



OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

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

OFFICE USE ONLY
APPLICATION #: OPM-0062-13

OSHPD Preapproval of Manufacturer's Certification (OPM)

Type: [ ] New [X] Renewal [ ] Update to Pre-CBC 2013 OPA Number:

Manufacturer Information

Manufacturer: ERICO International Corporation
Manufacturer's Technical Representative: Ward Judson, Ph.D.
Mailing Address: 34600 Solon Road, Solon, Ohio 44139
Telephone: 440-528-3788 Email: ward.judson@pentair.com

Product Information

Product Name: Seismic Sway Bracing for Fire Sprinkler Systems
Product Type: Seismic Sway Bracing
Product Model Number: CSBQIKCL, CSBQG, CSBSTU, CSBEZU, CSBBRP, CSBUNIV, CSBMA, CSBBRS3, CSBIB, CSBBC075, CSBBARJ, CSBBRS1, CSBU1, CSBU2, CSBS1, CSBS1A, CSBS2, CSBS3, CSBS4, CSBS5, CSB
General Description: The product consists of pipe clamps with brace pipes that are used for transverse, longitudinal, and vertical bracing of fire sprinkler service pipes. The products are attached to various support structures such as the underside of concrete floors or roofs.

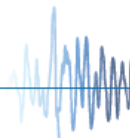
Applicant Information

Applicant Company Name: ERICO International Corporation
Contact Person: Ward Judson, Ph.D.
Mailing Address: 34600 Solon Road, Solon, Ohio 44139
Telephone: 440-528-3788 Email: ward.judson@pentair.com

I hereby agree to reimburse the Office of Statewide Health Planning and Development review fees in accordance with the California Administrative Code, 2013.

Signature of Applicant: Ward Judson Date: 12/19/16
Title: Engineering Manager, Product Certifications Company Name: ERICO International Corporation

"Access to Safe, Quality Healthcare Environments that Meet California's Diverse and Dynamic Needs"





**OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT  
FACILITIES DEVELOPMENT DIVISION**

**Registered Design Professional Preparing Engineering Recommendations**

Company Name: CYS Structural Engineers, Inc.

Name: Dieter T. Siebald California License Number: SE4346

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

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

**OSHPD Special Seismic Certification Preapproval (OSP)**

- Special Seismic Certification is preapproved under OSP-  
(Separate application for OSP is required)
- Special Seismic Certification is not preapproved

**Certification Method(s)**

- Testing in accordance with:  ICC-ES AC156  FM 1950-16
- Other\* (Please Specify): FM 1950-10

OPM-0062-13

\*Use of criteria other than those adopted by the California Building Standards Code, 2013 (CBSC 2013) 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 2013 maybe used when approved by OSHPD prior to testing.

- Analysis
- Experience Data
- Combination of Testing, Analysis, and/or Experience Data (Please Specify): Testing per FM 1950-10 and Analysis per pertinent chapters of 2013 CBC.

DATE: 09/11/2017

**List of Attachments Supporting the Manufacturer's Certification**

- Test Report  Drawings  Calculations  Manufacturer's Catalog
- Other(s) (Please Specify): \_\_\_\_\_

**OFFICE USE ONLY – OSHPD APPROVAL VALID FOR CBC 2013**

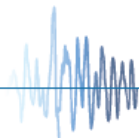
Signature:  Date: 09-11-2017

Print Name: Jeffrey Kikumoto

Title: SSE

Condition of Approval (if applicable): \_\_\_\_\_

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SEISMIC SWAY BRACING FOR  
FIRE SPRINKLER SYSTEMS

ADDENDUM #1 - SUMMARY

THE FOLLOWING PRODUCTS WILL BE PHASED OUT WITH A CORRESPONDING NEW REPLACEMENT. CONTACT THE MANUFACTURER FOR SPECIFIC DETAILS ABOUT THE PHASE-OUT PLAN. WE RECOMMEND USING THE NEW REPLACEMENT PRODUCTS TO REDUCE DELAYS & PROJECT RESUBMITTALS.

PHASED OUT PRODUCT

CORRESPONDING REPLACEMENT

CSBSTU .....	CSB
CSBEZU .....	CSB
CSBBARJ .....	CSBS1
CSBBC075 .....	CSBS1 OR CSBS2
CSBIB075085 .....	CSBS3
CSBIB075145 .....	CSBS4
CSBIB125180 .....	CSBS5
CSBUNIV .....	CSBU

NEW PRODUCT

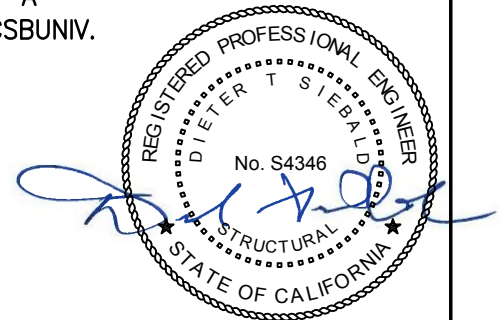
CSBT - TELESCOPING TRANSVERSE SWAY BRACE & VERTICAL SEISMIC BRACE

NEW CASE

CASE 4 - UNDERSIDE OF CIP CONCRETE FLOOR OR ROOF

NOTES

1. A PHASED OUT OR OTHER CURRENT (E) PRODUCT, SUCH AS THE CSBSTU OR CSBQG, MAY BE USED W/ A REPLACEMENT PRODUCT, SUCH AS THE CSBS1.
2. A REPLACEMENT PRODUCT, SUCH AS THE CSB, MAY BE USED W/ A PHASED OUT OR OTHER CURRENT (E) PRODUCT, SUCH AS THE CSBUNIV.



SHEET TITLE: ADDENDUM #1 - SUMMARY



**CYS STRUCTURAL ENGINEERS, INC.**

2495 NATOMAS PARK DRIVE, SUITE 650  
SACRAMENTO, CA 95833

TEL (916) 920-2020  
www.cyseng.com

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SEISMIC SWAY BRACING FOR  
FIRE SPRINKLER SYSTEMS

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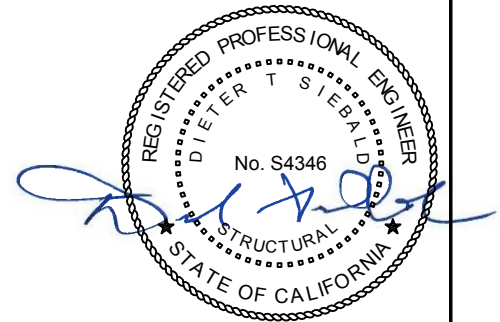
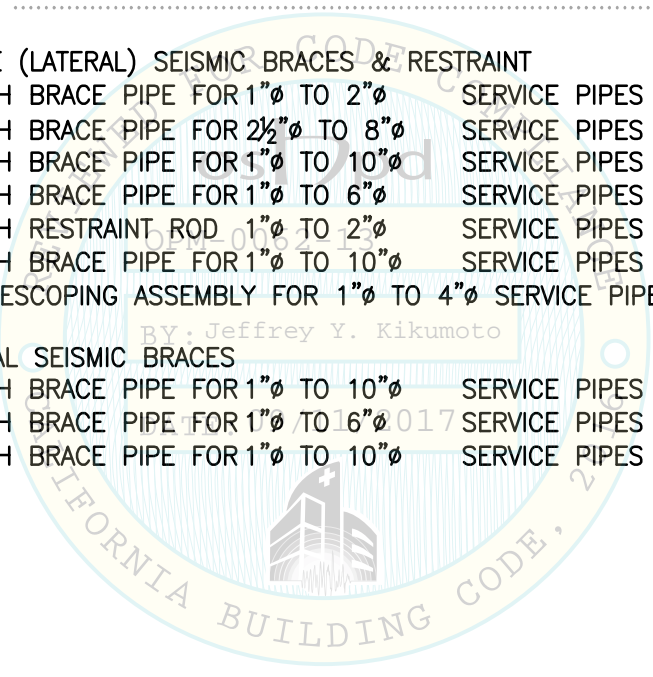
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BY: Jeffrey Y. Kikumoto



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**SECTION 4 – FOUR-WAY RISER SEISMIC BRACES**

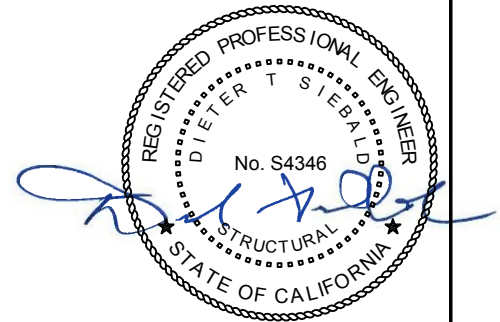
CSBSTU	WITH BRACE PIPES FOR 1"Ø TO 10"Ø	SERVICE PIPES	4.1
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FIRE SPRINKLER SYSTEMS

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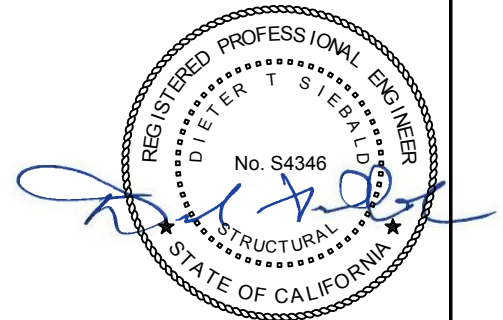
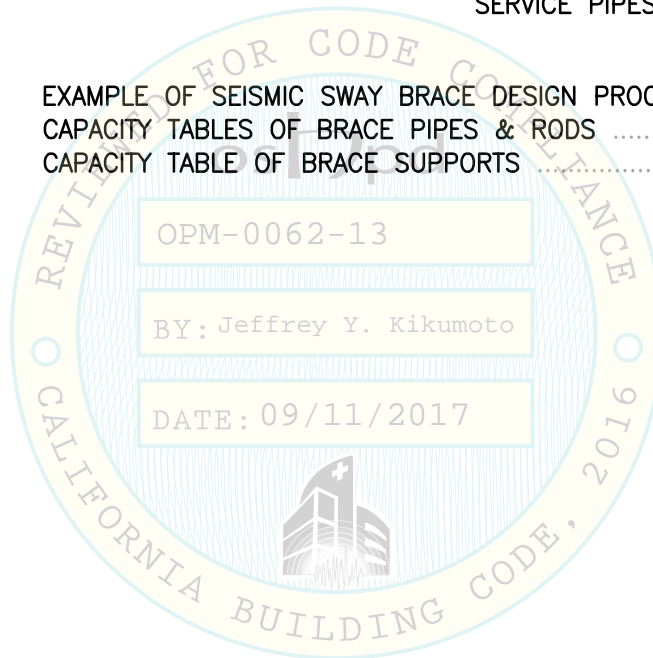
CSBUNIV	FOR 1/2" AND 3/4" BOLTS	7.1
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CSB	WITH BRACE PIPE FOR 1"Ø TO 10"Ø	SERVICE PIPES	8.6
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**APPENDICES:**

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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

## CONDITIONS OF USE:

1. THIS OSHPD PRE-APPROVAL OF MANUFACTURER'S CERTIFICATION (OPM) IS BASED ON THE CBC 2013. THE DEMAND (DESIGN FORCES) FOR USE W/ THIS OPM SHALL BE BASED ON THE CBC 2013.
2. THIS PRE-APPROVAL IS FOR THE SEISMIC BRG OF INTERIOR PIPES. 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. FIRE SPRINKLER SERVICE PIPE DIAMETERS:
    - STEEL: SCHEDULE 10 UP TO 8 INCHES  
(INCLUDES 0.188, REFER TO PG C6 FOOTNOTES p & v)
    - STEEL: SCHEDULE 40 UP TO 10 INCHES
    - STEEL: SCHEDULE LW (i.e., SCHEDULE 7, REFER TO C5 FOOTNOTE c) UP TO 6 INCHES
    - COPPER: NOT INCLUDED IN THIS OPM
  - B. BRACE PIPES:
    - STEEL: ASTM® A53 GR B, MIN NPS 1"Ø TO MAX NPS 2"Ø.
  - C. TELESCOPIC BRACE ASSEMBLY FOR TRANSVERSE & VERT BRG ONLY OF 1"Ø TO 4"Ø SERVICE PIPES. THE SUBSTRATES INCLUDED IN THIS PRE-APPROVAL ARE AS FOLLOWS: CONC, CONC/MTL DECK, & STL.
3. THESE DRAWINGS ARE PREPARED FOR ERICO INTERNATIONAL CORPORATION, SOLON, OHIO 44139.
4. THE CONTRACTOR AND THE INSPECTOR OF RECORD SHALL OBTAIN A COPY OF THIS PRE-APPROVAL FROM THE OSHPD PRE-APPROVAL PROGRAMS WEBSITE. 2-13
5. THIS PRE-APPROVAL IS FOR DESIGN AND ANCHORAGE OF FIRE SUPPRESSION SYSTEM SEISMIC SWAY BRACING ONLY.
6. THIS PRE-APPROVAL IS LIMITED TO INDOOR USE. by Y. Kikumoto

## SCOPE:

1. THIS PRE-APPROVAL MAY BE USED FOR SEISMIC BRACING OF 1"Ø TO 10"Ø SERVICE (RUN) PIPES.
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).

## CONSTRUCTION TOLERANCES:

1. CONSTRUCTION TOLERANCES SHALL BE AS NOTED ON THE DRAWING ATTACHMENT DTLS AND APPENDIX 'C' TABLE.
2. CONSTRUCTION TOLERANCE FOR ANGLES OF ALL BRACES FROM HORIZ SHALL BE LIMITED TO ±5 DEGREES.
3. CONSTRUCTION TOLERANCE FOR VERT SEISMIC BRACES FROM VERT SHALL BE LIMITED TO ±5 DEGREES.



SHEET TITLE: OVERVIEW

CONDITIONS OF USE: SCOPE; CONSTRUCTION TOLERANCES



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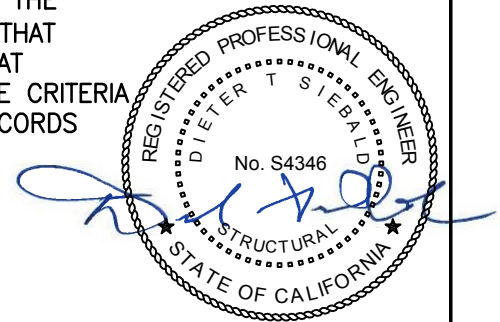
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

## HOW TO USE THIS PRE-APPROVAL:

1. THIS PRE-APPROVAL MAY BE USED FOR THE DESIGN OF SEISMIC SWAY BRCG OF FIRE SPRINKLER SYSTEMS. 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 FIRE SPRINKLER SYSTEM REQUIRES SUBMITTALS THAT MUST BE REVIEWED AND APPROVED BY OSHPD.
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 FIRE SPRINKLER 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 FIRE SPRINKLER SYSTEM, THESE PLANS MUST BE PREPARED, STAMPED & SIGNED BY A CALIFORNIA REGISTERED DESIGN PROFESSIONAL (CRDP). SEE 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 SHALL 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 SHALL 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 SHALL 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 THE OPM ARE BASED ON A MIN DISTANCE TO EDGE OF CONC, AS SHOWN IN THE TABLE ON PG 1.8 AND APPLICABLE LOAD COMBINATIONS PER ASCE® SECTION 12.4 IN THE ANALYSIS. THE ALLOWABLE ANCHOR CAPACITIES ARE FOR USE IN THE INTERACTION EQUATION PER ACI 318-11 SECTION D.7.
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

 <b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833	TEL (916) 920-2020 www.cyseng.com	Job No: 17020 Date: 08-18-2017 Page: 1.4 of 87
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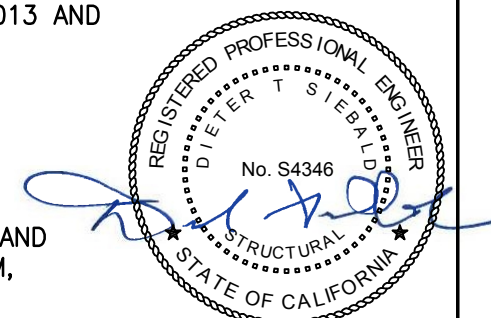
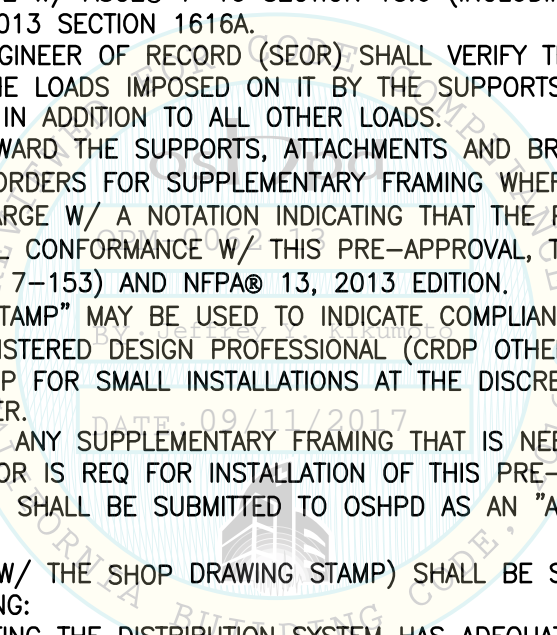


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS


## 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 SHALL 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 SHALL BE IN ACCORDANCE W/ ASCE® 7-10 SECTION 13.6 (INCLUDING SUPPLEMENTS #1 & #2) AS MODIFIED BY THE CBC 2013 SECTION 1616A.
    - a) THE STRUCTURAL ENGINEER OF RECORD (SEOR) SHALL 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 2013, SECTION 7-153) AND NFPA® 13, 2013 EDITION.
    - 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 OSHPD DISTRICT STRUCTURAL ENGINEER.
  - B. THE SEOR SHALL 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 SHALL BE SUBMITTED TO OSHPD AS AN "AMENDED CONSTRUCTION DOCUMENT" (ACD).
  - C. THE LAYOUT DRAWINGS (W/ THE SHOP DRAWING STAMP) SHALL BE SUBMITTED TO OSHPD FOR REVIEW OF THE FOLLOWING:
    - a) STRUCTURE SUPPORTING THE DISTRIBUTION SYSTEM HAS ADEQUATE CAPACITY.
    - b) SEISMIC DESIGN FORCES ( $F_p$ ) ARE IN ACCORDANCE W/ CBC 2013 AND  $W_p$  SHALL COMPLY W/ NFPA® 13 PROVISIONS.
    - c) VERIFY THAT THE SUBMITTAL IS WITHIN THE SCOPE OF OSHPD PRE-APPROVAL OF MANUFACTURER'S CERTIFICATION (OPM):
      - SIZE AND DISTRIBUTION SYSTEM COMPONENTS
      - SPACING OF BRCG AND FLEX JOINTS, AND
      - SUBSTRATE FOR ATTACHMENTS

FOR AN EXAMPLE PROBLEM SHOWING CALCULATIONS OF ELEMENTS AND SELECTION OF ELEMENTS TO SATISFY THE DEMANDS FROM THE OPM, SEE APPENDIX "A".



SHEET TITLE: OVERVIEW  
HOW TO USE THIS PRE-APPROVAL (CONTINUED)

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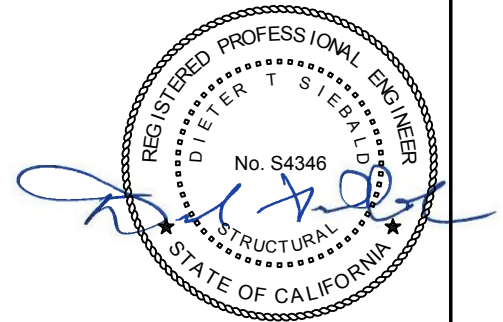
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

## HOW TO USE THIS PRE-APPROVAL (CONTINUED):

- 6. LAYOUT DRAWINGS (CONTINUED):
  - D. THE LAYOUT DRAWINGS (W/ THE SHOP DRAWING STAMP) SHALL BE KEPT ON THE JOB SITE AND CAN THEN BE USED FOR INSTALLATION OF THE SUPPORT AND BRCG. OSHPD FIELD STAFF WILL REVIEW THE INSTALLATION.
  - E. A COPY OF THIS PRE-APPROVAL SHALL 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 OSHPD PRE-APPROVALS FROM THE OSHPD PRE-APPROVAL PROGRAMS WEBSITE.
  - F. COMPONENTS OF TWO OR MORE PRE-APPROVED BRCG SYSTEMS SHALL NOT BE MIXED. ONLY THIS PRE-APPROVAL MAY BE USED FOR THE FIRE SPRINKLER SYSTEM. ANY SUBSTITUTION OF COMPONENT OF THIS PRE-APPROVAL SHALL REQUIRE OSHPD REVIEW AND APPROVAL.



SHEET TITLE: OVERVIEW  
HOW TO USE THIS PRE-APPROVAL (CONTINUED)



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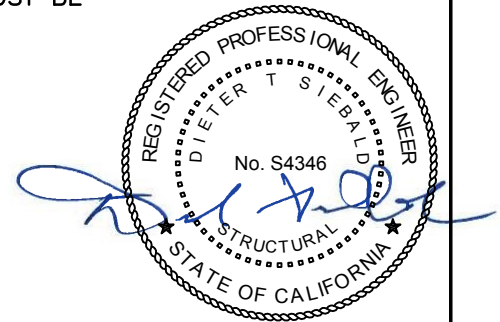


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

## GENERAL NOTES:

1. IT IS THE RESPONSIBILITY OF THE CRDP DESIGNING THE BRACE SYSTEM, TO VERIFY THAT THE SYSTEM DESIGN IS IN CONFORMANCE W/ THE 2013 CBC SECTION 1616A.1.25 AND W/ THE DTLS SHOWN IN THIS PRE-APPROVAL.
2. EXPANSION ANCHORS:
  - A. MECHANICAL ANCHORS INSTALLED IN NWC OR SLWC SHALL BE POWERS POWER-STUD+ SD2 AND SNAKE+ CONC ANCHORS AS NOTED ON THESE DRAWINGS, COMPLYING W/ ESR-2502, REISSUED MAY 1, 2012, REVISED JUNE 2013 AND ESR-2272 REISSUED DECEMBER 1, 2012 RESPECTIVELY. INSTALLATION SHALL COMPLY W/ SECTION 1616A.1.19 OF THE 2013 CBC. OTHER TYPES AND BRANDS OF CONC ANCHORS MAY BE USED PROVIDED THEIR CAPACITIES AND STRENGTHS ARE EQUAL OR BETTER THAN THE POWER-STUD+® AND SNAKE+™ AND ALL HAVE CURRENT ICC REPORTS W/ CRACKED CONC COMPLIANCE IN ACCORDANCE W/ AC193 ACCEPTANCE CRITERIA FOR MECHANICAL ANCHORS IN CONC ELEMENTS. AN OSHPD CHANGE ORDER IS REQ FOR ANY SUBSTITUTION OF A SPECIFIED MECHANICAL ANCHOR.
  - B. INSTALLATION: INSTALL THE CONC ANCHORS IN ACCORDANCE W/ THE REQUIREMENTS GIVEN IN THE ICC EVALUATION REPORT FOR THE SPECIFIC ANCHOR.
  - C. JOB TESTING: FOR VERIFYING SATISFACTORY INSTALLATION WORKMANSHIP, PERFORM JOB SITE TESTING IN ACCORDANCE W/ THE TENSION LOAD TABLE PROVIDED IN THIS DOCUMENT. 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 SHALL BE CONDUCTED BY A TESTING LABORATORY 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 SHALL BE PERFORMED 24 HOURS OR MORE AFTER INSTALLATION. TESTING MAY BE DONE PRIOR TO SEISMIC BRACE INSTALLATION. ALSO REFER TO THE 2013 CBC SECTION 1913A.7, "TESTS FOR POST-INSTALLED ANCHORS IN CONCRETE" FOR DETERMINATION OF TENSION TEST LOAD.
  - D. FAILURE/ACCEPTANCE CRITERIA: THE FOLLOWING CRITERIA APPLY FOR THE ACCEPTANCE OF INSTALLED ANCHORS:
    - 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.

DATE: 09/11/2017



SHEET TITLE: OVERVIEW  
GENERAL NOTES



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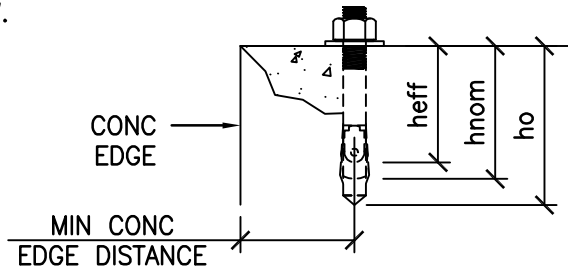
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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

### GENERAL NOTES CONTINUED:

2E. TEST VALUES: APPLY PROOF TEST LOADS TO ANCHORS WITHOUT REMOVING THE NUT IF POSSIBLE, SEE TABLE BLW.



MIN ANCHOR BOLT SPACING LISTED IS PER ICC REPORT, LARGER MIN SPACING MAY BE REQ AS SHOWN IN DTLs

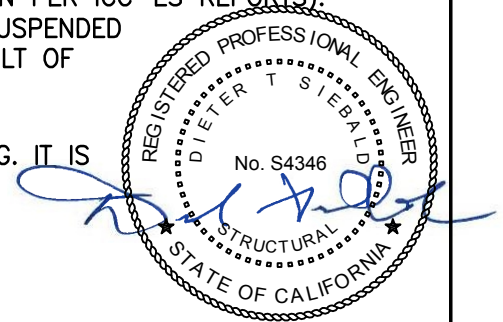
ANCHOR TYPE	ANCHOR DIA (INCH)	EFFECTIVE EMBED (INCH) heff	HOLE DEPTH (INCH) ho	MIN MEMBER THICKNESS (INCH) h	MIN EDGE DISTANCE (INCH)	MIN ANCHOR BOLT SPACING (INCH)	TENSION TEST LOAD (LBS)	TORQUE TEST (FT-LBS)	COMMENTS
SNAKE+™	3/8	1.10	2	SEE PG 5.8	3	6 3/4	655	8	CASE 1
SNAKE+	3/8	1.10	2	4	3	3	655	8	CASE 2
POWER-STUD+® SD2	1/2	2	2 3/4	SEE PG 5.1	8	6 3/4	893	40	CASE 1
POWER-STUD+ SD2	1/2	2	2 3/4	4 1/2	8	6	1605	40	CASES 2 & 3
POWER-STUD+ SD2	3/4	3 3/4	5	SEE PG 5.1	12	11 1/4	2115	110	CASE 1
POWER-STUD+ SD2	3/4	3 3/4	5	7	12	6	4120	110	CASES 2 & 3

3. 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 3/4" NWC OR SLWC TOPPING OVER 20 GAGE MIN MTL DECK (f'c = 3000 PSI, MIN & Fy= 36,000 PSI, MIN PER ICC-ES REPORTS).

**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 MIN 4 1/2" OR 7" THK (PER TABLE ABV) NORMAL WT REINFORCED CONC (f'c = 3000 PSI, MIN).

**CASE 3:** THE SEISMIC BRACE IS ATTACHED TO A CONC WALL IN A BLDG. IT IS ASSUMED THE NWC WALL IS A MIN OF 4 1/2" OR 7" THK (PER TABLE ABV, f'c= 3000 PSI, MIN). ANCHORAGE DTLs TO CONC START ON PG 5.1.



SHEET TITLE: OVERVIEW  
GENERAL NOTES (CONTINUED)

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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

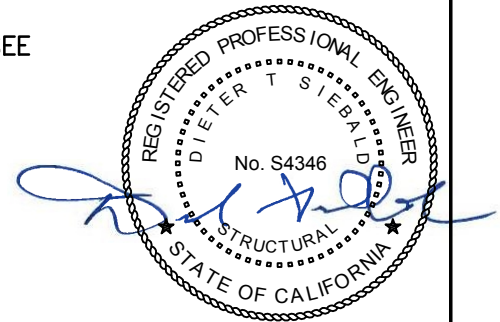
### GENERAL NOTES CONTINUED:

4. ONE (1) CONDITION 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 4½" NORMAL WT REINFORCED CONC ( $f'_c = 3000$  PSI MIN).

### DESIGN PARAMETERS:

1. DESIGN AND INSTALLATION OF THE SEISMIC BRCG FOR THE FIRE SUPPRESSION DISTRIBUTION SYSTEM MUST CONFORM TO NFPA® 13, SECTION 9.3.
2. THE SPACING AND DTLS OF THE SUPPORT AND BRCG OF FIRE SPRINKLER PIPING SHALL COMPLY W/ THE NFPA 13-13 AS MODIFIED BY 2013 CBC SECTIONS 1613A/1616A AND STATE FIRE MARSHALL AMENDMENTS.
3. THE CRDP SHALL PROVIDE DTLS AND CALCULATIONS FOR THE SWAY BRCG AND THEIR ANCHORAGE TO THE STRUCTURE. WHERE APPLICABLE, DTLS FOR THE SUPPORT AND BRCG MAY BE REFERRED TO THIS OSHPD PRE-APPROVAL. ALL LAYOUT DRAWINGS OF THE SPRINKLER SYSTEM SHALL BE SUBMITTED TO OSHPD FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.
4. THE CRDP SHALL DETERMINE THE CONFIGURATION OF THE PIPING SYSTEM AND THE DEMAND LOADS ON ALL PIPING COMPONENTS, BRCG, AND ANCHORAGE. SEE THE DESIGN PROCEDURE GIVEN IN NFPA® 13 SECTION A.9.3.5.9. THE CRDP SHALL 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 SERVICE PIPE AS GIVEN IN APPENDIX C (BASED ON TESTING).
  - B. THE ALLOWABLE AXIAL CAPACITY OF THE LATERAL SWAY BRACE PIPE OR BRANCH LINE RESTRAINT ROD AS GIVEN IN APPENDIX B.
  - C. THE ALLOWABLE HORIZ CAPACITY  $F_H$  OF THE BRACE COMPONENT ATTACHED TO THE STRUCTURE AS GIVEN AT THE END OF THE TABLE IN APPENDIX C (BASED ON TESTING).
  - D. THE CAPACITY OF THE ANCHORAGE TO CONC AS GIVEN ON PGS 5.1 TO 5.9. THESE TENSION AND SHEAR VALUES WERE DETERMINED USING ACI® 318-11 APPENDIX D, ESR-2502, AND THE VALUES IN THE TABLE ON PG 1.8. THE ANCHOR CAPACITIES LISTED ON PGS 5.1 TO 5.9 ARE AT LRFD FORCE LEVEL OF DESIGN AND CONSIDER A SINGLE ANCHOR ONLY. THE CRDP SHALL DETERMINE IF THE DEMAND LOADS EXCEED THE COMBINED FORCES CHECK PER ACI 318-11, SECTION D.7.
5. THE DEAD LOADS OF WATER FILLED PIPES MAY BE FOUND IN NFPA 13, TABLE A.9.3.5.9.
6. SWAY BRCG SHALL HAVE A MAX SPACING NOT EXCEEDING THAT SPECIFIED IN NFPA 13.
7. SWAY BRCG SHALL BE LIMITED TO AN L/R RATIO OF 300 PER NFPA 13, SECTION 9.3.5.11.3.
8. REFER TO NFPA 13, SECTIONS 9.3.5.5 TO 9.3.5.8 FOR ADDITIONAL BRCG REQUIREMENTS.
9. SWAY BRACE ANCHORAGE MUST BE AT LEAST 6" AWAY FROM ANY OTHER ANCHORAGE OR CONC EDGES UNO IN TABLE ON PG 1.8.
10. FOR AN EXAMPLE OF THE SEISMIC SWAY BRACE DESIGN PROCEDURE, SEE ATTACHED APPENDIX A.
11. IT IS THE RESPONSIBILITY OF THE CRDP TO DETERMINE THE GOVERNING SEISMIC LOADS.



SHEET TITLE: OVERVIEW  
DESIGN PARAMETERS

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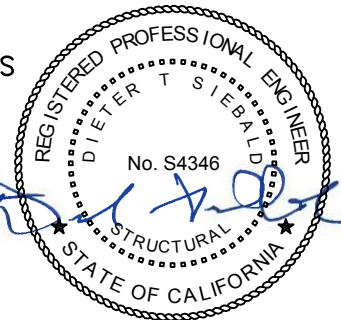
## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

### ABBREVIATIONS & TRADEMARK FOOTNOTES:

@	AT	f'c	SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE	OPM	OSHPD PRE-APPROVAL OF MANUFACTURER'S CERTIFICATION
AB	ANCHOR BOLT				
ABV	ABOVE	FLR	FLOOR	OSHPD	OFFICE OF STATEWIDE HEALTH PLANNING & DEVELOPMENT
ACI®	AMERICAN CONCRETE INSTITUTE	FM®	FM APPROVALS (AKA FACTORY MUTUAL)		
AISC®	AMERICAN INSTITUTE OF STEEL CONSTRUCTION	Fpw	HORIZONTAL SEISMIC FORCE PER NFPA 13 2013 EDITION SEISMIC FORCE REQUIREMENTS	PERP	PERPENDICULAR
ALT	ALTERNATE			PG	PAGE
ASCE®	AMERICAN SOCIETY OF CIVIL ENGINEERS	Fp	HORIZONTAL SEISMIC FORCE PER ASCE 7-10 SEISMIC FORCE REQUIREMENTS	R	RADIUS OF GYRATION
ASME®	AMERICAN SOCIETY OF MECHANICAL ENGINEERS			REQ	REQUIRED
ASD	ALLOWABLE STRENGTH DESIGN	Fvnet	VERTICAL FORCE RESULTANT FROM Fpw	SEOR	STRUCTURAL ENGINEER OF RECORD
ASTM®	AMERICAN SOCIETY FOR TESTING & MATERIALS			SIM	SIMILAR
BM	BEAM	Fpv	VERTICAL SEISMIC FORCE PER ASCE 7-10 SEISMIC FORCE REQUIREMENTS	SLWC	SAND LIGHTWEIGHT CONCRETE
BLDG	BUILDING			STL	STEEL
BLW	BELOW	Fy	SPECIFIED MINIMUM YIELD STRESS OF STEEL, KSI	STRUC	STRUCTURAL
BOTT	BOTTOM			T	ANCHORAGE TENSION REACTION DUE TO SEISMIC FORCE
BRCG	BRACING	GR	GRADE	T/C	TENSION OR COMPRESSION
CAC	CALIFORNIA ADMINISTRATIVE CODE	HORIZ	HORIZONTAL	THK	THICK/THICKNESS
CBC	CALIFORNIA BUILDING CODE	IN ("")	INCH	THRD	THREAD/THREADED
CG	CENTER OF GRAVITY	L	LENGTH	TYP	TYPICAL
CLSE	CALIFORNIA LICENSED STRUCTURAL ENGINEER	LRFD	LOAD & RESISTANCE FACTOR DESIGN	UNO	UNLESS NOTED OTHERWISE
Ⓞ	CENTERLINE	LWC	LIGHT WEIGHT CONCRETE	V	ANCHORAGE SHEAR REACTION DUE TO SEISMIC FORCE
CONC	CONCRETE	MAX	MAXIMUM	UL®	UNDERWRITERS' LABORATORIES
CRDP	CALIFORNIA REGISTERED DESIGN PROFESSIONAL	MFR	MANUFACTURER	USD	ULTIMATE STRENGTH DESIGN
		MIN	MINIMUM	VERT	VERTICAL
DTL(S)	DETAIL(S)	MTL	METAL	W/	WITH
DIA (φ)	DIAMETER	NA	NOT APPLICABLE	WF	WIDE FLANGE
(E)	EXISTING CONDITION	NFPA®	NATIONAL FIRE PROTECTION ASSOCIATION	Wp	WEIGHT OF WATER-FILLED PIPE x 1.15 AS PER NFPA 13 SECTION 9.3.5.9.2
EA	EACH	NWC	NORMAL WEIGHT CONCRETE	WT	WEIGHT
ELEV	ELEVATION				

### 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 INFASSTEC INTELLECTUAL PROPERTIES Pte. LTD.  
 FM IS A REGISTERED CERTIFICATION MARK OF FM APPROVALS LLC, LTD  
 NFPA IS A REGISTERED TRADEMARK OF NATIONAL FIRE PROTECTION ASSOCIATION  
 POWER-STUD+ IS A REGISTERED TRADEMARK OF POWERS FASTENERS, INC  
 SNAKE+ IS A REGISTERED TRADEMARK OF POWERS FASTENERS, INC.  
 UL IS A REGISTERED TRADEMARK OF UL, LLC.



SHEET TITLE: OVERVIEW

ABBREVIATIONS & TRADEMARK FOOTNOTES

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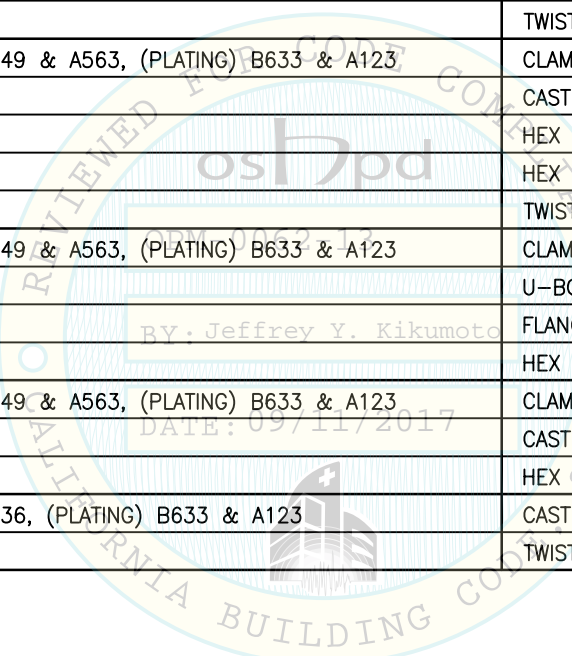
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**SEISMIC SWAY BRACING FOR  
FIRE SPRINKLER SYSTEMS**

**SUPPORT AND ATTACHMENT MATERIAL STANDARDS:**

SUPPORT	STANDARD	SUPPLEMENTARY SUPPORT & ATTACHMENT	STANDARD
CSBQIKCL	ASTM® A536, (PLATING) B633 & A123	CLAMP BRACKET	ASTM A36
		U-BOLT	ASTM A570 GR 33
		FLANGE NUT	GB699
		TWIST-OFF BOLT	ASTM A576
CSBSTU	ASTM A449 & A563, (PLATING) B633 & A123	CLAMP BRACKET	ASTM A570 GR 33
		CASTING	ASTM A536
		HEX BOLT	ASTM A449
		HEX NUT	ASTM A563
CSBEZU	ASTM A449 & A563, (PLATING) B633 & A123	TWIST-OFF BOLT	ASTM A449
		CLAMP BRACKET	ASTM A570 GR 33
		CASTING	ASTM A536
		HEX BOLT	ASTM A449
CSBQG	ASTM A449 & A563, (PLATING) B633 & A123	HEX NUT	ASTM A563
		TWIST-OFF BOLT	ASTM A449
		CLAMP BRACKET	ASTM A36
		U-BOLT	ASTM A570 GR 33
CSBBRP	ASTM A449 & A563, (PLATING) B633 & A123	FLANGE NUT	GB699
		HEX BOLT	ASTM A449
		CLAMP BRACKET	ASTM A570 GR 33
		CASTING	ASTM A536
CSBUNIV	ASTM A536, (PLATING) B633 & A123	HEX BOLT	ASTM A449
		CASTING	ASTM A536
		TWIST-OFF BOLT	ASTM A449



**SHEET TITLE: OVERVIEW  
COMPONENT MATERIAL STANDARDS**

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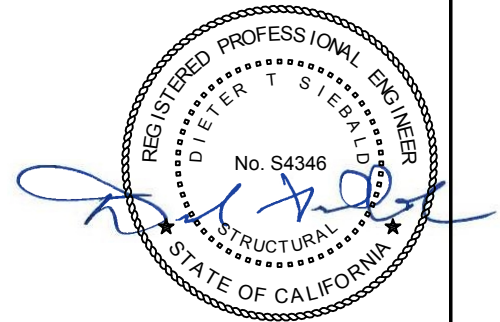


**SEISMIC SWAY BRACING FOR  
FIRE SPRINKLER SYSTEMS**

**SUPPORT AND ATTACHMENT MATERIAL STANDARDS:**

SUPPORT	STANDARD	SUPPLEMENTARY SUPPORT & ATTACHMENT	STANDARD
CSBMA	ASTM® A36, (PLATING) B633 & A123		
CSBIB	ASTM A449 & A563, (PLATING) B633 & A123	CASTING	ASTM A536
		THREADED ROD	ASTM A307 GR C
		½"Ø BOLT THREADED STUD	ASTM A449
CSBBC075	ASTM A449 & A563, (PLATING) B633 & A123	CASTING	ASTM A536
		TWIST-OFF BOLT	ASTM A449
CSBBARJ	ASTM A449 & A563, (PLATING) B633 & A123	CASTING	ASTM A536
		TWIST-OFF BOLT	ASTM A449
CSBBRS	ASTM A536, (PLATING) B633 & A123		
BRACE PIPE, 1", 1¼", 1½", 2"	ASTM A53		
		THREADED ROD, ¾", ½"	ASTM A36
		EXPANSION ANCHORS	REFER TO GENERAL NOTE 2
CSB	ASTM A1011 GR 36	BRACE & PIPE CLAMPS	
		SCREW	HRS GR 1045
		NUT	HRS GR 1045
		CARRIAGE BOLT	ASTM A307
CSBT (PG 8.8)	ASTM A36	TELESCOPING PIPES SCH 10	Fy= 28 KSI
		RIVETS	GR C1006
		V-BOLT	ASTM A307
		½"Ø SELF-TAPPING SCREW	ELCO ECC720
		STAMPING & CSBTB1	ASTM A36
		NUTS ON THRD ROD	Fy= 55 KSI

FOR CONTINUATION, SEE PG 1.19.



**SHEET TITLE: OVERVIEW  
COMPONENT MATERIAL STANDARDS (CONTINUED)**

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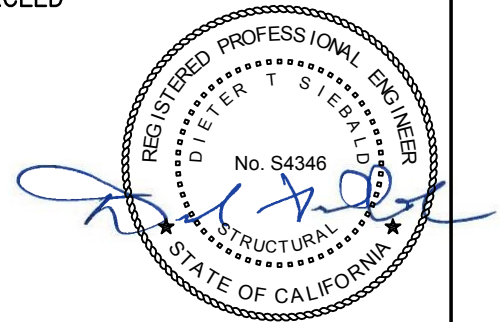




## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

### BRACING GUIDELINES PER NFPA 13:

1. A RUN OF PIPE IS CONSIDERED A CONTINUOUS RUN IF THE MAX OFFSET IS LESS THAN 24". IF THE OFFSET IS 24" OR GREATER, EA STRAIGHT SEGMENT SHALL BE TREATED AS AN INDEPENDENT RUN AND BRACED. REFER TO PARTIAL PLAN ON PG 1.15. PLEASE NOTE THAT RIGID GROOVED COUPLING LISTED FOR UL® STANDARD 213 SHALL BE PERMITTED IN HORIZ RUN OF SERVICE PIPE. FLEXIBLE GROOVED COUPLING LISTED FOR UL STANDARD 213 SHALL 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 SHALL NOT BE USED UNLESS APPROVED ON PROJECT SPECIFIC BASIS.
2. TRANSVERSE BRCG:
  - A. TRANSVERSE BRCG IS TO PROTECT PIPING AGAINST MOVEMENT PERP TO THE RUN OF PIPE.
  - B. TRANSVERSE BRCG SHALL BE PROVIDED ON ALL FEED AND CROSS MAINS REGARDLESS OF SIZE AND ALL BRANCH LINES AND OTHER PIPING W/ A DIA OF 2½" AND LARGER. THE LAST LENGTH OF PIPE AT THE END OF A FEED OR CROSS MAIN SHALL BE PROVIDED W/ A TRANSVERSE BRACE.
  - C. TRANSVERSE BRCG MAX SPACING FOR PIPING CONSTRUCTED OF DUCTILE MATERIALS (E.G. STL) SHALL BE 40 FEET (PIPING LARGER THAN 2½" DIA); 30 FEET MAX SPAN (PIPING SMALLER THAN 2½" DIA). REFER TO PARTIAL PLAN ON PG 1.16.
  - D. A TRANSVERSE BRACE PLACED ON THE PIPE RUN SECTION AT THE OPPOSITE SIDE OF AN ELBOW WITHIN 24" MAY ACT AS A LONGITUDINAL BRACE. REFER TO PARTIAL PLAN ON PG 1.16.
  - 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 1.17.
  - F. BRCG INSTALLED TO SMALLER PIPING SHALL NOT BE USED TO BRACE LARGER PIPING.
3. LONGITUDINAL BRCG:
  - A. LONGITUDINAL BRCG IS TO PROTECT PIPING AGAINST MOVEMENT PARALLEL TO THE RUN OF PIPE.
  - B. LONGITUDINAL BRCG MAX SPACING FOR PIPING CONSTRUCTED OF DUCTILE MATERIALS (E.G. STL) SHALL BE 80 FEET (PIPING LARGER THAN 2½" DIA); 60 FEET MAX SPAN (PIPING SMALLER THAN 2½" DIA). REFER TO PARTIAL PLAN ON PG 1.16.
  - C. EA PIPE 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 1.15, 1.16 AND 1.17.
4. VERT OFFSETS/RISERS:
  - A. TOPS OF VERT OFFSETS/RISERS EXCEEDING 3 FEET IN LENGTH SHALL BE PROVIDED W/ A FOUR-WAY BRACE. BRCG SHALL BE LOCATED WITHIN 24" OF THE END OF THE VERT RUN. REFER TO PARTIAL ISOMETRIC A ON PG 1.18.
  - B. DISTANCE BETWEEN FOUR-WAY BRACES FOR RISERS SHALL NOT EXCEED 25 FEET.



