OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION

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

OFFICE USE ONLY

APPLICATION #: OPM-0052-13

OSHPD Preapproval of Manufacturer's Certification (OPM)

Type: ☐ New ☒ Renewal ☐ Update to Pre-CBC 2013 OPA Number: ______

Manufacturer Information

Manufacturer: Eaton's B-Line Business

Manufacturer's Technical Representative: Alexander Schickling

Mailing Address: 509 W. Monroe St, Highland, IL 62249

Telephone: (951) 385-9491 Email: AlexanderWSchickling@Eaton.com

Product Information

Product Name: TOLCO

Product Type: Seismic bracing and hangers

Product Model Number: Various

General Description: Seismic bracing for Mechanical, Electrical, Plumbing and Fire Protection systems, hangers strut, cable, structural attachments and various non-structural supports

Applicant Information

Applicant Company Name: Eaton's B-Line Business

Contact Person: Amelia Grattan

Mailing Address: 509 W. Monroe St, Highland, IL 62249

Telephone: (858) 226-6201 Email: AmeliaGrattan@Eaton.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: Amelia Grattan Date: 05/23/2016

Title: Product Line Manager - Seismic Company Name: Eaton's B-Line Business

Registered Design Professional Preparing Engineering Recommendations

Company Name: MRH Structural Engineers, Inc.

Name: Mohammad Hariri California License Number: S 3545

Mailing Address: 1411 N. Batavia Street, Suite 121, Orange, CA 92867

Telephone: (714) 633-6302 Email: MRH_SE@sbcglobal.net

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 1950-10

☐ Other* (Please Specify):

*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 may be used when approved by OSHPD prior to testing.

☐ Analysis

☐ Experience Data

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

List of Attachments Supporting the Manufacturer's Certification

☐ Test Report ☒ Drawings ☒ Calculations ☐ Manufacturer's Catalog

☒ Other(s) (Please Specify): updated comment response log (online)

OFFICE USE ONLY – OSHPD APPROVAL VALID FOR CBC 2013 ONLY

Signature: [signature] Date: 08-17-2017

Print Name: Jeffrey Kikumoto

Title: SSE

Condition of Approval (if applicable):

OSHPD PRE-APPROVAL OF
MANUFACTURERS CERTIFICATION

OPM-0052-13

Seismic Restraint Systems Guidelines

CALIFORNIA BUILDING CODE 2013 (CBC 2013)

EATON'S B-LINE BUSINESS
509 WEST MONROE STREET | HIGHLAND, IL 62249
P: (800) 851-7415 | F: (800) 356 1438

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SECTION 1

GENERAL NOTES

0.0 PREFACE

THIS OSHPD PRE-APPROVAL OF MANUFACTURER'S CERTIFICATION (OPM) IS BASED ON THE CBC 2013. THE DEMAND (DESIGN FORCES) FOR USE WITH THIS OPM SHALL BE BASED ON THE CBC 2013.

I. SCOPE AND LIMITATIONS:

This pre-approval is for the seismic bracing of interior mechanical, electrical, plumbing and fire protection systems. It does not address other loads such as, but not limited to, those generated by, pressure, fluid dynamics, pipe rupture or movements of equipment that braced components are attached to. It does not address components that cross seismic separations of buildings or components attached to portions of the structure or equipment that will experience relative seismic drifts other than pipe risers. The max S_{DS} utilized for this OPM is $\leq$ 2.5.

II. The ranges of components sizes and material included in the pre-approval are as follows:

A. Pipes:
1. Steel; Sch. 40, 30, 20, 10 - Sizes 1" to 12"
2. Cast Iron Pipe - Sizes 1" to 12"

B. Ducts:
1. Galvanized Rectangular Duct; 18 - 24 gage - Sizes 12"x12" to 120"x60"
2. Galvanized Round Duct; 18 - 24 gage - Sizes 3" to 84"

C. Conduits:
1. Steel Conduit - Size 1/2" to 6"
2. EMT Conduit - Sizes 1" to 4"

D. Fire Sprinklers Pipe:
1. Steel Pipe Sizes:
   - Schedule (LW): 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 3 1/2", 4", 5", 6", 8"
   - Schedule 10: 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 3 1/2", 4", 5", 6", 8"
   - 0.188 (0.188" ≤ Pipe Wall Thickness): 8"
   - Schedule 40: 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 3 1/2", 4", 5", 6", 8", 10", 12"

E. Brace Members:
1. Steel (ASTM A53 Type E Grade B) Schedule 40: 1", 1 1/4", 1 1/2", 3", 3 1/2", 4" NPS.
2. Steel (ASTM A53 Type E Grade B) Schedule 10: 2", 2 1/2" 3", 3 1/2" and 4".
3. Strut Channel, B-Line B22.
4. Pre-Stretched galvanized, 7x19, aircraft cable, 1/8 ",3/16",1/4".

F. Calcium Silicate Shield
1. Pipe Size 1" - 4" B-Line B338 ASTM C533 1" Thickness
2. Pipe Size 5" : B-Line B338 ASTM C533 1-1/2" Thickness
3. Pipe Size 6" and larger : B-Line B338 ASTM C533 2" Thickness

III. The substrates included in this pre-approval are as follows:

A. Concrete
B. Metal Decking
C. Steel
D. Wood

VI. Construction Tolerances:

A. Construction Tolerances shall be as noted on the drawing details and appendices.
B. Construction Tolerance for angles of all braces shall be limited to ±5°, out of plane as shown on page 12-20
E. The recommended brace angle is 45° for the diagonal brace, or 1 (vert.) to 1 (horiz.) brace ratio. However, the brace can be installed between 30°-90° from vertical. See page 12-20.

1.0 INTRODUCTION AND CONDITIONS FOR USE OF THIS MANUAL

I. Seismic bracing design and layout drawings shall be prepared by a Registered Structural Engineer licensed in California with experience in the design of seismic bracing for mechanical, electrical, plumbing and fire protection systems. This Registered Design Professional (RDP) is responsible for:

A. Verifying that the nonstructural components or system is seismically qualified in accordance with CBC 2013.
B. Verifying that the B-Line TOLCO brace system selected meets the seismic requirements of this OPM.
C. Verifying that the structure to which the B-Line bracing system is anchored meets the requirements of the appropriate anchor's approved ICC-ESR Report.
D. Verifying that anchor edge distance and spacing meets the requirements of the applicable ICC-ESR.
E. Verifying that the installation is in conformance with the CBC 2013 and with the details shown in this OPM. Testing of post installed anchors shall also be performed in compliance with CBC 2013, Section 1913A.7.

II. For seismic bracing design per this manual, OSHPD to verify that the seismic force level used for bracing design for the site specific project matches.

III. Modifications and/or changes to the designs shown in this guideline shall be performed or reviewed by a qualified Registered Structural Engineer and approved by the design engineer of record.

IV. When more than one criteria is presented, the more stringent criteria shall be used. The data presented in this manual is subject to change without notice. Refer to the appropriate codes and standards for additional information and requirements.

V. The Structural Engineer of Record (SEOR) shall verify the adequacy of the supporting structure and its components for the loads applied to the supporting structure and its components by the seismic bracing systems, and compliance with the applicable codes and standards.

VI. A copy of this manual and copies of all other details, layouts and calculations shall be at the jobsite and readily available prior to installing the seismic bracing system.

VII. It is the responsibility of the user of this manual to be familiar with all requirements for seismic bracing and shall be proficient in determining and applying utility loads for their application.

VIII. The user of this manual shall determine the spacing and layout for the required bracing. The user shall determine the maximum horizontal, vertical and axial force component of the earthquake demand loads. The user's calculations must take into consideration the increases in loads caused by construction tolerances. Construction tolerances for angles of all braces, in plane or out of plane, from horizontal shall be limited to +/- 5 degrees.

IX. As with all pre-approved details, systems, etc., plans are still required showing how and where this pre-approved anchorage and bracing system will be applied on a project specific basis. This process is needed to verify that the appropriate detail has been selected and applied for each condition and for the actual substrate to which it will be connected/attached to.

X. The SEOR must review and forward the anchorage and bracing plans for plan check with a notation indicating that the plans have been reviewed and they have been found to be in general conformance with the design of the project. A "shop drawing stamp" is usually acceptable for compliance with this requirement. The regional staff, on a project specific basis, must review anchorage and bracing details and supporting calculations that are not part of this pre-approval. Review of anchorage and bracing details of this nature does not constitute a pre-approval that may be used on other projects without the benefit of plan review.

XI. Distribution system (HVAC ducts, pipes and electrical raceways) seismic supports and attachments OPMs:

A. Layout drawings of the supports, attachments, and bracing systems in accordance with approval shall be submitted to the Structural Engineer of Record/Registered Design Professional in responsible charge of the project for review to verify that the details are in conformance with the code requirements. The layout drawings shall as a minimum satisfy the requirements of ASCE 7 Section 13.6 as modified by the 2013 CBC Section 1616A.

a. The Structural Engineer of Record shall verify that the supporting structure is adequate for the forces imposed on it by the supports, attachments, and braces installed in accordance with the pre-approval addition to all other loads.

b. The Structural Engineer of Record shall forward the supports, attachments, and bracing drawings (including construction documents for supplementary framing where required) to the Registered Design Professional in responsible charge with a notation indicating that the drawings have been reviewed and are in general conformance with the pre-approval and the design of the project.

c. A review stamp shall be permitted to be used, by the Structural Engineer of Record, to indicate compliance with this requirement..

d. The Registered Design Professional other than Structural Engineer of Record, may provide the review stamp for small projects at the discretion of the OSHPD.

B. The layout drawings, with the review stamp, shall be submitted to OSHPD, as part of original CDs or as Deferred Submittal Items in accordance with 2013 CAC Section 7-126 and 2013 CBC Section 107.3.4.1 for verification that:

a. Structure supporting the distribution system has adequate capacity;

b. Seismic design forces (F_P) are in accordance with the CBC 2013;

c. Submittal is within the scope of the OPM:
- Size of distribution system components,
- Spacing of bracing and flexible joints, and
- Substrate for attachments

C. The layout drawings with the review stamp, shall be kept on the jobsite to be used for installation of the support and bracing.
- The approved agency/inspector of record shall provide inspection in accordance with CBC Sections 1704 or 1704A/CAC Section 7-145.
- OSHPD field staff will review/inspect the installation in accordance with CAC Section 7-147.

D. The Structural Engineer of Record shall design any supplementary framing that is needed to resist the loads, maintain stability and/or is required for installation of pre-approved system.
- The supplementary framing shall be submitted to OSHPD as part of original Construction Documents or as a Deferred Submittal Items shall be listed on the cover page of the original Construction Documents.

E. A copy of the chosen bracing system(s) installation guide/OPM manual shall be on the jobsite prior to starting the installation of hangers and/or braces.
- The approval agency/inspector shall maintain an approved copy of the OPM (obtained from OSHPD website) in accordance with CAC Section 7-145 Item # 4.

1.0 INTRODUCTION AND CONDITIONS FOR USE OF THIS MANUAL (CONTINUED)

F. Components of two or more pre-appvoed bracing systems shall not be mixed.
- Only one pre-approved bracing system may be used for a run of pipe, duct or raceway.
- Any substitution of component of an OPM system shall require OSHPD review and approval.

XII. Components of two or more pre-approved bracing systems shall not be mixed. Only this pre-approval may be used for the design of seismic bracing. Any substitution of component of this pre-approval shall require OSHPD review, approval and testing matching the OSHPD requirements.

XIII. Section 10 of this manual has been pre-approved by OSHPD for fire protection systems. The rest of this manual is applicable to Mechanical, Electrical, Plumbing, as well as, Fire Protection Systems.

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1.0 INTRODUCTION AND CONDITIONS FOR USE OF THIS MANUAL (CONTINUED)

XIV. This manual is prepared as a guideline for seismic bracing design for piping, ducts, conduits, cable trays and other systems. Following is an outline of the manual:

Section 1 - General Information. Presents general notes and requirements for seismic bracing of mechanical, electrical, fire protection and plumbing systems. It also includes a general step by step procedure for seismic bracing design using this manual.

Section 2 - Single Hanger Rigid Brace Details. Includes seismic bracing details for individually hung systems using rigid brace members.

Section 3 - Single Hanger Rigid Brace Spacing Charts. Presents seismic brace spacing charts for individually hung systems using rigid brace members. It includes structural attachments to concrete slabs, steel deck with sand lightweight concrete, steel beams, bar joists and wood beams.

Section 4 - Trapeze Rigid Brace Details. Includes seismic bracing details for trapeze assemblies for piping, ducts, conduits, cable trays, bus ducts, equipment and others using rigid brace members.

Section 5 - Trapeze Rigid Brace Spacing Charts. Presents seismic brace spacing charts for trapeze assemblies for piping, ducts, conduits, cable trays, bus ducts, equipment and others using rigid brace members. It includes structural attachments to concrete slabs, steel deck with sand lightweight concrete, steel beams, bar joists and wood beams.

Section 6 - Single Hanger Cable Brace Details. Includes seismic bracing details for individually hung systems using cable braces.

Section 7 - Single Hanger Cable Brace Spacing Charts. Presents seismic brace spacing charts for individually hung systems using cable braces. It includes structural attachments to concrete slabs, steel deck with sand lightweight concrete, steel beams, bar joists and wood beams.

Section 8 - Trapeze Cable Brace Details. Includes seismic bracing details for trapeze assemblies for piping, ducts, conduits, cable trays, bus ducts, equipment and others using cable braces.

Section 9 - Trapeze Cable Brace Spacing Charts. Presents seismic brace spacing charts for trapeze assemblies for piping, ducts, conduits, cable trays, bus ducts, equipment and others using cable braces. It includes structural attachments to concrete slabs, steel deck with sand lightweight concrete, steel beams, bar joists and wood beams.

Section 10 - OSHPD Approved Tolco Fire Protection OPM. Includes full copy of TOLCO OPM-0052-13, approved by OSHPD on 5/06/2014, for reference and use for fire protection systems.

Section 11 - Structural Attachments. Shows structural attachment details and allowable loads for attaching hanger rod and seismic bracing to supporting structure. It includes structural attachments to concrete slabs, steel deck with sand lightweight concrete, attachments to steel beams and bar joists, attachments to wood beams, and others.

Section 12 - Seismic Brace Components . Includes details and allowable loads for seismic bracing components used in the seismic bracing design. Components include brace attachment fitting, rod stiffening requirements, clevis bolt spacer details, and others.

Section 13 - Seismic Hanger Components . Includes details and allowable loads for seismic hanger components for single hung and trapeze hung assemblies.

Section 14 - Seismic Bracing Maximum Spacing Tables. Includes maximum seismic bracing spacing for various pipe and conduit types.

Section 15 - Special Seismic Floor Support Details . Includes details and allowable loads for various seismic floor support configurations.

Section 16 - Special Seismic Wall Support Details . Includes details and allowable loads for various seismic wall support configurations.

Section 17 - Special Seismic Riser Support Details . Includes details and allowable loads for various seismic riser support configurations.

Section 18 - Special Seismic Support Details . Includes details and allowable loads for various seismic support configurations.

2.0 BUILDING CODES, STANDARDS, & GUIDELINES

I. The Eaton B-LineTolco Seismic Restraint Guidelines are designed to meet or exceed the requirements of the following:

- 2013 California Building Code (CBC2013)
- ANSI / AF & PA NDS - 2012
- 2013 National Fire Protection Association Pamphlet 13 (NFPA-13-2013)
- American Concrete Institute (ACI 318-11)
- American Society of Civil Engineers (ASCE 7-10) including Supplement No. 1
- American Society of Mechanical Engineers (ASME B31E)
- American Institute of Steel Construction (ANSI/AISC 360-10)

These guidelines are intended to describe seismic restraints for the piping industry's most commonly used single rod pipe hangers for up to 12-inch pipe and mechanical/plumbing/electrical trapeze supports up to 12 feet wide. Spacing charts provided show pipe sizes and maximum loads based on the following:

- 1" through 4" sch. 40 steel, water filled w/ 1" insulation
- 5" through 12" sch. 40 steel, water filled w/ 1 1/2" insulation

For other piping, piping w/ additional weights such as flanges, and other mechanical/plumbing/electrical systems, determine bracing design based on maximum weight per foot equivalent to the total weight including additional weights.

3.0 SEISMIC BRACING GENERAL REQUIREMENTS - MECHANICAL & PLUMBING PIPING

$$a_P = 2.5;\ R_P = 3.0\ (6.0\ \text{MAX});\ S_{DS} = 2.5;\ \Omega_0 = 2.5;\ I_P = 1.5;\ z/h = 1$$

The above parameters for this section are worst case and apply to mechanical/plumbing piping and tubing of low (cast iron, glass, and non-ductile plastics), limited, or high deformability materials whether in accordance with ASME B31 or not. Joints can be threaded, bonded, compression coupling, grooved coupling, welded or brazed, per ASCE/SEI 7-10, Table 13.6-1. For additional factors for different systems see ASCE/SEI 7-10, Table 13.6-1.

I. Seismic restraints are required for the following piping installations:

A. All piping 1 1/4" diameter and larger where Seismic Design Category is D thru F and Ip is equal to 1.5.
B. All piping and trapeze supported piping weighing more than 10 lbs/ft with Ip of equal to 1.5 in Seismic Design Category D thru F.
C. Trapeze supported piping that would require seismic bracing if supported individually.

Exceptions:
Seismic restraints are not required where either condition i. or ii. below is met:

i. All piping suspended by individual hanger rods where hanger in piping run is 12 inches or less in length from the top of pipe to the bottom of the support structure where hanger is connected. (See Page 1-8a)

ii. Trapeze supported systems suspended 12 inches or less from the top of the trapeze to the bottom of the support structure where trapeze is connected. (See Page 1-8a)

In both exceptions above, all of the hangers of a run must comply with the 12-inch rule or bracing is required.

The 12-inch rod rule exception has additional requirements:

a. Lateral motion of the piping will not cause impact with other systems (e.g. other pipe, duct, or electrical systems, equipment, structural members etc., or fragile appurtenances such as sprinkler heads or lighting fixtures) or loss of system vertical support.
b. Piping must be made of ductile material with ductile connections (e.g. welded steel pipe, etc.)
c. Vertical rod hanger top connections to the building structure cannot develop moments. Moments may be eliminated by using swivel attachments or by other means.

II. Transverse bracing shall be provided at 40 ft. maximum spacing (unless reduced spacing is required per Section 3,5,7,9, and 14) for welded steel pipe, or grooved piping with UL 213 listed connections. Rigid grooved coupling listed for UL Standard 213 shall be permitted in horizontal run of pipe. Flexible grooved coupling listed for UL Standard 213 shall be permitted in vertical risers (to accommodate drift) and other locations (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.

III. Longitudinal bracing shall be provided at 80 ft. maximum spacing (unless reduced spacing is required per Section 3,5,7,and 9) for welded steel pipe, or grooved piping with UL 213 listed connections. Rigid grooved coupling listed for UL Standard 213 shall be permitted in horizontal run of pipe. Flexible grooved coupling listed for UL Standard 213 shall be permitted in vertical risers (to accommodate drift) and other locations (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. Maximum longitudinal brace spacing shall not exceed two times (2x) maximum transverse brace spacing.

IV. Cast iron pipe (No-Hub pipe) brace spacings shall not exceed the spacings tabulated in Section 14. No-hub couplings shall be manufactured in accordance with ASTM C1540, shall be certified in accordance with FM 1680 Class 1 and gravity hangers shall be spaced per the requirements of Table 313.1 of the 2013 California Plumbing Code (CPC 2013) for no-hub cast iron pipe.

Exception: Cast iron (No-hub) pipe joined by couplings not satisfying ASTM C1540 or not certified in accordance with FM 1680 Class 1 shall be designed on a project by project basis, and shall require project specific OSHPD approval.

V. Brace No-Hub piping on each side of 90 degree horizontal change in direction, both in transverse and longitudinal directions.

VI. When determining horizontal load requirements, consider all pipes full of water unless calculated for other substances.

VII. Seismic bracing shall not limit the expansion and contraction of the piping system. When thermal expansion or contraction is involved, longitudinal bracing shall be designed at the anchor point of the piping system. The longitudinal bracing and the connections must be capable of resisting the additional force induced by expansion and contraction designed by a Registered Design Professional (RDP) on a project-specific basis, since it is outside the scope of this OPM.

VIII. All braces shall be located at or within 6" of the vertical support. Provide rod stiffener for vertical support where required by Pages 12-16 or 12-17.

IX. When bracing trapeze supports, the bracing shall be attached directly to the trapeze with piping secured to the trapeze with approved components. At transverse brace locations, a minimum of one transverse brace is required per trapeze. At longitudinal brace locations, a minimum of two longitudinal braces are required per trapeze, one at each vertical support or rod. At trapeze locations where both transverse and longitudinal seismic bracing is required, both conditions apply.

X. Stacked trapezes supported by the same rods shall be braced independently from one another. The rod supports in each section may require stiffening (See page 4-21, 4-22, 4-23, 8-21, 8-22, 8-23, 12-16, 12-17).

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3.0 SEISMIC BRACING GENERAL REQUIREMENTS - MECHANICAL & PLUMBING PIPING (CONTINUED)

XI. Bracing installed on smaller piping shall not be used to brace larger piping.

XII. A piping system shall not be braced to different parts of the building that may respond differently during seismic activity.

XIII. See page 12-20 for Maximum Brace Member Lengths.

XIV. The following Tolco products were engineered with torque indicators to ensure proper installation:

A. Fig. 909 No-Thread Swivel Sway Brace Attachments have a connecting bolt head that bottoms out.
B. Fig. 980 & Fig. 981 Universal Swivel Sway Brace Attachments have break-off bolt heads.
C. Fig. 985 & Fig. 986 Swivel Sway Brace Attachments have break-off bolt heads.
D. Fig. 990 & Fig. 991 Cable Sway Brace Attachments have break-off nuts.
E. Fig. 1000 Sway Brace Attachments have material that flattens out or comes together to ensure proper engagement.
F. Fig. 1001 Sway Brace Attachment has bolt heads that bottom out.
G. Fig. 800, Fig. 825, & Fig. 828 Adjustable Sway Brace Attachment to Steel and Bar Joist have break-off bolt heads.
H. Fig. 4L & Fig. 4LA Sway Brace Attachments have break-off bolt heads.

XV. Continue with "Seismic Bracing Layout - General Requirements" on pages 1-14 to 1-17.

XVI. Rigid grooved coupling listed for UL Standard 213 shall be permitted in horizontal run of pipe. Flexible grooved coupling listed for UL standard 213 shall be permitted in vertical risers (to accommodate drift) and other locations (e.g., seismic separation, equipment nozzle, etc.) to accommodate all movement and/or rotation. Non-UL listed groove couplings shall not be used unless approved on project specific basis. See also Notes II and III on Pages 1-6 and 1-7.

XVII. Notes on Vertical Risers:

A. Vertical piping systems supported at each floor shall be considered seismically braced if the penetration through each floor is tightly packed with approved firestops, satisfying NFPA 13-13 Section 9.3.5.8.5 and the floor to floor spacing does not exceed the maximum brace spacing tabulated in section 14. Top of risers exceeding 3 feet shall be provided with a 4-way brace. Where the 4-way brace is attached to the horizontal piping, it shall be installed within 2 feet of the centerline of the riser.

B. Vertical pipe riser in an open shaft must be attached to steel supports with both steel supports and connections sized to accept the combined gravity and seismic loads. Thermal loads shall be considered, where applicable. Lateral seismic restraint spacing shall not exceed the spacings tabulated in Section 14. Supports and connections must be engineered on a job by job basis subject to approval by the enforcement agency. Seismic relative displacement between floors shall be considered in the design.

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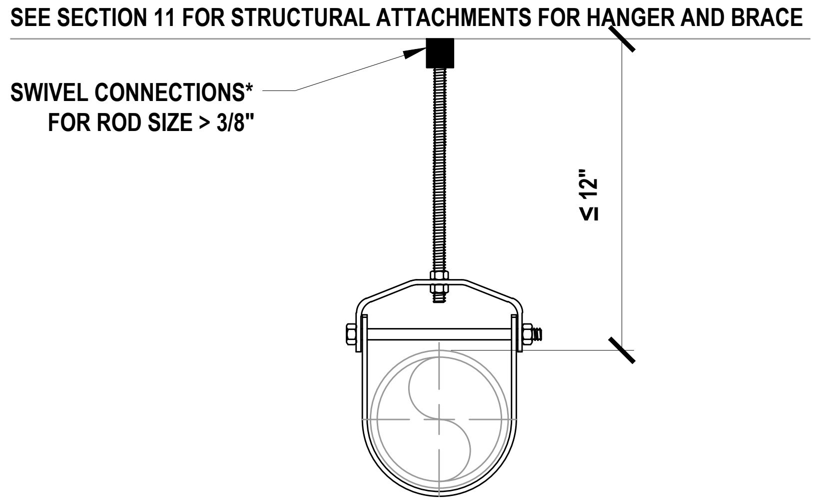
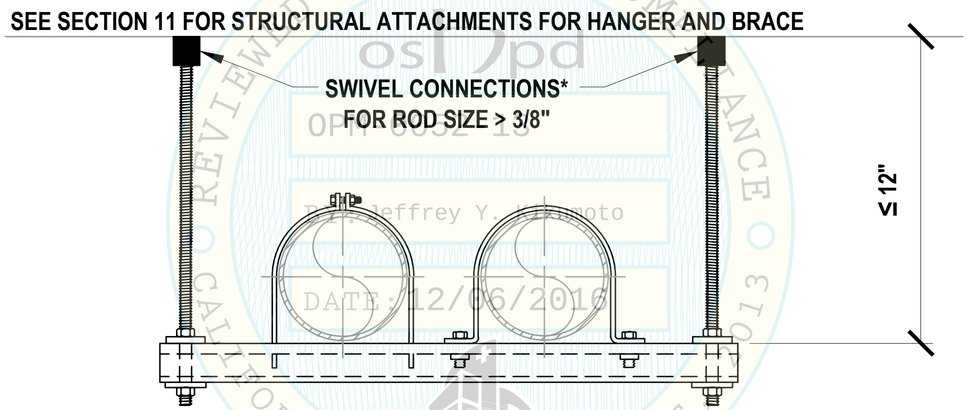
C. Vertical pipe risers subject to thermal expansion or contraction may be engineered to allow pipe movement and reduce load transfer between floors. Sliding guides and/or resilient anchors shall be employed to allow or control thermal movement while designed to accept seismic loads at maximum spacings tabulated in Section 14. Pipe penetrating cored holes at floor levels that are lightly packed may be considered as pipe guides. Where insulated pipes penetrate cored holes used as guides. a hard insulation insert that exceeds the floor depth at each end is required. Riser clamps or brackets shall be designed to transfer resultant horizontal and vertical loads from the pipe to the supports. Supports and connections must be engineered on a job by job basis subject to approval by the enforcement agency.

12" RULE FOR SUSPENDED PIPING



CLEVIS HUNG PIPE



PIPES ON TRAPEZE

*NOTE: CONNECTIONS COMPLYING INCLUDE SWIVEL JOINT, EYE BOLTS, ETC.

EATON Powering Business Worldwide
EATON'S B-LINE BUSINESS
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P: (800) 851-7415 | F: (800) 356 1438

MRH
Structural Engineer: Mohammad Hariri
California SE No. S3545

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DATE: NOVEMBER 29, 2016

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4.0 SEISMIC BRACING GENERAL REQUIREMENTS - FIRE PROTECTION PIPING

$$a_P = 2.5;\ R_P = 4.5;\ S_{DS} = 2.5;\ \Omega_0 = 2.5;\ I_P = 1.5;\ z/h = 1$$

The above parameters for this section are worst case and apply to Fire Protection piping of limited, or high deformability materials whether in accordance with ASME B31 or not. Joints can be threaded, bonded, compression coupling, grooved coupling, welded or brazed, per ASCE/SEI 7-10, Table 13.6-1. See also Section 10. For additional factors for different systems see ASCE/SEI 7-10, Table 13.6-1.

I. Lateral (transverse) Seismic Bracing is required for the following fire protection piping:

A. For Seismic Design Category C, D, E, or F, and Ip is equal to 1.5.
1. All mains.
2. All cross mains.
3. All branch lines 2 1/2" and larger
4. The last length of pipe at the end of a feed or cross main shall be provided with a lateral brace.

II. Transverse bracing shall be provided at 40 ft. maximum spacing (unless reduced spacing is required per Section 3,5,7,9, and 14) for welded steel pipe.

A. Lateral (transverse) seismic bracing is to protect piping against movement perpendicular to the run of pipe.
B. Lateral (transverse) seismic bracing shall be spaced at a maximum of 40' for piping (2 1/2" diameter and larger) constructed of ductile materials (e.g. Steel); 30' maximum span (piping smaller than 2 1/2" diameter).
C. A lateral (transverse) seismic brace placed on the pipe run section at the opposite side of an elbow withiN 24" may act as a longitudinal brace. For an example, see Section 10, Page 1-9.
D. The minimum required bracing for runs longer than 5' is a transverse brace at each end, and a longitudinal brace at one of those two positions. For an example, see Section 10, Page 1-9.
E. Rigid grooved couplings listed for UL Standard 213 shall be permitted in horizontal runs of pipe. Flexible grooved couplings listed for UL Standard 213 shall be permitted in vertical risers (to accommodate drift) and at other locations (e.g. seismic separations, equipment nozzles, etc.) to accommodate small movement and/or rotation. Non-UL listed grooved couplings shall not be used unless approved on a project specific basis.

Exceptions:
All piping suspended by individual hanger rods 6 inches or less in length from the top of the pipe to the bottom of the support structure where hanger is connected. All of the hangers of a run must comply with the 6 inch rule or bracing is required.

III. Longitudinal bracing shall be at 80 ft. maximum spacing (unless reduced spacing is required per Section 3,5,7,9) for welded steel pipe.

A. Longitudinal seismic bracing is to protect piping against movement parallel to the run of pipe.
B. Longitudinal seismic bracing shall be spaced a maximum of 80' for piping (2 1/2" diameter and larger) constructed of ductile materials (e.g. Steel); 60' maximum span (piping smaller than 2 1/2" diameter) for an example, see Section 10, Page 1-9.
C. Each pipe run shall have at least one longitudinal brace, additional longitudinal braces are required when the maximum longitudinal spacing is exceeded. For an example, see Section 10, Page 1-9.

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4.0 SEISMIC BRACING GENERAL REQUIREMENTS - FIRE PROTECTION PIPING (CONTINUED)

IV. When determining horizontal load requirements, follow NFPA 13 Zone of Influence requirements.

V. A piping system shall not be braced to different parts of the building that may respond differently during seismic activity.

VI. The following Tolco products were engineered with torque indicators to ensure proper installation:

A. Fig. 980 Universal Swivel Sway Brace Attachments have a break-off bolt head.
B. Fig. 1000 Sway Brace Attachments have material that flattens out or comes together to ensure proper engagement.
C. Fig. 1001 Sway Brace Attachments have bolt heads that bottom out.
D. Fig. 800, Fig. 825 & Fig. 828 Adjustable Sway Brace Attachments to Steel and Joist have break-off bolt heads.
E. Fig. 4L and 4LA Braced Pipe Attachments have break-off bolt heads.

VII. Refer to the appropriate codes and standards for additional information and requirements.

VIII. See Section 10, Appendix A, Pages 5-7 thru 5-9 for lateral sway bracing tables.

IX. Vertical Offsets / Risers:

A. Tops of vertical offsets/risers exceeding 3' in length shall be provided with a four-way brace. Bracing shall be located within 24" of the end of the vertical run. Refer to partial isometric on page 10-1-10.
B. Distance between four-way braces for risers shall not exceed 25'.

X. Continue with "Seismic Bracing Layout - General Requirements" on pages 1-14 to 1-17.

5.0 SEISMIC BRACING GENERAL REQUIREMENTS - DUCTS

$$a_P = 2.5;\ R_P = 3.0;\ S_{DS} = 2.5;\ \Omega_0 = 2.5;\ I_P = 1.5;\ z/h = 1$$

The above parameters for this section are worst case and apply to all ductwork of low (cast iron, glass, and non-ductile plastics), limited, or high deformability materials. Joints can be welded or brazed, or other than welded or brazed, per ASCE/SEI 7-10, Table 13.6-1. For additional factors for different systems see ASCE/SEI 7-10, Table 13.6-1.

I. Seismic restraints are required for the following duct installations:

A. All ducts having a cross-sectional area in excess of 6 sq. ft. or round ducts with diameter 33" or larger where Seismic Design Category D thru F and Ip is equal to 1.5.
B. Equipment installed independently of the duct system or is within a run of duct weighing 75 lbs or more where Seismic Design Category D thru F and Ip is equal to or greater than 1.5.
C. Duct designed to carry toxic, highly toxic, or explosive gases, or used for smoke control shall be designed and braced without exceptions.

Exceptions:
Seismic restraints are not required where either condition i. or ii. below are met:

i. All ducts suspended by hanger straps 12 inches or less in length from the duct support point to the bottom of the support structure where the hanger is connected. The strap hangers must be attached within 2 inches of the top of the duct with a minimum of two #10 sheet metal screws. (See Page 1-11a)

ii. Trapeze supported systems suspended 12 inches or less from the duct support point to the bottom of the support structure where trapeze is connected. (See Page 1-11a)

In both exceptions above, all of the hangers in a run must comply with the 12-inch rule or bracing is required.

The 12-inch rule exception has the following additional requirements:

a. Lateral motion of duct will not cause impact with other systems (e.g. other duct, pipes or electrical systems, equipment, structural members etc., or fragile appurtenances such as sprinkler heads or lighting fixtures) or loss of system vertical support.
b. Duct must be made of ductile material with ductile connections.
c. Vertical rod hanger top connections to the building structure cannot develop moments. Moments may be eliminated by using swivel attachments or other means.

II. Transverse bracing shall be provided at 30 ft. maximum spacing (unless reduced spacing is required per Section 2 thru 9).

II. Longitudinal bracing shall be provided at 60 ft. maximum spacing (unless reduced spacing is required peR Section 2 thru 9).

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5.0 SEISMIC BRACING GENERAL REQUIREMENTS - DUCTS (CONTINUED)

IV. Duct bracing for square, rectangle or oval duct shall consist of a trapeze support with two support rods to carry the gravity dead load. The trapeze must have a support member connected to the top of the duct and to the bottom of duct. Both trapeze members shall be connected to the duct with #10 sheet metal screws spaced at maximum 12" O.C. Support rods shall be stiffened where required by the following pages: 4-21, 4-22, 4-23, 8-21, 8-22, 8-23, 12-16, 12-17. Transverse and/or longitudinal bracing shall then be attached to the top of the upper trapeze member.

V. Wall penetrations may be considered transverse bracing where duct is tightly blocked unless smoke dampers are installed in the wall, subject to approval by SEOR. Penetrations can be through full height partitions or structural walls. Gap between duct and wall shall not exceed 1/8". Solid blocking shall be provided around duct penetrations at all stud wall construction. Walls must be confirmed adequate by the SEOR on a project specific basis.

VI. Ducts may be combined on a single support and braced based on their combined weight.

VII. Floor penetrations of vertical duct may be considered transverse and longitudinal brace locations where duct is tightly blocked, no smoke dampers are installed, and change in direction does not exceed the maximum allowable offset length (See Note IV, on Page 1-14) as measured from the floor penetration to the inside of a 90 degree turn.

VIII. See page 12-20 for Maximum Brace Member Lengths.

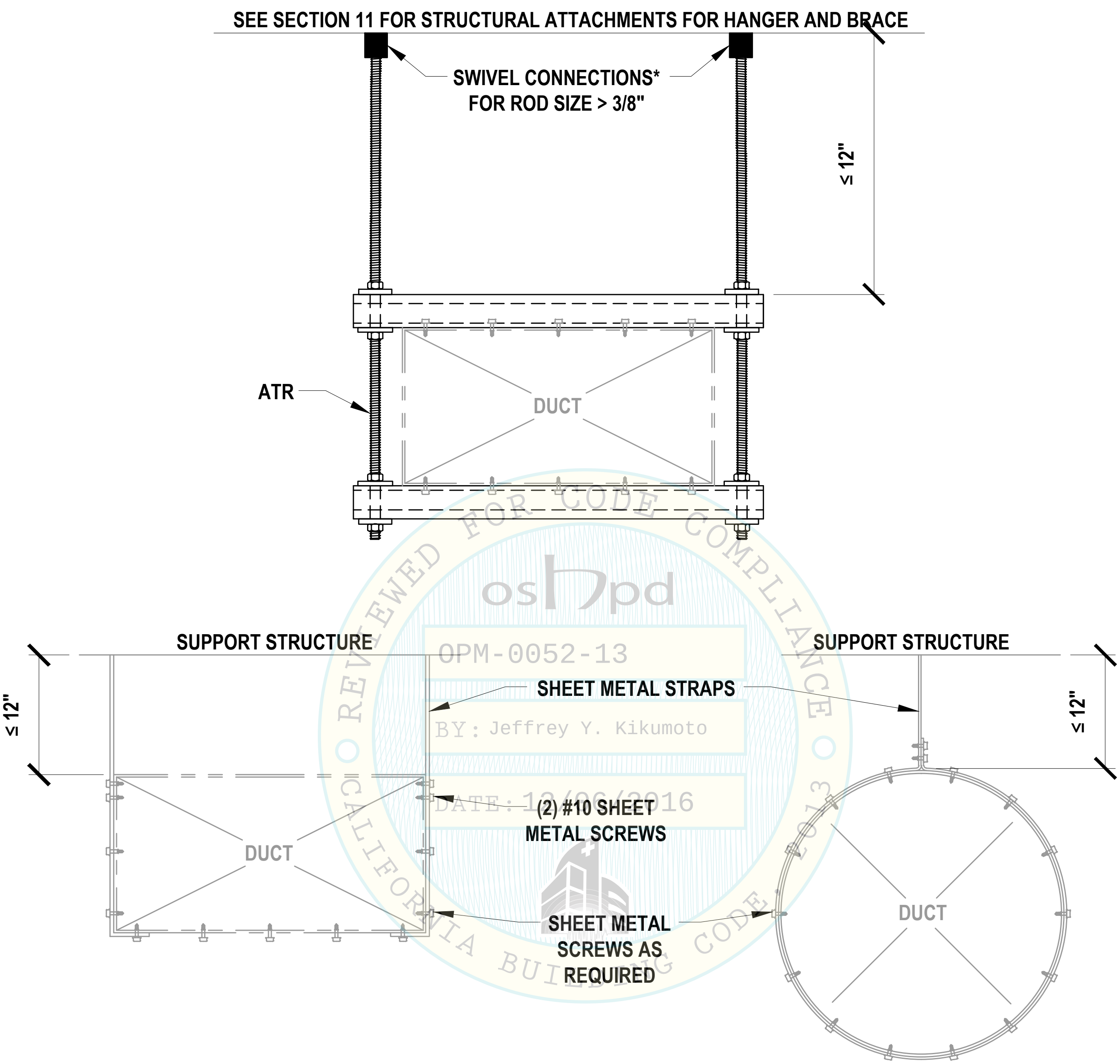
IX. The following Tolco products were engineered with torque indicators to ensure proper installation:

A. Fig. 909 No-Thread Swivel Sway Brace Attachments have a connecting bolt head that bottoms out.
B. Fig. 980 & Fig. 981 Universal Swivel Sway Brace Attachments have break-off bolt heads.
C. Fig. 985 & Fig. 986 Swivel Sway Brace Attachments have break-off bolt heads.
D. Fig. 990 & Fig. 991 Cable Sway Brace Attachments have break-off nuts.
E. Fig. 1000 Sway Brace Attachments have material that flattens out or comes together to ensure proper engagement.
F. Fig. 1001 Sway Brace Attachment has bolt heads that bottom out.
G. Fig. 800, Fig. 825, Fig. 825A & Fig. 828 Adjustable Sway Brace Attachment to Steel and Bar Joist have break-off bolt heads.
H. Fig. 4L & Fig. 4LA Sway Brace Attachments have break-off bolt heads.

X. For additional information and requirements refer to the appropriate codes and standards as listed on Page 1-5, Part 2.0, Note I.

XI. Continue with "Seismic Bracing Layout - General Requirements" on pages 1-14 to 1-17.

12" RULE FOR SUSPENDED DUCTWORK



*NOTE: CONNECTIONS COMPLYING INCLUDE SWIVEL JOINT, EYE BOLTS, ETC.

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PAGE: 1-11a
DATE: NOVEMBER 29, 2016

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6.0 SEISMIC BRACING GENERAL REQUIREMENTS - ELECTRICAL SYSTEMS

$$a_P = 2.5;\ R_P = 6.0;\ S_{DS} = 2.5;\ \Omega_0 = 2.5;\ I_P = 1.5;\ z/h = 1$$

The above parameters for this section are worst case and apply to Electrical Conduit and Cable Trays, per ASCE/SEI 7-10, Table 13.6-1. For additional factors for different systems see ASCE/SEI 7-10, Table 13.6-1.

I. Seismic restraints are required for the following electrical installations:

A. All conduits 3" diameter and larger where Seismic Design Category is D thru F and Ip is equal to 1.5.
B. All conduits, cable trays and trapeze assemblies weighing 10 lbs./ft. or more where Seismic Design Category is D thru F and Ip is equal to 1.5.
C. Trapeze supported conduit that would require seismic bracing if supported individually.

Exceptions:
Seismic restraints are not required where either condition i. or ii. below are met:

i. All conduit or cable trays suspended by individual hanger rods 12 inches or less in length from the top of the support point to the bottom of the support structure where hanger is connected. (See Page 1-13a).

ii. Trapeze supported systems suspended 12 inches or less from the top of the trapeze support point to the bottom of the support structure where trapeze is connected. (See Page 1-13a).

In both exceptions above, all of the hangers of a run must comply with the 12-inch rule or bracing is required.

The 12-inch rod rule exception has the following additional requirements:

a. Lateral motion of the electrical system will not cause impact with other systems (e.g. other electrical systems, piping, duct, equipment, structural members etc., or fragile appurtenances such as sprinkler heads or lighting fixtures) or loss of system vertical support.

b. Electrical system must be made of ductile material with ductile connections.

c. Vertical rod hanger top connections to the building structure cannot develop moments. Moments may be eliminated by using swivel attachments or by other means.

II. Transverse bracing shall be provided at 40 ft. maximum spacing (unless reduced spacing is required per Section 2 thru 9, and 14).

III. Longitudinal bracing shall be provided at 80 ft. maximum spacing (unless reduced spacing is required per Section 2 thru 9). Maximum longitudinal brace spacing shall not exceed (x2) maximum transverse brace spacing (S).

IV. Conduits constructed of non-ductile materials such as EMT, shall have the maximum brace spacing reduced, if necessary so as not to exceed spacings of either Notes II and III above, nor Section 14.

V. All braces shall be located at or within 6" of a vertical support. Provide rod stiffener for vertical support where required by Pages 12-16 or 12-17.

6.0 SEISMIC BRACING GENERAL REQUIREMENTS - ELECTRICAL SYSTEMS (CONTINUED)

VI. When bracing trapeze supports, the bracing shall be attached directly to the trapeze, with conduits or cable trays secured to the trapeze with straps, conduit clamps, or cable tray clips bolted to B-Line strut, as detailed in this OPM. At transverse brace locations, a minimum of one transverse brace is required per trapeze. At longitudinal brace locations, a minimum of two longitudinal brace are required per trapeze, one at each vertical support, or rod. At locations where both transverse and longitudinal seismic bracing is required, both conditions apply.

VII. Stacked trapezes supported by the same rods shall be braced independently from one another. The rod supports in each section may require stiffening. (See pages 4-21, 4-22, 4-23, 8-21, 8-22, 8-23, 12-16, 12-17)

VIII. See page 12-20 for Maximum Brace Member Lengths.

IX. The following Tolco products were engineered with torque indicators to ensure proper installation:

- A. Fig. 909 No-Thread Swivel Sway Brace Attachments have a connecting bolt head that bottoms out.
- B. Fig. 980 & Fig. 981 Universal Swivel Sway Brace Attachments have break-off bolt heads.
- C. Fig. 985 & Fig. 986 Swivel Sway Brace Attachments have break-off bolt heads.
- D. Fig. 990 & Fig. 991 Cable Sway Brace Attachments have break-off nuts.
- E. Fig. 1000 Sway Brace Attachments have material that flattens out or comes together to ensure proper engagement.
- F. Fig. 1001 Sway Brace Attachment has bolt heads that bottom out.
- G. Fig. 800, Fig. 825, Fig. 825A & Fig. 828 Adjustable Sway Brace Attachment to Steel and Bar Joist have break-off bolt heads.
- H. Fig. 4L & Fig. 4LA Sway Brace Attachments have break-off bolt heads.

X. For additional information and requirements refer to the appropriate codes and standards as listed on Page 1-5, Part 2.0, Note I.

XI. Continue with "Seismic Bracing Layout - General Requirements" on pages 1-14 to 1-17.

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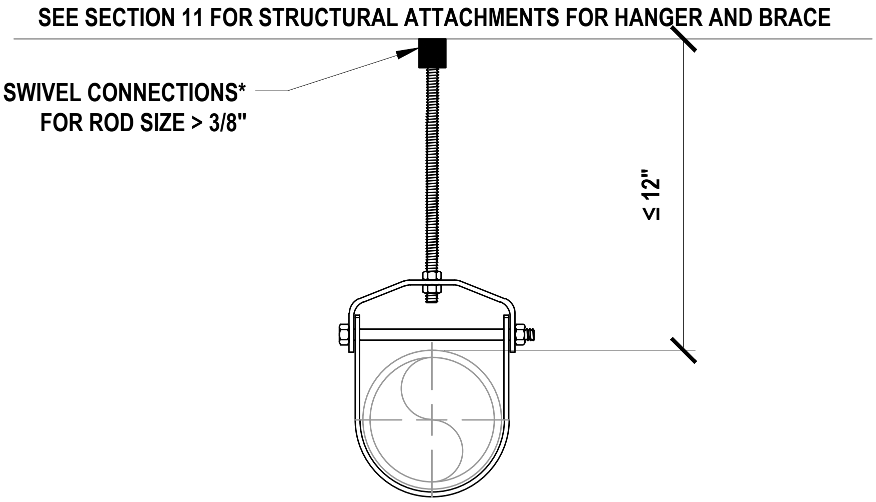
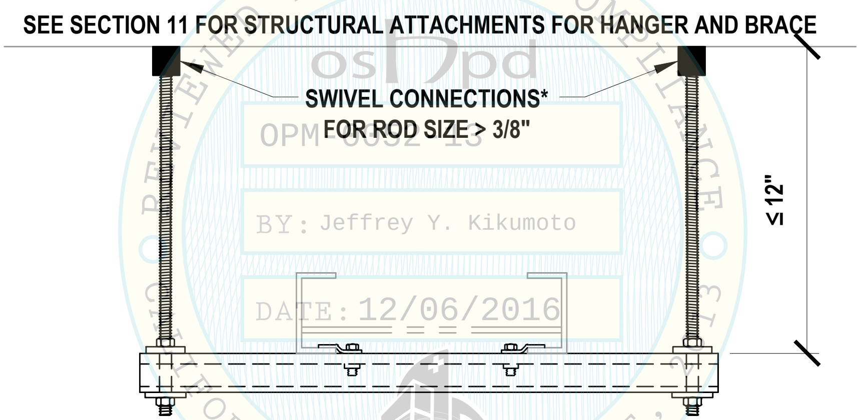
12" RULE FOR SUSPENDED RACEWAYS



CLEVIS HUNG CONDUIT



CONDUIT OR CABLE TRAY ON TRAPEZE

*NOTE: CONNECTIONS COMPLYING INCLUDE SWIVEL JOINT, EYE BOLTS, ETC.

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7.0 SEISMIC BRACING LAYOUT - GENERAL REQUIREMENTS

I. The Eaton B-Line TOLCO Seismic Restraint Guidelines provides for the protection of suspended pipe, ducts and electrical systems and equipment against excessive movement due to seismic forces.

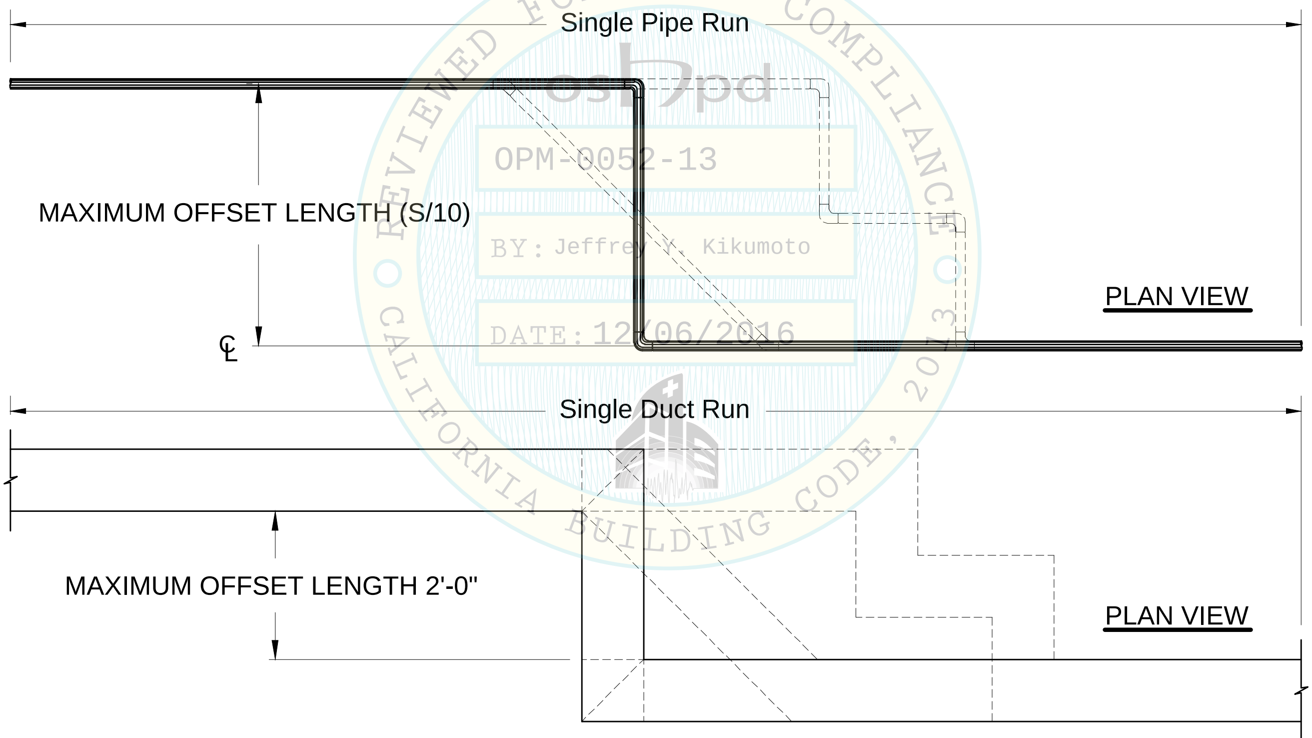
II. The seismic restraint assemblies in this guideline are designed to simultaneously resist vertical loads due to the weight of the component and its contents and both horizontal and vertical seismic loads.

III. Horizontal loads are braced with two types of seismic restraints;

A. Transverse Brace to protect pipe, duct, or electrical conduit and cable tray against movement perpendicular to its run.

B. Longitudinal Brace to protect pipe, duct, or electrical conduit and cable tray against movement parallel to its run.

IV. A run of pipe, duct or electrical system is defined as a straight length. If there occurs an offset(s) between changes of direction it may be neglected if the distance perpendicular to the run is less than the maximum offset length, S/10, where S is the maximum transverse brace spacing tabulated in Section 14 less any reductions from Sections 2 thru 13. For ductwork the maximum offset length shall be less than 2 feet (inside-to-inside). See detail below.



NOTE: When a run of pipe, duct or electrical system that requires bracing transitions down to a size that does not, the point of transition is considered the end of the run and will require a transverse brace.

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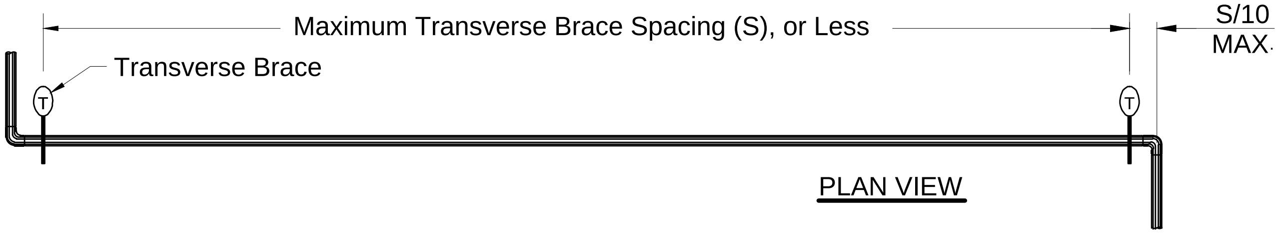
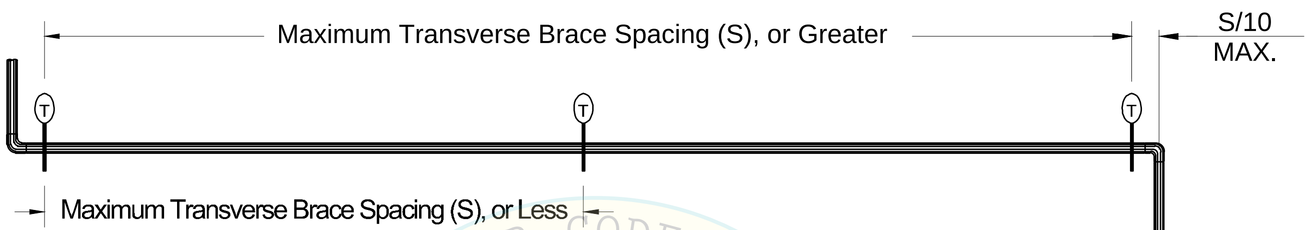
7.0 SEISMIC BRACING LAYOUT - GENERAL REQUIREMENTS (CONTINUED)

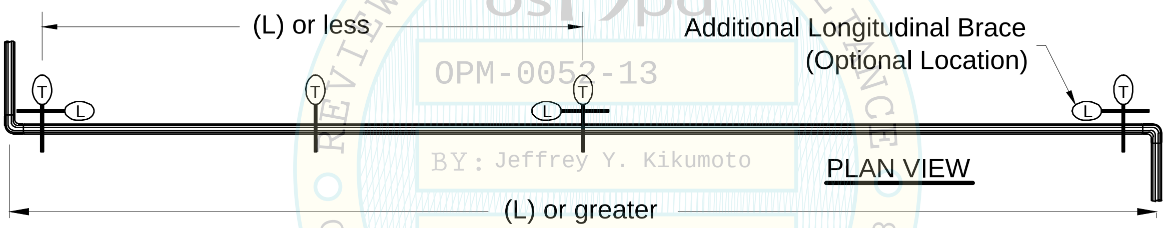
V. Each run of pipe, duct, electrical conduit, cable tray and others requires a minimum of two transverse braces one at each end of the run.



VI. If the distance between the two transverse braces exceeds the maximum allowable spacing (S), add transverse braces as needed.



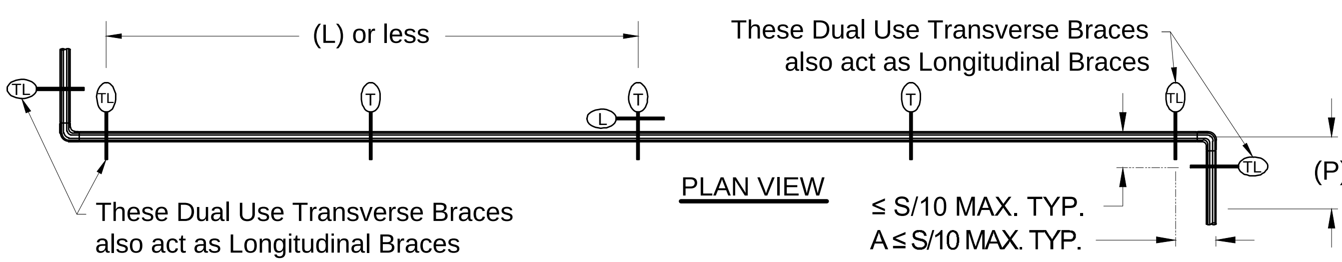
VII. Each run of pipe, duct, electrical system, cable tray and others must have at least one longitudinal brace. If the maximum allowable longitudinal spacing (L), is exceeded then add longitudinal braces to meet the spacing requirement. (L) shall not exceed 2x(S).



VIII. Each run of pipe, duct, electrical system, cable tray and others requires a minimum of one longitudinal brace. However, a transverse brace placed on the run section at the opposite side of an elbow or tee within S/10 MAX. may act as a longitudinal brace, and can be referred to as a "DUAL USE" brace. Dual Use Braces are to be designed for worst case of longitudinal or transverse loading. Distance to first longitudinal brace around corner (P) shall not exceed maximum longitudinal spacing (L), minus S/2, minus A. See layout example below.

A. Longitudinal and Longitudinal "DUAL USE" braces on single supported pipe or conduit shall be attached directly to the pipe or conduit.

B. Bracing installed to smaller piping shall not be used to brace larger piping.



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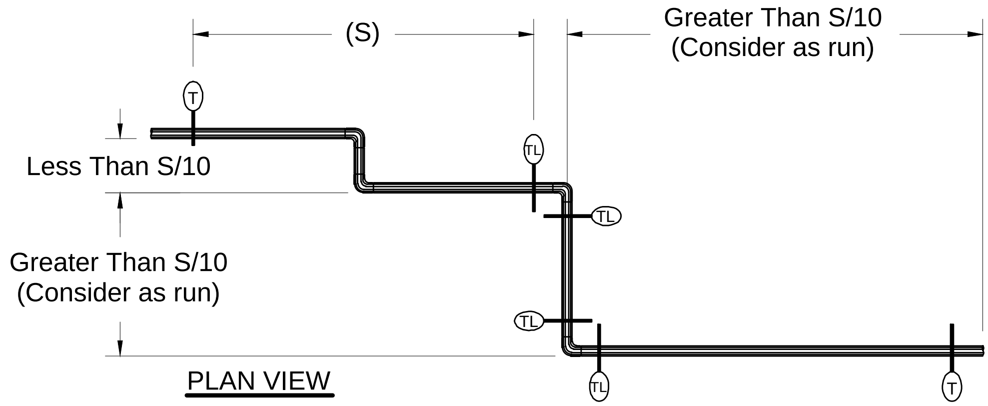
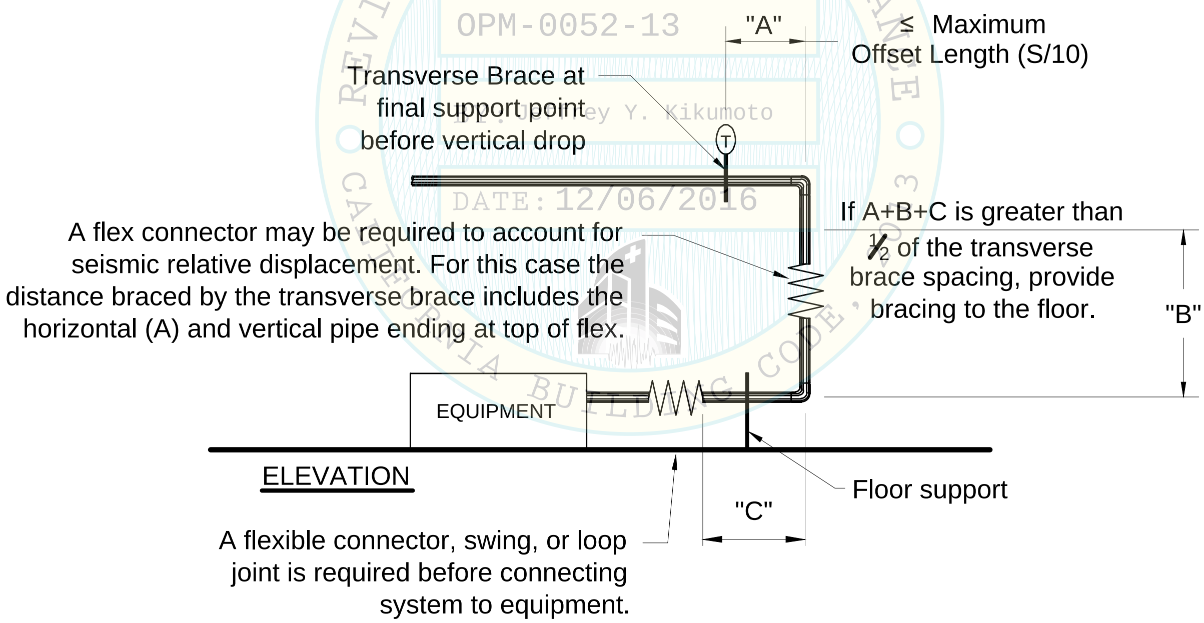
7.0 SEISMIC BRACING LAYOUT - GENERAL REQUIREMENTS (CONTINUED)

IX. In some cases several short runs may occur in close proximity. By following the preceding guidelines each run shall have longitudinal and transverse bracing. Transverse bracing may be used as longitudinal bracing and vice versa on runs adjacent to each other as long as the total length of pipe tributary to the brace does not exceed the maximum allowable spacing (S) (See Note IV). In cases where it does, additional braces are required.



X. At vertical pipe or conduit drop to equipment, where pipe or conduit is connected to the equipment using a flexible connection, provide transverse bracing before the vertical drop. The total length from the transverse brace to the vertical drop shall not be more than the allowable offset previously determined (S/10). Provide transverse bracing at the floor after the vertical drop if the total length of the pipe from the transverse brace before the vertical drop to the flexible connection is greater than ½ of the maximum transverse brace spacing (S/10).



XI. When systems cross a building seismic separation or seismic joint they must be capable of accommodating the joint displacements as specified by the engineer of record.

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7.0 SEISMIC BRACING LAYOUT - GENERAL REQUIREMENTS (CONTINUED)

XII. A system shall not be braced to dissimilar parts of a building structure or two dissimilar building systems that may move different from one another during an earthquake. Bracing shall be attached to the part of the building structure that is supporting the pipe, duct or electrical system.

XIII. Transverse and longitudinal braces shall be installed as shown in this guideline up to 60° from horizontal. However, the recommended brace ratio is 45° from horizontal, or 1 (vert.):1 (horiz.) brace ratio.

XIV. All transverse and longitudinal braces utilizing strut, steel pipe, or steel cable with Tolco Fig. 900 series fittings on both ends have an alignment tolerance of 5° from center without adversely affecting the given loads. This applies to single hanger supports as well as trapeze hanger support. See page 12-20 for more information.

XV. The seismic brace assemblies in this guideline consist of three important components; (a) supports and attachments to building structure; (b) brace member such as strut, pipe, angle iron, or cable; and (c) seismic brace attachments. For details and load information of structural attachments see Section 11, for details of brace assemblies see applicable "Brace Details" section(s).

XVI. Single Rigid Braces, where required, must be at or within 6 inches of a vertical hanger assembly to protect against vertical movement. When the vertical hanger assembly consists of threaded rod for support a stiffener is to be provided when required (see page 12-16, 12-17). An exception to this would be the use of two opposing rigid braces at the same location. The two opposing braces must be at the same angle from horizontal and within 5-degrees of perpendicular to the pipe. In this case no stiffening of vertical rod is necessary.

XVII. At a brace location, threaded rod and their building attachment components used in a vertical hanger assembly shall be increased in size when capacity is inadequate for loads due to the additional seismic tension loads placed upon them. The vertical hanger assembly is adequate if the maximum allowable load of its components is greater than or equal to the system gravity load plus any additional seismic loads.

XVIII. Steel bolt connections to steel structure or components shall not have a diameter less than 1/16" less than the mounting hole. Steel bolt connections to concrete structure shall not have a diameter less that 1/8" less than the mounting hole.

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8.0 GENERAL DESIGN PROCEDURE - SINGLE HANGER AND TRAPEZE BRACING

The following presents a general procedure for design of seismic bracing for single rod hangers and trapeze supports. The following assumes that a system design layout has been provided, and that gravity hanger supports have been designed by others. The following also assumes that seismic bracing has been determined to be required. Pre-designed table have been provided starting on Page 1-33, which allow skipping the following calculations for those configurations. For Registered Design Professionals (RDP), use the following design procedures, or the Pre-Designed Tables starting on Page 1-33. The following steps are to be followed, unless designated otherwise.

STEP 1 - Seismic Force Coefficient

Determine the total design lateral seismic force coefficient based on the applicable code, project drawings, and specifications. This coefficient is commonly referred to as the "G-factor"; i.e. Fp = .5G (ASD). In case of a conflict, use the more stringent criteria. The total design horizontal seismic force coefficient, when multiplied by the weight of the system, represents the total design lateral seismic force.

According to CBC 2013 and its referenced standards as listed on page 1-5, the total design lateral seismic force, Fp, and the total vertical seismic force, Fv, shall be determined from the following formulas. The final Fp and Fv shall be multiplied by 0.70 to convert the strength based seismic force to the allowable stress based seismic force (ASD) as included in formulas below. This is necessary because the loads and brace spacing in this manual are based on the allowable stress design (ASD).

Horizontal Seismic Force

$$F_p = \left[\frac{0.4\, a_p\, S_{ds}}{\frac{R_p}{I_p}}\left(1+2\frac{z}{h}\right) W_p\right](0.70)$$ (ASD)(ASCE 7-10 EQ. 13.3-1)

Except that:

Fp need not be greater than 1.6 Sds Ip Wp (0.70) (ASD)(ASCE 7-10 EQ. 13.3-2)
Shall not be less than (0.3 Sds Ip Wp (0.70) and (ASD)(ASCE 7-10 EQ. 13.3-3)

Vertical Seismic Force

Fv = 0.2 Sds Wp (0.70) (ASD)(ASCE 7-10, Section 13.3.1)

Where:

Sds = Design spectral acceleration for short periods
ap = Component amplification factor
Ip = Component importance factor
Wp = Component operating weight (lbs.)
Rp = Component response modification factor
z = Height of structure at point of attachment of component with respect to the base of building (ft.)
h = Average roof height of structure with respect to the base of building (ft.)

Refer to CBC 2013 codes for additional information & requirements. See also Parts 3.0, 4.0, 5.0, & 6.0 of Section 1 for allowable values for these parameters per ASCE 7-10, Table 13.6-1.

Step 2. - Seismic Bracing Detail

Tentatively select two Seismic Bracing Details; choose one detail for Transverse Bracing and one detail for a Longitudinal Bracing. If using rigid braces select from Section 2 for Single Hung Pipe or Section 4 for Trapeze. If using cable braces select from Section 6 for Single Hung Pipe or Section 8 for Trapeze Supported Pipe. The capacity of these two choices will be confirmed in a subsequent Step.

Step 3. - Structural Attachment Detail

Select a Structural Attachment Detail appropriate for the building construction from Sections 3, 5, 7, or 9. This section allows a detail to be selected by utilizing the Fp factor found in step 1 and either the pipe size of the pipe being braced or the weight being applied to the trapeze (see application in examples on pages 1-23, 1-26, and 1-31) . Select a Structural Attachment Detail appropriate for the building construction from Sections 3, 5, 7, or 9. Selection shall consider Seismic Bracing Detail from Step 2 so as to correspond to the same bracing configuration, rigid or cable brace. Sections that correspond to one another are as follows: Sections 2 and 3; Section 4 and 5; Sections 6 and 7; Sections 8 and 9. In any case Section 11 applies. At all tables with the following note, "Max load includes over strength factor Ω_0 = 2.5 per ASCE 7-10, Table 13.6-1 to satisfy ACI 318-11", compare values with F_P directly without amplification by Ω_0, since capacities have already been adjusted to consider it.

Step 4. - Brace Spacing

Determine the maximum transverse and maximum longitudinal brace spacings from the Section 3 "Single Hanger Rigid Brace Spacing Charts", or Section 5 "Trapeze Rigid Brace Spacing Charts", or Section 7 "Single Hanger Cable Brace Spacing Charts", Section 9 "Trapeze Cable Brace Spacing Charts", or Section 11 "Structural Attachments" and Section 14 "Pipe Stress and Deflections" (where pipe occurs). The maximum spacing chosen shall be the least of the allowable spacings for the specific structural attachment detail previously selected and/or the stresses to the pipe itself per Section 14.

The brace spacings listed in Sections 3, 5, 7, 9, and 14, are based on the pipe size, maximum pipe weight per ft., and the total design horizontal seismic force coefficients of 0.5G, 0.75G and 1.0G. To determine the maximum allowable spacing for other G-factors, use the spacing charts provided for 1.0G and divide the spacing given for the applicable pipe size or weight per ft. by the project specific G-factor, as previously determined.

Example: If the allowable spacing is 21ft for 1.0g, the allowable spacing for 0.7g will be: 21ft / 0.7g = 30ft.

The brace spacing shall not exceed the maximum allowable brace spacing based on the requirements listed in the general notes section. The transverse brace spacing shall not exceed the maximum allowable spacings tabulated in Section14.

When using single brace rigid bracing, brace spacing may be limited by the gravity hanger support system and its attachment to the structure due to the additional vertical load which is equal to the horizontal seismic load (for brace at 45 degrees; for other angles calculate appropriate vertical component based on the angle) applied by the seismic bracing on the gravity hanger support system. Verify that the hanger support system and its attachment to the structure are adequate for the applied gravity load plus vertical seismic force equal to the maximum horizontal seismic force (for brace at 45 degrees; for other angles calculate appropriate vertical

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8.0 GENERAL DESIGN PROCEDURE - SINGLE HANGER AND TRAPEZE BRACING (CONTINUED)

Step 5. - Attachment to Strut (Trapeze Supported Systems Only)

Verify the adequacy of the pipe, duct or electrical system attachment to the strut. The attachment must be adequate to transfer transverse, longitudinal and vertical seismic loads to strut as per Section 13. See Pages 13-10 thru 13-15.

Step 6. - Trapeze Support Member (Trapeze Supported Systems Only)

Determine the adequacy of the trapeze member to carry the seismic loads in addition to the gravity loads. The trapeze member shall be designed to carry the gravity loads and seismic loads. The gravity load and vertical seismic load will apply bending. The transverse seismic loads will apply an axial load and an additional bending. The longitudinal seismic loads are often much larger than the vertical gravity and seismic loads, and will apply loads about the weak axis causing additional bending. The trapeze support member shall be increased in size if required to satisfy the design criteria described above. Reference Pages 13-17 thru 13-20 to determine adequacy of strut.

Step 7. - Determine Demand

Determine the applied horizontal seismic loads, F_P, (DEMAND) by using the G-Factor from Step 1 and the Brace Spacing from Step 4. The DEMAND is the G-Factor x maximum weight-per-foot x brace spacing.

Step 8. - Confirm CAPACITY Exceeds DEMAND

Confirm the applied horizontal seismic load (DEMAND) calculated in Step 7 is less than the allowable horizontal seismic load (CAPACITY) in the detail load table chosen in Step 2. If not, then redo Step 2 and Step 4 by reducing the brace spacing until the DEMAND is less than the CAPACITY.

Step 9. - Determine Total Vertical Load at Hanger

Determine total vertical load at the hanger (DEMAND), which is gravity vertical + seismic vertical + brace induced-seismic vertical loads. Then select a hanger attachment detail from Section 11 with a CAPACITY that exceeds this DEMAND. If not, then redo Step 2 and Step 4 by reducing the brace spacing until the DEMAND is less than the CAPACITY

Step 10. - Bracing Layout

Layout the seismic bracing as explained in the previous Part 7.0 "Seismic Bracing Layout Procedure". Pages 1-14 thru 1-17.

Step 11. - Brace Member

Select a brace member and determine its total length. A brace member shall be B-Line strut channel or schedule 10, schedule 40 steel pipe or cable. Maximum allowable horizontal seismic loads and maximum allowable lengths for the different brace members are listed on page 12-20. The Maximum applied horizontal load (DEMAND) calculated in Step 7, shall be equal to or less than the maximum allowable horizontal seismic load (CAPACITY) of the brace chosen from Page 12-20.

Step 12. - Rod Stiffener

Determine if rod stiffeners are required. When the vertical hanger assembly consists of threaded rod for support a stiffener is to be provided when required. See Pages 12-16 and 12-17 for maximum lengths allowed for hanger rods without rod stiffeners. An exception to this would be the use of two opposing rigid braces at the same location. The two opposing braces must be at the same angle from horizontal and within 5 degrees of perpendicular to the pipe. In this case no stiffening of vertical rod is necessary.

8.1 TYPICAL DESIGN EXAMPLE - PIPE OR ELECTRICAL CONDUIT

The General Design Procedure steps are used as follows to determine hanger and brace components and the seismic brace spacings to seismically restrain a single hanger pipe or electrical conduit.

Step 1. Determine the "G" force factors for F_P and F_V using equations on Page 1-18 for each floor of the building.

Step 2. Select Seismic Bracing Details from Section 2 or Section 6.

Step 3. Select Structural Attachment Details from Section 3, Section 7 and/or Section 11, with a "G" force greater than or equal to that determined in Step 1.

Step 4. Determine the maximum Transverse Brace Spacing and the maximum Longitudinal Brace Spacing from the details chosen in Step 3. The transverse brace spacing shall not exceed the maximum allowable spacings tabulated in Section 14. The longitudinal brace spacing shall not exceed two times the allowable transverse brace spacing.

Step 5. Not applicable.

Step 6. Not applicable.

Step 7. Using the Brace Spacing from Step 4 and the seismic "G" factor from Step 1, determine the applied horizontal seismic load F_P (DEMAND), which is the **G-factor x maximum weight-per-foot x brace spacing** .

Step 8. Confirm the applied horizontal seismic load (DEMAND) calculated in Step 5 is less than the allowable horizontal seismic load (CAPACITY) in the detail load table chosen in Step 2. If not, then redo Step 2 and Step 6 by reducing the brace spacing until the DEMAND is less than the CAPACITY.

Step 9. Determine total vertical load at the hanger, which is **gravity vertical + seismic vertical + brace induced-seismic vertical loads** . Then select a hanger attachment detail from Section 11 that exceeds this DEMAND. If not, then redo Step 2 and Step 6 by reducing the brace spacing until the DEMAND is less than the CAPACITY.

Step 10. Prepare the seismic brace layout per Part 7.0, Page 1-14.

Step 11. Select a brace member and determine its total length. A brace member shall be B-Line strut channel sch. 40 steel pipe or cable.

Step 12. Determine if rod stiffeners are required.

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8.1 TYPICAL DESIGN EXAMPLE - PIPE OR ELECTRICAL CONDUIT (CONTINUED)

EXAMPLE:

Determine the hanger and seismic brace design for a 4"Ø (sch. 40) insulated, water filled, steel pipe hung on the third floor of a 4 story building of poured-in-place concrete slab construction. The gravity hanger spacing is S_h = 10 feet maximum. Each floor is 15 feet in height. The contract drawings specify S_{DS} = 1.50 and I_P = 1.5.

Step 1. Determine the "G" force factors.

$$Fp = \frac{0.4\, a_p\, S_{ds}\, W_p}{\frac{Rp}{Ip}} \left(1+2\left(\frac{z}{h}\right)\right)(0.70) \qquad \text{(ASD)(ASCE 7-10 EQ. 13.3-1)}$$

where:			
	a_P = 2.5	(component amplification)	(ASCE 7-10, Table 13.6-1)
	R_P = 4.5	(not ASME B31)	(ASCE 7-10, Table 13.6-1)
	Ω_0 = 2.5	(for concrete anchors)	(ASCE 7-10, Table 13.6-1)
	S_{DS} = 1.5	(from contract drawings)	
	I_P = 1.5	(from contract drawings)	
	z = 45 feet	(height to attachment)	
	h = 60 feet	(height of building)	

F_P = [(0.4)(2.5)(1.5)(1.5)/4.5]*(1+2(45/60)(0.70)W_P = 0.875 W_P
F_P need not exceed F_P = 1.6 S_{DS} I_P W_P (0.70) = 2.52 W_P
F_P must be greater than F_P = 0.3 S_{DS} I_P W_P (0.70) = 0.473 W_P
Since 0.473 ≤ 0.875 ≥ 2.52
F_P = 0.875 W_P

"G" Factor = 0.875 W_P (horizontal)
F_V = (0.20) S_{DS} W_P (0.70) = 0.21 W_P (vertical)

Weight of 4"Ø (sch. 40) steel pipe, full of water, with insulation,
W_P = 18.1 lb/ft. (Per Steel Pipe Weight Table, Page B-2)

Step 2. Tentatively select two Seismic Bracing Details from Section 2, Page 2-2 for Transverse Bracing and Page 2-13 for Longitudinal Bracing. The choices of Page 2-2 and Page 2-13 will be confirmed in Step 8.

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8.1 TYPICAL DESIGN EXAMPLE - PIPE OR ELECTRICAL CONDUIT (CONTINUED)

Step 3. Select Structural Attachment Details from Section 3, Section 7 and/or Section 11. For this example the deck is poured-in-place concrete. Checking Pages 3-1 thru 3-3, the one with a G factor higher than in Step 1 is Page 3-3. It has a "G" factor 1.0. So choose Page 3-3. Note that for this example the right hand table for Longitudinal Bracing on Page 3-3 requires TWO rigid braces. Compare values with F_P without amplification by Ω_0, since capacities have already been adjusted to consider it.

Step 4. Determine maximum Brace Spacings using the two tables on Page 3-3, then convert the 1.0 G spacings from the table to 0.875 G from Step 1. The transverse brace spacing shall not exceed the maximum allowable spacings tabulated in Section 14. The longitudinal brace spacing shall not exceed two times the allowable transverse brace spacing. All values are ASD.

From table on page 3-3, Maximum Transverse Brace Spacing @1.0 G = 25 ft
Maximum Transverse Brace Spacing @ 0.875 G = 25ft / 0.875 = 28ft
Checking Page 14-1, this Transverse Brace Spacing of 17ft. does not exceed the 1.0g maximum allowable of 42ft. for the 4 inch sch40 pipe of this example.

From table on page 3-3, Maximum Longitudinal Brace Spacing @1.0 G = 50 ft
Maximum Longitudinal Brace Spacing @ 0.875 G = 50 ft / 0.875 = 57 ft
(See notes for other restrictions.)

Therefore:

Maximum Transverse Brace Spacing @ 0.875 G = 25ft / 0.875 = 28ft (x1 brace).
Maximum Longitudinal Brace Spacing @ 0.875 G = 2 x 28 ft = 56ft (x2 braces).

Step 5. Not applicable.

Step 6. Not applicable.

Step 7. Determine the applied horizontal seismic loads, F_P (DEMAND) All values are ASD.

(0.875)(18.1 lb/ft)(28 ft) = 443.5 lb. (Transverse Seismic Load)
(0.875)(18.1 lb/ft)(56 ft) = 887.0 lb. (Longitudinal Seismic Load)

Step 8. Confirm the horizontal seismic load calculated in Step 7 (DEMAND) is less than the allowable horizontal seismic load in the detail load table chosen in Step 2 (CAPACITY). If not, then redo Step 2 and Step 4 by reducing the brace spacing until the DEMAND is less than the CAPACITY. For this example the brace angle is 45 degrees. All values are ASD.

A. Checking Page 2-2 for Transverse Bracing, the rigid brace table has an Allowable Load (CAPACITY) of 448 lb. Therefore, the CAPACITY is greater than the Applied Transverse Seismic Load (DEMAND) from Step 7 of 443.5 lb.

B. Checking Page 2-13 for Longitudinal Bracing, the rigid brace table has an Allowable Load of 730 lb. Since two braces are required by the table on Page 3-3 (determined in Step 3), the CAPACITY for this case is (2 x 730 lb = 1460 lb). Therefore, the CAPACITY is greater than the applied longitudinal seismic load (DEMAND) from Step 7 of 887.0 lb.

8.1 TYPICAL DESIGN EXAMPLE - PIPE OR ELECTRICAL CONDUIT (CONTINUED)

Step 9. Determine the total vertical load (DEMAND) at the critical hanger, P_S, wish equals **gravity + seismic vertical + brace-induced seismic vertical loads**. Then select a hanger attachment detail from Section 11 with a CAPACITY that exceeds this DEMAND. The induced seismic assumes the case of Longitudinal Seismic Load and brace angle of 45 degrees, and is therefore equal to F_P. All values are ASD.

$P_S = W_P (S_h) + F_V (S_h) + F_P$ (tan(brace angle from horiz))

P_S = (18.1 lb/ft)(10 ft) + (0.21)(18.1 lb/ft)(10 ft) + 887.0 lb./2 braces

P_S = 662.5 lb. vertical at hanger

Checking Page 11-2, and checking 1/2" dia. Hilti KB-TZ with 3 1/4" min. embed, the CAPACITY is 890 lb., which exceeds the DEMAND.

Step 10. Prepare the seismic brace layout per Part 7.0, Page 1-14.

Step 11. Select a brace member and determine it's total length. A brace member shall be B-Line strut channel or sch. 40 steel pipe or cable. Maximum allowable horizontal seismic loads and maximum allowable lengths for the different brace members are listed on Page 12-20. The Maximum applied horizontal load (DEMAND) calculated in Step 7, shall be equal to or less than the maximum allowable horizontal seismic load (CAPACITY) of the brace chosen from Page 12-20. For this example, assume a brace length of 7'-0".

A. From Page 12-20 Choose B-Line Strut brace with an Allowable Horizontal Seismic Load (CAPACITY) = 1097lb. horizontal which exceeds the Transverse Seismic Load (DEMAND) from Step 7 of 443.5 lb., and with a Maximum Length = 9'-6", which exceeds the example brace length of 7'-0".

B. From Page 12-20 choose B-Line B22 Strut brace with an Allowable Horizontal Seismic Load (CAPACITY) = 1097lb. horizontal which exceeds the Longitudinal Seismic Load (DEMAND) from Step 7 of 887.0 lb., and with a Maximum Length = 9'-6", which exceeds the example brace length of 7'-0"

Step 12. Determine if rod stiffeners are required. See Pages 12-16 or 12-17 for maximum lengths allowable for hanger rods without rod stiffeners. For this example, assume a hanger rod length of 60 inches. Checking the table on Page 12-17, the Maximum Rod Length without rod stiffener for the 1/2" rod of this example = 25". Since the example rod length exceeds this maximum, then Rod Stiffeners must be installed at a minimum of every 18", as shown on Page 12-17.

FLOOR LEVEL	PIPE SIZE	HANGER SPACING	HANGER ANCHOR DIA. (IN.)	HANGER ANCHOR EMBED (hef) (IN.)	TRANSVERSE BRACING			LONGITUDINAL BRACING			BRACE ANGLE FROM HORIZ. (DEG)	BRACE ANCHOR DIA. (IN.)	BRACE ANCHOR EMBED (hef) (IN.)
					BRACE SPACING (FT.)	BRACE DETAIL PAGE	ATTACHMENT DETAIL PAGE	BRACE SPACING (FT.)	BRACE DETAIL PAGE	ATTACHMENT DETAIL PAGE			
	1 1/4"												
	1 1/2"												
3	2"												
	3"												
	4"	10'	1/2	3 1/4	28'	2-2	11-1	56'	2-13	11-1	45	1/2	3 1/4

In conclusion, the 4" Ø (sch. 40) steel pipe in this example, hung at 10 ft. spacing on the third floor of a 4 story building, can be adequately braced using:

Page 2-2, Detail 1A, Transverse Rigid Bracing for Single Hung Pipe or Conduit,
Page 2-13, Detail 2LA, Longitudinal Rigid Brace for Single Hung Pipe or Conduit, 2 braces per location.
Page 3-3, Single Pipe Hanger Brace Spacing Chart for Concrete Wedge Anchors,
Page 11-1, Hilti KB-TZ Wedge Anchors in 4,000 psi NW Concrete,
Page 11-2, Hilti KB-TZ Wedge Anchors in 4,000 psi NW Concrete, for Hanger Attachments and with Brace Spacing at 28 ft Transverse and 56 ft Longitudinal.

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8.2 TYPICAL DESIGN EXAMPLE – TRAPEZE SUPPORTS

The General Design Procedure steps are used as follows to determine trapeze hanger and brace components and the seismic brace spacings to seismically restrain trapeze supports.

Step 1. Determine the “G” force factors for F_P and F_V using equations on Page 1-18 for each floor of the building.

Step 2. Select Seismic Bracing Details from Section 4 or Section 8.

Step 3. Select Structural Attachment Details from Section 5, Section 9 and/or Section 11, with a “G” force factor greater than or equal to that determined in Step 1.

Step 4. Determine the maximum Transverse Brace Spacing and the maximum Longitudinal Brace Spacing from the details chosen in Step 3. The transverse brace spacing shall not exceed the maximum allowable spacings tabulated in Section 14. The longitudinal brace spacing shall not exceed two times the allowable transverse brace spacing.

Step 5. Attachment to Strut (Trapeze Supported Systems Only) - Verify the adequacy of the pipe, duct or electrical system attachment to the strut. The attachment must be adequate to transfer transverse, longitudinal and vertical seismic loads to strut.

Step 6. Trapeze Support Member (Trapeze Supported Systems Only) - Determine the adequacy of the trapeze member to carry the seismic loads in addition to the gravity loads. The trapeze member should be designed to carry the gravity loads and seismic loads. The gravity load and vertical seismic load will apply bending. The transverse seismic loads will apply an axial load and an additional bending. The longitudinal seismic loads are often much larger than the vertical gravity and seismic loads, and will apply loads about the weak axis causing additional bending. The trapeze support member shall be increased in size if required to satisfy the design criteria described above.

Step 7. Using the Brace Spacing from Step 4 and the seismic “G” factor from Step 1, determine the applied horizontal seismic load, F_P (DEMAND), which is the **G-factor x maximum weight-per-foot x brace spacing** .

Step 8. Confirm the applied horizontal seismic load (DEMAND) calculated in Step 5 is less than the allowable horizontal seismic load (CAPACITY) in the detail load table chosen in Step 2. If not, then redo Step 2 and Step 6, by reducing the brace spacing until the DEMAND is less than the CAPACITY.

Step 9. Determine total vertical load at the hanger, which is **gravity vertical + seismic vertical + brace induced-seismic vertical loads** . Then select a hanger attachment detail from Section 11 that exceeds this DEMAND. If not, then redo Step 2 and Step 6, by reducing the brace spacing until the DEMAND is less than the CAPACITY.

Step 10. Prepare the seismic brace layout per Part 7.0, Page 1-14.

Step 11. Select a brace member and determine it's total length. A brace member shall be B-Line strut channel or sch. 40 steel pipe or cable.

Step 12. Determine if rod stiffeners are required.

EXAMPLE:

Determine the trapeze hanger seismic brace design to support one 4"Ø (sch. 40) insulated, water filled, steel pipe hung on the third floor of a 4 story building of poured-in-place concrete slab construction. The gravity hanger spacing is S_h = 10 feet maximum. Each floor is 15 feet in height. The contract drawings specify S_{DS} = 1.50 and Ip = 1.5.

Step 1. Determine the "G" force factors.

$$Fp = \frac{0.4\, a_p\, S_{ds}\, W_p}{\frac{Rp}{Ip}} \left(1+2\left(\frac{z}{h}\right)\right)(0.70) \qquad \text{(ASD)(ASCE 7-10 EQ. 13.3-1)}$$

where:

a_P = 2.5	(component amplification)	(ASCE 7-10, Table 13.6-1)
R_P = 4.5	(not ASME B31)	(ASCE 7-10, Table 13.6-1)
Ω_0 = 2.5	(for concrete anchors)	(ASCE 7-10, Table 13.6-1)
S_{DS} = 1.5	(from contract drawings)	
I_P = 1.5	(from contract drawings)	
z = 45 feet	(height to attachment)	
h = 60 feet	(height of building)	

F_P = [(0.4)(2.5)(1.5)(1.5)/4.5]*(1+2(45/60)(0.70)W_P = 0.875 W_P
F_P need not exceed F_P = 1.6 S_{DS} I_P W_P (0.70) = 2.52 W_P
F_P must be greater than F_P = 0.3 S_{DS} I_P W_P (0.70) = 0.473 W_P
Since 0.475 ≤ 0.875 ≥ 2.52
F_P = 0.875 W_P

"G" Factor = 0.875 W_P (horizontal)
F_V = (0.20) S_{DS} W_P (0.70) = 0.21 W_P (vertical)

Weight of 4"Ø (sch. 40) steel pipes, full of water, with insulation,
W_P = 18.1 lb/ft. (Per Steel Pipe Weight Table, Page B-2)

Step 2. Tentatively select two Trapeze Seismic Bracing Details from Section 4, Page 4-1 for Transverse Rigid Bracing, and Page 4-3 for combined Transverse and Longitudinal Rigid Bracing. The choices of Page 4-1 and Page 4-3 will be confirmed in Step 8.

Step 3. Select Structural Attachment Details from Section 5, Section 9 and/or Section 11. For this example the deck is poured-in-place concrete. Checking Pages 5-1 thru 5-3, the one with a "G" factor higher than in Step 1 is Page 5-3. It has a "G" factor 1.0. So choose Page 5-3. Compare Values with F_P without amplification by Ω_0, since capacities have already been adjusted to consider it.

8.2 TYPICAL DESIGN EXAMPLE - TRAPEZE SUPPORTS (CONTINUED)

Step 4. Determine maximum Brace Spacings for W_P = 18.1 lb/ft using the two tables on Page 5-3, then convert the 1.0 G spacings from the table to 0.875 G from Step 1. The transverse brace spacing shall not exceed the maximum allowable spacings tabulated in Section 14. The longitudinal brace spacing shall not exceed two times the allowable transverse brace spacing. All values are ASD.

From table on page 5-3, Maximum Transverse Brace Spacing @1.0 G = 22 ft
Maximum Transverse Brace Spacing @ 0.875 G = 22 ft / 0.875 = 25ft
Checking Page 14-1, this Transverse Brace Spacing of 25ft. does not exceed the 1.0g maximum allowable of 42ft. for the 4 inch sch40 pipe of this example:

From table on page 5-3, Maximum Longitudinal Brace Spacing @1.0 G = 45 ft
Maximum Longitudinal Brace Spacing @ 0.875 G = 45 ft / 0.875 = 51 ft
(See notes for other restrictions.)
Therefore:

Maximum Transverse Brace Spacing @ 0.875 G = 22 ft / 0.875 = 25ft (x1 braces).
Maximum Longitudinal Brace Spacing @ 0.875 G = 2 x 25 ft = 50ft (x2 braces).

Step 5. Attachment to Strut (Trapeze Supported Systems Only) - Verify the adequacy of the pipe, duct or electrical system attachment to the strut. The attachment must be adequate to transfer transverse, longitudinal and vertical seismic loads to strut.

Step 6. Trapeze Support Member (Trapeze Supported Systems Only) - Determine the adequacy of the trapeze member to carry the seismic loads in addition to the gravity loads. For this example assume a trapeze span (ro-to-rod) of 36 inches.

A. Determine the vertical load (DEMAND) as the gravity load (W_P) (S_h) plus the vertical seismic load (F_V)(S_h):

W_P = (18.1 lb/ft)(10ft) = 181 lb.
F_V = (0.21)(18.1 lb/ft)(10 ft) = 38.1 lb.
$P_S = W_P + F_V$ = 219.1 lb.

B. Determine the horizontal load (DEMAND) as the Longitudinal Seismic Load from Step 7, F_P = 792 lb.

C. Determine the minimum allowable Section Modulus, S_{Xmin}, assuming a point load:

$S_{Xmin} = M_X$ / 25 ksi
where $M_X = P_S$ (36 in) / 4 = 1,993 in/lb
S_{Xmin} = 1,993 / 25 ksi = 0.080 in^3
From Page 13-17, select B22A with S_X = 0.599 in^3 (CAPACITY), which is greater than S_{Xmin} = 0.080 in^3

D. Determine the minimum allowable Section Modulus, S_{Ymin}, assuming a point load:

$S_{Ymin} = M_Y$ / 25 ksi
where $M_Y = F_P$ (36 in) / 4 = 7,353 in/lb.
S_{Ymin} = 7,353 / 25 ksi = 0.294 in^3
From Page 13-17, select B22A with S_Y = 0.591 in ^3 (CAPACITY), which is greater than S_{Xmin} = 0.294 in^3

E. Check combined loading, (0.080 / 0.599) + (0.415 / 0.591) = 0.84, which is less than 1.0. Therefore, capacity of B22A double strut exceeds the demand of this example.

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8.2 TYPICAL DESIGN EXAMPLE - TRAPEZE SUPPORTS (CONTINUED)

Step 7. Determine the applied horizontal seismic loads, F_P (DEMAND). All values are ASD.

(0.875)(18.1 lb/ft)(25 ft) = 396 lb. (Transverse Seismic Load)
(0.875)(18.1 lb/ft)(50 ft) = 792 lb. (Longitudinal Seismic Load)

Step 8. Confirm the horizontal seismic load calculated in Step 7 (DEMAND) is less than the allowable horizontal seismic load in the detail load table chosen in Step 2 (CAPACITY). If not, then redo Step 2 and Step 4 by reducing the brace spacing until the DEMAND is less than the CAPACITY. For this example the brace angle is 45 degrees. All values are ASD.

A. Checking Page 4-1 for Transverse Bracing, the rigid brace table has an Allowable Load (CAPACITY) of 1224 lb. Therefore, the CAPACITY is greater than the Applied Transverse Seismic Load (DEMAND) from Step 7 of 396 lb.

B. Checking Page 4-3 for Longitudinal Bracing, the rigid brace table has an Allowable Load of 326 lb. Since this CAPACITY is less than the Applied Longitudinal Seismic Load (DEMAND) from Step 7 of 792 lb., the Longitudinal spacing must be reduced. The reduced spacing is (326 lb) / (18.1 lb/ft)(0.875) = 20.58 ft. At this reduced spacing the DEMAND then becomes (0.875)(18.1 lb/ft)(20ft) = 316 lb. Now the CAPACITY (326 lb) is greater than the DEMAND (316 lb).

Step 9. Determine the total vertical load (Demand) at the critical hanger, P_S, which equals **gravity vertical + seismic vertical + brace-induced seismic vertical loads**. Select a hanger attachment detail from Section 11 that exceeds this demand. The induced seismic assumes the case of Longitudinal Seismic Load and brace angle of 45 degrees and is therefore equal to F_P. All values are ASD.

$P_S = W_P (S_h) + F_V (S_h) + F_P$ (tan(brace angle from horiz))
P_S = (18.1 lb/ft)(10 ft) + (0.21)(18.1 lb/ft)(10 ft) + 320 lb/2 braces.
P_S = 379 lb vertical at hanger

Checking Page 11-2, the 1/2" Hilti KB-TZ with 2" embed has a CAPACITY of 435 lb., which exceeds the DEMAND.

Step 10. Prepare the seismic brace layout per Part 7.0, Page 1-14.

8.2 TYPICAL DESIGN EXAMPLE - TRAPEZE SUPPORTS (CONTINUED)

Step 11. Select a brace member and determine it's total length. A brace member shall be B-Line strut channel or sch. 40 steel pipe or cable. Maximum allowable horizontal seismic loads and maximum allowable lengths for the different brace members are listed on page 12-20. The Maximum applied horizontal load (DEMAND) calculated in Step 7, shall be equal to or less than the maximum allowable horizontal seismic load (CAPACITY) of the brace chosen from Page 12-20. For this example, assume a brace length of 7'-0".

A. From Page 12-20 choose B-Line B22 Strut brace with an Allowable Horizontal Seismic Load (CAPACITY) = 1097 lb. horizontal which exceeds the Transverse Seismic Load (DEMAND) from Step 7 of 396 lb., and with a Maximum Length = 9'-6", which exceed the example brace length of 7'-0"

B. From Page 12-20 choose B-Line B22 Strut brace with an Allowable Horizontal Seismic Load (CAPACITY) = 1097 lb. horizontal which exceeds the Longitudinal Seismic Load (DEMAND) from Step 7 of 792 / 2 braces = 396 lb., and with a Maximum Length = 9'-6", which exceeds the example brace length of 7'-0".

Step 12. Determine if rod stiffeners are required. See Pages 12-16 or 1-17 for maximum lengths allowable for hanger rods without rod stiffeners. For this example, assume a hanger rod length of 60 inches. Checking the table on Page 12-17, the Maximum Rod Length without Rod Stiffener for the 3/4" rod of this example = 37". Since the example rod length exceeds this maximum, then Rod Stiffeners must be installed at a minimum of every 28", as shown on Page 12-17.

FLOOR LEVEL	PIPE SIZE	HANGER SPACING	HANGER ANCHOR DIA. (IN.)	HANGER ANCHOR EMBED (hef) (IN.)	TRANSVERSE BRACING			LONGITUDINAL BRACING			BRACE ANGLE FROM HORIZ. (DEG)	BRACE ANCHOR DIA. (IN.)	BRACE ANCHOR EMBED (hef) (IN.)
					BRACE SPACING (FT.)	BRACE DETAIL PAGE	ATTACHMENT DETAIL PAGE	BRACE SPACING (FT.)	BRACE DETAIL PAGE	ATTACHMENT DETAIL PAGE			
3	1 1/4"												
	1 1/2"												
	2"												
	3"												
	4"	10'	1/2	2	25'	4-1	11-1	20'	4-3	11-1	45	5/8	4

In conclusion, the 4"Ø (sch. 40) steel pipe in this example, hung at 10 ft. spacing on the third floor of a 4 story building, can be adequately braced using:

Page 4-1, Detail 3, Transverse Rigid Bracing for Trapeze Support,
Page 4-3, Detail 3/4, Combo Transverse / Longitudinal Rigid Brace for Trapeze Support, 2 braces per location.
Page 5-3, Trapeze Brace Spacing Chart for Concrete Wedge Anchors,
Page 11-1, Hilti KB-TZ Wedge Anchors in 4,000 psi NW Concrete,
Page 11-2, Hilti KB-TZ Wedge Anchors in 4,000 psi NW Concrete, for Hanger Attachments, and with Brace Spacing at 25 ft Transverse and 20 ft Longitudinal.

8.3 TYPICAL DESIGN EXAMPLE – DUCT SUPPORTS

The General Design Procedure steps are used as follows to determine duct hanger and brace components, and the seismic brace spacings to seismically restrain trapeze supported ducts.

Step 1. Determine the "G" force factors for F_P and F_V using equations on Page 1-18 for each floor of the building.

Step 2. Select Seismic Bracing Details from Section 4 or Section 8.

Step 3. Select Structural Attachment Details from Section 5, Section 9 and/or Section 11, with a "G" force factor greater than or equal to that determined in Step 1.

Step 4. Determine the maximum Transverse Brace Spacing and the maximum Longitudinal Brace Spacing from the details chosen in Step 3.

Step 5. Not applicable.

Step 6. Not applicable.

Step 7. Using the Brace Spacing from Step 4 and the seismic "G" factor from Step 1, determine the applied horizontal seismic load, F_P (DEMAND), which is the **G-factor x maximum weight-per-foot x brace spacing**.

Step 8. Confirm the applied horizontal seismic load (DEMAND) calculated in Step 5 is less than the allowable horizontal seismic load (CAPACITY) in the detail load table chosen in Step 2. If not, then redo Step 2 and Step 6 by reducing the brace spacing until the DEMAND is less than the CAPACITY.

Step 9. Determine total vertical load at the hanger, which is **gravity vertical + seismic vertical + brace induced-seismic vertical loads**. Then select a hanger attachment detail from Section 11 that exceeds this DEMAND. If not, then redo Step 2 and Step 6 by reducing the brace spacing until the DEMAND is less than the CAPACITY.

Step 10. Prepare the seismic brace layout per Part 7.0, Page 1-14.

Step 11. Step a brace member and determine it's total length. A brace member shall be B-Line strut channel or sch. 40 steel pipe or cable.

Step 12. Determine if rod stiffeners are required.

8.3 TYPICAL DESIGN EXAMPLE - DUCT SUPPORTS (CONTINUED)

EXAMPLE:

Determine the duct hanger seismic brace design needed to seismically restrain a standard SMACNA, 30” x 40” x 18 gage duct hung by trapeze on the third floor of a 4 story building of poured-in-place concrete slab construction. The gravity hanger spacing is S_h = 8 feet maximum. Each floor is 15 feet in elevation. The contract drawings specify S_{DS} = 1.50 and I_p = 1.5.

Step 1. Determine the “G” force factors.

$$Fp = \frac{0.4\, a_p\, S_{ds}\, W_p}{\frac{Rp}{Ip}} \left(1+2\left(\frac{z}{h}\right)\right)(0.70)$$ (ASD)(ASCE 7-10 EQ. 13.3-1)

where:

a_P = 2.5	(component amplification)	(ASCE 7-10, Table 13.6-1)
R_P = 6.0	(joints other than welds/braze)	(ASCE 7-10, Table 13.6-1)
Ω_0 = 2.5	(for concrete anchors)	(ASCE 7-10, Table 13.6-1)
S_{DS} = 1.5	(from contract drawings)	
I_P = 1.5	(from contract drawings)	
z = 45 feet	(height to attachment)	
h = 60 feet	(height of building)	

F_P = [(0.4)(2.5)(1.5)(1.5)/6.0]*(1+2(45/60)(0.70)W_P = 0.656 W_P
F_P need not exceed F_P = 1.6 S_{DS} I_P W_P (0.70) = 2.52 W_P
F_P must be greater than F_P = 0.3 S_{DS} I_P W_P (0.70) = 0.473 W_P
Since 0.473 ≤ 0.656 ≥ 2.52
F_P = 0.656 W_P

“G” Factor = 0.656 W_P (horizontal)
F_V = (0.20) S_{DS} W_P (0.70) = 0.21 W_P (vertical)

Weight of the 30” x 40” x 18 gage duct (including seams and laps),
W_P = 26.9 lb/ft. (Per Rectangular Duct Weights Table, Page B-4)

Step 2. Tentatively select two Rectangular Duct Seismic Bracing Details from Section 4, Page 4-13 for Transverse Rigid Bracing and Page 4-15 for combined Transverse and Longitudinal Rigid Bracing. The choices of Page 4-13 and Page 4-15 will be confirmed in Step 8.

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8.3 TYPICAL DESIGN EXAMPLE - DUCT SUPPORTS (CONTINUED)

Step 3. Select Structural Attachment Details from Section 5 and/or Section 11. For this example the deck is poured-in-place concrete. Checking Pages 5-1 thru 5-3, the one with a “G” factor higher than in Step 1 is Page 5-2. It has a “G” factor 0.75. So choose Page 5-2. Compare values with F_P without amplification by Ω_0, since capacities have already been adjusted to consider it.

Step 4. Determine maximum Brace Spacings for W_P = 26.9 lb/ft using the two tables on Page 5-2, chosen in Step 3. All values are ASD.

From Table on page 5-2, Maximum Transverse Brace Spacing @0.75 G = 28 ft
From Table on page 5-2, Maximum Longitudinal Brace Spacing @0.75 G = 56 ft
(Do not exceed max of 30’T/60’L for suspended ductwork. See page 1-10, para. II & III. See notes for other restrictions.)

Therefore:

Maximum Transverse Brace Spacing = 28 ft (x1 braces)
Maximum Longitudinal Brace Spacing = 56 ft (x2 braces)

Step 5. Not applicable.

Step 6. Not applicable.

Step 7. Determine the applied horizontal seismic loads, F_P (DEMAND). All values are ASD.

(0.656)(26.9 lb/ft)(28 ft) = 494 lb. (Transverse Seismic Load)
(0.656)(26.9 lb/ft)(56 ft) = 988 lb. (Longitudinal Seismic Load)

Step 8. Confirm the horizontal seismic loads calculated in Step 7 (DEMAND) are less than the allowable horizontal seismic loads in the detail load table chosen in Step 2 (CAPACITY). If not, then redo Step 2 and Step 4 by reducing the brace spacing until the DEMAND is less than the CAPACITY. For this example the brace angle is 45 degrees. All values are ASD.

A. Checking Page 4-13 for Transverse Bracing, the rigid brace table has an Allowable Load (CAPACITY) of 1,224 lb. Therefore, the CAPACITY is greater than the Applied Transverse Seismic Load (DEMAND) from Step 7 of 494 lb.

B. Checking Page 4-15 for Longitudinal Bracing, the rigid brace table has an Allowable Load of 320 lb. Since two braces are required by the table on Sheet 5-2 (determined in Step 3), the CAPACITY for the two-brace case is 320 lb. Since this CAPACITY is less than the Applied Longitudinal Seismic Load (DEMAND) from Step 7 of 988 lb., the Longitudinal spacing must be reduced and the number of braces doubled to FOUR. The CAPACITY for FOUR braces is (2 x 320 lb = 640 lb). The reduced Longitudinal Spacing becomes (640 lb) / (26.9 lb/ft)(0.656) = 36ft. At this reduced spacing the DEMAND then becomes (0.656)(26.9 lb/ft)(36 ft) = 635 lb. Now, the CAPACITY (640 lb) is greater than the DEMAND (635 lb).

8.3 TYPICAL DESIGN EXAMPLE - DUCT SUPPORTS (CONTINUED)

Step 9. Determine total vertical load (DEMAND) at the critical hanger, P_S, which equals gravity vertical + seismic vertical + brace-induced seismic vertical loads. The induced seismic assumes the case of Longitudinal Seismic Load and brace angle of 45 degrees, and is therefore equal to F_P. All values are ASD.

$P_S = W_P (S_h) + F_V (S_h) + F_P$ (tan(brace angle from horiz.))

P_S = (26.9 lb/ft)(8 ft) + (0.21)(26.9 lb/ft)(8 ft) + 332 lb/2 braces.

P_S = 426 lb vertical at hanger

Checking Page 11-2, the 1/2” Hilti KB-TZ with 2” embed has a CAPACITY of 435 lb., which exceeds the DEMAND.

Step 10. Prepare the seismic brace layout per Part 7.0, Page 1-14.

Step 11. Select a brace member and determine it's total length. A brace member shall be B-Line strut channel or sch. 40 steel pipe or cable. Maximum allowable horizontal seismic loads and maximum allowable lengths for the different brace members are listed on page 12-20. The Maximum applied horizontal load (DEMAND) calculated in Step 7, shall be equal to or less than the maximum allowable horizontal seismic load (CAPACITY) of the brace chosen from Page 12-20. For this example, assume a brace length of 7'-0".

A. From Page 12-20 choose B-Line B22 Strut brace with an Allowable Horizontal Seismic Load (CAPACITY) = 1097 lb. horizontal which exceeds the Transverse Seismic Load (DEMAND) from Step 7 of 494 lb., and with a Maximum Length = 9'-6", which exceed the example brace length of 7'-0"

B. From Page 12-20 choose B-Line B22 Strut brace with an Allowable Horizontal Seismic Load (CAPACITY) = 1097 lb. horizontal which exceeds the Longitudinal Seismic Load (DEMAND) from Step 7 of 988 / 2 braces = 494 lb., and with a Maximum Length = 9'-6", which exceeds the example brace length of 7'-0".

Step 12. Determine if rod stiffeners are required. See Pages 12-16 or 1-17 for maximum lengths allowable for hanger rods without rod stiffeners. For this example, assume a hanger rod length of 60 inches. Checking the table on Page 12-17, the Maximum Rod Length without Rod Stiffener for the 1/2" rod of this example = 25". Since the example rod length exceeds this maximum, then Rod Stiffeners must be installed at a minimum of every 18", as shown on Page 12-17.

FLOOR LEVEL	DUCT WT. (LB/FT)	HANGER SPACING	HANGER ANCHOR DIA. (IN.)	HANGER ANCHOR EMBED (hef) (IN.)	TRANSVERSE BRACING			LONGITUDINAL BRACING			BRACE ANGLE FROM HORIZ. (DEG)	BRACE ANCHOR DIA. (IN.)	BRACE ANCHOR EMBED (hef) (IN.)
					BRACE SPACING (FT.)	BRACE DETAIL PAGE	ATTACHMENT DETAIL PAGE	BRACE SPACING (FT.)	BRACE DETAIL PAGE	ATTACHMENT DETAIL PAGE			
3	26.9	8'	1/2	3 1/4	28'	4-13	11-1	36'	4-15	11-1	45	5/8	4

In conclusion, the 30” x 40” x 18 gage duct in this example, trapeze hung at 8 ft. spacing on the third floor of a 4 story building, can be adequately braced using:

Page 4-13, Detail 7, Transverse Rigid Bracing for Trapeze Supported Duct,
Page 4-15, Detail 7/8, Combo Transv. / Longit. Rigid Brace for Trapeze Supported Duct, 4 braces per location
Page 5-2, Trapeze Brace Spacing Chart for Concrete Wedge Anchors,
Page 11-1, Hilti KB-TZ Wedge Anchors in 4,000 psi NW Concrete,
Page 11-2, Hilti KB-TZ Wedge Anchors in 4,000 psi NW Concrete, for Hanger Attachments, and with Brace Spacing at 28 ft Transverse and 36 ft Longitudinal.

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THE FOLLOWING TABLES ARE PRE-DESIGNED FOR IMMEDIATE USE. USING PIPE, DUCT, OR TRAPEZE SIZE/WEIGHT, AND PROJECT F_P, THESE TABLES PROVIDE SEISMIC BRACE SPACING AND COMPONENT DESIGN BASED ON OPM 0052-13.

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Structural Engineer: Mohammad Hariri
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PAGE: 1-33
DATE: NOVEMBER 29, 2016

MH

CABLE BRACE DUCT (SHEET STEEL)

INSTALLATION DETAILS: 8-13, 8-14, 8-15

F_P = 0.50 G F_V = 0.41 G			3/16" CABLE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
RECTANGULAR DUCT		HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
DUCT SIZE	MAX. WT. (PLF)		TRANS. (FT)	LONGIT. (FT)****	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
6 SQ FT	15.60	8	28	56	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
8 SQ FT	21.30	8	21	42	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
10 SQ FT	23.80	8	18	36	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
12 SQ FT	25.50	8	22	44	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
16 SQ FT	28.40	8	19	38	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
20 SQ FT	43.90	8	12	24	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
24 SQ FT	51.60	8	11	22	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
28 SQ FT	53.90	8	10	20	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
32 SQ FT	56.30	8	9	18	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
36 SQ FT	58.50	8	9	18	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0

* MAXIMUM PER SMACNA REQUIREMENTS.

** BASED ON HILTI KB-TZ

*** (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR

**** THE LONGITUDINAL SPACING IS VALID WHEN THE TRAPEZE IS LOADED CONCENTRICALLY

CABLE BRACE DUCT (SHEET STEEL)

INSTALLATION DETAILS: 8-13, 8-14, 8-15

F_P = 1.00 G F_V = 0.41 G			3/16" CABLE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
RECTANGULAR DUCT		HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
DUCT SIZE	MAX. WT. (PLF)		TRANS. (FT)	LONGIT. (FT)****	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
6 SQ FT	15.60	8	18	36	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
8 SQ FT	21.30	8	13	26	11-3 (D)	0.625 x 3.125 (2)	11-4 (S)	0.625 x 4.0
10 SQ FT	23.80	8	11	22	11-3 (D)	0.625 x 3.125 (2)	11-4 (S)	0.625 x 4.0
12 SQ FT	25.50	8	11	22	11-3 (D)	0.625 x 3.125 (2)	11-4 (S)	0.625 x 4.0
16 SQ FT	28.40	8	9	18	11-3 (D)	0.625 x 3.125 (2)	11-4 (D)	0.50 x 3.25 (2)
20 SQ FT	43.90	8	6	12	11-3 (D)	0.625 x 3.125 (2)	11-4 (D)	0.50 x 3.25 (2)
24 SQ FT	51.60	8	5	10	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)
28 SQ FT	53.90	8	5	10	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)
32 SQ FT	56.30	8	4	8	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)
36 SQ FT	58.50	8	4	8	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)

* MAXIMUM PER SMACNA REQUIREMENTS.

** BASED ON HILTI KB-TZ

*** (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR

**** THE LONGITUDINAL SPACING IS VALID WHEN THE TRAPEZE IS LOADED CONCENTRICALLY

CABLE BRACE SINGLE HUNG STEEL PIPE OR CONDUIT

INSTALLATION DETAILS: 6-2 THRU 6-13

F_P = 0.50 G F_v = 0.41 G			3/16" CABLE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
PIPE SIZE (DIA.)	MAX. WEIGHT (PLF)	HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
			TRANS. (FT)	LONGIT. (FT)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
1-1/4 ****	3.8	7	30*	58	11-3 (S)	0.50 x 3.25	11-4 (S)	0.375 x 2.0
			25*	25	11-3 (S)	0.375 x 2.0	11-4 (S)	0.375 x 2.0
1-1/2 ****	4.5	9	28	49	11-3 (S)	0.50 x 3.25	11-4 (S)	0.375 x 2.0
			21*	21	11-3 (S)	0.375 x 2.0	11-4 (S)	0.375 x 2.0
2 ****	6.2	10	36	36	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
			15	15	11-3 (S)	0.375 x 2.0	11-4 (S)	0.50 x 2.0
2-1/2	9.1	11	23	23	11-3 (D)	0.50 x 3.25 (2)	11-4 (S)	0.50 x 3.25
			10	10	11-3 (S)	0.5 x 3.25	11-4 (S)	0.50 x 3.25
3	12.1	12	17	17	11-3 (D)	0.50 x 3.25 (2)	11-4 (D)	0.50 x 3.25 (2)
		10	10	10	11-3 (S)	0.5 x 2.0	11-4 (S)	0.50 x 3.25
4	18.3	12	24	24	11-3 (D)	0.50 x 3.25 (2)	11-4 (D)	0.50 x 3.25 (2)
		10	12	12	11-3 (S)	0.5 x 3.25	11-4 (D)	0.50 x 3.25 (2)
6	34.8	10	14	14	11-3 (D)	0.50 x 3.25 (2)	11-4 (D)	0.50 / 3.25 (2)
			10	10	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 / 3.25 (2)
8	55.10	8	8	8	11-3 (D)	0.625 x 4.0 (2)	11-4 (D)	0.5 / 3.25 (2)

*   BASED ON MAXIMUM SEISMIC BRACE SPACINGS PER STRESS/DEFLECTION ON PAGE 14-1
**   BASED ON HILTI KB-TZ
***   (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR
**** INSTALLATION DETAILS 6-4, 6-6, 6-7 & 6-12 MAY BE USED FOR THESE PIPE DIAMETERS.

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CABLE BRACE SINGLE HUNG STEEL PIPE OR CONDUIT

INSTALLATION DETAILS: 6-2 THRU 6-13

F_P = 1.00 G F_V = 0.41 G			3/16" CABLE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
PIPE SIZE (DIA.)	MAX. WEIGHT (PLF)	HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
			TRANS. (FT)	LONGIT. (FT)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
1-1/4 ****	3.8	7	29	29	11-3 (S)	0.50 x 3.25	11-4 (S)	0.375 x 2.0
1-1/2 ****	4.5	9	24	24	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
2 ****	6.2	10	18	18	11-3 (S)	0.50 x 3.25	11-4 (S)	0.625 x 4.0
2-1/2	9.1	10	11	11	11-3 (S)	0.50 x 3.25	11-4 (S)	0.625 x 4.0
3	12.1	8	8	8	11-3 (S)	0.50 x 3.25	11-4 (S)	0.625 x 4.0
4	18.3	12	12	12	11-3 (D)	0.50 x 3.25 (2)	11-4 (D)	0.50 x 3.25 (2)
6	34.8	14	8	8	11-3 (D)	0.625 x 4.0 (2)	11-4 (D)	0.625 x 4.0 (2)
8	55.10	8	5	5	11-3 (D)	0.625 x 4.0 (2)	11-4 (D)	0.625 x 4.0 (2)

* BASED ON MAXIMUM SEISMIC BRACE SPACINGS PER STRESS/DEFLECTION ON PAGE 14-1

** BASED ON HILTI KB-TZ

*** (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR

**** INSTALLATION DETAILS 6-4, 6-6, 6-7 & 6-12 MAY BE USED FOR THESE PIPE DIAMETERS.

CABLE BRACE TRAPEZE STEEL PIPE OR CONDUIT

INSTALLATION DETAILS: 8-1, 8-2, 8-3, 8-4, 8-5, 8-6

F_P = 0.50 G F_V = 0.41 G		3/16" CABLE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
MAX. TRAPEZE WEIGHT (PLF)	HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
		TRANS.* (FT)	LONGIT. (FT)****	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
TRAPEZE 5 LB/FT	6	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 10 LB/FT	6	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 20 LB/FT	6	28	56	11-3 (S)	0.625 x 4.0	11-4 (S)	0.50 x 3.25
TRAPEZE 40 LB/FT	6	14	28	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 50 LB/FT	6	11	22	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 60 LB/FT	5	9	18	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 5 LB/FT	10	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 10 LB/FT	10	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 20 LB/FT	10	28	56	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 40 LB/FT	10	14	28	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 50 LB/FT	10	11	22	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 60 LB/FT	10	9	18	11-3 (S)	0.625 x 4.0	11-4 (D)	0.625 x 4.0 (2)

* FOR ANY PIPE/CONDUIT ON TRAPEZE, SEISMIC BRACE SPACING MUST NOT EXCEED MAX. TRANSVERSE SPACING GIVEN IN TABLES IN SECTION 14, AND THIS TABLE

** BASED ON HILTI KB-TZ

*** (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR

**** THE LONGITUDINAL SPACING IS VALID WHEN THE TRAPEZE IS LOADED CONCENTRICALLY

CABLE BRACE TRAPEZE STEEL PIPE OR CONDUIT

INSTALLATION DETAILS: 8-1, 8-2, 8-3, 8-4, 8-5, 8-6

F_P = 1.00 G F_v = 0.41 G		3/16" CABLE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
MAX. TRAPEZE WEIGHT (PLF)	HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
		TRANS.* (FT)	LONGIT. (FT)****	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
TRAPEZE 5 LB/FT	6	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 10 LB/FT	6	28	56	11-3 (S)	0.625 x 4.0	11-4 (S)	0.50 x 3.25
TRAPEZE 20 LB/FT	6	14	28	11-3 (S)	0.625 x 4.0	11-4 (S)	0.50 x 3.25
TRAPEZE 40 LB/FT	6	7	14	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 50 LB/FT	6	5	11	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 60 LB/FT	5	4	8	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 5 LB/FT	10	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 10 LB/FT	10	28	56	11-3 (S)	0.625 x 4.0	11-4 (S)	0.50 x 3.25
TRAPEZE 20 LB/FT	10	14	28	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)
TRAPEZE 40 LB/FT	10	7	14	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)
TRAPEZE 50 LB/FT	10	5	11	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)
TRAPEZE 60 LB/FT	10	4	8	11-3 (S)	0.625 x 4.0	11-4 (D)	0.625 x 4.0 (2)

* FOR ANY PIPE/CONDUIT ON TRAPEZE, SEISMIC BRACE SPACING MUST NOT EXCEED MAX. TRANSVERSE SPACING GIVEN IN TABLES IN SECTION 14, AND THIS TABLE

** BASED ON HILTI KB-TZ

*** (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR

**** THE LONGITUDINAL SPACING IS VALID WHEN THE TRAPEZE IS LOADED CONCENTRICALLY

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RIDGE BRACE DUCT (SHEET STEEL)

INSTALLATION DETAILS: 4-13, 4-14, 4-15

F_P = 0.50 G F_V = 0.41 G			RIDGE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
RECTANGULAR DUCT		HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
DUCT SIZE	MAX. WT. (PLF)		TRANS. (FT)	LONGIT. (FT)****	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
6 SQ FT	15.60	8	28	56	11-3 (S)	0.50 x 3.25	11-4 (S)	0.625 x 4.0
8 SQ FT	21.30	8	21	42	11-3 (S)	0.50 x 3.25	11-4 (S)	0.625 x 4.0
10 SQ FT	23.80	8	18	36	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
12 SQ FT	25.50	8	18	36	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
16 SQ FT	28.40	8	16	32	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
20 SQ FT	43.90	8	10	21	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
24 SQ FT	51.60	8	9	18	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
28 SQ FT	53.90	8	8	16	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
32 SQ FT	56.30	8	8	16	11-3 (S)	0.625 x 4.0	11-4 (D)	0.625 x 4.0 (2)
36 SQ FT	58.50	8	8	16	11-3 (S)	0.625 x 4.0	11-4 (D)	0.625 x 4.0 (2)

* MAXIMUM PER SMACNA REQUIREMENTS.
** BASED ON HILTI KB-TZ
*** (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR
**** THE LONGITUDINAL SPACING IS VALID WHEN THE TRAPEZE IS LOADED CONCENTRICALLY

RIDGE BRACE DUCT (SHEET STEEL)

INSTALLATION DETAILS: 4-13, 4-14, 4-15

F_P = 1.00 G F_V= 0.41 G			RIDGE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
RECTANGULAR DUCT		HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
DUCT SIZE	MAX. WT. (PLF)		TRANS. (FT)	LONGIT. (FT)****	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
6 SQ FT	15.60	8	15	30	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
8 SQ FT	21.30	8	11	22	11-3 (D)	0.625 x 3.125 (2)	11-4 (S)	0.625 x 4.0
10 SQ FT	23.80	8	9	18	11-3 (D)	0.625 x 3.125 (2)	11-4 (S)	0.625 x 4.0
12 SQ FT	25.50	8	9	18	11-3 (D)	0.625 x 3.125 (2)	11-4 (S)	0.625 x 4.0
16 SQ FT	28.40	8	8	16	11-3 (D)	0.625 x 3.125 (2)	11-4 (S)	0.625 x 4.0
20 SQ FT	43.90	8	5	10	11-3 (D)	0.625 x 3.125 (2)	11-4 (D)	0.625 x 4.0 (2)
24 SQ FT	51.60	8	4	8	11-3 (D)	0.625 x 3.125 (2)	11-4 (D)	0.625 x 4.0 (2)
28 SQ FT	53.90	8	4	8	11-3 (D)	0.625 x 3.125 (2)	11-4 (D)	0.625 x 4.0 (2)
32 SQ FT	56.30	6	4	8	11-3 (D)	0.625 x 3.125 (2)	11-4 (D)	0.625 x 4.0 (2)
36 SQ FT	58.50	6	4	8	11-3 (D)	0.625 x 3.125 (2)	11-4 (D)	0.625 x 4.0 (2)

* MAXIMUM PER SMACNA REQUIREMENTS.
** BASED ON HILTI KB-TZ
*** (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR
**** THE LONGITUDINAL SPACING IS VALID WHEN THE TRAPEZE IS LOADED CONCENTRICALLY.

RIDGE BRACE SINGLE HUNG STEEL PIPE OR CONDUIT

INSTALLATION DETAILS: 2-4, 2-10, 2-14, 2-14a

F_P = 0.50 G F_v = 0.41 G			RIDGE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
PIPE SIZE (DIA.)	MAX. WEIGHT (PLF)	HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
			TRANS. (FT)	LONGIT. (FT)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
1-1/4	3.8	7	30*	58	11-3 (S)	0.50 x 3.25	11-4 (S)	0.375 x 3.25
			25	25	11-3 (S)	0.375 x 2.0	11-4 (S)	0.375 x 3.25
1-1/2	4.5	9	28	49	11-3 (S)	0.50 x 3.25	11-4 (S)	0.375 x 3.25
			21	21	11-3 (S)	0.375 x 2.0	11-4 (S)	0.375 x 3.25
2	6.2	10	36	36	11-3 (S)	0.50 x 3.25	11-4 (S)	0.625 x 4.0
			15	15	11-3 (S)	0.375 x 2.0	11-4 (S)	0.625 x 4.0
2-1/2	9.1	11	34	34	11-3 (D)	0.50 x 3.25 (2)	11-4 (S)	0.625 x 4.0
			14	14	11-3 (S)	0.5 x 2.0	11-4 (S)	0.625 x 4.0
3	12.1	10	26	26	11-3 (D)	0.50 x 3.25 (2)	11-4 (D)	0.50 x 3.25 (2)
		8	10	10	11-3 (S)	0.5 x 3.25	11-4 (D)	0.50 x 3.25 (2)
4	18.3	12	27	27	11-3 (D)	0.50 x 3.25 (2)	11-4 (D)	0.625 x 4.0 (2)
		10	12	12	11-3 (S)	0.5 x 3.25	11-4 (D)	0.6.25 x 4.0 (2)
6	34.8	10	14	14	11-3 (D)	0.50 x 3.25 (2)	11-4 (D)	0.625 x 4.0 (2)
			6	6	11-3 (S)	0.50 x 3.25	11-4 (D)	0.625 x 4.0 (2)
8	55.10	8	8	8	11-3 (D)	0.50 x 3.25 (2)	11-4 (D)	0.625 x 4.0 (2)

* BASED ON MAXIMUM SEISMIC BRACE SPACING PER STRESS/DEFLECTION ON PAGE 14-1

** BASED ON HILTI KB-TZ

*** (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR

RIDGE BRACE SINGLE HUNG STEEL PIPE OR CONDUIT

INSTALLATION DETAILS: 2-4, 2-10, 2-14, 2-14a

F_P = 1.00 G F_V = 0.41 G			RIDGE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
PIPE SIZE (DIA.)	MAX. WEIGHT (PLF)	HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
			TRANS. (FT)	LONGIT. (FT)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
1-1/4	3.8	7	24	29	11-3 (S)	0.50 x 3.25	11-4 (S)	0.5 x3.25
1-1/2	4.5	9	24	24	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
2	6.2	10	18	18	11-3 (S)	0.50 x 3.25	11-4 (D)	0.50 x 3.25 (2)
2-1/2	9.1	10	12	12	11-3 (S)	0.50 x 3.25	11-4 (D)	0.50 x 3.25 (2)
3	12.1	8	9	9	11-3 (S)	0.50 x 3.25	11-4 (D)	0.625 x 4.0 (2)
4	18.3	10	13	13	11-3 (D)	0.50 x 3.25 (2)	11-4 (D)	0.625 x 4.0 (2)
6	34.8	8	7	7	11-3 (D)	0.625 x 4.0 (2)	11-4 (D)	0.625 x 4.0 (2)
8	55.10	4	4	4	11-3 (D)	0.625 x 4.0 (2)	11-4 (D)	0.625 x 4.0 (2)

* BASED ON MAXIMUM SEISMIC BRACE SPACINGS PER STRESS/DEFLECTION ON PAGE 14-1

** BASED ON HILTI KB-TZ

*** (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR

RIDGE BRACE TRAPEZE STEEL PIPE OR CONDUIT

INSTALLATION DETAILS: 4-1, 4-2, 4-3, 4-4, 4-5, 4-6

F_P = 0.50 G F_V = 0.41 G		RIDGE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
MAX. TRAPEZE WEIGHT (PLF)	HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
		TRANS.* (FT)	LONGIT. (FT)****	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
TRAPEZE 5 LB/FT	6	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 10 LB/FT	6	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 20 LB/FT	6	23	46	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 40 LB/FT	6	11	23	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 50 LB/FT	6	9	18	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 60 LB/FT	6	9	18	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 5 LB/FT	10	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 10 LB/FT	10	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 20 LB/FT	10	23	46	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 40 LB/FT	10	11	23	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 50 LB/FT	10	9	18	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 60 LB/FT	10	9	18	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)

* FOR ANY PIPE/CONDUIT ON TRAPEZE, SEISMIC BRACE SPACING MUST NOT EXCEED MAX. TRANSVERSE SPACING GIVEN IN TABLES IN SECTION 14, AND THIS TABLE

** BASED ON HILTI KB-TZ

*** (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR

**** THE LONGITUDINAL SPACING IS VALID WHEN THE TRAPEZE IS LOADED CONCENTRICALLY

RIDGE BRACE TRAPEZE STEEL PIPE OR CONDUIT

INSTALLATION DETAILS: 4-1, 4-3, 4-2, 4-4, 4-5, 4-6

F_P = 1.00 G F_V = 0.41 G		RIDGE BRACING AT 45 DEG. BRACE ANGLE SAND LIGHTWEIGHT CONCRETE OVER METAL DECK					
MAX. TRAPEZE WEIGHT (PLF)	HANGER SPACING (FT)	SEISMIC BRACE SPACING - MAX		SEISMIC BRACE ATTACHMENT		HANGER ATTACHMENT	
		TRANS.* (FT)	LONGIT. (FT)****	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)	DETAIL (PAGE)***	ANCHOR**x EMBED (IN)
TRAPEZE 5 LB/FT	6	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 10 LB/FT	6	28	56	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 20 LB/FT	6	14	28	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 40 LB/FT	6	5	10	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 50 LB/FT	6	4	8	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 60 LB/FT	5	3	6	11-3 (S)	0.625 x 4.0	11-4 (S)	0.625 x 4.0
TRAPEZE 5 LB/FT	10	40	80	11-3 (S)	0.50 x 3.25	11-4 (S)	0.50 x 3.25
TRAPEZE 10 LB/FT	10	28	56	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)
TRAPEZE 20 LB/FT	10	14	28	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)
TRAPEZE 40 LB/FT	10	5	10	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)
TRAPEZE 50 LB/FT	10	4	8	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)
TRAPEZE 60 LB/FT	10	3	6	11-3 (S)	0.625 x 4.0	11-4 (D)	0.50 x 3.25 (2)

* FOR ANY PIPE/CONDUIT ON TRAPEZE, SEISMIC BRACE SPACING MUST NOT EXCEED MAX. TRANSVERSE SPACING GIVEN IN TABLES IN SECTION 14, AND THIS TABLE

** BASED ON HILTI KB-TZ

*** (S) = SINGLE ANCHOR; (D) = DOUBLE ANCHOR

**** THE LONGITUDINAL SPACING IS VALID WHEN THE TRAPEZE IS LOADED CONCENTRICALLY

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MH

9.0 COMPONENT PART NUMBER REFERENCE:

B-LINE B3100	
Part Number	Description
78101105026	B3100-1 1/2 HDG CLVS HNGR
78101105024	B3100-1 1/2 PLN CLVS HNGR
78101105714	B3100-1 1/2 SS4
78101174556	B3100-1 1/2 SS6 CLVS
78101105025	B3100-1 1/2 ZN CLVS HGR
78101105020	B3100-1 1/4 HDG CLVS HNGR
78101105018	B3100-1 1/4 PLN CLVS HNGR
78101105713	B3100-1 1/4 SS4
78101174558	B3100-1 1/4 SS6 CLVS
78101105019	B3100-1 1/4 ZN CLVS HGR
78101105038	B3100-2 1/2 HDG CLVS HNGR
78101105036	B3100-2 1/2 PLN CLVS HNGR
78101105716	B3100-2 1/2 SS4
78101174567	B3100-2 1/2 SS6 CLVS
78101105037	B3100-2 1/2 ZN CLVS HGR
78101105032	B3100-2 HDG CLVS HNGR
78101105030	B3100-2 PLN CLVS HNGR
78101105715	B3100-2 SS4
78101174564	B3100-2 SS6 CLVS HNGR
78101105031	B3100-2 ZN CLVS HNGR
78101105050	B3100-3 1/2 HDG CLVS HNGR
78101105048	B3100-3 1/2 PLN CLVS HNGR
78101174575	B3100-3 1/2 SS4 CLVS
78101174576	B3100-3 1/2 SS6 CLEVIS
78101105049	B3100-3 1/2 ZN CLVS HGR
78101105044	B3100-3 HDG CLVS HNGR
78101105042	B3100-3 PLN CLVS HNGR
78101105717	B3100-3 SS4
78101174574	B3100-3 SS6 CLVS HNGR
78101105043	B3100-3 ZN CLVS HNGR
78101105056	B3100-4 HDG CLVS HNGR
78101105054	B3100-4 PLN CLVS HNGR
78101105718	B3100-4 SS4
78101174580	B3100-4 SS6 CLVS HNGR
78101105055	B3100-4 ZN CLVS HNGR
78101105062	B3100-5 HDG CLVS HNGR
78101105060	B3100-5 PLN CLVS HNGR
78101105719	B3100-5 SS4
78101174584	B3100-5 SS6 CLVS HNGR
78101105061	B3100-5 ZN CLVS HNGR
78101105065	B3100-6 HDG CLVS HNGR
78101105066	B3100-6 PLN CLVS HNGR
78101105720	B3100-6 SS4
78101174586	B3100-6 SS6 CLVS HNGR
78101105067	B3100-6 ZN CLVS HNGR
78101105071	B3100-8 HDG CLVS HNGR
78101105072	B3100-8 PLN CLVS HNGR
78101105721	B3100-8 SS4
78101174589	B3100-8 SS6 CLVS HNGR
78101105073	B3100-8 ZN CLVS HNGR

FIG. 1CBS	
Part Number	Description
Y006012	FIG. 1CBS 1 1/4 CLVSBLT SP PGL
Y006014	FIG. 1CBS 1 1/2"CLVSBLT SP PGL
Y006020	FIG. 1CBS 2" CLVSBLT SP PGL
Y006024	FIG. 1CBS 2 1/2"CLVSBLT SP PGL
Y006030	FIG. 1CBS 3" CLVSBLT SP PGL
Y006034	FIG. 1CBS 3 1/2"CLVSBLT SP PGL
Y006040	FIG. 1CBS 4" CLVSBLT SP PGL
Y006050	FIG. 1CBS 5" CLVSBLT SP PGL
Y006060	FIG. 1CBS 6" CLVSBLT SP PGL
Y006080	FIG. 1CBS 8" CLVSBLT SP PGL

FIG. 980	
Part Number	Description
Y3410003E	FIG. 980 3/8HL UNIVBRCATT EG
Y3410003	FIG. 980 3/8HL UNIVBRCATT PLN
Y3410004E	FIG. 980 1/2HL UNIVBRCATT EG
Y3410004	FIG. 980 1/2HL UNIVBRCATT PLN
Y3410005E	FIG. 980 5/8HL UNIVBRCATT EG
Y341000005	FIG. 980 5/8HL UNIVBRCATT PLN
Y3410006E	FIG. 980 3/4HL UNIVBRCATT EG
Y3410006	FIG. 980 3/4HL UNIVBRCATT PLN
Y3410004HDG	FIG. 980 1/2HL UNIVBRCATT HDG
Y3410006HDG	FIG. 980 3/4HL UNIVBRCATT HDG
Y3410005HDG	FIG. 980 5/8HL UNIVBRCATT HDG
Y341000S316	FIG. 980S 1/2" HL UNIVBRCATT SS 316

FIG. 980H	
Part Number	Description
Y341007HE	FIG. 980H 7/8" HEAVEDUTUNIVBRCATT EG
Y341010HE	FIG. 980H 1" HEAVEDUTUNIVBRCATT EG
Y341012HE	FIG. 980H 1-1/4" HEAVEDUTUNIVBRCATT EG

FIG. 909	
Part Number	Description
Y33901004E	FIG. 909 1" NO THRD SWVL 1/2" HL EG
Y33901004	FIG. 909 1" NO THRD SWVL 1/2" HL PLN
Y33901005E	FIG. 909 1" NO THRD SWVL 5/8" HL EG
Y33901005	FIG. 909 1" NO THRD SWVL 5/8" HL PLN
Y33901006E	FIG. 909 1" NO THRD SWVL 3/4" HL EG
Y33901006	FIG. 909 1" NO THRD SWVL 3/4" HL PLN

FIG. 910	
Part Number	Description
Y33701004E	FIG. 910 1 SVLEQBFTNG EG

FIG. 986	
Part Number	Description
Y355004EGP	FIG. 986 1/2 MECSEISMICSTRUCTL ATTACH EG

FIG. 98	
Part Number	Description
YS1900304	FIG. 98 STIFFENER 304
YS1900316	FIG. 98 STIFFENER 316
YS1900HDG	FIG. 98 STIFFENER HDG

FIG. 98B	
Part Number	Description
YS1900BE	FIG. 98B STIFFENER BREAK-OFF BLT HEAD EG
YS1900BEGP	FIG. 98B STIFFENER BREAK-OFF BLT HEAD EG

ATR	
Part Number	Description
	3/8", 1/2" , 5/8", 3/4"
78101169034	ATR, 3/8X120 PLN
78101169035	ATR, 3/8X120 ZN
78101187873	ATR, 3/8X120 HDG
78101187875	ATR, 3/8X120 SS4
78101191953	ATR, 3/8X120 SS6
78101104920	ATR, 3/8X144 SS6
78101169036	ATR, 3/8X144 PLN
78101169037	ATR, 3/8X144 ZN
78101187901	ATR, 3/8X144 SS4
78101104911	ATR, 1/2X120 SS6
78101169044	ATR, 1/2X120 PLN
78101169045	ATR, 1/2X120 ZN
78101187880	ATR, 1/2X120 HDG
78101187882	ATR, 1/2X120 SS4
78101104251	ATR, 1/2X144 SS4
78101169047	ATR, 1/2X144 ZN
78101187910	ATR, 1/2X144 SS6
78101169054	ATR, 5/8X120 PLN
78101169055	ATR, 5/8X120 ZN
78101193482	ATR, 5/8X120 SS4
78101169056	ATR, 5/8X144 PLN
78101169057	ATR, 5/8X144 ZN
78101187916	ATR, 5/8X144 SS4
78101187917	ATR, 5/8X144 SS6
12377616	ATR, 3/4X120 SS6
12463642	ATR, 3/4X120 HDG
78101169064	ATR, 3/4X120 PLN
78101169065	ATR, 3/4X120 ZN
78101187918	ATR, 3/4X120 SS4
11681009	ATR, 3/4X144 HDG
12307049	ATR, 3/4X144 SS6
78101169066	ATR, 3/4X144 PLN
78101169067	ATR, 3/4X144 ZN
78101187922	ATR, 3/4X144 SS4

9.0 COMPONENT PART NUMBER REFERENCE:

B-LINE FIG. 4B	
Part Number	Description
Y086012E	FIG. 4B 1 1/4 PIPE CLAMP EG
Y086012	FIG. 4B 1 1/4 PIPE CLAMP PLN
Y086014E	FIG. 4B 1 1/2 PIPE CLAMP EG
Y086014	FIG. 4B 1 1/2 PIPE CLAMP PLN
Y086020E	FIG. 4B 2" PIPE CLAMP EG
Y086020	FIG. 4B 2" PIPE CLAMP PLN
Y086024E	FIG. 4B 2 1/2 PIPE CLAMP EG
Y086024	FIG. 4B 2 1/2 PIPE CLAMP PLN
Y086030E	FIG. 4B 3" PIPE CLAMP EG
Y086030	FIG. 4B 3" PIPE CLAMP PLN
Y086040E	FIG. 4B 4" PIPE CLAMP EG
Y086040	FIG. 4B 4" PIPE CLAMP PLN
Y086060E	FIG. 4B 6" PIPE CLAMP EG
Y086060	FIG. 4B 6" PIPE CLAMP PLN
Y086080E	FIG. 4B 8" PIPE CLAMP EG
Y086080	FIG. 4B 8" PIPE CLAMP PLN

B-LINE B3380	
Part Number	Description
12382238	B3380-1 CAL/SIL
12382239	B3380-5 CAL/SIL
12383328	B3380-3/4 CAL/SIL
12383470	B3380-2 1/2 CAL/SIL
78101172344	B3380-3 CAL/SIL
78101172348	B3380-6 CAL/SIL - INA
78205133288	B3380-4 CAL/SIL
11677170	B3381-1
11677172	B3381-1 1/2
11677183	B3381-2
11677184	B3381-3

B-LINE B3380 (CONT.)	
Part Number	Description
11677185	B3381-4
11677193	B3381-6
12108236	B3381-2 1/2
78101172378	B3382-1
78101172380	B3382-1 1/2 CAL/SIL- INA
78101172379	B3382-1 1/4
11990436	B3382-1/2
78101172389	B3382-10 CAL/SIL - INA
12426167	B3382-12 CALCIUM SILICATE
12575128	B3382-14 CALCIUM SILICATE
11988039	B3382-16 CALCIUM SILICATE
11668155	B3382-18 CALCIUM SILICATE
11741042	B3382-2
11741044	B3382-2 1/2
12197451	B3382-20
12197450	B3382-24
78205128141	B3382-3
11935569	B3382-3/4
12197409	B3382-30
78205128139	B3382-4
11809817	B3382-5
78205128138	B3382-6
78205128137	B3382-8
11834663	B3383-1 1/2
11990433	B3383-1 1/4
12212993	B3383-1 CAL SIL SHIELD
11867182	B3383-1 SS4
78101172396	B3383-1/2
78205128151	B3383-10
78101172411	B3383-12 CAL/SIL - INA
12212997	B3383-12CI CAST IRON CAL/SIL
78101172412	B3383-14
12368401	B3383-16 CALCIUM SILICATE
11668156	B3383-18 CALCIUM SILICATE
78101172402	B3383-2 1/2 CAL/SIL- INA
11986637	B3383-2 CAL SIL SHIELD
11867183	B3383-2 SS4
12212994	B3383-2CI CAST IRON CAL/SIL
12464064	B3383-3 1/2 CAL/SIL - INA
78101172403	B3383-3 CAL/SIL - INA
78101172397	B3383-3/4 CAL/SIL - INA
12212995	B3383-3CI CAST IRON CAL/SIL
78205128155	B3383-4
11867184	B3383-4 SS4
12213866	B3383-4CI CAST IRON CAL/SIL
78205128154	B3383-5
78205128153	B3383-6

B-LINE B3380 (CONT.)	
Part Number	Description
12212996	B3383-6CI CAST IRON CAL/SIL
78205128152	B3383-8
12212998	B3383-8CI CAST IRON CAL/SIL
11837100	B3384-1 1/2 CAL/SIL
11734889	B3384-1 1/4 CAL/SIL
11837103	B3384-1 CAL/SIL
78101172430	B3384-10
11806145	B3384-12 CAL/SIL
11834065	B3384-14 CAL/SIL
11806039	B3384-16 CAL/SIL
11638916	B3384-2 1/2 CALCIUM SILICATE
11697932	B3384-2 CAL/SIL
11806040	B3384-20 CAL/SIL
12212992	B3384-24 CAL/SIL
78205128150	B3384-3
12004867	B3384-3/4 CAL/SIL
12212991	B3384-30 CAL/SIL
78205128149	B3384-4
11638919	B3384-5 CALCIUM SILICATE
78101172428	B3384-6 CAL/SIL - INA
78101172429	B3384-8 CAL/SIL - INA
11757728	B3385-2
78101172444	B3385-2 1/2 CAL/SIL- INA
78205132503	B3385-3
78205128148	B3385-4
12078560	B3385-6
11990432	B3386-1 1/2
11990434	B3386-1
11990435	B3386-3/4
11990479	B3386-2
12076209	B3386-2 1/2
12101422	B3386-3
12373875	B3386-1 1/4
78101172471	B3386-8
78101172472	B3386-10
78205128144	B3386-6 X 3 1/2
78205128145	B3386-4
78205128146	B3386-6
78205128147	B3386-5
11742722	B3387-6 CALCIUM SILICATE
11742724	B3387-8 CALCIUM SILICATE
12018235	B3387-4 CALCIUM SILICATE
12018237	B3387-1 CALCIUM SILICATE
12206382	B3387-10 CALCIUM SILICATE
12206383	B3387-14 CALCIUM SILICATE

9.0 COMPONENT PART NUMBER REFERENCE:

FIG. 4L

Part Number	Description
Y088020E	FIG. 4L 2" PIPECL EQB EG
Y088020	FIG. 4L 2" PIPECL EQB PLN
Y088024E	FIG. 4L 2 1/2" PIPECL EQB EG
Y088024	FIG. 4L 2 1/2" PIPECL EQB PLN
Y088030E	FIG. 4L 3" PIPECL EQB EG
Y088030	FIG. 4L 3" PIPECL EQB PLN
Y088040E	FIG. 4L 4" PIPECL EQB EG
Y088040	FIG. 4L 4" PIPECL EQB PLN
Y088060E	FIG. 4L 6" PIPECL EQB EG
Y088060	FIG. 4L 6" PIPECL EQB PLN
Y088080E	FIG. 4L 8" PIPECL EQB EG
Y088080	FIG. 4L 8" PIPECL EQB PLN

B-LINE B22 STRUT

Part Number	Description
78101121130	B22-120 GLV
78101121122	B22-120 SS4
78101121109	B22-120 HDG
78101104581	B22-120 SS6
11997954	B22-240 ZN
78101121117	B22-240 HDG
78101121126	B22-240 SS4
78101121135	B22-240 GLV
78101181236	B22-240 SS6

FIG. 4LA

Part Number	Description
Y093010E	FIG. 4LA 1" LONG LAT SWAY BRC ATT EG
Y093010	FIG. 4LA 1" LONG LAT SWAY BRC ATT PLN
Y093012E	FIG. 4LA 1 1/4" LONG LAT SWAY BRC ATT EG
Y093012	FIG. 4LA 1 1/4"LONG LAT SWAY BRC ATT PLN
Y093014E	FIG. 4LA 1 1/2" LONG LAT SWAY BRC ATT EG
Y093014	FIG. 4LA 1 1/2"LONG LAT SWAY BRC ATT PLN
Y093020E	FIG. 4LA 2" LONG LAT SWAY BRC ATT EG
Y093020	FIG. 4LA 2" LONG LAT SWAY BRC ATT PLN
Y093024E	FIG. 4LA 2 1/2" LONG LAT SWAY BRC ATT EG
Y093024	FIG. 4LA 2 1/2"LONG LAT SWAY BRC ATT PLN
Y093030E	FIG. 4LA 3" LONG LAT SWAY BRC ATT EG
Y093030	FIG. 4LA 3" LONG LAT SWAY BRC ATT PLN
Y093040E	FIG. 4LA 4" LONG LAT SWAY BRC ATT EG
Y093040	FIG. 4LA 4" LONG LAT SWAY BRC ATT PLN
Y093050E	FIG. 4LA 5" LONG LAT SWAY BRC ATT EG
Y093050	FIG. 4LA 5" LONG LAT SWAY BRC ATT PLN
Y093060E	FIG. 4LA 6" LONG LAT SWAY BRC ATT EG
Y093060	FIG. 4LA 6" LONG LAT SWAY BRC ATT PLN
Y093080E	FIG. 4LA 8" LONG LAT SWAY BRC ATT EG
Y093080	FIG. 4LA 8" LONG LAT SWAY BRC ATT PLN
Y093100E	FIG. 4LA 10" LONG LAT SWAY BRC ATT EG
Y093100	FIG. 4LA 10" LONG LAT SWAY BRC ATT PLN
Y093120E	FIG. 4LA 12" LONG LAT SWAY BRC ATT EG
Y093120	FIG. 4LA 12" LONG LAT SWAY BRC ATT PLN

HILTI KB-TZ

Part Number	Description
12454021	KBTZ-1/2 X 3 3/4 HILTI EXP ANCHOR

POWERS WOOD KNOCKER

Part Number	Description
78205131147	ACPW-25 WOOD KNOCKER
78205131149	ACPW-37 WOOD KNOCKER
78205131151	ACPW-50 WOOD KNOCKER
78205131152	ACPW-62 WOOD KNOCKER
78205131153	ACPW-75 WOOD KNOCKER

POWERS BANG-IT

Part Number	Description
11905158	ACPD-87 BANG-IT
78205131154	ACPD-25 BANG-IT
78205131156	ACPD-37 BANG-IT
78205131157	ACPD-50 BANG-IT
78205131158	ACPD-62 BANG-IT
78205131166	ACPD-75 BANG-IT

9.0 COMPONENT PART NUMBER REFERENCE:

FIG. 825	
Part Number	Description
Y340000E	FIG. 825 BJ EQBATMT EG
Y340000	FIG. 825 BJ EQBATMT PLN

FIG. 828	
Part Number	Description
Y340800E	FIG. 828 UNIV STRUCT SWAY BRC ATTACH EG
Y340800	FIG. 828 UNIV STRUCT SWAY BRC ATTACH PLN

FIG. 906	
Part Number	Description
Y334010012E	FIG. 906 1 & 1 1/4 MFA H1&H2=9/16 EG
Y334010012	FIG. 906 1 & 1 1/4 MFA H1&H2=9/16 PLN

B-LINE HN HEX NUT	
Part Number	Description
12463698	NUT,HEX 3/8 HDG
78101102538	NUT,HEX 3/8 SS6
78101102540	NUT,HEX 3/8 SS4
78101142423	NUT,HEX 3/8 ZN
78101195453	NUT,HEX 3/8 PLN
78101102525	NUT,HEX 1/2 SS6
78101142433	NUT,HEX 1/2 ZN
78205111179	NUT,HEX 1/2 HDG
12441978	NUT,HEX 5/8 HDG
78101104153	NUT,HEX 5/8 SS4
78101142443	NUT,HEX 5/8 ZN
78101185048	NUT,HEX 5/8 SS6
12279555	NUT,HEX 3/4 SS6
12441970	NUT,HEX 3/4 HDG
78101142453	NUT,HEX 3/4 ZN
78205115913	NUT,HEX 3/4 SS4
78101142463	NUT,HEX 7/8 ZN
78101185051	NUT,HEX 7/8 SS6
78101193143	NUT,HEX 7/8 PLN
78205115396	NUT,HEX 7/8 SS4
78205133165	NUT, HEX 7/8 HDG
12441977	NUT,HEX 1 HDG
78101185280	NUT,HEX 1 ZN

B-LINE B200 SQUARE WASHER	
Part Number	Description
78205138160	B200-1/4 ZN
78205138198	B200-1/4 SS4

B-LINE BN200 CHANNEL NUT	
Part Number	Description
78101140623	N224WO (1/4) ZN LOCK NUT
78101140626	N224WO (1/4) SS4 LOCK NUT
78101184914	N224WO (1/4) SS6 LOCK NUT
78101140613	N223WO (5/16) ZN LOCK NUT
78205138259	N223WO (5/16)SS6 LOCK NUT
78101140653	N228WO (3/8) ZN LOCK NUT
78101184915	N228WO (3/8) SS6 LOCK NUT
78101140643	N226WO (7/16) ZN LOCK NUT
78101140633	N225WO (1/2) ZN LOCK NUT
78101184916	N225WO (1/2) SS6 LOCK NUT
78101198428	N225WO (1/2) YZN LOCK NUT
12104411	N255WO (5/8) SS6 LOCK NUT
78101140663	N255WO (5/8) ZN LOCK NUT
12165894	N275WO (3/4) SS6 LOCK NUT
78101140773	N275WO (3/4) ZN LOCK NUT
78101191090	N275WO SS4 (3/4)
78101101853	N278WO HDG (7/8)
78101139013	N278WO (7/8) ZN LOCK NUT

FIG. 800	
Part Number	Description
Y338001E	FIG. 800 TYPE1X4-6 ATMT EG
Y338001	FIG. 800 TYPE1X4-6 ATMT PLN
Y338002E	FIG. 800 TYPE1X6-8 ATMT EG
Y338002HDG	FIG. 800 TYPE1X6-8 ATMT HDG
Y338002	FIG. 800 TYPE1X6-8 ATMT PLN
Y338003E	FIG. 800 TYPE1X8-10 ATMT EG
Y338003	FIG. 800 TYPE1X8-10 ATMT PLN
Y338004E	FIG. 800 TYPE1X10-12 ATMT EG
Y338004	FIG. 800 TYPE1X10-12 ATMT PLN
Y338005E	FIG. 800 TYPE1X12-14 ATMT EG
Y338005	FIG. 800 TYPE1X12-14 ATMT PLN
Y338006E	FIG. 800 TYPE1X14-16 ATMT EG
Y338006	FIG. 800 TYPE1X14-16 ATMT PLN
Y338007E	FIG. 800 TYPE1X16-18 ATMT EG
Y338007	FIG. 800 TYPE1X16-18 ATMT PLN
Y338201E	FIG. 800 TYPE2X4-6 ATMT EG
Y338201	FIG. 800 TYPE2X4-6 ATMT PLN
Y338202E	FIG. 800 TYPE2X6-8 ATMT EG
Y338202	FIG. 800 TYPE2X6-8 ATMT PLN
Y338203E	FIG. 800 TYPE2X8-10 ATMT EG
Y338203	FIG. 800 TYPE2X8-10 ATMT PLN
Y338204E	FIG. 800 TYPE2X10-12 ATMT EG
Y338204	FIG. 800 TYPE2X10-12 ATMT PLN
Y338205E	FIG. 800 TYPE2X12-14 ATMT EG
Y338205	FIG. 800 TYPE2X12-14 ATMT PLN
Y338206E	FIG. 800 TYPE2X14-16 ATMT EG
Y338206	FIG. 800 TYPE2X14-16 ATMT PLN
Y338207E	FIG. 800 TYPE2X16-18 ATMT EG
Y338207	FIG. 800 TYPE2X16-18 ATMT PLN

B-LINE B200 HEX BOLT	
Part Number	Description
CBLC000940	BLK HHCS 3/8X1 HDG
CBL6225247	BLK HHCS 3/8X1 PLN
CBL6225041	BLK HHCS 3/8X1 SS4
78101199015	BLK HHCS 3/8X1 SS6
78101198832	BLK HHCS 3/8X1 ZN
CBLT004082	BLK HHCS 3/8X1 1/4 HDG
CBL6225249	BLK HHCS 3/8X1 1/4 PLN
CBL6225042	BLK HHCS 3/8X1 1/4 SS4
78101102474	BLK HHCS 3/8X1 1/4 SS6
CBL6225074	BLK HHCS 3/8X1 1/4 ZN
CBL6225076	BLK HHCS 1/2X1 PLN
78205135757	BLK HHCS 1/2X1 SS4
78205121410	BLK HHCS 1/2X1 SS6
CBL6225043	BLK HHCS 1/2X1 ZN
CBL6225004	BLK HHCS 1/2X1 1/4 HDG
CBL6225087	BLK HHCS 1/2X1 1/4 SS4
CBL6225096	BLK HHCS 1/2X1 1/4 SS6
78205123692	BLK HHCS 1/2X1 1/4 ZN
12493440	BLK HHCS 5/8X1 ZN
12306021	HHCS 5/8X1 SS4
11906433	HHCS 5/8X1 1/4 SS4
CBL6225646	BLK HHCS 5/8X1 1/4 ZN
11906432	BLK HHCS 5/8X1 1/4 SS4
CBL6225526	BLK HHCS 3/4X1 1/4 ZN
12218059	BLK HHCS 7/8X1 ZN

B-LINE N200 SPRING NUT	
Part Number	Description
12460727	N224 HDG (1/4)
7810101317	N224 ZN (1/4)
78101102228	N224 SS4 LOCK NUT
78101140333	N224 ZN (1/4)
78101140334	N224 (1/4) SS6 LOCK NUT
78101101789	N223 (5/16) SS6 LOCK NUT
78101140323	N223 (5/16) ZN LOCK NUT
78101140363	N228 ZN (3/8)
78101140366	N228 (3/8) SS6 LOCK NUT
78101140353	N226 (7/16) ZN LCK NUT
78205122277	N226 SS6 (7/16)
78101140343	N225 ZN (1/2)
78101140346	N225 SS6
78101101829	N255 HDG (5/8)
78101140373	N255 (5/8) ZN LOCK NUT
78205137121	N255 SS6 (5/8)
78101140383	N275 (3/4) ZN LOCK NUT
78205137122	N275 SS6 (3/4)
78101140393	N278 (7/8) ZN LOCK NUT

9.0 COMPONENT PART NUMBER REFERENCE:

B-LINE B2000

Part Number	Description
78101160800	B2000 DCU 3/8EMT CLAMP
11990374	B2000 HDG 3/8EMT CLAMP
78101186878	B2000 PVC 3/8EMT CLAMP
78101160802	B2000 SS4 3/8EMT CLAMP
78205136254	B2000 SS6 3/8EMT CLAMP
78205122867	B2000 YZN 3/8EMT CLAMP
78101160803	B2000 ZN 3/8EMT CLAMP
78101160804	B2000PA ZN 3/8EMT CLAMP
78101160806	B2001 AL 3/8RGD 1/2EMT CLAMP
78101160809	B2001 HDG 3/8RGD 1/2EMT CLAMP
78101194637	B2001 HDG SS6HDW 3/8RGD 1/2EMT CLAMP
78101160811	B2001 PVC SS6HDW 3/8RGD 1/2EMT CLAMP
78101160812	B2001 SS4 3/8RGD 1/2EMT CLAMP
78205130417	B2001 SS6 3/8RGD 1/2EMT CLAMP
78101198433	B2001 YZN 3/8RGD 1/2EMT CLAMP
78101160813	B2001 ZN 3/8RGD 1/2EMT CLAMP
11881402	B2001PA AL SS6HDW 3/8RGD 1/2EMT CLAMP
12354818	B2001PA GRN 3/8RGD 1/2EMT CLAMP
11653005	B2001PA SS4 3/8RGD 1/2EMT CLAMP
11648925	B2001PA SS6 3/8RGD 1/2EMT CLAMP
78101104510	B2001PA YZN 3/8RGD 1/2EMT CLAMP
78101160814	B2001PA ZN 3/8RGD 1/2EMT CLAMP
78101160817	B2002 AL 3/4EMT CLAMP
78101160818	B2002 HDG 3/4EMT CLAMP
78101194638	B2002 HDG SS6HDW 3/4EMT CLAMP
78101160819	B2002 PVC SS6HDW 3/4EMT CLAMP
78101160820	B2002 SS4 3/4EMT CLAMP
78101186879	B2002 SS6 3/4EMT CLAMP
78205115610	B2002 YZN 3/4EMT CLAMP
78101160823	B2002 ZN 3/4EMT CLAMP
12348832	B2002PA AL 3/4EMT CLAMP
12354819	B2002PA GRN 3/4EMT CLAMP
11762007	B2002PA SS4 3/4EMT CLAMP
78101104511	B2002PA YZN 3/4EMT CLAMP
78101160824	B2002PA ZN 3/4EMT CLAMP
78101160826	B2003 AL 1EMT CLAMP
78101160828	B2003 HDG 1EMT CLAMP
78101194639	B2003 HDG SS6HDW 1EMT CLAMP
78101160829	B2003 PVC SS6HDW 1EMT CLAMP
78101160830	B2003 SS4 1EMT CLAMP
78101186880	B2003 SS6 1EMT CLAMP
78101198421	B2003 YZN 1EMT CLAMP
78101160833	B2003 ZN 1EMT CLAMP
12355020	B2003PA GRN 1EMT CLAMP
11762119	B2003PA SS4 1EMT CLAMP
78101104513	B2003PA YZN 1EMT CLAMP
78101160834	B2003PA ZN 1EMT CLAMP
78101160837	B2004 AL 1 1/4EMT 1 1/2OD CLAMP

B-LINE B2000 (CONT.)

