/MSS SP-58-2018: PIPE HANGERS AND SUPPORTS - MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION AND INSTALLATION" (MSS SP-58-2009).
4. $r = \text{sqrt}\ [(OD)^2 + (OD - 2*t_{design})^2]/4$ WHERE $t_{design} = 0.93\ t_{nom}$ (PER AISC 360).
5. PIPES MODELED AS PIN-PIN. THE FLEXURAL DEMAND EQUATION USED IS: $M = wL^2/8$. MAX TRANSVERSE SPACING INCLUDES EFFECTS OF BI-AXIAL BENDING FROM BOTH VERT & HORIZ LOADS. PER OSHPD, THE ALLOWABLE DEFLECTION IS LIMITED TO THE LESSER OF L/60 OR 6".
6. FOR SEISMIC DESIGN FORCE, "Fp" BTW TABULATED VALUES, LINEAR INTERPOLATION IS PERMITTED.
7. REFER TO ASCE 7-16, SECTION 13.6.5.
8. COUPLINGS FOR UP TO 2½" EMT TO MEET PROJECT SPECS. HOWEVER, COMPRESSION COUPLINGS OR COUPLINGS W/ MIN 2- SCREWS AT EA END; E.G. CONDUIT CAN BE PUSHED INTO COUPLING APPROX 2" & SET W/ MIN 2- SCREWS, SHALL BE USED FOR 3", 3½" & 4" EMT



SHEET TITLE: ELECTRICAL CONDUIT TRANSVERSE BRACE SPACING TABLES
ELECTRICAL METALLIC TUBING (EMT)

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CABLE TRAY WEIGHT TABLES

MAX WEIGHT AT ASD LEVEL OF DESIGN

Weight of Data Cable Filled Cable Trays

Depth of Tray	Width of Tray						
	6" (PLF)	9" (PLF)	12" (PLF)	18" (PLF)	24" (PLF)	30" (PLF)	36" (PLF)
2"	5.0	7.0	9.0	14.0	17.0	21.0	27.0
3"	7.0	10.0	14.0	21.0	26.0	32.0	41.0
4"	9.0	13.0	18.0	27.0	35.0	43.0	54.0
5"	12.0	17.0	23.0	34.0	43.0	53.0	68.0
6"	14.0	20.0	27.0	41.0	52.0	64.0	81.0

NOTE:
CABLE TRAY MUST BE APPROVED ON A PROJECT SPECIFIC BASIS OR PREAPPROVED BY OSHPD. DO NOT EXCEED SPACING LIMITS SET BY THE MFR. CABLE TRAY SPACING SHALL BE APPROVED OR PREAPPROVED BY OSHPD.

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SHEET TITLE: CABLE TRAY & MECHANICAL DUCTS WEIGHT TABLES
CABLE TRAYS

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RECTANGULAR DUCTS WEIGHT TABLES

MAX WEIGHT AT ASD LEVEL OF DESIGN

Depth (in) \ Width (in)	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70
Wt (plf)																							
6	12.9	13.8	14.4	15.1	15.9	16.8	17.6	18.4	18.6	19.4	20.0	20.8	21.6	22.4	23.1	23.9	24.7	25.4	26.2	27.0	27.7	28.5	29.3
8	13.8	14.6	15.1	15.9	16.8	17.6	18.4	19.1	19.4	20.0	20.8	21.6	22.4	23.1	23.9	24.7	25.5	26.2	27.0	27.7	28.5	29.3	30.0
10	14.6	15.3	15.9	16.8	17.6	18.4	19.1	20.0	20.0	20.8	21.6	22.4	23.1	23.9	24.7	25.5	26.3	27.0	27.7	28.5	29.3	30.0	30.8
12	15.3	16.3	16.8	17.6	18.4	19.1	20.0	20.8	20.8	21.6	22.4	23.1	23.9	24.7	25.5	26.3	27.0	27.7	28.5	29.3	30.0	30.8	31.6
14	16.3	17.0	17.6	18.4	19.1	20.0	20.8	21.6	21.6	22.4	23.1	23.9	24.7	25.5	26.3	27.0	27.8	28.5	29.3	30.0	30.9	31.6	32.3
16	17.0	17.8	18.4	19.1	20.0	20.8	21.6	22.3	22.4	23.1	23.9	24.7	25.5	26.3	27.0	27.8	28.6	29.3	30.0	30.8	31.6	32.3	33.1
18	17.8	18.7	19.1	20.0	20.8	21.6	22.3	23.1	23.1	23.9	24.7	25.5	26.3	27.0	27.8	28.6	29.4	30.0	30.8	31.6	32.3	33.1	33.9
20	18.7	19.4	20.0	20.8	21.6	22.3	23.1	24.0	23.9	24.7	25.5	26.3	27.0	27.8	28.6	29.4	30.2	30.8	31.6	32.3	33.1	33.9	34.7
22	19.4	20.4	20.8	21.6	22.3	23.1	24.0	24.8	24.7	25.5	26.3	27.0	27.8	28.6	29.4	30.2	30.9	31.6	32.3	33.1	33.9	34.7	35.4
24	20.4	21.1	21.6	22.3	23.1	24.0	24.8	25.6	25.5	26.3	27.0	27.8	28.6	29.4	30.2	30.9	31.7	32.3	33.1	33.9	34.7	35.4	36.2
26	21.1	21.9	22.3	23.1	24.0	24.8	25.6	26.3	26.3	27.0	27.8	28.6	29.4	30.2	30.9	31.7	32.4	33.1	33.9	34.7	35.4	36.2	37.0
28		22.8	23.1	24.0	24.8	25.6	26.3	27.1	27.0	27.8	28.6	29.4	30.2	30.9	31.7	32.4	33.2	33.9	34.7	35.4	36.2	37.0	37.7
30			24.0	24.8	25.6	26.3	27.1	28.0	27.8	28.6	29.4	30.2	30.9	31.7	32.4	33.2	33.9	34.7	35.4	36.2	37.0	37.7	38.5
32				25.6	26.3	27.1	28.0	28.8	28.6	29.4	30.2	30.9	31.7	32.4	33.2	33.9	34.7	35.4	36.2	37.0	37.7	38.5	39.3
34					27.1	28.0	28.8	29.5	29.4	30.2	30.9	31.7	32.4	33.2	33.9	34.7	35.5	36.2	37.0	37.7	38.5	39.3	40.0
36						28.8	29.5	30.3	30.2	30.9	31.7	32.4	33.2	33.9	34.7	35.5	36.3	37.0	37.7	38.5	39.3	40.0	40.8
38							30.3	31.2	30.9	31.7	32.4	33.2	33.9	34.7	35.5	36.3	37.1	37.7	38.5	39.3	40.0	40.8	41.6
40								32.0	31.7	32.4	33.2	33.9	34.7	35.5	36.3	37.1	37.8	38.5	39.3	40.0	40.8	41.6	42.4
42									32.4	33.2	33.9	34.7	35.5	36.3	37.1	37.8	38.6	39.3	40.0	40.8	41.6	42.4	43.1
44										33.9	34.7	35.5	36.3	37.1	37.8	38.6	39.4	40.0	40.8	41.6	42.4	43.1	43.9
46											35.5	36.3	37.1	37.8	38.6	39.4	40.2	40.8	41.6	42.4	43.1	43.9	44.7
48												37.1	37.8	38.6	39.4	40.2	41.0	41.6	42.4	43.1	43.9	44.7	45.4
50													38.6	39.4	40.2	41.0	41.7	42.4	43.1	43.9	44.7	45.4	46.2
52														40.2	41.0	41.7	42.5	43.1	43.9	44.7	45.4	46.2	47.0
54															41.7	42.5	43.3	43.9	44.7	45.4	46.2	47.0	47.7
56																43.3	44.1	44.7	45.4	46.2	47.0	47.7	48.5
58																	44.9	45.4	46.2	47.0	47.7	48.5	49.3
60																		46.2	47.0	47.7	48.5	49.3	50.1
62																			47.7	48.5	49.3	50.1	50.8
64																				49.3	50.1	50.8	51.6
66																					50.8	51.6	52.4
68																						52.4	53.1
70																							53.9

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SHEET TITLE: CABLE TRAY & MECHANICAL DUCTS WEIGHT TABLES
RECTANGULAR DUCTS 18 GA

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RECTANGULAR DUCTS WEIGHT TABLES

MAX WEIGHT AT ASD LEVEL OF DESIGN

Rectangular Duct Weights - 20 Gage

Depth (in) \ Width (in)	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58
Wt (plf)																							
10	7.4	8.0	8.7	9.3	9.9	10.6	11.2	11.7	12.3	13.0	13.6	14.2	14.8	15.5	15.4	16.0	16.6	17.2	17.8	18.4	19.0	19.6	20.2
12	8.0	8.7	9.3	9.9	10.6	11.2	11.7	12.4	13.0	13.6	14.2	14.8	15.5	16.0	16.0	16.6	17.2	17.8	18.4	19.0	19.6	20.2	20.8
14	8.7	9.3	9.9	10.6	11.2	11.7	12.4	13.0	13.6	14.2	14.8	15.5	16.0	16.6	16.6	17.2	17.8	18.4	19.0	19.6	20.2	20.8	21.4
16		9.9	10.6	11.2	11.7	12.4	13.0	13.6	14.2	14.8	15.5	16.0	16.6	17.2	17.2	17.8	18.4	19.0	19.6	20.2	20.8	21.4	22.0
18			11.2	11.7	12.4	13.0	13.6	14.3	14.8	15.5	16.0	16.6	17.2	17.8	17.8	18.4	19.0	19.6	20.2	20.8	21.4	22.0	22.6
20				12.4	13.0	13.6	14.3	14.9	15.5	16.0	16.6	17.2	17.8	18.5	18.4	19.0	19.6	20.2	20.8	21.4	22.0	22.6	23.2
22					13.6	14.3	14.9	15.6	16.0	16.6	17.2	17.8	18.5	19.1	19.0	19.6	20.2	20.8	21.4	22.0	22.6	23.2	23.8
24						14.9	15.6	16.2	16.6	17.2	17.8	18.5	19.1	19.7	19.6	20.2	20.8	21.4	22.0	22.6	23.2	23.8	24.4
26							16.2	16.7	17.2	17.8	18.5	19.1	19.7	20.3	20.2	20.8	21.4	22.0	22.6	23.2	23.8	24.4	24.9
28								17.4	17.8	18.5	19.1	19.7	20.3	20.9	20.8	21.4	22.0	22.6	23.2	23.8	24.4	24.9	25.5
30									18.5	19.1	19.7	20.3	20.9	21.6	21.4	22.0	22.6	23.2	23.8	24.4	24.9	25.5	26.1
32										19.7	20.3	20.9	21.6	22.2	22.0	22.6	23.2	23.8	24.4	24.9	25.5	26.1	26.7
34											20.9	21.6	22.2	22.8	22.6	23.2	23.8	24.4	24.9	25.5	26.1	26.7	27.3
36												22.2	22.8	23.4	23.2	23.8	24.4	24.9	25.5	26.1	26.7	27.3	27.9
38													23.4	24.1	23.8	24.4	24.9	25.5	26.1	26.7	27.3	27.9	28.5
40														24.7	24.4	24.9	25.5	26.1	26.7	27.3	27.9	28.5	29.1
42															24.9	25.5	26.1	26.7	27.3	27.9	28.5	29.1	29.7
44																26.1	26.7	27.3	27.9	28.5	29.1	29.7	30.3
46																	27.3	27.9	28.5	29.1	29.7	30.3	30.9
48																		28.5	29.1	29.7	30.3	30.9	31.5
50																			29.7	30.3	30.9	31.5	32.1
52																				30.9	31.5	32.1	32.7
54																					32.1	32.7	33.3
56																						33.3	33.9
58																							34.5

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SHEET TITLE: CABLE TRAY & MECHANICAL DUCTS WEIGHT TABLES
RECTANGULAR DUCTS 20 GA

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ROUND DUCTS WEIGHT TABLES
MAX WEIGHT AT ASD LEVEL OF DESIGN

Round Duct Weights

DIA. (IN)	22 GAGE SEAM GAGE		20 GAGE SEAM GAGE		18 GAGE SEAM GAGE		16 GAGE SEAM GAGE	
	SPIRAL (plf)	LONG. (plf)	SPIRAL (plf)	LONG. (plf)	SPIRAL (plf)	LONG. (plf)	SPIRAL (plf)	LONG. (plf)
14	5.40	5.33	6.40	6.28	8.30	8.19	11.70	10.08
16	6.20	6.07	7.30	7.15	9.40	9.32	13.40	11.47
18	6.90	6.80	8.10	8.01	10.50	10.45	15.00	12.86
20	7.80	7.54	9.00	8.88	11.70	11.58	16.70	14.25
22	8.40	8.28	9.90	9.75	12.90	12.71	18.40	15.84
24	9.50	9.01	11.00	10.83	14.40	13.84	20.00	17.04
26	10.30	9.75	12.20	11.48	15.80	14.97	21.70	18.43
28	11.00	10.49	12.90	12.35	16.50	16.10	23.40	19.82
30	11.80	11.22	13.60	13.22	17.20	17.23	25.00	21.21
32	12.60	11.96	14.60	14.09	18.90	18.36	26.70	22.60
34		12.70		14.95		19.49		24.00
36	14.20	13.43	16.66	15.82	21.50	20.62	30.00	25.38
40	15.50	14.91	18.50	17.56	23.80	22.88	33.40	26.17
44	17.40	16.38	20.50	19.29	26.70	25.15	36.70	30.96
48	18.70	17.85	22.20	21.03	29.20	27.41	40.10	33.74
50	19.50	18.59	23.30	21.89	30.00	28.54	41.70	35.13
46		20.06		23.63		30.80	45.10	37.91
54		20.79		24.50		31.93	46.70	39.31
60		22.27		26.23		34.19	50.10	42.09
72		26.69		31.44		40.98		50.44
84		31.11		36.64		47.76		58.79

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SHEET TITLE: CABLE TRAY & MECHANICAL DUCTS WEIGHT TABLES
ROUND DUCTS

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SEISMIC BRACING DESIGN PROCEDURE FOR 4" DIA SCHEDULE 10 STEEL PIPE:

A. GENERAL

1. THE CALIFORNIA REGISTERED DESIGN PROFESSIONAL (CRDP) REVIEWS SECTION 1 – OVERVIEW & GENERAL NOTES OF THIS OPM.

B. DEMAND

1. THE CRDP DETERMINES THE LATERAL ACCELERATION & VERT ACCELERATION "G" FOR THE SEISMIC FORCES Fp & Fpv USING INFORMATION PROVIDED IN THE PROJECT DOCUMENTS.
   a. **TRANSVERSE, LONGITUDINAL & VERTICAL SEISMIC BRACE DEMANDS ARE PRESENTED IN SECTION B OF THIS DESIGN PROCEDURE. FOR BRACE CAPACITIES & D/C RATIOS SEE SECTION C.**
   b. IN THE EXAMPLE BLW, THE MAX HORIZ & VERT FORCES ON THE BRACES ARE CALCULATED FOR AN ASSUMED SPECIFIC LOCATION THAT HAS AN S_{DS} VALUE OF 1.75 & A z/h RATIO OF ≤ 1.0.

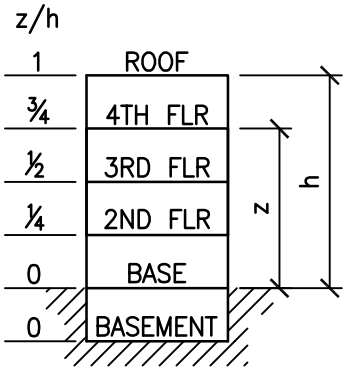
ASCE /SEI 7-16 AS AMENDED BY CBC 2019

SECTION 13.1.3 I_p = 1.5 (SEE CBC 1617A.1.17)

SECTION 13.3.1 SEISMIC DESIGN FORCES AT LRFD, UNO

$$F_p = \frac{0.4 a_p S_{DS} W_p (1+2\,z/h)}{R_p/I_p} = 1.75\,W_p$$

TABLE 13.6-1
- a_p = 2.5 (NOT ASME® B31)
- R_p = 4.5 (NOT ASME B31)
- Ω_o = 2.0 (FOR ANCHORAGE TO CONC, SEE CBC 1617A.1.23)
- S_{DS} = 1.75 (ASSUMED VALUE USED FOR THIS EXAMPLE)
- z = h z/h ≤ 1.0 (ASSUMED)

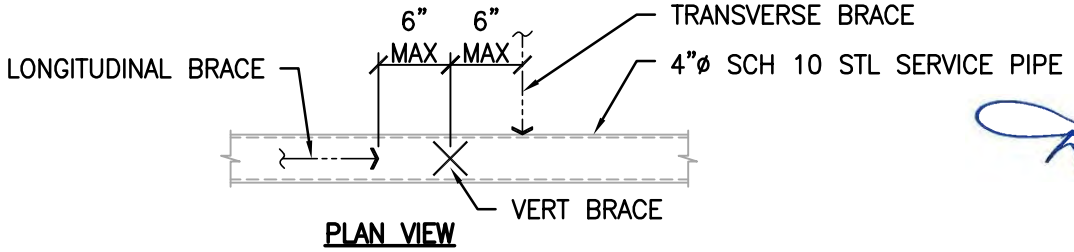


SAMPLE BLDG ELEV

FORCES AT LRFD
- F_p (MAX) = 1.6 S_{DS} I_p W_p = 4.2 W_p
- F_p (MIN) = 0.3 S_{DS} I_p W_p = 0.7875 W_p
- F_p = 1.75 W_p
- Ω_o F_p = 3.5 W_p (FOR LRFD ANCHORAGE TO CONC)
- F_{pv} = 0.20 S_{DS} W_p = 0.35 W_p

FORCES AT ASD
- F_p = 0.7 F_p = 0.7 (1.75 W_p) = 1.225 W_p
- F_{pv} = 0.7 F_{pv} = 0.7 (0.35 W_p) = 0.245 W_p

2. THE CRDP USES THE SECTION 1 DESIGN PARAMETERS & BRACING GUIDELINES TO PREPARE THE MEP LAYOUT DRAWINGS.
3. THE CRDP DETERMINES THE BRACE LOCATIONS & SHOWS THEM ON THE LAYOUT DRAWINGS AND VERIFIES THAT THERE IS A VERTICAL BRACE WITHIN SIX INCHES OF EA TRANSVERSE & LONGITUDUNAL BRACE. ASSUME BRACES ARE LOCATED AS SHOWN BELOW.



PLAN VIEW

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SHEET TITLE: PIPE EXAMPLES OF SEISMIC BRACING DESIGN PROCEDURES
STEEL PIPE SCHEDULE 10, 4" DIA

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PIPE BRACE SPACING:

SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

B. DEMAND (CONTINUED):

4. THE CRDP COMPARES THE BRACE LOCATIONS TO THE ALLOWABLE TRANSVERSE BRACE SPACING SHOWN IN PERMISSIBLE BRACE SPACING TABLES IN SECTION 200 FOR STL SERVICE PIPES. THE SCHEDULE 10 TABLE IS ON PG 200.2. LATERAL TRANSVERSE BRACE SPACING OF 32 FEET FOR THE 4" DIA SCHEDULE 10 INSULATED & WATER FILLED MAIN LINE SERVICE PIPE IS ALLOWED WHEN THE HORIZ FORCE, "Fp", IS LESS THAN 1.25 Wp AT ASD LEVEL OF DESIGN. THE CRDP MAY INTERPOLATE VALUES.
5. THE CRDP MAKES ADJUSTMENTS TO THE LATERAL TRANSVERSE BRACE SPACING ON THE LAYOUT DRAWINGS IF SO REQ.
6. THE CRDP DETERMINES THE OPERATING WT. IN THIS EXAMPLE Wp = 435 LBS. (13.6 PLF x 32 FT)
7a. THE CRDP CALCULATES THE LATERAL FORCE Fp & VERT FORCE Fpv ON THE SEISMIC BRACE USING THE Wp. NOTE THAT IN THE EXAMPLE, IT IS CONSERVATIVELY ASSUMED THAT THE VERT GRAVITY LOAD IS BASED ON THE MAX ALLOWABLE VERT HANGER SPACING OF 12 FT FOR THE MAIN STL SERVICE PIPE LINE PROVIDED IN THE TABLE ON PG 200.2. THIS EXAMPLE IS AT ASD LEVEL OF DESIGN, EXCEPT FOR CONC ATTACHMENT, WHICH IS AT LRFD W/ Ωo.