SHEET TITLE: OVERVIEW  
BRACING GUIDELINES

	<b>CYS STRUCTURAL ENGINEERS, INC.</b>	<b>Job No:</b>	17020
	2495 NATOMAS PARK DRIVE, SUITE 650	<b>Date:</b>	08-18-2017
	SACRAMENTO, CA 95833	<b>Page:</b>	1.13 of 87
	TEL (916) 920-2020 www.cyseng.com		

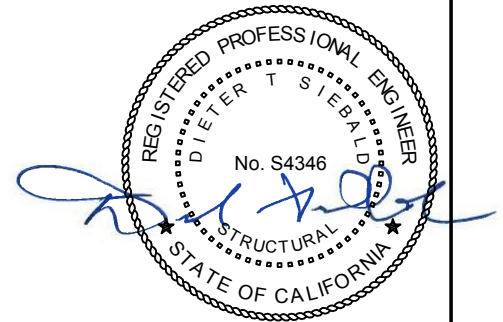
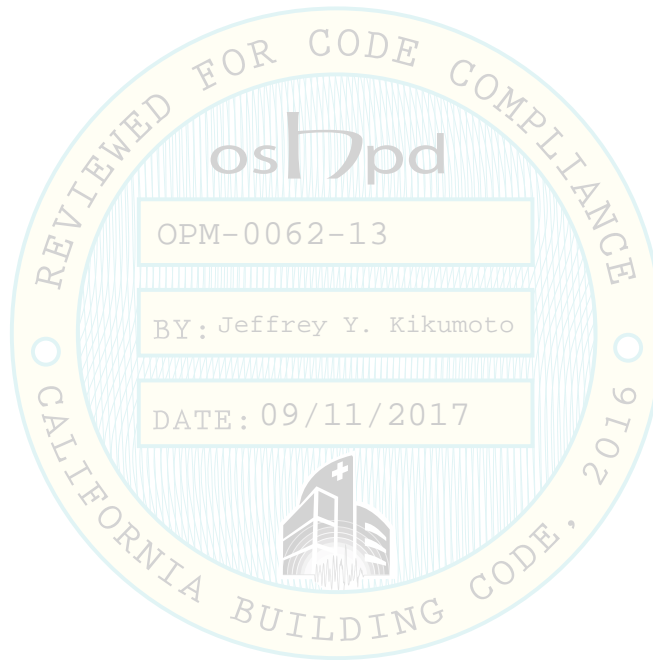
L:\Jobs\17020 ERICO - Addendum to OPM-0062-13\STRU\S1.dwg Time: Aug 18, 2017 - 02:24pm Login: camachom DimScale: 1 LTScale: 4



# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

## BRACING GUIDELINES (CONTINUED)

5. WHEN CALCULATING HORIZ LOAD REQUIREMENTS, USE TABLE A9.3.5.9 IN NFPA® 13 TO CALCULATE THE WT OF WATER FILLED PIPE.
6. FOR LATERAL SWAY BRACE PIPE AXIAL CAPACITY AND ALLOWABLE PIPE LENGTH, SEE TABLE ON PG B1.
7. DO NOT BRACE THE FIRE SPRINKLER 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 7-10, SECTION 13.3.2 OR AS SPECIFIED BY THE STRUCTURAL ENGINEER OF RECORD ON THE OSHPD APPROVED CONSTRUCTION DOCUMENTS.



SHEET TITLE: OVERVIEW  
BRACING GUIDELINES (CONTINUED)



### CYS STRUCTURAL ENGINEERS, INC.

2495 NATOMAS PARK DRIVE, SUITE 650  
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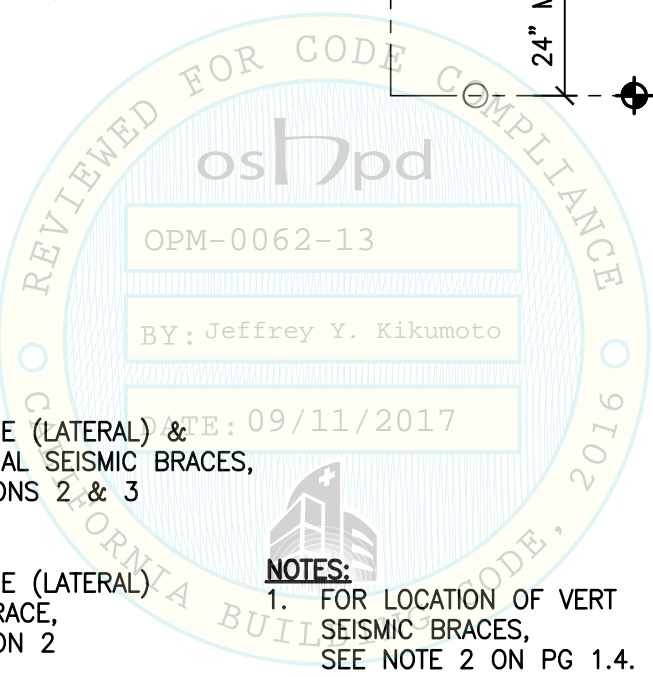
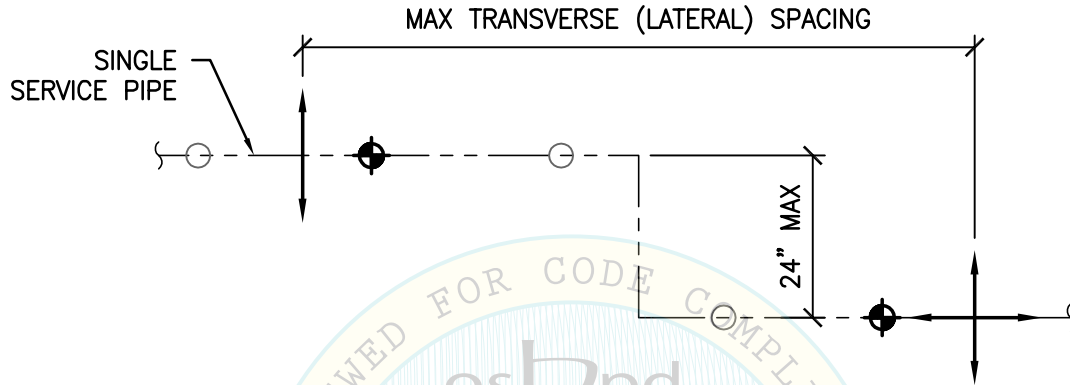
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**LEGEND:**



TRANSVERSE (LATERAL) &  
LONGITUDINAL SEISMIC BRACES,  
SEE SECTIONS 2 & 3



TRANSVERSE (LATERAL)  
SEISMIC BRACE,  
SEE SECTION 2



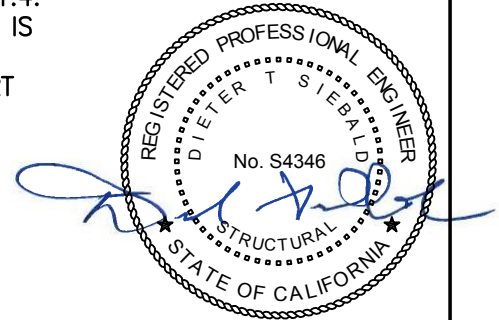
VERT SEISMIC BRACE –  
MUST BE WITHIN 6" OF  
ALL TRANSVERSE AND  
LONGITUDINAL BRACES



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

**NOTES:**

1. FOR LOCATION OF VERT SEISMIC BRACES, SEE NOTE 2 ON PG 1.4.
2. A VERT PIPE HANGER IS NOT A VERT SEISMIC BRACE & IS NOT PART OF THIS OPM.



SHEET TITLE: OVERVIEW  
BRACING GUIDELINES PARTIAL PLAN



**CYS STRUCTURAL ENGINEERS, INC.**

2495 NATOMAS PARK DRIVE, SUITE 650  
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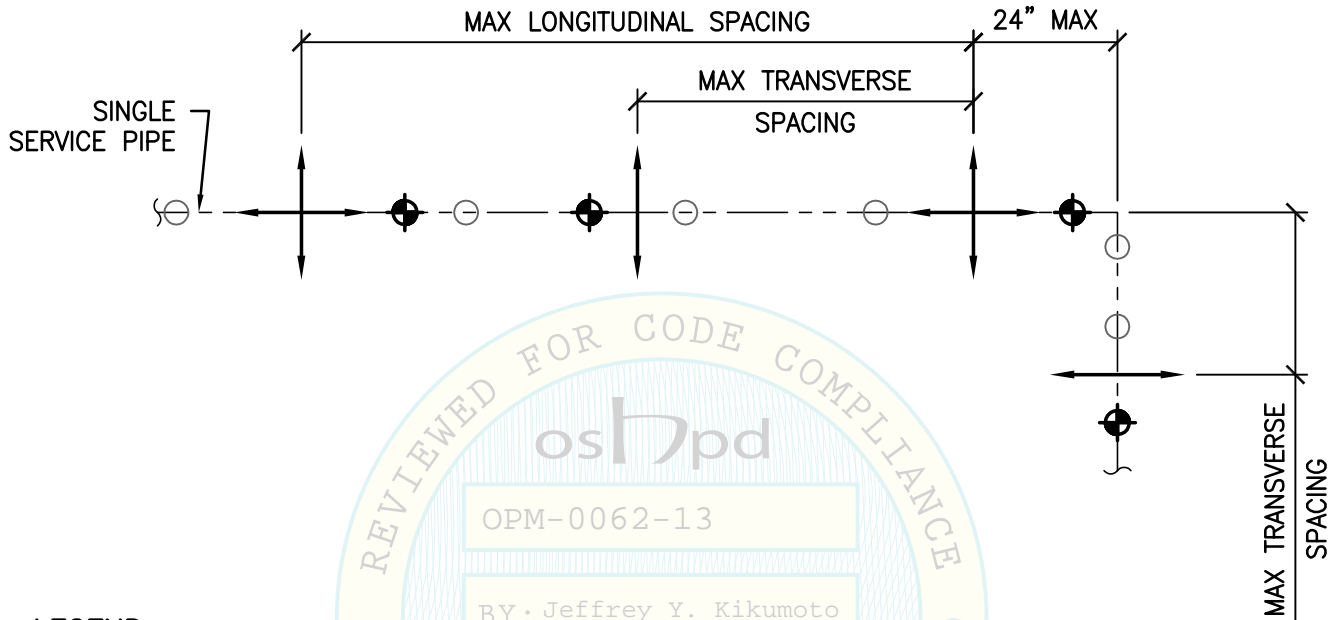
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**LEGEND:**



TRANSVERSE (LATERAL) &  
LONGITUDINAL SEISMIC BRACES,  
SEE SECTIONS 2 & 3



TRANSVERSE (LATERAL)  
SEISMIC BRACE,  
SEE SECTION 2



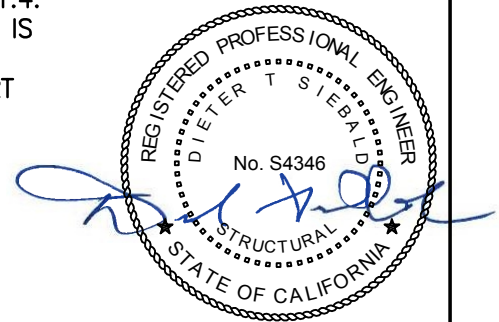
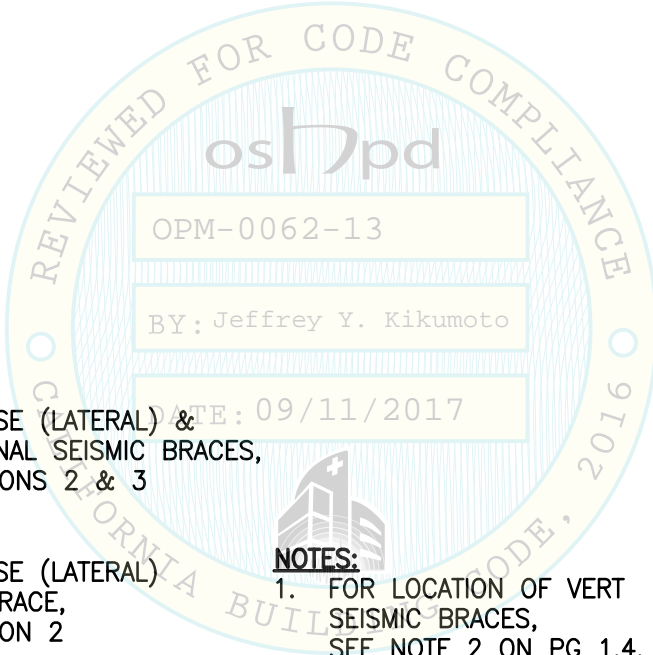
VERT SEISMIC BRACE –  
MUST BE WITHIN 6" OF  
ALL TRANSVERSE AND  
LONGITUDINAL BRACES



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

**NOTES:**

1. FOR LOCATION OF VERT SEISMIC BRACES, SEE NOTE 2 ON PG 1.4.
2. A VERT PIPE HANGER IS NOT A VERT SEISMIC BRACE & IS NOT PART OF THIS OPM.



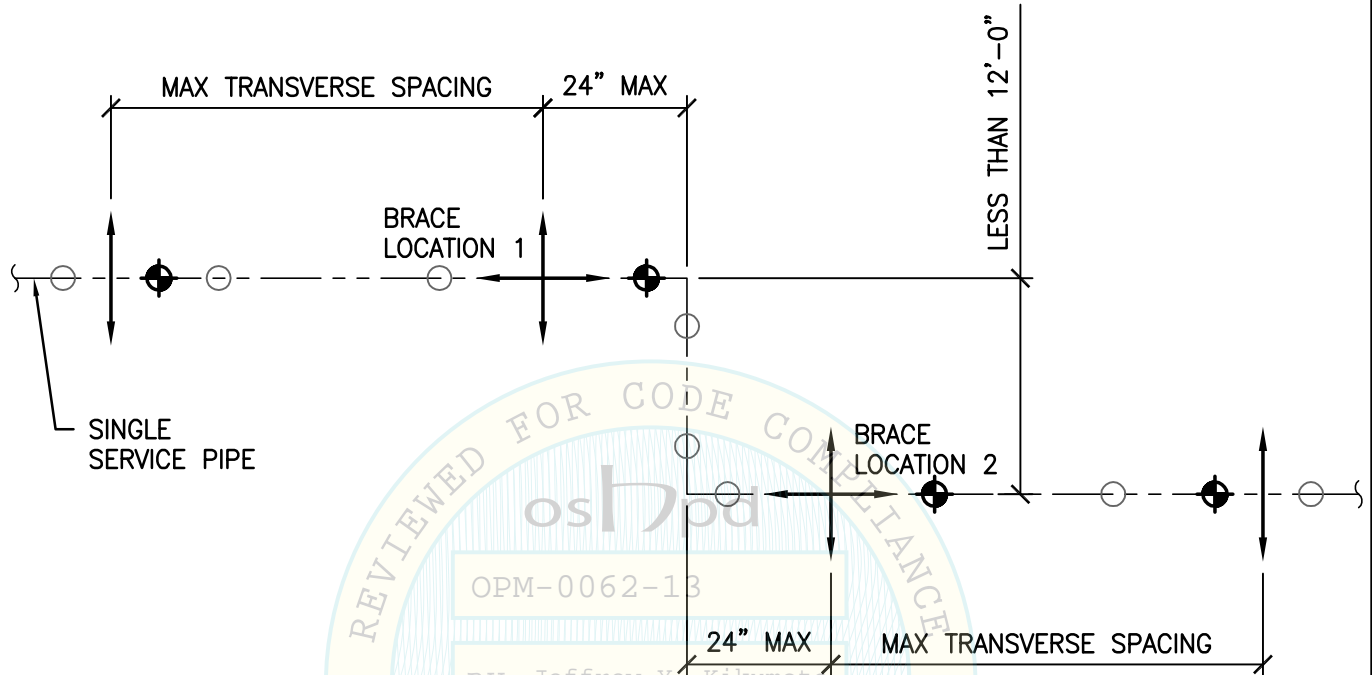
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BRACING GUIDELINES PARTIAL PLAN

<p><b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833</p>	TEL (916) 920-2020 www.cyseng.com	Job No: 17020 Date: 08-18-2017 Page: 1.16 of 87
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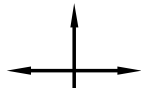
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



### LEGEND:



TRANSVERSE (LATERAL) &  
LONGITUDINAL SEISMIC BRACES,  
SEE SECTIONS 2 & 3



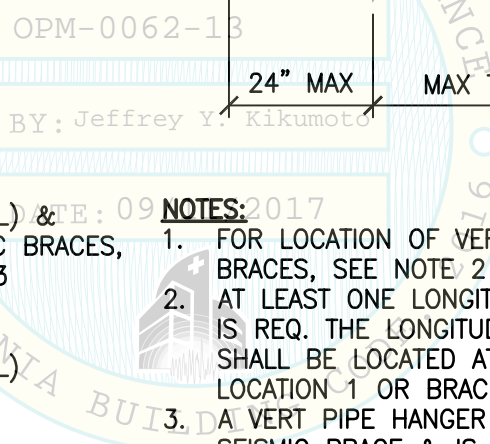
TRANSVERSE (LATERAL)  
SEISMIC BRACE,  
SEE SECTION 2



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

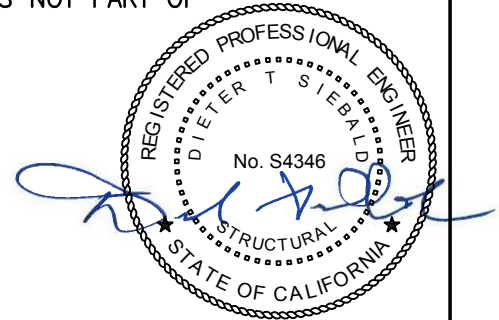


VERT PIPE HANGER  
(NOT PART OF OPM) SHOWN  
FOR REFERENCE ONLY



### NOTES:

1. FOR LOCATION OF VERT SEISMIC BRACES, SEE NOTE 2 ON PG 1.4.
2. AT LEAST ONE LONGITUDINAL BRACE IS REQ. THE LONGITUDINAL BRACE SHALL BE LOCATED AT EITHER BRACE LOCATION 1 OR BRACE LOCATION 2.
3. A VERT PIPE HANGER IS NOT A VERT SEISMIC BRACE & IS NOT PART OF THIS OPM.



SHEET TITLE: OVERVIEW  
BRACING GUIDELINES PARTIAL PLAN



**CYS STRUCTURAL ENGINEERS, INC.**

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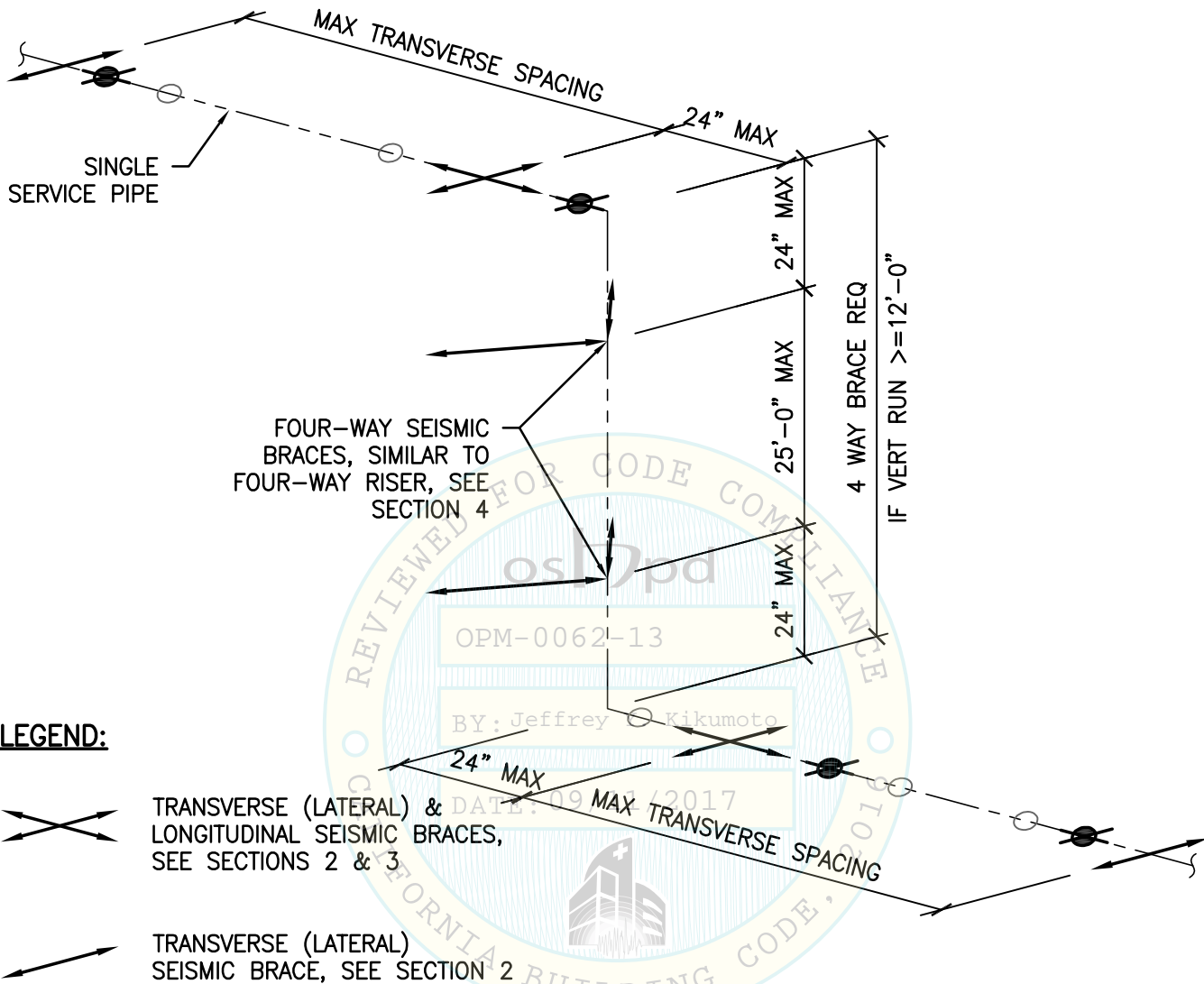
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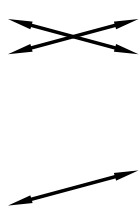
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**LEGEND:**



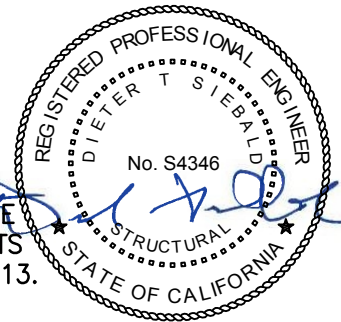
TRANSVERSE (LATERAL) & LONGITUDINAL SEISMIC BRACES, SEE SECTIONS 2 & 3

TRANSVERSE (LATERAL) SEISMIC BRACE, SEE SECTION 2

FOUR-WAY RISER SEISMIC BRACES, SEE SECTION 4

- VERT SEISMIC BRACE – MUST BE WITHIN 6" OF ALL TRANSVERSE AND LONGITUDINAL BRACES
- VERT PIPE HANGER (NOT PART OF OPM) SHOWN FOR REFERENCE ONLY

**NOTE:**  
FOUR-WAY BRCG SHALL NOT BE REQ WHERE RISERS PENETRATE INTERMEDIATE FLRS IN MULTI-STORY BLDGS WHERE THE CLEARANCE DOES NOT EXCEED THE LIMITS SPECIFIED IN SECTION 9.3.4 OF NFPA® 13.



SHEET TITLE: OVERVIEW  
BRACING GUIDELINES PARTIAL ISOMETRIC



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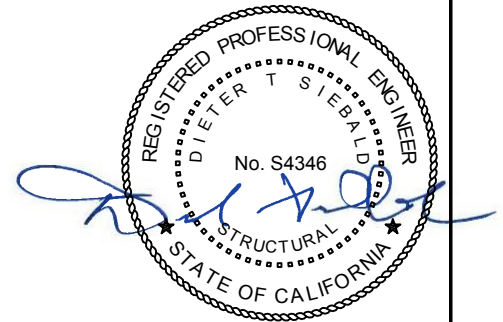
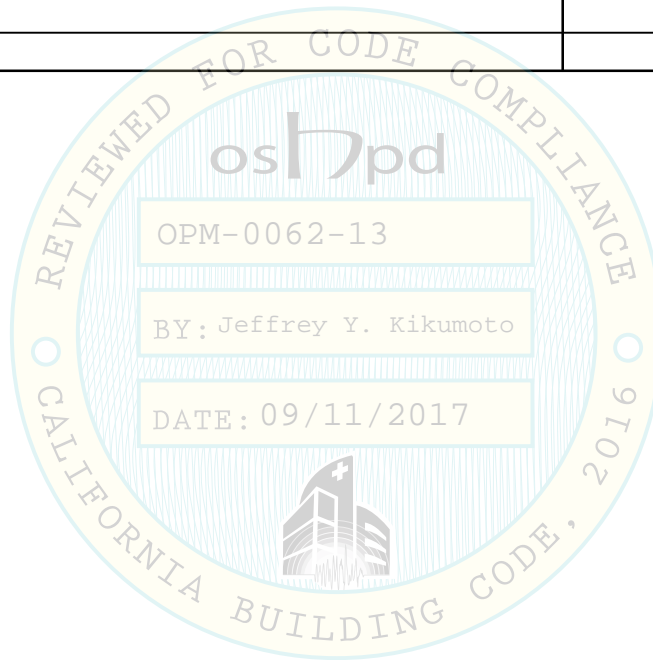
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SEISMIC SWAY BRACING FOR  
FIRE SPRINKLER SYSTEMS

**SUPPORT AND ATTACHMENT MATERIAL STANDARDS:**

SUPPORT	STANDARD	SUPPLEMENTARY SUPPORT & ATTACHMENT	STANDARD
CSBU BODY & BASE	ASTM A1011 GR 36	RIVET	CHS GR 1006
		CONE POINT SCREW	HRS GR 1045
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



SHEET TITLE: OVERVIEW  
COMPONENT MATERIAL STANDARDS (CONTINUED)



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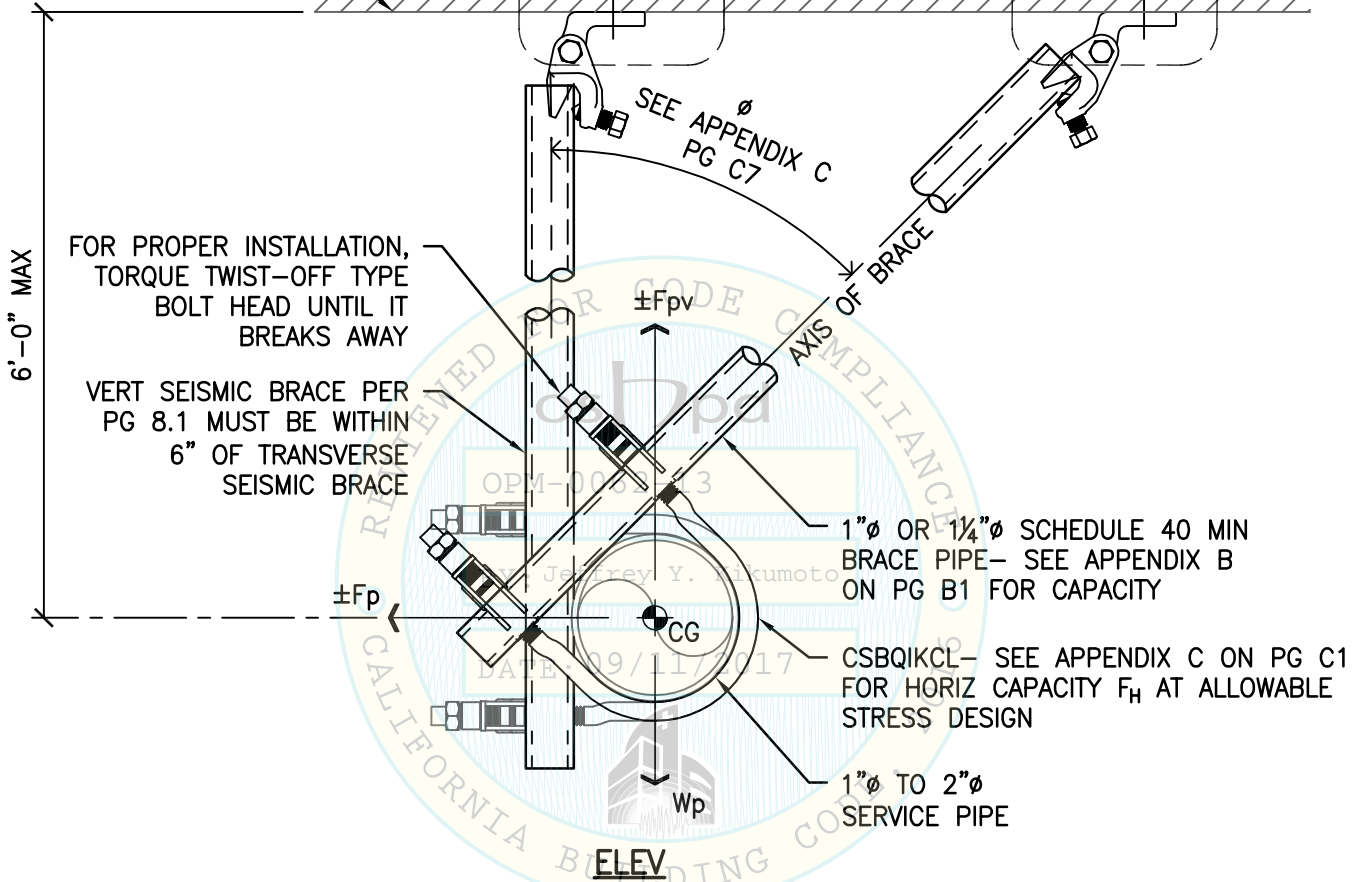


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

FOR ATTACHMENT TO CONC,  
SEE PGS 5.1, 5.2, 5.4 TO 5.7 & 5.10.  
FOR ATTACHMENT TO STL, SEE PGS  
6.1 TO 6.5 & 6.10 TO 6.15

FOR ATTACHMENT TO CONC,  
SEE PGS 5.1 TO 5.7 & 5.10  
FOR ATTACHMENT TO STL,  
SEE PGS 6.1 TO 6.5 & 6.10  
TO 6.15

SUPPORTING  
STRUCTURE



FOR PROPER INSTALLATION,  
TORQUE TWIST-OFF TYPE  
BOLT HEAD UNTIL IT  
BREAKS AWAY

VERT SEISMIC BRACE PER  
PG 8.1 MUST BE WITHIN  
6" OF TRANSVERSE  
SEISMIC BRACE

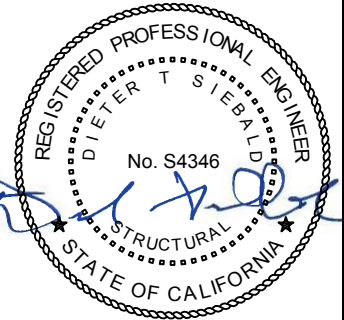
SEE  $\phi$   
APPENDIX C  
PG C7

1"  $\phi$  OR 1 1/4"  $\phi$  SCHEDULE 40 MIN  
BRACE PIPE- SEE APPENDIX B  
ON PG B1 FOR CAPACITY

CSBQIKCL- SEE APPENDIX C ON PG C1  
FOR HORIZ CAPACITY  $F_H$  AT ALLOWABLE  
STRESS DESIGN

1"  $\phi$  TO 2"  $\phi$   
SERVICE PIPE

ELEV



SHEET TITLE: TRANSVERSE SEISMIC BRACE  
CSBQIKCL WITH BRACE PIPE FOR 1"  $\phi$  TO 2"  $\phi$  SERVICE PIPE CONNECTION



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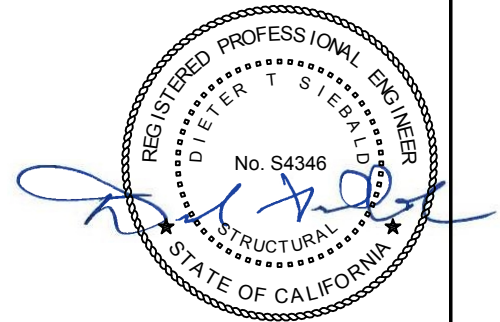
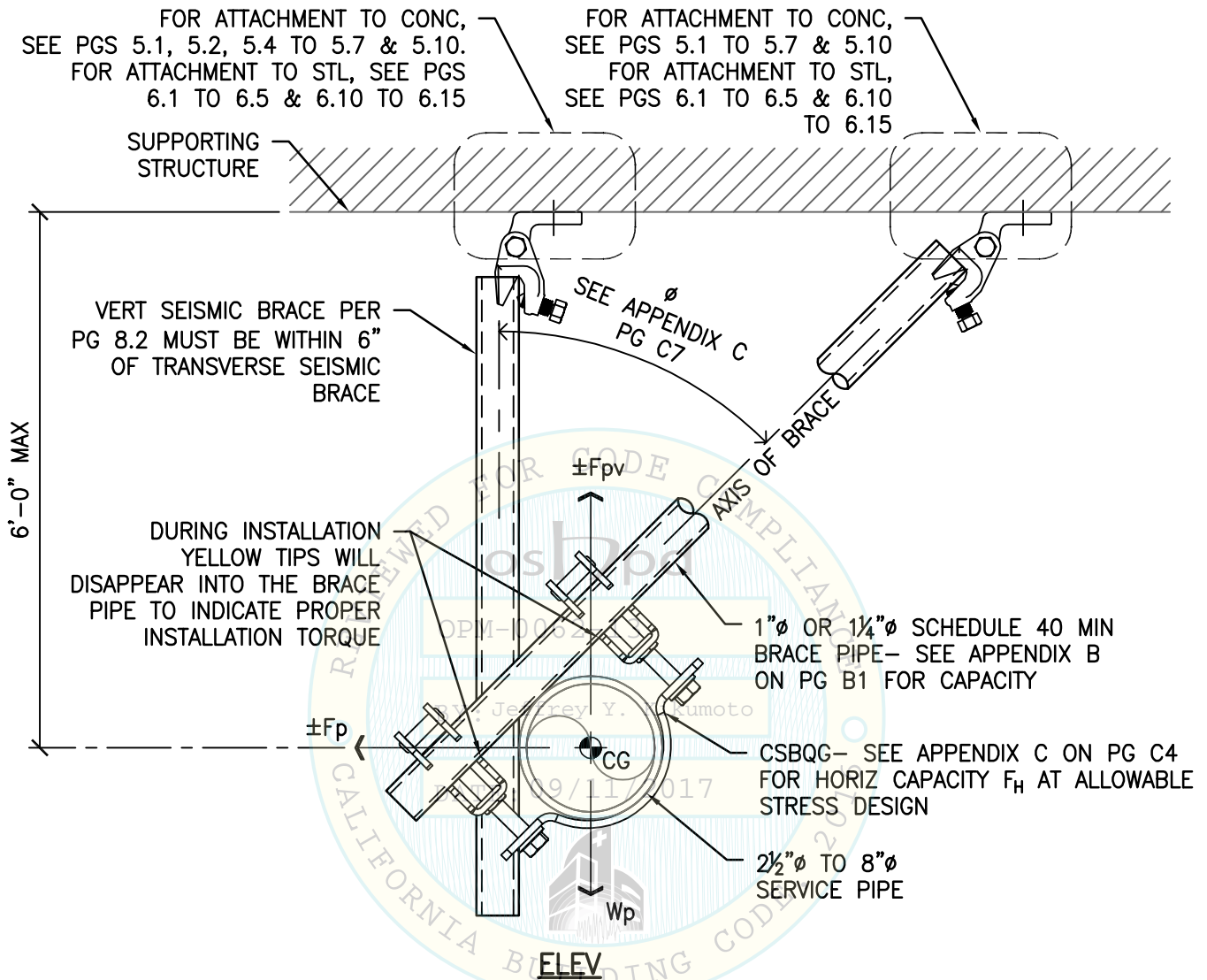
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



SHEET TITLE: TRANSVERSE SEISMIC BRACE  
CSBQG WITH BRACE PIPE FOR 2½"Ø TO 8"Ø SERVICE PIPE CONNECTION



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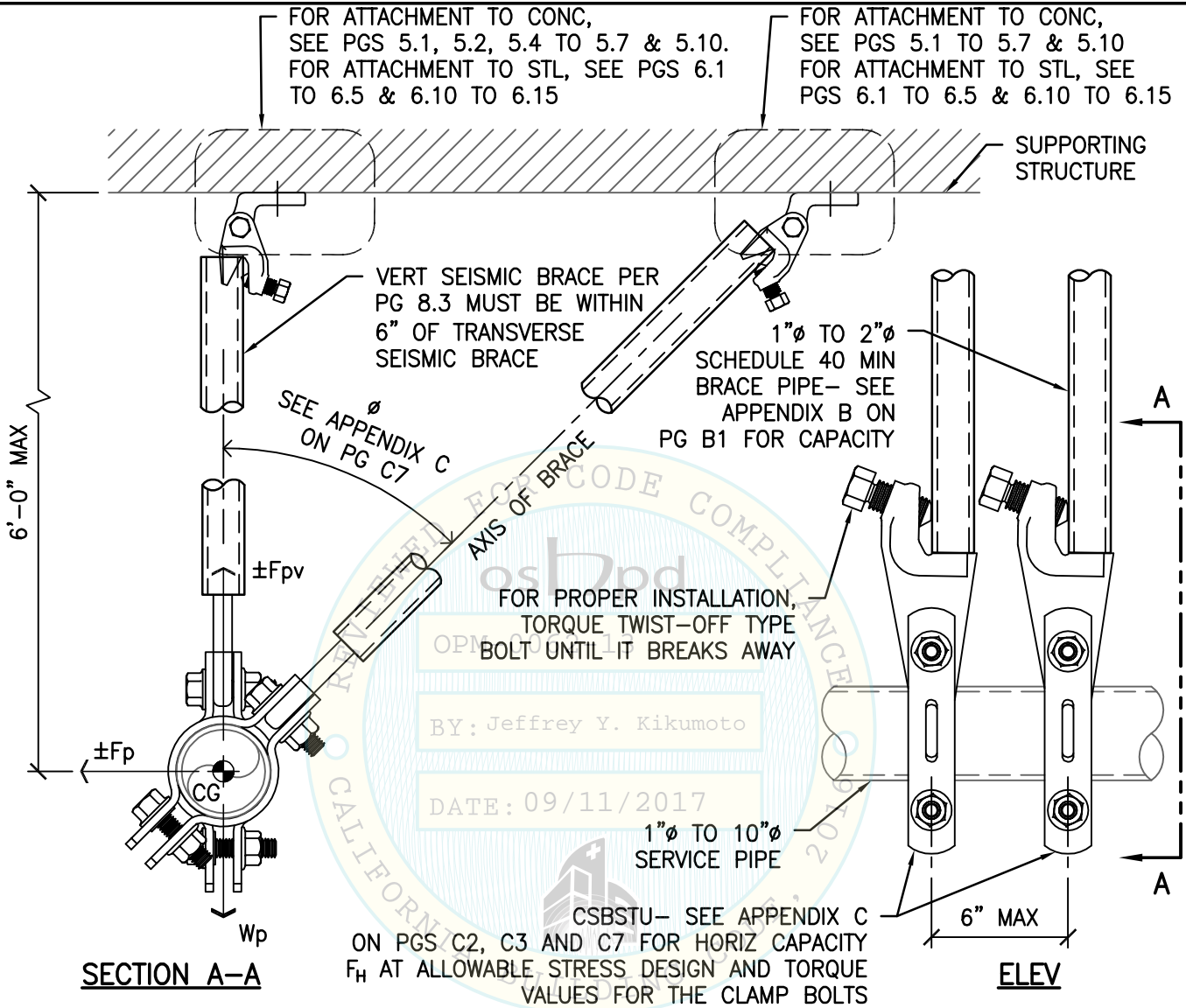
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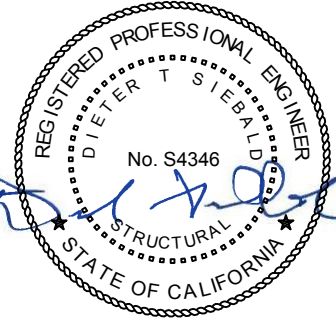
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED.  
FOR CORRESPONDING REPLACEMENT, SEE PG 2.6.



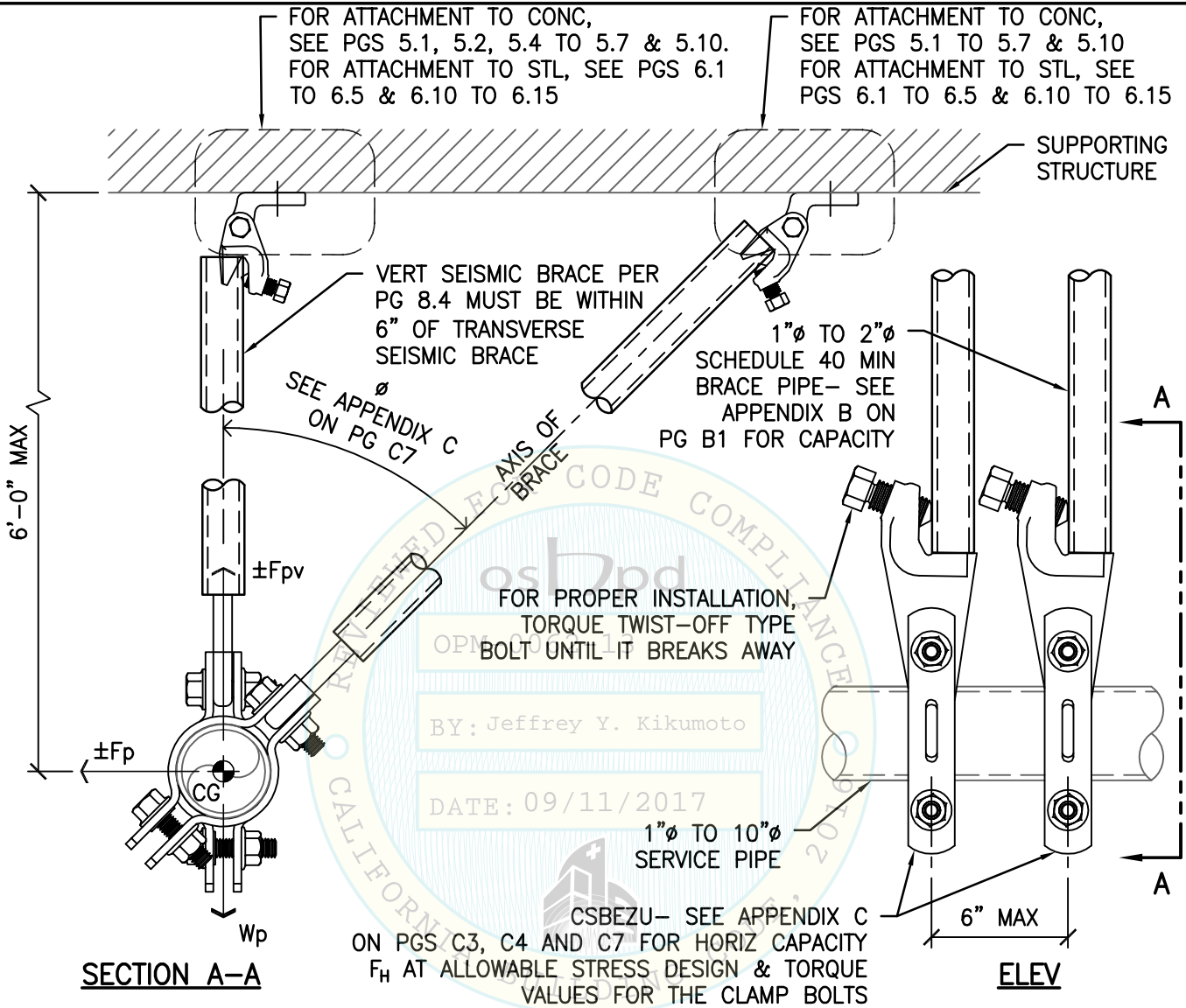
SHEET TITLE: TRANSVERSE SEISMIC BRACE  
CSBSTU WITH BRACE PIPE FOR 1"Ø TO 10"Ø SERVICE PIPE CONNECTION

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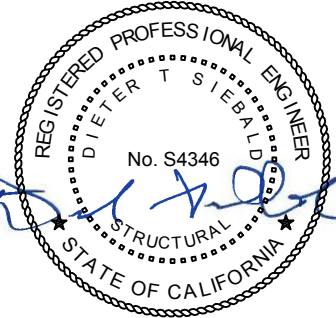
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED. FOR CORRESPONDING REPLACEMENT, SEE PG 2.6.