Part Number	Description
78101160839	B2004 HDG 1 1/4EMT 1 1/2OD CLAMP
78101194640	B2004 HDG SS6HDW 1 1/4EMT 1 1/2OD CLAMP
78101160840	B2004 PVC SS6HDW 1 1/4EMT 1 1/2OD CLAMP
78101160841	B2004 SS4 1 1/4EMT 1 1/2OD CLAMP
78101186881	B2004 SS6 1 1/4EMT 1 1/2OD CLAMP
78101198422	B2004 YZN 1 1/4EMT 1 1/2OD CLAMP
78101160843	B2004 ZN 1 1/4EMT 1 1/2OD CLAMP
11762125	B2004PA SS4 1 1/4EMT 1 1/2OD CLAMP
11962411	B2004PA SS6 1 1/4EMT 1 1/2OD CLAMP
78101104514	B2004PA YZN 1 1/4EMT 1 1/2OD CLAMP
78101160844	B2004PA ZN 1 1/4EMT 1 1/2OD CLAMP
78101160847	B2005 AL 1 1/2EMT 1 3/4OD CLAMP
78205110263	B2005 GRN 1 1/2EMT 1 3/4OD CLAMP
78101160850	B2005 HDG 1 1/2EMT 1 3/4OD CLAMP
78101194624	B2005 HDG SS6HDW 1 1/2EMT 1 3/4OD CLAMP
78101160851	B2005 PVC SS6HDW 1 1/2EMT 1 3/4OD CLAMP
78101160852	B2005 SS4 1 1/2EMT 1 3/4OD CLAMP
78205130418	B2005 SS6 1 1/2EMT 1 3/4OD CLAMP
78101198423	B2005 YZN 1 1/2EMT 1 3/4OD CLAMP
78101160853	B2005 ZN 1 1/2EMT 1 3/4OD CLAMP
11762158	B2005PA SS4 1 1/2EMT 1 3/4OD CLAMP
78101104515	B2005PA YZN 1 1/2EMT 1 3/4OD CLAMP
78101160854	B2005PA ZN 1 1/2EMT 1 3/4OD CLAMP
12246749	B2005PASS6 1 1/2EMT 1 3/4OD CLAMP
78101160865	B2006 AL 2EMT CLAMP
78101160866	B2006 DCU 2EMT CLAMP
78101160868	B2006 GRN 2EMT CLAMP
78101160869	B2006 HDG 2EMT CLAMP
78101194625	B2006 HDG SS6HDW 2EMT CLAMP
78101160870	B2006 PVC SS6HDW 2EMT CLAMP
78101160871	B2006 SS4 2EMT CLAMP
78101186882	B2006 SS6 2EMT CLAMP
78101198424	B2006 YZN 2EMT CLAMP
78101160863	B2006 ZN 2EMT CLAMP
11762162	B2006PA SS4 2EMT CLAMP
78101104517	B2006PA YZN 2EMT CLAMP
78101160864	B2006PA ZN 2EMT CLAMP
78101160094	B2008 AL 1/2RGD 7/8OD CLAMP
78101160095	B2008 AL SS6HDW 1/2RGD 7/8OD CLAMP
78101160096	B2008 DCU 3/4CT 7/8OD CLAMP
78101194427	B2008 GRN 1/2RGD 7/8OD CLAMP
78101160098	B2008 HDG 1/2RGD 7/8OD CLAMP
78101194642	B2008 HDG SS6HDW 1/2RGD 7/8OD CLAMP
78205125944	B2008 PTD 1/2RGD 7/8OD CLAMP
78101160099	B2008 PVC SS6HDW 1/2RGD 7/8OD CLAMP
78101160100	B2008 SS4 1/2RGD 7/8OD CLAMP
78101160101	B2008 SS6 1/2RGD 7/8OD CLAMP

B-LINE B2000 (CONT.)

Part Number	Description
78101186938	B2008 YZN 1/2RGD 7/8OD CLAMP
78101161013	B2008 ZN 1/2RGD 7/8OD CLAMP
78101161015	B2008PA AL 1/2RGD 7/8OD CLAMP
78101186850	B2008PA AL SS6HDW 1/2RGD 7/8OD CLAMP
78205141445	B2008PA DCU 3/4CT 7/8OD CLAMP
78101161016	B2008PA HDG 1/2RGD 7/8OD CLAMP
78101192843	B2008PA HDG SS6HDW 1/2RGD 7/8OD CLAMP
78101187186	B2008PA SS4 1/2RGD 7/8OD CLAMP
78205114438	B2008PA SS6 1/2RGD 7/8OD CLAMP
78101104461	B2008PA YZN 1/2RGD 7/8OD CLAMP
78101161014	B2008PA ZN 1/2RGD 7/8OD CLAMP
78101160104	B2009 AL 3/4RGD 1OD CLAMP
78101160106	B2009 AL SS6HDW 3/4RGD 1OD CLAMP
78101160107	B2009 DCU 3/4RGD 1OD CLAMP
78101160109	B2009 GRN 3/4RGD 1OD CLAMP
78101160110	B2009 HDG 3/4RGD 1OD CLAMP
78101186903	B2009 HDG SS6HDW 3/4RGD 1OD CLAMP
78101161020	B2009 PVC SS6HDW 3/4RGD 1OD CLAMP
78101161018	B2009 SS4 3/4RGD 1OD CLAMP
78101161025	B2009 SS6 3/4RGD 1OD CLAMP
78101186884	B2009 YZN 3/4RGD 1OD CLAMP
78101161023	B2009 ZN 3/4RGD 1OD CLAMP
78101186898	B2009 ZN SS6HDW 3/4RGD 1OD CLAMP
78101161027	B2009PA AL 3/4RGD 1OD CLAMP
78101102568	B2009PA AL SS6HDW 3/4RGD 1OD CLAMP
78101161028	B2009PA HDG 3/4RGD 1OD CLAMP
78101192844	B2009PA HDG SS6HDW 3/4RGD 1OD CLAMP
78101102590	B2009PA SS4 3/4RGD 1OD CLAMP
78205114439	B2009PA SS6 3/4RGD 1OD CLAMP
78101104464	B2009PA YZN 3/4RGD 1OD CLAMP
78101161024	B2009PA ZN 3/4RGD 1OD CLAMP
78101160114	B2010 AL 1RGD 1 3/8OD CLAMP
78101160116	B2010 AL SS6HDW 1RGD 1 3/8OD CLAMP
78101160117	B2010 DCU 1 1/4CT 1 3/8OD 1RGD CLAMP
78101160118	B2010 GRN 1RGD 1 3/8OD CLAMP
78101160120	B2010 HDG 1RGD 1 3/8OD CLAMP
78101186904	B2010 HDG SS6HDW 1RGD 1 3/8OD CLAMP
78101161030	B2010 PVC SS6HDW 1RGD 1 3/8OD CLAMP
78101161032	B2010 SS4 1RGD 1 3/8OD CLAMP
78101161035	B2010 SS6 1RGD 1 3/8OD CLAMP
78101101051	B2010 YZN 1RGD 1 3/8OD CLAMP
78101161033	B2010 ZN 1RGD 1 3/8OD CLAMP
78101186912	B2010 ZN SS6HDW 1RGD 1 3/8OD CLAMP
78101161038	B2010PA AL 1RGD 1 3/8OD CLAMP
78101102569	B2010PA AL SS6HDW 1RGD 1 3/8OD CLAMP
12304583	B2010PA DCU 1 1/4CT 1 3/8OD 1RGD CLAMP
11882187	B2010PA GRN 1RGD 1 3/8OD CLAMP

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9.0 COMPONENT PART NUMBER REFERENCE:

B-LINE B2000 (CONT.)	
Part Number	Description
78101161039	B2010PA HDG 1RGD 1 3/8OD CLAMP
78101192845	B2010PA HDG SS6HDW 1RGD 1 3/8OD CLAMP
78101102594	B2010PA SS4 1RGD 1 3/8OD CLAMP
78101196383	B2010PA SS6 1RGD 1 3/8OD CLAMP
78101104465	B2010PA YZN 1RGD 1 3/8OD CLAMP
78101161034	B2010PA ZN 1RGD 1 3/8OD CLAMP
78101160124	B2011 AL 1 1/4RGD 1 5/8OD CLAMP
78101160126	B2011 AL SS6HDW 1 1/4RGD 1 5/8OD CLAMP
78101160127	B2011 DCU 1 1/2CT 1 5/8OD 1 1/4RGD CLAMP
78101197523	B2011 GRN 1 1/4RGD 1 5/8OD CLAMP
78101160130	B2011 HDG 1 1/4RGD 1 5/8OD CLAMP
78101186918	B2011 HDG SS6HDW 1 1/4RGD 1 5/8OD CLAMP
11945463	B2011 PLN 1 1/4RGD 1 5/8OD CLAMP
78101160131	B2011 PVC SS6HDW 1 1/4RGD 1 5/8OD CLAMP
78101160133	B2011 SS4 1 1/4RGD 1 5/8OD CLAMP
78101161041	B2011 SS6 1 1/4RGD 1 5/8OD CLAMP
78101186899	B2011 YZN 1 1/4RGD 1 5/8OD CLAMP
78101161043	B2011 ZN 1 1/4RGD 1 5/8OD CLAMP
78101161046	B2011PA AL 1 1/4RGD 1 5/8OD CLAMP
78101102570	B2011PA AL SS6HDW 1 1/4RGD 1 5/8OD CLAMP
78205141498	B2011PA DCU 1 1/2CT 1 5/8OD 1 1/4RGD CLP
78101161047	B2011PA HDG 1 1/4RGD 1 5/8OD CLAMP
78101192846	B2011PA HDG SS6HDW 1 1/4RGD 1 5/8OD CLMP
78101161048	B2011PA SS4 1 1/4RGD 1 5/8OD CLAMP
78101199544	B2011PA SS6 1 1/4RGD 1 5/8OD CLAMP
78101104469	B2011PA YZN 1 1/4RGD 1 5/8OD CLAMP
78101161044	B2011PA ZN 1 1/4RGD 1 5/8OD CLAMP
78101160134	B2012 AL 1 1/2RGD 1 7/8OD CLAMP
78101160135	B2012 AL SS6HDW 1 1/2RGD 1 7/8OD CLAMP
78101160136	B2012 DCU 1 1/2RGD 1 7/8OD CLAMP
78101160138	B2012 GRN 1 1/2RGD 1 7/8OD CLAMP
78101160140	B2012 HDG 1 1/2RGD 1 7/8OD CLAMP
78101186905	B2012 HDG SS6HDW 1 1/2RGD 1 7/8OD CLAMP
78101160143	B2012 PVC SS6HDW 1 1/2RGD 1 7/8OD CLAMP
78101161051	B2012 SS4 1 1/2RGD 1 7/8OD CLAMP
78101161052	B2012 SS6 1 1/2RGD 1 7/8OD CLAMP
78101186889	B2012 YZN 1 1/2RGD 1 7/8OD CLAMP
78101161053	B2012 ZN 1 1/2RGD 1 7/8OD CLAMP
78101161059	B2012PA AL 1 1/2RGD 1 7/8OD CLAMP
78101102572	B2012PA AL SS6HDW 1 1/2RGD 1 7/8OD CLAMP
78101161060	B2012PA HDG 1 1/2RGD 1 7/8OD CLAMP
78101192847	B2012PA HDG SS6HDW 1 1/2RGD 1 7/8OD CLMP

B-LINE B2000 (CONT.)	
Part Number	Description
78101102596	B2012PA SS4 1 1/2RGD 1 7/8OD CLAMP
78101199545	B2012PA SS6 1 1/2RGD 1 7/8OD CLAMP
78101104471	B2012PA YZN 1 1/2RGD 1 7/8OD CLAMP
78101161054	B2012PA ZN 1 1/2RGD 1 7/8OD CLAMP
78101160144	B2013 AL 2RGD 2 3/8OD CLAMP
78101160145	B2013 AL SS6HDW 2RGD 2 3/8OD CLAMP
78101160147	B2013 DCU 2RGD 2 3/8OD CLAMP
78101160149	B2013 GRN 2RGD 2 3/8OD CLAMP
78101160150	B2013 GRN SS6HDW 2RGD 2 3/8OD CLAMP
78101160151	B2013 HDG 2RGD 2 3/8OD CLAMP
78101186906	B2013 HDG SS6HDW 2RGD 2 3/8OD CLAMP
78101161066	B2013 PVC SS6HDW 2RGD 2 3/8OD CLAMP
78101199305	B2013 PVCSS6 SS6HDW 2RGD 2 3/8OD CLAMP
78101161068	B2013 SS4 2RGD 2 3/8OD CLAMP
78101161069	B2013 SS6 2RGD 2 3/8OD CLAMP
78101186939	B2013 YZN 2RGD 2 3/8OD CLAMP
78101161063	B2013 ZN 2RGD 2 3/8OD CLAMP
12100342	B2013 ZN SS6HDW 2RGD 2 3/8OD CLAMP
78101161072	B2013PA AL 2RGD 2 3/8OD CLAMP
78101102573	B2013PA AL SS6HDW 2RGD 2 3/8OD CLAMP
78101161109	B2013PA HDG 2RGD 2 3/8OD CLAMP
78101192848	B2013PA HDG SS6HDW 2RGD 2 3/8OD CLAMP
78101102597	B2013PA SS4 2RGD 2 3/8OD CLAMP
78101196384	B2013PA SS6 2RGD 2 3/8OD CLAMP
78101104473	B2013PA YZN 2RGD 2 3/8OD CLAMP
78101161064	B2013PA ZN 2RGD 2 3/8OD CLAMP
78101160154	B2014 AL 2 1/2RGD 2 7/8OD CLAMP
78101101419	B2014 AL SS6HDW 2 1/2RGD 2 7/8OD CLAMP
78101160156	B2014 DCU 2 1/2RGD 2 7/8OD CLAMP
78205110264	B2014 GRN 2 1/2RGD 2 7/8OD CLAMP
78101160160	B2014 HDG 2 1/2RGD 2 7/8OD CLAMP
78101186907	B2014 HDG SS6HDW 2 1/2RGD 2 7/8OD CLAMP
78101160162	B2014 PVC SS6HDW 2 1/2RGD 2 7/8OD CLAMP
78101198881	B2014 PVCSS6 SS6HDW 2 1/2RGD 2 7/8OD CLP
78101160163	B2014 SS4 2 1/2RGD 2 7/8OD CLAMP
78101161075	B2014 SS6 2 1/2RGD 2 7/8OD CLAMP
78101186894	B2014 YZN 2 1/2RGD 2 7/8OD CLAMP
78101161073	B2014 ZN 2 1/2RGD 2 7/8OD CLAMP
78101186927	B2014 ZN SS6HDW 2 1/2RGD 2 7/8OD CLAMP
78101161078	B2014PA AL 2 1/2RGD 2 7/8OD CLAMP
78101102574	B2014PA AL SS6HDW 2 1/2RGD 2 7/8OD CLAMP
78101161079	B2014PA HDG 2 1/2RGD 2 7/8OD CLAMP
78205118185	B2014PA HDG SS6HDW 2 1/2RGD 2 7/8OD CLMP
78101187198	B2014PA SS4 2 1/2RGD 2 7/8OD CLAMP

B-LINE B2000 (CONT.)	
Part Number	Description
78205121791	B2014PA SS6 2 1/2RGD 2 7/8OD CLAMP
78101104475	B2014PA YZN 2 1/2RGD 2 7/8OD CLAMP
78101161074	B2014PA ZN 2 1/2RGD 2 7/8OD CLAMP
78101160164	B2015 AL 3RGD 3 1/2OD CLAMP
78101160167	B2015 AL SS6HDW 3RGD 3 1/2OD CLAMP
78101160169	B2015 DCU 3RGD 3 1/2OD CLAMP
78101194430	B2015 GRN 3RGD 3 1/2OD CLAMP
78101160172	B2015 HDG 3RGD 3 1/2OD CLAMP
78101186908	B2015 HDG SS6HDW 3RGD 3 1/2OD CLAMP
78101160173	B2015 PVC SS6HDW 3RGD 3 1/2OD CLAMP
78101103451	B2015 PVC SS6HDW 3RGD 3 1/2OD INDVBGD
78101199307	B2015 PVCSS6 SS6HDW 3RGD 3 1/2OD CLAMP
78101161082	B2015 SS4 3RGD 3 1/2OD CLAMP
78101161085	B2015 SS6 3RGD 3 1/2OD CLAMP
78101186891	B2015 YZN 3RGD 3 1/2OD CLAMP
78101161083	B2015 ZN 3RGD 3 1/2OD CLAMP
78101186929	B2015 ZN SS6HDW 3RGD 3 1/2OD CLAMP
78101161090	B2015PA AL 3RGD 3 1/2OD CLAMP
78101102578	B2015PA AL SS6HDW 3RGD 3 1/2OD CLAMP
78101161091	B2015PA HDG 3RGD 3 1/2OD CLAMP
78101192849	B2015PA HDG SS6HDW 3RGD 3 1/2OD CLAMP
78101104648	B2015PA SS4 3RGD 3 1/2OD CLAMP
78101125692	B2015PA SS6 3RGD 3 1/2OD CLAMP
78101104477	B2015PA YZN 3RGD 3 1/2OD CLAMP
78101161084	B2015PA ZN 3RGD 3 1/2OD CLAMP
78101160174	B2016 AL 3 1/2RGD 4OD CLAMP
78101160175	B2016 AL SS6HDW 3 1/2RGD 4OD CLAMP
78101160176	B2016 DCU 3 1/2RGD 4OD CLAMP
78101197304	B2016 GRN 3 1/2RGD 4OD CLAMP
78101160177	B2016 HDG 3 1/2RGD 4OD CLAMP
78101186928	B2016 HDG SS6HDW 3 1/2RGD 4OD CLAMP
78101160178	B2016 PVC SS6HDW 3 1/2RGD 4OD CLAMP
78101160179	B2016 SS4 3 1/2RGD 4OD CLAMP
78101186895	B2016 SS6 3 1/2RGD 4OD CLAMP
78101186909	B2016 YZN 3 1/2RGD 4OD CLAMP
78101161093	B2016 ZN 3 1/2RGD 4OD CLAMP
78101161096	B2016PA AL 3 1/2RGD 4OD CLAMP
78101102582	B2016PA AL SS6HDW 3 1/2RGD 4OD CLAMP
78101161097	B2016PA HDG 3 1/2RGD 4OD CLAMP
78205134395	B2016PA HDG SS6HDW 3 1/2RGD 4OD CLAMP
78101187201	B2016PA SS4 3 1/2RGD 4OD CLAMP
78101104479	B2016PA YZN 3 1/2RGD 4OD CLAMP
78101161094	B2016PA ZN 3 1/2RGD 4OD CLAMP
12246860	B2016PASS6 3 1/2RGD 4OD CLAMP
78101160184	B2017 AL 4RGD 4 1/2OD CLAMP
78101101421	B2017 AL SS6HDW 4RGD 4 1/2OD CLAMP
78101160188	B2017 DCU 4RGD 4 1/2OD CLAMP
78101160189	B2017 GRN 4RGD 4 1/2OD CLAMP

9.0 COMPONENT PART NUMBER REFERENCE:

B-LINE B2000 (CONT.)	
Part Number	Description
78101160191	B2017 HDG 4RGD 4 1/2OD CLAMP
78101186937	B2017 HDG SS6HDW 4RGD 4 1/2OD CLAMP
11643819	B2017 PTD 4RGD 4 1/2OD CLAMP
78101160193	B2017 PVC SS6HDW 4RGD 4 1/2OD CLAMP
78101199309	B2017 PVCSS6 SS6HDW 4RGD 4 1/2OD CLAMP
78101161105	B2017 SS4 4RGD 4 1/2OD CLAMP
78101161106	B2017 SS6 4RGD 4 1/2OD CLAMP
78101101104	B2017 YZN 4RGD 4 1/2OD CLAMP
78101161103	B2017 ZN 4RGD 4 1/2OD CLAMP
78101161107	B2017PA AL 4RGD 4 1/2OD CLAMP
78101102585	B2017PA AL SS6HDW 4RGD 4 1/2OD CLAMP
78101161111	B2017PA HDG 4RGD 4 1/2OD CLAMP
78205120836	B2017PA HDG SS6HDW 4RGD 4 1/2OD CLAMP
78101187203	B2017PA HDG ZN HDW 4RGD 4 1/2OD CLAMP
78101104649	B2017PA SS4 4RGD 4 1/2OD CLAMP
78205124531	B2017PA SS6 4RGD 4 1/2OD CLAMP
78101104482	B2017PA YZN 4RGD 4 1/2OD CLAMP
78101161104	B2017PA ZN 4RGD 4 1/2OD CLAMP
12021007	B2018 AL SS6HDW 4 1/2RGD 5OD CLAMP
78101104485	B2018PA YZN 4 1/2RGD 5OD CLAMP
78101160194	B2018 AL 4 1/2RGD 5OD CLAMP
78101160196	B2018 HDG 4 1/2RGD 5OD CLAMP
78101160197	B2018 PVC SS6HDW 4 1/2RGD 5OD CLAMP
78101160198	B2018 SS4 4 1/2RGD 5OD CLAMP
78101161113	B2018 ZN 4 1/2RGD 5OD CLAMP
78101161114	B2018PA ZN 4 1/2RGD 5OD CLAMP
78101187204	B2018PA HDG 4 1/2RGD 5OD CLAMP
78101194605	B2018 HDG SS6HDW 4 1 /2RGD 5OD CLAMP
78205122869	B2018 YZN 4 1/2RGD 5OD CLAMP
78205124338	B2018 SS6 4 1/2RGD 5OD CLAMP
78205135167	B2018PA SS6 4 1/2RGD 5OD CLAMP
78101160204	B2019 AL 5RGD 5 1/2OD CLAMP
78101160205	B2019 AL SS6HDW 5RGD 5 1/2OD CLAMP
12408402	B2019 GRN 5RGD 5 1/2OD CLAMP
78101160206	B2019 HDG 5RGD 5 1/2OD CLAMP
78101194606	B2019 HDG SS6HDW 5RGD 5 1/2OD CLAMP
78101160207	B2019 PVC SS6HDW 5RGD 5 1/2OD CLAMP
78101160208	B2019 SS4 5RGD 5 1/2OD CLAMP
78101199182	B2019 SS6 5RGD 5 1/2OD CLAMP
78205122335	B2019 YZN 5RGD 5 1/2OD CLAMP
78101161123	B2019 ZN 5RGD 5 1/2OD CLAMP
78205141364	B2019PA AL 5RGD 5 1/2OD CLAMP
78101161121	B2019PA HDG 5RGD 5 1/2OD CLAMP
78205113311	B2019PA SS4 5RGD 5 1/2OD CLAMP
78205128879	B2019PA YZN 5RGD 5 1/2OD CLAMP
78101161124	B2019PA ZN 5RGD 5 1/2OD CLAMP

B-LINE B2000 (CONT.)	
Part Number	Description
12249076	B2019PAHDG SS6HDW 5RGD 5 1/2OD CLAMP
12246862	B2019PASS6 5RGD 5 1/2OD CLAMP
78101160214	B2020 AL 6RGD 6 5/8OD CLAMP
78101160216	B2020 AL SS6HDW 6RGD 6 5/8OD CLAMP
78101160217	B2020 DCU 6RGD 6 5/8OD CLAMP
78101160218	B2020 GRN 6RGD 6 5/8OD CLAMP
78101160220	B2020 HDG 6RGD 6 5/8OD CLAMP
78101194607	B2020 HDG SS6HDW 6RGD 6 5/8 CLAMP
78101160213	B2020 PVC SS6HDW 6RGD 6 5/8OD CLAMP
78101199310	B2020 PVCSS6 SS6HDW 6RGD 6 5/8OD CLAMP
78101160212	B2020 SS4 6RGD 6 5/8OD CLAMP
78101160211	B2020 SS6 6RGD 6 5/8OD CLAMP
11664818	B2020 SS6NS 6RGD 6 5/8OD CLAMP
78101186919	B2020 YZN 6RGD 6 5/8OD CLAMP
78101161133	B2020 ZN 6RGD 6 5/8OD CLAMP
78101186853	B2020PA AL SS6HDW 6RGD 6 5/8OD CLAMP
78205119320	B2020PA HDG 6RGD 6 5/8OD CLAMP
78101187188	B2020PA SS4 6RGD 6 5/8OD CLAMP
78101104487	B2020PA YZN 6RGD 6 5/8OD CLAMP
78101161134	B2020PA ZN 6RGD 6 5/8OD CLAMP
12246865	B2020PAHDG SS6HDW 6RGD 6 5/8OD CLAMP
12246864	B2020PASS6 6RGD 6 5/8OD CLAMP
12052983	B2021 AL 7RGD 7 5/8OD CLAMP
12246867	B2021SS6 7RGD 7 5/8OD CLAMP
12246868	B2021PASS6 7RGD 7 5/8OD CLAMP
12408403	B2021 GRN (7 RGD)
78101161143	B2021 ZN (7 RGD)
78101161144	B2021PA ZN 7RGD 7 5/8OD CLAMP
78101186902	B2021 PVC SS6HDW 7RGD 7 5/8OD CLAMP
78101186933	B2021 SS4 7RGD 7 5/8OD CLAMP
78205140160	B2021 HDG 7RGD 7 5/8OD CLAMP
78101186851	B2022 AL 8RGD 8 5/8OD CLAMP
78101161152	B2022 GRN 8RGD 8 5/8OD CLAMP
78101161155	B2022 HDG 8RGD 8 5/8OD CLAMP
78101194608	B2022 HDG SS6HDW 8RGD 8 5/8OD CLAMP
78101186901	B2022 PVC SS6HDW 8RGD 8 5/8OD CLAMP
78101161156	B2022 SS4 8RGD 8 5/8OD CLAMP
78101186896	B2022 SS6 8RGD 8 5/8OD CLAMP
78205116459	B2022 YZN 8RGD 8 5/8OD CLAMP
78101161153	B2022 ZN 8RGD 8 5/8OD CLAMP
78205136569	B2022PA SS4 8RGD 8 5/8OD CLAMP
78101161154	B2022PA ZN 8RGD 8 5/8OD CLAMP
12246923	B2022PAHDG SS6HDW 8RGD 8 5/8OD CLAMP
12246921	B2022PASS6 8RGD 8 5/8OD CLAMP

B-LINE B1999	
Part Number	Description
78101103383	B1999 VIBR-CUSH 20FT ROLL

B-LINE 9ZN	
Part Number	Description
11733057	9ZN-1205 FB
11733060	9ZN-1205 WHITE
11733062	9ZN-1205 BLUE #57004
11733063	9ZN-1205 STORM
78101102685	9ZN-1205
11656391	9ZN-1208 FB
12425828	9ZN-1208 PANTONE#299U
78101102681	9ZN-1208
78101131123	9ZN-1241 HOLD DOWN

B-LINE B355	
Part Number	Description
11737705	B355 SS6 BM CLMP
78101153401	B355 AL BM CLMP
78101153402	B355 GRN BM CLMP
78101153403	B355 ZN BM CLMP
78101153404	B355 HDG BM CLMP
78101153406	B355 SS4 BM CLMP
78101198417	B355 YZN BM CLMP
78205115399	B355 SS4/PVC

FIG. 990	
Part Number	Description
Y347001003PG	FIG. 990 1/8CB 3/8RDSWYBC PGL
Y347001004PG	FIG. 990 1/8CB 1/2RDSWYBC PGL
Y347316003PG	FIG. 990 3/16CB3/8RDSWYBC PGL
Y347316004PG	FIG. 990 3/16CB1/2RDSWYBC PGL
Y347316005PG	FIG. 990 3/16CB 5/8 RD SWYBC PGL
Y347316006PG	FIG. 990 3/16CB 3/4RD SWYBC PGL
Y347002005PG	FIG. 990 1/4CB 5/8RD PGL
Y347002004PG	FIG. 990 1/4CB 1/2RDSWYBC PGL
Y347002006PG	FIG. 990 1/4CB 3/4RD SWYBC PGL

FIG. 991	
Part Number	Description
Y365002006007E	FIG. 991 1/4 CB 3/4-7/8 RD SWY BRC PGL
Y365002003005E	FIG. 991 1/4 CB 3/8-5/8 RD SWY BRC PGL
Y365001003005E	FIG. 991 1/8 CB 3/8-5/8 RD SWY BRC PGL
Y353001006E	FIG. 991 1/8CB 3/4 RD SWYBC PGL
Y365316006007E	FIG. 991 3/16 CB 3/4-7/8 RD SWY BRC PGL
Y365316003005E	FIG. 991 3/16 CB 3/8-5/8 RD SWY BRC PGL

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9.0 COMPONENT PART NUMBER REFERENCE:

B-LINE B2400	
Part Number	Description
78205139351	B2400-1/2 SS6
78101187264	B2400-12 ZN
78101187262	B2400-10 ZN
78101187259	B2400-10 HDG
78101187255	B2400-12 SS6
78101187254	B2400-10 SS4 PIPE STRP
78101187252	B2400-12 SS4
78101187250	B2400-10 SS6
78101187249	B2400-8 SS6
78101187248	B2400-6 SS6
78101187247	B2400-5 SS6
78101187246	B2400-5 SS4 PIPE STRP
78101187244	B2400-4 SS6
78101187241	B2400-3 SS4 PIPE STRP
78101187239	B2400-3 SS6
78101187238	B2400-2 1/2 SS6
78101187236	B2400-1 1/4 SS6
78101187235	B2400-3/4 SS6
78101185651	B2400-12 PLN
78101185650	B2400-10 PLN PIPE STRP
78101185306	B2400-12 HDG
78101185304	B2400-8 HDG PIPE STRP
78101163123	B2400-8 ZN PIPE STRP
78101163122	B2400-8 SS4 PIPE STRP
78101163118	B2400-6 SS4 PIPE STRP
78101163115	B2400-6 HDG PIPE STRP
78101163113	B2400-6 ZN PIPE STRP
78101163104	B2400-5 HDG PIPE STRP
78101163103	B2400-5 ZN PIPE STRP
78101163095	B2400-4 SS4 PIPE STRP
78101163093	B2400-4 ZN PIPE STRP
78101163091	B2400-4 HDG PIPE STRP
78101163084	B2400-3 1/2 SS4
78101163083	B2400-3 1/2 ZN
78101163081	B2400-3 1/2 HDG
78101163073	B2400-3 ZN PIPE STRP
78101163072	B2400-3 HDG PIPE STRP
78101163067	B2400-2 1/2 SS4 PIPE STRP
78101163064	B2400-2 1/2 HDG PIPE STRP
78101163063	B2400-2 1/2 ZN PIPE STRP
78101163059	B2400-2 SS6
78101163058	B2400-2 SS4 PIPE STRP
78101163055	B2400-2 HDG PIPE STRP
78101163053	B2400-2 ZN PIPE STRP
78101163044	B2400-1 1/2 SS6
78101163043	B2400-1 1/2 ZN PIPE STRP
78101163042	B2400-1 1/2 SS4 PIPE STRP
78101163039	B2400-1 1/2 HDG PIPE STRP
78101163034	B2400-1 1/4 SS4 PIPE STRP
78101163033	B2400-1 1/4 ZN PIPE STRP

B-LINE B2400 (CONT.)	
Part Number	Description
78101163030	B2400-1 1/4 HDG PIPE STRP
78101163026	B2400-1 SS4 PIPE STRP
78101163023	B2400-1 ZN PIPE STRP
78101163022	B2400-1 HDG PIPE STRP
78101163017	B2400-3/4 SS4 PIPE STRP
78101163015	B2400-3/4 HDG PIPE STRP
78101163013	B2400-3/4 ZN PIPE STRP
78101163006	B2400-1/2 SS4 PIPE STRP
78101163003	B2400-1/2 ZN PIPE STRP
78101163002	B2400-1/2 HDG PIPE STRP
78101102889	B2400-1 SS6
12275811	B2400-8 PLN PIPE STRP
12275661	B2400-3 PLN PIPE STRP
12275359	B2400-5 PLN PIPE STRP
11997311	B2400-3 1/2 SS6

FIG. 990H	
Part Number	Description
Y347002007PG	FIG. 990H HD 1/4CB 7/8RD SWYBC PGL

SEISMIC CABLE	
Part Number	Description
	1/8", 3/16", 1/4"

FIG. 1000	
Part Number	Description
Y380010010E	FIG. 1000 1X1 FASTC EG
Y380010010	FIG. 1000 1X1 FASTC PLN
Y380010012E	FIG. 1000 1 1/4X1 FASTC EG
Y380010012	FIG. 1000 1 1/4X1 FASTC PLN
Y380010014E	FIG. 1000 1 1/2X1 FASTC EG
Y380012014	FIG. 1000 1 1/2X1 1/4FASTC PLN
Y380010020E	FIG. 1000 2X1 FASTC EG
Y380010020	FIG. 1000 2X1 FASTC PLN
Y380012010E	FIG. 1000 1X1 1/4 FASTC EG
Y380012010	FIG. 1000 1X1 1/4 FASTC PLN
Y380012012E	FIG. 1000 1 1/4X1 1/4FASTC EG
Y380012012	FIG. 1000 1 1/4X1 1/4FASTC PLN
Y380012014E	FIG. 1000 1 1/2X1 1/4FASTC EG
Y380010014	FIG. 1000 1 1/2X1 FASTC PLN
Y380012020E	FIG. 1000 2X1 1/4 FASTC EG
Y380012020	FIG. 1000 2X1 1/4 FASTC PLN

FIG. 109A	
Part Number	Description
Y282003080GP	FIG. 109A 3/8X8 CONCRETE DECK INSERT
Y282004080GP	FIG. 109A 1/2X8 CONCRETE DECK INSERT
Y282005080GP	FIG. 109A 5/8X8 CONCRETE DECK INSERT
Y282006080	FIG. 109A 3/4X8 CONCRETE DECK INSERT
Y282007080	FIG. 109A 7/8X8 CONCRETE DECK INSERT

FIG. 1001	
Part Number	Description
Y379010010E	FIG. 1001 1 X 1 FC SWBA EG
Y379010010	FIG. 1001 1 X 1 FC SWBA PLN
Y379010012E	FIG. 1001 1 1/4 X 1 FC SWBA EG
Y379010012	FIG. 1001 1 1/4 X 1 FC SWBA PLN
Y379010014E	FIG. 1001 1 1/2 X 1 FC SWBA EG
Y379010014	FIG. 1001 1 1/2 X 1 FC SWBA PLN
Y379010020E	FIG. 1001 2 X 1 FC SWBA EG
Y379010020	FIG. 1001 2 X 1 FC SWBA PLN
Y379010024E	FIG. 1001 2 1/2 X 1 FC SWBA EG
Y379010024	FIG. 1001 2 1/2 X 1 FC SWBA PLN
Y379010030E	FIG. 1001 3 X 1 FC SWBA EG
Y379010030	FIG. 1001 3 X 1 FC SWBA PLN
Y379010040E	FIG. 1001 4 X1 FC SWBA EG
Y379010040	FIG. 1001 4 X1 FC SWBA PLN
Y379010060E	FIG. 1001 6 X1 FC SWBA EG
Y379010060	FIG. 1001 6 X1 FC SWBA PLN
Y379010080E	FIG. 1001 8 X1 FC SWBA EG
Y379010080	FIG. 1001 8 X1 FC SWBA PLN
Y379012010E	FIG. 1001 1 X 1 1/4 FC SWBA EG
Y379012010	FIG. 1001 1 X 1 1/4 FC SWBA PLN
Y379012012E	FIG. 1001 1 1/4 X 1 1/4 FC SWBA EG
Y379012012	FIG. 1001 1 1/4 X 1 1/4 FC SWBA PLN
Y379012014E	FIG. 1001 1 1/2 X 1 1/4 FC SWBA EG
Y379012014	FIG. 1001 1 1/2 X 1 1/4 FC SWBA PLN
Y379012020E	FIG. 1001 2 X 1 1/4 FC SWBA EG
Y379012020	FIG. 1001 2 X 1 1/4 FC SWBA PLN
Y379012024E	FIG. 1001 2 1/2 X 1 1/4 FC SWBA EG
Y379012024	FIG. 1001 2 1/2 X 1 1/4 FC SWBA PLN
Y379012030E	FIG. 1001 3 X 1 1/4 FC SWBA EG
Y379012030	FIG. 1001 3 X 1 1/4 FC SWBA PLN
Y379012040	FIG. 1001 4 X 1 1/4 FC SWBA PLN
Y379012040E	FIG. 1001 4 X1 1/4 FC SWBA EG
Y379012060E	FIG. 1001 6 X1 1/4 FC SWBA EG
Y379012060	FIG. 1001 6 X1 1/4 FC SWBA PLN
Y379012080E	FIG. 1001 8 X1 1/4 FC SWBA EG
Y379012080	FIG. 1001 8 X1 1/4 FC SWBA PLN

POWERS POWER STUD SD-2	
Part Number	Description
12556228	AWSD2-50-450 WEDGE ANCHOR

B-LINE BKC-100 KWIK WIRE	
Part Number	Description
11927522	BKC100

B-LINE BKC-200 KWIK WIRE	
Part Number	Description
11927523	BKC200

9.0 COMPONENT PART NUMBER REFERENCE:

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9.0 COMPONENT PART NUMBER REFERENCE:

B-LINE B3055	
Part Number	Description
78205134716	B3055-3/8X12 ZN
78205132704	B3055-3/4X4 HDG
78205128850	B3055-3/8X8 ZN
78205126263	B3055-5/8X4 ZN
78205124537	B3055-3/4X7 ZN
78101197337	B3055-5/8X5 RP
78101196399	B3055-5/8X8 ZN
78101194053	B3055-3/4X5 ZN
78101173173	B3055-1X12 RP
78101173170	B3055-1X12 PLN
78101173165	B3055-1X10 PLN
78101173159	B3055-1X9 PLN
78101173148	B3055-1X8 RP
78101173146	B3055-1X7 PLN
78101173132	B3055-1X5 RP
78101173129	B3055-1X4 RP
78101173124	B3055-7/8X12 PLN
78101173113	B3055-7/8X10 PLN
78101173109	B3055-7/8X9 PLN
78101173102	B3055-7/8X8 RP
78101173096	B3055-7/8X7 PLN
78101173095	B3055-7/8X7 GRN
78101173065	B3055-7/8X4 RP 1/4 THRU 3
78101173059	B3055-3/4X12 PLN
78101173055	B3055-3/4X12 ZN
78101173046	B3055-3/4X10 PLN
78101173042	B3055-3/4X9 PLN CLMP
78101173032	B3055-3/4X8 RP
78101173012	B3055-3/4X6 PLN
78101173006	B3055-3/4X5 RP 1/4 THRU 3
78101172998	B3055-3/4X4 RP
78101172994	B3055-3/4X4 PLN
78101172992	B3055-3/4X3 PLN
78101172981	B3055-5/8X10 PLN
78101172968	B3055-5/8X8 RP
78101172876	B3055-1/2X7 ZN
78101172852	B3055-1/2X6 HDG 1/2 FLG
78101172838	B3055-1/2X8 ZN
78101172768	B3055-3/8X6 ZN
78101172719	B3055-3/8X4 ZN
78101172702	B3055-3/8X2 PLN
78101102939	B3055-1/2X10 PLN
78101102922	B3055-1/2X7 PLN
78101102916	B3055-1/2X6 PLN
78101102911	B3055-1/2X4 PLN
78101102908	B3055-3/8X12 PLN
78101102893	B3055-3/8X8 RP
78101102803	B3055-3/8X10 PLN
78101102777	B3055-1/2X9 PLN
78101102747	B3055-1/2X8 RP

B-LINE B3055 (CONT.)	
Part Number	Description
78101102698	B3055-7/8X6 PLN
78101102690	B3055-5/8X6 PLN
78101102687	B3055-1/2X6 ZN
78101102684	B3055-3/8X6 PLN
78101102666	B3055-7/8X5 PLN
78101102662	B3055-3/4X5 PLN
78101102658	B3055-5/8X5 PLN
78101102657	B3055-1/2X5 RP
78101102655	B3055-1/2X5 PLN
78101102650	B3055-3/8X5 PLN
78101102638	B3055-1X4 PLN
78101102634	B3055-7/8X4 PLN
78101102627	B3055-5/8X4 RP
78101102623	B3055-1/2X4 ZN
78101102620	B3055-3/8X4 PLN
78101102614	B3055-1/2X3 PLN
78101102610	B3055-3/8X3 PLN
78101102607	B3055-1/2X2 PLN
12561656	B3055-3/4X9 ZN CLMP
12513136	B3055-3/4X4 SS4
12513045	B3055-1X12 HDG
12513043	B3055-7/8X12 HDG
12491911	B3055-1/2X8 HDG
12491034	B3055-3/4X3 SS6
12491033	B3055-3/4X6 SS6
12491031	B3055-3/4X7 SS6
12491030	B3055-3/4X8 SS6
12491018	B3055-3/4X9 SS6
12462143	B3055-1/2X12 HDG
12462142	B3055-1/2X10 HDG
12459786	B3055-1/2X4 HDG
12406429	B3055-1X10 HDG
12398167	B3055-1/2X5 ZN
12320905	B3055-1X10 ZN
12300653	B3055-1X7 HDG
12224600	B3055-3/4X8 ZN
12217272	B3055-5/8X3 ZN
12152677	B3055-1X5 HDG
12085800	B3055-7/8X8 ZN
12034127	B3055-1X12 ZN
12031701	B3055-1X3 ZN
12031066	B3055-5/8X3 PLN
12005501	B3055-1X8 HDG
12005399	B3055-1X6 HDG
11994595	B3055-5/8X10 ZN
11986903	B3055-3/4X7 PLN
11965632	B3055-7/8X4 HDG
11907706	B3055-1X5 ZN
11887972	B3055-7/8X4 ZN
11864050	B3055-7/8X9 ZN

B-LINE B3055 (CONT.)	
Part Number	Description
11858826	B3055-3/4X10 ZN
11850856	B3055-3/4X3 ZN
11844090	B3055-1/2X5 HDG
11844049	B3055-3/8X5 HDG
11837682	B3055-7/8X6 ZN
11835013	B3055-7/8X6 HDG
11834954	B3055-3/4X6 HDG
11822968	B3055-7/8X8 HDG
11822966	B3055-3/4X8 WO SHRT HDG
11822963	B3055-3/4X8 HDG
11820293	B3055-7/8X10 ZN
11816836	B3055-3/8X10 ZN
11816835	B3055-1/2X12 ZN
11812941	B3055-7/8X12 ZN
11805050	B3055-3/8X7 ZN
11787005	B3055-5/8X5 ZN
11787002	B3055-3/8X5 ZN
11777633	B3055-1/2X10 ZN
11770546	B3055-1/2X12 PLN
11758520	B3055-5/8X12 PLN
11743250	B3055-1X8 ZN
11743248	B3055-1X7 ZN
11741196	B3055-1X6 ZN
11741194	B3055-1X4 ZN
11728484	B3055-5/8X7 ZN
11728477	B3055-5/8X12 ZN
11717039	B3055-7/8X7 ZN
11700265	B3055-3/8X7 PLN
11699908	B3055-1X6 PLN
11698202	B3055-1X8 PLN
11691602	B3055-5/8X7 PLN
11680936	B3055-7/8X7 HDG
11680898	B3055-7/8X7 WO SHRT HDG
11678908	B3055-1X5 PLN
11670089	B3055-7/8X8 PLN
11670084	B3055-5/8X8 PLN
11670078	B3055-3/8X8 PLN
11670050	B3055-3/4X8 PLN
11670044	B3055-1/2X8 PLN
11667144	B3055-3/4X6 ZN
11667132	B3055-3/4X4 ZN
11663129	B3055-5/8X4 PLN
11650829	B3055-5/8X6 ZN
11643470	B3055-7/8X5 ZN

9.0 COMPONENT PART NUMBER REFERENCE:

B-LINE B3083WO OR TOLCO FIG 304	
Part Number	Description
11940882	B3083WO-1/2 HDG BM ATTACH
78101103800	B3083WO-3/8 PLN BM ATTACH
78101103805	B3083WO-1/2 PLN BM ATTACH
78101103810	B3083WO-5/8 PLN BM ATTACH
78101103815	B3083WO-3/4 PLN BM ATTACH
78101103820	B3083WO-7/8 PLN BM ATTACH
78101103825	B3083WO-1 PLN BM ATTACH
78101103830	B3083WO-1 1/8 PLN BM ATTA
78101103835	B3083WO-1 1/4 PLN BM ATTA
78101103840	B3083WO-1 1/2 PLN BM ATTA
78101103845	B3083WO-1 3/4 PLN BM ATTA
78101103850	B3083WO-2 PLN BM ATTACH
78101173469	B3083WO-1 1/2 RP BM ATTAC
78101173470	B3083WO-1 1/2 ZN BM ATTAC
78101173473	B3083WO-1 1/4 ZN BM ATTAC
78101173474	B3083WO-1 1/4 HDG BM
78101173476	B3083WO-1 3/4 ZN BM ATTAC
78101173478	B3083WO-1 RP BM ATTACH
78101173479	B3083WO-1 ZN BM ATTACH
78101173481	B3083WO-1/2 RP BM ATTACH
78101173483	B3083WO-1/2 ZN BM ATTACH
78101173485	B3083WO-1 1/8 RP BM ATTAC
78101173486	B3083WO-1 1/8 ZN BM ATTAC
78101173488	B3083WO-2 RP BM ATTACH
78101173489	B3083WO-2 ZN BM ATTACH
78101173492	B3083WO-3/4 RP BM ATTACH
78101173493	B3083WO-3/4 ZN BM ATTACH
78101173494	B3083WO-3/4 HDG BM ATTACH
78101173496	B3083WO-3/8 RP BM ATTACH
78101173497	B3083WO-3/8 ZN BM ATTACH
78101173503	B3083WO-5/8 RP BM ATTACH
78101173504	B3083WO-5/8 ZN BM ATTACH
78101173505	B3083WO-5/8 HDG BM ATTACH
78101173506	B3083WO-7/8 RP BM ATTACH
78101173508	B3083WO-7/8 ZN BM ATTACH
78101173509	B3083WO-7/8 HDG BM

B-LINE B3083 OR TOLCO FIG 305	
Part Number	Description
11650914	B3083-3/8 ZN W/HDW BM
11662730	B3083-5/8 ZN W/HDW BM
11664512	B3083-1 1/8 ZN W/HDW BM
11671032	B3083-7/8 HDG W/HDW BM ATTA
11681179	B3083-1 1/2 ZN W/HDW BM
11681182	B3083-7/8 ZN W/HDW
11685009	B3083-3/8 SS4 W/HDW BM AT
11686053	B3083-1/2 ZN W/HDW BM
11938402	B3083-1 1/2 HDG W/HDW
12221612	B3083-1/2 SS4 W/HDW BM
12494536	B3083-3/4 SS4 W/HDW BM
78101103870	B3083-3/8 PLN W/HDW BM AT
78101103875	B3083-1/2 PLN W/HDW BM AT
78101103880	B3083-5/8 PLN W/HDW BM AT
78101103885	B3083-3/4 PLN W/HDW BM AT
78101103890	B3083-7/8 PLN W/HDW BM AT
78101103895	B3083-1 PLN W/HDW BM ATTA
78101103900	B3083-1 1/8 PLN W/HDW BM
78101103905	B3083-1 1/4 PLN W/HDW BM
78101103910	B3083-1 1/2 PLN W/HDW BM
78101103915	B3083-1 3/4 PLN W/HDW BM
78101103920	B3083-2 PLN W/HDW BM ATTA
78101173420	B3083-1 HDG W/HDW BM ATTA
78101173422	B3083-1 RP W/HDW BM ATTAC
78101173423	B3083-1 ZN W/HDW BM ATTAC
78101173425	B3083-1/2 HDG W/HDW BM
78101173428	B3083-1/2 RP W/HDW BM ATT
78101173431	B3083-1 1/2 RP W/HDW BM A
78101173433	B3083-1 1/4 HDG W/HDW BM
78101173434	B3083-1 1/4 RP W/HDW BM A
78101173435	B3083-1 1/4 ZN W/HDW
78101173436	B3083-1 1/8 RP W/HDW BM
78101173440	B3083-1 3/4 RP W/HDW BM
78101173441	B3083-1 3/4 ZN W/HDW BM
78101173442	B3083-2 RP W/HDW BM ATTAC
78101173444	B3083-2 ZN W/HDW BM ATTAC
78101173449	B3083-5/8 HDG W/HDW BM AT
78101173451	B3083-3/4 RP W/HDW BM ATT
78101173452	B3083-3/4 ZN W/HDW BM
78101173453	B3083-3/8 HDG W/HDW
78101173456	B3083-3/8 RP W/HDW BM ATT
78101173458	B3083-3/4 HDG W/HDW BM AT
78101173459	B3083-5/8 GRN W/HDW BM AT
78101173462	B3083-5/8 RP W/HDW BM ATT
78101173467	B3083-7/8 RP W/HDW BM ATT

B-LINE B22A	
Part Number	Description
78101104665	B22A-120 YZN
78101104666	B22A-120 GRAY
78101121712	B22A-120 HDG
78101121714	B22A-120 SS4
78101121717	B22A-120 PVCBLK
78101121720	B22A-120 GRN
78101121723	B22A-120 HDG/PVCBLK
78101121730	B22A-120 GLV
78101121740	B22A-120 AL
78101184116	B22A-120 GRN (MIG WELD)
78101184127	B22A-120 GLV (MIG WELD)
78101184132	B22A-120 SS6
78101184145	B22A-120 WHITE ACRYLIC
78101199451	B22A-120 NB
78205139730	B22A-120 PTD
11656784	B22A-240 GLV (MIG WELD)
11708164	B22A-240 FB
11885799	B22A-240 PLN (MIG WELD)
11914925	B22A-240 WHITE POWDER COAT
11945080	B22A-240 PVCBLK
11995860	B22A-240 ARCTIC WHITE
11997957	B22A-240 ZN
78101102707	B22A-240 YZN
78101121719	B22A-240 HDG
78101121725	B22A-240 GRN
78101121735	B22A-240 GLV
78101121745	B22A-240 AL
78101184093	B22A-240 PTD
78101184117	B22A-240 GRN (MIG WELD)
78101184131	B22A-240 SS4
78101184133	B22A-240 SS6
78101191214	B22A-240 WHITE ACRYLIC
78205129856	B22A-240 CW
78205139876	B22A-240 PLAIN EPOXY
79903829914	B22A-240 NB

9.0 COMPONENT PART NUMBER REFERENCE:

B-LINE B12

Part Number	Description
12190670	B12-120 ARCTIC WHITE
78101120511	B12-120 HDG
78101120513	B12-120 PVCBLK
78101120520	B12-120 GRN
78101120530	B12-120 GLV
78101120540	B12-120 AL
78205132762	B12-120 YZN
12154762	B12-240 FB
12190649	B12-240 ARCTIC WHITE
12494158	B12-240 AL PAINTED BLACK
78101120516	B12-240 HDG
78101120525	B12-240 GRN
78101120535	B12-240 GLV
78101120545	B12-240 AL
78205129427	B12-240 YZN
12540173	B12S-120 AL
78101120910	B12S-120 PLN
78101120920	B12S-120 GRN
78101120930	B12S-120 GLV
78101190816	B12S-120 HDG
78101120913	B12S-240 HDG
78101120915	B12S-240 PLN
78101120925	B12S-240 GRN
78101120935	B12S-240 GLV
12332255	B12SH-120 PTD
78101120710	B12SH-120 PLN
78101120711	B12SH-120 HDG
78101120712	B12SH-120 PVCBLK
78101120720	B12SH-120 GRN
78101120730	B12SH-120 GLV
78101120740	B12SH-120 AL
78205132763	B12SH-120 YZN
12041123	B12SH-240 PTD
78101120715	B12SH-240 PLN
78101120716	B12SH-240 HDG
78101120725	B12SH-240 GRN
78101120735	B12SH-240 GLV
78101120745	B12SH-240 AL
78205132764	B12SH-240 YZN

B-LINE B12A

Part Number	Description
11950267	B12A-120 GRN (MIG WELD)
11968728	B12A-120 GLV (MIG WELD)
78101121010	B12A-120 PLN (MIG WELD)
78101121011	B12A-120 AL (MIG WELD)
78101184003	B12A-120 HDG (MIG WELD)
78101184041	B12A-120 PTD
78205119126	B12A-120 TG (MIG WELD)
78205133455	B12A-120 YZN (MIG WELD)
12490136	B12A-240 WHITE POWDER COAT
78101121015	B12A-240 PLN (MIG WELD)
78101121025	B12A-240 GRN (MIG WELD)
78101121035	B12A-240 GLV (MIG WELD)
78101184004	B12A-240 HDG (MIG WELD)
78205133456	B12A-240 YZN (MIG WELD)

B-LINE B11A

Part Number	Description
11786782	B11A-120 AL (MIG WELD)
78101120410	B11A-120 PLN
78101120411	B11A-120 HDG
78101120420	B11A-120 GRN
78101120430	B11A-120 GLV
78101183965	B11A-120 HDG (MIG WELD)
78101183967	B11A-120 PTD
78205120150	B11A-120 POWDER WHITE
78205133454	B11A-120 YZN
12154763	B11A-240 FB
78101120417	B11A-240 PTD
78101120425	B11A-240 GRN
78101120435	B11A-240 GLV
78101183944	B11A-240 YZN
78101183966	B11A-240 HDG

B-LINE B11

Part Number	Description
78101120003	B11-120 AL
78101120007	B11-120 HDG
78101120009	B11-120 PVCBLK
78101120020	B11-120 GRN
78101120030	B11-120 GLV
78205110039	B11-120 PTD
78205122241	B11-120 YZN
12230357	B11-240 PTD
12539941	B11-240 SEMI-GLOSS BLACK
78101120014	B11-240 AL
78101120016	B11-240 HDG
78101120025	B11-240 GRN
78101120035	B11-240 GLV
78101183943	B11-240 YZN
12540170	B11S-120 AL
78101120349	B11S-120 HDG
78101120350	B11S-120 PLN
78101120356	B11S-120 GRN
78101120362	B11S-120 GLV
78205122267	B11S-120 YZN
78101120353	B11S-240 PLN
78101120359	B11S-240 GRN
78101120365	B11S-240 GLV
11788058	B11SH-120 FB
78101120209	B11SH-120 HDG
78101120210	B11SH-120 PLN
78101120220	B11SH-120 GRN
78101120230	B11SH-120 GLV
78101183946	B11SH-120 AL
78101183949	B11SH-120 PVC
78101183955	B11SH-120 YZN
12232679	B11SH-240 SS6
78101120214	B11SH-240 AL
78101120215	B11SH-240 PLN
78101120216	B11SH-240 HDG
78101120225	B11SH-240 GRN
78101120235	B11SH-240 GLV
78101183957	B11SH-240 YZN
78205139407	B11SH-240 PTD
78205140278	B11SH-240 WHITE ACRYLIC

9.0 COMPONENT PART NUMBER REFERENCE:

B-LINE B24	
Part Number	Description
11847008	B24-120 PTD
78101102709	B24-120 YZN
78101122012	B24-120 HDG
78101122014	B24-120 PVCBLK
78101122016	B24-120 SS4
78101122017	B24-120 SS6
78101122020	B24-120 GRN
78101122030	B24-120 GLV
78101122040	B24-120 AL
12113682	B24-240 WHITE POWDER COAT
78101103997	B24-240 YZN
78101122018	B24-240 HDG
78101122021	B24-240 SS4
78101122022	B24-240 SS6
78101122025	B24-240 GRN
78101122035	B24-240 GLV
78101122045	B24-240 AL
78101184351	B24-240 PTD
12305142	B24S-120 SS6
78101122408	B24S-120 HDG
78101122409	B24S-120 AL
78101122410	B24S-120 PLN
78101122420	B24S-120 GRN
78101122430	B24S-120 GLV
78101184373	B24S-120 SS4
78101184376	B24S-120 YZN
78101122425	B24S-240 GRN
78101122435	B24S-240 GLV
78101184377	B24S-240 YZN
78205136760	B24S-240 HDG
12186654	B24SH-120 FB
78101103993	B24SH-120 YZN
78101122209	B24SH-120 PVCBLK
78101122211	B24SH-120 HDG
78101122213	B24SH-120 SS4
78101122214	B24SH-120 SS6
78101122220	B24SH-120 GRN
78101122230	B24SH-120 GLV
78101122240	B24SH-120 AL
78101182605	B24SH-120 PTD
78205133102	B24SH-120 WHITE
78101103998	B24SH-240 YZN
78101122215	B24SH-240 PLN
78101122216	B24SH-240 HDG
78101122217	B24SH-240 SS4
78101122218	B24SH-240 SS6
78101122225	B24SH-240 GRN
78101122235	B24SH-240 GLV
78101122245	B24SH-240 AL

B-LINE B52	
Part Number	Description
12349770	B52-120 SS6
12350591	B52-120 SS4
78101104707	B52-120 YZN
78101124808	B52-120 HDG
78101124812	B52-120 PVCBLK
78101124820	B52-120 GRN
78101124830	B52-120 GLV
78101181297	B52-120 GRAY
78101181298	B52-120 WHITE ACRYLIC
78101184468	B52-120 PVCGRY
78205128828	B52-120 PTD
12349765	B52-240 SS6
12350593	B52-240 SS4
78101124816	B52-240 HDG
78101124825	B52-240 GRN
78101124835	B52-240 GLV
78101196180	B52-240 YZN
78205120710	B52-240 WHITE ACRYLIC
78205136393	B52-240 PTD
11739856	B52S-120 PTD
78101125210	B52S-120 PLN
78101125211	B52S-120 HDG
78101125212	B52S-120 PVCBLK
78101125220	B52S-120 GRN
78101125230	B52S-120 GLV
78101181299	B52S-120 YZN
11874299	B52S-240 YZN
12311498	B52S-240 PTD
78101125215	B52S-240 PLN
78101125216	B52S-240 HDG
78101125225	B52S-240 GRN
78101125235	B52S-240 GLV
12050197	B52SH-120 WHITE POWDER COAT
12339755	B52SH-120 SS4
12347020	B52SH-120 SS6
12357370	B52SH-120 FB
12496805	B52SH-120 BS YZN
78101125010	B52SH-120 PLN
78101125011	B52SH-120 HDG
78101125012	B52SH-120 PVCBLK
78101125020	B52SH-120 GRN
78101125030	B52SH-120 GLV
78101184481	B52SH-120 WHITE ACRYLIC
78101184482	B52SH-120 YZN
12002943	B52SH-240 WHITE ACRYLIC
12211094	B52SH-240 PTD
12218883	B52SH-240 WHITE POWDER COAT
12349766	B52SH-240 SS6
12350594	B52SH-240 SS4

B-LINE B52 (CONT.)	
Part Number	Description
78101125015	B52SH-240 PLN
78101125016	B52SH-240 HDG
78101125025	B52SH-240 GRN
78101125035	B52SH-240 GLV
78101184483	B52SH-240 YZN

B-LINE B24A	
Part Number	Description
12454849	B24A-120 YZN
78101103982	B24A-120 SS6
78101122607	B24A-120 SS4
78101122608	B24A-120 HDG
78101122609	B24A-120 AL
78101122610	B24A-120 PLN
78101122620	B24A-120 GRN
78101122630	B24A-120 GLV
78101103983	B24A-240 SS6
78101122615	B24A-240 PLN
78101122617	B24A-240 HDG
78101122618	B24A-240 SS4
78101122625	B24A-240 GRN
78101122635	B24A-240 GLV

FIG. 27B	
Part Number	Description
Y138000B	FIG. 27B SPEED NUT PGL

FIG. 25	
Part Number	Description
Y213002	FIG. 25 3/4-2 SURGERSTNR PGL

MH

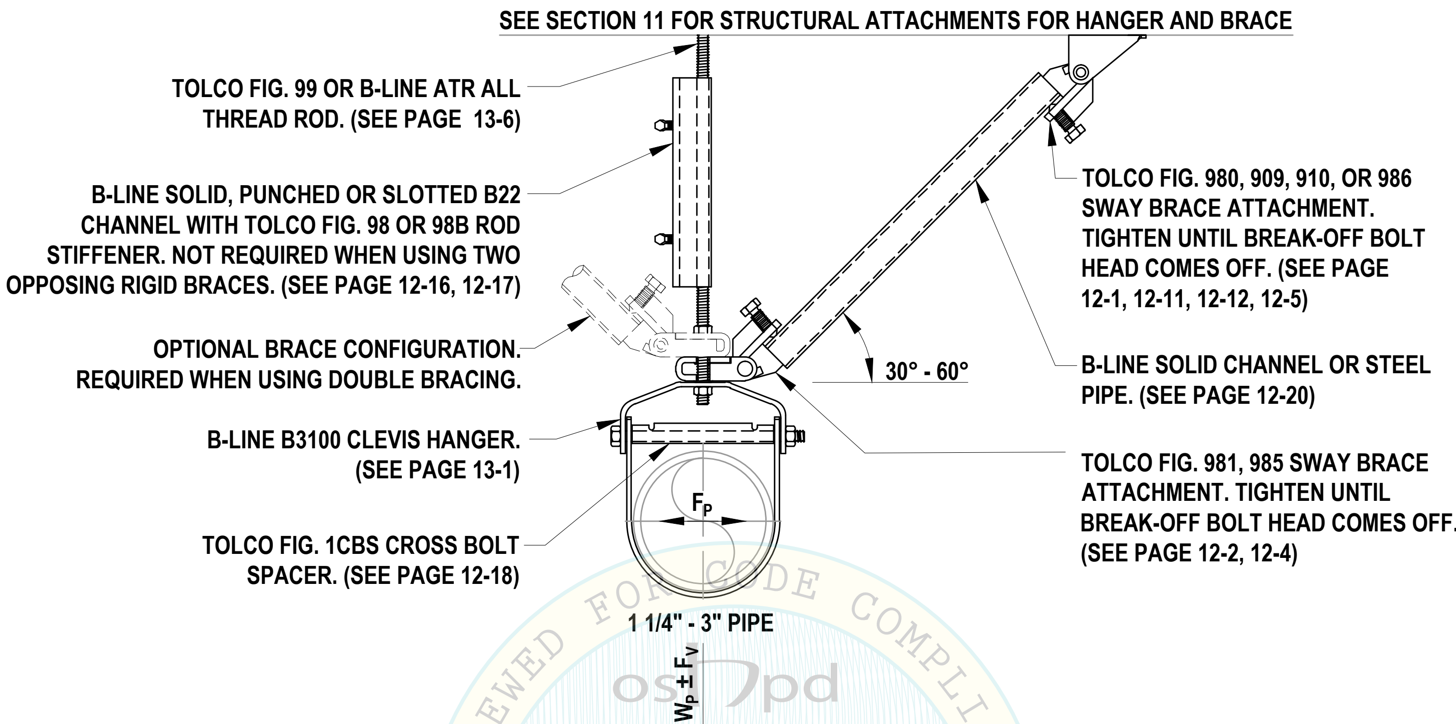
SECTION 2

SINGLE HANGER RIGID BRACE DETAILS

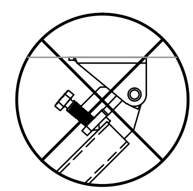
MH

TRANSVERSE RIGID BRACING FOR SINGLE HUNG PIPE OR CONDUIT WITH CLEVIS HANGER

DETAIL 1



PIPE DIAMETER	TRANSVERSE ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
1 1/4" - 2 1/2"	93	97	96
3"	111	109	107



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) THIN WALL PIPING - REDUCE LOADS BY 0%
   b.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%
2.) PIPES WITH INSULATION SHALL NOT BE USED.
3.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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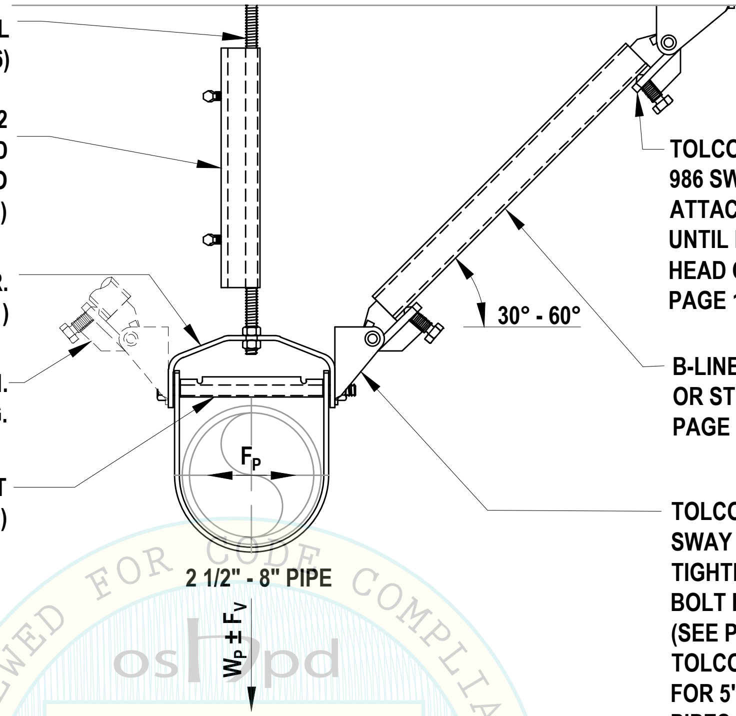
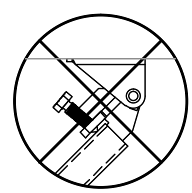
TRANSVERSE RIGID BRACING FOR SINGLE HUNG PIPE OR CONDUIT WITH CLEVIS HANGER

DETAIL 1A



PIPE DIAMETER	TRANSVERSE ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
2 1/2" - 3 1/2"	129	213	110
4" - 5"	236	448	292
6" - 8"	556	593	454



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) THIN WALL PIPING - REDUCE LOADS BY 0%
   b.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%
2.) PIPES WITH INSULATION SHALL NOT BE USED.
3.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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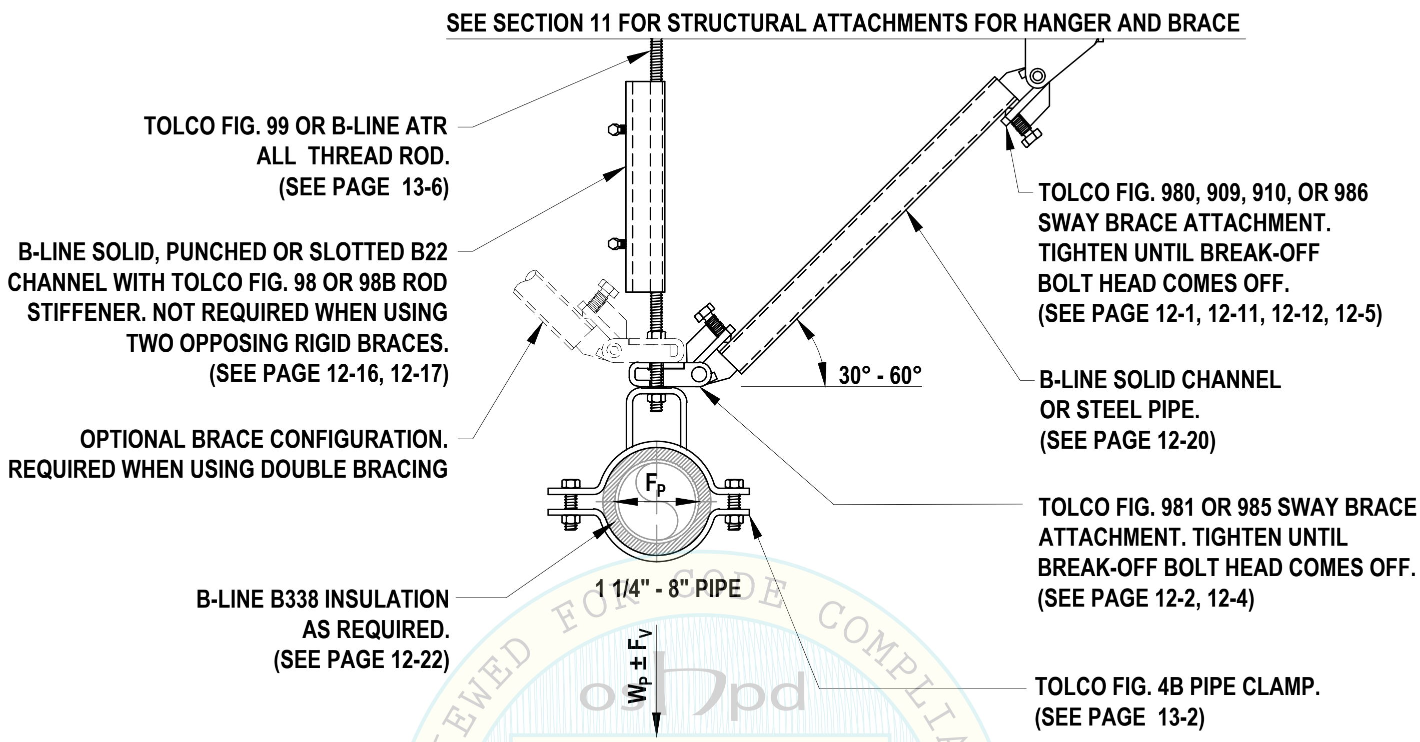
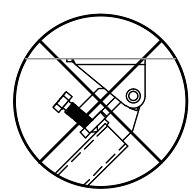
TRANSVERSE RIGID BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH PIPE CLAMP

DETAIL 1C



PIPE DIAMETER	TRANSVERSE ASSEMBLY ALLOWABLE LOAD (ASD)		
	BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
1 1/4" - 2"	272	317	310
2 1/2" - 3 1/2"	272	317	310
4" - 5"	582	724	517
6"	582	724	517
8"	920	746	636



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 40% FOR 1 1/4"-5" PIPES AND 25% FOR 6"-8" PIPES.
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%

2.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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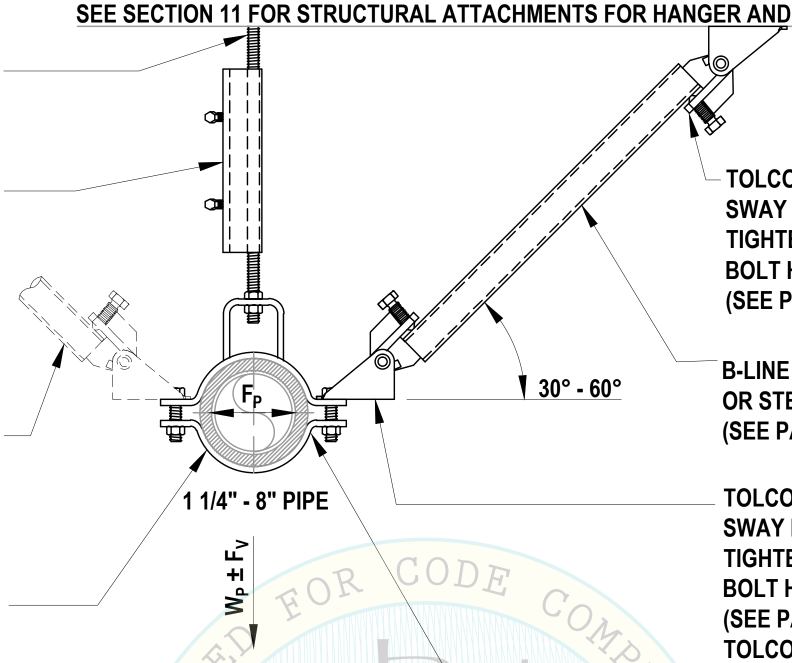
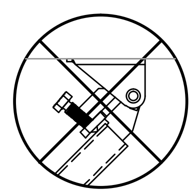
TRANSVERSE RIGID BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH PIPE CLAMP

DETAIL 1D

SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE



PIPE DIAMETER	TRANSVERSE ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
1 1/4" - 2"	272	317	310
2 1/2" - 3 1/2"	272	317	310
4" - 5"	582	724	517
6" - 8"	920	746	636



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 40% FOR 1 1/4"-5" PIPES AND 25% FOR 6"-8" PIPES.
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%
2.) TOLCO FIG. 4LA MAY ALSO BE USED AS A LATERAL BRACE. (SEE PAGE 12-6)
3.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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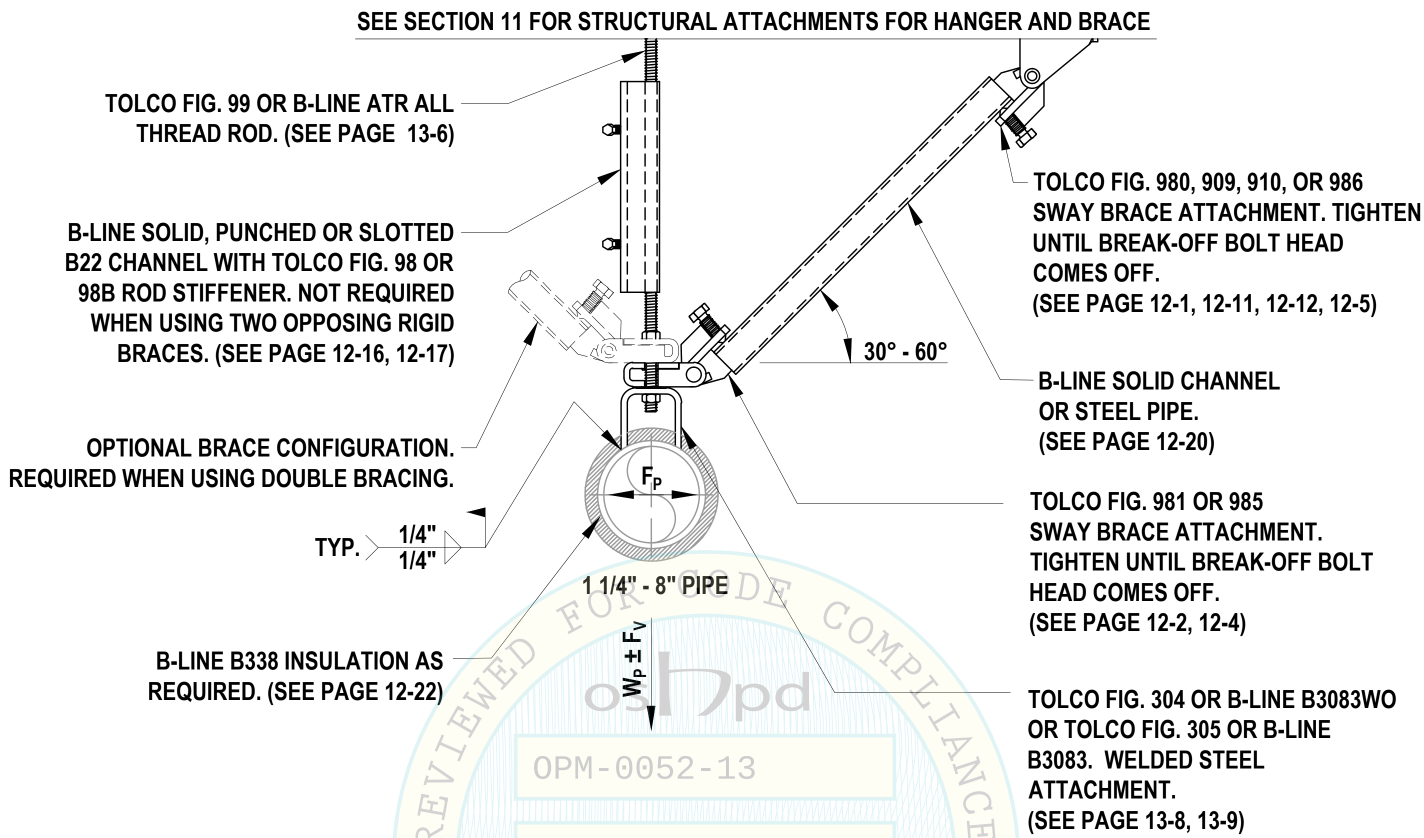
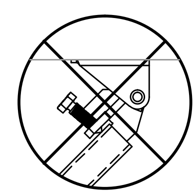
TRANSVERSE RIGID BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH WELDED STEEL ATTACHMENT

DETAIL 1E



PIPE SIZE	ROD SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
1 1/4" - 2"	3/8"	272	317	310
2 1/2" - 3 1/2"	1/2"	272	317	310
4" - 5"	5/8"	582	724	517
6"	3/4"	582	724	517
8"	7/8"	920	746	636



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 40 AND BETTER PIPING.
2.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
3.) THE TOLCO FIG. 304, TOLCO FIG. 305 AND B-LINE B3083 SHALL NOT BE USED WITH EMT.

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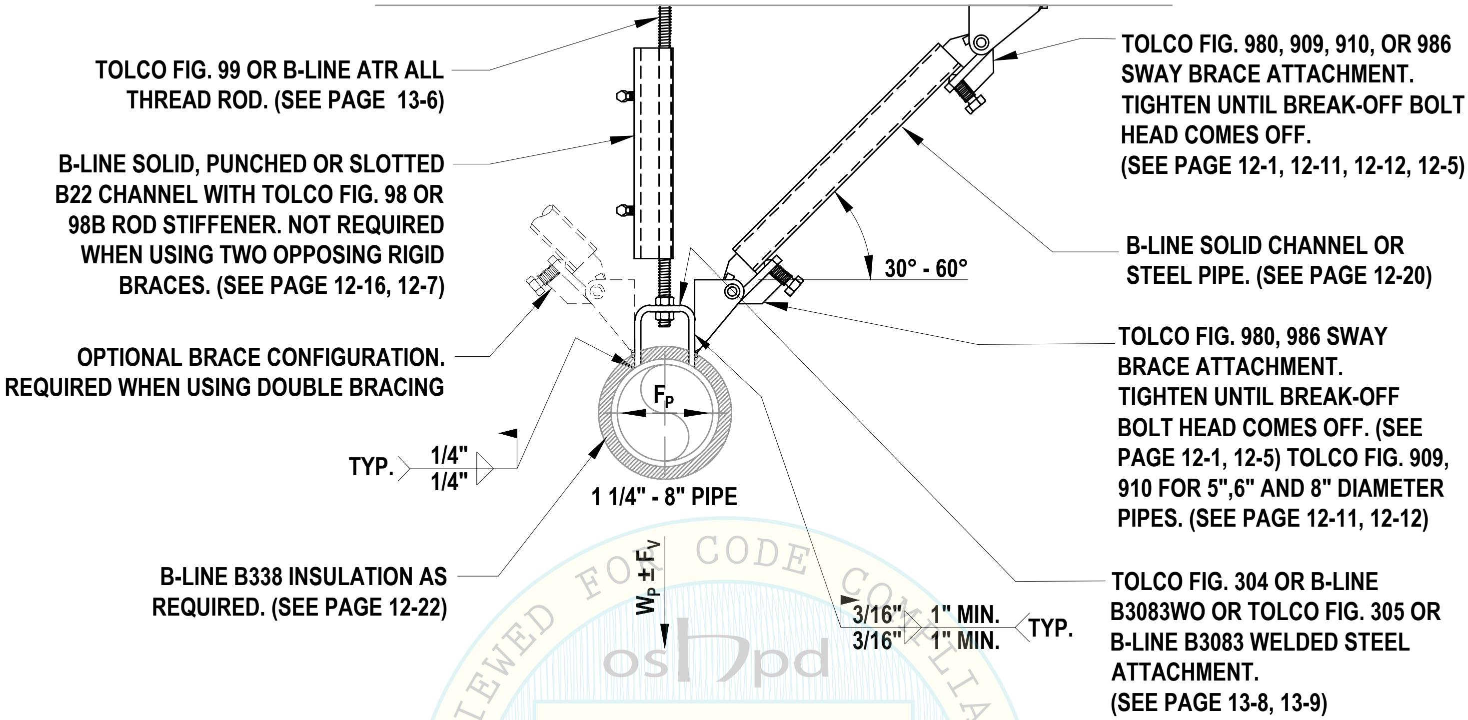
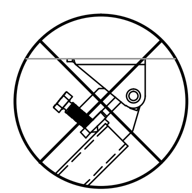
SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE



PIPE SIZE	ROD SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD (ASD)		
		BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
1 1/4" - 2"	3/8"	272	317	310
2 1/2" - 3 1/2"	1/2"	272	317	310
4" - 5"	5/8"	582	724	517
6"	3/4"	920	746	636
8"	7/8"	920	746	636



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 40 AND BETTER PIPING.
2.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
3.) THE TOLCO FIG. 304, TOLCO FIG. 305 AND B-LINE B3083 SHALL NOT BE USED WITH EMT.

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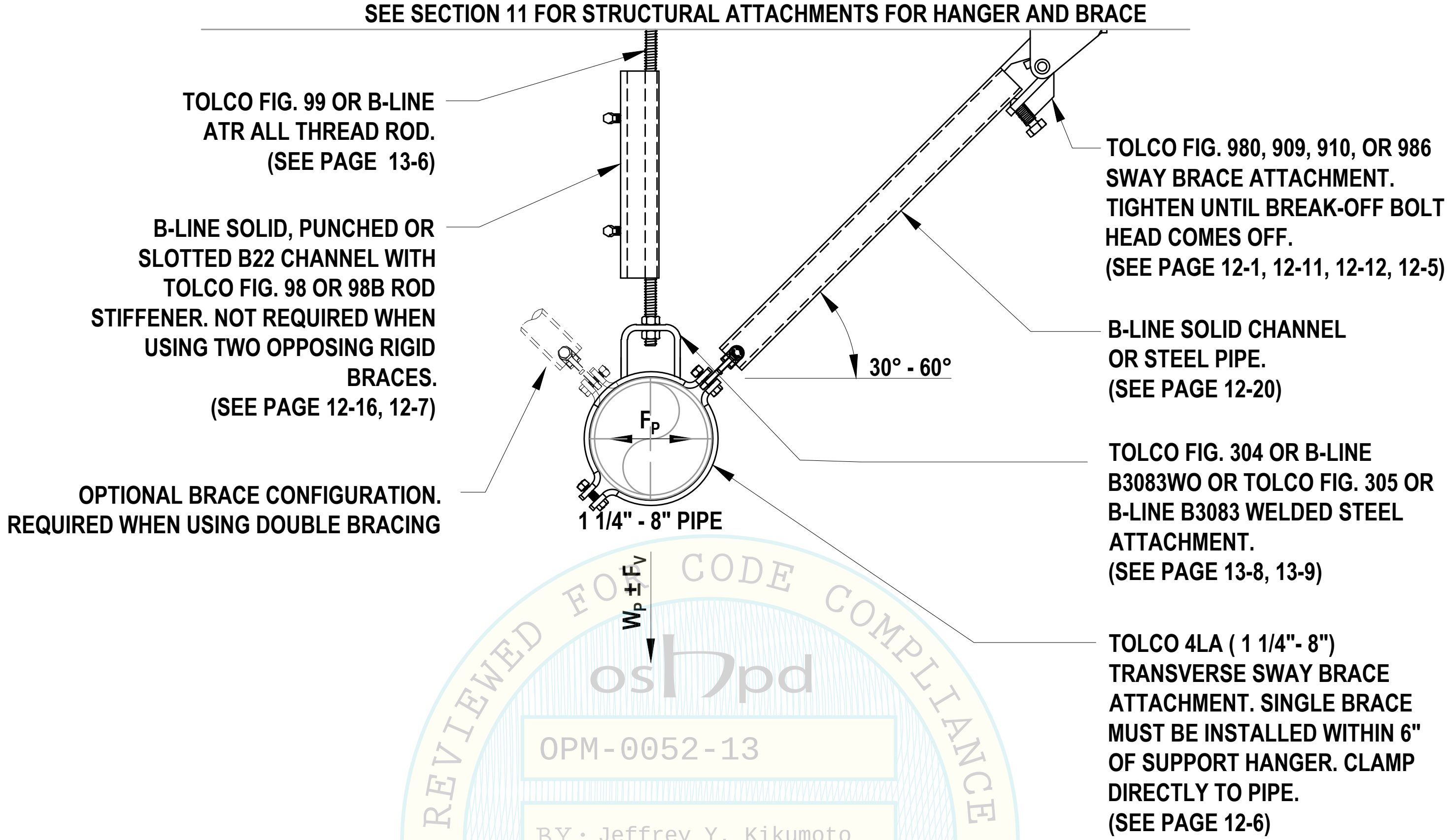
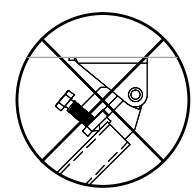
TRANSVERSE RIGID BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH TRANSVERSE PIPE CLAMP

DETAIL 4LA

SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE



PIPE SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD (ASD)		
	BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31°- 45°	46°- 60°
1 1/4" - 5"	1030	860	680
6"- 8"	2820	2300	1620



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 40 AND BETTER PIPING.
2.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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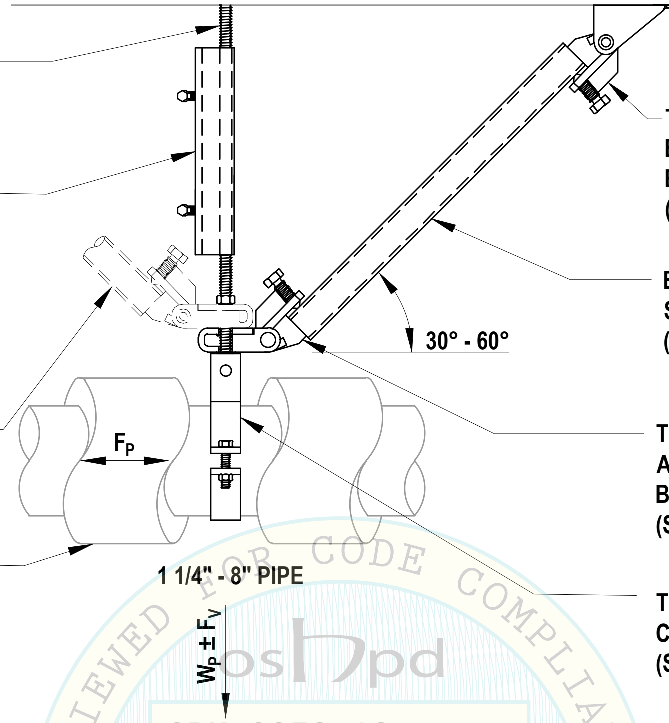
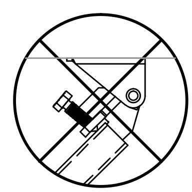
LONGITUDINAL RIGID BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH PIPE CLAMP

DETAIL 2B



PIPE DIAMETER	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
1 1/4" - 2"	868	865	407
2 1/2" - 3 1/2"	868	865	407
4"	1113	990	659
6"	1089	930	595
8"	1089	930	595



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%
2.) FIG. 986 MUST BE USED WITH 1/2" OR LARGER ALL THREAD ROD
3.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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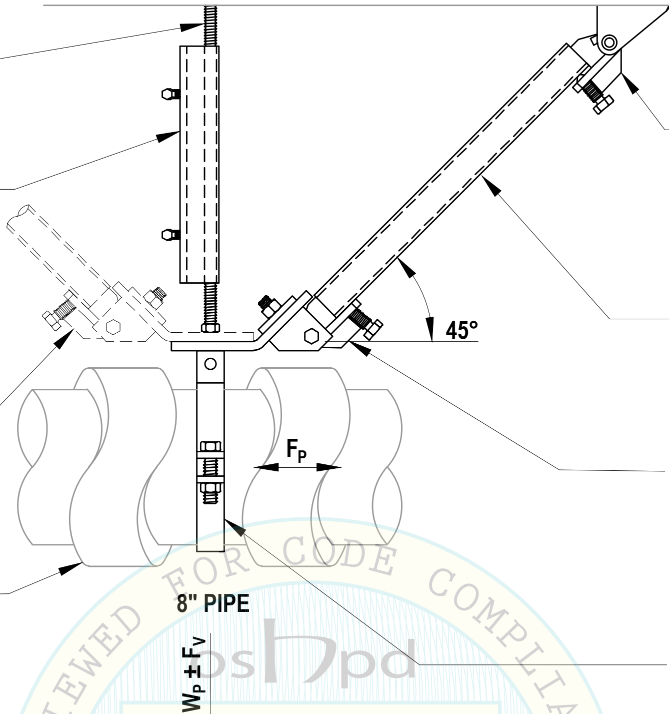
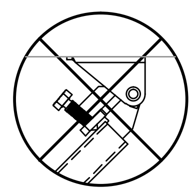
LONGITUDINAL RIGID BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH PIPE CLAMP

DETAIL 2C



PIPE DIAMETER	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]
	45°
8"	930



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
  a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
  b.) THIN WALL PIPING - REDUCE LOADS BY 0%
  c.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%

2.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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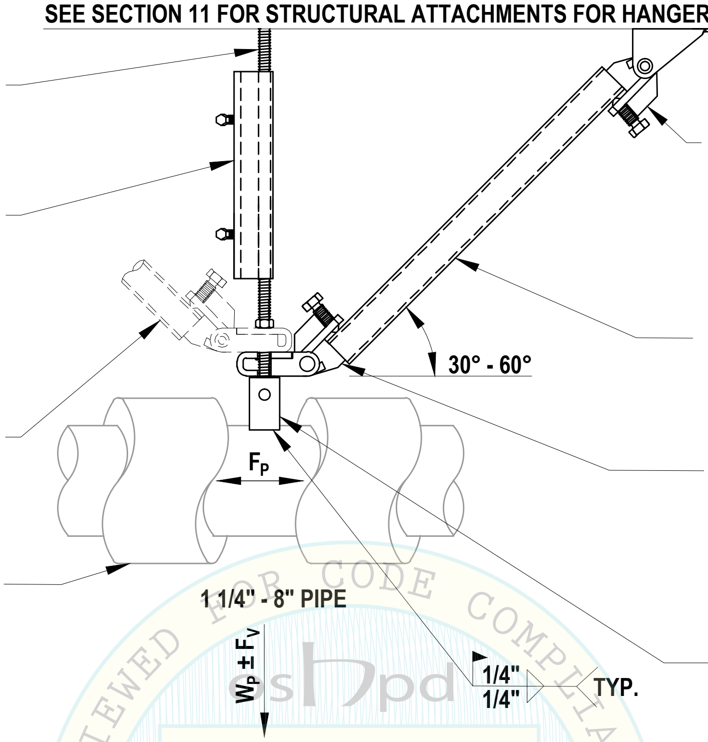
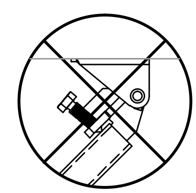
LONGITUDINAL RIGID BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH WELDED STEEL ATTACHMENT

DETAIL 2D



PIPE SIZE	ROD SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs] 30°	31° - 45°	46° - 60°
1 1/4" - 2"	3/8"	868	865	407
2 1/2" - 3 1/2"	1/2"	868	865	407
4" - 5"	5/8"	1113	990	659
6"	3/4"	1307	930	595
8"	7/8"	1307	930	595



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 40 AND BETTER PIPING.
2.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
3.) THE TOLCO FIG. 304, TOLCO FIG. 305 AND B-LINE B3083 SHALL NOT BE USED WITH EMT.

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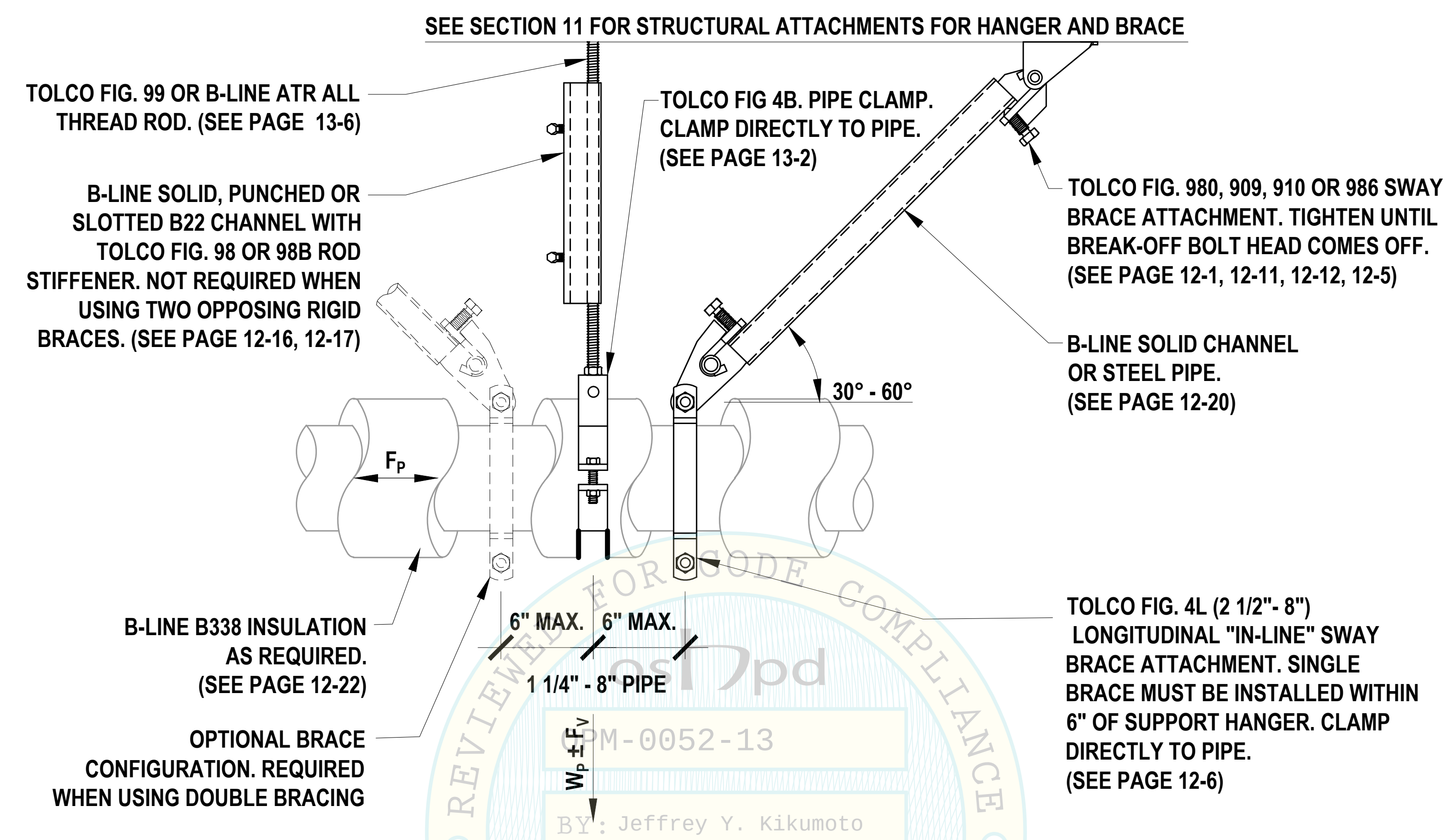
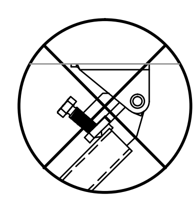
LONGITUDINAL RIGID BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH LONGITUDINAL "IN-LINE" PIPE CLAMP

DETAIL 2LA



PIPE DIAMETER	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
2 1/2"	1420	1180	1030
3" - 4"	890	730	530
5" - 8"	830	680	490



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING UNLESS NOTED OTHERWISE ON PAGE 12-6a. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   - a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   - b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   - c.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%

2.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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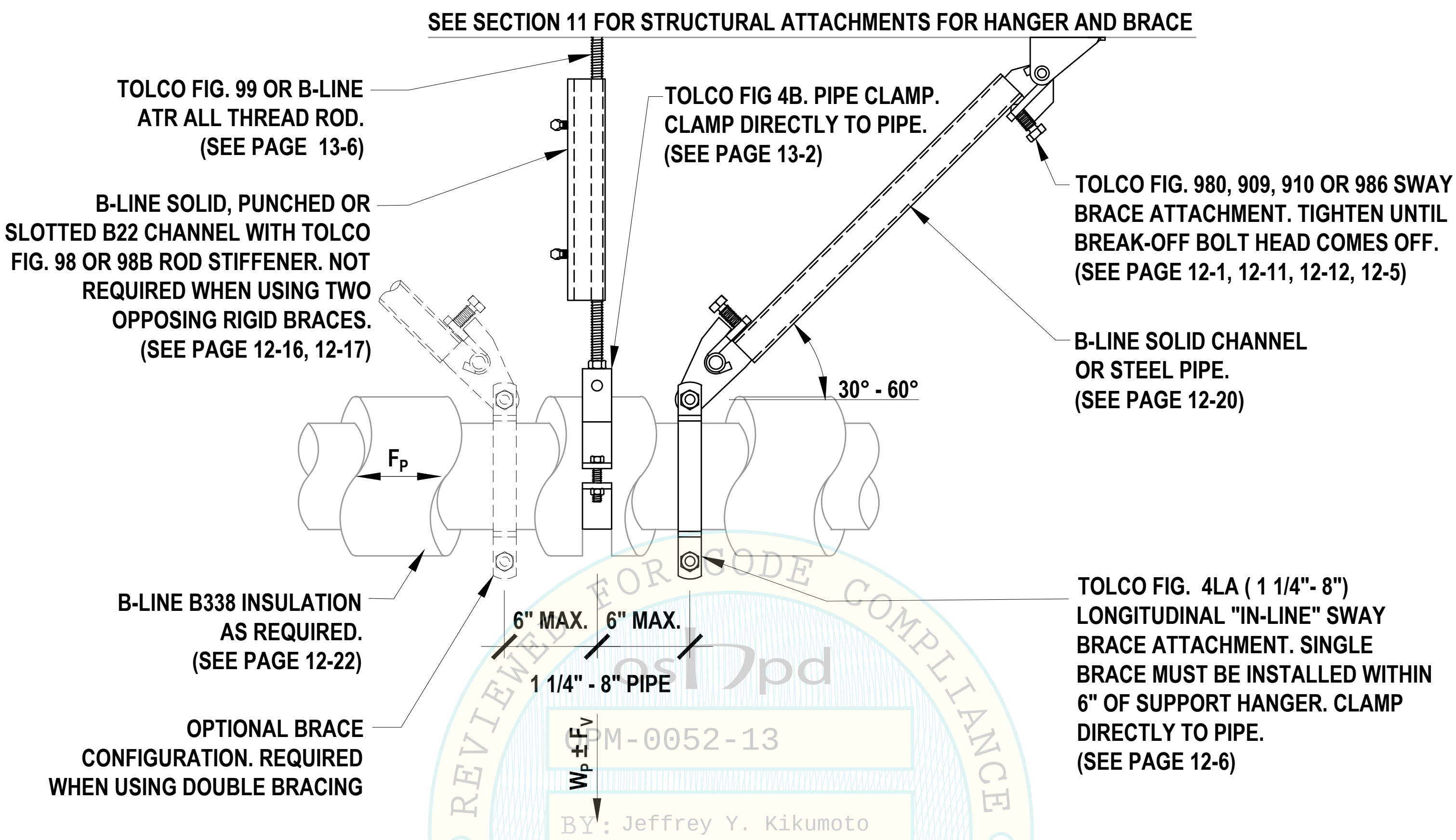
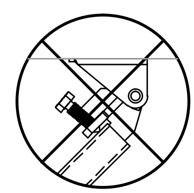
LONGITUDINAL RIGID BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH LONGITUDINAL "IN-LINE" PIPE CLAMP

DETAIL 2LA



PIPE DIAMETER	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
1 1/4" - 2"	1030	860	680
2 1/2"	1190	970	680
3" - 5"	1190	970	680
6" - 8"	1570	1660	1620



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPINGUNLESS NOTED OTHERWISE ON PAGE 12-6a. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%

2.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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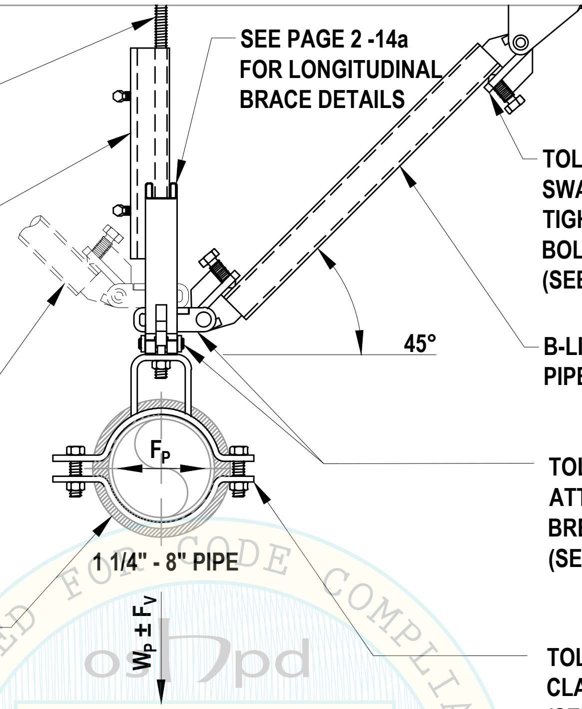
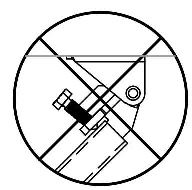
TRANSVERSE/LONGITUDINAL RIGID BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH PIPE CLAMP

DETAIL 1C/2B



PIPE DIAMETER	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]
	45°
1 1/4" - 3 1/2"	326
4"	564
6" - 8"	493



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%

2.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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MRH
Structural Engineer: Mohammad Hariri
California SE No. S3545

PAGE: 2-14

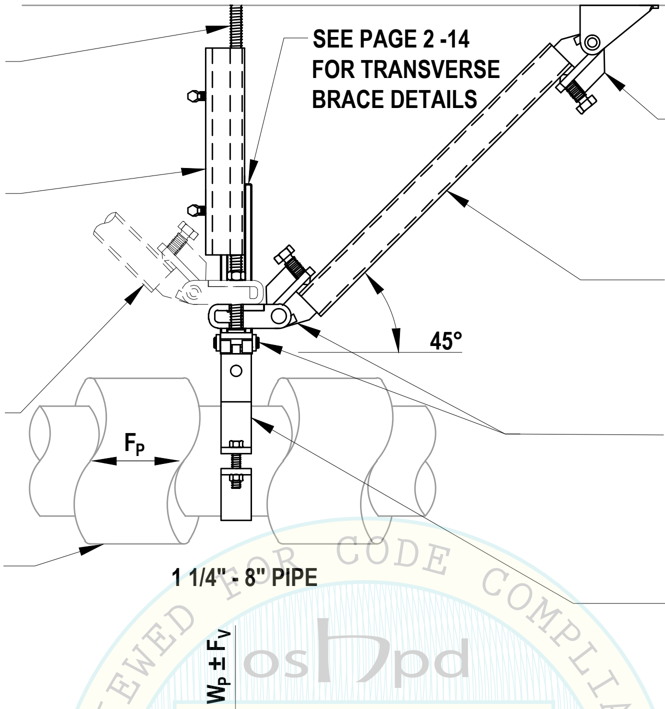
DATE: NOVEMBER 29, 2016

MH

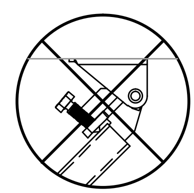
TRANSVERSE/LONGITUDINAL RIGID BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH PIPE CLAMP

DETAIL 1C/2B

SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE



PIPE DIAMETER	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]
	45°
1 1/4" - 3 1/2"	326
4"	564
6" - 8"	493



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%

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DATE: NOVEMBER 29, 2016

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SECTION 3

SINGLE HANGER RIGID BRACE SPACING CHARTS

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DATE:
NOVEMBER 29, 2016

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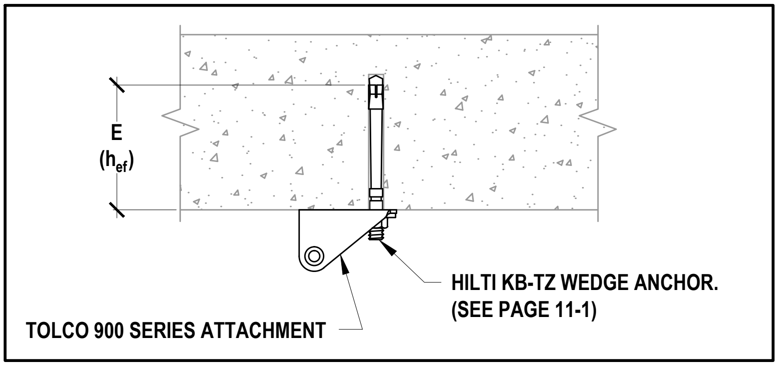
SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4000 PSI MIN.

0.50 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse Max. Spacing @ 0.50 "G"	Concrete Anchorage Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
1	2.9	40	1	(1)	3/8"	2"
1-1/4	3.7	40	1	(1)	3/8"	2"
1-1/2	4.6	40	1	(1)	3/8"	2"
2	6.2	40	1	(1)	3/8"	2"
2-1/2	9.2	40	1	(1)	3/8"	2"
3	12.2	40	1	(1)	1/2"	3 1/4"
4	18.1	40	1	(1)	1/2"	3 1/4"
5	26.6	34	1	(1)	1/2"	3 1/4"
6	33.8	26	1	(1)	1/2"	3 1/4"
8	55	22	1	(1)	5/8"	4"
10	80.1	31	*2	(1)	5/8"	4"
12	109	23	*2	(1)	5/8"	4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal Max. Spacing @ 0.50 "G"	Concrete Anchorage Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
1	2.9	80	1	(1)	3/8"	2"
1-1/4	3.7	80	1	(1)	3/8"	2"
1-1/2	4.6	80	1	(1)	3/8"	2"
2	6.2	64	1	(1)	3/8"	2"
2-1/2	9.2	43	1	(1)	3/8"	2"
3	12.2	33	1	(1)	3/8"	2"
4	18.1	80	*2	(1)	1/2"	3 1/4"
5	26.6	80	*2	(1)	5/8"	4"
6	33.8	74	*2	(1)	5/8"	4"
8	55	45	*2	(1)	5/8"	4"
10	80.1	31	*2	(1)	5/8"	4"
12	109	23	*2	(1)	5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013), WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
7.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
8.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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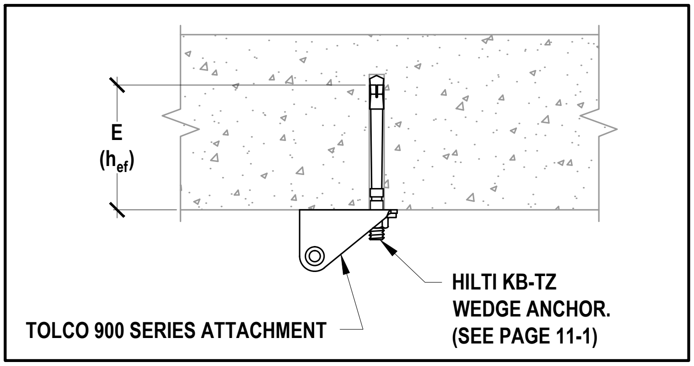
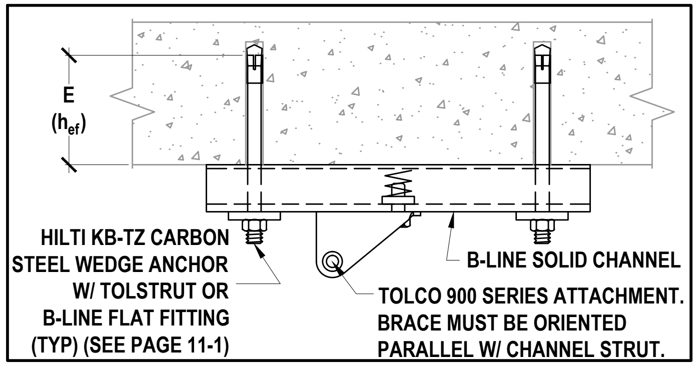
SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.75 "G"





Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 0.75 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
1	2.9	40	1	(1)	3/8"	2"
1-1/4	3.7	40	1	(1)	3/8"	2"
1-1/2	4.6	40	1	(1)	3/8"	2"
2	6.2	40	1	(1)	3/8"	2"
2-1/2	9.2	40	1	(1)	1/2"	3 1/4"
3	12.2	40	1	(1)	1/2"	3 1/4"
4	18.1	33	1	(1)	1/2"	3 1/4"
5	26.6	22	1	(1)	1/2"	3 1/4"
6	33.8	17	1	(1)	1/2"	3 1/4"
8	55	30	*2	(1)	5/8"	4"
10	80.1	21	*2	(1)	5/8"	4"
12	109	15	*2	(1)	5/8"	4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 0.75 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
1	2.9	80	1	(1)	3/8"	2"
1-1/4	3.7	80	1	(1)	1/2"	2"
1-1/2	4.6	80	1	(1)	1/2"	3 1/4"
2	6.2	80	1	(1)	1/2"	3 1/4"
2-1/2	9.2	65	1	(1)	1/2"	3 1/4"
3	12.2	49	1	(1)	1/2"	3 1/4"
4	18.1	67	*2	(1)	1/2"	3 1/4"
5	26.6	63	*2	(1)	5/8"	4"
6	33.8	49	*2	(1)	5/8"	4"
8	55	30	*2	(1)	5/8"	4"
10	80.1	21	*2	(1)	5/8"	4"
12	109	15	*2	(1)	5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013), WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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7.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
8.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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California SE No. S3545

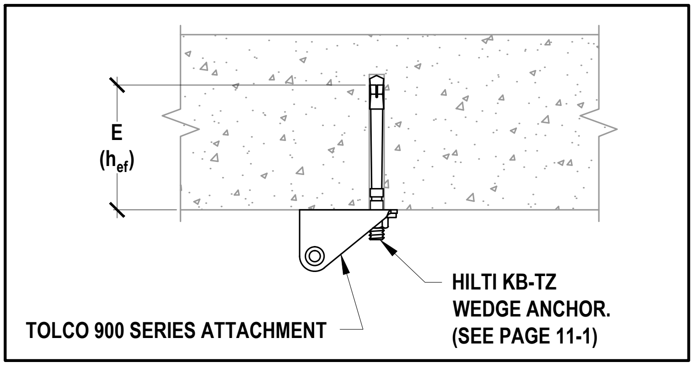
PAGE: 3-2

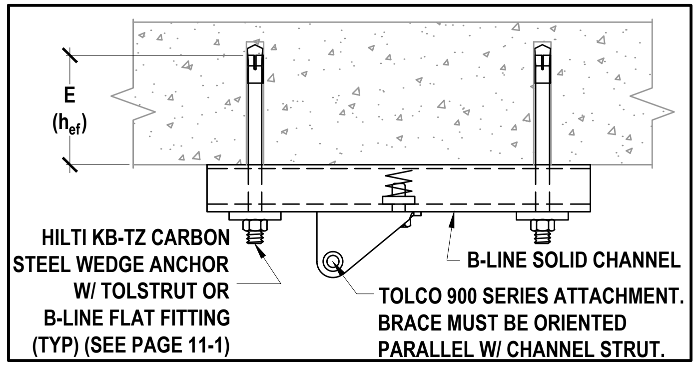
DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

1.0 "G"





Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 1.0 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
1	2.9	40	1	(1)	3/8"	2"
1-1/4	3.7	40	1	(1)	3/8"	2"
1-1/2	4.6	40	1	(1)	3/8"	2"
2	6.2	40	1	(1)	1/2"	3 1/4"
2-1/2	9.2	40	1	(1)	1/2"	3 1/4"
3	12.2	37	1	(1)	1/2"	3 1/4"
4	18.1	25	1	(1)	1/2"	3 1/4"
5	26.6	17	1	(1)	1/2"	3 1/4"
6	33.8	18	1	(1)	5/8"	4"
8	55	11	1	(1)	5/8"	4"
10	80.1	15	*2	(1)	5/8"	4"
12	109	11	*2	(1)	5/8"	4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 1.0 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
1	2.9	69	1	(1)	3/8"	2"
1-1/4	3.7	54	1	(1)	3/8"	2"
1-1/2	4.6	43	1	(1)	3/8"	2"
2	6.2	73	1	(1)	1/2"	3 1/4"
2-1/2	9.2	49	1	(1)	1/2"	3 1/4"
3	12.2	37	1	(1)	1/2"	3 1/4"
4	18.1	50	*2	(1)	1/2"	3 1/4"
5	26.6	47	*2	(1)	5/8"	4"
6	33.8	37	*2	(1)	5/8"	4"
8	55	22	*2	(1)	5/8"	4"
10	80.1	15	*2	(1)	5/8"	4"
12	109	11	*2	(1)	5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
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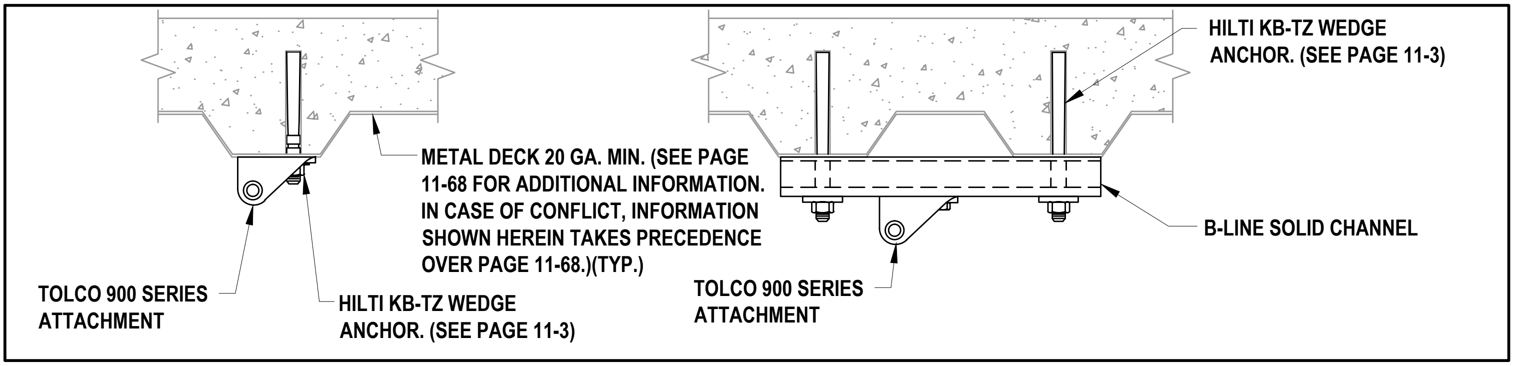
SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.50 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 0.50 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	1	1	3/8"	2"
1-1/4	3.7	40	1	1	3/8"	2"
1-1/2	4.6	40	1	1	3/8"	2"
2	6.2	40	1	1	1/2"	3 1/4"
2-1/2	9.2	40	1	1	1/2"	3 1/4"
3	12.2	36	1	1	1/2"	3 1/4"
4	18.1	24	1	1	1/2"	3 1/4"
5	26.6	16	1	1	1/2"	3 1/4"
6	33.8	13	1	1	1/2"	3 1/4"
8	55	18	1	2	(2) 1/2"	3 1/4"
10	80.1	25	*2	2	(2) 1/2"	3 1/4"
12	109	18	*2	2	(2) 1/2"	3 1/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 0.50 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	80	1	1	1/2"	3 1/4"
1-1/4	3.7	80	1	1	1/2"	3 1/4"
1-1/2	4.6	80	1	1	1/2"	3 1/4"
2	6.2	72	1	1	1/2"	3 1/4"
2-1/2	9.2	48	1	1	1/2"	3 1/4"
3	12.2	36	1	1	1/2"	3 1/4"
4	18.1	49	2	1	1/2"	3 1/4"
5	26.6	75	2	2	(2) 1/2"	3 1/4"
6	33.8	59	2	2	(2) 1/2"	3 1/4"
8	55	36	*2	2	(2) 1/2"	3 1/4"
10	80.1	25	*2	2	(2) 1/2"	3 1/4"
12	109	18	*2	2	(2) 1/2"	3 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013), WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
7.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
8.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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California SE No. S3545

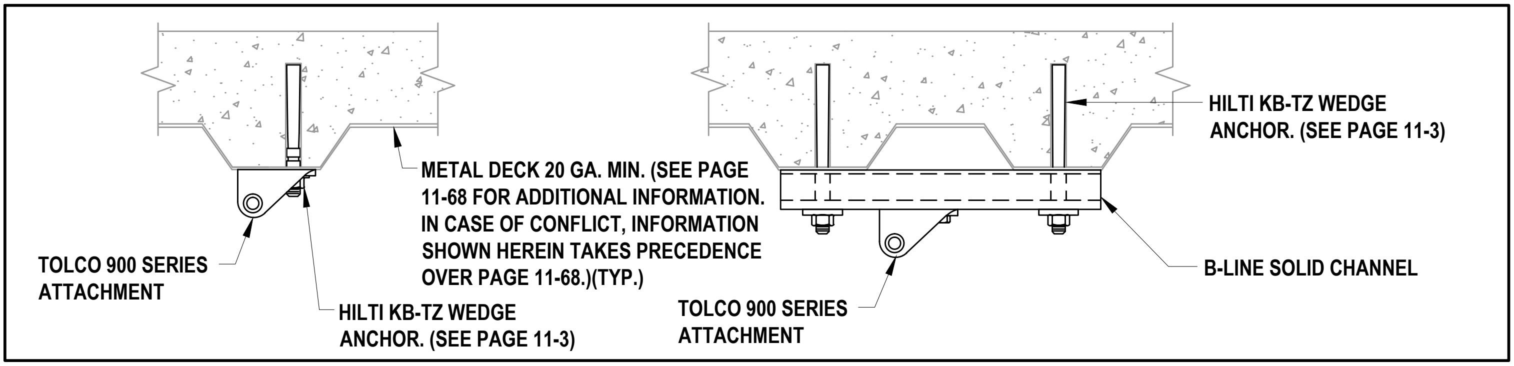
PAGE: 3-4

DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 0.75 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	1	1	3/8"	2"
1-1/4	3.7	40	1	1	1/2"	3 1/4"
1-1/2	4.6	40	1	1	1/2"	3 1/4"
2	6.2	40	1	1	1/2"	3 1/4"
2-1/2	9.2	32	1	1	1/2"	3 1/4"
3	12.2	40	1	2	(2) 1/2"	3 1/4"
4	18.1	37	1	2	(2) 1/2"	3 1/4"
5	26.6	25	1	2	(2) 1/2"	3 1/4"
6	33.8	19	1	2	(2) 1/2"	3 1/4"
8	55	24	*2	2	(2) 1/2"	3 1/4"
10	80.1	16	*2	2	(2) 1/2"	3 1/4"
12	109	12	*2	2	(2) 1/2"	3 1/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 0.75 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	80	1	1	1/2"	3 1/4"
1-1/4	3.7	80	1	1	1/2"	3 1/4"
1-1/2	4.6	64	1	1	1/2"	3 1/4"
2	6.2	48	1	1	1/2"	3 1/4"
2-1/2	9.2	73	1	2	(2) 1/2"	3 1/4"
3	12.2	55	1	2	(2) 1/2"	3 1/4"
4	18.1	74	*2	2	(2) 1/2"	3 1/4"
5	26.6	50	*2	2	(2) 1/2"	3 1/4"
6	33.8	39	*2	2	(2) 1/2"	3 1/4"
8	55	24	*2	2	(2) 1/2"	3 1/4"
10	80.1	16	*2	2	(2) 1/2"	3 1/4"
12	109	12	*2	2	(2) 1/2"	3 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013), WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) SPACING TABLE IS BASED ON A 1:1 (45°) BRACE ANGLE RATIO. FOR ALTERNATE BRACE ANGLE RATIOS FROM HORIZONTAL, REDUCE BRACE SPACING BY USING THE FOLLOWING FORMULAS: UP TO 1.5:1 SPACING/1.67; UP TO 2:1 SPACING/2.33.
7.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
8.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
9.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
10.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
11.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

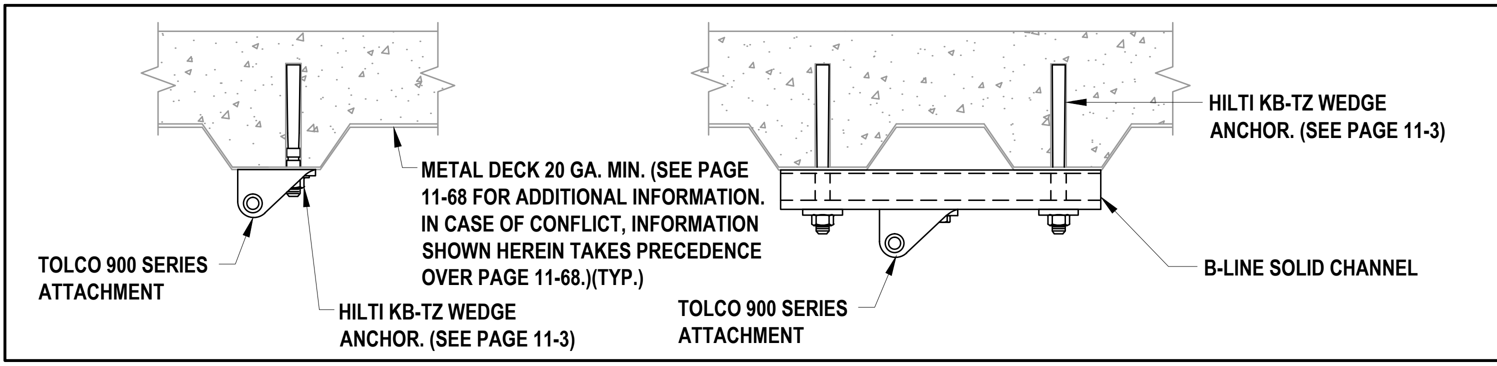
PAGE: 3-5

DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

1.0 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 1.0 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	1	1	1/2"	3 1/4"
1-1/4	3.7	40	1	1	1/2"	3 1/4"
1-1/2	4.6	40	1	1	1/2"	3 1/4"
2	6.2	36	1	1	1/2"	3 1/4"
2-1/2	9.2	24	1	1	1/2"	3 1/4"
3	12.2	18	1	1	1/2"	3 1/4"
4	18.1	27	1	2	(2) 1/2"	3 1/4"
5	26.6	19	1	2	(2) 1/2"	3 1/4"
6	33.8	14	1	2	(2) 1/2"	3 1/4"
8	55	18	*2	2	(2) 1/2"	3 1/4"
10	80.1	12	*2	2	(2) 1/2"	3 1/4"
12	109	9	*2	2	(2) 1/2"	3 1/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 01.0 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	77	1	1	1/2"	3 1/4"
1-1/4	3.7	60	1	1	1/2"	3 1/4"
1-1/2	4.6	48	1	1	1/2"	3 1/4"
2	6.2	36	1	1	1/2"	3 1/4"
2-1/2	9.2	54	1	2	(2) 1/2"	3 1/4"
3	12.2	41	1	2	(2) 1/2"	3 1/4"
4	18.1	55	*2	2	(2) 1/2"	3 1/4"
5	26.6	38	*2	2	(2) 1/2"	3 1/4"
6	33.8	29	*2	2	(2) 1/2"	3 1/4"
8	55	18	*2	2	(2) 1/2"	3 1/4"
10	80.1	12	*2	2	(2) 1/2"	3 1/4"
12	109	9	*2	2	(2) 1/2"	3 1/4"

NOTES:

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2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
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10.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
11.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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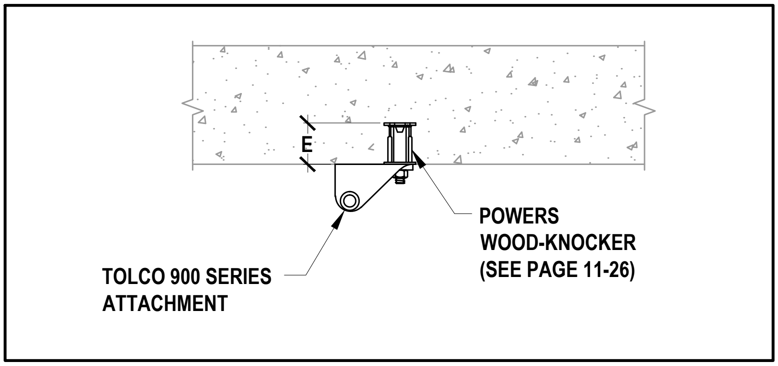
California SE No. S3545

PAGE: 3-6

DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.