Wp = 435 LBS

Fp = ±1.225 (435 LBS) = ±533 LBS

Fpv = ±0.245 (13.6 PLF x 12 FT) = ±40 LBS

LRFD:

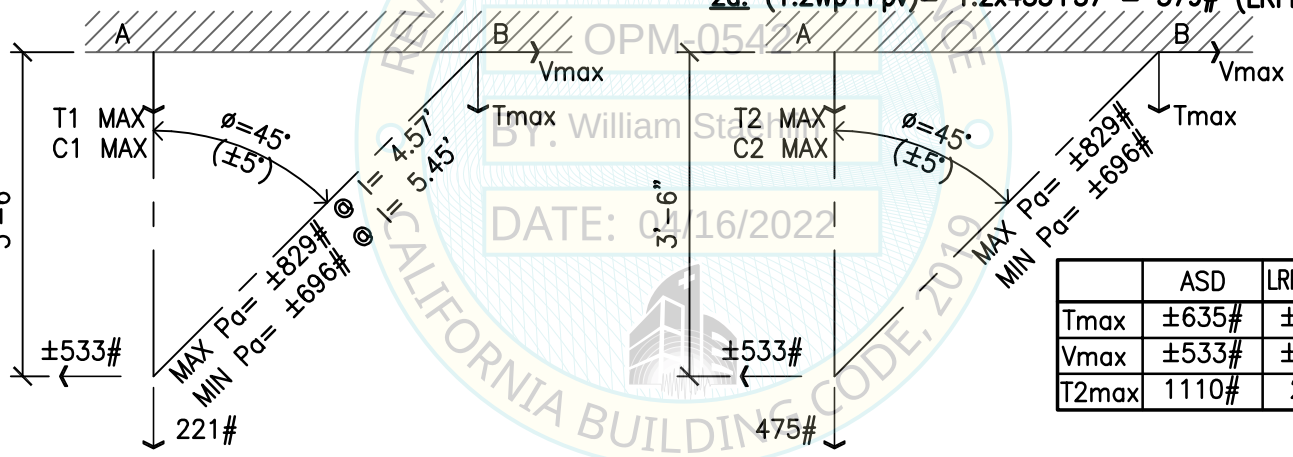
Ωo Fp Wp = ±2x1.75 (435 LBS) = ±1523 LBS

Fpv = ±0.35 (13.6 PLF x 12 FT) = ±57 LBS

7b. TRANSVERSE BRACING

LOAD COMBINATION 1. (0.6Wp−Fpv)= 261−40= 221# **LOAD COMBINATION 2. (Wp+Fpv)= 435+40= 475#**

2a. (1.2Wp+Fpv)= 1.2x435+57 = 579# (LRFD W/ Ωo)



	ASD	LRFD W/ Ωo
Tmax	±635#	±1814#
Vmax	±533#	±1523#
T2max	1110#	2395#

Tmax= $\frac{533\#}{\tan 40°}$ = 635#

T1 MAX= $\frac{533\#}{\tan 40°}$ + 221= 856#

C1 MAX= $\frac{533\#}{\tan 40°}$ − 221= **414#**

T2 MAX= $\frac{533\#}{\tan 40°}$ + 475= **1110#**

C2 MAX= $\frac{533\#}{\tan 40°}$ − 475= 160#

T2 MAX= $\frac{1523\#}{\tan 40°}$ + 579#= 2395# (LRFD W/ Ωo)

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SHEET TITLE: PIPE EXAMPLES OF SEISMIC BRACING DESIGN PROCEDURES
STEEL PIPE SCHEDULE 10, 4" DIA

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PIPE BRACE SPACING:

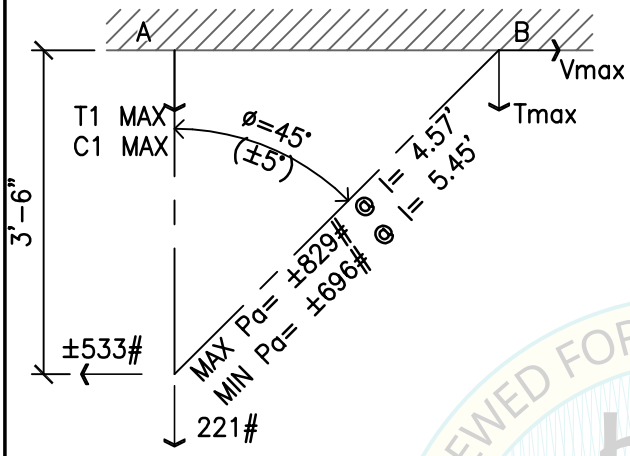
SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

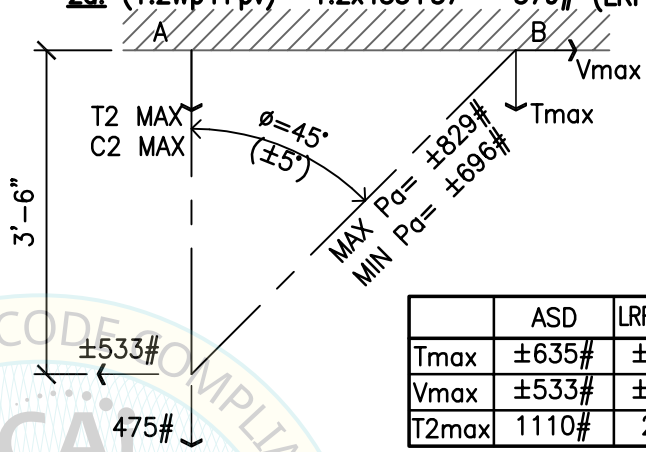
B. DEMAND (CONTINUED):

7c. LONGITUDINAL BRACING (ASSUME SAME SPACING AS TRANSVERSE BRACING)

LOAD COMBINATION 1. (0.6Wp−Fpv)= 261−40= 221# **LOAD COMBINATION 2.** (Wp+Fpv)= 435+40= 475#

2a. (1.2Wp+Fpv)= 1.2x435+57 = 579# (LRFD W/ Ωo)





	ASD	LRFD W/ Ωo
Tmax	±635#	±1814#
Vmax	±533#	±1523#
T2max	1110#	2395#

Tmax= $\frac{533\#}{\tan 40^\circ}$ = 635#

T1 MAX= $\frac{533\#}{\tan 40^\circ}$ + 221= 856#

C1 MAX= $\frac{533\#}{\tan 40^\circ}$ − 221= **414#**

T2 MAX= $\frac{533\#}{\tan 40^\circ}$ + 475= **1110#**

C2 MAX= $\frac{533\#}{\tan 40^\circ}$ − 475= 160#

T2 MAX= $\frac{1523\#}{\tan 40^\circ}$ + 579#= 2395# (LRFD W/ Ωo)

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PIPE BRACE SPACING:

SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

B. DEMAND (CONTINUED):

7d. VERTICAL BRACING

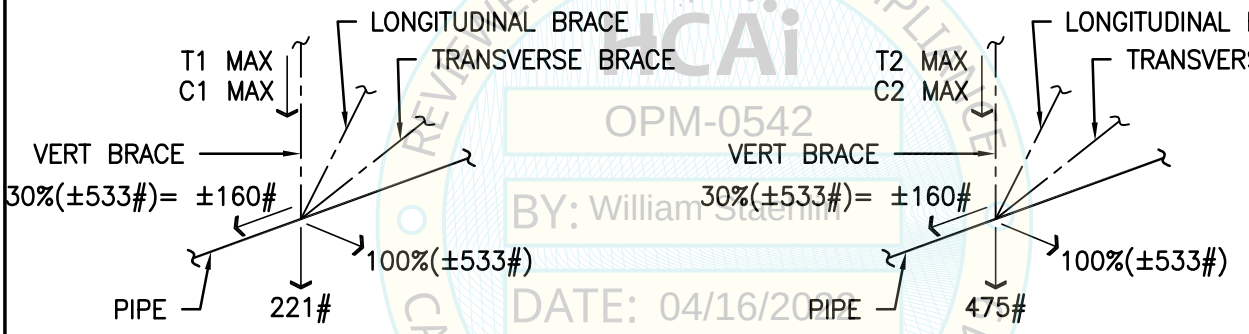
THE COMBINED REACTIONS DUE TO THE SEISMIC FORCES IN THE TRANSVERSE & LONGITUDINAL DIRECTIONS IS SUMMARIZED IN THE TABLE BELOW. THE GOVERNING REACTION SHOWN IS THE MAXIMUM OF THE TWO SCENARIOS WHERE THE SEISMIC LOAD IS:

1. 100% IN THE TRANSVERSE DIRECTION AND 30% IN THE LONGITUDINAL DIRECTION OR
2. 30% IN THE TRANSVERSE DIRECTION AND 100% IN THE LONGITUDINAL DIRECTION

NOTES:

1. SEISMIC LOADING IS THE SAME FOR LONGITUDINAL & TRANSVERSE BRACING SO BOTH SCENERIOS RESULT IN THE SAME REACTIONS. FOR SIMPLICITY'S SAKE, ONLY SCENERIO 1 IS SHOWN BELOW.
2. FOR LENGTH & ANGLE INFO NOT SHOWN, REFER TO SECTIONS 7b & 7c.

LOAD COMBINATION 1. (0.6Wp−Fpv)= 261−40= 221# **LOAD COMBINATION 2.** (Wp+Fpv)= 435+40= 475#
2a. (1.2Wp+Fpv)= 1.2x435+57 = 579# (LRFD W/ Ωo)



T1 MAX= 533#/tan 40° + 0.3(533#)/tan 40° + 221#= 1047#

C1 MAX= 533#/tan 40° + 0.3(533#)/tan 40° − 221#= **605#**

C1 MAX= 1523#/tan 40° + 0.3(1523#)/tan 40° − 579#= 1781# (LRFD W/ Ωo)

T2 MAX= 533#/tan 40° + 0.3(533#)/tan 40° + 475#= **1301#**

C2 MAX= 533#/tan 40° + 0.3(533#)/tan 40° − 475#= 351#

T2 MAX= 1523#/tan 40° + 0.3(1523#)/tan 40° + 579#= 2939# (LRFD W/ Ωo)

	ASD	LRFD W/ Ωo
C1max	±605#	±1781#
T2max	±1301#	±2939#

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SHEET TITLE: PIPE EXAMPLES OF SEISMIC BRACING DESIGN PROCEDURES
STEEL PIPE SCHEDULE 10, 4" DIA

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PIPE BRACE SPACING:

SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

C. CAPACITY

1. THE CRDP CHOOSES APPROPRIATE SEISMIC BRACE SUPPORT ELEMENTS PER SECTIONS 2 THRU 17 OF THIS OPM. FOR THIS EXAMPLE THE ERICO CSBQG SERVICE PIPE CONNECTION IS CHOSEN FOR BOTH THE TRANSVERSE & VERT SEISMIC BRACE SHOWN ON PGS 6.2 & 8.2 RESPECTIVELY. THE CSB SERVICE PIPE CONNECTION IS CHOSEN FOR THE LONGITUDINAL SEISMIC BRACE SHOWN ON PG 7.1.
2. THE CRDP CHOOSES APPROPRIATE SEISMIC ATTACHMENT ELEMENTS TO STRUCTURE AS PER SECTIONS 100 THRU 102 OF THIS OPM. (SEE NOTES c & d BELOW).
3. THE CRDP DETERMINES THE GOVERNING CAPACITY OF THE ASSEMBLED SUPPORTS & ATTACHMENT.
   - a1. TRANSVERSE & VERT BRACE – DETERMINE CAPACITY OF SUPPORT ELEMENT FOR SERVICE PIPE PER TESTED VALUES IN SECTION 500. PER PG 500.3, THE CSBQG CAPACITY FOR A 4" DIA, SCHEDULE 10 SERVICE PIPE IS 890 LBS FOR ANY BRACE ANGLE BTW 30 TO 90 DEGREES. THE CAPACITY IS 1730 LBS AT 90 DEGREES IF USED AS A VERT BRACE. THIS IS HIGHER THAN THE DEMAND & THE CSBQG CAN BE USED AS PART OF THE BRACE ASSEMBLY IN THIS EXAMPLE.
   - a2. LONGITUDINAL BRACE – DETERMINE CAPACITY OF SUPPORT ELEMENT FOR SERVICE PIPE PER TESTED VALUES IN SECTION 500. PER PG 500.2, THE CSB CAPACITY FOR A 4" DIA, SCHEDULE 10 SERVICE PIPE IS 1300 LBS FOR ANY BRACE ANGLE BTW 30 TO 90 DEGREES. THIS IS HIGHER THAN THE DEMAND & THE CSB CAN BE USED AS PART OF THE BRACE ASSEMBLY IN THIS EXAMPLE.
   - b. DETERMINE CAPACITY OF BRACE SUPPORT AS PER CALCULATED ALLOWABLE VALUES IN TABLES PROVIDED IN SECTION 400. FOR THIS EXAMPLE, IT IS ASSUMED THE BRACE PIPE IS NO LONGER THAN 6 FEET. PER PG 400.1, A 1 INCH DIA SCH 40 BRACE PIPE HAS AN AXIAL CAPACITY OF 1850 LBS & CAN BE USED AS PART OF THE TRANSVERSE, LONGITUDINAL & VERT BRACE ASSEMBLIES IN THIS EXAMPLE.
   - c. DETERMINE CAPACITY OF ASSUMED CSBU2 SUPPORT BTW BRACE PIPE & SEISMIC ATTACHMENT ELEMENT (SEE PG 101.9). PER PG 600.1 IN SECTION 600, THE CSBU2 HAS A CAPACITY OF 1110 LBS FOR ANY BRACE ANGLE BTW 30 TO 90 DEGREES.
   - d. DETERMINE CAPACITY OF SEISMIC ATTACHMENT TO SUPPORTING STRUCTURE. PER APPENDIX A, LRFD CAPACITIES FOR VARIOUS CONC ANCHORS HAVE BEEN PROVIDED. FOR THIS EXAMPLE, ASSUME A 6" THK CONC SLAB & f'c= 3000 PSI. CHOOSE 0.75"x3.75" EMBED HILTI KB–TZ2. PER PG A3, TENSION CAPACITY IS 3296# & SHEAR CAPACITY IS 6414# PER ANCHOR BOLT.

   NOTE:
   - THE CONC ANCHOR CAPACITIES WERE CALCULATED ACCORDING TO ACI® 318–14. AS PER SUPPLEMENT #1 OF ASCE/SEI® 7–16, THE OVERSTRENGTH FACTOR Ωo APPLIES TO CONC ANCHORAGE.
4. THE CRDP DETERMINES WHETHER THE DEMAND IN SECTION B, STEPS 1 THROUGH 7 IS LESS THAN THE CAPACITY OF THE ASSEMBLY DETERMINED IN SECTION C, STEPS 1a THROUGH 1d. FOR SUMMARY, SEE TABLE ON NEXT PG WHICH SHOWS ALL D/C RATIOS TO BE ACCEPTABLE.

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SHEET TITLE: PIPE EXAMPLES OF SEISMIC BRACING DESIGN PROCEDURES
STEEL PIPE SCHEDULE 10, 4" DIA

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PIPE BRACE SPACING:

SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

C. CAPACITY (CONTINUED):

5. IF THE D/C RATIOS ARE UNACCEPTABLE, SUCH AS THE BELOW D/C RATIO OF 1.17, THE CRDP DETERMINES VIA DIRECT DEMAND VS CAPACITY RATIO THE APPROXIMATE REVISED ALLOWABLE BRACE SPACING. FOR THIS EXAMPLE, (32 FEET)/(1.17) = 27.3 FEET > 10 FT MIN.

	STEP	COMPONENT	CAPACITY	DEMAND	DEMAND/CAPACITY RATIO	FORCE LEVEL
TRANSVERSE BRACE	a	CSBQG	890	533	0.60	ASD
	b	1" DIA BRACE PIPE	1850	829	0.45	
	c	CSBU2	1110	533	0.48	
	d*	ANCHOR–TENSION	2625	1814	0.69	LRFD, W/ OVERSTRENGTH
		ANCHOR–SHEAR	3572	1523	0.43	
		ANCHOR–COMBINED FORCES	–	–	0.78	
LONGITUDINAL BRACE	a	CSB	1300	533	0.41	ASD
	b	1" DIA BRACE PIPE	1850	829	0.45	
	c	CSBU2	1110	533	0.48	
	d*	ANCHOR–TENSION	2625	1814	0.69	LRFD, W/ OVERSTRENGTH
		ANCHOR–SHEAR	3572	1523	0.43	
		ANCHOR–COMBINED FORCES	–	–	0.78	
VERTICAL BRACE	a	CSBQG	1730	1301	0.75	ASD
	b	1" DIA BRACE PIPE	1850	1301	0.70	
	c	CSBU2	1110	1301	1.17	
	d*	ANCHOR–TENSION	3296	2939	0.89	LRFD, W/ OVERSTRENGTH

* FOR THIS EXAMPLE, IT WAS ASSUMED THAT THERE IS NO PRYING ACTION ON THE ATTACHMENT. IT IS THE RESPONSIBILITY OF THE CDRP TO CHECK FOR PRYING. SEE SECTION B ON PREVIOUS PG FOR DEMAND FORCES. COMBINED ANCHOR RATIO= (TENSION RATIO)$^{5/3}$ + (SHEAR RATIO)$^{5/3}$.

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SEISMIC BRACING DESIGN PROCEDURE FOR 4" DIA COPPER PIPE, TYPE K ANNEALED:

A. GENERAL
1. THE CALIFORNIA REGISTERED DESIGN PROFESSIONAL (CRDP) REVIEWS SECTION 1 – OVERVIEW & GENERAL NOTES OF THIS OPM.

B. DEMAND
1. THE CRDP DETERMINES THE LATERAL ACCELERATION & VERT ACCELERATION "G" FOR THE SEISMIC FORCES Fp & Fpv USING INFORMATION PROVIDED IN THE PROJECT DOCUMENTS.
   a. IN THE EXAMPLE BLW, THE MAX HORIZ & VERT FORCES ON THE BRACES ARE CALCULATED FOR AN ASSUMED SITE SPECIFIC LOCATION THAT HAS AN S_{DS} VALUE OF 1.75 & A z/h RATIO OF < 1.0.
   b. NOTE THAT ONLY TRANSVERSE BRACE DEMAND IS PRESENTED IN THIS DESIGN PROCEDURE. LONGITUDINAL BRACE DEMAND WILL BE SIM & RESULTING VERT SEISMIC FORCES SHALL BE COMBINED ON COMMON VERT BRACE MEMBER.

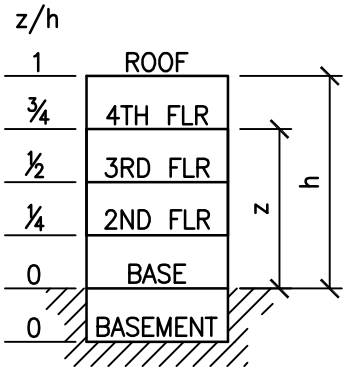
ASCE /SEI 7-16 AS AMENDED BY CBC 2019

SECTION 13.1.3 I_p = 1.5 (SEE CBC 1617A.1.17)

SECTION 13.3.1 SEISMIC DESIGN FORCES AT LRFD, UNO

$$F_p = \frac{0.4 a_p S_{DS} W_p}{R_p/I_p}(1+2\,z/h) = 1.75\,W_p$$

TABLE 13.6-1
a_p = 2.5 (NOT ASME® B31)
R_p = 4.5 (NOT ASME B31)
Ω_o = 2.0 (FOR ANCHORAGE TO CONC, SEE CBC 1617A.1.23)
S_{DS} = 1.75 (ASSUMED VALUE USED FOR THIS EXAMPLE)
z = h z/h ≤ 1.0 (ASSUMED)



SAMPLE BLDG ELEV

FORCES AT LRFD
F_p (MAX) = 1.6 S_{DS} I_p W_p = 4.2 W_p
F_p (MIN) = 0.3 S_{DS} I_p W_p = 0.7875 W_p
F_p = 1.75 W_p
Ω_o F_p = 3.5 W_p (FOR LRFD ANCHORAGE TO CONC)

F_{pv} = 0.20 S_{DS} W_p = 0.35 W_p

FORCES AT ASD
F_p = 0.7 F_p = 0.7 (1.75 W_p) = 1.225 W_p
F_{pv} = 0.7 F_{pv} = 0.7 (0.35 W_p) = 0.245 W_p

2. THE CRDP USES THE SECTION 1 DESIGN PARAMETERS & BRACING GUIDELINES TO PREPARE THE MEP LAYOUT DRAWINGS.
3. THE CRDP DETERMINES THE BRACE LOCATIONS & SHOWS THEM ON THE LAYOUT DRAWINGS.

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SHEET TITLE: PIPE EXAMPLES OF SEISMIC BRACING DESIGN PROCEDURES
COPPER PIPE TYPE K ANNEALED, 4" DIA

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PIPE TRANSVERSE BRACE SPACING:

SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

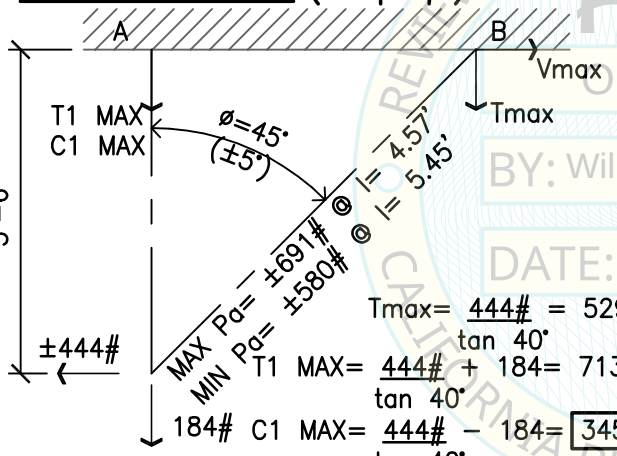
B. DEMAND (CONTINUED):

4. THE CRDP COMPARES THE BRACE LOCATIONS TO THE ALLOWABLE TRANSVERSE BRACE SPACING SHOWN IN PERMISSIBLE BRACE SPACING TABLES IN SECTION 200 FOR COPPER PIPES. THE TYPE K ANNEALED TABLE IS ON PG 200.5. LATERAL TRANSVERSE BRACE SPACING OF 27 FEET FOR THE 4" DIA TYPE K ANNEALED INSULATED & WATER FILLED PIPE IS ALLOWED WHEN THE HORIZ FORCE, "Fp", IS LESS THAN 1.25 Wp AT ASD LEVEL OF DESIGN. THE CRDP MAY INTERPOLATE VALUES.
5. THE CRDP MAKES ADJUSTMENTS TO THE LATERAL TRANSVERSE BRACE SPACING ON THE LAYOUT DRAWINGS IF SO REQ.
6. THE CRDP DETERMINES THE OPERATING WT. IN THIS EXAMPLE Wp = 362 LBS. (13.4 PLFx27 FT)
7. THE CRDP CALCULATES THE LATERAL FORCE Fp & VERT FORCE Fpv ON THE SEISMIC BRACE USING THE Wp PROVIDED BY THE RDP. NOTE THAT IN THE EXAMPLE, IT IS CONSERVATIVELY ASSUMED THAT THE VERT GRAVITY LOAD IS BASED ON THE MAX ALLOWABLE VERT HANGER SPACING OF 10 FT FOR THE MAIN COPPER SERVICE PIPE LINE PROVIDED IN THE TABLE ON PG 200.5. THIS EXAMPLE IS AT ASD LEVEL OF DESIGN, EXCEPT FOR CONC ATTACHMENT, WHICH IS AT LRFD W/ Ωo.