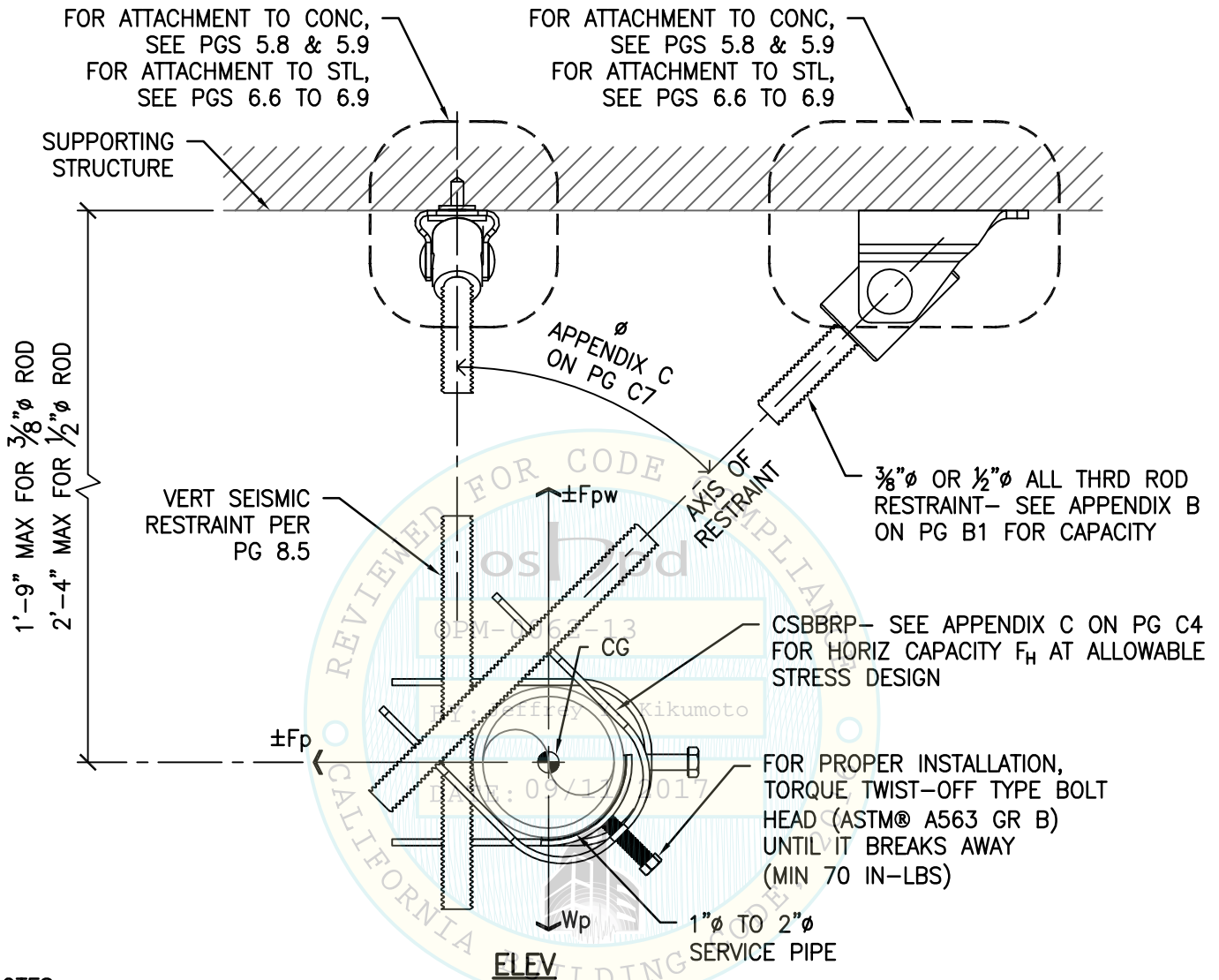
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CSBEZU WITH BRACE PIPE FOR 1"Ø TO 6"Ø SERVICE PIPE CONNECTION

<p><b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833</p>	<p>TEL (916) 920-2020 www.cyseng.com</p>	<p>Job No: 17020 Date: 08-18-2017 Page: 2.4 of 87</p>
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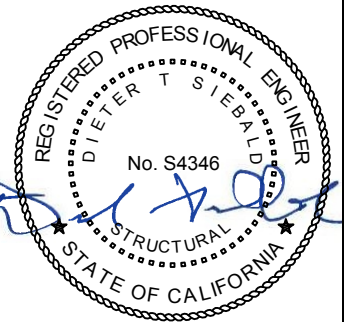


## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**NOTES:**

1. THE CSBBRP W/ RESTRAINT ROD IS A BRANCH LINE RESTRAINT DEVICE (NOT A BRACE). SEE NFPA® 13, SECTION 9.3.6.
2. BRANCH LINES SHALL BE LATERALLY RESTRAINED AT INTERVALS NOT EXCEEDING THOSE SPECIFIED IN NFPA 13 TABLE 9.3.6.4(a) BASED ON BRANCH LINE DIAM AND THE VALUE OF  $C_p$ .
3. PER NFPA 13 SECTION 9.3.6.6, SPRIGS ARE LIMITED TO LESS THAN 4'-0", OTHERWISE THEY SHALL BE RESTRAINED AGAINST LATERAL MOVEMENT. IF A SPRIG RISES 4'-0" OR MORE, A RESTRAINT DESIGN MUST BE SUBMITTED SEPARATELY FOR REVIEW BY OSHPD.



**SHEET TITLE: TRANSVERSE SEISMIC BRACE  
CSBBRP WITH RESTRAINT ROD FOR 1"Ø TO 2"Ø BRANCH LINE PIPE CONNECTION**



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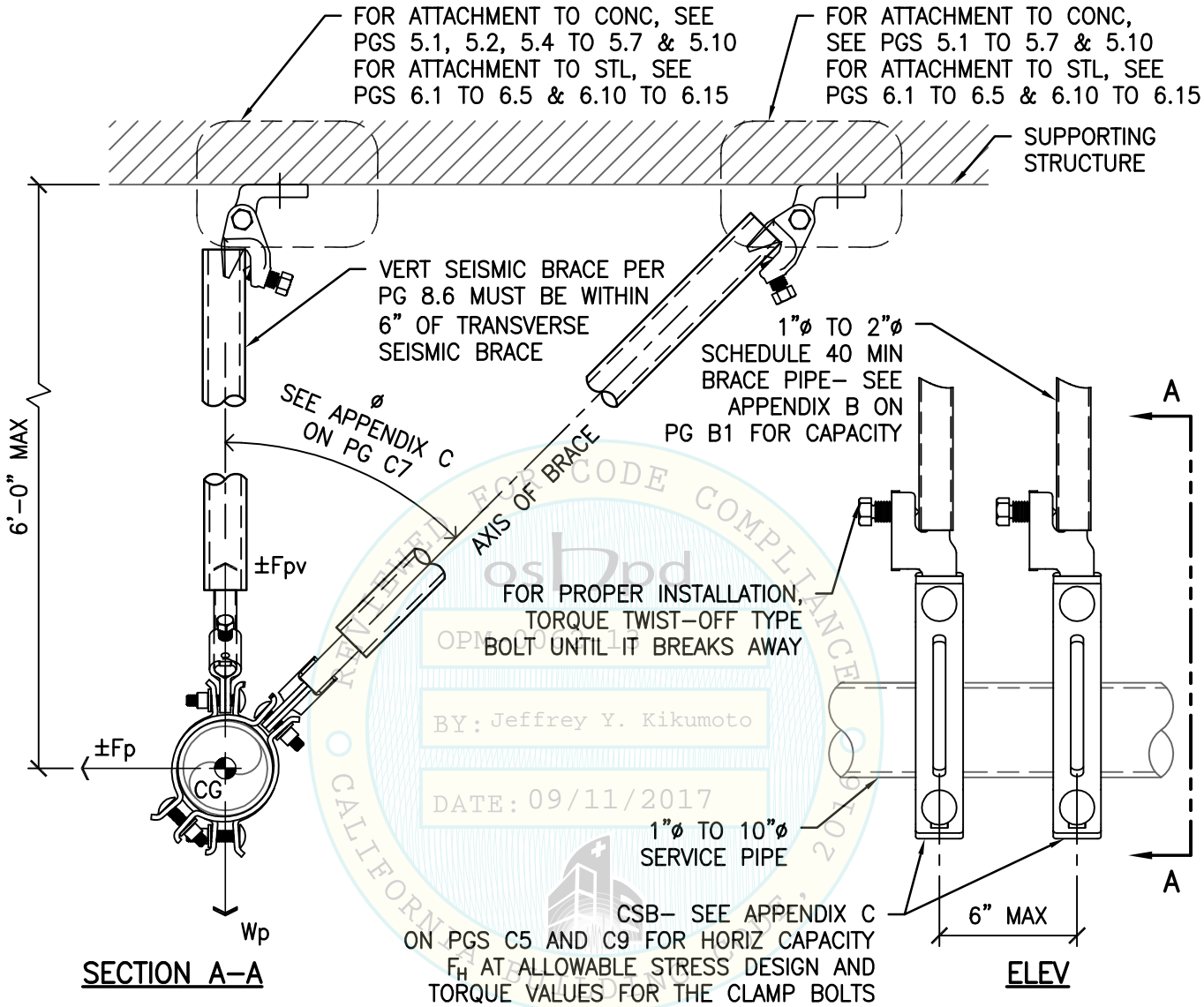
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



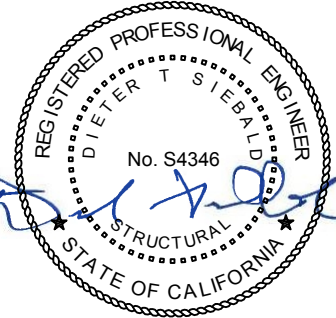
FOR PROPER INSTALLATION,  
TORQUE TWIST-OFF TYPE  
BOLT UNTIL IT BREAKS AWAY

BY: Jeffrey Y. Kikumoto

DATE: 09/11/2017

CSB- SEE APPENDIX C  
ON PGS C5 AND C9 FOR HORIZ  
CAPACITY  
 $F_H$  AT ALLOWABLE STRESS DESIGN AND  
TORQUE VALUES FOR THE CLAMP BOLTS

**THIS IS A NEW PRODUCT**



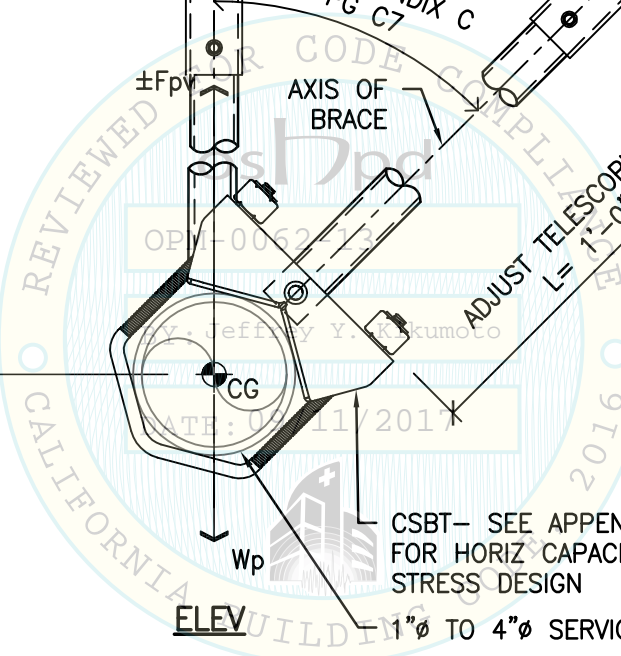
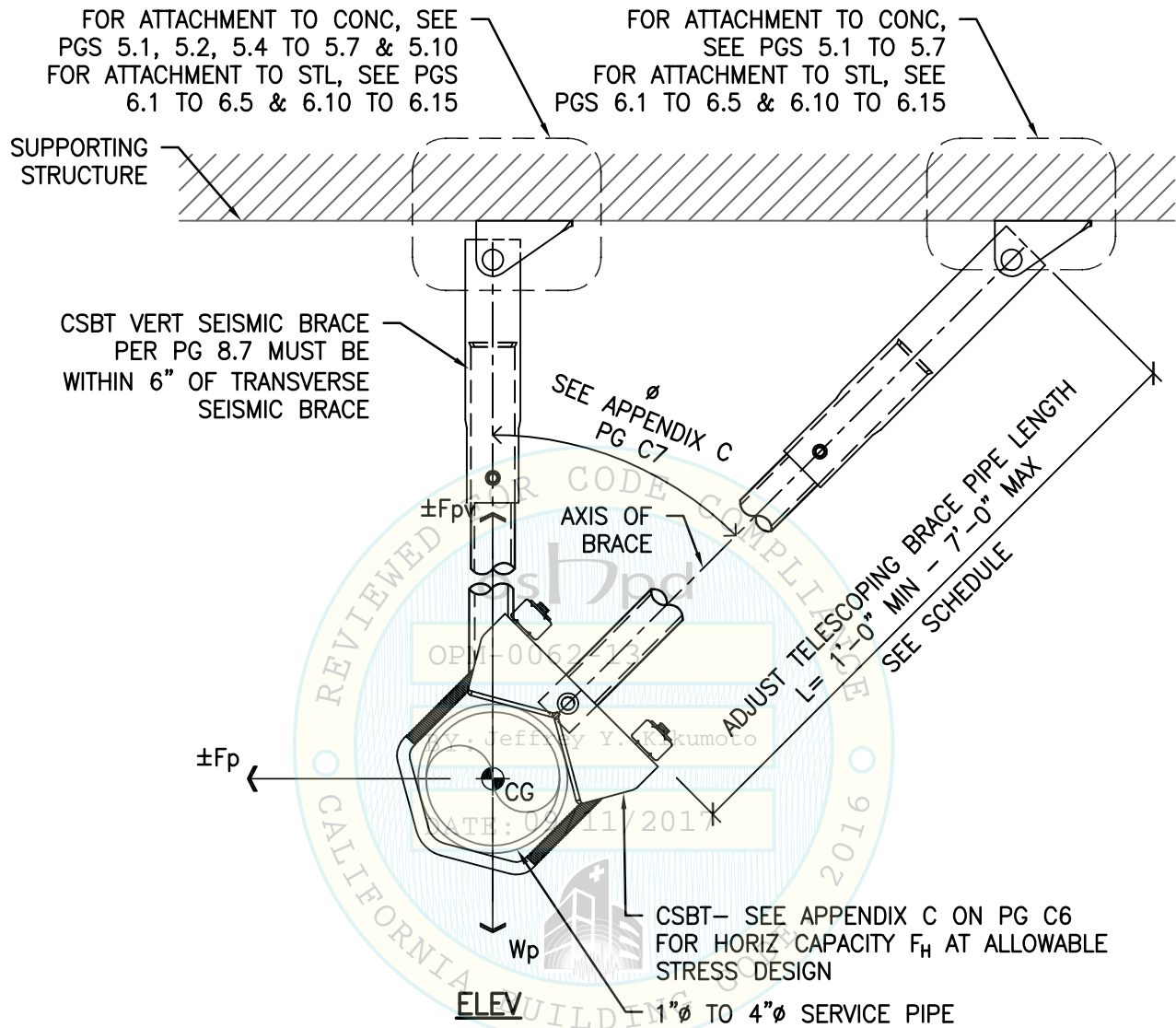
SHEET TITLE: TRANSVERSE SEISMIC BRACE  
CSB WITH BRACE PIPE FOR 1"Ø TO 10"Ø SERVICE PIPE CONNECTION

 <p><b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833</p>	TEL (916) 920-2020	Job No: 17020
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



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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 8.8 FOR CSBT  
ASSEMBLY & INSTALLATION  
INSTRUCTIONS

**THIS IS A NEW PRODUCT**

**SHEET TITLE: TRANSVERSE SEISMIC BRACE  
CSBT TELESCOPING ASSEMBLY FOR 1"Ø TO 4"Ø SERVICE PIPE CONNECTION**



**CYS STRUCTURAL ENGINEERS, INC.**

2495 NATOMAS PARK DRIVE, SUITE 650  
SACRAMENTO, CA 95833

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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

FOR ATTACHMENT TO CONC,  
SEE PGS 5.1, 5.2, 5.4 TO 5.7 & 5.10.  
FOR ATTACHMENT TO STL, SEE PGS  
6.1 TO 6.5 & 6.10 TO 6.15

FOR ATTACHMENT TO CONC,  
SEE PGS 5.1 TO 5.7 & 5.10  
FOR ATTACHMENT TO STL,  
SEE PGS 6.1 TO 6.5 & 6.10  
TO 6.15

SUPPORTING  
STRUCTURE

6'-0" MAX

VERT SEISMIC  
BRACE PER PG 8.3  
MUST BE WITHIN 6"  
OF LONGITUDINAL  
SEISMIC BRACE

SEE  $\phi$   
ON PG C7

FOR PROPER  
INSTALLATION, TORQUE  
TWIST-OFF TYPE BOLT  
UNTIL IT BREAKS AWAY

1"  $\phi$  TO 2"  $\phi$  SCHEDULE  
40 MIN BRACE PIPE-  
SEE APPENDIX B ON  
PG B1 FOR CAPACITY

1"  $\phi$  TO 10"  $\phi$   
SERVICE PIPE

CSBSTU - SEE APPENDIX C ON  
PGS C1, C2 AND C7 FOR HORIZ  
CAPACITY  $F_H$  AT ALLOWABLE  
STRESS DESIGN AND TORQUE  
VALUES FOR THE CLAMP BOLTS

ELEV

SECTION A-A



THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED.  
FOR CORRESPONDING REPLACEMENT, SEE PG 3.3.

SHEET TITLE: LONGITUDINAL SEISMIC BRACE  
CSBSTU WITH BRACE PIPE FOR 1"  $\phi$  TO 10"  $\phi$  SERVICE PIPE CONNECTION



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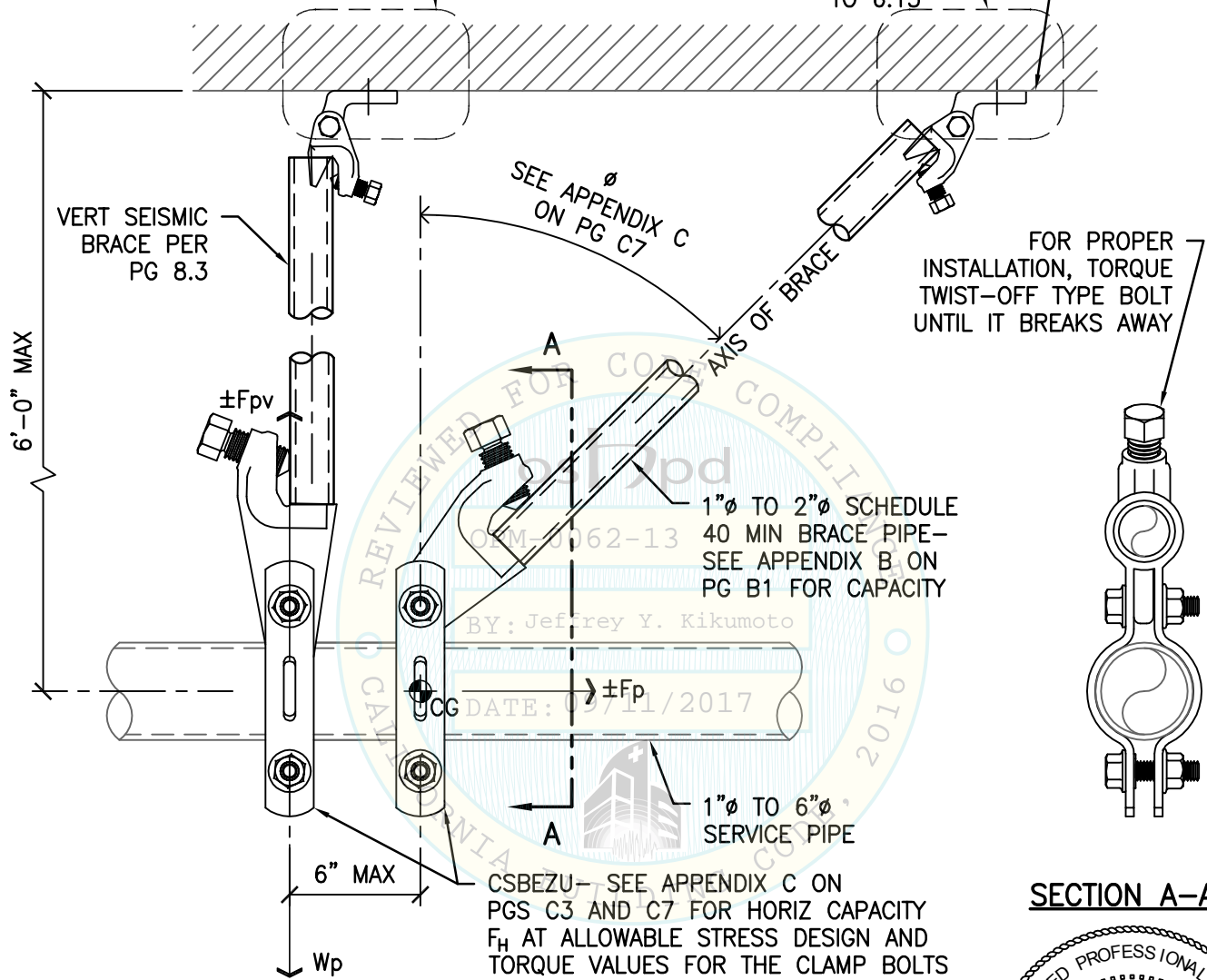


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

FOR ATTACHMENT TO CONC, SEE  
PGS 5.1, 5.2, 5.4 TO 5.7 & 5.10.  
FOR ATTACHMENT TO STL, SEE  
PGS 6.1 TO 6.5 & 6.10 TO 6.15

FOR ATTACHMENT TO CONC,  
SEE PGS 5.1 TO 5.7 & 5.10  
FOR ATTACHMENT TO STL,  
SEE PGS 6.1 TO 6.5 & 6.10  
TO 6.15

SUPPORTING  
STRUCTURE



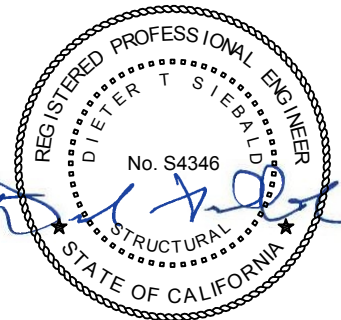
FOR PROPER  
INSTALLATION, TORQUE  
TWIST-OFF TYPE BOLT  
UNTIL IT BREAKS AWAY

1"Ø TO 2"Ø SCHEDULE  
40 MIN BRACE PIPE—  
SEE APPENDIX B ON  
PG B1 FOR CAPACITY

1"Ø TO 6"Ø  
SERVICE PIPE

CSBEZU— SEE APPENDIX C ON  
PGS C3 AND C7 FOR HORIZ CAPACITY  
 $F_H$  AT ALLOWABLE STRESS DESIGN AND  
TORQUE VALUES FOR THE CLAMP BOLTS

## SECTION A-A



**THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED.  
FOR CORRESPONDING REPLACEMENT, SEE PG 3.3.**

ELEV

SHEET TITLE: LONGITUDINAL SEISMIC BRACE  
CSBEZU WITH BRACE PIPE FOR 1"Ø TO 6"Ø SERVICE PIPE CONNECTION



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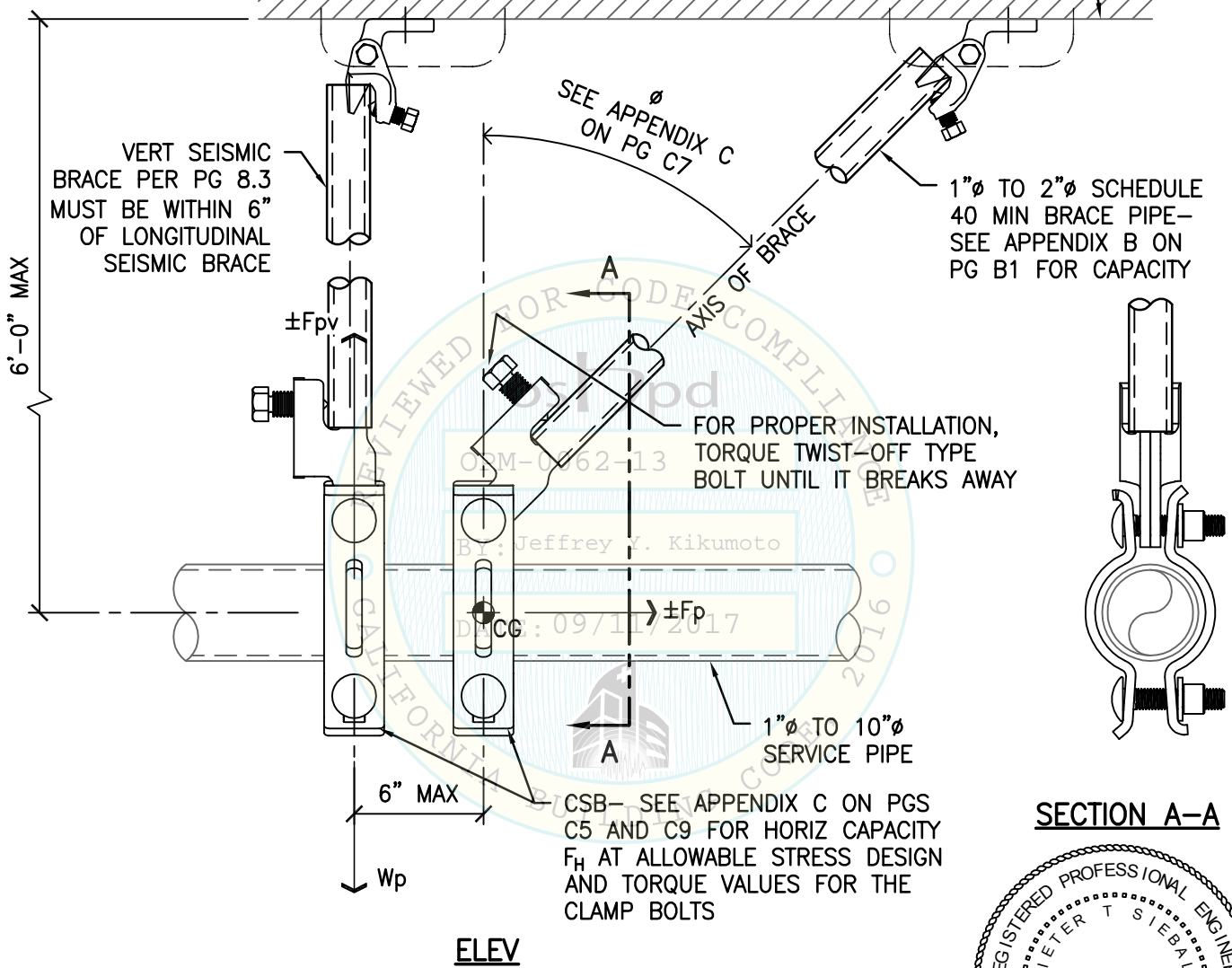


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

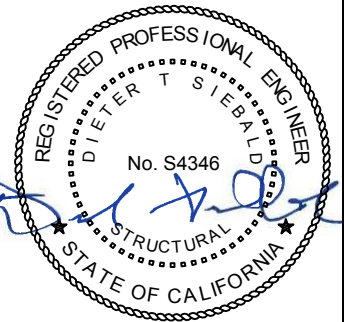
FOR ATTACHMENT TO CONC, SEE  
PGS 5.1, 5.2, 5.4 TO 5.7 & 5.10  
FOR ATTACHMENT TO STL, SEE  
PGS 6.1 TO 6.5 & 6.10 TO 6.15

FOR ATTACHMENT TO CONC,  
SEE PGS 5.1 TO 5.7 & 5.10  
FOR ATTACHMENT TO STL, SEE  
PGS 6.1 TO 6.5 & 6.10 TO 6.15

SUPPORTING  
STRUCTURE



### SECTION A-A



**THIS IS A NEW PRODUCT**

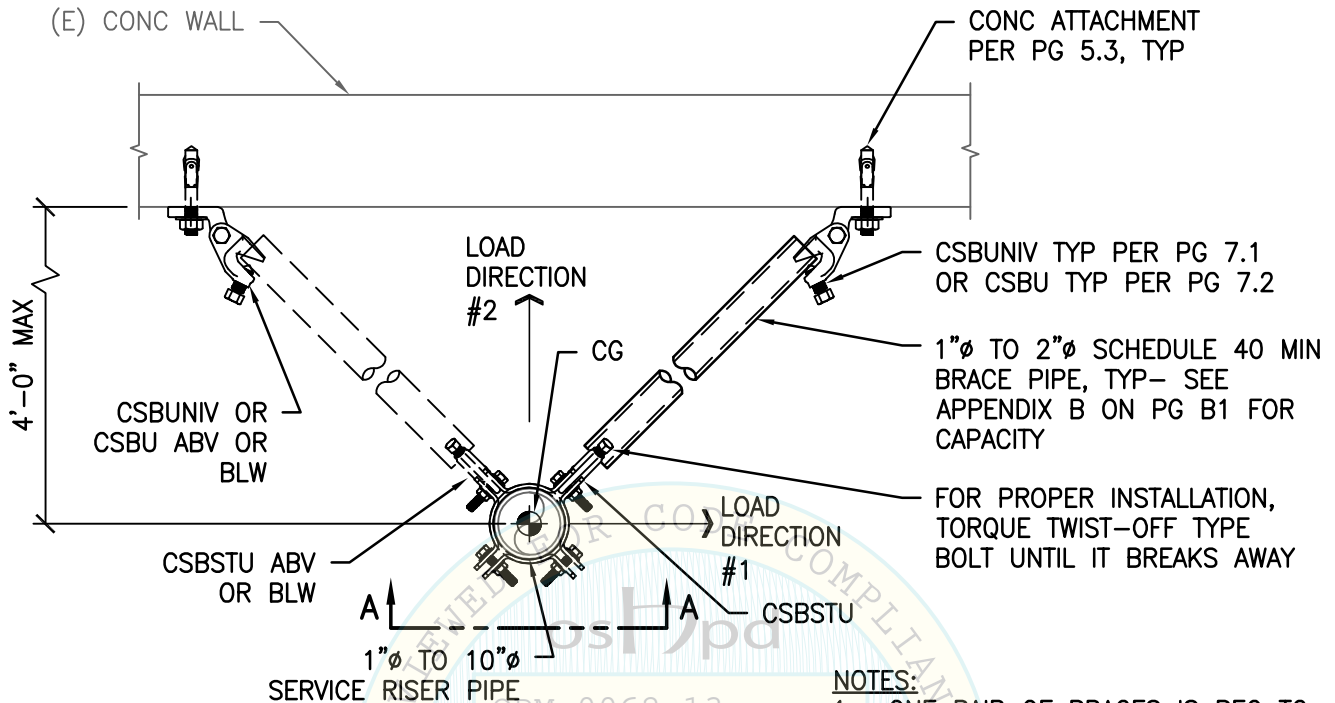
SHEET TITLE: LONGITUDINAL SEISMIC BRACE  
CSB WITH BRACE PIPE FOR 1"Ø TO 10"Ø SERVICE PIPE CONNECTION

 <p><b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833</p>	TEL (916) 920-2020	Job No: 17020
	www.cyseng.com	Date: 08-18-2017
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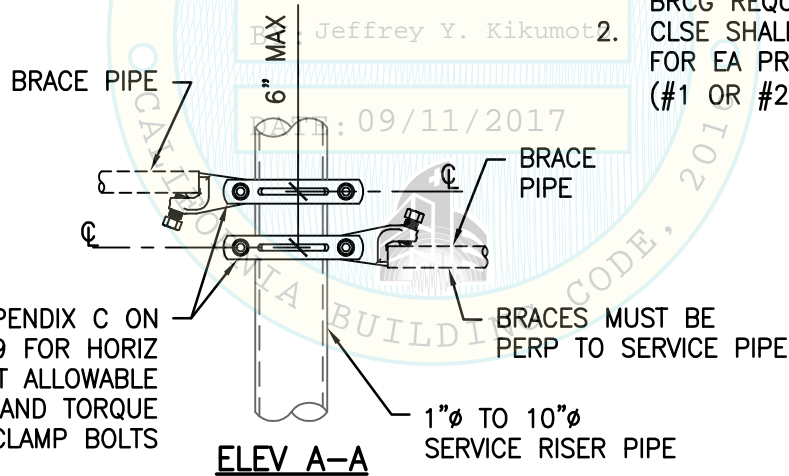
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



## PLAN VIEW

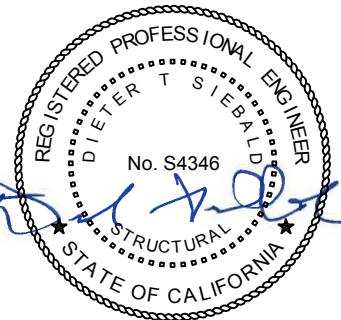


CSBSTU— SEE APPENDIX C ON PGS C2 AND C9 FOR HORIZ CAPACITY  $F_H$  AT ALLOWABLE STRESS DESIGN AND TORQUE VALUES FOR THE CLAMP BOLTS

### NOTES:

- ONE PAIR OF BRACES IS REQ TO SATISFY NFPA® 13, FOUR-WAY RISER BRCG REQUIREMENTS. CLSE SHALL EVALUATE  $\pm F_p$  OR  $\pm F_w$  FOR EA PRINCIPAL LOAD DIRECTION (#1 OR #2) AS SHOWN.

**THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED.  
FOR CORRESPONDING REPLACEMENT, SEE PG 4.5.**



SHEET TITLE: FOUR-WAY RISER SEISMIC BRACES  
CSBSTU WITH BRACE PIPE FOR 1"Ø TO 10"Ø SERVICE PIPE CONNECTION



**CYS STRUCTURAL ENGINEERS, INC.**

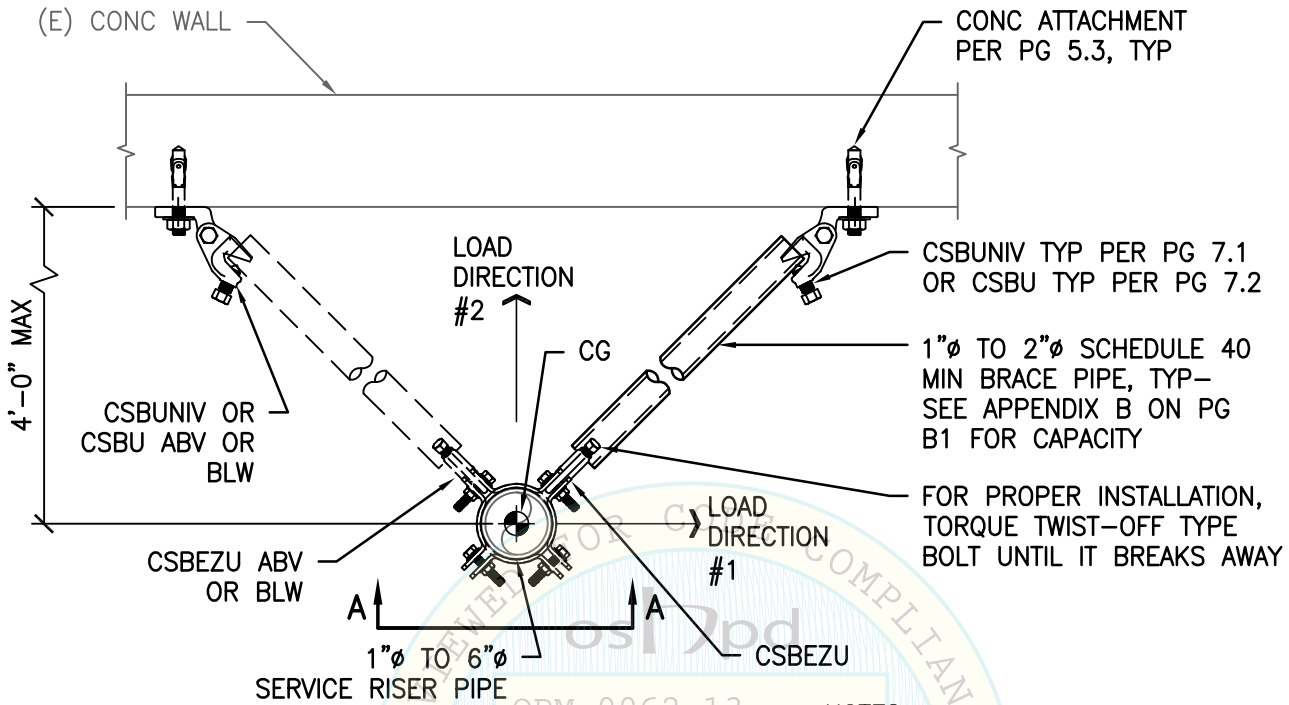
2495 NATOMAS PARK DRIVE, SUITE 650  
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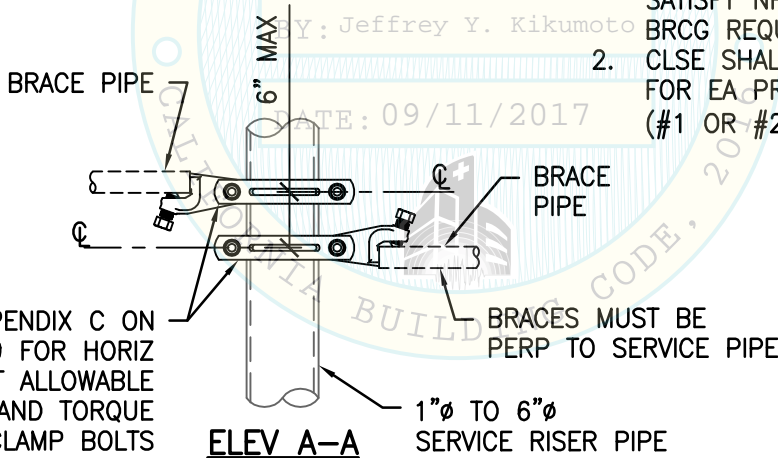
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



## PLAN VIEW

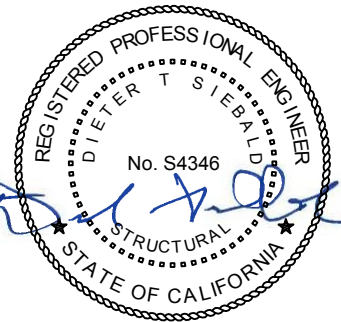
### NOTES:

- ONE PAIR OF BRACES IS REQ TO SATISFY NFPA® 13, FOUR-WAY RISER BRCG REQUIREMENTS.
- CLSE SHALL EVALUATE  $\pm F_p$  OR  $\pm F_{pw}$  FOR EA PRINCIPAL LOAD DIRECTION (#1 OR #2) AS SHOWN.



CSBEZU— SEE APPENDIX C ON PGS C3 AND C9 FOR HORIZ CAPACITY  $F_H$  AT ALLOWABLE STRESS DESIGN AND TORQUE VALUES FOR THE CLAMP BOLTS

**THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED.  
FOR CORRESPONDING REPLACEMENT, SEE PG 4.5.**



SHEET TITLE: FOUR-WAY RISER SEISMIC BRACES  
CSBEZU WITH BRACE PIPES FOR 1"Ø TO 6"Ø SERVICE PIPE CONNECTION



**CYS STRUCTURAL ENGINEERS, INC.**

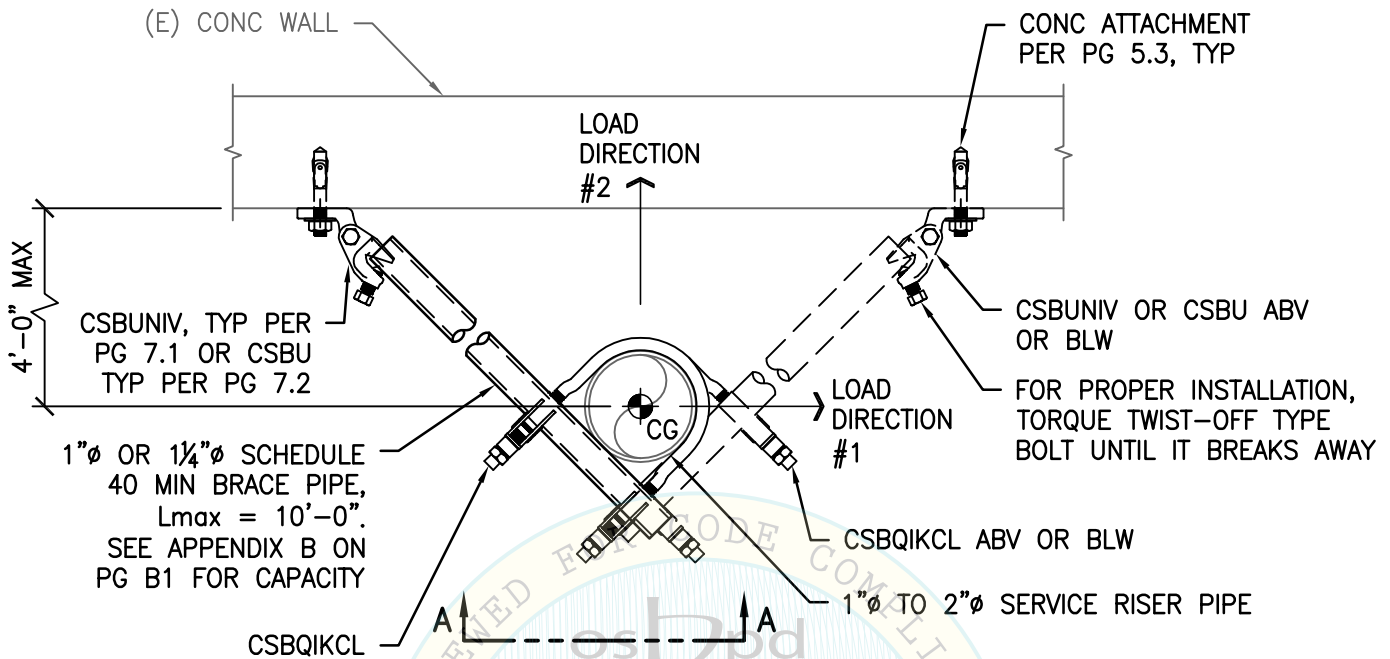
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Job No:	17020
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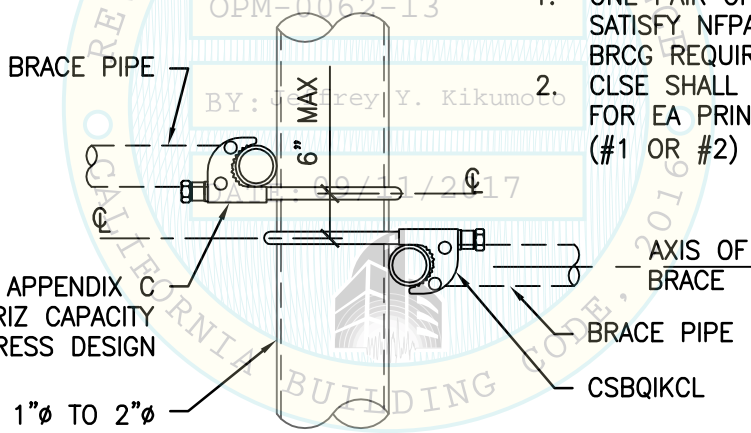
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**PLAN VIEW**

**NOTES:**

- ONE PAIR OF BRACES IS REQ TO SATISFY NFPA® 13 FOUR-WAY RISER BRCG REQUIREMENTS.
- CLSE SHALL EVALUATE  $\pm F_p$  OR  $\pm F_{pw}$  FOR EA PRINCIPAL LOAD DIRECTION (#1 OR #2) AS SHOWN.