Pipe Diameter	Max. Weight Per Ft.	Transverse Max. Spacing @ 0.50 "G"	Concrete Anchorage Brace Qty.	Concrete Anchorage Anchor per Brace	Concrete Anchorage Min. Diameter	Concrete Anchorage Min. Embed. "E"
1	2.9	40	1	(1)	3/8"	1 3/4"
1-1/4	3.7	40	1	(1)	3/8"	1 3/4"
1-1/2	4.6	40	1	(1)	3/8"	1 3/4"
2	6.2	40	1	(1)	3/8"	1 3/4"
2-1/2	9.2	40	1	(1)	3/8"	1 3/4"
3	12.2	40	1	(1)	3/8"	1 3/4"
4	18.1	40	1	(1)	3/8"	1 3/4"
5	26.6	36	1	(1)	1/2"	1 3/4"
6	33.8	28	1	(1)	1/2"	1 3/4"
8	55	17	1	(1)	1/2"	1 3/4"
10	80.1	24	*2	(1)	1/2"	1 3/4"
12	109	17	*2	(1)	1/2"	1 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal Max. Spacing @ 0.50 "G"	Concrete Anchorage Brace Qty.	Concrete Anchorage Anchor per Brace	Concrete Anchorage Min. Diameter	Concrete Anchorage Min. Embed. "E"
1	2.9	80	1	(1)	3/8"	1 3/4"
1-1/4	3.7	80	1	(1)	3/8"	1 3/4"
1-1/2	4.6	80	1	(1)	3/8"	1 3/4"
2	6.2	80	1	(1)	3/8"	1 3/4"
2-1/2	9.2	80	1	(1)	3/8"	1 3/4"
3	12.2	60	1	(1)	3/8"	1 3/4"
4	18.1	40	1	(1)	3/8"	1 3/4"
5	26.6	36	1	(1)	1/2"	1 3/4"
6	33.8	28	1	(1)	1/2"	1 3/4"
8	55	35	*2	(1)	1/2"	1 3/4"
10	80.1	24	*2	(1)	1/2"	1 3/4"
12	109	17	*2	(1)	1/2"	1 3/4"

NOTES:

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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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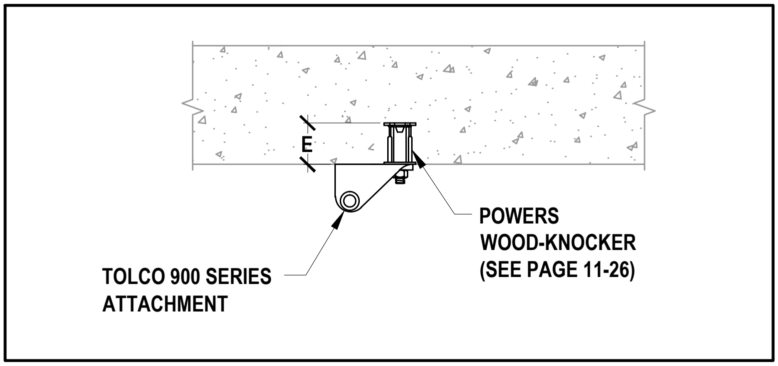
Structural Engineer: Mohammad Hariri
California SE No. S3545

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 0.75 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	1	(1)	3/8"	1 3/4"
1-1/4	3.7	40	1	(1)	3/8"	1 3/4"
1-1/2	4.6	40	1	(1)	3/8"	1 3/4"
2	6.2	40	1	(1)	3/8"	1 3/4"
2-1/2	9.2	40	1	(1)	3/8"	1 3/4"
3	12.2	40	1	(1)	3/8"	1 3/4"
4	18.1	27	1	(1)	3/8"	1 3/4"
5	26.6	24	1	(1)	1/2"	1 3/4"
6	33.8	19	1	(1)	1/2"	1 3/4"
8	55	23	*2	(1)	1/2"	1 3/4"
10	80.1	16	*2	(1)	1/2"	1 3/4"
12	109	11	*2	(1)	1/2"	1 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 0.75 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	80	1	(1)	3/8"	1 3/4"
1-1/4	3.7	80	1	(1)	3/8"	1 3/4"
1-1/2	4.6	80	1	(1)	3/8"	1 3/4"
2	6.2	79	1	(1)	3/8"	1 3/4"
2-1/2	9.2	53	1	(1)	3/8"	1 3/4"
3	12.2	52	1	(1)	1/2"	1 3/4"
4	18.1	35	1	(1)	1/2"	1 3/4"
5	26.6	48	*2	(1)	1/2"	1 3/4"
6	33.8	38	*2	(1)	1/2"	1 3/4"
8	55	23	*2	(1)	1/2"	1 3/4"
10	80.1	16	*2	(1)	1/2"	1 3/4"
12	109	11	*2	(1)	1/2"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
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7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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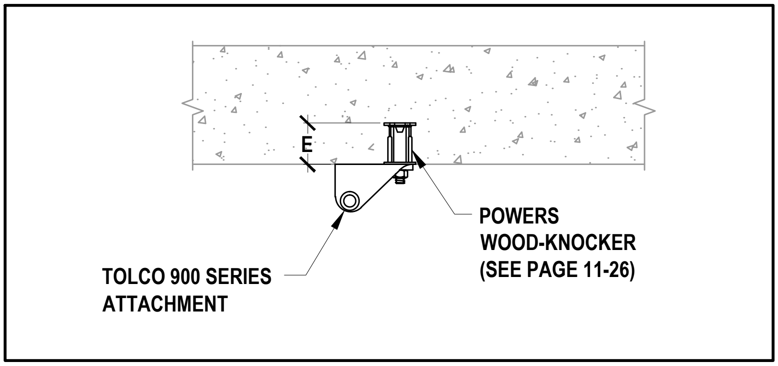

Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 1.0 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	1	(1)	3/8"	1 3/4"
1-1/4	3.7	40	1	(1)	3/8"	1 3/4"
1-1/2	4.6	40	1	(1)	3/8"	1 3/4"
2	6.2	40	1	(1)	3/8"	1 3/4"
2-1/2	9.2	40	1	(1)	3/8"	1 3/4"
3	12.2	30	1	(1)	3/8"	1 3/4"
4	18.1	20	1	(1)	3/8"	1 3/4"
5	26.6	18	1	(1)	1/2"	1 3/4"
6	33.8	14	1	(1)	1/2"	1 3/4"
8	55	17	*2	(1)	1/2"	1 3/4"
10	80.1	12	*2	(1)	1/2"	1 3/4"
12	109	8	*2	(1)	1/2"	1 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 1.0 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	80	1	(1)	3/8"	1 3/4"
1-1/4	3.7	80	1	(1)	3/8"	1 3/4"
1-1/2	4.6	80	1	(1)	3/8"	1 3/4"
2	6.2	59	1	(1)	3/8"	1 3/4"
2-1/2	9.2	40	1	(1)	3/8"	1 3/4"
3	12.2	39	1	(1)	1/2"	1 3/4"
4	18.1	26	1	(1)	1/2"	1 3/4"
5	26.6	36	*2	(1)	1/2"	1 3/4"
6	33.8	28	*2	(1)	1/2"	1 3/4"
8	55	17	*2	(1)	1/2"	1 3/4"
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NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
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8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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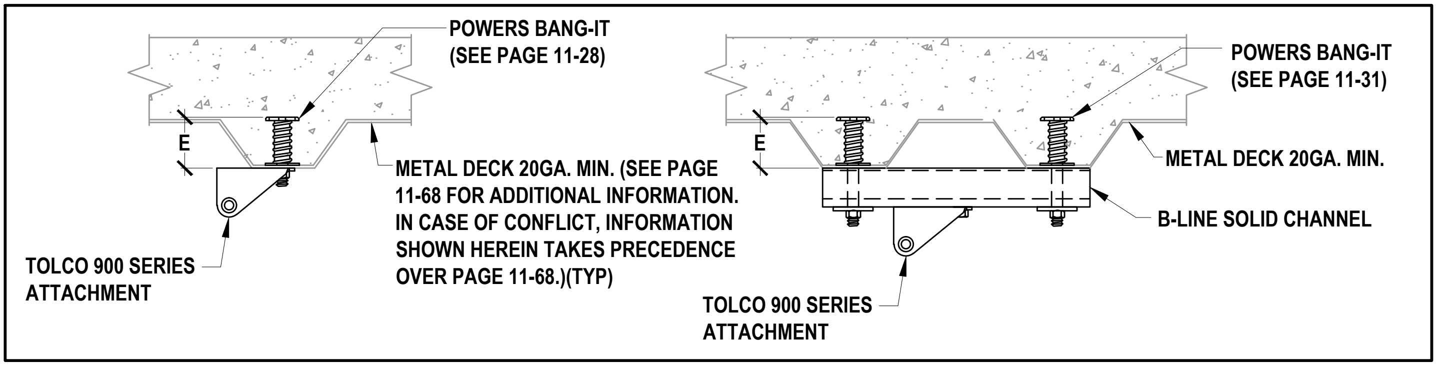
MRH
Structural Engineer: Mohammad Hariri
California SE No. S3545

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.50 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse Max. Spacing @ 0.50 "G"	Concrete Anchorage Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	1	1	1/2"	2 1/4"
1-1/4	3.7	40	1	1	1/2"	2 1/4"
1-1/2	4.6	40	1	1	1/2"	2 1/4"
2	6.2	40	1	1	1/2"	2 1/4"
2-1/2	9.2	40	1	1	1/2"	2 1/4"
3	12.2	39	1	1	1/2"	2 1/4"
4	18.1	40	1	2	(2) 1/2"	2 1/4"
5	26.6	40	1	2	(2) 1/2"	2 1/4"
6	33.8	40	1	2	(2) 1/2"	2 1/4"
8	55	31	1	2	(2) 1/2"	2 1/4"
10	80.1	40	*2	2	(2) 1/2"	2 1/4"
12	109	31	*2	2	(2) 1/2"	2 1/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal Max. Spacing @ 0.50 "G"	Concrete Anchorage Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	80	1	1	1/2"	2 1/4"
1-1/4	3.7	80	1	1	1/2"	2 1/4"
1-1/2	4.6	80	1	1	1/2"	2 1/4"
2	6.2	78	1	1	1/2"	2 1/4"
2-1/2	9.2	52	1	1	1/2"	2 1/4"
3	12.2	39	1	1	1/2"	2 1/4"
4	18.1	80	1	2	(2) 1/2"	2 1/4"
5	26.6	64	1	2	(2) 1/2"	2 1/4"
6	33.8	50	1	2	(2) 1/2"	2 1/4"
8	55	62	*2	2	(2) 1/2"	2 1/4"
10	80.1	42	*2	2	(2) 1/2"	2 1/4"
12	109	31	*2	2	(2) 1/2"	2 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
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8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
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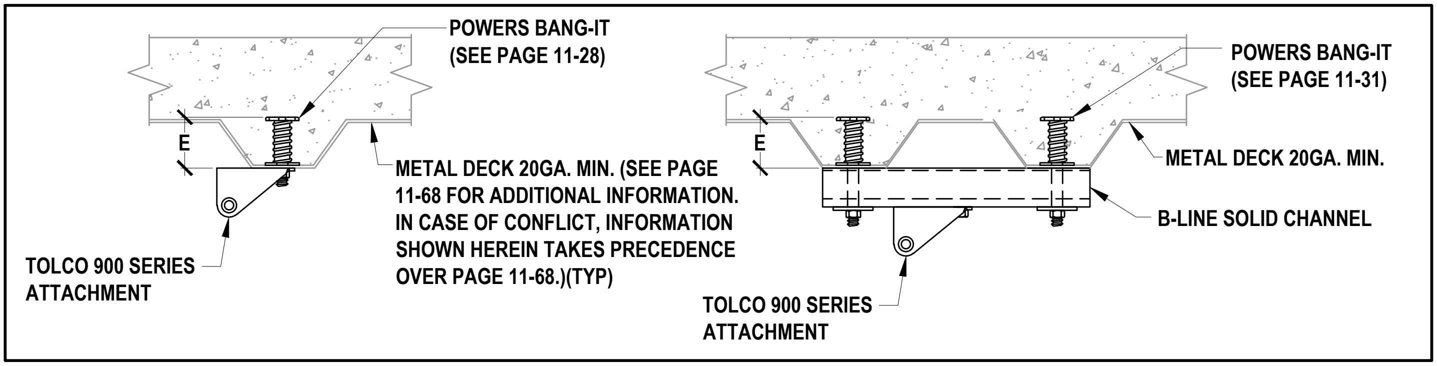
SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 0.75 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	1	1	3/8"	2 1/4"
1-1/4	3.7	40	1	1	3/8"	2 1/4"
1-1/2	4.6	40	1	1	3/8"	2 1/4"
2	6.2	40	1	1	3/8"	2 1/4"
2-1/2	9.2	40	1	2	(2) 1/2"	2 1/4"
3	12.2	40	1	2	(2) 1/2"	2 1/4"
4	18.1	40	1	2	(2) 1/2"	2 1/4"
5	26.6	40	1	2	(2) 1/2"	2 1/4"
6	33.8	40	*2	2	(2) 1/2"	2 1/4"
8	55	40	*2	2	(2) 1/2"	2 1/4"
10	80.1	28	*2	2	(2) 1/2"	2 1/4"
12	109	20	*2	2	(2) 1/2"	2 1/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 0.75 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	80	1	1	3/8"	2 1/4"
1-1/4	3.7	80	1	1	3/8"	2 1/4"
1-1/2	4.6	80	1	1	3/8"	2 1/4"
2	6.2	80	1	2	(2) 1/2"	2 1/4"
2-1/2	9.2	80	1	2	(2) 1/2"	2 1/4"
3	12.2	80	1	2	(2) 1/2"	2 1/4"
4	18.1	80	*2	2	(2) 1/2"	2 1/4"
5	26.6	80	*2	2	(2) 1/2"	2 1/4"
6	33.8	67	*2	2	(2) 1/2"	2 1/4"
8	55	41	*2	2	(2) 1/2"	2 1/4"
10	80.1	28	*2	2	(2) 1/2"	2 1/4"
12	109	20	*2	2	(2) 1/2"	2 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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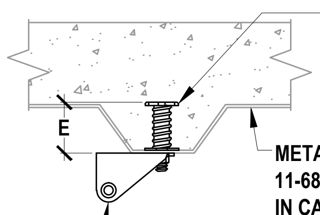
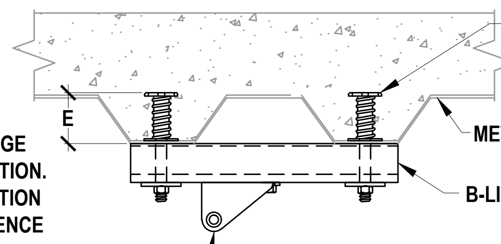
SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

1.0 "G"





Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 1.0 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	1	1	3/8"	2 1/4"
1-1/4	3.7	40	1	1	3/8"	2 1/4"
1-1/2	4.6	40	1	1	3/8"	2 1/4"
2	6.2	40	1	2	(2) 1/2"	2 1/4"
2-1/2	9.2	40	1	2	(2) 1/2"	2 1/4"
3	12.2	40	1	2	(2) 1/2"	2 1/4"
4	18.1	40	1	2	(2) 1/2"	2 1/4"
5	26.6	32	1	2	(2) 1/2"	2 1/4"
6	33.8	40	*2	2	(2) 1/2"	2 1/4"
8	55	31	*2	2	(2) 1/2"	2 1/4"
10	80.1	21	*2	2	(2) 1/2"	2 1/4"
12	109	15	*2	2	(2) 1/2"	2 1/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 1.0 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	80	1	1	3/8"	2 1/4"
1-1/4	3.7	63	1	1	3/8"	2 1/4"
1-1/2	4.6	51	1	1	3/8"	2 1/4"
2	6.2	80	1	2	(2) 1/2"	2 1/4"
2-1/2	9.2	80	1	2	(2) 1/2"	2 1/4"
3	12.2	70	1	2	(2) 1/2"	2 1/4"
4	18.1	80	*2	2	(2) 1/2"	2 1/4"
5	26.6	64	*2	2	(2) 1/2"	2 1/4"
6	33.8	50	*2	2	(2) 1/2"	2 1/4"
8	55	31	*2	2	(2) 1/2"	2 1/4"
10	80.1	21	*2	2	(2) 1/2"	2 1/4"
12	109	15	*2	2	(2) 1/2"	2 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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PAGE: 3-12

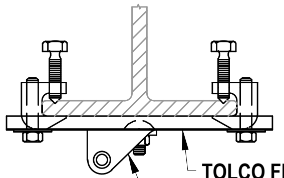
DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

0.50 "G"

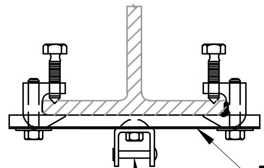
Brace Perpendicular to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 980 OR 986 BRACE ATTACHMENT

Brace Parallel to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 980 OR 986 BRACE ATTACHMENT

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 0.50 "G"	
			Perpendicular	Parallel
1	2.9	1	40	40
1-1/4	3.7	1	40	40
1-1/2	4.6	1	40	40
2	6.2	1	40	40
2-1/2	9.2	1	40	40
3	12.2	1	40	40
4	18.1	1	40	40
5	26.6	1	40	40
6	33.8	1	40	40
8	55	1	40	40
10	80.1	*2	40	40
12	109	*2	40	40

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 0.50 "G"	
			Perpendicular	Parallel
1	2.9	1	80	80
1-1/4	3.7	1	80	80
1-1/2	4.6	1	80	80
2	6.2	1	80	80
2-1/2	9.2	1	80	80
3	12.2	1	80	80
4	18.1	1	80	80
5	26.6	1	80	80
6	33.8	1	80	77
8	55	*2	80	80
10	80.1	*2	80	65
12	109	*2	72	48

NOTES:

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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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California SE No. S3545

PAGE: 3-13

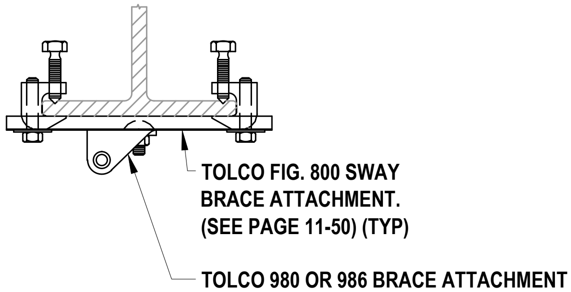
DATE: NOVEMBER 29, 2016

MH

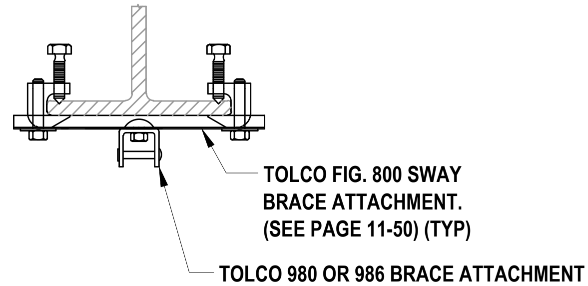
SINGLE PIPE HANGER BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

0.75 "G"

Brace Perpendicular to Beam



Brace Parallel to Beam



Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 0.75 "G"	
			Perpendicular	Parallel
1	2.9	1	40	40
1-1/4	3.7	1	40	40
1-1/2	4.6	1	40	40
2	6.2	1	40	40
2-1/2	9.2	1	40	40
3	12.2	1	40	40
4	18.1	1	40	40
5	26.6	1	40	40
6	33.8	1	40	40
8	55	*2	40	40
10	80.1	*2	40	40
12	109	*2	40	32

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 0.75 "G"	
			Perpendicular	Parallel
1	2.9	1	80	80
1-1/4	3.7	1	80	80
1-1/2	4.6	1	80	80
2	6.2	1	80	80
2-1/2	9.2	1	80	80
3	12.2	1	80	80
4	18.1	1	80	80
5	26.6	1	80	65
6	33.8	1	77	51
8	55	*2	80	63
10	80.1	*2	65	43
12	109	*2	48	32

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PAGE: 3-14

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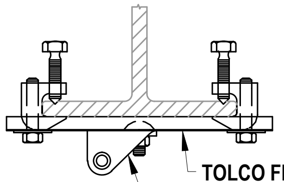
MH

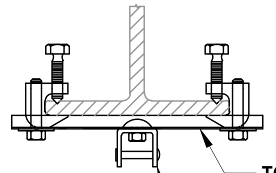
SINGLE PIPE HANGER BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

1.0 "G"

Brace Perpendicular to Beam



Brace Parallel to Beam



Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 1.0 "G"	
			Perpendicular	Parallel
1	2.9	1	40	40
1-1/4	3.7	1	40	40
1-1/2	4.6	1	40	40
2	6.2	1	40	40
2-1/2	9.2	1	40	40
3	12.2	1	40	40
4	18.1	1	40	40
5	26.6	1	40	40
6	33.8	1	40	38
8	55	*2	40	40
10	80.1	*2	40	32
12	109	*2	36	24

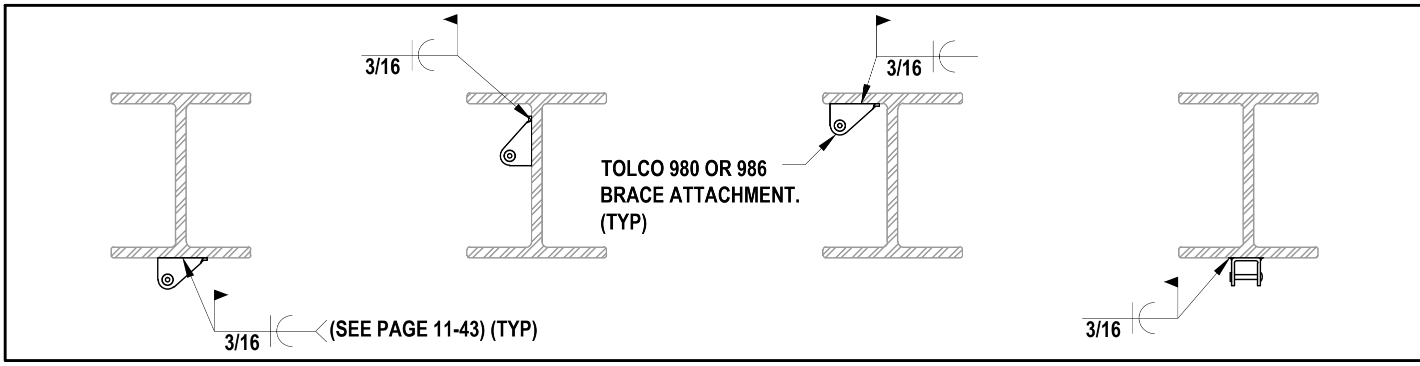
Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 1.0 "G"	
			Perpendicular	Parallel
1	2.9	1	80	80
1-1/4	3.7	1	80	80
1-1/2	4.6	1	80	80
2	6.2	1	80	80
2-1/2	9.2	1	80	80
3	12.2	1	80	80
4	18.1	1	80	72
5	26.6	*2	80	80
6	33.8	*2	80	77
8	55	*2	71	47
10	80.1	*2	49	32
12	109	*2	36	24

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.
10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

SINGLE PIPE HANGER BRACE SPACING CHART FOR WELDED ATTACHMENT TO STEEL BEAM

0.50 "G"



Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 0.50 "G"
1	2.9	1	40
1-1/4	3.7	1	40
1-1/2	4.6	1	40
2	6.2	1	40
2-1/2	9.2	1	40
3	12.2	1	40
4	18.1	1	40
5	26.6	1	40
6	33.8	1	40
8	55	1	40
10	80.1	*2	40
12	109	*2	40

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 0.50 "G"
1	2.9	1	80
1-1/4	3.7	1	80
1-1/2	4.6	1	80
2	6.2	1	80
2-1/2	9.2	1	80
3	12.2	1	80
4	18.1	1	80
5	26.6	1	80
6	33.8	1	72
8	55	*2	80
10	80.1	*2	60
12	109	*2	44

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.
10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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Structural Engineer: Mohammad Hariri
California SE No. S3545

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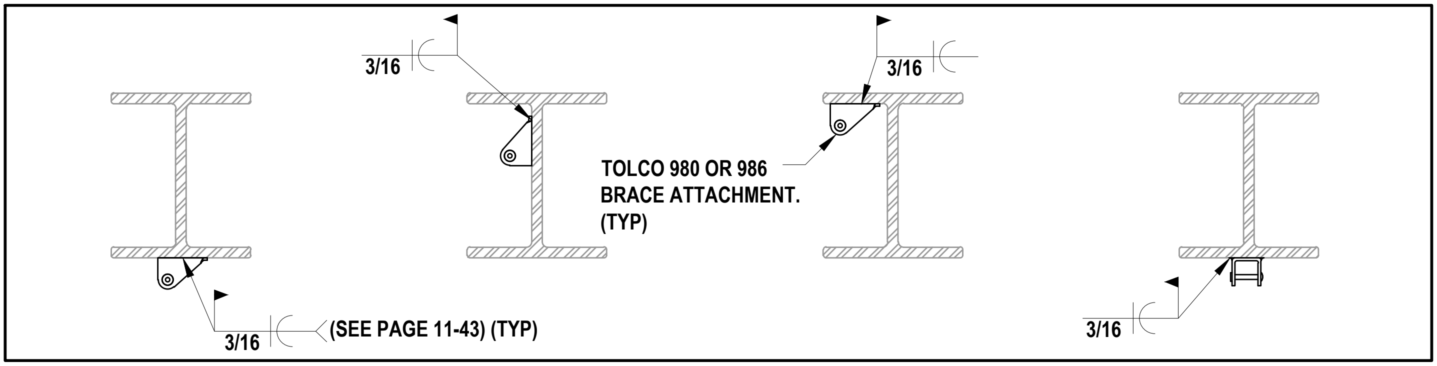
SINGLE PIPE HANGER BRACE SPACING CHART FOR WELDED ATTACHMENT TO STEEL BEAM

0.75 "G"



Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 0.75 "G"
1	2.9	1	40
1-1/4	3.7	1	40
1-1/2	4.6	1	40
2	6.2	1	40
2-1/2	9.2	1	40
3	12.2	1	40
4	18.1	1	40
5	26.6	1	40
6	33.8	1	40
8	55	*2	40
10	80.1	*2	40
12	109	*2	29

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 0.75 "G"
1	2.9	1	80
1-1/4	3.7	1	80
1-1/2	4.6	1	80
2	6.2	1	80
2-1/2	9.2	1	80
3	12.2	1	80
4	18.1	1	80
5	26.6	*2	80
6	33.8	*2	80
8	55	*2	59
10	80.1	*2	40
12	109	*2	29

NOTES:

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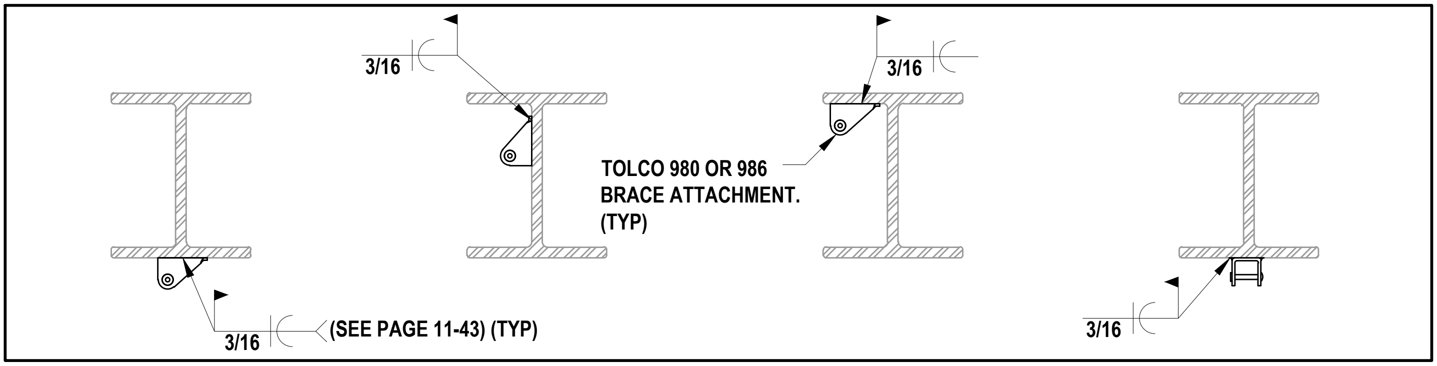
SINGLE PIPE HANGER BRACE SPACING CHART FOR WELDED ATTACHMENT TO STEEL BEAM | 1.0 "G"



Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 1.0 "G"
1	2.9	1	40
1-1/4	3.7	1	40
1-1/2	4.6	1	40
2	6.2	1	40
2-1/2	9.2	1	40
3	12.2	1	40
4	18.1	1	40
5	26.6	1	40
6	33.8	1	36
8	55	*2	40
10	80.1	*2	30
12	109	*2	22

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 1.0 "G"
1	2.9	1	80
1-1/4	3.7	1	80
1-1/2	4.6	1	80
2	6.2	1	80
2-1/2	9.2	1	80
3	12.2	1	80
4	18.1	1	67
5	26.6	*2	80
6	33.8	*2	72
8	55	*2	44
10	80.1	*2	30
12	109	*2	22

NOTES:

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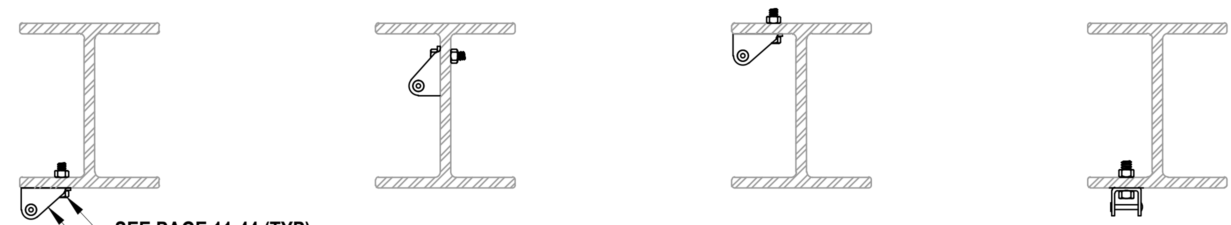
SINGLE PIPE HANGER BRACE SPACING CHART FOR BOLTED ATTACHMENT TO STEEL BEAM	0.50 "G"



Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Minimum Bolt Diameter	Transverse Max Spacing @ 0.50 "G"
1	2.9	1	3/8"	40
1-1/4	3.7	1	3/8"	40
1-1/2	4.6	1	3/8"	40
2	6.2	1	3/8"	40
2-1/2	9.2	1	3/8"	40
3	12.2	1	3/8"	40
4	18.1	1	3/8"	40
5	26.6	1	1/2"	40
6	33.8	1	1/2"	40
8	55	1	5/8"	40
10	80.1	*2	5/8"	40
12	109	*2	5/8"	40

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Minimum Bolt Diameter	Longitudinal Max Spacing @ 0.50 "G"
1	2.9	1	3/8"	80
1-1/4	3.7	1	3/8"	80
1-1/2	4.6	1	3/8"	80
2	6.2	1	3/8"	80
2-1/2	9.2	1	3/8"	80
3	12.2	1	3/8"	80
4	18.1	1	1/2"	80
5	26.6	1	5/8"	80
6	33.8	1	5/8"	71
8	55	*2	5/8"	80
10	80.1	*2	5/8"	59
12	109	*2	5/8"	44

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
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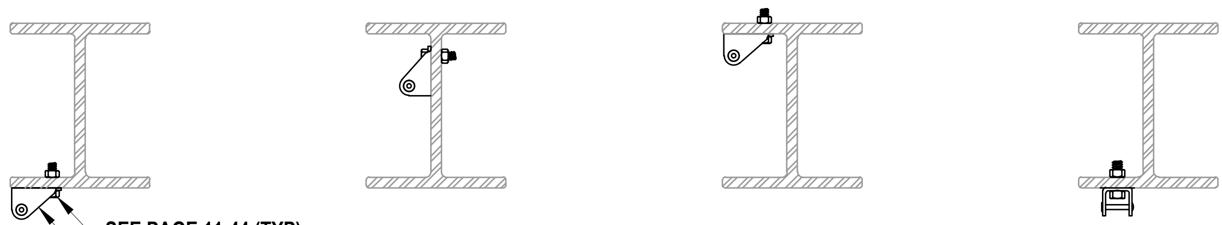
SINGLE PIPE HANGER BRACE SPACING CHART FOR BOLTED ATTACHMENT TO STEEL BEAM

0.75 "G"



Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Minimum Bolt Diameter	Transverse Max Spacing @ 0.75 "G"
1	2.9	1	3/8"	40
1-1/4	3.7	1	3/8"	40
1-1/2	4.6	1	3/8"	40
2	6.2	1	3/8"	40
2-1/2	9.2	1	3/8"	40
3	12.2	1	5/8"	40
4	18.1	1	1/2"	40
5	26.6	1	5/8"	40
6	33.8	1	5/8"	40
8	55	*2	5/8"	40
10	80.1	*2	5/8"	40
12	109	*2	5/8"	29

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Minimum Bolt Diameter	Longitudinal Max Spacing @ 0.75 "G"
1	2.9	1	3/8"	80
1-1/4	3.7	1	3/8"	80
1-1/2	4.6	1	3/8"	80
2	6.2	1	3/8"	80
2-1/2	9.2	1	1/2"	80
3	12.2	1	1/2"	80
4	18.1	1	5/8"	80
5	26.6	*2	5/8"	60
6	33.8	*2	5/8"	80
8	55	*2	5/8"	58
10	80.1	*2	5/8"	40
12	109	*2	5/8"	29

NOTES:

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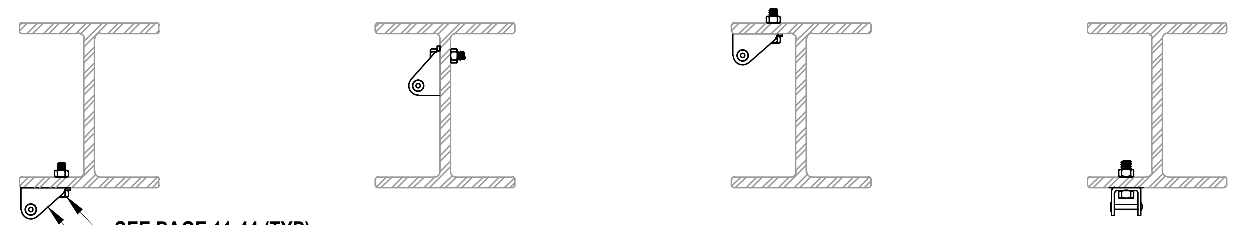
PAGE: 3-20
DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR BOLTED ATTACHMENT TO STEEL BEAM

1.0 "G"



Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Minimum Bolt Diameter	Transverse Max Spacing @ 1.0 "G"
1	2.9	1	3/8"	40
1-1/4	3.7	1	3/8"	40
1-1/2	4.6	1	3/8"	40
2	6.2	1	3/8"	40
2-1/2	9.2	1	3/8"	40
3	12.2	1	3/8"	40
4	18.1	1	1/2"	40
5	26.6	1	5/8"	40
6	33.8	1	5/8"	35
8	55	1	5/8"	21
10	80.1	*2	5/8"	30
12	109	*2	5/8"	22

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Minimum Bolt Diameter	Longitudinal Max Spacing @ 1.0 "G"
1	2.9	1	3/8"	80
1-1/4	3.7	1	3/8"	80
1-1/2	4.6	1	3/8"	80
2	6.2	1	3/8"	80
2-1/2	9.2	1	1/2"	80
3	12.2	1	5/8"	80
4	18.1	1	5/8"	66
5	26.6	1	5/8"	45
6	33.8	1	5/8"	35
8	55	*2	5/8"	43
10	80.1	*2	5/8"	30
12	109	*2	5/8"	22

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
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6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.
10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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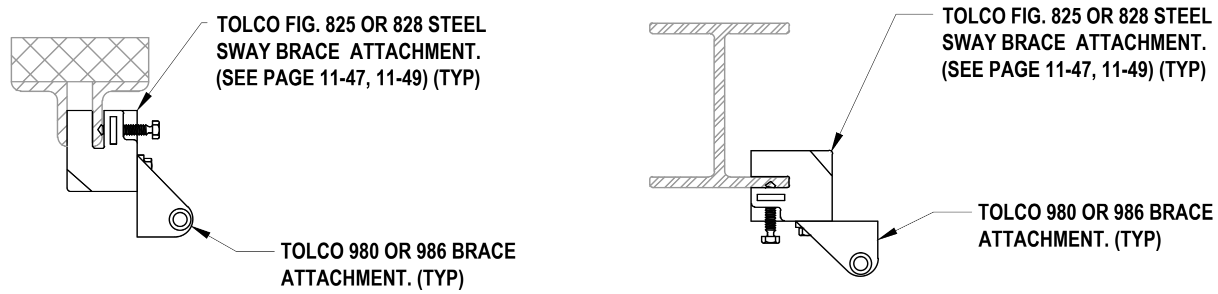
MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR ATTACHMENT TO STEEL TRUSS OR STEEL BEAM | 0.50 "G"



Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Transverse Max Spacing @ 0.50 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1	40	40
1-1/4	3.7	1	40	40
1-1/2	4.6	1	40	40
2	6.2	1	40	40
2-1/2	9.2	1	40	40
3	12.2	1	40	40
4	18.1	1	40	40
5	26.6	1	40	34
6	33.8	1	40	27
8	55	1	36	16
10	80.1	*2	40	23
12	109	*2	36	16

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Longitudinal Max Spacing @ 0.50 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1	80	80
1-1/4	3.7	1	80	80
1-1/2	4.6	1	80	80
2	6.2	1	80	80
2-1/2	9.2	1	80	80
3	12.2	1	80	75
4	18.1	1	80	50
5	26.6	1	74	34
6	33.8	1	58	27
8	55	*2	72	33
10	80.1	*2	49	23
12	109	*2	36	16

NOTES:

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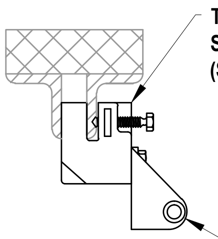
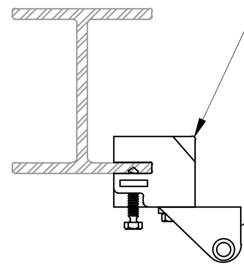
MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR ATTACHMENT TO STEEL TRUSS OR STEEL BEAM | 0.75 "G"





Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Transverse Max Spacing @ 0.75 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1	40	40
1-1/4	3.7	1	40	40
1-1/2	4.6	1	40	40
2	6.2	1	40	40
2-1/2	9.2	1	40	40
3	12.2	1	40	40
4	18.1	1	40	33
5	26.6	1	40	23
6	33.8	1	39	18
8	55	*2	40	22
10	80.1	*2	33	15
12	109	*2	24	11

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Longitudinal Max Spacing @ 0.75 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1	80	80
1-1/4	3.7	1	80	80
1-1/2	4.6	1	80	80
2	6.2	1	80	80
2-1/2	9.2	1	80	66
3	12.2	1	80	50
4	18.1	1	72	33
5	26.6	*2	80	46
6	33.8	*2	78	36
8	55	*2	48	22
10	80.1	*2	33	15
12	109	*2	24	11

NOTES:

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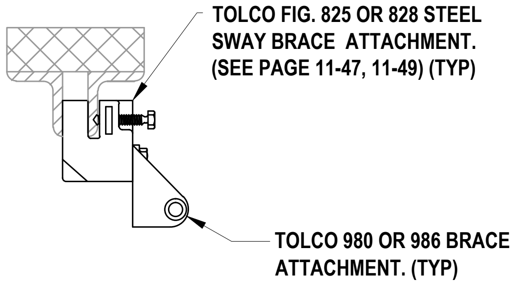
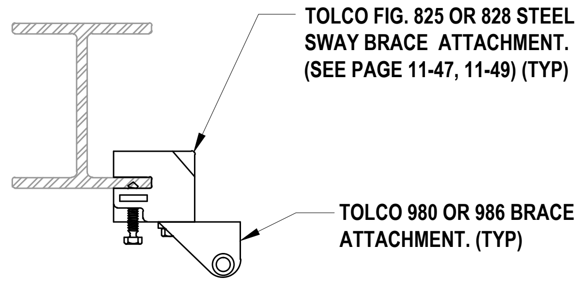
SINGLE PIPE HANGER BRACE SPACING CHART FOR ATTACHMENT TO STEEL TRUSS OR STEEL BEAM | 1.0 "G"





Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Transverse Max Spacing @ 1.0 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1	40	40
1-1/4	3.7	1	40	40
1-1/2	4.6	1	40	40
2	6.2	1	40	40
2-1/2	9.2	1	40	40
3	12.2	1	40	37
4	18.1	1	40	25
5	26.6	1	37	17
6	33.8	1	29	13
8	55	*2	36	16
10	80.1	*2	24	11
12	109	*2	18	8

Pipe Diameter	Maximum Weight Per Foot	Brace Qty.	Longitudinal Max Spacing @ 1.0 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1	80	80
1-1/4	3.7	1	80	80
1-1/2	4.6	1	80	80
2	6.2	1	80	74
2-1/2	9.2	1	80	50
3	12.2	1	80	37
4	18.1	1	54	25
5	26.6	*2	74	34
6	33.8	*2	58	27
8	55	*2	36	16
10	80.1	*2	24	11
12	109	*2	18	8

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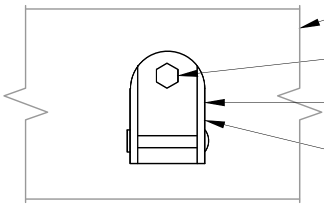
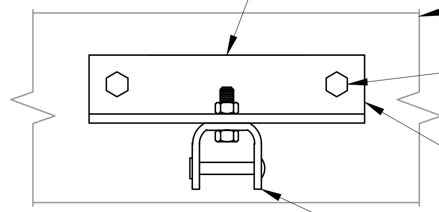
MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD





Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	40	1	1	1/2"
1-1/4	3.7	40	1	1	1/2"
1-1/2	4.6	40	1	1	1/2"
2	6.2	40	1	1	1/2"
2-1/2	9.2	40	1	1	1/2"
3	12.2	40	1	1	1/2"
4	18.1	40	1	1	3/4"
5	26.6	40	1	2	(2) 1/2"
6	33.8	40	1	2	(2) 5/8"
8	55	40	*2	2	(2) 5/8"
10	80.1	40	*2	2	(2) 3/4"
12	109	29	*2	2	(2) 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	80	1	1	1/2"
1-1/4	3.7	80	1	1	1/2"
1-1/2	4.6	80	1	1	1/2"
2	6.2	80	1	1	1/2"
2-1/2	9.2	80	1	1	3/4"
3	12.2	80	1	2	(2) 1/2"
4	18.1	80	1	2	(2) 3/4"
5	26.6	80	*2	2	(2) 1/2"
6	33.8	80	*2	2	(2) 5/8"
8	55	58	*2	2	(2) 3/4"
10	80.1	40	*2	2	(2) 3/4"
12	109	29	*2	2	(2) 3/4"

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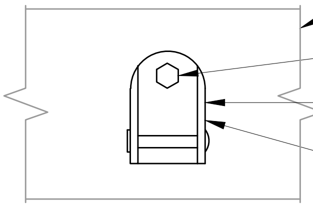
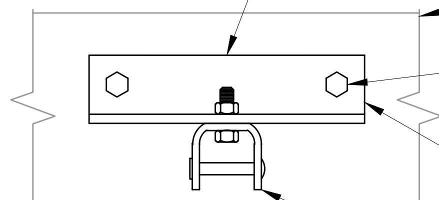
SINGLE PIPE HANGER BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.75 "G"





Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	40	1	1	1/2"
1-1/4	3.7	40	1	1	1/2"
1-1/2	4.6	40	1	1	1/2"
2	6.2	40	1	1	1/2"
2-1/2	9.2	40	1	1	3/4"
3	12.2	40	1	2	(2) 1/2"
4	18.1	40	1	2	(2) 3/4"
5	26.6	40	*2	2	(2) 1/2"
6	33.8	40	*2	2	(2) 5/8"
8	55	34	*2	2	(2) 5/8"
10	80.1	26	*2	2	(2) 3/4"
12	109	19	*2	2	(2) 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	80	1	1	1/2"
1-1/4	3.7	80	1	1	5/8"
1-1/2	4.6	80	1	1	3/4"
2	6.2	80	1	2	(2) 1/2"
2-1/2	9.2	80	1	2	(2) 3/4"
3	12.2	80	1	2	(2) 1/2"
4	18.1	80	1	2	(2) 3/4"
5	26.6	80	*2	2	(2) 3/4"
6	33.8	63	*2	2	(2) 3/4"
8	55	29	*2	2	(2) 3/4"
10	80.1	26	*2	2	(2) 3/4"
12	109	19	*2	2	(2) 3/4"

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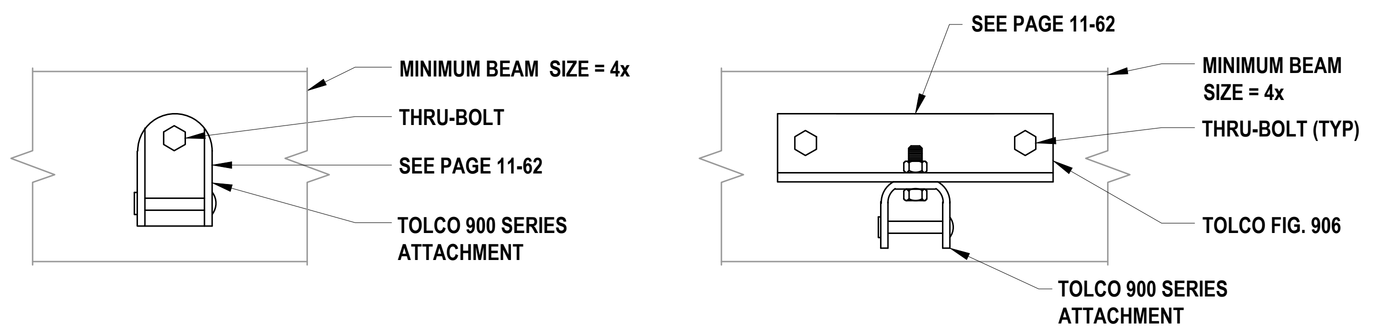
SINGLE PIPE HANGER BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

1.0 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	40	1	1	1/2"
1-1/4	3.7	40	1	1	1/2"
1-1/2	4.6	40	1	1	1/2"
2	6.2	40	1	1	1/2"
2-1/2	9.2	40	1	1	3/4"
3	12.2	40	1	2	(2) 1/2"
4	18.1	40	1	2	(2) 3/4"
5	26.6	40	*2	2	(2) 1/2"
6	33.8	40	*2	2	(2) 5/8"
8	55	26	*2	2	(2) 5/8"
10	80.1	20	*2	2	(2) 3/4"
12	109	14	*2	2	(2) 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	80	1	1	1/2"
1-1/4	3.7	80	1	1	5/8"
1-1/2	4.6	78	1	1	5/8"
2	6.2	80	1	2	(2) 1/2"
2-1/2	9.2	80	1	2	(2) 3/4"
3	12.2	80	*2	2	(2) 1/2"
4	18.1	80	*2	2	(2) 3/4"
5	26.6	60	*2	2	(2) 3/4"
6	33.8	47	*2	2	(2) 3/4"
8	55	29	*2	2	(2) 3/4"
10	80.1	20	*2	2	(2) 3/4"
12	109	14	*2	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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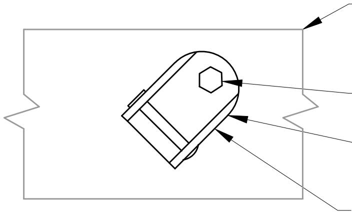
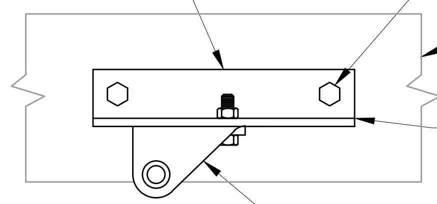
MRH
Structural Engineer: Mohammad Hariri
California SE No. S3545

SINGLE PIPE HANGER BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.50 "G"





Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	40	1	1	1/2"
1-1/4	3.7	40	1	1	1/2"
1-1/2	4.6	40	1	1	1/2"
2	6.2	40	1	1	1/2"
2-1/2	9.2	40	1	1	1/2"
3	12.2	40	1	1	1/2"
4	18.1	40	1	1	3/4"
5	26.6	40	1	2	(2) 5/8"
6	33.8	40	*2	2	(2) 1/2"
8	55	40	*2	2	(2) 3/4"
10	80.1	30	*2	2	(2) 3/4"
12	109	22	*2	2	(2) 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	80	1	1	1/2"
1-1/4	3.7	80	1	1	1/2"
1-1/2	4.6	80	1	1	1/2"
2	6.2	80	1	1	1/2"
2-1/2	9.2	80	1	1	3/4"
3	12.2	80	1	2	(2) 5/8"
4	18.1	80	*2	2	(2) 1/2"
5	26.6	80	*2	2	(2) 5/8"
6	33.8	63	*2	2	(2) 5/8"
8	55	43	*2	2	(2) 3/4"
10	80.1	30	*2	2	(2) 3/4"
12	109	22	*2	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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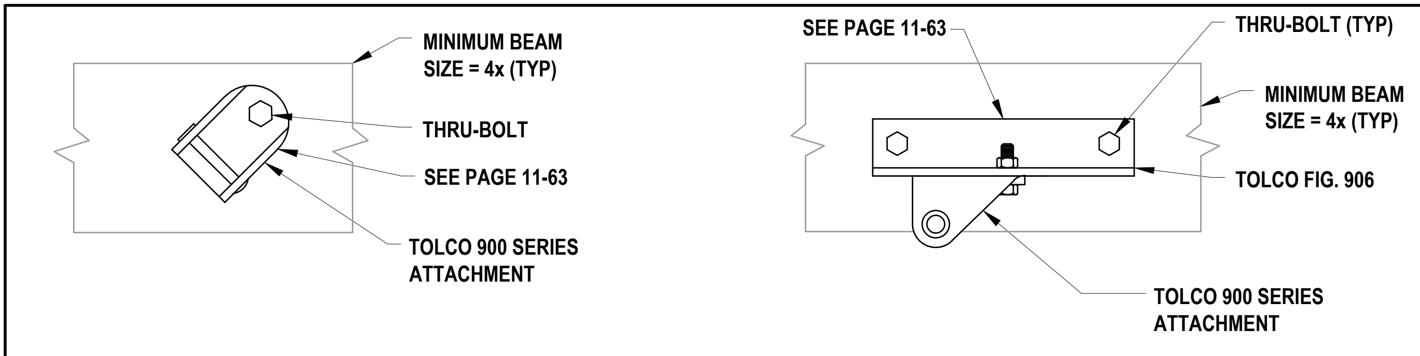
Structural Engineer: Mohammad Hariri
California SE No. S3545

PAGE: 3-28
DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	40	1	1	1/2"
1-1/4	3.7	40	1	1	1/2"
1-1/2	4.6	40	1	1	1/2"
2	6.2	40	1	1	1/2"
2-1/2	9.2	40	1	1	3/4"
3	12.2	40	1	2	(2) 5/8"
4	18.1	40	*2	2	(2) 1/2"
5	26.6	40	*2	2	(2) 3/4"
6	33.8	40	*2	2	(2) 3/4"
8	55	29	*2	2	(2) 3/4"
10	80.1	20	*2	2	(2) 3/4"
12	109	14	*2	2	(2) 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	80	1	1	1/2"
1-1/4	3.7	80	1	1	5/8"
1-1/2	4.6	80	1	1	3/4"
2	6.2	80	1	2	(2) 5/8"
2-1/2	9.2	80	*2	2	(2) 1/2"
3	12.2	80	*2	2	(2) 5/8"
4	18.1	80	*2	2	(2) 3/4"
5	26.6	60	*2	2	(2) 3/4"
6	33.8	47	*2	2	(2) 3/4"
8	55	29	*2	2	(2) 3/4"
10	80.1	20	*2	2	(2) 3/4"
12	109	14	*2	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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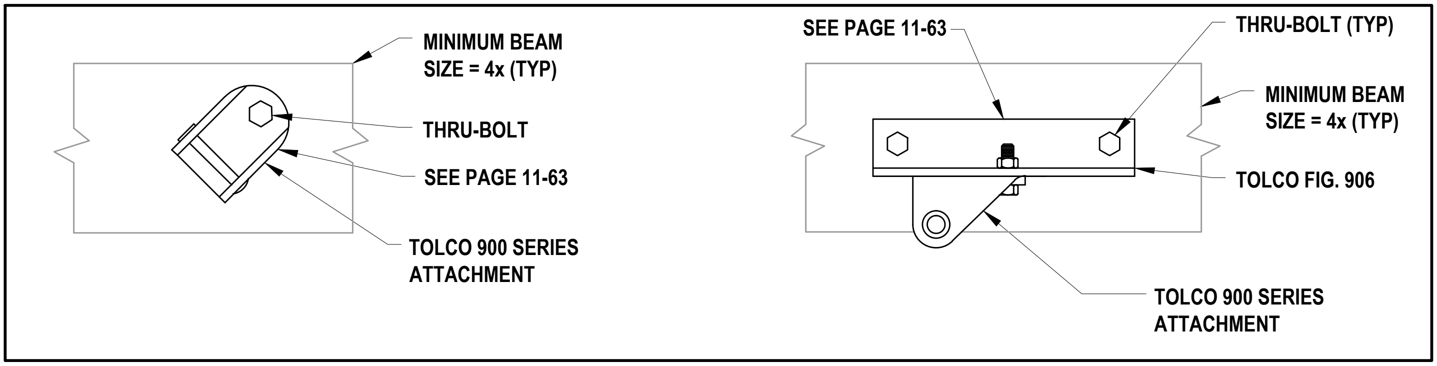
California SE No. S3545

PAGE: 3-29
DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

1.0 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	40	1	1	1/2"
1-1/4	3.7	40	1	1	1/2"
1-1/2	4.6	40	1	1	1/2"
2	6.2	40	1	1	1/2"
2-1/2	9.2	40	1	1	3/4"
3	12.2	40	1	2	(2) 5/8"
4	18.1	40	*2	2	(2) 1/2"
5	26.6	40	*2	2	(2) 3/4"
6	33.8	35	*2	2	(2) 3/4"
8	55	21	*2	2	(2) 3/4"
10	80.1	15	*2	2	(2) 3/4"
12	109	11	*2	2	(2) 3/4"

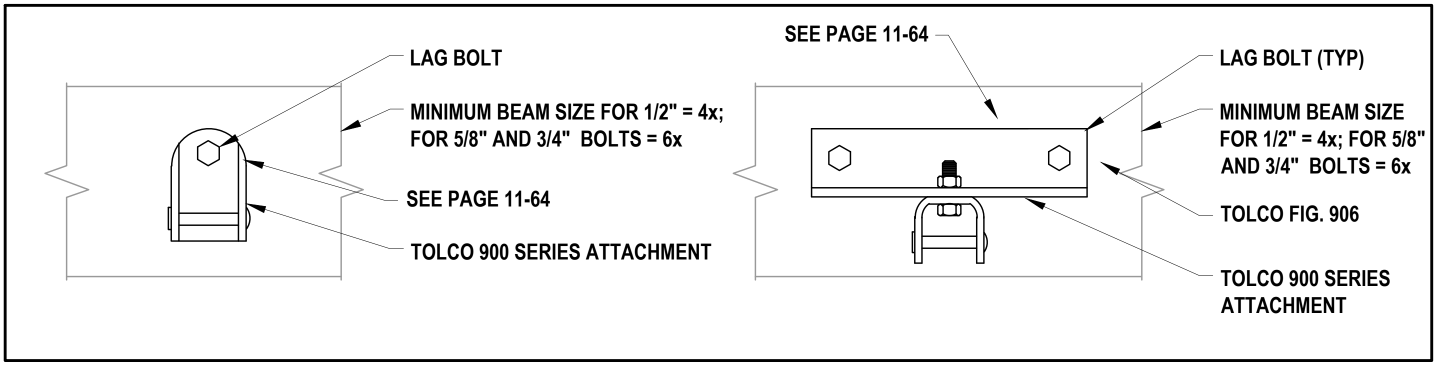
Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
1	2.9	80	1	1	1/2"
1-1/4	3.7	80	1	1	5/8"
1-1/2	4.6	80	1	1	3/4"
2	6.2	80	1	2	(2) 5/8"
2-1/2	9.2	80	*2	2	(2) 1/2"
3	12.2	80	*2	2	(2) 5/8"
4	18.1	66	*2	2	(2) 3/4"
5	26.6	45	*2	2	(2) 3/4"
6	33.8	35	*2	2	(2) 3/4"
8	55	21	*2	2	(2) 3/4"
10	80.1	15	*2	2	(2) 3/4"
12	109	11	*2	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

SINGLE PIPE HANGER BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.50 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	40	1	1	1/2"	3"
1-1/4	3.7	40	1	1	1/2"	3"
1-1/2	4.6	38	1	1	1/2"	3"
2	6.2	28	1	1	1/2"	3"
2-1/2	9.2	22	1	1	5/8"	4"
3	12.2	31	1	1	3/4"	5"
4	18.1	21	1	1	3/4"	5"
5	26.6	24	1	2	(2) 3/4"	5"
6	33.8	19	1	2	(2) 3/4"	5"
8	55	23	*2	2	(2) 3/4"	5"
10	80.1	16	*2	2	(2) 3/4"	5"
12	109	12	*2	2	(2) 3/4"	5"

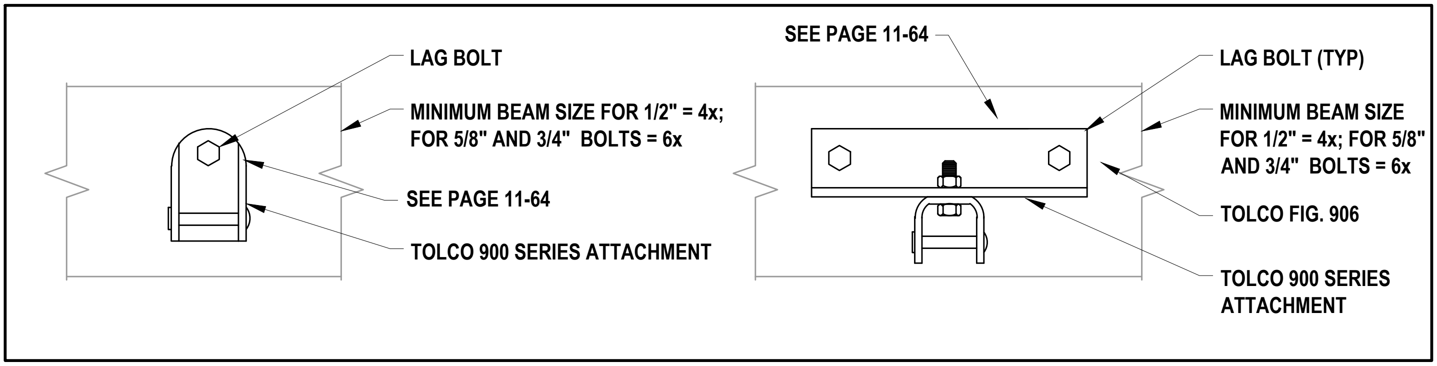
Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	61	1	1	1/2"	3"
1-1/4	3.7	48	1	1	1/2"	3"
1-1/2	4.6	38	1	1	1/2"	3"
2	6.2	62	1	1	3/4"	5"
2-1/2	9.2	42	1	1	3/4"	5"
3	12.2	53	1	2	(2) 3/4"	5"
4	18.1	36	1	2	(2) 3/4"	5"
5	26.6	49	*2	2	(2) 3/4"	5"
6	33.8	38	*2	2	(2) 3/4"	5"
8	55	23	*2	2	(2) 3/4"	5"
10	80.1	16	*2	2	(2) 3/4"	5"
12	109	12	*2	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

SINGLE PIPE HANGER BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	40	1	1	1/2"	3"
1-1/4	3.7	40	1	1	3/4"	5"
1-1/2	4.6	40	1	1	3/4"	5"
2	6.2	40	1	1	3/4"	5"
2-1/2	9.2	40	1	2	(2) 3/4"	5"
3	12.2	35	1	2	(2) 3/4"	5"
4	18.1	24	1	2	(2) 3/4"	5"
5	26.6	32	*2	2	(2) 3/4"	5"
6	33.8	25	*2	2	(2) 3/4"	5"
8	55	15	*2	2	(2) 3/4"	5"
10	80.1	10	*2	2	(2) 3/4"	5"
12	109	8	*2	2	(2) 3/4"	5"

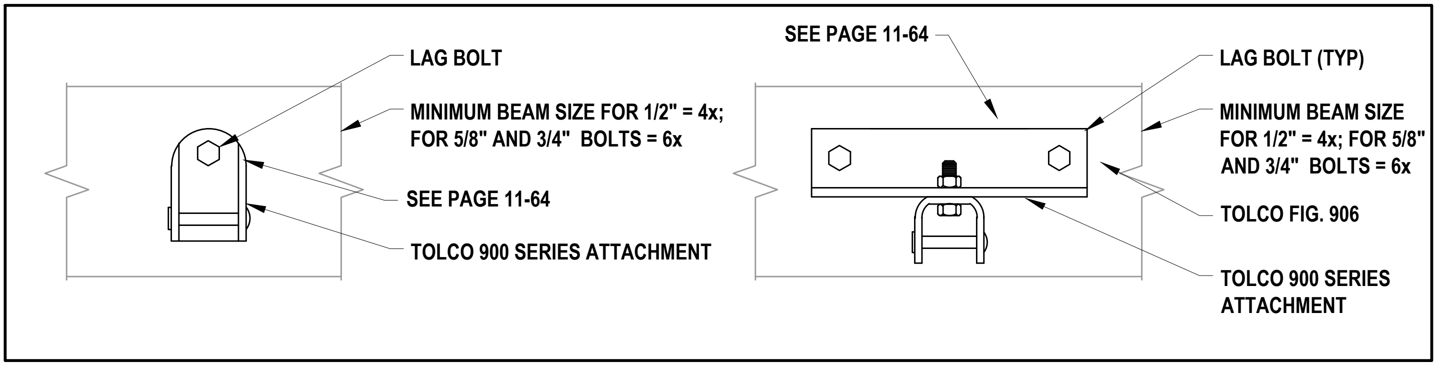
Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	80	1	1	3/4"	5"
1-1/4	3.7	69	1	1	3/4"	5"
1-1/2	4.6	55	1	1	3/4"	5"
2	6.2	70	1	2	(2) 3/4"	5"
2-1/2	9.2	80	*2	2	(2) 3/4"	5"
3	12.2	71	*2	2	(2) 3/4"	5"
4	18.1	48	*2	2	(2) 3/4"	5"
5	26.6	32	*2	2	(2) 3/4"	5"
6	33.8	25	*2	2	(2) 3/4"	5"
8	55	15	*2	2	(2) 3/4"	5"
10	80.1	10	*2	2	(2) 3/4"	5"
12	109	8	*2	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

SINGLE PIPE HANGER BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

1.0 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	30	1	1	1/2"	3"
1-1/4	3.7	24	1	1	1/2"	3"
1-1/2	4.6	19	1	1	1/2"	3"
2	6.2	31	1	1	3/4"	5"
2-1/2	9.2	21	1	1	3/4"	5"
3	12.2	26	1	2	(2) 3/4"	5"
4	18.1	18	1	2	(2) 3/4"	5"
5	26.6	24	*2	2	(2) 3/4"	5"
6	33.8	19	*2	2	(2) 3/4"	5"
8	55	11	*2	2	(2) 3/4"	5"
10	80.1	8	*2	2	(2) 3/4"	5"
12	109	6	*2	2	(2) 3/4"	5"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	52	1	1	3/4"	5"
1-1/4	3.7	40	1	1	3/4"	5"
1-1/2	4.6	32	1	1	3/4"	5"
2	6.2	52	1	2	(2) 3/4"	5"
2-1/2	9.2	35	1	2	(2) 3/4"	5"
3	12.2	53	*2	2	(2) 3/4"	5"
4	18.1	36	*2	2	(2) 3/4"	5"
5	26.6	24	*2	2	(2) 3/4"	5"
6	33.8	19	*2	2	(2) 3/4"	5"
8	55	11	*2	2	(2) 3/4"	5"
10	80.1	8	*2	2	(2) 3/4"	5"
12	109	6	*2	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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California SE No. S3545

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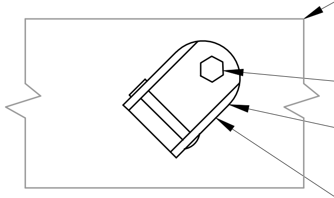
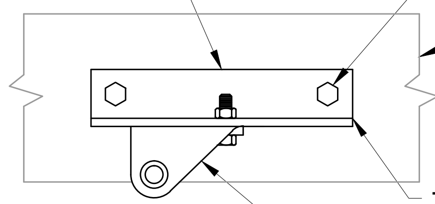
SINGLE PIPE HANGER BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.50 "G"





Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	40	1	1	1/2"	3"
1-1/4	3.7	40	1	1	1/2"	3"
1-1/2	4.6	37	1	1	1/2"	3"
2	6.2	28	1	1	1/2"	3"
2-1/2	9.2	29	1	1	5/8"	4"
3	12.2	31	1	1	3/4"	5"
4	18.1	21	1	1	3/4"	5"
5	26.6	16	1	2	(2) 3/4"	5"
6	33.8	26	*2	2	(2) 3/4"	5"
8	55	16	*2	2	(2) 3/4"	5"
10	80.1	11	*2	2	(2) 3/4"	5"
12	109	8	*2	2	(2) 3/4"	5"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	60	1	1	1/2"	3"
1-1/4	3.7	47	1	1	1/2"	3"
1-1/2	4.6	58	1	1	5/8"	4"
2	6.2	62	1	1	3/4"	5
2-1/2	9.2	42	1	1	3/4"	5"
3	12.2	36	1	2	(2) 3/4"	5"
4	18.1	49	*2	2	(2) 3/4"	5"
5	26.6	33	*2	2	(2) 3/4"	5"
6	33.8	26	*2	2	(2) 3/4"	5"
8	55	16	*2	2	(2) 3/4"	5"
10	80.1	11	*2	2	(2) 3/4"	5"
12	109	8	*2	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
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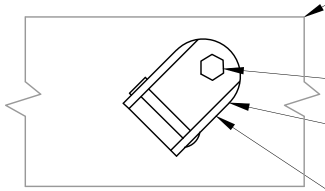
Structural Engineer: Mohammad Hariri
California SE No. S3545

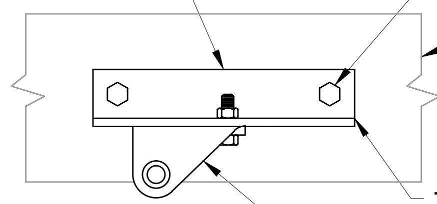
PAGE: 3-34
DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.75 "G"





Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	40	1	1	1/2"	3"
1-1/4	3.7	40	1	1	5/8"	4"
1-1/2	4.6	38	1	1	5/8"	4"
2	6.2	40	1	1	3/4"	5"
2-1/2	9.2	28	1	1	3/4"	5"
3	12.2	24	1	2	(2) 3/4"	5"
4	18.1	32	*2	2	(2) 3/4"	5"
5	26.6	22	*2	2	(2) 3/4"	5"
6	33.8	17	*2	2	(2) 3/4"	5"
8	55	10	*2	2	(2) 3/4"	5"
10	80.1	7	*2	2	(2) 3/4"	5"
12	109	5	*2	2	(2) 3/4"	5"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	80	1	1	3/4"	5"
1-1/4	3.7	69	1	1	3/4"	5"
1-1/2	4.6	56	1	1	3/4"	5"
2	6.2	41	1	1	3/4"	5"
2-1/2	9.2	64	*2	2	(2) 3/4"	5"
3	12.2	48	*2	2	(2) 3/4"	5"
4	18.1	32	*2	2	(2) 3/4"	5"
5	26.6	22	*2	2	(2) 3/4"	5"
6	33.8	17	*2	2	(2) 3/4"	5"
8	55	10	*2	2	(2) 3/4"	5"
10	80.1	7	*2	2	(2) 3/4"	5"
12	109	5	*2	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
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8.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

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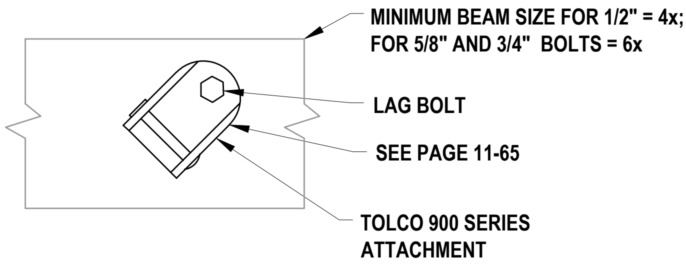
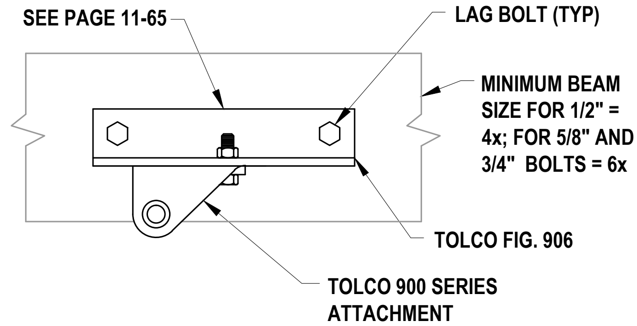
SINGLE PIPE HANGER BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

1.0 "G"





Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	30	1	1	1/2"	3"
1-1/4	3.7	23	1	1	1/2"	3"
1-1/2	4.6	29	1	1	5/8"	4"
2	6.2	31	1	1	3/4"	5"
2-1/2	9.2	21	1	1	3/4"	5"
3	12.2	18	1	2	(2) 3/4"	5"
4	18.1	24	*2	2	(2) 3/4"	5"
5	26.6	16	*2	2	(2) 3/4"	5"
6	33.8	13	*2	2	(2) 3/4"	5"
8	55	8	*2	2	(2) 3/4"	5"
10	80.1	5	*2	2	(2) 3/4"	5"
12	109	4	*2	2	(2) 3/4"	5"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	66	1	1	3/4"	5"
1-1/4	3.7	52	1	1	3/4"	5"
1-1/2	4.6	42	1	1	3/4"	5"
2	6.2	31	1	1	3/4"	5"
2-1/2	9.2	48	*2	2	(2) 3/4"	5"
3	12.2	36	*2	2	(2) 3/4"	5"
4	18.1	24	*2	2	(2) 3/4"	5"
5	26.6	16	*2	2	(2) 3/4"	5"
6	33.8	13	*2	2	(2) 3/4"	5"
8	55	8	*2	2	(2) 3/4"	5"
10	80.1	5	*2	2	(2) 3/4"	5"
12	109	4	*2	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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SECTION 4

TRAPEZE RIGID BRACE DETAILS

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PAGE: 4-0
DATE: NOVEMBER 29, 2016

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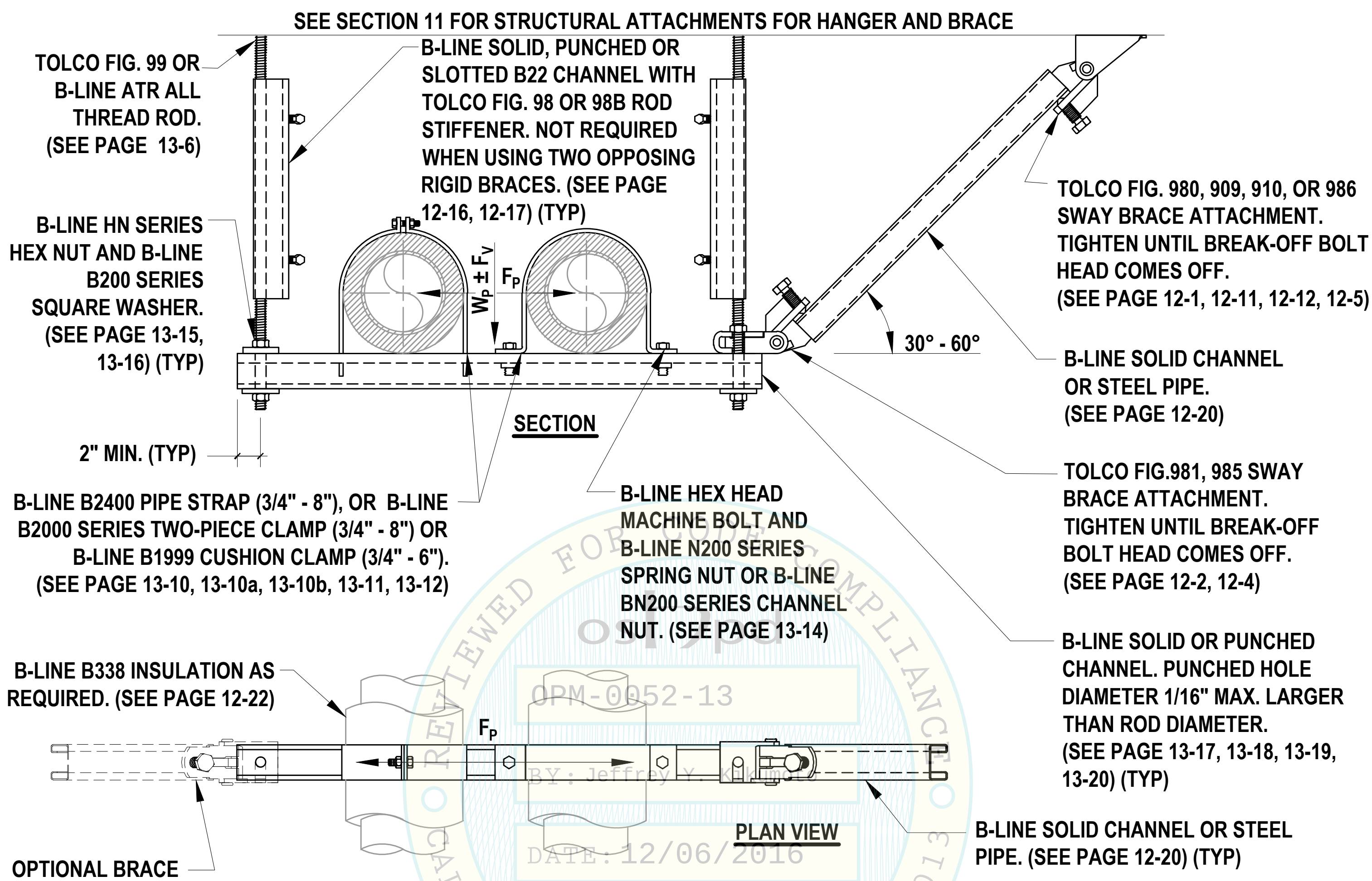
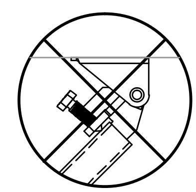
TRANSVERSE RIGID BRACING FOR TRAPEZE SUPPORTED PIPE OR CONDUIT WITH SINGLE TRAPEZE STRUT

DETAIL 3



ALL THREAD ROD SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	549	234	507
1/2"	549	234	507
3/4"	1449	1224	774



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 25% FOR 1"-2" PIPES, 32% FOR 2.5"-3.5" PIPES AND 43% FOR 4"-8" PIPES.
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 15%
2.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
3.) TRANSVERSE BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
5.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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PAGE: 4-1

DATE: NOVEMBER 29, 2016

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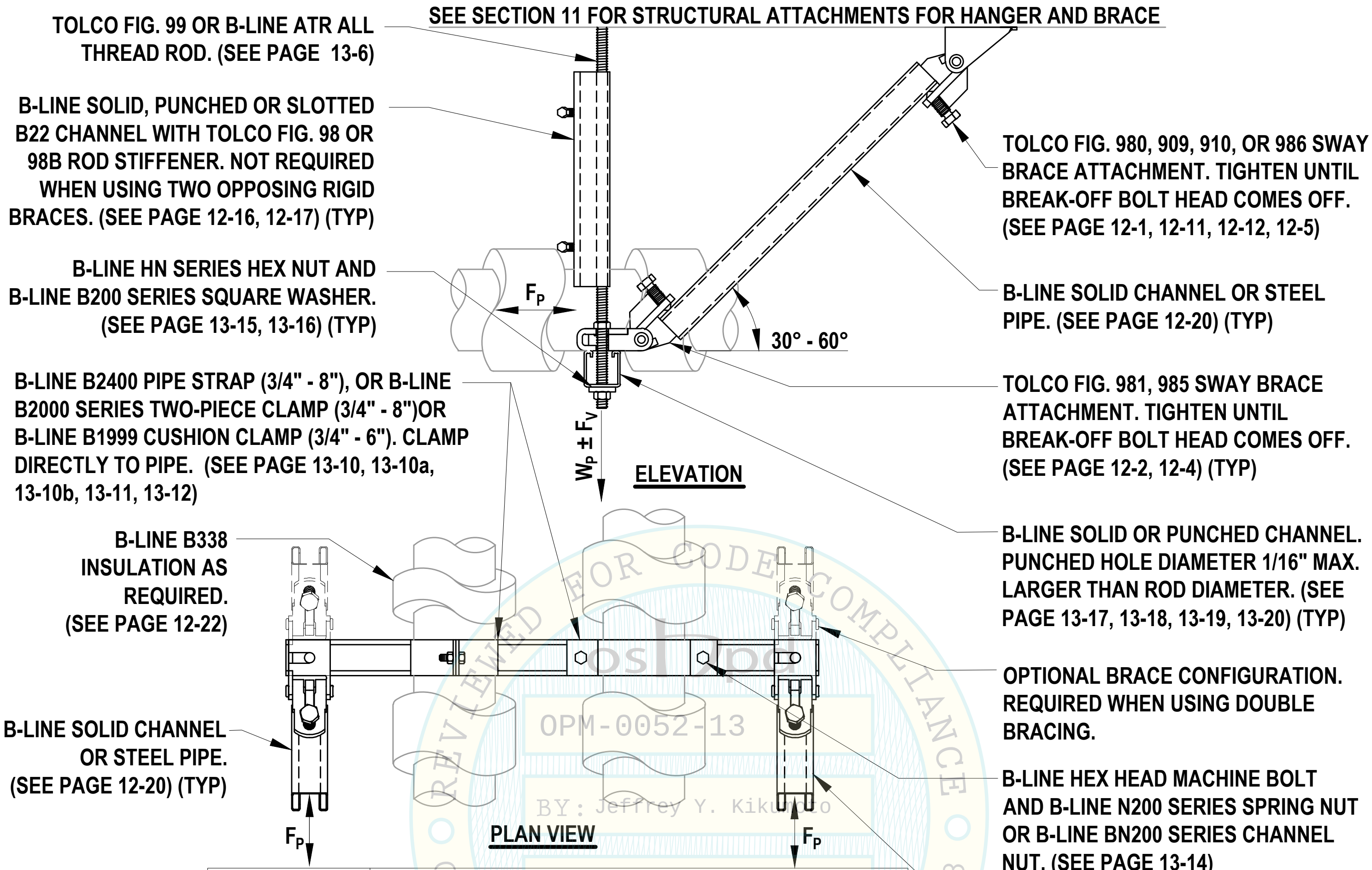
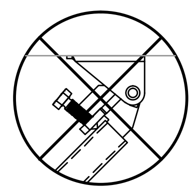
LONGITUDINAL RIGID BRACING FOR TRAPEZE SUPPORTED PIPE OR CONDUIT SYSTEMS WITH SINGLE TRAPEZE STRUT

DETAIL 4



ALL THREAD ROD SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	463	492 (7)	440
1/2"	463	492 (7)	440
3/4"	479	494	470



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 0%
2.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
3.) LONGITUDINAL BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
5.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
6.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.
7.) WHERE SEISMIC LOAD IS APPLIED FULLY ECCENTRIC, REDUCE F_P BY 50%. LINEARLY INTERPOLATE FOR CONDITION BETWEEN CENTER LINE AND BRACE.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

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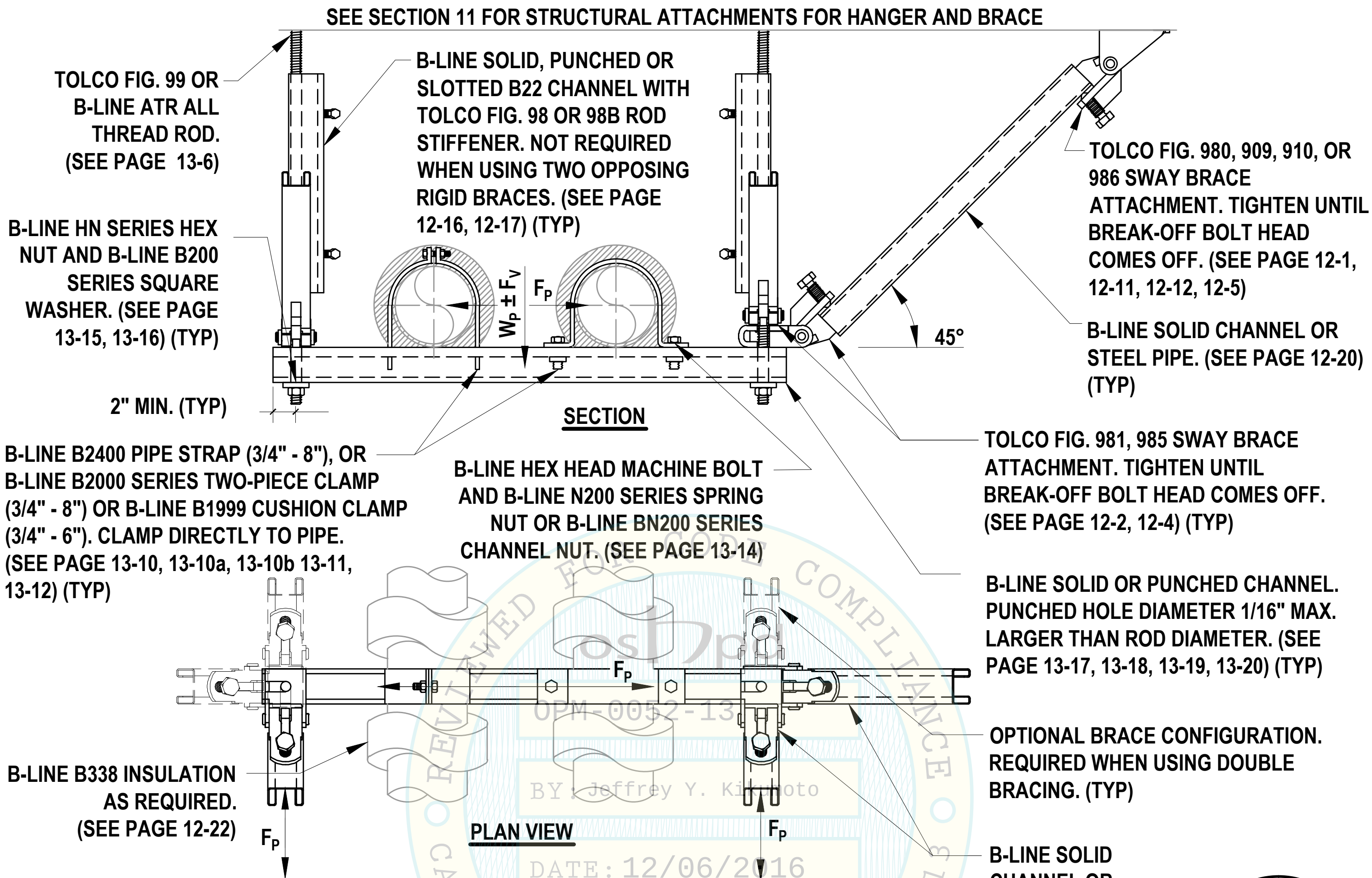
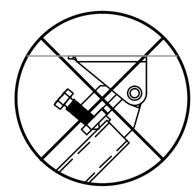
DATE: NOVEMBER 29, 2016

MH

TRANSVERSE AND LONGITUDINAL COMBINATION RIGID BRACING FOR TRAPEZE SUPPORTED PIPE OR CONDUIT WITH SINGLE TRAPEZE STRUT

DETAIL 3/4





DO NOT BEND BRACE PAST 90°

ALL THREAD ROD SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs] 45°
3/8"	320
1/2"	320
3/4"	326

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 0%
2.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
3.) BRACES MAY BE INSTALLED IN OPPOSING DIRECTION.
4.) THE ABOVE ASSEMBLY ALLOWABLE LOADS CAN BE APPLIED CONCURRENTLY TO BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS WITHOUT REDUCTION.
5.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
6.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
7.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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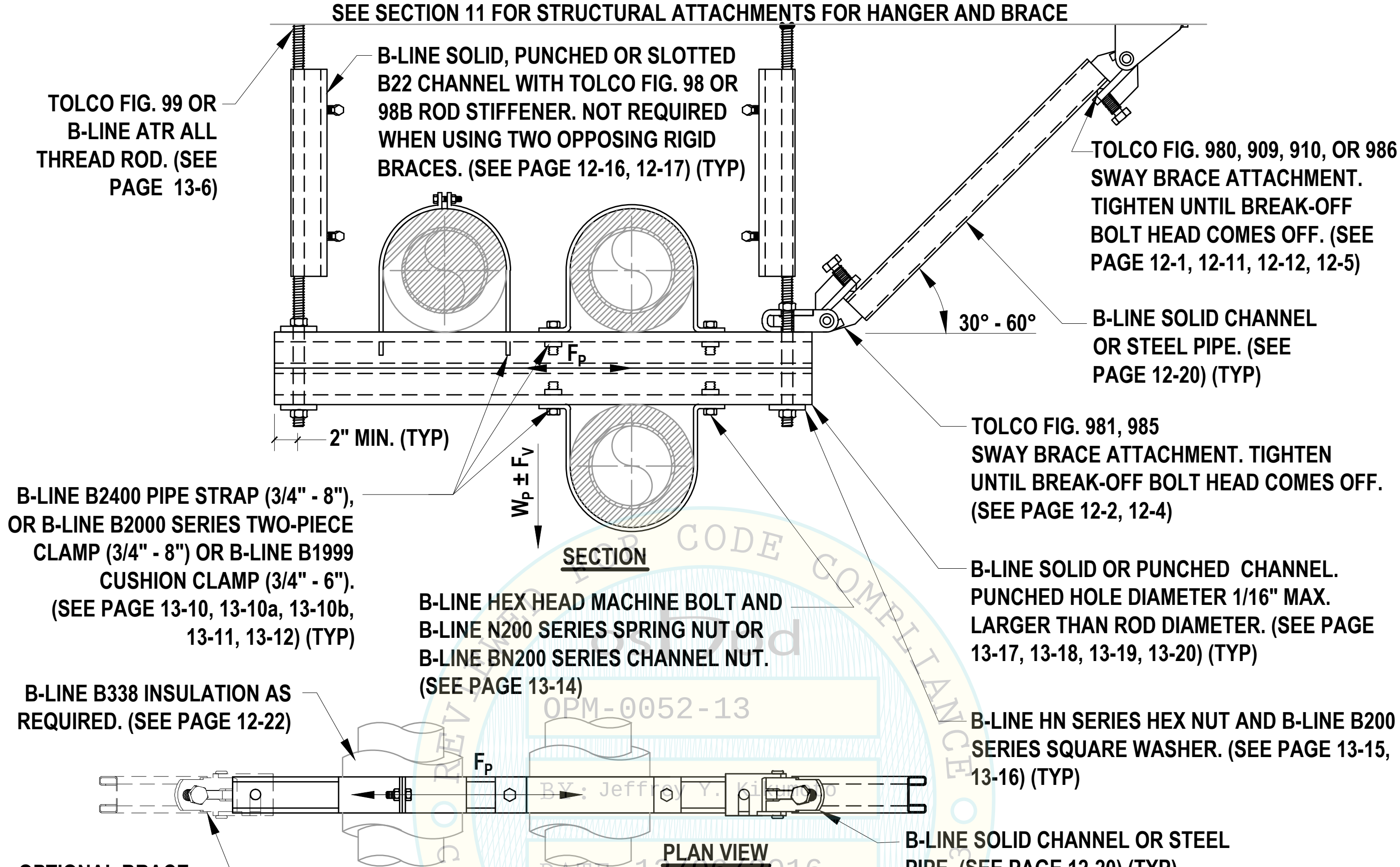
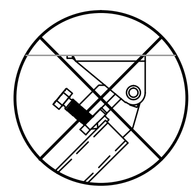
TRANSVERSE RIGID BRACING FOR TRAPEZE SUPPORTED PIPE OR CONDUIT WITH DOUBLE TRAPEZE STRUT

DETAIL 3A



ALL THREAD ROD SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	549	234	507
1/2"	549	234	507
3/4"	1449	1224	774



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 25% FOR 1"-2" PIPES, 32% FOR 2.5"-3.5" PIPES AND 43% FOR 4"-8" PIPES.
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 15%
2.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
3.) TRANSVERSE BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
4.) FOR 2" & SMALLER PIPING 2-PIECE CLAMP MAY BE USED WHEN PIPING IS SUPPORTED-HUNG FROM THE BOTTOM OF THE TRAPEZE STRUT. MAY USE B-LINE B2400 FOR UP TO 8" WHEN STRAPPING TO THE BOTTOM OF THE TRAPEZE.
5.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
6.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.

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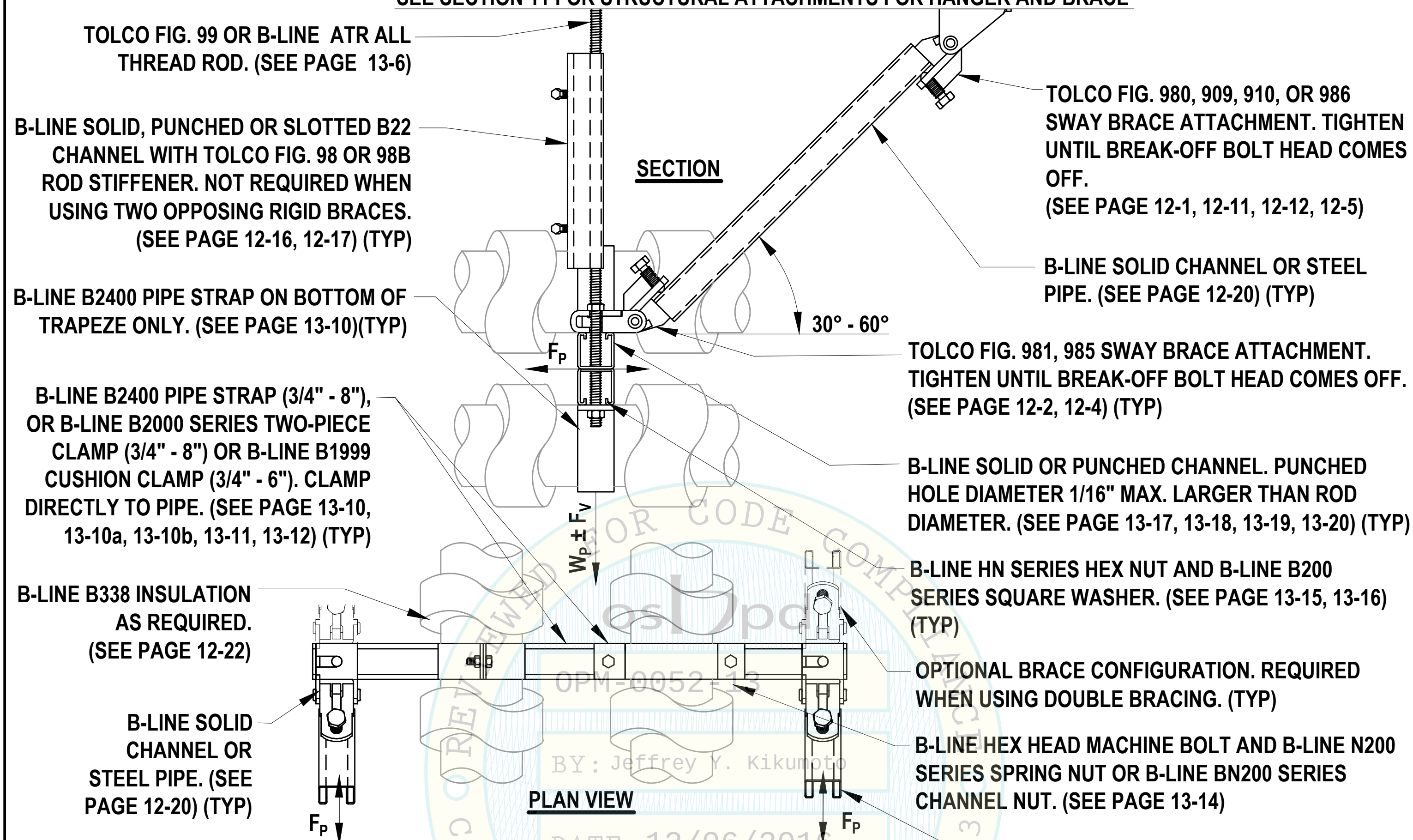
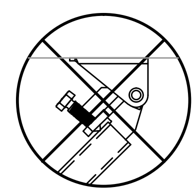
LONGITUDINAL RIGID BRACING FOR TRAPEZE SUPPORTED PIPE OR CONDUIT WITH DOUBLE TRAPEZE STRUT

DETAIL 4A



ALL THREAD ROD SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	463	492	440
1/2"	463	492	440
3/4"	479	494	470



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 0%
2.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
3.) TRANSVERSE BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
4.) FOR 2" & SMALLER PIPING 2-PIECE CLAMP MAY BE USED WHEN PIPING IS SUPPORTED-HUNG FROM THE BOTTOM OF THE TRAPEZE STRUT. MAY USE B-LINE B2400 FOR UP TO 8" WHEN STRAPPING TO THE BOTTOM OF THE TRAPEZE.
5.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
6.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
7.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.
8.) WHERE SEISMIC LOAD IS APPLIED FULLY ECCENTRIC, REDUCE F_P BY 50%. LINEARLY INTERPOLATE FOR CONDITION BETWEEN CENTER LINE AND BRACE.

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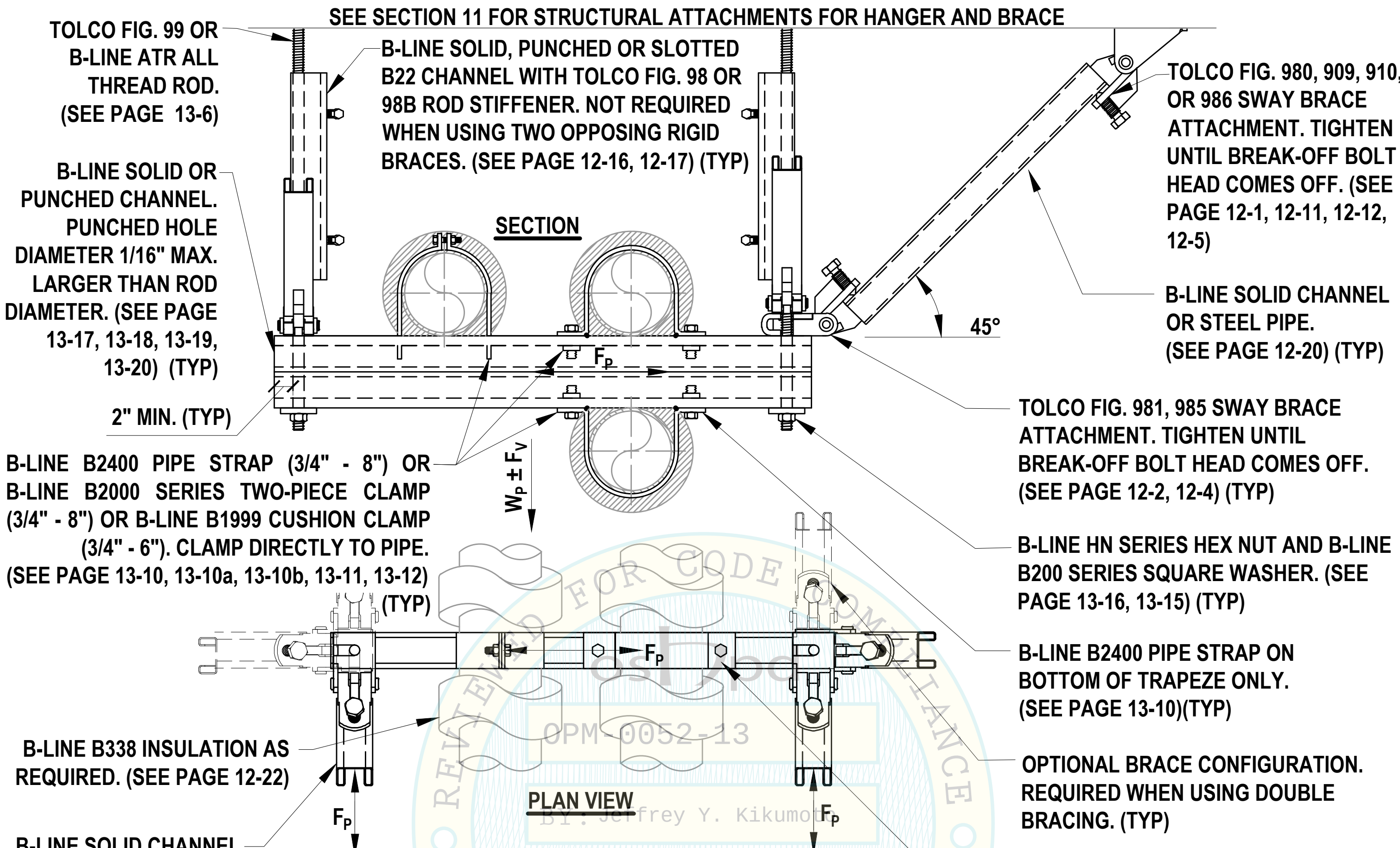
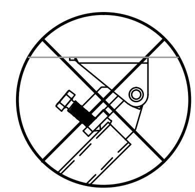
TRANSVERSE AND LONGITUDINAL COMBINATION RIGID BRACING FOR TRAPEZE SUPPORTED PIPE OR CONDUIT WITH DOUBLE TRAPEZE STRUT

DETAIL 3A/4A



ALL THREAD ROD SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]
	45°
3/8"	320
1/2"	320
3/4"	326



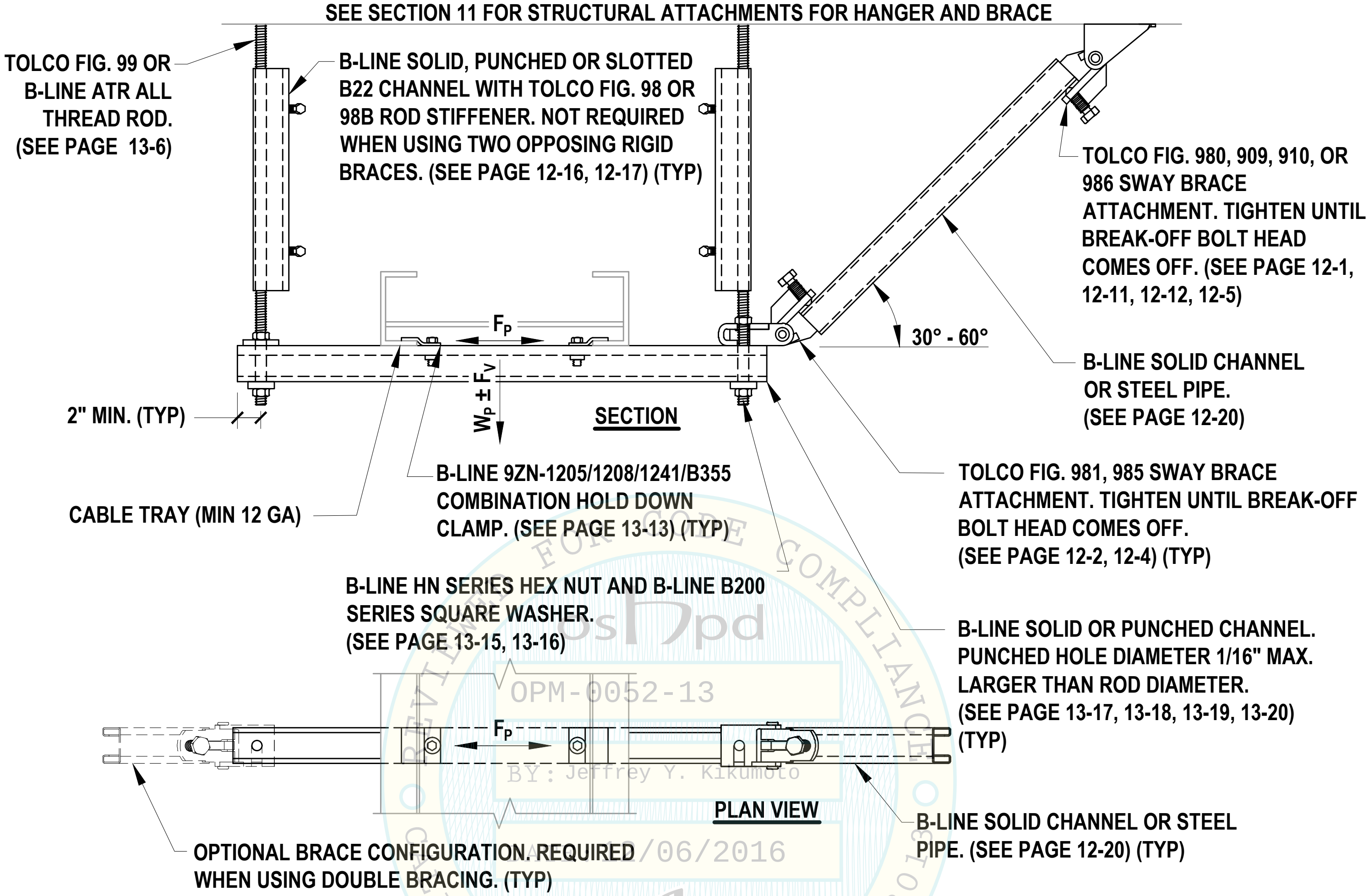
DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

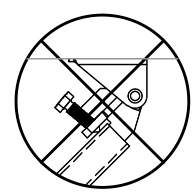
1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 0%
2.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
3.) TRANSVERSE BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
4.) FOR 2" & SMALLER PIPING 2-PIECE CLAMP MAY BE USED WHEN PIPING IS SUPPORTED-HUNG FROM THE BOTTOM OF THE TRAPEZE STRUT. MAY USE B-LINE B2400 FOR UP TO 8" WHEN STRAPPING TO THE BOTTOM OF THE TRAPEZE.
5.) THE ABOVE ASSEMBLY ALLOWABLE LOADS CAN BE APPLIED CONCURRENTLY TO BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS WITHOUT REDUCTION.
6.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
7.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
8.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

TRANSVERSE RIGID BRACING FOR TRAPEZE SUPPORTED ELECTRICAL CABLE TRAY

DETAIL 5



ALL THREAD ROD SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	549	234	507
1/2"	549	234	507
3/4"	949	949	774



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) TRANSVERSE BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
3.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.

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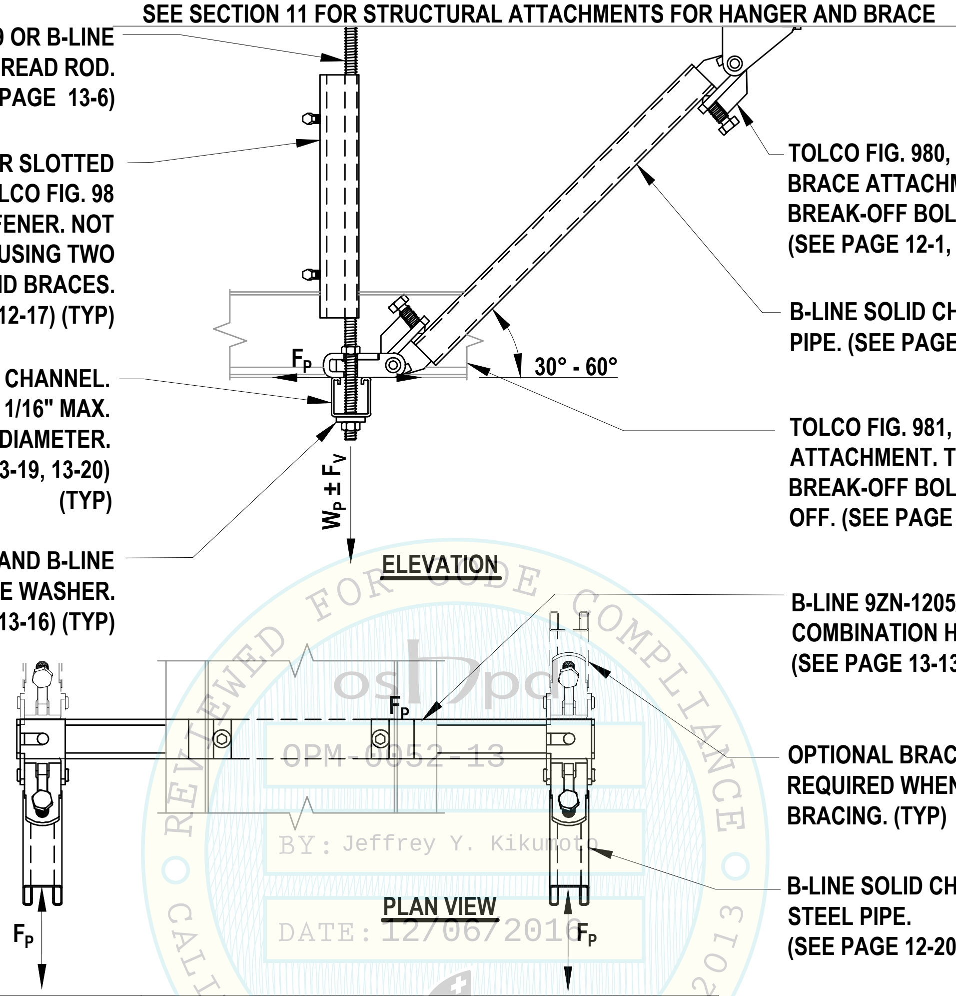
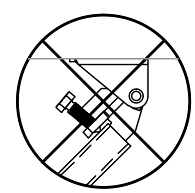
LONGITUDINAL RIGID BRACING FOR TRAPEZE SUPPORTED ELECTRICAL CABLE TRAY

DETAIL 6



ALL THREAD ROD SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	407	407	407
1/2"	407	407	407
3/4"	407	407	407



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) LONGITUDINAL BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
3.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
5.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.
6.) WHERE SEISMIC LOAD IS APPLIED FULLY ECCENTRIC, REDUCE F_P BY 40%. LINEARLY INTERPOLATE FOR CONDITION BETWEEN CENTER LINE AND BRACE.

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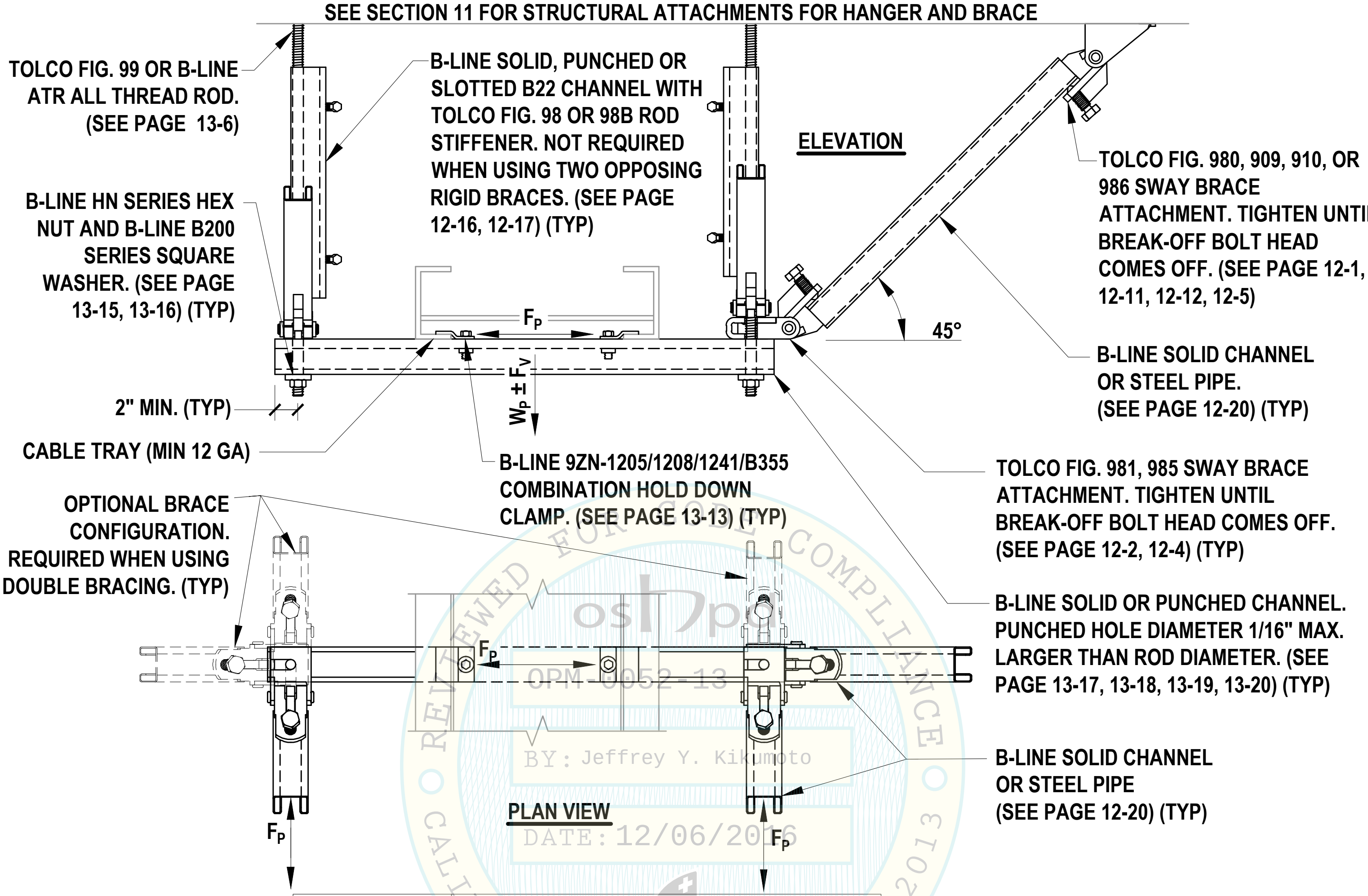
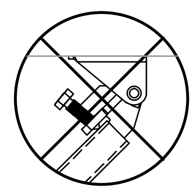
TRANSVERSE AND LONGITUDINAL COMBINATION RIGID BRACING FOR TRAPEZE SUPPORTED ELECTRICAL CABLE TRAY

DETAIL 5/6



ALL THREAD ROD SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs] 45°
3/8"	320
1/2"	320
3/4"	326



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) BRACES MAY BE INSTALLED IN OPPOSING DIRECTIONS.
3.) THE ABOVE ASSEMBLY ALLOWABLE LOADS CAN BE APPLIED CONCURRENTLY TO BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS CONSIDERING CODE-BASED ORTHOGONAL EFFECTS.
4.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
5.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
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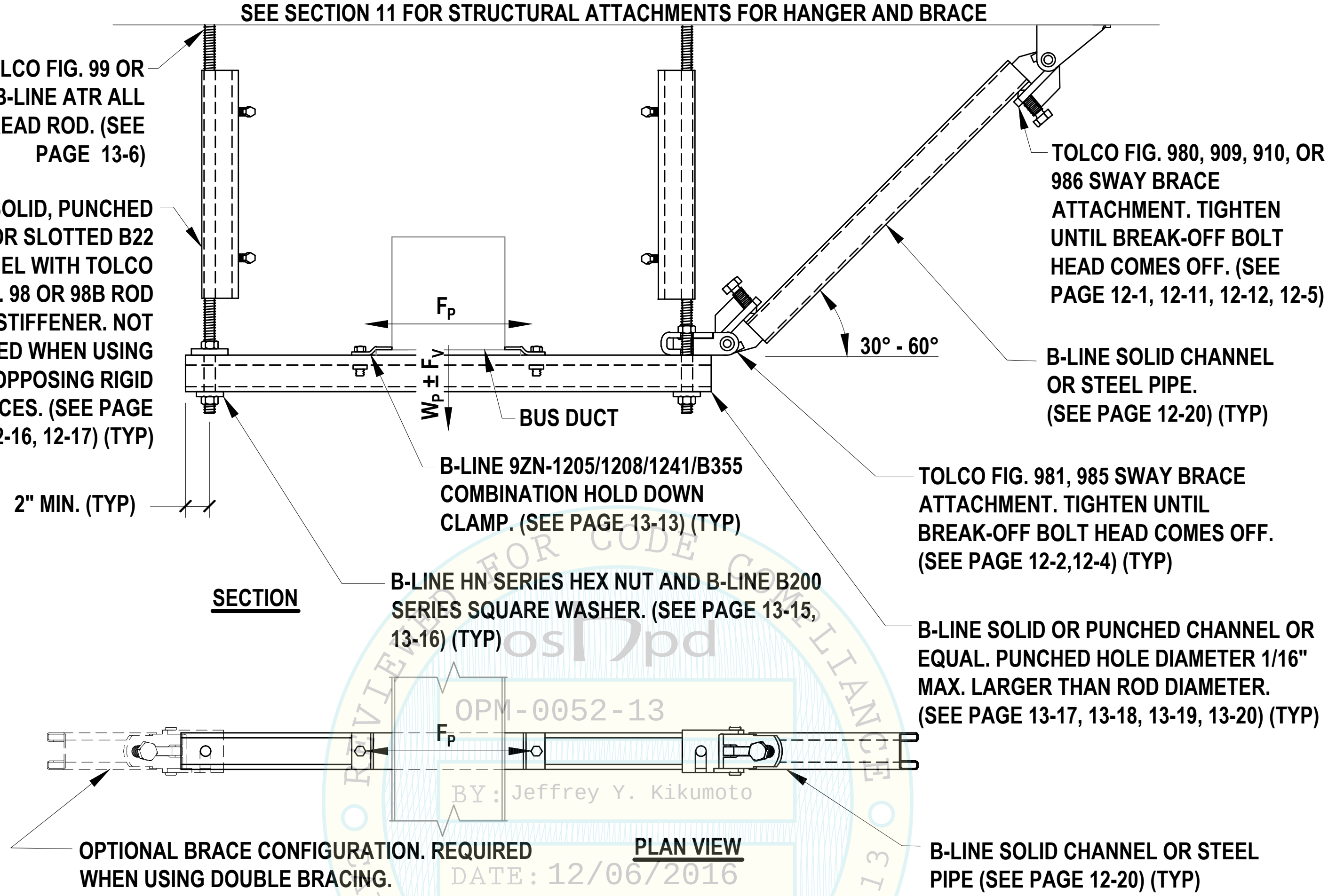
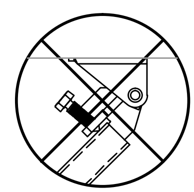
TRANSVERSE RIGID BRACING FOR TRAPEZE SUPPORTED BUS DUCT

DETAIL 5B



ALL THREAD ROD SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	549	234	507
1/2"	549	234	507
3/4"	949	949	774



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) TRANSVERSE BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
3.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
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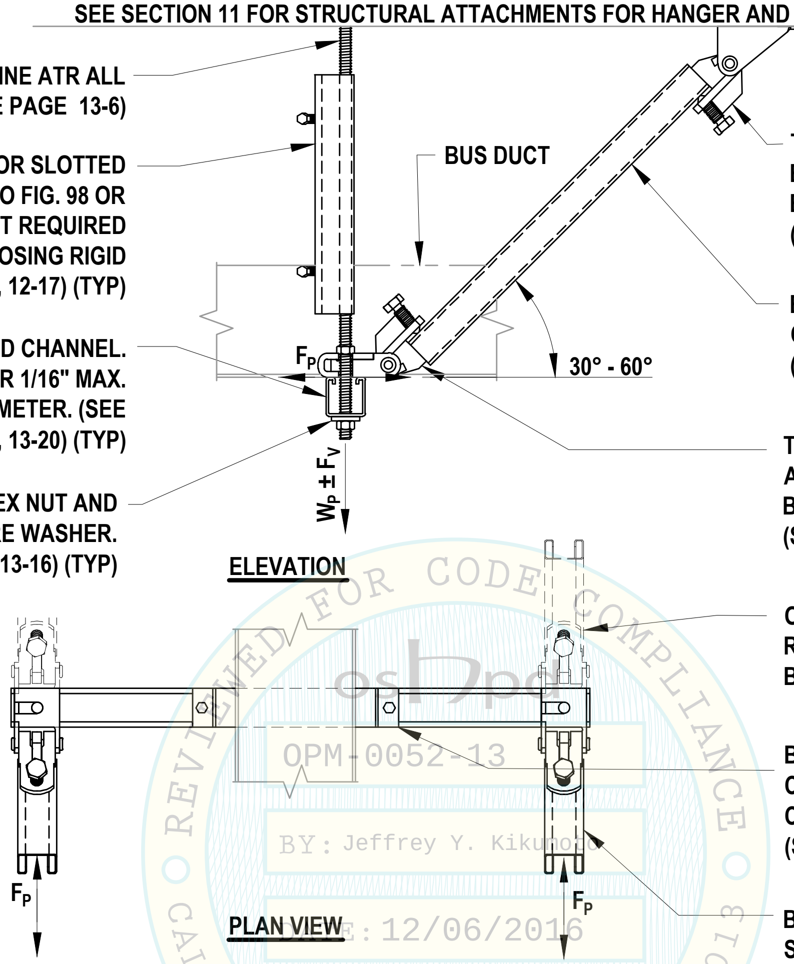
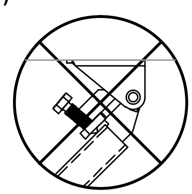
LONGITUDINAL RIGID BRACING FOR TRAPEZE SUPPORTED BUS DUCT

DETAIL 6B



ALL THREAD ROD SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	407	407	407
1/2"	407	407	407
3/4"	407	407	407



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) LONGITUDINAL BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
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5.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.
6.) WHERE SEISMIC LOAD IS APPLIED FULLY ECCENTRIC, REDUCE F_P BY 40%. LINEARLY INTERPOLATE FOR CONDITION BETWEEN CENTER LINE AND BRACE.

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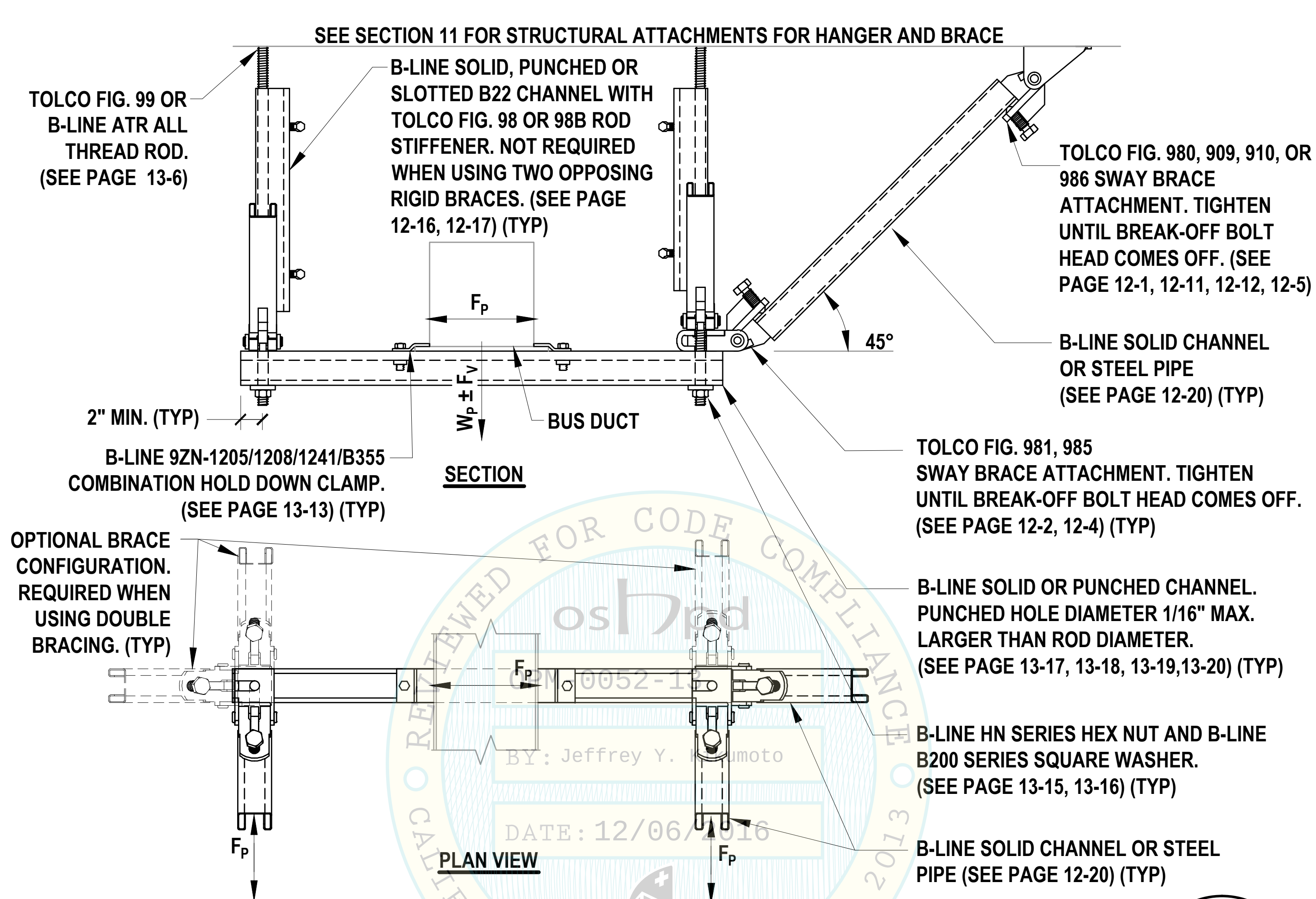
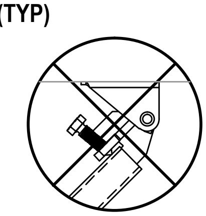
TRANSVERSE AND LONGITUDINAL COMBINATION RIGID BRACING FOR TRAPEZE SUPPORTED BUS DUCT

DETAIL 5B/6B



ALL THREAD ROD SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]
	45°
3/8"	320
1/2"	320
3/4"	326



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) BRACES MAY BE INSTALLED IN OPPOSING DIRECTIONS.
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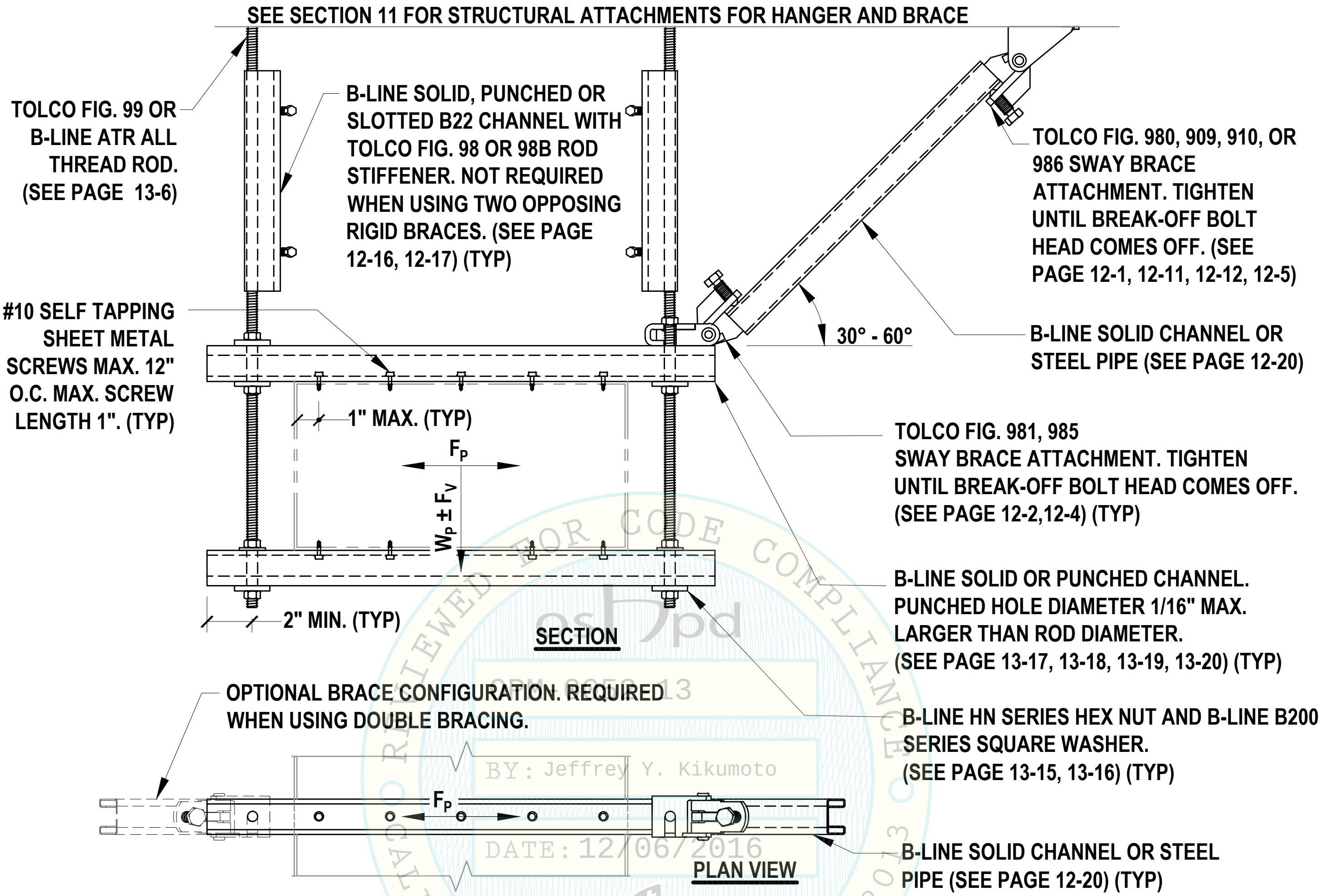
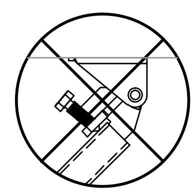
TRANSVERSE RIGID BRACING FOR TRAPEZE SUPPORTED RECTANGULAR DUCT

DETAIL 7



ALL THREAD ROD SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	549	234	507
1/2"	549	234	507
3/4"	1449	1224	774



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) TRANSVERSE BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
3.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.

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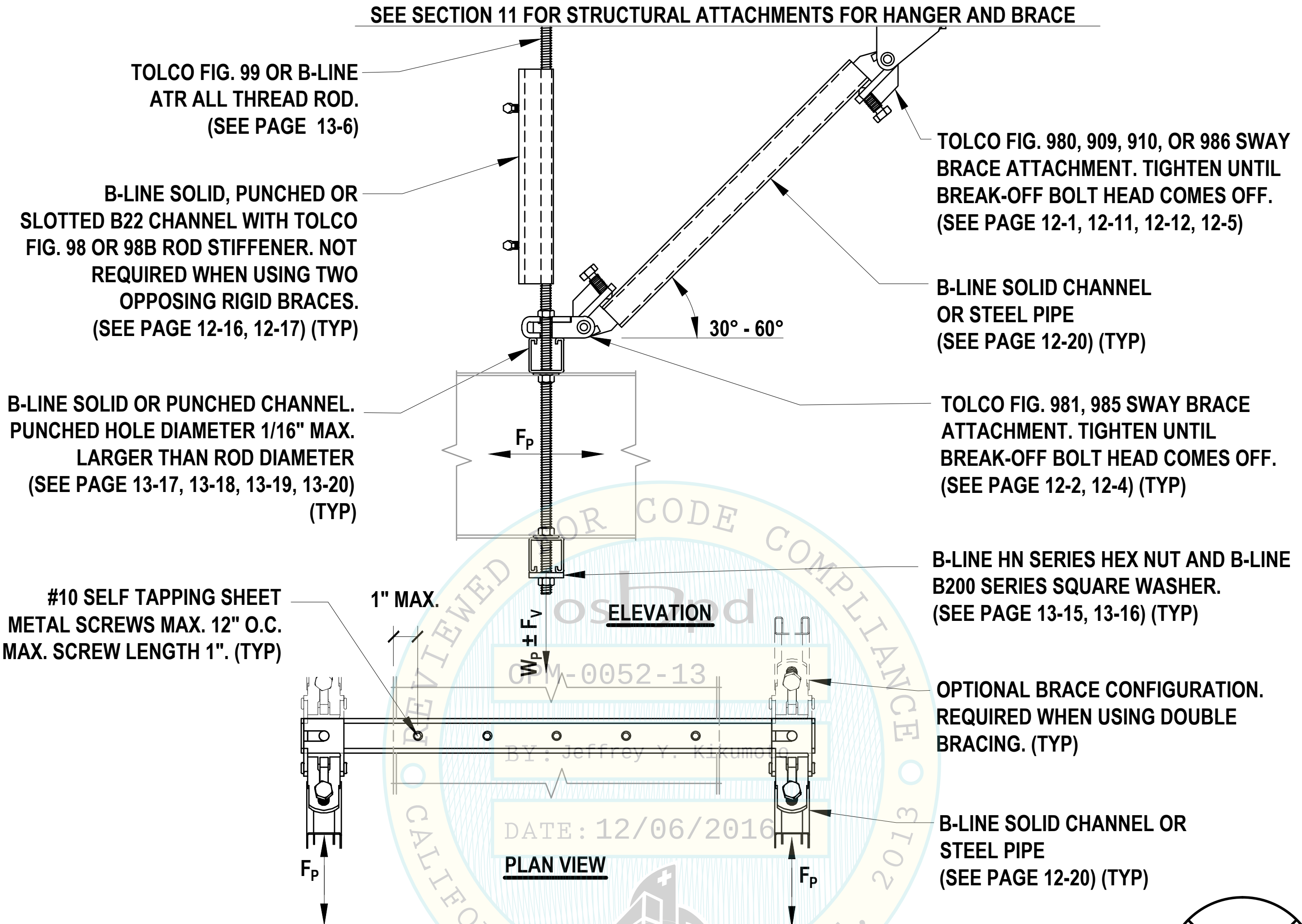
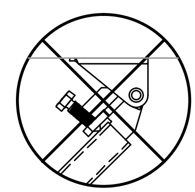
LONGITUDINAL RIGID BRACING FOR TRAPEZE SUPPORTED RECTANGULAR DUCT

DETAIL 8



ALL THREAD ROD SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P(ASD)		
	BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	463	492	440
1/2"	463	492	440
3/4"	479	494	470



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) LONGITUDINAL BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
3.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
5.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.
6.) WHERE SEISMIC LOAD IS APPLIED FULLY ECCENTRIC, REDUCE F_P BY 50%. LINEARLY INTERPOLATE FOR CONDITION BETWEEN CENTER LINE AND BRACE.

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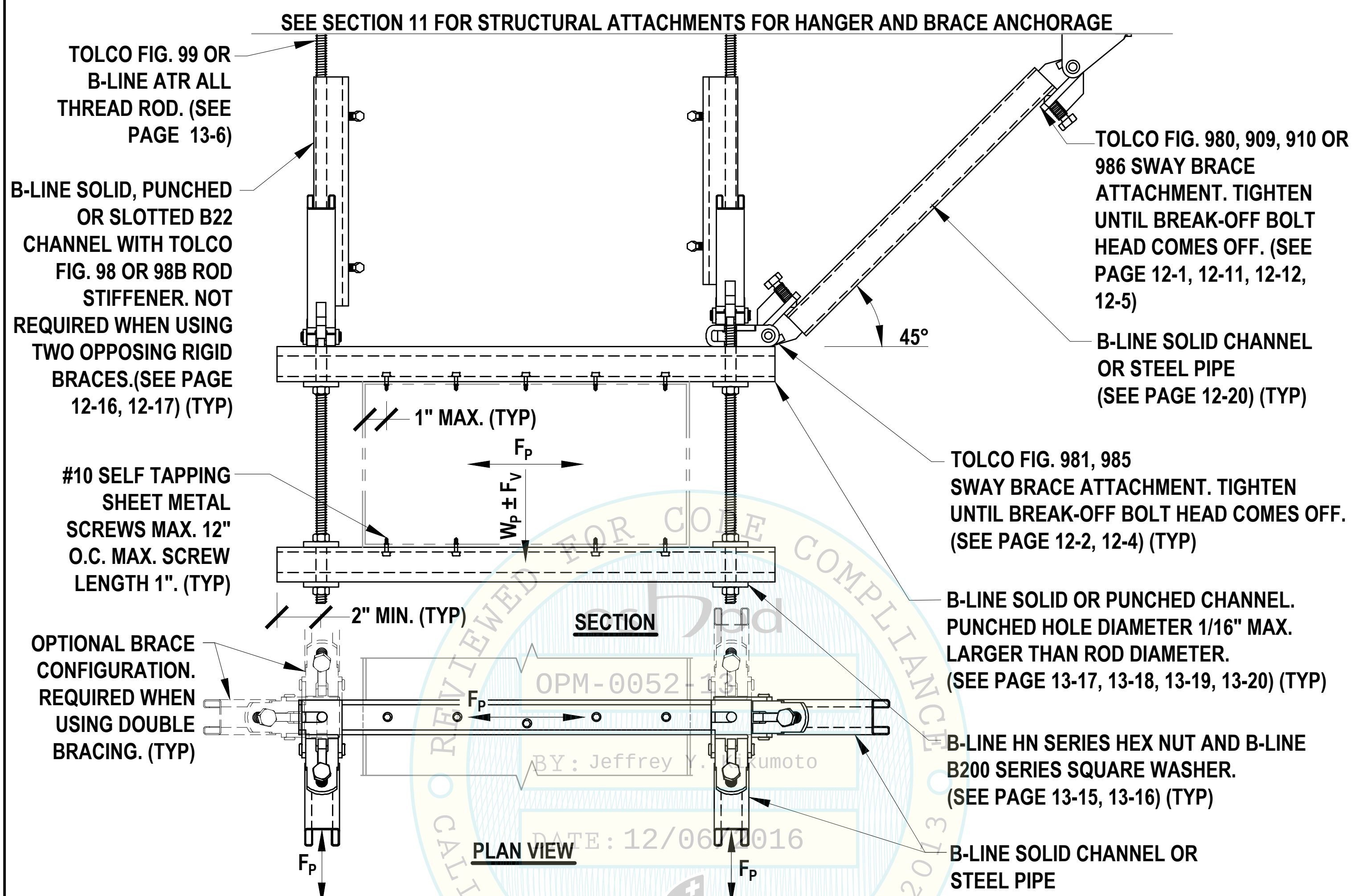
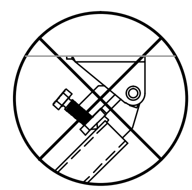
TRANSVERSE AND LONGITUDINAL COMBINATION RIGID BRACING FOR TRAPEZE SUPPORTED RECTANGULAR DUCT

DETAIL 7/8



ALL THREAD ROD SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]
	45°
3/8"	320
1/2"	320
3/4"	326



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) BRACES MAY BE INSTALLED IN OPPOSING DIRECTION.
3.) THE ABOVE ASSEMBLY ALLOWABLE LOADS CAN BE APPLIED CONCURRENTLY TO BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS WITHOUT REDUCTION.
4.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
5.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
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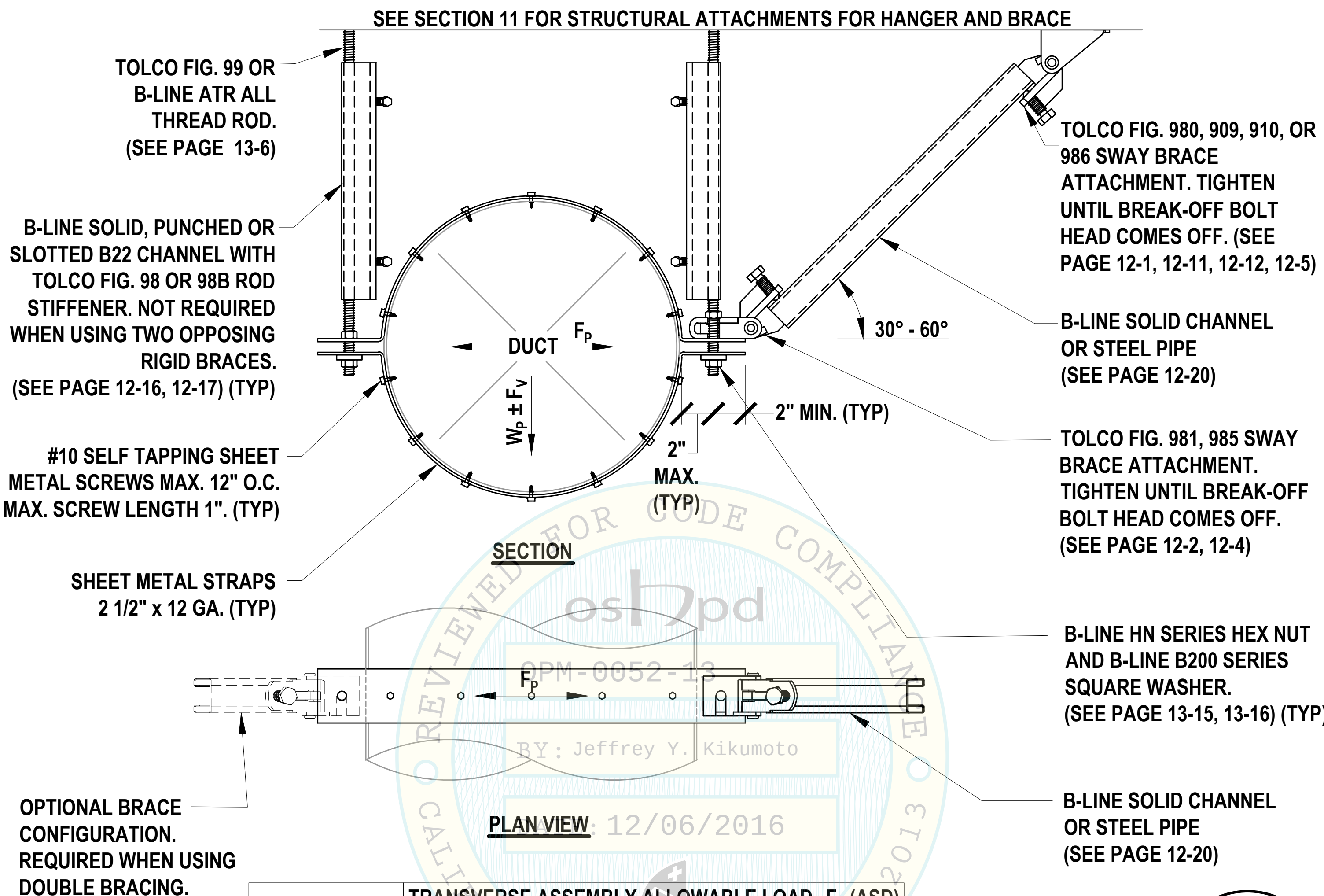
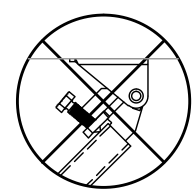
TRANSVERSE RIGID BRACING FOR STRAP SUPPORTED ROUND DUCT

DETAIL 9



ALL THREAD ROD SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	549	234	507
1/2"	549	234	507
3/4"	1449	1224	774



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) TRANSVERSE BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
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LONGITUDINAL RIGID BRACING FOR STRAP SUPPORTED ROUND DUCT

DETAIL 10

SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE

TOLCO FIG. 99 OR B-LINE ATR ALL THREAD ROD. (SEE PAGE 13-6)

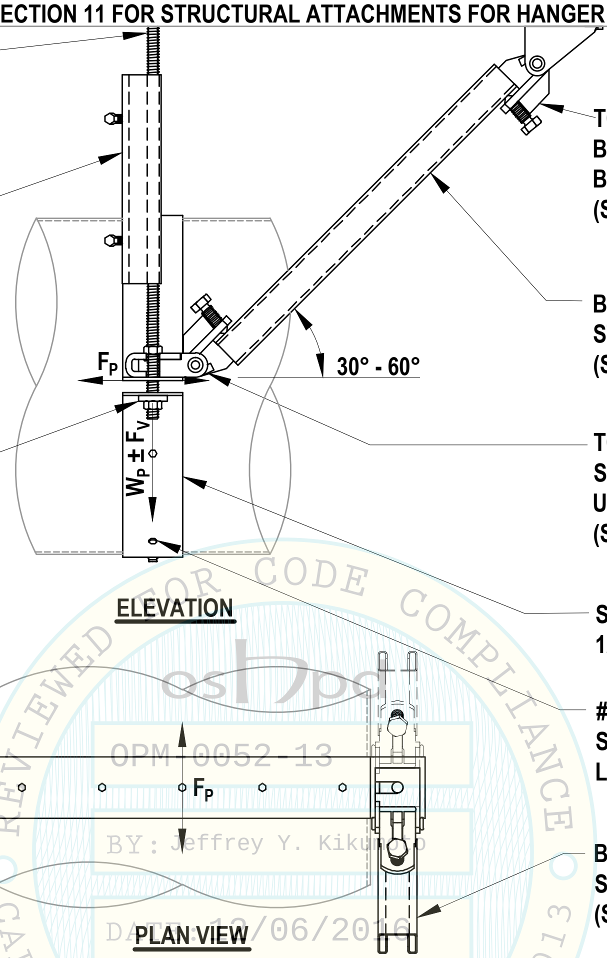
B-LINE SOLID, PUNCHED OR SLOTTED B22 CHANNEL WITH TOLCO FIG. 98 OR 98B ROD STIFFENER. NOT REQUIRED WHEN USING TWO OPPOSING RIGID BRACES. (SEE PAGE 12-16, 12-17) (TYP)

B-LINE HN SERIES HEX NUT AND B-LINE B200 SERIES SQUARE WASHER. (SEE PAGE 13-15, 13-16)(TYP)

TOLCO FIG. 980, 909, 910, OR 986 SWAY BRACE ATTACHMENT. TIGHTEN UNTIL BREAK-OFF BOLT HEAD COMES OFF. (SEE PAGE 12-1, 12-11, 12-12, 12-5)

B-LINE SOLID CHANNEL OR STEEL PIPE (SEE PAGE 12-20) (TYP)

TOLCO FIG. 981, 985 SWAY BRACE ATTACHMENT. TIGHTEN UNTIL BREAK-OFF BOLT HEAD COMES OFF. (SEE PAGE 12-2, 12-4) (TYP)



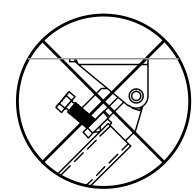
SHEET METAL STRAPS 2 1/2" x 12 GA. (TYP)

#10 SELF TAPPING SHEET METAL SCREWS MAX. 12" O.C. MAX. SCREW LENGTH 1". (TYP)

OPTIONAL BRACE CONFIGURATION. REQUIRED WHEN USING DOUBLE BRACING. (TYP)

B-LINE SOLID CHANNEL OR STEEL PIPE (SEE PAGE 12-20) (TYP)

ALL THREAD ROD SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
	30°	31° - 45°	46° - 60°
3/8"	463	492	440
1/2"	463	492	440
3/4"	479	494	470



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
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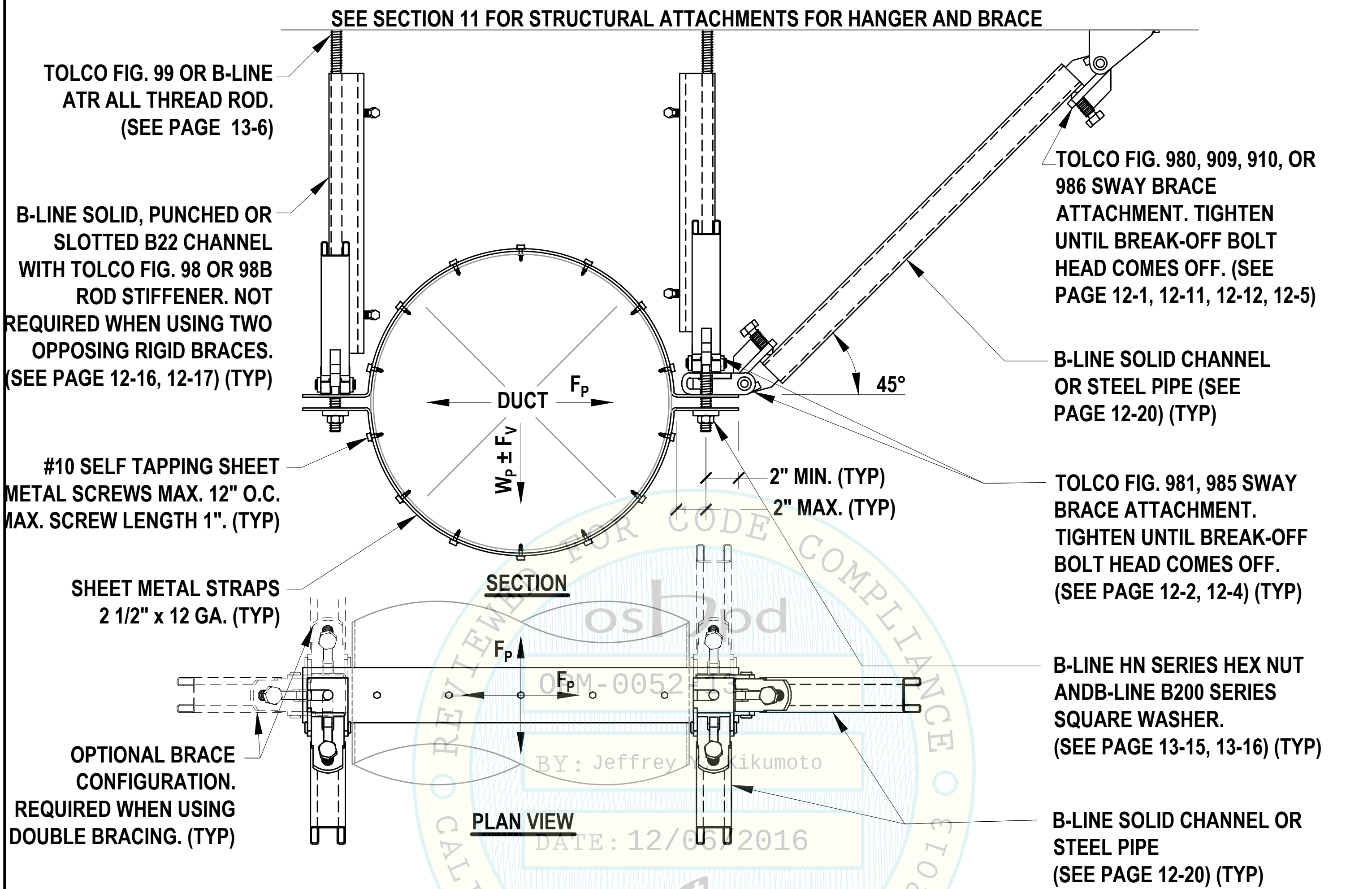
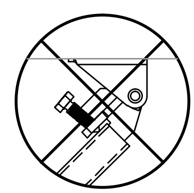
TRANSVERSE AND LONGITUDINAL COMBINATION RIGID BRACING FOR STRAP SUPPORTED ROUND DUCT

DETAIL 9/10



ALL THREAD ROD SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs] 45°
3/8"	320
1/2"	320
3/4"	326



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
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4.) THE ABOVE ASSEMBLY ALLOWABLE LOADS CAN BE APPLIED CONCURRENTLY TO BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS WITHOUT REDUCTION.
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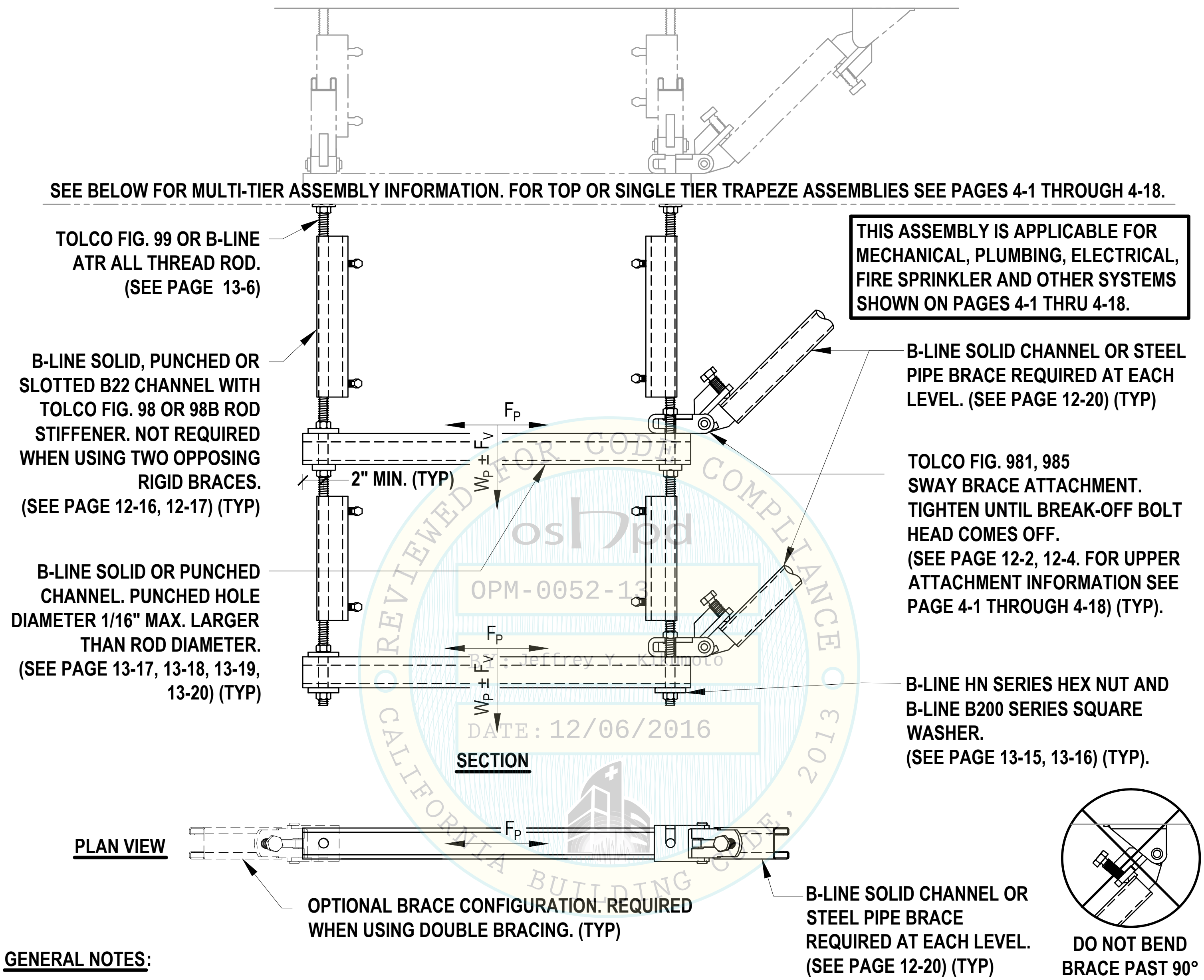
TRANSVERSE RIGID BRACING FOR MULTI-TIER TRAPEZE SUPPORT

DETAIL MR1



GENERAL NOTES:

1.) SEE PAGE 4-22, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) BRACES MAY BE INSTALLED IN OPPOSING DIRECTION.
3.) WHEN CALCULATING TOTAL VERTICAL LOAD AT HANGER, INDUCED LOADS FROM BOTH BRACES MUST BE CONSIDERED AT THE SAME TIME. THIS TOTAL DEMAND IS THEN USED IN STEP 9 ON PAGE 1-20.
4.) THE DEMAND OF EACH TIER SHALL NOT EXCEED THE SINGLE TIER CAPACITY AS GIVEN ON CORRESPONDING PAGES 4-1 THRU 4-18 AND SHALL COMPLY WITH ALL OTHER RESTRICTIONS ON PAGES 4-1 THRU 4-18.
5.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
6.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.