Wp = 362 LBS
Fp = ±1.225 (362 LBS) = ±444 LBS
Fpv = ±0.245 (13.4 PLFx10 FT) = ±33 LBS

LRFD:
Ωo Fp Wp = ±2 (1.75) (362 LBS) = ±1267 LBS

LOAD COMBINATION 1. (0.6Wp−Fpv)= 217−33= 184#

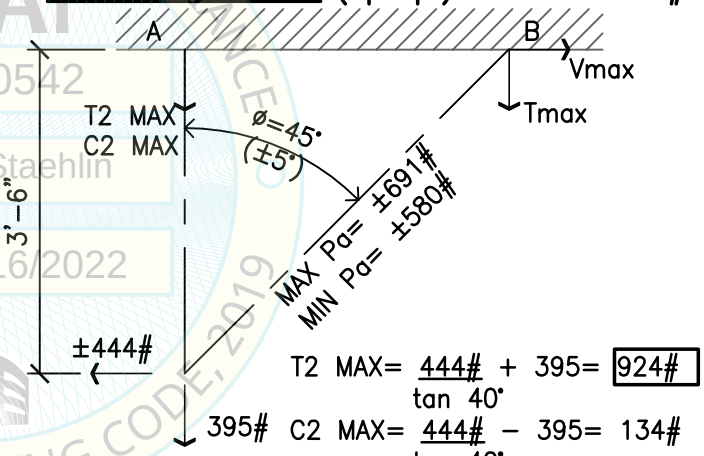


Tmax= 444# / tan 40° = 529#

T1 MAX= 444# / tan 40° + 184= 713#

C1 MAX= 444# / tan 40° − 184= **345#**

LOAD COMBINATION 2. (Wp+Fpv)= 362+33= 395#



T2 MAX= 444# / tan 40° + 395= **924#**

C2 MAX= 444# / tan 40° − 395= 134#

	ASD	LRFD W/ Ωo
Tmax	±529#	±1510#
Vmax	±444#	±1267#

8. THE CRDP VERIFIES THAT THERE IS A VERT SEISMIC BRACE WITHIN SIX INCHES OF EA TRANSVERSE & LONGITUDINAL BRACE.
9. THE CRDP CHOOSES APPROPRIATE SEISMIC BRACE SUPPORT ELEMENTS PER SECTIONS 2 THRU 17 OF THIS OPM. FOR THIS EXAMPLE THE ERICO CSBQG SERVICE PIPE CONNECTION IS CHOSEN FOR BOTH THE TRANSVERSE & VERT SEISMIC BRACE SHOWN ON PGS 6.2 & 8.2 RESPECTIVELY.
10. THE CRDP CHOOSES APPROPRIATE SEISMIC ATTACHMENT ELEMENTS TO STRUCTURE AS PER SECTIONS 100 THRU 105 OF THIS OPM. (SEE SECTION C, NOTES c & d, NEXT PG.

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SHEET TITLE: PIPE EXAMPLES OF SEISMIC BRACING DESIGN PROCEDURES
COPPER PIPE TYPE K ANNEALED, 4" DIA

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PIPE TRANSVERSE BRACE SPACING:

SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

C. CAPACITY

1. THE CRDP DETERMINES THE GOVERNING CAPACITY OF THE ASSEMBLED SUPPORTS & ATTACHMENT.
   a. DETERMINE CAPACITY OF SUPPORT ELEMENT FOR SERVICE PIPE PER TESTED VALUES IN SECTION 500. PER PG 500.3, THE CSBQG CAPACITY FOR A 4" DIA, TYPE K ANNEALED PIPE IS 1190 LBS FOR ANY BRACE ANGLE BTW 30 TO 90 DEGREES. THE CAPACITY IS 2300 LBS AT 90 DEGREES IF USED AS A VERT BRACE. THIS IS HIGHER THAN THE DEMAND & THE CSBQG CAN BE USED AS PART OF THE BRACE ASSEMBLY IN THIS EXAMPLE.
   b. DETERMINE CAPACITY OF BRACE SUPPORT AS PER CALCULATED ALLOWABLE VALUES IN TABLES PROVIDED IN SECTION 400. FOR THIS EXAMPLE, IT IS ASSUMED THE BRACE PIPE IS NO LONGER THAN 6 FEET. PER PG 400.1, A 1 INCH DIA SCH 40 BRACE PIPE HAS AN AXIAL CAPACITY OF 1850 LBS & CAN BE USED AS PART OF THE TRANSVERSE & VERT BRACE ASSEMBLIES IN THIS EXAMPLE.
   c. DETERMINE CAPACITY OF ASSUMED CSBU1 SUPPORT BTW BRACE PIPE & SEISMIC ATTACHMENT ELEMENT. PER PG 600.1 IN SECTION 600, THE CSBU1 HAS A CAPACITY OF 1270 LBS FOR ANY BRACE ANGLE BTW 30 TO 90 DEGREES.
   d. DETERMINE CAPACITY OF SEISMIC ATTACHMENT TO SUPPORTING STRUCTURE. PER APPENDIX A, LRFD CAPACITIES FOR VARIOUS CONC ANCHORS HAVE BEEN PROVIDED. FOR THIS EXAMPLE, ASSUME A 5¾" THK CONC SLAB & f'c= 3000 PSI. CHOOSE 0.5"x3.25" EMBED POWERS POWER-STUD SD2. PER PG A3, TENSION CAPACITY IS 2336# & SHEAR CAPACITY IS 3130#.
   NOTE:
   - THE CONC ANCHOR CAPACITIES WERE CALCULATED ACCORDING TO ACI® 318-14. AS PER SUPPLEMENT #1 OF ASCE/SEI® 7-16, THE OVERSTRENGTH FACTOR Ωo APPLIES TO CONC ANCHORAGE.
2. THE CRDP DETERMINES WHETHER THE DEMAND IN SECTION B, STEPS 1 THROUGH 7 IS LESS THAN THE CAPACITY OF THE ASSEMBLY DETERMINED IN SECTION C, STEPS 1a THROUGH 1d. FOR SUMMARY, SEE TABLE BLW WHICH SHOWS ALL D/C RATIOS TO BE ACCEPTABLE.
3. IF THE D/C RATIOS ARE UNACCEPTABLE, SUCH AS AN ASSUMED D/C RATIO OF 1.08, THE CRDP DETERMINES VIA DIRECT DEMAND VS CAPACITY RATIO THE APPROXIMATE REVISED ALLOWABLE BRACE SPACING. FOR THIS EXAMPLE, (29 FEET)/(1.08) = 26.8 FEET > 10 FEET MIN.

STEP	COMPONENT	CAPACITY	DEMAND	DEMAND/CAPACITY RATIO	FORCE LEVEL
a	CSBQG	1190	444	0.37	ASD
b	1" DIA BRACE PIPE	1850	691	0.37	
c	CSBU1	1270	444	0.35	
d*	ANCHOR-TENSION	2336	1510	0.64	LRFD, W/ OVERSTRENGTH
	ANCHOR-SHEAR	3130	1267	0.40	
	ANCHOR-COMBINED FORCES	–	–	0.69	

* FOR THIS EXAMPLE, IT WAS ASSUMED THAT THERE IS NO PRYING ACTION ON THE ATTACHMENT. IT IS THE RESPONSIBILITY OF THE RDP TO CHECK FOR PRYING. SEE SECTION B ON PREVIOUS PG FOR DEMAND FORCES. COMBINED ANCHOR RATIO= (TENSION RATIO)$^{5/3}$ + (SHEAR RATIO)$^{5/3}$.

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COPPER PIPE TYPE K ANNEALED, 4" DIA

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SEISMIC BRACING DESIGN PROCEDURE FOR 8" DIA CAST IRON PIPE:

A. GENERAL

1. THE CALIFORNIA REGISTERED DESIGN PROFESSIONAL (CRDP) REVIEWS SECTION 1 – OVERVIEW & GENERAL NOTES OF THIS OPM.

B. DEMAND

1. THE CRDP DETERMINES THE LATERAL ACCELERATION & VERT ACCELERATION "G" FOR THE SEISMIC FORCES Fp & Fpv USING INFORMATION PROVIDED IN THE PROJECT DOCUMENTS.
   a. IN THE EXAMPLE BLW, THE MAX HORIZ & VERT FORCES ON THE BRACES ARE CALCULATED FOR AN ASSUMED SITE SPECIFIC LOCATION THAT HAS AN S_{DS} VALUE OF 1.15 & A z/h RATIO OF < 1.0.
   b. NOTE THAT ONLY TRANSVERSE BRACE DEMAND IS PRESENTED IN THIS DESIGN PROCEDURE. LONGITUDINAL BRACE DEMAND WILL BE SIM & RESULTING VERT SEISMIC FORCES SHALL BE COMBINED ON COMMON VERT BRACE MEMBER.

ASCE /SEI 7-16 AS AMENDED BY CBC 2019

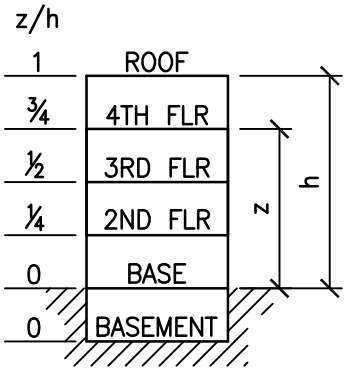
SECTION 13.1.3 — $I_p = 1.5$ (SEE CBC 1617A.1.17)

SECTION 13.3.1 — SEISMIC DESIGN FORCES AT LRFD, UNO

$$F_p = \frac{0.4 a_p S_{DS} W_p}{R_p / I_p} (1 + 2\, z/h) = 0.83\, W_p$$

TABLE 13.6-1

$a_p = 1.0$ (PLUMBING)
$R_p = 2.5$ (PLUMBING)
$\Omega_o = 2.0$ (FOR ANCHORAGE TO CONC, SEE CBC 1617A.1.23)
$S_{DS} = 1.15$ (ASSUMED VALUE USED FOR THIS EXAMPLE)
$z = h$ $z/h \leq 1.0$ (ASSUMED)



SAMPLE BLDG ELEV

FORCES AT LRFD

F_p (MAX) $= 1.6\, S_{DS}\, I_p\, W_p = 2.76\, W_p$
F_p (MIN) $= 0.3\, S_{DS}\, I_p\, W_p = 0.52\, W_p$
$F_p = 0.83\, W_p$
$\Omega_o F_p = 1.66\, W_p$ (FOR LRFD ANCHORAGE TO CONC)

$F_{pv} = 0.20\, S_{DS}\, W_p = 0.23\, W_p$

FORCES AT ASD

$F_p = 0.7\, F_p = 0.7\,(0.83\, W_p) = 0.58\, W_p$
$F_{pv} = 0.7\, F_{pv} = 0.7\,(0.23\, W_p) = 0.161\, W_p$

2. THE CRDP USES THE SECTION 1 DESIGN PARAMETERS & BRACING GUIDELINES TO PREPARE THE MEP LAYOUT DRAWINGS.
3. THE CRDP DETERMINES THE BRACE LOCATIONS & SHOWS THEM ON THE LAYOUT DRAWINGS.

SHEET TITLE: PIPE EXAMPLES OF SEISMIC BRACING DESIGN PROCEDURES
CAST IRON PIPE - NO HUB, 8" DIA

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PIPE TRANSVERSE BRACE SPACING:

SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

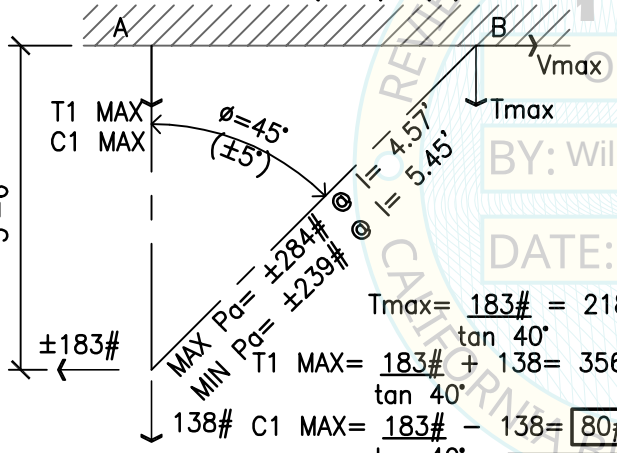
B. DEMAND (CONTINUED):

4. THE CRDP COMPARES THE BRACE LOCATIONS TO THE ALLOWABLE TRANSVERSE BRACE SPACING SHOWN IN PERMISSIBLE BRACE SPACING TABLES IN SECTION 200 FOR CAST IRON PIPES. CAST IRON TABLE IS ON PG 200.8. LATERAL TRANSVERSE BRACE SPACING OF 9 FEET FOR THE 8" DIA WATER FILLED PIPE IS ALLOWED WHEN THE HORIZ FORCE, "Fp", IS LESS THAN 1.25 Wp AT ASD LEVEL OF DESIGN. HOWEVER FOR THIS DESIGN EXAMPLE USE 8 FT TO MATCH MAX ALLOWABLE VERT HANGER SPACING. THE CRDP MAY INTERPOLATE VALUES.
5. THE CRDP MAKES ADJUSTMENTS TO THE LATERAL TRANSVERSE BRACE SPACING ON THE LAYOUT DRAWINGS IF SO REQ.
6. THE CRDP DETERMINES THE OPERATING WT. IN THIS EXAMPLE Wp = 315 LBS. (39.3 PLF x 8 FT)
7. THE CRDP CALCULATES THE LATERAL FORCE Fp & VERT FORCE Fpv ON THE SEISMIC BRACE USING THE Wp PROVIDED BY THE RDP. NOTE THAT IN THE EXAMPLE, IT IS CONSERVATIVELY ASSUMED THAT THE VERT GRAVITY LOAD IS BASED ON THE MAX ALLOWABLE VERT HANGER SPACING AT 8 FT FOR THE CAST IRON PIPE LINE PROVIDED IN THE TABLE ON PG 200.8. THIS EXAMPLE IS AT ASD LEVEL OF DESIGN, EXCEPT FOR CONC ATTACHMENT WHICH IS AT LRFD W/ Ωo.

Wp = 315 LBS
Fp = ±0.58 (315 LBS) = ±183 LBS
Fpv = ±0.161 (315 LBS) = ±51 LBS

LRFD:
Ωo Fp Wp = ±2x0.828 (315 LBS) = ±522 LBS

LOAD COMBINATION 1. (0.6Wp−Fpv)= 189−51= 138#

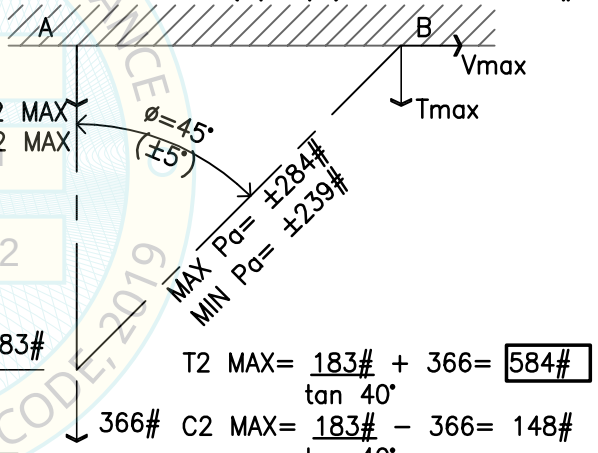


Tmax= 183# / tan 40° = 218#

T1 MAX= 183# / tan 40° + 138 = 356#

C1 MAX= 183# / tan 40° − 138 = **80#**

LOAD COMBINATION 2. (Wp+Fpv)= 315+51= 366#



T2 MAX= 183# / tan 40° + 366 = **584#**

C2 MAX= 183# / tan 40° − 366 = 148#

	ASD	LRFD W/ Ωo
Tmax	±218#	±622#
Vmax	±183#	±522#

8. THE CRDP VERIFIES THAT THERE IS A VERT SEISMIC BRACE WITHIN SIX INCHES OF EA TRANSVERSE & LONGITUDINAL BRACE.
9. THE CRDP CHOOSES APPROPRIATE SEISMIC BRACE SUPPORT ELEMENTS PER SECTIONS 2 THRU 17 OF THIS OPM. FOR THIS EXAMPLE THE ERICO CSBQG SERVICE PIPE CONNECTION IS CHOSEN FOR BOTH THE TRANSVERSE & VERT SEISMIC BRACE SHOWN ON PGS 6.2 & 8.2 RESPECTIVELY.
10. THE CRDP CHOOSES APPROPRIATE SEISMIC ATTACHMENT ELEMENTS TO STRUCTURE AS PER SECTIONS 100 THRU 105 OF THIS OPM. (SEE SECTION c & d, NEXT PG).

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SHEET TITLE: PIPE EXAMPLES OF SEISMIC BRACING DESIGN PROCEDURES
CAST IRON PIPE - NO HUB, 8" DIA

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PIPE TRANSVERSE BRACE SPACING:

SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

C. CAPACITY

1. THE CRDP DETERMINES THE GOVERNING CAPACITY OF THE ASSEMBLED SUPPORTS & ATTACHMENT.
   a. DETERMINE CAPACITY OF SUPPORT ELEMENT FOR CAST IRON PIPE PER TESTED VALUES IN SECTION 500. PER PG 500.3, THE CSBQG (PG 106.21) CAPACITY FOR AN 8" DIA, CAST IRON PIPE IS 590 LBS FOR ANY BRACE ANGLE BTW 30 TO 90 DEGREES. THE CAPACITY IS 1140 LBS AT 90 DEGREES IF USED AS A VERT BRACE. THIS IS HIGHER THAN THE DEMAND & THE CSBQG CAN BE USED AS PART OF THE BRACE ASSEMBLY IN THIS EXAMPLE.
   b. DETERMINE CAPACITY OF BRACE SUPPORT AS PER CALCULATED ALLOWABLE VALUES IN TABLES PROVIDED IN SECTION 400. FOR THIS EXAMPLE, IT IS ASSUMED THE BRACE PIPE IS NO LONGER THAN 6 FEET. PER PG 400.1, A 1 INCH DIA SCH 40 BRACE PIPE HAS AN AXIAL CAPACITY OF 1850 LBS & CAN BE USED AS PART OF THE TRANSVERSE & VERT BRACE ASSEMBLIES IN THIS EXAMPLE.
   c. DETERMINE CAPACITY OF ASSUMED CSBU1 SUPPORT BTW BRACE PIPE & SEISMIC ATTACHMENT ELEMENT. PER PG 600.1 IN SECTION 600, THE CSBU1 HAS A CAPACITY OF 1270 LBS FOR ANY BRACE ANGLE BTW 30 TO 90 DEGREES.
   d. DETERMINE CAPACITY OF SEISMIC ATTACHMENT TO SUPPORTING STRUCTURE. PER APPENDIX A, LRFD CAPACITIES FOR VARIOUS CONC ANCHORS HAVE BEEN PROVIDED. FOR THIS EXAMPLE, ASSUME A 5¾" THK CONC SLAB & f'c= 3000 PSI. CHOOSE 0.5"x3.25" EMBED POWERS POWER-STUD SD2. PER PG A3, TENSION CAPACITY IS 2336# & SHEAR CAPACITY IS 3130#.
   NOTE:
   - THE CONC ANCHOR CAPACITIES WERE CALCULATED ACCORDING TO ACI® 318-14. AS PER SUPPLEMENT #1 OF ASCE/SEI® 7-16, THE OVERSTRENGTH FACTOR Ωo APPLIES TO CONC ANCHORAGE.
2. THE CRDP DETERMINES WHETHER THE DEMAND IN SECTION B, STEPS 1 THROUGH 7 IS LESS THAN THE CAPACITY OF THE ASSEMBLY DETERMINED IN SECTION C, STEPS 1a THROUGH 1d. FOR SUMMARY, SEE TABLE BLW WHICH SHOWS ALL D/C RATIOS TO BE ACCEPTABLE.
3. IF THE D/C RATIOS ARE UNACCEPTABLE, SUCH AS AN ASSUMED D/C RATIO OF 1.1 FOR THE CSBQG, THE CRDP DETERMINES VIA DIRECT DEMAND VS CAPACITY RATIO THE APPROXIMATE REVISED ALLOWABLE BRACE SPACING. FOR THIS EXAMPLE, (8 FEET)/(1.1) = 7.38 FEET. THE CRDP PROCEEDS TO CHECK WHETHER THE D/C RATIO FOR THE CSBQG WILL MEET THE REVISED ALLOWABLE BRACE SPACING.

STEP	COMPONENT	CAPACITY	DEMAND	DEMAND/CAPACITY RATIO	FORCE LEVEL
a	CSBQG	590	183	0.31	ASD
b	1" DIA BRACE PIPE	1850	584	0.32	
c	CSBU1	1270	183	0.14	
d*	ANCHOR-TENSION	2336	622	0.27	LRFD, W/ OVERSTRENGTH
	ANCHOR-SHEAR	3130	522	0.17	
	ANCHOR-COMBINED FORCES	–	–	0.17	

* FOR THIS EXAMPLE, IT WAS ASSUMED THAT THERE IS NO PRYING ACTION ON THE ATTACHMENT. IT IS THE RESPONSIBILITY OF THE RDP TO CHECK FOR PRYING. SEE SECTION B ON PREVIOUS PG FOR DEMAND FORCES. COMBINED ANCHOR RATIO= $(\text{TENSION RATIO})^{5/3} + (\text{SHEAR RATIO})^{5/3}$.