**ELEV A-A**

CSBQIKCL- SEE APPENDIX C ON PG C1 FOR HORIZ CAPACITY  $F_H$  AT ALLOWABLE STRESS DESIGN



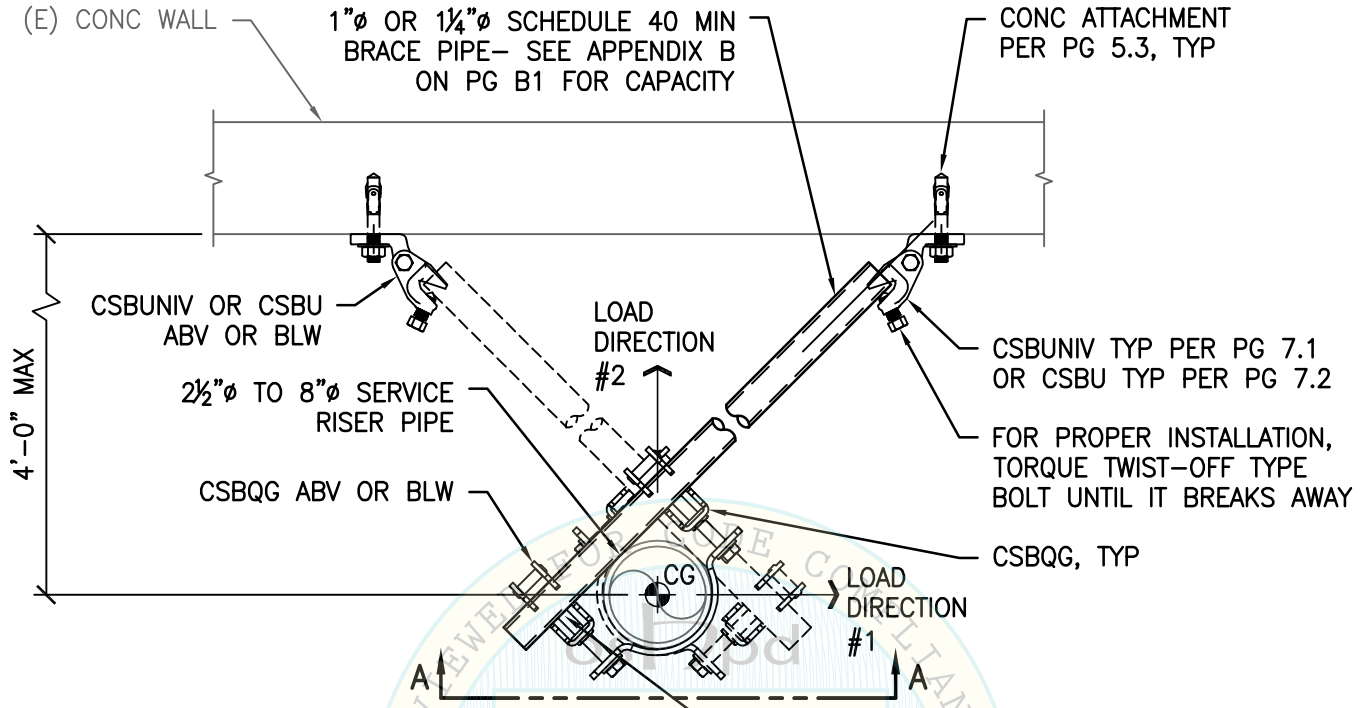
**SHEET TITLE: FOUR-WAY RISER SEISMIC BRACES  
CSBQIKCL WITH BRACE PIPES FOR 1"Ø TO 2"Ø SERVICE PIPE CONNECTION**

<p><b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833</p>	Job No: 17020
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



OPM-0062-13

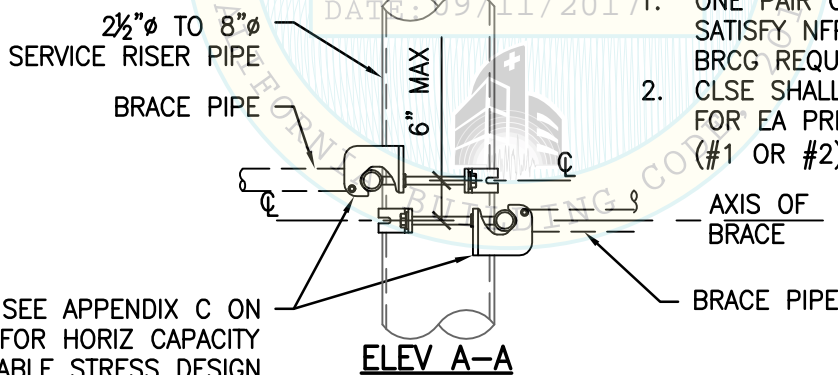


### PLAN VIEW

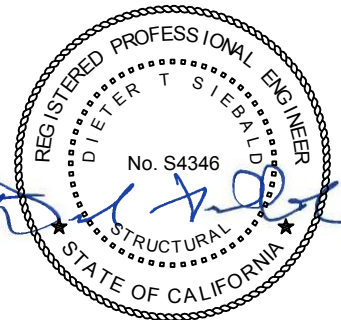
DURING INSTALLATION, YELLOW TIPS WILL DISAPPEAR INTO THE BRACE PIPE TO INDICATE PROPER INSTALLATION TORQUE

### NOTES:

- ONE PAIR OF BRACES IS REQ TO SATISFY NFPA® 13, FOUR-WAY RISER BRCG REQUIREMENTS.
- CLSE SHALL EVALUATE  $\pm F_p$  OR  $\pm F_{pw}$  FOR EA PRINCIPAL LOAD DIRECTION (#1 OR #2) AS SHOWN.



CSBQG— SEE APPENDIX C ON PG C1 FOR HORIZ CAPACITY  $F_H$  AT ALLOWABLE STRESS DESIGN



SHEET TITLE: FOUR-WAY RISER BRACE SEISMIC BRACES  
CSBQG WITH BRACE PIPES FOR 2 1/2"Ø TO 8"Ø SERVICE PIPE CONNECTION



**CYS STRUCTURAL ENGINEERS, INC.**

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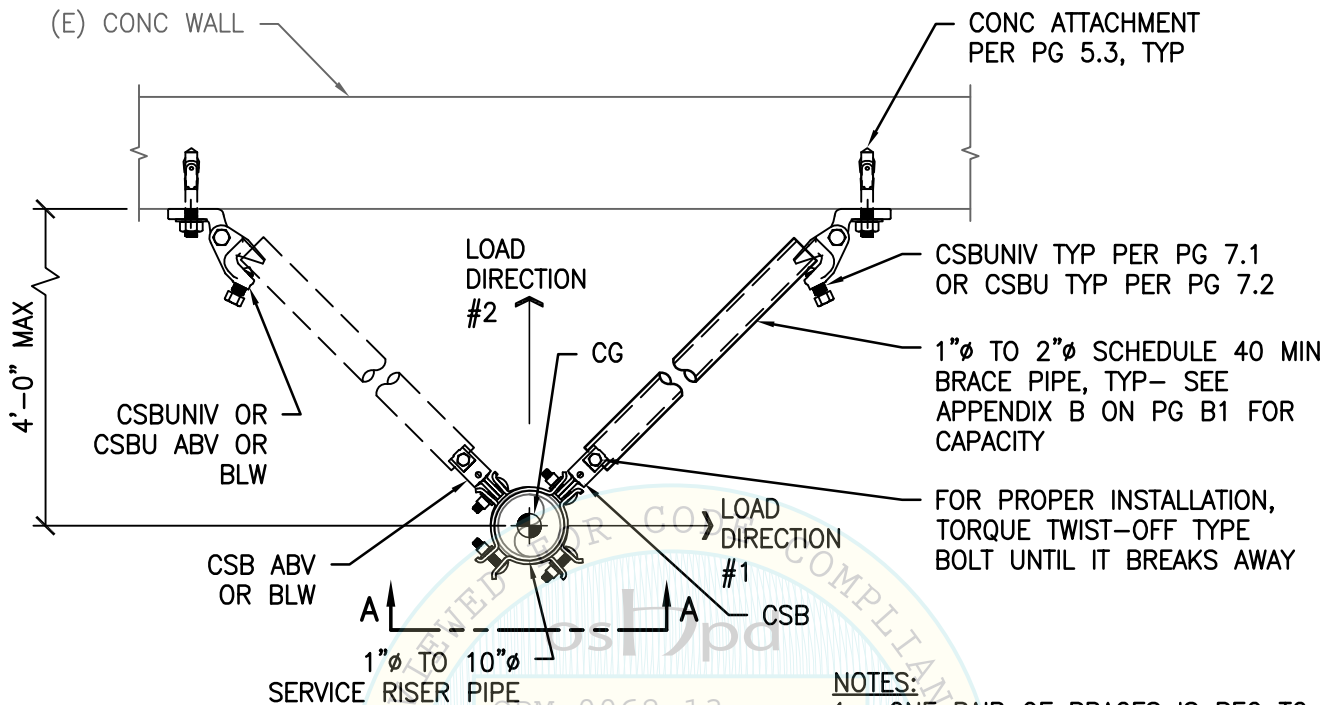
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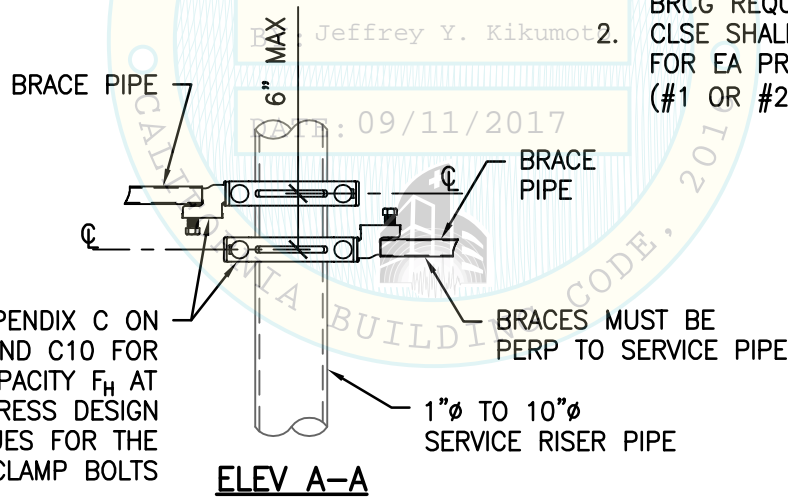
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



## PLAN VIEW



CSB- SEE APPENDIX C ON PGS C5, C6 AND C10 FOR HORIZ CAPACITY  $F_H$  AT ALLOWABLE STRESS DESIGN AND TORQUE VALUES FOR THE CLAMP BOLTS

## NOTES:

- ONE PAIR OF BRACES IS REQ TO SATISFY NFPA® 13, FOUR-WAY RISER BRCG REQUIREMENTS. CLSE SHALL EVALUATE  $\pm F_p$  OR  $\pm F_w$  FOR EA PRINCIPAL LOAD DIRECTION (#1 OR #2) AS SHOWN.

**THIS IS A NEW PRODUCT**



SHEET TITLE: FOUR-WAY RISER SEISMIC BRACES  
CSB WITH BRACE PIPE FOR 1"Ø TO 10"Ø SERVICE PIPE CONNECTION



**CYS STRUCTURAL ENGINEERS, INC.**

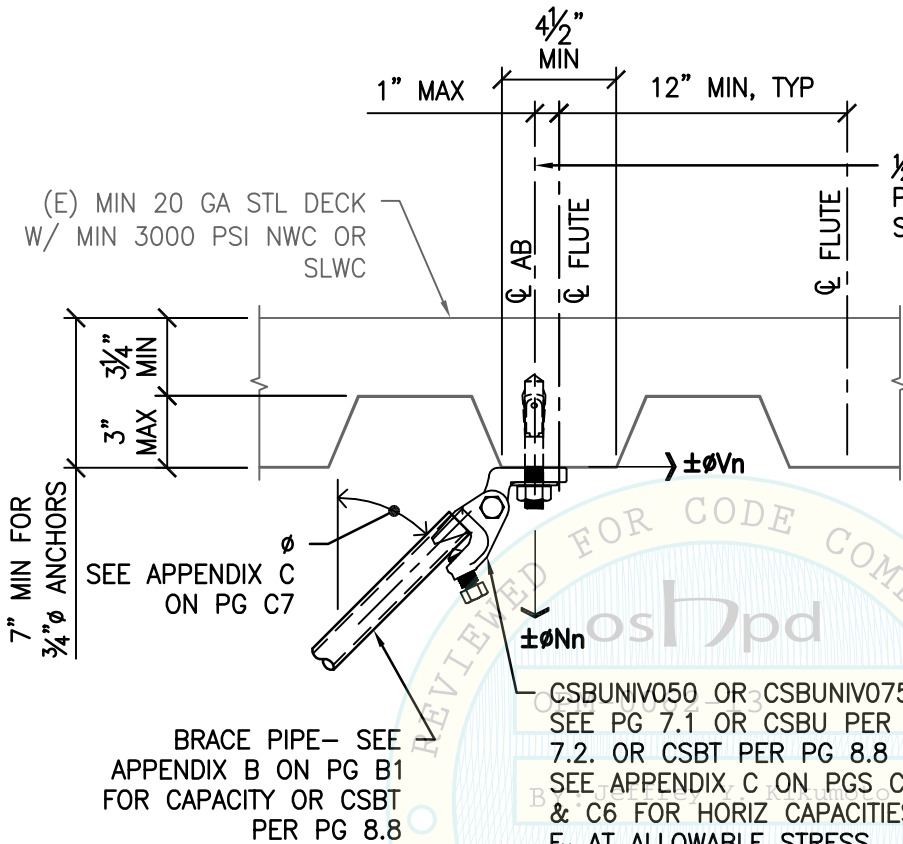
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

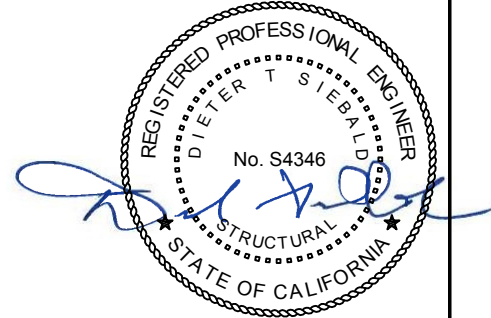
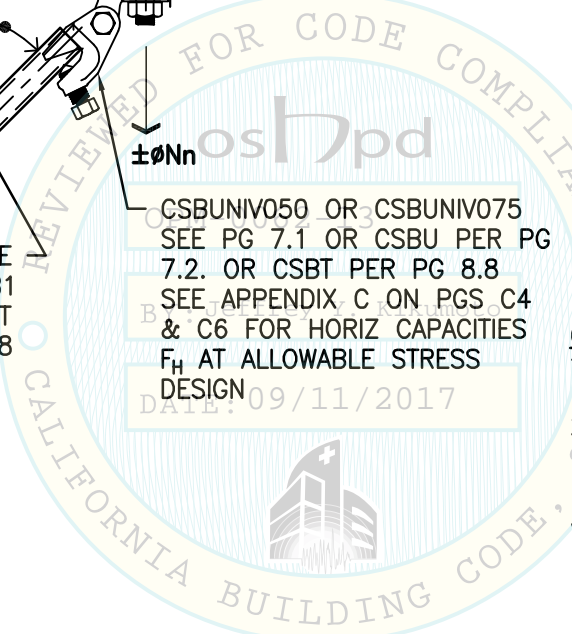


$\frac{1}{2}$ " $\phi$  OR  $\frac{3}{4}$ " $\phi$  POWERS  
POWERSTUD+<sup>®</sup> SD2. SEE  
SECTION 1, GENERAL NOTE 2.

**NOTE:**  
WHEN ATTACHING TO CONC  
FILL OVER MTL DECK,  
POWER-STUD+ SD2  
MUST BE INSTALLED IN LOWER  
FLUTE OF DECK.

CASE 1 SINGLE ANCHOR CAPACITY AT LRFD (SEE NOTES)		
	$\frac{1}{2}$ " $\phi$	$\frac{3}{4}$ " $\phi$
SHEAR ( $\phi V_n$ )	2480#	1833#
TENSION ( $\phi N_n$ )	714#	1692#

- CASE 1 TABLE NOTES:**
- VALUES ARE GIVEN FOR SLWC & ARE CONSERVATIVE FOR NWC.
  - DEMAND FORCES SHALL INCLUDE OVERSTRENGTH FACTOR ( $\Omega_0$ ).
  - SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.



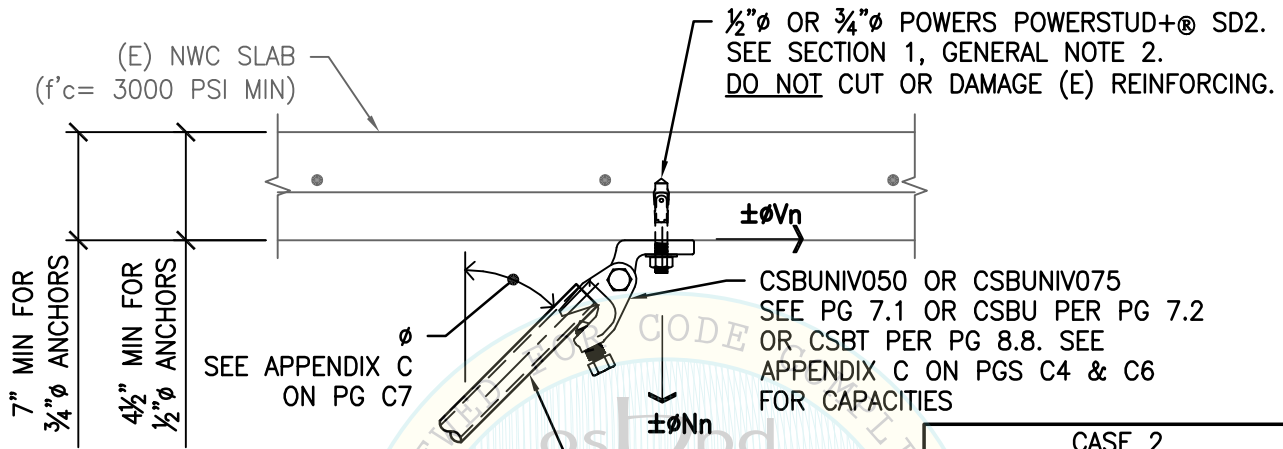
SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO CONCRETE  
CSBUNIV/CSBU CASE 1 - UNDERSIDE OF METAL DECK W/ CONCRETE FILL

<p><b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833</p>	<p>TEL (916) 920-2020 www.cyseng.com</p>	Job No: 17020
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



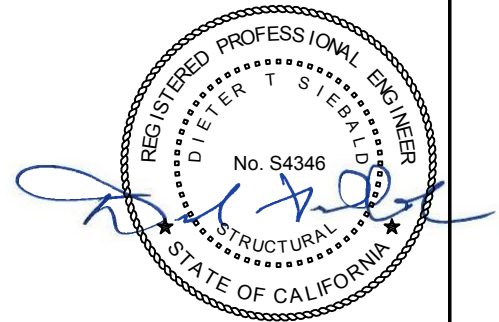
BRACE PIPE— SEE APPENDIX B  
ON PG B1 FOR CAPACITY OR  
CSBT PER PG 8.8

CASE 2 SINGLE ANCHOR CAPACITY AT LRFD (SEE NOTES)		
	1/2"φ	3/4"φ
SHEAR (φVn)	1383#	4676#
TENSION (φNn)	1284#	3296#

**CASE 2 TABLE NOTES:**

1. DEMAND FORCES SHALL INCLUDE OVERSTRENGTH FACTOR (Ω<sub>0</sub>)
2. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.

OPM-0062-13  
BY: Jeffrey Y. Kikumoto  
DATE: 09/11/2017



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO CONCRETE  
CSBUNIV/CSBU CASE 2 - UNDERSIDE OF CONCRETE FLOOR OR ROOF



**CYS STRUCTURAL ENGINEERS, INC.**

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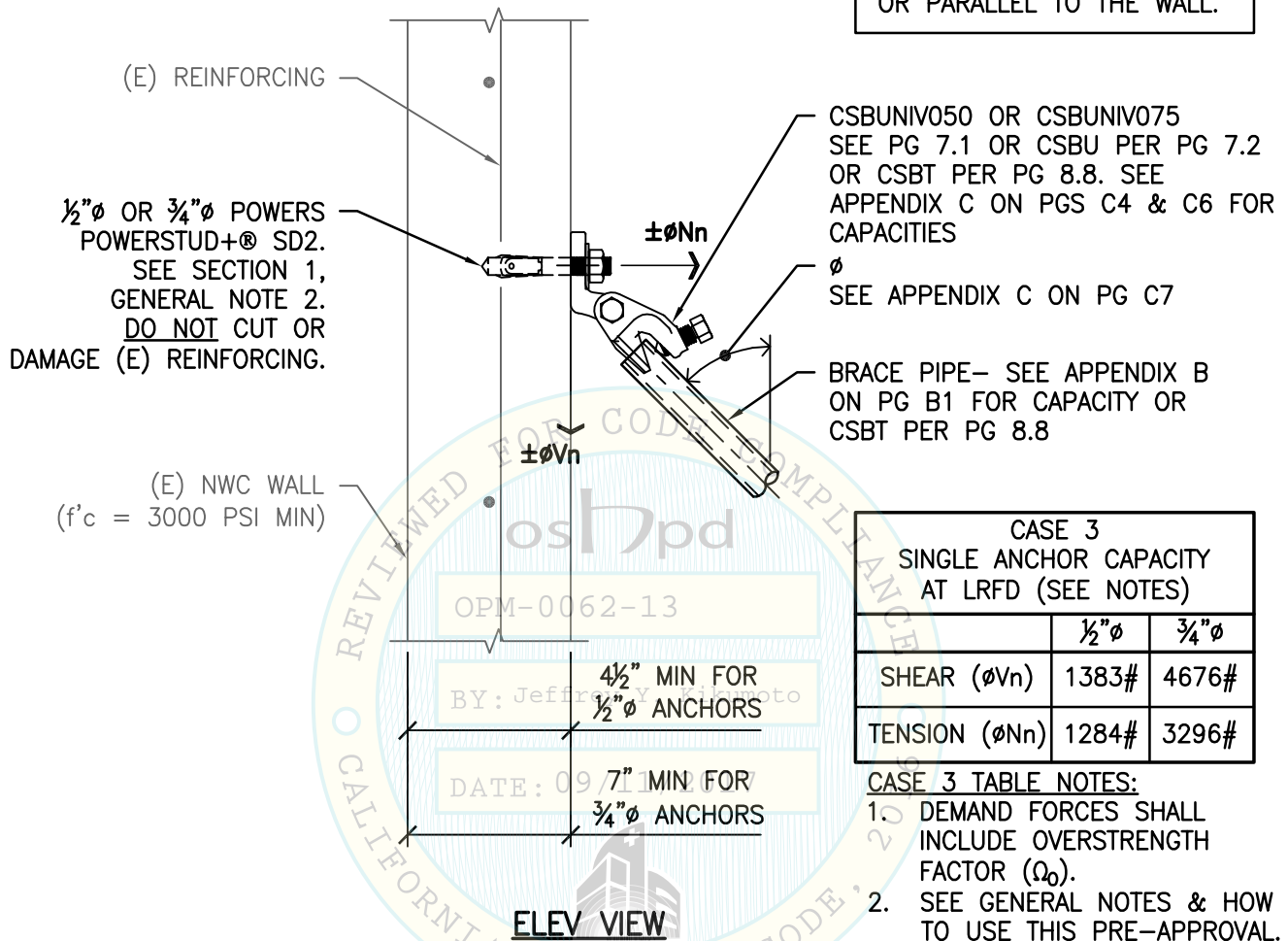
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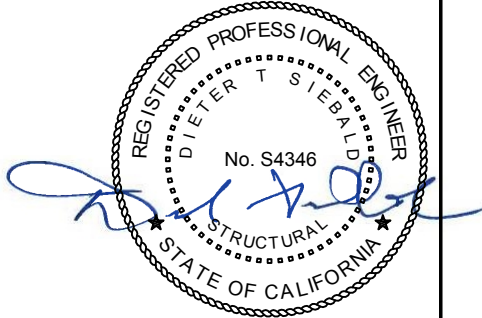
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

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



CASE 3 SINGLE ANCHOR CAPACITY AT LRFD (SEE NOTES)		
	1/2"φ	3/4"φ
SHEAR ( $\phi V_n$ )	1383#	4676#
TENSION ( $\phi N_n$ )	1284#	3296#

- CASE 3 TABLE NOTES:**
- DEMAND FORCES SHALL INCLUDE OVERSTRENGTH FACTOR ( $\Omega_0$ ).
  - SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.



**SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO CONCRETE  
CSBUNIV/CSBU CASE 3 - WALL MOUNTED**

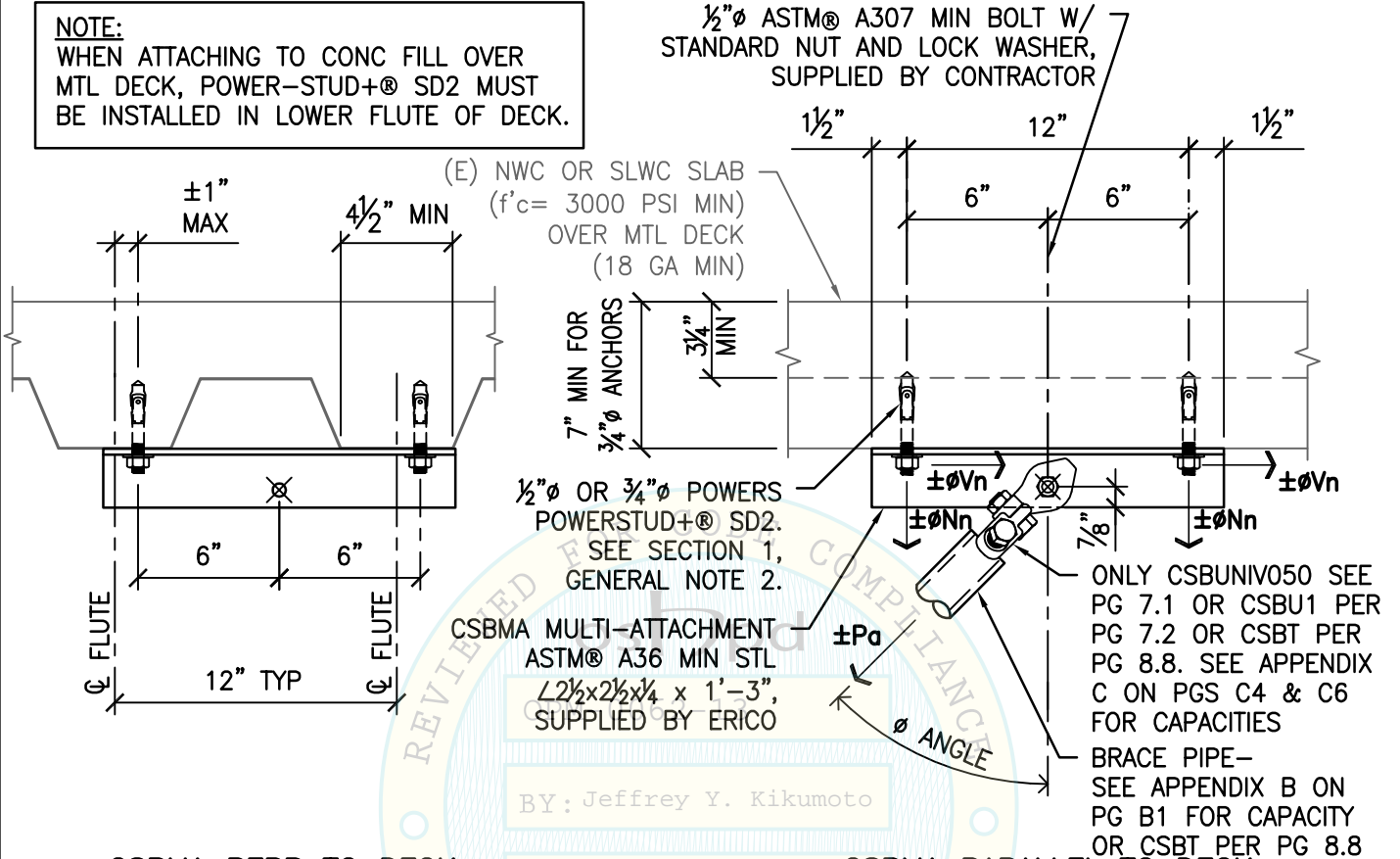
	<b>CYS STRUCTURAL ENGINEERS, INC.</b>	<b>Job No:</b> 17020
	2495 NATOMAS PARK DRIVE, SUITE 650	<b>Date:</b> 08-18-2017
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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

**NOTE:**  
WHEN ATTACHING TO CONC FILL OVER  
MTL DECK, POWER-STUD+® SD2 MUST  
BE INSTALLED IN LOWER FLUTE OF DECK.



BY: Jeffrey Y. Kikumoto

### CSBMA PERP TO DECK      CSBMA PARALLEL TO DECK BRACE PIPE HORIZ VECTOR LOAD PARALLEL TO CSBMA

ALLOWABLE AXIAL BRACE FORCE, Pa AT ASD		
BRACE ANGLE $\phi$	ANCHOR	
	$\frac{1}{2}$ " $\phi$	$\frac{3}{4}$ " $\phi$
0 DEG	292#	688#
01 DEG - 15 DEG	287#	677#
16 DEG - 30 DEG	287#	636#
31 DEG - 45 DEG	303#	627#
46 DEG - 60 DEG	345#	627#
61 DEG - 90 DEG	411#	662#

CASE 1 SINGLE ANCHOR CAPACITY AT LRFD (SEE NOTES)		
	$\frac{1}{2}$ " $\phi$	$\frac{3}{4}$ " $\phi$
SHEAR ( $\phi V_n$ )	2480#	1833#
TENSION ( $\phi N_n$ )	714#	1692#

- CASE 1 TABLE NOTES:**
- VALUES ARE GIVEN FOR SLWC & ARE CONSERVATIVE FOR NWC.
  - VALUES ARE FOR EA ANCHOR.
  - DEMAND FORCES SHALL INCLUDE OVERSTRENGTH FACTOR ( $\Omega_0$ ).
  - SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO CONCRETE  
CSBMA CASE 1 - UNDERSIDE OF METAL DECK W/ CONCRETE FILL

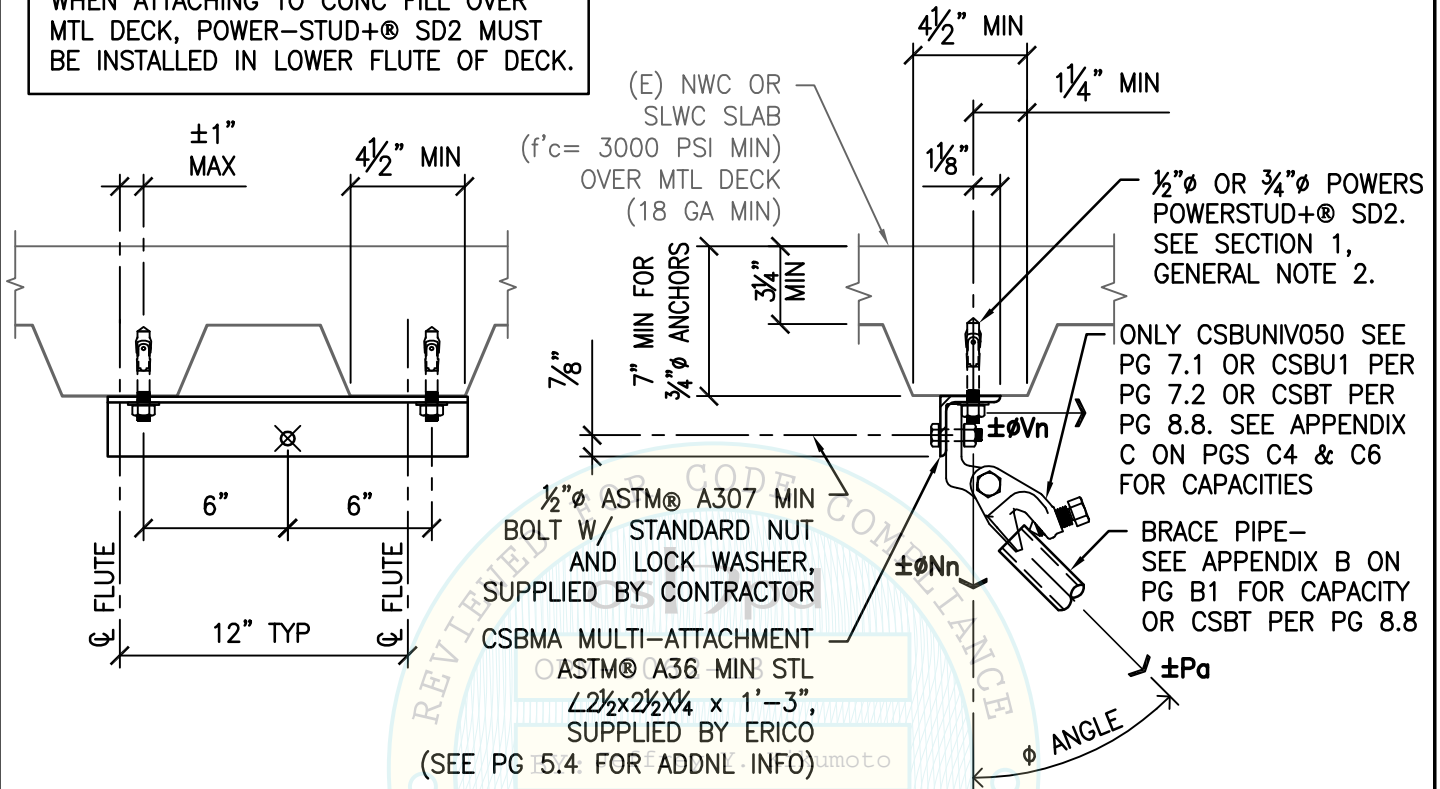
<p><b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833</p>	TEL (916) 920-2020	Job No: 17020
	www.cyseng.com	Date: 08-18-2017
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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

**NOTE:**  
WHEN ATTACHING TO CONC FILL OVER  
MTL DECK, POWER-STUD+® SD2 MUST  
BE INSTALLED IN LOWER FLUTE OF DECK.



**CSBMA PERP TO DECK**

**CSBMA PARALLEL TO DECK**

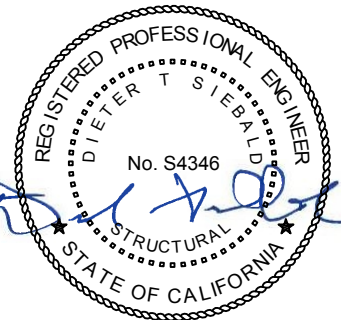
**BRACE PIPE HORIZ VECTOR LOAD PERP TO CSBMA**

ALLOWABLE AXIAL BRACE FORCE, Pa AT ASD		
BRACE ANGLE $\phi$	ANCHOR	
	$\frac{1}{2}''\phi$	$\frac{3}{4}''\phi$
0 DEG	292#	688#
01 DEG - 15 DEG	292#	688#
16 DEG - 30 DEG	199#	445#
31 DEG - 45 DEG	157#	337#
46 DEG - 60 DEG	137#	286#
61 DEG - 90 DEG	130#	260#

CASE 1 SINGLE ANCHOR CAPACITY AT LRFD (SEE NOTES)		
	$\frac{1}{2}''\phi$	$\frac{3}{4}''\phi$
SHEAR ( $\phi V_n$ )	2480#	1833#
TENSION ( $\phi N_n$ )	714#	1692#

**CASE 1 TABLE NOTES:**

- VALUES ARE GIVEN FOR SLWC & ARE CONSERVATIVE FOR NWC.
- VALUES ARE FOR EA ANCHOR.
- DEMAND FORCES SHALL INCLUDE OVERSTRENGTH FACTOR ( $\Omega_0$ ).
- SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.



**SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO CONCRETE  
CSBMA CASE 1 - UNDERSIDE OF METAL DECK W/ CONCRETE FILL**



**CYS STRUCTURAL ENGINEERS, INC.**

2495 NATOMAS PARK DRIVE, SUITE 650  
SACRAMENTO, CA 95833

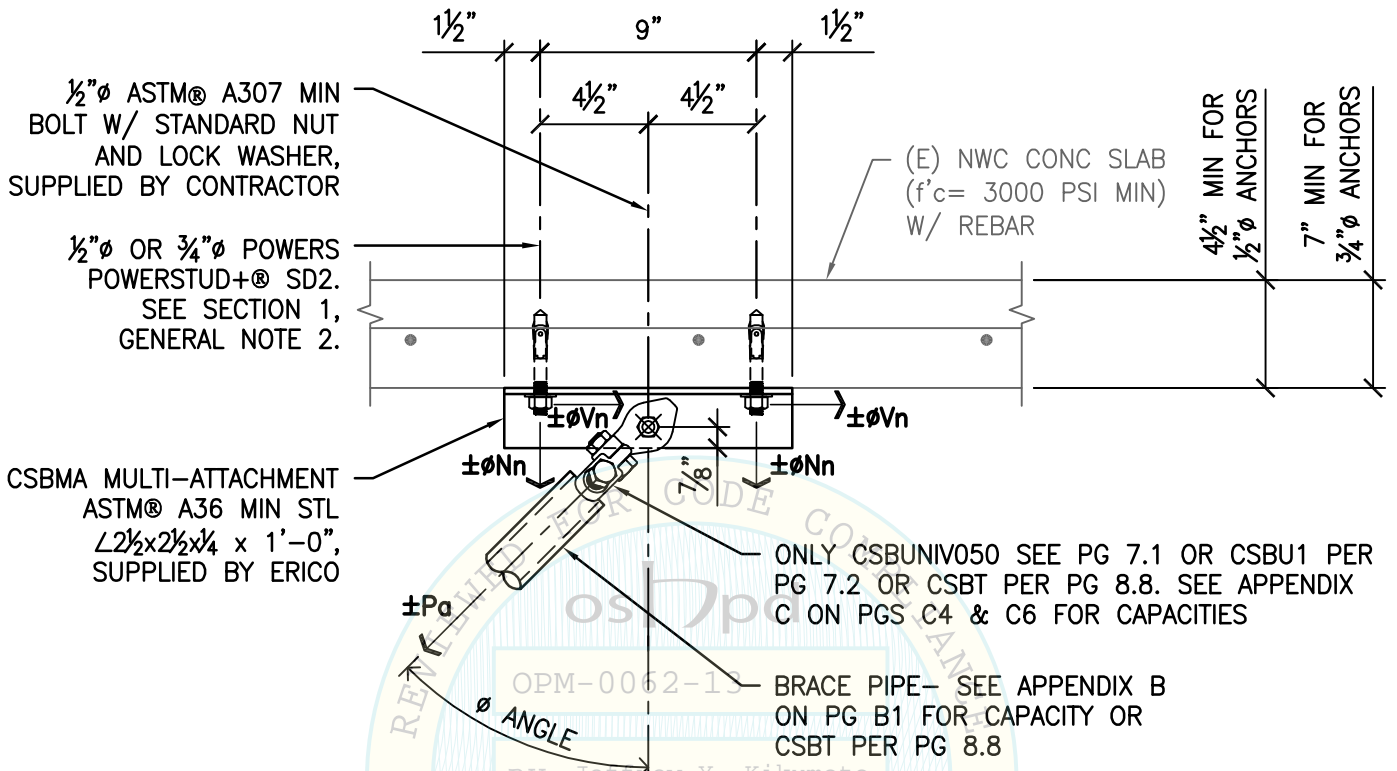
TEL (916) 920-2020  
www.cyseng.com

Job No:	17020
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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



### BRACE PIPE HORIZ VECTOR LOAD PARALLEL TO CSBMA

OPM-0062-13  
 BY: Jeffrey Y. Kikumoto  
 DATE: 09/11/2017

ALLOWABLE AXIAL BRACE FORCE, $P_a$ AT ASD		
BRACE ANGLE $\phi$	ANCHOR	
	$\frac{1}{2}$ " $\phi$	$\frac{3}{4}$ " $\phi$
0 DEG	523#	1192#
01 DEG - 15 DEG	506#	1130#
16 DEG - 30 DEG	471#	991#
31 DEG - 45 DEG	459#	938#
46 DEG - 60 DEG	459#	938#
61 DEG - 90 DEG	479#	950#

CASE 2 SINGLE ANCHOR CAPACITY AT LRFD (SEE NOTES)		
	$\frac{1}{2}$ " $\phi$	$\frac{3}{4}$ " $\phi$
SHEAR ( $\phi V_n$ )	1383#	2338#
TENSION ( $\phi N_n$ )	1284#	2967#

- CASE 2 TABLE NOTES:**
- VALUES ARE FOR EA ANCHOR.
  - DEMAND FORCES SHALL INCLUDE OVERSTRENGTH FACTOR ( $\phi_o$ ).
  - SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.



**SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO CONCRETE**  
**CSBMA CASE 2 - UNDERSIDE OF CONCRETE FLOOR OR ROOF**



**CYS STRUCTURAL ENGINEERS, INC.**

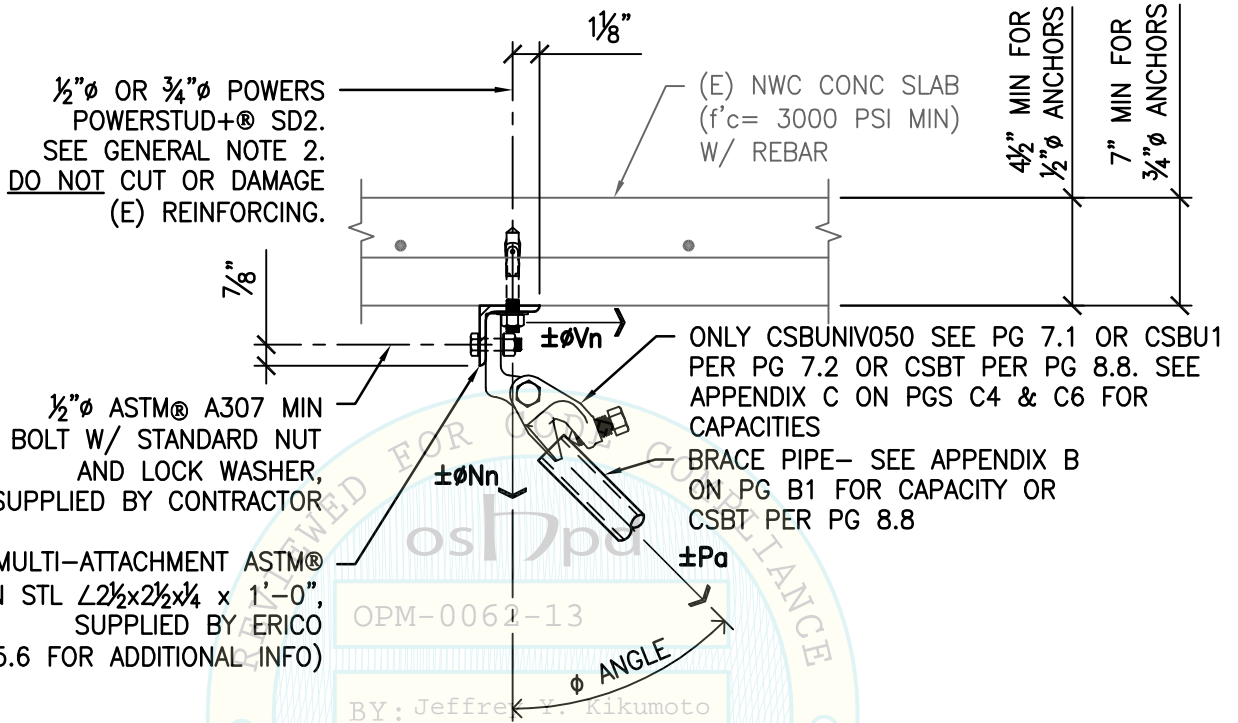
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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



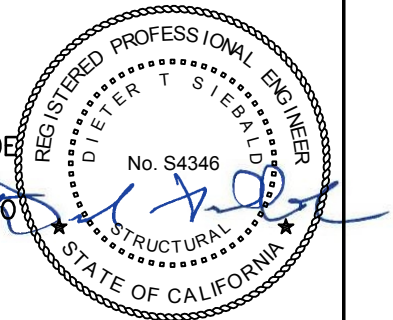
### BRACE PIPE HORIZ VECTOR LOAD PERP TO CSBMA

ALLOWABLE AXIAL BRACE FORCE, Pa AT ASD		
BRACE ANGLE $\phi$	ANCHOR	
	$\frac{1}{2}$ " $\phi$	$\frac{3}{4}$ " $\phi$
0 DEG	523#	1192#
01 DEG - 15 DEG	523#	1163#
16 DEG - 30 DEG	341#	697#
31 DEG - 45 DEG	260#	511#
46 DEG - 60 DEG	222#	423#
61 DEG - 90 DEG	203#	369#

CASE 2 SINGLE ANCHOR CAPACITY AT LRFD (SEE NOTES)		
	$\frac{1}{2}$ " $\phi$	$\frac{3}{4}$ " $\phi$
SHEAR ( $\phi V_n$ )	1383#	2338#
TENSION ( $\phi N_n$ )	1284#	2967#

**CASE 2 TABLE NOTES:**

- VALUES ARE FOR EA ANCHOR.
- DEMAND FORCES SHALL INCLUDE OVERSTRENGTH FACTOR ( $\phi_o$ ).
- SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO CONCRETE  
CSBMA CASE 2 - UNDERSIDE OF CONCRETE FLOOR OR ROOF



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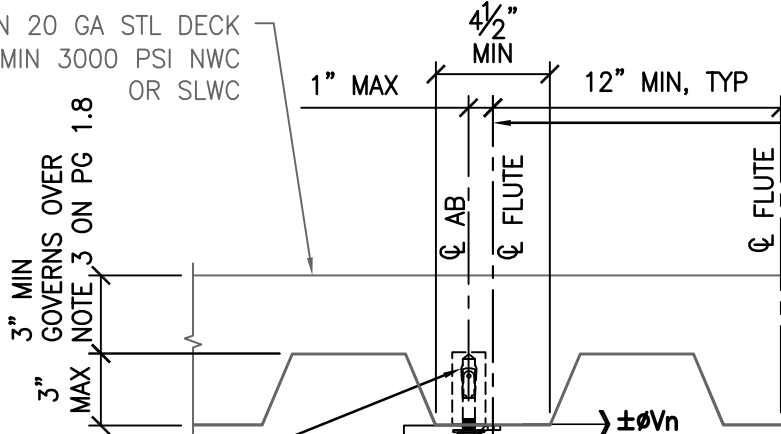
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

(E) MIN 20 GA STL DECK  
W/ MIN 3000 PSI NWC  
OR SLWC

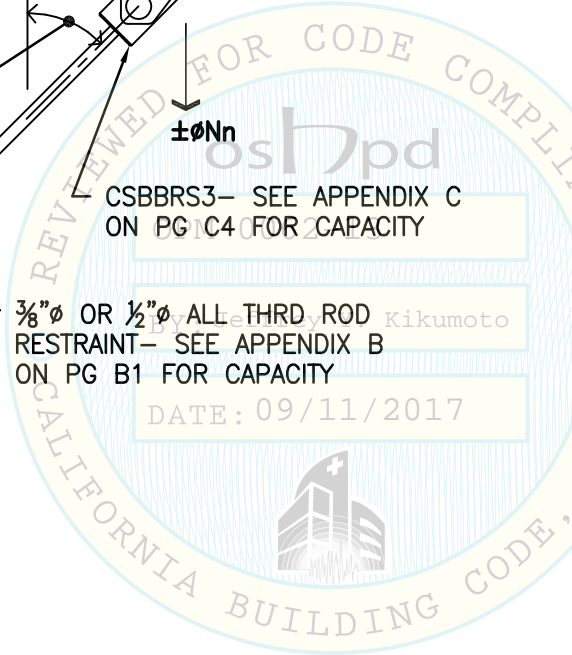


POWERS SNAKE+™ 3/8"Ø ANCHOR.  
SEE SECTION 1, GENERAL NOTE 3.

**NOTE:**  
WHEN ATTACHING TO CONC  
FILL OVER MTL DECK,  
POWER-SNAKE+™ MUST BE  
INSTALLED IN LOWER FLUTE  
OF DECK.

CASE 1 SINGLE ANCHOR CAPACITY AT LRFD (SEE NOTES)	
	3/8"Ø
SHEAR ( $\phi V_n$ )	462#
TENSION ( $\phi N_n$ )	524#

- CASE 1 TABLE NOTES:**
- VALUES ARE GIVEN FOR SLWC & ARE CONSERVATIVE FOR NWC.
  - DEMAND FORCES SHALL INCLUDE OVERSTRENGTH FACTOR ( $\Omega_0$ ).
  - SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
  - VALUES ARE GIVEN FOR ANCHORS. HOWEVER, ALL THRD ROD MAY CONTROL THE CAPACITY OF THE RESTRAINT ASSEMBLY.



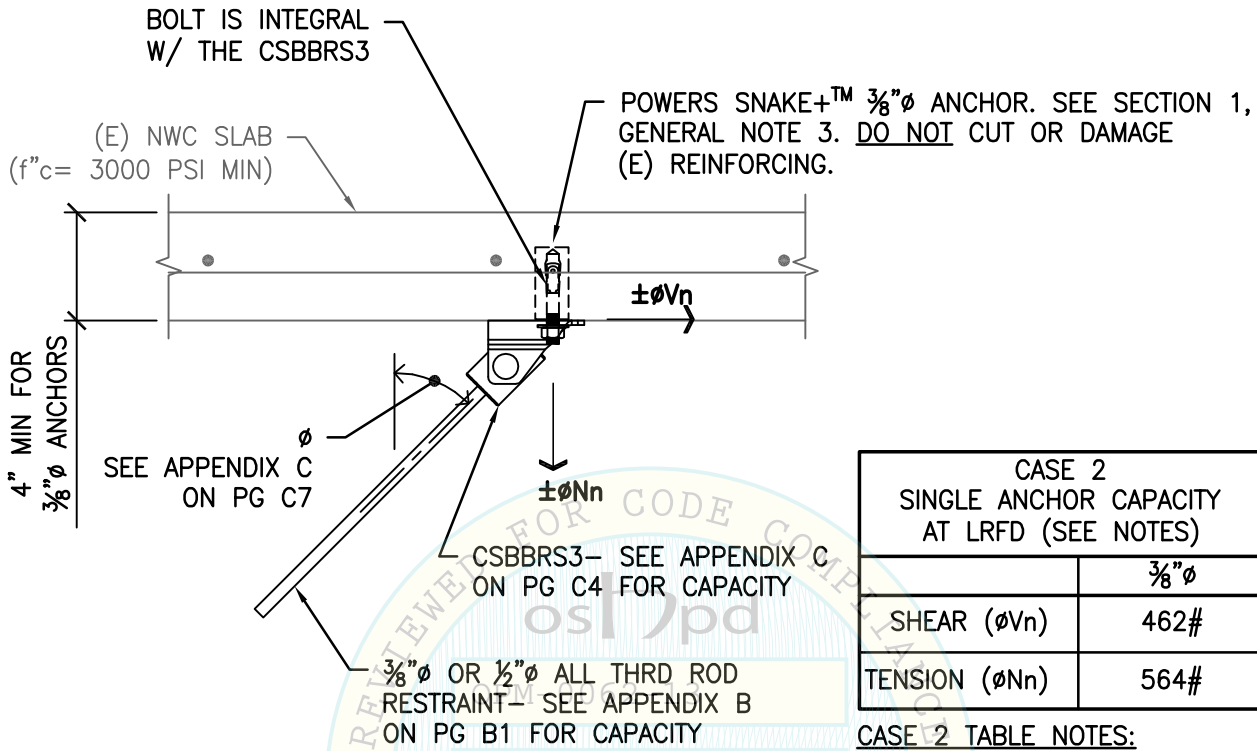
SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO CONCRETE  
CSBBRS3 CASE 1 - UNDERSIDE OF METAL DECK W/ CONCRETE FILL

<p><b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833</p>	<p>TEL (916) 920-2020 www.cyseng.com</p>	Job No: 17020
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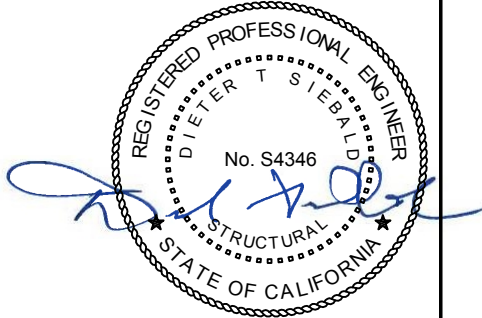
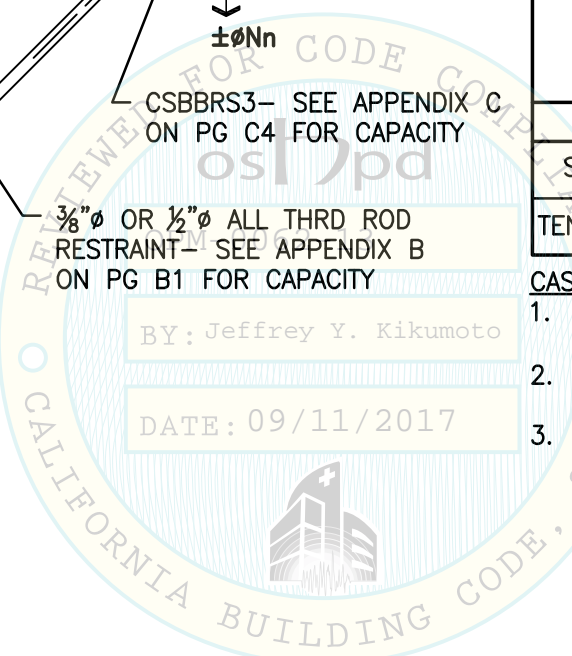
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



CASE 2 SINGLE ANCHOR CAPACITY AT LRFD (SEE NOTES)	
	3/8"φ
SHEAR (φVn)	462#
TENSION (φNn)	564#

- CASE 2 TABLE NOTES:**
1. DEMAND FORCES SHALL INCLUDE OVERSTRENGTH FACTOR ( $\Omega_0$ ).
  2. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
  3. VALUES ARE GIVEN FOR ANCHORS. HOWEVER, ALL THRD ROD MAY CONTROL THE CAPACITY OF THE RESTRAINT ASSEMBLY.

BY: Jeffrey Y. Kikumoto  
DATE: 09/11/2017



**SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO CONCRETE  
CSBBRS3 CASE 2 - UNDERSIDE OF CONCRETE FLOOR OR ROOF**

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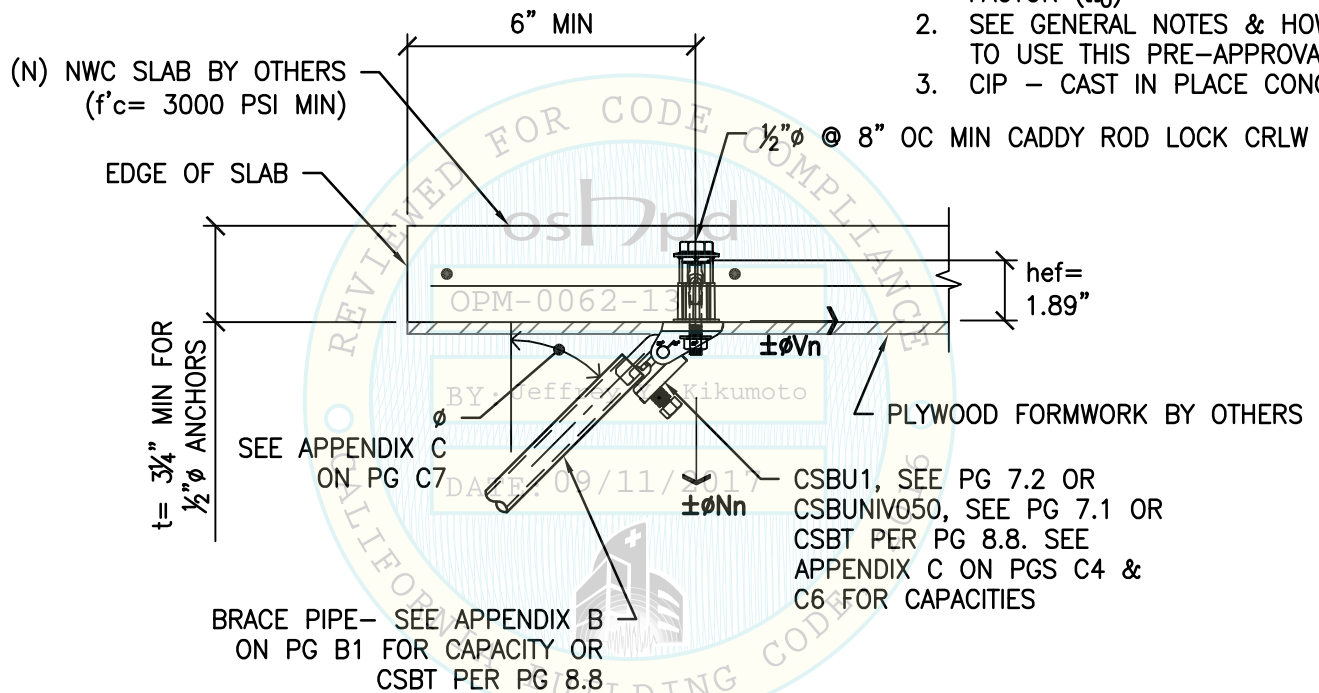


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

CASE 4 SINGLE INSERT CAPACITY AT LRFD (SEE NOTES)	
DIA	$\frac{1}{2}"\phi$
	$t = \frac{3}{4}"$ $t = 4\frac{1}{2}"$
SHEAR ( $\phi V_n$ )	1640# 1793#
TENSION ( $\phi N_n$ )	1665# 1665#

**CASE 4 TABLE NOTES:**

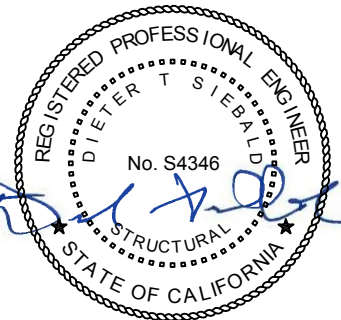
1. DEMAND FORCES SHALL INCLUDE OVERSTRENGTH FACTOR ( $\Omega_0$ )
2. SEE GENERAL NOTES & HOW TO USE THIS PRE-APPROVAL.
3. CIP - CAST IN PLACE CONC.



**NOTES:**

1. SPECIALTY INSERTS INSTALLED IN NWC SHALL BE CADDY ROD LOCK PLYWOOD FORM (CRLW) HEADED CAST-IN SPECIALTY INSERTS IN CRACKED CONCRETE AS NOTED ON THIS DWG, COMPLYING W/ ESR-3864 ISSUED MAY 2017.
2. INSTALLATION SHALL BE IN ACCORDANCE W/ THE REQUIREMENTS OF THE ICC-ES EVALUATION REPORT FOR THE SPECIFIED ANCHOR.

**THIS IS A NEW CASE**



**SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO CONCRETE  
CSBU1 CASE 4 - UNDERSIDE OF CIP CONCRETE FLOOR OR ROOF**



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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

PART NUMBER	FLANGE THICKNESS	FLANGE WIDTH
CSBIB075085	¼" TO ¾"	4" TO 8½"
CSBIB075145	¼" TO ¾"	8½" TO 14½"
CSBIB125180	¾" TO 1¼"	4" TO 18"

CSBIB- SEE APPENDIX C ON PG C4 FOR CAPACITY

FOR PROPER INSTALLATION,  
TORQUE TWIST-OFF TYPE BOLT HEAD  
(ASTM® A563 GR B) UNTIL IT  
BREAKS AWAY (40-50 FT-LBS)

ONLY CSBUNIV050 PER PG 7.1  
FOR CSBIB OR CSBT PER PG  
8.8. FOR CSBUNIV050 &  
CSBT, SEE APPENDIX C ON  
PGS C4 & C6 FOR CAPACITIES

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

THRD ROD IS  
INTEGRAL TO THE  
CSBIB, TYP OF 2

SEE APPENDIX C  
ON PG C7

BRACE PIPE (ORIENTATION MAY  
ALSO BE PARALLEL TO THE LENGTH  
OF THE WF BM)- SEE APPENDIX B  
ON PG B1 FOR CAPACITY OR CSBT  
PER PG 8.8

½"Ø BOLT SUPPLIED BY ERICO®  
(ASTM A449, 25-34 HRC HARDNESS)

FOR PROPER INSTALLATION,  
TORQUE TWIST-OFF TYPE  
BOLT HEAD UNTIL IT  
BREAKS AWAY

**NOTE:**  
SEE APPENDIX C FOR HORIZ  
CAPACITY  $F_H$  OF CSBIB AT  
ALLOWABLE STRESS DESIGN.

**THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED.  
FOR CORRESPONDING REPLACEMENT, SEE PG 6.15.**



**SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBIB - BOTTOM FLANGE OF WIDE FLANGE BEAM**



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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

FOR PROPER INSTALLATION, TORQUE  
TWIST-OFF TYPE BOLT HEAD  
(ASTM A563 GR B) UNTIL IT BREAKS AWAY  
(40-50 FT-LBS)

CSBBC075- SEE APPENDIX  
C ON PG C4 FOR CAPACITY

ONLY CSBUNIV050 PER PG 7.1  
OR CSBT PER PG 8.8 FOR  
CSBBC075. FOR CSBUNIV050 &  
CSBT, SEE APPENDIX C ON  
PGS C4 & C6 FOR CAPACITIES

SEE APPENDIX C  
ON PG C7

BRACE PIPE (ORIENTATION  
MAY ALSO BE PARALLEL  
TO THE LENGTH OF THE  
WF BM)- SEE APPENDIX B  
ON PG B1 FOR CAPACITY  
OR CSBT PER PG 8.8

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

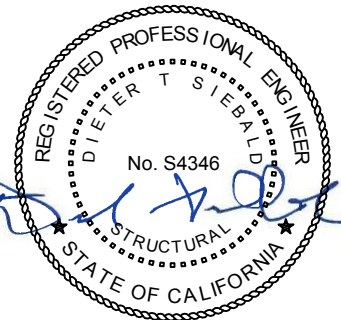
1/4" MIN TO 3/4" MAX  
FLANGE THICKNESS

1/2" Ø BOLT SUPPLIED BY ERICO®  
(ASTM® A449, 25-34 HRC HARDNESS)

FOR PROPER INSTALLATION, TORQUE TWIST-OFF  
TYPE BOLT HEAD UNTIL IT BREAKS AWAY

**NOTE:**  
SEE APPENDIX C FOR HORIZ  
CAPACITY  $F_H$  OF CSBBC075 AT  
ALLOWABLE STRESS DESIGN.

**THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED.  
FOR CORRESPONDING REPLACEMENT, SEE PG 6.14.**



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBBC075 - BOTTOM FLANGE OF WIDE FLANGE BEAM



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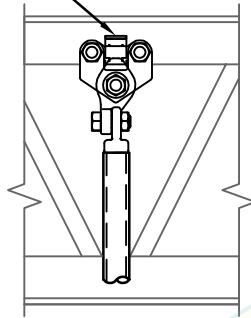
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

FOR PROPER INSTALLATION, TORQUE TWIST-OFF  
TYPE BOLT HEAD (ASTM® A563 GR B)  
UNTIL IT BREAKS AWAY (40-50 FT-LBS)

CSBBARJ



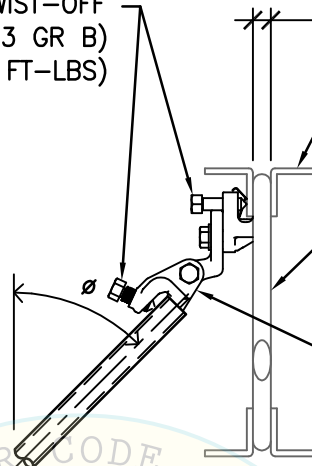
BRACE PERP TO JOIST

$\frac{3}{4}$ " MIN  
REQ

$\frac{1}{4}$ " MIN TO  $\frac{1}{2}$ " MAX  
ANGLE THICKNESS

(E) BAR JOIST, SEE  
SEOR RESPONSIBILITIES  
IN SECTION 1

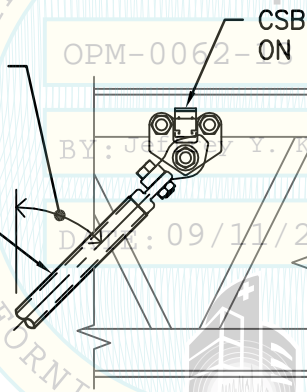
CSBUNIV OR CSBT- SEE  
APPENDIX C ON PGS C4 &  
C6 FOR CAPACITIES



BRACE PERP TO JOIST

SEE APPENDIX C  
ON PG C7

BRACE PIPE-  
SEE APPENDIX B ON  
PG B1 FOR CAPACITY  
OR CSBT PER PG 8.8



BRACE PARALLEL TO JOIST

CSBBARJ- SEE APPENDIX C  
ON PG C4 FOR CAPACITY

**NOTE:**  
SEE APPENDIX C FOR HORIZ  
CAPACITY  $F_H$  OF CSBBARJ AT  
ALLOWABLE STRESS DESIGN.

SIDE ATTACHMENT

THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED.  
FOR CORRESPONDING REPLACEMENT, SEE PG 6.11.



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBBARJ - TOP CHORD OF OPEN WEB JOIST SIDE INSTALL



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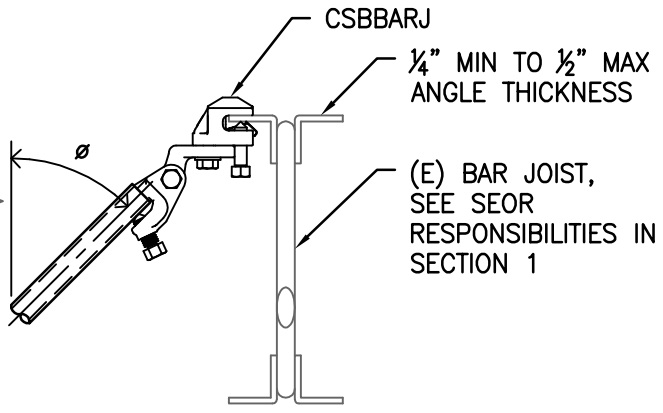
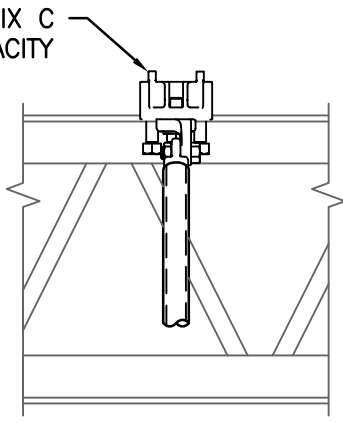
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

CSBBARJ— SEE APPENDIX C  
ON PG C4 FOR CAPACITY

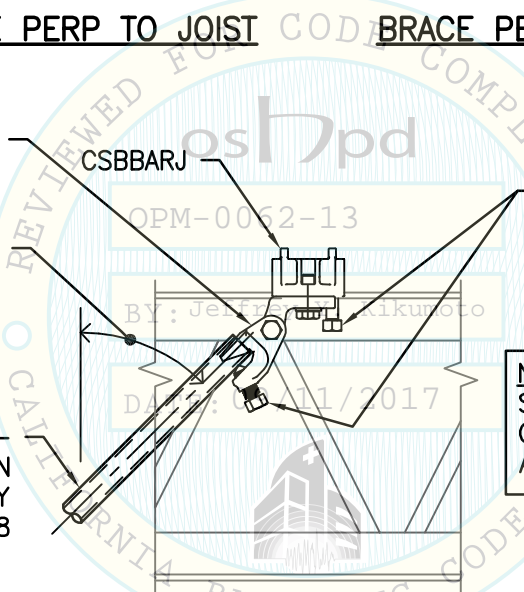


BRACE PERP TO JOIST      BRACE PERP TO JOIST

CSBUNIV OR CSBT— SEE  
APPENDIX C ON PGS C4 &  
C6 FOR CAPACITIES

SEE APPENDIX C  
ON PG C7

BRACE PIPE—  
SEE APPENDIX B ON  
PG B1 FOR CAPACITY  
OR CSBT PER PG 8.8



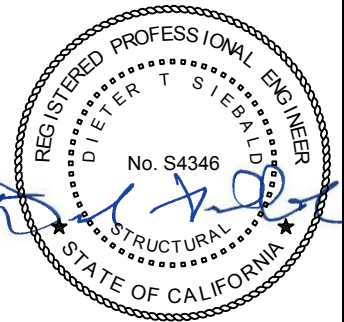
FOR PROPER INSTALLATION,  
TORQUE TWIST-OFF TYPE BOLT  
HEAD (ASTM® A563 GR B) UNTIL  
IT BREAKS AWAY (40-50 FT-LBS)

**NOTE:**  
SEE APPENDIX C FOR HORIZ  
CAPACITY  $F_H$  OF CSBBARJ AT  
ALLOWABLE STRESS DESIGN.

BRACE PARALLEL  
TO JOIST

TOP FLANGE ATTACHMENT

**THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED.  
FOR CORRESPONDING REPLACEMENT, SEE PG 6.12.**



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBBARJ - TOP CHORD OF OPEN WEB JOIST TOP INSTALL



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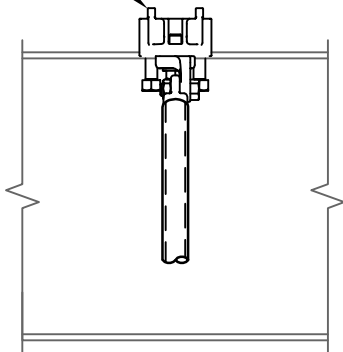
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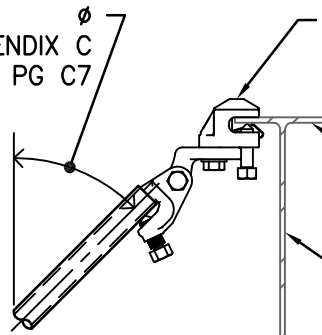


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

CSBBARJ TO TOP  
OR BOTT FLANGE



SEE APPENDIX C  
ON PG C7



CSBBARJ TO TOP OR BOTT FLANGE—  
SEE APPENDIX C ON PG C4 FOR  
CAPACITY

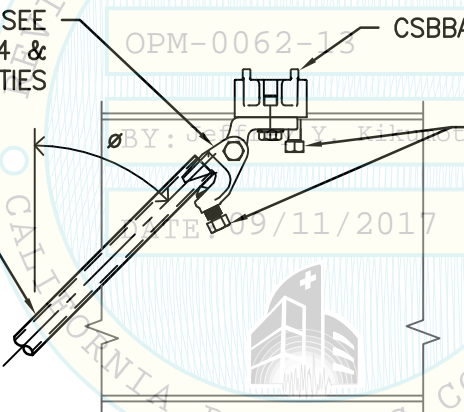
1/4" MIN TO 1/2" MAX  
TOP OR BOTT  
FLANGE THICKNESS

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

**BRACE PERP TO BM**

**BRACE PERP TO BM**

CSBUNIV OR CSBT— SEE  
APPENDIX C ON PGS C4 &  
C6 FOR CAPACITIES



CSBBARJ TO TOP OR BOTT FLANGE

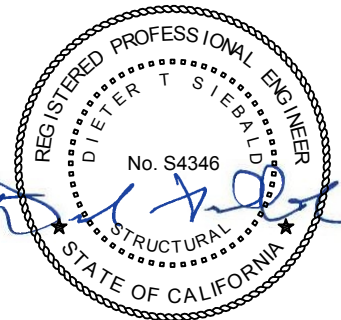
FOR PROPER INSTALLATION,  
TORQUE TWIST-OFF TYPE BOLT HEAD  
(ASTM® A563 GR B) UNTIL IT BREAKS  
AWAY (40-50 FT-LBS)

BRACE PIPE  
LIMIT TO 1/4"Ø MAX FOR  
TOP FLANGE ATTACHMENT—  
SEE APPENDIX B ON PG  
B1 FOR CAPACITY OR  
CSBT PER PG 8.8

**NOTE:**  
SEE APPENDIX C FOR HORIZ  
CAPACITY  $F_H$  OF CSBBARJ AT  
ALLOWABLE STRESS DESIGN.

**BRACE PARALLEL TO BM**

THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED.  
FOR CORRESPONDING REPLACEMENT, SEE PG 6.10.



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBBARJ - TOP OR BOTTOM FLANGE OF WIDE FLANGE BEAM



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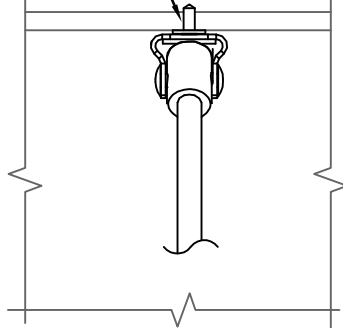
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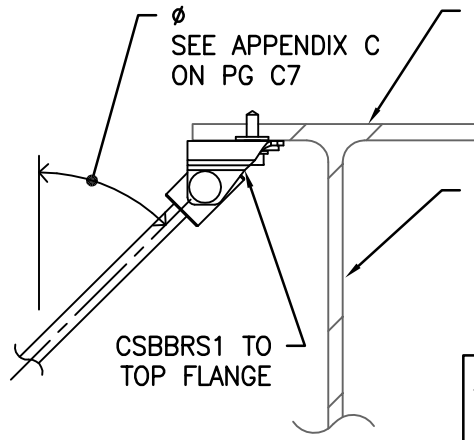


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

CSBBS1 TO TOP OR  
BOTT FLANGE- SEE  
APPENDIX C ON PG C4  
FOR CAPACITY



SEE APPENDIX C  
ON PG C7



CSBBS1 TO  
TOP FLANGE

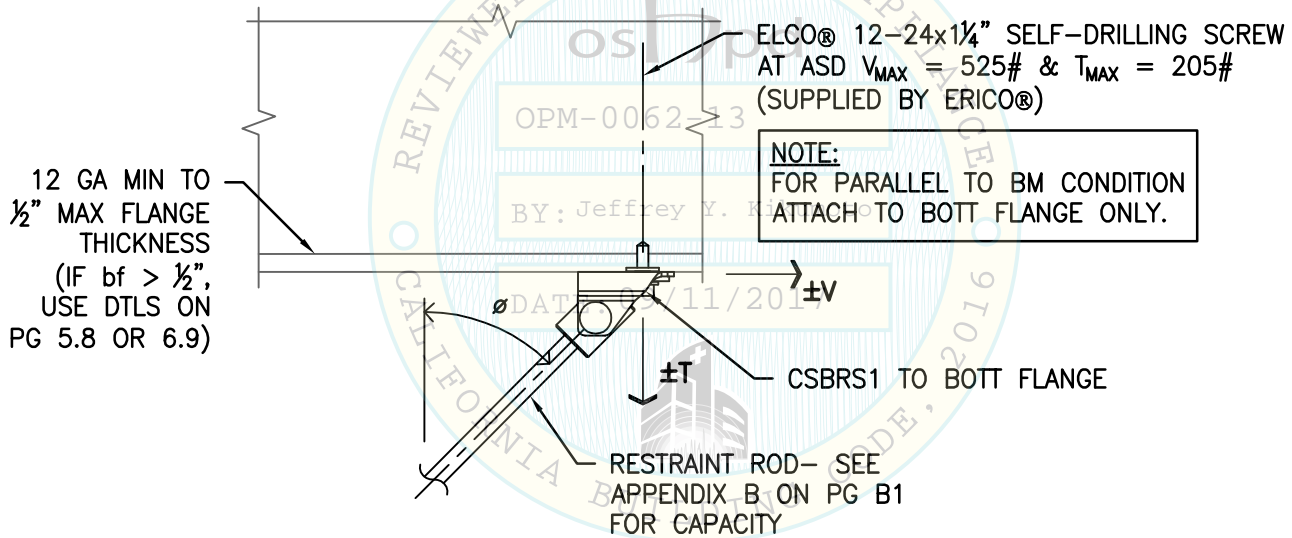
12 GA MIN TO 1/2" MAX  
FLANGE THICKNESS  
(IF bf > 1/2", USE DTLS ON  
PG 5.8 OR 6.9)

(E) STRUC STL MEMBER  
(IE WF BM, CHANNEL,  
ANGLE, ETC.)  
SEE SEOR RESPONSIBILITES  
IN SECTION 1

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

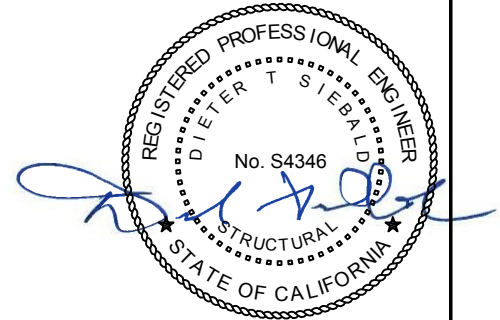
## RESTRAINT PERP TO BM

## RESTRAINT PERP TO BM



## RESTRAINT PARALLEL TO BM

**NOTE:**  
SEE APPENDIX C FOR HORIZ CAPACITY  $F_H$   
OF CSBBS1 AT ALLOWABLE STRESS DESIGN.



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBBS1 - TOP OR BOTTOM FLANGE OF WIDE FLANGE BEAM



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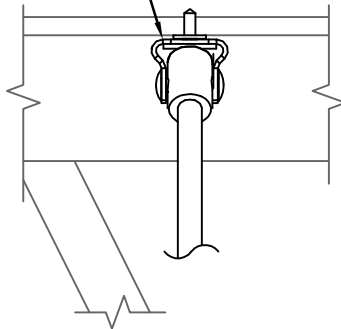
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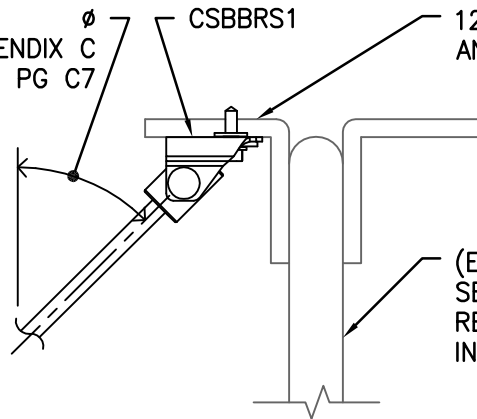


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

CSBBS1- SEE  
APPENDIX C ON PG C4  
FOR CAPACITY



SEE APPENDIX C  
ON PG C7



12 GA MIN TO 1/2" MAX  
ANGLE THICKNESS

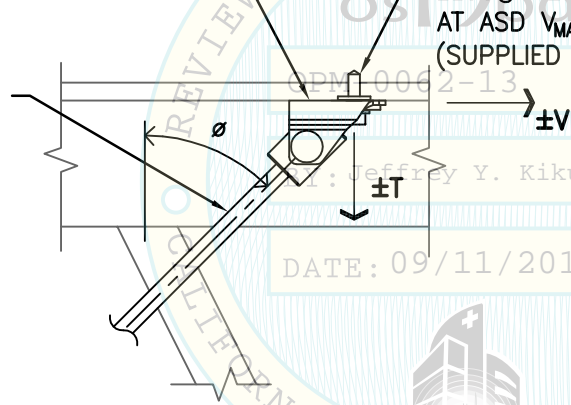
(E) BAR JOIST,  
SEE SEOR  
RESPONSIBILITIES  
IN SECTION 1

RESTRAINT PERP TO JOIST

RESTRAINT PERP TO JOIST

RESTRAINT ROD-  
SEE APPENDIX B  
ON PG B1 FOR  
CAPACITY

CSBBS1



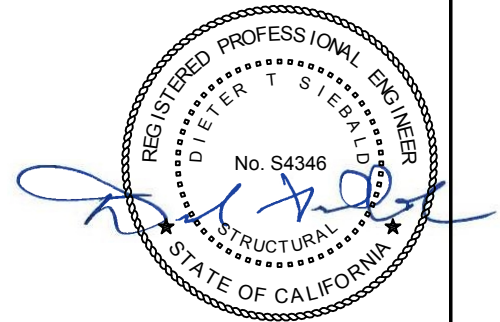
ELCO® 12-24x1 1/4" SELF DRILLING SCREW  
AT ASD  $V_{MAX} = 525\#$  &  $T_{MAX} = 205\#$   
(SUPPLIED BY ERICO®)

RESTRAINT PARALLEL  
TO JOIST

TOP FLANGE ATTACHMENT

**NOTES:**

1. SEE APPENDIX C FOR HORIZ CAPACITY  $F_H$  OF CSBBS1 AT ALLOWABLE STRESS DESIGN.
2. THE CSBBS1 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.



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBBS1 - TOP CHORD OF OPEN WEB JOIST



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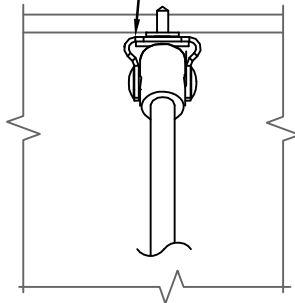
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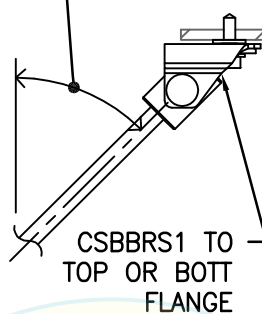


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

CSBBRS1 TO TOP OR  
BOTT FLANGE- SEE  
APPENDIX C ON PG C4  
FOR CAPACITY



∅  
SEE APPENDIX C  
ON PG C7



12 GA MIN TO 1/2" MAX  
FLANGE THICKNESS

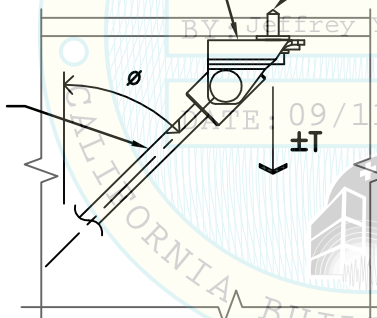
(E) C OR Z PURLIN,  
SEE SEOR  
RESPONSIBILITIES  
IN SECTION 1

**NOTE:**  
ATTACHMENT MAY ALSO BE TO  
THE WEB OF THE PURLIN.  
SUGGEST ATTACHMENT BE MADE  
SO AS TO MINIMIZE TORSION.

## RESTRAINT PERP TO PURLIN

## RESTRAINT PERP TO PURLIN

CSBBRS1 TO TOP  
OR BOTT FLANGE

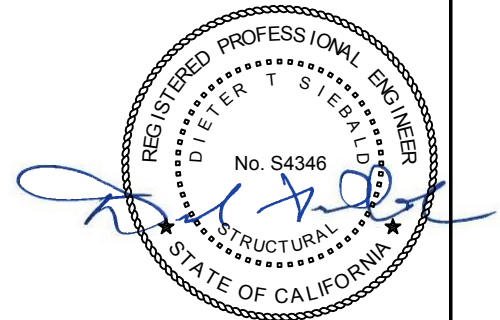


RESTRAINT ROD-  
SEE APPENDIX B ON  
PG B1 FOR CAPACITY

ELCO® 12-24x1/4" SELF DRILLING SCREW  
AT ASD  $V_{MAX} = 525\#$  &  $T_{MAX} = 205\#$   
(SUPPLIED BY ERICO®)

**NOTES:**  
1. SEE APPENDIX C FOR HORIZ CAPACITY  $F_H$   
OF CSBBRS1 AT ALLOWABLE STRESS DESIGN.  
2. THE RESTRAINT ROD MAY GOVERN THE  
CAPACITY OF THE RESTRAINT ASSEMBLY.