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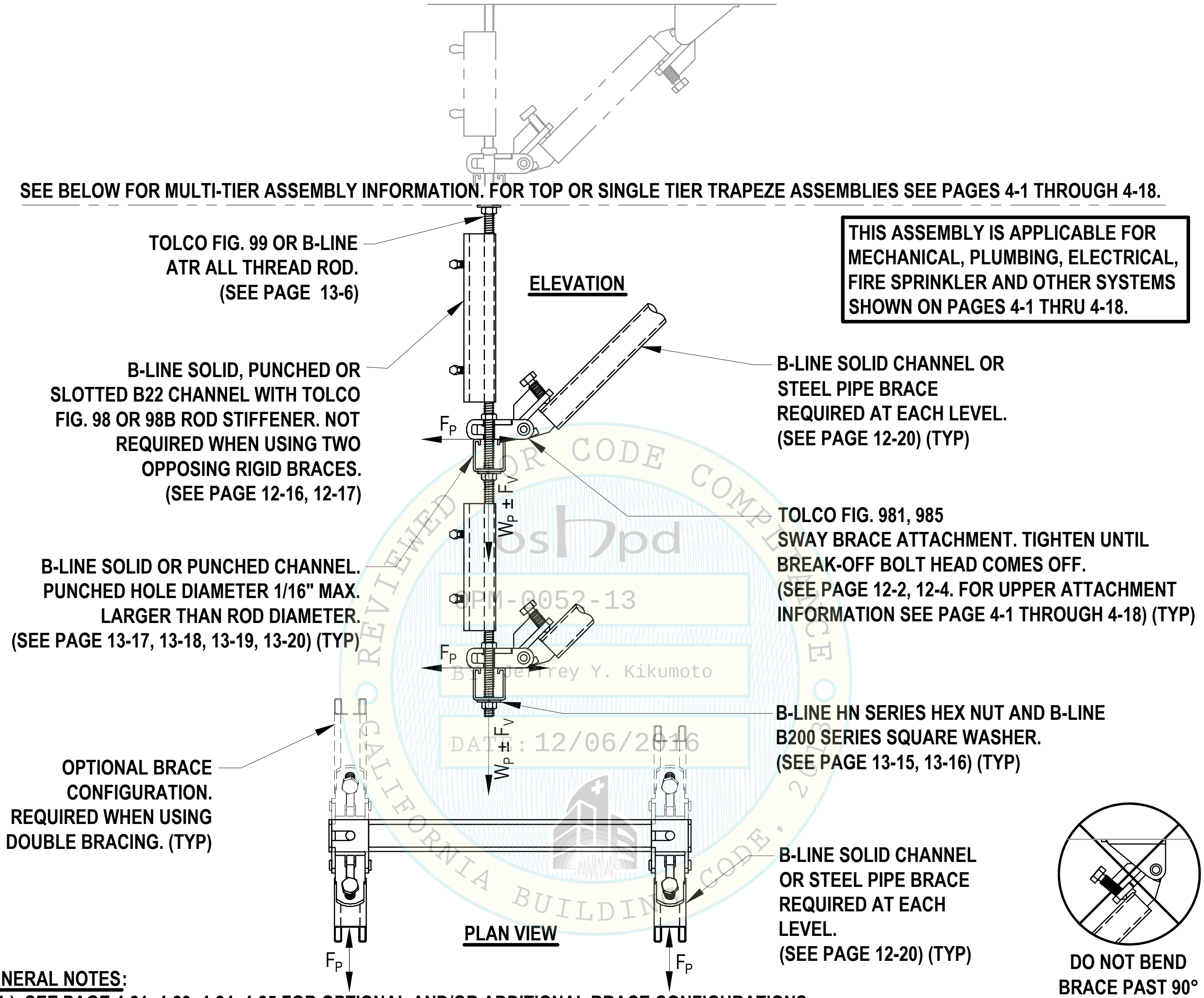
LONGITUDINAL RIGID BRACING FOR MULTI-TIER TRAPEZE SUPPORT

DETAIL
MR2



GENERAL NOTES:

1.) SEE PAGE 4-21, 4-23, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) BRACE MAY BE INSTALLED IN OPPOSING DIRECTION.
3.) WHEN CALCULATING TOTAL VERTICAL LOAD AT HANGER, INDUCED LOADS FROM BOTH BRACES MUST BE CONSIDERED AT THE SAME TIME. THIS TOTAL DEMAND IS THEN USED IN STEP 9 ON PAGE 1-20.
4.) THE DEMAND OF EACH TIER SHALL NOT EXCEED THE SINGLE TIER CAPACITY AS GIVEN ON CORRESPONDING PAGES 4-1 THRU 4-18 AND SHALL COMPLY WITH ALL OTHER RESTRICTIONS ON PAGES 4-1 THRU 4-18.
5.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
6.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
7.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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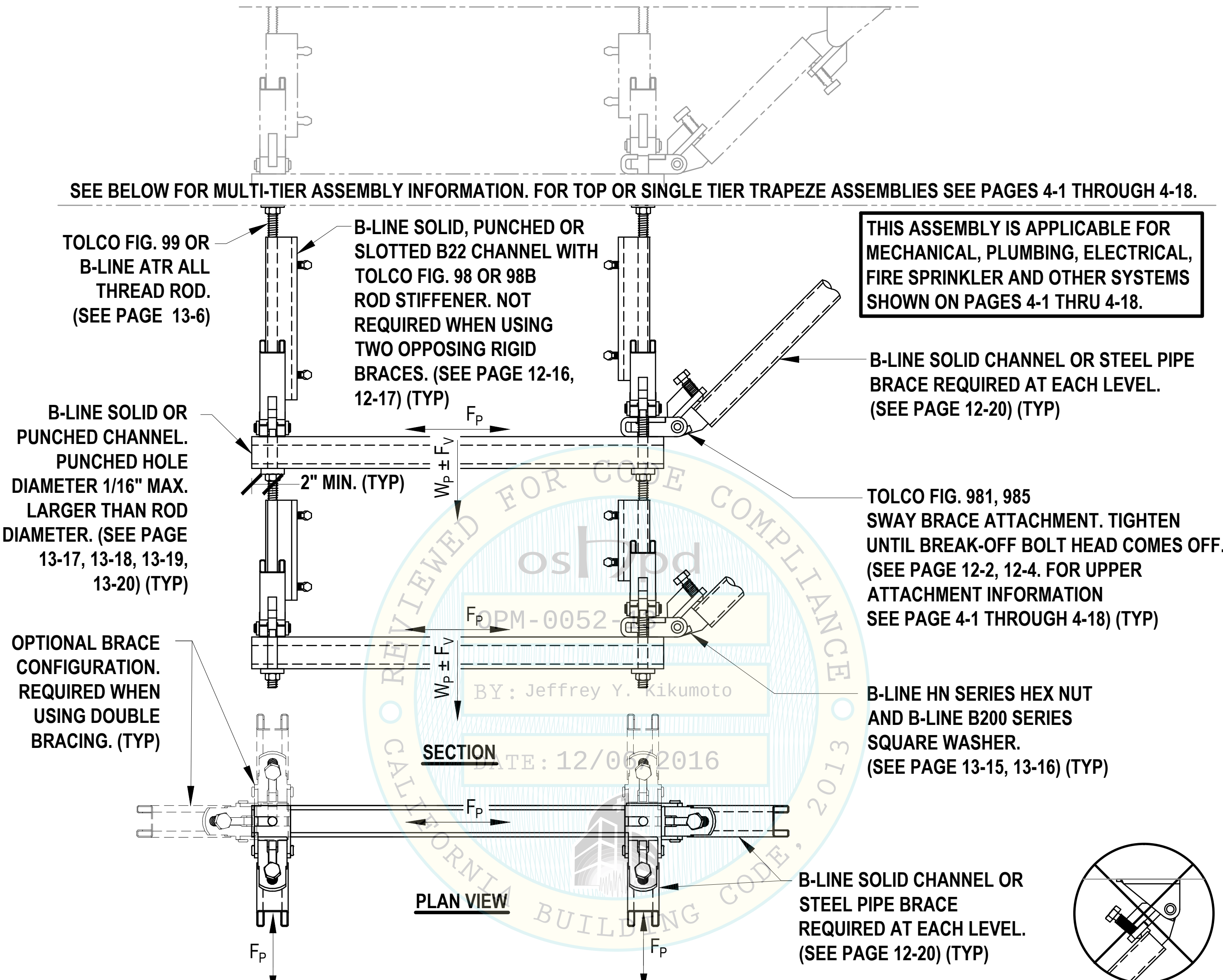
PAGE:
4-22
DATE:
NOVEMBER 29, 2016

MH

TRANSVERSE AND LONGITUDINAL COMBINATION RIGID BRACING FOR MULTI-TIER TRAPEZE SUPPORT

DETAIL MR1/MR2



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-24, 4-25 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) BRACES MAY BE INSTALLED IN OPPOSING DIRECTION.
3.) WHEN CALCULATING TOTAL VERTICAL LOAD AT HANGER, INDUCED LOADS FROM BOTH BRACES MUST BE CONSIDERED AT THE SAME TIME. THIS TOTAL DEMAND IS THEN USED IN STEP 9 ON PAGE 1-20.
4.) THE DEMAND OF EACH TIER SHALL NOT EXCEED THE SINGLE TIER CAPACITY AS GIVEN ON CORRESPONDING PAGES 4-1 THRU 4-18 AND SHALL COMPLY WITH ALL OTHER RESTRICTIONS ON PAGES 4-1 THRU 4-18.
5.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
6.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
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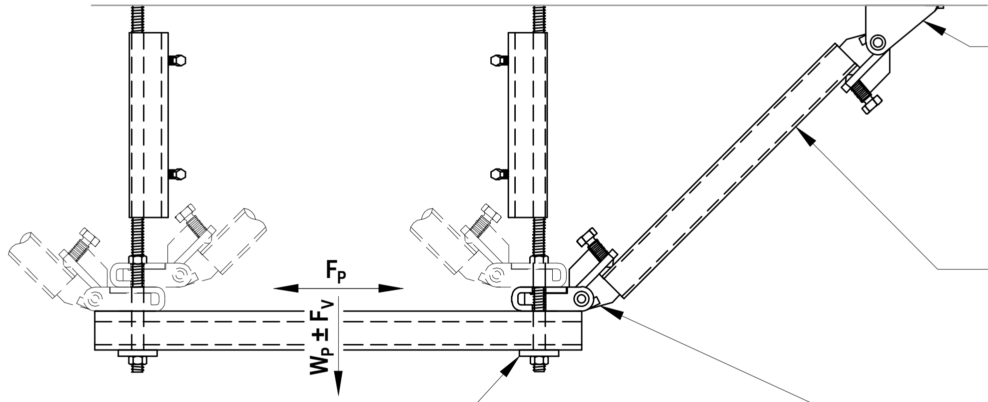
OPTIONAL BRACE CONFIGURATIONS

DETAIL
OPT3

SEE BELOW FOR OPTIONAL BRACE CONFIGURATIONS.
FOR TOP OF TRAPEZE ASSEMBLIES SEE PAGES 4-1 THROUGH 4-18.



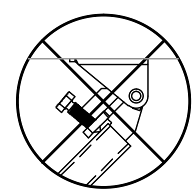
TOLCO FIG. 980, 909, 910, OR 986 SWAY BRACE ATTACHMENT. TIGHTEN UNTIL BREAK-OFF BOLT HEAD COMES OFF. (SEE PAGE 12-1, 12-11, 12-12, 12-5) (TYP)

B-LINE SOLID CHANNEL OR STEEL PIPE (SEE PAGE 12-20) (TYP)

TOLCO FIG. 981, 985 SWAY BRACE ATTACHMENT. TIGHTEN UNTIL BREAK-OFF BOLT HEAD COMES OFF. (SEE PAGE 12-2, 12-4) (TYP)

B-LINE HN SERIES HEX NUT AND B-LINE B200 SERIES SQUARE WASHER. (SEE PAGE 13-15, 13-16) (TYP)

SECTION



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 4-21, 4-22, 4-23 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) BRACES MAY BE POSITIONED IN ANY OF THE ABOVE SHOWN CONFIGURATIONS. QUANTITY OF BRACES MAY VARY BASED ON DESIGN CRITERIA.
3.) THE FIG 909 AND FIG 910 ARE FOR USE ONLY WITH STEEL PIPE BRACES, PER PAGES 12-11 AND 12-12.
4.) THIS OPTIONAL BRACE CONFIGURATION IS APPLICABLE TO PAGES 4-1, 4-3, 4-4, 4-6, 4-7, 4-9, 4-10, 4-12, 4-13, 4-15, 4-21, 4-23.
5.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.

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SECTION 5

TRAPEZE RIGID BRACE SPACING CHARTS

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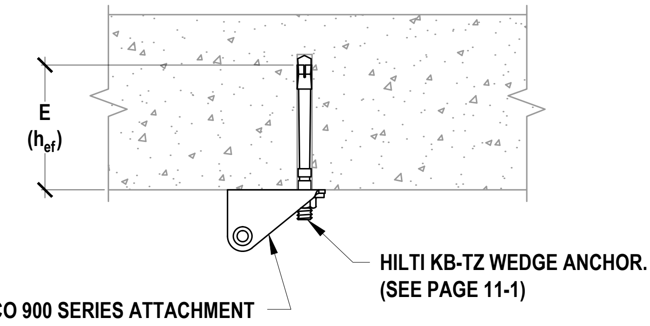
TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 0.50 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	40	1	1	3/8"	2"
20	40	1	1	1/2"	3 1/4"
30	30	1	1	1/2"	3 1/4"
40	22	1	1	1/2"	3 1/4"
50	25	1	1	5/8"	4"
60	21	1	1	5/8"	4"
70	36	*2	1	5/8"	4"
80	31	*2	1	5/8"	4"
90	28	*2	1	5/8"	4"
100	25	*2	1	5/8"	4"
125	20	*2	1	5/8"	4"
150	16	*2	1	5/8"	4"
175	14	*2	1	5/8"	4"
200	12	*2	1	5/8"	4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 0.50 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	80	2	1	3/8"	2"
20	80	2	1	1/2"	3 1/4"
30	60	2	1	1/2"	3 1/4"
40	45	2	1	1/2"	3 1/4"
50	50	2	1	5/8"	4"
60	42	2	1	5/8"	4"
70	72	*4	1	5/8"	4"
80	63	*4	1	5/8"	4"
90	56	*4	1	5/8"	4"
100	50	*4	1	5/8"	4"
125	40	*4	1	5/8"	4"
150	33	*4	1	5/8"	4"
175	28	*4	1	5/8"	4"
200	25	*4	1	5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013), WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
7.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
8.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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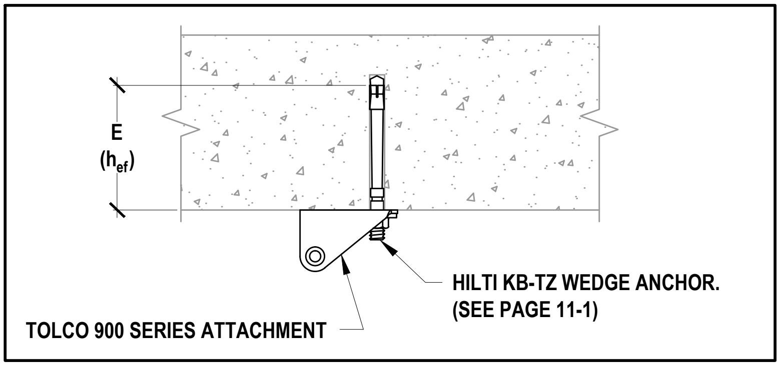
MRH
Structural Engineer: Mohammad Hariri
California SE No. S3545

PAGE: 5-1

DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	40	1	1	1/2"	3 1/4"
20	30	1	1	1/2"	3 1/4"
30	28	1	1	5/8"	4"
40	30	*2	1	1/2"	3 1/4"
50	33	*2	1	5/8"	4"
60	28	*2	1	5/8"	4"
70	24	*2	1	5/8"	4"
80	21	*2	1	5/8"	4"
90	18	*2	1	5/8"	4"
100	16	*2	1	5/8"	4"
125	13	*2	1	5/8"	4"
150	11	*2	1	5/8"	4"
175	9	*2	1	5/8"	4"
200	8	*2	1	5/8"	4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	80	2	1	1/2"	3 1/4"
20	60	2	1	1/2"	3 1/4"
30	56	2	1	5/8"	4"
40	80	*4	1	5/8"	4"
50	67	*4	1	5/8"	4"
60	56	*4	1	5/8"	4"
70	48	*4	1	5/8"	4"
80	42	*4	1	5/8"	4"
90	37	*4	1	5/8"	4"
100	33	*4	1	5/8"	4"
125	26	*4	1	5/8"	4"
150	22	*4	1	5/8"	4"
175	19	*4	1	5/8"	4"
200	16	*4	1	5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
7.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
8.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

DATE: NOVEMBER 29, 2016

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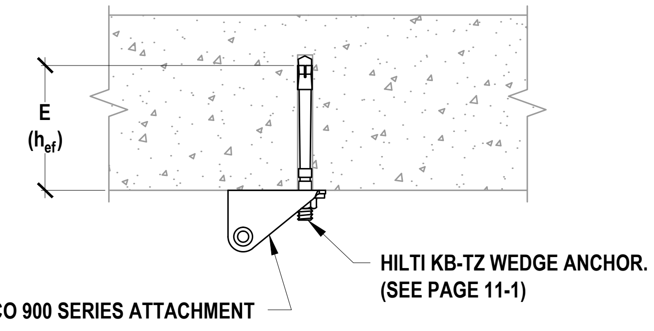
TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

1.0 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 1.0 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	20	1	1	3/8"	2"
20	22	1	1	1/2"	3 1/4"
30	21	1	1	5/8"	4"
40	22	*2	1	1/2"	3 1/4"
50	25	*2	1	5/8"	4"
60	21	*2	1	5/8"	4"
70	18	*2	1	5/8"	4"
80	15	*2	1	5/8"	4"
90	14	*2	1	5/8"	4"
100	12	*2	1	5/8"	4"
125	10	*2	1	5/8"	4"
150	8	*2	1	5/8"	4"
175	7	*2	1	5/8"	4"
200	6	*2	1	5/8"	4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 1.0 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	40	2	1	3/8"	2"
20	45	2	1	1/2"	3 1/4"
30	42	2	1	5/8"	4"
40	63	*4	1	5/8"	4"
50	50	*4	1	5/8"	4"
60	42	*4	1	5/8"	4"
70	36	*4	1	5/8"	4"
80	31	*4	1	5/8"	4"
90	28	*4	1	5/8"	4"
100	25	*4	1	5/8"	4"
125	20	*4	1	5/8"	4"
150	16	*4	1	5/8"	4"
175	14	*4	1	5/8"	4"
200	12	*4	1	5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
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5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
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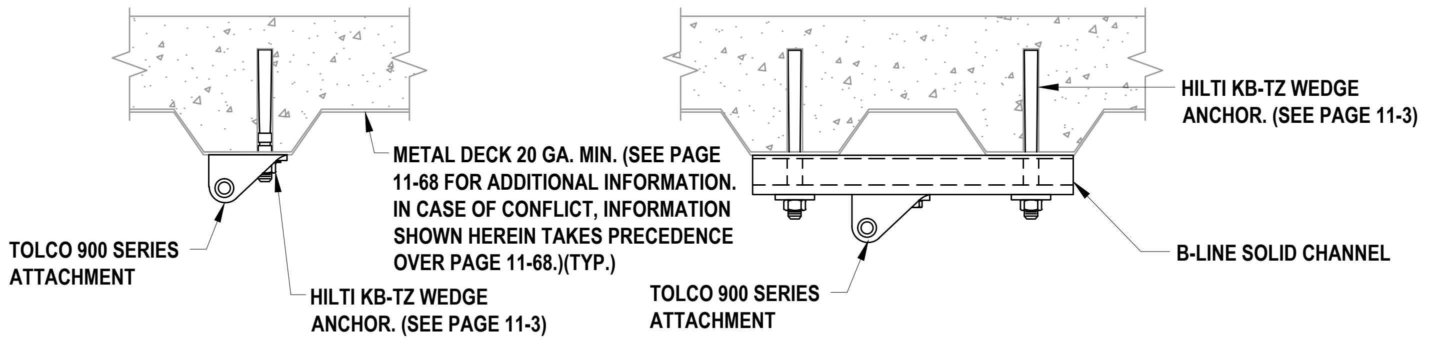
8.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 0.50 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	40	1	1	1/2"	3 1/4"
20	22	1	1	1/2"	3 1/4"
30	33	1	2	(2) 1/2"	3 1/4"
40	25	1	2	(2) 1/2"	3 1/4"
50	20	1	2	(2) 1/2"	3 1/4"
60	16	1	2	(2) 1/2"	3 1/4"
70	28	*2	2	(2) 1/2"	3 1/4"
80	25	*2	2	(2) 1/2"	3 1/4"
90	22	*2	2	(2) 1/2"	3 1/4"
100	20	*2	2	(2) 1/2"	3 1/4"
125	16	*2	2	(2) 1/2"	3 1/4"
150	13	*2	2	(2) 1/2"	3 1/4"
175	11	*2	2	(2) 1/2"	3 1/4"
200	10	*2	2	(2) 1/2"	3 1/4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 0.50 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	80	2	1	1/2"	3 1/4"
20	44	2	1	1/2"	3 1/4"
30	67	2	2	(2) 1/2"	3 1/4"
40	50	2	2	(2) 1/2"	3 1/4"
50	40	2	2	(2) 1/2"	3 1/4"
60	33	2	2	(2) 1/2"	3 1/4"
70	57	*4	2	(2) 1/2"	3 1/4"
80	50	*4	2	(2) 1/2"	3 1/4"
90	44	*4	2	(2) 1/2"	3 1/4"
100	40	*4	2	(2) 1/2"	3 1/4"
125	32	*4	2	(2) 1/2"	3 1/4"
150	26	*4	2	(2) 1/2"	3 1/4"
175	23	*4	2	(2) 1/2"	3 1/4"
200	20	*4	2	(2) 1/2"	3 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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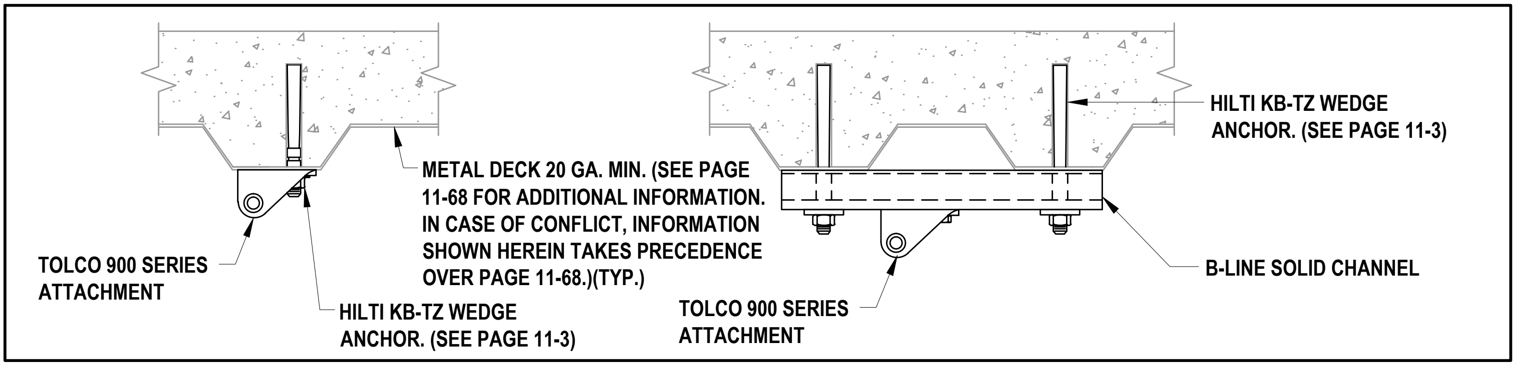
TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	29	1	1	1/2"	3 1/4"
20	33	1	2	(2) 1/2"	3 1/4"
30	40	*2	2	(2) 1/2"	3 1/4"
40	33	*2	2	(2) 1/2"	3 1/4"
50	26	*2	2	(2) 1/2"	3 1/4"
60	22	*2	2	(2) 1/2"	3 1/4"
70	19	*2	2	(2) 1/2"	3 1/4"
80	16	*2	2	(2) 1/2"	3 1/4"
90	15	*2	2	(2) 1/2"	3 1/4"
100	13	*2	2	(2) 1/2"	3 1/4"
125	10	*2	2	(2) 1/2"	3 1/4"
150	9	*2	2	(2) 1/2"	3 1/4"
175	7	*2	2	(2) 1/2"	3 1/4"
200	6	*2	2	(2) 1/2"	3 1/4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	59	2	1	1/2"	3 1/4"
20	67	2	2	(2) 1/2"	3 1/4"
30	80	*4	2	(2) 1/2"	3 1/4"
40	67	*4	2	(2) 1/2"	3 1/4"
50	53	*4	2	(2) 1/2"	3 1/4"
60	44	*4	2	(2) 1/2"	3 1/4"
70	38	*4	2	(2) 1/2"	3 1/4"
80	33	*4	2	(2) 1/2"	3 1/4"
90	29	*4	2	(2) 1/2"	3 1/4"
100	26	*4	2	(2) 1/2"	3 1/4"
125	21	*4	2	(2) 1/2"	3 1/4"
150	18	*4	2	(2) 1/2"	3 1/4"
175	15	*4	2	(2) 1/2"	3 1/4"
200	13	*4	2	(2) 1/2"	3 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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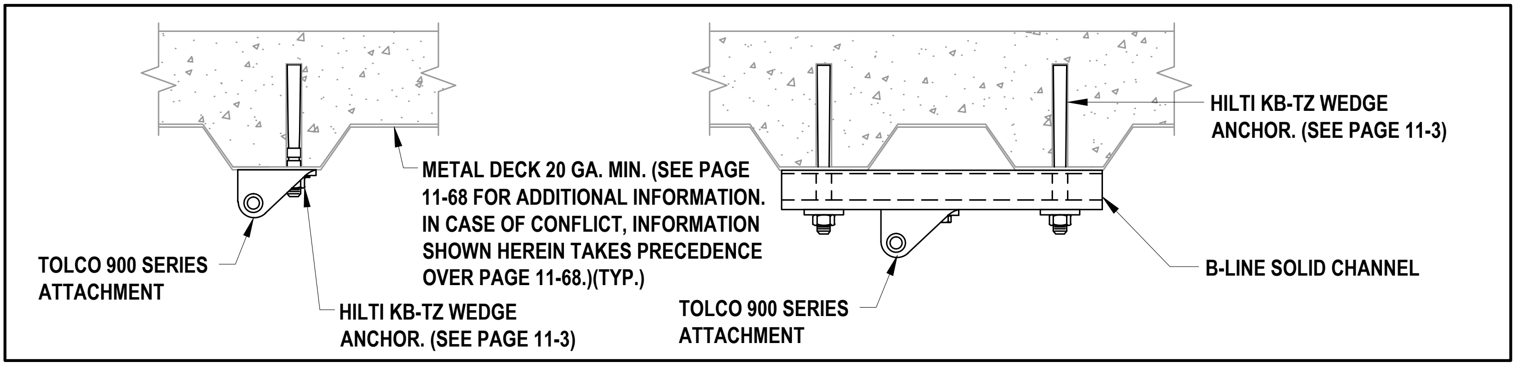
PAGE: 5-5

DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

1.0 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 1.0 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	22	1	1	1/2"	3 1/4"
20	25	1	2	(2) 1/2"	3 1/4"
30	16	1	2	(2) 1/2"	3 1/4"
40	25	*2	2	(2) 1/2"	3 1/4"
50	20	*2	2	(2) 1/2"	3 1/4"
60	16	*2	2	(2) 1/2"	3 1/4"
70	14	*2	2	(2) 1/2"	3 1/4"
80	12	*2	2	(2) 1/2"	3 1/4"
90	11	*2	2	(2) 1/2"	3 1/4"
100	10	*2	2	(2) 1/2"	3 1/4"
125	8	*2	2	(2) 1/2"	3 1/4"
150	10	*2	2	(2) 5/8"	4"
175	8	*2	2	(2) 5/8"	4"
200	7	*2	2	(2) 5/8"	4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 1.0 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	44	2	1	1/2"	3 1/4"
20	50	2	2	(2) 1/2"	3 1/4"
30	33	2	2	(2) 1/2"	3 1/4"
40	50	*4	2	(2) 1/2"	3 1/4"
50	40	*4	2	(2) 1/2"	3 1/4"
60	33	*4	2	(2) 1/2"	3 1/4"
70	28	*4	2	(2) 1/2"	3 1/4"
80	25	*4	2	(2) 1/2"	3 1/4"
90	22	*4	2	(2) 1/2"	3 1/4"
100	20	*4	2	(2) 1/2"	3 1/4"
125	16	*4	2	(2) 1/2"	3 1/4"
150	20	*4	2	(2) 5/8"	4"
175	17	*4	2	(2) 5/8"	4"
200	15	*4	2	(2) 5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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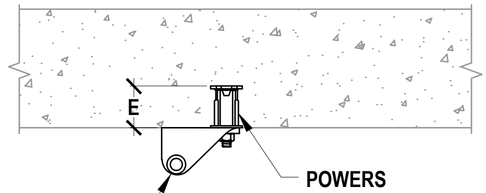
TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 0.50 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	40	1	1	3/8"	1 3/4"
20	37	1	1	3/8"	1 3/4"
30	32	1	1	1/2"	1 3/4"
40	24	1	1	1/2"	1 3/4"
50	19	1	1	1/2"	1 3/4"
60	32	*2	1	1/2"	1 3/4"
70	27	*2	1	1/2"	1 3/4"
80	24	*2	1	1/2"	1 3/4"
90	21	*2	1	1/2"	1 3/4"
100	19	*2	1	1/2"	1 3/4"
125	15	*2	1	1/2"	1 3/4"
150	13	*2	1	5/8"	1 3/4"
175	11	*2	1	5/8"	1 3/4"
200	10	*2	1	5/8"	1 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 0.50 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	80	2	1	3/8"	1 3/4"
20	74	2	1	3/8"	1 3/4"
30	64	2	1	1/2"	1 3/4"
40	48	2	1	1/2"	1 3/4"
50	38	2	1	1/2"	1 3/4"
60	32	2	1	1/2"	1 3/4"
70	55	*4	1	1/2"	1 3/4"
80	48	*4	1	1/2"	1 3/4"
90	42	*4	1	1/2"	1 3/4"
100	38	*4	1	1/2"	1 3/4"
125	30	*4	1	1/2"	1 3/4"
150	26	*4	1	5/8"	1 3/4"
175	22	*4	1	5/8"	1 3/4"
200	20	*4	1	5/8"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
7.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
8.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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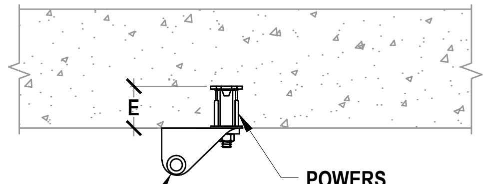
MRH
Structural Engineer: Mohammad Hariri
California SE No. S3545

PAGE: 5-7
DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	40	1	1	3/8"	1 3/4"
20	40	1	1	1/2"	1 3/4"
30	40	*2	1	1/2"	1 3/4"
40	32	*2	1	1/2"	1 3/4"
50	25	*2	1	1/2"	1 3/4"
60	21	*2	1	1/2"	1 3/4"
70	18	*2	1	1/2"	1 3/4"
80	16	*2	1	1/2"	1 3/4"
90	14	*2	1	1/2"	1 3/4"
100	12	*2	1	1/2"	1 3/4"
125	10	*2	1	1/2"	1 3/4"
150	8	*2	1	1/2"	1 3/4"
175	7	*2	1	1/2"	1 3/4"
200	6	*2	1	1/2"	1 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	80	2	1	3/8"	1 3/4"
20	49	2	1	3/8"	1 3/4"
30	42	2	1	1/2"	1 3/4"
40	64	*4	1	1/2"	1 3/4"
50	51	*4	1	1/2"	1 3/4"
60	42	*4	1	1/2"	1 3/4"
70	36	*4	1	1/2"	1 3/4"
80	32	*4	1	1/2"	1 3/4"
90	28	*4	1	1/2"	1 3/4"
100	25	*4	1	1/2"	1 3/4"
125	20	*4	1	1/2"	1 3/4"
150	17	*4	1	1/2"	1 3/4"
175	15	*4	1	5/8"	1 3/4"
200	13	*4	1	5/8"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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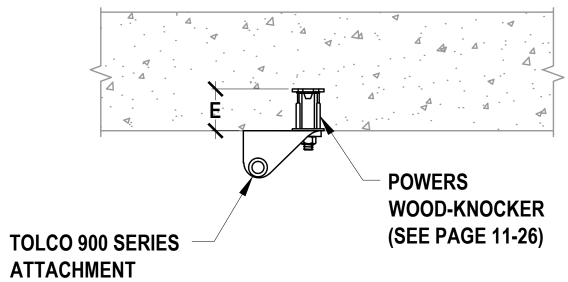
California SE No. S3545

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

1.0 "G"



Max. Trapeze Weight Per Foot	Transverse Max. Spacing @ 1.0 "G"	Concrete Anchorage Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	37	1	1	3/8"	1 3/4"
20	40	*2	1	1/2"	1 3/4"
30	32	*2	1	1/2"	1 3/4"
40	24	*2	1	1/2"	1 3/4"
50	19	*2	1	1/2"	1 3/4"
60	16	*2	1	1/2"	1 3/4"
70	13	*2	1	1/2"	1 3/4"
80	12	*2	1	1/2"	1 3/4"
90	10	*2	1	1/2"	1 3/4"
100	9	*2	1	1/2"	1 3/4"
125	7	*2	1	1/2"	1 3/4"
150	6	*2	1	1/2"	1 3/4"
175	5	*2	1	1/2"	1 3/4"
200	5	*2	1	5/8"	1 3/4"

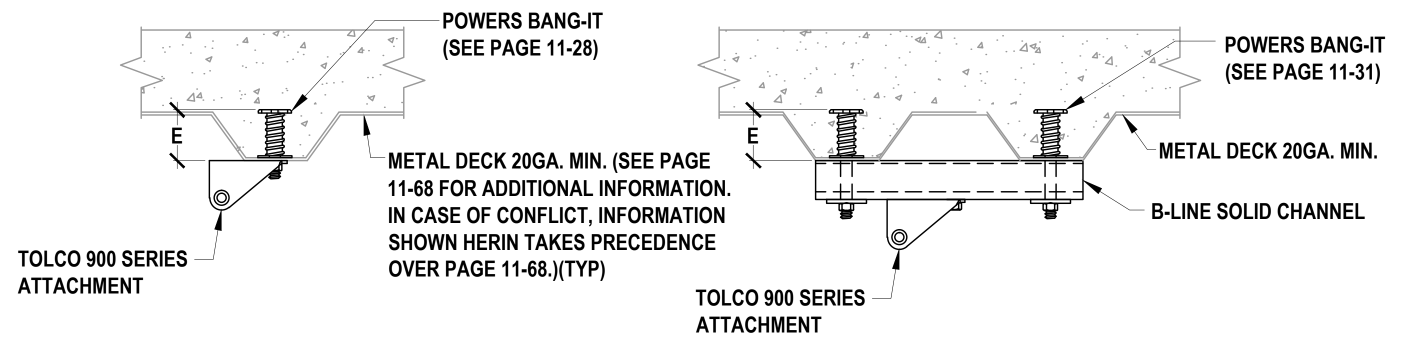
Max. Trapeze Weight Per Foot	Longitudinal Max. Spacing @ 1.0 "G"	Concrete Anchorage Brace Qty.	Anchor per Brace	Min. Diameter	Min. Embed "E"
10	74	2	1	3/8"	1 3/4"
20	48	2	1	1/2"	1 3/4"
30	32	2	1	1/2"	1 3/4"
40	48	*4	1	1/2"	1 3/4"
50	38	*4	1	1/2"	1 3/4"
60	32	*4	1	1/2"	1 3/4"
70	27	*4	1	1/2"	1 3/4"
80	24	*4	1	1/2"	1 3/4"
90	21	*4	1	1/2"	1 3/4"
100	19	*4	1	1/2"	1 3/4"
125	15	*4	1	1/2"	1 3/4"
150	12	*4	1	1/2"	1 3/4"
175	11	*4	1	1/2"	1 3/4"
200	10	*4	1	5/8"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 0.50 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	40	1	1	3/8"	1 3/4"
20	40	1	2	(2) 3/8"	1 3/4"
30	40	1	2	(2) 1/2"	1 3/4"
40	40	1	2	(2) 1/2"	1 3/4"
50	34	1	2	(2) 1/2"	1 3/4"
60	28	1	2	(2) 1/2"	1 3/4"
70	40	*2	2	(2) 1/2"	1 3/4"
80	40	*2	2	(2) 1/2"	1 3/4"
90	38	*2	2	(2) 1/2"	1 3/4"
100	34	*2	2	(2) 1/2"	1 3/4"
125	27	*2	2	(2) 1/2"	1 3/4"
150	22	*2	2	(2) 1/2"	1 3/4"
175	19	*2	2	(2) 1/2"	1 3/4"
200	17	*2	2	(2) 1/2"	1 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 0.50 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	80	2	1	3/8"	1 3/4"
20	80	2	2	(2) 3/8"	1 3/4"
30	80	2	2	(2) 1/2"	1 3/4"
40	80	2	2	(2) 1/2"	1 3/4"
50	68	2	2	(2) 1/2"	1 3/4"
60	57	2	2	(2) 1/2"	1 3/4"
70	80	*4	2	(2) 1/2"	1 3/4"
80	80	*4	2	(2) 1/2"	1 3/4"
90	76	*4	2	(2) 1/2"	1 3/4"
100	68	*4	2	(2) 1/2"	1 3/4"
125	54	*4	2	(2) 1/2"	1 3/4"
150	45	*4	2	(2) 1/2"	1 3/4"
175	39	*4	2	(2) 1/2"	1 3/4"
200	34	*4	2	(2) 1/2"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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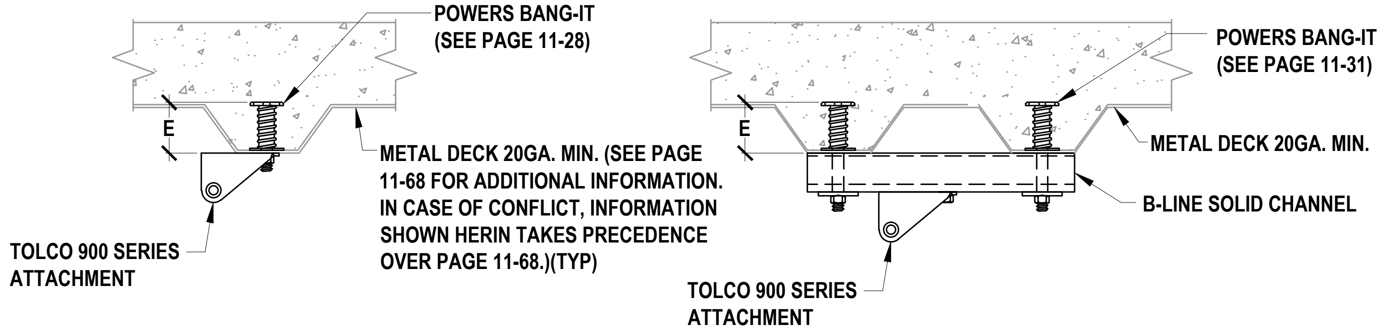
TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	32	1	1	1/2"	1 3/4"
20	40	1	2	(2) 1/2"	1 3/4"
30	38	1	2	(2) 1/2"	1 3/4"
40	40	*2	2	(2) 1/2"	1 3/4"
50	40	*2	2	(2) 1/2"	1 3/4"
60	38	*2	2	(2) 1/2"	1 3/4"
70	32	*2	2	(2) 1/2"	1 3/4"
80	28	*2	2	(2) 1/2"	1 3/4"
90	25	*2	2	(2) 1/2"	1 3/4"
100	22	*2	2	(2) 1/2"	1 3/4"
125	18	*2	2	(2) 1/2"	1 3/4"
150	15	*2	2	(2) 1/2"	1 3/4"
175	13	*2	2	(2) 1/2"	1 3/4"
200	11	*2	2	(2) 1/2"	1 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	62	2	1	3/8"	1 3/4"
20	80	2	2	(2) 1/2"	1 3/4"
30	76	2	2	(2) 1/2"	1 3/4"
40	80	*4	2	(2) 1/2"	1 3/4"
50	80	*4	2	(2) 1/2"	1 3/4"
60	76	*4	2	(2) 1/2"	1 3/4"
70	65	*4	2	(2) 1/2"	1 3/4"
80	57	*4	2	(2) 1/2"	1 3/4"
90	50	*4	2	(2) 1/2"	1 3/4"
100	45	*4	2	(2) 1/2"	1 3/4"
125	36	*4	2	(2) 1/2"	1 3/4"
150	30	*4	2	(2) 1/2"	1 3/4"
175	26	*4	2	(2) 1/2"	1 3/4"
200	22	*4	2	(2) 1/2"	1 3/4"

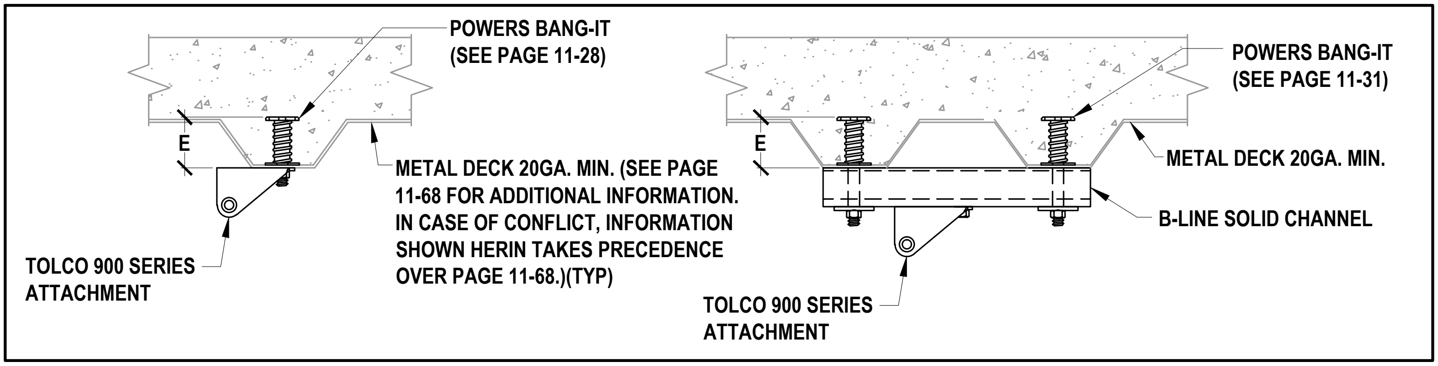
NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

1.0 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 1.0 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	23	1	1	3/8"	1 3/4"
20	40	1	2	(2) 1/2"	1 3/4"
30	28	1	2	(2) 1/2"	1 3/4"
40	40	*2	2	(2) 1/2"	1 3/4"
50	34	*2	2	(2) 1/2"	1 3/4"
60	28	*2	2	(2) 1/2"	1 3/4"
70	24	*2	2	(2) 1/2"	1 3/4"
80	21	*2	2	(2) 1/2"	1 3/4"
90	19	*2	2	(2) 1/2"	1 3/4"
100	17	*2	2	(2) 1/2"	1 3/4"
125	13	*2	2	(2) 1/2"	1 3/4"
150	11	*2	2	(2) 1/2"	1 3/4"
175	9	*2	2	(2) 1/2"	1 3/4"
200	8	*2	2	(2) 1/2"	1 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 1.0 "G"	Brace Qty.	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	47	2	1	3/8"	1 3/4"
20	80	2	2	(2) 1/2"	1 3/4"
30	57	2	2	(2) 1/2"	1 3/4"
40	80	*4	2	(2) 1/2"	1 3/4"
50	68	*4	2	(2) 1/2"	1 3/4"
60	57	*4	2	(2) 1/2"	1 3/4"
70	48	*4	2	(2) 1/2"	1 3/4"
80	42	*4	2	(2) 1/2"	1 3/4"
90	38	*4	2	(2) 1/2"	1 3/4"
100	34	*4	2	(2) 1/2"	1 3/4"
125	27	*4	2	(2) 1/2"	1 3/4"
150	22	*4	2	(2) 1/2"	1 3/4"
175	19	*4	2	(2) 1/2"	1 3/4"
200	17	*4	2	(2) 1/2"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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MRH
Structural Engineer: Mohammad Hariri
California SE No. S3545

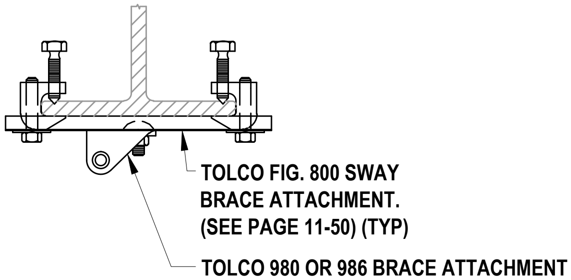
DATE:
NOVEMBER 29, 2016

MH

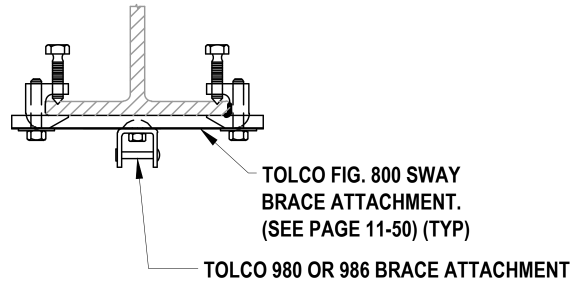
TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

0.50 "G"

Brace Perpendicular to Beam



Brace Parallel to Beam



Max. Trapeze Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 0.50 "G" Perpendicular	Transverse Max. Spacing @ 0.50 "G" Parallel
10	1	40	40
20	1	40	40
30	1	40	40
40	1	40	40
50	1	40	40
60	1	40	40
70	1	40	37
80	*2	40	40
90	*2	40	40
100	*2	40	40
125	*2	40	40
150	*2	40	34
175	*2	40	29
200	*2	39	26

Max. Trapeze Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 0.50 "G" Perpendicular	Longitudinal Max. Spacing @ 0.50 "G" Parallel
10	2	80	80
20	2	80	80
30	2	80	80
40	2	80	80
50	2	80	80
60	2	80	80
70	2	80	74
80	*4	80	80
90	*4	80	80
100	*4	80	80
125	*4	80	80
150	*4	80	69
175	*4	80	59
200	*4	78	52

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
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10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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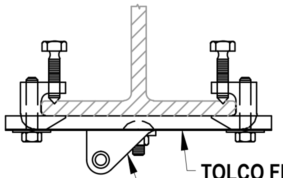
TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

0.75 "G"

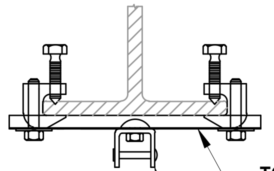
Brace Perpendicular to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 980 OR 986 BRACE ATTACHMENT

Brace Parallel to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 980 OR 986 BRACE ATTACHMENT

Max. Trapeze Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 0.75 "G"	
		Perpendicular	Parallel
10	1	40	40
20	1	40	40
30	1	40	40
40	1	40	40
50	1	40	40
60	1	40	40
70	*2	40	40
80	*2	40	40
90	*2	40	38
100	*2	40	34
125	*2	40	27
150	*2	35	23
175	*2	30	20
200	*2	26	17

Max. Trapeze Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 0.75 "G"	
		Perpendicular	Parallel
10	2	80	80
20	2	80	80
30	2	80	80
40	2	80	80
50	2	80	80
60	2	80	80
70	*4	80	80
80	*4	80	80
90	*4	80	77
100	*4	80	69
125	*4	80	55
150	*4	70	46
175	*4	60	39
200	*4	52	34

NOTES:

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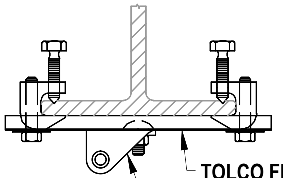
California SE No. S3545

MH

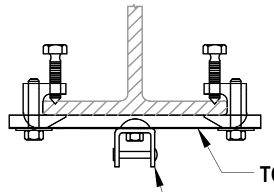
TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

1.0 "G"

Brace Perpendicular to Beam



Brace Parallel to Beam



Max. Trapeze Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 1.0 "G"	
		Perpendicular	Parallel
10	1	40	40
20	1	40	40
30	1	40	40
40	1	40	32
50	*2	40	40
60	*2	40	40
70	*2	40	37
80	*2	40	32
90	*2	40	29
100	*2	39	26
125	*2	31	21
150	*2	26	17
175	*2	22	15
200	*2	19	13

Max. Trapeze Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 1.0 "G"	
		Perpendicular	Parallel
10	2	80	80
20	2	80	80
30	2	80	80
40	2	80	65
50	*4	80	80
60	*4	80	80
70	*4	80	74
80	*4	80	65
90	*4	80	58
100	*4	78	52
125	*4	63	41
150	*4	52	34
175	*4	45	29
200	*4	39	26

NOTES:

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California SE No. S3545

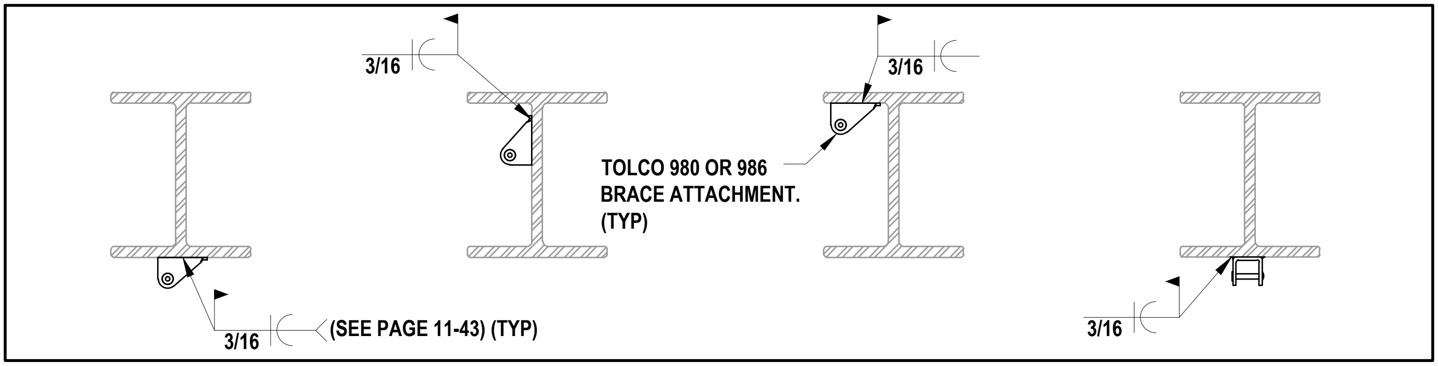
PAGE: 5-15

DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR WELDED ATTACHMENT TO STEEL BEAM

0.50 "G"



Max. Trapeze Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 0.50 "G"
10	1	40
20	1	40
30	1	40
40	1	40
50	1	40
60	1	40
70	*2	40
80	*2	40
90	*2	40
100	*2	40
125	*2	39
150	*2	32
175	*2	27
200	*2	24

Max. Trapeze Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 0.50 "G"
10	1	80
20	1	80
30	1	80
40	1	61
50	1	48
60	1	40
70	1	69
80	*2	61
90	*2	54
100	*2	48
125	*2	39
150	*2	32
175	*2	27
200	*2	24

NOTES:

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PAGE: 5-16
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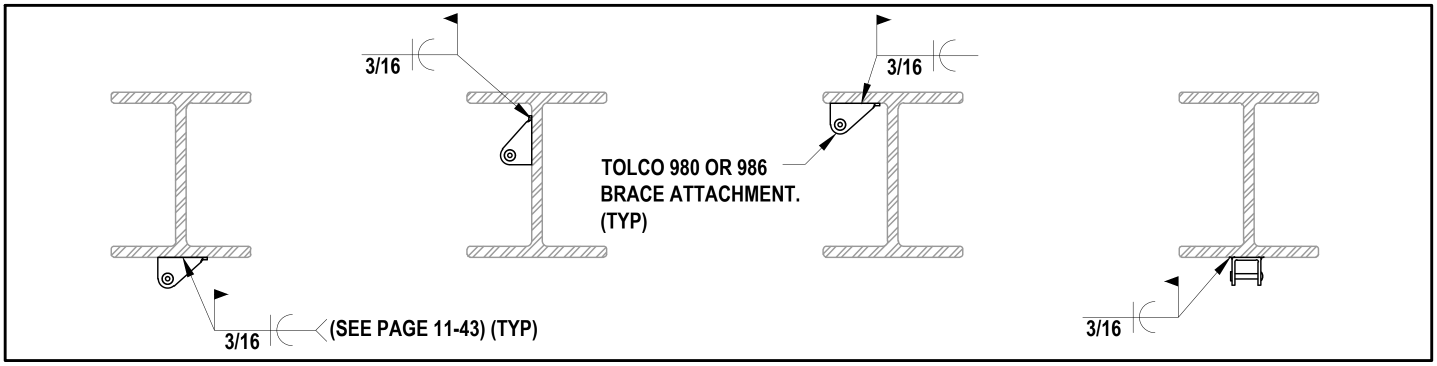
MH



Max. Trapeze Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 0.75 "G"
10	1	40
20	1	40
30	1	40
40	1	40
50	*2	40
60	*2	40
70	*2	40
80	*2	40
90	*2	36
100	*2	32
125	*2	26
150	*2	21
175	*2	18
200	*2	16

Max. Trapeze Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 0.75 "G"
10	1	80
20	1	80
30	1	54
40	1	40
50	*2	65
60	*2	54
70	*2	46
80	*2	40
90	*2	36
100	*2	32
125	*2	26
150	*2	21
175	*2	18
200	*2	16

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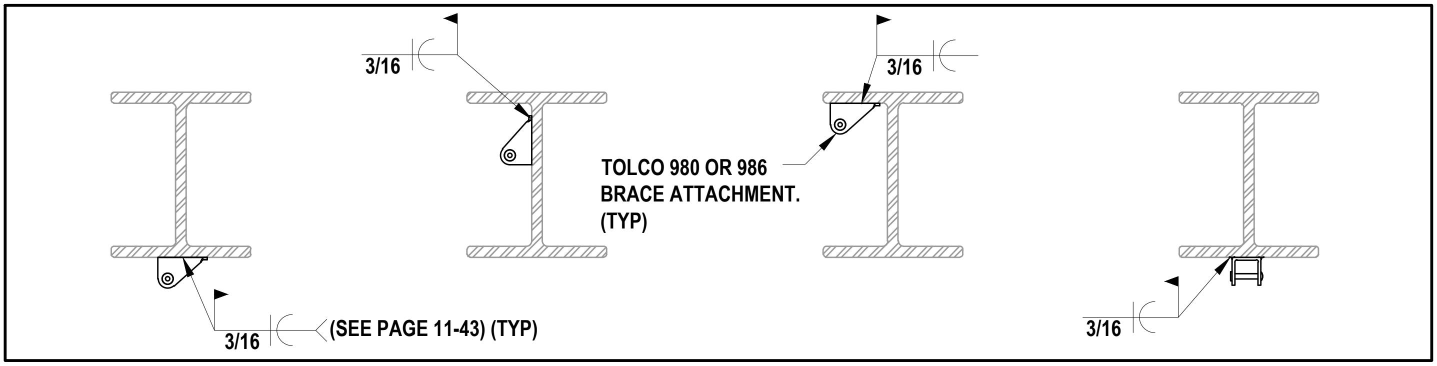
1.0 "G"



Max. Trapeze Weight Per Foot	Brace Qty.	Transverse Max. Spacing @ 1.0 "G"
10	1	40
20	1	40
30	1	40
40	1	30
50	*2	40
60	*2	40
70	*2	34
80	*2	30
90	*2	27
100	*2	24
125	*2	19
150	*2	16
175	*2	13
200	*2	12

Max. Trapeze Weight Per Foot	Brace Qty.	Longitudinal Max. Spacing @ 1.0 "G"
10	1	80
20	1	61
30	1	40
40	1	30
50	*2	48
60	*2	40
70	*2	34
80	*2	30
90	*2	27
100	*2	24
125	*2	19
150	*2	16
175	*2	13
200	*2	12

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10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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California SE No. S3545

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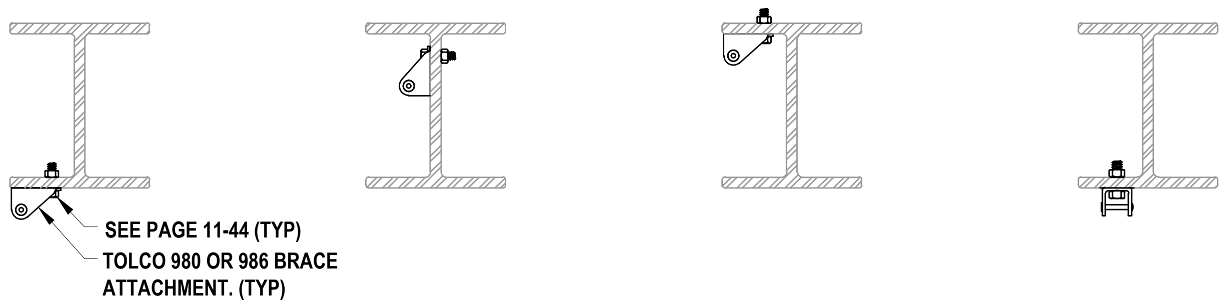
MH

TRAPEZE BRACE SPACING CHART FOR BOLTED ATTACHMENT TO STEEL BEAM

0.50 "G"



Max. Trapeze Weight Per Foot	Bolt Dia.	Brace Qty.	Transverse Max. Spacing @ 0.50 "G"
10	3/8"	1	40
20	3/8"	1	40
30	1/2"	1	40
40	1/2"	1	40
50	5/8"	1	40
60	5/8"	1	40
70	3/4"	1	37
80	3/4"	*2	40
90	3/4"	*2	40
100	3/4"	*2	40
125	3/4"	*2	40
150	3/4"	*2	35
175	3/4"	*2	30
200	3/4"	*2	26

Max. Trapeze Weight Per Foot	Bolt Dia.	Brace Qty.	Longitudinal Max. Spacing @ 0.50 "G"
10	3/8"	2	80
20	3/8"	2	80
30	1/2"	2	80
40	1/2"	2	80
50	1/2"	2	64
60	5/8"	2	80
70	3/4"	2	75
80	3/4"	*4	80
90	3/4"	*4	80
100	3/4"	*4	80
125	3/4"	*4	80
150	3/4"	*4	70
175	3/4"	*4	60
200	3/4"	*4	52

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
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TRAPEZE BRACE SPACING CHART FOR BOLTED ATTACHMENT TO STEEL BEAM

0.75 "G"

Max. Trapeze Weight Per Foot	Bolt Dia.	Brace Qty.	Transverse Max. Spacing @ 0.75 "G"
10	3/8"	1	40
20	3/8"	1	33
30	1/2"	1	35
40	1/2"	*2	40
50	1/2"	*2	40
60	5/8"	*2	40
70	5/8"	*2	40
80	5/8"	*2	40
90	3/4"	*2	39
100	3/4"	*2	35
125	3/4"	*2	28
150	3/4"	*2	23
175	3/4"	*2	20
200	3/4"	*2	17

Max. Trapeze Weight Per Foot	Bolt Dia.	Brace Qty.	Longitudinal Max. Spacing @ 0.75 "G"
10	3/8"	2	80
20	3/8"	2	66
30	1/2"	2	71
40	1/2"	*4	80
50	1/2"	*4	80
60	5/8"	*4	80
70	5/8"	*4	80
80	5/8"	*4	80
90	3/4"	*4	78
100	3/4"	*4	70
125	3/4"	*4	56
150	3/4"	*4	47
175	3/4"	*4	40
200	3/4"	*4	35

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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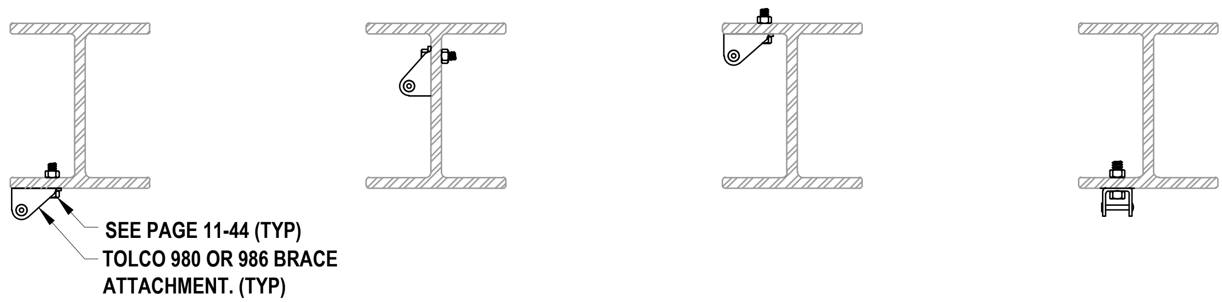
TRAPEZE BRACE SPACING CHART FOR BOLTED ATTACHMENT TO STEEL BEAM



Max. Trapeze Weight Per Foot	Bolt Dia.	Brace Qty.	Transverse Max. Spacing @ 1.0 "G"
10	3/8"	1	40
20	3/8"	1	25
30	1/2"	1	26
40	5/8"	*2	40
50	5/8"	*2	40
60	5/8"	*2	40
70	3/4"	*2	37
80	3/4"	*2	33
90	3/4"	*2	29
100	3/4"	*2	26
125	3/4"	*2	21
150	3/4"	*2	17
175	3/4"	*2	15
200	3/4"	*2	13

Max. Trapeze Weight Per Foot	Bolt Dia.	Brace Qty.	Longitudinal Max. Spacing @ 1.0 "G"
10	3/8"	2	80
20	3/8"	2	50
30	1/2"	2	53
40	1/2"	2	40
50	1/2"	*4	64
60	5/8"	*4	80
70	3/4"	*4	75
80	3/4"	*4	66
90	3/4"	*4	58
100	3/4"	*4	52
125	3/4"	*4	42
150	3/4"	*4	35
175	3/4"	*4	30
200	3/4"	*4	26

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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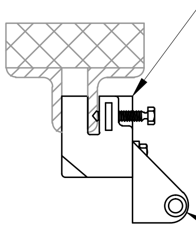
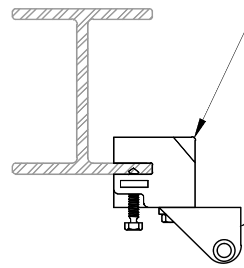
TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL TRUSS OR STEEL BEAM	0.50 "G"





Max. Trapeze Weight Per Foot	Brace Qty.	Transverse Max Spacing @ 0.50 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	1	40	40
20	1	40	40
30	1	40	30
40	1	40	23
50	1	39	18
60	1	33	15
70	1	28	13
80	*2	40	23
90	*2	40	20
100	*2	39	18
125	*2	31	14
150	*2	26	12
175	*2	22	10
200	*2	19	9

Max. Trapeze Weight Per Foot	Brace Qty.	Longitudinal Max Spacing @ 0.50 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	2	80	80
20	2	80	80
30	2	80	61
40	2	80	46
50	2	79	36
60	2	66	30
70	2	56	26
80	*4	80	46
90	*4	80	40
100	*4	79	36
125	*4	63	29
150	*4	52	24
175	*4	45	21
200	*4	39	18

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
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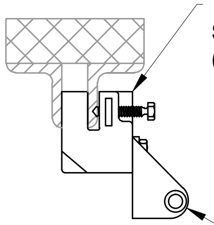
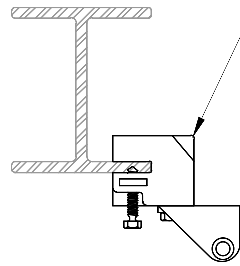
MH

TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL TRUSS OR STEEL BEAM

0.75 "G"





Max. Trapeze Weight Per Foot	Brace Qty.	Transverse Max Spacing @ 0.75 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	1	40	40
20	1	40	30
30	1	40	40
40	1	33	30
50	*2	40	24
60	*2	40	20
70	*2	37	17
80	*2	33	15
90	*2	29	13
100	*2	26	12
125	*2	21	9
150	*2	17	8
175	*2	15	7
200	*2	13	6

Max. Trapeze Weight Per Foot	Brace Qty.	Longitudinal Max Spacing @ 0.75 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	2	80	80
20	2	80	61
30	2	80	80
40	2	66	61
50	*4	80	49
60	*4	80	40
70	*4	75	35
80	*4	66	30
90	*4	58	27
100	*4	52	24
125	*4	42	19
150	*4	35	16
175	*4	30	14
200	*4	26	12

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, BRAZED COPPER, OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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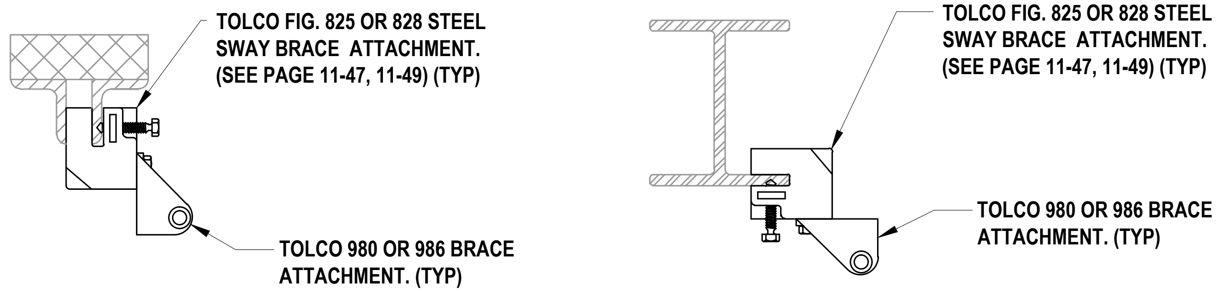
TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL TRUSS OR STEEL BEAM

1.0 "G"



Max. Trapeze Weight Per Foot	Brace Qty.	Transverse Max Spacing @ 1.0 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	1	40	40
20	1	40	23
30	1	33	15
40	1	24	11
50	*2	39	18
60	*2	33	15
70	*2	28	13
80	*2	24	11
90	*2	22	10
100	*2	19	9
125	*2	15	7
150	*2	13	6
175	*2	11	5
200	*2	9	4

Max. Trapeze Weight Per Foot	Brace Qty.	Longitudinal Max Spacing @ 1.0 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	2	80	80
20	2	80	46
30	2	66	30
40	2	49	23
50	*4	79	36
60	*4	66	30
70	*4	56	26
80	*4	49	23
90	*4	44	20
100	*4	39	18
125	*4	31	14
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175	*4	22	10
200	*4	19	9

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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
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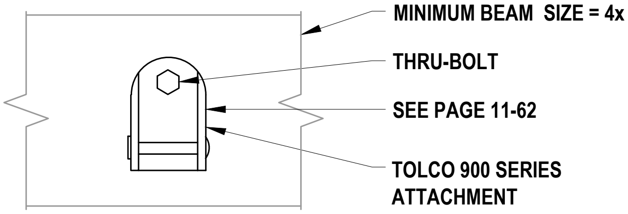
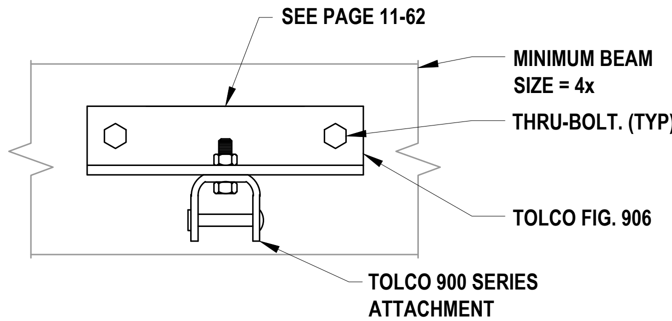
TRAPEZE BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.50 "G"





Max. Trapeze Weight Per Foot	Transverse Max Spacing @ 0.50 "G"	Thru-Bolts Brace Qty.	Thru-Bolts Bolt Qty.	Thru-Bolts Min. Diameter
10	40	1	1	1/2"
20	40	1	1	3/4"
30	40	1	2	(2) 1/2"
40	40	1	2	(2) 3/4"
50	40	*2	2	(2) 1/2"
60	40	*2	2	(2) 1/2"
70	40	*2	2	(2) 5/8"
80	40	*2	2	(2) 3/4"
90	35	*2	2	(2) 3/4"
100	32	*2	2	(2) 3/4"

Max. Trapeze Weight Per Foot	Longitudinal Max Spacing @ 0.50 "G"	Thru-Bolts Brace Qty.	Thru-Bolts Bolt Qty.	Thru-Bolts Min. Diameter
10	80	2	1	1/2"
20	80	2	1	3/4"
30	80	2	2	(2) 1/2"
40	80	2	2	(2) 3/4"
50	80	*4	2	(2) 1/2"
60	80	*4	2	(2) 1/2"
70	80	*4	2	(2) 5/8"
80	80	*4	2	(2) 3/4"
90	71	*4	2	(2) 3/4"
100	64	*4	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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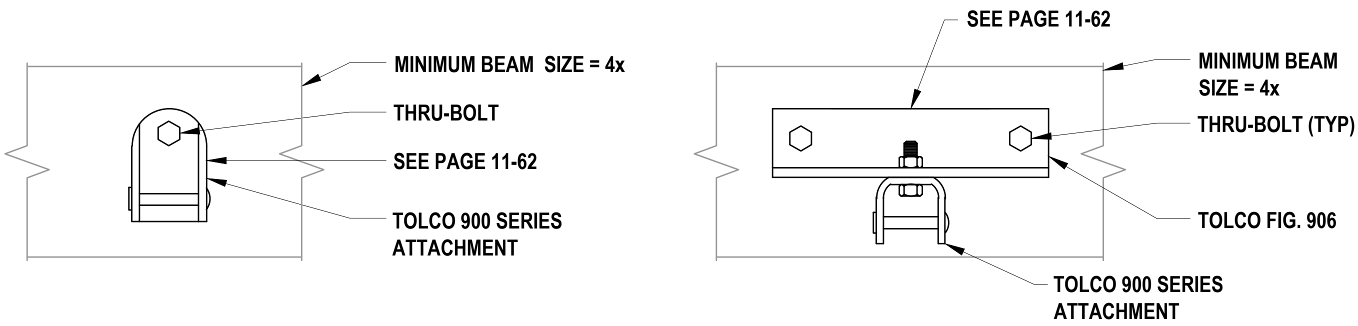
PAGE: 5-25

DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse	Thru-Bolts		
	Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
10	40	1	1	3/4"
20	40	1	2	(2) 1/2"
30	40	*2	2	(2) 1/2"
40	40	*2	2	(2) 1/2"
50	40	*2	2	(2) 3/4"
60	35	*2	2	(2) 3/4"
70	30	*2	2	(2) 3/4"
80	26	*2	2	(2) 3/4"
90	23	*2	2	(2) 3/4"
100	21	*2	2	(2) 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Thru-Bolts		
	Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
10	80	2	1	3/4"
20	80	2	2	(2) 1/2"
30	80	*4	2	(2) 1/2"
40	80	*4	2	(2) 1/2"
50	80	*4	2	(2) 3/4"
60	71	*4	2	(2) 3/4"
70	61	*4	2	(2) 3/4"
80	53	*4	2	(2) 3/4"
90	47	*4	2	(2) 3/4"
100	42	*4	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
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8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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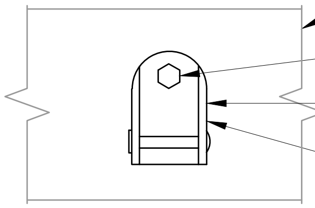
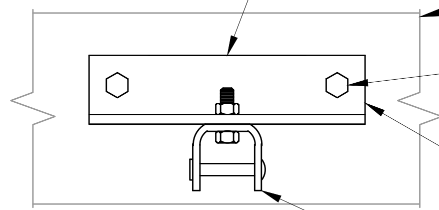
TRAPEZE BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD





Max. Trapeze Weight Per Foot	Transverse	Thru-Bolts		
	Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
10	40	1	1	3/4"
20	40	1	2	(2) 3/4"
30	40	*2	2	(2) 1/2"
40	40	*2	2	(2) 3/4"
50	32	*2	2	(2) 3/4"
60	26	*2	2	(2) 3/4"
70	22	*2	2	(2) 3/4"
80	20	*2	2	(2) 3/4"
90	17	*2	2	(2) 3/4"
100	16	*2	2	(2) 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Thru-Bolts		
	Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
10	80	2	1	3/4"
20	80	2	2	(2) 3/4"
30	80	*4	2	(2) 1/2"
40	80	*4	2	(2) 3/4"
50	64	*4	2	(2) 3/4"
60	53	*4	2	(2) 3/4"
70	45	*4	2	(2) 3/4"
80	40	*4	2	(2) 3/4"
90	35	*4	2	(2) 3/4"
100	32	*4	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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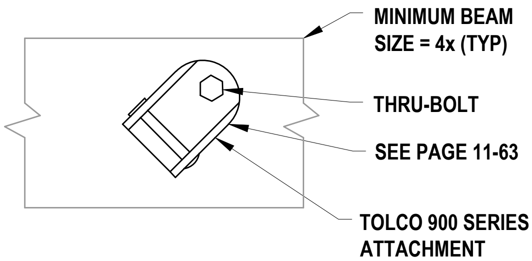
California SE No. S3545

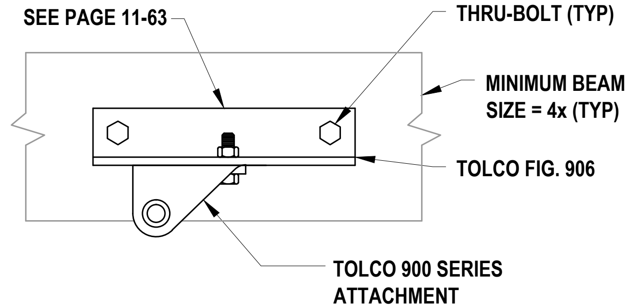
DATE:
NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.50 "G"





Max. Trapeze Weight Per Foot	Transverse	Thru-Bolts		
	Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
10	40	1	1	1/2"
20	40	1	2	(2) 1/2"
30	40	1	2	(2) 3/4"
40	40	*2	2	(2) 1/2"
50	40	*2	2	(2) 5/8"
60	40	*2	2	(2) 3/4"
70	34	*2	2	(2) 3/4"
80	30	*2	2	(2) 3/4"
90	26	*2	2	(2) 3/4"
100	24	*2	2	(2) 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Thru-Bolts		
	Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
10	80	2	1	1/2"
20	80	2	2	(2) 1/2"
30	80	2	2	(2) 3/4"
40	80	*4	2	(2) 1/2"
50	80	*4	2	(2) 5/8"
60	80	*4	2	(2) 3/4"
70	68	*4	2	(2) 3/4"
80	60	*4	2	(2) 3/4"
90	53	*4	2	(2) 3/4"
100	48	*4	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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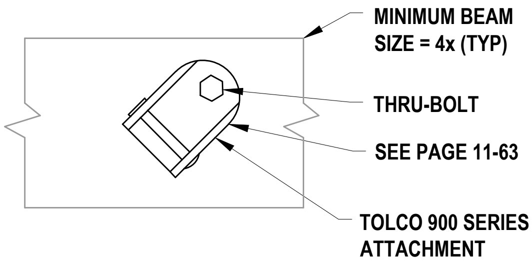
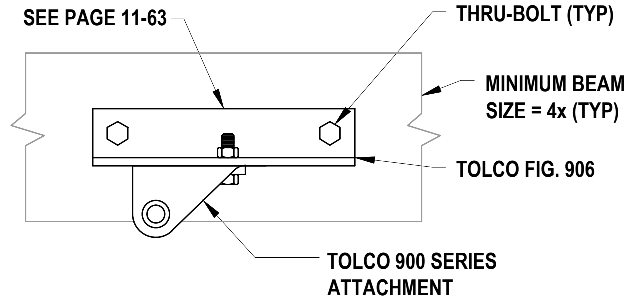
TRAPEZE BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.75 "G"





Max. Trapeze Weight Per Foot	Transverse	Thru-Bolts		
	Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
10	40	1	2	(2) 1/2"
20	40	*2	2	(2) 1/2"
30	40	*2	2	(2) 3/4"
40	40	*2	2	(2) 3/4"
50	32	*2	2	(2) 3/4"
60	26	*2	2	(2) 3/4"
70	22	*2	2	(2) 3/4"
80	20	*2	2	(2) 3/4"
90	17	*2	2	(2) 3/4"
100	16	*2	2	(2) 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Thru-Bolts		
	Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
10	80	2	2	(2) 1/2"
20	80	*4	2	(2) 1/2"
30	80	*4	2	(2) 3/4"
40	80	*4	2	(2) 3/4"
50	64	*4	2	(2) 3/4"
60	53	*4	2	(2) 3/4"
70	45	*4	2	(2) 3/4"
80	40	*4	2	(2) 3/4"
90	35	*4	2	(2) 3/4"
100	32	*4	2	(2) 3/4"

NOTES:

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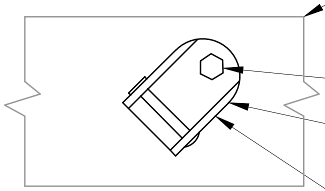
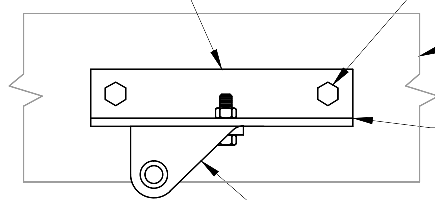
TRAPEZE BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

1.0 "G"





Max. Trapeze Weight Per Foot	Transverse	Thru-Bolts		
	Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
10	40	1	2	(2) 1/2"
20	40	*2	2	(2) 1/2"
30	40	*2	2	(2) 3/4"
40	30	*2	2	(2) 3/4"
50	24	*2	2	(2) 3/4"
60	20	*2	2	(2) 3/4"
70	17	*2	2	(2) 3/4"
80	15	*2	2	(2) 3/4"
90	13	*2	2	(2) 3/4"
100	12	*2	2	(2) 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Thru-Bolts		
	Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter
10	80	2	2	(2) 1/2"
20	80	*4	2	(2) 1/2"
30	80	*4	2	(2) 3/4"
40	60	*4	2	(2) 3/4"
50	48	*4	2	(2) 3/4"
60	40	*4	2	(2) 3/4"
70	34	*4	2	(2) 3/4"
80	30	*4	2	(2) 3/4"
90	26	*4	2	(2) 3/4"
100	24	*4	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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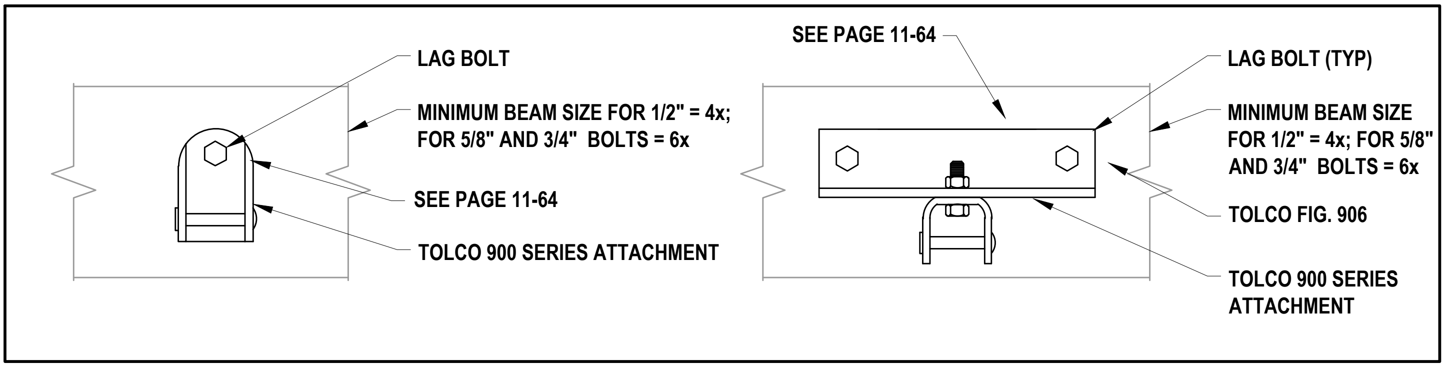
TRAPEZE BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse	Lag Bolts			
	Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	20	1	1	5/8"	4"
20	17	1	2	(2) 5/8"	4"
30	21	1	2	(2) 3/4"	5"
40	17	*2	2	(2) 5/8"	4"
50	26	*2	2	(2) 3/4"	5"
60	21	*2	2	(2) 3/4"	5"
70	18	*2	2	(2) 3/4"	5"
80	16	*2	2	(2) 3/4"	5"
90	14	*2	2	(2) 3/4"	5"
100	13	*2	2	(2) 3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	40	2	1	5/8"	4"
20	34	2	2	(2) 5/8"	4"
30	43	2	2	(2) 3/4"	5"
40	34	*4	2	(2) 5/8"	4"
50	52	*4	2	(2) 3/4"	5"
60	43	*4	2	(2) 3/4"	5"
70	37	*4	2	(2) 3/4"	5"
80	32	*4	2	(2) 3/4"	5"
90	29	*4	2	(2) 3/4"	5"
100	26	*4	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.

2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).

3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.

4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.

5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.

6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.

7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.

8.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.

9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.

10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

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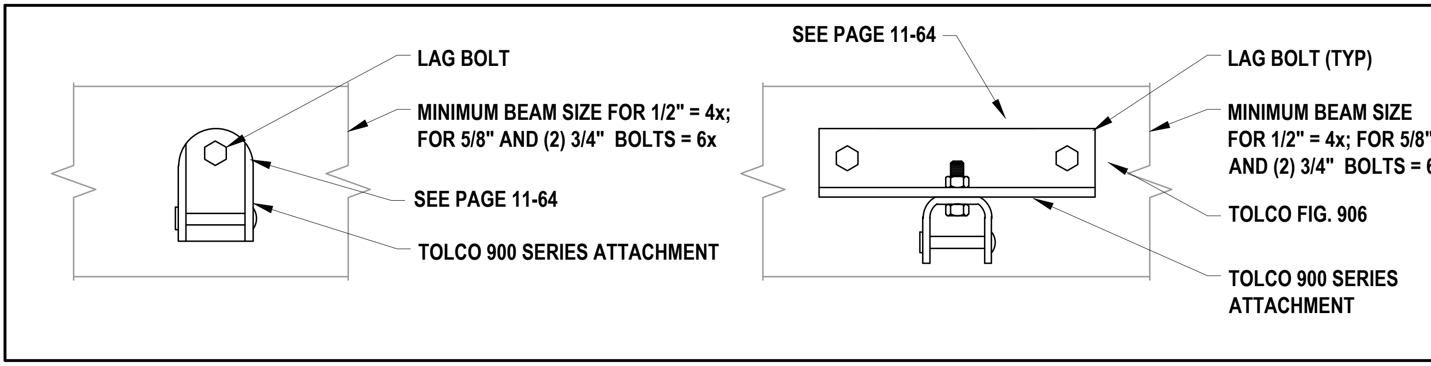
DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse	Lag Bolts			
	Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	40	1	2	(2) 3/4"	5"
20	40	*2	2	(2) 3/4"	5"
30	29	*2	2	(2) 3/4"	5"
40	21	*2	2	(2) 3/4"	5"
50	17	*2	2	(2) 3/4"	5"
60	14	*2	2	(2) 3/4"	5"
70	12	*2	2	(2) 3/4"	5"
80	10	*2	2	(2) 3/4"	5"
90	9	*2	2	(2) 3/4"	5"
100	8	*2	2	(2) 3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	80	2	2	(2) 3/4"	5"
20	80	*4	2	(2) 3/4"	5"
30	58	*4	2	(2) 3/4"	5"
40	43	*4	2	(2) 3/4"	5"
50	34	*4	2	(2) 3/4"	5"
60	29	*4	2	(2) 3/4"	5"
70	24	*4	2	(2) 3/4"	5"
80	21	*4	2	(2) 3/4"	5"
90	19	*4	2	(2) 3/4"	5"
100	17	*4	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
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7.) THE ADEQUACY OF OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, IF NOT INCLUDED IN THIS OPM, ARE TO BE VERIFIED BY THE RESPONSIBLE DESIGN PROFESSIONAL.
8.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
9.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
10.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

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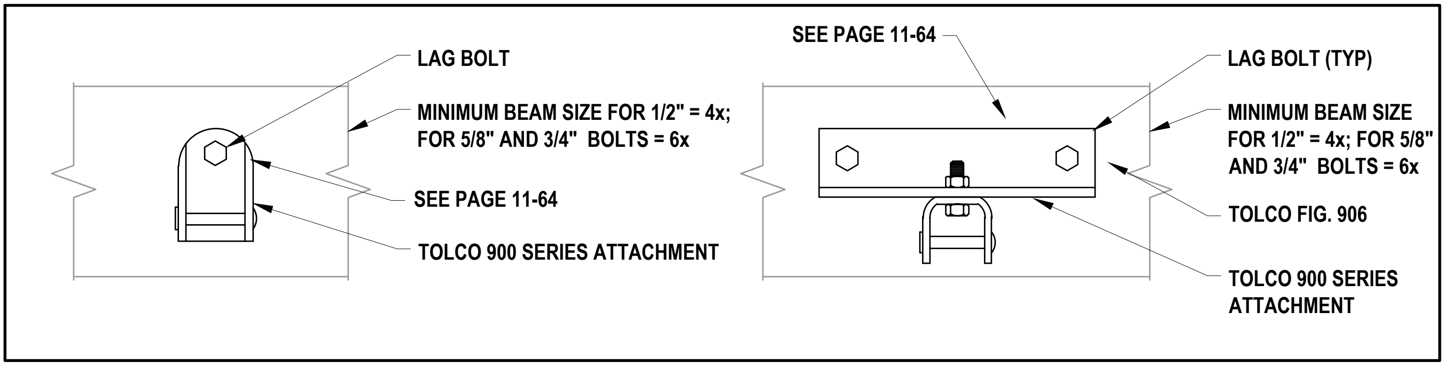

Max. Trapeze Weight Per Foot	Transverse	Lag Bolts			
	Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	17	1	2	(2) 5/8"	4"
20	17	*2	2	(2) 5/8"	4"
30	21	*2	2	(2) 3/4"	5"
40	16	*2	2	(2) 3/4"	5"
50	13	*2	2	(2) 3/4"	5"
60	10	*2	2	(2) 3/4"	5"
70	9	*2	2	(2) 3/4"	5"
80	8	*2	2	(2) 3/4"	5"
90	7	*2	2	(2) 3/4"	5"
100	6	*2	2	(2) 3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	34	2	2	(2) 5/8"	4"
20	34	*4	2	(2) 5/8"	4"
30	43	*4	2	(2) 3/4"	5"
40	32	*4	2	(2) 3/4"	5"
50	26	*4	2	(2) 3/4"	5"
60	21	*4	2	(2) 3/4"	5"
70	18	*4	2	(2) 3/4"	5"
80	16	*4	2	(2) 3/4"	5"
90	14	*4	2	(2) 3/4"	5"
100	13	*4	2	(2) 3/4"	5"

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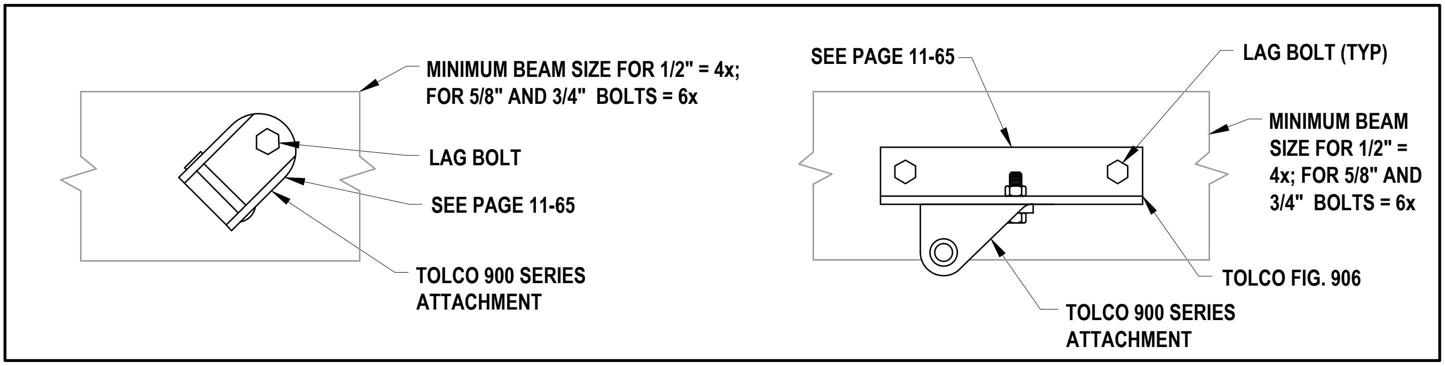
TRAPEZE BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse	Lag Bolts			
	Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	38	1	1	3/4"	5"
20	22	1	2	(2) 3/4"	5"
30	14	1	2	(2) 3/4"	5"
40	22	*2	2	(2) 3/4"	5"
50	17	*2	2	(2) 3/4"	5"
60	14	*2	2	(2) 3/4"	5"
70	12	*2	2	(2) 3/4"	5"
80	11	*2	2	(2) 3/4"	5"
90	9	*2	2	(2) 3/4"	5"
100	8	*2	2	(2) 3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 0.50 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	34	2	1	1/2"	3"
20	17	2	1	1/2"	3"
30	17	2	1	5/8"	4"
40	38	*4	1	3/4"	5"
50	31	*4	1	3/4"	5"
60	29	*4	2	(2) 3/4"	5"
70	25	*4	2	(2) 3/4"	5"
80	22	*4	2	(2) 3/4"	5"
90	19	*4	2	(2) 3/4"	5"
100	17	*4	2	(2) 3/4"	5"

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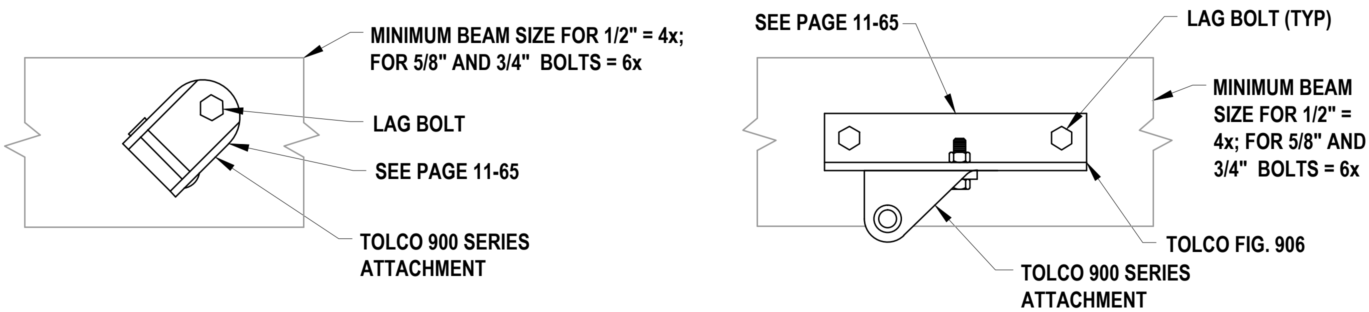
TRAPEZE BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse	Lag Bolts			
	Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	40	*2	2	3/4"	5"
20	22	*2	2	3/4"	5"
30	14	*2	2	3/4"	5"
40	11	*2	2	3/4"	5"
50	8	*2	2	3/4"	5"
60	7	*2	2	3/4"	5"
70	6	*2	2	3/4"	5"
80	5	*2	2	3/4"	5"
90	4	*2	2	3/4"	5"
100	4	*2	2	3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 0.75 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	80	*4	2	(2) 3/4"	5"
20	44	*4	2	(2) 3/4"	5"
30	29	*4	2	(2) 3/4"	5"
40	22	*4	2	(2) 3/4"	5"
50	17	*4	2	(2) 3/4"	5"
60	14	*4	2	(2) 3/4"	5"
70	12	*4	2	(2) 3/4"	5"
80	11	*4	2	(2) 3/4"	5"
90	9	*4	2	(2) 3/4"	5"
100	8	*4	2	(2) 3/4"	5"

NOTES:

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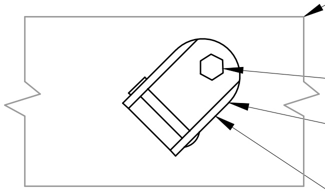

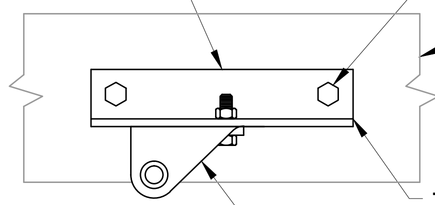

Max. Trapeze Weight Per Foot	Transverse	Lag Bolts			
	Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	22	1	2	(2) 3/4"	5"
20	22	*2	2	(2) 3/4"	5"
30	14	*2	2	(2) 3/4"	5"
40	11	*2	2	(2) 3/4"	5"
50	8	*2	2	(2) 3/4"	5"
60	7	*2	2	(2) 3/4"	5"
70	6	*2	2	(2) 3/4"	5"
80	5	*2	2	(2) 3/4"	5"
90	4	*2	2	(2) 3/4"	5"
100	4	*2	2	(2) 3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 1.0 "G"	Brace Qty.	Bolt Qty.	Min. Diameter	Min. Length
10	44	2	2	(2) 3/4"	5"
20	44	*4	2	(2) 3/4"	5"
30	29	*4	2	(2) 3/4"	5"
40	22	*4	2	(2) 3/4"	5"
50	17	*4	2	(2) 3/4"	5"
60	14	*4	2	(2) 3/4"	5"
70	12	*4	2	(2) 3/4"	5"
80	11	*4	2	(2) 3/4"	5"
90	9	*4	2	(2) 3/4"	5"
100	8	*4	2	(2) 3/4"	5"

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SECTION 6

SINGLE HANGER CABLE BRACE DETAILS

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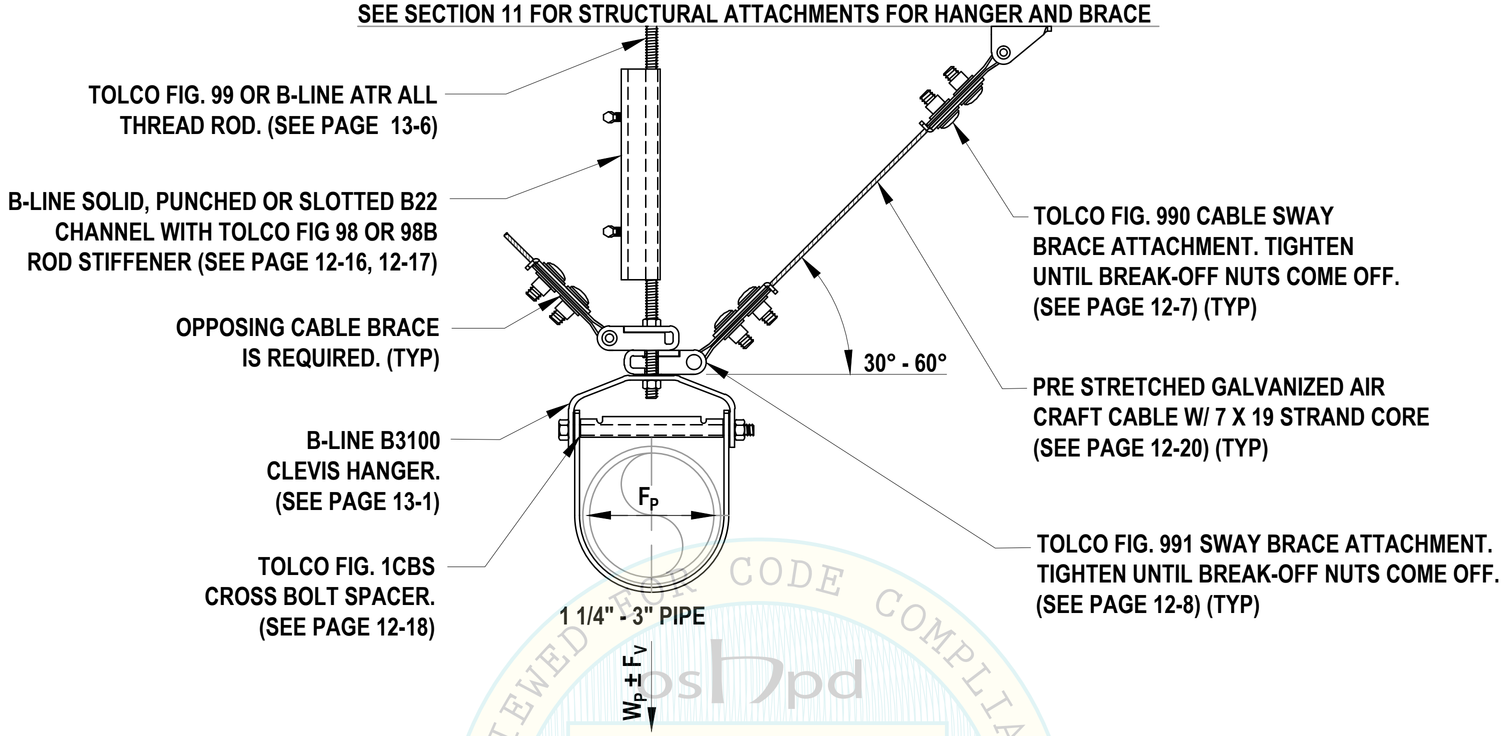
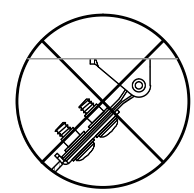
TRANSVERSE CABLE BRACING FOR SINGLE HUNG PIPE OR CONDUIT WITH CLEVIS HANGER

DETAIL 11

SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE



PIPE DIAMETER	MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
			30°	31° - 45°	46° - 60°
1 1/4" - 2"	3/8"	1/8"	93	97	96
2 1/2" - 3"	1/2"	1/8"	111	109	107



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) THIN WALL PIPING - REDUCE LOADS BY 0%
   b.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%

2.) PIPES WITH INSULATION SHALL NOT BE USED.

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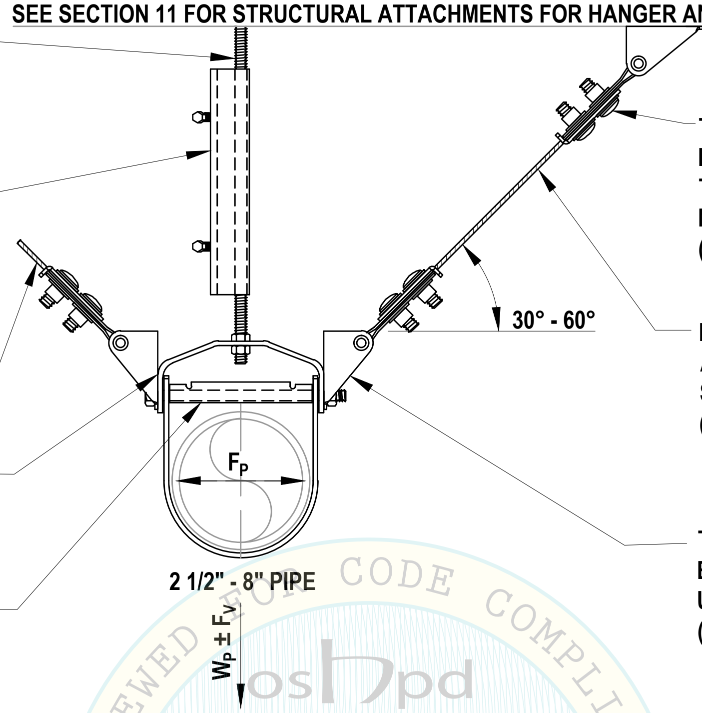
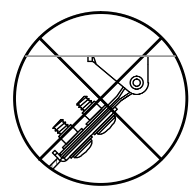
TRANSVERSE CABLE BRACING FOR SINGLE HUNG PIPE OR CONDUIT WITH CLEVIS HANGER

DETAIL 11A

SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE



PIPE DIAMETER	MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
			30°	31° - 45°	46° - 60°
2 1/2" - 3 1/2"	1/2"	1/8"	129	213	110
4" - 5"	5/8"	3/16"	236	448	292
6" - 8"	3/4"	3/16"	556	593	442



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) THIN WALL PIPING - REDUCE LOADS BY 0%
   b.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%

2.) PIPES WITH INSULATION SHALL NOT BE USED.

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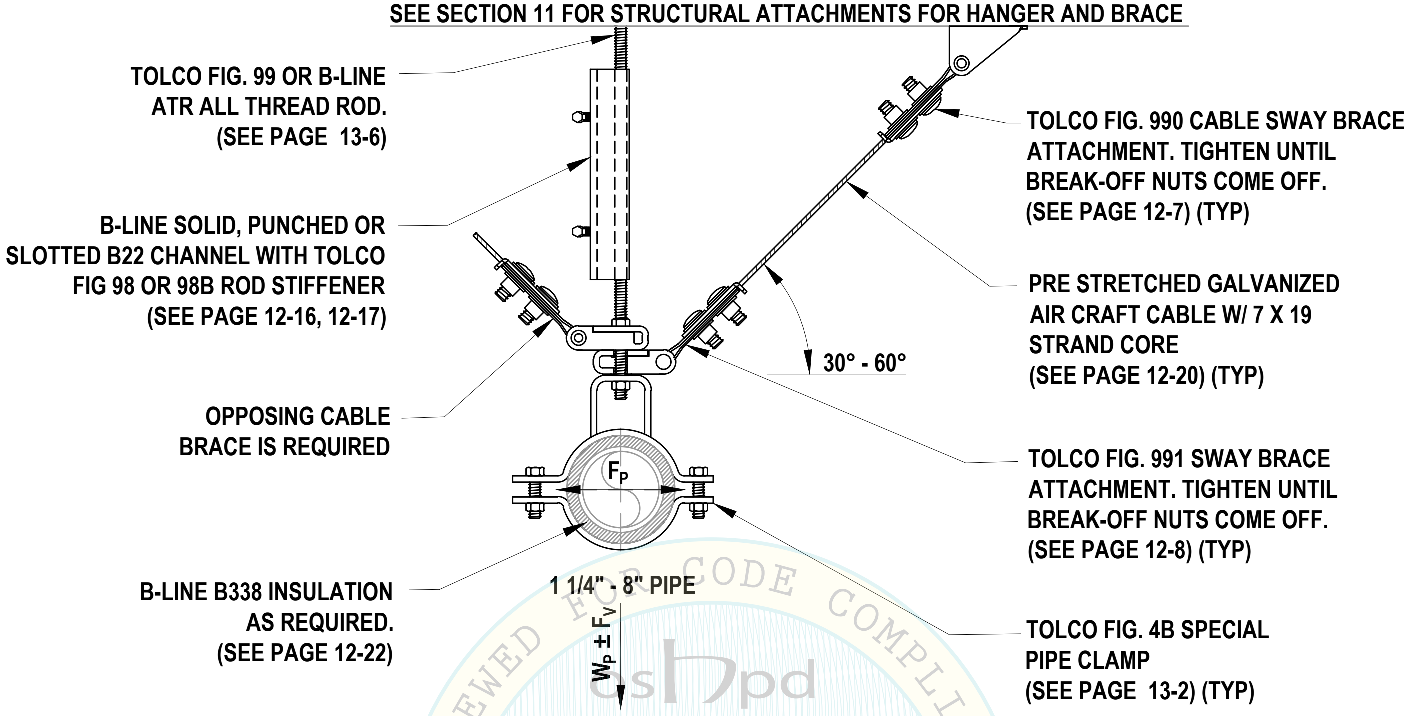
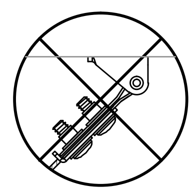
TRANSVERSE CABLE BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH PIPE CLAMP

DETAIL
11C



PIPE DIAMETER	MINIMUM ROD SIZE	MINIMUM CABLE SIZE	ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs] 30°	31° - 45°	46° - 60°
1 1/4" - 2"	3/8"	1/8"	272	317	310
2 1/2" - 3 1/2"	1/2"	1/8"	272	317	310
4" - 5"	5/8"	3/16"	582	724	517
6"	3/4"	3/16"	582	724	517
8"	7/8"	3/16"	920	746	636



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 40% FOR 1 1/4"-5" PIPES AND 25% FOR 6"-8" PIPES.
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%

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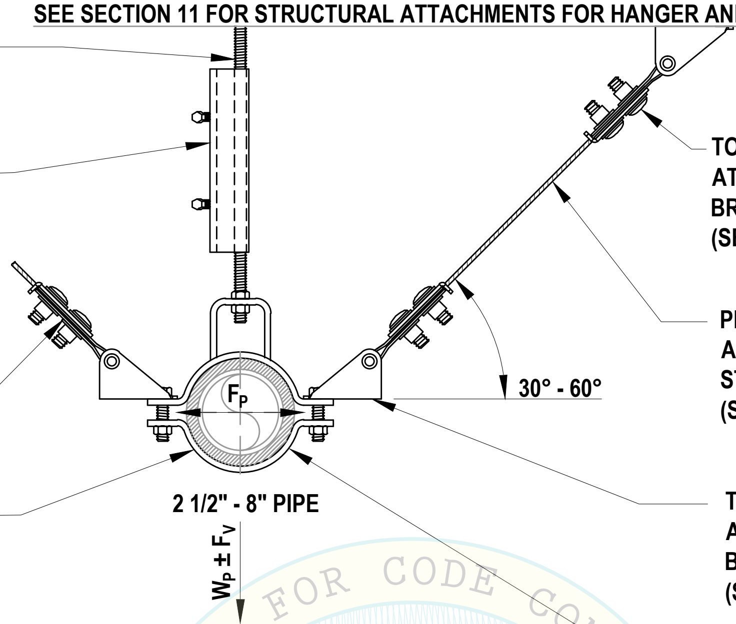
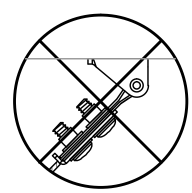
TRANSVERSE CABLE BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH PIPE CLAMP

DETAIL 11D

SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE



PIPE DIAMETER	MINIMUM ROD SIZE	MINIMUM CABLE SIZE	ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
			30°	31° - 45°	46° - 60°
2 1/2" - 3 1/2"	1/2"	1/8"	272	317	310
4" - 5"	5/8"	3/16"	582	724	517
6"	3/4"	3/16"	582	724	517
8"	7/8"	3/16"	920	746	636



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 40% FOR 2 1/2"-5" PIPES AND 25% FOR 6"-8" PIPES.
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%

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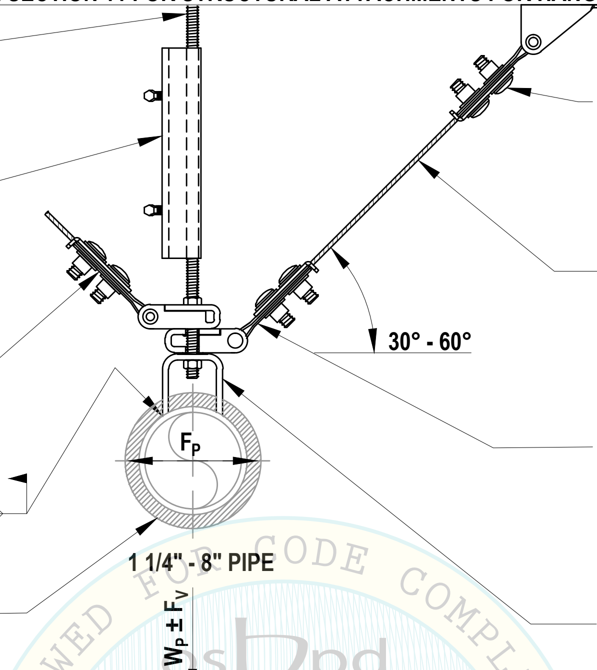
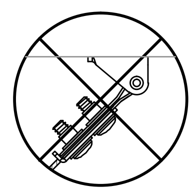
TRANSVERSE CABLE BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH WELDED STEEL ATTACHMENT

DETAIL 11E

SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE



PIPE SIZE	ROD SIZE	MINIMUM CABLE SIZE	ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs] 30°	31° - 45°	46° - 60°
1 1/4" - 2"	3/8"	1/8"	272	317	310
2 1/2"- 3 1/2"	1/2"	1/8"	272	317	310
4"- 5"	5/8"	3/16"	582	724	517
6"	3/4"	3/16"	582	724	517
8"	7/8"	3/16"	920	746	636



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 40 AND BETTER PIPING.
2.) THE TOLCO FIG. 304, TOLCO FIG. 305 AND B-LINE B3083 SHALL NOT BE USED WITH EMT.

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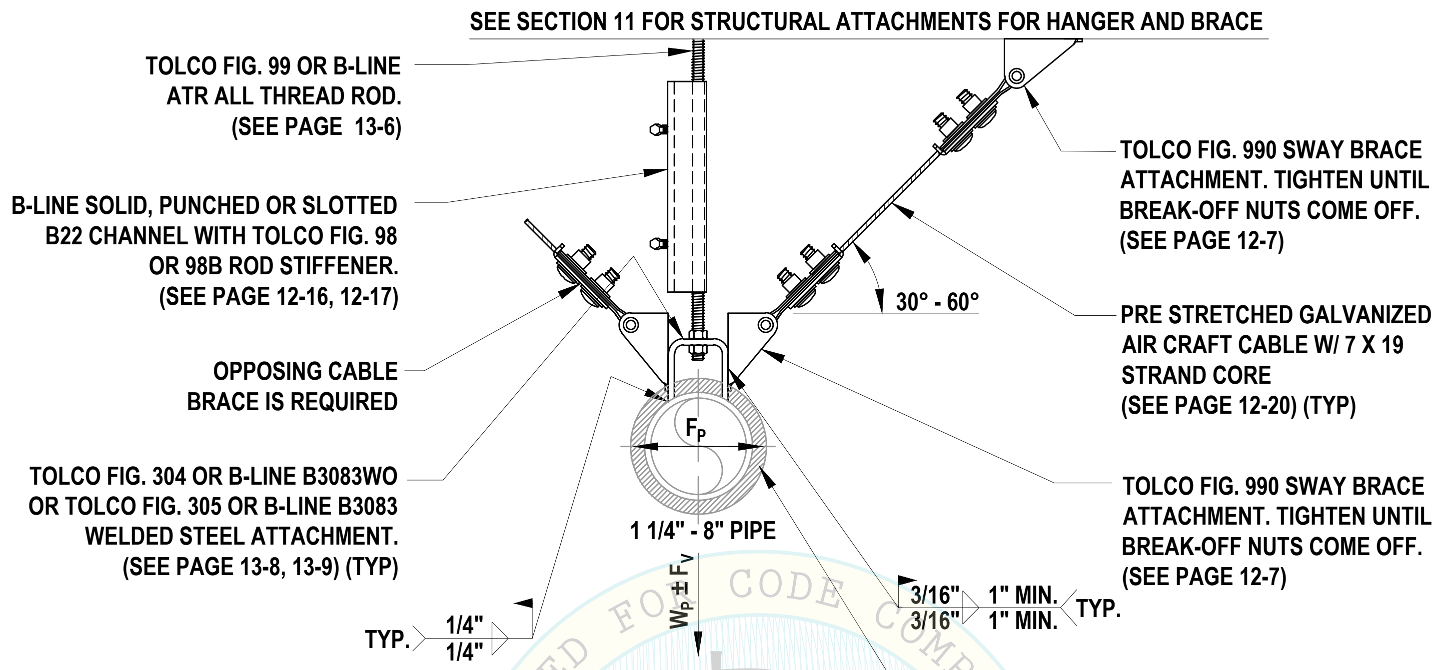
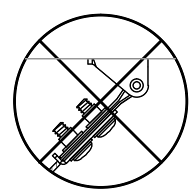
TRANSVERSE CABLE BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH WELDED STEEL ATTACHMENT

DETAIL 11F



PIPE DIAMETER	ROD SIZE	MINIMUM CABLE SIZE	ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
			30°	31° - 45°	46° - 60°
1 1/4"- 2"	3/8"	1/8"	272	317	310
2 1/2"- 3 1/2"	1/2"	1/8"	272	317	310
4"- 5"	5/8"	3/16"	582	724	517
6"	3/4"	3/16"	582	724	517
8"	7/8"	3/16"	920	746	636



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 40 AND BETTER PIPING.
2.) THE TOLCO FIG. 304, TOLCO FIG. 305 AND B-LINE B3083 SHALL NOT BE USED WITH EMT.

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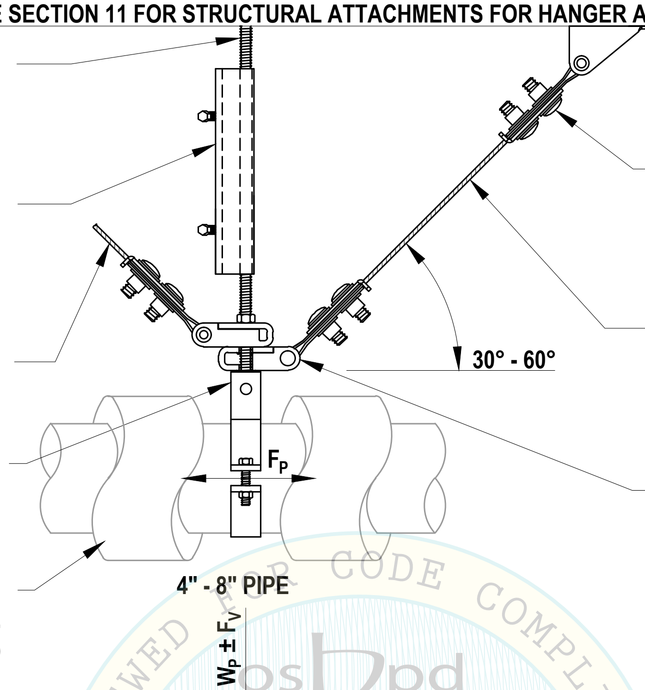
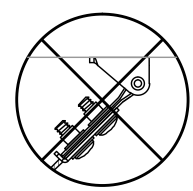
LONGITUDINAL CABLE BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH PIPE CLAMP



PIPE DIAMETER	MINIMUM ROD SIZE	MINIMUM CABLE SIZE	ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
			30°	31° - 45°	46° - 60°
4"	5/8"	3/16"	1113	990	659
5"	5/8"	3/16"	1105	930	595
6"	3/4"	3/16"	1089	930	595
8"	7/8"	3/16"	1089	930	595



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS EXCLUDING EMT - REDUCE LOADS BY 0%

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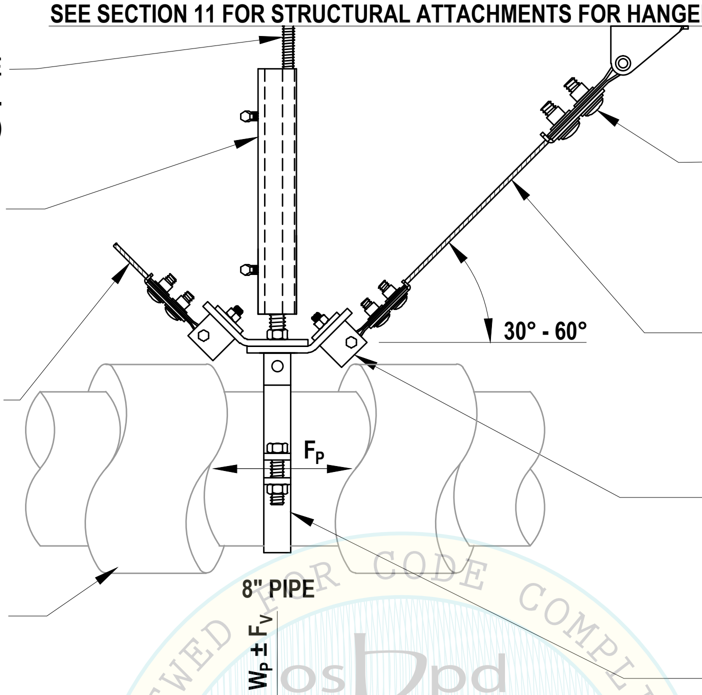
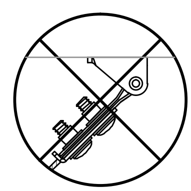
LONGITUDINAL CABLE BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH PIPE CLAMP

DETAIL
12C



PIPE DIAMETER	MINIMUM ROD SIZE	MINIMUM CABLE SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
			30°	31° - 45°	46° - 60°
8"	7/8"	3/16"	1089	930	595



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%

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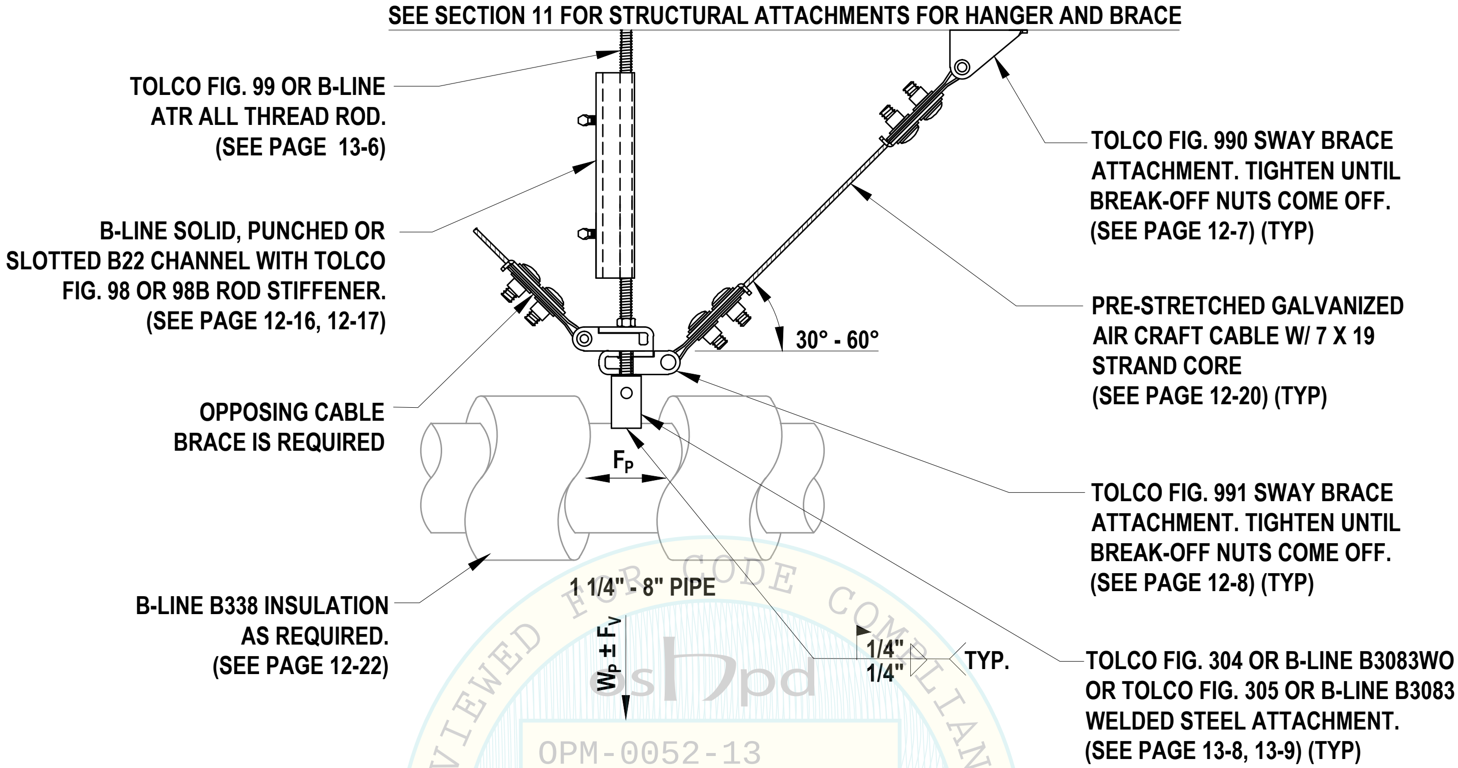
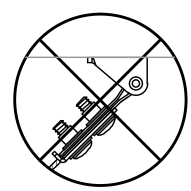
LONGITUDINAL CABLE BRACE FOR SINGLE HUNG PIPE OR CONDUIT WITH WELDED STEEL ATTACHMENT

DETAIL 12D



PIPE DIAMETER	ROD SIZE	MINIMUM CABLE SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
			30°	31° - 45°	46° - 60°
1 1/4"- 2"	3/8"	1/8"	868	865	407
2 1/2"- 3 1/2"	1/2"	1/8"	868	865	407
4"- 5"	5/8"	3/16"	1113	990	659
6"	3/4"	3/16"	1089	930	595
8"	7/8"	3/16"	1089	930	595



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 40 AND BETTER PIPING.
2.) THE TOLCO FIG. 304, TOLCO FIG. 305 AND B-LINE B3083 SHALL NOT BE USED WITH EMT.

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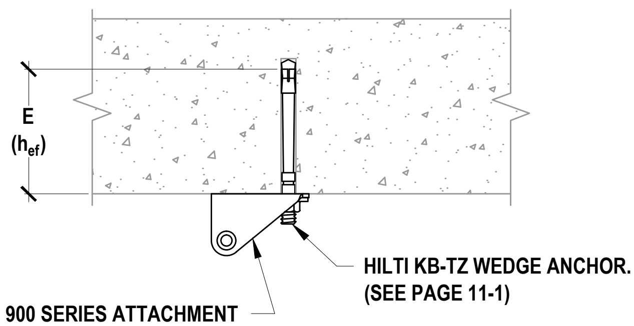
SECTION 7

SINGLE HUNG CABLE BRACE SPACING CHARTS

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.50 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse Max. Spacing @ 0.50 "G"	Cable Diameter	Concrete Anchorage Anchor per Brace	Concrete Anchorage Min. Diameter	Concrete Anchorage Min. Embed "E"
1	2.9	40	3/16"	1	3/8"	2"
1-1/4	3.7	40	3/16"	1	3/8"	2"
1-1/2	4.6	40	3/16"	1	3/8"	2"
2	6.2	40	3/16"	1	3/8"	2"
2-1/2	9.2	40	3/16"	1	3/8"	2"
3	12.2	40	3/16"	1	1/2"	3 1/4"
4	18.1	40	3/16"	1	1/2"	3 1/4"
5	26.6	34	3/16"	1	1/2"	3 1/4"
6	33.8	26	3/16"	1	1/2"	3 1/4"
8	55	22	3/16"	1	5/8"	4"
10	80.1	15	3/16"	1	5/8"	4"
12	109	11	3/16"	1	5/8"	4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal Max. Spacing @ 0.50 "G"	Cable Diameter	Concrete Anchorage Anchor per Brace	Concrete Anchorage Min. Diameter	Concrete Anchorage Min. Embed "E"
1	2.9	80	3/16"	1	3/8"	2"
1-1/4	3.7	80	3/16"	1	3/8"	2"
1-1/2	4.6	80	3/16"	1	3/8"	2"
2	6.2	80	3/16"	1	1/2"	3 1/4"
2-1/2	9.2	80	3/16"	1	1/2"	3 1/4"
3	12.2	74	3/16"	1	1/2"	3 1/4"
4	18.1	50	3/16"	1	1/2"	3 1/4"
5	26.6	47	3/16"	1	5/8"	4"
6	33.8	37	3/16"	1	5/8"	4"
8	55	22	3/16"	1	5/8"	4"
10	80.1	15	3/16"	1	5/8"	4"
12	109	11	3/16"	1	5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
7.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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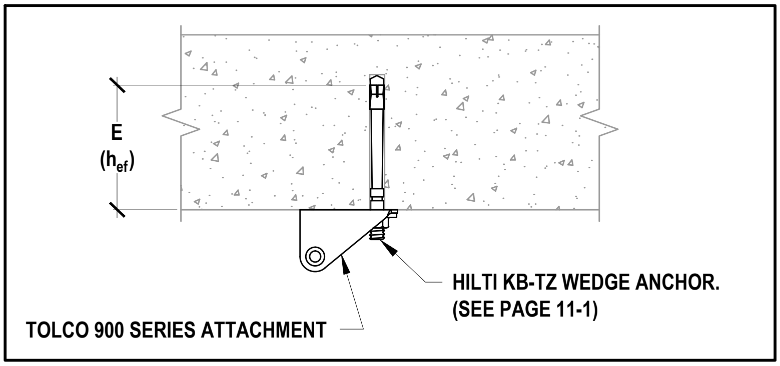
SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Cable Diameter	Concrete Anchorage		
		Max. Spacing @ 0.75 "G"		Anchor per Brace	Min. Diameter	Min. Embed "E"
1	2.9	40	3/16"	1	3/8"	2"
1-1/4	3.7	40	3/16"	1	3/8"	2"
1-1/2	4.6	40	3/16"	1	3/8"	2"
2	6.2	40	3/16"	1	3/8"	2"
2-1/2	9.2	40	3/16"	1	1/2"	3 1/4"
3	12.2	40	3/16"	1	1/2"	3 1/4"
4	18.1	33	3/16"	1	1/2"	3 1/4"
5	26.6	31	3/16"	1	5/8"	4"
6	33.8	24	3/16"	1	5/8"	4"
8	55	15	3/16"	1	5/8"	4"
10	80.1	21	3/16"	1	5/8"	4"
12	109	15	3/16"	1	5/8"	4"

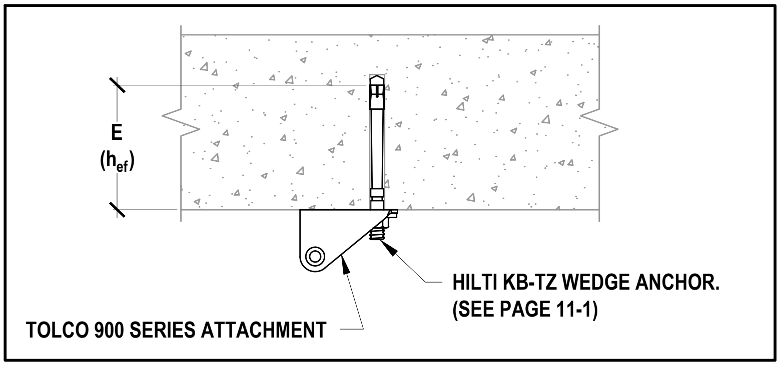
Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Cable Diameter	Concrete Anchorage		
		Max. Spacing @ 0.75 "G"		Anchor per Brace	Min. Diameter	Min. Embed "E"
1	2.9	80	3/16"	1	3/8"	2"
1-1/4	3.7	80	3/16"	1	1/2"	3 1/4"
1-1/2	4.6	80	3/16"	1	1/2"	3 1/4"
2	6.2	80	3/16"	1	1/2"	3 1/4"
2-1/2	9.2	80	3/16"	1	5/8"	4"
3	12.2	68.9	3/16"	1	5/8"	4"
4	18.1	46	3/16"	1	5/8"	4"
5	26.6	31	3/16"	1	5/8"	4"
6	33.8	24	3/16"	1	5/8"	4"
8	55	15	3/16"	1	5/8"	4"
10	80.1	21	3/16"	1	5/8"	4"
12	109	15	3/16"	1	5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
7.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

1.0 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse Max. Spacing @ 1.0 "G"	Cable Diameter	Concrete Anchorage: Anchor per Brace	Concrete Anchorage: Min. Diameter	Concrete Anchorage: Min. Embed "E"
1	2.9	40	3/16"	1	3/8"	2"
1-1/4	3.7	40	3/16"	1	3/8"	2"
1-1/2	4.6	40	3/16"	1	3/8"	2"
2	6.2	40	3/16"	1	1/2"	3 1/4"
2-1/2	9.2	40	3/16"	1	1/2"	3 1/4"
3	12.2	37	3/16"	1	1/2"	3 1/4"
4	18.1	25	3/16"	1	1/2"	3 1/4"
5	26.6	23	3/16"	1	5/8"	4"
6	33.8	18	3/16"	1	5/8"	4"
8	55	11	3/16"	1	5/8"	4"
10	80.1	7	3/16"	1	5/8"	4"
12	109	5	3/16"	1	5/8"	4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal Max. Spacing @ 1.0 "G"	Cable Diameter	Concrete Anchorage: Anchor per Brace	Concrete Anchorage: Min. Diameter	Concrete Anchorage: Min. Embed "E"
1	2.9	80	3/16"	1	1/2"	3 1/4"
1-1/4	3.7	80	3/16"	1	1/2"	3 1/4"
1-1/2	4.6	80	3/16"	1	1/2"	3 1/4"
2	6.2	73	3/16"	1	1/2"	3 1/4"
2-1/2	9.2	49	3/16"	1	1/2"	3 1/4"
3	12.2	51	3/16"	1	5/8"	4"
4	18.1	34	3/16"	1	3/4"	3 3/4"
5	26.6	23	3/16"	1	3/4"	3 3/4"
6	33.8	18	3/16"	1	3/4"	3 3/4"
8	55	11	3/16"	1	3/4"	3 3/4"
10	80.1	7	3/16"	1	3/4"	3 3/4"
12	109	5	3/16"	1	3/4"	3 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
7.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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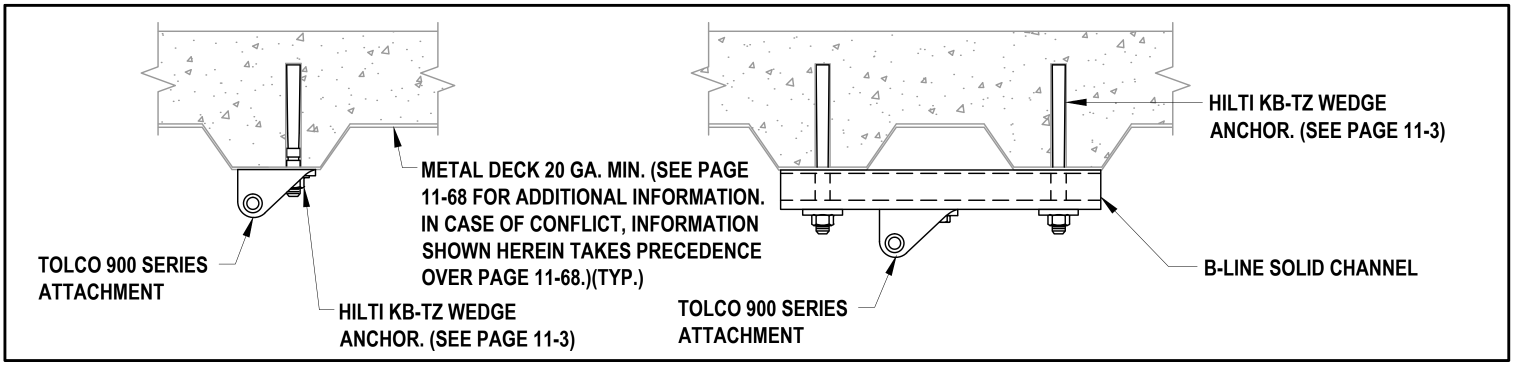
Structural Engineer: Mohammad Hariri
California SE No. S3545

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.50 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 0.50 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	3/16"	1	3/8"	2"
1-1/4	3.7	40	3/16"	1	3/8"	2"
1-1/2	4.6	40	3/16"	1	3/8"	2"
2	6.2	40	3/16"	1	1/2"	3 1/4"
2-1/2	9.2	40	3/16"	1	1/2"	3 1/4"
3	12.2	36	3/16"	1	1/2"	3 1/4"
4	18.1	40	3/16"	2	(2) 1/2"	3 1/4"
5	26.6	38	3/16"	2	(2) 1/2"	3 1/4"
6	33.8	29	3/16"	2	(2) 1/2"	3 1/4"
8	55	18	3/16"	2	(2) 1/2"	3 1/4"
10	80.1	12	3/16"	2	(2) 1/2"	3 1/4"
12	109	9	3/16"	2	(2) 1/2"	3 1/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 0.50 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	66	3/16"	1	3/8"	2"
1-1/4	3.7	52	3/16"	1	3/8"	2"
1-1/2	4.6	42	3/16"	1	3/8"	2"
2	6.2	31	3/16"	1	3/8"	2"
2-1/2	9.2	48	3/16"	1	1/2"	3 1/4"
3	12.2	36	3/16"	1	1/2"	3 1/4"
4	18.1	55	3/16"	2	(2) 1/2"	3 1/4"
5	26.6	38	3/16"	2	(2) 1/2"	3 1/4"
6	33.8	29	3/16"	2	(2) 1/2"	3 1/4"
8	55	18	3/16"	2	(2) 1/2"	3 1/4"
10	80.1	12	3/16"	2	(2) 1/2"	3 1/4"
12	109	9	3/16"	2	(2) 1/2"	3 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

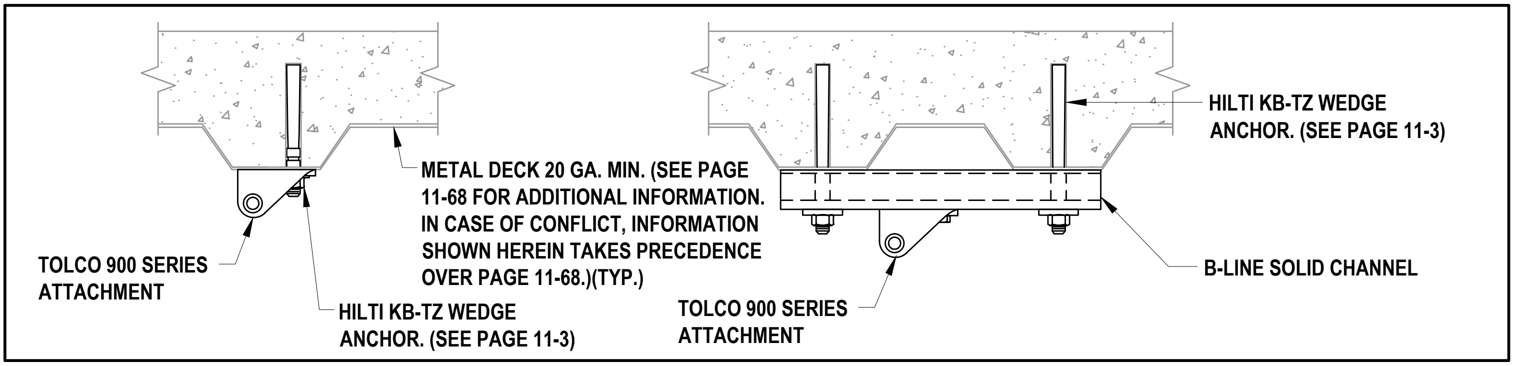
PAGE: 7-4

DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 0.75 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	3/16"	1	3/8"	2"
1-1/4	3.7	35	3/16"	1	3/8"	2"
1-1/2	4.6	28	3/16"	1	3/8"	2"
2	6.2	40	3/16"	1	1/2"	3 1/4"
2-1/2	9.2	32	3/16"	1	1/2"	3 1/4"
3	12.2	24	3/16"	1	1/2"	3 1/4"
4	18.1	37	3/16"	2	(2) 1/2"	3 1/4"
5	26.6	25	3/16"	2	(2) 1/2"	3 1/4"
6	33.8	19	3/16"	2	(2) 1/2"	3 1/4"
8	55	12	3/16"	2	(2) 1/2"	3 1/4"
10	80.1	8	3/16"	2	(2) 1/2"	3 1/4"
12	109	6	3/16"	2	(2) 1/2"	3 1/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 0.75 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	80	3/16"	1	1/2"	3 1/4"
1-1/4	3.7	80	3/16"	1	1/2"	3 1/4"
1-1/2	4.6	64	3/16"	1	1/2"	3 1/4"
2	6.2	48	3/16"	1	1/2"	3 1/4"
2-1/2	9.2	73	3/16"	2	(2) 1/2"	3 1/4"
3	12.2	55	3/16"	2	(2) 1/2"	3 1/4"
4	18.1	37	3/16"	2	(2) 1/2"	3 1/4"
5	26.6	25	3/16"	2	(2) 1/2"	3 1/4"
6	33.8	19	3/16"	2	(2) 1/2"	3 1/4"
8	55	12	3/16"	2	(2) 1/2"	3 1/4"
10	80.1	8	3/16"	2	(2) 1/2"	3 1/4"
12	109	6	3/16"	2	(2) 1/2"	3 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
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6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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California SE No. S3545

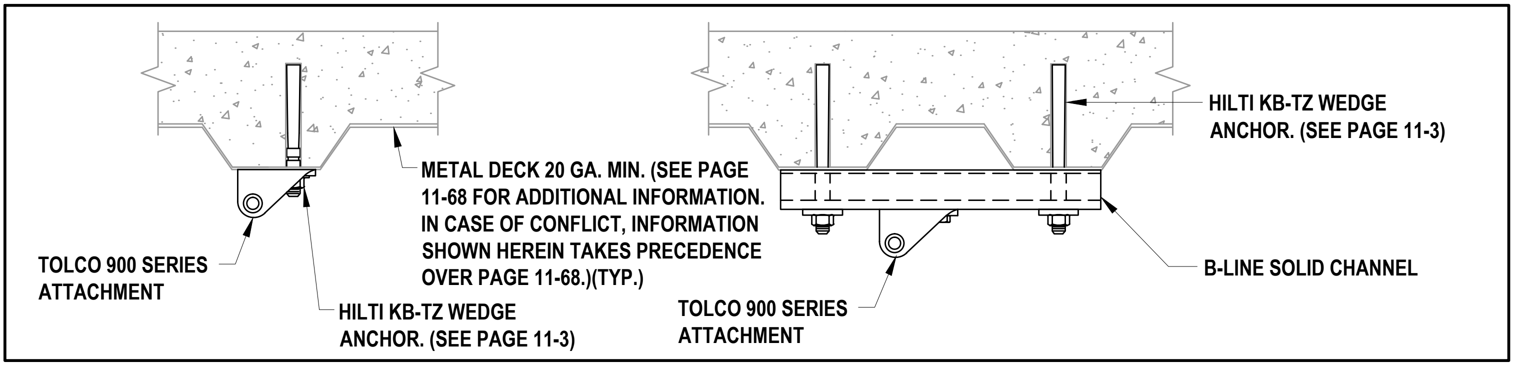
PAGE: 7-5

DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

1.0 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 1.0 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	33	3/16"	1	3/8"	2"
1-1/4	3.7	26	3/16"	1	3/8"	2"
1-1/2	4.6	21	3/16"	1	3/8"	2"
2	6.2	15	3/16"	1	3/8"	2"
2-1/2	9.2	24	3/16"	1	1/2"	3 1/4"
3	12.2	18	3/16"	1	1/2"	3 1/4"
4	18.1	27	3/16"	2	(2) 1/2"	3 1/4"
5	26.6	19	3/16"	2	(2) 1/2"	3 1/4"
6	33.8	14	3/16"	2	(2) 1/2"	3 1/4"
8	55	9	3/16"	2	(2) 1/2"	3 1/4"
10	80.1	6	3/16"	2	(2) 1/2"	3 1/4"
12	109	4	3/16"	2	(2) 1/2"	3 1/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 1.0 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	33	3/16"	1	3/8"	2"
1-1/4	3.7	26	3/16"	1	3/8"	2"
1-1/2	4.6	48	3/16"	1	1/2"	3 1/4"
2	6.2	36	3/16"	1	1/2"	3 1/4"
2-1/2	9.2	24	3/16"	1	1/2"	3 1/4"
3	12.2	41	3/16"	2	(2) 1/2"	3 1/4"
4	18.1	27	3/16"	2	(2) 1/2"	3 1/4"
5	26.6	19	3/16"	2	(2) 1/2"	3 1/4"
6	33.8	14	3/16"	2	(2) 1/2"	3 1/4"
8	55	9	3/16"	2	(2) 1/2"	3 1/4"
10	80.1	6	3/16"	2	(2) 1/2"	3 1/4"
12	109	4	3/16"	2	(2) 1/2"	3 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION.
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6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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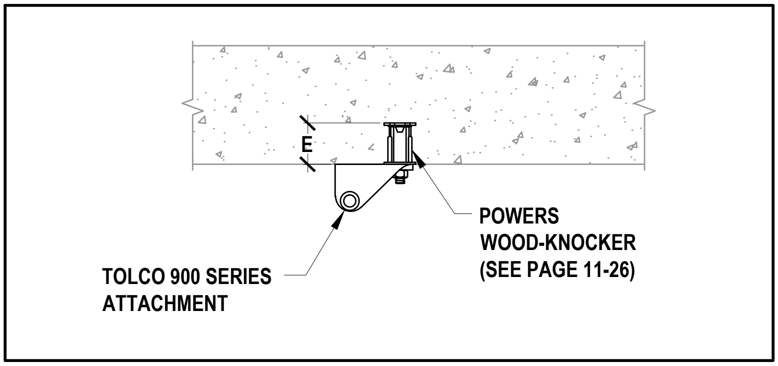
Structural Engineer: Mohammad Hariri
California SE No. S3545

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.50 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Cable Diameter	Concrete Anchorage		
		Max. Spacing @ 0.50 "G"		Anchor per Brace	Min. Diameter	Min. Embed "E"
1	2.9	40	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	40	1/8"	1	3/8"	1 3/4"
1-1/2	4.6	40	1/8"	1	3/8"	1 3/4"
2	6.2	40	1/8"	1	3/8"	1 3/4"
2-1/2	9.2	40	1/8"	1	3/8"	1 3/4"
3	12.2	40	1/8"	1	3/8"	1 3/4"
4	18.1	40	1/8"	1	3/8"	1 3/4"
5	26.6	36	1/8"	1	1/2"	1 3/4"
6	33.8	28	3/16"	1	1/2"	1 3/4"
8	55	17	3/16"	1	1/2"	1 3/4"
10	80.1	12	3/16"	1	5/8"	1 3/4"
12	109	9	3/16"	1	5/8"	1 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Cable Diameter	Concrete Anchorage		
		Max. Spacing @ 0.50 "G"		Anchor per Brace	Min. Diameter	Min. Embed "E"
1	2.9	80	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	80	1/8"	1	3/8"	1 3/4"
1-1/2	4.6	80	1/8"	1	3/8"	1 3/4"
2	6.2	80	1/8"	1	3/8"	1 3/4"
2-1/2	9.2	80	1/8"	1	3/8"	1 3/4"
3	12.2	60	1/8"	1	3/8"	1 3/4"
4	18.1	53	3/16"	1	1/2"	1 3/4"
5	26.6	36	3/16"	1	1/2"	1 3/4"
6	33.8	29	3/16"	1	5/8"	1 3/4"
8	55	18	3/16"	1	5/8"	1 3/4"
10	80.1	12	3/16"	1	5/8"	1 3/4"
12	109	9	3/16"	1	5/8"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

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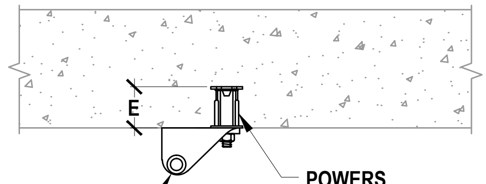
DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse Max. Spacing @ 0.75 "G"	Cable Diameter	Concrete Anchorage: Anchor per Brace	Concrete Anchorage: Min. Diameter	Concrete Anchorage: Min. Embed "E"
1	2.9	40	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	40	1/8"	1	3/8"	1 3/4"
1-1/2	4.6	40	1/8"	1	3/8"	1 3/4"
2	6.2	40	1/8"	1	3/8"	1 3/4"
2-1/2	9.2	40	1/8"	1	3/8"	1 3/4"
3	12.2	40	1/8"	1	3/8"	1 3/4"
4	18.1	35	3/16"	1	1/2"	1 3/4"
5	26.6	24	3/16"	1	1/2"	1 3/4"
6	33.8	19	3/16"	1	5/8"	1 3/4"
8	55	12	3/16"	1	5/8"	1 3/4"
10	80.1	8	3/16"	1	5/8"	1 3/4"
12	109	6	3/16"	1	5/8"	1 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal Max. Spacing @ 0.75 "G"	Cable Diameter	Concrete Anchorage: Anchor per Brace	Concrete Anchorage: Min. Diameter	Concrete Anchorage: Min. Embed "E"
1	2.9	80	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	80	1/8"	1	3/8"	1 3/4"
1-1/2	4.6	80	1/8"	1	3/8"	1 3/4"
2	6.2	80	1/8"	1	1/2"	1 3/4"
2-1/2	9.2	70	3/16"	1	1/2"	1 3/4"
3	12.2	52	3/16"	1	1/2"	1 3/4"
4	18.1	36	3/16"	1	5/8"	1 3/4"
5	26.6	25	3/16"	1	5/8"	1 3/4"
6	33.8	19	3/16"	1	5/8"	1 3/4"
8	55	12	3/16"	1	5/8"	1 3/4"
10	80.1	8	3/16"	1	5/8"	1 3/4"
12	109	6	3/16"	1	5/8"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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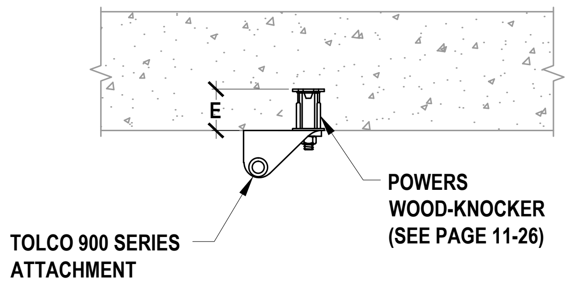
MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

1.0 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse Max. Spacing @ 1.0 "G"	Cable Diameter	Concrete Anchorage Anchor per Brace	Concrete Anchorage Min. Diameter	Concrete Anchorage Min. Embed "E"
1	2.9	40	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	40	1/8"	1	3/8"	1 3/4"
1-1/2	4.6	40	1/8"	1	3/8"	1 3/4"
2	6.2	40	1/8"	1	3/8"	1 3/4"
2-1/2	9.2	40	1/8"	1	3/8"	1 3/4"
3	12.2	39	1/8"	1	1/2"	1 3/4"
4	18.1	27	3/16"	1	5/8"	1 3/4"
5	26.6	18	3/16"	1	5/8"	1 3/4"
6	33.8	14	3/16"	1	5/8"	1 3/4"
8	55	9	3/16"	1	5/8"	1 3/4"
10	80.1	6	3/16"	1	5/8"	1 3/4"
12	109	4	3/16"	1	5/8"	1 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal Max. Spacing @ 1.0 "G"	Cable Diameter	Concrete Anchorage Anchor per Brace	Concrete Anchorage Min. Diameter	Concrete Anchorage Min. Embed "E"
1	2.9	80	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	80	1/8"	1	3/8"	1 3/4"
1-1/2	4.6	80	1/8"	1	3/8"	1 3/4"
2	6.2	59	1/8"	1	3/8"	1 3/4"
2-1/2	9.2	40	3/16"	1	3/8"	1 3/4"
3	12.2	39	3/16"	1	1/2"	1 3/4"
4	18.1	27	3/16"	1	5/8"	1 3/4"
5	26.6	18	3/16"	1	5/8"	1 3/4"
6	33.8	14	3/16"	1	5/8"	1 3/4"
8	55	9	3/16"	1	5/8"	1 3/4"
10	80.1	6	3/16"	1	5/8"	1 3/4"
12	109	4	3/16"	1	5/8"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
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California SE No. S3545

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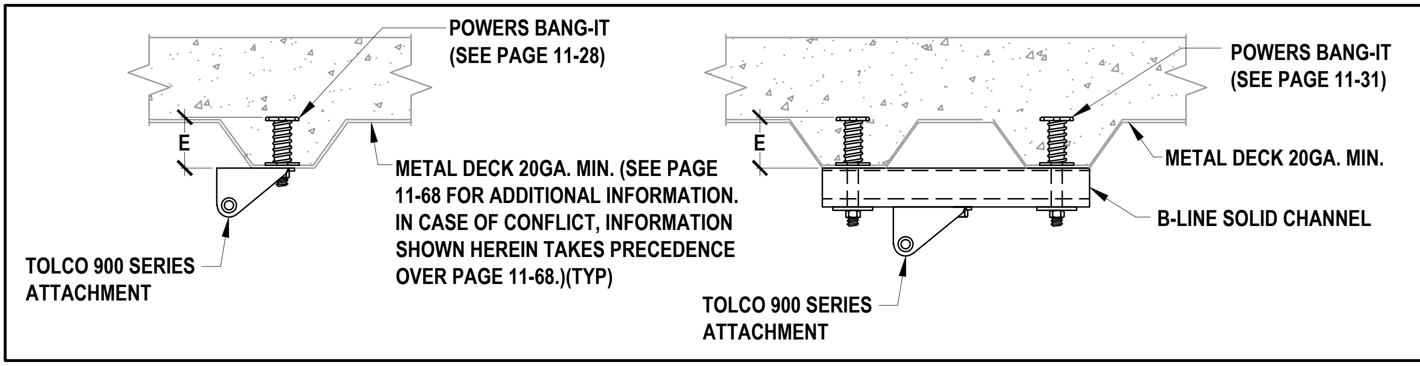
MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.



Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 0.50 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. 1 3/4"
1	2.9	40	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	40	1/8"	1	3/8"	1 3/4"
1-1/2	4.6	40	1/8"	1	3/8"	1 3/4"
2	6.2	40	1/8"	1	3/8"	1 3/4"
2-1/2	9.2	40	1/8"	1	3/8"	1 3/4"
3	12.2	39	1/8"	1	1/2"	1 3/4"
4	18.1	40	1/8"	2	(2) 3/8"	1 3/4"
5	26.6	34	1/8"	2	(2) 3/8"	1 3/4"
6	33.8	27	3/16"	2	(2) 3/8"	1 3/4"
8	55	31	3/16"	2	(2) 1/2"	1 3/4"
10	80.1	21	3/16"	2	(2) 1/2"	1 3/4"
12	109	15	3/16"	2	(2) 1/2"	1 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 0.50 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	80	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	80	1/8"	1	3/8"	1 3/4"
1-1/2	4.6	80	1/8"	1	3/8"	1 3/4"
2	6.2	75	1/8"	1	3/8"	1 3/4"
2-1/2	9.2	51	1/8"	1	3/8"	1 3/4"
3	12.2	38	1/8"	1	3/8"	1 3/4"
4	18.1	51	3/16"	2	(2) 3/8"	1 3/4"
5	26.6	34	3/16"	2	(2) 3/8"	1 3/4"
6	33.8	27	3/16"	2	(2) 3/8"	1 3/4"
8	55	31	3/16"	2	(2) 1/2"	1 3/4"
10	80.1	21	3/16"	2	(2) 1/2"	1 3/4"
12	109	15	3/16"	2	(2) 1/2"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT, , OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
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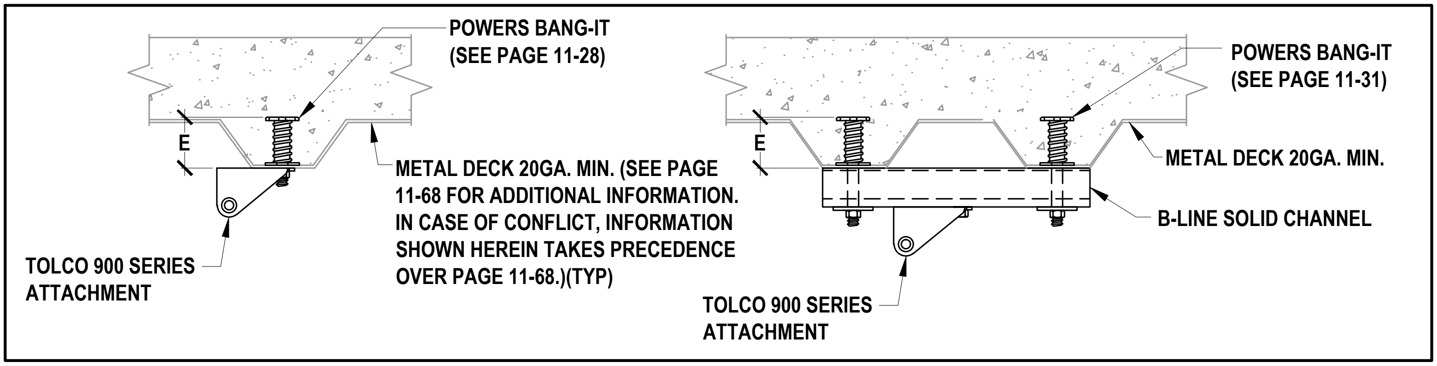
SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse Max. Spacing @ 0.75 "G"	Concrete Anchorage Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	40	1/8"	1	3/8"	1 3/4"
1-1/2	4.6	40	1/8"	1	3/8"	1 3/4"
2	6.2	40	1/8"	1	3/8"	1 3/4"
2-1/2	9.2	35	1/8"	1	1/2"	1 3/4"
3	12.2	40	1/8"	2	(2) 3/8"	1 3/4"
4	18.1	34	3/16"	2	(2) 3/8"	1 3/4"
5	26.6	40	3/16"	2	(2) 1/2"	1 3/4"
6	33.8	33	3/16"	2	(2) 1/2"	1 3/4"
8	55	20	3/16"	2	(2) 1/2"	1 3/4"
10	80.1	14	3/16"	2	(2) 1/2"	1 3/4"
12	109	10	3/16"	2	(2) 1/2"	1 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal Max. Spacing @ 0.75 "G"	Concrete Anchorage Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	80	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	80	1/8"	1	3/8"	1 3/4"
1-1/2	4.6	70	1/8"	1	1/2"	1 3/4"
2	6.2	80	1/8"	2	(2) 3/8"	1 3/4"
2-1/2	9.2	80	3/16"	2	(2) 1/2"	1 3/4"
3	12.2	80	3/16"	2	(2) 1/2"	1 3/4"
4	18.1	63	3/16"	2	(2) 1/2"	1 3/4"
5	26.6	42	3/16"	2	(2) 1/2"	1 3/4"
6	33.8	33	3/16"	2	(2) 1/2"	1 3/4"
8	55	20	3/16"	2	(2) 1/2"	1 3/4"
10	80.1	14	3/16"	2	(2) 1/2"	1 3/4"
12	109	10	3/16"	2	(2) 1/2"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
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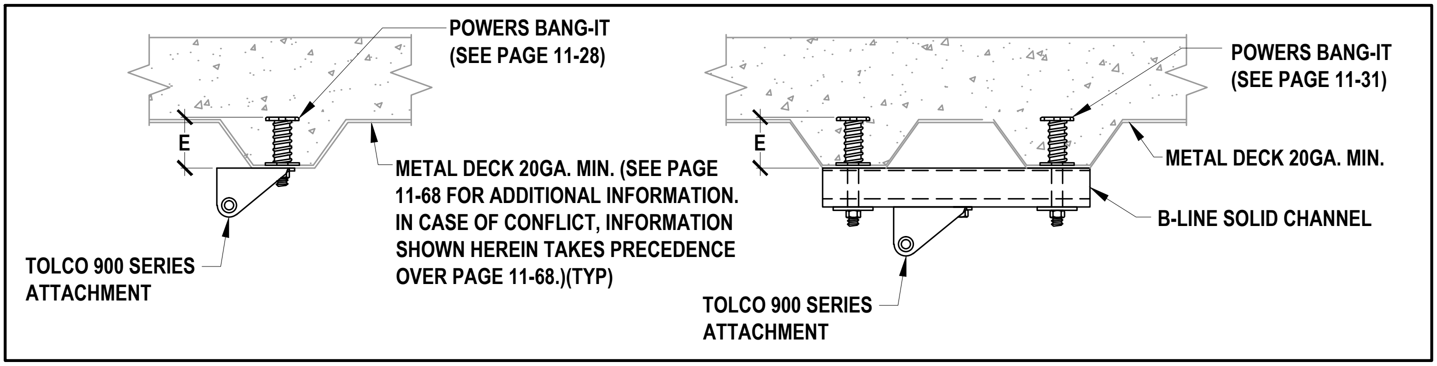
SINGLE PIPE HANGER BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

1.0 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Concrete Anchorage			
		Max. Spacing @ 1.0 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	40	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	40	1/8"	1	3/8"	1 3/4"
1-1/2	4.6	40	1/8"	1	3/8"	1 3/4"
2	6.2	39	1/8"	1	1/2"	1 3/4"
2-1/2	9.2	40	1/8"	2	(2) 3/8"	1 3/4"
3	12.2	37	1/8"	2	(2) 3/8"	1 3/4"
4	18.1	40	3/16"	2	(2) 1/2"	1 3/4"
5	26.6	32	3/16"	2	(2) 1/2"	1 3/4"
6	33.8	25	3/16"	2	(2) 1/2"	1 3/4"
8	55	15	3/16"	2	(2) 1/2"	1 3/4"
10	80.1	10	3/16"	2	(2) 1/2"	1 3/4"
12	109	7	3/16"	2	(2) 1/2"	1 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Concrete Anchorage			
		Max. Spacing @ 1.0 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
1	2.9	80	1/8"	1	3/8"	1 3/4"
1-1/4	3.7	80	1/8"	1	(2) 3/8"	1 3/4"
1-1/2	4.6	80	1/8"	1	(2) 3/8"	1 3/4"
2	6.2	74	1/8"	1	(2) 3/8"	1 3/4"
2-1/2	9.2	80	3/16"	2	(2) 1/2"	1 3/4"
3	12.2	70	3/16"	2	(2) 1/2"	1 3/4"
4	18.1	47	3/16"	2	(2) 1/2"	1 3/4"
5	26.6	32	3/16"	2	(2) 1/2"	1 3/4"
6	33.8	25	3/16"	2	(2) 1/2"	1 3/4"
8	55	15	3/16"	2	(2) 1/2"	1 3/4"
10	80.1	10	3/16"	2	(2) 1/2"	1 3/4"
12	109	7	3/16"	2	(2) 1/2"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
7.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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MRH
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California SE No. S3545

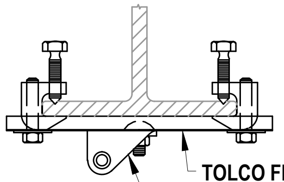
DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

0.50 "G"

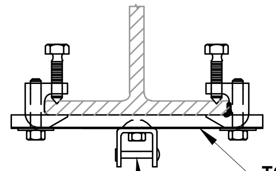
Brace Perpendicular to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Brace Parallel to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Transverse Max. Spacing @ 0.50 "G"	
			Perpendicular	Parallel
1	2.9	1/8"	40	40
1-1/4	3.7	1/8"	40	40
1-1/2	4.6	1/8"	40	40
2	6.2	1/8"	40	40
2-1/2	9.2	1/8"	40	40
3	12.2	1/8"	40	40
4	18.1	1/8"	40	40
5	26.6	1/8"	40	40
6	33.8	3/16"	40	40
8	55	3/16"	40	40
10	80.1	3/16"	40	32
12	109	3/16"	36	24

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Longitudinal Max. Spacing @ 0.50 "G"	
			Perpendicular	Parallel
1	2.9	1/8"	80	80
1-1/4	3.7	1/8"	80	80
1-1/2	4.6	1/8"	80	80
2	6.2	1/8"	80	80
2-1/2	9.2	1/8"	80	80
3	12.2	1/8"	80	80
4	18.1	3/16"	80	80
5	26.6	3/16"	80	80
6	33.8	3/16"	80	77
8	55	3/16"	71	47
10	80.1	3/16"	49	32
12	109	3/16"	36	24

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.
10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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PAGE: 7-13

DATE: NOVEMBER 29, 2016

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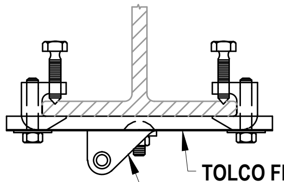
SINGLE PIPE HANGER BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

0.75 "G"

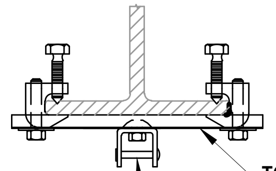
Brace Perpendicular to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Brace Parallel to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Transverse Max. Spacing @ 0.75 "G"	
			Perpendicular	Parallel
1	2.9	1/8"	40	40
1-1/4	3.7	1/8"	40	40
1-1/2	4.6	1/8"	40	40
2	6.2	1/8"	40	40
2-1/2	9.2	1/8"	40	40
3	12.2	1/8"	40	40
4	18.1	3/16"	40	40
5	26.6	3/16"	40	40
6	33.8	3/16"	40	40
8	55	3/16"	40	31
10	80.1	3/16"	32	21
12	109	3/16"	24	16

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Longitudinal Max. Spacing @ 0.75 "G"	
			Perpendicular	Parallel
1	2.9	1/8"	80	80
1-1/4	3.7	1/8"	80	80
1-1/2	4.6	1/8"	80	80
2	6.2	1/8"	80	80
2-1/2	9.2	3/16"	80	80
3	12.2	3/16"	80	80
4	18.1	3/16"	80	80
5	26.6	3/16"	80	65
6	33.8	3/16"	77	51
8	55	3/16"	47	31
10	80.1	3/16"	32	21
12	109	3/16"	24	16

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.
10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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DATE: NOVEMBER 29, 2016

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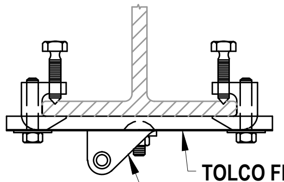
SINGLE PIPE HANGER BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

1.0 "G"

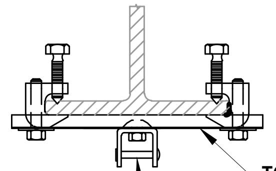
Brace Perpendicular to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Brace Parallel to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Transverse Max. Spacing @ 1.0 "G"	
			Perpendicular	Parallel
1	2.9	1/8"	40	40
1-1/4	3.7	1/8"	40	40
1-1/2	4.6	1/8"	40	40
2	6.2	1/8"	40	40
2-1/2	9.2	1/8"	40	40
3	12.2	1/8"	40	40
4	18.1	3/16"	40	40
5	26.6	3/16"	40	40
6	33.8	3/16"	40	38
8	55	3/16"	35	23
10	80.1	3/16"	24	16
12	109	3/16"	18	12

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Longitudinal Max. Spacing @ 1.0 "G"	
			Perpendicular	Parallel
1	2.9	1/8"	80	80
1-1/4	3.7	1/8"	80	80
1-1/2	4.6	1/8"	80	80
2	6.2	1/8"	80	80
2-1/2	9.2	3/16"	80	80
3	12.2	3/16"	80	80
4	18.1	3/16"	80	72
5	26.6	3/16"	74	49
6	33.8	3/16"	58	38
8	55	3/16"	35	23
10	80.1	3/16"	24	16
12	109	3/16"	18	12

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.
10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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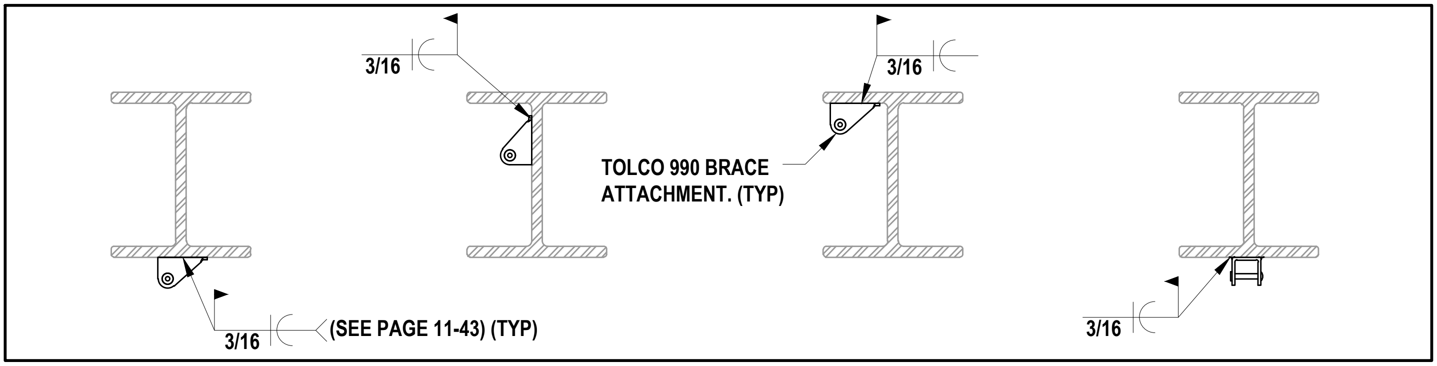
SINGLE PIPE HANGER BRACE SPACING CHART FOR WELDED ATTACHMENT TO STEEL BEAM

0.50 "G"



Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Transverse
			Max. Spacing @ 0.50 "G"
1	2.9	1/8"	40
1-1/4	3.7	1/8"	40
1-1/2	4.6	1/8"	40
2	6.2	1/8"	40
2-1/2	9.2	1/8"	40
3	12.2	1/8"	40
4	18.1	1/8"	40
5	26.6	1/8"	40
6	33.8	3/16"	40
8	55	3/16"	40
10	80.1	3/16"	30
12	109	3/16"	22

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Longitudinal
			Max. Spacing @ 0.50 "G"
1	2.9	1/8"	80
1-1/4	3.7	1/8"	80
1-1/2	4.6	1/8"	80
2	6.2	1/8"	80
2-1/2	9.2	1/8"	80
3	12.2	1/8"	80
4	18.1	3/16"	80
5	26.6	3/16"	80
6	33.8	3/16"	72
8	55	3/16"	44
10	80.1	3/16"	30
12	109	3/16"	22

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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PAGE: 7-16
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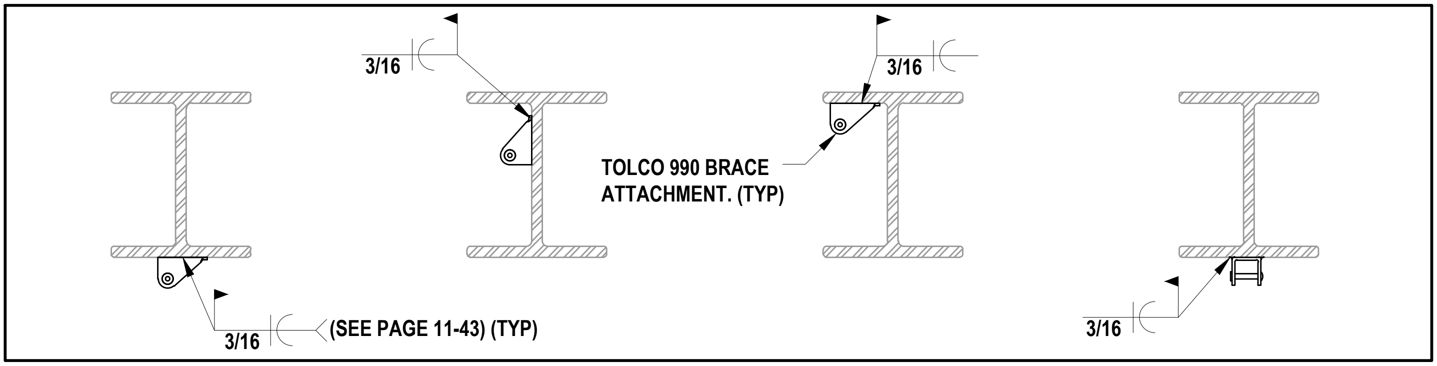
SINGLE PIPE HANGER BRACE SPACING CHART FOR WELDED ATTACHMENT TO STEEL BEAM

0.75 "G"



Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Transverse Max. Spacing @ 0.75 "G"
1	2.9	1/8"	40
1-1/4	3.7	1/8"	40
1-1/2	4.6	1/8"	40
2	6.2	1/8"	40
2-1/2	9.2	1/8"	40
3	12.2	1/8"	40
4	18.1	3/16"	40
5	26.6	3/16"	40
6	33.8	3/16"	40
8	55	3/16"	29
10	80.1	3/16"	20
12	109	3/16"	14

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Longitudinal Max. Spacing @ 0.75 "G"
1	2.9	1/8"	80
1-1/4	3.7	1/8"	80
1-1/2	4.6	1/8"	80
2	6.2	1/8"	80
2-1/2	9.2	3/16"	80
3	12.2	3/16"	80
4	18.1	3/16"	80
5	26.6	3/16"	61
6	33.8	3/16"	48
8	55	3/16"	29
10	80.1	3/16"	20
12	109	3/16"	14

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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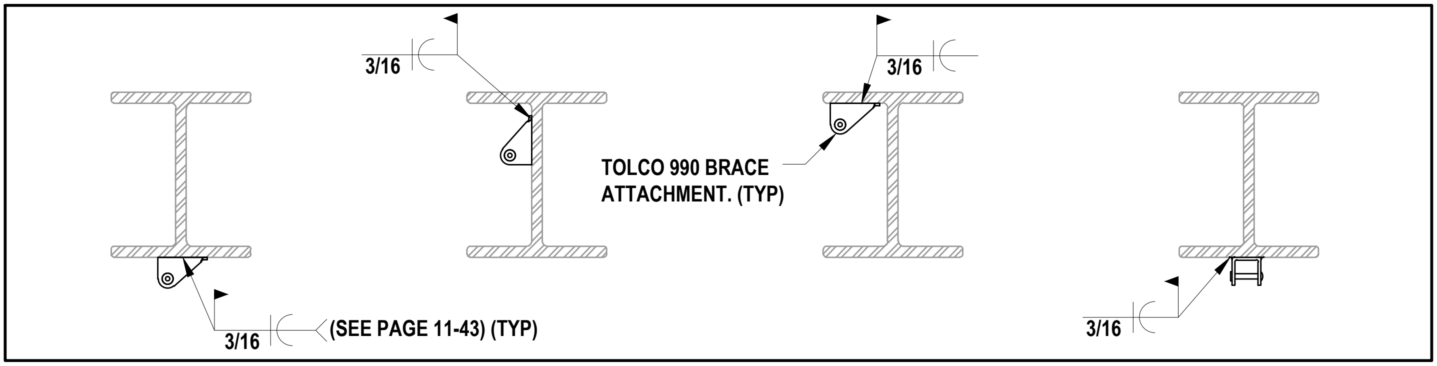
SINGLE PIPE HANGER BRACE SPACING CHART FOR WELDED ATTACHMENT TO STEEL BEAM

1.0 "G"



Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Transverse Max. Spacing @ 1.0 "G"
1	2.9	1/8"	40
1-1/4	3.7	1/8"	40
1-1/2	4.6	1/8"	40
2	6.2	1/8"	40
2-1/2	9.2	1/8"	40
3	12.2	1/8"	40
4	18.1	3/16"	40
5	26.6	3/16"	40
6	33.8	3/16"	36
8	55	3/16"	22
10	80.1	3/16"	15
12	109	3/16"	11

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Longitudinal Max. Spacing @ 1.0 "G"
1	2.9	1/8"	80
1-1/4	3.7	1/8"	80
1-1/2	4.6	1/8"	80
2	6.2	1/8"	80
2-1/2	9.2	3/16"	80
3	12.2	3/16"	80
4	18.1	3/16"	67
5	26.6	3/16"	45
6	33.8	3/16"	36
8	55	3/16"	22
10	80.1	3/16"	15
12	109	3/16"	11

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *HALF THE NUMBER OF BRACES MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.
10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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Structural Engineer: Mohammad Hariri
California SE No. S3545

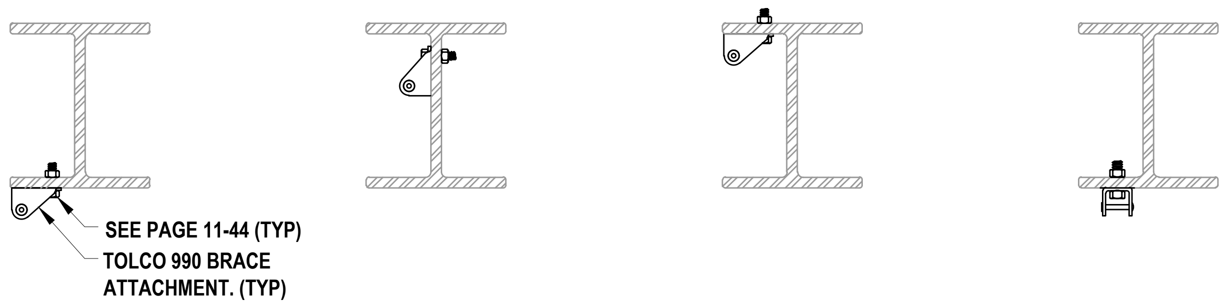
PAGE: 7-18

DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR BOLTED ATTACHMENT TO STEEL BEAM

0.50 "G"



Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Minimum Bolt Diameter	Transverse Max. Spacing @ 0.50 "G"
1	2.9	1/8"	3/8"	40
1-1/4	3.7	1/8"	3/8"	40
1-1/2	4.6	1/8"	3/8"	40
2	6.2	1/8"	3/8"	40
2-1/2	9.2	1/8"	3/8"	40
3	12.2	1/8"	3/8"	40
4	18.1	1/8"	3/8"	40
5	26.6	3/16"	1/2"	40
6	33.8	3/16"	1/2"	40
8	55	3/16"	5/8"	40
10	80.1	1/4"	3/4"	33
12	109	1/4"	3/4"	24

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Minimum Bolt Diameter	Longitudinal Max. Spacing @ 0.50 "G"
1	2.9	1/8"	3/8"	80
1-1/4	3.7	1/8"	3/8"	80
1-1/2	4.6	1/8"	3/8"	80
2	6.2	1/8"	3/8"	80
2-1/2	9.2	1/8"	3/8"	80
3	12.2	1/8"	3/8"	80
4	18.1	3/16"	1/2"	80
5	26.6	3/16"	5/8"	80
6	33.8	1/4"	3/4"	78
8	55	1/4"	3/4"	48
10	80.1	1/4"	3/4"	33
12	109	1/4"	3/4"	24

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0
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6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.
10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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California SE No. S3545

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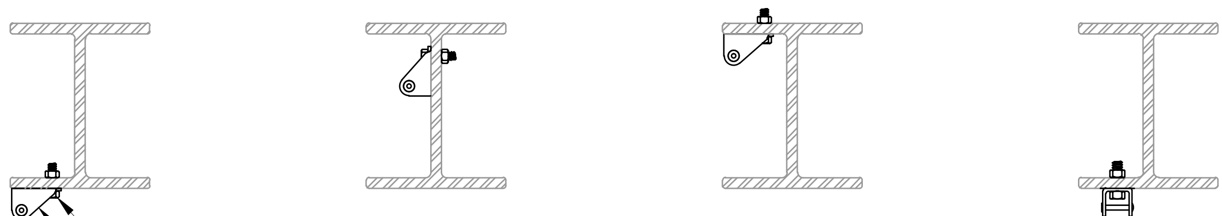
SINGLE PIPE HANGER BRACE SPACING CHART FOR BOLTED ATTACHMENT TO STEEL BEAM

0.75 "G"



Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Minimum Bolt Diameter	Transverse Max. Spacing @ 0.75 "G"
1	2.9	1/8"	3/8"	40
1-1/4	3.7	1/8"	3/8"	40
1-1/2	4.6	1/8"	3/8"	40
2	6.2	1/8"	3/8"	40
2-1/2	9.2	1/8"	3/8"	40
3	12.2	1/8"	3/8"	40
4	18.1	3/16"	1/2"	40
5	26.6	3/16"	1/2"	40
6	33.8	3/16"	5/8"	40
8	55	1/4"	3/4"	32
10	80.1	1/4"	3/4"	22
12	109	1/4"	3/4"	16

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Minimum Bolt Diameter	Longitudinal Max. Spacing @ 0.75 "G"
1	2.9	1/8"	3/8"	80
1-1/4	3.7	1/8"	3/8"	80
1-1/2	4.6	1/8"	3/8"	80
2	6.2	1/8"	3/8"	80
2-1/2	9.2	3/16"	1/2"	80
3	12.2	3/16"	1/2"	80
4	18.1	3/16"	5/8"	80
5	26.6	1/4"	3/4"	66
6	33.8	1/4"	3/4"	52
8	55	1/4"	3/4"	32
10	80.1	1/4"	3/4"	22
12	109	1/4"	3/4"	16

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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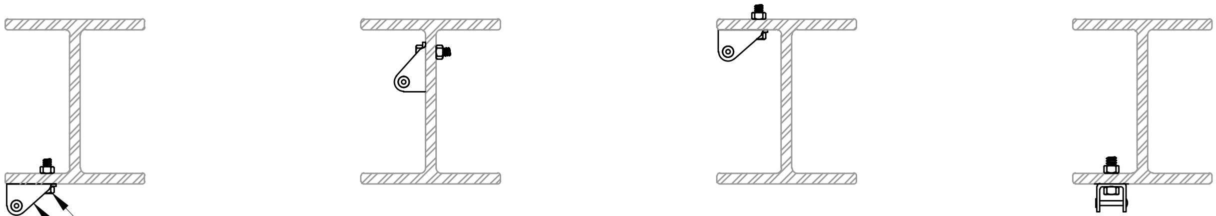
SINGLE PIPE HANGER BRACE SPACING CHART FOR BOLTED ATTACHMENT TO STEEL BEAM

1.0 "G"



Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Minimum Bolt Diameter	Transverse Max. Spacing @ 1.0 "G"
1	2.9	1/8"	3/8"	40
1-1/4	3.7	1/8"	3/8"	40
1-1/2	4.6	1/8"	3/8"	40
2	6.2	1/8"	3/8"	40
2-1/2	9.2	1/8"	3/8"	40
3	12.2	1/8"	3/8"	40
4	18.1	3/16"	1/2"	40
5	26.6	3/16"	5/8"	40
6	33.8	1/4"	3/4"	39
8	55	1/4"	3/4"	24
10	80.1	1/4"	3/4"	16
12	109	1/4"	3/4"	12

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Minimum Bolt Diameter	Longitudinal Max. Spacing @ 1.0 "G"
1	2.9	1/8"	3/8"	80
1-1/4	3.7	1/8"	3/8"	80
1-1/2	4.6	1/8"	3/8"	80
2	6.2	1/8"	3/8"	80
2-1/2	9.2	3/16"	1/2"	80
3	12.2	3/16"	5/8"	80
4	18.1	1/4"	3/4"	72
5	26.6	1/4"	3/4"	49
6	33.8	1/4"	3/4"	39
8	55	1/4"	3/4"	24
10	80.1	1/4"	3/4"	16
12	109	1/4"	3/4"	12

NOTES:

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PAGE: 7-21

DATE: NOVEMBER 29, 2016

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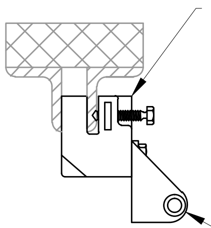
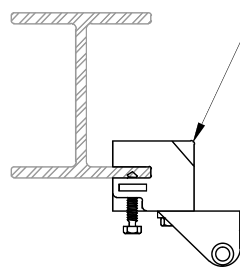
SINGLE PIPE HANGER BRACE SPACING CHART FOR ATTACHMENT TO STEEL TRUSS OR STEEL BEAM | 0.50 "G"





Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Transverse Max Spacing @ 0.50 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1/8"	40	40
1-1/4	3.7	1/8"	40	40
1-1/2	4.6	1/8"	40	40
2	6.2	1/8"	40	40
2-1/2	9.2	1/8"	40	40
3	12.2	1/8"	40	40
4	18.1	1/8"	40	40
5	26.6	1/8"	40	34
6	33.8	3/16"	40	27
8	55	3/16"	36	16
10	80.1	3/16"	24	11
12	109	3/16"	18	8

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Longitudinal Max Spacing @ 0.50 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1/8"	80	80
1-1/4	3.7	1/8"	80	80
1-1/2	4.6	1/8"	80	80
2	6.2	1/8"	80	80
2-1/2	9.2	1/8"	80	80
3	12.2	1/8"	80	75
4	18.1	3/16"	80	50
5	26.6	3/16"	74	34
6	33.8	3/16"	58	27
8	55	3/16"	36	16
10	80.1	3/16"	24	11
12	109	3/16"	18	8

NOTES:

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7.) THE SPACINGS LISTED ABOVE ARE BASED ON TOLCO FIG 825. SPACINGS MAY BE INCREASED IF TOLCO FIGUR4E 828 IS USED BASED ON ALLOWABLE LOADS FIGURE 825 AND TOLCO FIGURE 828. SEE PAGE 11-47, 11-49.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.
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PAGE: 7-22
DATE: NOVEMBER 29, 2016

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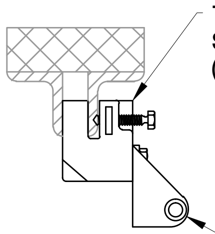
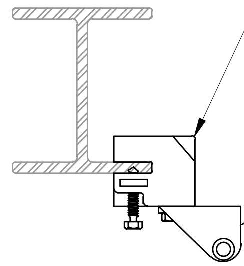
SINGLE PIPE HANGER BRACE SPACING CHART FOR ATTACHMENT TO STEEL TRUSS OR STEEL BEAM

0.75 "G"





Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Transverse Max Spacing @ 0.75 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1/8"	40	40
1-1/4	3.7	1/8"	40	40
1-1/2	4.6	1/8"	40	40
2	6.2	1/8"	40	40
2-1/2	9.2	1/8"	40	40
3	12.2	1/8"	40	40
4	18.1	3/16"	40	33
5	26.6	3/16"	40	23
6	33.8	3/16"	39	18
8	55	3/16"	24	11
10	80.1	3/16"	16	7
12	109	3/16"	12	5

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Longitudinal Max Spacing @ 0.75 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1/8"	80	80
1-1/4	3.7	1/8"	80	80
1-1/2	4.6	1/8"	80	80
2	6.2	1/8"	80	80
2-1/2	9.2	3/16"	80	66
3	12.2	3/16"	80	50
4	18.1	3/16"	72	33
5	26.6	3/16"	49	23
6	33.8	3/16"	39	18
8	55	3/16"	24	11
10	80.1	3/16"	16	7
12	109	3/16"	12	5

NOTES:

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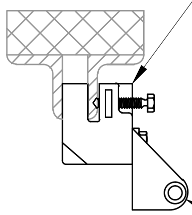
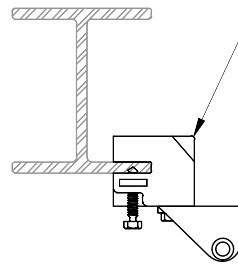
1.0 "G"





Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Transverse Max Spacing @ 1.0 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1/8"	40	40
1-1/4	3.7	1/8"	40	40
1-1/2	4.6	1/8"	40	40
2	6.2	1/8"	40	40
2-1/2	9.2	1/8"	40	40
3	12.2	1/8"	40	37
4	18.1	3/16"	40	25
5	26.6	3/16"	37	17
6	33.8	3/16"	29	13
8	55	3/16"	18	8
10	80.1	3/16"	12	5
12	109	3/16"	9	4

Pipe Diameter	Maximum Weight Per Foot	Cable Dia.	Longitudinal Max Spacing @ 1.0 "G" Fig. 825 or 828	
			Perpendicular	Parallel
1	2.9	1/8"	80	80
1-1/4	3.7	1/8"	80	80
1-1/2	4.6	1/8"	80	80
2	6.2	1/8"	80	74
2-1/2	9.2	3/16"	80	50
3	12.2	3/16"	80	37
4	18.1	3/16"	54	25
5	26.6	3/16"	37	17
6	33.8	3/16"	29	13
8	55	3/16"	18	8
10	80.1	3/16"	12	5
12	109	3/16"	9	4

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
7.) THE SPACINGS LISTED ABOVE ARE BASED ON TOLCO FIG 825. SPACINGS MAY BE INCREASED IF TOLCO FIGUR4E 828 IS USED BASED ON ALLOWABLE LOADS FIGURE 825 AND TOLCO FIGURE 828. SEE PAGE 11-47, 11-49.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.
9.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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California SE No. S3545

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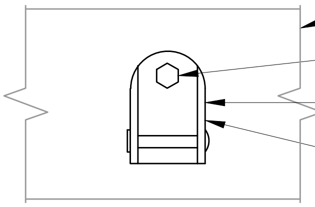
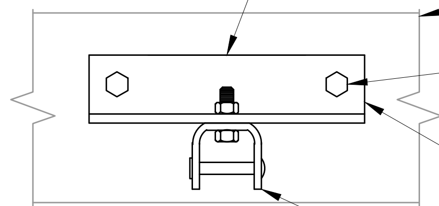
SINGLE PIPE HANGER BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.50 "G"





Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	40	1/8"	1	1/2"
1-1/4	3.7	40	1/8"	1	1/2"
1-1/2	4.6	40	1/8"	1	1/2"
2	6.2	40	1/8"	1	1/2"
2-1/2	9.2	40	1/8"	1	1/2"
3	12.2	40	1/8"	1	1/2"
4	18.1	40	1/8"	1	3/4"
5	26.6	40	1/8"	2	(2) 5/8"
6	33.8	40	1/8"	2	(2) 3/4"
8	55	29	1/8"	2	(2) 3/4"
10	80.1	20	1/8"	2	(2) 3/4"
12	109	14	1/8"	2	(2) 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	80	1/8"	1	1/2"
1-1/4	3.7	80	1/8"	1	1/2"
1-1/2	4.6	80	1/8"	1	1/2"
2	6.2	80	1/8"	1	1/2"
2-1/2	9.2	80	1/8"	1	3/4"
3	12.2	80	1/8"	2	(2) 5/8"
4	18.1	80	1/8"	2	(2) 3/4"
5	26.6	60	1/8"	2	(2) 5/8"
6	33.8	47	1/8"	2	(2) 3/4"
8	55	29	1/8"	2	(2) 3/4"
10	80.1	20	1/8"	2	(2) 3/4"
12	109	14	1/8"	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIRED.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

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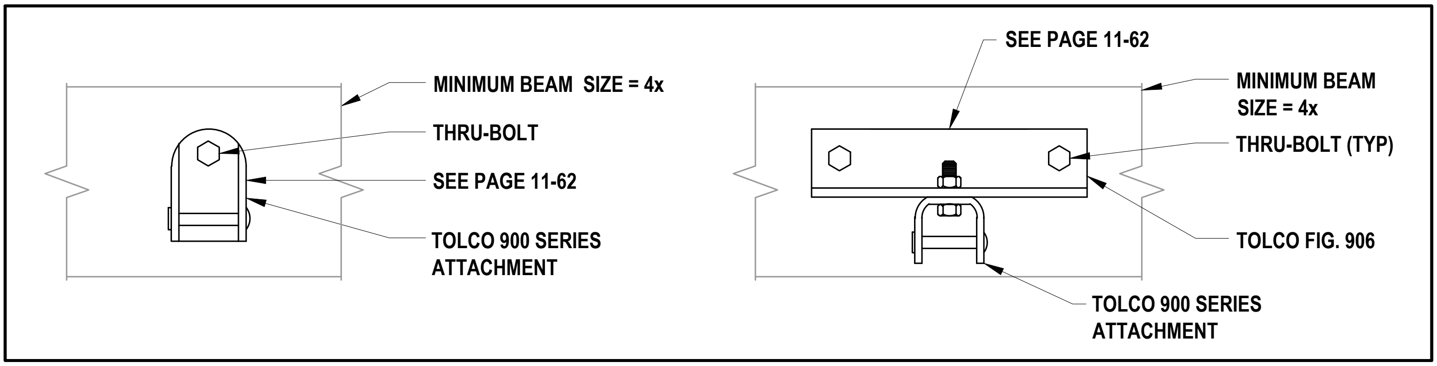
SINGLE PIPE HANGER BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	40	1/8"	1	1/2"
1-1/4	3.7	40	1/8"	1	1/2"
1-1/2	4.6	40	1/8"	1	1/2"
2	6.2	40	1/8"	1	1/2"
2-1/2	9.2	40	1/8"	1	3/4"
3	12.2	40	1/8"	1	3/4"
4	18.1	40	1/8"	2	(2) 1/2"
5	26.6	40	1/8"	2	(2) 3/4"
6	33.8	31	1/8"	2	(2) 3/4"
8	55	19	1/8"	2	(2) 3/4"
10	80.1	13	1/8"	2	(2) 3/4"
12	109	9	1/8"	2	(2) 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	80	1/8"	1	1/2"
1-1/4	3.7	80	1/8"	1	5/8"
1-1/2	4.6	80	1/8"	1	3/4"
2	6.2	80	1/8"	1	3/4"
2-1/2	9.2	80	1/8"	2	(2) 1/2"
3	12.2	80	1/8"	2	(2) 3/4"
4	18.1	58	1/8"	2	(2) 3/4"
5	26.6	40	1/8"	2	(2) 3/4"
6	33.8	31	1/8"	2	(2) 3/4"
8	55	19	1/8"	2	(2) 3/4"
10	80.1	13	1/8"	2	(2) 3/4"
12	109	9	1/8"	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIRED.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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California SE No. S3545

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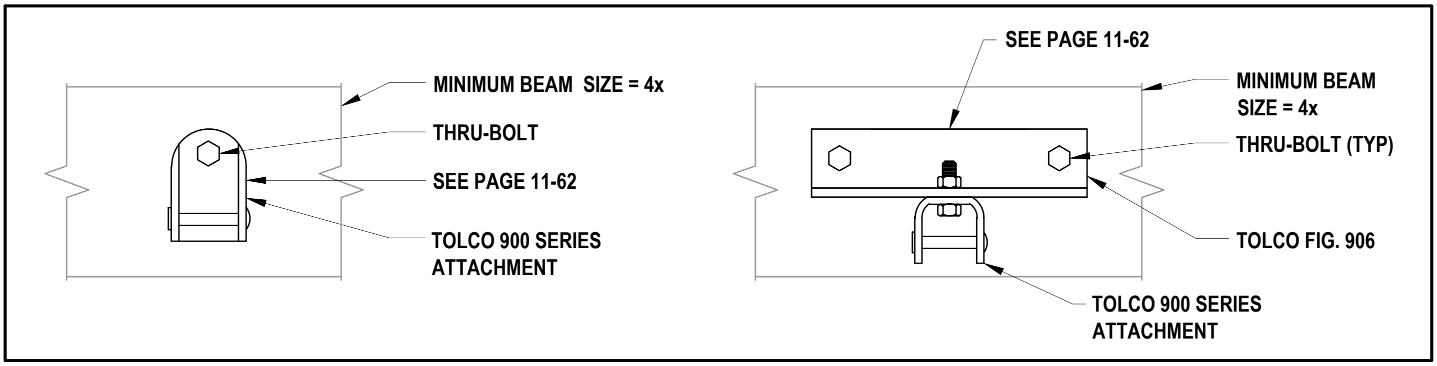
DATE: NOVEMBER 29, 2016

MH



Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	40	1/8"	1	1/2"
1-1/4	3.7	40	1/8"	1	1/2"
1-1/2	4.6	40	1/8"	1	1/2"
2	6.2	40	1/8"	1	1/2"
2-1/2	9.2	40	1/8"	1	3/4"
3	12.2	40	1/8"	2	(2) 5/8"
4	18.1	40	1/8"	2	(2) 3/4"
5	26.6	30	1/8"	2	(2) 3/4"
6	33.8	23	1/8"	2	(2) 3/4"
8	55	14	1/8"	2	(2) 3/4"
10	80.1	10	1/8"	2	(2) 3/4"
12	109	7	1/8"	2	(2) 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	80	1/8"	1	1/2"
1-1/4	3.7	80	1/8"	1	5/8"
1-1/2	4.6	80	1/8"	1	3/4"
2	6.2	80	1/8"	2	(2) 5/8"
2-1/2	9.2	80	1/8"	2	(2) 3/4"
3	12.2	65	1/8"	2	(2) 3/4"
4	18.1	44	1/8"	2	(2) 3/4"
5	26.6	30	1/8"	2	(2) 3/4"
6	33.8	23	1/8"	2	(2) 3/4"
8	55	14	1/8"	2	(2) 3/4"
10	80.1	10	1/8"	2	(2) 3/4"
12	109	7	1/8"	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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California SE No. S3545

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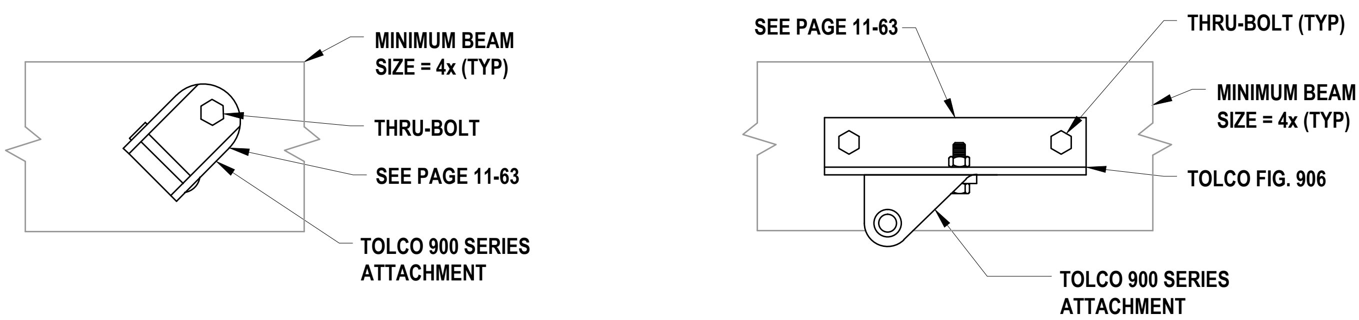
SINGLE PIPE HANGER BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.50 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	40	1/8"	1	1/2"
1-1/4	3.7	40	1/8"	1	1/2"
1-1/2	4.6	40	1/8"	1	1/2"
2	6.2	40	1/8"	1	1/2"
2-1/2	9.2	40	1/8"	1	1/2"
3	12.2	40	1/8"	1	1/2"
4	18.1	35	1/8"	1	5/8"
5	26.6	33	1/8"	2	(2) 1/2"
6	33.8	32	3/16"	2	(2) 5/8"
8	55	21	3/16"	2	(2) 3/4"
10	80.1	15	3/16"	2	(2) 3/4"
12	109	11	3/16"	2	(2) 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	80	1/8"	1	1/2"
1-1/4	3.7	80	1/8"	1	1/2"
1-1/2	4.6	80	1/8"	1	5/8"
2	6.2	80	1/8"	1	5/8"
2-1/2	9.2	69	1/8"	1	5/8"
3	12.2	72	1/8"	2	(2) 1/2"
4	18.1	59	3/16"	2	(2) 5/8"
5	26.6	45	3/16"	2	(2) 3/4"
6	33.8	35	3/16"	2	(2) 3/4"
8	55	21	3/16"	2	(2) 3/4"
10	80.1	15	3/16"	2	(2) 3/4"
12	109	11	3/16"	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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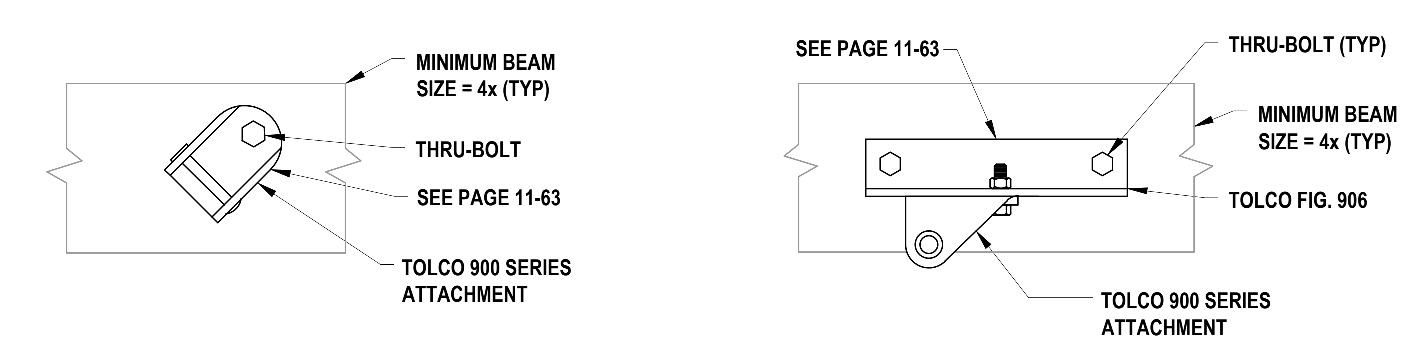
PAGE: 7-28

DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	40	1/8"	1	1/2"
1-1/4	3.7	40	1/8"	1	1/2"
1-1/2	4.6	40	1/8"	1	1/2"
2	6.2	40	1/8"	1	1/2"
2-1/2	9.2	40	1/8"	1	5/8"
3	12.2	40	1/8"	1	5/8"
4	18.1	40	3/16"	2	(2) 5/8"
5	26.6	30	3/16"	2	(2) 5/8"
6	33.8	23	3/16"	2	(2) 5/8"
8	55	14	3/16"	2	(2) 5/8"
10	80.1	10	3/16"	2	(2) 5/8"
12	109	7	3/16"	2	(2) 5/8"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	80	1/8"	1	1/2"
1-1/4	3.7	80	1/8"	1	1/2"
1-1/2	4.6	80	1/8"	1	5/8"
2	6.2	80	1/8"	2	(2) 3/4"
2-1/2	9.2	80	3/16"	2	(2) 3/4"
3	12.2	65	3/16"	2	(2) 3/4"
4	18.1	44	3/16"	2	(2) 3/4"
5	26.6	30	3/16"	2	(2) 3/4"
6	33.8	23	3/16"	2	(2) 3/4"
8	55	14	3/16"	2	(2) 3/4"
10	80.1	10	3/16"	2	(2) 3/4"
12	109	7	3/16"	2	(2) 3/4"

NOTES:

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4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0
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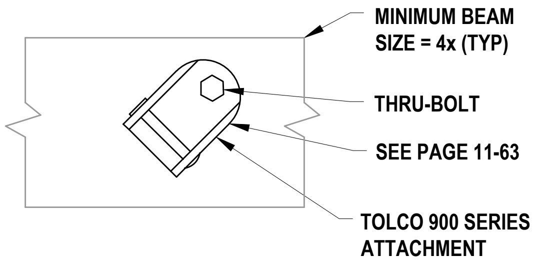

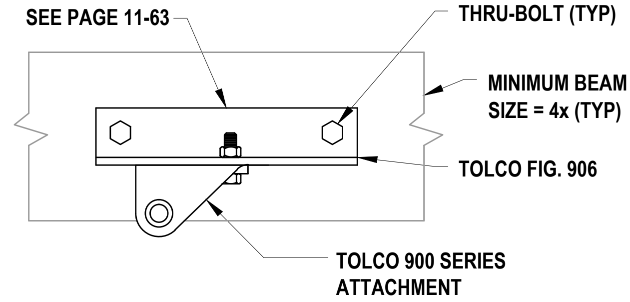

Pipe Diameter	Max. Weight Per Ft.	Transverse	Thru-Bolts		
		Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	40	1/8"	1	1/2"
1-1/4	3.7	40	1/8"	1	1/2"
1-1/2	4.6	40	1/8"	1	1/2"
2	6.2	40	1/8"	1	1/2"
2-1/2	9.2	34	1/8"	1	5/8"
3	12.2	36	1/8"	2	(2) 1/2"
4	18.1	29	3/16"	2	(2) 5/8"
5	26.6	22	3/16"	2	(2) 3/4"
6	33.8	17	3/16"	2	(2) 3/4"
8	55	10	3/16"	2	(2) 3/4"
10	80.1	7	3/16"	2	(2) 3/4"
12	109	5	3/16"	2	(2) 3/4"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Thru-Bolts		
		Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter
1	2.9	80	1/8"	1	1/2"
1-1/4	3.7	80	1/8"	1	1/2"
1-1/2	4.6	69	1/8"	1	5/8"
2	6.2	71	1/8"	2	(2) 1/2"
2-1/2	9.2	58	3/16"	2	(2) 5/8"
3	12.2	49	3/16"	2	(2) 3/4"
4	18.1	33	3/16"	2	(2) 3/4"
5	26.6	22	3/16"	2	(2) 3/4"
6	33.8	17	3/16"	2	(2) 3/4"
8	55	10	3/16"	2	(2) 3/4"
10	80.1	7	3/16"	2	(2) 3/4"
12	109	7	3/16"	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIRED.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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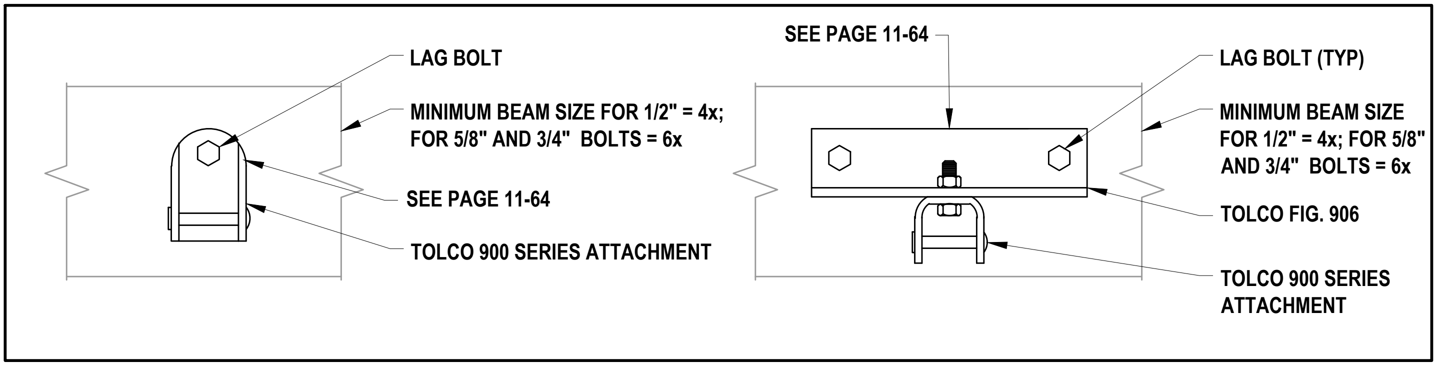
Structural Engineer: Mohammad Hariri
California SE No. S3545

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.50 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	40	1/8"	1	1/2"	3"
1-1/4	3.7	40	1/8"	1	1/2"	3"
1-1/2	4.6	38	1/8"	1	1/2"	3"
2	6.2	28	1/8"	1	1/2"	3"
2-1/2	9.2	19	1/8"	1	1/2"	3"
3	12.2	31	1/8"	1	3/4"	5"
4	18.1	21	1/8"	1	3/4"	5"
5	26.6	24	1/8"	2	(2) 3/4"	5"
6	33.8	19	3/16"	2	(2) 3/4"	5"
8	55	11	3/16"	2	(2) 3/4"	5"
10	80.1	8	3/16"	2	(2) 3/4"	5"
12	109	6	3/16"	2	(2) 3/4"	5"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	61	1/8"	1	1/2"	3"
1-1/4	3.7	48	1/8"	1	1/2"	3"
1-1/2	4.6	38	1/8"	1	1/2"	3"
2	6.2	62	1/8"	1	3/4"	5"
2-1/2	9.2	42	1/8"	1	3/4"	5"
3	12.2	53	1/8"	2	(2) 3/4"	5"
4	18.1	36	3/16"	2	(2) 3/4"	5"
5	26.6	24	3/16"	2	(2) 3/4"	5"
6	33.8	19	3/16"	2	(2) 3/4"	5"
8	55	11	3/16"	2	(2) 3/4"	5"
10	80.1	8	3/16"	2	(2) 3/4"	5"
12	109	6	3/16"	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIRED.
7.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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California SE No. S3545

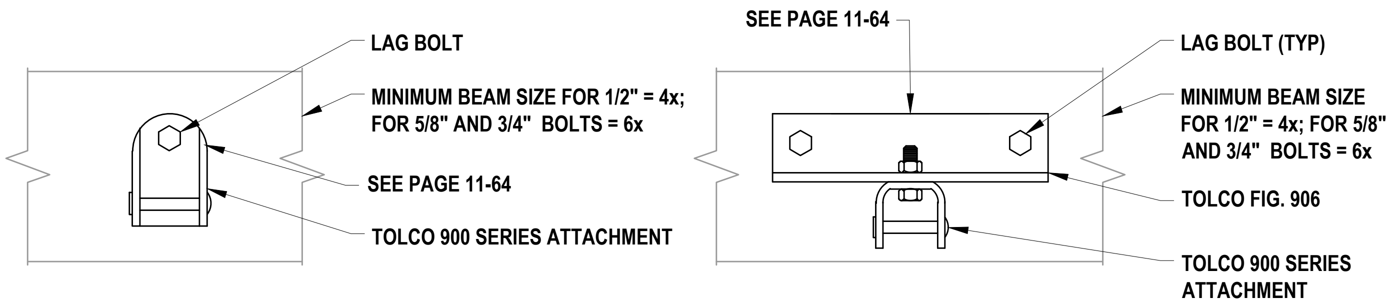
PAGE: 7-31

DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	40	1/8"	1	1/2"	3"
1-1/4	3.7	40	1/8"	1	3/4"	5"
1-1/2	4.6	40	1/8"	1	3/4"	5"
2	6.2	40	1/8"	1	3/4"	5"
2-1/2	9.2	28	1/8"	1	3/4"	5"
3	12.2	35	1/8"	2	(2) 3/4"	5"
4	18.1	24	3/16"	2	(2) 3/4"	5"
5	26.6	32	3/16"	2	(2) 3/4"	5"
6	33.8	25	3/16"	2	(2) 3/4"	5"
8	55	7	3/16"	2	(2) 3/4"	5"
10	80.1	5	3/16"	2	(2) 3/4"	5"
12	109	4	3/16"	2	(2) 3/4"	5"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	80	1/8"	1	3/4"	5"
1-1/4	3.7	69	1/8"	1	3/4"	5"
1-1/2	4.6	55	1/8"	1	3/4"	5"
2	6.2	70	1/8"	2	(2) 3/4"	5"
2-1/2	9.2	47	3/16"	2	(2) 3/4"	5"
3	12.2	35	3/16"	2	(2) 3/4"	5"
4	18.1	24	3/16"	2	(2) 3/4"	5"
5	26.6	16	3/16"	2	(2) 3/4"	5"
6	33.8	12	3/16"	2	(2) 3/4"	5"
8	55	7	3/16"	2	(2) 3/4"	5"
10	80.1	5	3/16"	2	(2) 3/4"	5"
12	109	5	3/16"	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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7.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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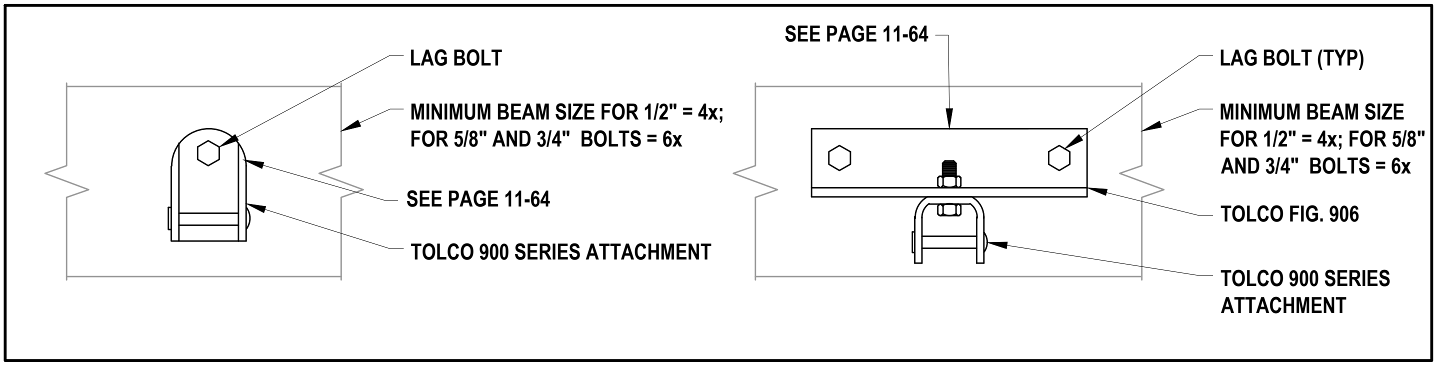
California SE No. S3545

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

1.0 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	30	1/8"	1	1/2"	3"
1-1/4	3.7	24	1/8"	1	1/2"	3"
1-1/2	4.6	19	1/8"	1	1/2"	3"
2	6.2	31	1/8"	1	3/4"	5"
2-1/2	9.2	21	1/8"	1	3/4"	5"
3	12.2	26	1/8"	2	(2) 3/4"	5"
4	18.1	18	3/16"	2	(2) 3/4"	5"
5	26.6	24	3/16"	2	(2) 3/4"	5"
6	33.8	19	3/16"	2	(2) 3/4"	5"
8	55	5	3/16"	2	(2) 3/4"	5"
10	80.1	4	3/16"	2	(2) 3/4"	5"
12	109	3	3/16"	2	(2) 3/4"	5"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	66	1/8"	1	3/4"	5"
1-1/4	3.7	52	1/8"	1	3/4"	5"
1-1/2	4.6	42	1/8"	1	3/4"	5"
2	6.2	52	1/8"	2	(2) 3/4"	5"
2-1/2	9.2	35	3/16"	2	(2) 3/4"	5"
3	12.2	26	3/16"	2	(2) 3/4"	5"
4	18.1	18	3/16"	2	(2) 3/4"	5"
5	26.6	12	3/16"	2	(2) 3/4"	5"
6	33.8	9	3/16"	2	(2) 3/4"	5"
8	55	5	3/16"	2	(2) 3/4"	5"
10	80.1	4	3/16"	2	(2) 3/4"	5"
12	109	3	3/16"	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
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5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIRED.
7.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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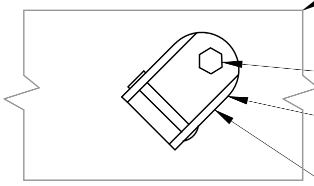
California SE No. S3545

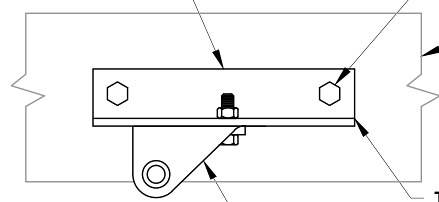
PAGE: 7-33
DATE: NOVEMBER 29, 2016

MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.50 "G"





Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	40	1/8"	1	1/2"	3"
1-1/4	3.7	40	1/8"	1	1/2"	3"
1-1/2	4.6	37	1/8"	1	1/2"	3"
2	6.2	28	1/8"	1	1/2"	3"
2-1/2	9.2	29	1/8"	1	5/8"	4"
3	12.2	31	1/8"	1	3/4"	5"
4	18.1	21	1/8"	1	3/4"	5"
5	26.6	16	1/8"	2	(2) 3/4"	5"
6	33.8	13	1/8"	2	(2) 3/4"	5"
8	55	8	1/8"	2	(2) 3/4"	5"
10	80.1	5	1/8"	2	(2) 3/4"	5"
12	109	4	1/8"	2	(2) 3/4"	5"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	60	1/8"	1	1/2"	3"
1-1/4	3.7	47	1/8"	1	1/2"	3"
1-1/2	4.6	58	1/8"	1	5/8"	4"
2	6.2	62	1/8"	1	3/4"	5"
2-1/2	9.2	42	1/8"	1	3/4"	5"
3	12.2	36	1/8"	2	(2) 3/4"	5"
4	18.1	24	1/8"	2	(2) 3/4"	5"
5	26.6	16	1/8"	2	(2) 3/4"	5"
6	33.8	13	1/8"	2	(2) 3/4"	5"
8	55	8	1/8"	2	(2) 3/4"	5"
10	80.1	5	1/8"	2	(2) 3/4"	5"
12	109	4	1/8"	2	(2) 3/4"	5"

NOTES:

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PAGE: 7-34

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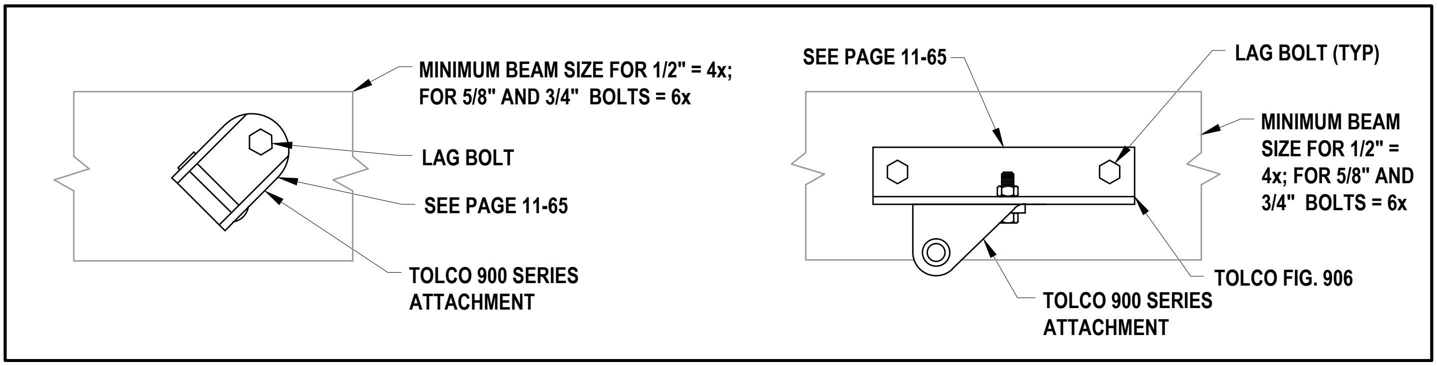
MH

SINGLE PIPE HANGER BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.75 "G"



Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	40	1/8"	1	1/2"	3"
1-1/4	3.7	40	1/8"	1	5/8"	4"
1-1/2	4.6	38	1/8"	1	5/8"	4"
2	6.2	40	1/8"	1	3/4"	5"
2-1/2	9.2	28	1/8"	1	3/4"	5"
3	12.2	24	1/8"	2	(2) 3/4"	5"
4	18.1	16	1/8"	2	(2) 3/4"	5"
5	26.6	11	1/8"	2	(2) 3/4"	5"
6	33.8	8	1/8"	2	(2) 3/4"	5"
8	55	5	1/8"	2	(2) 3/4"	5"
10	80.1	3	1/8"	2	(2) 3/4"	5"
12	109	2	1/8"	2	(2) 3/4"	5"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	80	1/8"	1	3/4"	5"
1-1/4	3.7	80	1/8"	2	(2) 3/4"	5"
1-1/2	4.6	64	1/8"	2	(2) 3/4"	5"
2	6.2	47	1/8"	2	(2) 3/4"	5"
2-1/2	9.2	32	1/8"	2	(2) 3/4"	5"
3	12.2	24	1/8"	2	(2) 3/4"	5"
4	18.1	16	1/8"	2	(2) 3/4"	5"
5	26.6	11	1/8"	2	(2) 3/4"	5"
6	33.8	8	1/8"	2	(2) 3/4"	5"
8	55	5	1/8"	2	(2) 3/4"	5"
10	80.1	3	1/8"	2	(2) 3/4"	5"
12	109	2	1/8"	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIRED.
7.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

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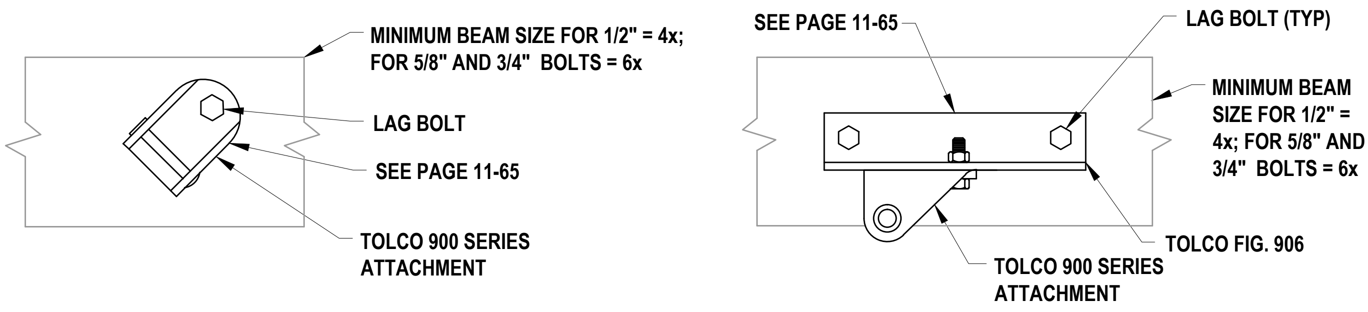

Pipe Diameter	Max. Weight Per Ft.	Transverse	Lag Bolts			
		Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	30	1/8"	1	1/2"	3"
1-1/4	3.7	23	1/8"	1	1/2"	3"
1-1/2	4.6	29	1/8"	1	5/8"	4"
2	6.2	31	1/8"	1	3/4"	5"
2-1/2	9.2	21	1/8"	1	3/4"	5"
3	12.2	18	1/8"	2	(2) 3/4"	5"
4	18.1	24	1/8"	2	(2) 3/4"	5"
5	26.6	16	1/8"	2	(2) 3/4"	5"
6	33.8	13	1/8"	2	(2) 3/4"	5"
8	55	8	1/8"	2	(2) 3/4"	5"
10	80.1	5	1/8"	2	(2) 3/4"	5"
12	109	4	1/8"	2	(2) 3/4"	5"

Pipe Diameter	Max. Weight Per Ft.	Longitudinal	Lag Bolts			
		Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
1	2.9	66	1/8"	1	3/4"	5"
1-1/4	3.7	52	1/8"	1	3/4"	5"
1-1/2	4.6	42	1/8"	1	3/4"	5"
2	6.2	35	1/8"	2	(2) 3/4"	5"
2-1/2	9.2	48	1/8"	2	(2) 3/4"	5"
3	12.2	36	1/8"	2	(2) 3/4"	5"
4	18.1	24	1/8"	2	(2) 3/4"	5"
5	26.6	16	1/8"	2	(2) 3/4"	5"
6	33.8	13	1/8"	2	(2) 3/4"	5"
8	55	8	1/8"	2	(2) 3/4"	5"
10	80.1	5	1/8"	2	(2) 3/4"	5"
12	109	4	1/8"	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIRED.
7.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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NOVEMBER 29, 2016

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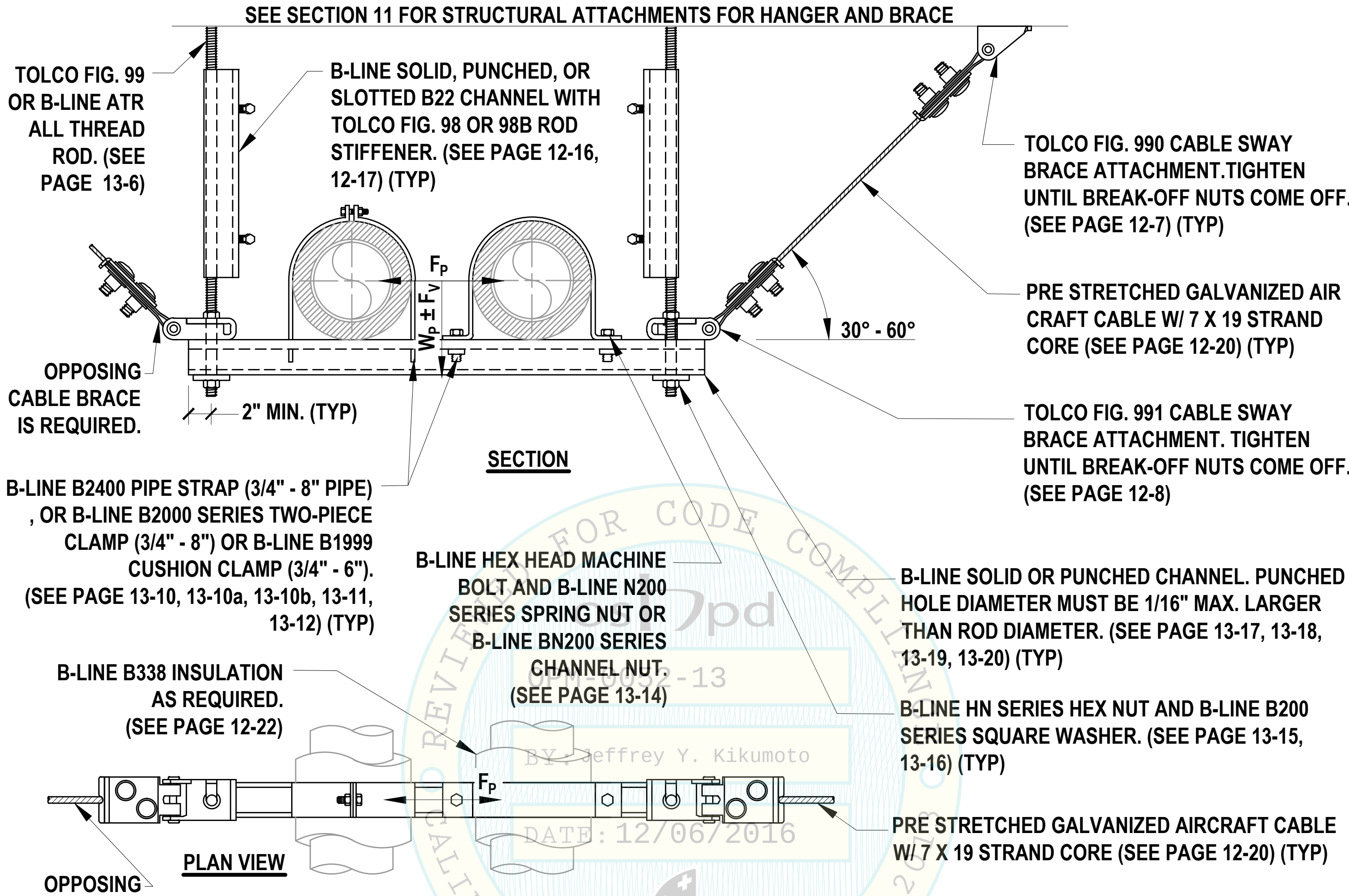
SECTION 8

TRAPEZE CABLE BRACE DETAILS

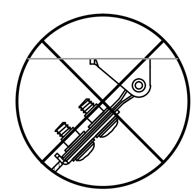
MH

TRANSVERSE CABLE BRACING FOR TRAPEZE SUPPORTED PIPE OR CONDUIT WITH SINGLE TRAPEZE STRUT

DETAIL 13



MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P(ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	876	480	435
1/2"	3/16"	1263	893	666
3/4"	3/16"	1492	786	758



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 25% FOR 1"-2" PIPES, 32% FOR 2.5"-3.5" PIPES AND 43% FOR 4"-8" PIPES.
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 15%

2.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.

3.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.

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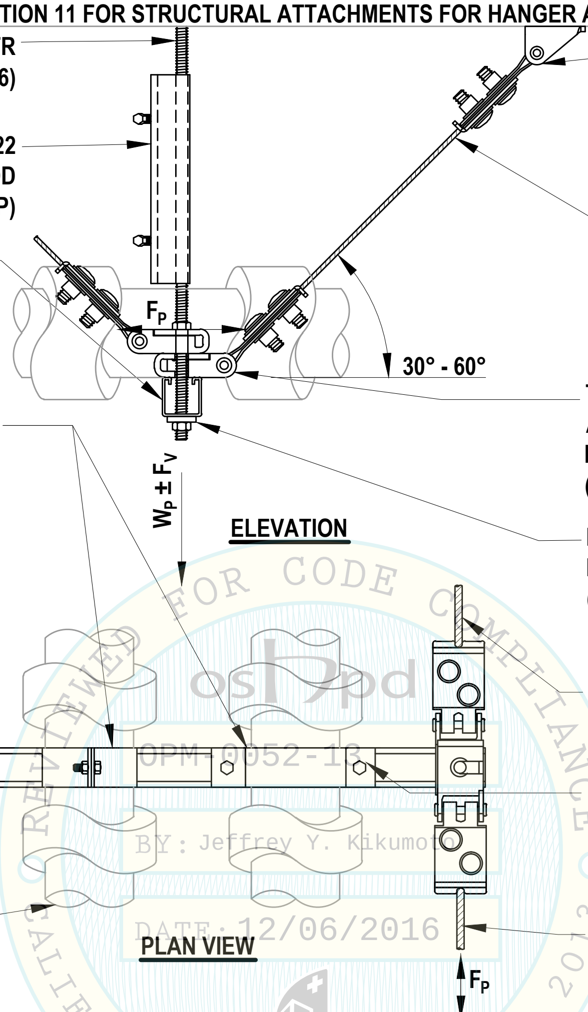
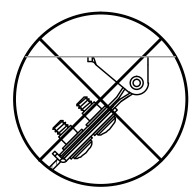
LONGITUDINAL CABLE BRACING FOR TRAPEZE SUPPORTED PIPE OR CONDUIT WITH SINGLE TRAPEZE STRUT

DETAIL 14



MINIMUM ROD SIZE	MINIMUM CABLE SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	419	438	408
1/2"	3/16"	422	424	437
3/4"	3/16"	458	470	447



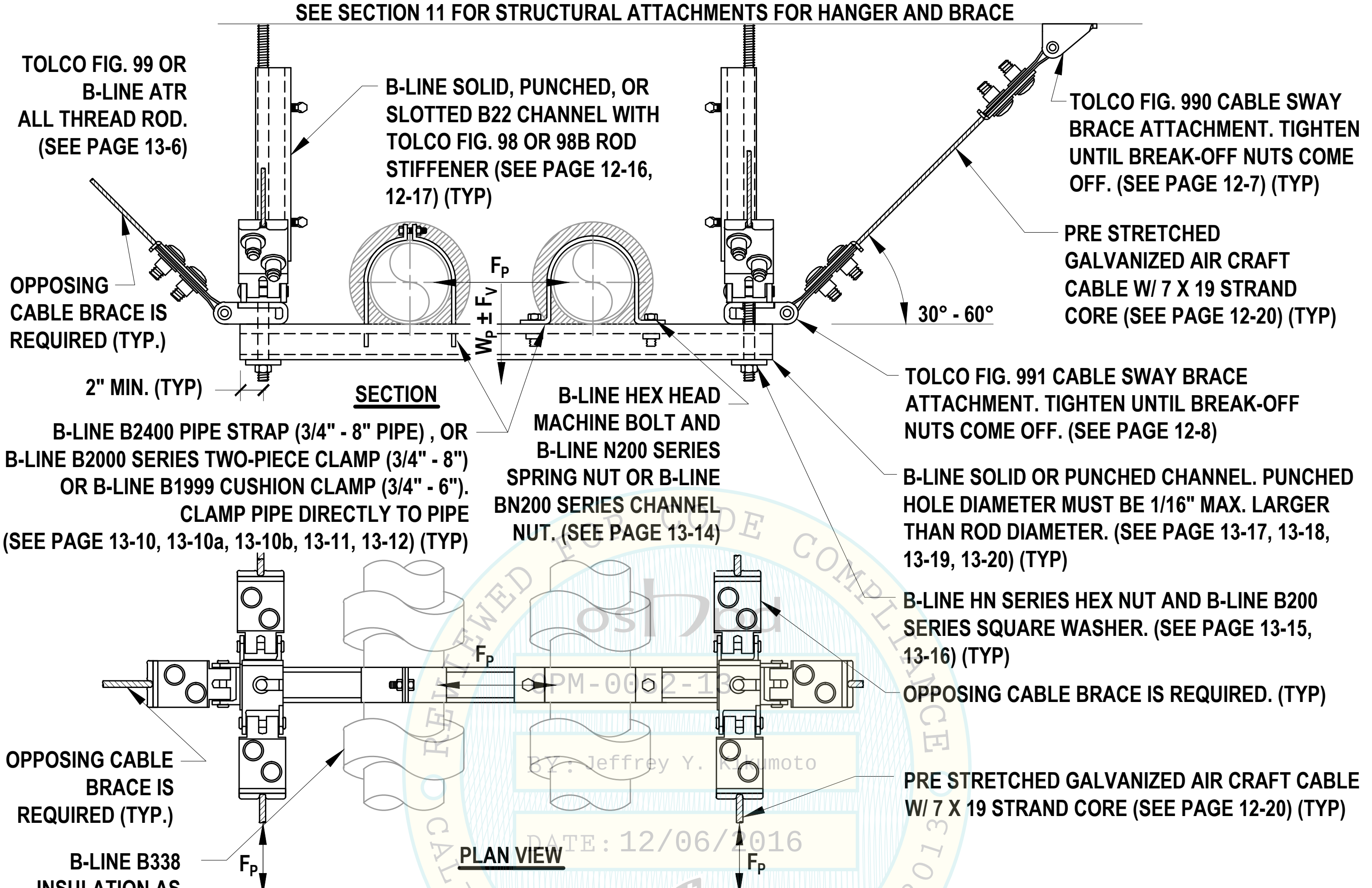
DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

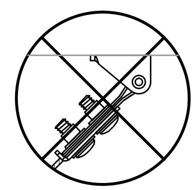
1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 0%
2.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
3.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
4.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

TRANSVERSE AND LONGITUDINAL COMBINATION CABLE BRACING FOR TRAPEZE SUPPORTED PIPE OR CONDUIT WITH SINGLE TRAPEZE STRUT

DETAIL 13/14



MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	253	241	183
1/2"	3/16"	301	281	274
3/4"	3/16"	309	319	306



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 0%
2.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
3.) THE ABOVE ASSEMBLY ALLOWABLE LOADS CAN BE APPLIED CONCURRENTLY TO BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS WITHOUT REDUCTION
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
5.) THE LONGITUDINAL BRACES SHALL BE INSTALLED AT 45 DEGREES.
6.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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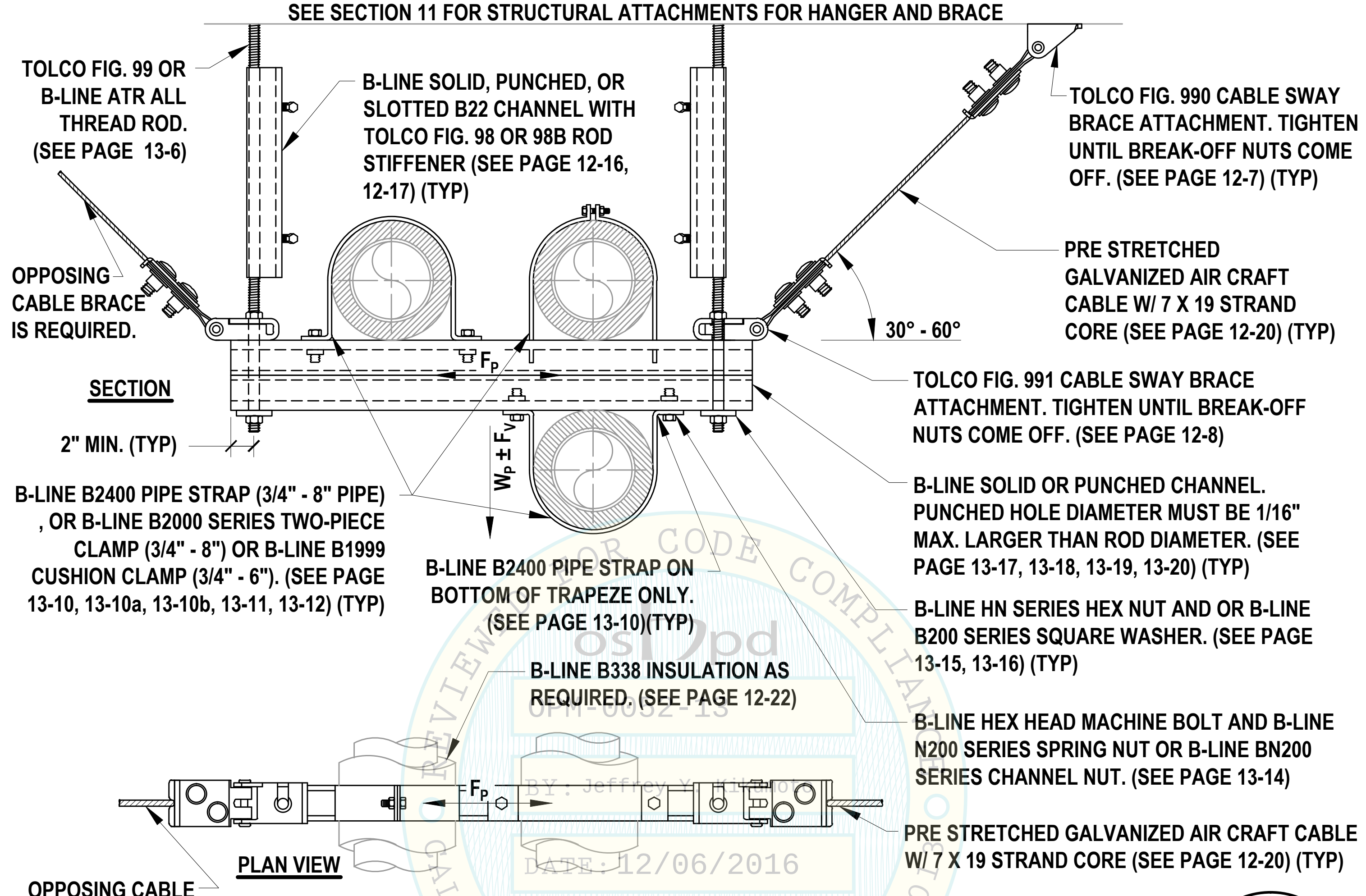
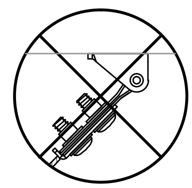
TRANSVERSE CABLE BRACING FOR TRAPEZE SUPPORTED PIPE OR CONDUIT WITH DOUBLE TRAPEZE STRUT

DETAIL 13A



MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	876	480	435
1/2"	3/16"	1263	893	666
3/4"	3/16"	1492	786	758



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 25% FOR 1"-2" PIPES, 32% FOR 2.5"-3.5" PIPES AND 43% FOR 4"-8" PIPES.
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 15%
2.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
3.) FOR 2" & SMALLER PIPING 2-PIECE CLAMP MAY BE USED WHEN PIPING IS SUPPORTED-HUNG FROM THE BOTTOM OF TRAPEZE STRUT. MAY USE B2400 FOR UP TO 8" WHEN STRAPPING TO THE BOTTOM OF THE TRAPEZE.
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.

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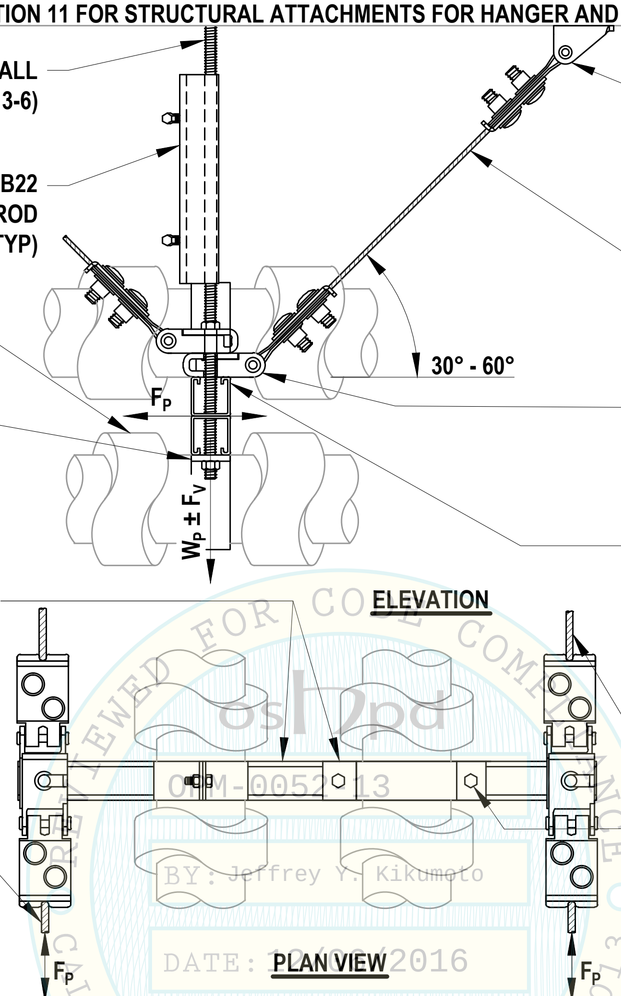
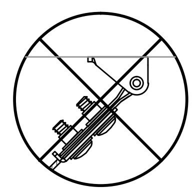
LONGITUDINAL CABLE BRACING FOR TRAPEZE SUPPORTED PIPE OR CONDUIT WITH DOUBLE TRAPEZE STRUT

DETAIL 14A

SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE ANCHORAGE



MINIMUM ROD SIZE	MINIMUM CABLE SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	419	438	408
1/2"	3/16"	422	424	437
3/4"	3/16"	458	470	447



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 0%
2.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
3.) FOR 2" & SMALLER PIPING 2-PIECE CLAMP MAY BE USED WHEN PIPING IS SUPPORTED-HUNG FROM THE BOTTOM OF TRAPEZE STRUT MAY USE B2400 FOR UP TO 8" WHEN STRAPPING TO THE BOTTOM OF THE TRAPEZE..
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
5.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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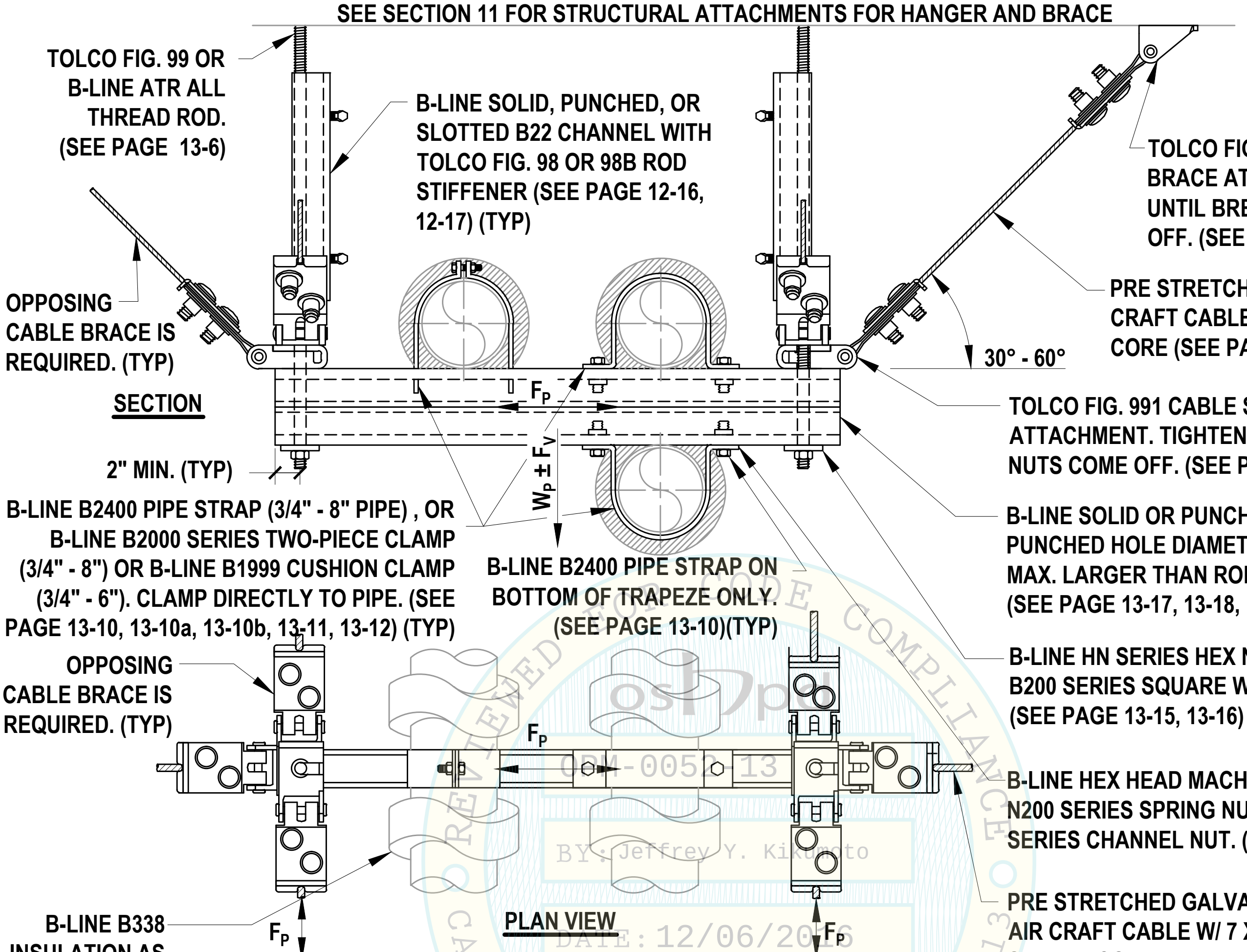
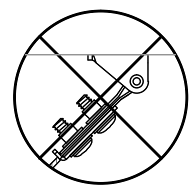


MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	253	241	183
1/2"	3/16"	301	281	274
3/4"	3/16"	309	319	306



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) LOADS LISTED ABOVE ARE FOR SCHEDULE 10 AND BETTER PIPING. THE FOLLOWING REDUCTIONS SHALL APPLY FOR OTHER PIPING AND SYSTEMS:
   a.) PIPING WITH INSULATION - REDUCE LOADS BY 0%
   b.) THIN WALL PIPING - REDUCE LOADS BY 0%
   c.) CONDUITS INCLUDING EMT - REDUCE LOADS BY 0%
2.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
3.) FOR 2" & SMALLER PIPING 2-PIECE CLAMP MAY BE USED WHEN PIPING IS SUPPORTED-HUNG FROM THE BOTTOM OF TRAPEZE STRUT. MAY USE B2400 FOR UP TO 8" WHEN STRAPPING TO THE BOTTOM OF THE TRAPEZE.
4.) THE ABOVE ASSEMBLY ALLOWABLE LOADS CAN BE APPLIED CONCURRENTLY TO BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS WITHOUT REDUCTION.
5.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13
6.) THE LONGITUDINAL BRACES SHALL BE INSTALLED AT 45- DEGREES.
7.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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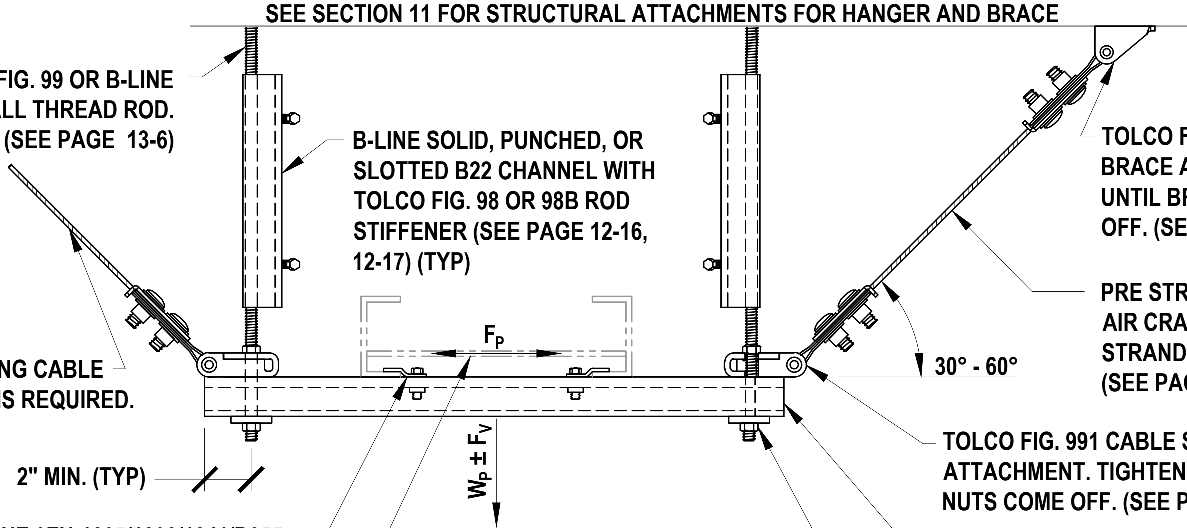
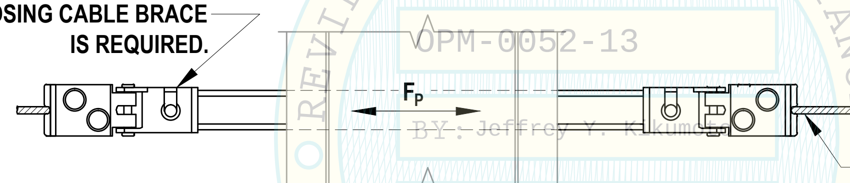
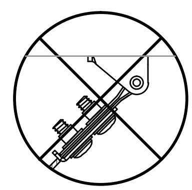
TRANSVERSE CABLE BRACING FOR TRAPEZE SUPPORTED ELECTRICAL CABLE TRAY



SECTION



PLAN VIEW



DO NOT BEND BRACE PAST 90°

MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	876	480	435
1/2"	3/16"	949	893	666
3/4"	3/16"	949	786	758

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.

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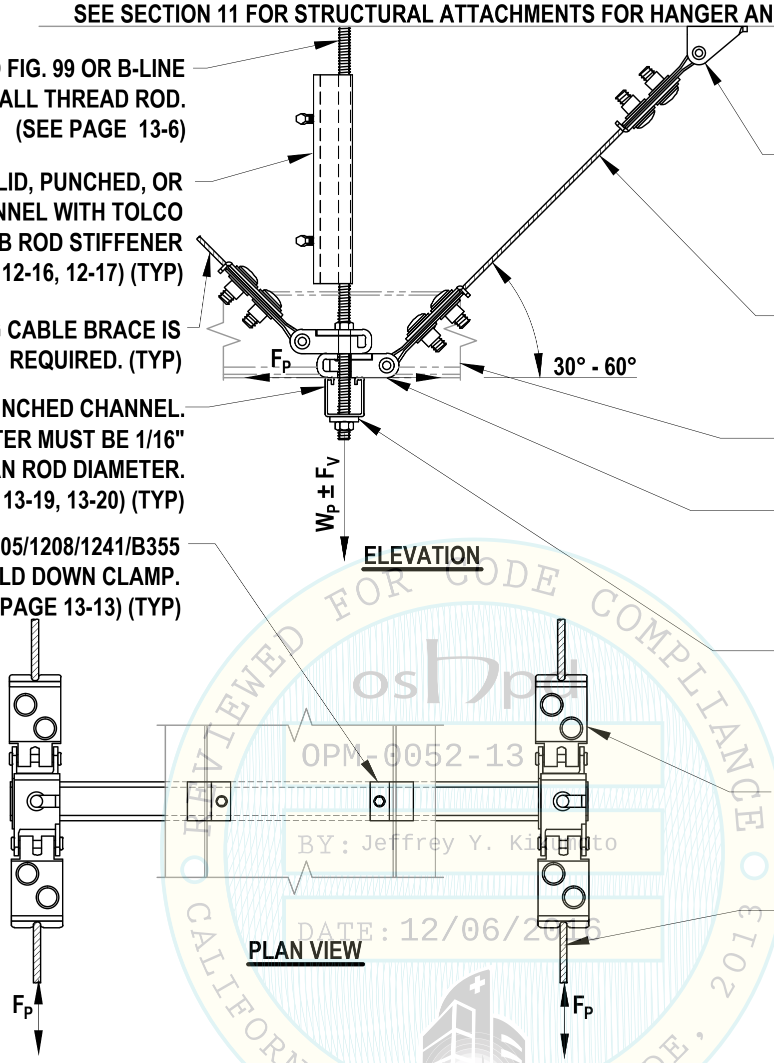
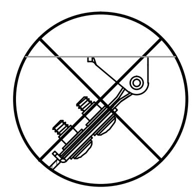
LONGITUDINAL CABLE BRACING FOR TRAPEZE SUPPORTED ELECTRICAL CABLE TRAY

DETAIL 16





DO NOT BEND BRACE PAST 90°

MINIMUM ROD SIZE	MINIMUM CABLE SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	407	407	407
1/2"	3/16"	407	407	407
3/4"	3/16"	407	407	407

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
3.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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Structural Engineer: Mohammad Hariri
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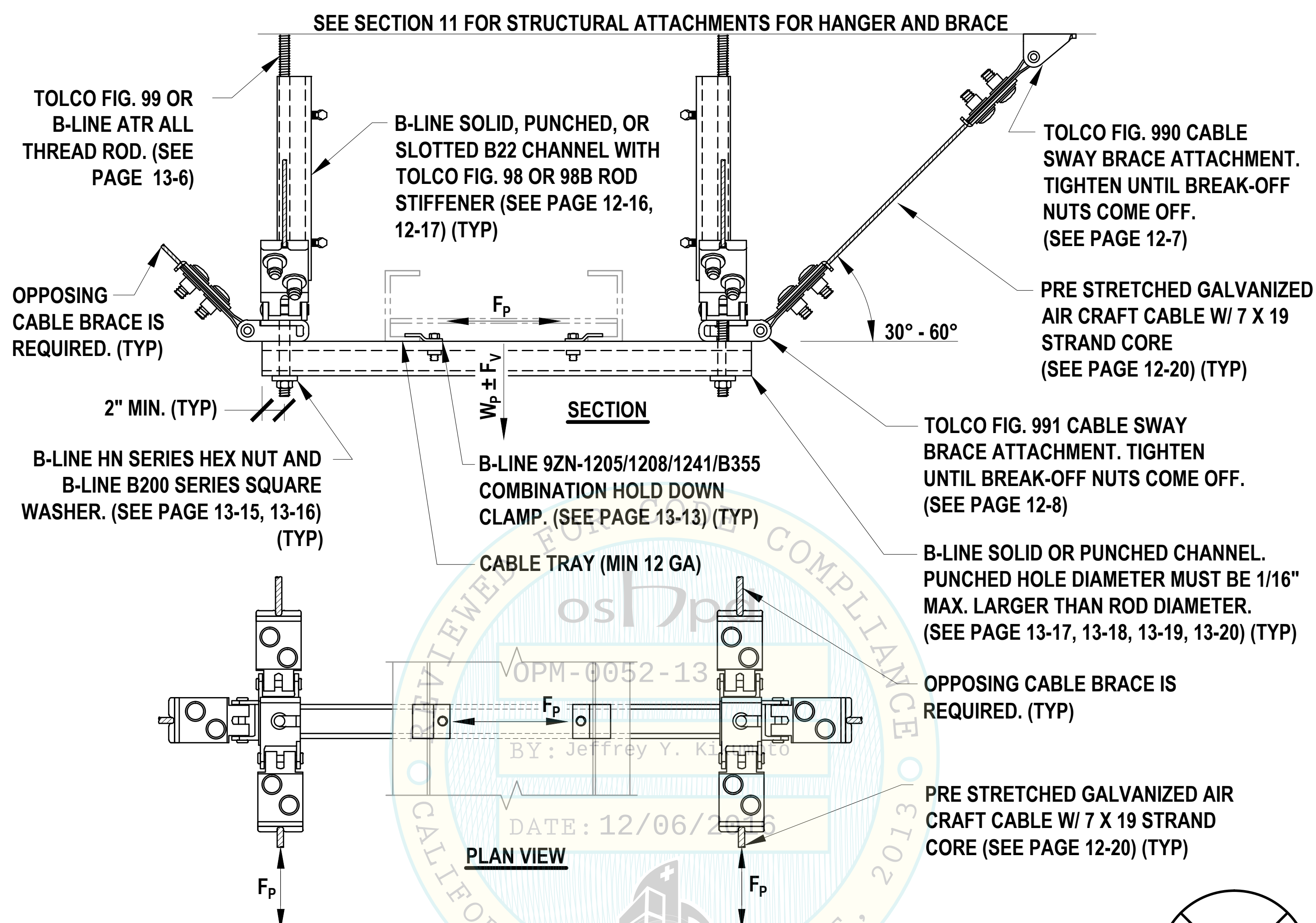
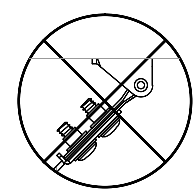


MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD)		
		BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	253	241	183
1/2"	3/16"	296	281	274
3/4"	3/16"	296	296	296



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) THE ABOVE ASSEMBLY ALLOWABLE LOADS CAN BE APPLIED CONCURRENTLY TO BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS WITHOUT REDUCTION.
3.) THE LONGITUDINAL BRACES SHALL BE INSTALLED AT 45- DEGREES.
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
5.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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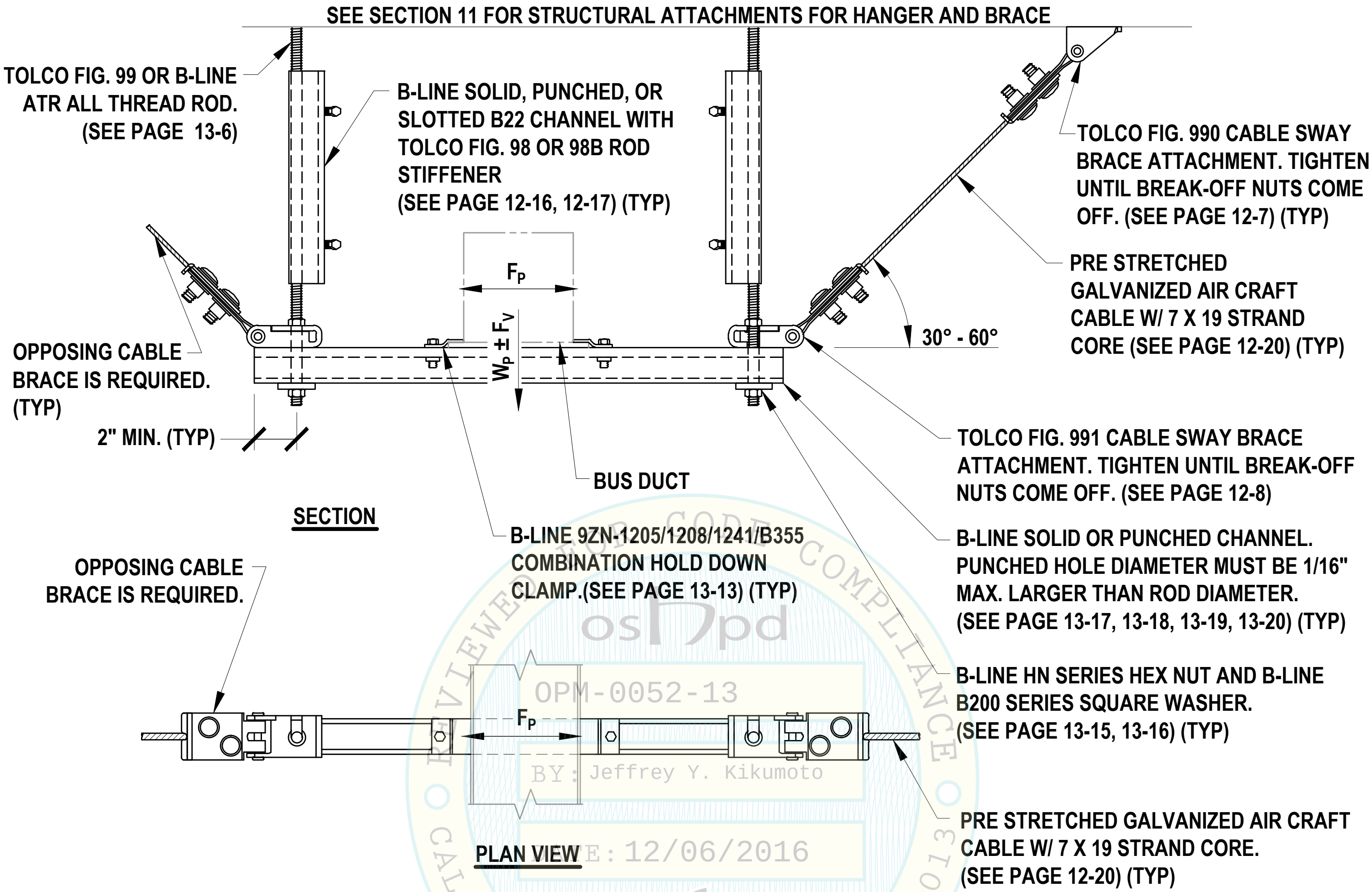
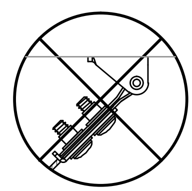
TRANSVERSE CABLE BRACING FOR TRAPEZE SUPPORTED BUS DUCT

DETAIL 15B



MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	876	480	435
1/2"	3/16"	949	893	666
3/4"	3/16"	949	786	758



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.

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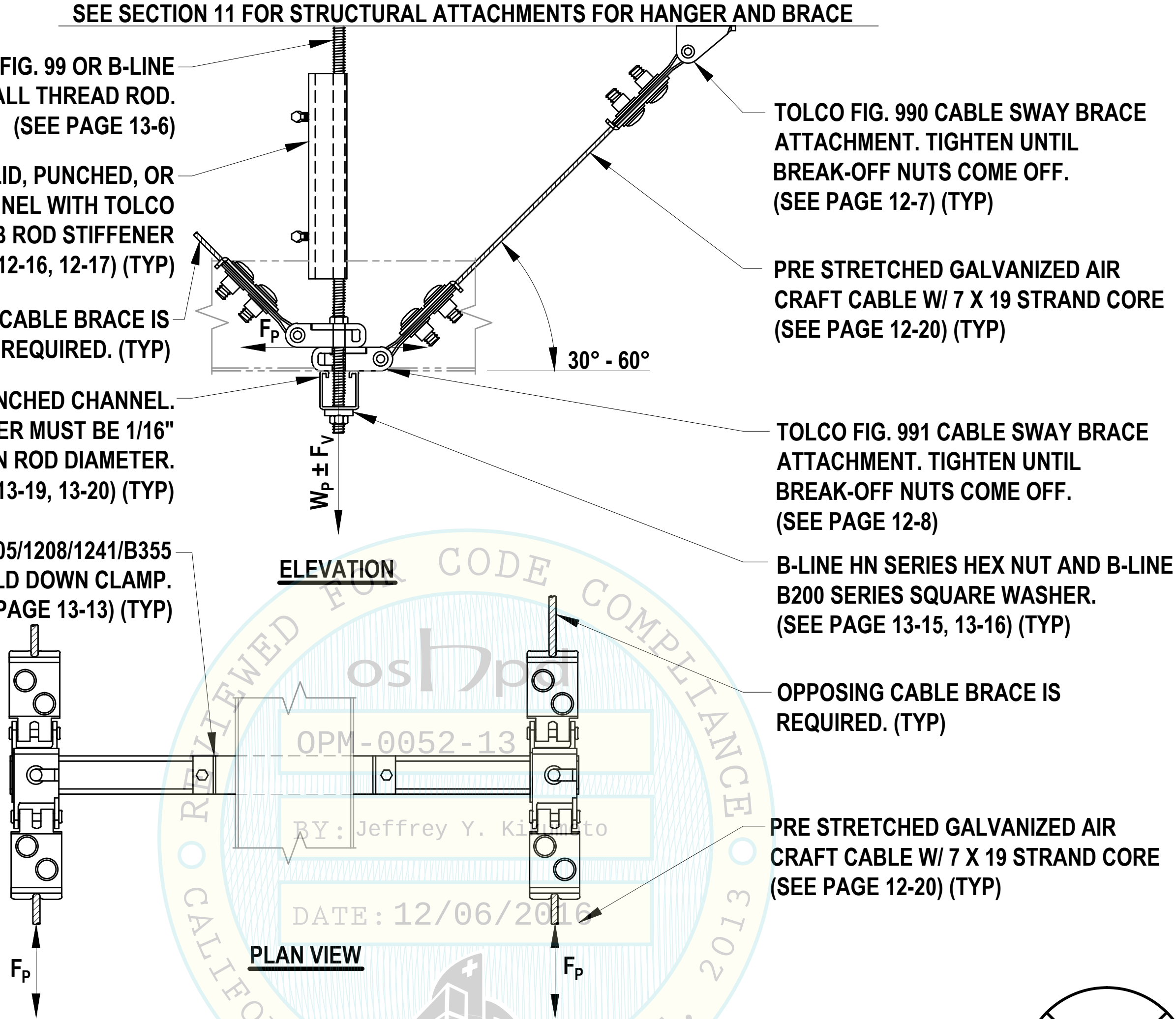
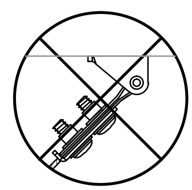
LONGITUDINAL CABLE BRACING FOR TRAPEZE SUPPORTED BUS DUCT

DETAIL 16B



MINIMUM ROD SIZE	MINIMUM CABLE SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD)		
		BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	407	407	407
1/2"	3/16"	407	407	407
3/4"	3/16"	407	407	407



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 1.
3.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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DATE: NOVEMBER 29, 2016

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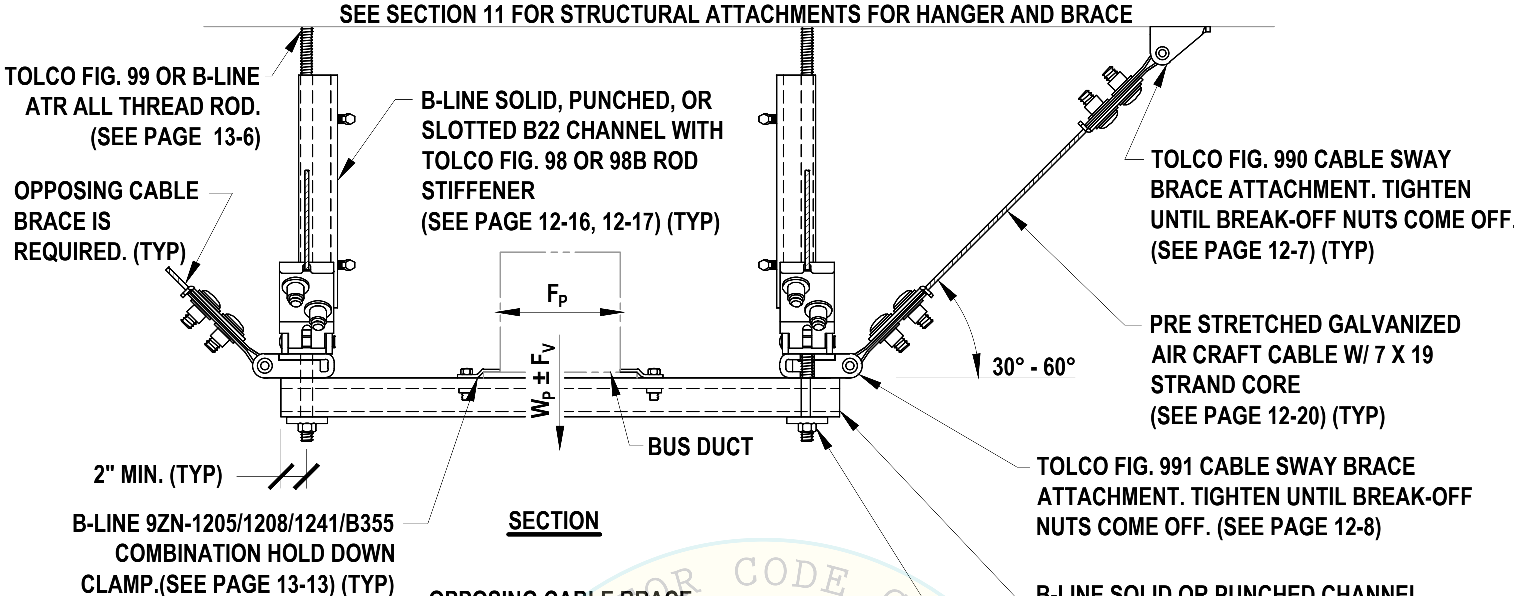
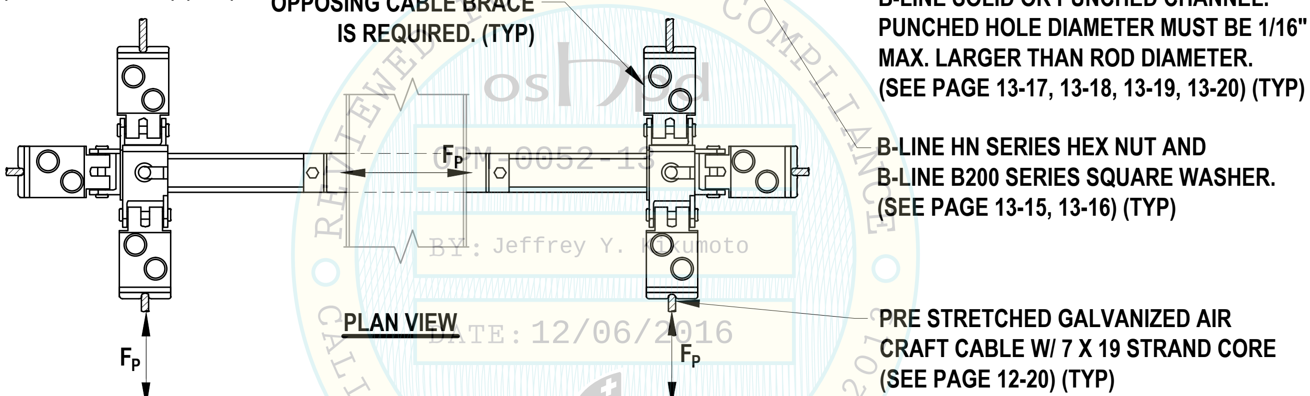
TRANSVERSE AND LONGITUDINAL COMBINATION CABLE BRACING FOR TRAPEZE SUPPORTED BUS DUCT

DETAIL 15B/16B

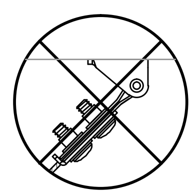


SECTION



PLAN VIEW

MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	253	241	183
1/2"	3/16"	296	281	274
3/4"	3/16"	296	296	296



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) THE ABOVE ASSEMBLY ALLOWABLE LOADS CAN BE APPLIED CONCURRENTLY TO BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS WITHOUT REDUCTION.
3.) THE LONGITUDINAL BRACES SHALL BE INSTALLED AT 45- DEGREES.
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
5.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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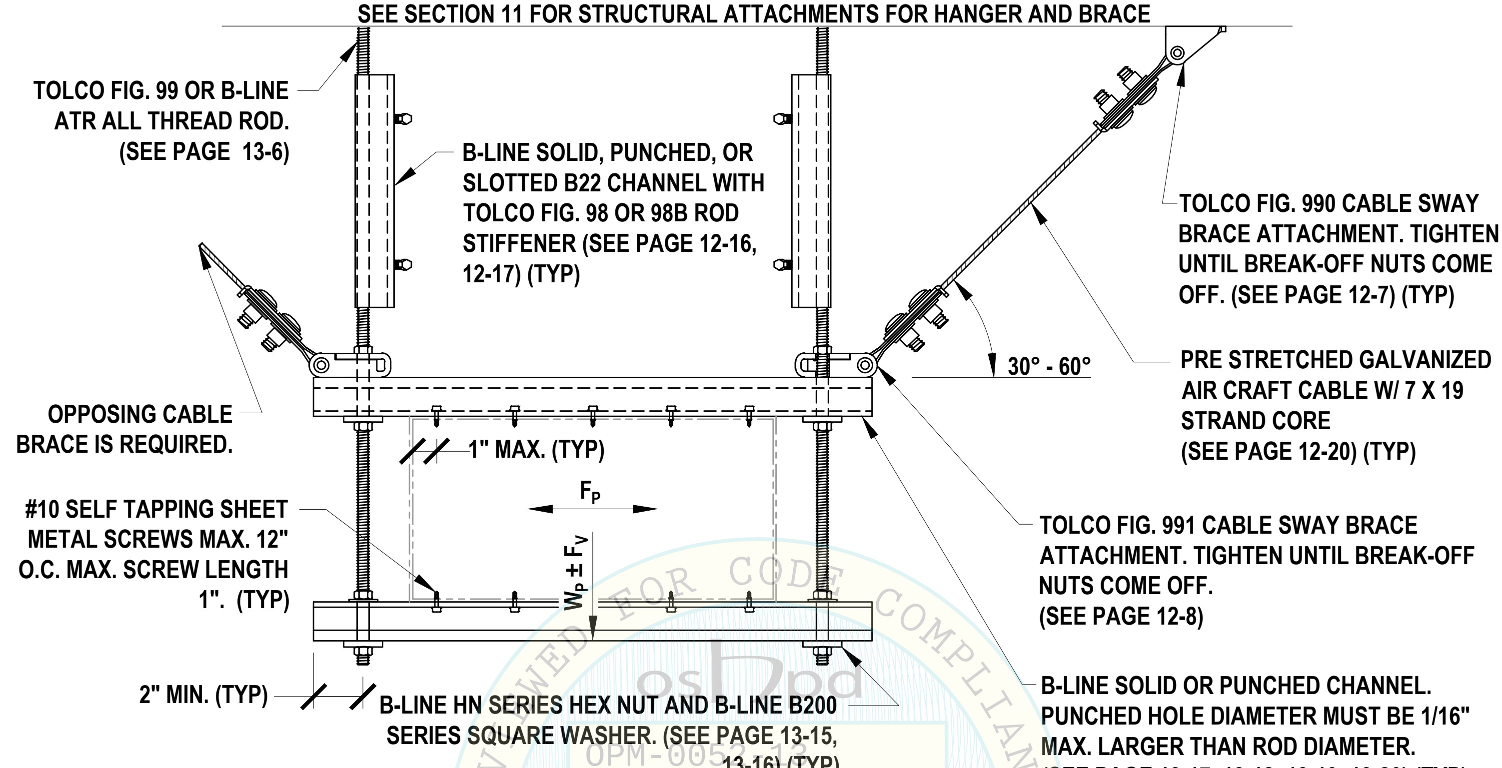
TRANSVERSE CABLE BRACING FOR TRAPEZE SUPPORTED RECTANGULAR DUCT

DETAIL 17



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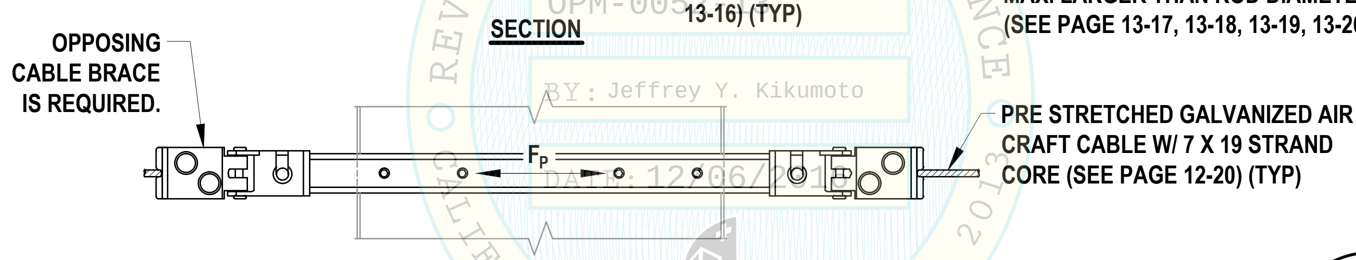
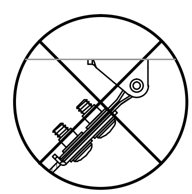


PLAN VIEW

MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	876	480	435
1/2"	3/16"	1263	893	666
3/4"	3/16"	1492	786	758



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13

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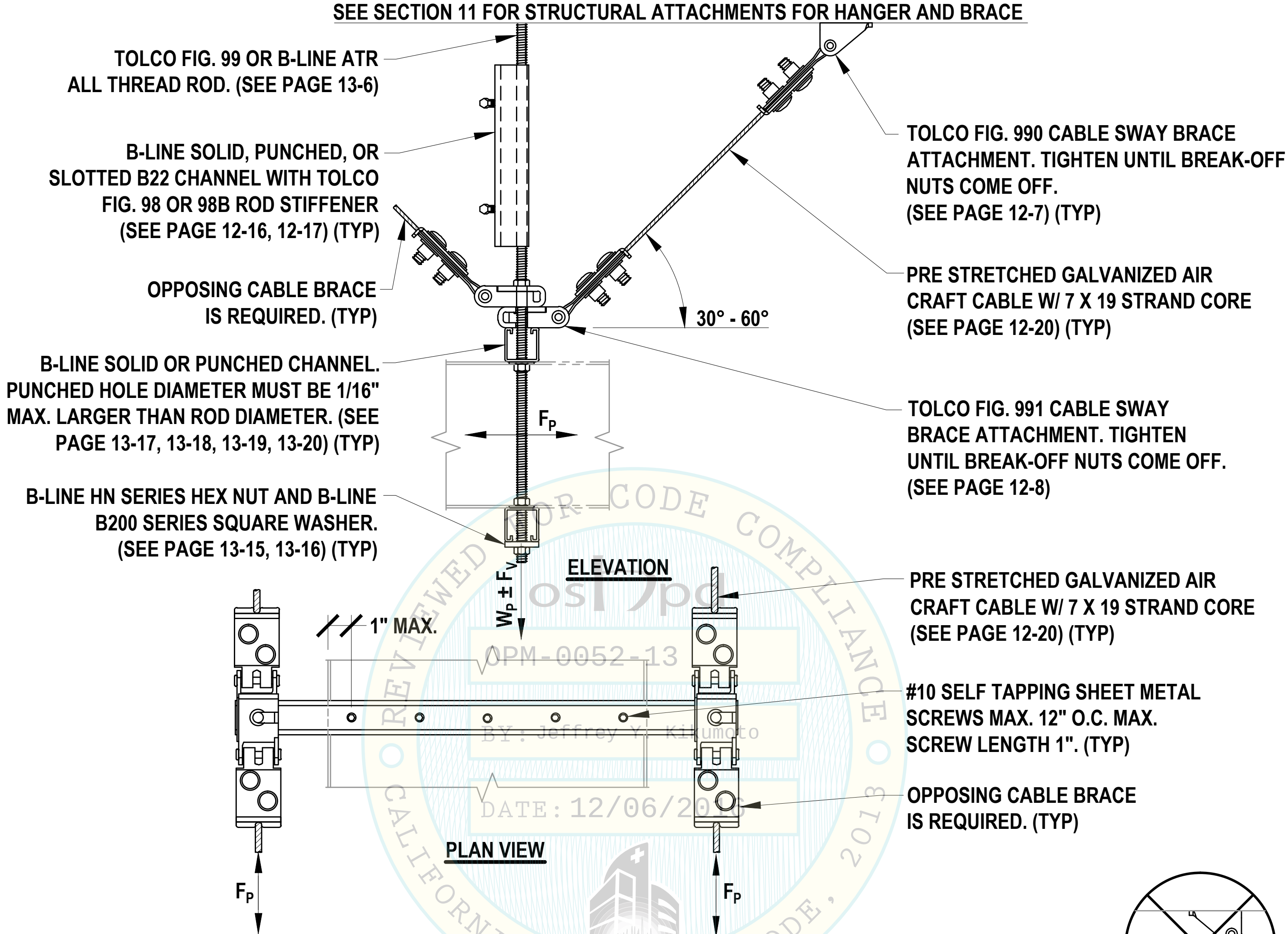
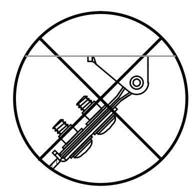
LONGITUDINAL CABLE BRACING FOR TRAPEZE SUPPORTED RECTANGULAR DUCT

DETAIL
18

SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE





DO NOT BEND BRACE PAST 90°

MINIMUM ROD SIZE	MINIMUM CABLE SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	419	438	408
1/2"	3/16"	422	424	437
3/4"	3/16"	458	470	447

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
3.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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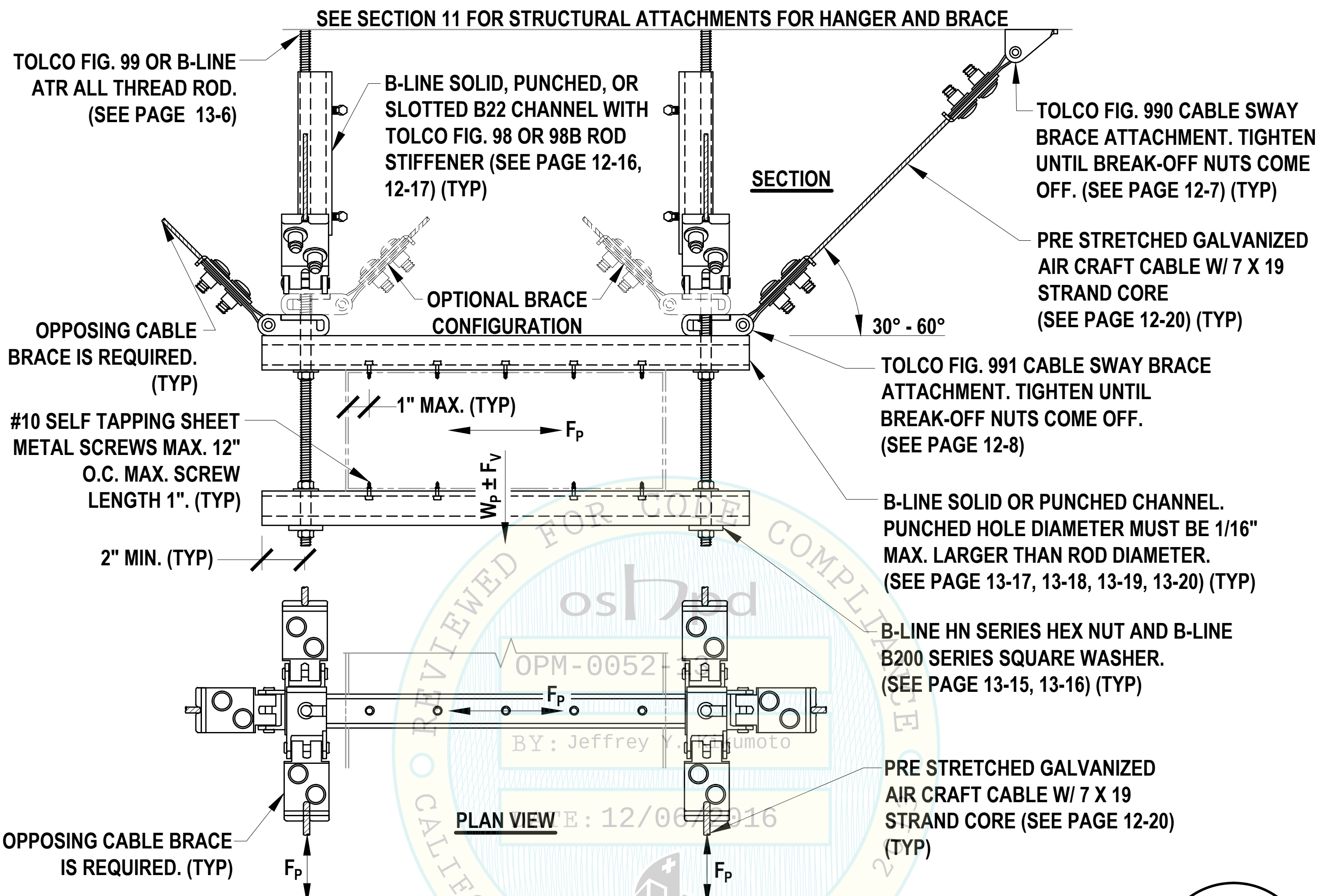
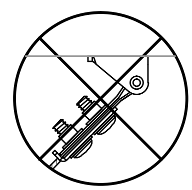
TRANSVERSE AND LONGITUDINAL COMBINATION CABLE BRACING FOR TRAPEZE SUPPORTED RECTANGULAR DUCT

DETAIL 17/18



MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	253	241	183
1/2"	3/16"	301	281	274
3/4"	3/16"	309	319	306



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) THE ABOVE ASSEMBLY ALLOWABLE LOADS CAN BE APPLIED CONCURRENTLY TO BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS WITHOUT REDUCTION.
3.) THE LONGITUDINAL BRACES SHALL BE INSTALLED AT 45- DEGREES.
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
5.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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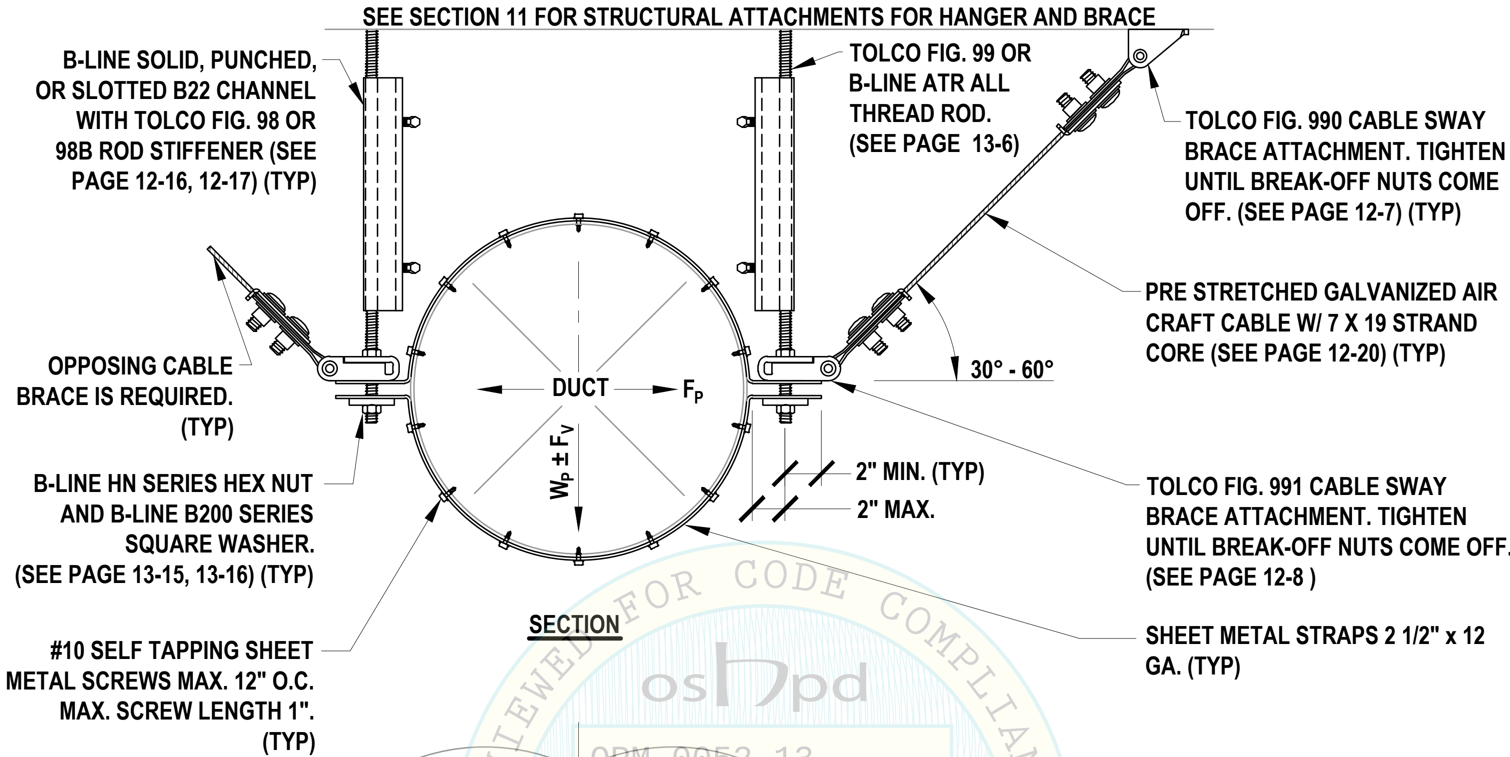
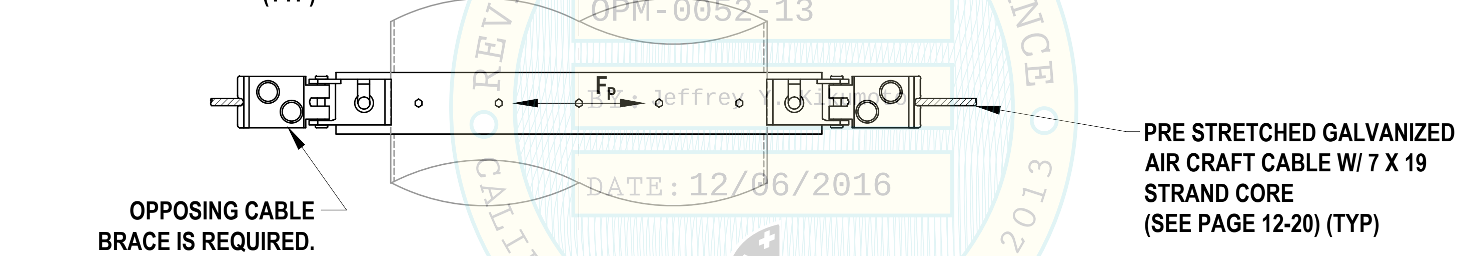
TRANSVERSE CABLE BRACING DETAIL FOR STRAP SUPPORTED ROUND DUCT

DETAIL 19

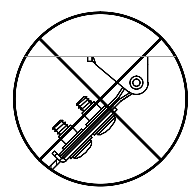


SECTION



PLAN VIEW

MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	876	480	435
1/2"	3/16"	1263	893	666
3/4"	3/16"	1492	786	758



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13

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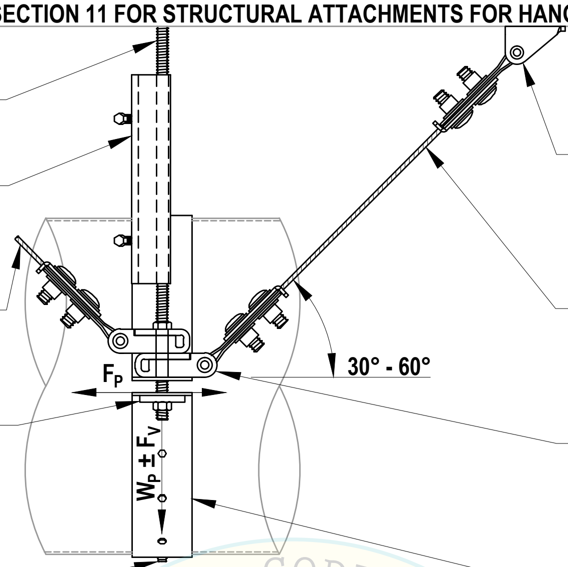
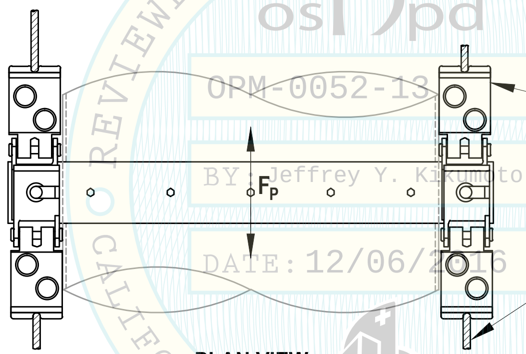
LONGITUDINAL CABLE BRACING DETAIL FOR STRAP SUPPORTED ROUND DUCT

DETAIL 20

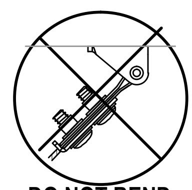
SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE



ELEVATION



PLAN VIEW



DO NOT BEND BRACE PAST 90°

MINIMUM ROD SIZE	MINIMUM CABLE SIZE	LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD) BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
		30°	31° - 45°	46° - 60°
3/8"	1/8"	419	438	408
1/2"	3/16"	422	424	437
3/4"	3/16"	458	470	447

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
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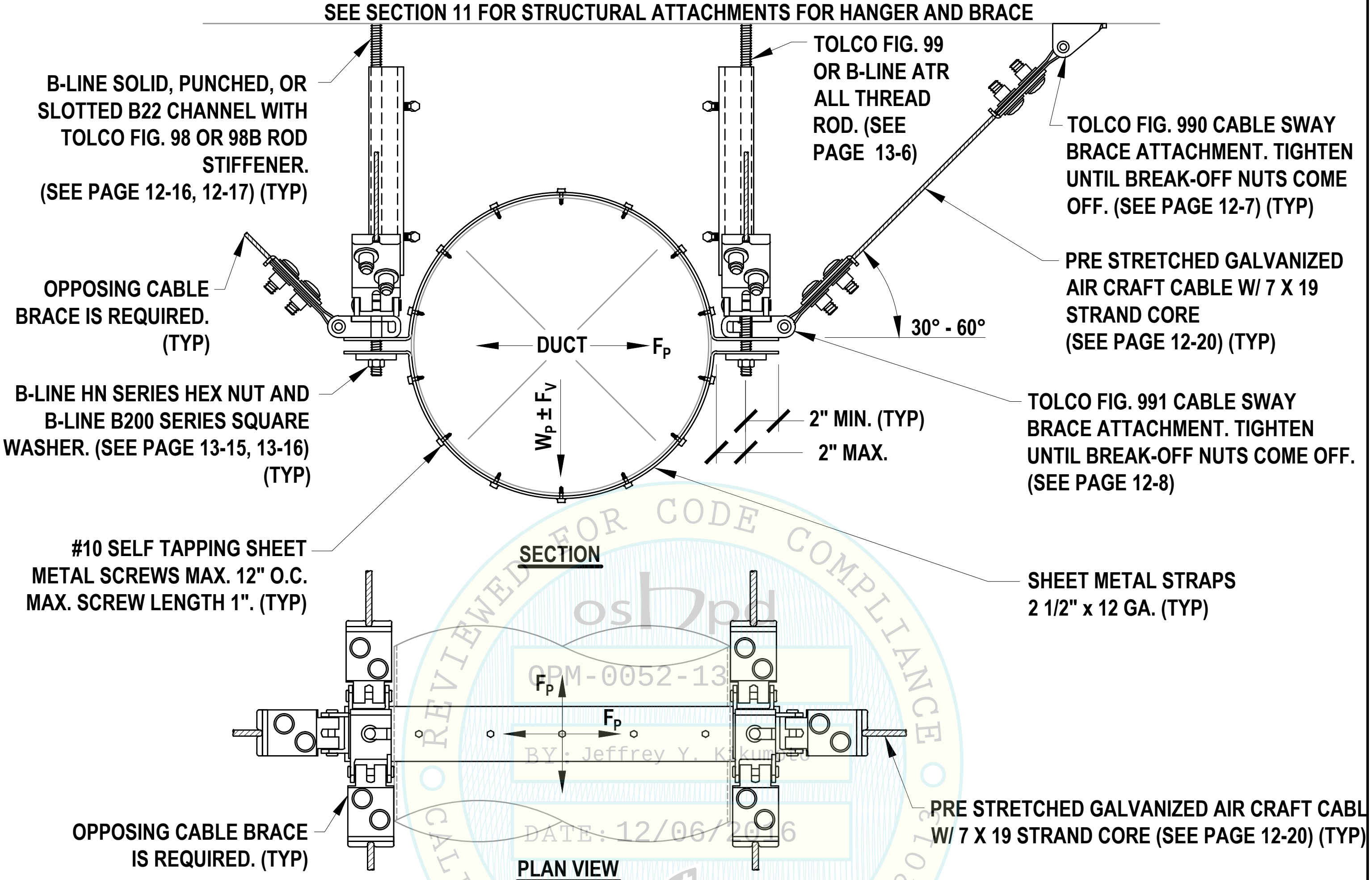
TRANSVERSE AND LONGITUDINAL COMBINATION CABLE BRACING DETAIL FOR STRAP SUPPORTED ROUND DUCT

DETAIL 19/20

SEE SECTION 11 FOR STRUCTURAL ATTACHMENTS FOR HANGER AND BRACE



MINIMUM ROD SIZE	MINIMUM CABLE SIZE	TRANSVERSE / LONGITUDINAL ASSEMBLY ALLOWABLE LOAD, F_P (ASD)		
		BRACE ANGLE MEASURED FROM HORIZ. [lbs]		
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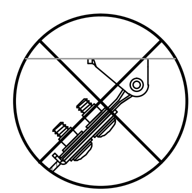
3/8"	1/8"	253	241	183
1/2"	3/16"	301	281	274
3/4"	3/16"	309	319	306



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) THE ABOVE ASSEMBLY ALLOWABLE LOADS CAN BE APPLIED CONCURRENTLY TO BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS WITHOUT REDUCTION.
3.) THE LONGITUDINAL BRACES SHALL BE INSTALLED AT 45- DEGREES.
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.