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SHEET TITLE: PIPE EXAMPLES OF SEISMIC BRACING DESIGN PROCEDURES
CAST IRON PIPE - NO HUB, 8" DIA

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SEISMIC BRACING DESIGN PROCEDURE FOR 4" DIA RIGID METAL CONDUIT (RMC):

A. GENERAL

1. THE CALIFORNIA REGISTERED DESIGN PROFESSIONAL (CRDP) REVIEWS SECTION 1 – OVERVIEW & GENERAL NOTES OF THIS OPM.

B. DEMAND

1. THE CRDP DETERMINES THE LATERAL ACCELERATION & VERT ACCELERATION "G" FOR THE SEISMIC FORCES Fp & Fpv USING INFORMATION PROVIDED IN THE PROJECT DOCUMENTS.
   a. IN THE EXAMPLE BLW, THE MAX HORIZ & VERT FORCES ON THE BRACES ARE CALCULATED FOR AN ASSUMED SPECIFIC LOCATION THAT HAS AN S_{DS} VALUE OF 1.75 & A z/h RATIO OF $\leq$ 1.0.
   b. **NOTE THAT ONLY TRANSVERSE BRACE DEMAND IS PRESENTED IN THIS DESIGN PROCEDURE. LONGITUDINAL BRACE DEMAND WILL BE SIM & RESULTING VERT SEISMIC FORCES SHALL BE COMBINED ON COMMON VERT BRACE MEMBER.**

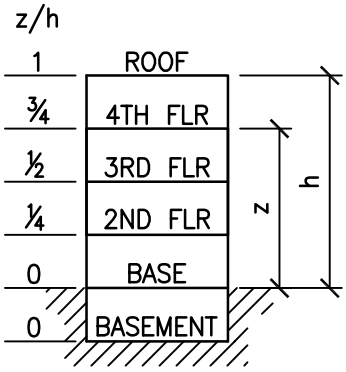
ASCE /SEI 7-16 AS AMENDED BY CBC 2019

SECTION 13.1.3 $I_p = 1.5$ (SEE CBC 1617A.1.17)

SECTION 13.3.1 SEISMIC DESIGN FORCES AT LRFD, UNO

$$F_p = \frac{0.4 a_p S_{DS} W_p}{R_p / I_p} (1 + 2\, z/h) = 1.31\, W_p$$

TABLE 13.6-1
- $a_p = 2.5$ (ELECTRICAL CONDUIT)
- $R_p = 6.0$ (ELECTRICAL CONDUIT)
- $\Omega_o = 2.0$ (FOR ANCHORAGE TO CONC, SEE CBC 1617A.1.23)
- $S_{DS} = 1.75$ (ASSUMED VALUE USED FOR THIS EXAMPLE)
- $z = h$ $z/h \leq 1.0$ (ASSUMED)

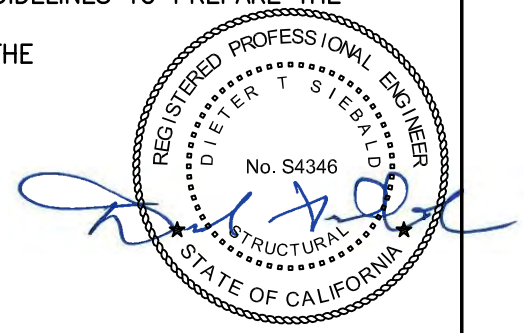


SAMPLE BLDG ELEV

FORCES AT LRFD
- F_p (MAX) $= 1.6\, S_{DS}\, I_p\, W_p = 4.2\, W_p$
- F_p (MIN) $= 0.3\, S_{DS}\, I_p\, W_p = 0.7875\, W_p$
- $F_p = 1.31\, W_p$
- $\Omega_o F_p = 2.62\, W_p$ (FOR LRFD ANCHORAGE TO CONC)
- $F_{pv} = 0.20\, S_{DS}\, W_p = 0.35\, W_p$

FORCES AT ASD
- $F_p = 0.7\, F_p = 0.7\,(1.31\, W_p) = 0.917\, W_p$
- $F_{pv} = 0.7\, F_{pv} = 0.7\,(0.35\, W_p) = 0.245\, W_p$

2. THE CRDP USES THE SECTION 1 DESIGN PARAMETERS & BRACING GUIDELINES TO PREPARE THE MEP LAYOUT DRAWINGS.
3. THE CRDP DETERMINES THE BRACE LOCATIONS & SHOWS THEM ON THE LAYOUT DRAWINGS.



SHEET TITLE: CONDUIT EXAMPLE OF SEISMIC BRACING DESIGN PROCEDURES
RIGID METAL CONDUIT (RMC)

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TRANSVERSE BRACE SPACING:

SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

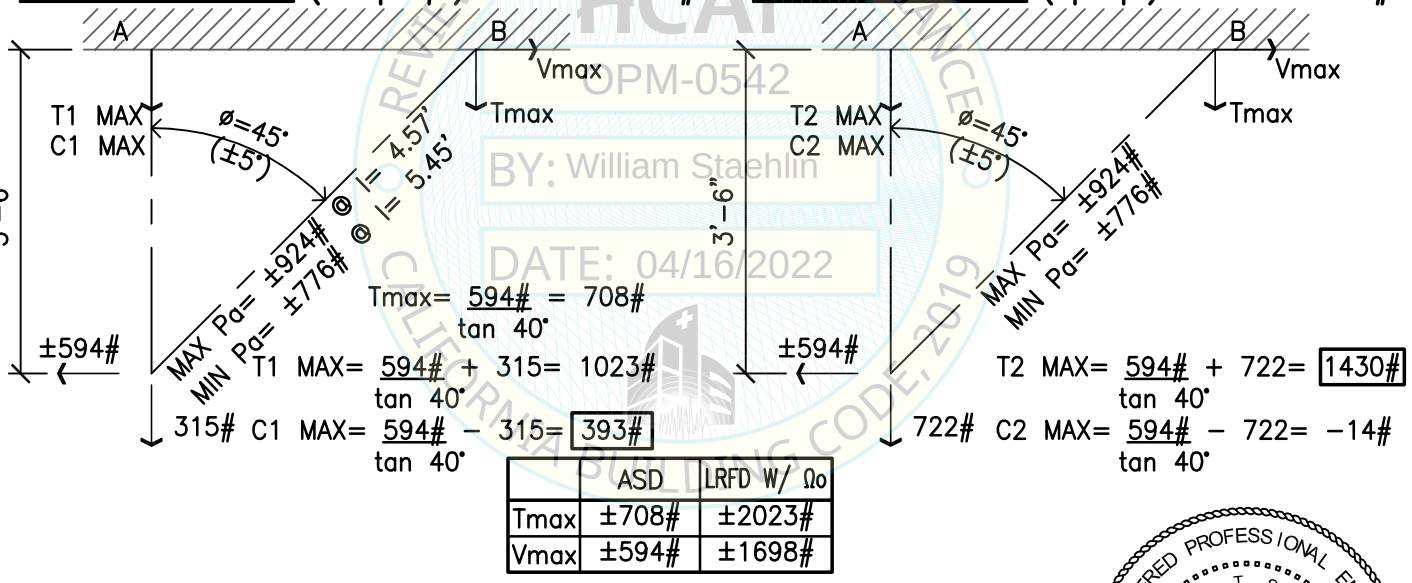
B. DEMAND (CONTINUED):

4. THE CRDP COMPARES THE BRACE LOCATIONS TO THE ALLOWABLE TRANSVERSE BRACE SPACING SHOWN IN PERMISSIBLE BRACE SPACING TABLES IN SECTION 201 FOR ELECTRICAL CONDUIT. THE RIGID METAL CONDUIT TABLE IS ON PG 201.1. LATERAL TRANSVERSE BRACE SPACING OF 30 FEET FOR THE 4" DIA RIGID METAL CONDUIT IS ALLOWED WHEN THE HORIZ FORCE, "Fp", IS LESS THAN 1.00 Wp AT ASD LEVEL OF DESIGN. THE CRDP MAY INTERPOLATE VALUES.
5. THE CRDP MAKES ADJUSTMENTS TO THE LATERAL TRANSVERSE BRACE SPACING ON THE LAYOUT DRAWINGS IF SO REQ.
6. THE CRDP DETERMINES THE OPERATING WT. IN THIS EXAMPLE Wp = 648 LBS. (21.6 PLF x 30 FT)
7. THE CRDP CALCULATES THE LATERAL FORCE Fp & VERT FORCE Fpv ON THE SEISMIC BRACE USING THE Wp PROVIDED BY THE RDP. NOTE THAT IN THE EXAMPLE, IT IS CONSERVATIVELY ASSUMED THAT THE VERT GRAVITY LOAD IS BASED ON THE MAX ALLOWABLE VERT HANGER SPACING OF 14 FT FOR THE CONDUIT LINE PROVIDED IN THE TABLE ON PG 201.1. THIS EXAMPLE IS AT ASD LEVEL OF DESIGN, EXCEPT FOR CONC ATTACHMENT WHICH IS AT LRFD W/ Ωo.

Wp = 648 LBS
Fp = ±0.917 (648 LBS) = ±594 LBS
Fpv = ±0.245 (21.6 PLF x 14 FT) = ±74 LBS

LRFD:
Ωo Fp Wp = ±2.0x1.31 (648 LBS) = ±1698 LBS

LOAD COMBINATION 1. (0.6Wp−Fpv)= 389−74= 315# **LOAD COMBINATION 2. (Wp+Fpv)= 648+74= 722#**



	ASD	LRFD W/ Ωo
Tmax	±708#	±2023#
Vmax	±594#	±1698#

8. THE CRDP VERIFIES THAT THERE IS A VERT SEISMIC BRACE WITHIN SIX INCHES OF EA TRANSVERSE & LONGITUDINAL BRACE.
9. THE CRDP CHOOSES APPROPRIATE SEISMIC BRACE SUPPORT ELEMENTS PER SECTIONS 2 THRU 17 OF THIS OPM. FOR THIS EXAMPLE THE ERICO CSBQG SERVICE PIPE CONNECTION IS CHOSEN FOR BOTH THE TRANSVERSE & VERT SEISMIC BRACE SHOWN ON PGS 6.2 & 8.2 RESPECTIVELY.
10. THE CRDP CHOOSES APPROPRIATE SEISMIC ATTACHMENT ELEMENTS TO STRUCTURE AS PER SECTIONS 100 THRU 105 OF THIS OPM. (SEE SECTION C, NOTES c & d, NEXT PG).

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SHEET TITLE: CONDUIT EXAMPLE OF SEISMIC BRACING DESIGN PROCEDURES
RIGID METAL CONDUIT (RMC)

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TRANSVERSE BRACE SPACING:

SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

C. CAPACITY

1. THE CRDP DETERMINES THE GOVERNING CAPACITY OF THE ASSEMBLED SUPPORTS & ATTACHMENT.
   a. DETERMINE CAPACITY OF SUPPORT ELEMENT FOR SERVICE PIPE PER TESTED VALUES IN SECTION 500. PER PG 500.3, THE CSBQG CAPACITY FOR A 4" DIA PIPE/RMC IS 1190 LBS FOR ANY BRACE ANGLE BTW 30 TO 90 DEGREES. THE CAPACITY IS 2300 LBS AT 90 DEGREES IF USED AS A VERT BRACE. THIS IS HIGHER THAN THE DEMAND & THE CSBQG CAN BE USED AS PART OF THE BRACE ASSEMBLY IN THIS EXAMPLE.
   b. DETERMINE CAPACITY OF BRACE SUPPORT AS PER CALCULATED ALLOWABLE VALUES IN TABLES PROVIDED IN SECTION 400. FOR THIS EXAMPLE, IT IS ASSUMED THE BRACE PIPE IS NO LONGER THAN 6 FEET. PER PG 400.1, A 1 INCH DIA SCH 40 BRACE PIPE HAS AN AXIAL CAPACITY OF 1850 LBS & CAN BE USED AS PART OF THE TRANSVERSE & VERT BRACE ASSEMBLIES IN THIS EXAMPLE.
   c. DETERMINE CAPACITY OF ASSUMED CSBU1 SUPPORT BTW BRACE PIPE & SEISMIC ATTACHMENT ELEMENT. PER PG 600.1 IN SECTION 600, THE CSBU1 HAS A CAPACITY OF 1690 LBS FOR ANY BRACE ANGLE BTW 30 TO 90 DEGREES.
   d. DETERMINE CAPACITY OF VERT BRACE ATTACHMENT TO STRUCTURE. USE CSBU1 PER PG 101.9. THE CAPACITY IS 1690 LBS WHICH IS HIGHER THAN THE DEMAND. THE CSBU1 CAN BE USED AS PART OF THE BRACE ASSEMBLY IN THIS EXAMPLE.
   e. DETERMINE CAPACITY OF SEISMIC ATTACHMENT TO SUPPORTING STRUCTURE. PER APPENDIX A, LRFD CAPACITIES FOR VARIOUS CONC ANCHORS HAVE BEEN PROVIDED. FOR THIS EXAMPLE, ASSUME A 5¾" THICK CONC SLAB & f'c= 3000 PSI. CHOOSE 0.50"x3.25" EMBED POWERS POWER-STUD SD2. PER PG A3, TENSION CAPACITY IS 2336# & SHEAR CAPACITY IS 3130#.

   NOTE:
   - THE CONC ANCHOR CAPACITIES WERE CALCULATED ACCORDING TO ACI® 318-14. AS PER SUPPLEMENT #1 OF ASCE/SEI® 7-16, THE OVERSTRENGTH FACTOR Ωo APPLIES TO CONC ANCHORAGE.

2. THE CRDP DETERMINES WHETHER THE DEMAND IN SECTION B, STEPS 1 THROUGH 7 IS LESS THAN THE CAPACITY OF THE ASSEMBLY DETERMINED IN SECTION C, STEPS 1a THROUGH 1d. FOR SUMMARY, SEE TABLE BLW WHICH SHOWS ALL D/C RATIOS TO BE ACCEPTABLE.
3. IF THE D/C RATIOS ARE UNACCEPTABLE, SUCH AS AN ASSUMED D/C RATIO OF 1.15, THE CRDP DETERMINES VIA DIRECT DEMAND VS CAPACITY RATIO THE APPROXIMATE REVISED ALLOWABLE BRACE SPACING. FOR THIS EXAMPLE, (30 FEET)/(1.15) = 26.1 FEET > 10 FEET MIN.

STEP	COMPONENT	CAPACITY	DEMAND	DEMAND/CAPACITY RATIO	FORCE LEVEL
a	CSBQG	1190	594	0.50	ASD
b	1" DIA BRACE PIPE	1850	924	0.50	
c	CSBU1	1690	594	0.35	
d*	ANCHOR-TENSION	2336	2023	0.87	LRFD, W/ OVERSTRENGTH
	ANCHOR-SHEAR	3130	1698	0.54	
	ANCHOR-COMBINED FORCES	–	–	1.15	

* FOR THIS EXAMPLE, IT WAS ASSUMED THAT THERE IS NO PRYING ACTION ON THE ATTACHMENT. IT IS THE RESPONSIBILITY OF THE RDP TO CHECK FOR PRYING. SEE SECTION B ON PREVIOUS PG FOR DEMAND FORCES. COMBINED ANCHOR RATIO= $(\text{TENSION RATIO})^{5/3} + (\text{SHEAR RATIO})^{5/3}$.

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SHEET TITLE: CONDUIT EXAMPLE OF SEISMIC BRACING DESIGN PROCEDURES
RIGID METAL CONDUIT (RMC)

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SEISMIC BRACING DESIGN PROCEDURE FOR CABLE TRAYS & DUCTS:

SINGLE HORIZONTAL TRAPEZE STRUT W/ VERTICAL & TRANSVERSE SEISMIC BRACES

A. GENERAL

1. THE CALIFORNIA REGISTERED DESIGN PROFESSIONAL (CRDP) REVIEWS SECTION 1 – OVERVIEW & GENERAL NOTES OF THIS OPM.
2. DESIGN EXAMPLE IS FOR A CABLE TRAY SUPPORTED BY A TRAPEZE. THE PROCEDURE FOR DUCTS SUPPORTED BY TRAPEZES IS SIMILAR. FOR ATTACHMENT OF A DUCT OR CABLE TRAY TO THE TRAPEZE, SEE SECTION 13 OR 16. FOR CLIP CAPACITY, SEE SECTION 500.

B. DEMAND

1. THE CRDP DETERMINES THE LATERAL ACCELERATION & VERT ACCELERATION "G" FOR THE SEISMIC FORCES Fp & Fpv USING INFORMATION PROVIDED IN THE PROJECT DOCUMENTS.
   - a. **TRANSVERSE, LONGITUDINAL & VERTICAL SEISMIC BRACE DEMANDS ARE PRESENTED IN SECTION B OF THIS DESIGN PROCEDURE. FOR BRACE CAPACITIES & D/C RATIOS SEE SECTION C.**
   - b. IN THE EXAMPLE BLW, THE MAX HORIZ & VERT FORCES ON THE BRACES ARE CALCULATED FOR AN ASSUMED SPECIFIC LOCATION THAT HAS AN S_{DS} VALUE OF 1.75 & A z/h RATIO OF $\leq$ 1.0.

ASCE /SEI 7-16 AS AMENDED BY CBC 2019

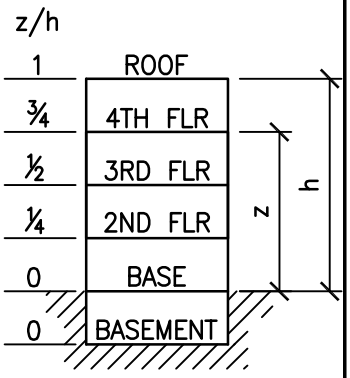
SECTION 13.1.3 — I_p = 1.5 (SEE CBC 1617A.1.17)

SECTION 13.3.1 — SEISMIC DESIGN FORCES AT LRFD, UNO

$$F_p = \frac{0.4 a_p S_{DS} W_p}{R_p/I_p} (1+2\,z/h) = 1.31\ W_p$$

TABLE 13.6-1

- a_p = 2.5 (CABLE TRAYS)
- R_p = 6.0 (CABLE TRAYS)
- Ω_o = 2.0 (FOR ANCHORAGE TO CONC, SEE CBC 1617A.1.23)
- S_{DS} = 1.75 (ASSUMED VALUE USED FOR THIS EXAMPLE)
- z = h z/h $\leq$ 1.0 (ASSUMED)



SAMPLE BLDG ELEV

FORCES AT LRFD

- F_p (MAX) = 1.6 S_{DS} I_p W_p = 4.2 W_p
- F_p (MIN) = 0.3 S_{DS} I_p W_p = 0.7875 W_p
- F_p = 1.31 W_p
- Ω_o F_p = 2.62 W_p (FOR LRFD ANCHORAGE TO CONC)
- F_{pv} = 0.20 S_{DS} W_p = 0.35 W_p

FORCES AT ASD

- F_p = 0.7 F_p = 0.7 (1.31 W_p) = 0.917 W_p
- F_{pv} = 0.7 F_{pv} = 0.7 (0.35 W_p) = 0.245 W_p

SHEET TITLE: CABLE TRAY & DUCT EXAMPLE OF SEISMIC BRACING DESIGN PROCEDURES
CABLE TRAY

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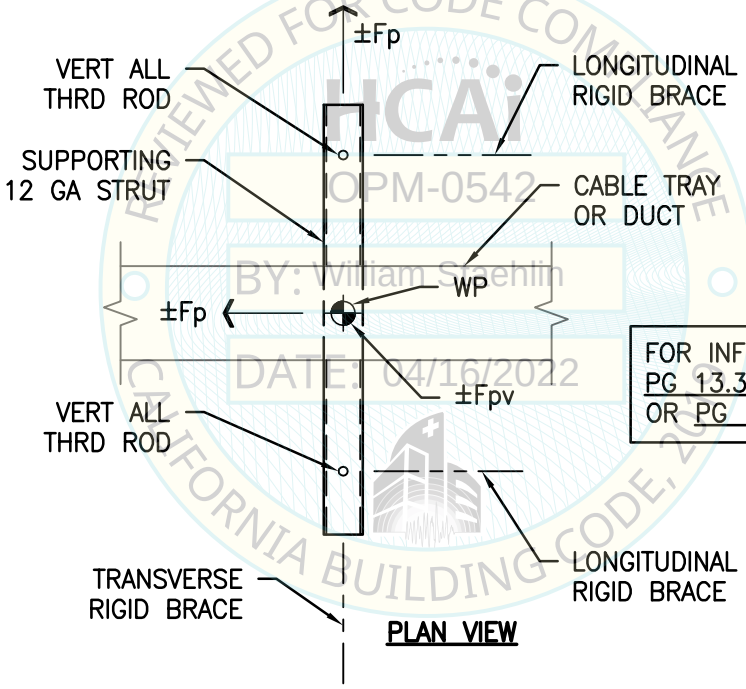
SEISMIC BRACING DESIGN PROCEDURE FOR CABLE TRAYS & DUCTS:

B. DEMAND (CONTINUED):

2. THE CRDP USES THE SECTION 1 DESIGN PARAMETERS & BRACING GUIDELINES TO PREPARE THE MEP LAYOUT DRAWINGS.
3. THE CRDP DETERMINES THE BRACED TRAPEZE LOCATIONS & SHOWS THEM ON THE LAYOUT DRAWINGS.
4. THE CRDP DETERMINES THE TRIBUTARY MAIN LINE WT (Wp) FOR EA SEISMIC BRACED TRAPEZE. FOR THIS EXAMPLE, SEE PLAN VIEW BELOW. ASSUME THAT Wp = 360 LBS (18 PLF x 20 FT) FOR A 4" DEEP x 12" WIDE CABLE TRAY AS SHOWN ON PG 202.1.
5. THE CRDP COMPARES THE CALCULATED 360 LBS WT TO THE ALLOWABLE WT TABLES FOR TRAPEZES IN SECTION 401. FOR THIS EXAMPLE, WHICH USES A HORIZ FORCE (Fp), EQ TO OR LESS THAN 0.917 Wp AT ASD LEVEL OF DESIGN, THE USE OF A 24" LONG P1000 IS PERMITTED FOR THE TRAPEZE SINCE PER PG 401.1 FOR A 24" LONG SINGLE STRUT & Fp < 1.225 Wp THE 360 LBS DEMAND IS LESS THAN THE 375 LBS ALLOWABLE CAPACITY. THE CALCULATED WEIGHT IS BASED ON THE CABLE TRAY WT (IN PLF) PER PG 202.1 x AN ASSUMED TRANSVERSE & LONGITUDINAL BRACE SPACING OF 20 FT. IT IS ASSUMED THAT THE CABLE TRAY IS CTRD ON THE SUPPORTING STRUT. FOR DUCTS (NOT USED IN THIS EXAMPLE), SEE PGS 202.2 & 202.3 FOR WT.