## RESTRAINT PARALLEL TO PURLIN



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBBRS1 - PURLIN



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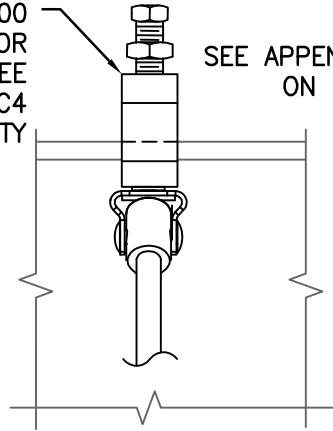
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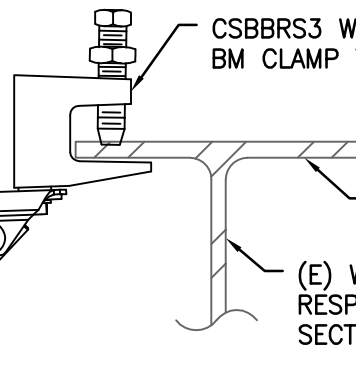
## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

CSBBS3 W/ MODEL 300  
BM CLAMP TO TOP OR  
BOTT FLANGE- SEE  
APPENDIX C ON PG C4  
FOR CAPACITY



SEE APPENDIX C  
ON PG C7

CSBBS3 W/ MODEL 300  
BM CLAMP TO TOP FLANGE



1/4" MIN TO 3/4" MAX  
FLANGE THICKNESS

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

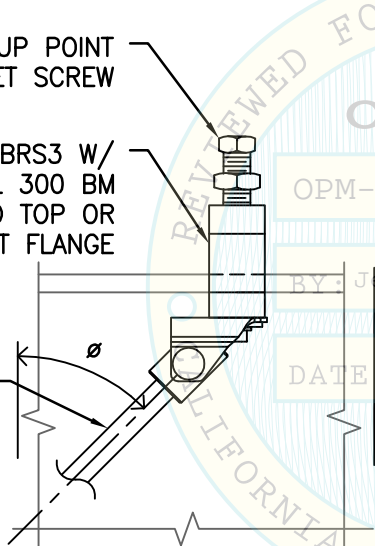
**RESTRAINT PERP TO BM**

**RESTRAINT PERP TO BM**

3/8" Ø CUP POINT  
SET SCREW

CSBBS3 W/  
MODEL 300 BM  
CLAMP TO TOP OR  
BOTT FLANGE

RESTRAINT ROD-  
SEE APPENDIX B  
ON PG B1 FOR  
CAPACITY



**RESTRAINT PARALLEL  
TO BEAM**

(E) WF BEAM, SEE  
SEOR RESPONSIBILITIES  
IN SECTION 1

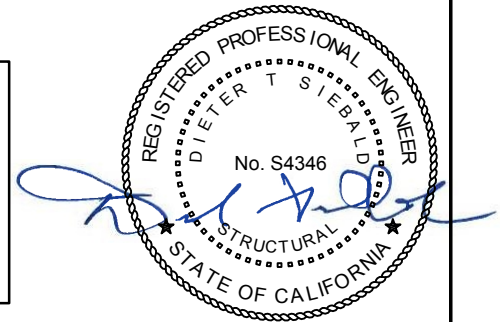
1/4" MIN TO 3/4" MAX  
FLANGE THICKNESS

CSBBS3 W/ MODEL 300  
BM CLAMP TO BOTT FLANGE

**RESTRAINT PERP TO BM**

**NOTES:**

1. SEE APPENDIX C FOR HORIZ CAPACITY  $F_H$  OF CSBBS3 W/ MODEL 300 BM CLAMP AT ALLOWABLE STRESS DESIGN.
2. SET SCREW CAN BE EITHER UP OR DOWN ON TOP OR BOTT FLANGE.
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 DETAIL TO STEEL  
CSBBS3 - W/ MODEL 300 BM CLAMP TO TOP OR BOTT FLANGE OF WF BM



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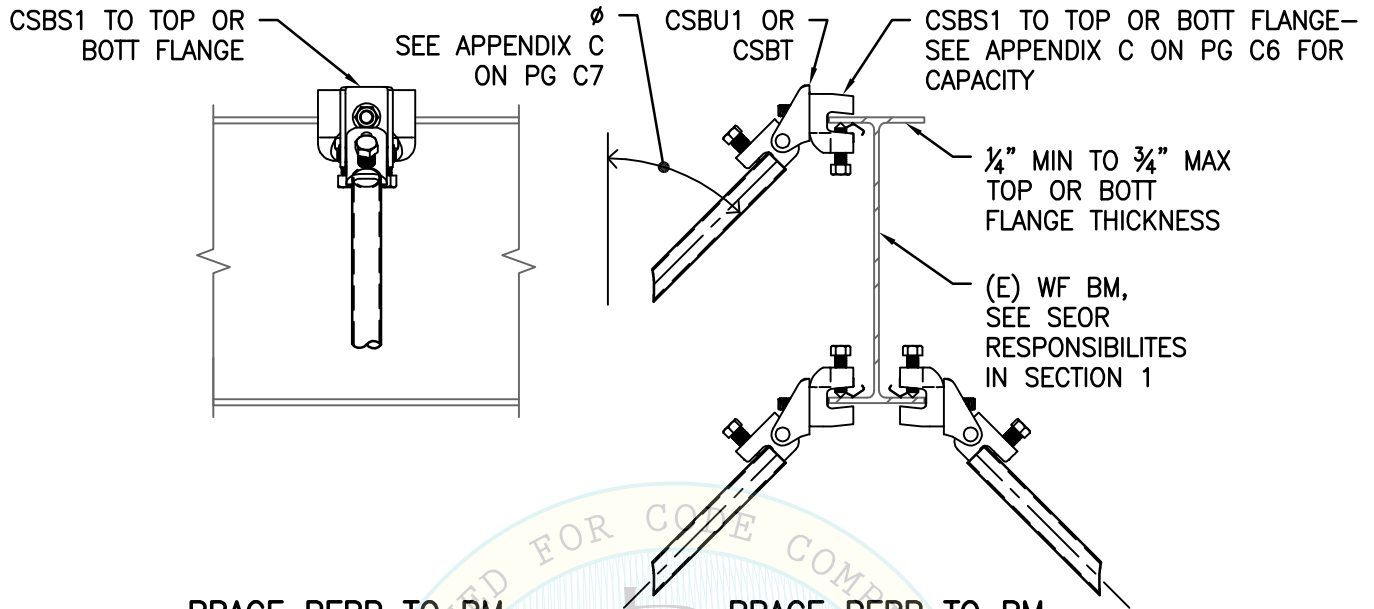
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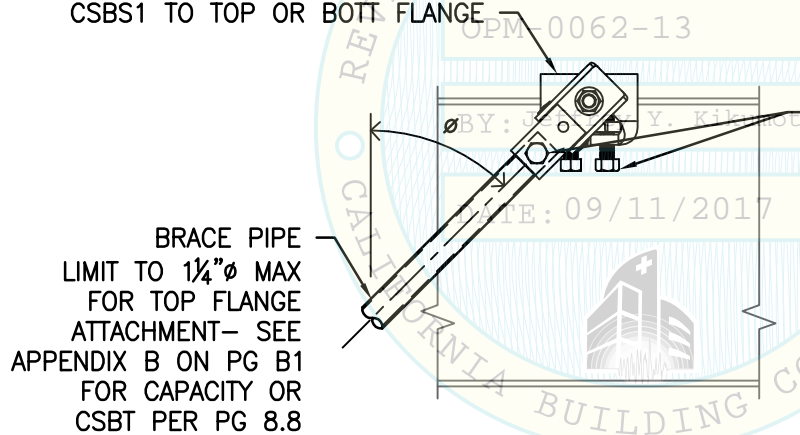
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**BRACE PERP TO BM**

**BRACE PERP TO BM**

CSBS1 TO TOP OR BOTT FLANGE



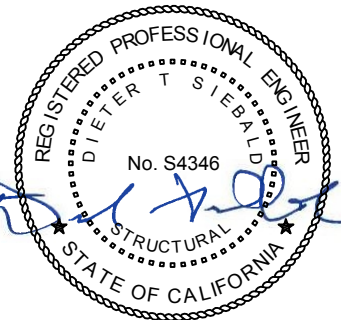
**BRACE PARALLEL TO BM**

FOR PROPER INSTALLATION,  
TORQUE TWIST-OFF TYPE BOLT HEAD  
(ASTM® A563 GR B) UNTIL IT BREAKS  
AWAY (35-45 FT-LBS)

**NOTE:**

SEE APPENDIX C ON PG C6 FOR  
HORIZ CAPACITY  $F_H$  OF CSBS1 AT  
ALLOWABLE STRESS DESIGN.

**THIS IS A NEW PRODUCT**



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBS1 - TOP OR BOTTOM FLANGE OF WIDE FLANGE BEAM



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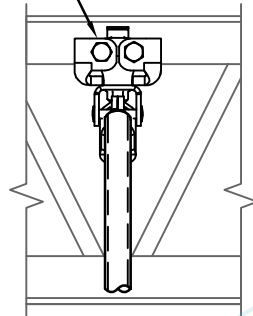
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

FOR PROPER INSTALLATION, TORQUE TWIST-OFF  
TYPE BOLT HEAD (ASTM® A563 GR B)  
UNTIL IT BREAKS AWAY (35-45 FT-LBS)

CSBS1



**BRACE PERP TO JOIST**

$\frac{7}{8}$ " MIN  
REQ

$\frac{1}{4}$ " MIN TO  $\frac{3}{4}$ " MAX  
ANGLE THICKNESS

(E) BAR JOIST, SEE  
SEOR RESPONSIBILITIES  
IN SECTION 1

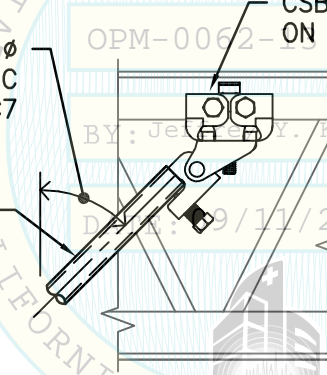
CSBU1 OR CSBT- SEE  
APPENDIX C ON PG C6 FOR  
CAPACITY

**BRACE PERP TO JOIST**

SEE APPENDIX C  
ON PG C7

BRACE PIPE-  
SEE APPENDIX B ON  
PG B1 FOR CAPACITY  
OR CSBT PER PG 8.8

CSBS1- SEE APPENDIX C  
ON PG C6 FOR CAPACITY



**BRACE PARALLEL TO JOIST**

**NOTE:**  
SEE APPENDIX C ON PG C6 FOR  
HORIZ CAPACITY  $F_H$  OF CSBS1 AT  
ALLOWABLE STRESS DESIGN.

**SIDE ATTACHMENT**

**THIS IS A NEW PRODUCT**



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBS1 - TOP CHORD OF OPEN WEB JOIST SIDE INSTALL



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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

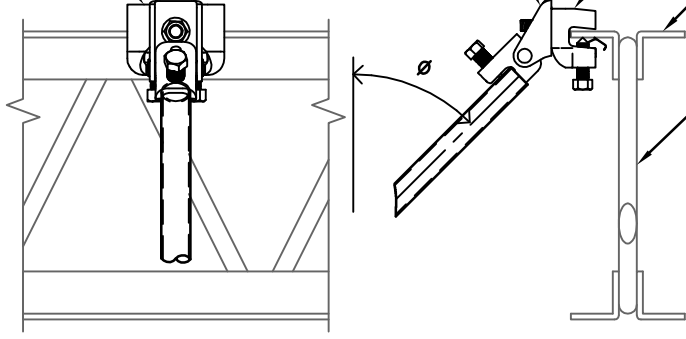
CSBS1— SEE APPENDIX C  
ON PG C6 FOR CAPACITY

CSBU1 OR CSBT

CSBS1

1/4" MIN TO 3/4" MAX  
ANGLE THICKNESS

(E) BAR JOIST,  
SEE SEOR  
RESPONSIBILITIES IN  
SECTION 1



BRACE PERP TO JOIST      BRACE PERP TO JOIST

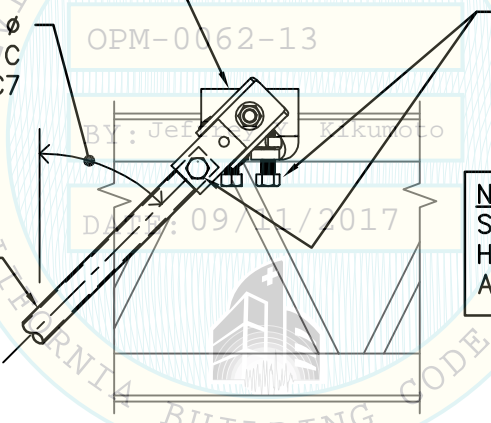
SEE APPENDIX C  
ON PG C7

CSBS1

FOR PROPER INSTALLATION,  
TORQUE TWIST-OFF TYPE BOLT  
HEAD (ASTM® A563 GR B) UNTIL  
IT BREAKS AWAY (35-45 FT-LBS)

BRACE PIPE—  
SEE APPENDIX B ON  
PG B1 FOR CAPACITY  
OR CSBT PER PG 8.8

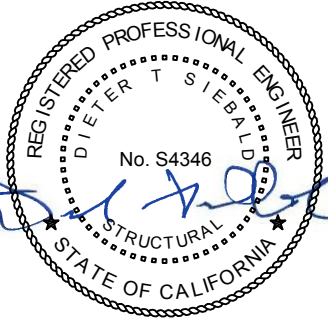
**NOTE:**  
SEE APPENDIX C ON PG C6 FOR  
HORIZ CAPACITY  $F_H$  OF CSBS1  
AT ALLOWABLE STRESS DESIGN.



BRACE PARALLEL  
TO JOIST

TOP FLANGE ATTACHMENT

**THIS IS A NEW PRODUCT**



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBS1 - TOP CHORD OF OPEN WEB JOIST TOP INSTALL

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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

FOR PROPER INSTALLATION, TORQUE  
TWIST-OFF TYPE BOLT HEAD  
(ASTM A563 GR B) UNTIL IT BREAKS AWAY  
(35-45 FT-LBS)

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

1/2"  $\phi$  BOLT SUPPLIED BY ERICO®  
(ASTM® A449, 25-34 HRC  
HARDNESS)

1/4" MIN TO 3/4" MAX  
FLANGE THICKNESS

SEE APPENDIX C  
ON PG C7

CSBS1- SEE APPENDIX C  
ON PG C6 FOR CAPACITY

ONLY CSBU1 PER PG 7.2 OR CSBT PER  
PG 8.8 FOR CSBS1. FOR CSBU1 & CSBT,  
SEE APPENDIX C ON PG C6 FOR  
CAPACITIES

BRACE PIPE (ORIENTATION MAY ALSO  
BE PARALLEL TO THE LENGTH OF THE  
WF BM)- SEE APPENDIX B ON PG B1  
FOR CAPACITY OR CSBT PER PG 8.8

### NOTES:

1. SEE APPENDIX C ON PG C6 FOR HORIZ CAPACITY  $F_H$  OF CSBS1A AT ALLOWABLE STRESS DESIGN.
2. CSBS1A IS A PRE-ASSEMBLY OF CSBS1 & CSBU1.
3. PRE-ASSEMBLY CSBS1A CAN BE USED WHENEVER THE CSBS1 & CSBU1 ARE CALLED OUT.

**THIS IS A NEW PRODUCT**



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBS1A - BOTTOM FLANGE OF WIDE FLANGE BEAM



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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

FOR PROPER INSTALLATION, TORQUE  
TWIST-OFF TYPE BOLT HEAD  
(ASTM A563 GR B) UNTIL IT BREAKS  
AWAY (35-45 FT-LBS)

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

$\frac{1}{2}$ "  $\phi$  BOLT SUPPLIED BY ERICO®  
(ASTM® A449, 25-34 HRC  
HARDNESS)

$\frac{3}{4}$ " MIN TO  $1\frac{1}{4}$ " MAX  
FLANGE THICKNESS

SEE APPENDIX C  
ON PG C7

CSBS2- SEE APPENDIX C  
ON PG C6 FOR CAPACITY

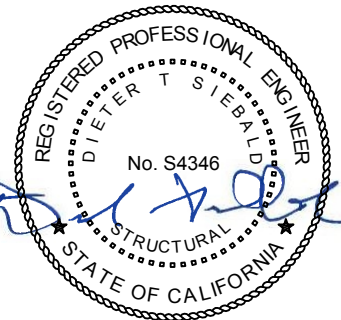
ONLY CSBU1 PER PG 7.2 or CSBT PER  
PG 8.8 FOR CSBS2. FOR CSBU1 & CSBT,  
SEE APPENDIX C ON PG C6 FOR  
CAPACITIES

BRACE PIPE (ORIENTATION MAY ALSO  
BE PARALLEL TO THE LENGTH OF THE  
WF BM)- SEE APPENDIX B ON PG B1  
FOR CAPACITY OR CSBT PER PG 8.8

**NOTE:**

SEE APPENDIX C ON PG C6 FOR  
HORIZ CAPACITY  $F_H$  OF CSBS2  
AT ALLOWABLE STRESS DESIGN.

**THIS IS A NEW PRODUCT**



SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBS2 - BOTTOM FLANGE OF WIDE FLANGE BEAM



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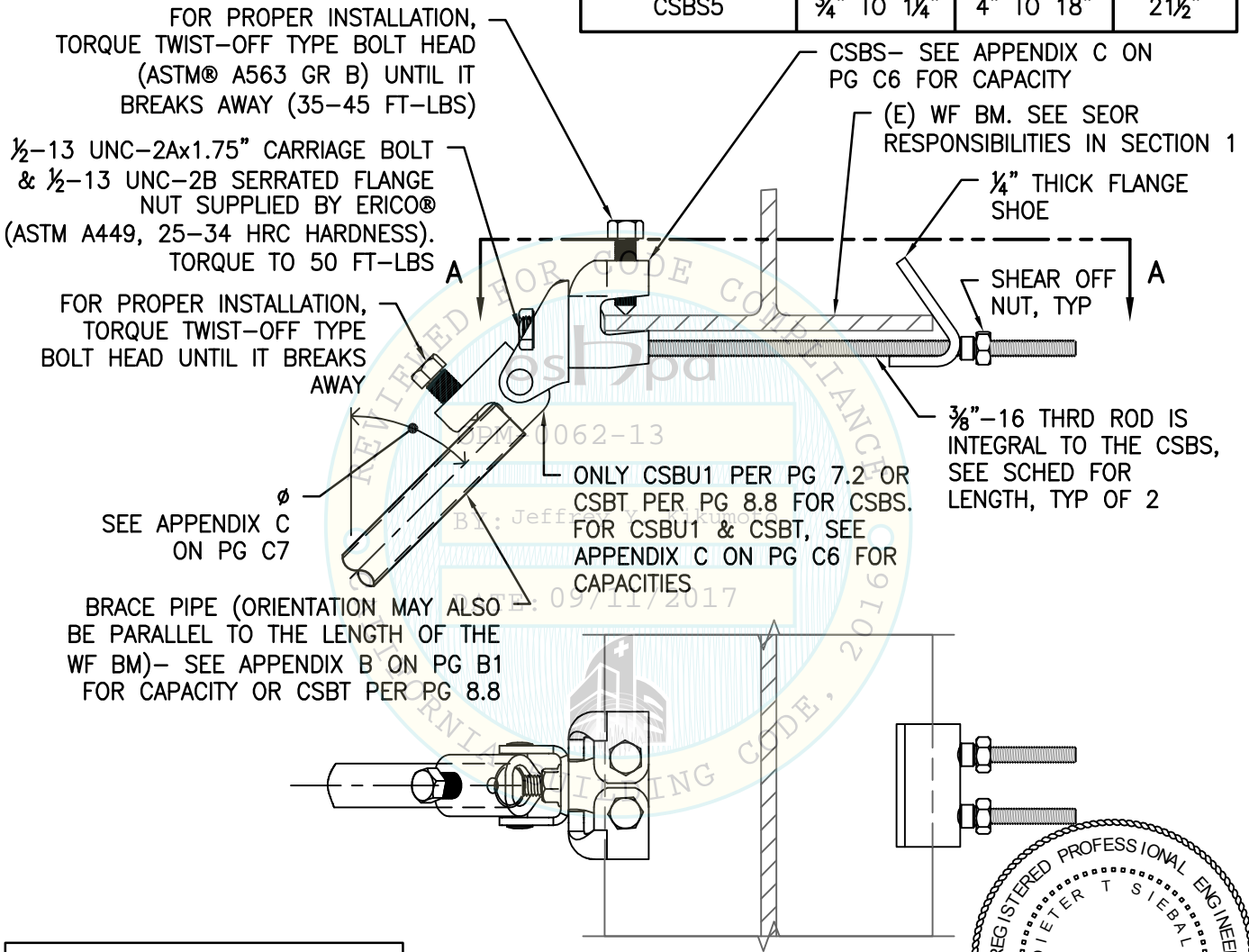
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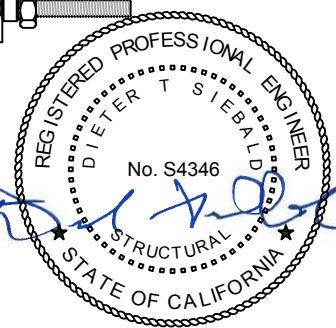
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

PART NUMBER	FLANGE THICKNESS	FLANGE WIDTH	THRD ROD
CSBS3	1/4" TO 3/4"	4" TO 8 1/2"	12"
CSBS4	1/4" TO 3/4"	4" TO 14 1/2"	17"
CSBS5	3/4" TO 1 1/4"	4" TO 18"	21 1/2"



**NOTE:**  
SEE APPENDIX C ON PG C6 FOR HORIZ CAPACITY  $F_H$  OF CSBS AT ALLOWABLE STRESS DESIGN.

THIS IS A NEW PRODUCT



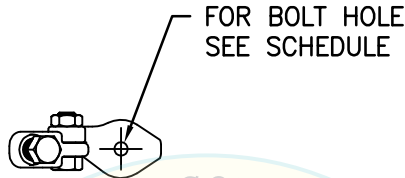
SHEET TITLE: SUPPORTS & ATTACHMENT DETAIL TO STEEL  
CSBS3, 4 & 5 - BOTTOM FLANGE OF WIDE FLANGE BEAM

	<b>CYS STRUCTURAL ENGINEERS, INC.</b>	Job No: 17020	
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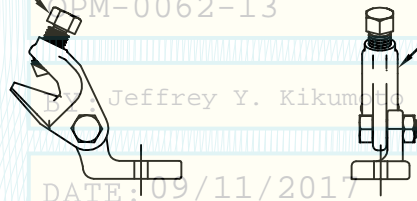
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**TOP VIEW**

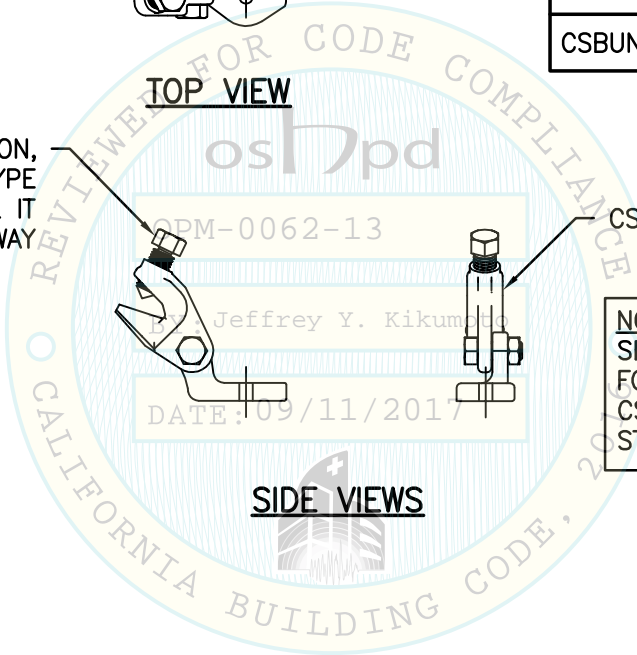
	BOLT HOLE DIA
CSBUNIV050	0.56"
CSBUNIV075	0.80"

FOR PROPER INSTALLATION,  
TORQUE TWIST-OFF TYPE  
BOLT HEAD UNTIL IT  
BREAKS AWAY

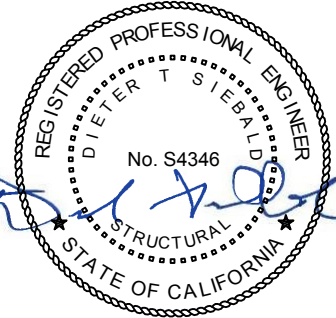


**SIDE VIEWS**

**NOTE:**  
SEE APPENDIX C ON PG C4  
FOR HORIZ CAPACITY  $F_H$  OF  
CSBUNIV AT ALLOWABLE  
STRESS DESIGN.



**THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED.  
FOR CORRESPONDING REPLACEMENT, SEE PG 7.2.**



SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS  
CSBUNIV050 & CSBUNIV075 FOR 1/2" AND 3/4" BOLTS

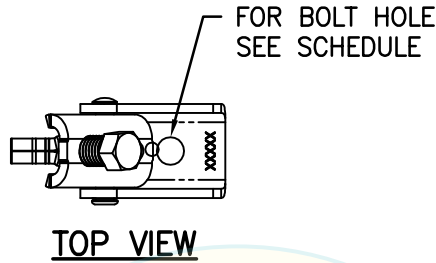
 <b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833	TEL (916) 920-2020 www.cyseng.com	Job No: 17020 Date: 08-18-2017 Page: 7.1 of 87
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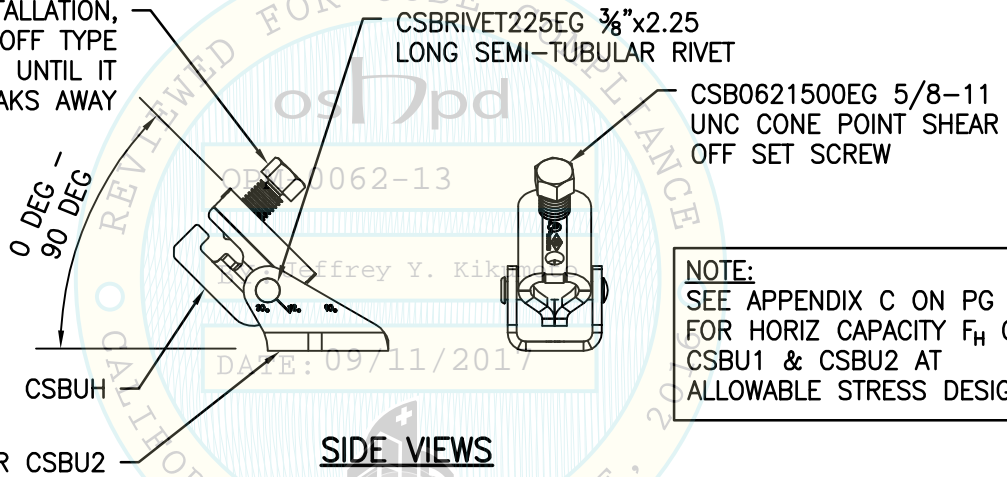


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

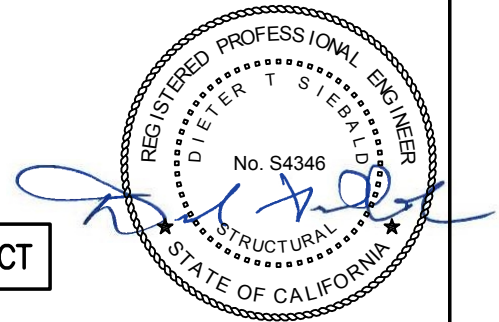


	BOLT HOLE DIA
CSBU1	0.56"
CSBU2	0.81"

FOR PROPER INSTALLATION,  
TORQUE TWIST-OFF TYPE  
BOLT HEAD UNTIL IT  
BREAKS AWAY



**THIS IS A NEW PRODUCT**



SHEET TITLE: SEISMIC BRACE SUPPORT DETAILS  
CSBU1 & CSBU2 FOR  $\frac{1}{2}$ " AND  $\frac{3}{4}$ " BOLTS



**CYS STRUCTURAL ENGINEERS, INC.**

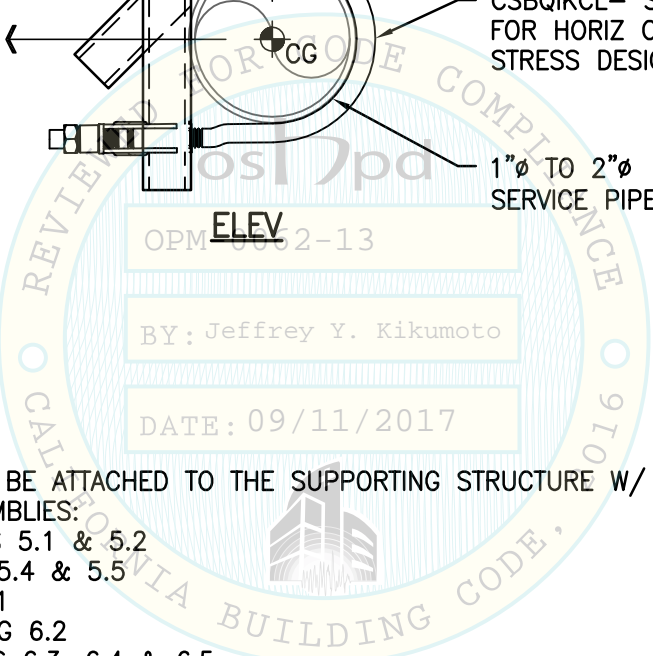
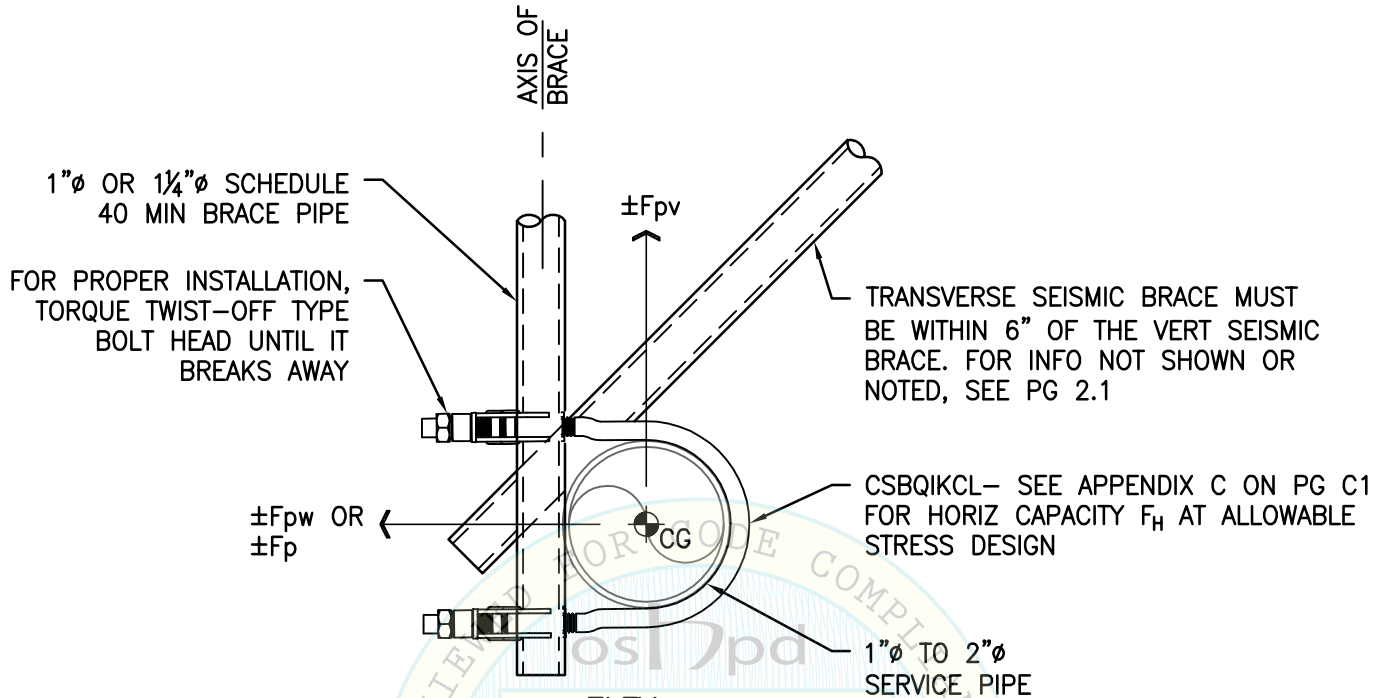
2495 NATOMAS PARK DRIVE, SUITE 650  
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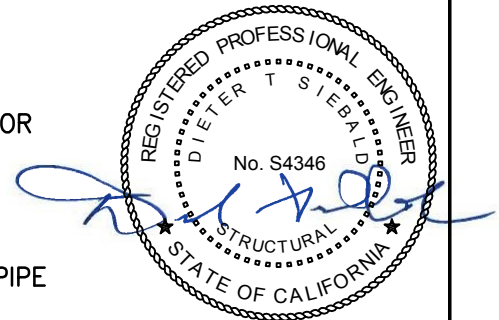


## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**NOTES:**

1. THE BRACE PIPE MAY BE ATTACHED TO THE SUPPORTING STRUCTURE W/  
THE FOLLOWING ASSEMBLIES:
  - A. CSBUNIV PER PGS 5.1 & 5.2
  - B. CSBMA PER PGS 5.4 & 5.5
  - C. CSBIB PER PG 6.1
  - D. CSBBC075 PER PG 6.2
  - E. CSBBARJ PER PGS 6.3, 6.4 & 6.5
2. FOR CONSTRUCTION TOLERANCE, SEE NOTE 3 ON PG 1.3.
3. USE  $\phi=90^\circ$  OF TRANSVERSE MODE (SEE APPENDIX "C" ON PG C7) FOR AXIAL CAPACITY OF COMPONENT.
4. FOR BRACE PIPE AXIAL CAPACITY, SEE APPENDIX "B" ON PG B1.
5. THIS VERT SEISMIC BRACE SHALL NOT BE USED AS A TYP SERVICE PIPE HANGER FOR LONG TERM GRAVITY LOADS.



**SHEET TITLE: VERTICAL SEISMIC BRACE  
CSBQIKCL WITH BRACE PIPE FOR 1"Ø TO 2"Ø SERVICE PIPE CONNECTION**



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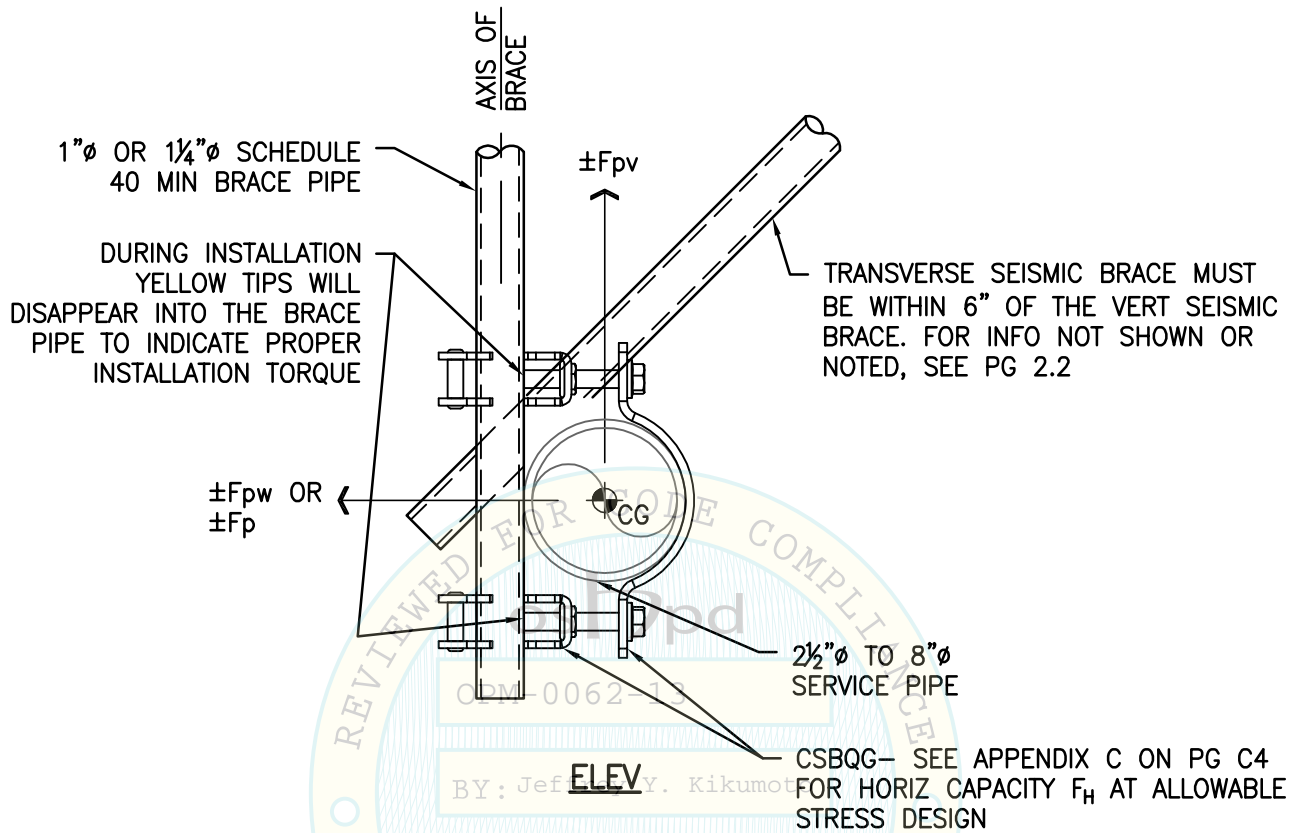
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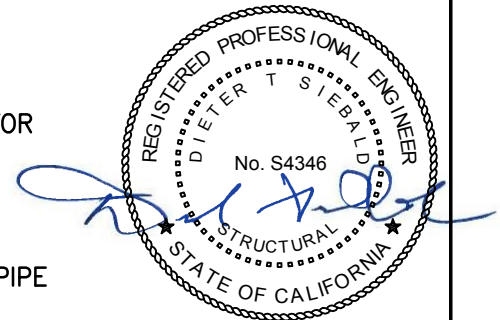
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



REVIEWED FOR CODE COMPLIANCE  
BY: Jeffrey Kikumoto  
DATE: 09/11/2017

**NOTES:**

1. THE BRACE PIPE MAY BE ATTACHED TO THE SUPPORTING STRUCTURE W/ THE FOLLOWING ASSEMBLIES:
  - A. CSBUNIV PER PGS 5.1 & 5.2
  - B. CSBMA PER PGS 5.4 & 5.5
  - C. CSBIB PER PG 6.1
  - D. CSBBCO75 PER PG 6.2
  - E. CSBBARJ PER PGS 6.3, 6.4 & 6.5
2. FOR CONSTRUCTION TOLERANCE, SEE NOTE 3 ON PG 1.3.
3. USE  $\phi=90^\circ$  OF TRANSVERSE MODE (SEE APPENDIX "C" ON PG C7) FOR AXIAL CAPACITY OF COMPONENT.
4. FOR BRACE PIPE AXIAL CAPACITY, SEE APPENDIX "B" ON PG B1.
5. THIS VERT SEISMIC BRACE SHALL NOT BE USED AS A TYP SERVICE PIPE HANGER FOR LONG TERM GRAVITY LOADS.



**SHEET TITLE: VERTICAL SEISMIC BRACE  
CSBQG WITH BRACE PIPE FOR 2 1/2"Ø TO 8"Ø SERVICE PIPE CONNECTION**



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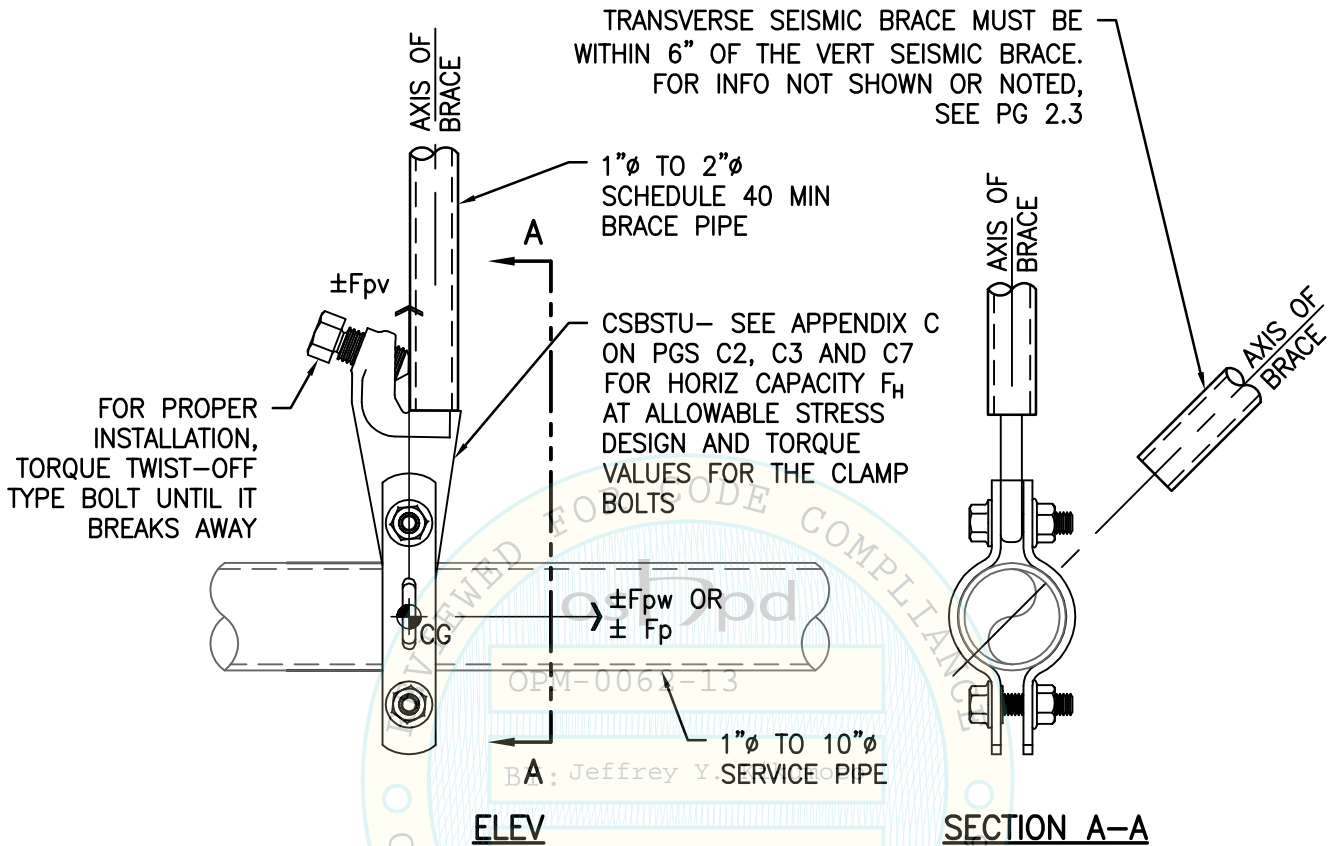
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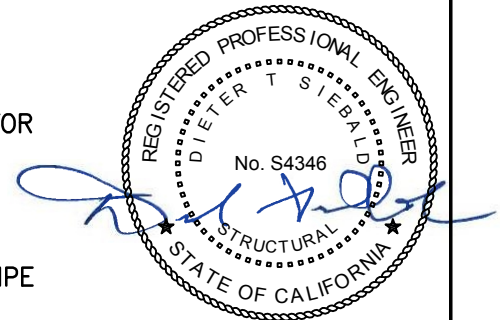
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**NOTES:**

- THE BRACE PIPE MAY BE ATTACHED TO THE SUPPORTING STRUCTURE W/ THE FOLLOWING ASSEMBLIES:
  - CSBUNIV PER PGS 5.1 & 5.2
  - CSBMA PER PGS 5.4 & 5.5
  - CSBIB PER PG 6.1
  - CSBBC075 PER PG 6.2
  - CSBBARJ PER PGS 6.3, 6.4 & 6.5
- FOR CONSTRUCTION TOLERANCE, SEE NOTE 3 ON PG 1.3.
- USE  $\phi=90^\circ$  OF TRANSVERSE MODE (SEE APPENDIX "C" ON PG C7) FOR AXIAL CAPACITY OF COMPONENT.
- FOR BRACE PIPE AXIAL CAPACITY, SEE APPENDIX "B" ON PG B1.
- THIS VERT SEISMIC BRACE MAY ALSO BE USED AS A TYP SERVICE PIPE HANGER FOR LONG TERM GRAVITY LOADS.

THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED. FOR CORRESPONDING REPLACEMENT, SEE PG 8.6.



SHEET TITLE: VERTICAL SEISMIC BRACE  
CSBSTU WITH BRACE PIPE FOR 1"Ø TO 10"Ø SERVICE PIPE CONNECTION



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SACRAMENTO, CA 95833

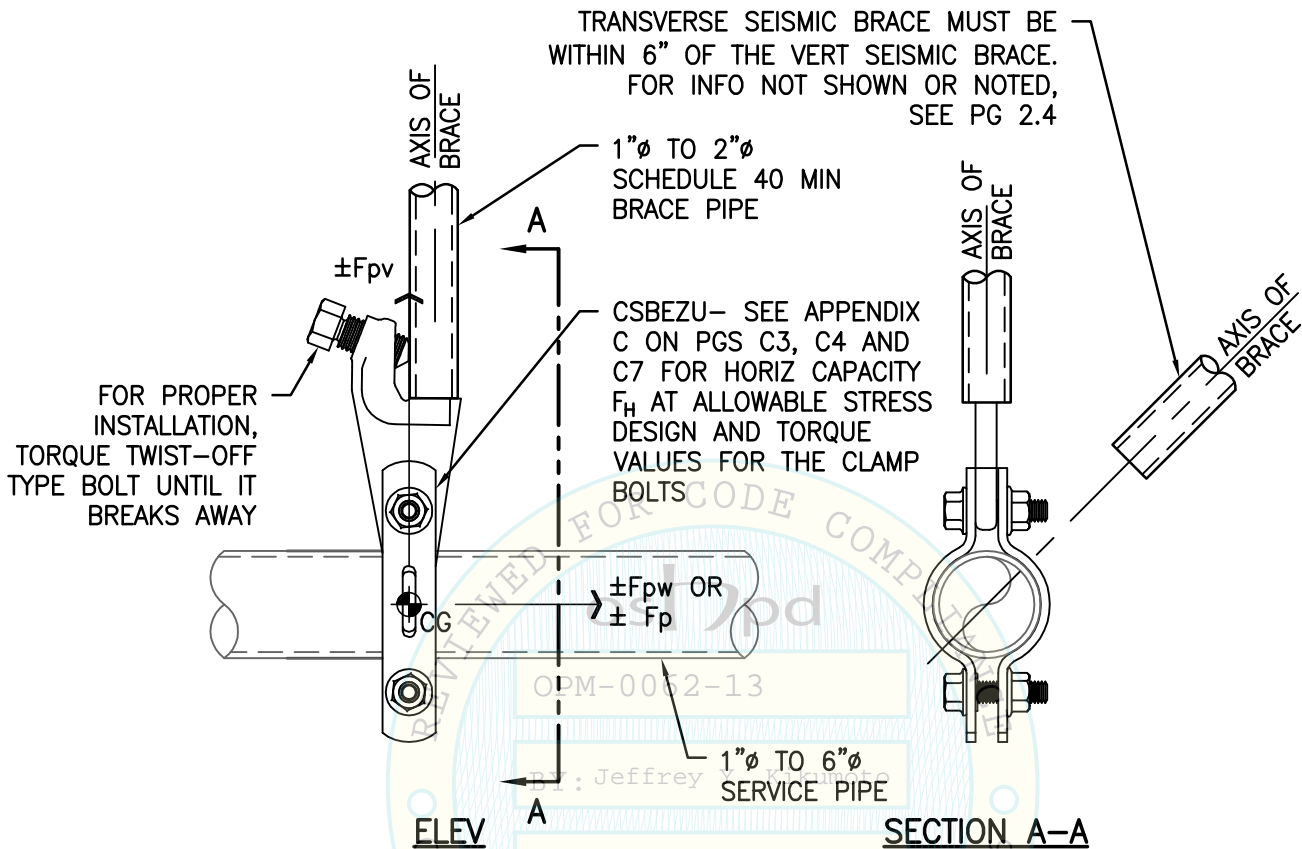
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Date:	08-18-2017
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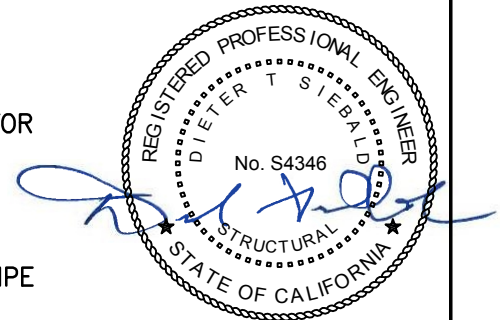
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**NOTES:**

1. THE BRACE PIPE MAY BE ATTACHED TO THE SUPPORTING STRUCTURE W/ THE FOLLOWING ASSEMBLIES:
  - A. CSBUNIV PER PGS 5.1 & 5.2
  - B. CSBMA PER PGS 5.4 & 5.5
  - C. CSBIB PER PG 6.1
  - D. CSBBC075 PER PG 6.2
  - E. CSBBARJ PER PGS 6.3, 6.4 & 6.5
2. FOR CONSTRUCTION TOLERANCE, SEE NOTE 3 ON PG 1.3.
3. USE  $\phi=90^\circ$  OF TRANSVERSE MODE (SEE APPENDIX "C" ON PG C7) FOR AXIAL CAPACITY OF COMPONENT.
4. FOR BRACE PIPE AXIAL CAPACITY, SEE APPENDIX "B" ON PG B1.
5. THIS VERT SEISMIC BRACE MAY ALSO BE USED AS A TYP SERVICE PIPE HANGER FOR LONG TERM GRAVITY LOADS.