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DATE: NOVEMBER 29, 2016

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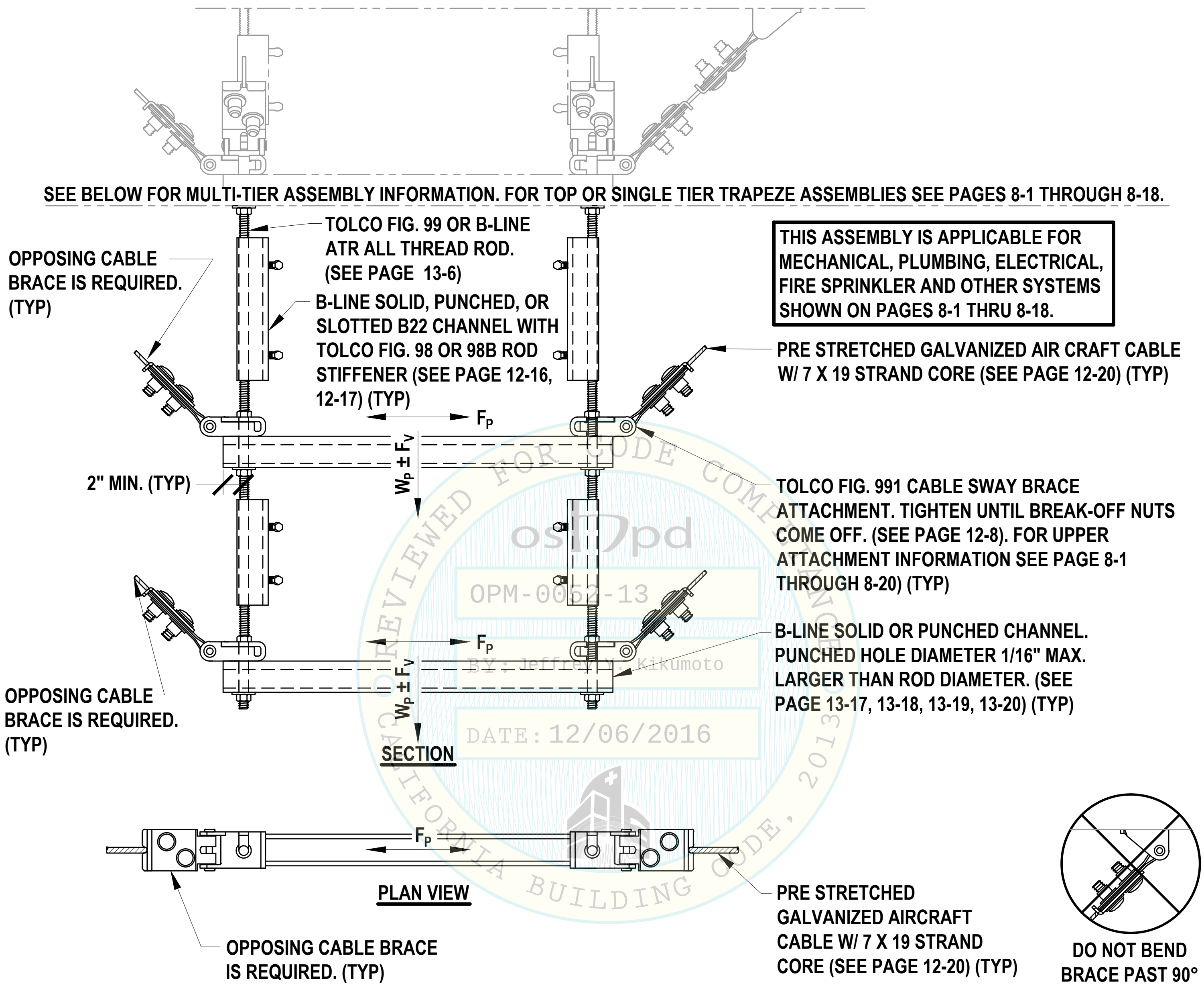
TRANSVERSE CABLE BRACING FOR MULTI-TIER TRAPEZE SUPPORT

DETAIL MC1



GENERAL NOTES:

1.) SEE PAGE 8-22, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) WHEN CALCULATING TOTAL VERTICAL LOAD AT HANGER, INDUCED LOADS FROM BOTH BRACES MUST BE CONSIDERED AT THE SAME TIME. THIS TOTAL DEMAND IS THEN USED IN STEP 9 ON PAGE 1-20.
3.) THE DEMAND OF EACH TIER SHALL NOT EXCEED THE SINGLE TIER CAPACITY AS GIVEN ON CORRESPONDING PAGES 8-1 THRU 8-18
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13

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PAGE: 8-21
DATE: NOVEMBER 29, 2016

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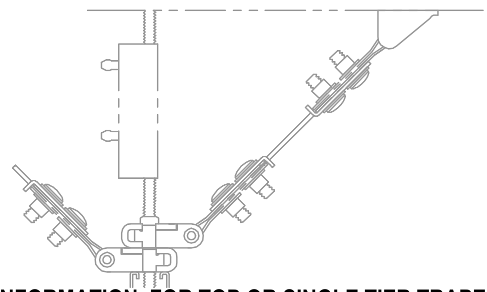
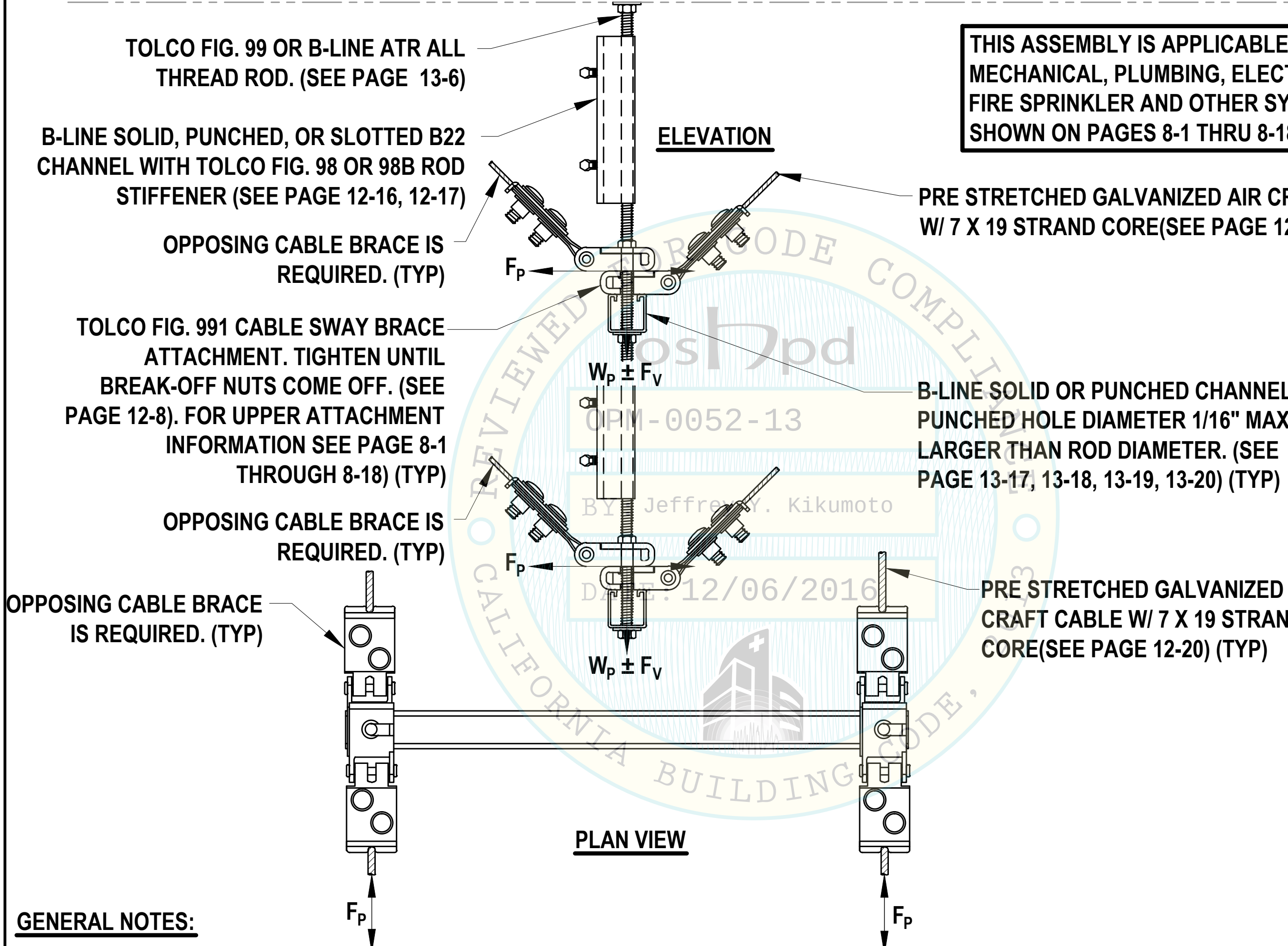
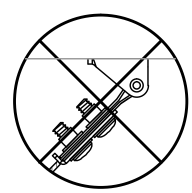
LONGITUDINAL CABLE BRACING FOR MULTI-TIER TRAPEZE SUPPORT	DETAIL MC2



SEE BELOW FOR MULTI-TIER ASSEMBLY INFORMATION. FOR TOP OR SINGLE TIER TRAPEZE ASSEMBLIES SEE PAGES 8-1 THROUGH 8-18.

THIS ASSEMBLY IS APPLICABLE FOR MECHANICAL, PLUMBING, ELECTRICAL, FIRE SPRINKLER AND OTHER SYSTEMS SHOWN ON PAGES 8-1 THRU 8-18.





DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-23, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) WHEN CALCULATING TOTAL VERTICAL LOAD AT HANGER, INDUCED LOADS FROM BOTH BRACES MUST BE CONSIDERED AT THE SAME TIME. THIS TOTAL DEMAND IS THEN USED IN STEP 9 ON PAGE 1-20.
3.) THE DEMAND OF EACH TIER SHALL NOT EXCEED THE SINGLE TIER CAPACITY AS GIVEN ON CORRESPONDING PAGES 8-1 THRU 8-18
4.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
5.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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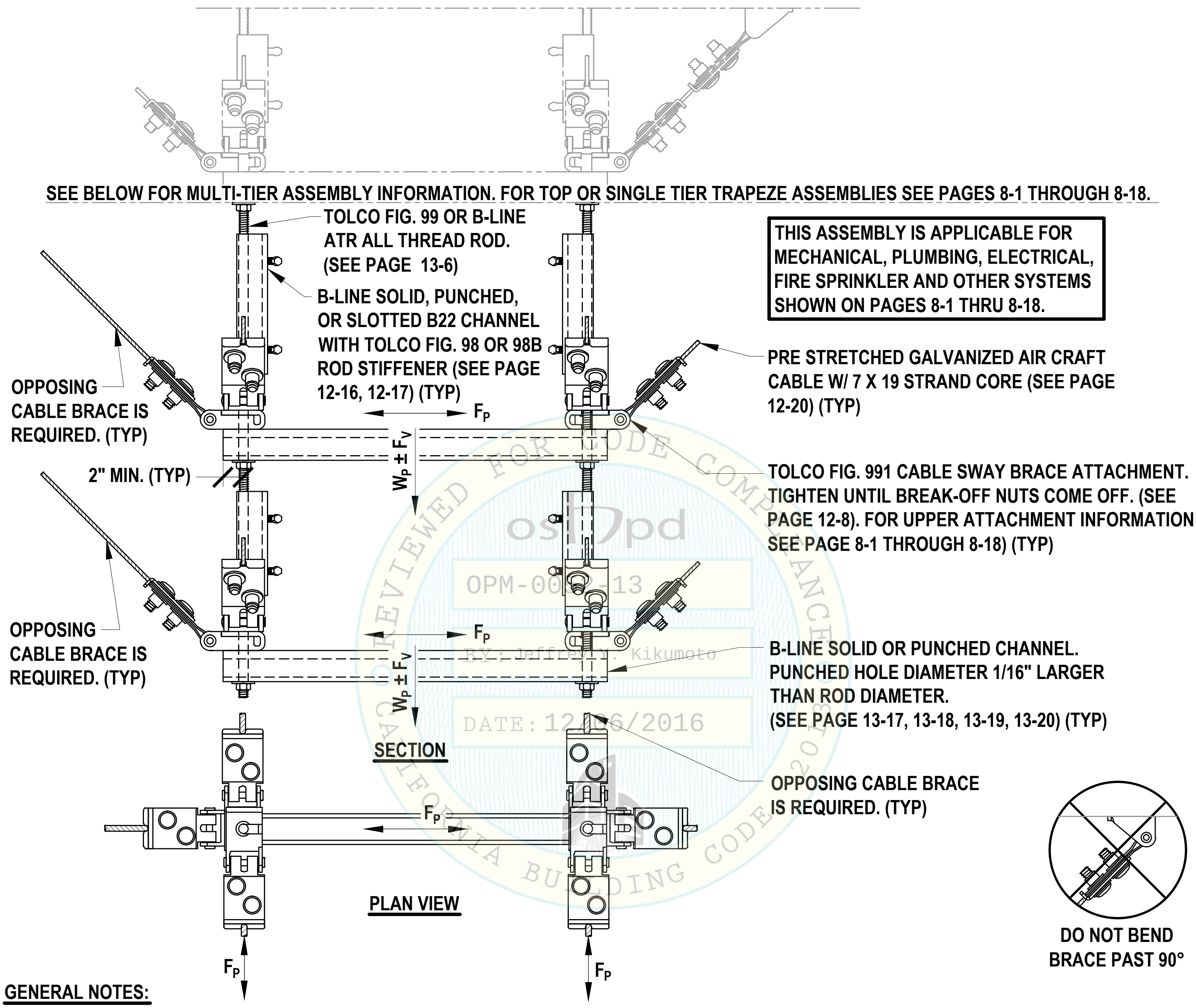
MRH
Structural Engineer: Mohammad Hariri
California SE No. S3545

PAGE: 8-22
DATE: NOVEMBER 29, 2016

MH



GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-24 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) WHEN CALCULATING TOTAL VERTICAL LOAD AT HANGER, INDUCED LOADS FROM BOTH BRACES MUST BE CONSIDERED AT THE SAME TIME. THIS TOTAL DEMAND IS THEN USED IN STEP 9 ON PAGE 1-20.
3.) THE DEMAND OF EACH TIER SHALL NOT EXCEED THE SINGLE TIER CAPACITY AS GIVEN ON CORRESPONDING PAGES 8-1 THRU 8-18.
4.) THE LONGITUDINAL BRACES SHALL BE INSTALLED AT 45- DEGREES.
5.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.
6.) DESIGN PROFESSIONAL SHALL CONSIDER ECCENTRIC LOAD DISTRIBUTION WHEN DETERMINING THE F_P VALUE USED IN DESIGN.

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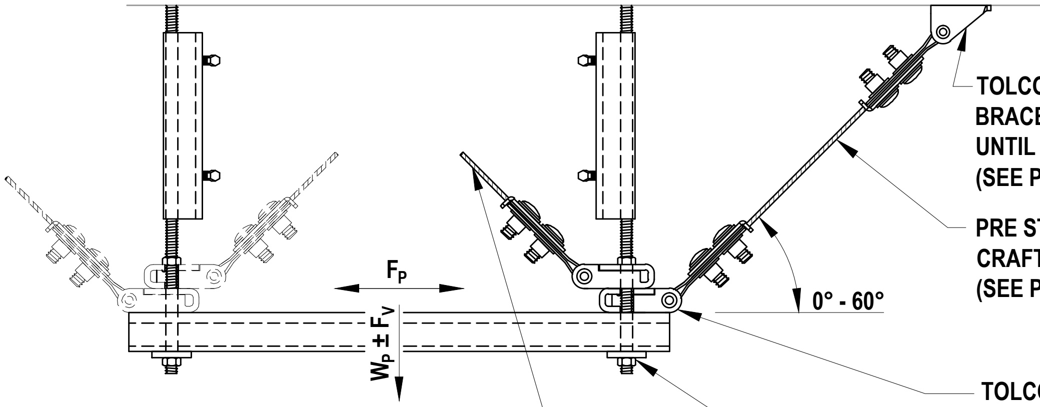
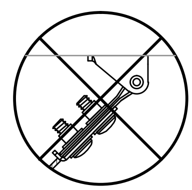
OPTIONAL BRACE CONFIGURATIONS

DETAIL
OPT13

SEE BELOW FOR OPTIONAL BRACE CONFIGURATIONS.
FOR TOP OR TRAPEZE ASSEMBILIES SEE PAGE 8-1 THROUGH 8-18.



ELEVATION



DO NOT BEND BRACE PAST 90°

GENERAL NOTES:

1.) SEE PAGE 8-21, 8-22, 8-23 FOR OPTIONAL AND/OR ADDITIONAL BRACE CONFIGURATIONS.
2.) BRACES MAY BE PLACED IN ANY OF THE ABOVE SHOWN CONFIGURATIONS. QUANTITY OF BRACES MAY VARY BASED ON DESIGN CRITERIA.
3.) VERIFY THE ADEQUACY OF THE SYSTEM ATTACHMENT TO THE STRUT. THE ATTACHMENT MUST BE ADEQUATE TO TRANSFER TRANSVERSE, LONGITUDINAL AND VERTICAL SEISMIC LOADS TO STRUT AS PER SECTION 13.

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DATE: NOVEMBER 29, 2016

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SECTION 9

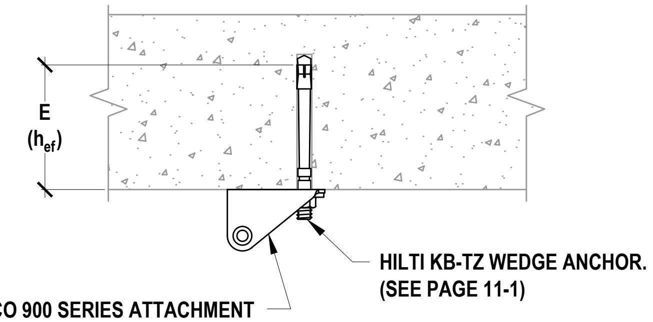
TRAPEZE CABLE BRACE SPACING CHARTS

REVIEWED FOR CODE COMPLIANCE
oshpd
OPM-0052-13
BY: Jeffrey Y. Kikumoto
DATE: 12/06/2016
CALIFORNIA BUILDING CODE, 2013

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse	Cable Diameter	Concrete Anchorage		
	Max. Spacing @ 0.50 "G"		Anchor per Brace	Min. Diameter	Min. Embed "E"
10	40	3/16"	1	3/8"	2"
20	40	3/16"	1	1/2"	3 1/4"
30	30	3/16"	1	1/2"	3 1/4"
40	22	3/16"	1	1/2"	3 1/4"
50	25	3/16"	1	5/8"	4"
60	21	3/16"	1	5/8"	4"
70	18	3/16"	1	5/8"	4"
80	15	3/16"	1	5/8"	4"
90	14	3/16"	1	5/8"	4"
100	12	3/16"	1	5/8"	4"
125	10	3/16"	1	5/8"	4"
150	8	3/16"	1	5/8"	4"
175	7	3/16"	1	5/8"	4"
200	6	3/16"	1	5/8"	4"

Max. Trapeze Weight Per Foot	Longitudinal	Cable Diameter	Concrete Anchorage		
	Max. Spacing @ 0.50 "G"		Anchor per Brace	Min. Diameter	Min. Embed "E"
10	80	3/16"	1	3/8"	2"
20	80	3/16"	1	1/2"	3 1/4"
30	80	3/16"	1	5/8"	4"
40	63	3/16"	1	5/8"	4"
50	50	3/16"	1	5/8"	4"
60	42	3/16"	1	5/8"	4"
70	36	3/16"	1	5/8"	4"
80	31	3/16"	1	5/8"	4"
90	28	3/16"	1	5/8"	4"
100	25	3/16"	1	5/8"	4"
125	20	3/16"	1	5/8"	4"
150	16	3/16"	1	5/8"	4"
175	14	3/16"	1	5/8"	4"
200	12	3/16"	1	5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1.0G BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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California SE No. S3545

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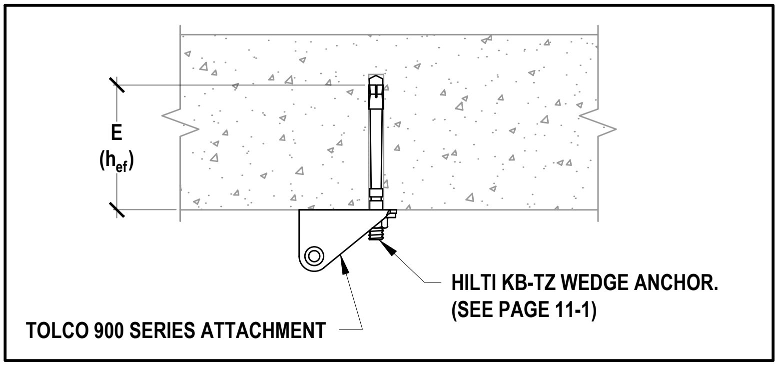
TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse Max. Spacing @ 0.75 "G"	Cable Diameter	Concrete Anchorage: Anchor per Brace	Concrete Anchorage: Min. Diameter	Concrete Anchorage: Min. Embed "E"
10	40	3/16"	1	1/2"	3 1/4"
20	40	3/16"	1	5/8"	4"
30	28	3/16"	1	5/8"	4"
40	21	3/16"	1	5/8"	4"
50	16	3/16"	1	5/8"	4"
60	14	3/16"	1	5/8"	4"
70	12	3/16"	1	5/8"	4"
80	10	3/16"	1	5/8"	4"
90	9	3/16"	1	5/8"	4"
100	8	3/16"	1	5/8"	4"
125	6	3/16"	1	5/8"	4"
150	5	3/16"	1	5/8"	4"
175	4	3/16"	1	5/8"	4"
200	4	3/16"	1	5/8"	4"

Max. Trapeze Weight Per Foot	Longitudinal Max. Spacing @ 0.75 "G"	Cable Diameter	Concrete Anchorage: Anchor per Brace	Concrete Anchorage: Min. Diameter	Concrete Anchorage: Min. Embed "E"
10	80	3/16"	1	1/2"	3 1/4"
20	60	3/16"	1	1/2"	3 1/4"
30	56	3/16"	1	5/8"	4"
40	42	3/16"	1	5/8"	4"
50	33	3/16"	1	5/8"	4"
60	28	3/16"	1	5/8"	4"
70	24	3/16"	1	5/8"	4"
80	21	3/16"	1	5/8"	4"
90	18	3/16"	1	5/8"	4"
100	16	3/16"	1	5/8"	4"
125	13	3/16"	1	5/8"	4"
150	11	3/16"	1	5/8"	4"
175	9	3/16"	1	5/8"	4"
200	8	3/16"	1	5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION..
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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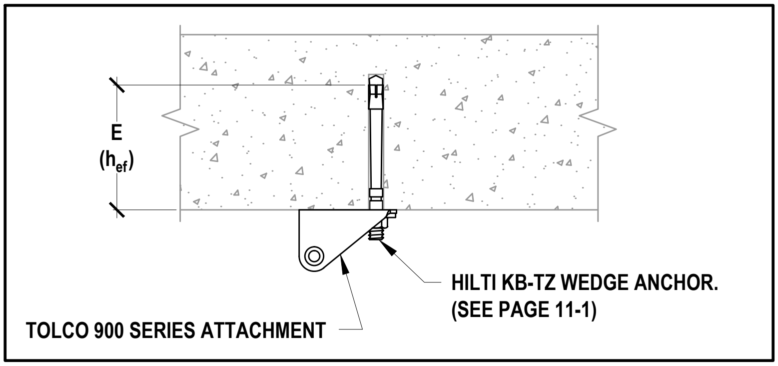
Structural Engineer: Mohammad Hariri
California SE No. S3545

DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

1.0 "G"



Max. Trapeze Weight Per Foot	Transverse	Cable Diameter	Concrete Anchorage		
	Max. Spacing @ 1.0 "G"		Anchor per Brace	Min. Diameter	Min. Embed "E"
10	20	3/16"	1	3/8"	2"
20	22	3/16"	1	1/2"	3 1/4"
30	21	3/16"	1	5/8"	4"
40	15	3/16"	1	5/8"	4"
50	12	3/16"	1	5/8"	4"
60	10	3/16"	1	5/8"	4"
70	9	3/16"	1	5/8"	4"
80	7	3/16"	1	5/8"	4"
90	7	3/16"	1	5/8"	4"
100	6	3/16"	1	5/8"	4"
125	5	3/16"	1	5/8"	4"
150	4	3/16"	1	5/8"	4"
175	3	3/16"	1	5/8"	4"
200	3	3/16"	1	5/8"	4"

Max. Trapeze Weight Per Foot	Longitudinal	Cable Diameter	Concrete Anchorage		
	Max. Spacing @ 1.0 "G"		Anchor per Brace	Min. Diameter	Min. Embed "E"
10	80	3/16"	1	1/2"	3 1/4"
20	63	3/16"	1	5/8"	4"
30	42	3/16"	1	5/8"	4"
40	31	3/16"	1	5/8"	4"
50	25	3/16"	1	5/8"	4"
60	21	3/16"	1	5/8"	4"
70	18	3/16"	1	5/8"	4"
80	15	3/16"	1	5/8"	4"
90	14	3/16"	1	5/8"	4"
100	12	3/16"	1	5/8"	4"
125	10	3/16"	1	5/8"	4"
150	8	3/16"	1	5/8"	4"
175	7	3/16"	1	5/8"	4"
200	6	3/16"	1	5/8"	4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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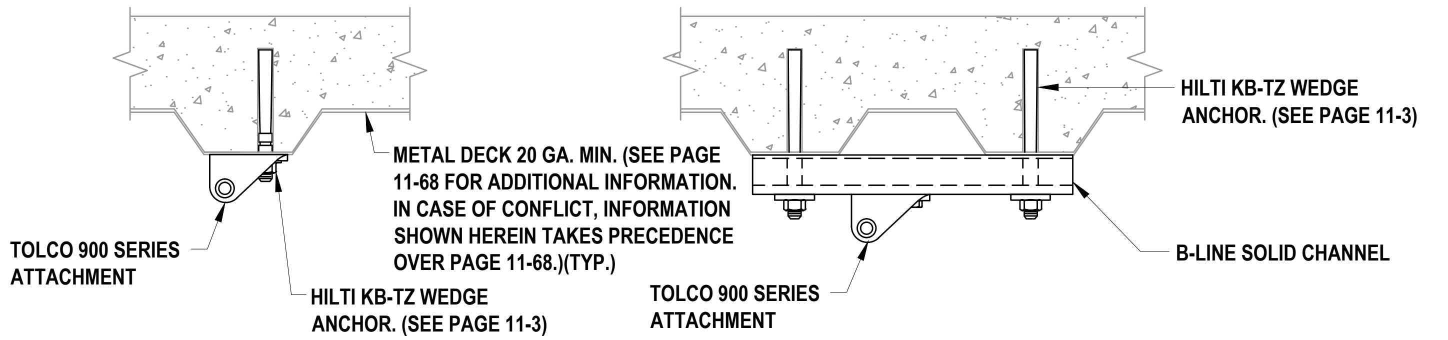
TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 0.50 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	40	3/16"	1	1/2"	3 1/4"
20	40	3/16"	2	(2) 1/2"	3 1/4"
30	33	3/16"	2	(2) 1/2"	3 1/4"
40	25	3/16"	2	(2) 1/2"	3 1/4"
50	20	3/16"	2	(2) 1/2"	3 1/4"
60	16	3/16"	2	(2) 1/2"	3 1/4"
70	14	3/16"	2	(2) 1/2"	3 1/4"
80	12	3/16"	2	(2) 1/2"	3 1/4"
90	11	3/16"	2	(2) 1/2"	3 1/4"
100	10	3/16"	2	(2) 1/2"	3 1/4"
125	8	3/16"	2	(2) 1/2"	3 1/4"
150	6	3/16"	2	(2) 1/2"	3 1/4"
175	5	3/16"	2	(2) 1/2"	3 1/4"
200	5	3/16"	2	(2) 1/2"	3 1/4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 0.50 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	80	3/16"	1	1/2"	3 1/4"
20	80	3/16"	2	(2) 1/2"	3 1/4"
30	67	3/16"	2	(2) 1/2"	3 1/4"
40	50	3/16"	2	(2) 1/2"	3 1/4"
50	40	3/16"	2	(2) 1/2"	3 1/4"
60	33	3/16"	2	(2) 1/2"	3 1/4"
70	28	3/16"	2	(2) 1/2"	3 1/4"
80	25	3/16"	2	(2) 1/2"	3 1/4"
90	22	3/16"	2	(2) 1/2"	3 1/4"
100	20	3/16"	2	(2) 1/2"	3 1/4"
125	16	3/16"	2	(2) 1/2"	3 1/4"
150	13	3/16"	2	(2) 1/2"	3 1/4"
175	11	3/16"	2	(2) 1/2"	3 1/4"
200	10	3/16"	2	(2) 1/2"	3 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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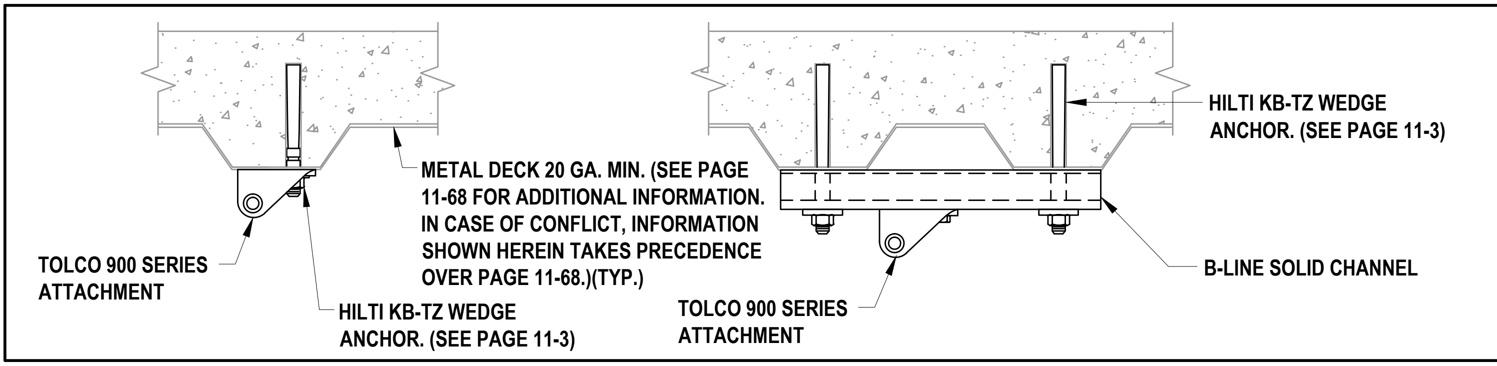
DATE:
NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	22	3/16"	1	1/2"	3 1/4"
20	25	3/16"	2	(2) 1/2"	3 1/4"
30	16	3/16"	2	(2) 1/2"	3 1/4"
40	12	3/16"	2	(2) 1/2"	3 1/4"
50	10	3/16"	2	(2) 1/2"	3 1/4"
60	8	3/16"	2	(2) 1/2"	3 1/4"
70	7	3/16"	2	(2) 1/2"	3 1/4"
80	6	3/16"	2	(2) 1/2"	3 1/4"
90	5	3/16"	2	(2) 1/2"	3 1/4"
100	5	3/16"	2	(2) 1/2"	3 1/4"
125	4	3/16"	2	(2) 1/2"	3 1/4"
150	3	3/16"	2	(2) 1/2"	3 1/4"
175	2	3/16"	2	(2) 1/2"	3 1/4"
200	2	3/16"	2	(2) 1/2"	3 1/4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	44	3/16"	1	1/2"	3 1/4"
20	50	3/16"	2	(2) 1/2"	3 1/4"
30	33	3/16"	2	(2) 1/2"	3 1/4"
40	25	3/16"	2	(2) 1/2"	3 1/4"
50	20	3/16"	2	(2) 1/2"	3 1/4"
60	16	3/16"	2	(2) 1/2"	3 1/4"
70	14	3/16"	2	(2) 1/2"	3 1/4"
80	12	3/16"	2	(2) 1/2"	3 1/4"
90	11	3/16"	2	(2) 1/2"	3 1/4"
100	10	3/16"	2	(2) 1/2"	3 1/4"
125	8	3/16"	2	(2) 1/2"	3 1/4"
150	6	3/16"	2	(2) 1/2"	3 1/4"
175	5	3/16"	2	(2) 1/2"	3 1/4"
200	5	3/16"	2	(2) 1/2"	3 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE ABOVE LOADS ARE ACCEPTABLE.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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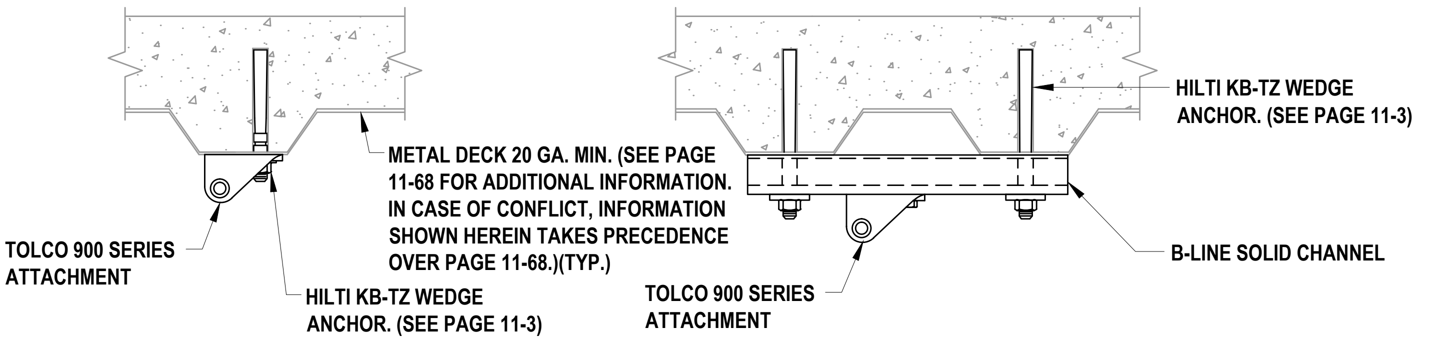
MRH
Structural Engineer: Mohammad Hariri
California SE No. S3545

PAGE: 9-5
DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE WEDGE ANCHORS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

1.0 "G"



Max. Trapeze Weight Per Foot	Transverse Max. Spacing @ 1.0 "G"	Concrete Anchorage Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	22	3/16"	1	1/2"	3 1/4"
20	25	3/16"	2	(2) 1/2"	3 1/4"
30	16	3/16"	2	(2) 1/2"	3 1/4"
40	12	3/16"	2	(2) 1/2"	3 1/4"
50	10	3/16"	2	(2) 1/2"	3 1/4"
60	8	3/16"	2	(2) 1/2"	3 1/4"
70	7	3/16"	2	(2) 1/2"	3 1/4"
80	6	3/16"	2	(2) 1/2"	3 1/4"
90	5	3/16"	2	(2) 1/2"	3 1/4"
100	5	3/16"	2	(2) 1/2"	3 1/4"
125	4	3/16"	2	(2) 1/2"	3 1/4"
150	3	3/16"	2	(2) 1/2"	3 1/4"
175	2	3/16"	2	(2) 1/2"	3 1/4"
200	2	3/16"	2	(2) 1/2"	3 1/4"

Max. Trapeze Weight Per Foot	Longitudinal Max. Spacing @ 1.0 "G"	Concrete Anchorage Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	44	3/16"	1	1/2"	3 1/4"
20	50	3/16"	2	(2) 1/2"	3 1/4"
30	33	3/16"	2	(2) 1/2"	3 1/4"
40	25	3/16"	2	(2) 1/2"	3 1/4"
50	20	3/16"	2	(2) 1/2"	3 1/4"
60	16	3/16"	2	(2) 1/2"	3 1/4"
70	14	3/16"	2	(2) 1/2"	3 1/4"
80	12	3/16"	2	(2) 1/2"	3 1/4"
90	11	3/16"	2	(2) 1/2"	3 1/4"
100	10	3/16"	2	(2) 1/2"	3 1/4"
125	8	3/16"	2	(2) 1/2"	3 1/4"
150	6	3/16"	2	(2) 1/2"	3 1/4"
175	5	3/16"	2	(2) 1/2"	3 1/4"
200	5	3/16"	2	(2) 1/2"	3 1/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) CHARTS BASED ON TENSION AND SHEAR LOADS FROM HILTI KWIK BOLT (KB-TZ) ANCHOR (ICC ESR-1917, MAY 1, 2013) WITH SPECIAL INSPECTION.
4.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
5.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE ABOVE LOADS ARE ACCEPTABLE.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

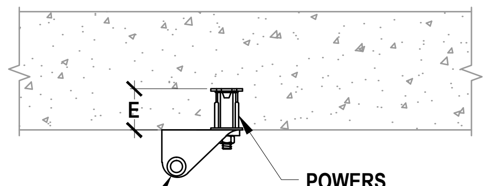
PAGE: 9-6

DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse Max. Spacing @ 0.50 "G"	Cable Diameter	Concrete Anchorage: Anchor per Brace	Concrete Anchorage: Min. Diameter	Concrete Anchorage: Min. Embed "E"
10	40	3/16"	1	3/8"	1 3/4"
20	37	3/16"	1	3/8"	1 3/4"
30	32	3/16"	1	1/2"	1 3/4"
40	24	3/16"	1	1/2"	1 3/4"
50	19	3/16"	1	1/2"	1 3/4"
60	16	3/16"	1	1/2"	1 3/4"
70	13	3/16"	1	1/2"	1 3/4"
80	12	3/16"	1	5/8"	1 3/4"
90	11	3/16"	1	5/8"	1 3/4"
100	10	3/16"	1	5/8"	1 3/4"
125	8	3/16"	1	5/8"	1 3/4"
150	6	3/16"	1	5/8"	1 3/4"
175	5	3/16"	1	5/8"	1 3/4"
200	5	3/16"	1	5/8"	1 3/4"

Max. Trapeze Weight Per Foot	Longitudinal Max. Spacing @ 0.50 "G"	Cable Diameter	Concrete Anchorage: Anchor per Brace	Concrete Anchorage: Min. Diameter	Concrete Anchorage: Min. Embed "E"
10	80	3/16"	1	3/8"	1 3/4"
20	74	3/16"	1	3/8"	1 3/4"
30	49	3/16"	1	3/8"	1 3/4"
40	37	3/16"	1	3/8"	1 3/4"
50	38	3/16"	1	1/2"	1 3/4"
60	33	3/16"	1	5/8"	1 3/4"
70	28	3/16"	1	5/8"	1 3/4"
80	25	3/16"	1	5/8"	1 3/4"
90	22	3/16"	1	5/8"	1 3/4"
100	20	3/16"	1	5/8"	1 3/4"
125	16	3/16"	1	5/8"	1 3/4"
150	13	3/16"	1	5/8"	1 3/4"
175	11	3/16"	1	5/8"	1 3/4"
200	10	3/16"	1	5/8"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
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5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
7.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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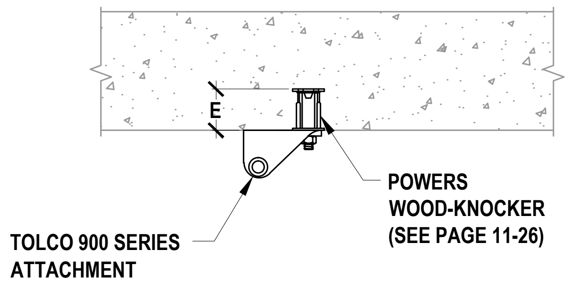
Structural Engineer: Mohammad Hariri
California SE No. S3545

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse Max. Spacing @ 0.75 "G"	Cable Diameter	Concrete Anchorage: Anchor per Brace	Concrete Anchorage: Min. Diameter	Concrete Anchorage: Min. Embed "E"
10	40	3/16"	1	3/8"	1 3/4"
20	33	3/16"	1	5/8"	1 3/4"
30	22	3/16"	1	5/8"	1 3/4"
40	16	3/16"	1	5/8"	1 3/4"
50	13	3/16"	1	5/8"	1 3/4"
60	11	3/16"	1	5/8"	1 3/4"
70	9	3/16"	1	5/8"	1 3/4"
80	8	3/16"	1	5/8"	1 3/4"
90	7	3/16"	1	5/8"	1 3/4"
100	6	3/16"	1	5/8"	1 3/4"
125	5	3/16"	1	5/8"	1 3/4"
150	4	3/16"	1	5/8"	1 3/4"
175	3	3/16"	1	5/8"	1 3/4"
200	3	3/16"	1	5/8"	1 3/4"

Max. Trapeze Weight Per Foot	Longitudinal Max. Spacing @ 0.75 "G"	Cable Diameter	Concrete Anchorage: Anchor per Brace	Concrete Anchorage: Min. Diameter	Concrete Anchorage: Min. Embed "E"
10	80	3/16"	1	3/8"	1 3/4"
20	66	3/16"	1	5/8"	1 3/4"
30	44	3/16"	1	5/8"	1 3/4"
40	33	3/16"	1	5/8"	1 3/4"
50	26	3/16"	1	5/8"	1 3/4"
60	22	3/16"	1	5/8"	1 3/4"
70	19	3/16"	1	5/8"	1 3/4"
80	16	3/16"	1	5/8"	1 3/4"
90	14	3/16"	1	5/8"	1 3/4"
100	13	3/16"	1	5/8"	1 3/4"
125	10	3/16"	1	5/8"	1 3/4"
150	8	3/16"	1	5/8"	1 3/4"
175	7	3/16"	1	5/8"	1 3/4"
200	6	3/16"	1	5/8"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
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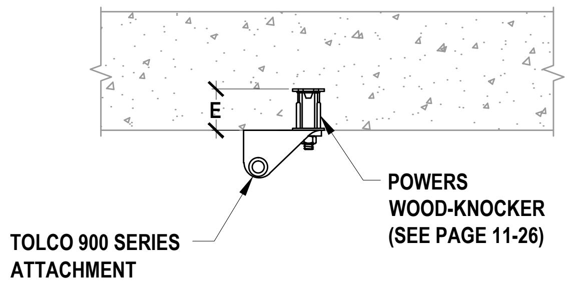
TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN NORMAL WEIGHT CONCRETE - 4,000 PSI MIN.

1.0 "G"



Max. Trapeze Weight Per Foot	Transverse Max. Spacing @ 1.0 "G"	Cable Diameter	Concrete Anchorage Anchor per Brace	Concrete Anchorage Min. Diameter	Concrete Anchorage Min. Embed "E"
10	40	3/16"	1	5/8"	1 3/4"
20	25	3/16"	1	5/8"	1 3/4"
30	16	3/16"	1	5/8"	1 3/4"
40	12	3/16"	1	5/8"	1 3/4"
50	10	3/16"	1	5/8"	1 3/4"
60	8	3/16"	1	5/8"	1 3/4"
70	7	3/16"	1	5/8"	1 3/4"
80	6	3/16"	1	5/8"	1 3/4"
90	5	3/16"	1	5/8"	1 3/4"
100	5	3/16"	1	5/8"	1 3/4"
125	4	3/16"	1	5/8"	1 3/4"
150	3	3/16"	1	5/8"	1 3/4"
175	2	3/16"	1	5/8"	1 3/4"
200	2	3/16"	1	5/8"	1 3/4"

Max. Trapeze Weight Per Foot	Longitudinal Max. Spacing @ 1.0 "G"	Cable Diameter	Concrete Anchorage Anchor per Brace	Concrete Anchorage Min. Diameter	Concrete Anchorage Min. Embed "E"
10	80	3/16"	1	5/8"	1 3/4"
20	50	3/16"	1	5/8"	1 3/4"
30	33	3/16"	1	5/8"	1 3/4"
40	25	3/16"	1	5/8"	1 3/4"
50	20	3/16"	1	5/8"	1 3/4"
60	16	3/16"	1	5/8"	1 3/4"
70	14	3/16"	1	5/8"	1 3/4"
80	12	3/16"	1	5/8"	1 3/4"
90	11	3/16"	1	5/8"	1 3/4"
100	10	3/16"	1	5/8"	1 3/4"
125	8	3/16"	1	5/8"	1 3/4"
150	6	3/16"	1	5/8"	1 3/4"
175	5	3/16"	1	5/8"	1 3/4"
200	5	3/16"	1	5/8"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
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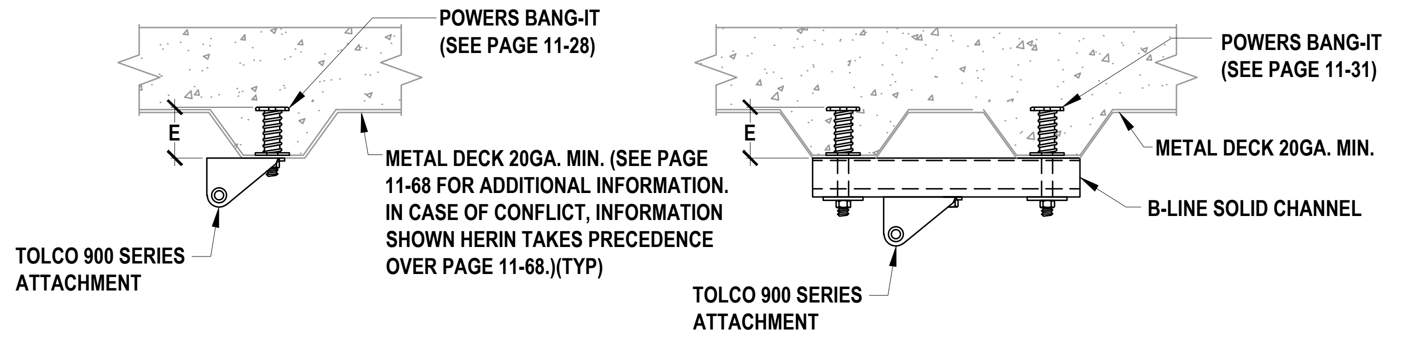
TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse Max. Spacing @ 0.50 "G"	Concrete Anchorage Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	40	3/16"	1	5/8"	1 3/4"
20	25	3/16"	1	5/8"	1 3/4"
30	17	3/16"	1	5/8"	1 3/4"
40	40	3/16"	2	(2) 1/2"	1 3/4"
50	34	3/16"	2	(2) 1/2"	1 3/4"
60	28	3/16"	2	(2) 1/2"	1 3/4"
70	24	3/16"	2	(2) 1/2"	1 3/4"
80	21	3/16"	2	(2) 1/2"	1 3/4"
90	19	3/16"	2	(2) 1/2"	1 3/4"
100	17	3/16"	2	(2) 1/2"	1 3/4"
125	13	3/16"	2	(2) 1/2"	1 3/4"
150	11	3/16"	2	(2) 1/2"	1 3/4"
175	9	3/16"	2	(2) 1/2"	1 3/4"
200	8	3/16"	2	(2) 1/2"	1 3/4"

Max. Trapeze Weight Per Foot	Longitudinal Max. Spacing @ 0.50 "G"	Concrete Anchorage Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	80	1/8"	1	3/8"	1 3/4"
20	51	1/8"	1	5/8"	1 3/4"
30	34	1/8"	1	5/8"	1 3/4"
40	80	3/16"	2	(2) 1/2"	1 3/4"
50	68	3/16"	2	(2) 1/2"	1 3/4"
60	57	3/16"	2	(2) 1/2"	1 3/4"
70	48	3/16"	2	(2) 1/2"	1 3/4"
80	42	3/16"	2	(2) 1/2"	1 3/4"
90	38	3/16"	2	(2) 1/2"	1 3/4"
100	34	3/16"	2	(2) 1/2"	1 3/4"
125	27	3/16"	2	(2) 1/2"	1 3/4"
150	22	3/16"	2	(2) 1/2"	1 3/4"
175	19	3/16"	2	(2) 1/2"	1 3/4"
200	17	3/16"	2	(2) 1/2"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
7.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

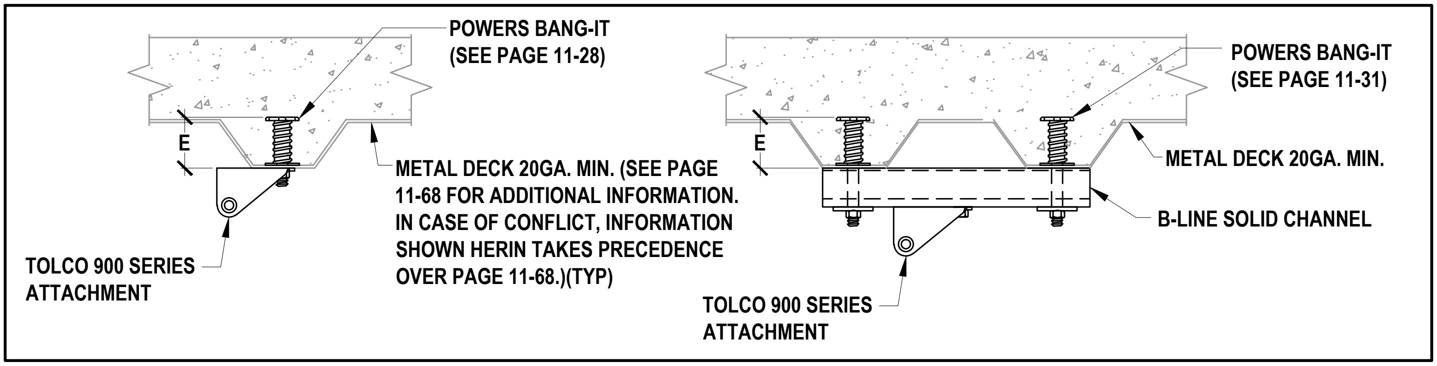
PAGE: 9-10

DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	34	3/16"	1	5/8"	1 3/4"
20	40	3/16"	2	(2) 1/2"	1 3/4"
30	38	3/16"	2	(2) 1/2"	1 3/4"
40	28	3/16"	2	(2) 1/2"	1 3/4"
50	22	3/16"	2	(2) 1/2"	1 3/4"
60	19	3/16"	2	(2) 1/2"	1 3/4"
70	16	3/16"	2	(2) 1/2"	1 3/4"
80	14	3/16"	2	(2) 1/2"	1 3/4"
90	12	3/16"	2	(2) 1/2"	1 3/4"
100	11	3/16"	2	(2) 1/2"	1 3/4"
125	9	3/16"	2	(2) 1/2"	1 3/4"
150	7	3/16"	2	(2) 1/2"	1 3/4"
175	6	3/16"	2	(2) 1/2"	1 3/4"
200	5	3/16"	2	(2) 1/2"	1 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 0.75 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	68	3/16"	1	5/8"	1 3/4"
20	80	3/16"	2	(2) 1/2"	1 3/4"
30	76	3/16"	2	(2) 1/2"	1 3/4"
40	57	3/16"	2	(2) 1/2"	1 3/4"
50	45	3/16"	2	(2) 1/2"	1 3/4"
60	38	3/16"	2	(2) 1/2"	1 3/4"
70	32	3/16"	2	(2) 1/2"	1 3/4"
80	28	3/16"	2	(2) 1/2"	1 3/4"
90	25	3/16"	2	(2) 1/2"	1 3/4"
100	22	3/16"	2	(2) 1/2"	1 3/4"
125	18	3/16"	2	(2) 1/2"	1 3/4"
150	15	3/16"	2	(2) 1/2"	1 3/4"
175	13	3/16"	2	(2) 1/2"	1 3/4"
200	11	3/16"	2	(2) 1/2"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
7.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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California SE No. S3545

DATE: NOVEMBER 29, 2016

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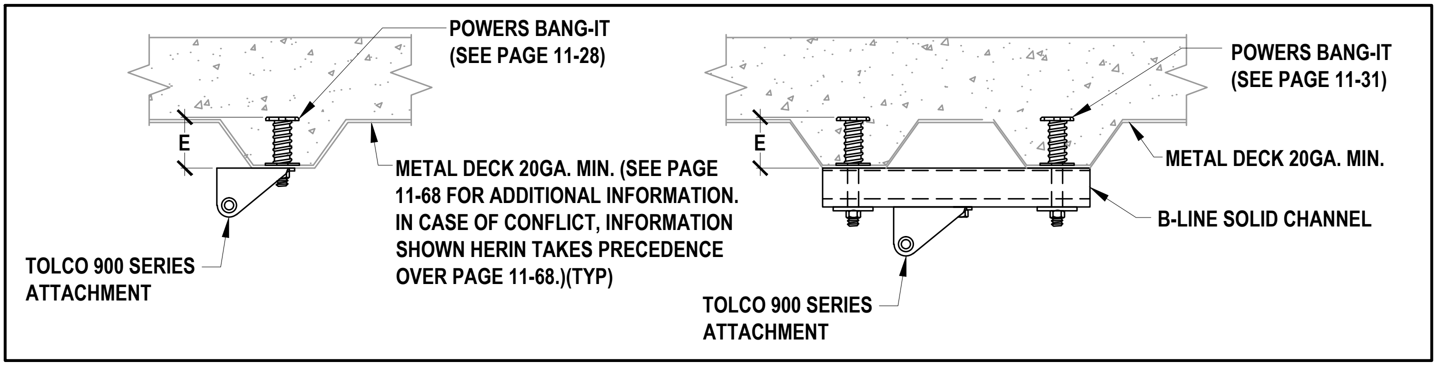
TRAPEZE BRACE SPACING CHART FOR CONCRETE DECK INSERTS IN SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA. MIN. - 3,000 PSI MIN.

1.0 "G"



Max. Trapeze Weight Per Foot	Transverse	Concrete Anchorage			
	Max. Spacing @ 1.0 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	25	3/16"	1	5/8"	1 3/4"
20	40	3/16"	2	(2) 1/2"	1 3/4"
30	28	3/16"	2	(2) 1/2"	1 3/4"
40	21	3/16"	2	(2) 1/2"	1 3/4"
50	17	3/16"	2	(2) 1/2"	1 3/4"
60	14	3/16"	2	(2) 1/2"	1 3/4"
70	12	3/16"	2	(2) 1/2"	1 3/4"
80	10	3/16"	2	(2) 1/2"	1 3/4"
90	9	3/16"	2	(2) 1/2"	1 3/4"
100	8	3/16"	2	(2) 1/2"	1 3/4"
125	6	3/16"	2	(2) 1/2"	1 3/4"
150	5	3/16"	2	(2) 1/2"	1 3/4"
175	4	3/16"	2	(2) 1/2"	1 3/4"
200	4	3/16"	2	(2) 1/2"	1 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Concrete Anchorage			
	Max. Spacing @ 1.0 "G"	Cable Diameter	Anchors Per Brace	Min. Diameter	Min. Embed. "E"
10	51	3/16"	1	3/8"	1 3/4"
20	80	3/16"	2	(2) 1/2"	1 3/4"
30	57	3/16"	2	(2) 1/2"	1 3/4"
40	42	3/16"	2	(2) 1/2"	1 3/4"
50	34	3/16"	2	(2) 1/2"	1 3/4"
60	28	3/16"	2	(2) 1/2"	1 3/4"
70	24	3/16"	2	(2) 1/2"	1 3/4"
80	21	3/16"	2	(2) 1/2"	1 3/4"
90	19	3/16"	2	(2) 1/2"	1 3/4"
100	17	3/16"	2	(2) 1/2"	1 3/4"
125	13	3/16"	2	(2) 1/2"	1 3/4"
150	11	3/16"	2	(2) 1/2"	1 3/4"
175	9	3/16"	2	(2) 1/2"	1 3/4"
200	8	3/16"	2	(2) 1/2"	1 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, ANCHOR QUANTITY, ANCHOR DIAMETER, AND ANCHOR EMBEDMENT PER THE LONGITUDINAL BRACE TABLE.
7.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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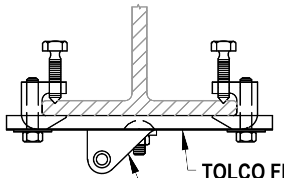
Structural Engineer: Mohammad Hariri
California SE No. S3545

MH

TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

0.50 "G"

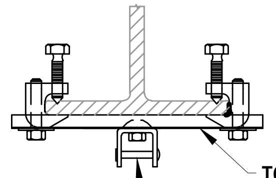
Brace Perpendicular to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Brace Parallel to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Max. Trapeze Weight Per Foot	Cable Dia.	Transverse Max. Spacing @ 0.50 "G"	
		Perpendicular	Parallel
10	1/8"	40	40
20	1/8"	40	40
30	1/8"	40	40
40	3/16"	40	40
50	3/16"	40	40
60	3/16"	40	40
70	1/4"	40	37
80	1/4"	40	32
90	1/4"	40	29
100	1/4"	39	26
125	1/4"	31	21
150	1/4"	26	17
175	1/4"	22	15
200	1/4"	19	13

Max. Trapeze Weight Per Foot	Cable Dia.	Longitudinal Max. Spacing @ 0.50 "G"	
		Perpendicular	Parallel
10	1/8"	80	80
20	1/8"	80	80
30	1/8"	80	80
40	3/16"	80	80
50	3/16"	80	80
60	3/16"	80	80
70	1/4"	80	74
80	1/4"	80	65
90	1/4"	80	58
100	1/4"	78	52
125	1/4"	63	41
150	1/4"	52	34
175	1/4"	45	29
200	1/4"	39	26

NOTES:

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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
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8.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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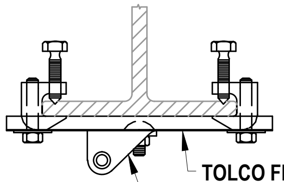
TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

0.75 "G"

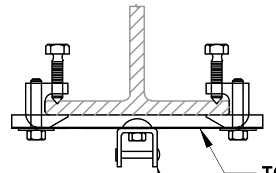
Brace Perpendicular to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Brace Parallel to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Max. Trapeze Weight Per Foot	Cable Dia.	Transverse Max. Spacing @ 0.75 "G"	
		Perpendicular	Parallel
10	1/8"	40	40
20	3/16"	40	40
30	3/16"	40	40
40	3/16"	40	40
50	1/4"	40	34
60	1/4"	40	29
70	1/4"	37	25
80	1/4"	32	21
90	1/4"	29	19
100	1/4"	26	17
125	1/4"	21	14
150	1/4"	17	11
175	1/4"	15	10
200	1/4"	13	8

Max. Trapeze Weight Per Foot	Cable Dia.	Longitudinal Max. Spacing @ 0.75 "G"	
		Perpendicular	Parallel
10	1/8"	80	80
20	3/16"	80	80
30	3/16"	80	80
40	3/16"	80	80
50	1/4"	80	69
60	1/4"	80	58
70	1/4"	75	49
80	1/4"	65	43
90	1/4"	58	38
100	1/4"	52	34
125	1/4"	42	27
150	1/4"	35	23
175	1/4"	30	20
200	1/4"	26	17

NOTES:

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Structural Engineer: Mohammad Hariri
California SE No. S3545

PAGE: 9-14

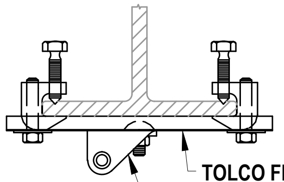
DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL BEAM

1.0 "G"

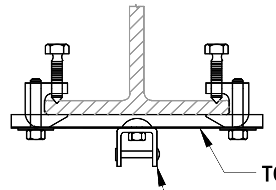
Brace Perpendicular to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Brace Parallel to Beam



TOLCO FIG. 800 SWAY BRACE ATTACHMENT. (SEE PAGE 11-50) (TYP)

TOLCO 990 BRACE ATTACHMENT

Max. Trapeze Weight Per Foot	Cable Dia.	Transverse Max. Spacing @ 1.0 "G"	
		Perpendicular	Parallel
10	1/8"	40	40
20	3/16"	40	40
30	3/16"	40	40
40	1/4"	40	32
50	1/4"	39	26
60	1/4"	32	21
70	1/4"	28	18
80	1/4"	24	16
90	1/4"	21	14
100	1/4"	19	13
125	1/4"	15	10
150	1/4"	13	8
175	1/4"	11	7
200	1/4"	9	6

Max. Trapeze Weight Per Foot	Cable Dia.	Longitudinal Max. Spacing @ 1.0 "G"	
		Perpendicular	Parallel
10	1/8"	80	80
20	3/16"	80	80
30	3/16"	80	80
40	1/4"	80	65
50	1/4"	78	52
60	1/4"	65	43
70	1/4"	56	37
80	1/4"	49	32
90	1/4"	43	29
100	1/4"	39	26
125	1/4"	31	21
150	1/4"	26	17
175	1/4"	22	15
200	1/4"	19	13

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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8.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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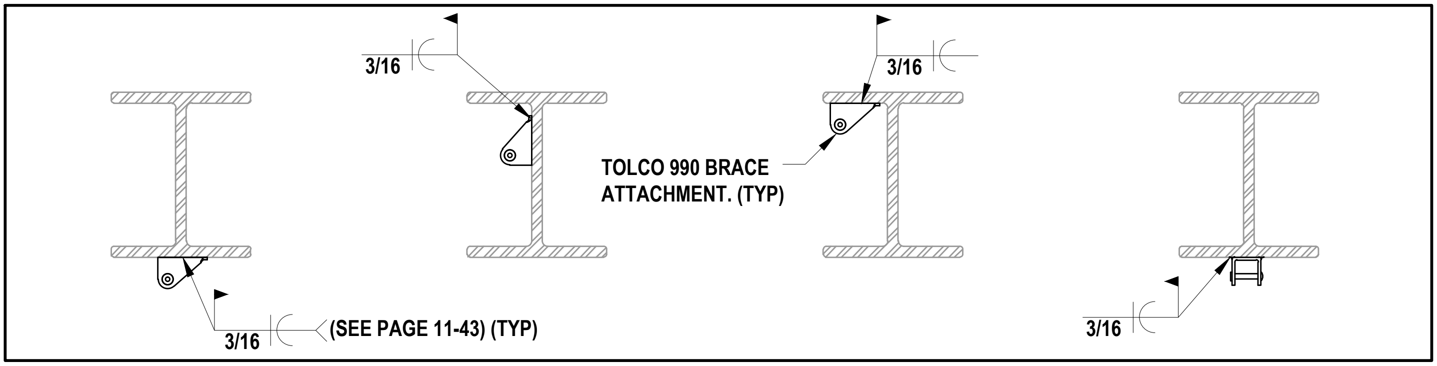
Structural Engineer: Mohammad Hariri
California SE No. S3545

PAGE: 9-15

DATE: NOVEMBER 29, 2016

TRAPEZE BRACE SPACING CHART FOR WELDED ATTACHMENT TO STEEL BEAM

0.50 "G"



Max. Trapeze Weight Per Foot	Cable Dia.	Transverse Max. Spacing @ 0.50 "G"
10	1/8"	40
20	1/8"	40
30	1/8"	40
40	3/16"	40
50	3/16"	40
60	3/16"	40
70	3/16"	34
80	3/16"	30
90	3/16"	27
100	3/16"	24
125	3/16"	19
150	3/16"	16
175	3/16"	13
200	3/16"	12

Max. Trapeze Weight Per Foot	Cable Dia.	Longitudinal Max. Spacing @ 0.50 "G"
10	1/8"	80
20	1/8"	80
30	1/8"	80
40	3/16"	80
50	3/16"	80
60	3/16"	80
70	3/16"	69
80	3/16"	61
90	3/16"	54
100	3/16"	48
125	3/16"	39
150	3/16"	32
175	3/16"	27
200	3/16"	24

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
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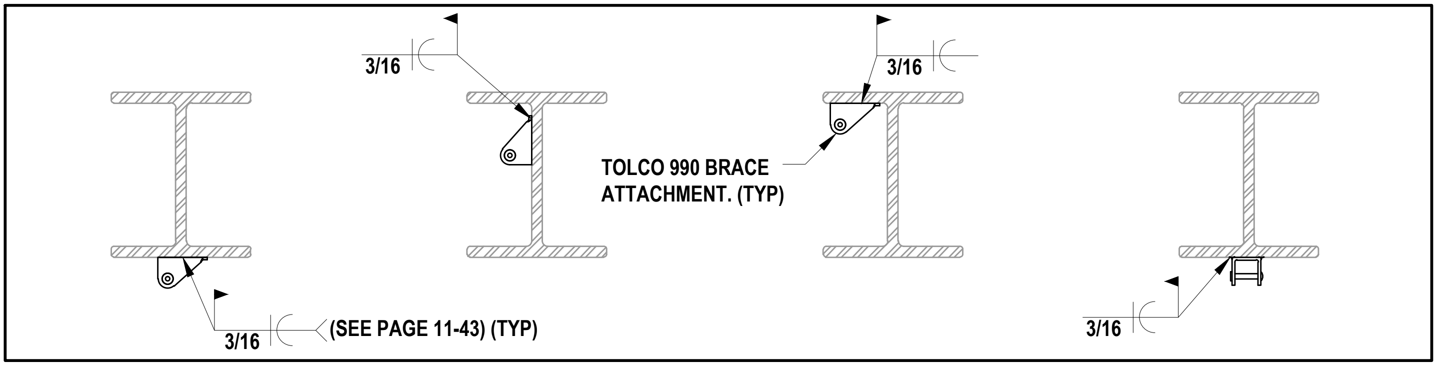
TRAPEZE BRACE SPACING CHART FOR WELDED ATTACHMENT TO STEEL BEAM

0.75 "G"



Max. Trapeze Weight Per Foot	Cable Dia.	Transverse Max. Spacing @ 0.75 "G"
10	1/8"	40
20	1/8"	40
30	3/16"	40
40	3/16"	40
50	3/16"	32
60	3/16"	27
70	3/16"	23
80	3/16"	20
90	3/16"	18
100	3/16"	16
125	3/16"	13
150	3/16"	10
175	3/16"	9
200	3/16"	8

Max. Trapeze Weight Per Foot	Cable Dia.	Longitudinal Max. Spacing @ 0.75 "G"
10	1/8"	80
20	1/8"	80
30	3/16"	80
40	3/16"	80
50	3/16"	65
60	3/16"	54
70	3/16"	46
80	3/16"	40
90	3/16"	36
100	3/16"	32
125	3/16"	26
150	3/16"	21
175	3/16"	18
200	3/16"	16

NOTES:

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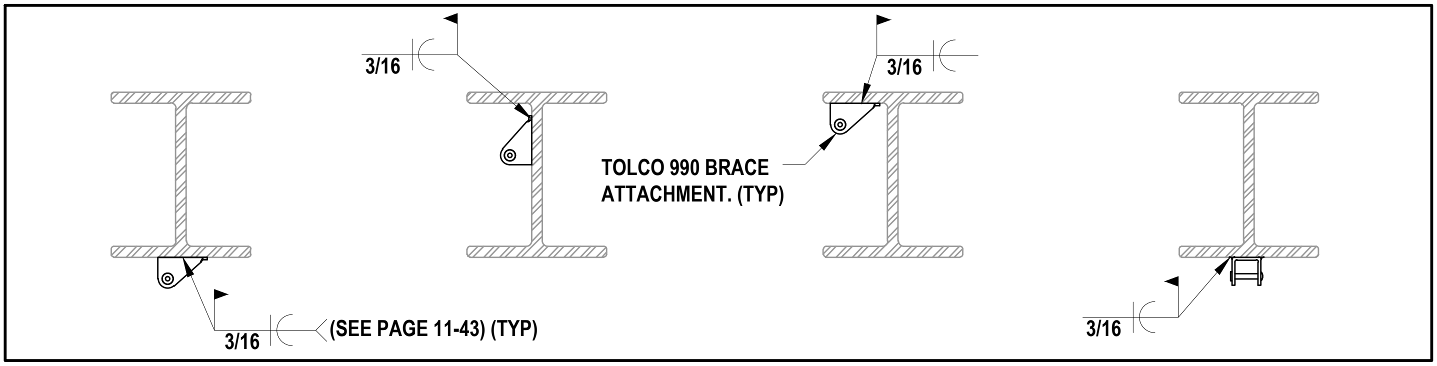
TRAPEZE BRACE SPACING CHART FOR WELDED ATTACHMENT TO STEEL BEAM

1.0 "G"



Max. Trapeze Weight Per Foot	Cable Dia.	Transverse Max. Spacing @ 1.0 "G"
10	1/8"	40
20	3/16"	40
30	3/16"	40
40	3/16"	30
50	3/16"	24
60	3/16"	20
70	3/16"	17
80	3/16"	15
90	3/16"	13
100	3/16"	12
125	3/16"	9
150	3/16"	8
175	3/16"	7
200	3/16"	6

Max. Trapeze Weight Per Foot	Cable Dia.	Longitudinal Max. Spacing @ 1.0 "G"
10	1/8"	80
20	3/16"	80
30	3/16"	80
40	3/16"	61
50	3/16"	48
60	3/16"	40
70	3/16"	34
80	3/16"	30
90	3/16"	27
100	3/16"	24
125	3/16"	19
150	3/16"	16
175	3/16"	13
200	3/16"	12

NOTES:

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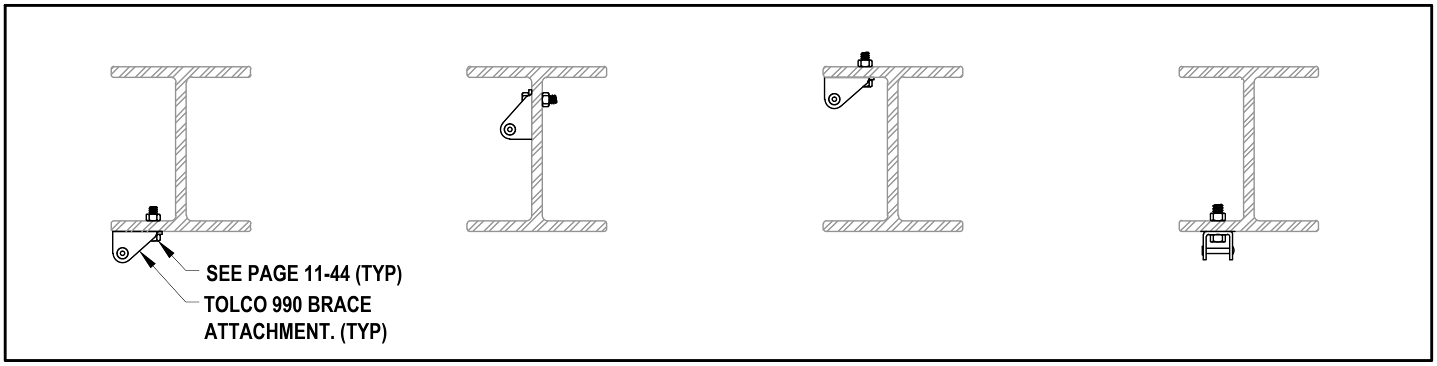
PAGE: 9-18
DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR BOLTED ATTACHMENT TO STEEL BEAM

0.50 "G"



Max. Trapeze Weight Per Foot	Bolt Dia.	Cable Dia.	Transverse Max. Spacing @ 0.50 "G"
10	3/8"	1/8"	40
20	3/8"	1/8"	40
30	1/2"	3/16"	40
40	1/2"	3/16"	40
50	5/8"	3/16"	40
60	5/8"	3/16"	40
70	3/4"	1/4"	37
80	3/4"	1/4"	33
90	3/4"	1/4"	29
100	3/4"	1/4"	26
125	3/4"	1/4"	21
150	3/4"	1/4"	17
175	3/4"	1/4"	15
200	3/4"	1/4"	13

Max. Trapeze Weight Per Foot	Bolt Dia.	Cable Dia.	Longitudinal Max. Spacing @ 0.50 "G"
10	3/8"	1/8"	80
20	3/8"	1/8"	80
30	1/2"	3/16"	80
40	1/2"	3/16"	80
50	5/8"	3/16"	80
60	5/8"	3/16"	80
70	3/4"	1/4"	75
80	3/4"	1/4"	66
90	3/4"	1/4"	58
100	3/4"	1/4"	52
125	3/4"	1/4"	42
150	3/4"	1/4"	35
175	3/4"	1/4"	30
200	3/4"	1/4"	26

NOTES:

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PAGE: 9-19

DATE: NOVEMBER 29, 2016

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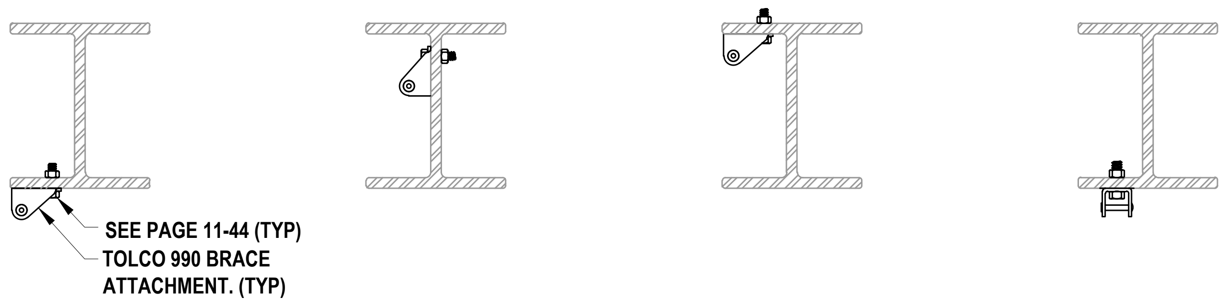
TRAPEZE BRACE SPACING CHART FOR BOLTED ATTACHMENT TO STEEL BEAM	0.75 "G"



Max. Trapeze Weight Per Foot	Bolt Dia.	Cable Dia.	Transverse Max. Spacing @ 0.75 "G"
10	3/8"	1/8"	40
20	1/2"	3/16"	40
30	5/8"	3/16"	40
40	5/8"	3/16"	40
50	3/4"	1/4"	35
60	3/4"	1/4"	29
70	3/4"	1/4"	25
80	3/4"	1/4"	22
90	3/4"	1/4"	19
100	3/4"	1/4"	17
125	3/4"	1/4"	14
150	3/4"	1/4"	11
175	3/4"	1/4"	10
200	3/4"	1/4"	8

Max. Trapeze Weight Per Foot	Bolt Dia.	Cable Dia.	Longitudinal Max. Spacing @ 0.75 "G"
10	3/8"	1/8"	80
20	1/2"	3/16"	80
30	5/8"	3/16"	80
40	5/8"	3/16"	80
50	3/4"	1/4"	70
60	3/4"	1/4"	58
70	3/4"	1/4"	50
80	3/4"	1/4"	44
90	3/4"	1/4"	39
100	3/4"	1/4"	35
125	3/4"	1/4"	28
150	3/4"	1/4"	23
175	3/4"	1/4"	20
200	3/4"	1/4"	17

NOTES:

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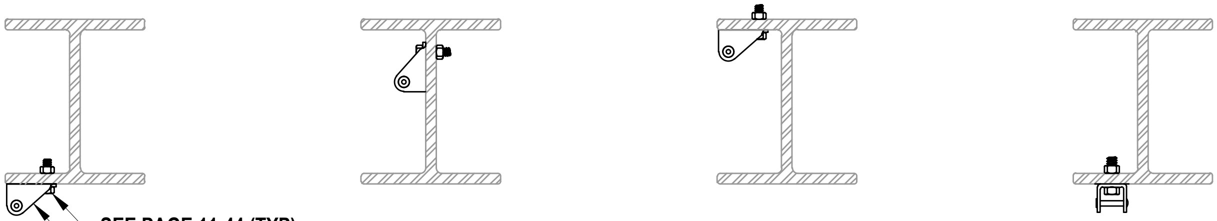
1.0 "G"



Max. Trapeze Weight Per Foot	Bolt Dia.	Cable Dia.	Transverse Max. Spacing @ 1.0 "G"
10	3/8"	1/8"	40
20	1/2"	3/16"	40
30	5/8"	3/16"	40
40	3/4"	1/4"	33
50	3/4"	1/4"	26
60	3/4"	1/4"	22
70	3/4"	1/4"	18
80	3/4"	1/4"	16
90	3/4"	1/4"	14
100	3/4"	1/4"	13
125	3/4"	1/4"	10
150	3/4"	1/4"	8
175	3/4"	1/4"	7
200	3/4"	1/4"	6

Max. Trapeze Weight Per Foot	Bolt Dia.	Cable Dia.	Longitudinal Max. Spacing @ 1.0 "G"
10	3/8"	1/8"	80
20	1/2"	3/16"	80
30	5/8"	3/16"	80
40	3/4"	1/4"	66
50	3/4"	1/4"	52
60	3/4"	1/4"	44
70	3/4"	1/4"	37
80	3/4"	1/4"	33
90	3/4"	1/4"	29
100	3/4"	1/4"	26
125	3/4"	1/4"	21
150	3/4"	1/4"	17
175	3/4"	1/4"	15
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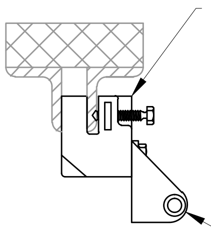
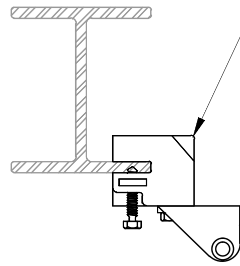
TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL TRUSS OR STEEL BEAM

0.50 "G"





Max. Trapeze Weight Per Foot	Cable Dia.	Transverse Max Spacing @ 0.50 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	1/8"	40	40
20	1/8"	40	40
30	3/16"	40	30
40	3/16"	40	23
50	3/16"	39	18
60	3/16"	33	15
70	3/16"	28	13
80	3/16"	24	11
90	3/16"	22	10
100	3/16"	19	9
125	3/16"	15	7
150	3/16"	13	6
175	3/16"	11	5
200	3/16"	9	4

Max. Trapeze Weight Per Foot	Cable Dia.	Longitudinal Max Spacing @ 0.50 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	1/8"	80	80
20	1/8"	80	80
30	3/16"	80	61
40	3/16"	80	46
50	3/16"	79	36
60	3/16"	66	30
70	3/16"	56	26
80	3/16"	49	23
90	3/16"	44	20
100	3/16"	39	18
125	3/16"	31	14
150	3/16"	26	12
175	3/16"	22	10
200	3/16"	19	9

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) *SINGLE BRACE MAY BE USED AT HALF THE SPACING LISTED.
6.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
8.) THE SPACINGS LISTED ABOVE ARE BASED ON TOLCO FIG 825. SPACINGS MAY BE INCREASED IF TOLCO FIGUR4E 828 IS USED BASED ON ALLOWABLE LOADS FIGURE 825 AND TOLCO FIGURE 828. SEE PAGE 11-47, 11-49.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.
10.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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California SE No. S3545

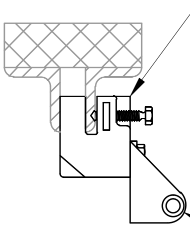
PAGE: 9-22

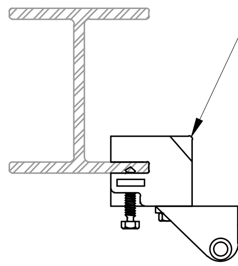
DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL TRUSS OR STEEL BEAM

0.75 "G"





Max. Trapeze Weight Per Foot	Cable Dia.	Transverse Max Spacing @ 0.75 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	1/8"	40	40
20	3/16"	40	30
30	3/16"	40	20
40	3/16"	33	15
50	3/16"	26	12
60	3/16"	22	10
70	3/16"	18	8
80	3/16"	16	7
90	3/16"	14	6
100	3/16"	13	6
125	3/16"	10	4
150	3/16"	8	4
175	3/16"	7	3
200	3/16"	6	3

Max. Trapeze Weight Per Foot	Cable Dia.	Longitudinal Max Spacing @ 0.75 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	1/8"	80	80
20	3/16"	80	61
30	3/16"	80	40
40	3/16"	66	30
50	3/16"	52	24
60	3/16"	44	20
70	3/16"	37	17
80	3/16"	33	15
90	3/16"	29	13
100	3/16"	26	12
125	3/16"	21	9
150	3/16"	17	8
175	3/16"	15	7
200	3/16"	13	6

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY PER THE LONGITUDINAL BRACE TABLE.
7.) THE SPACINGS LISTED ABOVE ARE BASED ON TOLCO FIG 825. SPACINGS MAY BE INCREASED IF TOLCO FIGUR4E 828 IS USED BASED ON ALLOWABLE LOADS FIGURE 825 AND TOLCO FIGURE 828. SEE PAGE 11-47, 11-49.
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California SE No. S3545

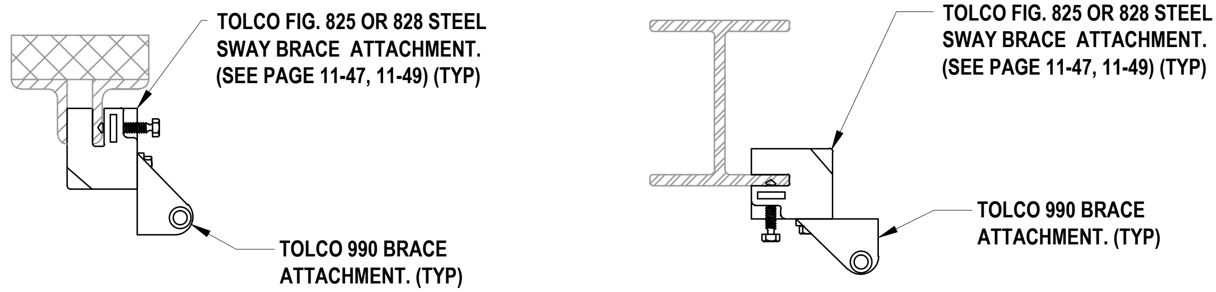
PAGE: 9-23

DATE: NOVEMBER 29, 2016

MH

TRAPEZE BRACE SPACING CHART FOR ATTACHMENT TO STEEL TRUSS OR STEEL BEAM

1.0 "G"



Max. Trapeze Weight Per Foot	Cable Dia.	Transverse Max Spacing @ 1.0 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	1/8"	40	40
20	3/16"	40	23
30	3/16"	33	15
40	3/16"	24	11
50	3/16"	19	9
60	3/16"	16	7
70	3/16"	14	6
80	3/16"	12	5
90	3/16"	11	5
100	3/16"	9	4
125	3/16"	7	3
150	3/16"	6	3
175	3/16"	5	2
200	3/16"	5	2

Max. Trapeze Weight Per Foot	Cable Dia.	Longitudinal Max Spacing @ 1.0 "G" Fig. 825 or 828	
		Perpendicular	Parallel
10	1/8"	80	80
20	3/16"	80	46
30	3/16"	66	30
40	3/16"	49	23
50	3/16"	39	18
60	3/16"	33	15
70	3/16"	28	13
80	3/16"	24	11
90	3/16"	22	10
100	3/16"	19	9
125	3/16"	15	7
150	3/16"	13	6
175	3/16"	11	5
200	3/16"	9	4

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
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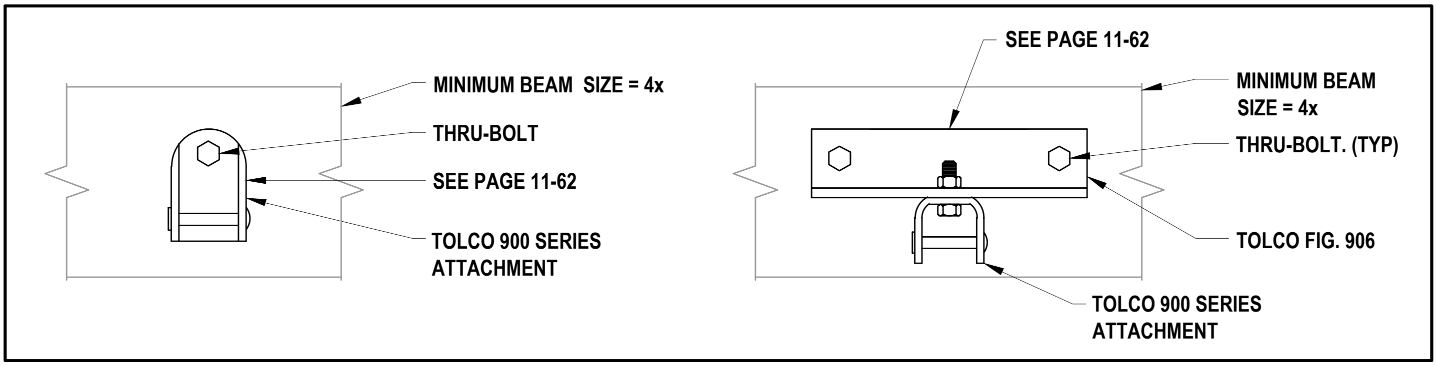
9.) NO ATTACHMENT SHALL BE MADE WITHIN PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

TRAPEZE BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse	Min. Cable Dia.	Thru-Bolts	
	Max Spacing @ 0.50 "G"		Bolt Qty.	Min. Diameter
10	40	1/8"	1	1/2"
20	40	1/8"	2	(2) 1/2"
30	40	1/8"	2	(2) 3/4"
40	40	1/8"	2	(2) 3/4"
50	32	1/8"	2	(2) 3/4"
60	26	1/8"	2	(2) 3/4"
70	22	1/8"	2	(2) 3/4"
80	20	1/8"	2	(2) 3/4"
90	17	1/8"	2	(2) 3/4"
100	16	1/8"	2	(2) 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Min. Cable Dia.	Thru-Bolts	
	Max Spacing @ 0.50 "G"		Bolt Qty.	Min. Diameter
10	80	1/8"	1	1/2"
20	80	1/8"	2	(2) 1/2"
30	80	1/8"	2	(2) 3/4"
40	80	1/8"	2	(2) 3/4"
50	64	1/8"	2	(2) 3/4"
60	53	1/8"	2	(2) 3/4"
70	45	1/8"	2	(2) 3/4"
80	40	1/8"	2	(2) 3/4"
90	35	1/8"	2	(2) 3/4"
100	32	1/8"	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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6.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIRED.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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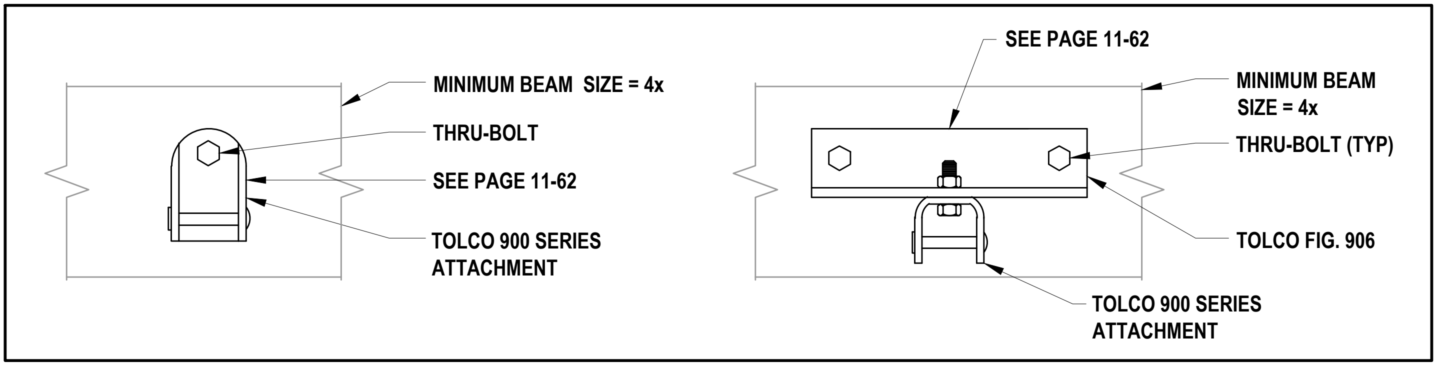
MH

TRAPEZE BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse Max Spacing @ 0.75 "G"	Min. Cable Dia.	Thru-Bolts Bolt Qty.	Thru-Bolts Min. Diameter
10	40	1/8"	2	(2) 1/2"
20	40	1/8"	2	(2) 1/2"
30	35	1/8"	2	(2) 3/4"
40	26	1/8"	2	(2) 3/4"
50	21	1/8"	2	(2) 3/4"
60	17	1/8"	2	(2) 3/4"
70	15	1/8"	2	(2) 3/4"
80	13	1/8"	2	(2) 3/4"
90	11	1/8"	2	(2) 3/4"
100	10	1/8"	2	(2) 3/4"

Max. Trapeze Weight Per Foot	Longitudinal Max Spacing @ 0.75 "G"	Min. Cable Dia.	Thru-Bolts Bolt Qty.	Thru-Bolts Min. Diameter
10	80	1/8"	2	(2) 1/2"
20	80	1/8"	2	(2) 1/2"
30	71	1/8"	2	(2) 3/4"
40	53	1/8"	2	(2) 3/4"
50	42	1/8"	2	(2) 3/4"
60	35	1/8"	2	(2) 3/4"
70	30	1/8"	2	(2) 3/4"
80	26	1/8"	2	(2) 3/4"
90	23	1/8"	2	(2) 3/4"
100	21	1/8"	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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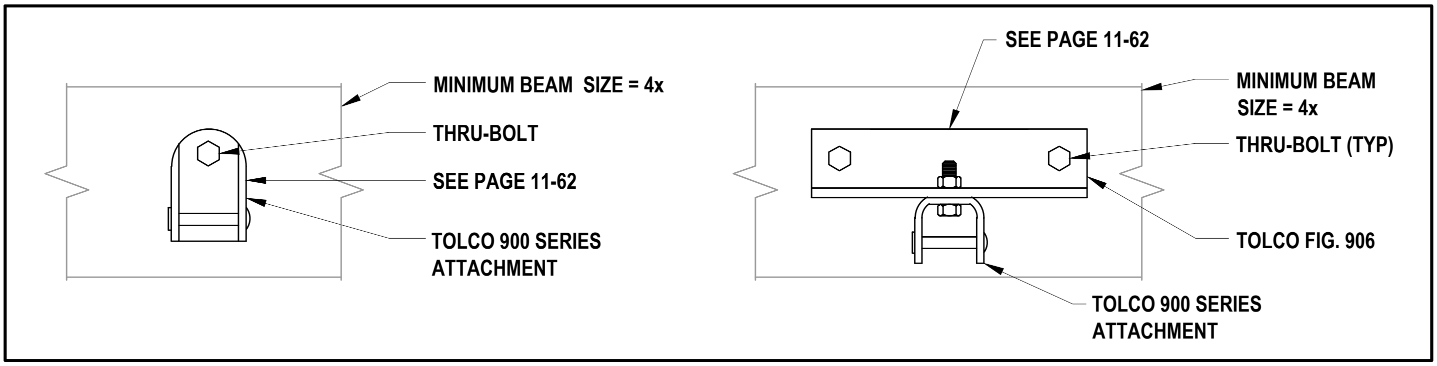
TRAPEZE BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

1.0 "G"



Max. Trapeze Weight Per Foot	Transverse	Min. Cable Dia.	Thru-Bolts	
	Max Spacing @ 1.0 "G"		Bolt Qty.	Min. Diameter
10	40	1/8"	2	(2) 1/2"
20	40	1/8"	2	(2) 3/4"
30	26	1/8"	2	(2) 3/4"
40	20	1/8"	2	(2) 3/4"
50	16	1/8"	2	(2) 3/4"
60	13	1/8"	2	(2) 3/4"
70	11	1/8"	2	(2) 3/4"
80	10	1/8"	2	(2) 3/4"
90	8	1/8"	2	(2) 3/4"
100	8	1/8"	2	(2) 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Min. Cable Dia.	Thru-Bolts	
	Max Spacing @ 1.0 "G"		Bolt Qty.	Min. Diameter
10	80	1/8"	2	(2) 1/2"
20	80	1/8"	2	(2) 3/4"
30	53	1/8"	2	(2) 3/4"
40	40	1/8"	2	(2) 3/4"
50	32	1/8"	2	(2) 3/4"
60	26	1/8"	2	(2) 3/4"
70	22	1/8"	2	(2) 3/4"
80	20	1/8"	2	(2) 3/4"
90	17	1/8"	2	(2) 3/4"
100	16	1/8"	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
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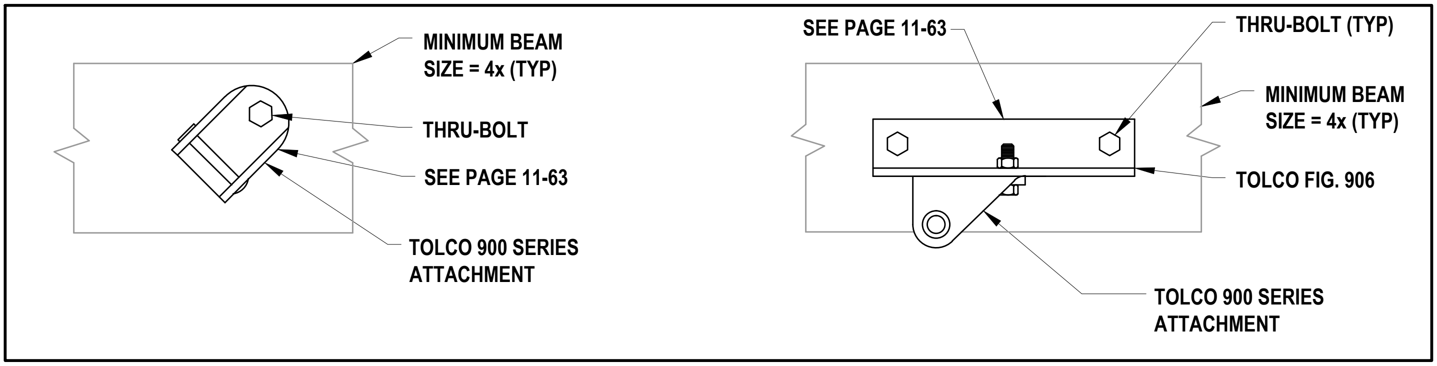
0.50 "G"



Max. Trapeze Weight Per Foot	Transverse	Min. Cable Dia.	Thru-Bolts	
	Max Spacing @ 0.50 "G"		Bolt Qty.	Min. Diameter
10	40	1/8"	1	1/2"
20	38	1/8"	1	3/4"
30	29	1/8"	2	(2) 1/2"
40	30	3/16"	2	(2) 3/4"
50	24	3/16"	2	(2) 3/4"
60	20	3/16"	2	(2) 3/4"
70	17	3/16"	2	(2) 3/4"
80	15	3/16"	2	(2) 3/4"
90	13	3/16"	2	(2) 3/4"
100	12	3/16"	2	(2) 3/4"

Max. Trapeze Weight Per Foot	Longitudinal	Min. Cable Dia.	Thru-Bolts	
	Max Spacing @ 0.50 "G"		Bolt Qty.	Min. Diameter
10	80	1/8"	1	1/2"
20	76	1/8"	1	3/4"
30	58	1/8"	2	(2) 1/2"
40	60	3/16"	2	(2) 3/4"
50	48	3/16"	2	(2) 3/4"
60	40	3/16"	2	(2) 3/4"
70	34	3/16"	2	(2) 3/4"
80	30	3/16"	2	(2) 3/4"
90	26	3/16"	2	(2) 3/4"
100	24	3/16"	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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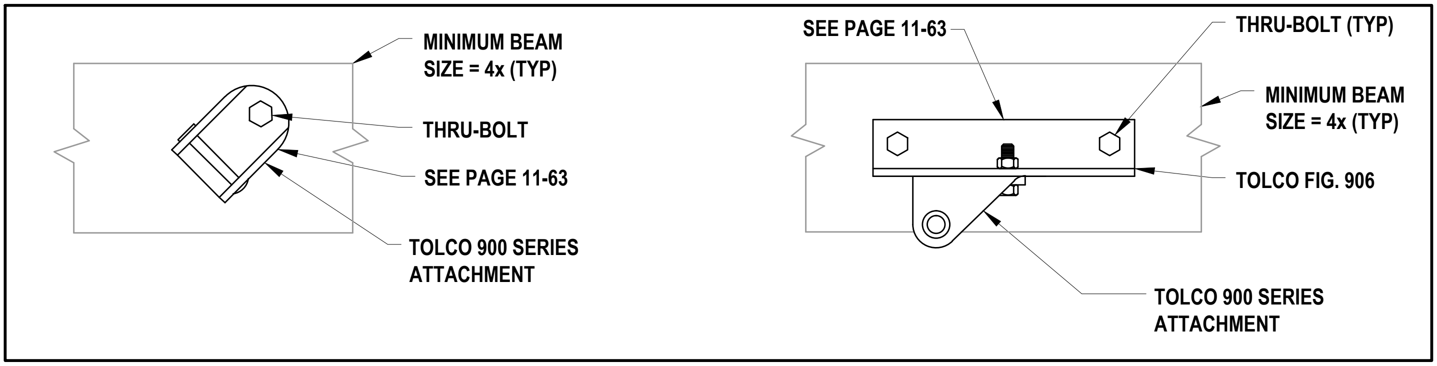
TRAPEZE BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse	Min. Cable Dia.	Thru-Bolts	
	Max Spacing @ 0.75 "G"		Bolt Qty.	Min. Diameter
10	40	1/8"	2	(2) 1/2"
20	40	3/16"	2	(2) 3/4"
30	26	3/16"	2	(2) 3/4"
40	20	3/16"	2	(2) 3/4"
50	16	3/16"	2	(2) 3/4"
60	13	3/16"	2	(2) 3/4"
70	11	3/16"	2	(2) 3/4"
80	10	3/16"	2	(2) 3/4"
90	8	3/16"	2	(2) 3/4"
100	8	3/16"	2	(2) 3/4"

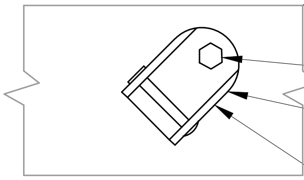
Max. Trapeze Weight Per Foot	Longitudinal	Min. Cable Dia.	Thru-Bolts	
	Max Spacing @ 0.75 "G"		Bolt Qty.	Min. Diameter
10	80	1/8"	2	(2) 1/2"
20	80	3/16"	2	(2) 3/4"
30	53	3/16"	2	(2) 3/4"
40	40	3/16"	2	(2) 3/4"
50	32	3/16"	2	(2) 3/4"
60	26	3/16"	2	(2) 3/4"
70	22	3/16"	2	(2) 3/4"
80	20	3/16"	2	(2) 3/4"
90	17	3/16"	2	(2) 3/4"
100	16	3/16"	2	(2) 3/4"

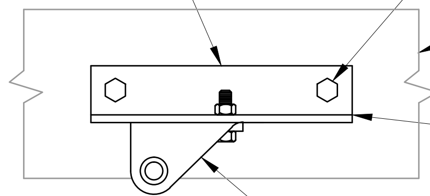
NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIRED.
7.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
8.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

TRAPEZE BRACE SPACING CHART FOR THRU-BOLT ATTACHMENT TO WOOD

1.0 "G"





Max. Trapeze Weight Per Foot	Transverse Max Spacing @ 1.0 "G"	Min. Cable Dia.	Thru-Bolts Bolt Qty.	Thru-Bolts Min. Diameter
10	38	1/8"	1	3/4"
20	30	3/16"	2	(2) 3/4"
30	20	3/16"	2	(2) 3/4"
40	15	3/16"	2	(2) 3/4"
50	12	3/16"	2	(2) 3/4"
60	10	3/16"	2	(2) 3/4"
70	8	3/16"	2	(2) 3/4"
80	7	3/16"	2	(2) 3/4"
90	6	3/16"	2	(2) 3/4"
100	6	3/16"	2	(2) 3/4"

Max. Trapeze Weight Per Foot	Longitudinal Max Spacing @ 1.0 "G"	Min. Cable Dia.	Thru-Bolts Bolt Qty.	Thru-Bolts Min. Diameter
10	76	1/8"	1	3/4"
20	60	3/16"	2	(2) 3/4"
30	40	3/16"	2	(2) 3/4"
40	30	3/16"	2	(2) 3/4"
50	24	3/16"	2	(2) 3/4"
60	20	3/16"	2	(2) 3/4"
70	17	3/16"	2	(2) 3/4"
80	15	3/16"	2	(2) 3/4"
90	13	3/16"	2	(2) 3/4"
100	12	3/16"	2	(2) 3/4"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
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California SE No. S3545

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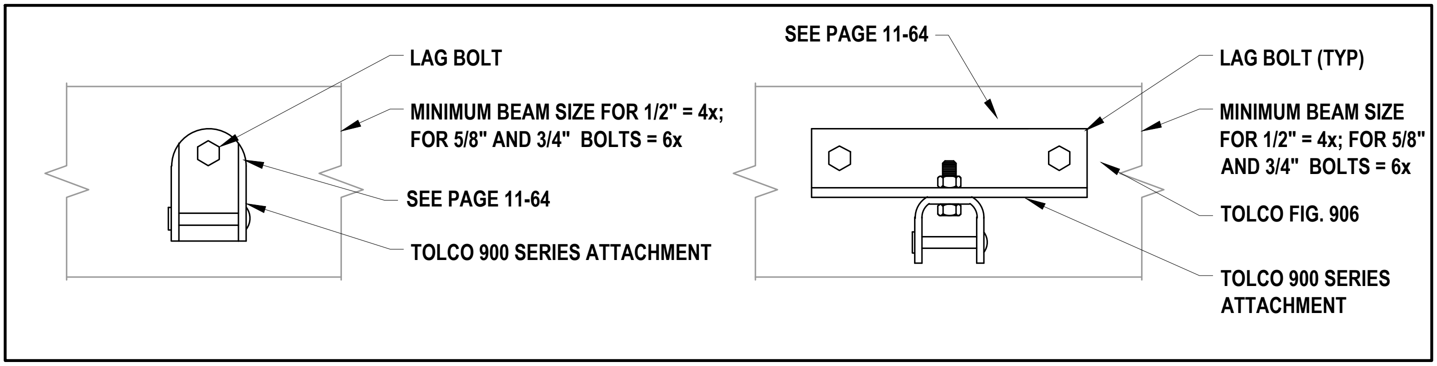
MH

TRAPEZE BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.50 "G"



Max. Trapeze Weight Per Foot	Transverse	Lag Bolts			
	Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	20	1/8"	1	5/8"	4"
20	17	1/8"	2	(2) 5/8"	4"
30	21	1/8"	2	(2) 3/4"	5"
40	16	3/16"	2	(2) 3/4"	5"
50	13	3/16"	2	(2) 3/4"	5"
60	10	3/16"	2	(2) 3/4"	5"
70	9	3/16"	2	(2) 3/4"	5"
80	8	3/16"	2	(2) 3/4"	5"
90	7	3/16"	2	(2) 3/4"	5"
100	6	3/16"	2	(2) 3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	40	1/8"	1	5/8"	4"
20	34	1/8"	2	(2) 5/8"	4"
30	43	1/8"	2	(2) 3/4"	5"
40	32	3/16"	2	(2) 3/4"	5"
50	26	3/16"	2	(2) 3/4"	5"
60	21	3/16"	2	(2) 3/4"	5"
70	18	3/16"	2	(2) 3/4"	5"
80	16	3/16"	2	(2) 3/4"	5"
90	14	3/16"	2	(2) 3/4"	5"
100	13	3/16"	2	(2) 3/4"	5"

NOTES:

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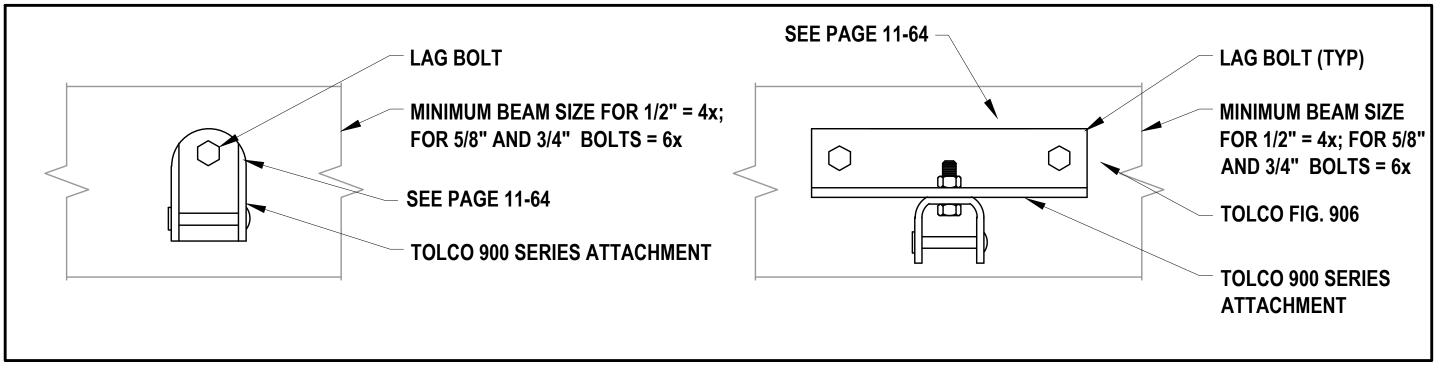
MH

TRAPEZE BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

0.75 "G"



Max. Trapeze Weight Per Foot	Transverse	Lag Bolts			
	Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	40	1/8"	2	(2) 3/4"	5"
20	21	3/16"	2	(2) 3/4"	5"
30	14	3/16"	2	(2) 3/4"	5"
40	10	3/16"	2	(2) 3/4"	5"
50	8	3/16"	2	(2) 3/4"	5"
60	7	3/16"	2	(2) 3/4"	5"
70	6	3/16"	2	(2) 3/4"	5"
80	5	3/16"	2	(2) 3/4"	5"
90	4	3/16"	2	(2) 3/4"	5"
100	4	3/16"	2	(2) 3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	80	1/8"	2	(2) 3/4"	5"
20	43	3/16"	2	(2) 3/4"	5"
30	29	3/16"	2	(2) 3/4"	5"
40	21	3/16"	2	(2) 3/4"	5"
50	17	3/16"	2	(2) 3/4"	5"
60	14	3/16"	2	(2) 3/4"	5"
70	12	3/16"	2	(2) 3/4"	5"
80	10	3/16"	2	(2) 3/4"	5"
90	9	3/16"	2	(2) 3/4"	5"
100	8	3/16"	2	(2) 3/4"	5"

NOTES:

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7.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
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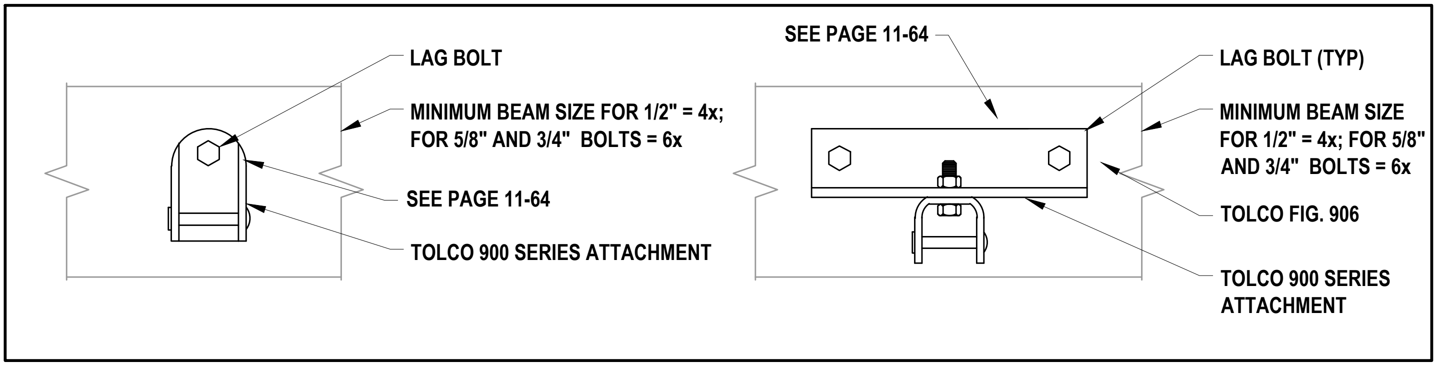
TRAPEZE BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD

1.0 "G"



Max. Trapeze Weight Per Foot	Transverse	Lag Bolts			
	Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	17	1/8"	2	(2) 5/8"	4"
20	8	3/16"	2	(2) 3/4"	5"
30	10	3/16"	2	(2) 3/4"	5"
40	8	3/16"	2	(2) 3/4"	5"
50	6	3/16"	2	(2) 3/4"	5"
60	5	3/16"	2	(2) 3/4"	5"
70	4	3/16"	2	(2) 3/4"	5"
80	4	3/16"	2	(2) 3/4"	5"
90	3	3/16"	2	(2) 3/4"	5"
100	3	3/16"	2	(2) 3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	34	1/8"	2	(2) 5/8"	4"
20	17	3/16"	2	(2) 3/4"	5"
30	21	3/16"	2	(2) 3/4"	5"
40	16	3/16"	2	(2) 3/4"	5"
50	13	3/16"	2	(2) 3/4"	5"
60	10	3/16"	2	(2) 3/4"	5"
70	9	3/16"	2	(2) 3/4"	5"
80	8	3/16"	2	(2) 3/4"	5"
90	7	3/16"	2	(2) 3/4"	5"
100	6	3/16"	2	(2) 3/4"	5"

NOTES:

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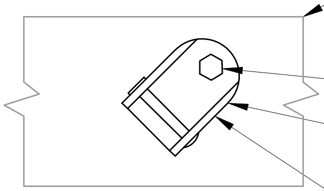
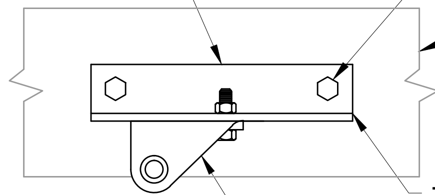
0.50 "G"





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	Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	38	1/8"	1	3/4"	5"
20	22	1/8"	2	(2) 3/4"	5"
30	14	1/8"	2	(2) 3/4"	5"
40	11	1/8"	2	(2) 3/4"	5"
50	8	1/8"	2	(2) 3/4"	5"
60	7	1/8"	2	(2) 3/4"	5"
70	6	1/8"	2	(2) 3/4"	5"
80	5	1/8"	2	(2) 3/4"	5"
90	4	1/8"	2	(2) 3/4"	5"
100	4	1/8"	2	(2) 3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 0.50 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	77	1/8"	1	3/4"	5"
20	44	1/8"	2	(2) 3/4"	5"
30	29	1/8"	2	(2) 3/4"	5"
40	22	1/8"	2	(2) 3/4"	5"
50	17	1/8"	2	(2) 3/4"	5"
60	14	1/8"	2	(2) 3/4"	5"
70	12	1/8"	2	(2) 3/4"	5"
80	11	1/8"	2	(2) 3/4"	5"
90	9	1/8"	2	(2) 3/4"	5"
100	8	1/8"	2	(2) 3/4"	5"

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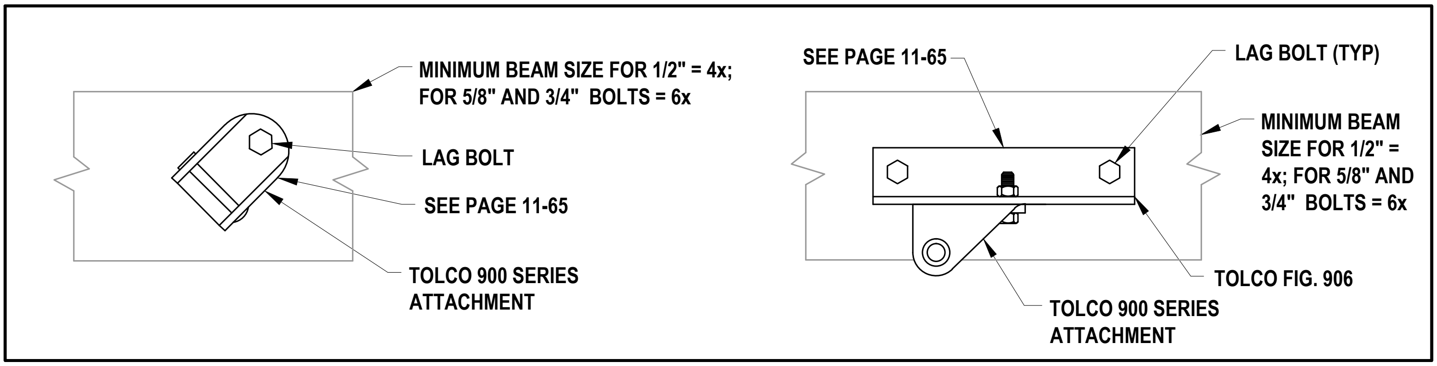
0.75 "G"



Max. Trapeze Weight Per Foot	Transverse	Lag Bolts			
	Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	29	1/8"	2	(2) 3/4"	5"
20	14	1/8"	2	(2) 3/4"	5"
30	9	1/8"	2	(2) 3/4"	5"
40	7	1/8"	2	(2) 3/4"	5"
50	5	1/8"	2	(2) 3/4"	5"
60	4	1/8"	2	(2) 3/4"	5"
70	4	1/8"	2	(2) 3/4"	5"
80	3	1/8"	2	(2) 3/4"	5"
90	3	1/8"	2	(2) 3/4"	5"
100	3	1/8"	2	(2) 3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 0.75 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	59	1/8"	2	(2) 3/4"	5"
20	29	1/8"	2	(2) 3/4"	5"
30	19	1/8"	2	(2) 3/4"	5"
40	14	1/8"	2	(2) 3/4"	5"
50	11	1/8"	2	(2) 3/4"	5"
60	9	1/8"	2	(2) 3/4"	5"
70	8	1/8"	2	(2) 3/4"	5"
80	7	1/8"	2	(2) 3/4"	5"
90	6	1/8"	2	(2) 3/4"	5"
100	5	1/8"	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIRED.
7.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

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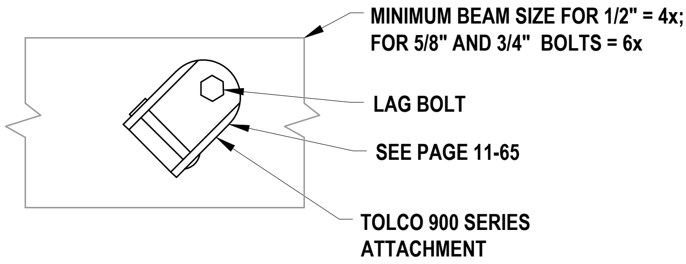
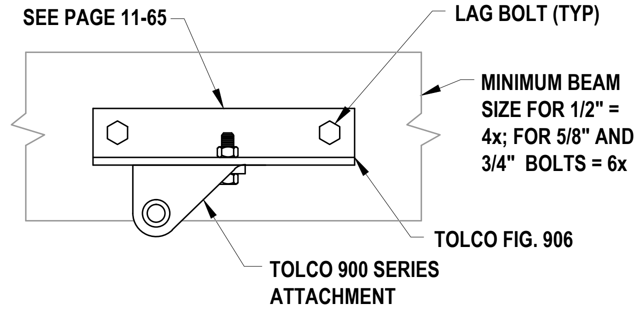
TRAPEZE BRACE SPACING CHART FOR LAG BOLT ATTACHMENT TO WOOD





Max. Trapeze Weight Per Foot	Transverse	Lag Bolts			
	Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	22	1/8"	2	(2) 3/4"	5"
20	11	1/8"	2	(2) 3/4"	5"
30	7	1/8"	2	(2) 3/4"	5"
40	5	1/8"	2	(2) 3/4"	5"
50	4	1/8"	2	(2) 3/4"	5"
60	3	1/8"	2	(2) 3/4"	5"
70	3	1/8"	2	(2) 3/4"	5"
80	2	1/8"	2	(2) 3/4"	5"
90	2	1/8"	2	(2) 3/4"	5"
100	2	1/8"	2	(2) 3/4"	5"

Max. Trapeze Weight Per Foot	Longitudinal	Lag Bolts			
	Max Spacing @ 1.0 "G"	Cable Diameter	Bolt Qty.	Min. Diameter	Min. Length
10	44	1/8"	2	(2) 3/4"	5"
20	22	1/8"	2	(2) 3/4"	5"
30	14	1/8"	2	(2) 3/4"	5"
40	11	1/8"	2	(2) 3/4"	5"
50	8	1/8"	2	(2) 3/4"	5"
60	7	1/8"	2	(2) 3/4"	5"
70	6	1/8"	2	(2) 3/4"	5"
80	5	1/8"	2	(2) 3/4"	5"
90	4	1/8"	2	(2) 3/4"	5"
100	4	1/8"	2	(2) 3/4"	5"

NOTES:

1.) SPACING ABOVE IS FOR WELDED STEEL PIPE, RIGID CONDUIT OR GROOVED PIPING WITH UL 213 LISTED CONNECTIONS. FOR OTHER PIPE TYPES CONSTRUCTED OF NON-DUCTILE MATERIAL (CAST IRON, NO HUB, PLASTIC, ETC.) SPACING SHALL NOT EXCEED 1/2 OF THAT LISTED IN THE ABOVE TABLES.
2.) BRACE SPACING FOR ANY HORIZONTAL FORCE FACTOR CAN BE DETERMINED BY DIVIDING THE SPACING GIVEN FOR 1g BY THE ACTUAL HORIZONTAL FORCE FACTOR. FOR EXAMPLE, IF THE ALLOWABLE SPACING IS 21FT FOR 1.0G, THE ALLOWABLE SPACING FOR 0.7G WILL BE: 21FT / 0.7G = 30FT (NOT TO EXCEED MAXIMUM ALLOWABLE SPACING FROM GENERAL NOTES SECTION).
3.) WEIGHTS ARE BASED ON WATER FILLED SCH. 40/30/20 STEEL PIPE WITH INSULATION. SEE PAGE 1-4 FOR DETAILS.
4.) FOR BRACING ANGLE FROM HORIZONTAL 0°-30° NO SPACING CHANGE REQUIRED, 31°-45° NO SPACING CHANGE REQUIRED, 46°-60° DIVIDE SPACING BY 2.0.
5.) THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THAT THE APPLIED LOADS ARE ACCEPTABLE.
6.) VERIFY ADEQUACY OF THE OTHER SUPPORT COMPONENTS AND THE OVERALL SUPPORT SYSTEM FOR THE APPLIED LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIRED.
7.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
8.) WHEN USING TRANSVERSE BRACE AS "DUAL USE" BRACE, USE BRACE QUANTITY, BOLT QUANTITY AND BOLT DIAMETER PER THE LONGITUDINAL BRACE TABLE.
9.) SPACING LISTED ABOVE SHALL BE REDUCED IF THE APPLICABLE SPACING LISTED IN SECTION 14 IS LESS THAN THE SPACING LISTED ABOVE BASED ON PIPE MATERIAL, CONSTRUCTION, JOINTS AND DIAMETER.

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California SE No. S3545

DATE: NOVEMBER 29, 2016

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Seismic Restraint Systems Guidelines

CALIFORNIA BUILDING CODE 2013 (CBC2013)

SECTION 10

OSHPD APPROVED TOLCO FIRE PROTECTION

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ANY PAGE REFERENCES MADE WITHIN SECTION 10 ARE TO PAGES WITHIN SECTION 10 ONLY

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Table of Contents

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Appendix A - For Reference Only

SECTION 1

GENERAL INFORMATION

MH

0.0 PREFACE

This OSHPD Pre-approval of Manufacturer's Certification (OPM) is based on the CBC 2013.
The demand (Design Forces) for use with this OPM shall be based on the CBC 2013.

I. SCOPE AND LIMITATIONS:

This pre-approval is for the seismic bracing of interior fire sprinkler piping. It does not address other loads such as, but not limited to, those generated by thermal growth, pressure, fluid dynamics, pipe rupture or movements of equipment that braced components are attached to. It does not address components that cross seismic separations of buildings or components attached to portions of the structure or equipment that will experience relative seismic drifts other than pipe risers.

II. The ranges of components sizes and material included in the pre-approval are as follows:

a) Fire Sprinklers Pipe:
- i. Steel Pipe Sizes:
  - Schedule (LW): 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 3 1/2", 4", 5", 6", 8"
  - Schedule 10: 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 3 1/2", 4", 5", 6", 8"
  - 0.188 (0.188" <= Pipe Wall Thickness): 8"
  - Schedule 40: 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 3 1/2", 4", 5", 6", 8", 10", 12"

b) Brace Pipe:
- i. Steel (ASTM A53 Type E Grade B) Schedule 40: 1", 1 1/4", 1 1/2", 2" NPS

III. The substrates included in this pre-approval are as follows:

a. Concrete
b. Metal Decking
c. Steel
d. Wood

IV. This Pre-approval is for the design of supports and attachments of fire seismic sway bracing only.

V. Construction Tolerances:

a. Construction tolerances shall be as noted on the drawing details and appendices.
b. Construction tolerance for angles of all braces shall be limited to ±5°, out of plan as shown on page 4-6.
a. The recommended brace angle is 45° for the diagonal brace, or 1 (vert.) to 1 (horiz.) brace ratio. However, the brace can be installed between 30°-90° from vertical. See page 4-6.

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1.0 INTRODUCTION

I. This manual is prepared as a guideline for seismic bracing design for fire sprinkler system piping. Following is an outline of the manual:

Section 1 - General Information . Presents general notes and requirements for seismic bracing fire protection systems. It also includes a general step by step procedure for seismic bracing design using this manual.

Section 2 - Single Hanger Rigid Brace Details . Includes seismic bracing details for individually hung piping using rigid brace members.

Section 3 - Structural Attachments . Shows structural attachment details and allowable strengths for attaching seismic bracing to supporting structure. It includes structural attachments to concrete slabs, steel deck with sand lightweight concrete, attachments to steel beams and bar joists, and attachments to wood beams.

Section 4 - Seismic Brace Components . Includes details and allowable strengths for seismic bracing components used in the seismic bracing design. Components include brace attachment fittings.

Appendix A - Pipe . Includes a metric conversion chart and weight charts for pipe. Utility weights are for reference only and are not within scope of work of the OPM approval.

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II. This pre-approval may be used for the design of seismic sway bracing of fire sprinkler systems. A California Licensed Structural Engineer (CLSE) has designed this pre-approval, along with supporting calculations. Therefore, the pre-approved details and calculations are not to be re-reviewed by regional staff. However, each fire sprinkler system requires submittals that must be reviewed and approved by OSHPD.

III. Seismic bracing design and layout drawings shall be either prepared by a Registered Structural Engineer licensed in California with experience in the design of seismic bracing for fire protection systems, or prepared by a qualified engineer with experience in the design of seismic bracing for fire protection systems and reviewed, stamped and signed by a Registered Structural Engineer licensed in California with experience in the design of seismic bracing fire protection systems. This is the definition of "user" below and as allowed for Licensed Specialty Contractors by CAC 2013, Title 24, Part 1, 7-115(c).

IV. Not Used

V. Modifications and/or changes to the designs shown in this guideline shall be performed or reviewed by a qualified Registered Structural Engineer and approved by OSHPD.

VI. When more than one criteria is presented, the more stringent criteria shall be used. The data presented in this manual is subject to change without notice. Refer to the appropriate codes and standards for additional information and requirements.

VII. Not Used

VIII. It is the responsibility of the user of this manual to be familiar with all requirements for seismic bracing and shall be proficient in determining and applying utility loads for their application.

IX. The user of this manual shall determine the spacing and layout for the required bracing. The user shall determine the maximum horizontal, vertical and axial force component of the earthquake demand loads. The user's calculations must take into consideration the increases in loads caused by construction tolerances.

X. As with all pre-approved details, systems, etc., construction documents are still required showing how and where this pre-approved support, attachment and bracing system will be applied on a project specific basis. This process is needed to verify that the appropriate detail has been selected and applied for each condition and for the actual substrate that it will be connected/attached to.

XI. The Structural Engineer of Record (SEOR) must review and forward the support, attachment and bracing plans for plan check with a notation indicating that the plans have been reviewed and they have been found to be in general conformance with the design of the project. A "shop drawing stamp" is usually acceptable for compliance with this requirement. The regional staff, on a project specific basis, must review support, attachment and bracing details and supporting calculations that are not part of this pre-approval. Review of support, attachment and bracing details of this nature does not constitute a pre-approval that may be used on other projects without the benefit of plan review. The structural engineer of record shall verify the adequacy of the supporting structure and its components for the loads applied to the supporting structure and its components by the seismic bracing systems, and compliance with the applicable codes and standards.

XII. **Layout Drawings:**

a. Layout drawings of the support and bracing systems per this pre-approval shall be submitted to the discipline in responsible charge of the project for review to verify that the details are in conformance with all code requirements. The layout drawings shall be in accordance with ASCE 7-10 (including supplements nos. 1 & 2) as modified by the CBC 2013 Section 1616A.

i. 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.

ii. The SEOR will forward the supports, attachments and bracing plans (including approved change orders for supplementary framing where required) to the discipline in responsible charge with a notation indicating that the plans have been reviewed and are in general conformance with this pre-approval, the design of the project (CBC 2013, Section 7-153), and NFPA 13, 2013 Edition.

iii. A "shop drawing stamp" may be used to indicate compliance with this requirement.

iv. The Registered Design Professional (other than the SEOR) may provide the shop drawing stamp for small installations at the discretion of the District Structural Engineer.

b. The SEOR shall design any supplementary framing that is needed to resist the loads, maintain stability and/or is required for installation of this pre-approval. The supplementary framing shall be submitted to OSHPD as an Amended Construction Document (ACD).

c. The layout drawings (with the shop drawing stamp) shall be submitted to OSHPD to review:

i. Structure supporting the distribution system has adequate capacity.
ii. Seismic Design Forces (F_P) are in accordance with the CBC 2013.
iii. Verify that the submittal is within the scope of the OSHPD Pre-approval of Manufacturer's Certification (OPM):

a. Size of distribution system components.
b. Spacing of bracing and flex joints.
c. Substrate for attachments.

d. The layout drawings (with the shop drawing stamp) shall be kept on the jobsite and can then be used for installation for the support and bracing. OSHPD field staff will review the installation.

e. A copy of this pre-approval shall be on the jobsite prior to starting 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 Program's website.

XIII. Components of two or more pre-approved bracing systems shall not be mixed. Only this pre-approved bracing system may be used for a run of pipe. Any substitution of a component of this pre-approval shall require OSHPD review and approval.

2.0 BUILDING CODES, STANDARDS, & GUIDELINES

I. The Tolco Seismic Restraint Guidelines are designed to meet or exceed the requirements of the following:

2013 California Building Code (CBC 2013)
ANSI / AWC NDS-2012
NFPA 13 Standard for the Installation of Sprinkler Systems 2013 Edition
American Concrete Institute (ACI 318-11)
American Society of Civil Engineers (ASCE 7-10) Including Supplements Nos. 1 & 2.

These guidelines are intended to describe seismic restraints for the fire protection industry's most commonly used single hung pipe for up to 12-inch pipe.

Determine bracing design based on NFPA 13, 2013 zone of influence, Annex E.

$$a_P = 2.5;\ R_P = 4.5;\ S_{DS} = 2.5;\ \Omega_0 = 2.5;\ I_P = 1.5;\ z/h = 1;$$

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3.0 SEISMIC BRACING GENERAL REQUIREMENTS - FIRE PROTECTION PIPING

I. Lateral (transverse) Seismic Bracing is required for the following fire protection piping.

a) For Seismic Design Category C, D, E, or F, and Ip is equal to 1.5.
   - i. All mains.
   - ii. All cross mains.
   - iii. All branch lines 2 1/2" and larger
   - iv. The last length of pipe at the end of a feed or cross main shall be provided with a lateral brace.

II. Transverse bracing shall be provided at 40 ft. maximum spacing for welded steel pipe.

a) Lateral (transverse) seismic bracing is to protect piping against movement perpendicular to the run of pipe.
b) Lateral (transverse) seismic bracing shall be spaced at a maximum of 40' for piping (2 1/2" diameter and larger) constructed of ductile materials (e.g. Steel); 30' maximum span (piping smaller than 2 1/2" diameter).
c) A lateral (transverse) seismic brace placed on the pipe run section at the opposite side of an elbow within 24" may act as a longitudinal brace. For an example, see page 1-9.
d) The minimum required bracing for runs longer than 5' is a transverse brace at each end, and a longitudinal brace at one of those two positions. For an example, see page 1-9.
e) Rigid grooved couplings listed for UL Standard 213 shall be permitted in horizontal runs of pipe. Flexible grooved couplings listed for UL Standard 213 shall be permitted in vertical risers (to accommodate drift) and at other locations (e.g. seismic separations, equipment nozzles, etc.) to accommodate small movement and/or rotation. Non-UL listed grooved couplings shall not be used unless approved on a project specific basis.

Exceptions

All piping suspended by individual hanger rods 6 inches or less in length from the top of the pipe to the bottom of the support structure where hanger is connected. All of the hangers of a run must comply with the 6 inch rule or bracing is required.

III. Longitudinal bracing shall be at 80 ft. maximum spacing for welded steel pipe.

a) Longitudinal seismic bracing is to protect piping against movement parallel to the run of pipe.
b) Longitudinal seismic bracing shall be spaced a maximum of 80' for piping (2 1/2" diameter and larger) constructed of ductile materials (e.g. Steel); 60' maximum span (piping smaller than 2 1/2" diameter) for an example, see page 1-9.
c) Each pipe run shall have at least one longitudinal brace, additional longitudinal braces are required when the maximum longitudinal spacing is exceeded. For an example, see page 1-9.

IV. When determining horizontal load requirements, follow NFPA 13 Zone of Influence requirements.

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V. A piping system shall not be braced to different parts of the building that may respond differently during seismic activity.

The following Tolco products were engineered with torque indicators to ensure proper installation:

Fig. 980 Universal Swivel Sway Brace Attachments have a break-off bolt head

Fig. 1000 Sway Brace Attachments have material that flattens out or comes together to ensure proper engagement

Fig. 1001 Sway Brace Attachments have bolt heads that bottom out

Fig. 800, Fig. 825 & Fig. 828 Adjustable Sway Brace Attachments to Steel and Joist have break-off head bolts

Fig. 4L and 4LA Braced Pipe Attachments have break-off bolts heads

VI. Refer to the appropriate codes and standards for additional information and requirements.

VII. See Appendix pages 5-7 thru 5-10 for lateral sway bracing tables.

VJ. Vertical Offsets / Risers:

d) Tops of vertical offsets/risers exceeding 3' in length shall be provided with a four-way brace. Bracing shall be located within 24" of the end of the vertical run. Refer to partial isometric A on page 1.16.

e) Distance between four-way braces for risers shall not exceed 25'.

4.0 SEISMIC BRACING LAYOUT - GENERAL REQUIREMENTS

I. The TOLCO Seismic Restraint Guidelines provides for the protection of suspended pipe systems against excessive movement due to seismic forces.

II. The seismic restraint assemblies in this guideline are designed to simultaneously resist vertical loads due to the weight of the component and its contents and both horizontal and vertical seismic loads.

III. Horizontal loads are braced with two types of seismic restraints;

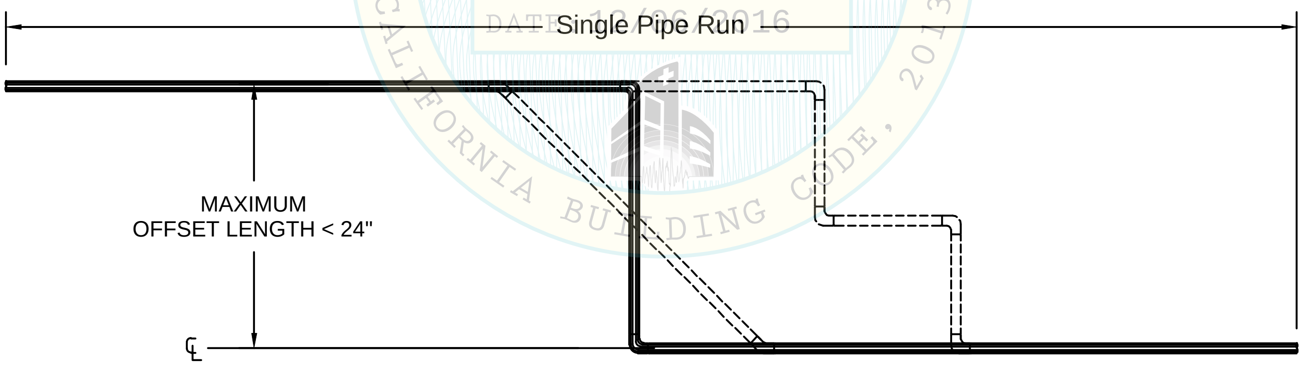
a) Transverse Brace to protect pipe against movement perpendicular to its run.

b) Longitudinal Brace to protect pipe against movement parallel to its run.

IV. A run of pipe is defined as a continuous straight length, or one with allowable offsets, that are less than 24". If the offset is 24" or greater, each straight segment shall be treated as an independent run and shall be braced. Refer to partial plan on page 1-10.

LEGEND

T	Transverse Location
L	Longitudinal Location
TL	Transverse Location also acting as Longitudinal
VSB	A Vertical Seismic Brace (VSB) shall be placed within 6" of all Single Transverse & Longitudinal braces. See XVI.



NOTE: When a run of pipe that requires bracing transitions down to a size that does not, the point of transition is considered the end of the run and will require a transverse brace. For an offset less than 24", this is still considered a single run of pipe.

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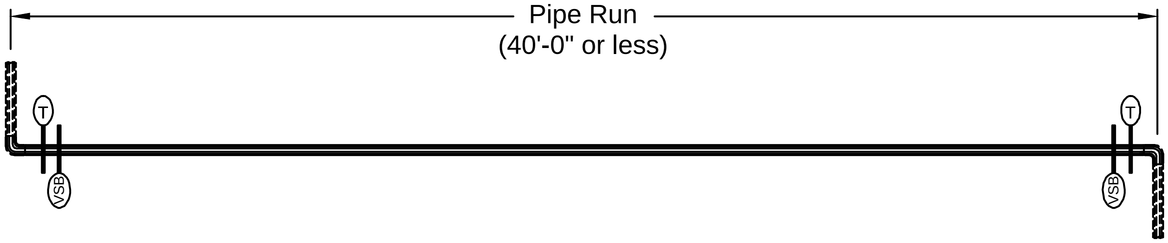
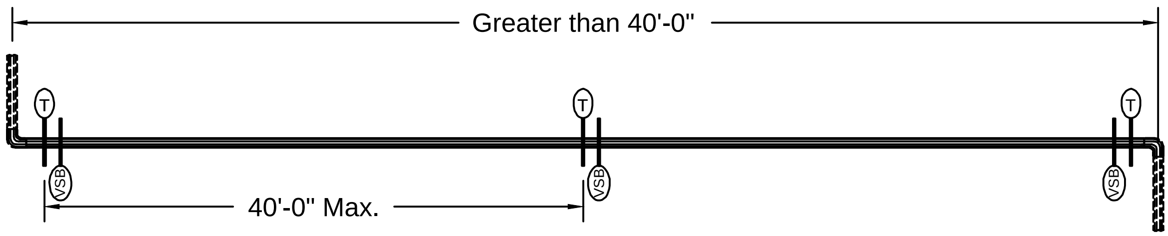
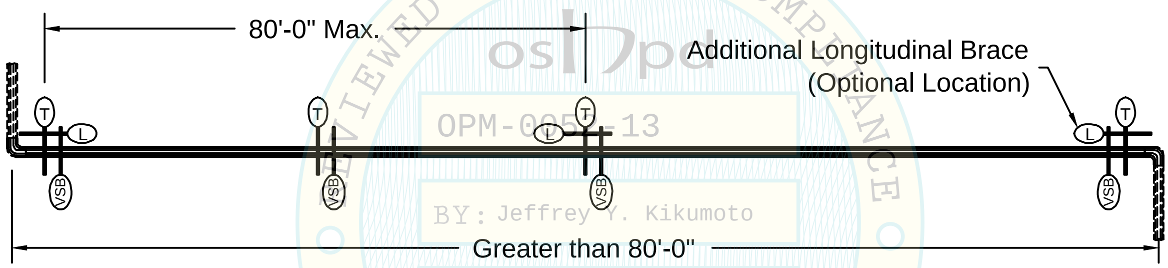
V. Each run of pipe requires a minimum of two transverse braces, one at each end of the run.



VI. If the distance between the two transverse braces exceeds the maximum allowable spacing, add transverse braces as needed.

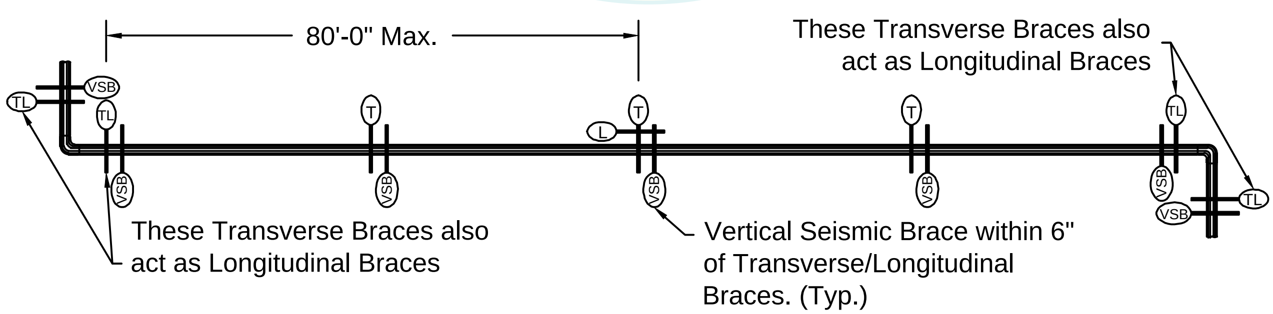


VII. Each pipe run must have at least one longitudinal brace. If the maximum allowable longitudinal spacing is exceeded then add longitudinal braces to meet the spacing requirement.

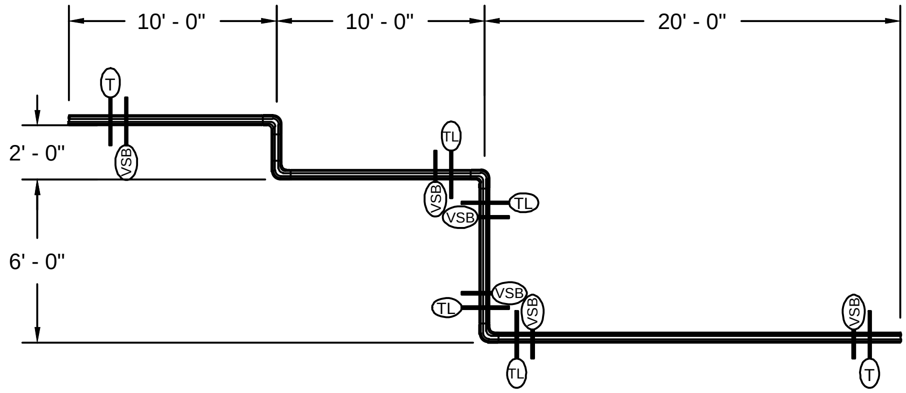


VIII. Each run of pipe requires a minimum of one longitudinal brace. However, a transverse brace placed on the run section at the opposite side of an elbow or tee within 24" may act as a longitudinal brace, and is labeled a "DUAL USE" brace. See layout example below.

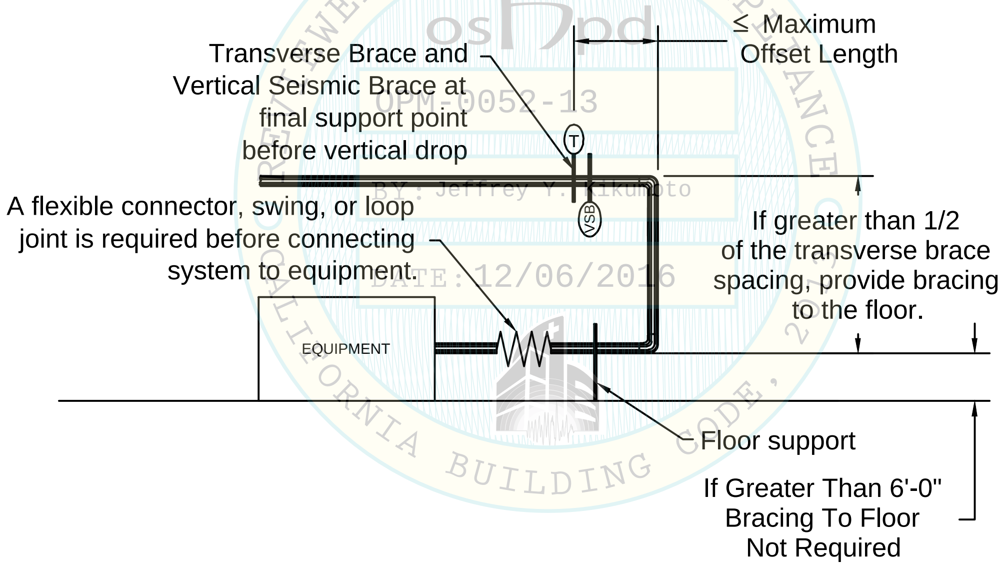
a) Longitudinal and Longitudinal "DUAL USE" braces on single supported pipe shall be attached directly to the pipe.
b) Bracing installed to smaller piping shall not be used to brace larger piping.



IX. In some cases several short runs may occur in close proximity. By following the preceding guidelines each run should have longitudinal and transverse bracing. Transverse bracing may be used as longitudinal bracing and vice versa on runs adjacent to each other as long as the total length of pipe tributary to the brace does not exceed the maximum allowable spacing. In cases where it does, additional braces are required.



X. At vertical pipe drop to equipment, where pipe is connected to the equipment using a flexible connection, provide transverse bracing before the vertical drop. The total length from the transverse brace to the vertical drop should not be more than the allowable offset previously determined. Provide transverse bracing at the floor after the vertical drop if the total length of the pipe from the transverse brace before the vertical drop to the flexible connection is greater than ½ of the maximum transverse brace spacing.



XI. When pipe crosses a building seismic separation or seismic joint it must be capable of accommodating the joint displacements as specified by the engineer of record.

XII. A rigid pipe shall not be braced to dissimilar parts of a building structure or two dissimilar building systems that may move different from one another during an earthquake. Bracing should be attached to the part of the building structure that is supporting the pipe.

XIII. Transverse and longitudinal braces shall be installed as shown in this guideline up to 90° from horizontal. However, the recommended brace ratio is 45° from horizontal, or 1 (vert.) to 1 (horiz.) brace ratio. Spacing for additional brace angles may be achieved by the following:

XIV. All transverse, longitudinal, and vertical braces utilizing steel pipe with Tolco Fig. 900 series fittings may have an alignment tolerance of 5° from center without adversely affecting the given loads.

XV. The seismic brace assemblies in this guideline consist of three important components; Anchorage and connections to building structure, brace member such as pipe, and seismic brace attachments. For details and load information of structural attachments see Section 3, for details of brace assemblies see applicable "Brace Details" section(s).

XVI. Single Rigid Brace locations are required to be at or within 6 inches of a vertical seismic brace (VSB) assembly to protect against vertical movement. An exception to this would be the use of two opposing rigid braces at the same location. In this case no additional vertical seismic brace assembly is necessary.

XVII. Steel bolt connections to steel structure or components shall not have a diameter less than 1/16" less than the mounting hole. Steel bolt connections to concrete structure shall not have a diameter less that 1/8" less than the mounting hole.

5.0 GENERAL DESIGN PROCEDURE

The following presents a general procedure for design of seismic bracing. The following assumes that a piping design layout has been provided, and that gravity hanger supports have been designed by others. The following also assumes that seismic bracing has been determined to be required. Refer to the appropriate codes and standards for additional information and requirements.

I. Seismic Force Coefficient

Determine the total design lateral seismic force coefficient based on the applicable code, project drawings, and specifications. This coefficient is commonly referred to as the "G-factor"; i.e. Fp = .5G. In case of a conflict, use the more stringent criteria. The total design horizontal seismic force coefficient, when multiplied by the weight of the piping, represents the total design lateral seismic force.

According to CBC 2013 the total design lateral seismic force, Fp, or per NFPA, C_P and the total vertical seismic force, Fv, shall be determined from the following formulas. The final Fp, Fv shall be divided by 1.4 to convert the strength based seismic force to the allowable stress based seismic force. This is necessary because the loads and brace spacing in this manual are based on the allowable stress design.