FOR INFO NOT SHOWN SEE PG 13.3 FOR CABLE TRAYS OR PG 14.3 FOR DUCTS

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BRACE SPACING:

SEISMIC BRACING PROCEDURE (CONTINUED)

B. DEMAND (CONTINUED):

6. THE CRDP MAKES ADJUSTMENTS TO THE LATERAL TRANSVERSE BRACE & TRAPEZE SPACING ON THE LAYOUT DRAWINGS & RECALCULATES WT IF SO REQ.
7. THE CRDP DETERMINES THE OPERATING WT IN THIS EXAMPLE Wp = 360 LBS & IS ASSUMED EQUALLY DISTRIBUTED TO VERT SUPPORT RODS. IF ECCENTRIC LOAD DISTRIBUTION OCCURS, APPLY 2/3 & 1/3 DISTRIBUTION TO RODS.

8a. THE CRDP CALCULATES THE LATERAL FORCE Fp & VERT FORCE Fpv ON THE SEISMIC BRACE & TRAPEZE USING THE Wp PROVIDED BY THE RDP. NOTE THAT IN THE EXAMPLE, IT IS CONSERVATIVELY ASSUMED THAT THE VERT GRAVITY LOAD Wp= 360 LBS EVEN THOUGH THE MAX ALLOWABLE VERT HANGER SPACING IS ONLY 10 FT. THIS EXAMPLE IS AT ASD LEVEL OF DESIGN, EXCEPT FOR CONC ATTACHMENT WHICH IS AT LRFD W/ Ωo.

Wp = 360 LBS

Fp = ±0.917 (360 LBS) = ±330 LBS

Fpv = ±0.245 (360 LBS) = ±88 LBS

NOTE: CONSERVATIVELY USED Wp= 360# FOR EASE OF CALC.
ACTUAL IS 18plf x 10 FT= 180#

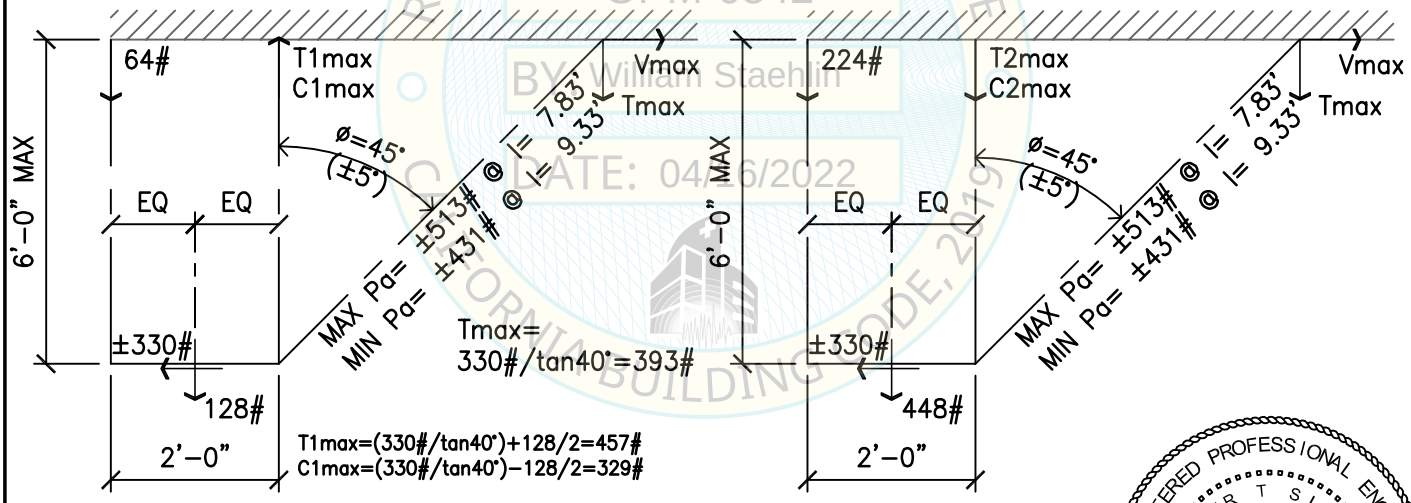
LRFD:
Ωo Fp = ±2x1.31 (360 LBS) = ±943 LBS

Fpv = ±0.35 (360 LBS) = ±126 LBS

8b. TRANSVERSE BRACING

LOAD COMBINATION 1. (0.6Wp−Fpv)= 216−88= 128# **LOAD COMBINATION 2. (Wp+Fpv)= 360+88= 448#**

2a. (1.2Wp+Fpv)= 1.2x360+126 = 558# (LRFD W/ Ωo)



	ASD	LRFD W/ Ωo
Tmax	±393#	±1124#
Vmax	±330#	±943#
T2max	617#	1403#

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BRACE SPACING:

SEISMIC BRACING PROCEDURE (CONTINUED)

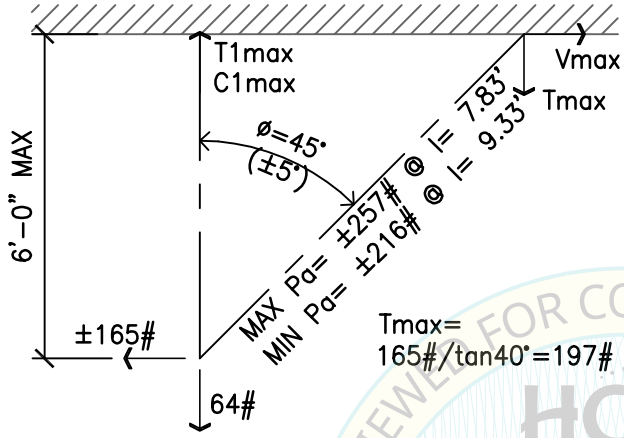
B. DEMAND (CONTINUED):

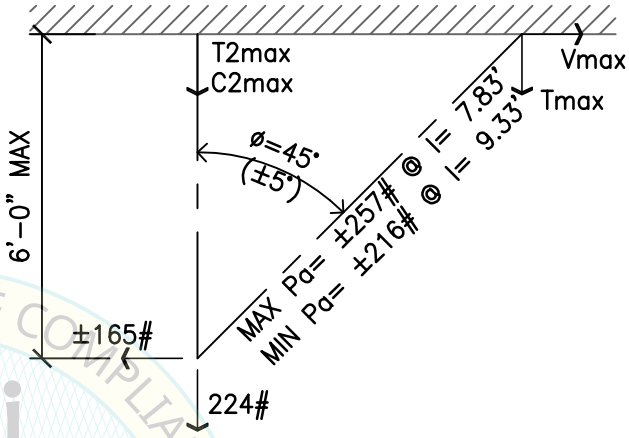
8c. LONGITUDINAL BRACING (ASSUME SAME SPACING AS TRANSVERSE BRACING)

LOAD COMBINATION 1. (0.6Wp−Fpv)= 108−44= 64#

LOAD COMBINATION 2. (Wp+Fpv)= 180+44= 224#

2a. (1.2Wp+Fpv)= 1.2x180+63 = 279# (LRFD W/ Ωo)





T1max=(165#/tan40°)+64=261#
C1max=(165#/tan40°)−64=133#

T2max=(472#/tan40°)+279=842# (LRFD W/ Ωo)
T2max=(165#/tan40°)+224=420#
C2max=(165#/tan40°)−224<0 (NO COMPRESSION)

	ASD	LRFD W/ Ωo
Tmax	±197#	±562#
Vmax	±165#	±472#
T2max	420#	842#

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BRACE SPACING:

SEISMIC BRACING PROCEDURE (CONTINUED)

B. DEMAND (CONTINUED):

7d. VERTICAL BRACING

THE COMBINED REACTIONS DUE TO THE SEISMIC FORCES IN THE TRANSVERSE & LONGITUDINAL DIRECTIONS IS SUMMARIZED IN THE TABLE BELOW. THE GOVERNING REACTION SHOWN IS THE MAXIMUM OF THE TWO SCENARIOS WHERE THE SEISMIC LOAD IS:

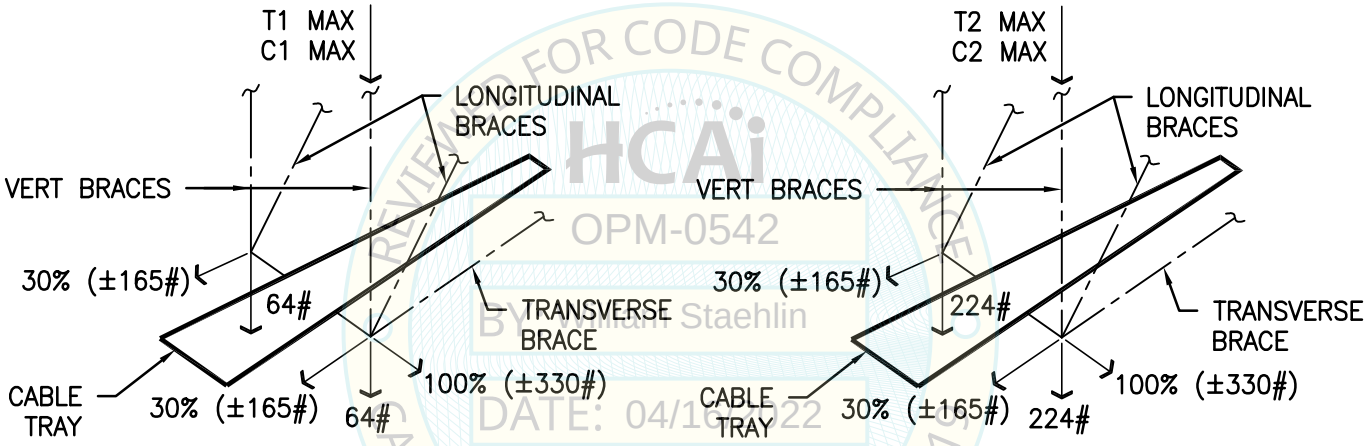
1. 100% IN THE TRANSVERSE DIRECTION AND 30% IN THE LONGITUDINAL DIRECTION OR
2. 30% IN THE TRANSVERSE DIRECTION AND 100% IN THE LONGITUDINAL DIRECTION

NOTE:

1. FOR LENGTH & ANGLE INFO NOT SHOWN, REFER TO SECTIONS 7b & 7c.

LOAD COMBINATION 1. (0.6Wp−Fpv)= 216−88= 128# **LOAD COMBINATION 2.** (Wp+Fpv)= 360+88= 448#
2a. (1.2Wp+Fpv)= 1.2x360+126 = 558# (LRFD W/ Ωo)

SCENARIO 1



T1 MAX= $\frac{330\#}{\tan 40^\circ} + \frac{0.3(165\#)}{\tan 40^\circ} + 64\# = 516\#$

C1 MAX= $\frac{330\#}{\tan 40^\circ} + \frac{0.3(165\#)}{\tan 40^\circ} - 64\# = \boxed{388\#}$

T2 MAX= $\frac{330\#}{\tan 40^\circ} + \frac{0.3(165\#)}{\tan 40^\circ} + 224\# = \boxed{676\#}$

C2 MAX= $\frac{330\#}{\tan 40^\circ} + \frac{0.3(165\#)}{\tan 40^\circ} - 224\# = 228\#$

T2 MAX= $\frac{943\#}{\tan 40^\circ} + \frac{0.3(943/2)}{\tan 40^\circ} + 279\# = 1571\#$ (LRFD W/ Ωo)

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SHEET TITLE: CABLE TRAY & DUCT EXAMPLE OF SEISMIC BRACING DESIGN PROCEDURES
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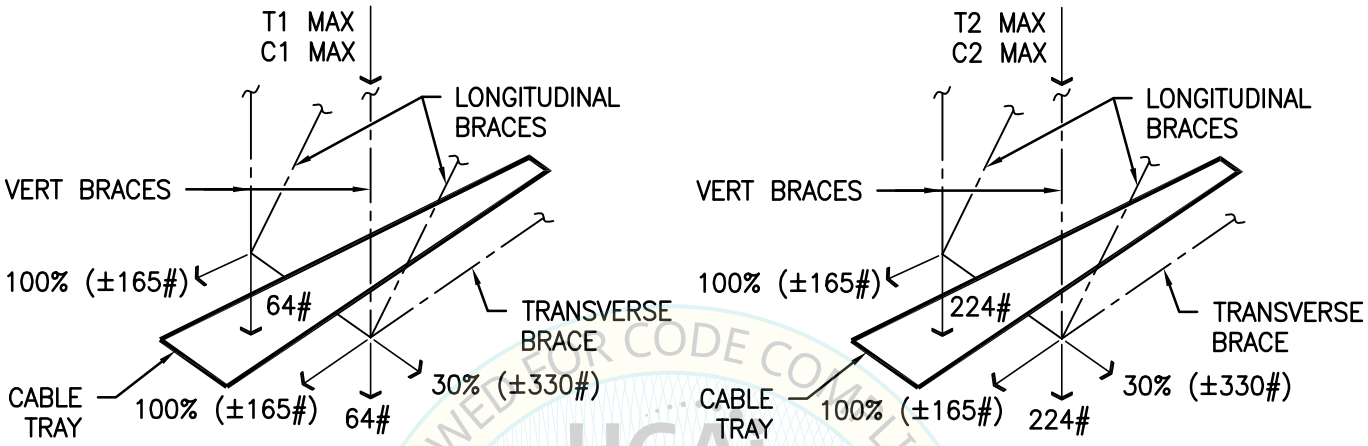
BRACE SPACING:

SEISMIC BRACING PROCEDURE (CONTINUED)

B. DEMAND (CONTINUED):

SCENARIO 2



$$T1\ MAX = \frac{165\#}{\tan 40^\circ} + \frac{0.3(330\#)}{\tan 40^\circ} + 64\# = 379\#$$

$$C1\ MAX = \frac{165\#}{\tan 40^\circ} + \frac{0.3(330\#)}{\tan 40^\circ} - 64\# = 251\#$$

$$C1\ MAX = \frac{943/2}{\tan 40^\circ} + \frac{0.3(943\#)}{\tan 40^\circ} - 99\# = 1193\#\ \text{(LRFD W/ } \Omega o\text{)}$$

$$T2\ MAX = \frac{165\#}{\tan 40^\circ} + \frac{0.3(330\#)}{\tan 40^\circ} + 224\# = 539\#$$

$$C2\ MAX = \frac{165\#}{\tan 40^\circ} + \frac{0.3(330\#)}{\tan 40^\circ} - 224\# = 91\#$$

$$T2\ MAX = \frac{943/2}{\tan 40^\circ} + \frac{0.3(943\#)}{\tan 40^\circ} + 279\# = 1178\#\ \text{(LRFD W/ } \Omega o\text{)}$$

	ASD	LRFD W/ Ωo
C1max	±388#	±1193#
T2max	±676#	±1571#

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SHEET TITLE: CABLE TRAY & DUCT EXAMPLE OF SEISMIC BRACING DESIGN PROCEDURES
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BRACE SPACING:

SEISMIC BRACING PROCEDURE (CONTINUED)

C. CAPACITY

1. THE CRDP CHOOSES APPROPRIATE SEISMIC BRACE SUPPORT ELEMENTS PER SECTIONS 2 THRU 17 OF THIS OPM. FOR THIS EXAMPLE THE ERICO CSBR1 CONNECTION & SCH 40 BRACE PIPE IS CHOSEN FOR THE TRANSVERSE & LONGITUDINAL SEISMIC BRACES SHOWN ON PG 13.3 & CADDY STRUT CLIP BC200000EG FOR THE CABLE TRAY TO STRUT CONNECTION. THE VERT BRACES WILL CONSIST OF THE ALL-THRD ROD W/ 12 GA STRUT W/ INTERNAL ROD STIFFENER CSBRS.
2. THE CRDP CHOOSES APPROPRIATE SEISMIC ATTACHMENT ELEMENTS TO STRUCTURE AS PER SECTIONS 100 THRU 105 OF THIS OPM. (SEE NOTES f & g BELOW).
3. THE CRDP DETERMINES THE GOVERNING CAPACITY OF THE ASSEMBLED SUPPORTS & ATTACHMENT.
   a. DETERMINE CAPACITY OF HORIZ TRAPEZE STRUT PER VALUES IN SECTION 401. PER PG 401.1, THE CAPACITY FOR A 24" LONG NON-SLOTTED UNISTRUT P1000 IS 375# FOR COMBINED VERT, TRANSVERSE & LONGITUDINAL LOADING (AT Fp = 1.225 Wp)
   b. DETERMINE CAPACITY OF BC200000EG PER VALUES IN SECTION 500. PER PG 500.4, THE CAPACITY FOR TRANSVERSE LOADING IS 396#. THE CAPACITY FOR LONGITUDINAL LOADING IS 2400#.
   c. DETERMINE CAPACITY OF CSBR1 PER VALUES IN SECTION 500. PER PG 500.4, THE CAPACITY WHEN USED WITH A SCH 40 BRACE PIPE IS 755# FOR ANY BRACE ANGLE BTW 30 DEG TO 90 DEG.
   d. AS AN ALTERNATE, DETERMINE CAPACITY OF CSBR2 PER VALUES IN SECTION 500 PER PG 500.4, THE CAPACITY WHEN USED WITH A BRACE STRUT IS 1051# FOR ANY BRACE ANGLE BTW 30 DEG TO 90 DEG.
   e. DETERMINE CAPACITY OF AXIAL BRACE AS PER CALCULATED ALLOWABLE VALUES IN TABLES PROVIDED IN SECTION 400. FOR THIS EXAMPLE, IT IS ASSUMED THE TRANSVERSE & LONGITUDINAL BRACE PIPES ARE NO LONGER THAN 6 FEET. PER PG 400.1, A 1 INCH DIA SCH 40 BRACE PIPE HAS AN AXIAL CAPACITY OF 1850 LBS & CAN BE USED AS PART OF THE TRANSVERSE & LONGITUDINAL BRACE ASSEMBLIES IN THIS EXAMPLE. FOR THIS EXAMPLE, IT IS ALSO ASSUMED THE VERTICAL BRACE ROD LENGTH NOT WITHIN THE 1⅝"x1⅝"x12GA STRUT IS NO LONGER THAN 9 INCHES. PER PG 400.4, A ⅜" DIA RESTRAINT ROD HAS AN AXIAL CAPACITY OF 777#.
   f. DETERMINE CAPACITY OF CSBU1 SUPPORT BTW BRACE PIPE & SEISMIC ATTACHMENT ELEMENT. PER PG 600.1 IN SECTION 600, THE CSBU1 HAS A CAPACITY OF 1270 LBS, BASED ON SCHEDULE 40 PIPE USED FOR BRACE, FOR ANY BRACE ANGLE BTW 30 TO 90 DEGREES.
   g. DETERMINE CAPACITY OF UNISTRUT STRUT NUT SUPPORT BTW THREAD ROD & SEISMIC ATTACHMENT ELEMENT. PER PG 101.13, NOTE 4 IN SECTION 101, THE UNSITRUT STRUT NUT HAS A SLIP LOAD CAPACITY OF 1370 LBS & TENSION LOAD CAPACITY OF 2810 LBS.
   h. DETERMINE CAPACITY OF SEISMIC ATTACHMENT TO SUPPORTING STRUCTURE. PER APPENDIX A, LRFD CAPACITIES FOR VARIOUS CONC ANCHORS HAVE BEEN PROVIDED. FOR THIS EXAMPLE, CHOOSE 0.5"x3.25" EMBED POWERS POWER-STUD SD2. PER PG A3, TENSION CAPACITY IS 2336# & SHEAR CAPACITY IS 3130#.

   NOTE:
   - THE CONC ANCHOR CAPACITIES WERE CALCULATED ACCORDING TO ACI® 318-14. AS PER SUPPLEMENT #1 OF ASCE/SEI® 7-16, THE OVERSTRENGTH FACTOR Ωo APPLIES TO CONC ANCHORAGE.
4. THE CRDP DETERMINES WHETHER THE DEMAND IN SECTION B, STEPS 1 THROUGH 7 IS LESS THAN THE CAPACITY OF THE ASSEMBLY DETERMINED IN SECTION C, STEPS 1a THROUGH 1d FOR SUMMARY. FOR SUMMARY, SEE TABLE ON PG 302.8 WHICH SHOWS ALL D/C RATIOS TO BE ACCEPTABLE.

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SHEET TITLE: CABLE TRAY & DUCT EXAMPLE OF SEISMIC BRACING DESIGN PROCEDURES
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BRACE SPACING:

SEISMIC BRACING PROCEDURE (CONTINUED)

C. CAPACITY

5. IF THE D/C RATIOS ARE UNACCEPTABLE, SUCH AS THE BLW D/C RATIO OF 1.19, THE CRDP DETERMINES VIA DIRECT DEMAND VS CAPACITY RATIO THE APPROXIMATE REVISED ALLOWABLE BRACE SPACING. FOR THIS EXAMPLE, (20 FEET)/(1.19) = 16.8 FEET

	STEP	COMPONENT	CAPACITY	DEMAND	DEMAND/CAPACITY RATIO	FORCE LEVEL
TRANSVERSE BRACE	a	UNISTRUT P1000 TRAPEZE	375	448	1.19	ASD
	b	BC200000EG	396	330	0.83	
	c	CSBR1	755	330	0.44	
	e	1" DIA SCH 40 BRACE PIPE	1850	513	0.28	
	f	CSBU1	1270	330	0.26	
	h*	ANCHOR-TENSION	2336	1124	0.48	LRFD, W/ OVERSTRENGTH
		ANCHOR-SHEAR	3130	943	0.30	
		ANCHOR-COMBINED FORCES	–	–	0.43	
LONGITUDINAL BRACES	c	CSBR1	755	165	0.22	ASD
	e	1" DIA SCH 40 BRACE PIPE	1850	257	0.14	
	f	CSBU1	1270	165	0.13	
	h*	ANCHOR-TENSION	2336	562	0.24	LRFD, W/ OVERSTRENGTH
		ANCHOR-SHEAR	3130	472	0.15	
		ANCHOR-COMBINED FORCES	–	–	0.14	
VERTICAL BRACES						ASD
	e	VERT ALL THRD ROD	777	676	0.87	
	g	UNISTRUT STRUT NUT	1370	330	0.24	
	h*	ANCHOR-TENSION	2336	786	0.34	LRFD, W/ OVERSTRENGTH

* FOR THIS EXAMPLE, IT WAS ASSUMED THAT THERE IS NO PRYING ACTION ON THE ATTACHMENT. IT IS THE RESPONSIBILITY OF THE CDRP TO CHECK FOR PRYING. SEE SECTION B ON PREVIOUS PG FOR DEMAND FORCES. COMBINED ANCHOR RATIO= $(\text{TENSION RATIO})^{5/3} + (\text{SHEAR RATIO})^{5/3}$.