**THIS IS A PHASED OUT PRODUCT AND MAY STILL BE USED. FOR CORRESPONDING REPLACEMENT, SEE PG 8.6.**



SHEET TITLE: VERTICAL SEISMIC BRACE  
CSBEZU WITH BRACE PIPE FOR 1"Ø TO 6"Ø SERVICE PIPE CONNECTION



**CYS STRUCTURAL ENGINEERS, INC.**

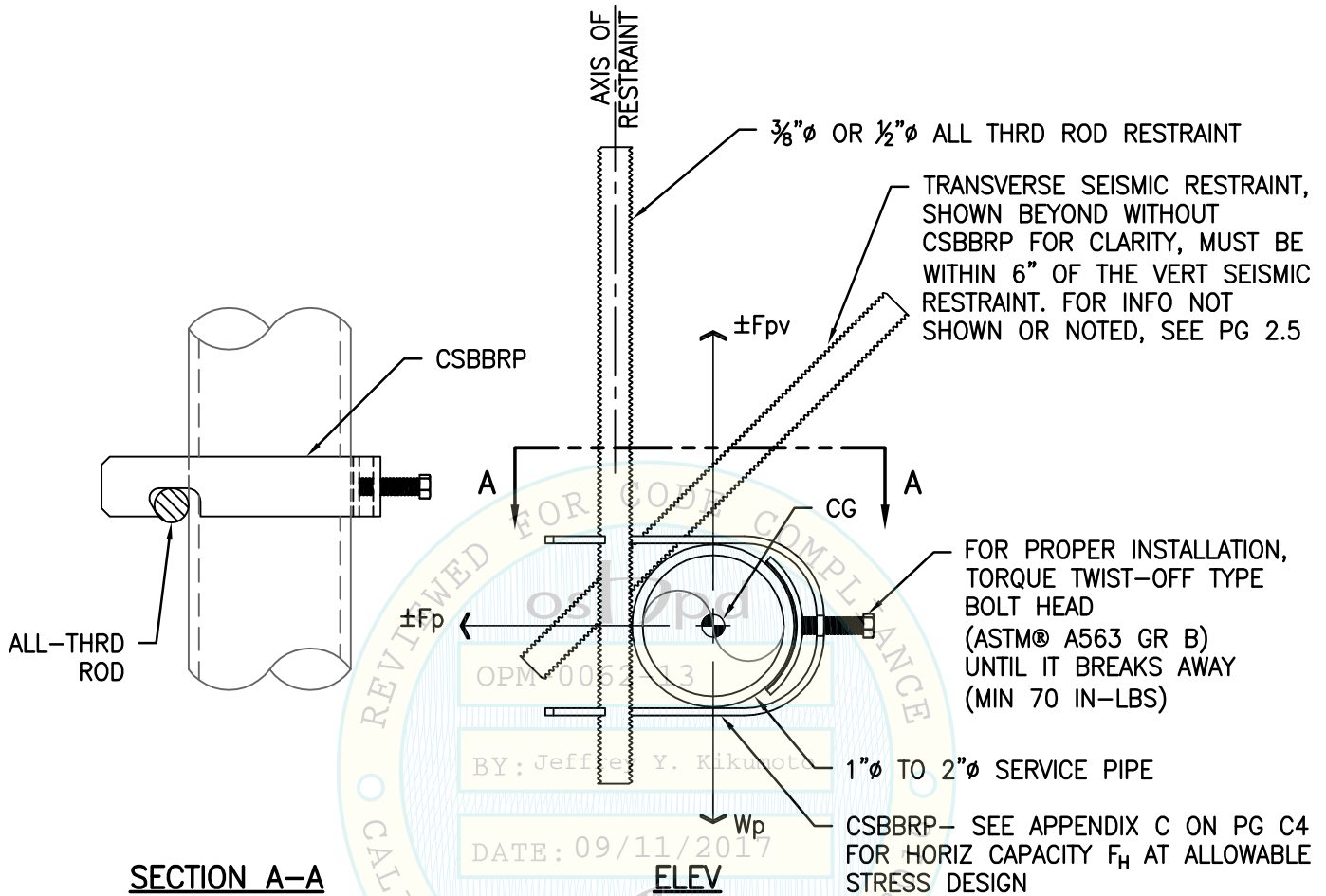
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

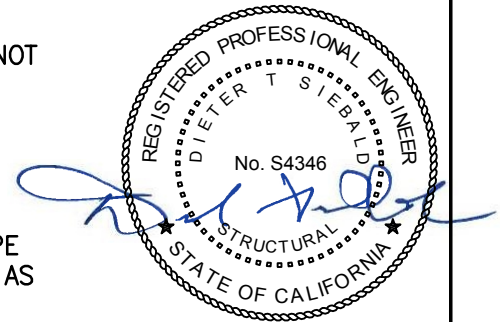


**SECTION A-A**

**ELEV**

**NOTES:**

1. THE RESTRAINT ROD MAY BE ATTACHED TO THE SUPPORTING STRUCTURE W/ THE FOLLOWING ASSEMBLIES:
  - A. CSBBRS1EG PER PGS 6.6, 6.7 & 6.8
  - B. CSBBRS3EG PER PGS 5.6, 5.7
  - C. CSBBRS3EG W/ MODEL 300 BM CLAMP PER PG 6.9
2. THE CSBBRP W/ RESTRAINT ROD IS A BRANCH LINE RESTRAINT DEVICE (NOT A BRACE). SEE NFPA® 13, SECTION 9.3.6.
3. FOR CONSTRUCTION TOLERANCE, SEE NOTE 3 ON PG 1.3.
4. USE  $\phi=90^\circ$  OF TRANSVERSE MODE (SEE APPENDIX "C" ON PG C7) FOR AXIAL CAPACITY OF COMPONENT.
5. FOR ROD RESTRAINT AXIAL CAPACITY, SEE APPENDIX "B" ON PG B1.
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.



SHEET TITLE: VERTICAL SEISMIC RESTRAINT

CSBBRP WITH RESTRAINT ROD FOR 1"Ø TO 2"Ø SERVICE PIPE CONNECTION



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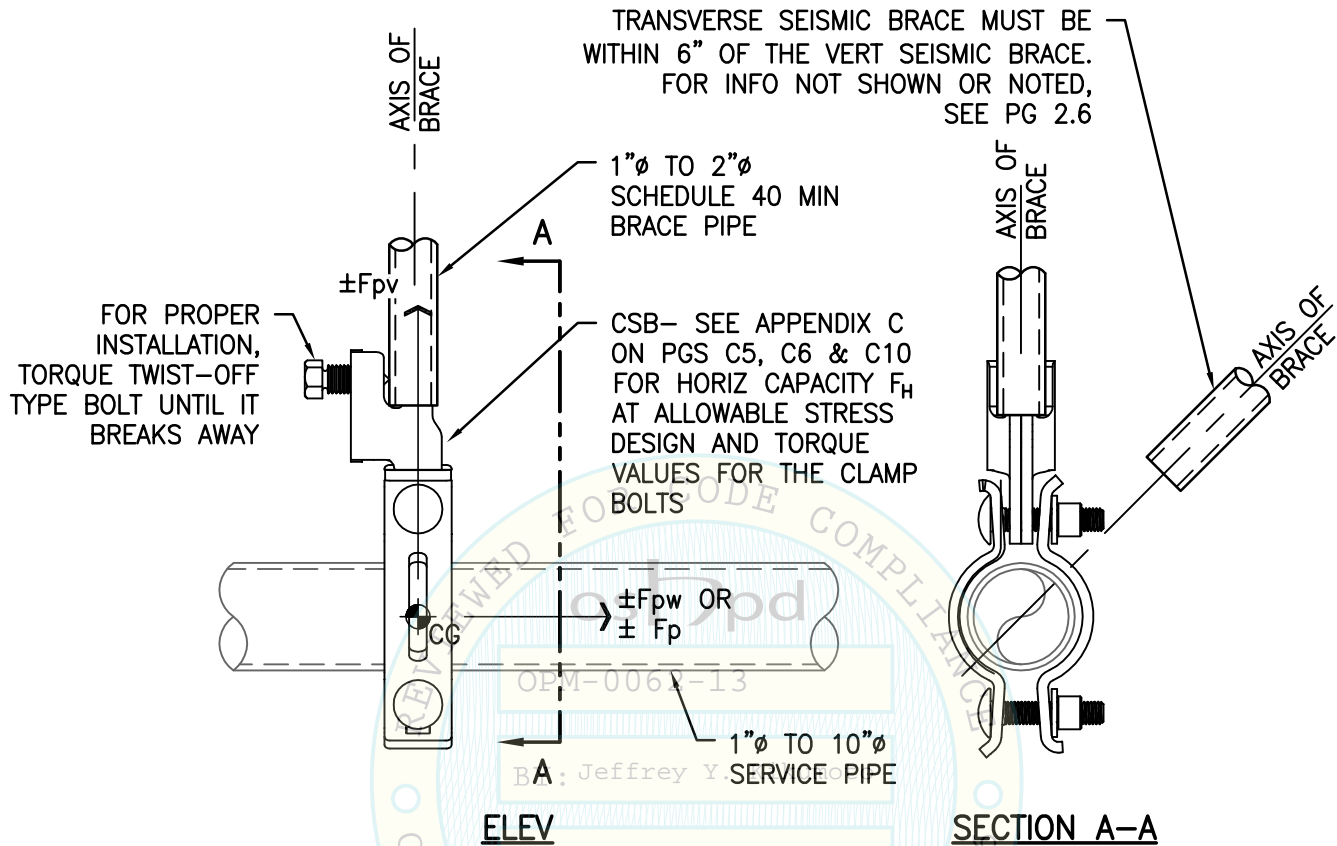
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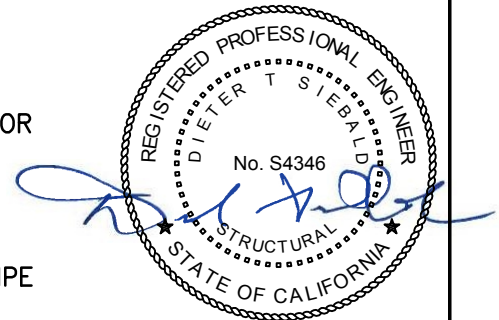
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**NOTES:**

1. THE BRACE PIPE MAY BE ATTACHED TO THE SUPPORTING STRUCTURE W/ THE FOLLOWING ASSEMBLIES:
  - A. CSBUNIV PER PGS 5.1 & 5.2
  - B. CSBMA PER PGS 5.4 & 5.5
  - C. CSBIB PER PG 6.1
  - D. CSBBC075 PER PG 6.2
  - E. CSBBARJ PER PGS 6.3, 6.4 & 6.5
2. FOR CONSTRUCTION TOLERANCE, SEE NOTE 3 ON PG 1.3.
3. USE  $\phi=90^\circ$  OF TRANSVERSE MODE (SEE APPENDIX "C" ON PG C7) FOR AXIAL CAPACITY OF COMPONENT.
4. FOR BRACE PIPE AXIAL CAPACITY, SEE APPENDIX "B" ON PG B1.
5. THIS VERT SEISMIC BRACE MAY ALSO BE USED AS A TYP SERVICE PIPE HANGER FOR LONG TERM GRAVITY LOADS.

**THIS IS A NEW PRODUCT**



**SHEET TITLE: VERTICAL SEISMIC BRACE  
CSB WITH BRACE PIPE FOR 1"Ø TO 10"Ø SERVICE PIPE CONNECTION**



**CYS STRUCTURAL ENGINEERS, INC.**

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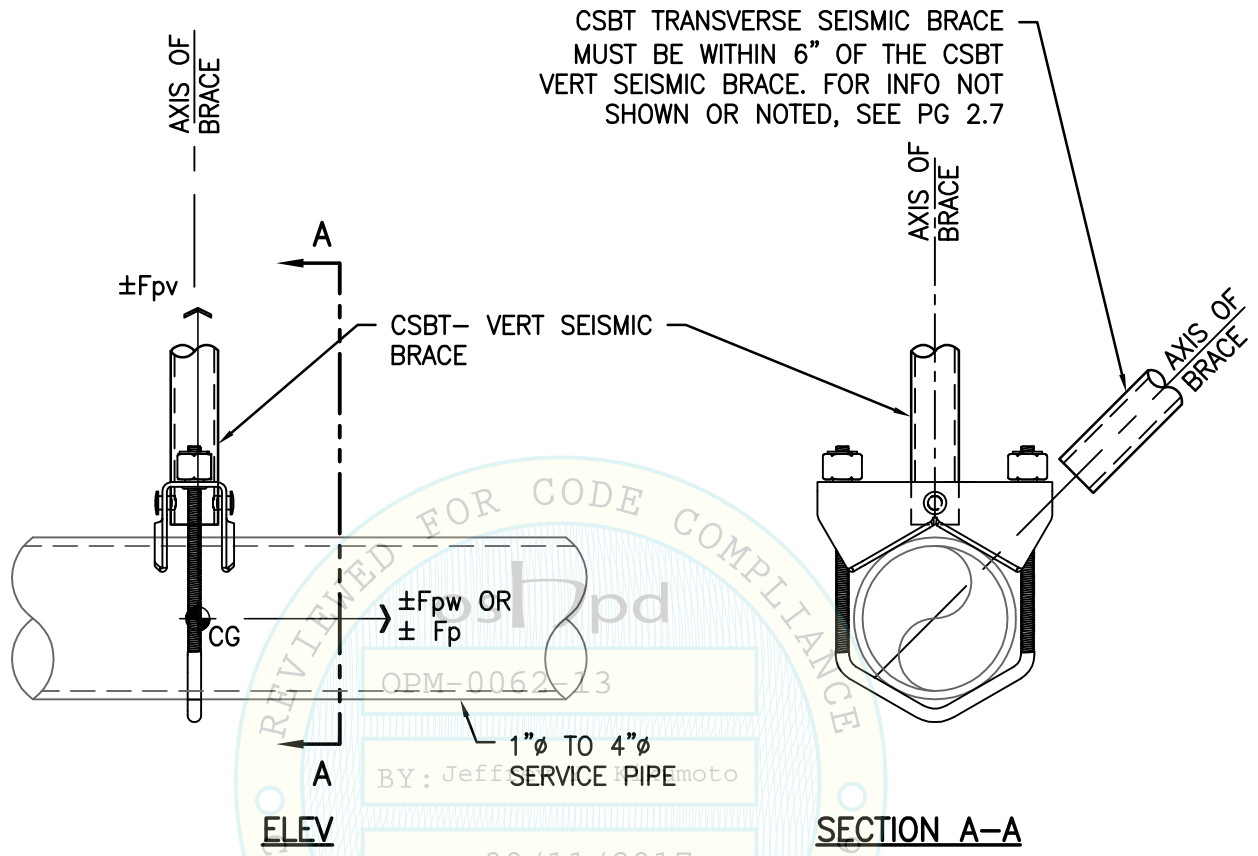
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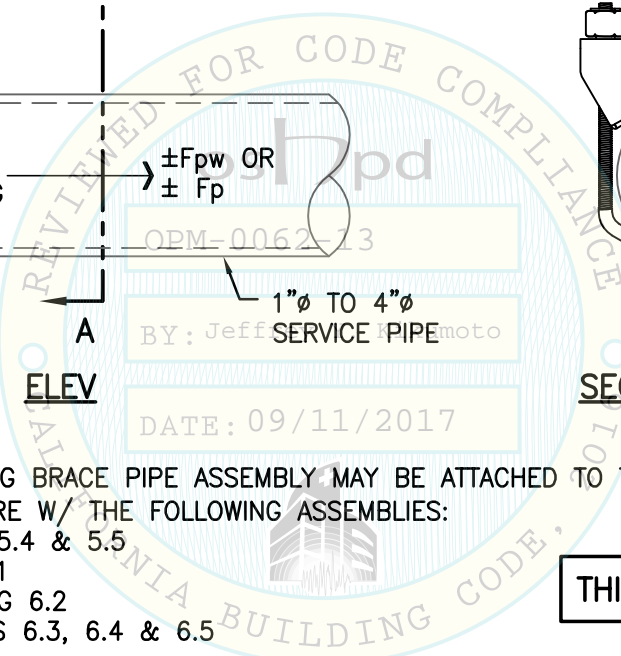
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



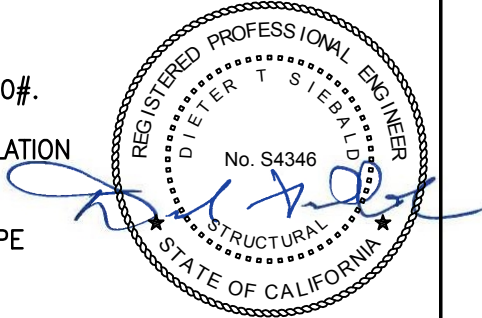
CSBT TRANSVERSE SEISMIC BRACE  
MUST BE WITHIN 6" OF THE CSBT  
VERT SEISMIC BRACE. FOR INFO NOT  
SHOWN OR NOTED, SEE PG 2.7



**THIS IS A NEW PRODUCT**

**NOTES:**

1. THE CSBT TELESCOPING BRACE PIPE ASSEMBLY MAY BE ATTACHED TO THE SUPPORTING STRUCTURE W/ THE FOLLOWING ASSEMBLIES:  
 A. CSBMA PER PGS 5.4 & 5.5  
 B. CSBIB PER PG 6.1  
 C. CSBBC075 PER PG 6.2  
 D. CSBBARJ PER PGS 6.3, 6.4 & 6.5
2. FOR CONSTRUCTION TOLERANCE, SEE NOTE 3 ON PG 1.3.
3. THE CSBT TELESCOPING BRACE PIPE ASSEMBLY AXIAL CAPACITY IS 890#.
4. THE CSBT TESCOPIING BRACE PIPE ASSEMBLY COMPONENTS & INSTALLATION INSTRUCTIONS ARE SHOWN ON PG 8.8.
5. THIS VERT SEISMIC BRACE MAY ALSO BE USED AS A TYP SERVICE PIPE HANGER FOR LONG TERM GRAVITY LOADS.



SHEET TITLE: VERTICAL SEISMIC BRACE  
CSBT TELESCOPING ASSEMBLY FOR 1"Ø TO 4"Ø SERVICE PIPE CONNECTION

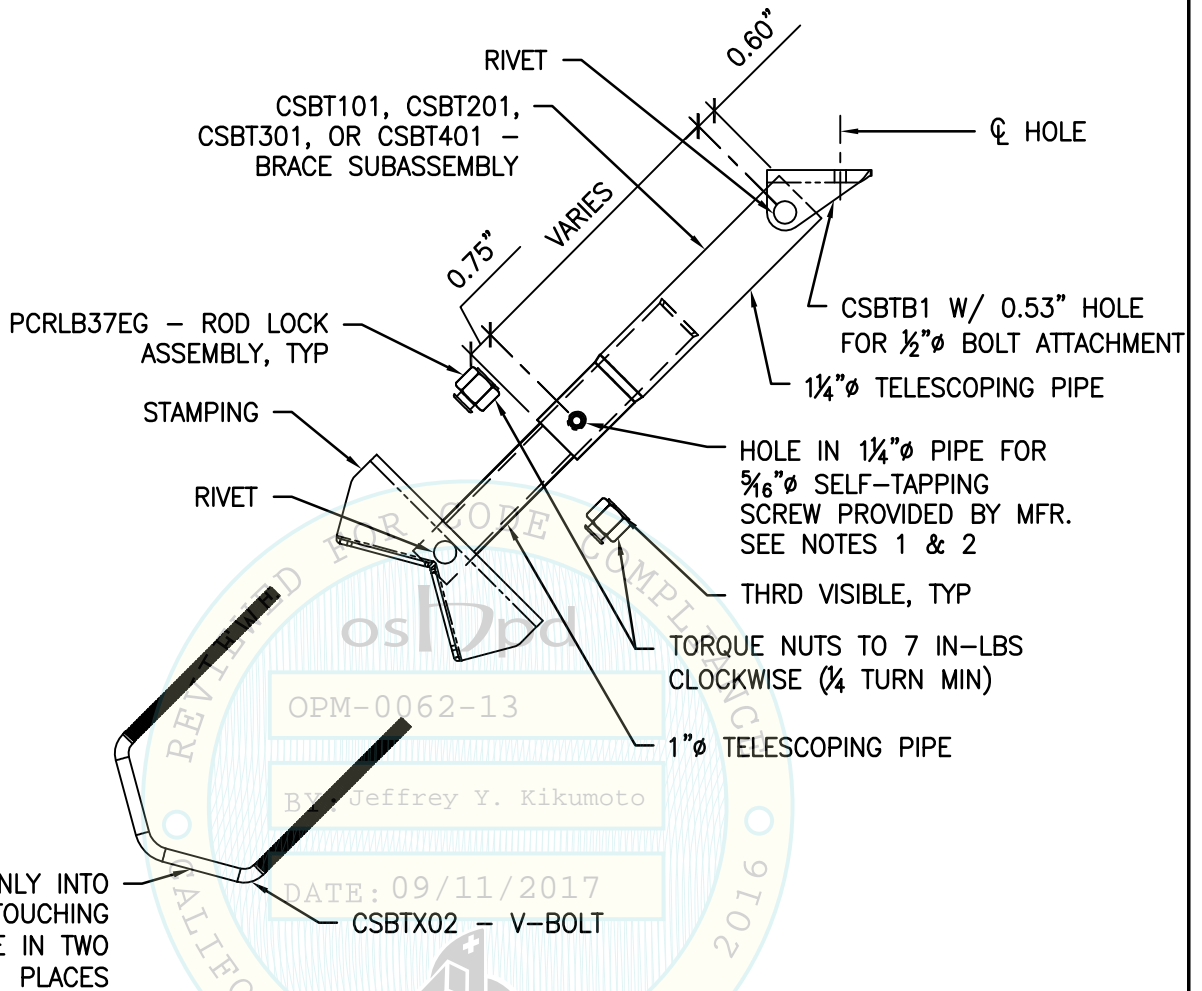
<p><b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833</p>	<p>TEL (916) 920-2020 www.cyseng.com</p>	<p>Job No: 17020 Date: 08-18-2017 Page: 8.7 of 87</p>
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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS



**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 APPENDIX C PG C6 FOR CAPACITY OF SHOWN ASSEMBLY.
4. THE CSBT TELESCOPING ASSEMBLY IS A COMPLETE MANUFACTURED BRACE ASSEMBLY & IS REFERENCED AS SUCH IN THIS OPM.



SHEET TITLE: VERTICAL SEISMIC BRACE  
CSBT TELESCOPING ASSEMBLY FOR 1"Ø TO 4"Ø SERVICE PIPE CONNECTION

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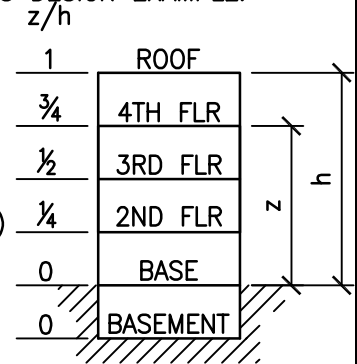
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

## APPENDIX 'A': SUMMARY OF TYP DESIGN EXAMPLE

- A. GENERAL
1. THE CALIFORNIA REGISTERED DESIGN PROFESSIONAL (CRDP) REVIEWS SECTION 1 – OVERVIEW OF THIS OPM.
- B. DEMAND
1. THE CRDP DETERMINES THE LATERAL ACCELERATION AND VERT ACCELERATION “G” ( $C_p$  IN NFPA® 13) FOR THE SEISMIC FORCES  $F_p$  AND  $F_{pv}$  USING INFORMATION PROVIDED IN THE PROJECT DOCUMENTS. FOR SIMPLICITY, THE HORIZ SEISMIC FORCE,  $F_{pw}$ , MAY BE DETERMINED USING NFPA TABLE 9.3.5.9.3 OR THE EXPANDED SEISMIC COEFFICIENT TABLE ON THE FOLLOWING PG TO FIND THE  $C_p$  DIRECTLY FROM  $S_s$ . (SEE NOTE BLW FOR APPLICABILITY OF THESE TABLES.)
    - a. IN THE EXAMPLE BLW, THE MAX HORIZ AND VERT FORCES ON THE BRACES ARE CALCULATED FOR USE ANYWHERE WITHIN THE STATE OF CALIFORNIA. THE SEISMIC LOAD IS ALSO DETERMINED BY THE SIMPLIFIED METHOD: LOOK UP THE VALUE OF  $S_s = 3.75$  (MAX IN CALIFORNIA) IN THE SEISMIC COEFFICIENT TABLE, THIS VALUE COORDINATES TO A  $C_p = 1.75$ . PLEASE NOTE THAT THESE MAX VALUES MAY BE REDUCED FOR THE SITE SPECIFIC PROJECT LOCATION AS WELL AS FOR THE LOCATION WITHIN THE HT OF A BLDG IN ORDER TO OBTAIN LOWER DEMAND VALUES IF SO REQ TO MEET BRACE SPACING CRITERIA. NOTE THAT OSHPD PIN #62 ALLOWS THE USE OF 2.0 FOR OMEGA ( $\Omega_o$ ) FOR 2013 CBC PROJECTS, 2.5 IS USED IN THIS DESIGN EXAMPLE.

### ASCE 7-10 AS AMENDED BY CBC 2013

SECTION	13.3	FORCES AT LRFD, UNO
SECTION	13.3.1	$F_p = 0.4 a_p S_{DS} W_p (1+2 z/h) = 2.5 W_p$
TABLE	13.6.1	$R_p/l_p$ $a_p = 2.5$ (NOT ASME® B31) $R_p = 4.5$ (NOT ASME B31) $\Omega_o = 2.50$ (FOR ANCHORAGE TO CONC, ALSO SEE B.1.a) $S_{DS} = 2.5$ (MAX STATE OF CALIFORNIA VALUE)
SECTION	13.1.3	$l_p = 1.5$ (EMERGENCY SYSTEM) $z = h$ $z/h \leq 1.0$ $\Omega_o F_p = 6.25 W_p$ (FOR LRFD ANCHORAGE TO CONC)
SECTION	13.3.1	$F_p$ (MAX) = $1.6 S_{DS} l_p W_p = 6.0 W_p$ $F_p$ (MIN) = $0.3 S_{DS} l_p W_p = 1.125 W_p$ $1.125 W_p \leq 2.5 W_p \leq 6.0 W_p$
SECTION	13.3.1	$F_{pv} = 0.20 S_{DS} W_p = 0.50 W_p$
FORCES AT ASD		$F_p = 0.7 F_p = 0.7 (2.5 W_p) = 1.75 W_p = C_p W_p$ $F_{pv} = 0.7 F_{pv} = 0.7 (0.50 W_p) = 0.35 W_p$



**SAMPLE BLDG ELEV**

NOTE: NFPA 13 uses a simplified seismic factor,  $C_p$ , which combines ground shaking  $S_{DS}$ , dynamic amplification  $a_p$ , component response  $R_p/l_p$ , and location in the building ( $z/h$ ) into a single variable.  $S_{DS} = \frac{2}{3} F_a S_s$  where  $S_s$  is the mapped short-period spectral acceleration for the project location and  $F_a$  is the amplification factor based on soil conditions.  $C_p$  is calculated using the maximum tabulated  $F_a$  values given in ASCE 7 Table 11.4-1 and  $z/h = 1.0$ .  
 CRDP SHOULD USE THE  $C_p$  TABLES ONLY WHEN APPLICABLE.



SHEET TITLE: APPENDIX 'A'  
 EXAMPLE OF SEISMIC SWAY BRACE DESIGN PROCEDURE

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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

## APPENDIX 'A': SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

### B. DEMAND (CONTINUED):

2. THE CRDP USES THE NFPA® 13 GUIDELINES TO PREPARE THE FIRE SPRINKLER LAYOUT DRAWINGS.
3. THE CRDP DETERMINES THE BRACE LOCATIONS AND SHOWS THEM ON THE LAYOUT DRAWINGS.
4. THE CRDP DETERMINES THE BRANCH LINE WT PLUS TRIBUTARY MAIN LINE WT (W) FOR EA SEISMIC BRACE USING THE NFPA 13 ZONE OF INFLUENCE (ZOI) METHOD. FOR THIS EXAMPLE ASSUME THAT W = 500 LBS FOR A 4" DIA SCHEDULE 10 MAIN LINE SERVICE PIPE.
5. THE CRDP COMPARES THE CALCULATED 500 LBS WT TO THE ALLOWABLE WT (W) SHOWN IN PERMISSIBLE WT TABLES FOR SERVICE PIPES. SEE THE THREE SCHEDULE LW, 10 & 40 TABLES BLW. THE 500 LBS WILL ALLOW A LATERAL TRANSVERSE BRACE SPACING OF 25 FEET FOR THE 4" DIA MAIN LINE SERVICE PIPE (i.e. 601 LBS > 500 LBS). PLEASE NOTE THAT THE THREE SCHEDULE TABLES DO NOT MATCH THE NFPA 13 PUBLISHED VALUES BECAUSE THEY CONSIDER VERT PLUS LATERAL LOAD DEMAND AND USE  $t_{design} = 0.96 t_{nom}$  AS PER TABLE FOOTNOTE 2.

**Seismic Coefficient Table**

$S_s^{(1)}$	$S_{ps}$	$C_p$ (ASD)
2.80	1.87	1.31
2.90	1.93	1.35
3.00	2.00	1.40
3.10	2.07	1.45
3.20	2.13	1.49
3.30	2.20	1.54
3.40	2.27	1.59
3.50	2.33	1.63
3.60	2.40	1.68
3.70	2.47	1.73
3.75	2.50	1.75

← California Maximum

<sup>1</sup> See NFPA Table 9.3.5.9.3 for  $S_s$  values less than 2.80.

IN ADDITION, THE SEISMIC ACCELERATION VALUES ARE HIGHER IN CALIFORNIA THAN THE CURRENT PUBLISHED NFPA 13 VALUES.

BY: Jeffrey Y. Kikumoto

### MAX LOAD IN ZONE OF INFLUENCE (ZOI) OF A LATERAL SWAY BRACE

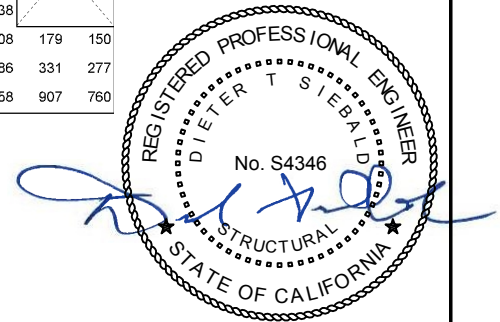
Schedule LW Steel Pipe (Light-Wall Schedule 7)

										HORIZONTAL SEISMIC FORCE $F_{pw} = C_p W_p = 1.75 W_p$									
										Max Permissible ZOI Load, $F_{LW}$ (lbs)					Max Permissible ZOI Weight, $W$ $W = F_{pw} / 1.15 C_p$ (lbs)				
										Lateral Sway Brace Spacing, L (ft)					Lateral Sway Brace Spacing, L (ft)				
Pipe (1)	OD (1)	$t_{nom}$ (1)	S (2)	$M_{cap}$	Water-Filled Pipe Wt (plf)	$w_v = W_p + F_{pw}$ (plf)	$L_v =$ Hanger Spacing (2) (ft)	$M_v = 0.10 w_v L_v^2$ (ft-lb)	$M_h$ (ft-lb)	20	25	30	35	40	20	25	30	35	40
1 1/4	1.660	0.062	0.11	183	1.9	2.8	12	40	178	102	81	67			51	40	33		
1 1/2	1.900	0.080	0.19	305	2.6	3.9	12	56	299	171	137	112			85	68	56		
2	2.375	0.080	0.30	487	3.6	5.4	12	78	481	275	220	180			137	109	90		
2 1/2	2.875	0.083	0.46	751	5.0	7.5	12	107	743	425	340	278			211	169	138		
3	3.500	0.083	0.69	1129	6.8	10.2	12	147	1120	640	512	419	359	301	318	254	208	179	150
4	4.500	0.092	1.29	2088	10.7	16.0	12	231	2076	1186	949	777	666	558	589	471	386	331	277
6	6.625	0.115	3.51	5707	21.9	32.9	12	474	5687	3250	2600	2130	1826	1529	1615	1292	1058	907	760

<sup>1</sup> Steel pipe dimension as provided by ERICO.

<sup>2</sup>  $S = [ \pi (OD)^4 - (OD - 2 * t_{design})^4 ] / 32 (OD)$  where  $t_{design} = 0.93 t_{nom}$  (per AISC 360).

<sup>3</sup> Maximum distance between hangers per NFPA Table 9.2.2.1 (a).



SHEET TITLE: APPENDIX 'A'  
EXAMPLE OF SEISMIC SWAY BRACE DESIGN PROCEDURE



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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

## APPENDIX 'A': SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

B. DEMAND (CONTINUED):  
5. (CONTINUED):

### MAX LOAD IN ZONE OF INFLUENCE (ZOI) OF A LATERAL SWAY BRACE

#### Schedule 10 Steel Pipe

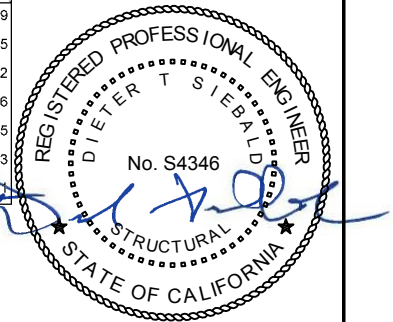
Schedule 10 Steel Pipe										HORIZONTAL SEISMIC FORCE $F_{pw} = C_p W_p = 1.75 W_p$									
Fy = 30 ksi					Water-Filled Pipe Wt (plf)	$w_p + F_{pv}$ (plf)	$L_v =$ Hanger Spacing <sup>(3)</sup> (ft)	$M_1 = 0.10 w_p L_v^2$ (ft-lb)	$M_2$ (ft-lb)	Max Permissible ZOI Load, $F_{ow}$ (lbs)	Max Permissible ZOI Weight, W = $F_{pw} / 1.15 C_p$ (lbs)								
Pipe (1)	OD (1)	$t_{nom}$ (1)	S (2)	$M_{cap}$ (ft-lb)							Lateral Sway Brace Spacing, L (ft)					Lateral Sway Brace Spacing, L (ft)			
(in)	(in)	(in)	(in <sup>2</sup> )	(ft-lb)	(plf)	(plf)	(ft)	(ft-lb)	(ft-lb)	20	25	30	35	40	20	25	30	35	40
1	1.315	0.109	0.11	177	1.8	2.7	12	39	173	99	79	65			49	39	32		
1 1/4	1.660	0.109	0.18	296	2.5	3.8	12	54	291	166	133	109			83	66	54		
1 1/2	1.900	0.109	0.24	397	3.0	4.6	15	103	384	219	176	144			109	87	71		
2	2.375	0.109	0.39	642	4.2	6.3	15	143	625	357	286	234			178	142	116		
2 1/2	2.875	0.120	0.64	1047	5.9	8.8	15	199	1028	587	470	385			292	234	191		
3	3.500	0.120	0.98	1585	8.0	11.9	15	268	1562	893	714	585	501	420	444	355	291	249	209
3 1/2	4.000	0.120	1.29	2095	9.8	14.7	15	330	2069	1182	946	775	664	556	587	470	385	330	276
4	4.500	0.120	1.65	2677	11.8	17.7	15	398	2647	1513	1210	991	850	712	752	601	493	422	354
5	5.563	0.134	2.83	4601	17.3	26.0	15	585	4564	2608	2086	1709	1465	1227	1295	1037	849	728	610
6	6.625	0.134	4.06	6597	23.1	34.6	15	778	6551	3743	2995	2453	2103	1761	1860	1488	1219	1045	875
8	8.625	0.188*	9.61	15617	40.1	60.2	15	1354	15558	8891	7112	5827	4995	4182	4418	3534	2895	2482	2078
10	10.75	0.188*	15.1	24556	57.9	86.8	15	1953	24478	13987	11190	9168	7858	6580	6950	5560	4555	3905	3270

<sup>1</sup> Steel pipe dimension per NFPA Table A.6.3.2.  
<sup>2</sup>  $S = [\pi (OD)^4 - (OD - 2 * t_{design})^4] / 32 (OD)$  where  $t_{design} = 0.93 t_{nom}$  (per AISC 360).  
<sup>3</sup> Maximum distance between hangers per NFPA Table 9.2.2.1 (a).  
 \* Wall thickness specified in NFPA Section 6.3.2.

#### Schedule 40 Steel Pipe

Schedule 40 Steel Pipe										HORIZONTAL SEISMIC FORCE $F_{pw} = C_p W_p = 1.75 W_p$									
Fy = 30 ksi					Water-Filled Pipe Wt (plf)	$w_p + F_{pv}$ (plf)	$L_v =$ Hanger Spacing <sup>(3)</sup> (ft)	$M_1 = 0.10 w_p L_v^2$ (ft-lb)	$M_2$ (ft-lb)	Max Permissible ZOI Load, $F_{ow}$ (lbs)	Max Permissible ZOI Weight, W = $F_{pw} / 1.15 C_p$ (lbs)								
Pipe (1)	OD (1)	$t_{nom}$ (1)	S (2)	$M_{cap}$ (ft-lb)							Lateral Sway Brace Spacing, L (ft)					Lateral Sway Brace Spacing, L (ft)			
(in)	(in)	(in)	(in <sup>2</sup> )	(ft-lb)	(plf)	(plf)	(ft)	(ft-lb)	(ft-lb)	20	25	30	35	40	20	25	30	35	40
1	1.315	0.133	0.13	205	2.1	3.1	12	44	200	114	92	75			57	45	37		
1 1/4	1.660	0.140	0.22	361	2.9	4.4	12	63	355	203	162	133			101	81	66		
1 1/2	1.900	0.145	0.31	501	3.6	5.4	15	122	486	278	222	182			138	110	90		
2	2.375	0.154	0.53	859	5.1	7.7	15	172	842	481	385	315			239	191	157		
2 1/2	2.875	0.203	1.00	1632	7.9	11.8	15	266	1611	920	736	603			457	366	300		
3	3.500	0.216	1.62	2640	10.8	16.2	15	364	2615	1494	1195	979	839	703	742	594	487	417	349
3 1/2	4.000	0.226	2.25	3662	13.4	20.1	15	452	3633	2076	1661	1361	1166	977	1032	825	676	580	485
4	4.500	0.237	3.02	4913	16.3	24.5	15	551	4882	2790	2232	1828	1567	1312	1386	1109	909	779	652
5	5.563	0.258	5.12	8320	23.3	35.0	15	786	8282	4733	3786	3102	2659	2226	2352	1881	1541	1321	1106
6	6.625	0.280	7.97	12955	31.5	47.3	15	1064	12911	7378	5902	4836	4145	3471	3666	2933	2403	2060	1725
8	8.625	0.322	15.8	25605	50.3	75.4	15	1696	25549	14599	11679	9569	8202	6868	7254	5803	4755	4075	3413
10	10.75	0.365	28.0	45519	74.7	112.0	15	2521	45449	25971	20777	17022	14590	12218	12905	10324	8458	7250	6071

<sup>1</sup> Steel pipe dimension per NFPA Table A.6.3.2.  
<sup>2</sup>  $S = [\pi (OD)^4 - (OD - 2 * t_{design})^4] / 32 (OD)$  where  $t_{design} = 0.93 t_{nom}$  (per AISC 360).  
<sup>3</sup> Maximum distance between hangers per NFPA Table 9.2.2.1 (a).



## SHEET TITLE: APPENDIX 'A' EXAMPLE OF SEISMIC SWAY BRACE DESIGN PROCEDURE



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# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

## APPENDIX 'A': SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)

### B. DEMAND (CONTINUED):

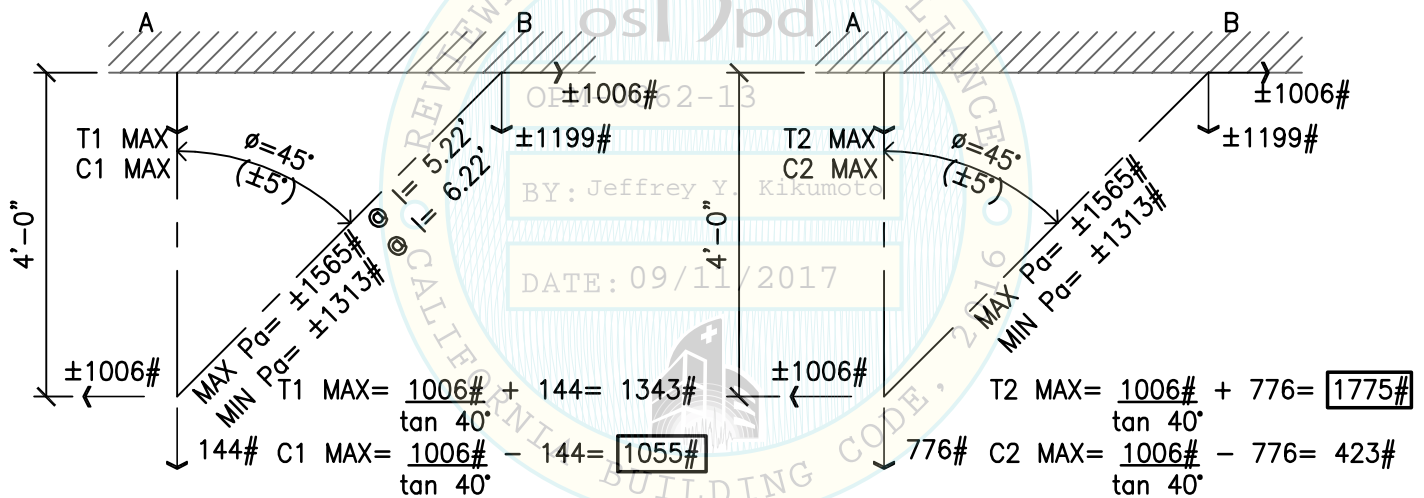
6. THE CRDP MAKES ADJUSTMENTS TO THE LATERAL TRANSVERSE BRACE SPACING ON THE LAYOUT DRAWINGS AND RECALCULATES W IF SO REQ.
7. THE CRDP DETERMINES THE OPERATING WT ( $W_p = 1.15W$ ) BY APPLYING THE 1.15 FACTOR AS PER NFPA@ 13 SECTION 9.3.5.9.2. IN THIS EXAMPLE  $W_p = 1.15 (500 \text{ LBS}) = 575 \text{ LBS}$ .
8. THE CRDP CALCULATES THE LATERAL FORCE  $F_p$  AND VERT FORCE  $F_{pv}$  ON THE SEISMIC BRACE USING THE  $W_p$  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 FOR THE MAIN SERVICE PIPE LINE PER NFPA 13. FOR THIS EXAMPLE, AT ASD LEVEL OF DESIGN.