Horizontal Seismic Force

$$Fp = \frac{0.4\ ap\ Sds}{\frac{Rp}{Ip}}\left(1+2\frac{z}{h}\right) Wp$$

Except that:

Fp shall not be less than 0.3 Sds Ip Wp and
Need not be more than 1.6 Sds Ip Wp

Seismic Coefficient Table NFPA-13

S_s	C_P	S_s	C_P
0.33 or less	0.31	1.50	0.71
0.50	0.40	2.00	0.95
0.75	0.43	2.40	1.14
0.95	0.50	3.00	1.43
1.00	0.52	3.50	1.63
1.25	0.60	3.73	1.74

Linear Interpolation of NFPA-13 2013 Table (9.3.5.9.3)

$$C_P = C_{p\text{ - low}} + \frac{C_{P\text{ - high}} - C_{p\text{ - low}}}{S_{S\text{ - high}} - S_{S\text{ - low}}}\left(S_S - S_{S\text{ - low}}\right)$$

$C_P = 0.467\ S_S$
(See NFPA 13-13, 9.3.5.9.3 and E3)

Vertical Seismic Force

Fv = 0.2 Sds Wp

Sds - Design spectral acceleration for short periods

ap - Component amplification factor (Per NFPA 13, for steel pipe ap = 2.5)

Ip - Component importance factor (Per NFPA 13, Ip = 1.5)

Wp - Component operating weight (Per NFPA 13, 9.3.5.9.2, Wp shall be taken as 1.15 times the weight of the water filled piping)

Rp - Component response modification factor (Per NFPA 13, for steel pipe. Rp = 4.5)

z - Height of structure at point of attachment with respect to the base (For worst case scenario, use z/h = 1)

h - Average roof height of structure with respect to the base (For worst case scenario, use z/h = 1)

$Sds = \frac{2}{3}\ Fa \cdot Ss$ (Per NFPA 13, May assume Fa = 2.5)

Refer to CBC 2013 codes for additional information & requirements.

II. Seismic Bracing Detail

Select a seismic bracing detail. For example, if a rigid transverse brace is required for installation, go to page 2-1 through 2-6 in Section 2 "Single Hanger Rigid Brace Details" for all applicable transverse brace details.

III. Structural Attachment Detail

Select a structural attachment detail. For example, if a wedge anchor into normal weight concrete slab is required for installation at a seismic brace location, go to page 3-1 thru 3-3 in Section 3 "Structural Attachment" for all applicable seismic brace attachment details corresponding to various wedge anchor types.

IV. Brace Spacing

Determine the maximum transverse and longitudinal brace spacing from the section "Structural Attachments". This brace spacing is based on the allowable loads for the specific structural attachment detail previously selected.

The brace spacing shall not exceed the maximum allowable brace spacing requirements listed in section 1 general notes.

Also see Appendix pages 5-7 thru 5-9 for lateral sway bracing tables for ZOI weights of various brace spacing and sprinkler pipe specifications.

V. Brace Member

Select a brace member and determine its total length. A brace member may be steel pipe. Maximum allowable horizontal seismic loads and maximum allowable lengths for the different brace members are listed on page 4-6. The maximum applied horizontal seismic load shall be equal to or less than the maximum allowable horizontal seismic loads.

VI. Bracing Layout

Layout the seismic bracing as explained in the previous section "Seismic Bracing Layout Procedure".

6.0 GENERAL INSTALLATION NOTES:

I. Single Hanger Rigid Brace Installation Guideline

a) The design of all gravity hangers is not in the scope of this pre-approval. SEOR to verify the vertical seismic brace within 6" of the diagonal brace member are designed for gravity load plus vertical seismic loads. The design of the gravity hangers not within 6" of seismic braces to be approved on a project specific basis by OSHPD.

b) All vertical seismic braces must be plumbed to the support structure.

c) The recommended brace angle is 45° for the diagonal brace, or 1 (Vert.) to 1 (Horiz.) brace ratio. However, the brace can be installed between 30°-90° degrees from vertical.

d) All transverse, longitudinal , and vertical braces utilizing steel pipe with Tolco Fig. 900 series fitting has an alignment tolerance of 5° from center without adversely affecting the given capacities. See page 4-6 for more information.

7.0 COMPONENT PART NUMBER REFERENCE:

Tolco Fig. 4L	
Part Number	Description
Y088024*	FG 4L 2 1/2" IN LINE SWAY BRACE ATT
Y088030*	FG 4L 3" IN LINE SWAY BRACE ATT
Y088040*	FG 4L 4" IN LINE SWAY BRACE ATT
Y088050*	FG 4L 5" IN LINE SWAY BRACE ATT
Y088060*	FG 4L 6" IN LINE SWAY BRACE ATT
Y088080*	FG 4L 8" IN LINE SWAY BRACE ATT

Tolco Fig. 4LA	
Part Number	Description
Y093010*	FG 4LA 1" LONG LAT SWAY BRC ATT
Y093012*	FG 4LA 1 1/4" LONG LAT SWAY BRC ATT
Y093014*	FG 4LA 1 1/2" LONG LAT SWAY BRC ATT
Y093020*	FG 4LA 2" LONG LAT SWAY BRC ATT
Y093024*	FG 4LA 2 1/2" LONG LAT SWAY BRC ATT
Y093030*	FG 4LA 3" LONG LAT SWAY BRC ATT
Y093040*	FG 4LA 4" LONG LAT SWAY BRC ATT
Y093060*	FG 4LA 6" LONG LAT SWAY BRC ATT
Y093080*	FG 4LA 8" LONG LAT SWAY BRC ATT
Y093100*	FG 4LA 10" LONG LAT SWAY BRC ATT
Y093120*	FG 4LA 12" LONG LAT SWAY BRC ATT

Tolco Fig. 800	
Part Number	Description
Y338001*	FG 800 TYPE1X4-6 ATMT
Y338002*	FG 800 TYPE1X6-8 ATMT
Y338003*	FG 800 TYPE1X8-10 ATMT
Y338004*	FG 800 TYPE1X10-12 ATMT
Y338005*	FG 800 TYPE1X12-14 ATMT
Y338006*	FG 800 TYPE1X14-16 ATMT
Y338007*	FG 800 TYPE1X16-18 ATMT
Y338201*	FG 800 TYPE2X4-6 ATMT
Y338202*	FG 800 TYPE2X6-8 ATMT
Y338203*	FG 800 TYPE2X8-10 ATMT
Y338204*	FG 800 TYPE2X10-12 ATMT
Y338205*	FG 800 TYPE2X12-14 ATMT
Y338206*	FG 800 TYPE2X14-16 ATMT
Y338207*	FG 800 TYPE2X16-18 ATMT

Tolco Fig. 825	
Part Number	Description
Y340000*	FG 825 BJ EQBATMT

Tolco Fig. 828	
Part Number	Description
Y340800*	FG 828 UNIV STRUCT SWAY BRC ATTACH

Tolco Fig. 906	
Part Number	Description
Y334010012 *	FIG. 906 1 & 1 1/4 MFA PLN W 9/16 HOLE

Tolco Fig. 980	
Part Number	Description
Y3410003*	FG 980 3/8" HL UNIVBRCATT
Y341000*	FG 980 1/2" HL UNIVBRCATT
Y3410005*	FG 980 5/8" HL UNIVBRCATT
Y3410006*	FG 980 3/4" HL UNIVBRCATT

Tolco Fig. 1000	
Part Number	Description
Y380010010*	1X1 FASTC
Y380010012*	1 1/4X1 FASTC PLN
Y380010014*	1 1/2X1 FASTC PLN
Y380010020*	2X1 "FAST CLAMP" SWAY BRACE ATTMNT
Y380010024*	2 1/2X1 "FAST CLAMP" SWAY BRACE ATTACHMENT
Y380010030*	3X1 "FAST CLAMP" SWAY BRACE ATTACHMENT
Y380010034*	3 1/2X1 FASTC
Y380010040*	4X1 "FAST CLAMP" SWAY BRACE ATTACHMENT
Y380012010*	1X1 1/4" "FAST CLAMP" SWAY BRACE ATTACHMENT
Y380012012*	1 1/4X1 1/4FASTC
Y380012014*	1 1/2X1 1/4FASTC
Y380012020*	2X1 1/4 FASTC
Y380012024*	2 1/2X1 1/4""FAST CLAMP" SWAY BRACE ATTMNT
Y380012030*	3X1 1/4" "FAST CLAMP" SWAY BRACE ATTACHMENT
Y380012034*	3 1/2X1 1/4FASTC PLN
Y380012040*	4X1 1/4" "FAST CLAMP" SWAY BRACE ATTACHMENT

Tolco Fig. 1001	
Part Number	Description
Y379010010*	1 X 1 SWAY BRACE ATTACHMENT
Y379010012*	1 1/ 4 X 1 SWAY BRACE ATTACHMENT
Y379010014*	1 1/2 X 1 SWAY BRACE ATTACHMENT
Y379010020*	2 X 1 SWAY BRACE ATTACHMENT
Y379010024*	2 1/2X 1 SWAY BRACE ATTACHMENT
Y379010030*	3X 1 SWAY BRACE ATTACHMENT
Y379010040*	4X 1 SWAY BRACE ATTACHMENT
Y379010060*	6X 1 SWAY BRACE ATTACHMENT
Y379010080*	8X 1 SWAY BRACE ATTACHMENT
Y379012010*	1 X 1 1/4 SWAY BRACE ATTACHMENT
Y379012012*	1 1/4 X 1 1/4 SWAY BRACE ATTACHMENT
Y379012014*	1 1/2 X 1 1/4 SWAY BRACE ATTACHMENT
Y379012020*	2 X 1 1/4 SWAY BRACE ATTACHMENT
Y379012024*	2 1/2X 1 1/4 SWAY BRACE ATTACHMENT
Y379012030*	3X 1 1/4" SWAY BRACE ATTACHMENT
Y379012040*	4X 1 1/4" SWAY BRACE ATTACHMENT
Y379012060*	6X 1 1/4" SWAY BRACE ATTACHMENT
Y379012080*	8X 1 1/4" SWAY BRACE ATTACHMENT

*ADD THE FOLLOWING SUFFIEXES TO CHANGE THE FINISH OF THE COMPONENT.

NO SUFFIX INDICATES PLAIN FINISH.

a.) E - Electro- Galvanized

b.) HDG - Hot Dipped Galvanized

c.) 304 - Stainless Steel [Grade 304]

d.) 316 - Stainless Steel [Grade 316]

FOR EXAMPLE, THE PART NUMBER FOR A TOLCO FIG. 4L WITH AN ELECTRO-GALVANIZED FINISH IS Y088060E

SECTION 10-2

SINGLE HANGER RIGID BRACE DETAILS

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EATON'S B-LINE BUSINESS
509 WEST MONROE STREET | HIGHLAND, IL 62249
P: (800) 851-7415 | F: (800) 356 1438

MRH
Structural Engineer: Mohammad Hariri
California SE No. S3545

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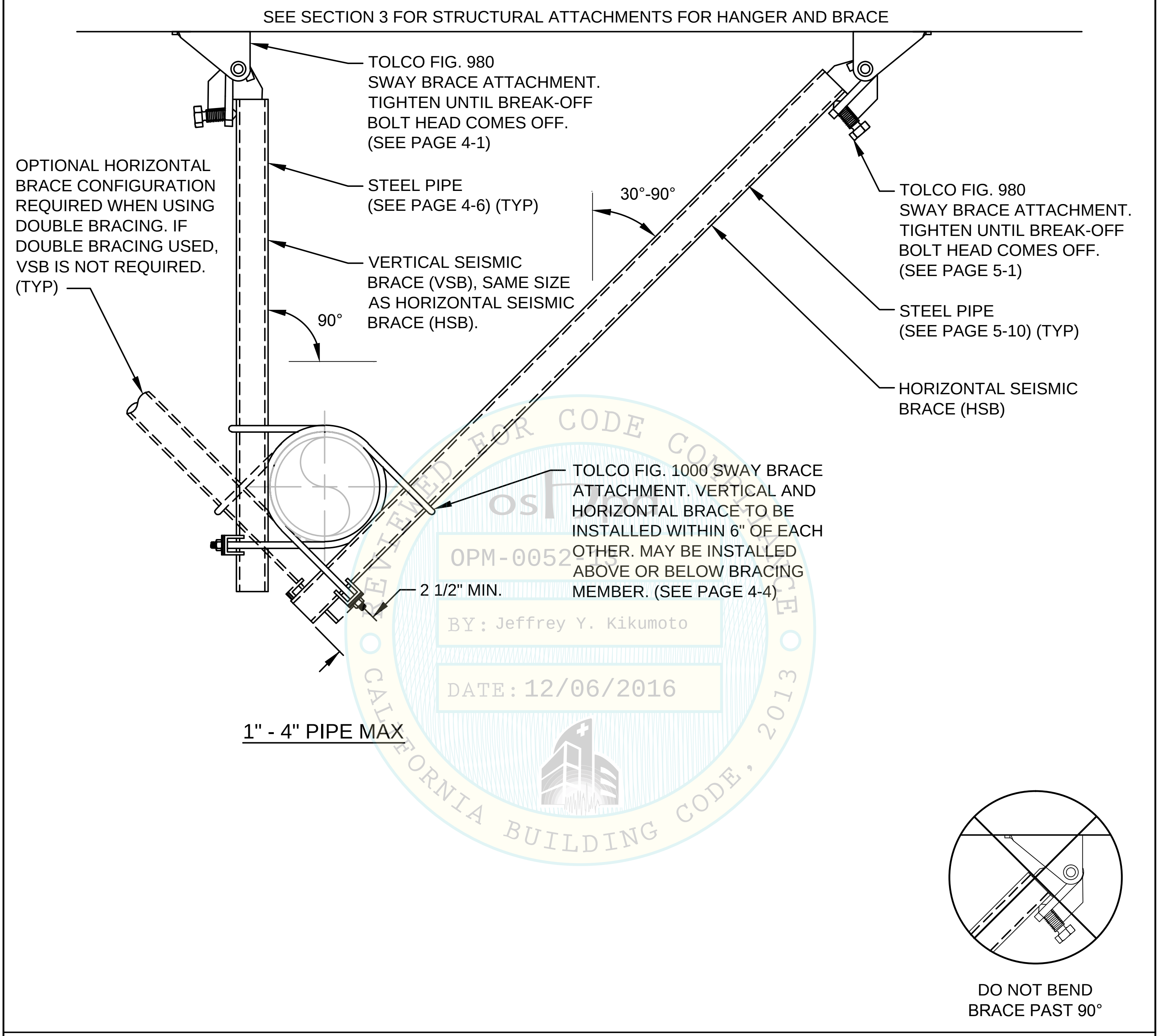
MH

TRANSVERSE RIGID BRACE FOR SINGLE HUNG PIPE WITH FIG. 1000 FAST CLAMP

DETAIL
1G-A



NOTES:
1.) DESIGN OF HANGER SUPPORTING GRAVITY LOADS ONLY NOT IN SCOPE OF THIS PRE-APPROVAL. DESIGN OF HANGER TO BE APPROVED ON PROJECT SPECIFIC BASIS BY OSHPD.
2.) SEE SECTION 3 AND SECTION 4 FOR ALLOWABLE LOADS FOR VARIOUS BRACE ANGLE CONFIGURATIONS.
3.) VSB AND HORIZONTAL SEISMIC BRACE MAY USE DIFFERENT APPROVED COMPONENTS.

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PAGE: **10-2-1**
DATE: **NOVEMBER 29, 2016**

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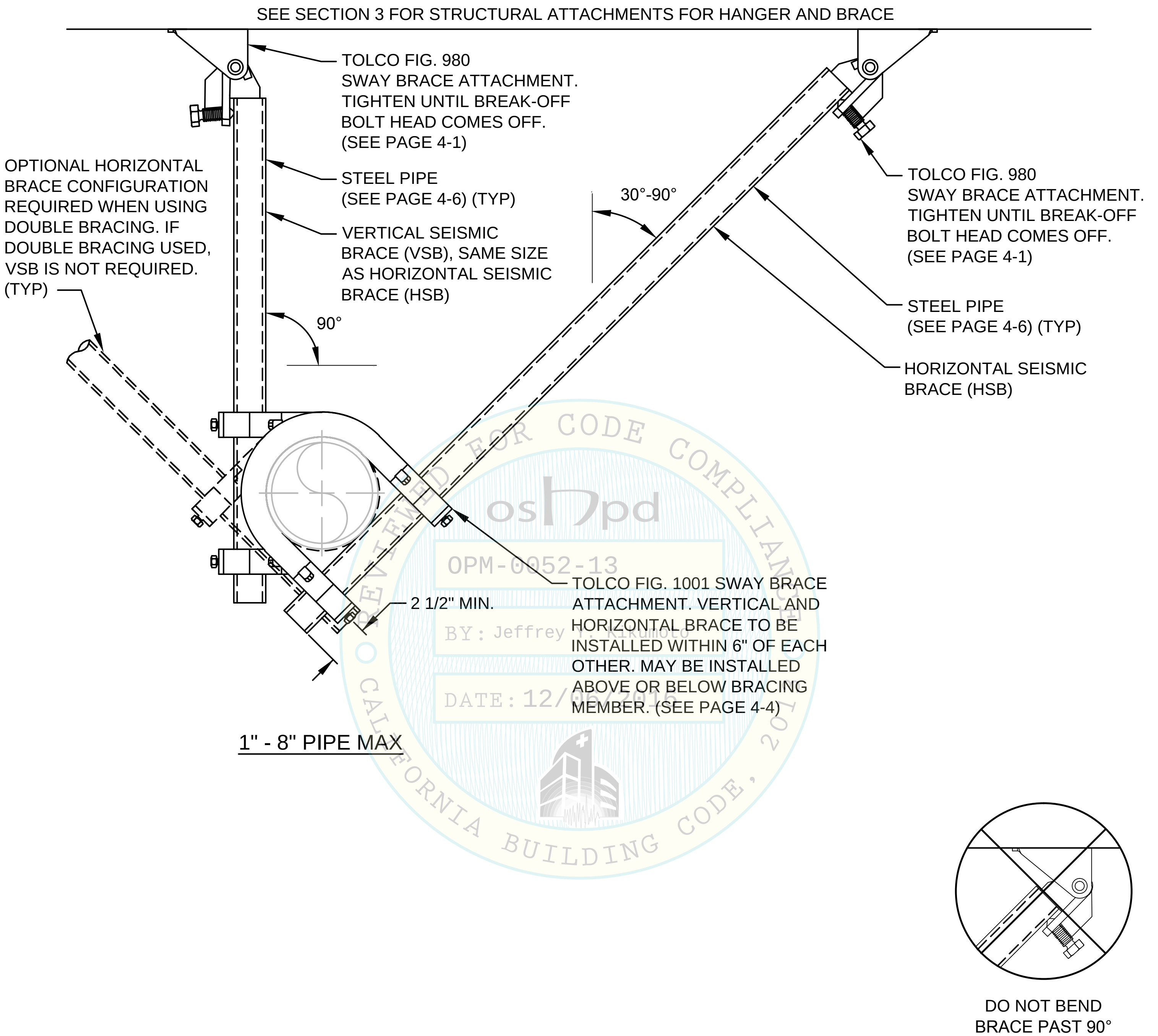
MH

TRANSVERSE RIGID BRACE FOR SINGLE HUNG PIPE WITH FIG. 1001 FAST CLAMP

DETAIL 1G-B



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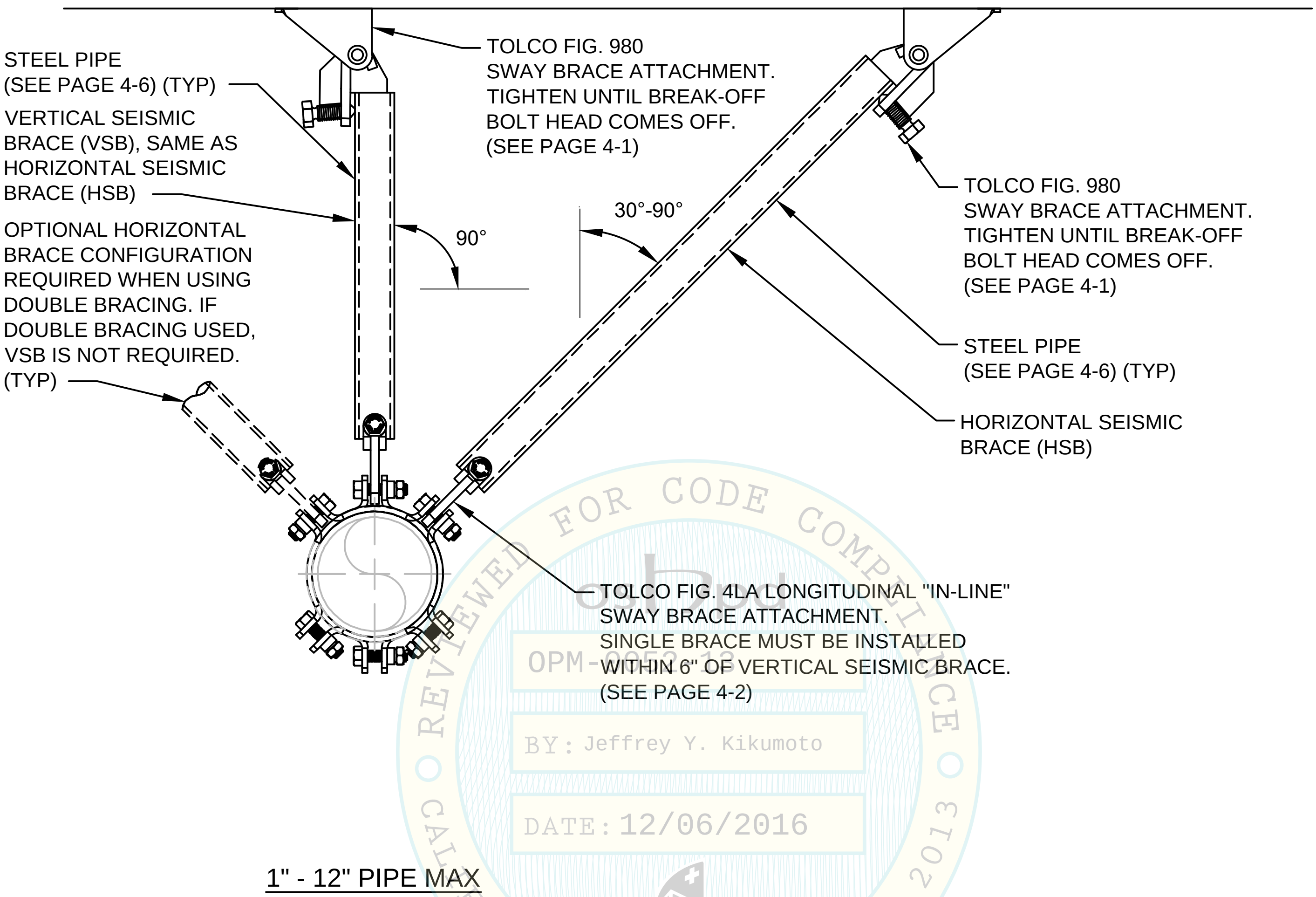
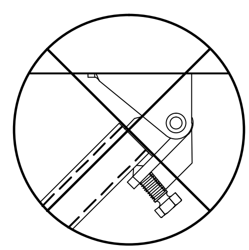
	TRANSVERSE RIGID BRACE FOR SINGLE HUNG PIPE WITH FIG. 4LA1 FAST CLAMP	DETAIL 1LA





DO NOT BEND BRACE PAST 90°

NOTES:

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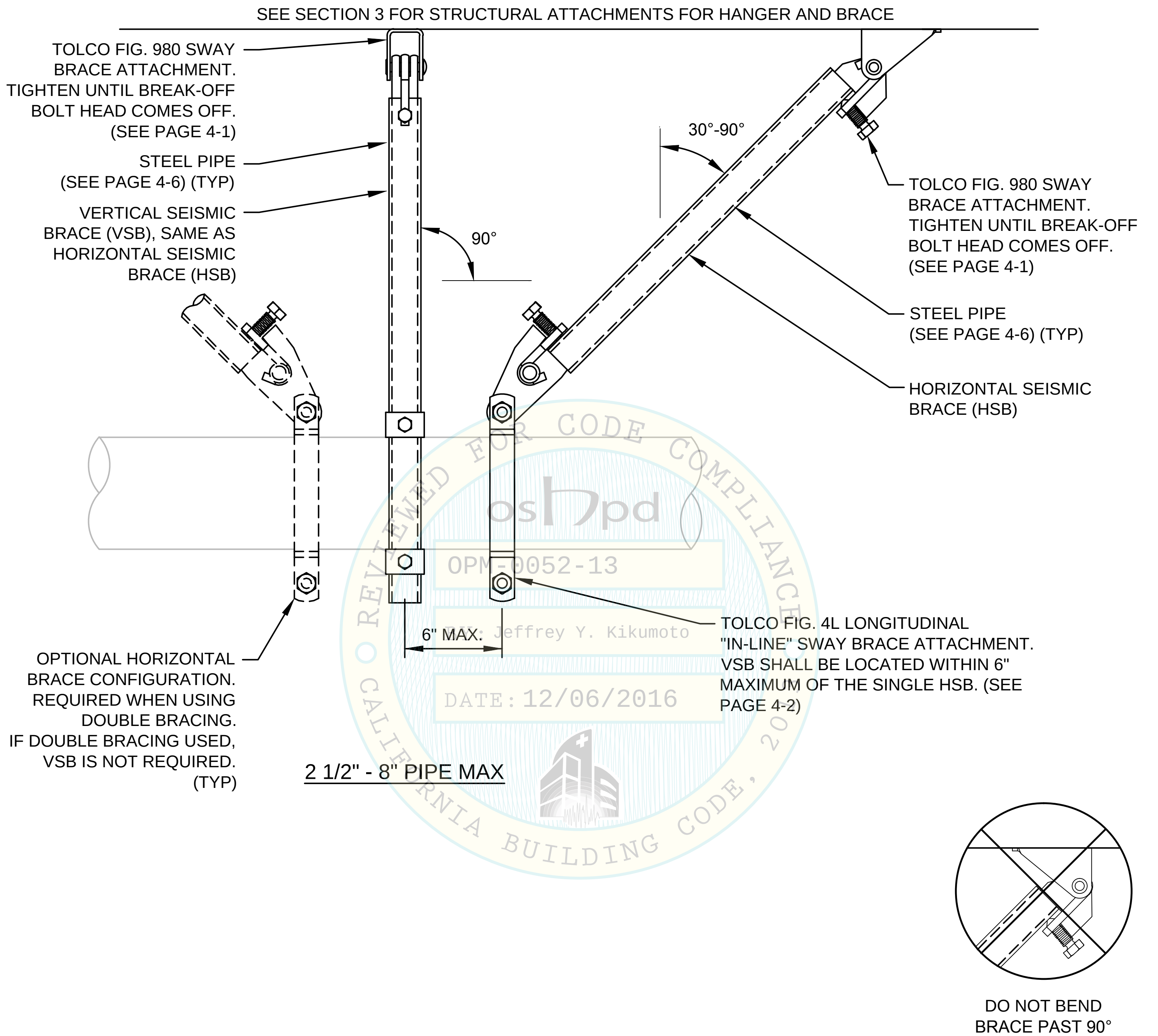
MH

LONGITUDINAL RIGID BRACE FOR SINGLE HUNG PIPE WITH LONGITUDINAL "IN-LINE" PIPE CLAMP

DETAIL
2L



NOTES:

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2.) SEE SECTION 3 AND SECTION 4 FOR ALLOWABLE LOADS FOR VARIOUS BRACE ANGLE CONFIGURATIONS.
3.) VSB AND HORIZONTAL SEISMIC BRACE MAY USE DIFFERENT APPROVED COMPONENTS.

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PAGE: 10-2-4

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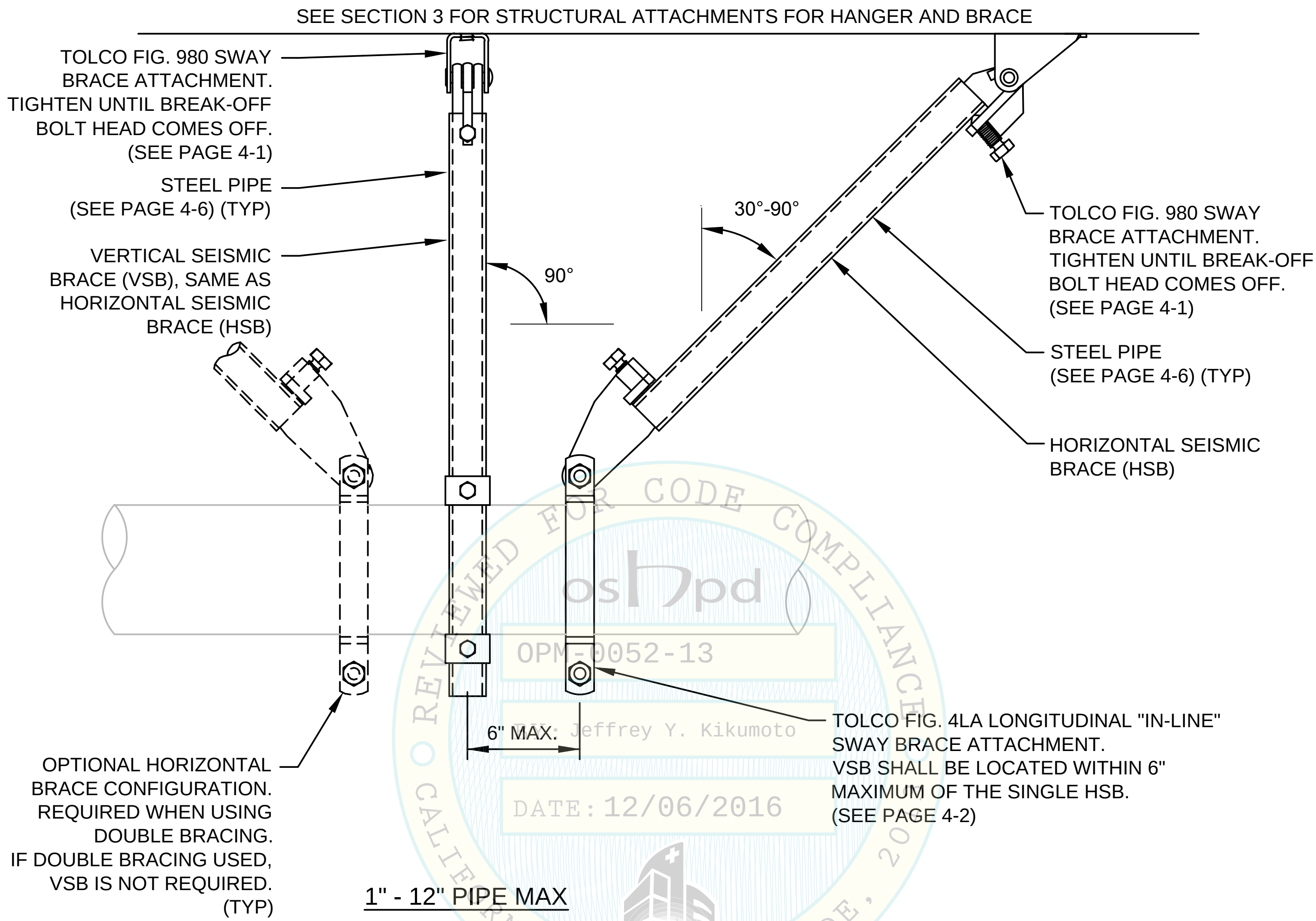
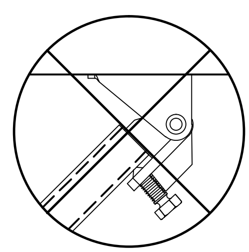
MH

LONGITUDINAL RIGID BRACE FOR SINGLE HUNG PIPE WITH LONGITUDINAL "IN-LINE" PIPE CLAMP

DETAIL
2LA





DO NOT BEND BRACE PAST 90°

NOTES:

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2.) SEE SECTION 3 AND SECTION 4 FOR ALLOWABLE LOADS FOR VARIOUS BRACE ANGLE CONFIGURATIONS.
3.) VSB AND HORIZONTAL SEISMIC BRACE MAY USE DIFFERENT APPROVED COMPONENTS.

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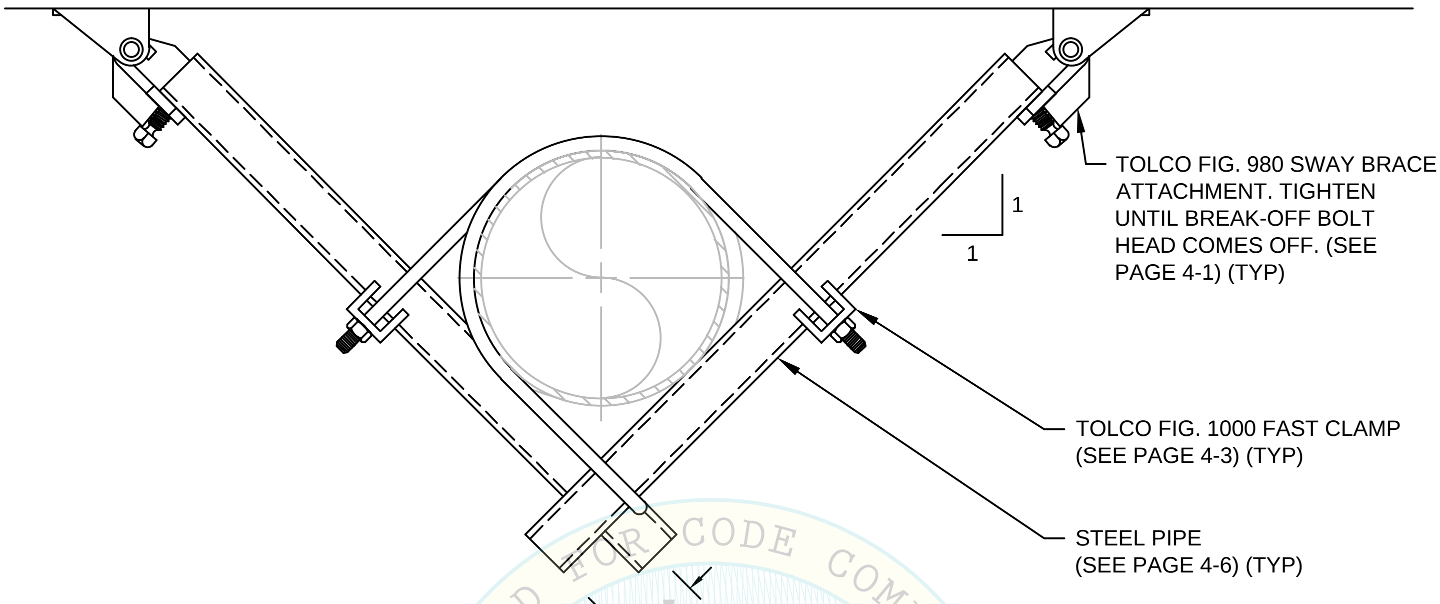
MH

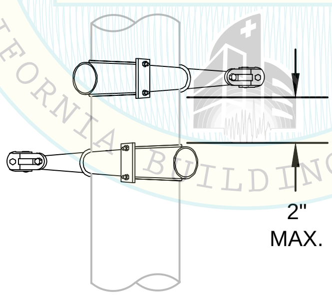
DOUBLE FAST CLAMP RISER BRACE

DETAIL
R1-A

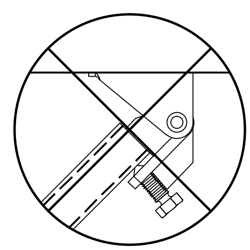
SEE SECTION 3 FOR STRUCTURAL ATTACHMENTS FOR BRACE



1" - 4" PIPE MAX
PLAN VIEW



ELEVATION



DO NOT BEND BRACE PAST 90°

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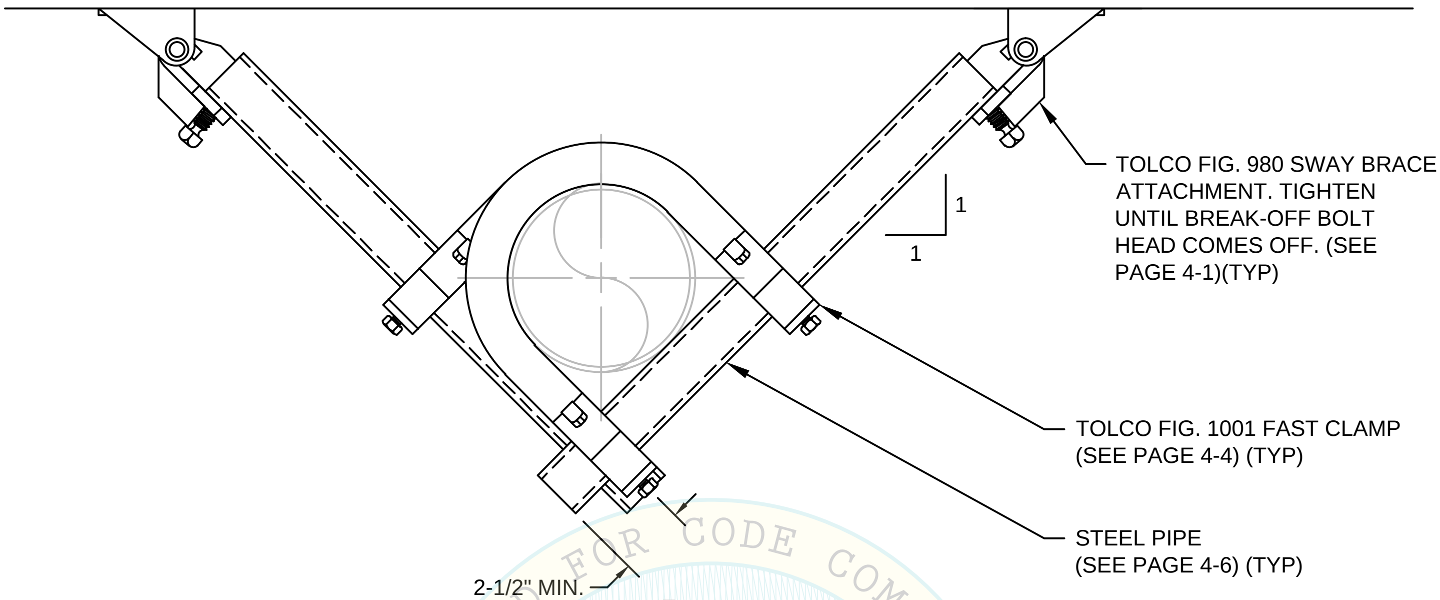
DOUBLE FAST CLAMP RISER BRACE

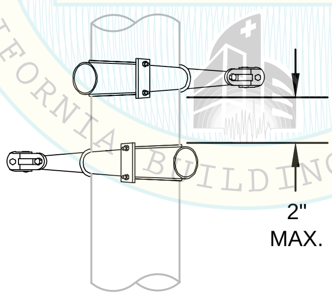
DETAIL
R1-B

SEE SECTION 3 FOR STRUCTURAL ATTACHMENTS FOR BRACE

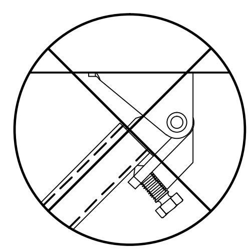


1" - 8" PIPE MAX

PLAN VIEW



ELEVATION



DO NOT BEND BRACE PAST 90°

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10-2-7

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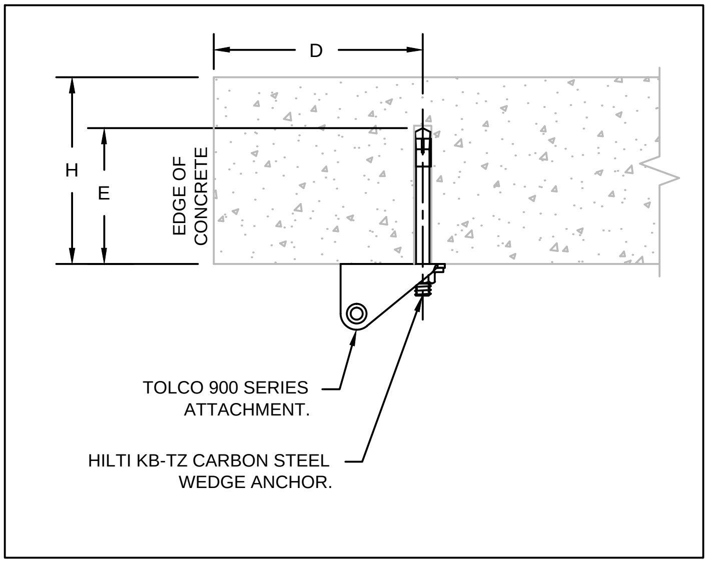
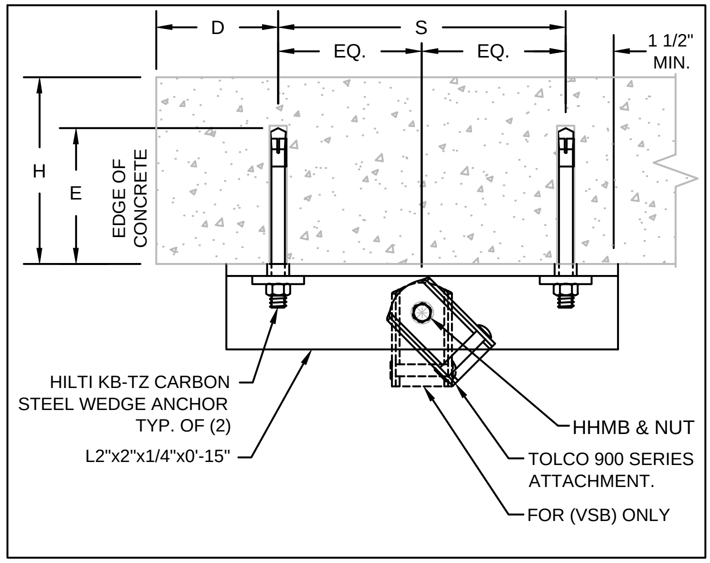
SECTION 10-3

STRUCTURAL ATTACHMENT

REVIEWED FOR CODE COMPLIANCE
oshpd
OPM-0052-13
BY: Jeffrey Y. Kikumoto
DATE: 12/06/2016
CALIFORNIA BUILDING CODE, 2013

HILTI KB-TZ WEDGE ANCHORS IN 4,000 PSI NORMAL WEIGHT CONCRETE





ANCHOR DIA.	'E' MIN. EFFECTIVE ANCHOR EMBED. DEPTH	'D' MIN. EDGE DISTANCE	'S' MIN. SPACING BETWEEN ANCHORS (MAX 12")	'H' MIN. BASE MATERIAL THICKNESS	ANCHOR CAPACITY				
					MAX. HORIZONTAL LOAD W/ BRACE ANGLE FROM VERTICAL @				MAX. VERTICAL LOAD W/ BRACE ANGLE FROM VERTICAL @
					30-44	45-59	60-74	75-90	0
3/8"	2"	12"	6"	4"	288	288	288	288	288
1/2"	2"	12"	6"	4"	328	328	328	328	328
1/2"	3 1/4"	12"	9 3/4"	6"	450	653	883	1235	880
5/8"	3 1/8"	12"	9 1/2"	5"	656	656	656	656	656
5/8"	4"	12"	12"	6"	902	902	902	902	902
3/4"	3 3/4"	12"	11 1/4"	6"	594	884	1235	1235	1105

MAX. HORIZONTAL LOAD INCLUDES OVER STRENGTH FACTOR Ω_0 =2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN STONE AGGREGATE CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 4,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 FOR ALLOWABLE LOADS GOVERNED BY CONCRETE FAILURE MODES PER ACI 318-11, APPENDIX D, D.3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, TEST ALL PREVIOUS UNTESTED ANCHORS OF THE SAME TYPE AND INSTALLED BY THE SAME TRADE UNTIL 20 CONSECUTIVE ANCHORS PASS, THEN RESUME WITH 50% TESTING OF ANCHOR. SEE PAGE 3-17.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)
4.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
5.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
6.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
7.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE.
8.)TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER. SEE PAGE 3-17.
9.) HOLE SIZE IN ANGLE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI. SEE PAGE 4-5.
10.) TEST AND TEST LOADS FOR POST-INSTALLED ANCHORS IN CONCRETE MUST COMPLY WITH CBC 1913A.7 AND MANUFACTURERS ICC REPORT. TEST ACCEPTANCE CRITERIA MUST COMPLY WITH CBC 1913A.7.4

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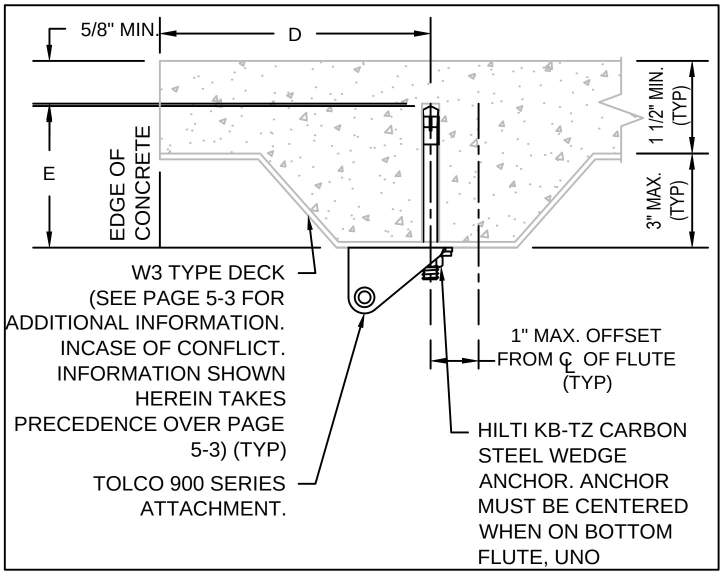
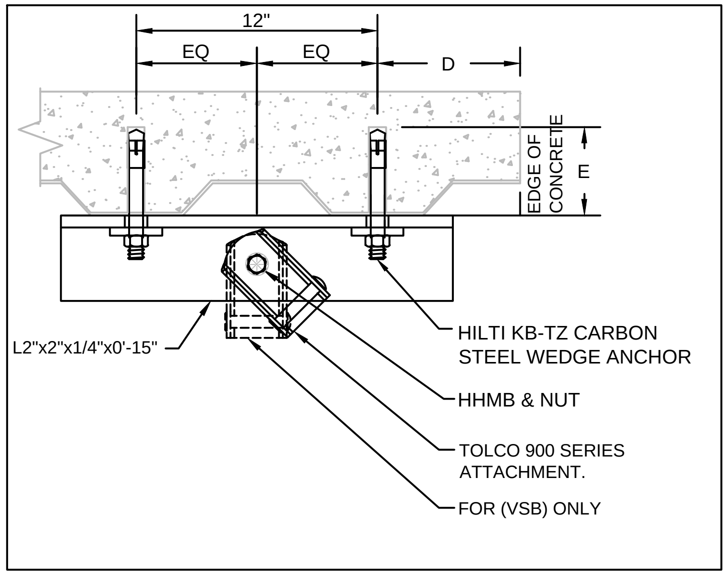
MH

HILTI KB-TZ WEDGE ANCHOR IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)





ANCHOR DIA.	'E' MIN. EFFECTIVE ANCHOR EMBED. DEPTH	'D' MIN. EDGE DISTANCE	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	ANCHOR CAPACITY				
				MAX. HORIZONTAL LOAD W/ BRACE ANGLE FROM VERTICAL @				MAX. VERTICAL LOAD W/ BRACE ANGLE FROM VERTICAL @
				30-44	45-59	60-74	75-90	0
3/8"	2"	12"	6 3/4"	143	143	143	143	143
1/2"	2"	12"	6 3/4"	186	186	186	186	186
1/2"	3 1/4"	12"	9 3/4"	211	327	476	706	370
5/8"	3 1/8"	12"	9 3/8"	258	258	258	258	258
5/8"	4"	12"	12"	344	508	698	1012	654

MAX. HORIZONTAL LOAD INCLUDES OVER STRENGTH FACTOR Ω_0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 FOR ALLOWABLE LOADS GOVERNED BY CONCRETE FAILURE MODES PER ACI 318-11, APPENDIX D, D.3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, TEST ALL PREVIOUS UNTESTED ANCHORS OF THE SAME TYPE AND INSTALLED BY THE SAME TRADE UNTIL 20 CONSECUTIVE ANCHORS PASS, THEN RESUME WITH 50% TESTING OF ANCHOR. SEE PAGE 3-17.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)
4.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-1917 (2012) REFER TO METAL DECK DIMENSIONS SHOWN ABOVE.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE.
9.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER. SEE PAGE 3-17.
10.) HOLE SIZE IN ANGLE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
11.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.
12.) TEST AND TEST LOADS FOR POST-INSTALLED ANCHORS IN CONCRETE MUST COMPLY WITH CBC 1913A.7 AND MANUFACTURERS ICC REPORT. TEST ACCEPTANCE CRITERIA MUST COMPLY WITH CBC 1913A.7.4

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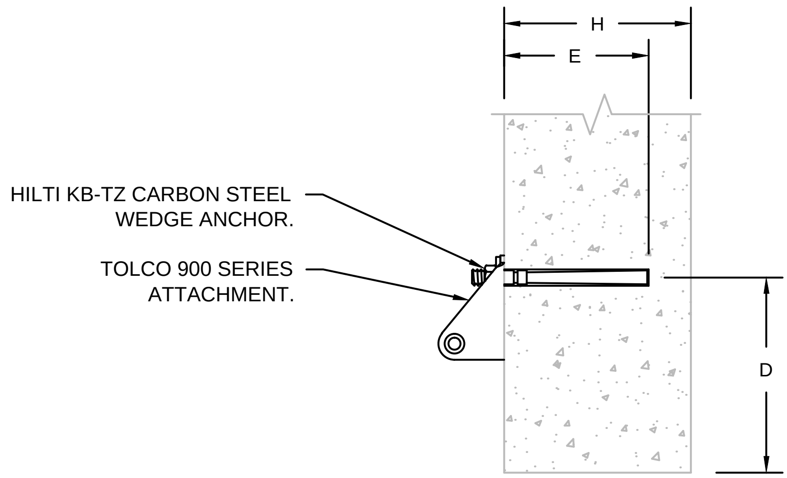
HILTI KB-TZ WEDGE ANCHORS IN 4,000 PSI NORMAL WEIGHT CONCRETE WALL / BEAM



ANCHOR DIA.	'E' MIN. EFFECTIVE ANCHOR EMBED. DEPTH	'D' MIN. EDGE DISTANCE	'H' MIN. BASE MATERIAL THICKNESS	ANCHOR CAPACITY MAX. HORIZONTAL LOAD W/ BRACE @ 45-90° FROM VERTICAL (LB)
3/8"	2"	12"	4"	288
1/2"	2"	12"	4"	328
1/2"	3 1/4"	12"	6"	653
5/8"	3 1/8"	12"	5"	656
5/8"	4"	12"	6"	902
3/4"	3 3/4"	12"	6"	884

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN STONE AGGREGATE CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 4,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 FOR ALLOWABLE LOADS GOVERNED BY CONCRETE FAILURE MODES PER ACI 318-11, APPENDIX D, D.3.3.4.4 AND INTERACTION BASED ON D.7.3.

2.) 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, TEST ALL PREVIOUS UNTESTED ANCHORS OF THE SAME TYPE AND INSTALLED BY THE SAME TRADE UNTIL 20 CONSECUTIVE ANCHORS PASS, THEN RESUME WITH 50% TESTING OF ANCHOR. SEE PAGE 3-17.

3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)

4.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.

5.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.

6.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

7.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE.

8.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER.

9.) TEST AND TEST LOADS FOR POST-INSTALLED ANCHORS IN CONCRETE MUST COMPLY WITH CBC 1913A.7 AND MANUFACTURERS ICC REPORT. TEST ACCEPTANCE CRITERIA MUST COMPLY WITH CBC 1913A.7.4. SEE PAGE 3-17

10.) DESIGN LOAD INFORMATION LISTED IN TABLE BECOMES INVALID WHEN THE BRACE ANGLE IS GREATER THAN 45° FROM THE HORIZONTAL. SUCH USE IS NOT INCLUDED IN THE SCOPE OF THIS PRE-APPROVAL AND IS TO BE SUBMITTED FOR REVIEW AND APPROVAL ON A PROJECT SPECIFIC BASIS BY OSHPD.

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NOT
USED

PAGE NOT USED

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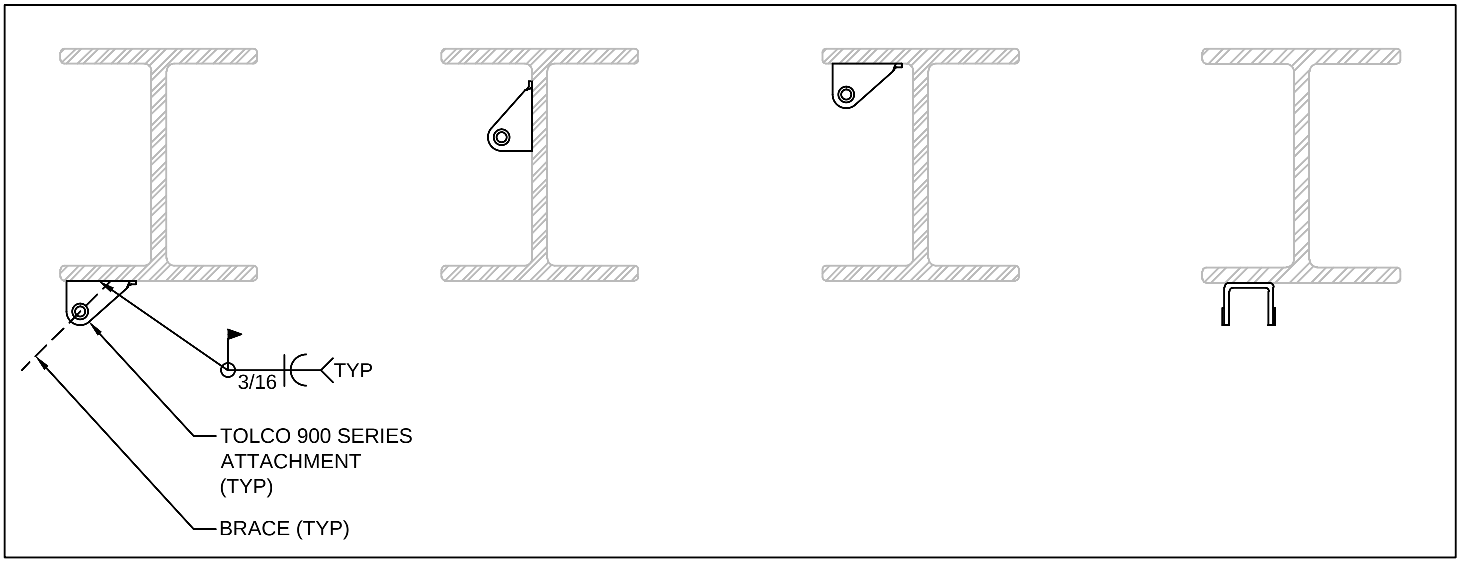
WELD TO STEEL



MIN. WELD	MAX. HORIZONTAL SEISMIC LOAD W/ BRACE @ 45° FROM VERTICAL (Lbs.)
3/16"	1970*

* LOAD GOVERNED BY TOLCO 900 SERIES ATTACHMENT

MIN. WELD	MAX. VERTICAL SEISMIC LOAD W/ BRACE @ 0° FROM VERTICAL (Lbs.)
3/16"	1970*

* LOAD GOVERNED BY TOLCO 900 SERIES ATTACHMENT

NOTES:

1.) ALL STRUCTURAL STEEL SHALL BE MINIMUM A36.
2.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
3.) WELDING SHALL BE DONE BY ELECTRIC SHIELDED ARC PROCESS USING E-70XX ELECTRODES.
4.) ALL WELDING SHALL BE PERFORMED BY A CERTIFIED WELDER.
5.) ALL WELDS SHALL BE IN CONFORMANCE WITH 2013 CALIFORNIA BUILDING CODE. (CBC)
6.) CONTINUOUS INSPECTION IS REQUIRED FOR ALL WELDING.
7.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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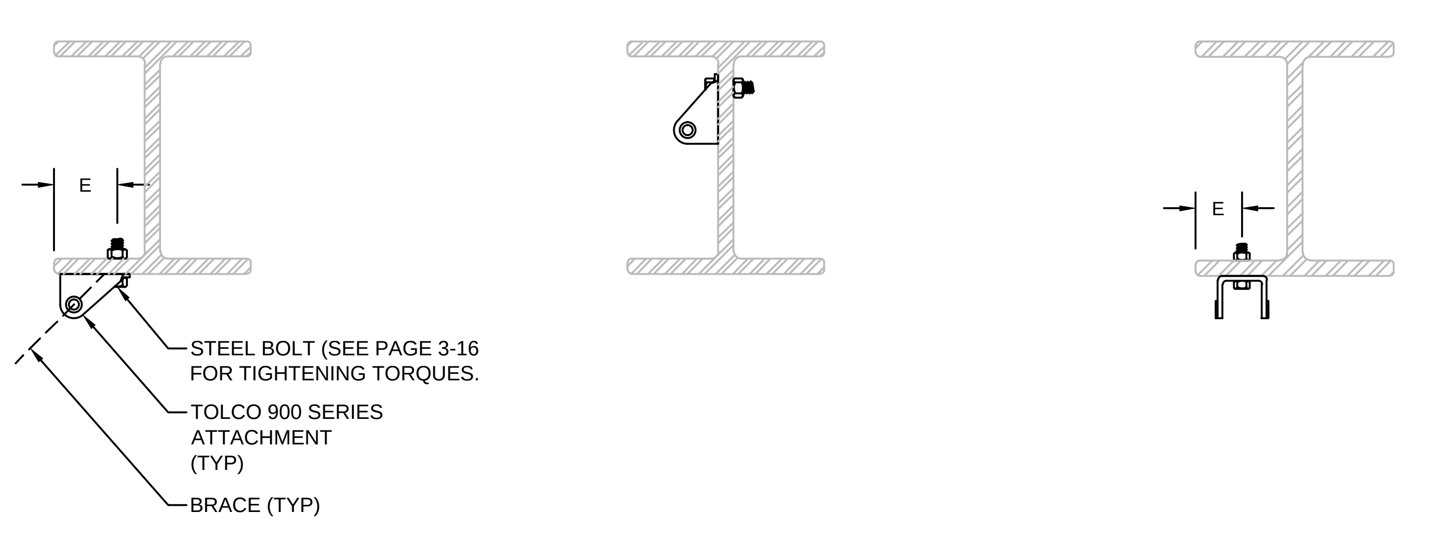
BOLT TO STEEL



BOLT DIA.	MAX. HORIZONTAL SEISMIC LOAD W/ BRACE @ 45° FROM VERTICAL (Lbs.)	'E' MIN. EDGE DISTANCE
3/8"	500	1"
1/2"	800	1"
5/8"	1200	1 1/2"
3/4"	1970*	1 1/2"

*LOAD GOVERNED BY TOLCO 900 SERIES ATTACHMENT

BOLT DIA.	MAX. VERTICAL SEISMIC LOAD W/ BRACE @ 0° FROM VERTICAL (Lbs.)	'E' MIN. EDGE DISTANCE
3/8"	500	1"
1/2"	800	1"
5/8"	1200	1 1/2"
3/4"	1970*	1 1/2"

*LOAD GOVERNED BY TOLCO 900 SERIES ATTACHMENT

NOTES:

1.) ALL STRUCTURAL STEEL SHALL BE MINIMUM A36.
2.) FASTENERS SHALL BE A307 BOLTS OR BETTER.
3.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STRUCTURE TO RESIST ALL BRACE LOADS.
4.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)

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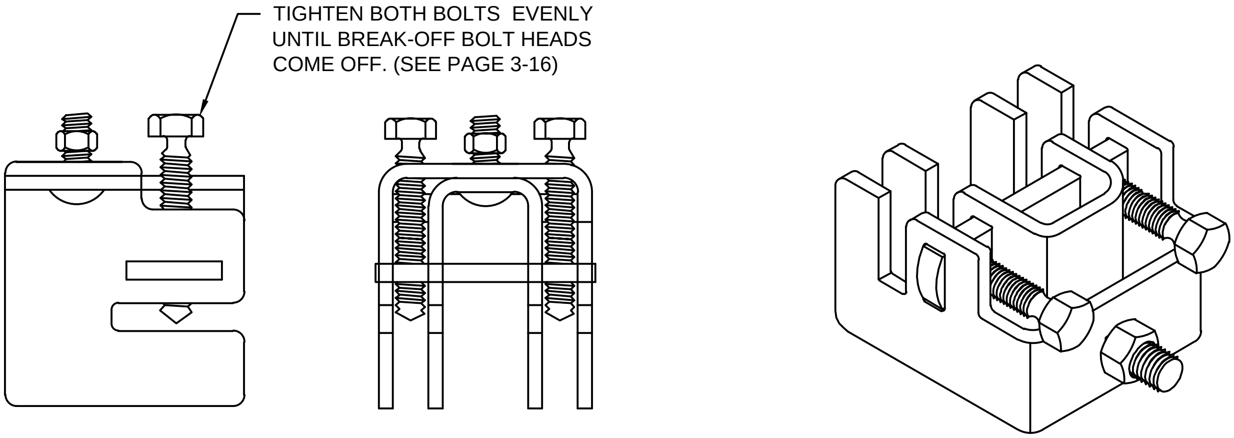
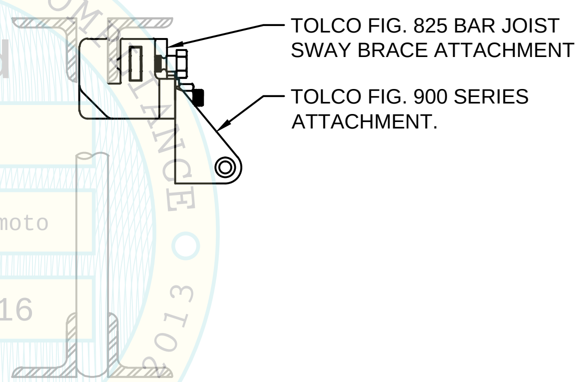
TOLCO FIG. 825 STEEL MEMBER ATTACHMENT





ORIENTATION	ALLOWABLE HORIZONTAL CAPACITY (lbf) PER INSTALLATION ANGLE FROM VERTICAL, lb (N)				REMARKS
	30°-44°	45°-59°	60°-74°	75°-90°	
PERPENDICULAR TO BEAM	990 (4405)	1360 (6050)	1670 (7430)	1860 (8275)	a, b
PARALLEL TO BEAM	460 (2045)	630 (2800)	770 (3425)	860 (3825)	a, b

a.) FM APPROVED WHEN USED WITH 1", 1-1/4", 1-1/2", OR 2" SCH. 40 STEEL PIPE AS THE BRACE MEMBER.
b.) JOIST OR BEAM THICKNESS: MAXIMUM 3/8" THICK.

NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
2.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
3.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)
4.) PRODUCT COMES WITH 1/2" STUD TO CONNECT SWIVEL SWAY BRACE ATTACHMENT. FOR FIG. 980, MUST USE PART NUMBER Y341000*.

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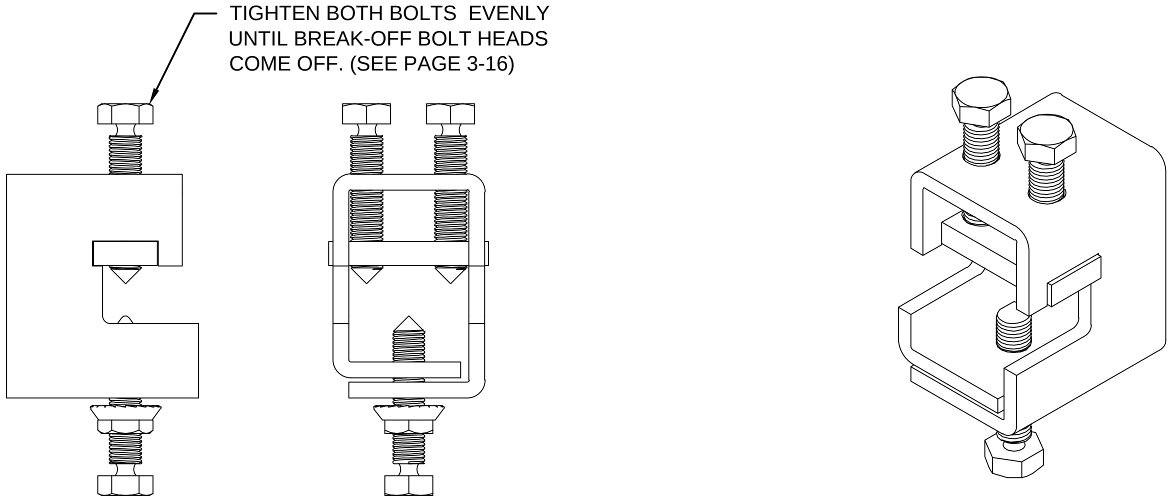
TOLCO FIG. 828 STEEL BEAM ATTACHMENT



ORIENTATION	ALLOWABLE HORIZONTAL CAPACITY (lbf) PER INSTALLATION ANGLE FROM VERTICAL, lb (N)				REMARKS
	30°-44°	45°-59°	60°-74°	75°-90°	
PERPENDICULAR TO BEAM	1570	2220	1210	700	a, b
	(6980)	(9870)	(5380)	(3110)	
PARALLEL TO BEAM	690	970	1210	1330	a, b
	(3060)	(4310)	(5380)	(5910)	

a.) FM APPROVED WHEN USED WITH 1", 1-1/4", 1-1/2", OR 2" SCH. 40 STEEL PIPE AS THE BRACE MEMBER.
b.) JOIST OR BEAM THICKNESS: MAXIMUM 3/8" TO 7/8".

NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STEEL MEMBER TO RESIST ALL BRACE LOADS.
2.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTED ZONES. (SEE AISC 341AND/OR STRUCTURAL DRAWINGS.)
3.) PRODUCT COMES WITH 1/2" STUD TO CONNECT SWIVEL SWAY BRACE ATTACHMENT. FOR FIG. 980, MUST USE PART NUMBER Y341000*.

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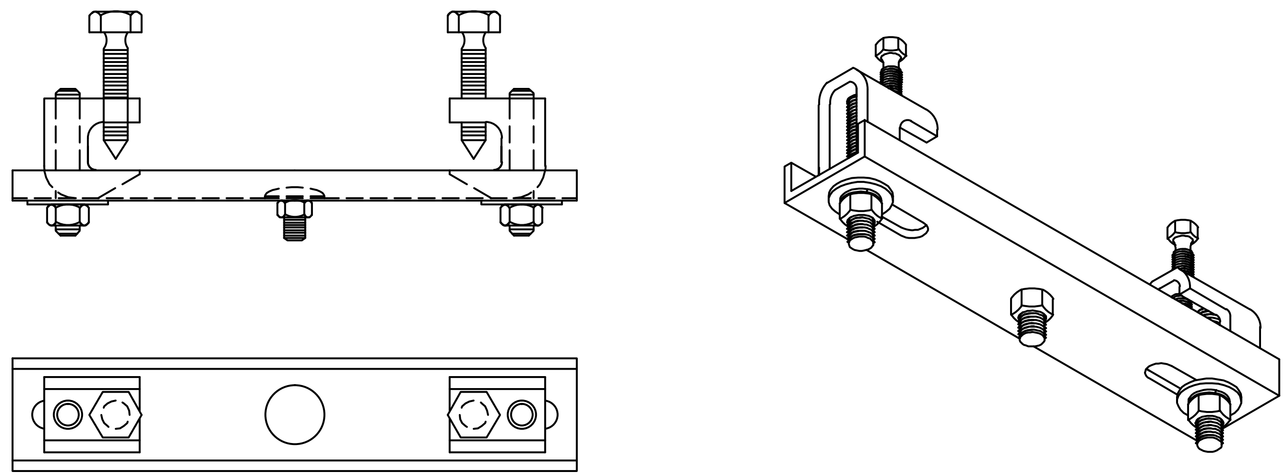
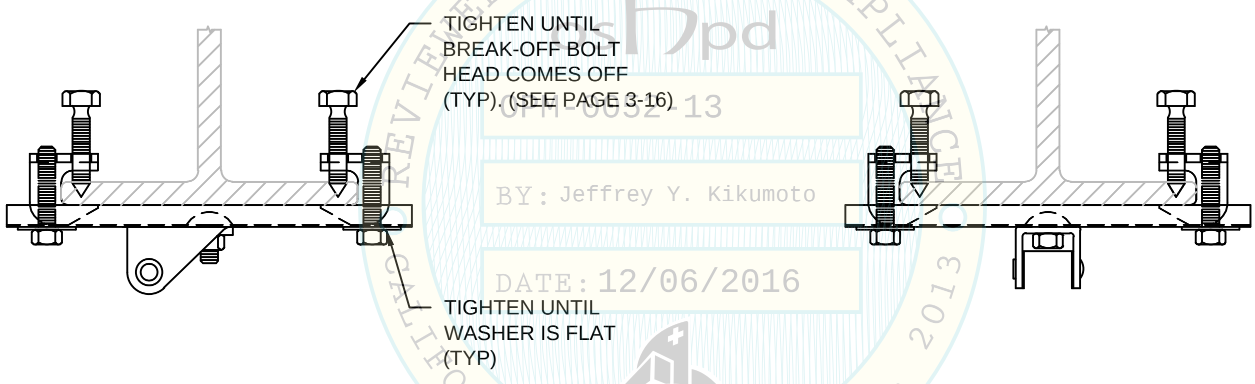
TOLCO FIG. 800 ATTACHMENT TO STEEL BEAM



SHOWN WITH 900 SERIES ATTACHMENT ACROSS BEAM

SHOWN WITH 900 SERIES ATTACHMENT ALONG BEAM



ORIENTATION	ALLOWABLE HORIZONTAL CAPACITY (lbf) PER INSTALLATION ANGLE FROM VERTICAL, lb (N)				REMARKS
	30°-44°	45°-59°	60°-74°	75°-90°	
PERPENDICULAR TO BEAM	1430 (6360)	1970 (8765)	1980 (8805)	NOT RATED	a, b
PARALLEL TO BEAM	930 (4135)	1310 (5825)	1610 (7160)	1800 (8005)	a, b

a.) FM APPROVED WHEN USED WITH 1", 1-1/4", 1-1/2", OR 2" SCH. 40 STEEL PIPE AS THE BRACE MEMBER.
b.) 4"-18" WIDE MAX.; 3/4" THICK FLANGE MAX.

NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STEEL MEMBER TO RESIST ALL BRACE LOADS.
2.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)
3.) PRODUCT COMES WITH 1/2" STUD TO CONNECT SWIVEL SWAY BRACE ATTACHMENT. FOR FIG. 980, MUST USE PART NUMBER Y341000*.

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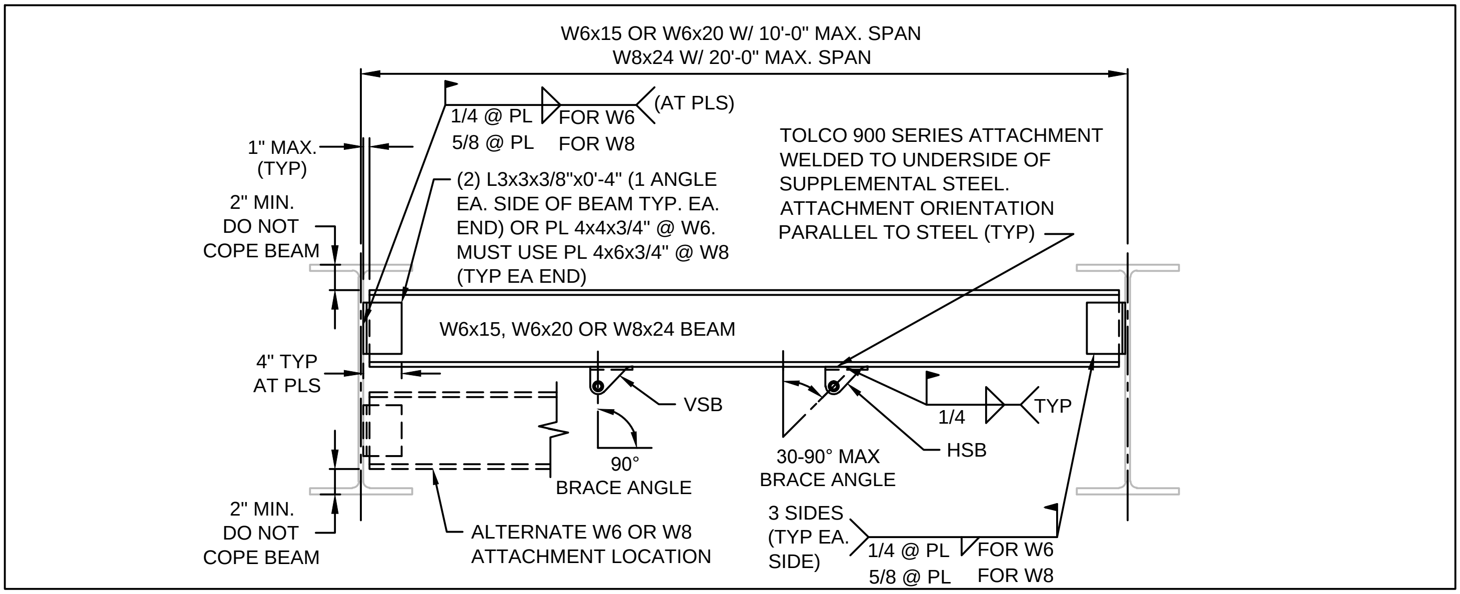
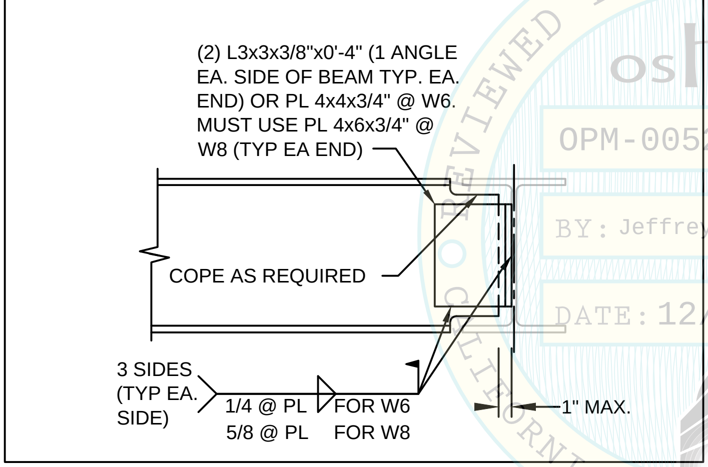
WIDE FLANGE BEAM SUPPLEMENTAL STEEL
HORIZONTAL/ VERTICAL SEISMIC SUPPORT DETAIL



OPTIONAL ATTACHMENT



NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STRUCTURE TO RESIST ALL BRACE LOADS.
2.) W6x15 OR W6x20 W/ SPAN = 10'-0" MAX., MAXIMUM TOTAL HORIZONTAL AND VERTICAL ALLOWABLE LOAD - 1,590 LBS.
3.) W8x24 W/ SPAN = 20'-0" MAX., MAXIMUM TOTAL HORIZONTAL AND VERTICAL ALLOWABLE LOAD - 1,590 LBS.
4.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTED ZONES. (SEE AISC 341 AND/OR STRUCTURAL DRAWINGS.)
5.) WELDING SHALL BE DONE BY ELECTRIC SHIELDED ARC PROCESS USING E-70XX ELECTRODES.
6.) ALL WELDING SHALL BE PERFORMED BY A CERTIFIED WELDER.
7.) ALL WELDS SHALL BE IN CONFORMANCE WITH 2013 CALIFORNIA BUILDING CODE. (CBC)
8.) CONTINUOUS INSPECTION IS REQUIRED FOR ALL WELDING.

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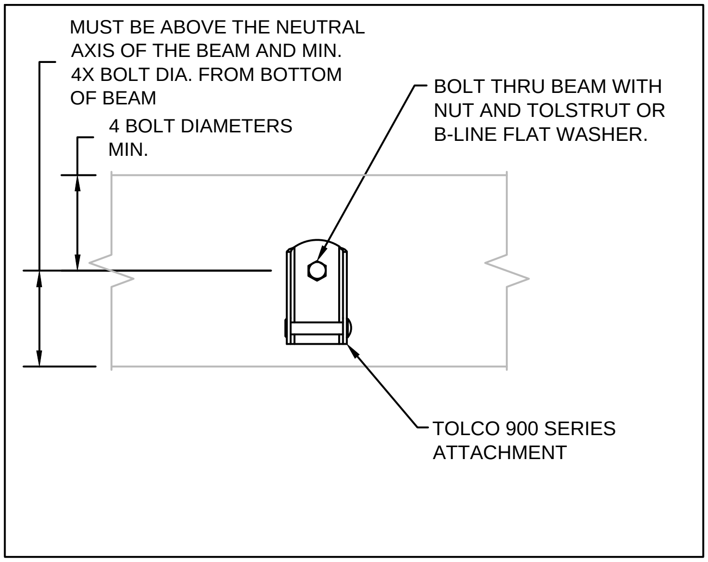
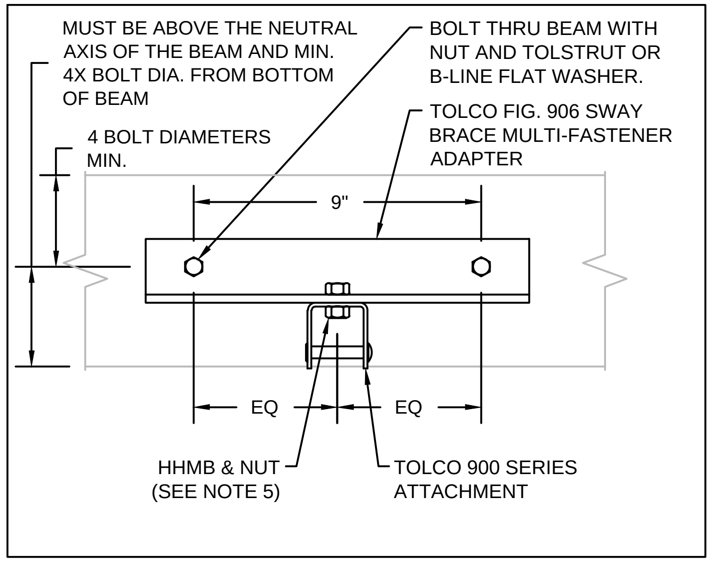
THRU-BOLT STRUCTURAL ATTACHMENTS PERPENDICULAR TO WOOD BEAM





BOLT DIAMETER	MAX. HORIZONTAL SEISMIC LOAD W/ BRACE @ 45° FROM VERTICAL (Lbs.)	
	1 BOLT	2 BOLT
1/2"	300	600
5/8"	360	720
3/4"	400	800

BOLT DIAMETER	MAX. VERTICAL SEISMIC LOAD W/ BRACE @ 0° FROM VERTICAL (Lbs.)	
	1 BOLT	2 BOLT
1/2"	300	600
5/8"	360	720
3/4"	400	800

NOTES:

1.) BOLT HOLES SHALL BE BORED 1/16" LARGER THAN THE NOMINAL BOLT DIAMETER.
2.) LOADS FOR THRU-BOLT ATTACHMENTS ARE DERIVED FROM CBC 2013 AND NDS 2012 FOR DOUGLAS FIR-LARCH [S.G. = 0.50], CALIFORNIA REDWOOD (CLOSE GRAIN) [S.G. = 0.44] AND SOUTHERN PINE [S.G. = 0.55].
3.) MINIMUM BEAM SIZE = 4x
4.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIREMENTS.
5.) FASTENERS SHALL BE A307 BOLTS OR BETTER.
6.) DESIGN LOAD INFORMATION LISTED IN TABLE BECOMES INVALID WHEN THE BRACE ANGLE IS GREATER THAN 45° FROM THE VERTICAL. SUCH USE IS NOT INCLUDED IN THE SCOPE OF THIS PRE-APPROVAL AND IS TO BE SUBMITTED FOR REVIEW AND APPROVAL ON A PROJECT SPECIFIC BASIS BY OSHPD, EXCEPT WHEN BRACE IS 0° FROM VERTICAL.

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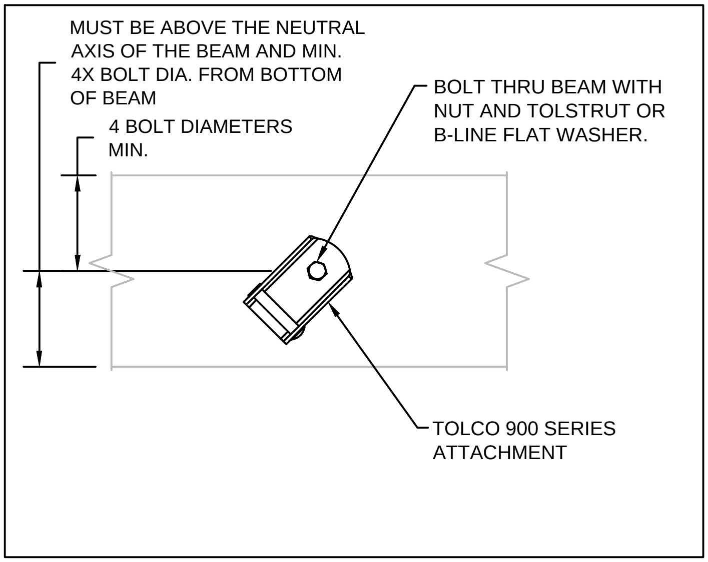
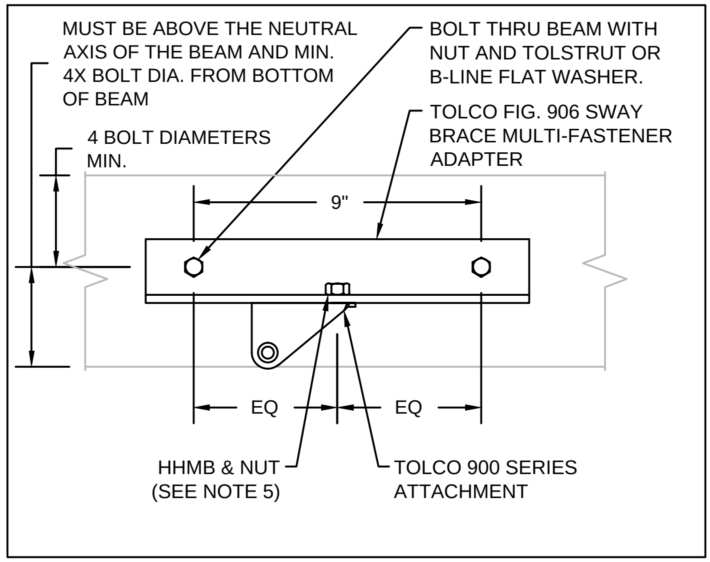
THRU-BOLT STRUCTURAL ATTACHMENTS
PARALLEL TO WOOD BEAM





BOLT DIAMETER	MAX. HORIZONTAL SEISMIC LOAD W/ BRACE @ 45° FROM VERTICAL (Lbs.)	
	1 BOLT	2 BOLT
1/2"	260	440
5/8"	320	540
3/4"	380	600

BOLT DIAMETER	MAX. VERTICAL SEISMIC LOAD W/ BRACE @ 0° FROM VERTICAL (Lbs.)	
	1 BOLT	2 BOLT
1/2"	260	440
5/8"	320	540
3/4"	380	600

NOTES:

1.) BOLT HOLES SHALL BE BORED 1/16" LARGER THAN THE NOMINAL BOLT DIAMETER.
2.) LOADS FOR THRU-BOLT ATTACHMENTS ARE DERIVED FROM CBC 2013 AND NDS 2012 FOR DOUGLAS FIR - LARCH [Sg = 0.50], LARCH, CALIFORNIA REDWOOD (CLOSE GRAIN) [S.G. = 0.44] AND SOUTHERN PINE [Sg = 0.55].
3.) MINIMUM BEAM SIZE = 4x
4.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIREMENTS.
5.) FASTENERS SHALL BE A307 BOLTS OR BETTER.
6.) DESIGN LOAD INFORMATION LISTED IN TABLE BECOMES INVALID WHEN THE BRACE ANGLE IS GREATER THAN 45° FROM THE VERTICAL. SUCH USE IS NOT INCLUDED IN THE SCOPE OF THIS PRE-APPROVAL AND IS TO BE SUBMITTED FOR REVIEW AND APPROVAL ON A PROJECT SPECIFIC BASIS BY OSHPD, EXCEPT WHEN BRACE IS AT 0° FROM VERTICAL.

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NOT
USED

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BOLT AND NUT TIGHTENING REQUIREMENTS

TORQUE FOR NUTS USED W/ GRADE A307 AND GRADE A36 THREADED ROD

SIZE	TORQUE (FT-LBS)
1/4"	6
5/16"	11
3/8"	20
1/2"	49
5/8"	97
3/4"	173

APPROXIMATE TORQUES FOR BREAK-OFF BOLTS

SIZE	TORQUE (FT-LBS)
FIG. 4L	36-40
FIG. 4LA - SMALL	15-17
FIG. 4LA - LARGE	36-40
FIG. 800	36-40
FIG. 825	31-35
FIG. 828	31-35
FIG. 828	36-40

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TEST LOADS AND ACCEPTANCE CRITERIA FOR EXPANSION ANCHORS

ANCHOR SIZE	EMBED h_{ef} (INCH)	ANCHOR SIZE		TENSION TEST TORQUE (FT-LB)
		4000 PSI NWC (CAP x 1.25)	3000 PSI SAND LWC ON METAL DECK (CAP x 1.25)	
HILTI KB-TZ 3/8"	2	1854	1186	25
HILTI KB-TZ 1/2"	2	1854	1186	40
HILTI KB-TZ 1/2"	3 1/4"	3789	2128	40
HILTI KB-TZ 5/8"	3 1/8"	3620	1625	60
HILTI KB-TZ 5/8"	4"	5241	3774	60
HILTI KB-TZ 3/4"	3 3/4"	4758	----	110

INSTALLATION: INSTALL THE CONCRETE ANCHORS IN ACCORDANCE WITH THE REQUIREMENTS GIVEN IN THE ICC EVALUATION REPORT FOR THE SPECIFIC ANCHOR.

JOB TESTING: FOR VERIFYING SATISFACTORY INSTALLATION WORKMANSHIP, PERFORM JOB SITE TESTING IN ACCORDANCE WITH THE TENSION LOAD TABLE PROVIDED IN THIS DOCUMENT. TEST 50% OF THE INSTALLED ANCHORS. THE TEST LOAD MAY BE APPLIED BY ANY METHOD INCLUDING MANUFACTURER'S TORQUE CRITERIA TESTING THAT WILL EFFECTIVELY MEASURE THE TENSION IN THE ANCHOR SUCH AS DIRECT PULL WITH 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. SPECIAL INSPECTOR SHALL FILE A REPORT OF THE TEST RESULTS WITH OSHPD PER CBC 2013, SECTION 1913A.7.3. IF ANY ANCHORS 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. THEN 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.

FAILURE/ACCEPTANCE CRITERIA: THE FOLLOWING CRITERIA APPLY FOR THE ACCEPTANCE OF INSTALLED ANCHORS:

- HYDRAULIC RAM METHOD: APPLY AND HOLD TEST LOAD FOR A MINIMUM 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 ($\frac{1}{2}$) TURN OF THE NUT.

SECTION 10-4

SEISMIC BRACE COMPONENTS

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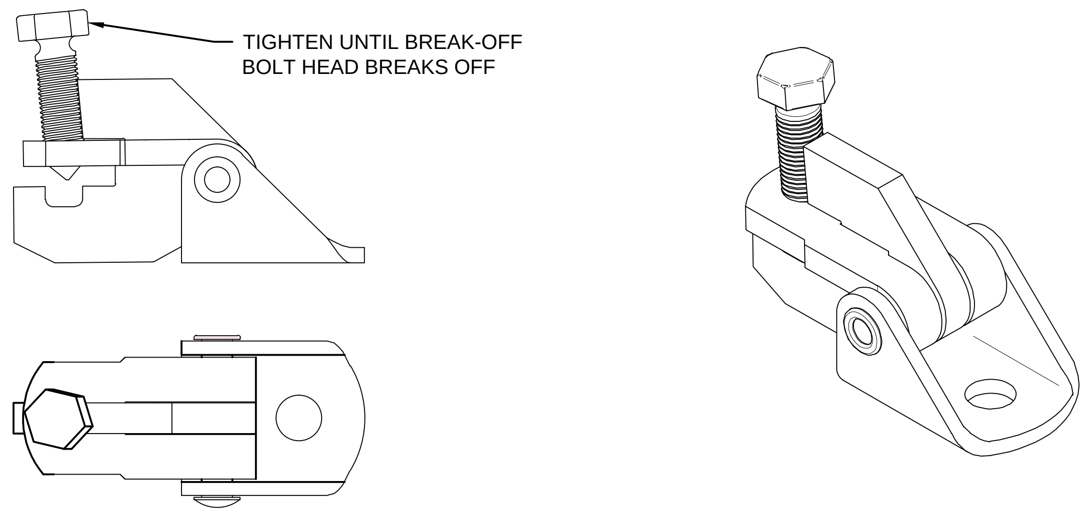
TOLCO FIG. 980 UNIVERSAL SWIVEL SWAY BRACE ATTACHMENT



ALLOWABLE CAPACITY (lbf) per INSTALLATION ANGLE FROM VERTICAL, lb (N)				
30°-44°	45°-59°	60°-74°	75°-90°	REMARKS
1320 (5870)	1970 (8760)	2310 (10270)	2550 (11340)	a

a. FM APPROVED WHEN USED WITH 1, 1-1/4, 1-1/2, OR 2 INCH SCHEDULE 40 STEEL PIPE AS THE BRACE MEMBER.

NOTES:

1.) BRACE MUST BE SCH. 40 STEEL PIPE.
2.) DESIGN OF HANGER SUPPORTING GRAVITY LOADS ONLY NOT IN SCOPE OF THIS PRE-APPROVAL. DESIGN OF HANGER TO BE APPROVED ON PROJECT SPECIFIC BASIS BY OSHPD.

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TOLCO FIG. 4L OR 4LA "IN-LINE" PIPE CLAMP SWAY BRACE

FIG. 4L - LONGITUDINAL ORIENTATION

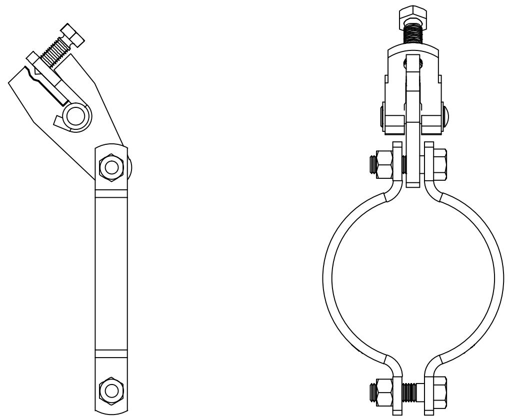


FIG. 4LA - LONGITUDINAL ORIENTATION

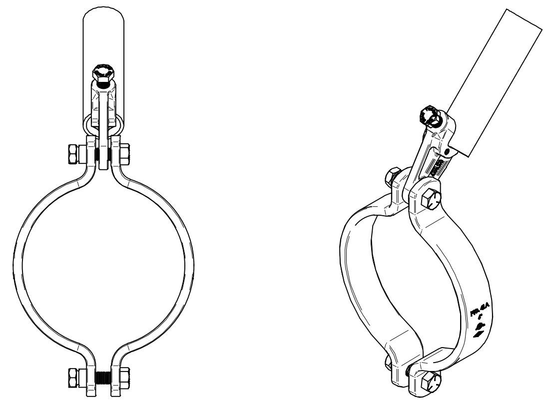
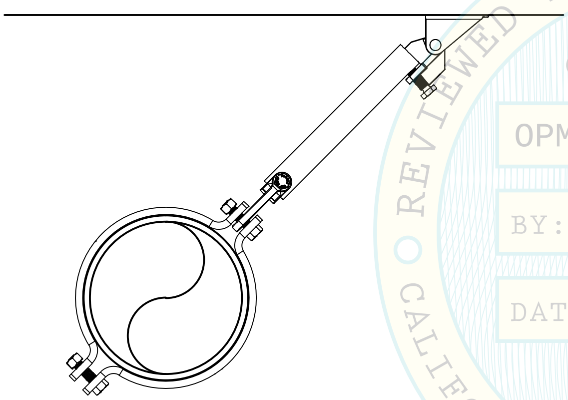


FIG. 4LA - LATERAL ORIENTATION



NOTES:

1.) TIGHTEN BOLTS TO FOLLOWING TORQUE VALUES:

1/4"	6 FT-LBS
5/16"	11 FT-LBS
3/8"	20 FT-LBS
1/2"	49 FT-LBS
5/8"	97 FT-LBS
3/4"	173 FT-LBS
1"	250 FT-LBS

2.) REFERENCE PAGE 4-2a FOR ALLOWABLE LONGITUDINAL AND LATERAL LOADS, AND PIPE DIAMETERS PERMITTED.

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TOLCO FIG. 4L OR 4LA "IN-LINE" PIPE CLAMP SWAY BRACE (LOADS)

MODEL	PART DESCRIPTION	ORIENTATION	RUN PIPE NOMINAL SIZE, IN.	PIPE RUN REFERENCE	ALLOWABLE CAPACITY (lbf) PER INSTALLATION ANGLE, lb (N)				REMARKS
					30°-44°	45°-59°	60°-74°	75°-90°	
4L	LONGITUDINAL IN-LINE ATTACHMENT	LONGITUDINAL	2 1/2	SCHD 10, SCHD 40	1030 (4581)	1180 (5248)	1420 (6315)	1590 (7072)	b
4L	LONGITUDINAL IN-LINE ATTACHMENT	LONGITUDINAL	3, 4	SCHD 10, SCHD 40	530 (2357)	730 (3247)	890 (3958)	990 (4403)	b
4L	LONGITUDINAL IN-LINE ATTACHMENT	LONGITUDINAL	5, 6, 8	0.188, SCHD 40	490 (2179)	680 (3024)	830 (3692)	930 (4136)	b, c

REMARKS:

a.) NOT USED
b.) LOAD RATING FOR SCH. 10 ABOVE MAY BE APPLIED TO SCH. 40 STEEL PIPES.
c.) LOAD RATING FOR 0.188 ABOVE REFERS TO 0.188 INCH WALL THICKNESS PIPE AND CAN BE APPLIED TO ANY THICKER WALL.

MODEL	RUN PIPE NOMINAL SIZE, in.	RUN PIPE REFERENCE	LONGITUDINAL ALLOWABLE CAPACITY(lbf) per INSTALLATION ANGLE, lb (N)				LATERAL ALLOWABLE CAPACITY (lbf) per INSTALLATION ANGLE, lb (N)				REMARKS
			30°-44°	45°-59°	60°-74°	75°-90°	30°-44°	45°-59°	60°-74°	75°-90°	
4LA	1	LW, 10, 40	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	a, b, c
4LA	1 1/4	LW, 10, 40	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	a, b, c
4LA	1 1/2	LW, 10, 40	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	a, b, c
4LA	2	LW, 10, 40	680 (3020)	860 (3820)	1030 (4580)	1150 (5110)	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	a, b, c
4LA	2 1/2	LW, 10, 40	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	a, b, c
4LA	3	LW, 10, 40	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	a, b, c
4LA	3 1/2	LW, 10, 40	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	a, b, c
4LA	4	LW, 10, 40	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	680 (3020)	970 (4310)	1190 (5290)	1320 (5870)	a, b, c
4LA	6	LW, 10, 40	1620 (7200)	2260 (10050)	2010 (8940)	2220 (9870)	1620 (7200)	2300 (10230)	2820 (12540)	3140 (13960)	a, b, c
4LA	8	188, 40	1620 (7200)	1660 (7380)	1570 (6980)	1740 (7730)	1620 (7200)	2300 (10230)	2820 (12540)	3140 (13960)	a, b, d
4LA	10	40	1620 (7200)	1660 (7380)	1570 (6980)	1740 (7730)	1620 (7200)	2300 (10230)	2820 (12540)	3140 (13960)	a
4LA	12	40	1620 (7200)	1660 (7380)	1570 (6980)	1740 (7730)	1620 (7200)	2300 (10230)	2820 (12540)	3140 (13960)	a

REMARKS:

a.) FM APPROVED WHEN USED WITH 1", 1 1/4", 1 1/2" OR 2" SCH. 40 STEEL PIPE AS THE BRACE MEMBER.
b.) LOAD RATING FOR LW ABOVE REFERS TO FM APPROVED LIGHTWALL PIPE, COMMONLY REFERRED TO AS "SCHEDULE 7".
c.) LOAD RATING FOR SCHEDULE 10 ABOVE MAY BE APPLIED TO FM APPROVED THINWALL PIPE AND SCHEDULE 40 STEEL PIPES.
d.) LOAD RATING FOR 0.188 ABOVE REFERS TO 0.188 INCH WALL THICKNESS PIPE AND CAN BE APPLIED TO ANY THICKER WALL.

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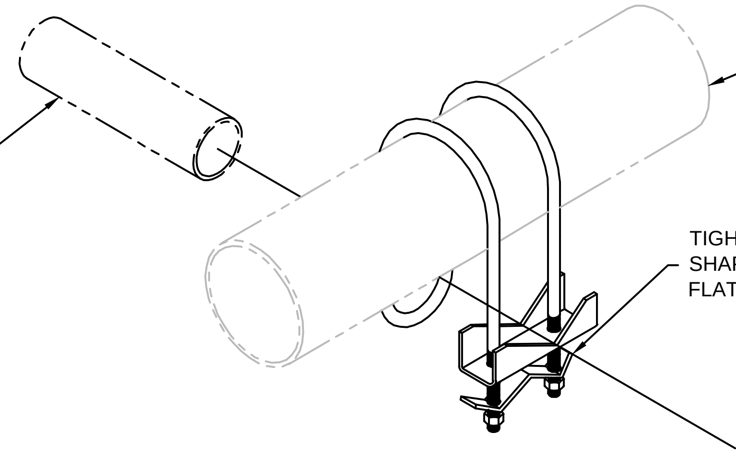
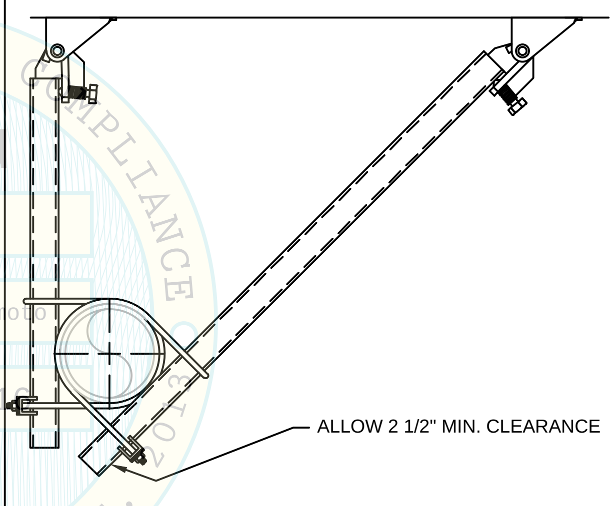
TOLCO FIG. 1000 FAST CLAMP



RUN PIPE REF.	RUN PIPE SIZE (in)	ORIENTATION	ALLOWABLE CAPACITY (lbf) PER INSTALLATION ANGLE FROM VERTICAL, lb (N)				REMARKS
			30°-44°	45°-59°	60°-74°	75°-90°	
LW, 10, 40.	1, 1-1/4 1-1/2, 2, 2-1/2	LATERAL	200 (880)	280 (1240)	340 (1510)	380 (1690)	a, b
LW, 10, 40.	3, 4	LATERAL	230 (1020)	320 (1420)	400 (1770)	450 (2000)	a, b

a.) FM APPROVED WHEN USED WITH 1, 1-1/4, 1-1/2, OR 2 INCH SCHEDULE 40 STEEL PIPE AS THE BRACE MEMBER.
b.) LOAD RATING FOR SCHEDULE 10 ABOVE MAY BE APPLIED TO FM APPROVED THINWALL PIPE AND SCHEDULE 40 STEEL PIPES.



NOTES:

1.) FIG. 1000 MAY BE POSITIONED ABOVE OR BELOW BRACE MEMBER.

2.) FIG. 1000 MAY BE INSTALLED SUCH THAT NUTS ARE ON THE OPPOSITE SIDE THAN AS SHOWN.

3.) DESIGN OF HANGER SUPPORTING GRAVITY LOADS ONLY NOT IN SCOPE OF THIS PRE-APPROVAL. DESIGN OF HANGER TO BE APPROVED ON PROJECT SPECIFIC BASIS BY OSHPD.

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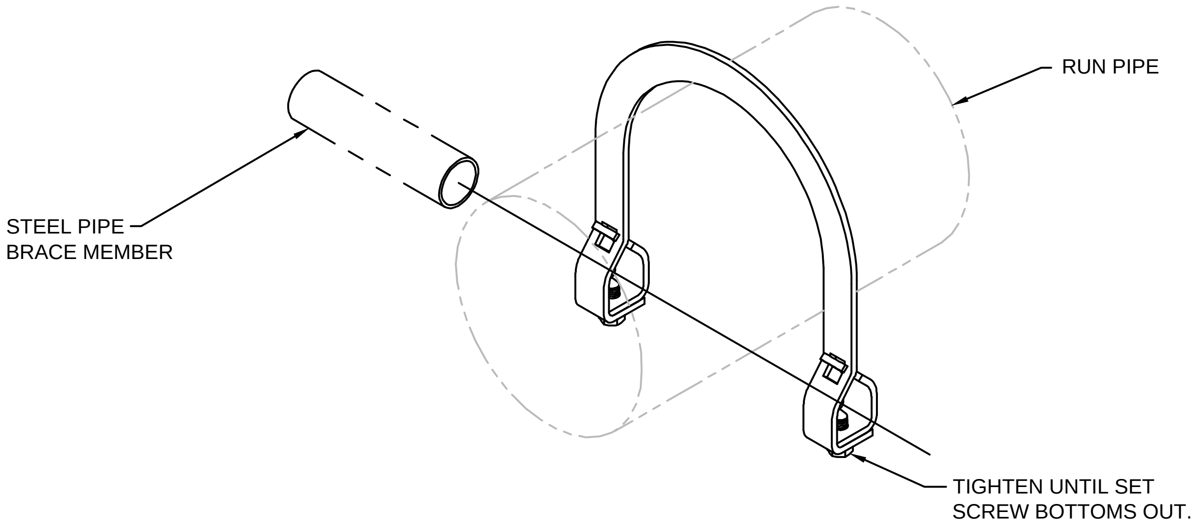
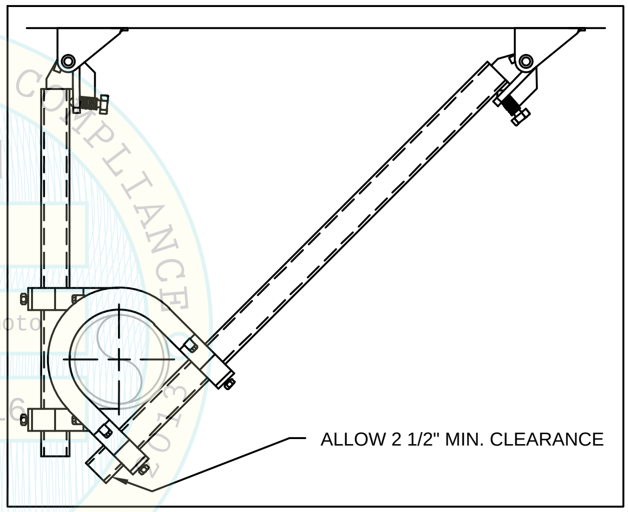
TOLCO FIG. 1001 SWAY BRACE ATTACHMENT



RUN PIPE REF.	RUN PIPE SIZE (in)	ORIENTATION	ALLOWABLE CAPACITY (lbf) PER INSTALLATION ANGLE FROM VERTICAL, lb (N)				REMARKS
			30°-44°	45°-59°	60°-74°	75°-90°	
LW, 10, 40.	1	LATERAL	1800	2550	3120	3490	a, b
			(8000)	(11340)	(13870)	(15520)	
LW, 10, 40.	1 1/4, 1 1/2, 2	LATERAL	1230	1740	2140	2380	a, b
			(5470)	(7730)	(9510)	(10580)	
LW, 10, 40.	2 1/2	LATERAL	800	1130	1380	1540	a, b
			(3550)	(5020)	(6130)	(6850)	
LW, 10, 40.	3, 4	LATERAL	850	1200	1470	1640	a, b
			(3780)	(5330)	(6530)	(7290)	
LW, 10, 40.	5, 6, 8	LATERAL	510	730	890	990	a, b
			(2260)	(3240)	(3950)	(4400)	

a.) FM APPROVED WHEN USED WITH 1, 1-1/4, 1-1/2, OR 2 INCH SCHEDULE 40 STEEL PIPE AS THE BRACE MEMBER.
b.) LOAD RATING FOR SCHEDULE 10 ABOVE MAY BE APPLIED TO GB/T 3091, GB/T 3092, EN 10255M AND H, JIS G3454, FM APPROVED THINWALL PIPE AND SCHEDULE 40 STEEL PIPES.



NOTES:

1.) FIG. 1001 MAY BE POSITIONED ABOVE OR BELOW BRACE MEMBER.

2.) DESIGN OF HANGER SUPPORTING GRAVITY LOADS ONLY NOT IN SCOPE OF THIS PRE-APPROVAL. DESIGN OF HANGER TO BE APPROVED ON PROJECT SPECIFIC BASIS BY OSHPD.

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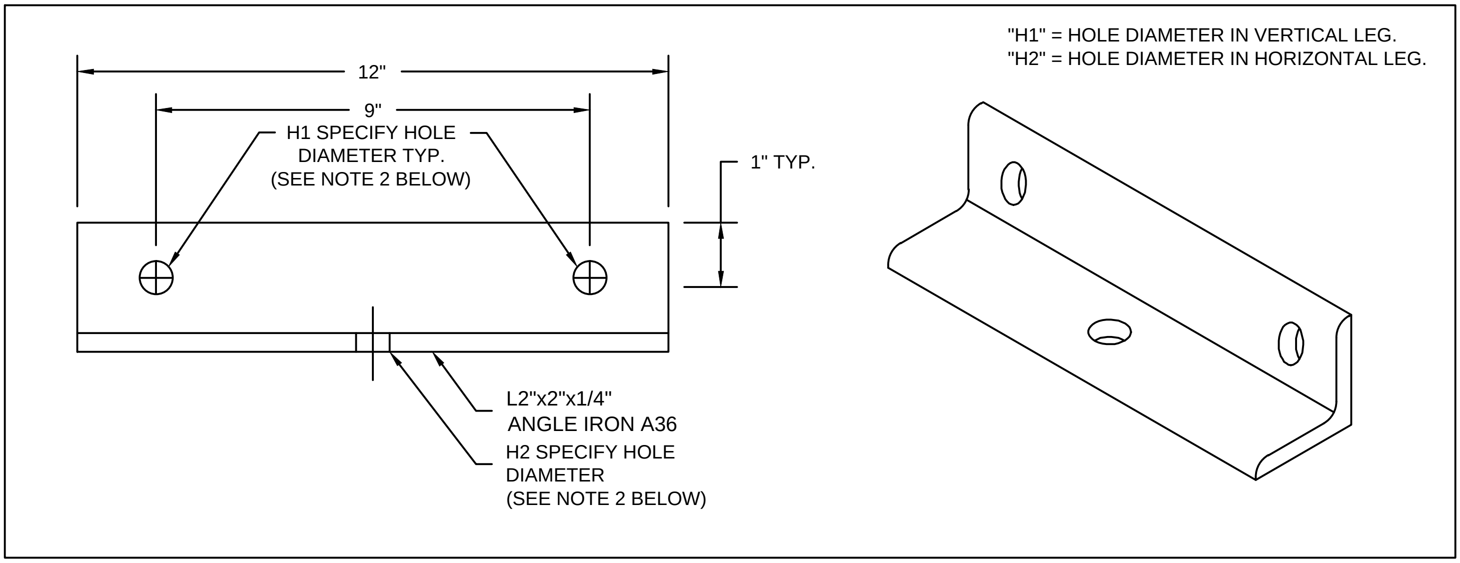
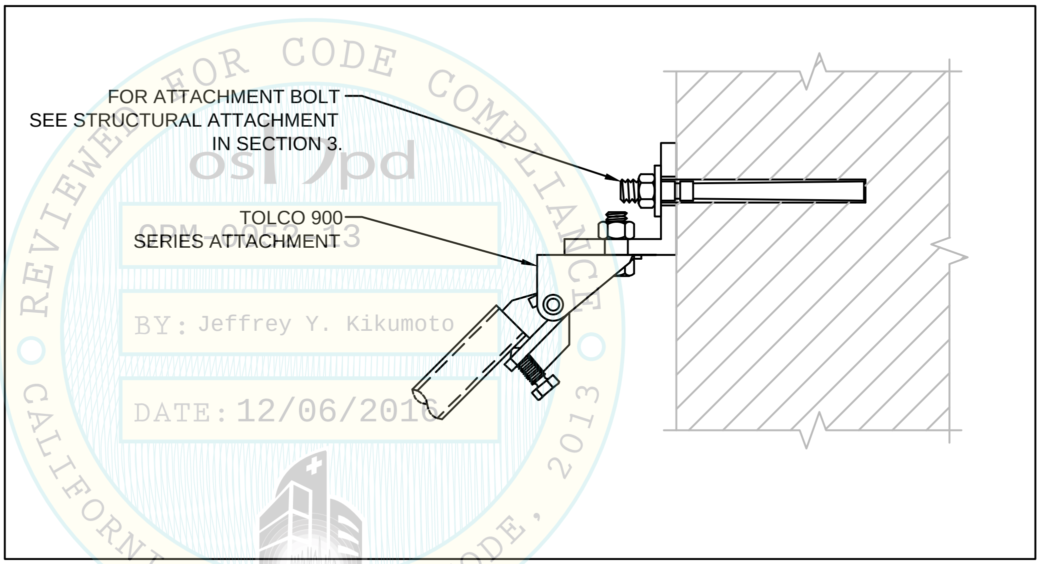
TOLCO FIG. 906 SWAY BRACE MULTI-FASTENER ADAPTER





NOTES:

1.) FOR DESIGN LOADS SEE STRUCTURAL ATTACHMENT IN SECTION 3.
2.) HOLE DIAMETER TO BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
3.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS, VERTICAL SEISMIC LOAD AND HORIZONTAL SEISMIC LOADS.

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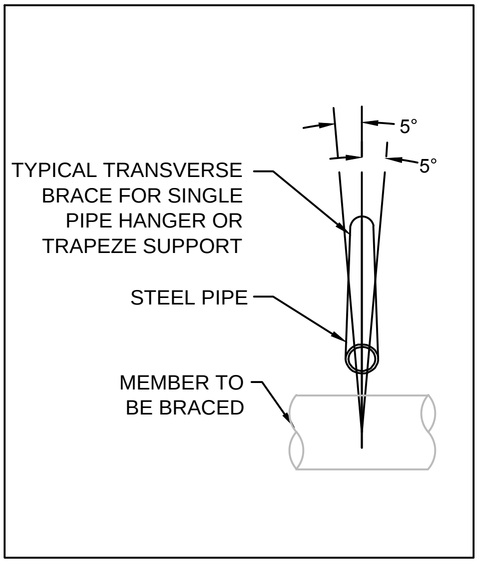
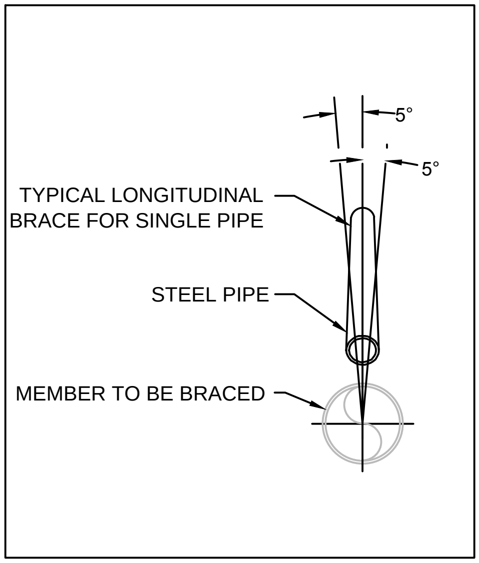
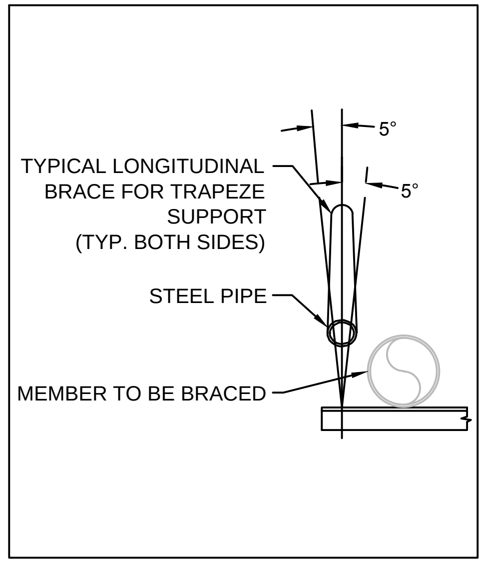
MAXIMUM ALLOWABLE LENGTHS AND CONCENTRIC LOADS FOR BRACE MEMBERS







PIPE DIAMETER	MAXIMUM LENGTH	SCH.	BRACE CAPACITY				
			ALLOWABLE HORIZONTAL SEISMIC LOAD W/ BRACE @ MAX. INSTALLATION ANGLE FROM VERTICAL (Lbs.)				MAX. VERTICAL SEISMIC LOAD W/ BRACE ANGLE FROM VERTICAL @
			30-44	45-59	60-74	75-90	0°
SEISMIC BRACING (KL / r = 200)							
1"	7'-0"	40	560	792	970	1082	1121
1 1/4"	9'-0"	40	755	1067	1307	1458	1510
1 1/2"	10'-4"	40	920	1301	1594	1778	1841
2"	13'-1"	40	1227	1735	2126	2371	2455
SEISMIC BRACING (KL / r = 300)							
1"	10'-6"	40	306	432	530	591	612
1 1/4"	13'-6"	40	410	580	711	793	821
1 1/2"	15'-7"	40	493	697	853	952	986
2"	19'-9"	40	650	919	1125	1255	1300

NOTES:

1.) ALL LONGITUDINAL AND TRANSVERSE BRACING UTILIZING PIPE AS THE BRACING MEMBER HAS A TOLERANCE OF 5° FROM CENTER IN EITHER DIRECTION WITHOUT AFFECTING THE ALLOWABLE LOADS.
2.) TABULATED LOADS ARE SUBJECT TO LIMITS GOVERNED BY THE CAPACITY OF THE PRIMARY STRUCTURE, INCLUDING, BUT NOT LIMITED TO CONCRETE FILL OVER METAL DECK CAPACITY. PER THE CONTRACT DOCUMENTS.
3.) STEEL (ASTM A53 TYPE E GRADE B) SCHEDULE 40: 1", 1 1/4", 1 1/2", 2" NPS. SEE ALSO PAGE 1-1.

MH

BRANCH LINE RESTRAINT
ROD RESTRAINT TABLES

ROD RESTRAINT (KL / r = 200)

ROD DIAMETER	MAXIMUM LENGTH (in)	"r" RADIUS OF GYRATION (in)	ROD RESTRAINT CAPACITY: ALLOWABLE HORIZONTAL SEISMIC LOAD W/ BRACE @ MAX. INSTALLATIONS ANGLE FROM VERTICAL (lb.)				MAX. VERTICAL SEISMIC LOAD W/ BRACE ANGLE FROM VERTICAL @
			30-44	45-59	60-74	75-90	0
3/8"	15"	0.07675	132	187	229	255	265
1/2"	20"	0.10425	262	371	454	507	525

ROD RESTRAINT (KL / r = 300)

ROD DIAMETER	MAXIMUM LENGTH (in)	"r" RADIUS OF GYRATION (in)	ROD RESTRAINT CAPACITY: ALLOWABLE HORIZONTAL SEISMIC LOAD W/ BRACE @ MAX. INSTALLATIONS ANGLE FROM VERTICAL (lb.)				MAX. VERTICAL SEISMIC LOAD W/ BRACE ANGLE FROM VERTICAL @
			30-44	45-59	60-74	75-90	0
3/8"	23"	0.07675	57	81	99	111	115
1/2"	30"	0.10425	112	159	194	217	225

ROD RESTRAINT (KL / r = 400)

ROD DIAMETER	MAXIMUM LENGTH (in)	"r" RADIUS OF GYRATION (in)	ROD RESTRAINT CAPACITY: ALLOWABLE HORIZONTAL SEISMIC LOAD W/ BRACE @ MAX. INSTALLATIONS ANGLE FROM VERTICAL (lb.)				MAX. VERTICAL SEISMIC LOAD W/ BRACE ANGLE FROM VERTICAL @
			30-44	45-59	60-74	75-90	0
3/8"	30"	0.07675	34	48	58	65	68
1/2"	40"	0.10425	67	95	116	130	135

NOTES:

1.) THE INTENT OF THIS PAGE IS TO SHOW COMPLIANCE WITH NFPA SECTION 9.3.6.1 (5).

2.) PER NFPA 13 SECTION 9.3.6.1: RESTRAINT IS CONSIDERED A LESSER DEGREE OF RESISTING LOADS THAN BRACING.

3.) RESTRAINT MAY BE PROVIDED USING HANGERS NOT LESS THAN 45 DEGREES FROM VERTICAL INSTALLED WITHIN 6 INCHES OF THE VERTICAL HANGER ARRANGED FOR RESTRAINT AGAINST UPWARD MOVEMENT, PROVIDED IT IS UTILIZED SUCH THAT KL/r DOES NOT EXCEED 400, WHERE THE ROD SHALL EXTEND TO THE PIPE OR HAVE A SURGE CLIP INSTALLED.

4.) SEE NFPA 13 SECTION 9.3.6 FOR ADDITIONAL OPTIONS.

APPENDIX A
FOR REFERENCE ONLY

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METRIC CONVERSION CHART

Convert From	To	Multiply By
Angle		
degree	radian(rad)	1.745329 x 10-2
radian(rad)	degree	5.729578 x 10+1
Area		
foot^2	square meter (m^2)	9.290304 x 10-2
inch^2	square meter (m^2)	6.451600 x 10-4
circular mil	square meter (m^2)	5.067075 x 10-10
sq. centimeter (cm^2)	square inch (in^2)	1.550003 x 10-1
sq. meter (m^2)	foot^2	1.076391 x 10+1
sq. meter (m^2)	inch^2	1.550003 x 10+3
sq. meter (m^2)	circular mil	1.973525 x 10+9
Temperature		
degree Fahrenheit	degree Celsius	t°C = (t°F-32) /1.8
degree Celsius	degree Fahrenheit	t°F = 1.8t°C + 32
Force		
pounds-force (lbs)	newtons (N)	4.448222
Length		
foot (ft)	meter (m)	3.047000 x 10-1
inch (in)	meter (m)	2.540000 x 10-2
mil	meter (m)	2.540000 x 10-5
inch (in)	micrometer (μm)	2.540000 x 10+4
meter (m)	foot (ft)	3.280840
meter (m)	inch (in)	3.937008 x 10+1
meter (m)	mil	3.937008 x 10+4
micrometer (μm)	inch (in)	3.937008 x 10-5
Volume		
foot^3	cubic meter (m^3)	2.831685 x 10-2
inch^3	cubic meter (m^3)	1.638706 x 10-5
cubic centimeter (cm^3)	cubic inch (in^3)	6.102374 x 10-2
cubic meter (m^3)	foot^3	3.531466 x 10+1
cubic meter (m^3)	inch^3	6.102376 x 10+4
gallon (U.S. liquid)	cubic meter (m^3)	3.785412 x 10-3

Convert From	To	Multiply By
Mass		
pound (avoirdupois)	kilogram (kg)	4.535924 x 10-1
kilogram (kg)	pound (avoirdupois)	2.204622
Mass Per Unit Length		
lb/ft	kilogram/meter (kg/m)	1.488164
lb/in	kilogram/meter (kg/m)	1.785797 x 10+1
kg/m	lb/ft	6.719689 x 10-1
kg/m	lb/in	5.599741 x 10-2
Mass Per Unit Volume		
lb/ft^3	kilogram/meter (kg/m^3)	1.601846 x 10+1
lb/in^3	kilogram/meter (kg/m^3)	2.767990 x 10+4
kg/m^3	lb/ft^3	6.242797 x 10-2
kg/m^3	lb/in^3	3.612730 x 10-5
lbs/ft^3	lbs/in^3	1.728000 x 10+3
Mass Per Area Unit		
lb/ft^2	kilogram/sq.meter(kg/m^2)	1.601846 x 10+1
kg/m^2	kilogram/sq.meter(kg/m^2)	2.767990 x 10+4
Mass Per Unit Volume		
lbf/in^2 (psi)	pascal (Pa)	6.894757 x 10+3
kip/in^2 (ksi)	pascal (Pa)	6.894757 x 10+6
lbf/in^2 (psi)	megapascals (MPa)	6.894757 x 10-3
pascal (Pa)	pound force/sq. inch(psi)	1.450377 x 10-4
pascal (Pa)	kip per sq. inch (ksi)	1.450377 x 10-7
Bending Moment or Torque		
lbf•ft	newton meter (N•m)	1.355818
lbf•in	newton meter (N•m)	1.129848 x 10-1
N•m	lbf•ft	7.375621 x 10-1
N•m	lbf•in	8.850748

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PIPE WEIGHTS

STEEL PIPE			
Pipe Dia.	Pipe Sch.	Weight Per Foot (lbs.)	
		Water Filled	Total*
1"	40	2.05	2.36
1-1/4"	40	2.93	3.37
1-1/2"	40	3.61	4.15
2"	40	5.13	5.90
2-1/2"	40	7.89	9.07
3"	40	10.82	12.44
3-1/2"	40	13.48	15.50
4"	40	16.40	18.86
5"	40	23.47	26.99
6"	40	31.69	36.44
8"	**	40.15	46.17
8"	40	50.23	57.76
10"	40	74.65	85.85
12"	40	98.58	113.37

*FOR PIPE SIZES 1"-6" WATER FILLED WEIGHT BASED ON NFPA-13-13, TABLE A.9.3.5.9, WEIGHT TABLES PLUS 15% FITTINGS ALLOWANCE.
** = 0.188" WALL PIPE

STEEL PIPE			
Pipe Dia.	Pipe Sch.	Weight Per Foot (lbs.)	
		Water Filled	Total*
1"	10	1.81	2.08
1-1/4"	10	2.52	2.90
1-1/2"	10	3.04	3.50
2"	10	4.22	4.85
2-1/2"	10	5.89	6.77
3"	10	7.94	9.13
3-1/2"	10	9.78	11.25
4"	10	11.78	13.55
5"	10	17.30	19.90
6"	10	23.03	26.49
8"	10	40.08	46.09

*WATER FILLED WEIGHT BASED ON NFPA-13-13, TABLE A.9.3.5.9, WEIGHT TABLES PLUS 15% FITTINGS ALLOWANCE.

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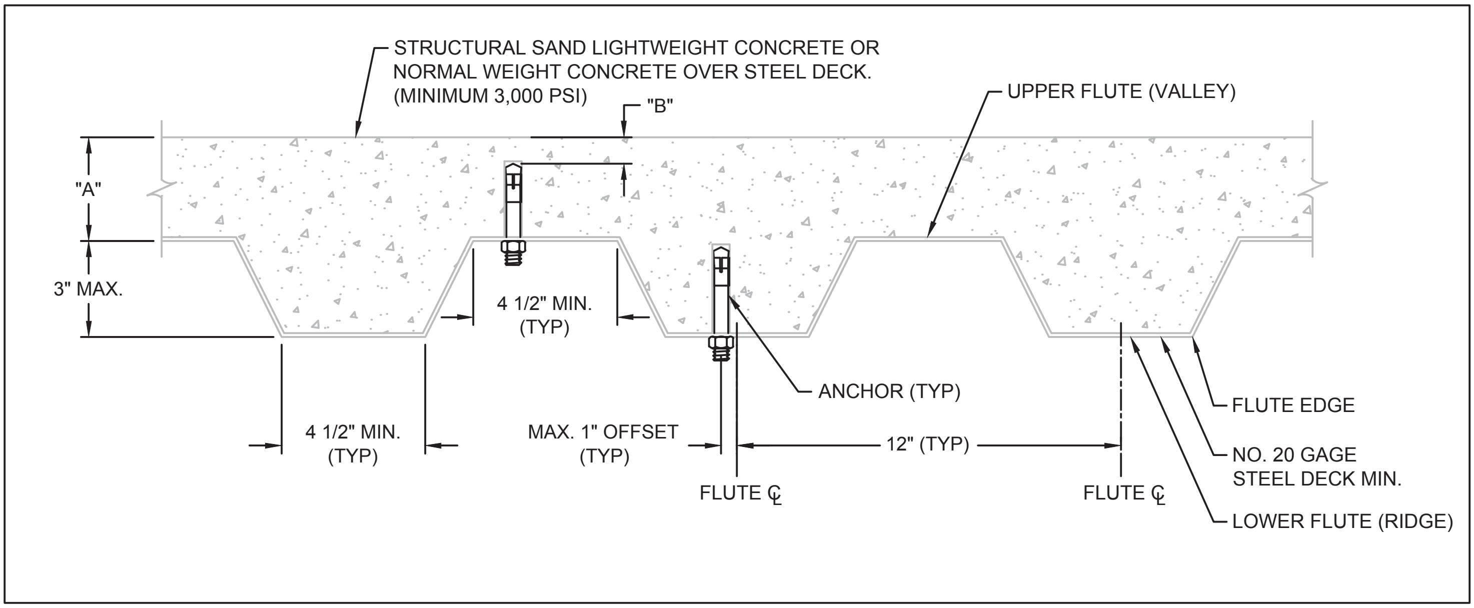
W3 TYPE DECKS INFORMATION



WEDGE ANCHOR TYPE	MIN. CONCRETE FILL COVER "A"	ICC-ES ESR #	ANCHOR DIA.	COVER "B"
HILTI KB-TZ	3 1/4"	1917	3/8", 1/2", 5/8"	5/8"

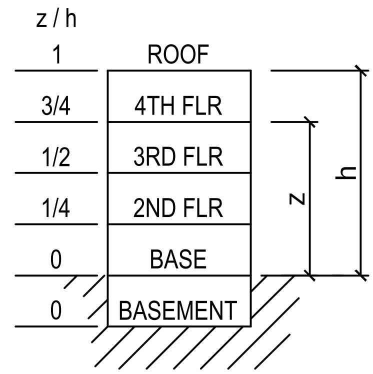
1.0 SUMMARY OF TYPICAL DESIGN EXAMPLE

A. GENERAL

1. The Registered Design Professional (RDP) reviews Section 1 - overview of this OPM.

B. DEMAND

1. The RDP determines the lateral acceleration and vertical acceleration "G" (Cp in NFPA 13) for the seismic forces Fp and Fpv using information provided in the project documents. In the example below, the maximim horizontal and vertical forces on the seismic braces are calculated for use anywhere within the state of California. Please note that these maximum values may be reduced for the site specific project location as well as for the location within the height of a building in order to obtain lower demand values if so required to meet brace spacing criteria.



SAMPLE BLDG ELEV.

ASCE 7-10 AS AMENDED BY CBC 2013

SECTION	13.3	FORCES FOR LRFD, UNO	
SECTION	13.3.1	$F_p = \dfrac{0.4 a_p S_{DS} W_p}{R_p/I_p}(1+2\,z/h) = W_p$	
TABLE	13.6.1	$a_p = 2.5$	(NOT ASME® B31)
		$R_p = 4.5$	(NOT ASME B31)
		$\Omega_o = 2.50$	(FOR ANCHORAGE TO CONC)
		$S_{DS} = 2.5$	(MAX STATE OF CALIFORNIA VALUE)
SECTION	13.1.3	$I_p = 1.5$	(EMERGENCY SYSTEM)
		$z = h$	$z/h \le 1.0$
		$\Omega_o\ F_p = 6.25$	W_p (FOR LRFD ANCHORAGE TO CONCRETE)
SECTION	13.3.1	MAX $F_p = 1.6\ S_{DS}\ I_p\ W_p = 6.0\ W_p$	
SECTION	13.3.1	MIN $F_p = 0.3\ S_{DS}\ I_p\ W_p = 1.125\ W_p$	
		$1.125\ W_p \le 2.5\ W_p \le 6.0\ W_p$	
SECTION	13.3.1	$F_{pv} = \pm 0.20\ S_{DS}\ W_p = \pm 0.50\ W_p$:	

FOR ASD $F_p = (2.5\ W_p)(0.7) = 1.75\ W_p$ AND $F_{pv} = (\pm 0.50\ W_p)(0.7) = \pm 0.35\ W_p$

2. The RDP uses the NFPA 13 guidelines to prepare the fire sprinkler layout drawings.
3. The RDP determines the brace locations and shows them on the layout drawings.
4. The RDP determines the branch line weight plus tributary main line weight (W) for each seismic brace using the NFPA 13 zone of influence (ZOI) method. For this example assume that W = 500 LBS for a 4" diameter schedule 10 main line service pipe.
5. The RDP compares the calculated 500 LBS weight to the allowable weight (W) shown in permissible total weight tables for service pipes. The 500 LB for this example was taken from the "water filled" column on page 5-2, and must be factored as shown in step 7 on page 5-5. From page 5.8, the maximum permissible weight of 589 lbs. will allow a lateral transverse brace spacing of 25 feet for the 4" diameter main line service pipe.

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B. DEMAND (CONTINUED)

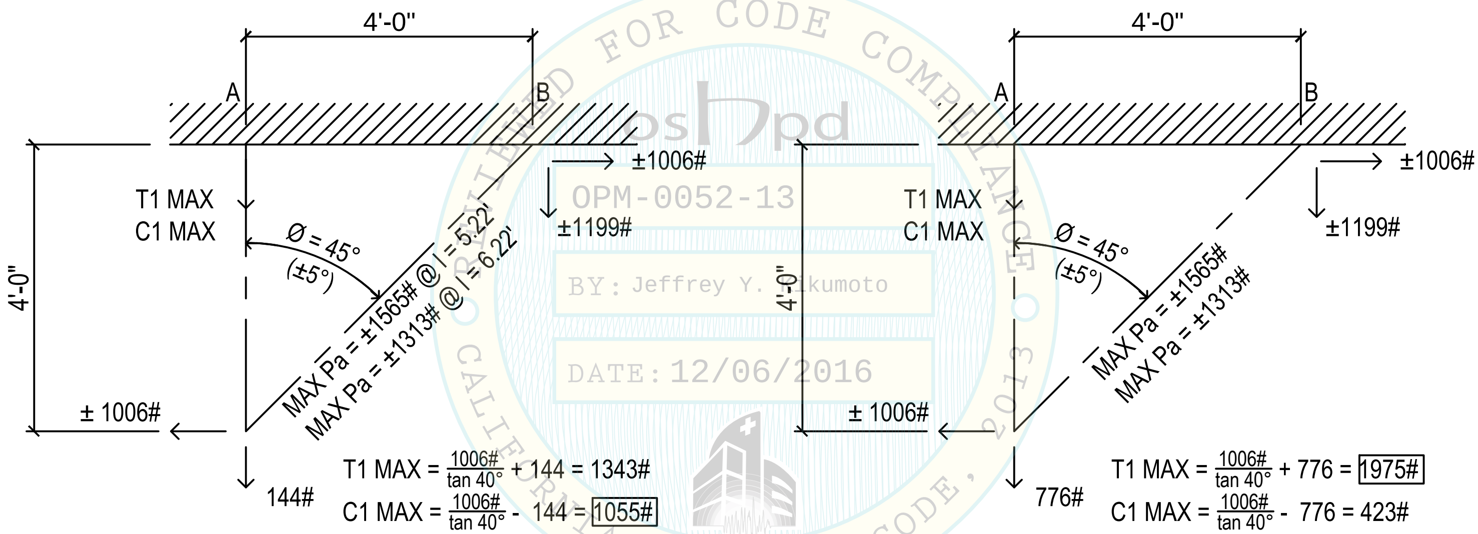
6. The RDP makes adjustments to the lateral transverse brace spacing and recalculates (W) if so required.
7. The RDP determines the operating weight (Wp = 1.15W) by applying the 1.15 factor as per NFPA 13 SECTION 9.3.5.9.2. in this example Wp = 1.15 (500 LBS) = 575 LBS. If TOTAL weight values from tables on page 5-2 are used, skip this step, since 1.15 factor is already included in table values. The 500 LBS for this example does not included the 1.15 factor and so is applied here.
8. The RDP calculates the lateral force Fp and Vertical force Fpv on the seismic brace using the Wp provided by the Specialty Contractor. Note that in the example, it is conservatively assumed that the vertical gravity load is based on the maximum allowable vertical hanger spacing for the main service pipe line per NFPA 13. for this example, at ASD level of design

Wp = 575 LBS

Fp = ±1.75 (575 LBS) = ±1,006 LBS

Fpv = ±0.35 (575 LBS) = ±201 LBS

LOAD COMBINATION 1 (0.6Wp-Fpv) = 345-201 = 144#   LOAD COMBINATION 2 (Wp+Fpv) = 575+201 = 776#



9. The RDP verifies that there is a vertical seismic brace within six inches of each transverse and longitudinal brace.
10. The RDP chooses appropriate seismic brace support elements per pages 2-2 and 4-4 of the OPM. For this example the Tolco Fig. 1001 Fast Clamp connection is chosen for both the transverse and vertical seismic brace. Refer to pages 2-2 and 4-4.
11. The RDP chooses appropriate seismic attachment elements to structure as per section 3 of the OPM.

C. CAPACITY

1. The RDP determines the governing capacity of the assembled supports and attachment.
   a. Determine capacity of support element for service pipe per tested values on page 4-4. Per page 4-4 the Tolco Fig. 1001 Fast Clamp capacity for a 4" diameter, schedule 10 service pipe is 850 lbs for any brace angle between 30 to 90 degrees. The capacity is 850 lbs at 90 degrees if used as a vertical brace. This is lower than the demand and the Fig. 1001 can be used as part of the brace assembly for this approval only if spacing is reduced, see steps c.3 below:
   b. Determine capacity of brace pipe support as per calculated allowable values in table provided on page 4-6. For this example, it is assumed that the brace pipe is no longer than 7 feet. A 1 1/4" diameter brace pipe has a horizontal capacity of 755 lbs and can be used as part of the transverse and vertical brace assemblies in this example.
   c. Determine capacity of the typical Tolco Fig. 980 support between brace pipe and seismic attachment element. Per page 4-1 the Fig. 980 has a capacity of 1320 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 Section 3 of the OPM, anchorage to concrete. For this example choose Hilti 5/8" w/ 3-1/4" embed concrete anchor as shown on page 3-1. The maximum allowable horizontal load capacity of the attachment for a brace angle of 40 degree is 902 lbs. This is much less than the calculated demand of 1006 lbs.
   e. Please note that for anchorage to concrete, use combined forces check as ACI 318-11 as well as the over strength factor Ω_0 per ASCE 7-10 supplement #1 for concrete that is included in the Section 3 tables.
2. The RDP determines whether the demand on the brace is less than the capacity of the assembly. In this example, the brace pipe capacity of 755 lbs is found to be much less than the calculated demand of 1006 lbs thus, the brace spacing (i.e. (W) based on ZOI) will need to be reduced.
3. The RDP determines using a capacity versus demand ratio the approximate revised allowable brace spacing.
   a. For this example (755 lb/1006 lb) 25 ft = 18 ft. The revised spacing and new ZOI loads can then be determined for the assembly chosen.
   b. Alternatively, by instead first choosing a larger brace pipe with a larger capacity, the assembly's capacity can be increased. In that case the Fig. 1001 Fast Clamp at 850 lb would govern. Performing the capacity versus demand ratio would then determine a new larger allowable brace spacing of (850 lb/1006 lb) 25 ft = 21 ft. The revised spacing and new ZOI loads can then be determined for the assembly chosen.

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

Schedule 10 Steel Pipe

Pipe Size (1)	Outside Diameter OD (1)	t_{nom} (1)	S (2)	M_{max}	Weight w/ water Wp	Fv+Wp	Hanger Spacing (3) S_{hanger}	Applied Moment M_{hanger}	Max M Horiz. $M_{horizental}$	Max Load from ZOI in lb., Fpw Transverse Brace Spacing in ft.					Max Weight from ZOI in lb., W W = Fpw/ 1.15 Cp Transverse Brace Spacing in ft.				
in	in	in	in^3	ft-lb	lb/ft	lb/ft	ft	ft-lb	ft-lb	20	25	30	35	40	20	25	30	35	40
1	1.315	0.065	0.071	116	1.36	1.84	12	33	111	64	50	42			32	25	21		
1 - 1/4	1.66	0.065	0.117	190	1.93	2.60	12	47	185	106	83	69			52	41	34		
1 - 1/2	1.9	0.065	0.156	253	2.37	3.20	12	58	246	141	111	92			70	55	46		
2	2.375	0.065	0.248	403	3.35	4.53	12	81	395	226	177	148			112	88	73		
2 - 1/2	2.875	0.083	0.462	751	5.03	6.78	12	122	741	423	333	278			210	165	138		
3	3.5	0.083	0.695	1129	6.88	9.28	12	167	1117	638	502	418	359	314	317	249	208	178	156
3 - 1/2	4	0.083	0.915	1487	8.55	11.54	12	208	1473	842	662	552	473	414	418	329	274	235	206
4	4.5	0.083	1.166	1895	10.39	14.03	12	253	1878	1073	844	703	603	527	533	419	349	300	262
5	5.5625	0.109	2.332	3789	16.21	21.88	12	394	3769	2154	1694	1412	1210	1059	1070	842	701	601	526
6	6.625	0.109	3.337	5423	21.72	29.32	12	528	5397	3084	2426	2021	1733	1516	1532	1205	1004	861	753
8	8.625	0.109	5.717	9290	34.18	46.14	12	831	9253	5287	4159	3466	2790	2599	2627	2066	1722	1476	1292

Density of medium: 62.4 lb/ cu ft Water
Density of pipe: 500 lb/ cu ft Steel
FP= 1.786 Wp
Fv= 0.536 Wp

Steel Strength Fy: 30000 psi

1 Steel pipe dimension per NFPA 13 Table A.6.3.2
2 S = (PI * OD^4 - (OD -2 * 0.93 * t_{nom}) ^4) / 32 * OD
3 Maximum distance between hangers per NFPA 13, Table 9.2.2.1

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

Schedule 10 Steel Pipe

Pipe Size (1)	Outside Diameter OD (1)	t_{nom} (1)	S (2)	M_{Max}	Weight w/ water Wp	Fv+Wp	Hanger Spacing (3) S_{hanger}	Applied Moment M_{hanger}	Max M Horiz. $M_{horizontal}$	Max Load from ZOI in lb., Fpw — Transverse Brace Spacing in ft.					Max Weight from ZOI in lb., W; W = Fpw/1.15 Cp — Transverse Brace Spacing in ft.				
in	in	in	in^3	ft-lb	lb/ft	lb/ft	ft	ft-lb	ft-lb	20	25	30	35	40	20	25	30	35	40
1	1.315	0.109	0.109	177	1.84	2.83	12	51	170	97	76	64			47	37	31		
1-1/4	1.66	0.109	0.182	296	2.55	3.92	12	71	288	164	129	108			80	63	52		
1-1/2	1.9	0.109	0.245	397	3.09	4.75	15	134	374	214	168	140			104	82	68		
2	2.375	0.109	0.395	642	4.28	6.57	15	185	614	351	276	230			171	134	112		
2-1/2	2.875	0.12	0.644	1047	5.97	9.17	15	258	1015	580	456	380			282	222	185		
3	3.5	0.12	0.975	1585	8.04	12.35	15	347	1546	884	695	579	496	434	430	338	282	242	211
3-1/2	4	0.12	1.289	2095	9.89	15.19	15	427	2051	1172	922	768	658	576	571	449	374	321	281
4	4.5	0.12	1.647	2677	11.91	18.29	15	515	2627	1501	1181	984	843	738	731	575	479	411	359
6	6.625	0.134	4.059	6597	23.24	35.70	15	1004	6520	3726	2930	2442	2093	1831	1814	1427	1189	1019	892
8	8.625	0.188	9.611	15617	40.46	62.15	15	1748	15519	8868	6975	5812	4982	4359	4318	3396	2830	2426	2122
10	10.75	0.188	15.111	24556	58.29	89.53	15	2518	24426	13958	10978	9148	7842	6861	6796	5345	4454	3818	3341

Density of medium: 62.4 lb/cu ft Water
Density of pipe: 500 lb/cu ft Steel
Fp= 1.786 Wp
Fv= 0.536 Wp
Steel strength Fy: 30000 psi

1 Steel pipe dimensions per NFPA 13 Table A.6.3.2
2 S = (PI * OD^4 - (OD - 2 * 0.93 * t_{nom})^4) / 32 * OD
3 Maximum distance between hangers per NFPA 13, Table 9.2.2.1

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

Schedule 40 Steel Pipe

Pipe Size (1)	Outside Diameter OD (1)	t_{nom} (1)	S (2)	M_{Max}	Weight w/ water Wp	Fv+Wp	Hanger Spacing (3) S_{hanger}	Applied Moment M_{hanger}	Max M Horiz. $M_{horizontal}$	Max Load from ZOI in lb., Fpw — Transverse Brace Spacing in ft.					Max Weight from ZOI in lb., W — W = Fpw/1.15 Cp — Transverse Brace Spacing in ft.				
in	in	in	in^3	ft-lb	lb/ft	lb/ft	ft	ft-lb	ft-lb	20	25	30	35	40	20	25	30	35	40
1	1.315	0.133	0.126	205	2.09	3.21	12	58	197	112	88	74			55	43	36		
1-1/4	1.66	0.14	0.222	361	2.97	4.56	12	82	352	201	158	132			98	77	64		
1-1/2	1.9	0.145	0.308	501	3.66	5.62	15	158	476	272	214	178			132	104	87		
2	2.375	0.154	0.529	859	5.19	7.96	15	224	829	474	373	311			231	181	151		
2-1/2	2.875	0.203	1.005	1632	7.99	12.27	15	345	1596	912	717	598			444	349	291		
3	3.5	0.216	1.625	2640	10.94	16.81	15	473	2597	1484	1167	973	834	730	723	568	474	406	355
3-1/2	4	0.226	2.253	3662	13.59	20.87	15	587	3614	2065	1624	1354	1160	1015	1006	791	659	565	494
4	4.5	0.237	3.023	4913	16.54	25.40	15	714	4860	2777	2184	1820	1560	1365	1352	1064	886	760	665
6	6.625	0.28	7.972	12955	31.90	49.00	15	1378	12882	7361	5789	4825	4135	3618	3584	2819	2349	2013	1762
8	8.625	0.322	15.757	25605	50.84	78.09	15	2196	25510	14577	11465	9554	8190	7166	7097	5582	4652	3987	3489
10	10.75	0.365	28.012	45519	75.52	116.00	15	3262	45402	25944	20405	17004	14575	12753	12632	9935	8279	7096	6209
12.00	12.75	0.375	41.005	66633	99.63	153.03	15	4304	66493	37996	29885	24904	21346	18678	18500	14550	12125	10393	9094

Density of medium: 62.4 lb/cu ft Water
Density of pipe: 500 lb/cu ft Steel
Fp= 1.786 Wp
Fv= 0.536 Wp
Steel strength Fy: 30000 psi

1 Steel pipe dimensions per NFPA 13 Table A.6.3.2
2 S = (PI * OD^4 - (OD - 2 * 0.93 * tnom)^4) / 32 * OD
3 Maximum distance between hangers per NFPA 13, Table 9.2.2.1

CBC 2013 SEISMIC FORCE CALCULATION

PIPING SEISMIC FORCE FACTOR (HIGH DEFORMABILITY)

Seismic force per California Building Code CBC 2013, Title 24 Part 2, and California Maximum

$a_p = 2.5$ — Component Amplification Factor

$R_p = 4.5$ — Component Response modification Factor

$S_{DS} = 2.5$ — Design Spectral Response Acceleration at Short Periods Maximum in California

$I_p = 1.5$ — Importance Factor

$1.6\, S_{DS}\, I_p = 6$ — Horizontal Seismic Shear Coefficient, Upper Limit

$$\frac{0.4\, a_p S_{DS}}{\frac{R_p}{I_p}} \left(1 + 2\,\frac{1}{1}\right) = 2.5$$
Horizontal Seismic Shear Coefficient, Controls

$0.3\, S_{DS}\, I_p = 1.125$ — Horizontal Seismic Shear Coefficient, Lower Limit

$$\frac{0.4\, a_p S_{DS}}{\frac{R_p}{I_p}} \left(1 + 2\,\frac{1}{1}\right) (0.7) = 1.75$$
Seismic Shear Coefficient, Service Level

$$F_p = \frac{0.4\, a_p S_{DS}}{\frac{R_p}{I_p}} \left(1 + 2\,\frac{1}{1}\right) (0.7)\, W_p$$
Seismic Shear Coefficient, Service Level

$0.2\, S_{DS}\, (0.7) = 0.35$ — Seismic Vertical Coefficient, Service Leve l

$F_v = 0.2\, S_{DS}\, (0.7)\, W_p$ — Seismic Vertical Force, Service Leve l

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PAGE: 10-5-9
DATE: NOVEMBER 29, 2016

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SECTION 11

STRUCTURAL ATTACHMENTS

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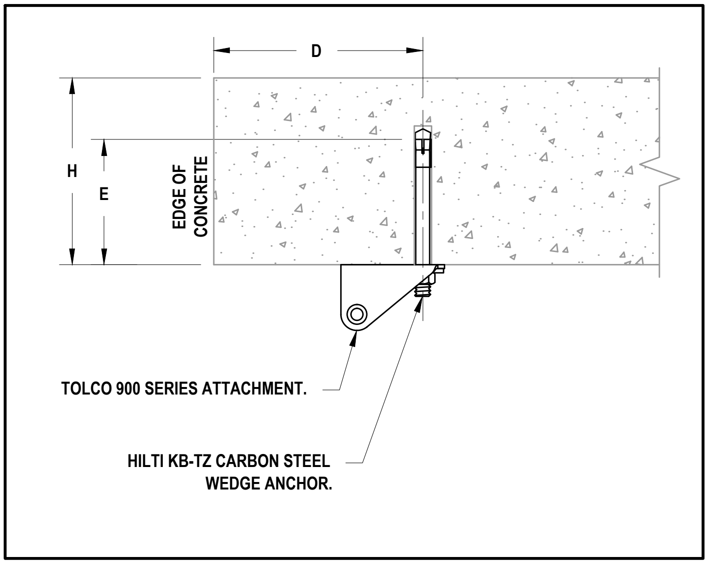
HILTI KB-TZ WEDGE ANCHORS IN 4,000 PSI NORMAL WEIGHT CONCRETE



ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	'S' MIN. SPACING BETWEEN ANCHORS (MAX 12")	'H' MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL						B-LINE SOLID CHANNEL
					SINGLE (LB)			DOUBLE (LB)			
					0° - 30°	31° - 45°	46° - 60°	0° - 30°	31° - 45°	46° - 60°	
3/8"	2"	6"	12"	4"	268	201	140	350	347	315	B22
1/2"	2"	6"	12"	4"	316	230	157	680	510	355	B22
1/2"	3 1/4"	9 3/4"	12"	6"	620	455	315	778	760	653	B22
5/8"	3 1/8"	9 1/2"	12"	5"	635	460	310	1046	852	653	B22
5/8"	4"	12"	12"	6"	855	630	435	1046	852	653	B22
3/4"	3 3/4"	11 1/4"	12"	6"	860	620	415	1046	852	653	B22

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN STONE AGGREGATE CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 4,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 FOR ALLOWABLE LOADS GOVERNED BY CONCRETE FAILURE MODES PER ACI 318-11 APPENDIX D, D3.3.3.3 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)
4.) NOT USED.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.