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SHEET TITLE: CABLE TRAY & DUCT EXAMPLE OF SEISMIC BRACING DESIGN PROCEDURES
CABLE TRAY

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AXIAL CAPACITIES OF BRACES

PIPES

LATERAL SWAY BRACE PIPE AXIAL CAPACITY (POUNDS)										
NOMINAL DIA	OUTSIDE DIA	NOMIMAL WALL THK	DESIGN WALL THK	AREA Ag (in^2)	D/t	r (in)	PIPE LENGTH			
							4'	6'	8'	10'
1.00"	1.32"	0.133"	0.124"	0.46	10.6	0.423	3082	1850	N/A	N/A
1.25"	1.66"	0.140"	0.130"	0.62	12.8	0.543	4764	3523	2332	N/A
1.50"	1.90"	0.145"	0.135"	0.75	14.1	0.626	5983	4843	3447	2452
2.00"	2.38"	0.154"	0.143"	1.00	16.6	0.791	8409	7452	6149	4667

NOTES:

1. BRACE PIPE AXIAL CAPACITY SHOWN IS AT ASD LEVEL DESIGN. FOR LRFD–LEVEL DESIGN, PER ANSI/AISC 360–16 SECTION E1, MULTIPLY BY 1.5.
2. LOAD APPLIED AT EDGE OF PIPE TO ACCOUNT FOR ECCENTRICITY OF BRACE ATTACHMENT.
3. BRACE DIAMETERS AND THICKNESSES ARE GIVEN FOR SCHEDULE 40 PIPE AS PER ANSI/AISC® STEEL CONSTRUCTION MANUAL TABLE 1–14, AND kl/r < 200.

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SHEET TITLE: AXIAL CAPACITIES OF BRACES
PIPES

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AXIAL CAPACITIES OF BRACES

STRUTS

ERICO TYPE A SINGLE STRUT AXIAL CAPACITY (POUNDS)								
I_{xx} (in^4)	S_{xx} (m^3)	AREA Ag (in^2)	r_x (in)	STRUT LENGTH				FORCE LEVEL
				4'	6'	8'	10'	
0.182	0.199	0.533	0.574	2600	2000	1500	1200	ASD
				3900	3000	2250	1800	LRFD

NOTES:

1. BRACE STRUT AXIAL CAPACITIES ARE GIVEN FOR ERICO TYPE A SOLID SINGLE STRUT (1⅝"x1⅝"x12 GA) AND kl/r < 200. SEE SECTION "SEISMIC BRACE SUPPORT DETAILS", PG 106.5 FOR ADDNL PROPERTIES.
2. DESIGN PARAMETERS ARE FOR X AXIS ONLY.
3. LOAD APPLIED AT SLOT FACE TO ACCOUNT FOR ECCENTRICITY OF BRACE ATTACHMENT.
4. REDUCE CAPACITIES BY 15% FOR PUNCHED OT SLOTTED TRACK CAPACITIES. SEOR SHALL VERIFY STRUT PROPERTIES MEET OR EXCEED THOSE SHOWN IN THIS OPM.
5. FOR MATERIAL PROPERTIES, SEE PG 1.31.

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SHEET TITLE: AXIAL CAPACITIES OF BRACES
STRUTS

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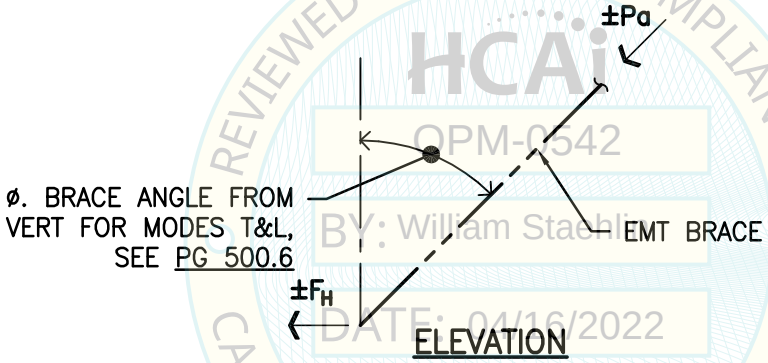
AXIAL CAPACITIES OF BRACES
ELECTRICAL METALLIC TUBING (EMT)

LATERAL SWAY BRACE EMT AXIAL CAPACITY Pa (POUNDS)															
NOMINAL DIA	OUTSIDE DIA	NOMINAL WALL THK	DESIGN WALL THK	AREA Ag (in^2)	D/t	r (in)	PIPE LENGTH							
							1'	2'	3'	4'	5'	6'	8'	10'
1.00"	1.16"	0.057"	0.057"	0.20	20.4	0.392	2246	2058	1746	1332	966	724	N/A	N/A

NOTES:
1. BRACE EMT AXIAL CAPACITY SHOWN IS AS Pa AT ASD LEVEL DESIGN WHERE kl/r < 200.
2. BRACE DIAMETERS AND THICKNESSES ARE GIVEN FOR EMT AS PER UL 797 & ANSI C80.3.
3. MATERIAL SHALL BE HOT-DIPPED GALV W/ YIELD STRESS Fy= 45 KSI MIN.
4. LOAD APPLIED AT EDGE OF EMT TO ACCOUNT FOR ECCENTRICITY OF BRACE ATTACHMENT.



ELEVATION

ALLOWABLE ±F_H (LBS)				
UNBRACED LGTH (FT)	ø (DEGREES)			
	30–44	45–59	60–74	75–90
1	1123	1588	1945	2170
2	1029	1455	1783	1988
3	873	1235	1512	1687
4	666	942	1154	1287
5	483	683	837	934
6	362	512	627	699
8	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A

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SHEET TITLE: AXIAL CAPACITIES OF BRACES
ELECTRICAL METALLIC TUBING (EMT)

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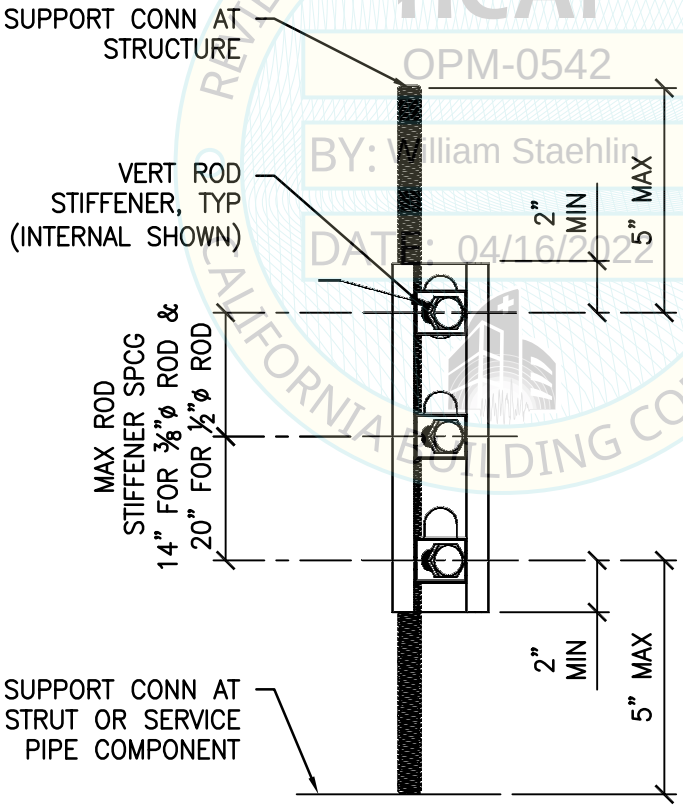
AXIAL CAPACITIES OF BRACES

RESTRAINT RODS

RESTRAINT ROD AXIAL COMPRESSION CAPACITY (POUNDS)						
NOMINAL DIA	ROD LENGTH					
	1'–9"	1'–5"	1'–3"	1'–1"	0'–11"	0'–9"
⅜"	–	–	293#	390#	544#	777#
½"	505#	770#	989#	1295#	1635#	1985#
⅝"	1286#	1952#	2370#	2810#	3251#	3671#
¾"	2829#	3861#	4401#	4935#	5444#	5908#

NOTES:

1. RESTRAINT ROD AXIAL CAPACITY SHOWN IS AT ASD LEVEL DESIGN. FOR LRFD–LEVEL DESIGN, PER ANSI/AISC 360–16 SECTION E1, MULTIPLY CAPACITY BY 1.5.
2. ROD DIAMETERS ARE BASED ON ALL THREAD ROD, CAPACITY IS BASED ON ASTM® A36 AND $kl/r \leq 200$. INTERPOLATION IS ACCEPTABLE.
3. FOR RODS W/ ROD STIFFENERS, "ROD LENGTH" REFERS TO MAX DISTANCE BTW ROD STIFFENERS AS PER PG 106.14.
4. ROD STIFFENERS MUST BE INSTALLED PER ERICO/nVENT INSTRUCTIONS.



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SHEET TITLE: AXIAL CAPACITIES OF BRACES
RESTRAINT RODS

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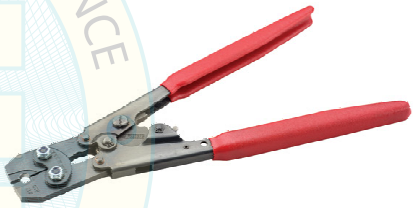
AXIAL CAPACITIES OF BRACES
TENSION CABLES

AIRCRAFT CABLE SIZE[4]	ERICO SLEEVE PART#[1]	CABLE MIN BREAKING FORCE	SAFETY FACTOR	ALLOW LOAD AT ASD	REQ # OF SWAGES PER SLEEVE[2]
3/32" (#12)	CSB12SLVB	920 LBS	2.20	410	2 (1)
1/8" (#18)	CSB18SLVB	1700 LBS	2.20	770	2 (1)
3/16" (#36)	CSB36SLVB	4200 LBS	2.20	1900	3 (2)

NOTES:
1. NOTE THAT THE CAPACITY OF THE SLEEVED LOOPS IS THE SAME AS THE MIN BREAK STRENGTH OF THE CABLE.
2. NUMBER OF SWAGES PER SLEEVE WHEN THE ERICO HAND SWAGE TOOL IS USED. NUMBER IN PARENTHESIS IS THE NUMBER OF SWAGES PER SLEEVE WHEN THE ERICO BATTERY SWAGE TOOL IS USED.
3. ERICO HAND SWAGE TOOL IS SHOWN BLW. IT IS USED TO CRIMP THE ERICO PROVIDED OVAL SLEEVE SHOWN ON PG 17.2 AS PER ERICO'S INSTRUCTIONS.
4. PRE-STRETCHED GALV 7x7 STRAND (#12 & #18) AIRCRAFT CABLE & GALV 7x19 STRAND (#36) AIRCRAFT CABLE IS IN COMPLIANCE W/ ASTM A1023 TABLE 7.



SHEET TITLE: AXIAL CAPACITIES OF BRACES
TENSION CABLES

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AXIAL & FLEXURAL CAPACITIES OF HORIZONTAL TRAPEZE STRUTS

MAX LOAD TO EACH TRAPEZE AT ASD LEVEL OF DESIGN

LOAD SUMMARY @ ASD: 12GA 1⅝" x 1⅝" NON-SLOTTED SINGLE STRUT ("P" SERIES)

MAX TRIBUTARY WEIGHT (LBS) TO TRAPEZE AT ASD. SINGLE STRUT					
STRUT LENGTH (IN)	WEIGHT, Wp ($@F_p/Wp=1.225$, $E_v/Wp=0.245$)	WEIGHT, Wp ($@F_p/Wp=1.40$, $E_v/Wp=0.28$)	WEIGHT, Wp ($@F_p/Wp=1.50$, $E_v/Wp=0.30$)	WEIGHT, Wp ($@F_p/Wp=1.57$, $E_v/Wp=0.31$)	WEIGHT, Wp ($@F_p/Wp=1.75$, $E_v/Wp=0.35$)
18	500	460	440	429	408
24	375	350	340	330	310
30	300	280	270	265	252
36	250	235	225	220	210

LOAD SUMMARY @ ASD: 12GA 1⅝" x 1⅝" SLOTTED SINGLE STRUT ("T" SERIES)

MAX TRIBUTARY WEIGHT (LBS) TO TRAPEZE AT ASD. SINGLE STRUT					
STRUT LENGTH (IN)	WEIGHT, Wp ($@F_p/Wp=1.225$, $E_v/Wp=0.245$)	WEIGHT, Wp ($@F_p/Wp=1.40$, $E_v/Wp=0.28$)	WEIGHT, Wp ($@F_p/Wp=1.50$, $E_v/Wp=0.30$)	WEIGHT, Wp ($@F_p/Wp=1.57$, $E_v/Wp=0.31$)	WEIGHT, Wp ($@F_p/Wp=1.75$, $E_v/Wp=0.35$)
18	415	385	370	360	335
24	320	285	285	275	255
30	255	235	225	220	205
36	215	200	190	185	175

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SHEET TITLE: AXIAL & FLEXURAL CAPACITIES OF HORIZONTAL TRAPEZE STRUTS
12 GA SINGLE STRUT

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AXIAL & FLEXURAL CAPACITIES OF HORIZONTAL TRAPEZE STRUTS

MAX LOAD TO EACH TRAPEZE AT ASD LEVEL OF DESIGN

LOAD SUMMARY @ ASD: 12GA 1⅝" x 3¼" UNISTRUT: P1001

MAX TRIBUTARY WEIGHT (LBS) TO TRAPEZE AT ASD. UNISTRUT					
STRUT LENGTH (IN)	$S_{DS} \leq 1.75$	$S_{DS} \leq 2.0$	$S_{DS} \leq 2.15$	$S_{DS} \leq 2.25$	$S_{DS} \leq 2.50$
	WEIGHT, Wp ($@F_p/Wp=1.225$, $E_v/Wp=0.245$)	WEIGHT, Wp ($@F_p/Wp=1.40$, $E_v/Wp=0.28$)	WEIGHT, Wp ($@F_p/Wp=1.50$, $E_v/Wp=0.30$)	WEIGHT, Wp ($@F_p/Wp=1.57$, $E_v/Wp=0.31$)	WEIGHT, Wp ($@F_p/Wp=1.75$, $E_v/Wp=0.35$)
18	700	640	610	590	535
24	640	580	550	530	485
30	580	520	495	480	440
36	520	480	450	440	410

NOTE: WEIGHTS ARE THE MAX TOTAL "POINT" LOAD TO THE STRUT

LOAD SUMMARY @ ASD: 12GA 1⅝" x 3¼" SLOTTED UNISTRUT: T1001

MAX TRIBUTARY WEIGHT (LBS) TO TRAPEZE AT ASD. UNISTRUT					
STRUT LENGTH (IN)	$S_{DS} \leq 1.75$	$S_{DS} \leq 2.0$	$S_{DS} \leq 2.15$	$S_{DS} \leq 2.25$	$S_{DS} \leq 2.50$
	WEIGHT, Wp ($@F_p/Wp=1.225$, $E_v/Wp=0.245$)	WEIGHT, Wp ($@F_p/Wp=1.40$, $E_v/Wp=0.28$)	WEIGHT, Wp ($@F_p/Wp=1.50$, $E_v/Wp=0.30$)	WEIGHT, Wp ($@F_p/Wp=1.57$, $E_v/Wp=0.31$)	WEIGHT, Wp ($@F_p/Wp=1.75$, $E_v/Wp=0.35$)
18	610	545	515	495	450
24	540	480	460	445	410
30	485	440	420	400	375
36	440	405	380	370	345

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SHEET TITLE: AXIAL & FLEXURAL CAPACITIES OF HORIZONTAL TRAPEZE STRUTS
12 GA DOUBLE STRUT

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SEISMIC BRACING FOR
MEP SYSTEMS

CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS

ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' ARE TYP UNO)

MODE	COMPONENT DESCRIPTION	RUN PIPE NOMINAL DIA (INCHES)	RUN PIPE REFERENCE	HORIZ CAPACITY F_H (POUNDS) PER INSTALLATION ANGLE ø				NOTES
				30° – 44°	45° – 59°	60° – 74°	75° – 90°	
T	CSBQIKCL	1,1¼,1½	LW	218	308	371	413	c,i
T	CSBQIKCL	2,2½,3,3½	LW	293	413	503	563	c,i
T	CSBQIKCL	4	LW	353	495	608	683	c,i
R	CSBQIKCL	1,1¼,1½	LW	413	413	413	413	c,i
R	CSBQIKCL	2,2½,3,3½	LW	563	563	563	563	c,i
R	CSBQIKCL	4	LW	683	683	683	683	c,i
T	CSBQIKCL	1,1¼,1½	10	113	158	210	236	i,k
T	CSBQIKCL	2,2½,3,3½	10	263	375	465	518	i,k
T	CSBQIKCL	4	10	383	548	668	743	i,k
R	CSBQIKCL	1,1¼,1½	10	236	236	236	236	i,k
R	CSBQIKCL	2,2½,3,3½	10	518	518	518	518	i,k
R	CSBQIKCL	4	10	743	743	743	743	i,k
T	CSBQIKCL	1,1¼,1½	40	356	499	619	694	i,j
T	CSBQIKCL	2,2½,3,3½	40	368	518	638	713	i,j
T	CSBQIKCL	4	40	375	533	653	728	i,j
R	CSBQIKCL	1,1¼,1½	40	694	694	694	694	i,j
R	CSBQIKCL	2,2½,3,3½	40	713	713	713	713	i,j
R	CSBQIKCL	4	40	728	728	728	728	i,j

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SHEET TITLE: CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS
CSBQIKCL

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SEISMIC BRACING FOR MEP SYSTEMS

CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS

ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' ARE TYP)

MODE	COMPONENT DESCRIPTION	RUN PIPE NOMINAL DIA (INCHES)	RUN PIPE REFERENCE	HORIZ CAPACITY F_H (POUNDS) PER INSTALLATION ANGLE ø				NOTES
				30° – 44°	45° – 59°	60° – 74°	75° – 90°	
L	CSB	1	LW,10,40	970 (480)	930 (420)	950 (480)	1050 (NR)	c,h,j,k,ac
L	CSB	1¼	LW,10,40	970 (480)	930 (420)	950 (480)	1050 (NR)	c,h,j,k,ac
L	CSB	1½	LW,10,40	900 (920)	1390 (970)	1630 (1170)	1690 (NR)	c,h,j,k,ac
L	CSB	2	LW,10,40	900 (660)	1360 (910)	1630 (1170)	1690 (NR)	c,h,j,k,ac
L	CSB	2½	LW,10,40	900 (660)	1360 (910)	1640 (1370)	1870 (NR)	c,h,j,k,ac
L	CSB	3	LW,10,40	980 (660)	1340 (910)	1640 (1370)	1870 (NR)	c,h,j,k,ac
L	CSB	4	LW,10,40	980 (1010)	1340 (1380)	1640 (1760)	1970 (NR)	c,h,j,k,ac
L	CSB	5	LW,10,40	980 (1010)	1340 (1380)	1640 (1440)	1970 (NR)	c,h,j,k,ac
L	CSB	6	LW,10,40	1060 (1080)	1460 (1390)	1760 (1440)	2010 (NR)	c,h,j,k,ac
L	CSB	8,10	0.188,40	910 (920)	1250 (1250)	1760 (1440)	1980 (NR)	g,h,j,ac
L	CSB	12	0.188,40	1030 (920)	1300 (1270)	1570 (1560)	1870 (NR)	g,h,j,ac
T	CSB	1	LW,10,40	1120 (780)	1580 (1100)	1940 (1350)	2170 (1510)	c,h,j,k,ac
T	CSB	1¼	LW,10,40	1040 (780)	1470 (1100)	1800 (1350)	2020 (1510)	c,h,j,k,ac
T	CSB	1½	LW,10,40	1040 (1190)	1470 (1680)	1800 (2060)	2020 (2300)	c,h,j,k,ac
T	CSB	2	LW,10,40	1040 (1190)	1470 (1680)	1800 (2060)	2020 (2300)	c,h,j,k,ac
T	CSB	2½	LW,10,40	1080 (1220)	1520 (1720)	1870 (2110)	2090 (2370)	c,h,j,k,ac
T	CSB	3	LW,10,40	1040 (1140)	1480 (1620)	1810 (1980)	2030 (2220)	c,h,j,k,ac
T	CSB	4	LW,10,40	1040 (1140)	1480 (1620)	1810 (1980)	2030 (2220)	c,h,j,k,ac
T	CSB	5	LW,10,40	1040 (1140)	1480 (1620)	1810 (1980)	2030 (2220)	c,h,j,k,ac
T	CSB	6	LW,10,40	1090 (1170)	1540 (1660)	1890 (2040)	2120 (2280)	c,h,j,k,ac
T	CSB	8,10	0.188,40	990 (1060)	1410 (1500)	1730 (1830)	1930 (2060)	g,h,j,ac
T	CSB	12	0.188,40	1260 (1090)	1780 (1550)	2180 (1900)	2440 (2130)	g,h,j,ac
R	CSB	1	LW,10,40	2170	2170	2170	2170	c,h,j,k
R	CSB	1¼	LW,10,40	2020	2020	2020	2020	c,h,j,k
R	CSB	1½	LW,10,40	2020	2020	2020	2020	c,h,j,k
R	CSB	2	LW,10,40	2020	2020	2020	2020	c,h,j,k