$W_p = 575 \text{ LBS}$

$F_p = \pm 1.75 (575 \text{ LBS}) = \pm 1,006 \text{ LBS}$

$F_{pv} = \pm 0.35 (575 \text{ LBS}) = \pm 201 \text{ LBS}$

**LOAD COMBINATION 1.**  $(0.6W_p - F_{pv}) = 345 - 201 = 144\#$       **LOAD COMBINATION 2.**  $(W_p + F_{pv}) = 575 + 201 = 776\#$



9. THE CRDP VERIFIES THAT THERE IS A VERT SEISMIC BRACE WITHIN SIX INCHES OF EA TRANSVERSE AND LONGITUDINAL BRACE.
10. THE CRDP CHOOSES APPROPRIATE SEISMIC BRACE SUPPORT ELEMENTS PER SECTIONS 2, 3, 4 AND 8 OF THE OPM. FOR THIS EXAMPLE THE ERICO CSBQG SERVICE PIPE CONNECTION IS CHOSEN FOR BOTH THE TRANSVERSE AND VERT SEISMIC BRACE. REFER TO PGS 2.2 AND 8.2.
11. THE CRDP CHOOSES APPROPRIATE SEISMIC ATTACHMENT ELEMENTS TO STRUCTURE AS PER SECTIONS 5 AND 6 OF THE OPM.



SHEET TITLE: APPENDIX 'A'  
EXAMPLE OF SEISMIC SWAY BRACE DESIGN PROCEDURE



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SEISMIC SWAY BRACING FOR  
FIRE SPRINKLER SYSTEMS

**APPENDIX 'A':  
SUMMARY OF TYP DESIGN EXAMPLE (CONTINUED)**

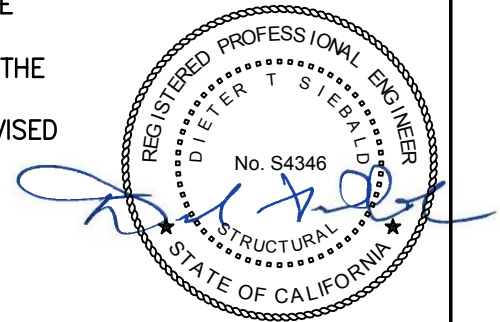
C. CAPACITY

1. THE CRDP DETERMINES THE GOVERNING CAPACITY OF THE ASSEMBLED SUPPORTS AND ATTACHMENT.
  - a. DETERMINE CAPACITY OF SUPPORT ELEMENT FOR SERVICE PIPE PER TESTED VALUES ON PAGES C1 TO C6 OF APPENDIX C. PER PG C4, THE CSBQG CAPACITY FOR A 4" DIA, SCHEDULE 10 SERVICE PIPE IS 1190 LBS FOR ANY BRACE ANGLE BETWEEN 30 TO 90 DEGREES. THE CAPACITY IS 2300 LBS AT 90 DEGREES IF USED AS A VERT BRACE. THIS IS HIGHER THAN THE DEMAND AND THE CSBQG CAN BE USED AS PART OF THE BRACE ASSEMBLY IN THIS EXAMPLE.
  - b. DETERMINE CAPACITY OF BRACE PIPE SUPPORT AS PER CALCULATED ALLOWABLE VALUES IN TABLE PROVIDED ON PG B1 OF APPENDIX B. FOR THIS EXAMPLE, IT IS ASSUMED THE BRACE PIPE IS NO LONGER THAN 6 FEET. A 1" DIA BRACE PIPE HAS AN AXIAL CAPACITY OF 1850 LBS AND CAN BE USED AS PART OF THE TRANSVERSE AND VERT BRACE ASSEMBLIES IN THIS EXAMPLE.
  - c. DETERMINE CAPACITY OF CSBUNIV SUPPORT BETWEEN BRACE PIPE AND SEISMIC ATTACHMENT ELEMENT. PER PG C4 IN APPENDIX C, THE CSBUNIV050 HAS A CAPACITY OF 1620 LBS FOR ANY BRACE ANGLE BETWEEN 30 TO 90 DEGREES AND CAN BE USED AS PART OF THE BRACE ASSEMBLY IN THIS EXAMPLE.
  - d. DETERMINE CAPACITY OF SEISMIC ATTACHMENT ELEMENTS TO SUPPORTING STRUCTURE AS PER CALCULATED ALLOWABLE VALUES IN TABLES PROVIDED IN SECTION 5, "ANCHORAGE DETAILS TO CONCRETE", OF THIS OPM. FOR THIS EXAMPLE, CHOOSE ERICO® CSBMA MOUNTED TO UNDERSIDE OF CONC FLR (CASE 2). PER PG 5.6, FOR CSBMA W/ 2- 3/4"φ ANCHORS, THE ALLOWABLE AXIAL BRACE FORCE IS 938 LBS FOR A BRACE ANGLE OF 45 (±5) DEGREES. THIS IS MUCH LESS THAN THE CALCULATED DEMAND OF 1565 LBS.

**NOTE:**

- A STRENGTH-LEVEL AXIAL BRACE FORCE WAS EVALUATED BASED ON THE INTERACTION OF SHEAR AND TENSION CAPACITIES OF THE ANCHORS IN CONC. THE CONC ANCHOR CAPACITIES WERE CALCULATED ACCORDING TO ACI® 318-11 APPENDIX D. AS PER SUPPLEMENT #1 OF ASCE® 7-10, THE OVERSTRENGTH FACTOR  $\Omega_o$  APPLIES TO CONC ANCHORAGE. THEREFORE, THE ALLOWABLE AXIAL BRACE FORCE,  $P_a$ , LISTED ON PGS 5.4 TO 5.7 WAS DETERMINED FROM THE STRENGTH-LEVEL AXIAL BRACE FORCE,  $P_u$ , USING THE RELATIONSHIP  $P_a = 0.7 P_u / \Omega_o$ .
2. THE CRDP DETERMINES WHETHER THE DEMAND ON THE BRACE IS LESS THAN THE CAPACITY OF THE ASSEMBLY. IN THIS EXAMPLE, THE ATTACHMENT CAPACITY OF 938 LBS IS FOUND TO BE MUCH LESS THAN THE CALCULATED DEMAND OF 1565 LBS. THUS, THE BRACE SPACING (i.e. W BASED ON ZOI) WILL NEED TO BE REDUCED.
  3. THE CRDP DETERMINES VIA DIRECT DEMAND VS CAPACITY RATIO THE APPROXIMATE REVISED ALLOWABLE BRACE SPACING. FOR THIS EXAMPLE, (938 LBS/1565 LBS) (25 FEET) = 15 FEET. THE REVISED SPACING & NEW ZONE OF INFLUENCE LOADS CAN THEN BE DETERMINED.

BY: Jeffrey Y. Kikumoto



SHEET TITLE: APPENDIX 'A'  
EXAMPLE OF SEISMIC SWAY BRACE DESIGN PROCEDURE



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**SEISMIC SWAY BRACING FOR  
FIRE SPRINKLER SYSTEMS**

**APPENDIX 'B':**

LATERAL SWAY BRACE PIPE AXIAL CAPACITY (POUNDS)										
NOMINAL DIA	OUTSIDE DIA	NOMINAL WALL THK	DESIGN WALL THK	AREA Ag (in <sup>2</sup> )	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	1158	782
1.25"	1.66"	0.140"	0.130"	0.62	12.8	0.543	4764	3523	2332	1623
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

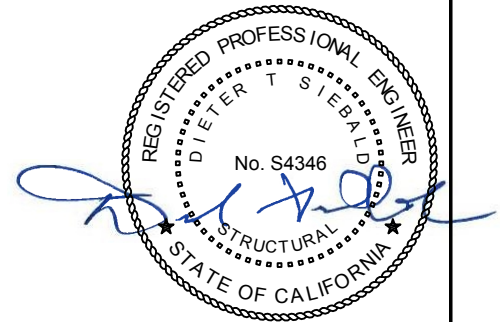
**NOTES:**

- BRACE PIPE AXIAL CAPACITY SHOWN IS AT ASD LEVEL DESIGN. FOR LRFD-LEVEL DESIGN PER AISC® 360-10 SECTION E3, MULTIPLY BY 1.5.
- BRACE DIAMETERS AND THICKNESSES ARE GIVEN FOR SCHEDULE 40 PIPE AS PER AISC® 360-10 TABLE 1-14, AND  $k/r < 300$ .

ROD RESTRAINT AXIAL CAPACITY						
NOMINAL DIA	ROD LENGTH					
	3'-4"	3'-0"	2'-6"	2'-0"	1'-10"	1'-6"
3/8"	-	-	73#	114#	136#	202#
1/2"	140#	172#	248#	387#	463#	689#

**NOTES:**

- ROD RESTRAINT AXIAL CAPACITY SHOWN IS AT ASD LEVEL DESIGN. FOR LRFD-LEVEL DESIGN PER AISC 360-10 SECTION E3, MULTIPLY BY 1.5.
- ROD DIAMETERS ARE BASED ON ALL THREAD ROD, CAPACITY IS BASED ON ASTM® A36 AND  $k/r \leq 400$ . INTERPOLATION IS ACCEPTABLE.



**SHEET TITLE: APPENDIX 'B'  
CAPACITY TABLES OF BRACE PIPES & RODS**

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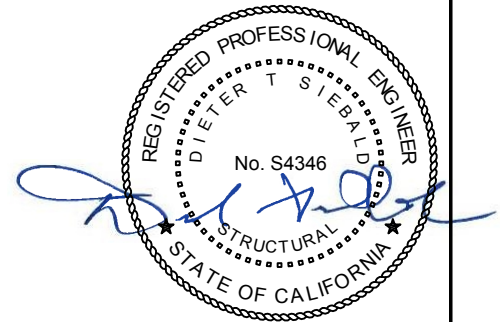
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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

### APPENDIX 'C' ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' AND t, u ARE TYP)

MODE	COMPONENT DESCRIPTION	RUN PIPE NOMINAL DIA (INCHES)	RUN PIPE REFERENCE	HORIZ CAPACITY F <sub>H</sub> (POUNDS) PER INSTALLATION ANGLE $\phi$				NOTES
				30° - 44°	45° - 59°	60° - 74°	75° - 90°	
T	CSBQIKCL	1	LW	290	410	495	550	s
T	CSBQIKCL	1¼	LW	290	410	495	550	s
T	CSBQIKCL	1½	LW	290	410	495	550	s
T	CSBQIKCL	2	LW	390	550	670	750	s
R	CSBQIKCL	1	LW	550	550	550	550	s
R	CSBQIKCL	1¼	LW	550	550	550	550	s
R	CSBQIKCL	1½	LW	550	550	550	550	s
R	CSBQIKCL	2	LW	750	750	750	750	s
T	CSBQIKCL	1	10	150	210	280	315	s
T	CSBQIKCL	1¼	10	150	210	280	315	s
T	CSBQIKCL	1½	10	150	210	280	315	s
T	CSBQIKCL	2	10	350	500	620	690	s
R	CSBQIKCL	1	10	315	315	315	315	s
R	CSBQIKCL	1¼	10	315	315	315	315	s
R	CSBQIKCL	1½	10	315	315	315	315	s
R	CSBQIKCL	2	10	690	690	690	690	s
T	CSBQIKCL	1	40	475	665	825	925	s
T	CSBQIKCL	1¼	40	475	665	825	925	s
T	CSBQIKCL	1½	40	475	665	825	925	s
T	CSBQIKCL	2	40	490	690	850	950	s
R	CSBQIKCL	1	40	925	925	925	925	s
R	CSBQIKCL	1¼	40	925	925	925	925	s
R	CSBQIKCL	1½	40	925	925	925	925	s
R	CSBQIKCL	2	40	950	950	950	950	s
L	CSBSTU	1	LW,10,40	970	720	860	960	r,w
L	CSBSTU	1¼	LW,10,40	970	720	860	960	r,w



SHEET TITLE: APPENDIX 'C'  
CAPACITY TABLE OF BRACE SUPPORTS



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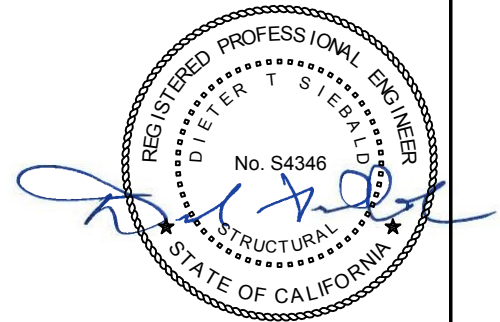




## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

### APPENDIX 'C' ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' AND t, u ARE TYP)

MODE	COMPONENT DESCRIPTION	RUN PIPE NOMINAL DIA (INCHES)	RUN PIPE REFERENCE	HORIZ CAPACITY F <sub>H</sub> (POUNDS) PER INSTALLATION ANGLE φ				NOTES
				30° - 44°	45° - 59°	60° - 74°	75° - 90°	
L	CSBSTU	1½	LW,10,40	970	720	860	960	r,w
L	CSBSTU	2	LW,10,40	870	690	830	930	r,w
L	CSBSTU	2½	LW,10,40	870	690	830	930	r,w
L	CSBSTU	3	LW,10,40	870	690	830	930	r,w
L	CSBSTU	4	LW,10,40	1550	1390	1680	1870	r,w
L	CSBSTU	5	LW,10,40	1550	1390	1680	1870	r,w
L	CSBSTU	6	LW,10,40	1470	1170	1410	1570	r,w
L	CSBSTU	8,10	0.188,40	1200	1700	2090	2330	p,r,w
R	CSBSTU	1	LW,10,40	1670	1670	1670	1670	r,w
R	CSBSTU	1¼	LW,10,40	1670	1670	1670	1670	r,w
R	CSBSTU	1½	LW,10,40	1670	1670	1670	1670	r,w
R	CSBSTU	2	LW,10,40	2960	2960	2960	2960	r,w
R	CSBSTU	2½	LW,10,40	2960	2960	2960	2960	r,w
R	CSBSTU	3	LW,10,40	2960	2960	2960	2960	r,w
R	CSBSTU	4	LW,10,40	3030	3030	3030	3030	r,w
R	CSBSTU	5	LW,10,40	3030	3030	3030	3030	r,w
R	CSBSTU	6	LW,10,40	3840	3840	3840	3840	r,w
R	CSBSTU	8,10	0.188,40	3950	3950	3950	3950	p,r,w
T	CSBSTU	1	LW,10,40	860	1220	1500	1670	r,w
T	CSBSTU	1¼	LW,10,40	860	1220	1500	1670	r,w
T	CSBSTU	1½	LW,10,40	860	1220	1500	1670	r,w
T	CSBSTU	2	LW,10,40	1530	2160	2650	2960	r,w
T	CSBSTU	2½	LW,10,40	1530	2160	2650	2960	r,w
T	CSBSTU	3	LW,10,40	1530	2160	2650	2960	r,w
T	CSBSTU	4	LW,10,40	1570	2220	2720	3030	r,w
T	CSBSTU	5	LW,10,40	1570	2220	2720	3030	r,w



SHEET TITLE: APPENDIX 'C' (CONTINUED)  
CAPACITY TABLE OF BRACE SUPPORTS



**CYS STRUCTURAL ENGINEERS, INC.**

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SACRAMENTO, CA 95833

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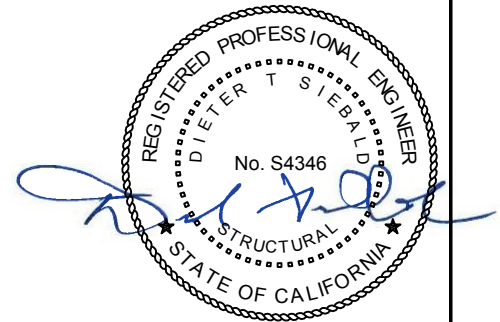
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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

### APPENDIX 'C' ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' AND t, u ARE TYP)

MODE	COMPONENT DESCRIPTION	RUN PIPE NOMINAL DIA (INCHES)	RUN PIPE REFERENCE	HORIZ CAPACITY F <sub>H</sub> (POUNDS) PER INSTALLATION ANGLE $\phi$				NOTES
				30° - 44°	45° - 59°	60° - 74°	75° - 90°	
T	CSBSTU	6	LW,10,40	1980	2810	3440	3840	r,w
T	CSBSTU	8,10	0.188,40	2040	2890	3540	3950	p,r,w
L	CSBEZU	1	LW,10,40	390	550	670	750	r,x
L	CSBEZU	1¼	LW,10,40	390	550	670	750	r,x
L	CSBEZU	1½	LW,10,40	390	550	670	750	r,x
L	CSBEZU	2	LW,10,40	520	690	830	930	r,x
L	CSBEZU	2½	LW,10,40	520	690	830	930	r,x
L	CSBEZU	3	LW,10,40	520	690	830	930	r,x
L	CSBEZU	4	LW,10,40	630	900	1100	1230	r,x
L	CSBEZU	5	LW,10,40	630	900	1100	1230	r,x
L	CSBEZU	6	LW,10,40	730	1000	1230	1370	r,x
R	CSBEZU	1	LW,10,40	1670	1670	1670	1670	r,x
R	CSBEZU	1¼	LW,10,40	1670	1670	1670	1670	r,x
R	CSBEZU	1½	LW,10,40	1670	1670	1670	1670	r,x
R	CSBEZU	2	LW,10,40	2960	2960	2960	2960	r,x
R	CSBEZU	2½	LW,10,40	2960	2960	2960	2960	r,x
R	CSBEZU	3	LW,10,40	2960	2960	2960	2960	r,x
R	CSBEZU	4	LW,10,40	3030	3030	3030	3030	r,x
R	CSBEZU	5	LW,10,40	3030	3030	3030	3030	r,x
R	CSBEZU	6	LW,10,40	3030	3030	3030	3840	r,x
T	CSBEZU	1	LW,10,40	860	1220	1500	1670	r,x
T	CSBEZU	1¼	LW,10,40	860	1220	1500	1670	r,x
T	CSBEZU	1½	LW,10,40	860	1220	1500	1670	r,x
T	CSBEZU	2	LW,10,40	1530	2160	2650	2960	r,x
T	CSBEZU	2½	LW,10,40	1530	2160	2650	2960	r,x
T	CSBEZU	3	LW,10,40	1530	2160	2650	2960	r,x



SHEET TITLE: APPENDIX 'C' (CONTINUED)  
CAPACITY TABLE OF BRACE SUPPORTS

 <b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833	TEL (916) 920-2020 www.cyseng.com	Job No: 17020 Date: 08-18-2017 Page: C3 of 87
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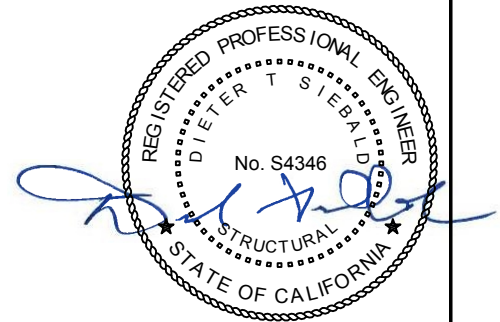
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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

### APPENDIX 'C' ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' AND t, u ARE TYP)

MODE	COMPONENT DESCRIPTION	RUN PIPE NOMINAL DIA (INCHES)	RUN PIPE REFERENCE	HORIZ CAPACITY F <sub>H</sub> (POUNDS) PER INSTALLATION ANGLE $\phi$				NOTES
				30° - 44°	45° - 59°	60° - 74°	75° - 90°	
T	CSBEZU	4	LW,10,40	1570	2220	2720	3030	r,x
T	CSBEZU	5	LW,10,40	1570	2220	2720	3030	r,x
T	CSBEZU	6	LW,10,40	1980	2810	3440	3840	r,x
T	CSBBRP	1 AND 1¼	LW,10,40	120	170	210	230	e
T	CSBBRP	1 AND 1¼	LW,10,40	140	190	240	270	f
T	CSBBRP	1½ AND 2	LW,10,40	140	190	240	270	e
T	CSBBRP	1½ AND 2	LW,10,40	110	150	190	210	f
T	CSBQG	2½	LW,10,40	1410	2000	2450	2740	s
T	CSBQG	3	LW,10,40	1190	1680	2060	2300	s
T	CSBQG	4	LW,10,40	1190	1680	2060	2300	s
T	CSBQG	5,6	LW,10	870	1230	1510	1690	s
T	CSBQG	5,6	40	970	1370	1680	1870	s
T	CSBQG	8	0.188,40	790	1110	1360	1520	p,s
-	CSBUNIV050	NA	NA	1620	2300	2820	3140	r
-	CSBUNIV075	NA	NA	1620	2300	2820	3140	r
-	CSBBC075	NA	NA	1190	1680	1160	1280	m,r
-	CSBBC075	NA	NA	1620	1710	1010	1110	k,r
-	CSBBARJ	NA	NA	1740	1710	2060	2300	m,r
-	CSBBARJ	NA	NA	1410	2110	2540	2830	k,r
-	CSBBIB	NA	NA	1620	2300	2820	3140	m,r
-	CSBBIB	NA	NA	1620	1710	1010	1110	k,r
-	CSBBRS1	NA	NA	220	310	210	210	e,k,m
-	CSBBRS1	NA	NA	210	290	200	220	f,k,m
-	CSBBRS3	NA	NA	120	170	210	230	e,f,g,m
-	CSBBRS3	NA	NA	140	200	230	260	e,f,g,k
-	CSBBRS3	NA	NA	320	310	190	210	e,f,h



SHEET TITLE: APPENDIX 'C' (CONTINUED)  
CAPACITY TABLE OF BRACE SUPPORTS

 <b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833	TEL (916) 920-2020 www.cyseng.com	Job No: 17020 Date: 08-18-2017 Page: C4 of 87
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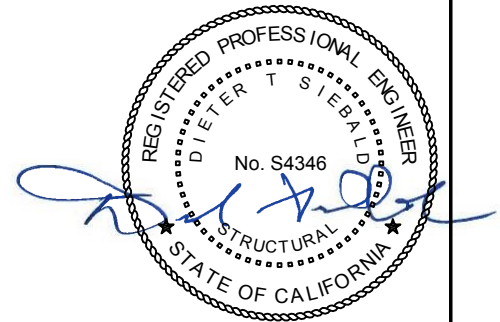
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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

### APPENDIX 'C' ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' AND t, u ARE TYP)

MODE	COMPONENT DESCRIPTION	RUN PIPE NOMINAL DIA (INCHES)	RUN PIPE REFERENCE	HORIZ CAPACITY F <sub>H</sub> (POUNDS) PER INSTALLATION ANGLE $\phi$				NOTES
				30° - 44°	45° - 59°	60° - 74°	75° - 90°	
L	CSB	1	LW,10,40	1290	1240	1260	1400	r
L	CSB	1¼	LW,10,40	1290	1240	1260	1400	r
L	CSB	1½	LW,10,40	1200	1860	2180	2250	r
L	CSB	2	LW,10,40	1200	1820	2180	2250	r
L	CSB	2½	LW,10,40	1320	1820	2190	2500	r
L	CSB	3	LW,10,40	1300	1790	2190	2500	r
L	CSB	4	LW,10,40	1300	1790	2190	2500	r
L	CSB	5	LW,10,40	1300	1790	2190	2500	r
L	CSB	6	LW,10,40	1410	1950	2350	2680	r
L	CSB	8,10	0.188,40	1400	1920	2350	2640	p,r
T	CSB	1	LW,10,40	1490	2110	2580	2900	r
T	CSB	1¼	LW,10,40	1380	1960	2400	2690	r
T	CSB	1½	LW,10,40	1380	1960	2400	2690	r
T	CSB	2	LW,10,40	1380	1960	2400	2690	r
T	CSB	2½	LW,10,40	1440	2030	2490	2790	r
T	CSB	3	LW,10,40	1390	1970	2420	2710	r
T	CSB	4	LW,10,40	1390	1970	2420	2710	r
T	CSB	5	LW,10,40	1390	1970	2420	2710	r
T	CSB	6	LW,10,40	1460	2060	2520	2830	r
T	CSB	8,10	0.188,40	1330	1880	2300	2580	p,r
R	CSB	1	LW,10,40	2900	2900	2900	2900	r
R	CSB	1¼	LW,10,40	2690	2690	2690	2690	r
R	CSB	1½	LW,10,40	2690	2690	2690	2690	r
R	CSB	2	LW,10,40	2690	2690	2690	2690	r



SHEET TITLE: APPENDIX 'C' (CONTINUED)  
CAPACITY TABLE OF BRACE SUPPORTS



**CYS STRUCTURAL ENGINEERS, INC.**

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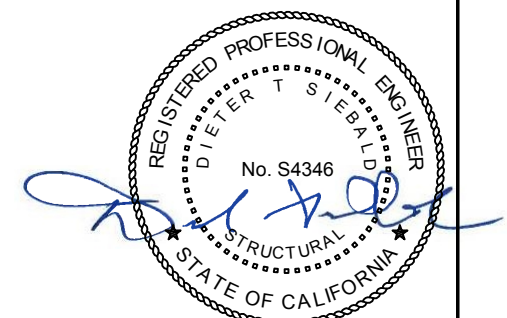
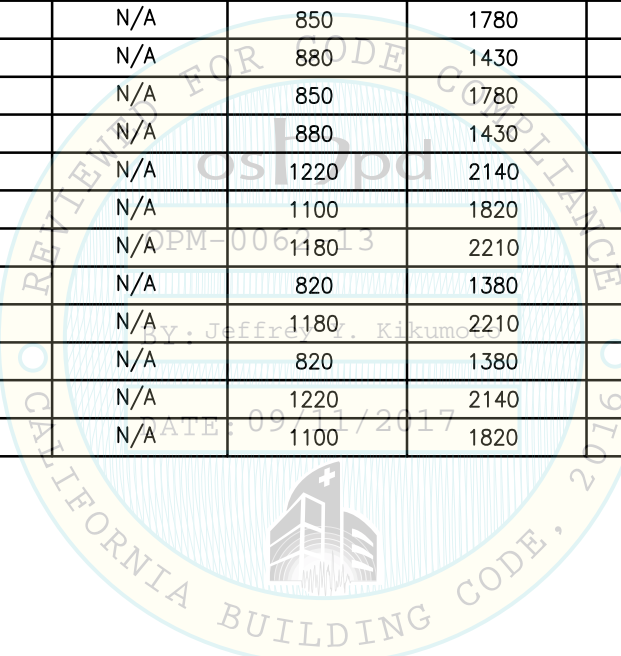
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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

### APPENDIX 'C' ALSO SEE NOTES AT END OF TABLE (NOTES 'a' THRU 'd' AND t, u ARE TYP)

MODE	COMPONENT DESCRIPTION	RUN PIPE NOMINAL DIA (INCHES)	RUN PIPE REFERENCE	HORIZ CAPACITY F <sub>H</sub> (POUNDS) PER INSTALLATION ANGLE φ				NOTES
				30° - 44°	45° - 59°	60° - 74°	75° - 90°	
R	CSB	2½	LW,10,40	2790	2790	2790	2790	r
R	CSB	3	LW,10,40	2710	2710	2710	2710	r
R	CSB	4	LW,10,40	2710	2710	2710	2710	r
R	CSB	5	LW,10,40	2710	2710	2710	2710	r
R	CSB	6	LW,10,40	2830	2830	2830	2830	r
R	CSB	8, 10	0.188,40	2580	2580	2580	2580	p,r
T	CSBT	1 - 4	LW,10,40	475	790	790	890	y
-	CSBU1	N/A	N/A	1690	2210	2660	3090	r
-	CSBU2	N/A	N/A	1480	2290	2860	3090	r
-	CSBS1	N/A	N/A	850	1780	2770	2840	m,r
-	CSBS1	N/A	N/A	880	1430	2020	2410	k,r
-	CSBS1A	N/A	N/A	850	1780	2770	2840	m,r
-	CSBS1A	N/A	N/A	880	1430	2020	2410	k,r
-	CSBS2	N/A	N/A	1220	2140	2580	2870	m,r
-	CSBS2	N/A	N/A	1100	1820	2190	2680	k,r
-	CSBS3	N/A	N/A	1180	2210	2830	2940	m,r
-	CSBS3	N/A	N/A	820	1380	2080	3010	k,r
-	CSBS4	N/A	N/A	1180	2210	2830	2940	m,r
-	CSBS4	N/A	N/A	820	1380	2080	3010	k,r
-	CSBS5	N/A	N/A	1220	2140	2580	2870	m,r
-	CSBS5	N/A	N/A	1100	1820	2190	2680	k,r



SHEET TITLE: APPENDIX 'C' (CONTINUED)  
CAPACITY TABLE OF BRACE SUPPORTS



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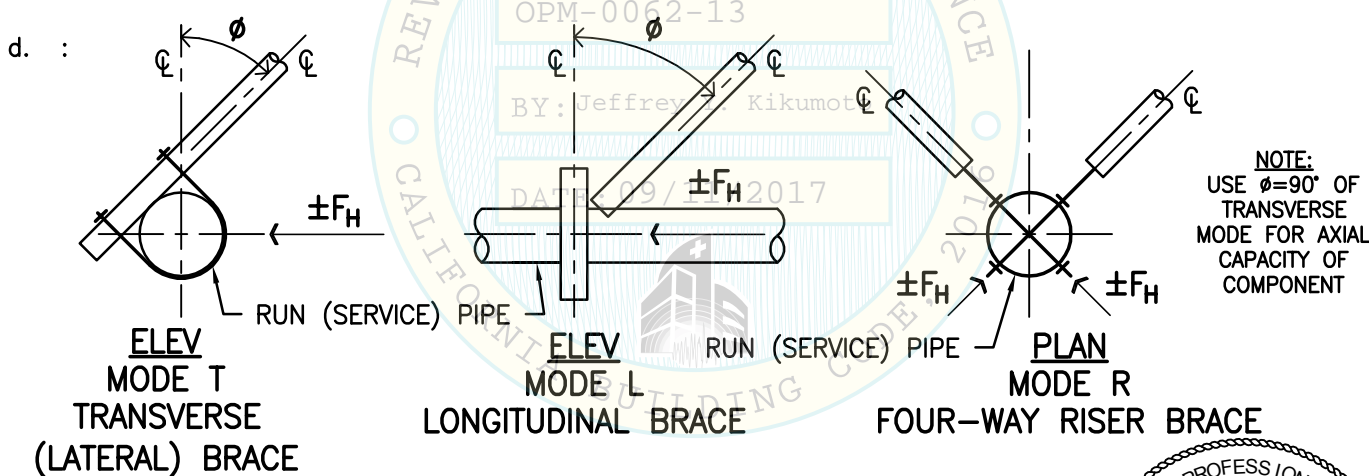


# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

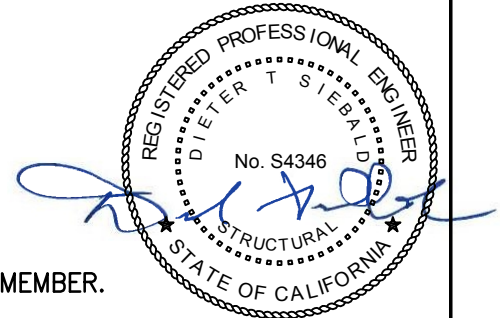
## APPENDIX 'C'

### NOTES:

- a. ALLOWABLE HORIZ CAPACITIES AT ALLOWABLE STRESS DESIGN OF BRACE COMPONENTS,  $F_H$  IN THE TABLE, ARE BASED ON TESTING PER FM® APPROVAL STANDARD FOR SEISMIC SWAY BRACES FOR AUTOMATIC SPRINKLER SYSTEMS, CLASS NUMBER 1950, MARCH 2010, AND EFFECTIVE DATE OF JUNE 30, 2010. THE FM CERTIFICATES OF COMPLIANCE (APPROVAL IDENTIFICATION NUMBERS 3042360 SIGNED AND DATED 02/03/2012 AND 3044398 SIGNED AND DATED 12/23/2011) AND FM APPROVAL REPORTS SIGNED AND DATED 02/03/2012 AND 06/02/2017 AND FM SPECIFICATION TESTED DATED 05/10/2016 HAVE BEEN FILED W/ OSHPD. 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 1.5 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 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 EN10220, AND GB/T 8163 PIPE, UNLESS OTHERWISE SPECIFIED.



- e. LOAD RATINGS BASED ON THE USE OF A  $\frac{3}{8}$ " $\phi$ -16 UNC (M10x1.5) THRD ROD AS THE BRACE MEMBER.
- f. LOAD RATINGS BASED ON THE USE OF A  $\frac{1}{2}$ " $\phi$ -13 UNC (M12x1.75) THRD ROD AS THE BRACE MEMBER.
- g. LOAD RATINGS BASED ON THE USE OF A MODEL 300 BM CLAMP ( $\frac{3}{8}$ " $\phi$ -16 UNC/M10x1.5 BOLT) AS MEANS FOR ATTACHMENT TO STRUC MEMBER.



SHEET TITLE: APPENDIX 'C' (CONTINUED)  
CAPACITY TABLE OF BRACE SUPPORTS



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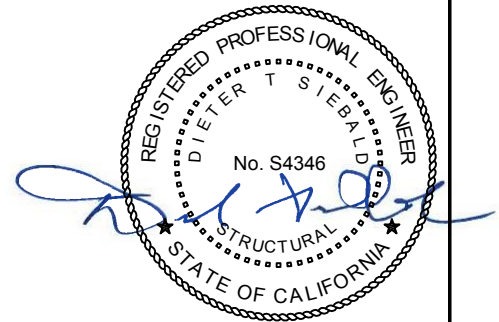
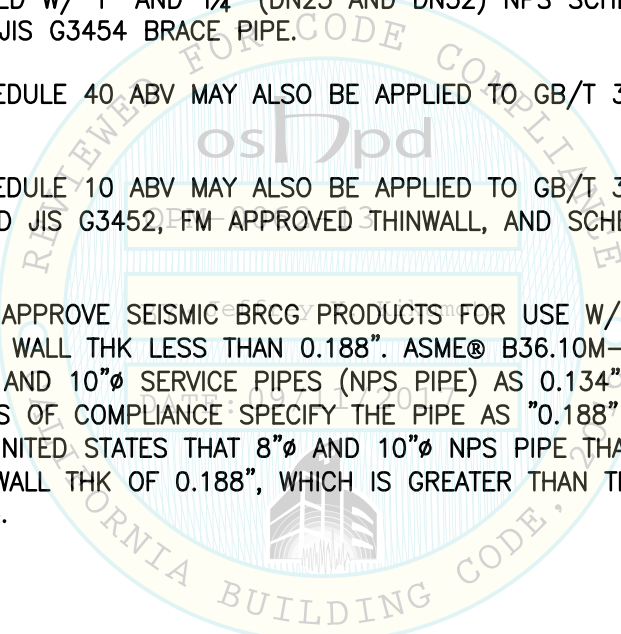


## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

### APPENDIX 'C'

#### NOTES (CONTINUED):

- h. LOAD RATINGS BASED ON THE USE OF A  $\frac{3}{8}$ " $\phi$ -16 UNC (M10x1.5) THRD FASTENER AS THE ATTACHMENT FASTENER TO A CONC INSERT.
- k. BRACE PIPE PARALLEL TO STRUC STL MEMBER.
- m. BRACE PIPE PERP TO STRUC STL MEMBER.
- p. LOAD RATINGS FOR "0.188 WALL" (i.e. SCHEDULE 10 PER NFPA 13-13 TABLE A.6.3.2) ABV MAY BE APPLIED TO ANY THICKER WALLED PIPE UNLESS OTHERWISE SPECIFIED.
- r. FM<sup>®</sup> APPROVED WHEN USED W/ 1", 1 $\frac{1}{4}$ ", 1 $\frac{1}{2}$ " OR 2" (DN25, DN32, DN40, DN50) NPS SCHEDULE 40, GB/T 3091, EN 10255 (HEAVY), OR JIS G3454 BRACE PIPE.
- s. FM APPROVED WHEN USED W/ 1" AND 1 $\frac{1}{4}$ " (DN25 AND DN32) NPS SCHEDULE 40, GB/T 3091, EN 10255 (HEAVY), OR JIS G3454 BRACE PIPE.
- t. LOAD RATINGS FOR SCHEDULE 40 ABV MAY ALSO BE APPLIED TO GB/T 3091, EN 10255 (HEAVY), AND JIS G3454 PIPE.
- u. LOAD RATINGS FOR SCHEDULE 10 ABV MAY ALSO BE APPLIED TO GB/T 3091, EN 10255 (MEDIUM OR HEAVY), AND JIS G3452, FM APPROVED THINWALL, AND SCHEDULE 40 PIPES UNLESS OTHERWISE INDICATED.
- v. FM APPROVALS DO NOT APPROVE SEISMIC BRCC PRODUCTS FOR USE W/ 8" $\phi$  AND 10" $\phi$  SERVICE PIPES (NPS PIPE) W/ A WALL THK LESS THAN 0.188". ASME<sup>®</sup> B36.10M-2004 DEFINES SCHEDULE 10 MIN WALL THK FOR 8" $\phi$  AND 10" $\phi$  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" $\phi$  AND 10" $\phi$  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.



SHEET TITLE: APPENDIX 'C' (CONTINUED)  
CAPACITY TABLE OF BRACE SUPPORTS



**CYS STRUCTURAL ENGINEERS, INC.**

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## SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

### APPENDIX 'C'

#### NOTES (CONTINUED):

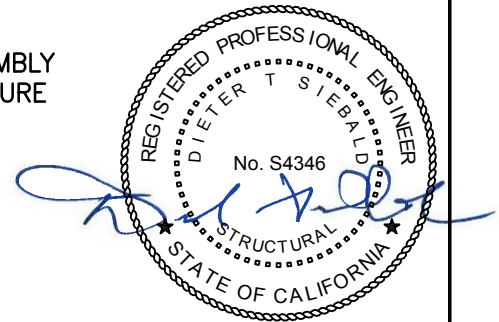
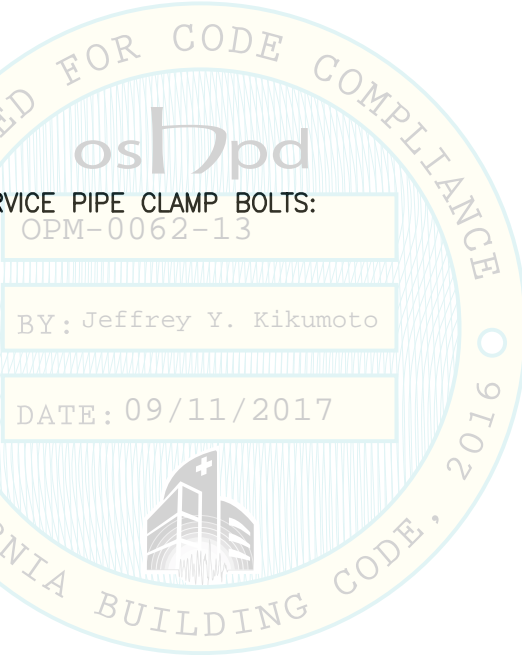
w. TORQUE VALUES FOR CSBSTU SERVICE PIPE CLAMP BOLTS:

PART NUMBER	TORQUE FT-LBS (N-m)
CSBSTU0100(XX)	25 (34)
CSBSTU0125(XX)	25 (34)
CSBSTU0150(XX)	25 (34)
CSBSTU0200(XX)	25 (34)
CSBSTU0250(XX)	25 (34)
CSBSTU0300(XX)	50 (68)
CSBSTU0400(XX)	50 (68)
CSBSTU0500(XX)	50 (68)
CSBSTU0600(XX)	50 (68)
CSBSTU0800(XX)	65 (88)
CSBSTU1000(XX)	65 (88)

x. TORQUE VALUES FOR CSBEZU SERVICE PIPE CLAMP BOLTS:

PART NUMBER	TORQUE FT-LBS (N-m)
CSBEZU0100(XX)	25 (34)
CSBEZU0125(XX)	25 (34)
CSBEZU0150(XX)	25 (34)
CSBEZU0200(XX)	25 (34)
CSBEZU0250(XX)	25 (34)
CSBEZU0300(XX)	50 (68)
CSBEZU0400(XX)	50 (68)
CSBEZU0500(XX)	50 (68)
CSBEZU0600(XX)	50 (68)

y. TESTING FOR THE CSBT IS FOR THE WHOLE TELESCOPING BRACE ASSEMBLY INCLUDING THE ATTACHMENT COMPONENTS TO THE SUPPORTING STRUCTURE AS SHOWN ON PG 8.8.



SHEET TITLE: APPENDIX 'C' (CONTINUED)  
CAPACITY TABLE OF BRACE SUPPORTS

 <b>CYS STRUCTURAL ENGINEERS, INC.</b> 2495 NATOMAS PARK DRIVE, SUITE 650 SACRAMENTO, CA 95833	TEL (916) 920-2020 www.cyseng.com	Job No: 17020 Date: 08-18-2017 Page: C9 of 87
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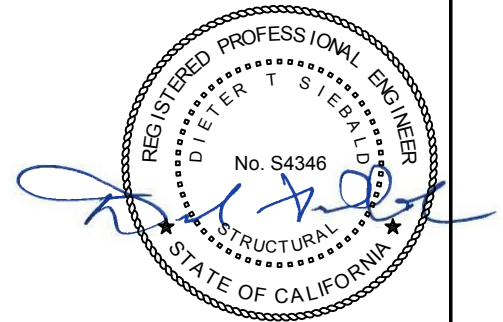
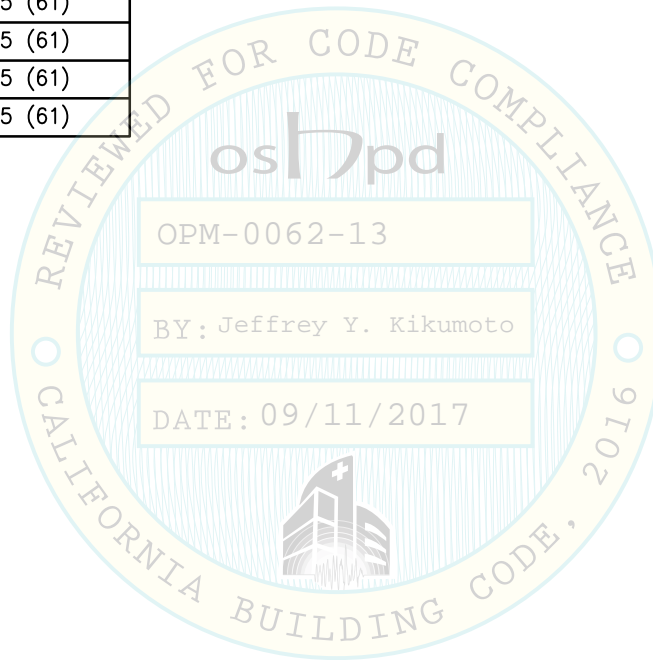
# SEISMIC SWAY BRACING FOR FIRE SPRINKLER SYSTEMS

## APPENDIX 'C'

### NOTES (CONTINUED):

z. TORQUE VALUES FOR CSB SERVICE PIPE CLAMP BOLTS:

PART NUMBER	TORQUE FT-LBS (N-m)
CSB0100(XX)	40 (54)
CSB0125(XX)	40 (54)
CSB0150(XX)	40 (54)
CSB0200(XX)	40 (54)
CSB0250(XX)	40 (54)
CSB0300(XX)	40 (54)
CSB0400(XX)	40 (54)
CSB0500(XX)	45 (61)
CSB0600(XX)	45 (61)
CSB0800(XX)	45 (61)
CSB1000(XX)	45 (61)



SHEET TITLE: APPENDIX 'C' (CONTINUED)  
CAPACITY TABLE OF BRACE SUPPORTS



**CYS STRUCTURAL ENGINEERS, INC.**

2495 NATOMAS PARK DRIVE, SUITE 650  
SACRAMENTO, CA 95833

TEL (916) 920-2020  
www.cyseng.com

Job No:	17020
Date:	08-18-2017
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L:\Jobs\17\17020 ERICO - Addendum to OPM-0062-13\STRU\S1.dwg Time:Aug18,2017-02:27pm Login:camachom DimScale:1 LTScale:4