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SHEET TITLE: CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS
CSB

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CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS

ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' ARE TYP)

MODE	COMPONENT DESCRIPTION	RUN PIPE NOMINAL DIA (INCHES)	RUN PIPE REFERENCE	HORIZ CAPACITY F_H (POUNDS) PER INSTALLATION ANGLE ø				NOTES
				30° – 44°	45° – 59°	60° – 74°	75° – 90°	
R	CSB	2½	LW,10,40	2090	2090	2090	2090	c,h,j,k
R	CSB	3	LW,10,40	2030	2030	2030	2030	c,h,j,k
R	CSB	4	LW,10,40	2030	2030	2030	2030	c,h,j,k
R	CSB	5	LW,10,40	2030	2030	2030	2030	c,h,j,k
R	CSB	6	LW,10,40	2120	2120	2120	2120	c,h,j,k
R	CSB	8, 10	0.188,40	1930	1930	1930	1930	g,h,j
R	CSB	12	0.188,40	2440	2440	2440	2440	g,h,j
T	CSBBRP	1 AND 1¼	LW,10,40	90	120	150	170	c,e,j,k,
T	CSBBRP	1 AND 1¼	LW,10,40	100	140	180	200	c,f,j,k
T	CSBBRP	1½ AND 2	LW,10,40	100	140	180	200	c,e,j,k
T	CSBBRP	1½ AND 2	LW,10,40	80	110	140	150	c,f,j,k
T	CSBQG	2½	LW,10,40	670	1060	1390	1610	c,i,j,k,s
T	CSBQG	3	LW,10,40	890	1260	1550	1730	c,i,j,k
T	CSBQG	4	LW,10,40	890	1260	1550	1730	c,i,j,k
T	CSBQG	5,6	LW,10,40	650	920	1130	1260	c,i,j,k
T	CSBQG	8	0.188,40	590	830	1020	1140	g,i,j
R	CSBQG	2½	LW,10,40	1610	1610	1610	1610	c,i,j,k,s
R	CSBQG	3	LW,10,40	1730	1730	1730	1730	c,i,j,k
R	CSBQG	4	LW,10,40	1730	1730	1730	1730	c,i,j,k
R	CSBQG	5,6	LW,10,40	1260	1260	1260	1260	c,i,j,k
R	CSBQG	8	0.188,40	1140	1140	1140	1140	g,i,j
T	CSBT	1 – 4	LW,10,40	475	790	790	890	aa,ab,j,k, m,x

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SHEET TITLE: CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS
CSB, CSBBRP, CSBQG & CSBT

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SEISMIC BRACING FOR MEP SYSTEMS

CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS

ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' ARE TYP, UNO)

MODE	COMPONENT DESCRIPTION	RUN PIPE NOMINAL DIA (INCHES)	RUN PIPE REFERENCE	HORIZ CAPACITY F_H (POUNDS) PER INSTALLATION ANGLE ø						NOTES
				0°	30° – 44°	45° – 59°	60° – 74°	75° – 90°	90°	
T	CSBCS	1	EMT,LW,10,40	–	115	240	173	191	–	j,k,q,t,x,aa
T	CSBCS	2	EMT,LW,10,40	–	191	318	179	198	–	j,k,q,t,x,aa
T	CSBCS	2½	EMT,LW,10,40	–	293	363	290	321	–	j,k,q,t,x,aa
T	CSBCS	4, 5, 6	EMT,LW,10,40	–	186	412	439	485	–	j,k,q,t,x,aa
T	CSBR1	–	NA	–	623	876	1055	1176	–	o,v
T	CSBR1	–	NA	–	755	1109	1681	1875	–	h,v
T	CSBR2	–	NA	–	1051	1480	1781	1987	–	v,w
VERTICAL	SCH–B	½	EMT,LW,10,40	418	–	–	–	–	–	k,x,y,aa
T	SCH–B	½	EMT,LW,10,40	–	–	–	–	–	54	k,x,y,aa
L	SCH–B	½	EMT,LW,10,40	–	–	–	–	–	46	k,x,y,aa
VERTICAL	SCH–B	1	EMT,LW,10,40	432	–	–	–	–	–	k,x,y,aa
T	SCH–B	1	EMT,LW,10,40	–	–	–	–	–	76	k,x,y,aa
L	SCH–B	1	EMT,LW,10,40	–	–	–	–	–	84	k,x,y,aa
VERTICAL	SCH–B	2	EMT,LW,10,40	1013	–	–	–	–	–	k,x,y,aa
T	SCH–B	2	EMT,LW,10,40	–	–	–	–	–	100	k,x,y,aa
L	SCH–B	2	EMT,LW,10,40	–	–	–	–	–	118	k,x,y,aa
VERTICAL	SCH–B	4	EMT,LW,10,40	976	–	–	–	–	–	k,x,y,aa
T	SCH–B	4	EMT,LW,10,40	–	–	–	–	–	68	k,x,y,aa
L	SCH–B	4	EMT,LW,10,40	–	–	–	–	–	58	k,x,y,aa
VERTICAL	BC200000EG	NA	CABLE TRAY	2400	–	–	–	–	–	u
T	BC200000EG	NA	CABLE TRAY	–	–	–	–	–	396	u
L	BC200000EG	NA	CABLE TRAY	–	–	–	–	–	2400	u

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SHEET TITLE: CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS
CSBU1, CSBCS, CSBR1, CSBR2, CSBTR, SCH & BC200000BG

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CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS

ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' ARE TYP)

MODE	COMPONENT DESCRIPTION	RUN PIPE NOMINAL DIA (INCHES)	RUN PIPE REFERENCE	HORIZ CAPACITY F_H (POUNDS) PER INSTALLATION ANGLE ø						NOTES
				0°	30° – 44°	45° – 59°	60° – 74°	75° – 90°	90°	
VERTICAL	USC	½	EMT,LW,10,40	790	–	–	–	–	–	k,x,y,aa
T	USC	½	EMT,LW,10,40	–	–	–	–	–	118	k,x,y,aa
L	USC	½	EMT,LW,10,40	–	–	–	–	–	91	k,x,y,aa
VERTICAL	USC	1	EMT,LW,10,40	754	–	–	–	–	–	k,x,y,aa
T	USC	1	EMT,LW,10,40	–	–	–	–	–	198	k,x,y,aa
L	USC	1	EMT,LW,10,40	–	–	–	–	–	82	k,x,y,aa
VERTICAL	USC	2	EMT,LW,10,40	1652	–	–	–	–	–	k,x,y,aa
T	USC	2	EMT,LW,10,40	–	–	–	–	–	559	k,x,y,aa
L	USC	2	EMT,LW,10,40	–	–	–	–	–	130	k,x,y,aa
VERTICAL	USC	4	EMT,LW,10,40	1297	–	–	–	–	–	k,x,y,aa
T	USC	4	EMT,LW,10,40	–	–	–	–	–	749	k,x,y,aa
L	USC	4	EMT,LW,10,40	–	–	–	–	–	310	k,x,y,aa
VERTICAL	CCC	½	EMT,LW,10,40	1012	–	–	–	–	–	k,x,z,aa
T	CCC	½	EMT,LW,10,40	–	–	–	–	–	61	k,x,z,aa
L	CCC	½	EMT,LW,10,40	–	–	–	–	–	117	k,x,z,aa
VERTICAL	CCC	1	EMT,LW,10,40	1312	–	–	–	–	–	k,x,z,aa
T	CCC	1	EMT,LW,10,40	–	–	–	–	–	115	k,x,z,aa
L	CCC	1	EMT,LW,10,40	–	–	–	–	–	89	k,x,z,aa
VERTICAL	CCC	2	EMT,LW,10,40	1493	–	–	–	–	–	k,x,z,aa
T	CCC	2	EMT,LW,10,40	–	–	–	–	–	123	k,x,z,aa
L	CCC	2	EMT,LW,10,40	–	–	–	–	–	130	k,x,z,aa
VERTICAL	CCC	4	EMT,LW,10,40	1394	–	–	–	–	–	k,x,z,aa
T	CCC	4	EMT,LW,10,40	–	–	–	–	–	74	k,x,z,aa
L	CCC	4	EMT,LW,10,40	–	–	–	–	–	181	k,x,z,aa

SHEET TITLE: CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS
USC & CCC

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CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS

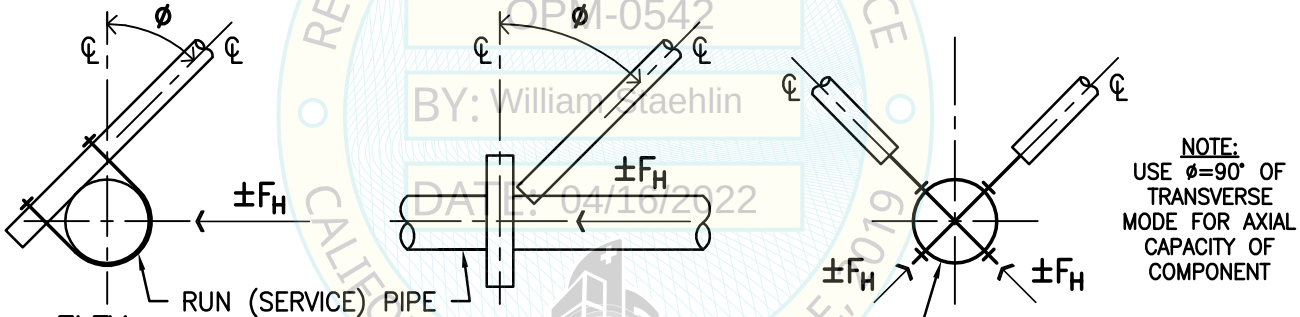
TABLE FOOTNOTES:

a. ALLOWABLE HORIZ CAPACITIES AT ALLOWABLE STRESS DESIGN OF BRACE COMPONENTS, F_H IN THE TABLE, ARE BASED ON TESTING PER ANSI/FM® APPROVAL STANDARD FOR SEISMIC SWAY BRACES FOR PIPE, TUBING AND CONDUIT, CLASS NUMBER 1950–2016 APPROVED FEBRUARY 1, 2016. THE FM SPECIFICATION TESTED REPORT PROJECT NUMBERS PR449669 REISSUE 1 SIGNED 01/16/2020 & PR449672 REISSUE 3, APPENDIX "A", REISSUED MARCH 10, 2021; PR3056157 APPENDIX "A" DATED MAY 10, 2016; PR3060189 APPENDIX "B" DATED JUNE 2, 2017; PR454958 APPENDIX "A" REISSUED APRIL 6, 2021. ALLOWABLE HORIZ CAPACITY, F_H IN THE TABLE, OF BRACE SUB–ASSEMBLIES HAVE BEEN DETERMINED BY RESOLVING THE LOAD RATING (i.e. THE LOAD RESULTING IN FAILURE OR EXCEEDANCE OF DEFORMATION LIMITS) TO THE HORIZ DIRECTION AND DIVIDING BY A SAFETY FACTOR OF 2.0 TO ALLOW THE VALUES TO BE USED DIRECTLY FOR ALLOWABLE STRESS DESIGN (ASD). FOR LOAD AND RESISTANCE FACTOR DESIGN (LRFD) CAPACITIES, THE ABV VALUES WILL NEED TO BE MULTIPLIED BY 1.5.

b. ALLOWABLE HORIZ CAPACITY, F_H AT ASD, FOR THINNER WALLED RUN (SERVICE) PIPES MAY BE USED FOR THICKER WALLED PIPES BUT NOT VICE VERSA (i.e. SCHEDULE LW CAPACITIES F_H AT ASD MAY BE USED FOR SCHEDULE 10).

c. LOAD RATINGS FOR LW ABV REFERS TO FM APPROVED LIGHTWALL PIPE, COMMONLY REFERRED TO AS "SCHEDULE 7". THESE RATINGS MAY ALSO BE APPLIED TO AS 1074 LIGHTWALL, EN 10220, EN 10255 L, AND GB/T 8163 RUN (SERVICE) PIPE, UNLESS OTHERWISE SPECIFIED.

d. :



e. LOAD RATINGS BASED ON THE USE OF A ⅜"ø–16 UNC (M10x1.5) THRD ROD AS THE BRACE MEMBER.

f. LOAD RATINGS BASED ON THE USE OF A ½"ø–13 UNC (M12x1.75) THRD ROD AS THE BRACE MEMBER.

g. LOAD RATINGS FOR "0.188 WALL" ABV MAY BE APPLIED TO ANY THICKER WALLED PIPE UNLESS OTHERWISE SPECIFIED.

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SHEET TITLE: CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS TABLE FOOTNOTES

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CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS

TABLE FOOTNOTES (CONTINUED):

h. FM® APPROVED WHEN USED W/ 1", 1¼", 1½" OR 2" (DN25, DN32, DN40, DN50) NPS SCHEDULE 40, GB/T 3091, EN 10255 (HEAVY), AS 1074 (HEAVY) OR JIS G3454 **BRACE PIPE**.

i. FM APPROVED WHEN USED W/ 1" AND 1¼" (DN25 AND DN32) NPS SCHEDULE 40, AS 1074 (HEAVY), GB/T 3091, EN 10255 (HEAVY), OR JIS G3454 **BRACE PIPE**.

j. LOAD RATINGS FOR SCHEDULE 40 IN TABLE ABV MAY ALSO BE APPLIED TO AS 1074 (HEAVY), GB/T 3091, EN 10255 (HEAVY), AND JIS G3454 PIPE.

k. LOAD RATINGS FOR SCHEDULE 10 IN TABLE ABV MAY ALSO BE APPLIED TO GB/T 3091, EN 10255 (MEDIUM OR HEAVY), JIS G3452, FM APPROVED THINWALL, AND SCHEDULE 40 PIPES UNLESS OTHERWISE INDICATED.

l. FM APPROVALS DO NOT APPROVE SEISMIC BRCG PRODUCTS FOR USE W/ 8"ø AND 10"ø SERVICE PIPES (NPS PIPE) W/ A WALL THK LESS THAN 0.188". ASME® B36.10M–2004 DEFINES SCHEDULE 10 MIN WALL THK FOR 8"ø AND 10"ø SERVICE PIPES (NPS PIPE) AS 0.134" AND 0.159", RESPECTIVELY. THEREFORE, CERTIFICATES OF COMPLIANCE SPECIFY THE PIPE AS "0.188" RATHER THAN "SCHEDULE 10". IT IS TYP IN THE UNITED STATES THAT 8"ø AND 10"ø NPS PIPE THAT IS MARKETED AS "SCHEDULE 10" HAS A WALL THK OF 0.188", WHICH IS GREATER THAN THE MIN WALL THK SPECIFIED BY ASME B36.10M–2004.

m. TESTING FOR THE CSBT IS FOR THE WHOLE TELESCOPING BRACE ASSEMBLY FOR ALL LENGTHS & INCLUDING THE ATTACHMENT COMPONENTS TO THE SUPPORTING STRUCTURE AS SHOWN IN SECTION 8.

n. LOAD RATING FOR SCH. 40 **BRACE PIPE** NOTED IN FOOTNOTES h & i ABV MAY BE APPLIED TO SCH. 80 **BRACE PIPE** HAVING THE SAME DIA.

o. LOAD RATING FOR EMT IN TABLE ABV REFERS TO 1" DIA MIN ELECTRICAL METALLIC TUBE CONDUIT OR 1" DIA MIN RIGID METALLIC CONDUIT–STEEL AS **BRACE MEMBER**.

p. LOAD RATING FOR NO HUB CAST IRON PIPE.

q. CSBCS RATING APPLIES WHEN CSBCS IS USED W/ nVENT CADDY MODEL 401 CLEVIS HANGER & CSBU1 ATTACHED TO THE CROSS BOLT ON THE SIDE OF THE 401 CLEVIS HANGER

r. WHEN THE CSBT IS ATTACHED TO A VERT FACE OF A WALL OR BM, THE CAPACITY IS LIMITED TO 475 LBS.

s. INCLUDES CSBQG0250MEG TO ACCOMMODATE DN65 PIPE SIZE.

t. LOAD RATING FOR EMT RUN PIPE ABV REFERS TO ELECTRIC METALLIC TUBE CONDUIT, 1" DIA MIN.

u. LOAD RATING WHEN USED AS A PAIR.

v. LOAD RATING APPLIES TO ⅜" OR ½" ROD AS VERT MEMBER BEING BRACED.

w. LOAD RATING APPLIES WHEN 12 GA STRUT IS USED AS **BRACE MEMBER**.

x. LOAD RATING FOR SCH 40 MAY BE APPLIED TO SCH 80.

y. LOAD RATING APPLIES WHEN THE PRODUCT IS USED W/ ELECTRIC METALLIC TUBING OR RIGID METAL CONDUIT–STEEL AS DEFINED IN ANSI C80.1.

z. LOAD RATING APPLIES WHEN THE PRODUCT IS USED W/ COPPER TUBING, ELECTRIC METALLIC TUBING, RIGID METALLIC CONDUIT–STEEL AS DEFINED IN ANSI C80.1.

aa. LOAD RATINGS FOR LW ABV REFERS TO FM APPROVED LIGHTWALL PIPE, COMMONLY REFERRED TO AS "SCHEDULE 7". THESE RATINGS MAY ALSO BE APPLIED TO EN 10220 & GB/T 8163 RUN (SERVICE) PIPE.

ab. IF THE CSBTB1 ATTACHMENT TO THE BRACE IS ROTATED 90° FROM WHAT IS SHOWN ON PG 5.2. THE ALLOWABLE VALUE MUST NOT EXCEED 475 POUNDS.

ac. VALUES IN PARENTHESES ARE LOAD RATINGS WHEN USED W/ ERICO "TYPE A" 1⅝"x1⅝"x12 GA SOLID SINGLE STRUT **BRACE MEMBER**.

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SHEET TITLE: CAPACITY TABLE OF BRACE SUPPORTS AT SYSTEM COMPONENTS TABLE FOOTNOTES

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SEISMIC BRACING FOR MEP SYSTEMS

CAPACITY TABLE OF BRACE SUPPORTS AT SUPPORTING STRUCTURE

ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' ARE TYP UNO)

MODE	COMPONENT DESCRIPTION	JOIST OR BM THICKNESS INCHES	JOIST OR BM WIDTH INCHES	ORIENTATION	HORIZ CAPACITY F_H (POUNDS) PER INSTALLATION ANGLE ø				NOTES
					30° – 44°	45° – 59°	60° – 74°	75° – 90°	
NA	CSBBRS1	12 GA (0.1094") – 0.50	NA	NA	160	230	150	150	e
NA	CSBBRS1	12 GA (0.1094") – 0.50	NA	NA	160	220	150	170	f
NA	CSBBRS3	NA	NA	NA	240	230	140	150	h
NA	CSBBRS3	16 GA MIN	NA	NA	240	230	140	150	l
NA	CSBBRS3	0.25 – 0.75	NA	LATERAL	120	170	150	170	e,f,g
NA	CSBBRS3	0.25 – 0.75	NA	LONGITUDINAL	80	120	160	190	e,f,g
NA	CSBU1	NA	NA	NA	530	910	1110	1220	m
NA	CSBU1	NA	NA	NA	1270	1660	1990	2320	j
NA	CSBU2	NA	NA	NA	1110	1710	2140	2320	j
NA	CSBS1	0.25 – 0.75	NA	LATERAL	640	1330	208	2130	j
NA	CSBS1	0.25 – 0.75	NA	LONGITUDINAL	520	1070	1510	1800	j
NA	CSBS1A	0.25 – 0.75	NA	LATERAL	640	1330	208	2130	j
NA	CSBS1A	0.25 – 0.75	NA	LONGITUDINAL	520	1070	1510	1800	j
NA	CSBS2	0.75 – 1.25	NA	LATERAL	790	1610	1930	2150	j
NA	CSBS2	0.75 – 1.25	NA	LONGITUDINAL	650	1320	1640	2010	j
NA	CSBS3	0.25 – 0.75	4 – 8.5	LATERAL	790	1610	1930	2150	j
NA	CSBS3	0.25 – 0.75	4 – 8.5	LONGITUDINAL	650	1320	1640	2010	j
NA	CSBS4	0.25 – 0.75	4 – 14.5	LATERAL	820	1660	2120	2210	j
NA	CSBS4	0.25 – 0.75	4 – 14.5	LONGITUDINAL	450	970	1460	2250	j
NA	CSBS5	0.75 – 1.25	4 – 18	LATERAL	820	1660	2120	2210	j
NA	CSBS5	0.75 – 1.25	4 – 18	LONGITUDINAL	450	970	1460	2250	j
NA	CSBUS1	NA	NA	NA	1230	2130	2560	2860	k
NA	CSBUS2	NA	NA	NA	1230	2130	2560	2860	k
NA	CSBUS1PA	NA	NA	NA	760	1160	1400	1920	k
NA	CSBUS2PA	NA	NA	NA	760	1160	1400	1920	k
NA	CSBMA	NA	NA	NA	1385	2400	4156	4700	n
NA	CSBU1	NA	NA	NA	1090	1370	1400	1550	o
NA	CSBU2	NA	NA	NA	1090	1370	1400	1550	o
NA	CSBU1	NA	NA	NA	1000	1380	1830	2030	o,p
NA	CSBU2	NA	NA	NA	1000	1380	1830	2030	o,p

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SHEET TITLE: CAPACITY TABLE OF BRACE SUPPORTS AT SUPPORTING STRUCTURE
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CAPACITY TABLE OF BRACE SUPPORTS AT SUPPORTING STRUCTURE

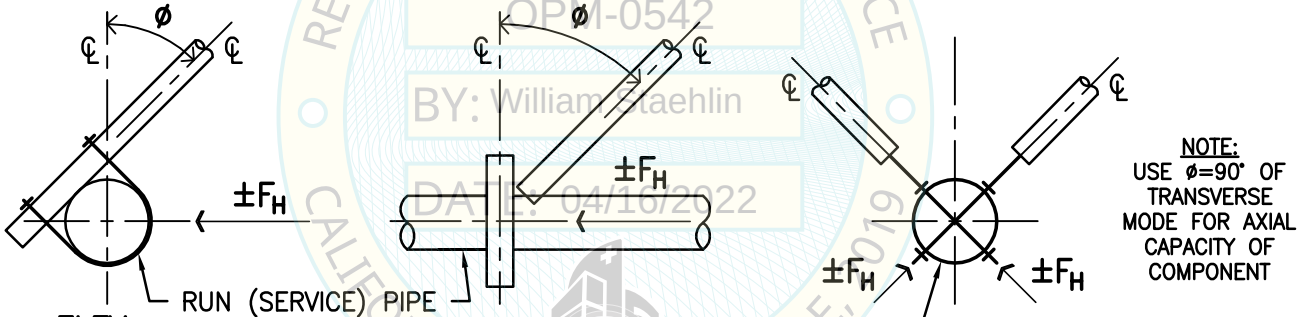
TABLE FOOTNOTES:

a. ALLOWABLE HORIZ CAPACITIES AT ALLOWABLE STRESS DESIGN OF BRACE COMPONENTS, F_H IN THE TABLE, ARE BASED ON TESTING PER ANSI/FM® APPROVAL STANDARD FOR SEISMIC SWAY BRACES FOR PIPE, TUBING AND CONDUIT, CLASS NUMBER 1950–2016 APPROVED FEBRUARY 1, 2016, FM SPECIFICATION TESTED REPORT PROJECT NUMBER PR454958 REISSUE 1 SIGNED AND DATED 03/17/2020 & REISSUED 04/06/2021, FM APPROVAL REPORT PROJECT NO. 003060189 APPENDIX B SPECIFICATION TESTED PRODUCTS SIGNED AND DATED 06/02/2017, & FM SPECIFICATION TESTED REPORT PROJECT NO. 449672 REISSUE 3 SIGNED & DATED 03/04/2019 & REISSUED 03/10/2021. ALLOWABLE HORIZ CAPACITY, F_H IN THE TABLE, OF BRACE SUB–ASSEMBLIES HAVE BEEN DETERMINED BY RESOLVING THE LOAD RATING (i.e. THE LOAD RESULTING IN FAILURE OR EXCEEDANCE OF DEFORMATION LIMITS) TO THE HORIZ DIRECTION AND DIVIDING BY A SAFETY FACTOR OF 2.0 TO ALLOW THE VALUES TO BE USED DIRECTLY FOR ALLOWABLE STRESS DESIGN (ASD). FOR LOAD AND RESISTANCE FACTOR DESIGN (LRFD) CAPACITIES, THE ABV VALUES WILL NEED TO BE MULTIPLIED BY 1.5.

b. ALLOWABLE HORIZ CAPACITY, F_H AT ASD, FOR THINNER WALLED RUN (SERVICE) PIPES MAY BE USED FOR THICKER WALLED PIPES BUT NOT VICE VERSA (i.e. SCHEDULE LW CAPACITIES F_H AT ASD MAY BE USED FOR SCHEDULE 10).

c. LOAD RATINGS FOR LW ABV REFERS TO FM APPROVED LIGHTWALL PIPE, COMMONLY REFERRED TO AS "SCHEDULE 7". THESE RATINGS MAY ALSO BE APPLIED TO AS 1074 LIGHTWALL, EN 10255 L, EN 10220 AND GB/T 8163 RUN (SERVICE) PIPE, UNLESS OTHERWISE SPECIFIED.

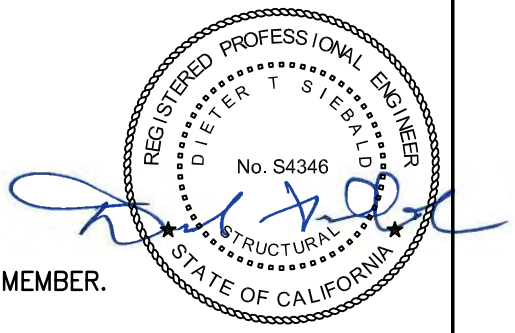
d. :



e. LOAD RATINGS BASED ON THE USE OF A ⅜"ø–16 UNC (M10x1.5) THRD ROD AS THE **BRACE MEMBER**.

f. LOAD RATINGS BASED ON THE USE OF A ½"ø–13 UNC (M12x1.75) THRD ROD AS THE **BRACE MEMBER**.

g. LOAD RATINGS BASED ON THE USE OF A MODEL 300 BM CLAMP (⅜"ø–16 UNC/M10x1.5 BOLT) AS MEANS FOR ATTACHMENT TO STRUC MEMBER.



SHEET TITLE: CAPACITY TABLE OF BRACE SUPPORTS AT SUPPORTING STRUCTURE
TABLE FOOTNOTES

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CAPACITY TABLE OF BRACE SUPPORTS AT SUPPORTING STRUCTURE

TABLE FOOTNOTES (CONTINUED):

h. LOAD RATINGS BASED ON THE USE OF A ⅜"ø–16 UNC (M10x1.5) THRD FASTENER AS THE ATTACHMENT FASTENER TO A CONC INSERT.

i. FM APPROVED WHEN USED W/ 1" AND 1¼" (DN25 AND DN32) NPS SCHEDULE 40 AS 1074 HEAVY, GB/T 3091, EN 10255 (HEAVY), OR JIS G3454 **BRACE PIPE**.

j. FM APPROVED WHEN USED W/ 1", 1¼", 1½" OR 2" (DN25, DN32, DN40, DN50) NPS SCHEDULE 40, GB/T 3091, EN 10255 (HEAVY), AS 1074 HEAVY OR JIS G3454 **BRACE PIPE**.

k. FM APPROVED W/ 1⅝"x1⅝" 12 GA OR THICKER ERICO "TYPE A" STRUT AS **BRACE MEMBER**. FOR "TYPE A" STRUT SEE PGS 1.31 & 106.5.

l. LOAD RATINGS BASED ON THE USE OF ⅜"–16 UNC (M10x1.5) THRD FASTENER AS THE ATTACHMENT FASTENER TO THE STRUCTURAL MEMBER.

m. LOAD RATING WHEN USED W/ A 1" DIA MIN EMT CONDUIT OR A 1" DIA MIN RMC AS DETAILED IN ANSI C80.1 AS **BRACE MEMBER**.

n. CSBMA LOADS ARE LIMITED PER SHEET 106.4, NOTE 1. THE FM VALUES ARE SUPERSEDED BY VALUES PROVIDED ON PG 106.4.

o. LOAD RATING WHEN USED W/ AN ERICO "TYPE A" 1⅝"x1⅝"x12 GA SOLID SINGLE STRUT **BRACE MEMBER**.

p. LOAD RATING USED WHEN THE CSBU1 OR CSBU2 IS ATTACHED TO THE SIDE OF THE ERICO "TYPE A" 1⅝"x1⅝"x12 GA SOLID SINGLE STRUT **BRACE MEMBER** INSTEAD OF THE BACK (ASYMMETRICAL INSTALL).

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SHEET TITLE: CAPACITY TABLE OF BRACE SUPPORTS AT SUPPORTING STRUCTURE TABLE FOOTNOTES

CYS STRUCTURAL ENGINEERS, INC.
2495 NATOMAS PARK DRIVE, SUITE 650
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www.cyseng.com

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APPENDIX 'A'

MECHANICAL ANCHOR CAPACITY (CASE 1: METAL DECK WITH CONCRETE FILL)

MFR	TYPE	ESR REPORT	ANCHOR DIAMETER (IN) d_a	EFFECTIVE EMBED (IN) h_{ef}	LRFD TENSION CAPACITY (LBS) ϕTn	LRFD SHEAR CAPACITY (LBS) ϕVn
DEWALT / POWERS	Power-Stud+ SD1	ESR-2818	0.5	2	1165	1489
			0.5	3.25	1165	1489
			0.75	3.125	1377	2971
			0.75	4.75	1377	2971
	Power-Stud+ SD2	ESR-2502	0.5	2	714	2480
			0.5	3.25	1268	3276
			0.75	3.75	1692	1833
	Snake+	ESR-2272	0.375	1.1	524	462
			0.5	1.54	634	1197
	Hangermate+	ESR-3889	0.25	1.2	141	624
			0.25	1.94	141	624
HILTI	Kwik Bolt TZ2	ESR-4266	0.5	2	1041	1469
			0.5	3.25	1628	2753
			0.75	3.25	1621	2655
			0.75	3.75	1818	5112

NOTE:
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SHEET TITLE: APPENDIX 'A'
CAPACITY TABLES OF ANCHORS

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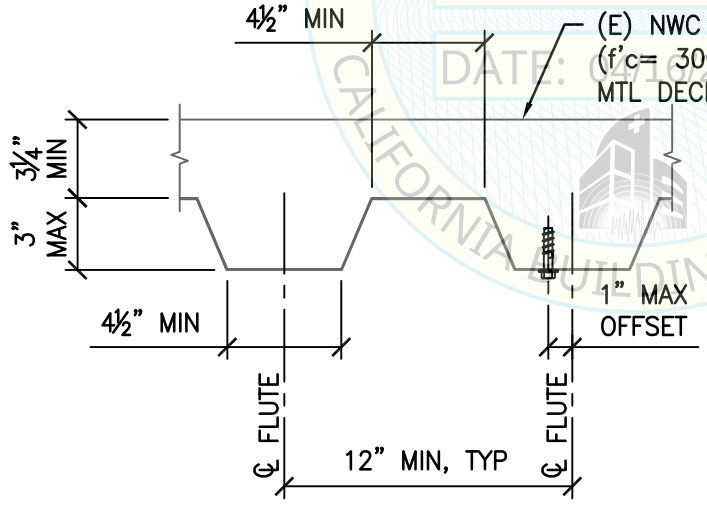
APPENDIX 'A'

MECHANICAL ANCHOR CAPACITY (CASE 1: METAL DECK WITH CONCRETE FILL)						
MFR	TYPE	ESR REPORT	ANCHOR DIAMETER (IN) d_a	EFFECTIVE EMBED (IN) h_{ef}	LRFD TENSION CAPACITY (LBS) ϕTn	LRFD SHEAR CAPACITY (LBS) ϕVn
SIMPSON	Strong-Tie Strong-Bolt 2	ESR-3037	0.5	2.25	995	1248
			0.5	4	1777	2678
			0.75	3.375	1372	2399
	Strong-Tie Strong-Bolt 2 SS	ESR-3037	0.5	2.25	970	1560
			0.5	4	1243	2129
			0.75	3.375	1477	3588
	Strong-Tie Titen HD	ESR-2713	0.5	1.29	441	939
			0.5	2.56	995	1708



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APPENDIX 'A'

MECHANICAL ANCHOR CAPACITY (CASE 2, 3: CONCRETE FLOOR, ROOF, OR WALL)

MFR	TYPE	ESR REPORT	ANCHOR DIAMETER (IN) d_a	EFFECTIVE EMBED (IN) h_{ef}	LRFD TENSION CAPACITY (LBS) ϕTn	LRFD SHEAR CAPACITY (LBS) ϕVn
DEWALT / POWERS	Power-Stud+ SD1	ESR-2818	0.5	2	1284	1844
			0.5	3.25	1338	2574
			0.75	3.125	2508	5577
			0.75	4.75	4699	6263
	Power-Stud+ SD2	ESR-2502	0.5	2	1284	1844
			0.5	3.25	2336	3130
			0.75	3.75	3296	5239
			0.75	5	4163	5239
	Power-Stud+ SD4 (SS304)	ESR-2502	0.5	2	1284	1797
			0.75	3.75	3296	5034
	Power-Stud+ SD6 (SS316)	ESR-2502	0.5	2	1284	1797
			0.75	3.75	3296	5034
	Snake+	ESR-2272	0.375	1.1	524	501
			0.5	1.54	867	1246
	Mini-Undercut+ (5/8" OD)	ESR-3912	0.375	0.75	135	272
	Hangermate+	ESR-3889	0.25	1.2	192	360
			0.25	1.94	625	834
HILTI	HDI-P TZ	ESR-4236	0.375	0.75	153	272
	Kwik Bolt TZ2	ESR-4266	0.5	2	1284	1844
			0.5	3.25	2660	4415
			0.75	3.25	2216	6365
			0.75	3.75	3296	6414
			0.75	4.75	4646	7764
	Kwik Bolt TZ2 SS	ESR-4266	0.5	2	1086	1560
			0.5	3.25	2660	4415
			0.75	3.75	3296	6414
			0.75	4.75	4697	7764

NOTE:
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REGISTERED PROFESSIONAL ENGINEER
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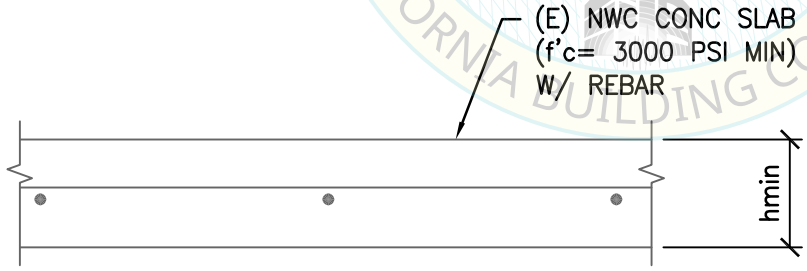
APPENDIX 'A'

MECHANICAL ANCHOR CAPACITY (CASE 2, 3: CONCRETE FLOOR, ROOF, OR WALL)

MFR	TYPE	ESR REPORT	ANCHOR DIAMETER (IN) d_a	EFFECTIVE EMBED (IN) h_{ef}	LRFD TENSION CAPACITY (LBS) ϕTn	LRFD SHEAR CAPACITY (LBS) ϕVn
SIMPSON	Strong-Tie Strong-Bolt 2	ESR-3037	0.5	2.25	1532	2200
			0.5	3.375	2662	4232
			0.75	3.375	2814	5329
			0.75	5	4539	6563
	Strong-Tie Strong-Bolt 2 SS	ESR-3037	0.5	2.25	1367	2200
			0.5	3.375	2299	3965
			0.75	3.375	2814	5329
			0.75	5	4395	6563
	Strong-Tie Titen HD	ESR-2713	0.5	2.35	1635	2348
			0.5	2.99	2347	2874
			0.75	2.94	2051	5610
			0.75	4.22	3242	5610
			0.75	4.86	3842	5610

NOTES:

1. ANCHOR CAPACITY VALUES SHOWN ARE AT LRFD LEVEL DESIGN & FOR SINGLE ANCHOR WITHOUT EFFECTS DUE TO ADJ ANCHORS. FOR ANCHOR GROUPS, SEOR MUST PROVIDE ADDNL CONC BREAKOUT CHECKS AS REQ. VERIFY THAT SUPPORTING STRUCTURE IS ADEQUATE TO SUPPORT THE WEIGHT & FORCES SHOWN IN ADDITION TO ALL OTHER LOADS.
2. SEE SECTION 1 – OVERVIEW & GENERAL NOTES FOR SETTING INFO. SEE SECTION 101 & SECTION 102 FOR SLAB PROPERTIES.
3. SEE PG 1.13 FOR CASES 2 & 3 DESCRIPTION.



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APPENDIX 'A'

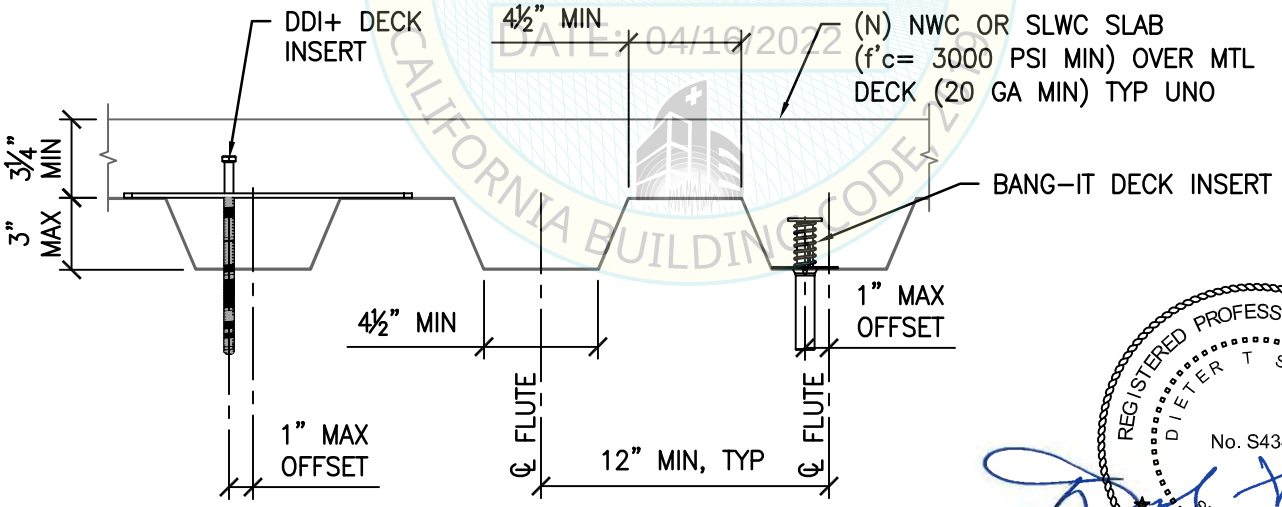
CAST-IN PLACE ANCHOR CAPACITY (CASE 4: METAL DECK WITH CONCRETE FILL)

MFR	TYPE	ESR REPORT	ANCHOR DIAMETER (IN) d_a	EFFECTIVE EMBED (IN) h_{ef}	LRFD TENSION CAPACITY (LBS) ϕTn	LRFD SHEAR CAPACITY (LBS) ϕVn
DEWALT / POWERS	Bang-It Deck Insert	ESR-3657	0.7(*)	1.75	970	1368
			1(*)	1.75	970	1617
	DDI+ Deck Insert	ESR-3958	0.375	1.5	808	1209
			0.5	1.75	970	2046
			0.625	2	1141	3441

(*) OUTSIDE DIA OF THE STL INSERT BODY

NOTES:

1. ANCHOR CAPACITY VALUES SHOWN ARE AT LRFD LEVEL DESIGN & FOR SINGLE ANCHOR WITHOUT EFFECTS DUE TO ADJ ANCHORS. FOR ANCHOR GROUPS, SEOR MUST PROVIDE ADDNL CONC BREAKOUT CHECKS AS REQ. VERIFY THAT SUPPORTING STRUCTURE IS ADEQUATE TO SUPPORT THE WEIGHT & FORCES SHOWN IN ADDITION TO ALL OTHER LOADS.
2. SEE SECTION 1 – OVERVIEW & GENERAL NOTES FOR SETTING INFO. SEE SECTION 100 FOR DECK DIMS & CONC FILL PROPERTIES.
3. SEE PG 1.15 FOR CASE 4 DESCRIPTION.
4. SEE PG 1.13 FOR ANCHORAGE CASES 1 THROUGH 3 & PG 1.15 FOR ANCHORAGE CASES 4 & 5.
5. SEE PG 1.14 FOR THRD ROD SIZES THAT CAN BE USED FOR "BANG-IT" DECK INSERTS.
6. "DDI+" DECK INSERTS MUST BE INSTALLED SO THAT THRD PORTION IS LOCATED IN BOTT FLUTE AS SHOWN BLW. SEE PG 1.14 FOR DECK REQ FOR DDI DECK INSERT.



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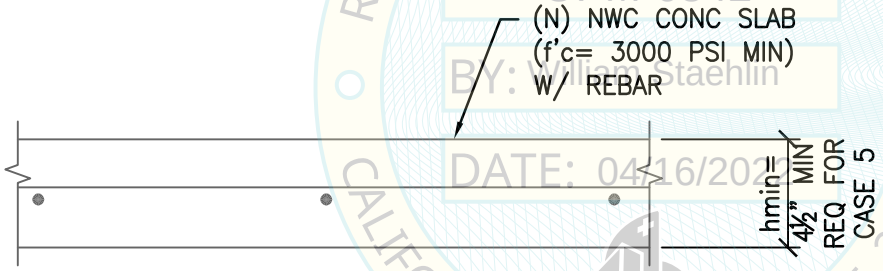
APPENDIX 'A'

CAST-IN PLACE ANCHOR CAPACITY (CASE 5: CONCRETE FLOOR, ROOF, OR WALL)						
MFR	TYPE	ESR REPORT	ANCHOR DIAMETER (IN) d_a	EFFECTIVE EMBED (IN) h_{ef}	LRFD TENSION CAPACITY (LBS) ϕTn	LRFD SHEAR CAPACITY (LBS) ϕVn
DEWALT / POWERS						
	Wood-Knocker II+ Insert	ESR-3657	0.7	1.75	1484	2131
			1	1.75	1484	2131

NOTES:

1. ANCHOR CAPACITY VALUES SHOWN ARE AT LRFD LEVEL DESIGN & FOR SINGLE ANCHOR WITHOUT EFFECTS DUE TO ADJ ANCHORS. FOR ANCHOR GROUPS, SEOR MUST PROVIDE ADDNL CONC BREAKOUT CHECKS AS REQ. VERIFY THAT SUPPORTING STRUCTURE IS ADEQUATE TO SUPPORT THE WEIGHT & FORCES SHOWN IN ADDITION TO ALL OTHER LOADS.
2. SEE SECTION 1 – OVERVIEW & GENERAL NOTES FOR SETTING INFO. SEE SECTION 101 & SECTION 102 FOR SLAB PROPERTIES.
3. SEE PG 1.15 FOR CASE 5 DESCRIPTION.
4. SEE PG 1.13 FOR ANCHORAGE CASES 1 THROUGH 3 & PG 1.15 FOR ANCHORAGE CASES 4 & 5.
5. SEE PG 1.14 THRD ROD SIZES THAT CAN BE USED FOR WOOD–KNOCKER II+ INSERTS.



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