NOTES CONTINUED:

7.)STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) NOT USED
10.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER.
11.) NOT USED.
12.) STRUT HOLE SIZE SHALL NOT BE LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.

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Structural Engineer: Mohammad Hariri
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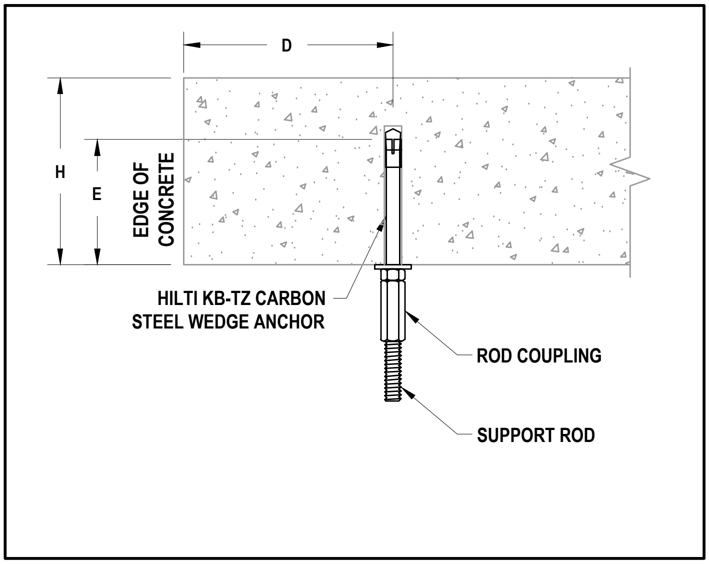
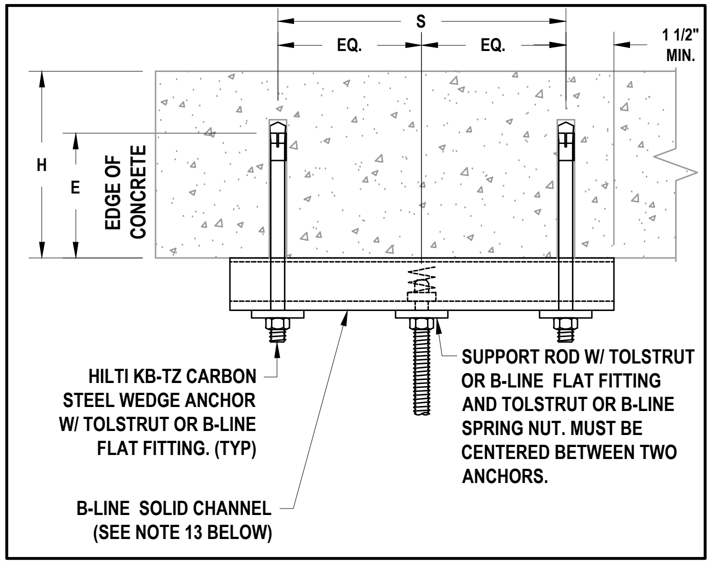
MH

HILTI KB-TZ WEDGE ANCHORS IN 4,000 PSI NORMAL WEIGHT CONCRETE





ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	'S' MIN. SPACING BETWEEN ANCHORS (MAX 12")	'H' MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD) MAX. VERTICAL LOAD SINGLE (LB)	DOUBLE (LB)	B-LINE SOLID CHANNEL
3/8"	2"	6"	12"	4"	410	820	B22
1/2"	2"	6"	12"	4"	435	875	B22
1/2"	3 1/4"	9 3/4"	12"	6"	890	1775	B22A
5/8"	3 1/8"	9 1/2"	12"	5"	850	1700	B22A
5/8"	4"	12"	12"	6"	1230	2000	B22A
3/4"	3 3/4"	11 1/4"	12"	6"	1120	2000	B22A

MAX. LOAD INCLUDES OVER STRENGTH FACTOR $\Omega 0$=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN STONE AGGREGATE CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 4,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 FOR ALLOWABLE LOADS GOVERNED BY CONCRETE FAILURE MODES PER ACI 318-11 APPENDIX D, D3.3.3.3 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)
4.) NOT USED.

NOTES CONTINUED:

5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
10.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED, HANGER ROD MAY BE OFF CENTER WHEN USING TWO ANCHORS WITH STRUT.
11.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
12.) NOT USED.
13.) STRUT HOLE SIZE SHALL NOT BE LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.

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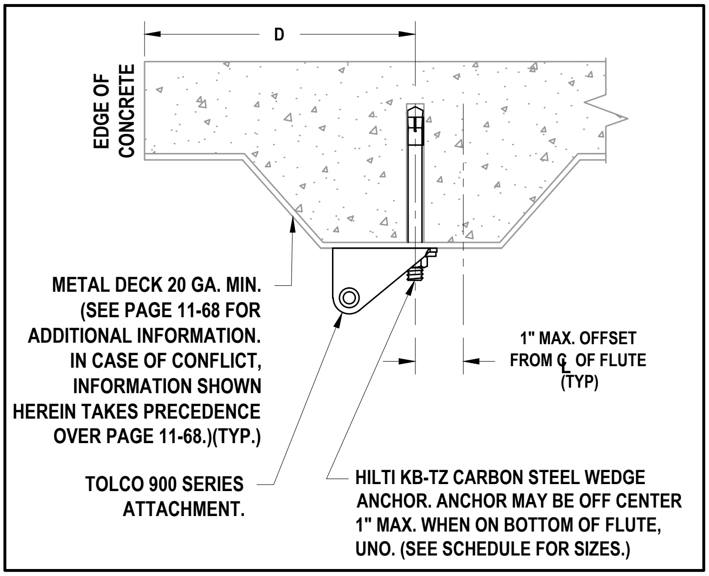
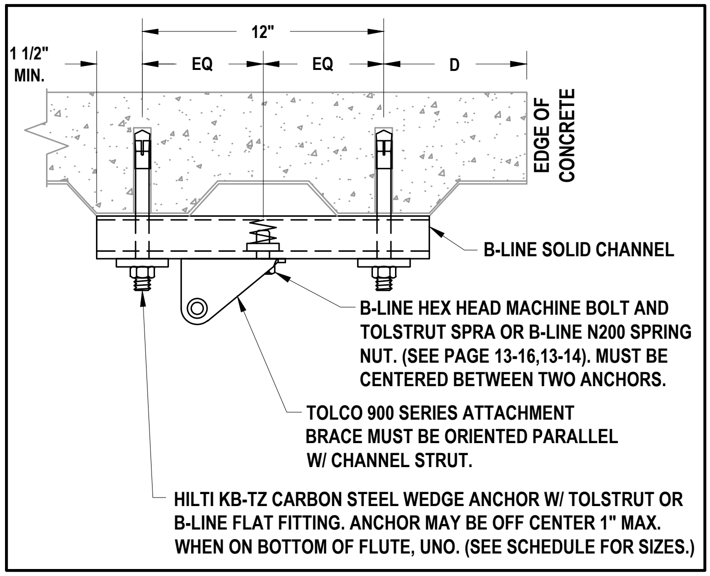
HILTI KB-TZ WEDGE ANCHOR IN 3,000 PSI
SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)





ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL						B-LINE SOLID CHANNEL
				SINGLE (LB)			DOUBLE (LB)			
				0° - 30°	31° - 45°	46° - 60°	0° - 30°	31° - 45°	46° - 60°	
3/8"	2"	6 3/4"	12"	127	97	68	272	212	154	B-22
1/2"	2"	6 3/4"	12"	187	128	83	412	290	190	B-22
1/2"	3 1/4"	9 3/4"	12"	324	224	147	715	505	337	B-22
5/8"	3 1/8"	9 3/8"	12"	260	177	115	575	403	263	B-22
5/8"	4"	12"	12"	470	347	238	1020	768	535	B-22

MAX. LOAD INCLUDES OVER STRENGTH FACTOR $\Omega 0=2.5$ PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

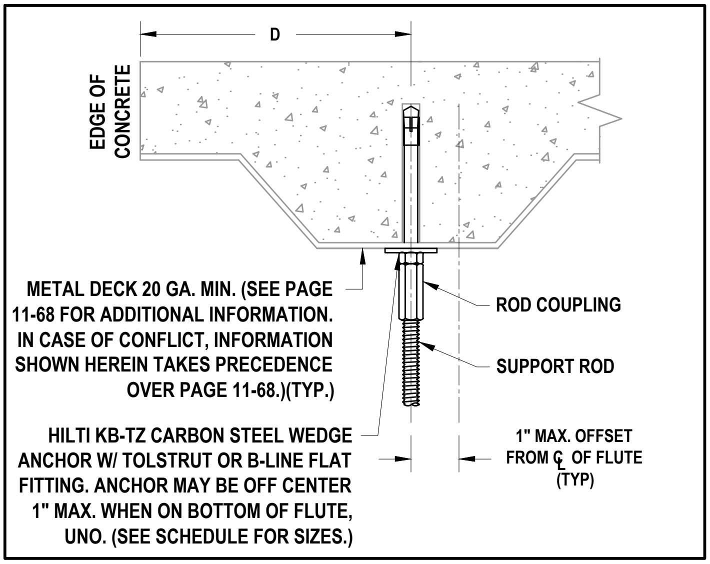
1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 FOR ALLOWABLE LOADS GOVERNED BY CONCRETE FAILURE MODES PER ACI 318-11 APPENDIX D, D3.3.3.3 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013).
4.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-1917 (2013). REFER TO METAL DECK DIMENSIONS SHOWN ABOVE.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.

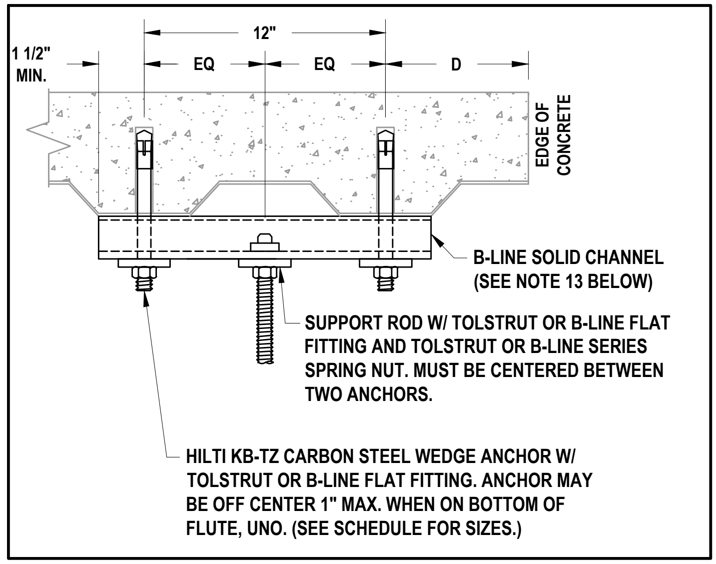
NOTES CONTINUED:

7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) NOT USED
10.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER.
11.) NOT USED.
12.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
13.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.

MH

HILTI KB-TZ WEDGE ANCHOR IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)





ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	ALLOWABLE STRENGTH DESIGN (ASD) MAX. VERTICAL LOAD SINGLE (LB)	DOUBLE (LB)	B-LINE SOLID CHANNEL
3/8"	2"	6 3/4"	12"	210	420	B22
1/2"	2"	6 3/4"	12"	210	420	B22
1/2"	3 1/4"	9 3/4"	12"	377	750	B22A
5/8"	3 1/8"	9 3/8"	12"	288	575	B22A
5/8"	4"	12"	12"	668	1335	B22A

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 FOR ALLOWABLE LOADS GOVERNED BY CONCRETE FAILURE MODES PER ACI 318-11 APPENDIX D, D3.3.3.3 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)

NOTES CONTINUED:

4.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-1917 (2013). REFER TO METAL DECK DIMENSIONS SHOWN ABOVE.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
10.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED, HANGER ROD MAY BE OFF CENTER WHEN USING TWO ANCHORS WITH STRUT.
11.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
12.) NOT USED.
13.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
14.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.

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PAGE: 11-4

DATE: NOVEMBER 29, 2016

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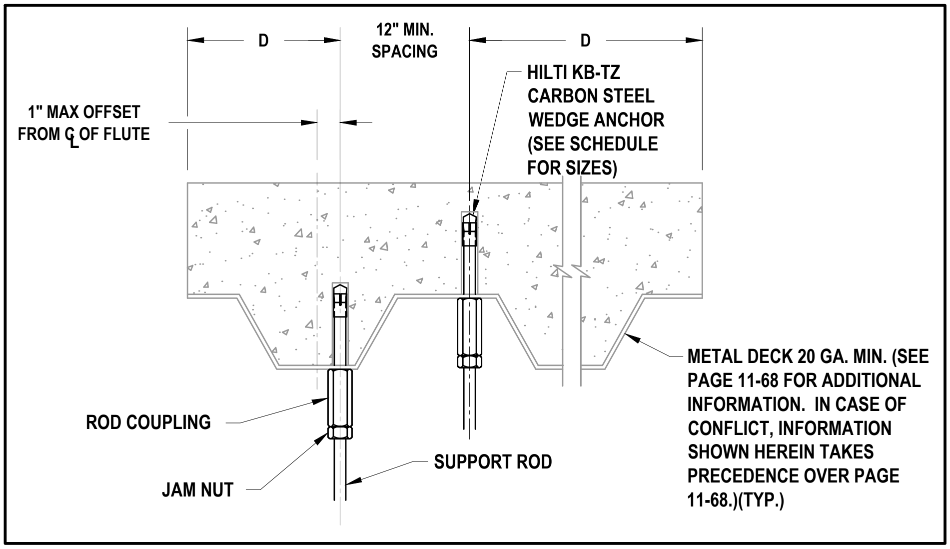
SINGLE HILTI KB-TZ ANCHOR VERTICAL SUPPORT CONNECTION IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE



ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	ALLOWABLE STRENGTH DESIGN (ASD) MAX. VERTICAL LOAD SINGLE (LB)
3/8"	2"	6 3/4"	12"	210
1/2"	2"	6 3/4"	12"	210
1/2"	3 1/4"	9 3/4"	12"	375
5/8"	3 1/8"	9 3/8"	12"	288
5/8"	4"	12"	12"	665

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.3.3 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)

NOTES CONTINUED:

4.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-1917 (2013). REFER TO METAL DECK DIMENSIONS SHOWN ABOVE.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
10.) NOT USED.
11.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
12.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.

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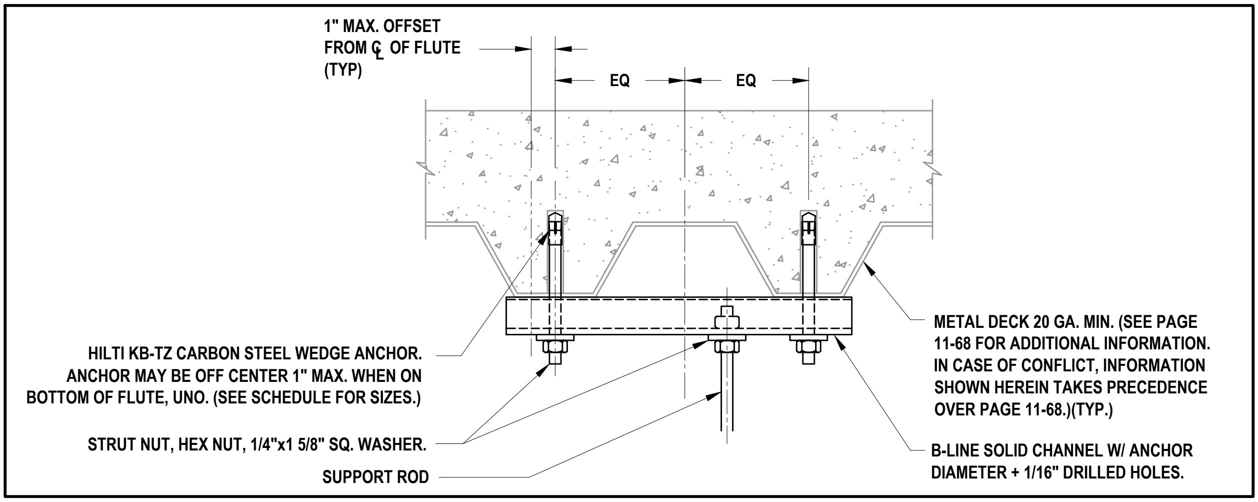
Structural Engineer: Mohammad Hariri
California SE No. S3545

DATE: NOVEMBER 29, 2016

MH

DUAL HILTI KB-TZ ANCHOR VERTICAL SUPPORT CONNECTION IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE



ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	MIN. EDGE DISTANCE	TWO ANCHOR CONNECTION (ASD) COMBINED TOTAL ALLOWABLE ROD TENSION DESIGN VALUE (Lbs.) VERTICAL SUPPORT ROD MAX. OFFSET FROM C.L. (LB)					MAX. ALLOWABLE LOAD ON SINGLE ANCHOR (LB) (ASD)	B-LINE SOLID CHANNEL
				CL ± 0"	CL ± 1"	CL ± 2"	CL ± 3"	CL ± 4"		
3/8"	2"	12"	6 3/4"	420	360	315	278	250	209	B22
1/2"	2"	12"	6 3/4"	420	360	315	278	250	209	B22
1/2"	3 1/4"	12"	9 3/4"	755	645	565	500	450	376	B22A
5/8"	3 1/8"	12"	9 3/8"	575	490	430	383	345	286	B22A
5/8"	4"	12"	12"	1335	1145	1000	885	800	666	B22A

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

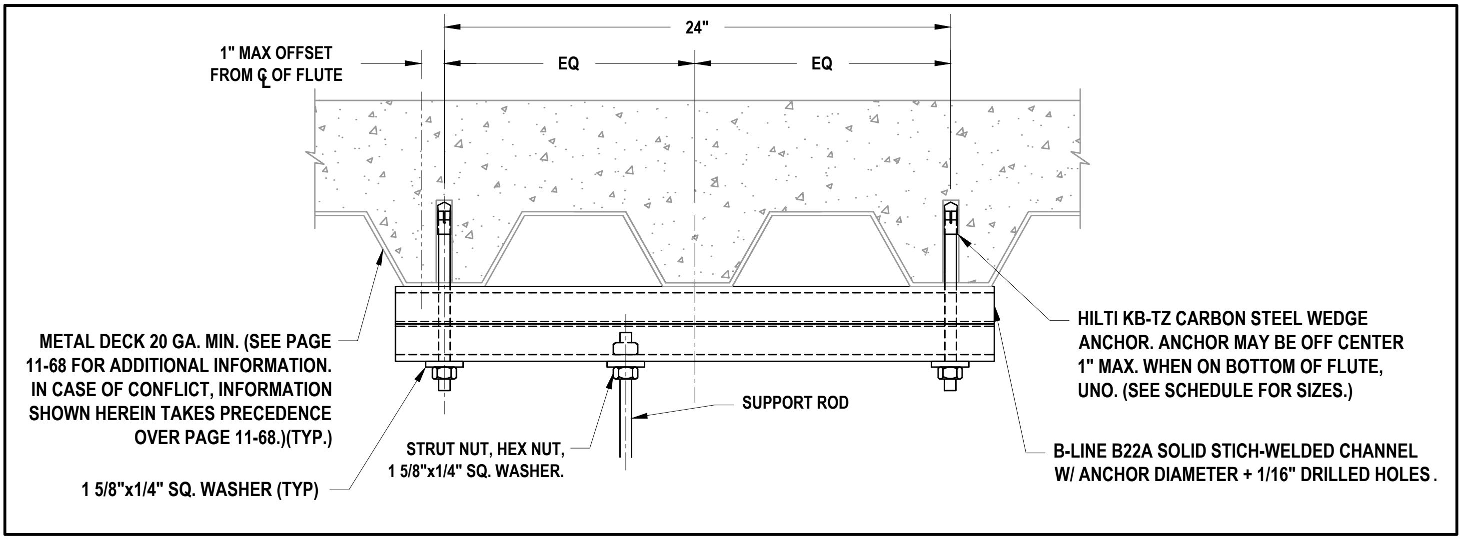
NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)
4.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-1917 (2013). REFER TO METAL DECK DIMENSIONS ABOVE.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

NOTES CONTINUED:

8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
10.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED, HANGER ROD MAY BE OFFSET ANYWHERE BETWEEN THE TWO ANCHORS.
11.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
12.) NOT USED.
13.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
14.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.

DUAL HILTI KB-TZ ANCHOR IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE WITH BACK-TO-BACK STRUT VERTICAL SUPPORT CONNECTION



ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	MIN. EDGE DISTANCE	TWO ANCHOR CONNECTION — COMBINED TOTAL ALLOWABLE ROD TENSION DESIGN VALUE (Lbs.) VERTICAL SUPPORT ROD MAX. OFFSET FROM C.L. (LB)(ASD)					MAX. ALLOWABLE LOAD ON SINGLE ANCHOR (LB) (ASD)
				CL ± 0"	CL ± 1"	CL ± 2"	CL ± 3"	CL ± 4"	
3/8"	2"	12"	6 3/4"	418	388	360	335	313	209
1/2"	2"	12"	6 3/4"	418	388	360	335	313	209
1/2"	3 1/4"	12"	9 3/4"	750	695	645	603	565	376
5/8"	3 1/8"	12"	9 3/8"	575	530	490	460	430	286
5/8"	4"	12"	12"	1050	1050	1050	1050	1000	666

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)
4.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-1917 (2013). REFER TO METAL DECK DIMENSIONS SHOWN ABOVE.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

NOTES CONTINUED:

8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
10.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED, HANGER ROD MAY BE OFFSET ANYWHERE BETWEEN THE TWO ANCHORS.
11.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
12.) NOT USED.
13.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
14.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.

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Structural Engineer: Mohammad Hariri
California SE No. S3545

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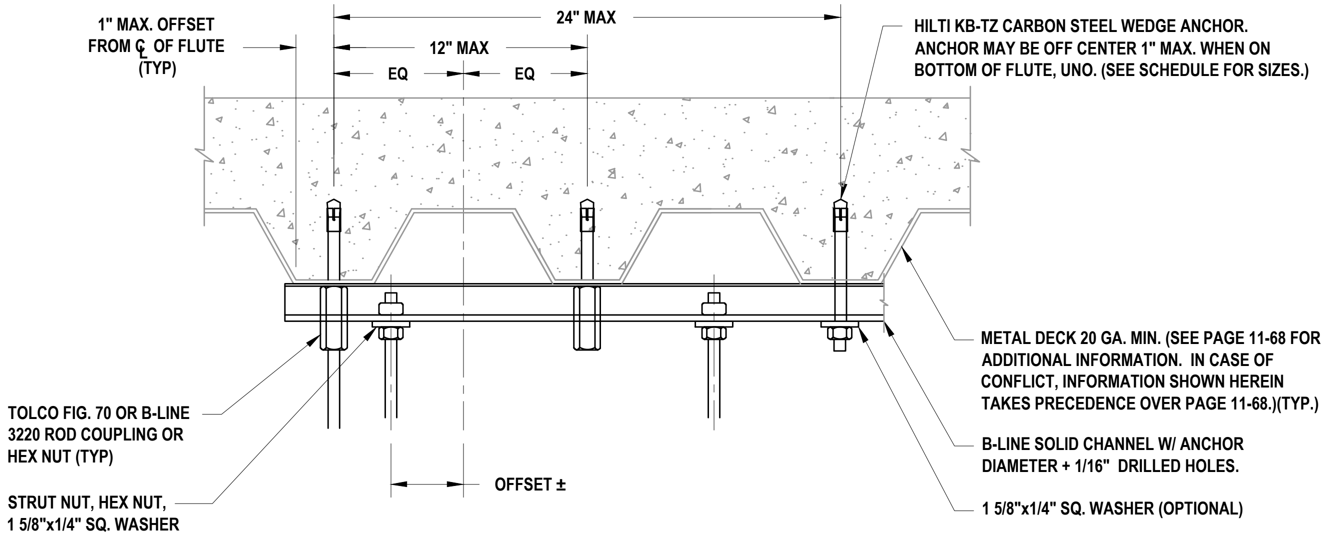
TRIPLE HILTI KB-TZ ANCHOR IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE
MULTIPLE VERTICAL SUPPORT CONNECTION



ANCHOR DIAMETER	MIN. EFFECTIVE EMBED. DEPTH h_{ef}	MIN. ANCHOR SPACING	MIN. EDGE DISTANCE	TWO ANCHOR CONNECTION (ASD) COMBINED TOTAL ALLOWABLE ROD TENSION DESIGN VALUE (Lbs.) VERTICAL SUPPORT ROD MAX. OFFSET FROM C.L. (LB)(ASD)					MAX. ALLOWABLE LOAD ON ANCHOR (LB) (ASD)
				CL ± 0"	CL ± 1"	CL ± 2"	CL ± 3"	CL ± 4"	
3/8"	2"	12"	6 3/4"	418	360	315	280	250	209
1/2"	2"	12"	6 3/4"	418	360	315	280	250	209
1/2"	3 1/4"	12"	9 3/4"	750	645	565	500	450	376
5/8"	3 1/8"	12"	9 3/8"	575	490	430	383	343	286
5/8"	4"	12"	12"	1050	1050	1000	890	800	666

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.

2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.

3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013).

4.) MINIMUM CONCRETE THICKNESS OF 1 1/2 TIMES THE EMBEDMENT DEPTH, OR THE EMBEDMENT DEPTH PLUS THREE TIMES THE DIAMETER, WHICHEVER IS GREATER, SHALL BE PROVIDED, UNLESS NOTED OTHERWISE.

5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.

6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE, LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.

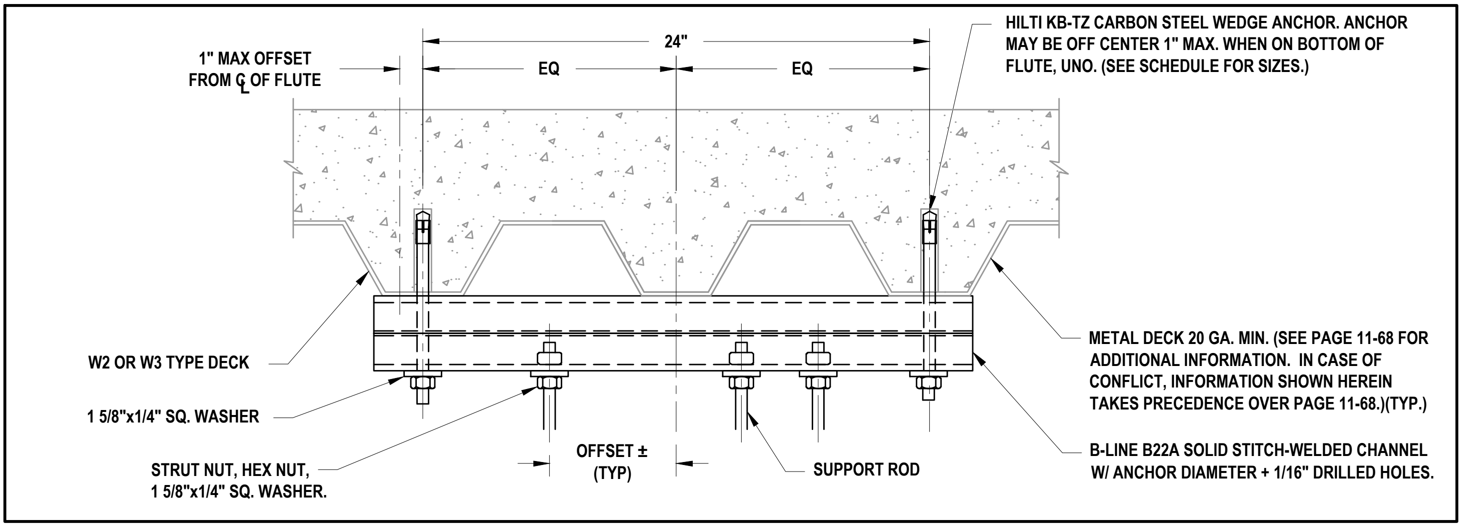
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.

9.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR MORE THAN THE ANCHOR DIAMETER.

10.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED, HANGER ROD MAY BE OFF CENTER WHEN USING TWO ANCHORS WITH STRUT.

DUAL HILTI KB-TZ ANCHOR MULTIPLE VERTICAL SUPPORT CONNECTION IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE



ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	MIN. EDGE DISTANCE	TWO ANCHOR CONNECTION — COMBINED TOTAL ALLOWABLE ROD TENSION DESIGN VALUE (Lbs.) VERTICAL SUPPORT ROD MAX. OFFSET FROM C.L. (LB)(ASD)					MAX. ALLOWABLE LOAD ON SINGLE ANCHOR (LB) (ASD)
				CL ± 0"	CL ± 1"	CL ± 2"	CL ± 3"	CL ± 4"	
3/8"	2"	12"	6 3/4"	420	388	360	335	313	209
1/2"	2"	12"	6 3/4"	420	388	360	335	313	209
1/2"	3 1/4"	12"	9 3/4"	750	695	645	603	565	376
5/8"	3 1/8"	12"	9 3/8"	575	530	490	460	430	286
5/8"	4"	12"	12"	1050	1050	1050	1050	1000	666

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)
4.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-1917 (2013). REFER TO METAL DECK DIMENSIONS SHOWN ABOVE.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

NOTES CONTINUED:

8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
10.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED, HANGER ROD(S) MAY BE OFFSET ANYWHERE BETWEEN THE TWO ANCHORS.
11.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
12.) NOT USED.
13.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
14.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.

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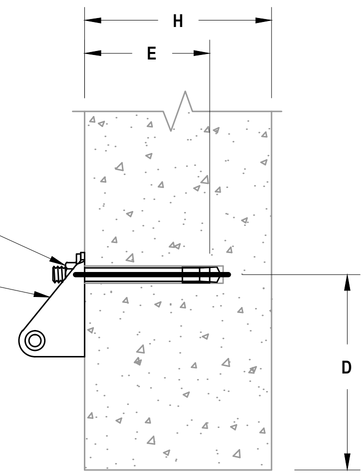
HILTI KB-TZ WEDGE ANCHORS IN 4,000 PSI NORMAL WEIGHT CONCRETE WALL / BEAM



ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	'H' MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZ. (LB)		
				0° - 30°	31° - 45°	46° - 60°
3/8"	2"	12"	4"	243	201	155
1/2"	2"	12"	4"	272	230	182
1/2"	3 1/4"	12"	6"	545	458	358
5/8"	3 1/8"	12"	5"	540	460	365
5/8"	4"	12"	6"	755	633	495
3/4"	3 3/4"	12"	6"	720	620	500

MAX. LOAD INCLUDES OVER STRENGTH FACTOR $\Omega 0=2.5$ PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN STONE AGGREGATE CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 4,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)
4.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
5.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
6.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

NOTES CONTINUED:

7.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
8.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER.

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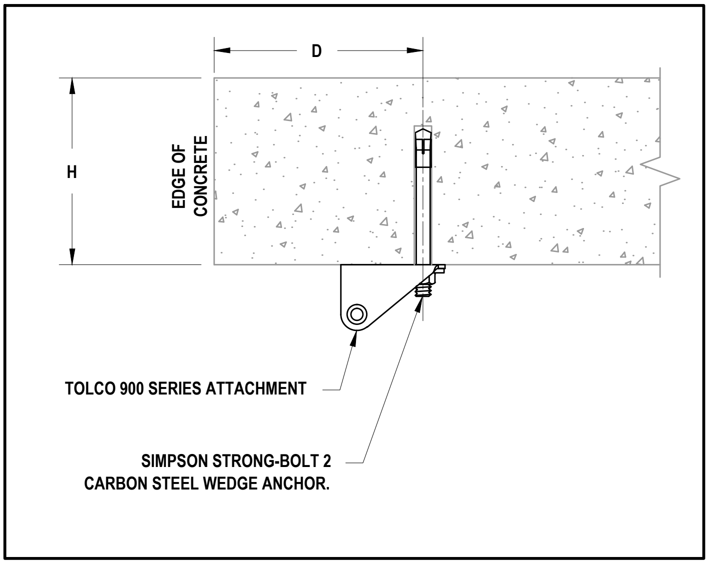
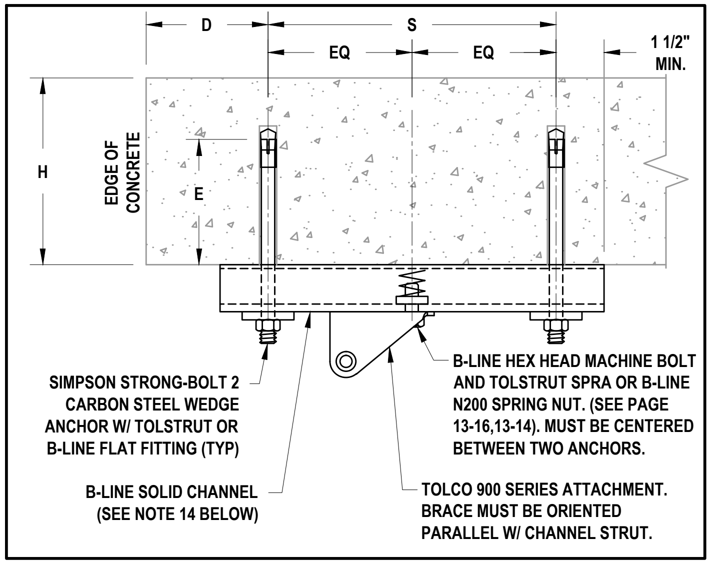
MH

SIMPSON STRONG-BOLT 2 WEDGE ANCHORS IN 4,000 PSI NORMAL WEIGHT CONCRETE





ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	'S' MIN. SPACING BETWEEN ANCHORS (16" MAX)	'H' MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL — SINGLE (LB) 0° - 30°	SINGLE (LB) 31° - 45°	SINGLE (LB) 46° - 60°	DOUBLE (LB) 0° - 30°	DOUBLE (LB) 31° - 45°	DOUBLE (LB) 46° - 60°	B-LINE SOLID CHANNEL
1/2"	2 1/4"	7"	7"	4 1/2"	388	281	190	715	550	395	B22
1/2"	3 3/8"	7"	7"	6"	580	442	315	780	760	535	B22
5/8"	2 3/4"	6 1/2"	6 1/2"	5 1/2"	480	357	245	970	760	535	B22
5/8"	4 1/2"	6 1/2"	6 1/2"	7 7/8"	730	575	420	1010	760	535	B22
3/4"	3 3/8"	7"	8"	6 3/4"	625	468	327	1010	760	535	B22
3/4"	5"	7"	8"	8 3/4"	860	670	485	1010	760	535	B22

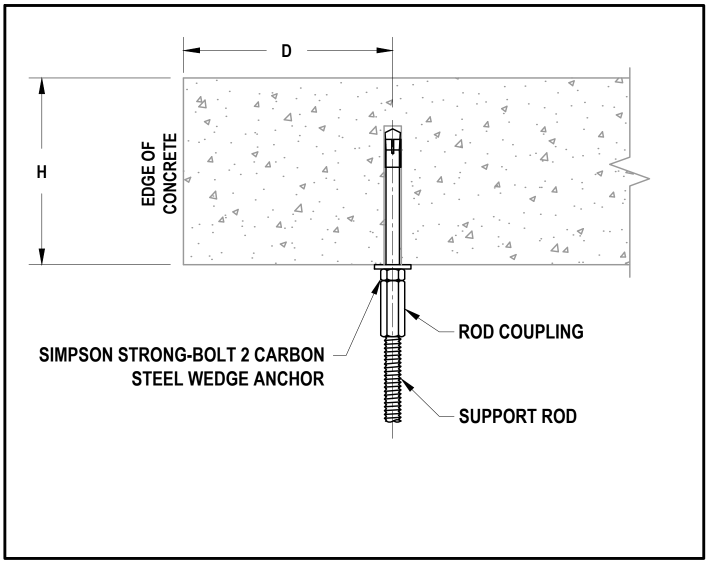
NOTES:

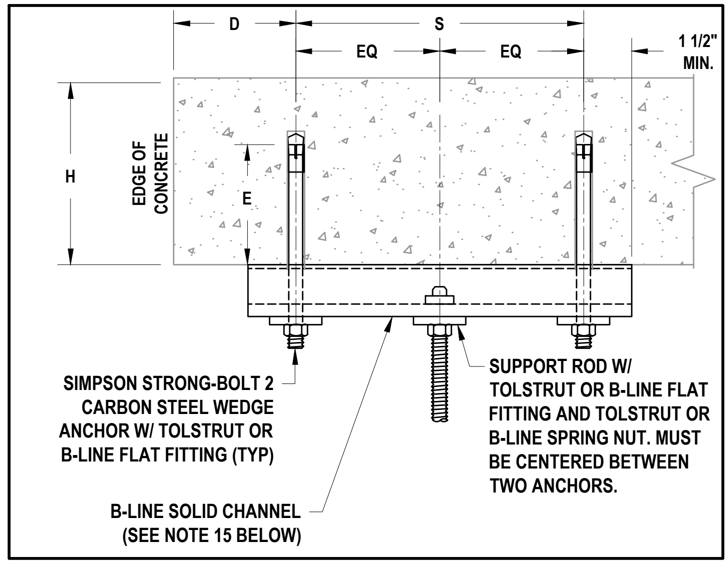
1.) LOAD VALUES PER ICC ESR-3037 (STRONG-BOLT 2) FOR STRUCTURAL NORMAL WEIGHT CONCRETE (fc = 4,000 PSI) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-3037. (2013).
4.) NOT USED.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.

NOTES CONTINUED:

7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER.
10.) NOT USED.
11.) NOT USED.
12.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.

SIMPSON STRONG-BOLT 2 WEDGE ANCHORS IN 4,000 PSI NORMAL WEIGHT CONCRETE





ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	'S' MIN. SPACING BETWEEN ANCHORS (16" MAX)	'H' MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD) MAX. VERTICAL LOAD (LB) SINGLE (LB)	DOUBLE (LB)	B-LINE SOLID CHANNEL
1/2"	2 1/4"	7"	7"	4 1/2"	520	1040	B22
1/2"	3 3/8"	7"	7"	6"	680	1300	B22
5/8"	2 3/4"	6 1/2"	6 1/2"	5 1/2"	700	1300	B22
5/8"	4 1/2"	6 1/2"	6 1/2"	7 7/8"	1250	1300	B22
3/4"	3 3/8"	7"	8"	6 3/4"	960	1300	B22
3/4"	5"	7"	8"	8 3/4"	1545	1300	B22

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) LOAD VALUES PER ICC ESR-3037 (STRONG-BOLT 2) FOR STRUCTURAL NORMAL WEIGHT CONCRETE (fc = 4,000 PSI) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) ANCHOR SHALL BE A MINIMUM OF 18 x DIAMETERS AWAY FROM SECOND EDGE. EDGE DISTANCE LESS THAN 18 x DIAMETERS CAN BE EVALUATED USING APPENDIX D OF ACI 318 INCLUDING ESR-3037.
3.) NOT USED.
4.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.

NOTES CONTINUED:

5.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-3037 (2013).
6.) NOT USED.
7.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
8.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
9.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
10.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
11.) HANGER DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
12.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED, HANGER ROD MAY BE OFF CENTER WHEN USING TWO ANCHORS WITH STRUT.
13.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
14.) NOT USED.
15.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.

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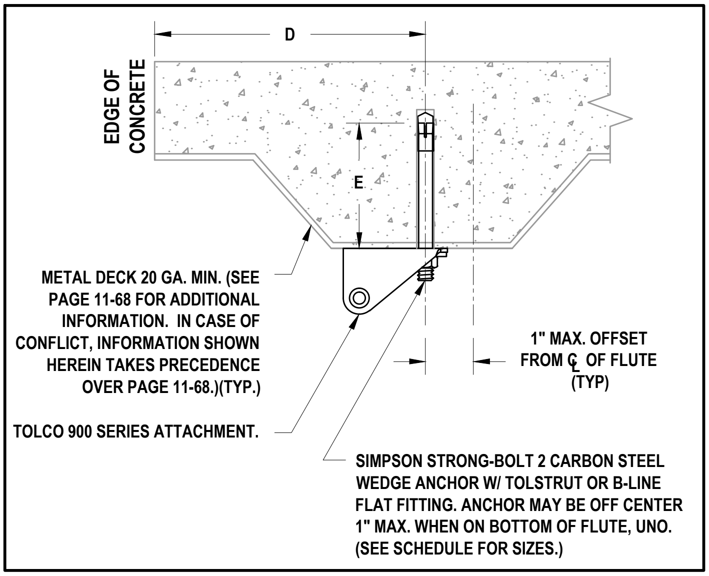
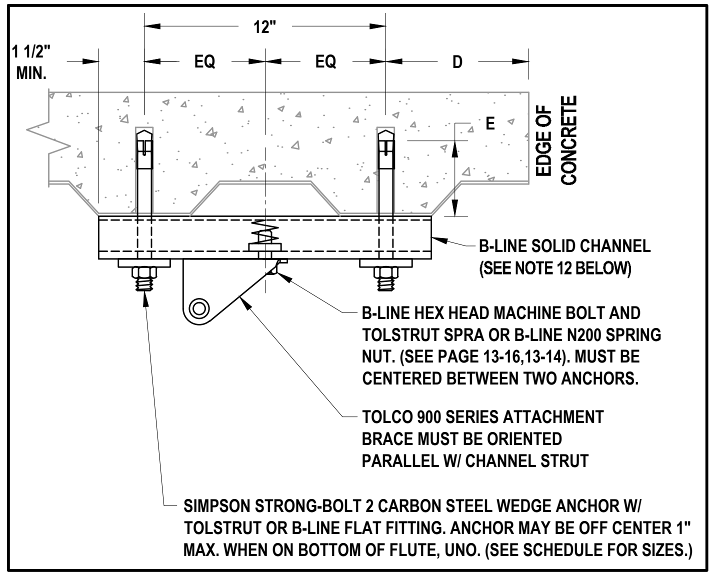
SIMPSON STRONG-BOLT 2 WEDGE ANCHOR IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)





ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL						B-LINE SOLID CHANNEL
				SINGLE (LB)			DOUBLE (LB)			
				0° - 30°	31° - 45°	46° - 60°	0° - 30°	31° - 45°	46° - 60°	
1/2"	2 1/4"	12"	6 3/4"	210	154	105	455	340	237	B22
1/2"	4"	12"	12"	345	238	155	763	537	355	B22
5/8"	2 3/4"	12"	8 1/4"	345	238	155	571	429	300	B22
5/8"	5"	12"	13 1/2"	515	367	242	1050	818	554	B22

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) LOAD VALUES PER ICC ESR-3037 (STRONG-BOLT 2) FOR STRUCTURAL SAND LIGHTWEIGHT CONCRETE (fc = 3,000 PSI) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) SPACING MEASURE PARALLEL TO LOWER FLUTE. MINIMUM SPACING DOES NOT APPLY TO ANCHORS PLACE IN ADJACENT FLUTES.
3.) NOT USED.
4.) ANCHORS MAY BE OFFSET 1" FROM THE CENTERLINE OF LOWER FLUTE.
5.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
6.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-3037 (2013).
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

NOTES CONTINUED:

8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER.
10.) NOT USED
11.) NOT USED.
12.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
13.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.
14.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-3037 (2013). REFER TO METAL DECK DIMENSIONS SHOWN ABOVE.

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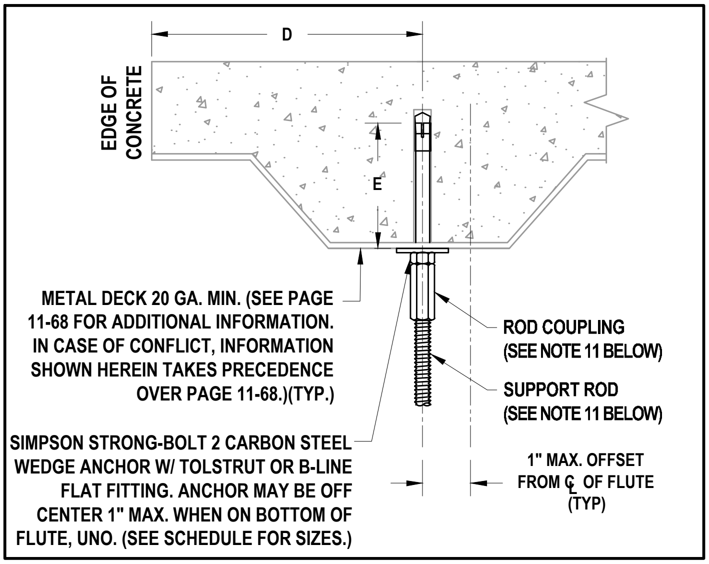
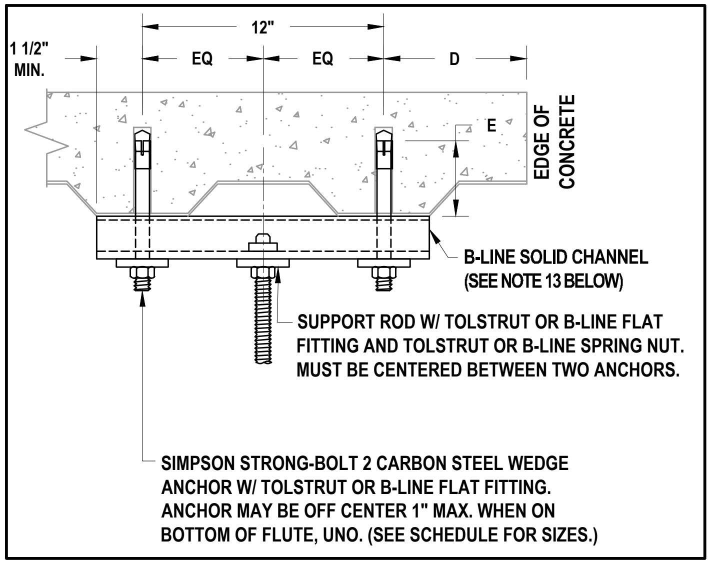
SIMPSON STRONG-BOLT 2 WEDGE ANCHOR IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)





ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	ALLOWABLE STRENGTH DESIGN (ASD) MAX. VERTICAL LOAD SINGLE (LB)	DOUBLE (LB)	B-LINE SOLID CHANNEL
1/2"	2 1/4"	12"	6 3/4"	293	585	B-22
1/2"	4"	12"	12"	393	780	B-22
5/8"	2 3/4"	12"	8 1/4"	375	750	B-22
5/8"	4 1/2"	12"	13 1/2"	640	1280	B-22

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω_0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) LOAD VALUES PER ICC ESR-3037 (STRONG-BOLT 2) FOR STRUCTURAL SAND LIGHTWEIGHT CONCRETE (fc = 3,000 PSI) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) SPACING MEASURE PARALLEL TO LOWER FLUTE. MINIMUM SPACING DOES NOT APPLY TO ANCHORS PLACE IN ADJACENT FLUTES.
3.) ANCHORS MAY BE OFFSET 1" FROM THE CENTERLINE OF LOWER FLUTE
4.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
5.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-3037 (2013).

NOTES CONTINUED:

6.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
7.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
8.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
9.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED, HANGER ROD MAY BE OFF CENTER WHEN USING TWO ANCHORS WITH STRUT.
10.) NOT USED.
11.) NOT USED.
12.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
13.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.
14.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-3037 (2013). REFER TO METAL DECK DIMENSIONS SHOWN ABOVE.

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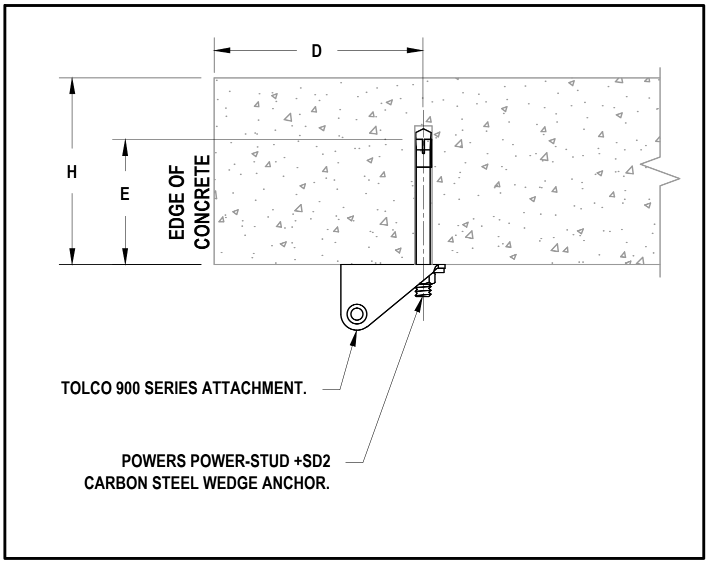
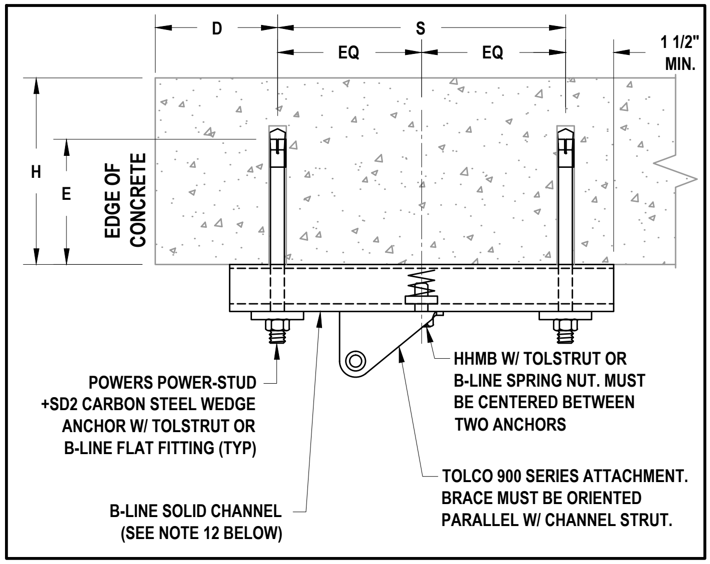
POWERS POWER-STUD +SD2 WEDGE ANCHORS IN 4,000 PSI NORMAL WEIGHT CONCRETE





ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	'S' MIN. SPACING BETWEEN ANCHORS (16" MAX)	'H' MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL						B-LINE SOLID CHANNEL
					SINGLE (LB)			DOUBLE (LB)			
					0° - 30°	31° - 45°	46° - 60°	0° - 30°	31° - 45°	46° - 60°	
3/8"	2"	6 1/2"	12"	4"	225	170	120	350	345	270	B22
1/2"	2"	8"	12"	4 1/2"	280	210	147	600	463	332	B22
1/2"	3 1/4"	10"	12"	5 3/4"	535	400	275	777	695	523	B22
5/8"	3 1/4"	8"	12"	5 3/4"	530	407	292	1013	760	536	B22
5/8"	4 1/4"	15 3/4"	12"	6 1/2"	680	492	330	1013	760	536	B22
3/4"	3 3/4"	12"	12"	7"	760	565	390	1013	760	536	B22
3/4"	5"	12"	12"	10"	845	645	460	1013	760	536	B22

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN STONE AGGREGATE CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 4,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-2502 (POWERS POWER-STUD SD+2 EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-2502 (2012).
4.) NOT USED.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.

NOTES CONTINUED:

6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) NOT USED
10.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER.
11.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.

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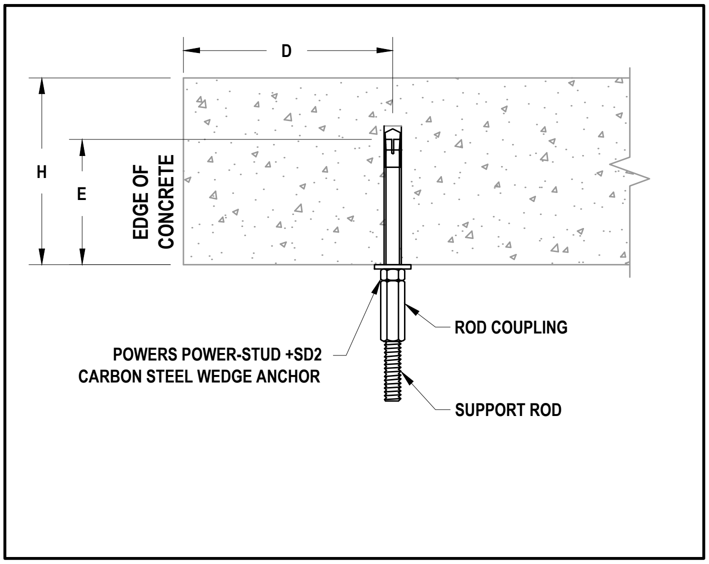
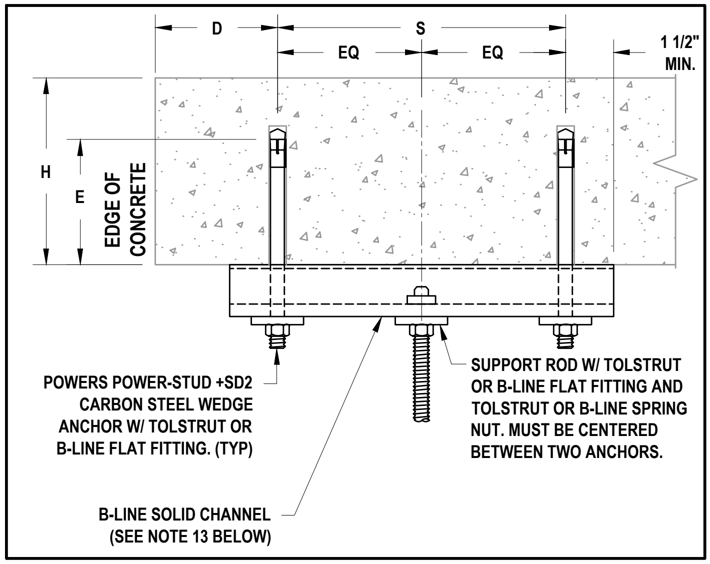
POWERS POWER-STUD +SD2 WEDGE ANCHORS IN 4,000 PSI NORMAL WEIGHT CONCRETE





ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	'S' MIN. SPACING BETWEEN ANCHORS (16" MAX)	'H' MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD) MAX. VERTICAL LOAD (LB) SINGLE (LB)	DOUBLE (LB)	B-LINE SOLID CHANNEL
3/8"	2"	6 1/2"	12"	4"	363	725	B22
1/2"	2"	8"	12"	4 1/2"	435	725	B22
1/2"	3 1/4"	10"	12"	5 3/4"	797	725	B22
5/8"	3 1/4"	8"	12"	5 3/4"	900	1760	B22
5/8"	4 1/4"	15 3/4"	12"	6 1/2"	905	1760	B22
3/4"	3 3/4"	12"	12"	7"	1115	1760	B22
3/4"	5"	12"	12"	10"	1410	1760	B22

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN STONE AGGREGATE CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 4,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-2502 (POWERS POWER-STUD SD+2 EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-2502 (2012)
4.) NOT USED.

NOTES CONTINUED:

5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
10.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED HANGER ROD MAY BE OFF CENTER WHEN USING TWO ANCHORS WITH STRUT.
11.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
12.) NOT USED.
13.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.

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DATE: NOVEMBER 29, 2016

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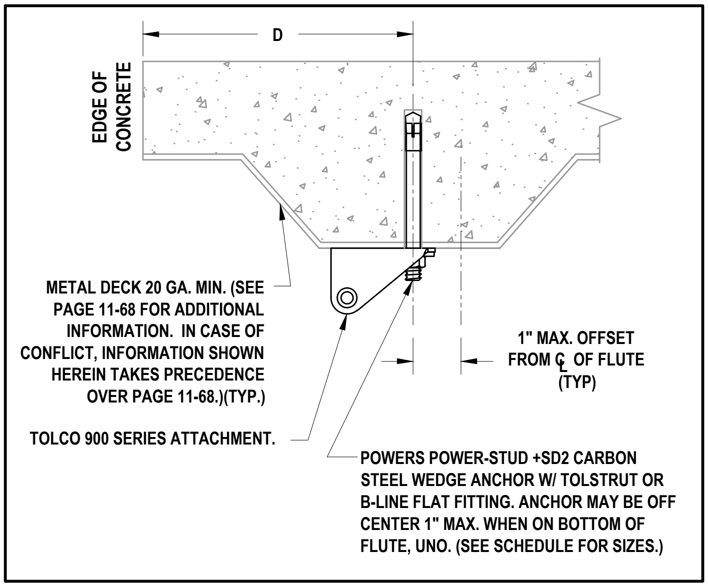
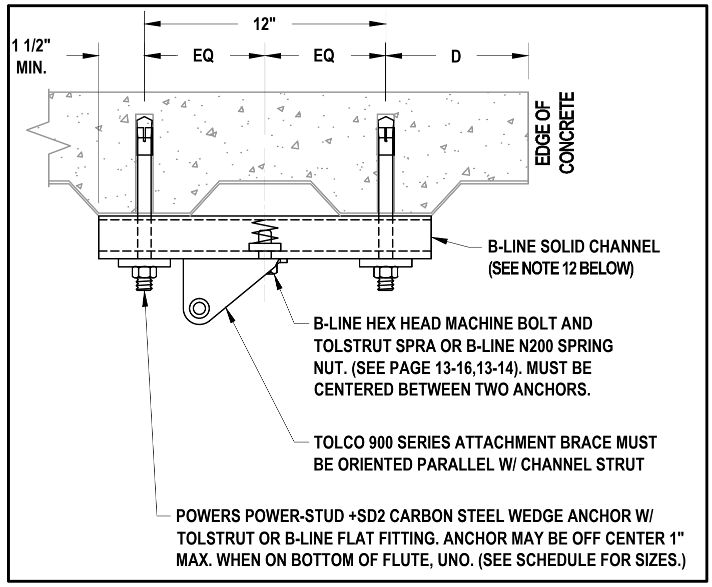
POWERS POWER-STUD +SD2 WEDGE ANCHOR IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)





ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL						B-LINE SOLID CHANNEL
				SINGLE (LB)			DOUBLE (LB)			
				0° - 30°	31° - 45°	46° - 60°	0° - 30°	31° - 45°	46° - 60°	
3/8"	2"	6 1/2"	12"	175	122	80	350	275	183	B-22
1/2"	2"	8"	12"	222	144	89	500	330	208	B-22
1/2"	3 1/4"	10"	12"	360	242	153	777	550	353	B-22
5/8"	3 1/4"	8"	12"	315	235	163	675	515	368	B-22
5/8"	4 1/4"	15 3/4"	12"	413	290	192	908	650	438	B-22
3/4"	3 3/4"	12"	12"	330	246	172	710	545	385	B-22
3/4"	5"	12"	12"	330	246	172	710	545	385	B-22

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-2502 (POWERS POWER-STUD SD+2 EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-2502 (2012)
4.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-2502 (2012). REFER TO METAL DECK DIMENSIONS SHOWN ABOVE.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.

NOTES CONTINUED:

6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) NOT USED
10.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER.
11.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
12.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.

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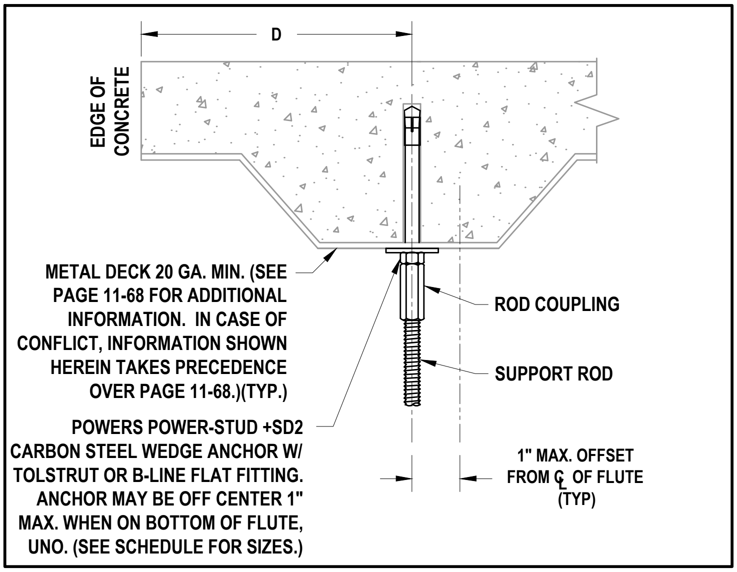
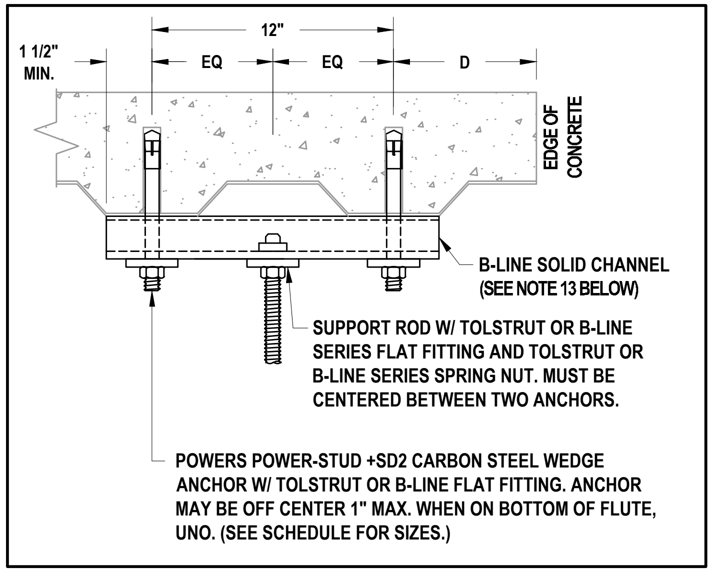
POWERS POWER-STUD +SD2 WEDGE ANCHOR IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)





ANCHOR DIA.	'E' MIN. EFFECTIVE EMBED. DEPTH h_{ef}	'D' MIN. EDGE DISTANCE	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	ALLOWABLE STRENGTH DESIGN (ASD) MAX. VERTICAL LOAD		B-LINE SOLID CHANNEL
				SINGLE (LB)	DOUBLE (LB)	
3/8"	2"	6 1/2"	12"	208	415	B22
1/2"	2"	8"	12"	210	420	B22
1/2"	3 1/4"	10"	12"	373	745	B22
5/8"	3 1/4"	8"	12"	473	950	B22
5/8"	4 1/4"	15 3/4"	12"	500	1000	B22
3/4"	3 3/4"	12"	12"	500	1000	B22
3/4"	5"	12"	12"	500	1000	B22

MAX. LOAD INCLUDES OVER STRENGTH FACTOR $\Omega 0=2.5$ PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

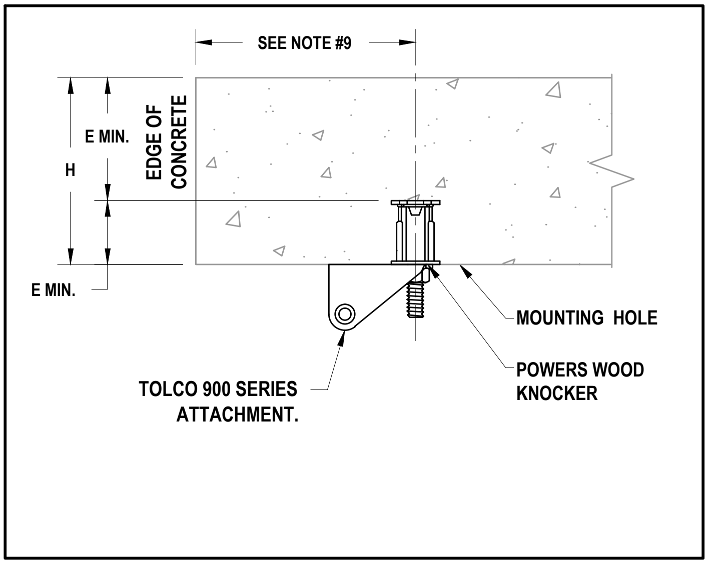
1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-2502 (POWERS POWER-STUD SD+2 EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-66 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-2502 (2012)

NOTES CONTINUED:

4.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-2502 (2012). REFER TO METAL DECK DIMENSIONS SHOWN ABOVE.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE. LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
10.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED, HANGER ROD MAY BE OFF CENTER WHEN USING TWO ANCHORS WITH STRUT.
11.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
12.) NOT USED.
13.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
14.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.

MH

POWERS WOOD KNOCKER CONCRETE DECK INSERT IN 4,000 PSI NORMAL WEIGHT CONCRETE



ANCHOR DIAMETER	'E' EFFECTIVE EMBEDMENT DEPTH	'H' MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZ. (LB)		
			0° - 30°	31° - 45°	46° - 60°
3/8"	1 3/4"	3 1/2"	465	370	275
1/2"	1 3/4"	3 1/2"	658	483	330
5/8"	1 3/4"	3 1/2"	685	500	338
3/4"	1 3/4"	3 1/2"	685	500	338

MAX. LOAD INCLUDES OVER STRENGTH FACTOR $\Omega 0=2.5$ PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) WOOD-KNOCKER INSERTS MUST BE POSITIONED ON WOOD OR SIMILAR FORMWORK WITH ALL THREE NAILS IN CONTACT WITH THE FORM. THE HEAD OF THE WOOD-KNOCKER MUST BE IMPACTED WITH SUFFICIENT FORCE TO DRIVE NAILS ALL THE WAY INTO THE FORMWORK UNTIL THE PLASTIC BASE SITS FLUSH AND TIGHT AGAINST THE FORM.
2.) ALLOWABLE LOADS ARE FOR 4,000 PSI NORMAL WEIGHT CONCRETE.
3.) MINIMUM CONCRETE THICKNESS OF 2 TIMES THE EFFECTIVE EMBEDMENT DEPTH, OR THE EMBEDMENT DEPTH PLUS THREE TIMES THE DIAMETER, WHICHEVER IS GREATER, SHALL BE PROVIDED, UNLESS NOTED OTHERWISE.
4.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
5.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS AND ANCHOR EMBEDMENT. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.

NOTES CONTINUED:

6.) MINIMUM SPACING BETWEEN THE INSERTS SHALL BE 3 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER (WHICH EVER IS GREATER), UNLESS NOTED OTHERWISE.
7.) POWERS WOOD KNOCKER IS A CAST-IN-PLACE ANCHOR BOLT AND COMPLIES WITH ACI 318 APPENDIX D AND DOES NOT REQUIRE ADDITIONAL TESTING CERTIFICATION.
8.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER.
9.) MINIMUM EDGE DISTANCE SHALL BE 1.5 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER WHICHEVER IS GREATER, UNLESS NOTED OTHERWISE.
10.) FOLLOW ALL WOOD KNOCKER INSTALLATION REQUIREMENTS PER ICC-ESR 3657.

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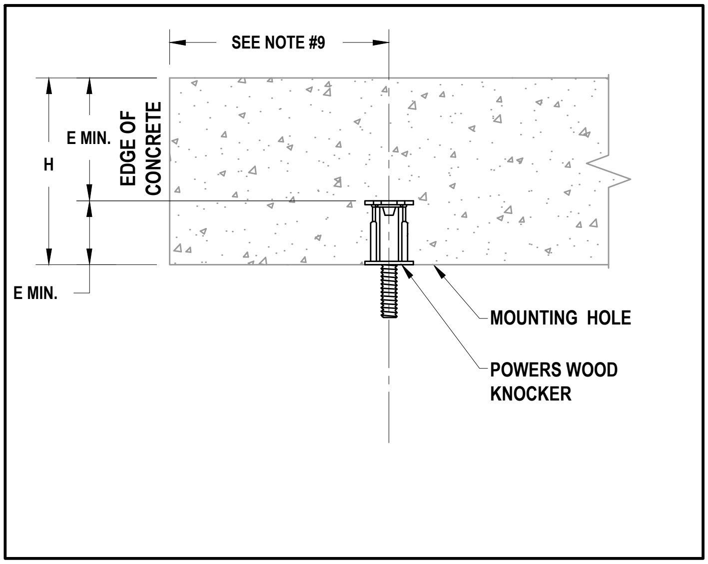
MH

POWERS WOOD KNOCKER CONCRETE DECK INSERT IN 4,000 PSI NORMAL WEIGHT CONCRETE



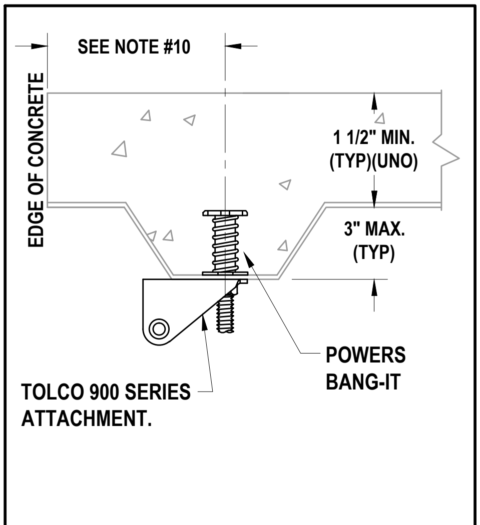
ANCHOR DIAMETER	'E' EFFECTIVE EMBEDMENT DEPTH	'H' MIN. BASE MATERIAL THICKNESS	ALLOWABLE STRENGTH DESIGN (ASD)
			MAX. VERTICAL LOAD (LB)
3/8"	1 3/4"	3 1/2"	885
1/2"	1 3/4"	3 1/2"	885
5/8"	1 3/4"	3 1/2"	885
3/4"	1 3/4"	3 1/2"	885

MAX. LOAD INCLUDES OVER STRENGTH FACTOR $\Omega 0$=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

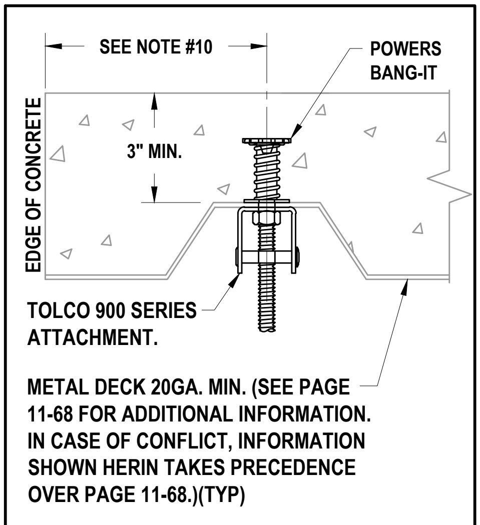
NOTES:

1.) WOOD-KNOCKER INSERTS MUST BE POSITIONED ON WOOD OR SIMILAR FORMWORK WITH ALL THREE NAILS IN CONTACT WITH THE FORM. THE HEAD OF THE WOOD-KNOCKER MUST BE IMPACTED WITH SUFFICIENT FORCE TO DRIVE NAILS ALL THE WAY INTO THE FORMWORK UNTIL THE PLASTIC BASE SITS FLUSH AND TIGHT AGAINST THE FORM.
2.) ALLOWABLE LOADS ARE FOR 4,000 PSI NORMAL WEIGHT CONCRETE.
3.) MINIMUM CONCRETE THICKNESS OF 3 TIMES THE EFFECTIVE EMBEDMENT DEPTH, OR THE EMBEDMENT DEPTH PLUS THREE TIMES THE DIAMETER, WHICHEVER IS GREATER, SHALL BE PROVIDED.
4.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
5.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS AND ANCHOR EMBEDMENT. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
6.) MINIMUM SPACING BETWEEN THE INSERTS SHALL BE 3 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER (WHICH EVER IS GREATER), UNLESS NOTED OTHERWISE.
7.) POWERS WOOD KNOCKER IS A CAST-IN-PLACE ANCHOR BOLT AND COMPLIES WITH ACI 318 APPENDIX D AND DOES NOT REQUIRE ADDITIONAL TESTING CERTIFICATION.
8.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR MORE THAN THE ANCHOR DIAMETER.
9.) MINIMUM EDGE DISTANCE SHALL BE 1.5 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER WHICHEVER IS GREATER, UNLESS NOTED OTHERWISE.
10.) FOLLOW ALL WOOD KNOCKER INSTALLATION REQUIREMENTS PER ICC-ESR 3657.

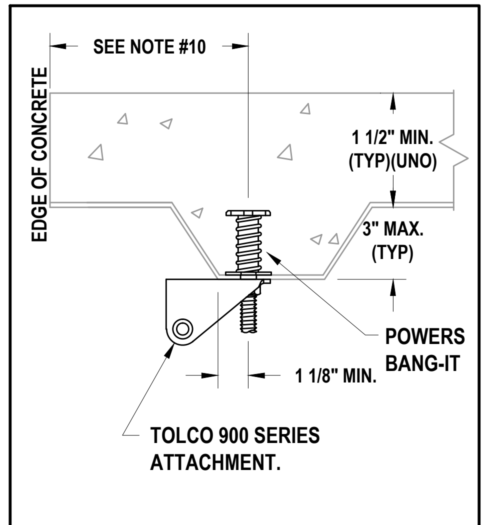
POWERS BANG-IT CONCRETE DECK INSERT IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)



LOWER FLUTE



UPPER FLUTE



LOWER FLUTE

ANCHOR DIAMETER	MIN. ANCHOR EFFECTIVE DEPTH	ALLOWABLE STRENGTH DESIGN (ASD) UPPER FLUTE MAX. HORIZONTAL LOAD (LB) BRACE ANGLE MEASURED FROM HORIZ. 0° - 30°	UPPER FLUTE 31° - 45°	UPPER FLUTE 46° - 60°	LOWER FLUTE MAX. HORIZONTAL LOAD (LB) BRACE ANGLE MEASURED FROM HORIZ. 0° - 30°	LOWER FLUTE 31° - 45°	LOWER FLUTE 46° - 60°
3/8"	1 3/4"	413	315	224	330	235	158
1/2"	1 3/4"	435	328	230	343	243	162
5/8"	1 3/4"	478	351	242	368	255	167
3/4"	1 3/4"	478	351	242	368	255	167

MAX. LOAD INCLUDES OVER STRENGTH FACTOR $\Omega 0=2.5$ PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE.
2.) CALIFORNIA BUILDING CODE STATES: "ALL BOLTS SHALL BE ACCURATELY AND SECURELY SET PRIOR TO PLACEMENT OF CONCRETE..." NAILS OR SCREWS MAY BE USED. TYPICAL FOR ALL APPLICATIONS.
3.) A HOLE MUST BE MADE IN THE STEEL DECK USING A STEP-DRILL, HOLE SAW, DECK PUNCH OR EQUIVALENT IN ACCORDANCE WITH THE ANCHOR DIAMETER.
4.) THE BANG-IT PLATIC SLEEVE MUST BE PLACED IN THE HOLE, AND FOLLOWING THIS, THE HEAD OF THE INSERT MUST BE IMPACTED WITH SUFFICIENT FORCE TO COMPRESS THE OUTER SPRING AND DRIVE THE FLARED PLASTIC FINS OF THE SLEEVE COMPLETELY THROUGH THE HOLE IN THE STEEL DECK. THE BANG-IT METAL BASE PLATE MAY BE SCREWED TO THE DECK FOR ADDITIONAL STABILITY (OPTIONAL).
5.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

NOTES CONTINUED:

6.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS AND ANCHOR EMBEDMENT. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
7.) MINIMUM SPACING BETWEEN INSERTS SHALL BE 3 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER (WHICH EVER IS GREATER), UNLESS NOTED OTHERWISE.
8.) POWERS BANG-IT IS A CAST-IN-PLACE ANCHOR BOLT AND COMPLIES WITH ACI 318 APPENDIX D AND DOES NOT REQUIRE ADDITIONAL TESTING - CERTIFICATION.
9.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER.
10.) MINIMUM EDGE DISTANCE SHALL BE 1.5 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER WHICHEVER IS GREATER, UNLESS NOTED OTHERWISE.
11.) FOLLOW ALL BANG-IT INSTALLATION REQUIREMENTS PER ICC-ESR 3657.

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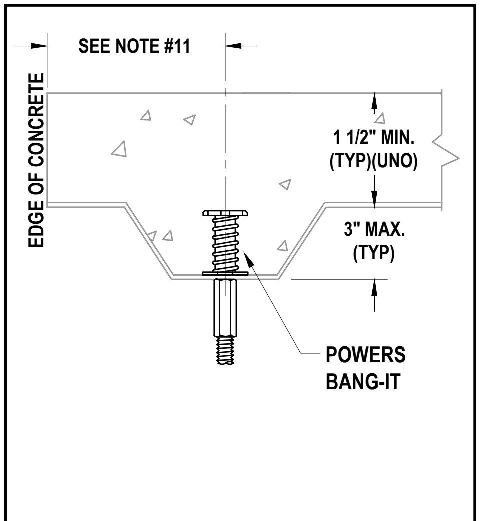
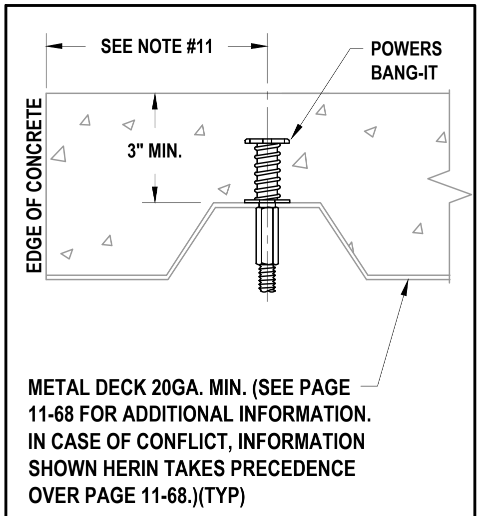
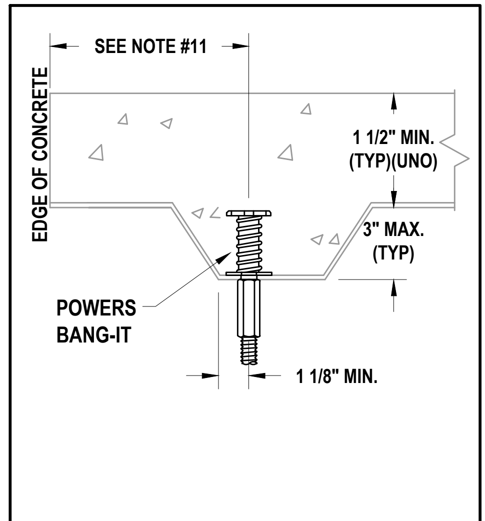
POWERS BANG-IT CONCRETE DECK INSERT IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)



LOWER FLUTE



UPPER FLUTE



LOWER FLUTE

ANCHOR DIAMETER	MIN. ANCHOR EMBEDMENT DEPTH	ALLOWABLE STRENGTH DESIGN (ASD)	
		UPPER FLUTE MAX. VERTICAL LOAD (LB)	LOWER FLUTE MAX. VERTICAL LOAD (LB)
3/8"	1 3/4"	650	405
1/2"	1 3/4"	650	405
5/8"	1 3/4"	650	405
3/4"	1 3/4"	650	405

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE.
2.) CALIFORNIA BUILDING CODE STATES: "ALL BOLTS SHALL BE ACCURATELY AND SECURELY SET PRIOR TO PLACEMENT OF CONCRETE..." NAILS OR STRUT MAY BE USED. TYPICAL FOR ALL APPLICATIONS.
3.) A HOLE MUST BE MADE IN THE STEEL DECK USING A STEP-DRILL, HOLE SAW, DECK PUNCH OR EQUIVALENT IN ACCORDANCE WITH THE ANCHOR DIAMETER.
4.) THE BANG-IT PLATIC SLEEVE MUST BE PLACED IN THE HOLE, AND FOLLOWING THIS, THE HEAD OF THE INSERT MUST BE IMPACTED WITH SUFFICIENT FORCE TO COMPRESS THE OUTER SPRING AND DRIVE THE FLARED PLASTIC FINS OF THE SLEEVE COMPLETELY THROUGH THE HOLE IN THE STEEL DECK. THE BANG-IT METAL BASE PLATE MAY BE SCREWED TO THE DECK FOR ADDITIONAL STABILITY (OPTIONAL).
5.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
6.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS AND ANCHOR EMBEDMENT. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
7.) MINIMUM SPACING BETWEEN INSERTS SHALL BE 3 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER (WHICH EVER IS GREATER), UNLESS NOTED OTHERWISE.
8.) POWERS BANG-IT IS A CAST-IN-PLACE ANCHOR BOLT AND COMPLIES WITH ACI 318 APPENDIX D AND DOES NOT REQUIRE ADDITIONAL TESTING - CERTIFICATION.
9.) ROD COUPLING DOES NOT NEED TO BE TIGHT UP AGAINST THE UNDERSIDE OF THE DECK.
10.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR MORE THAN THE ANCHOR DIAMETER.
11.) MINIMUM EDGE DISTANCE SHALL BE 1.5 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER WHICHEVER IS GREATER, UNLESS NOTED OTHERWISE.
12.) FOLLOW ALL BANG-IT INSTALLATION REQUIREMENTS PER ICC-ESR 3657.

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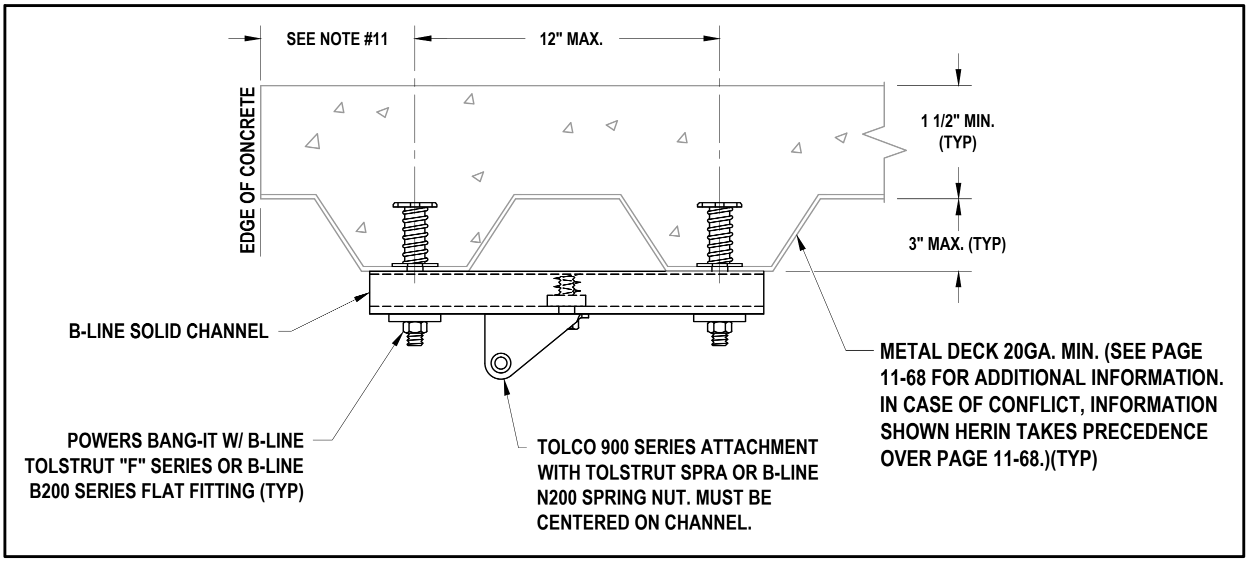
MH

DOUBLE POWERS BANG-IT CONCRETE DECK INSERT IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)



ANCHOR DIAMETER	'E' MIN. ANCHOR EMBEDMENT DEPTH	ALLOWABLE STRENGTH DESIGN (ASD) LOWER FLUTE MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZ. (LB)		
		0° - 30°	31° - 45°	46° - 60°
3/8"	1 3/4"	563	462	354
1/2"	1 3/4"	1046	855	652
5/8"	1 3/4"	1046	855	652
3/4"	1 3/4"	1046	855	652

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE.
2.) CALIFORNIA BUILDING CODE STATES: "ALL BOLTS SHALL BE ACCURATELY AND SECURELY SET PRIOR TO PLACEMENT OF CONCRETE..." NAILS OR SCREWS MAY BE USED. TYPICAL FOR ALL APPLICATIONS.
3.) A HOLE MUST BE MADE IN THE STEEL DECK USING A STEP-DRILL, HOLE SAW, DECK PUNCH OR EQUIVALENT IN ACCORDANCE WITH THE ANCHOR DIAMETER.
4.) THE BANG-IT PLATIC SLEEVE MUST BE PLACED IN THE HOLE, AND FOLLOWING THIS, THE HEAD OF THE INSERT MUST BE IMPACTED WITH SUFFICIENT FORCE TO COMPRESS THE OUTER SPRING AND DRIVE THE FLARED PLASTIC FINS OF THE SLEEVE COMPLETELY THROUGH THE HOLE IN THE STEEL DECK. THE BANG-IT METAL BASE PLATE MAY BE SCREWED TO THE DECK FOR ADDITIONAL STABILITY (OPTIONAL).
5.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

NOTES CONTINUED:

6.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS AND ANCHOR EMBEDMENT. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
7.) MINIMUM SPACING BETWEEN INSERTS SHALL BE 3 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER (WHICH EVER IS GREATER), UNLESS NOTED OTHERWISE.
8.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED,TOLCO 900 SERIES MAY BE OFF CENTER WHEN USING TWO ANCHORS WITH STRUT.
9.) POWERS BANG-IT IS A CAST-IN-PLACE ANCHOR BOLT AND COMPLIES WITH ACI 318 APPENDIX D AND DOES NOT REQUIRE ADDITIONAL TESTING - CERTIFICATION.
10.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR MORE THAN THE ANCHOR DIAMETER.
11.) MINIMUM EDGE DISTANCE SHALL BE 1.5 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER WHICHEVER IS GREATER, UNLESS NOTED OTHERWISE.
12.) FOLLOW ALL BANG-IT INSTALLATION REQUIREMENTS PER ICC-ESR 3657.

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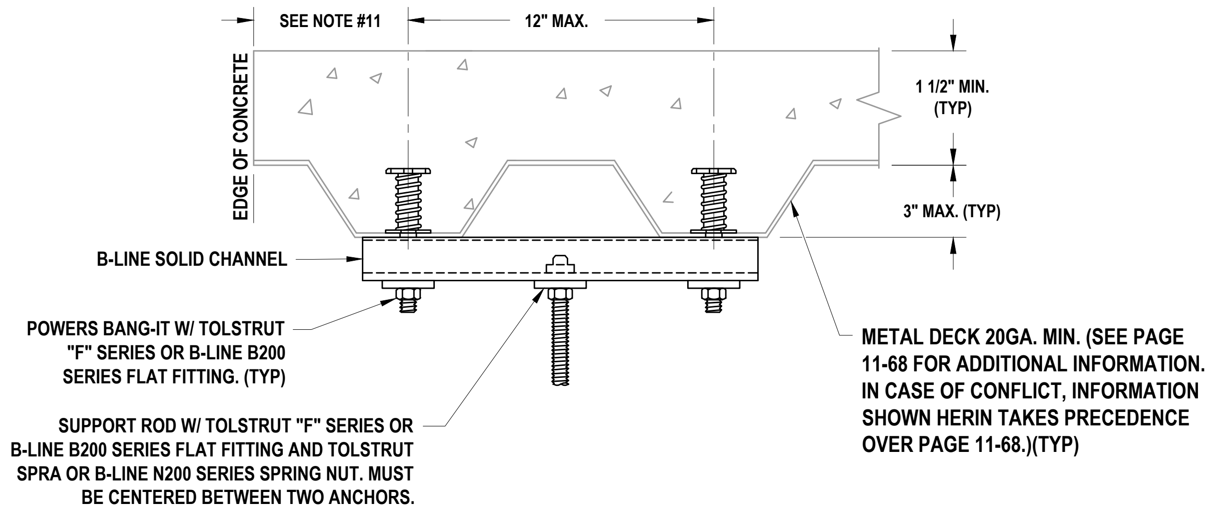
DOUBLE POWERS BANG-IT CONCRETE DECK INSERT IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE OVER METAL DECK - 20 GA (MIN.)



ANCHOR DIAMETER	'E' MIN. ANCHOR EMBEDMENT DEPTH	ALLOWABLE STRENGTH DESIGN (ASD)
		MAX. VERTICAL LOAD (LB)
3/8"	1 3/4"	810
1/2"	1 3/4"	810
5/8"	1 3/4"	810
3/4"	1 3/4"	810

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

NOTES:

1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE.
2.) CALIFORNIA BUILDING CODE STATES: "ALL BOLTS SHALL BE ACCURATELY AND SECURELY SET PRIOR TO PLACEMENT OF CONCRETE..." NAILS OR SCREWS MAY BE USED. TYPICAL FOR ALL APPLICATIONS.
3.) A HOLE MUST BE MADE IN THE STEEL DECK USING A STEP-DRILL, HOLE SAW, DECK PUNCH OR EQUIVALENT IN ACCORDANCE WITH THE ANCHOR DIAMETER.
4.) THE BANG-IT PLATIC SLEEVE MUST BE PLACED IN THE HOLE, AND FOLLOWING THIS, THE HEAD OF THE INSERT MUST BE IMPACTED WITH SUFFICIENT FORCE TO COMPRESS THE OUTER SPRING AND DRIVE THE FLARED PLASTIC FINS OF THE SLEEVE COMPLETELY THROUGH THE HOLE IN THE STEEL DECK. THE BANG-IT METAL BASE PLATE MAY BE SCREWED TO THE DECK FOR ADDITIONAL STABILITY (OPTIONAL).
5.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
6.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS AND ANCHOR EMBEDMENT. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
7.) MINIMUM SPACING BETWEEN INSERTS SHALL BE 3 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER (WHICH EVER IS GREATER), UNLESS NOTED OTHERWISE.
8.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED, HANGER ROD MAY BE OFF CENTER WHEN USING TWO ANCHORS WITH STRUT.
9.) POWERS BANG-IT IS A CAST-IN-PLACE ANCHOR BOLT AND COMPLIES WITH ACI 318 APPENDIX D AND DOES NOT REQUIRE ADDITIONAL TESTING - CERTIFICATION.
10.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
11.) MINIMUM EDGE DISTANCE SHALL BE 1.5 TIMES THE EMBEDMENT DEPTH OR 6 TIMES THE ANCHOR DIAMETER WHICHEVER IS GREATER, UNLESS NOTED OTHERWISE.
12.) FOLLOW ALL BANG-IT INSTALLATION REQUIREMENTS PER ICC-ESR 3657.

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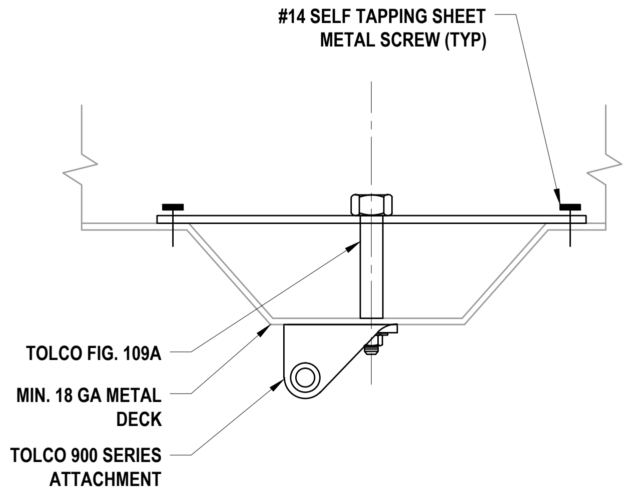
TOLCO FIG. 109A DECK INSERT INTO UNFILLED MIN. 18 GA. METAL DECK



ANCHOR DIA.	ALLOWABLE STRENGTH DESIGN (ASD)		
	MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL (LB)		
	0° - 30°	31° - 45°	46° - 60°
1/2"	100	100	100

NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
2.) TOLCO 900 SERIES ATTACHMENT DIAMETER SHALL BE EQUAL TO THE ANCHOR DIAMETER.

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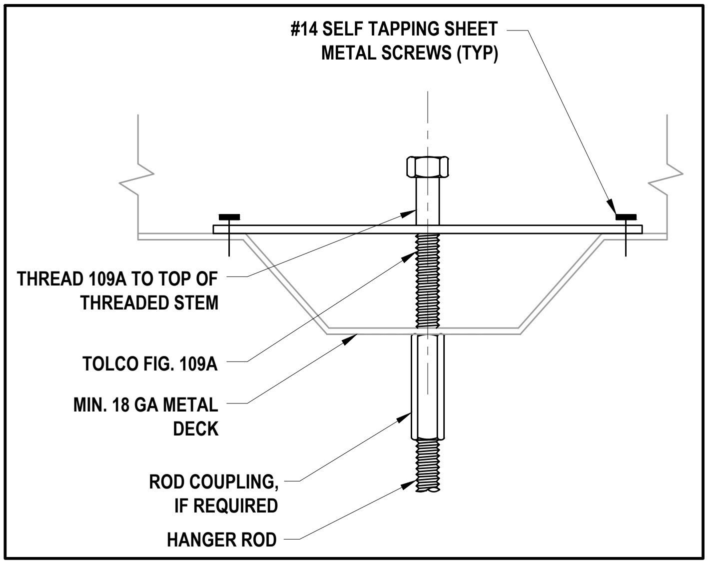
TOLCO FIG. 109A DECK INSERT INTO UNFILLED MIN. 18 GA. METAL DECK



ANCHOR DIAMETER	ALLOWABLE STRENGTH DESIGN (ASD)
	MAX. VERTICAL LOAD (LB)
1/2"	100

NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
2.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
3.) MAX. VERTICAL LOAD INTENDED TO INCLUDE VERTICAL SEISMIC LOADS.

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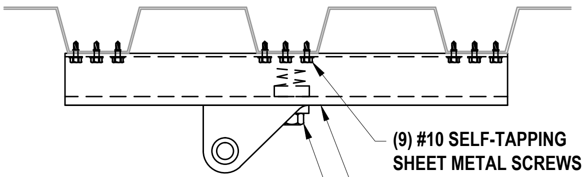
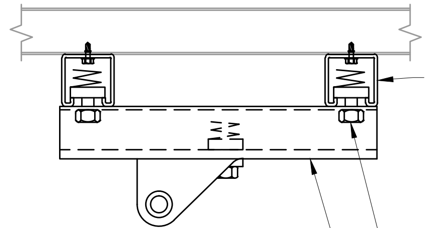
SCREWS TO 18 GA. MIN. METAL DECK WITH NO CONCRETE FILL

SHOWN WITH 900 SERIES ATTACHMENT PERPENDICULAR TO FLUTES



SHOWN WITH 900 SERIES ATTACHMENT PARALLEL TO FLUTES



ALLOWABLE STRENGTH DESIGN (ASD)					
MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL (LB)					
PERPENDICULAR			PARALLEL		
0° - 30°	31° - 45°	46° - 60°	0° - 30°	31° - 45°	46° - 60°
100	100	100	100	100	100

NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
2.) STRUT NUTS MAY BE USED INSTEAD OF SPRING NUTS AS SHOWN.
3.) SCREWS SHALL BE 1" MIN. LONG.
4.) SCREWS SHALL BE SPACED AT 1/4" MINIMUM SPACING.
5.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.

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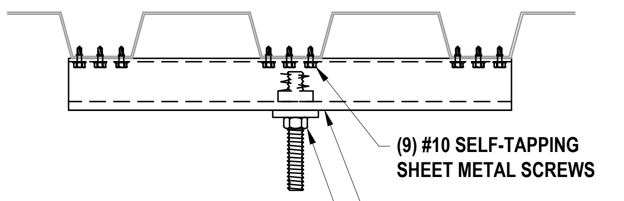
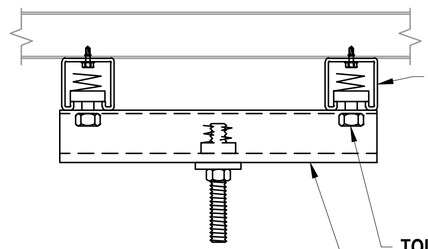
SCREWS TO 18 GA. MIN. METAL DECK WITH NO CONCRETE FILL

SHOWN WITH 900 SERIES ATTACHMENT PERPENDICULAR TO FLUTES



SHOWN WITH 900 SERIES ATTACHMENT PARALLEL TO FLUTES



ALLOWABLE STRENGTH DESIGN (ASD)	
MAX. VERTICAL LOAD (LB)	
PERPENDICULAR	PARALLEL
100	100

NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
2.) STRUT NUTS MAY BE USED INSTEAD OF SPRING NUTS AS SHOWN.
3.) SCREWS SHALL BE 1" MIN. LONG.
4.) SCREWS SHALL BE SPACED AT 5/8" MINIMUM SPACING WITH 3/8" MIN. EDGE DISTANCE.
5.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
6.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.

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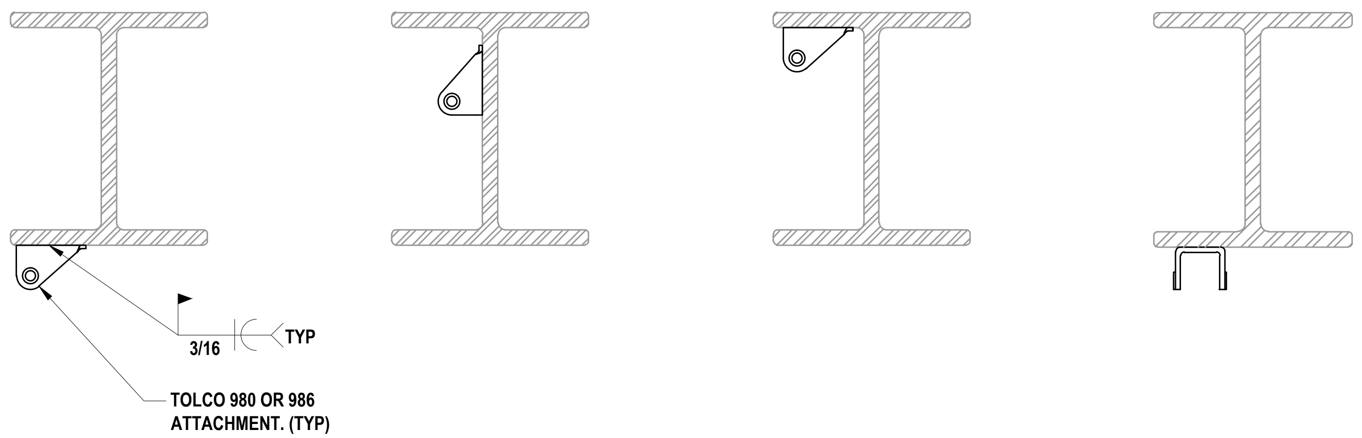
WELD TO STEEL



MIN. WELD	ALLOWABLE STRENGTH DESIGN (ASD)		
	MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL (LB)		
	0° - 30°	31° - 45°	46° - 60°
3/16"	1155	1220	1250

* LOAD GOVERNED BY TOLCO 980 OR 986 ATTACHMENT.

NOTES:

1.) ALL STRUCTURAL STEEL SHALL BE A36 OR EQUAL
2.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STRUCTURE TO RESIST ALL BRACE LOADS.
3.) WELDING SHALL BE DONE BY ELECTRIC SHIELDED ARC PROCESS USING E-70XX ELECTRODES.
4.) ALL WELDING SHALL BE PERFORMED BY A CERTIFIED WELDER.
5.) ALL WELDS SHALL BE IN CONFORMANCE WITH THE LATEST EDITION OF THE STRUCTURAL WELDING CODE OF THE AMERICAN WELDING SOCIETY.
6.) CONTINUOUS INSPECTION IS REQUIRED FOR ALL WELDING.
7.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)

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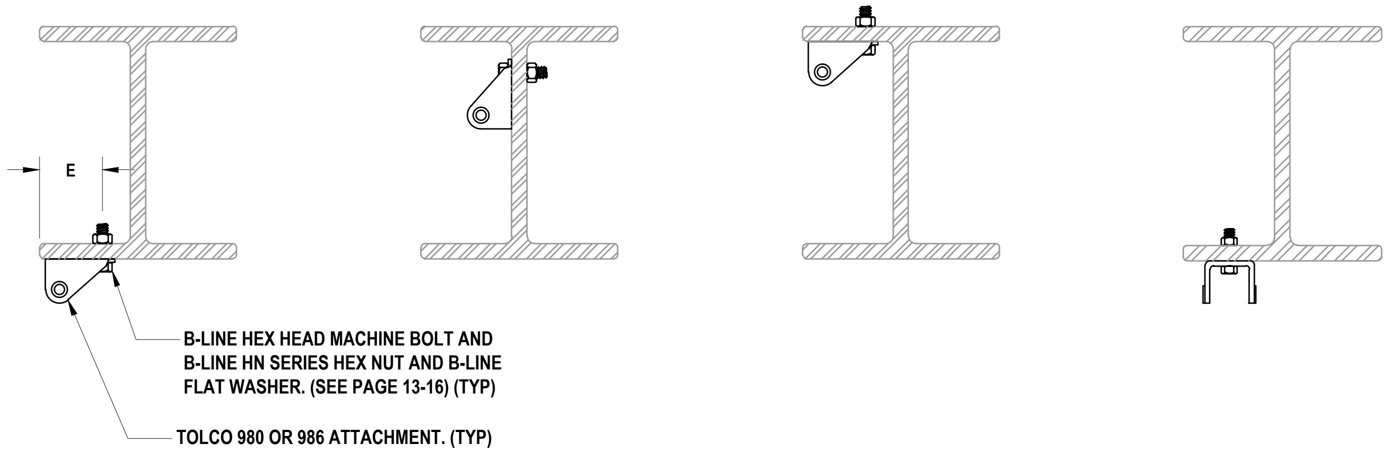
BOLT TO STEEL



BOLT DIA.	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL (LB)			'E' MIN. EDGE DISTANCE
	0° - 30°	31° - 45°	46° - 60°	
3/8"	500	500	500	1"
1/2"	800	800	800	1"
5/8"	1200	1200	1200	1 1/2"
3/4"	1320	1320	1320	1 1/2"

* LOAD GOVERNED BY TOLCO 980 OR 986 ATTACHMENT.

NOTES:

1.) ALL STRUCTURAL STEEL SHALL BE A36 OR EQUAL
2.) FASTENERS SHALL BE A307 BOLTS OR BETTER
3.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STRUCTURE TO RESIST ALL BRACE LOADS.
4.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTION ZONES. (SEE AISC 341, SECTION 7.4).

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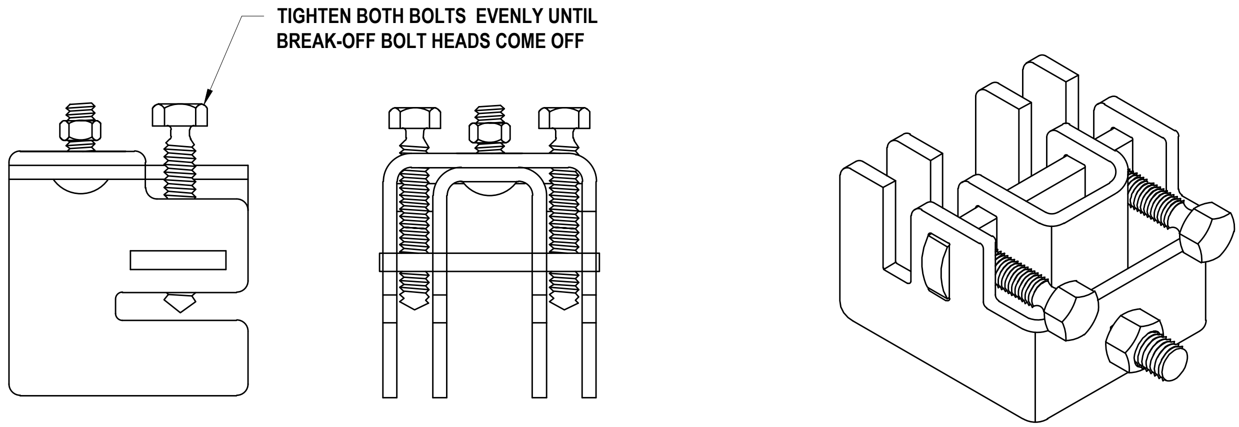
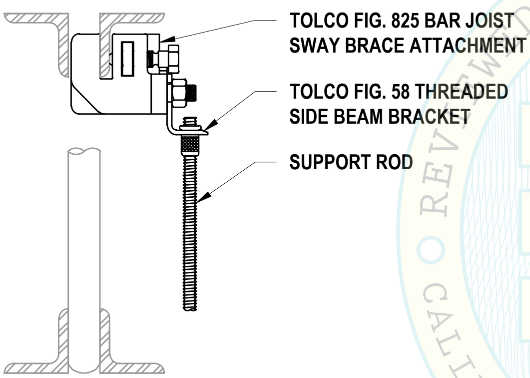
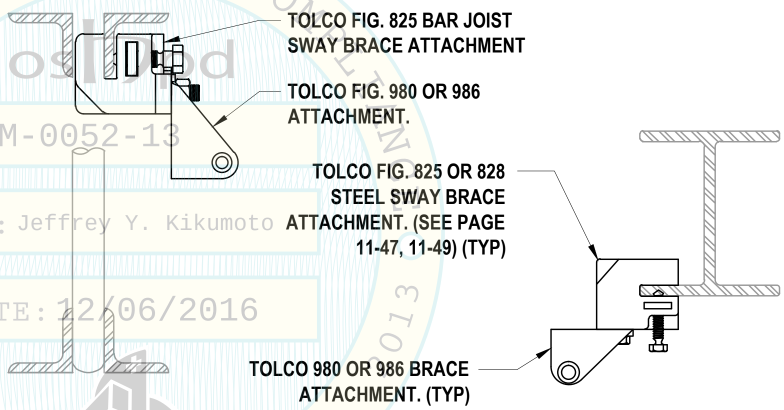
TOLCO FIG. 825 BAR JOIST ATTACHMENT



HANGER ASSEMBLY CONFIGURATION



SEISMIC BRACE ASSEMBLY CONFIGURATION



ORIENTATION	ALLOWABLE STRENGTH DESIGN (ASD)		
	MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL (LB)		
	0° - 30°	31° - 45°	46° - 60°
PERPENDICULAR TO BEAM	990	990	990
PARALLEL TO BEAM	460	460	460

FM APPROVED WHEN USED WITH 1", 1-1/4", 1-1/2", OR 2" SCH. 40,
GB/T 3091, EN 10255H, OR JIS G3454 STEEL PIPE AS THE BRACE MEMBER.

NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
2.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
3.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)
4.) PRODUCT COMES WITH 1/2" STUD TO CONNECT SWIVEL SWAY BRACE ATTACHMENT. FOR FIG. 980, MUST USE PART NUMBER Y341000*.

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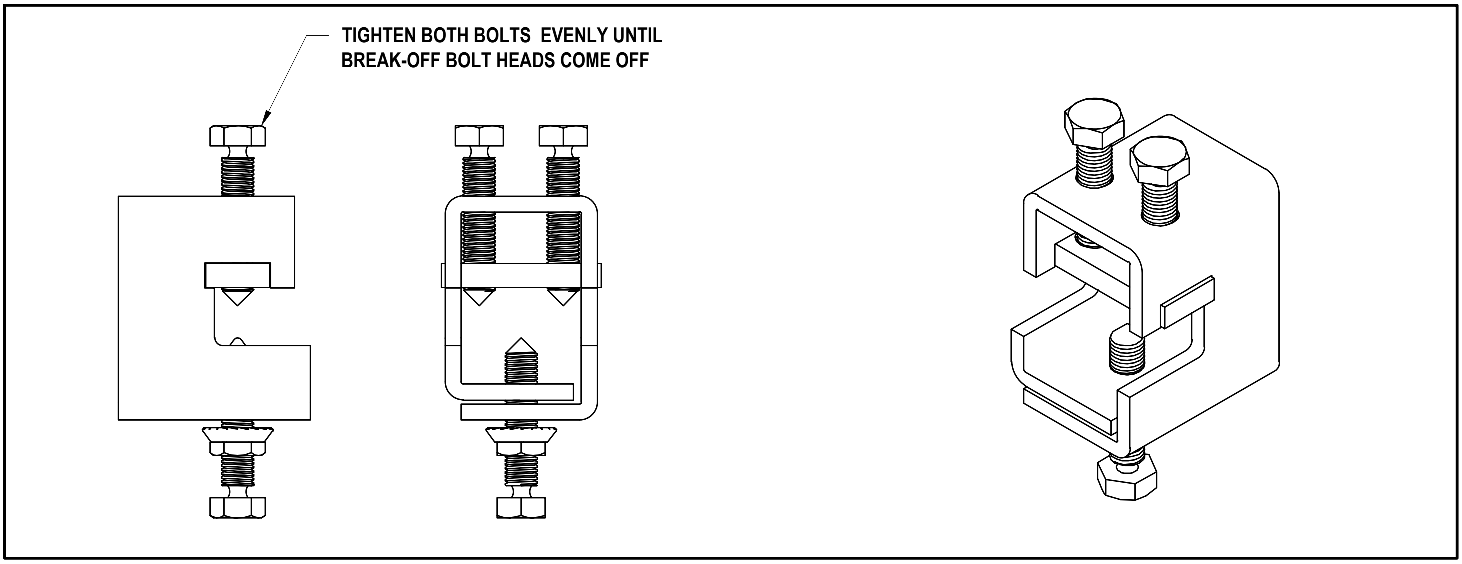
TOLCO FIG. 828 BAR JOIST/BEAM ATTACHMENT

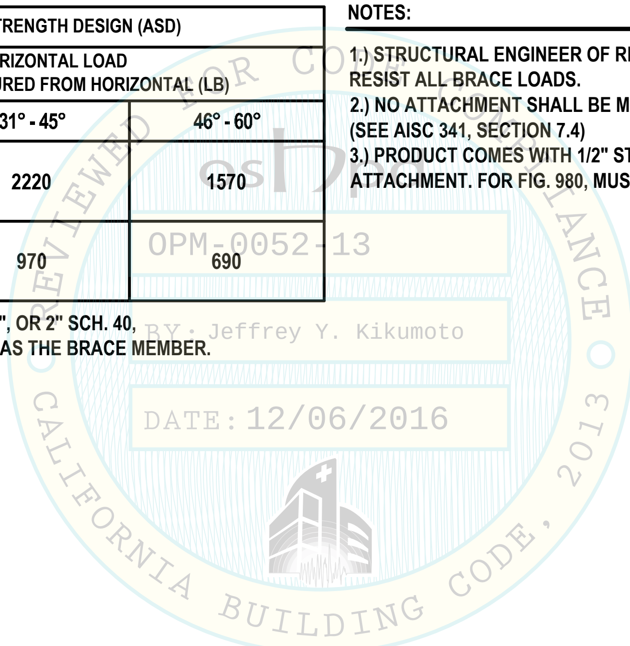


ORIENTATION	ALLOWABLE STRENGTH DESIGN (ASD)		
	MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL (LB)		
	0° - 30°	31° - 45°	46° - 60°
PERPENDICULAR TO BEAM	1210	2220	1570
PARALLEL TO BEAM	1210	970	690

FM APPROVED WHEN USED WITH 1", 1-1/4", 1-1/2", OR 2" SCH. 40,
GB/T 3091, EN 10255H, OR JIS G3454 STEEL PIPE AS THE BRACE MEMBER.

NOTES:

1.) STRUCTURAL ENGINEER OF RECORD TO VERIFY ADEQUACY OF JOIST TO RESIST ALL BRACE LOADS.
2.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)
3.) PRODUCT COMES WITH 1/2" STUD TO CONNECT SWIVEL SWAY BRACE ATTACHMENT. FOR FIG. 980, MUST USE PART NUMBER Y341000*.



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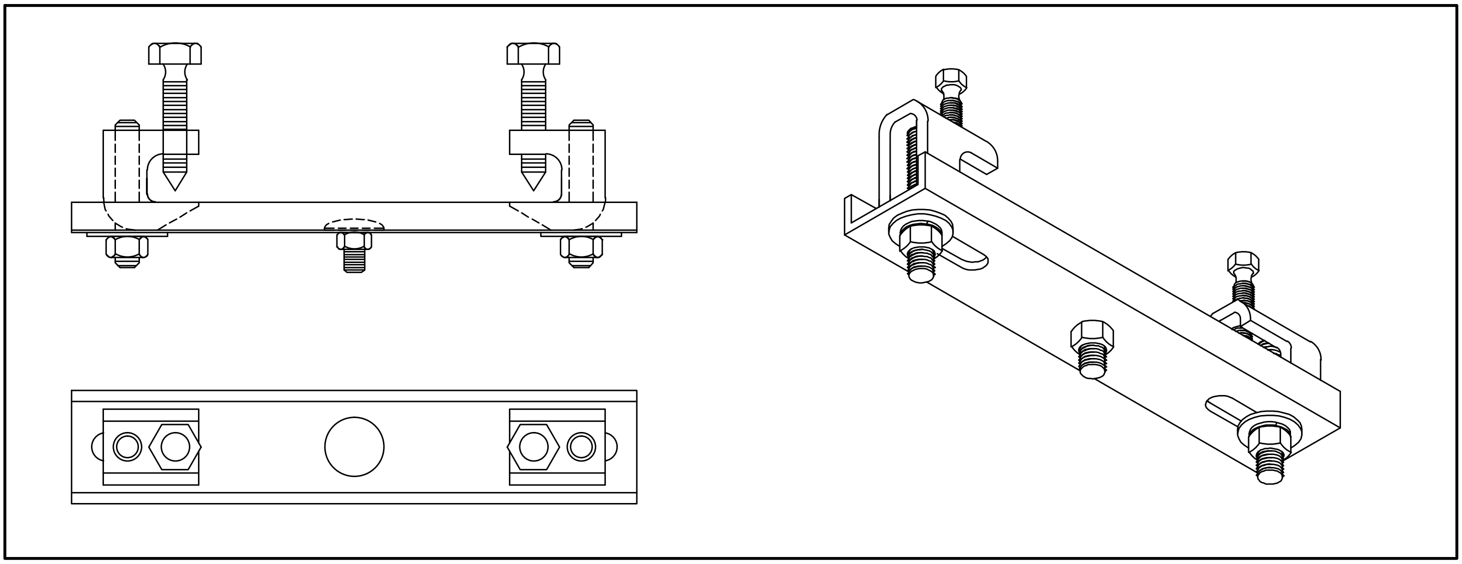
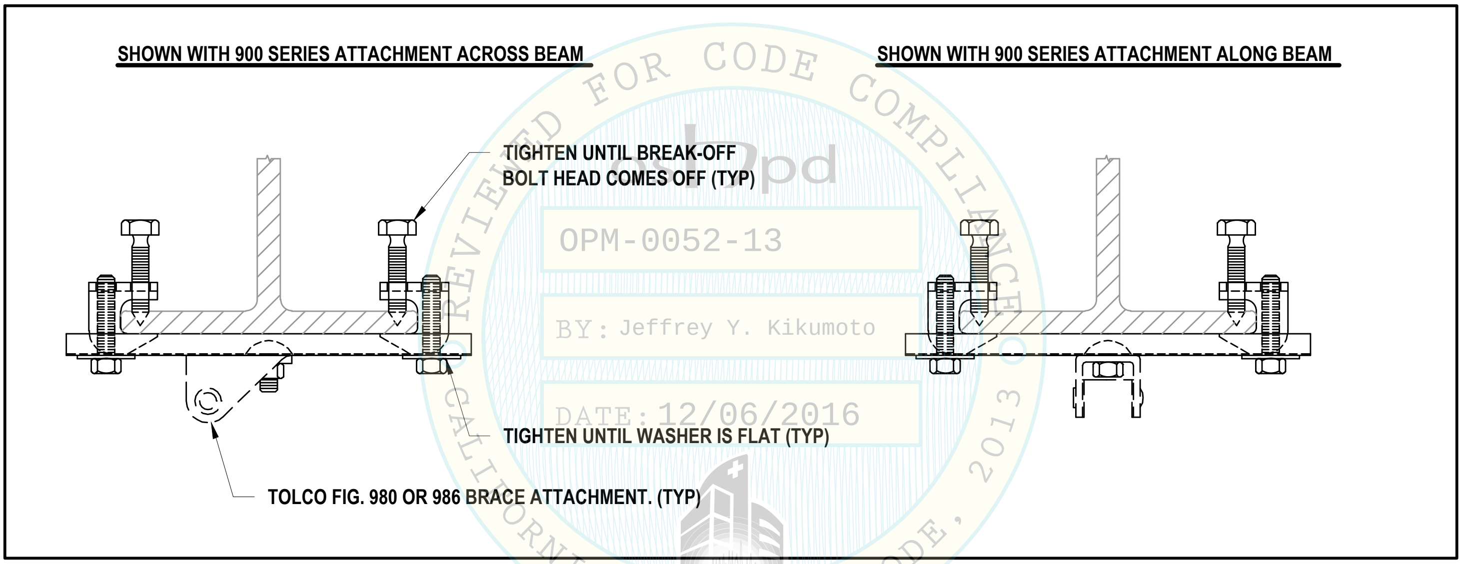
TOLCO FIG. 800 ATTACHMENT TO STEEL BEAM





ORIENTATION	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL (LB)		
	0° - 30°	31° - 45°	46° - 60°
PERPENDICULAR TO BEAM	1980	1970	1430
PARALLEL TO BEAM	1610	1310	930

FM APPROVED WHEN USED WITH 1", 1-1/4", 1-1/2", OR 2" SCH. 40, GB/T 3091, EN 10255H, OR JIS G3454 STEEL PIPE AS THE BRACE MEMBER.

NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STEEL MEMBER TO RESIST ALL BRACE LOADS.
2.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)
3.) PRODUCT COMES WITH 1/2" STUD TO CONNECT SWIVEL SWAY BRACE ATTACHMENT. FOR FIG. 980, MUST USE PART NUMBER Y341000*.

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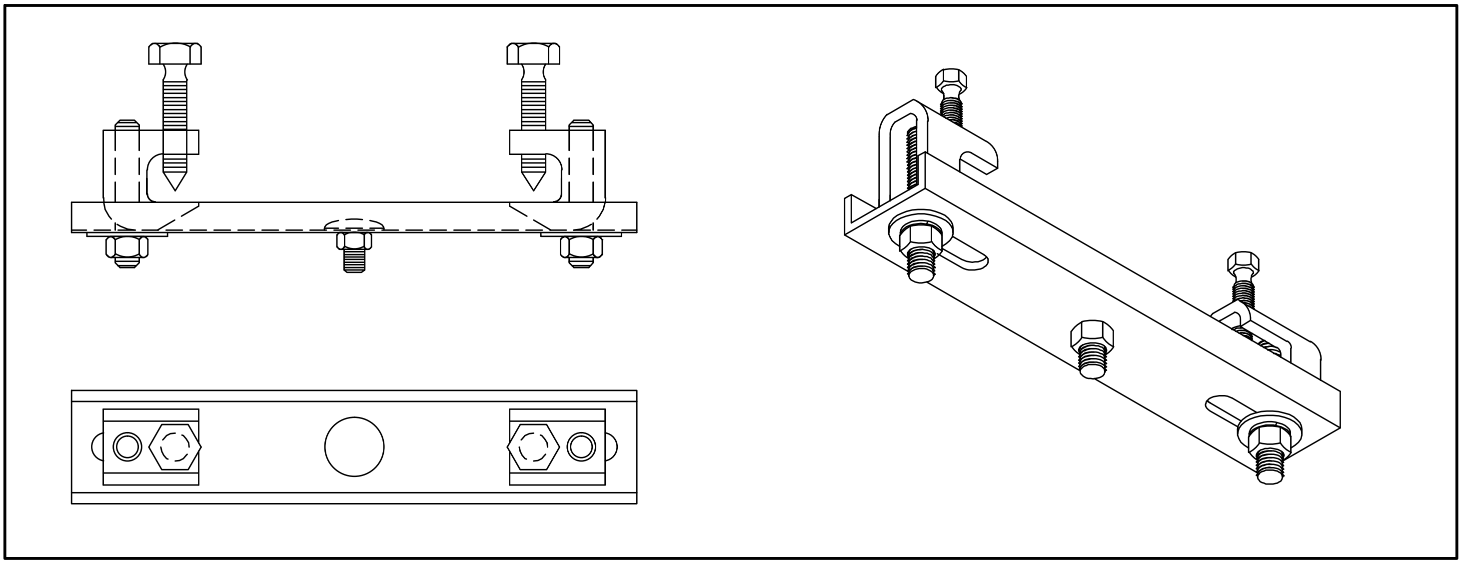
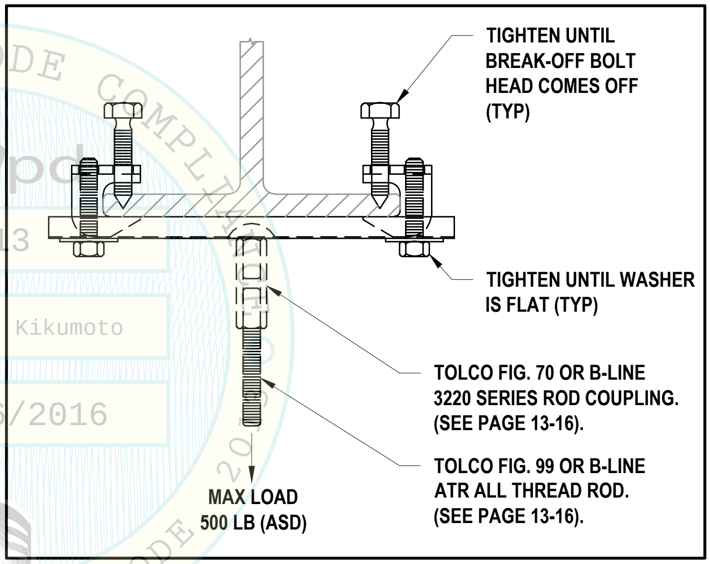
TOLCO FIG. 800 ATTACHMENT TO STEEL BEAM





NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STRUCTURE TO RESIST ALL BRACE LOADS.
2.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
3.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)

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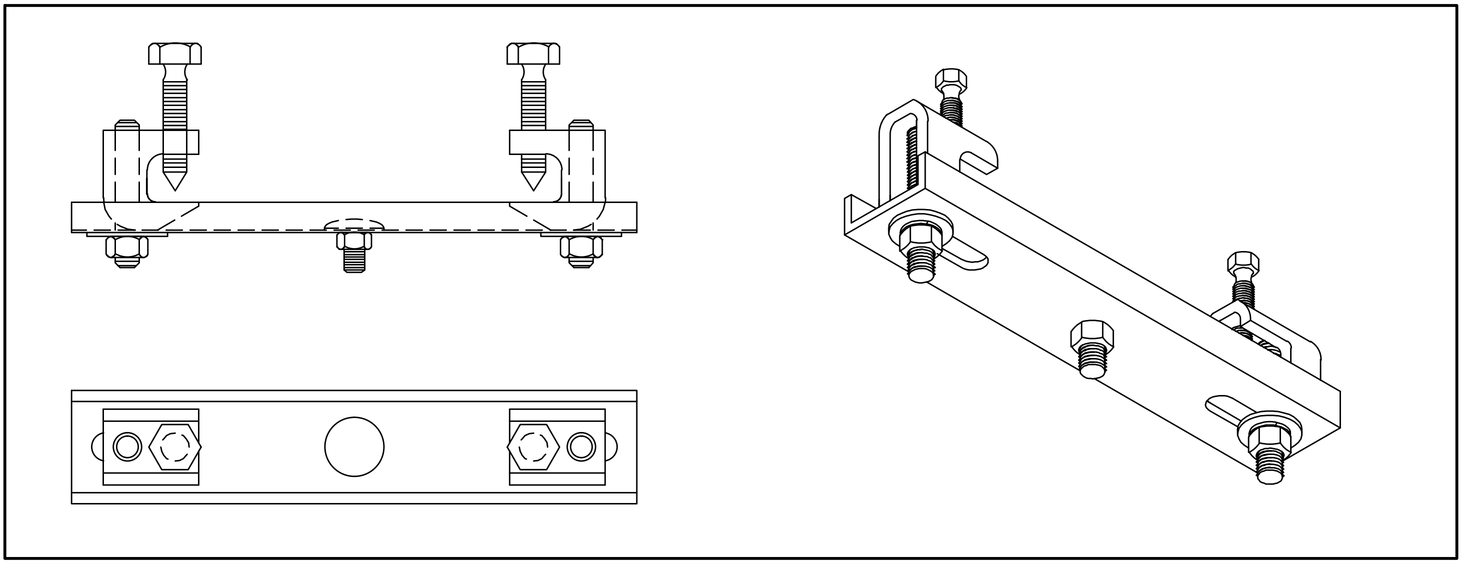
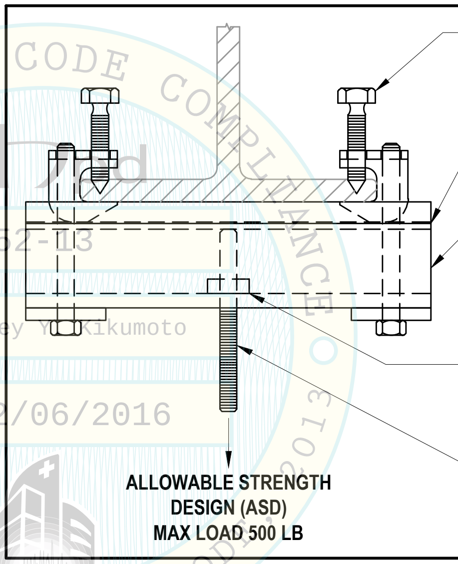
TOLCO FIG. 800 ATTACHMENT TO STEEL BEAM WITH STRUT





NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STRUCTURE TO RESIST ALL BRACE LOADS.
2.) FITS BEAM WITH FLANGE THICKNESS UP TO 1 1/4" AND WIDTH UP TO 18".
3.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTION ZONES. (SEE AISC 341,SECTION 7.4)

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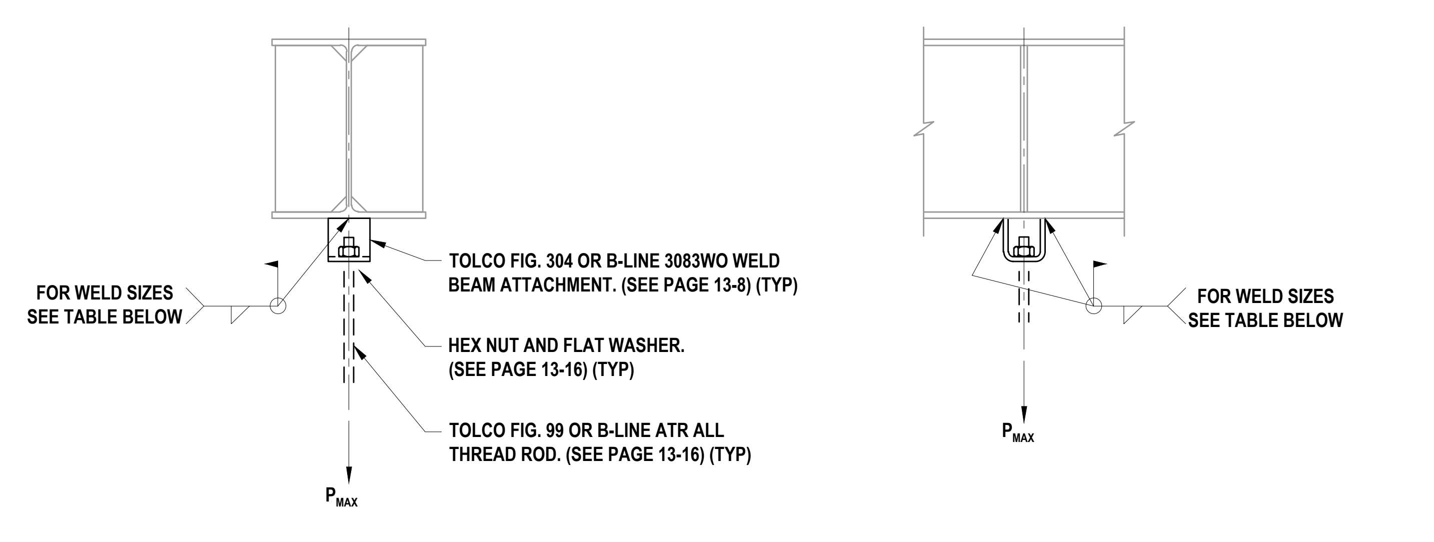
WELDED LUG ATTACHMENT TO STEEL BEAM



HANGER ROD DIAMETER	MIN. WELD SIZE	ALLOWABLE STRENGTH DESIGN (ASD) MAX. VERTICAL LOAD P_{MAX} (LB)
3/8"	3/16"	730
1/2"	3/16"	1350
5/8"	3/16"	2160
3/4"	1/4"	3230
7/8"	1/4"	4480
1"	1/4"	4480

NOTES:

1.) CONNECTION TO STRUCTURAL BEAM SUBJECT TO PRIOR APPROVAL FROM STRUCTURAL ENGINEER OF RECORD.
2.) NO ATTACHMENTS SHALL BE MADE IN THE PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)

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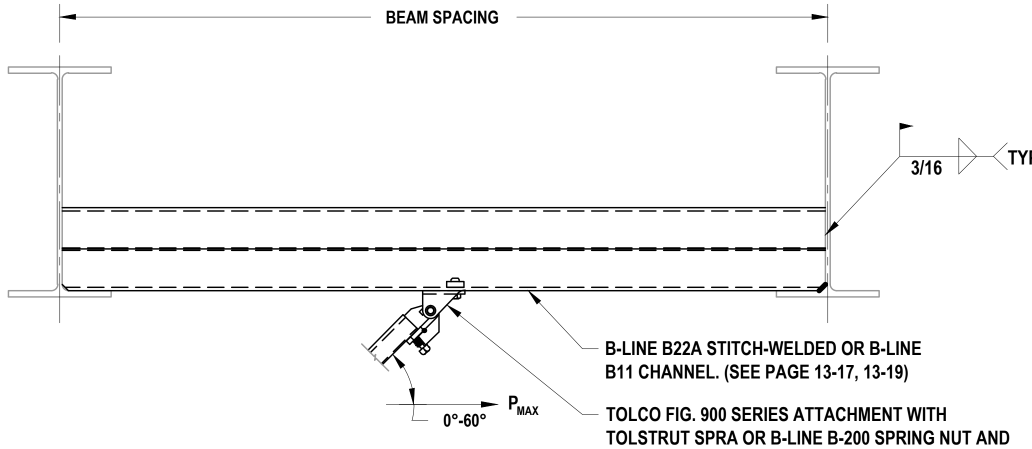
BRACE ATTACHMENT TO SUPPLEMENTAL STRUT



MAXIMUM BEAM SPAN	P_{MAX} MAXIMUM HORIZONTAL ALLOWABLE LOAD (LB)(ASD)	
	BRACE ANGLE MEASURED FROM HORIZONTAL	
	0° - 45°	46° - 60°
6'-0"	350	300
10'-0"	225	180

NOTES:

1.) FOR 6'-0" BEAM SPACING, TOTAL PMAX = 350# AT ANY LOCATION WITH BRACE ANGLE MEASURED FROM HORIZONTAL OF 0°-45°, PMAX = 300# AT ANY LOCATION WITH BRACE ANGLE MEASURED FROM HORIZONTAL OF 46°-60°.
2.) FOR 10'-0" BEAM SPACING, TOTAL PMAX = 225# AT ANY LOCATION WITH BRACE ANGLE MEASURED FROM HORIZONTAL OF 0°-45°, PMAX = 180# AT ANY LOCATION WITH BRACE ANGLE MEASURED FROM HORIZONTAL OF 46°-60°.
3.) STRUCTURAL ENGINEER OF RECORD TO VERIFY ADEQUACY OF THE STRUCTURE FOR THE APPLIED LOADS.
4.) NO ATTACHMENTS SHALL BE IN PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)
5.) WELDING SHALL BE DONE BY ELECTRIC SHIELDED ARC PROCESS USING E-70XX ELECTRODES.
6.) ALL WELDING SHALL BE PREFORMED BY A CERTIFIED WELDER.
7.) ALL WELDS SHAL BE IN CONFORMANCE WITH 2013 CALIFORNIA BUILDING CODE. (CBC)
8.) CONTINUOUS INSPECTION IS REQUIRED FOR AL WELDING
9.) LOADS ARE BASED ON ALLOWABLE STRENGTH DESIGN.

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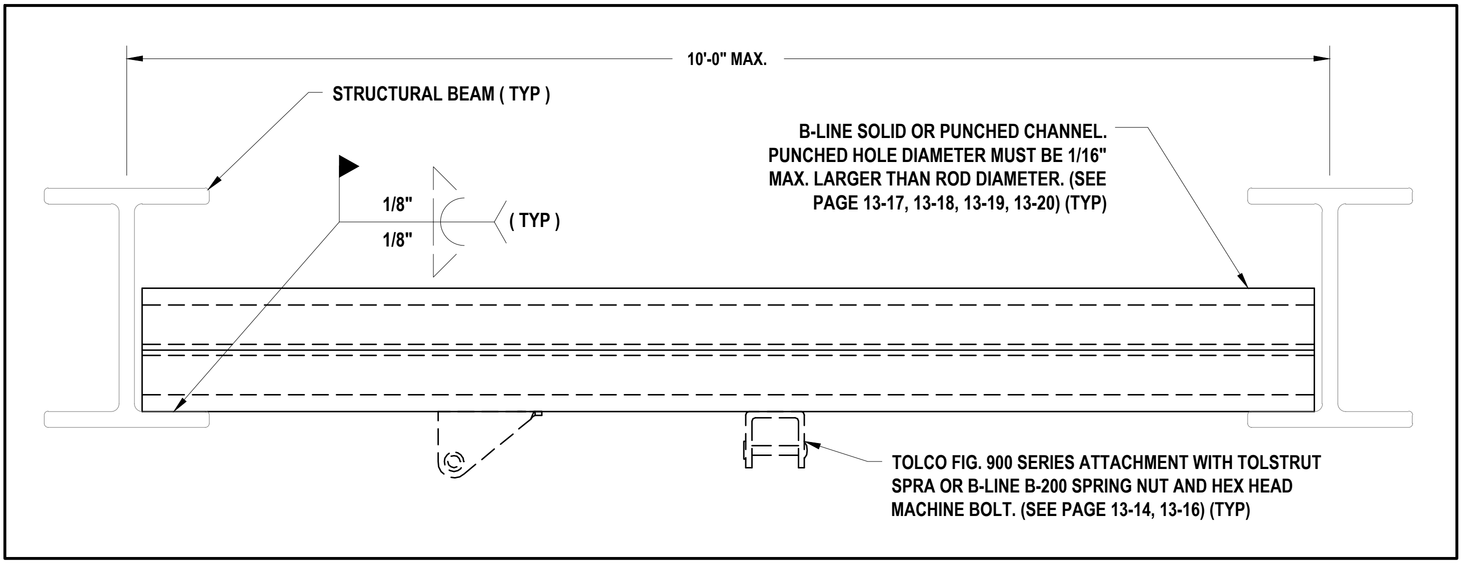
BRACE ATTACHMENT TO SUPPLEMENTAL STRUT



NOTES:

1.) BRACE MAY BE INSTALLED PARALLEL OR PERPENDICULAR TO THE CHANNEL
2.) ALLOWABLE LOADS SHALL BE CALCULATED PER STRUT SECTION PROPERTIES. (SEE PAGE 13-17, 13-18, 13-19, 13-20).
3.) STRUCTURAL ENGINEER OF RECORD TO VERIFY ADEQUACY OF THE STRUCTURE FOR THE APPLIED LOADS.
4.) NO ATTACHMENTS SHALL BE IN PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)
5.) WELDING SHALL BE DONE BY ELECTRIC SHIELDED ARC PROCESS USING E-70XX ELECTRODES.
6.) ALL WELDING SHALL BE PREFORMED BY A CERTIFIED WELDER.
7.) ALL WELDS SHAL BE IN CONFORMANCE WITH 2013 CALIFORNIA BUILDING CODE. (CBC)
8.) CONTINUOUS INSPECTION IS REQUIRED FOR ALL WELDING.

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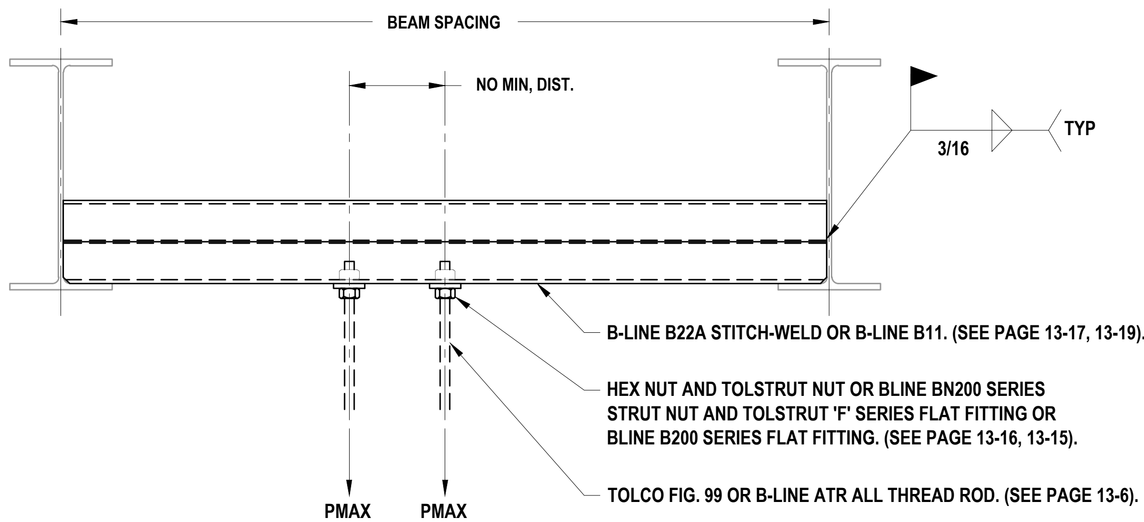
HANGER ATTACHMENT TO SUPPLEMENTAL STEEL



MAXIMUM BEAM SPAN	P_{MAX} MAXIMUM VERTICAL ALLOWABLE LOAD (LB)(ASD) (TOTAL OF ALL APPLIED INDIVIDUAL LOADS SHALL NOT EXCEED P_{MAX})
6'-0"	500
10'-0"	475

NOTES:

1.) FOR 10'-0" BEAM SPACING, TOTAL PMAX = 475# AT ANY LOCATION.
2.) FOR 6'-0" BEAM SPACING, TOTAL PMAX = 500# AT ANY LOCATION.
3.) CONNECTION TO STRUCTURAL STEEL BEAMS SUBJECT TO APPROVAL FROM STRUCTURAL ENGINEER OF RECORD.
4.) NO ATTACHMENTS SHALL BE IN PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)
5.) WELDING SHALL BE DONE BY ELECTRIC SHIELDED ARC PROCESS USING E-70XX ELECTRODES.
6.) ALL WELDING SHALL BE PREFORMED BY A CERTIFIED WELDER.
7.) ALL WELDS SHAL BE IN CONFORMANCE WITH 2013 CALIFORNIA BUILDING CODE. (CBC)
8.) CONTINUOUS INSPECTION IS REQUIRED FOR AL WELDING
9.) LOADS ARE BASED ON ALLOWABLE STRENGTH DESIGN.
10.) ECCENTRIC LOADING IS NOT ALLOWED.

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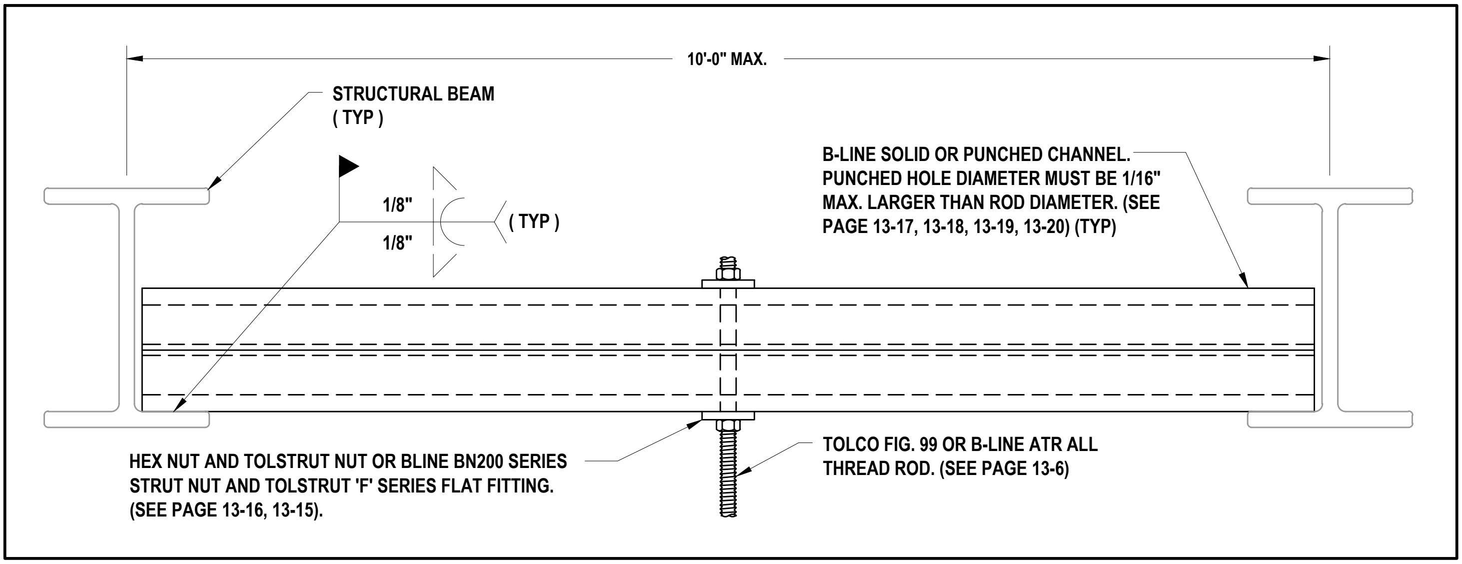
HANGER ATTACHMENT TO SUPPLEMENTAL STRUT



NOTES:

1.) STRUT MAY BE WELDED TO THE BOTTOM-UNDERSIDE OF BEAM FLANGE USING THE SAME WELD AS WHEN WELDED TO THE TOP OF BEAM BOTTOM FLANGE.
2.) ALLOWABLE LOADS SHALL BE CALCULATED PER STRUT SECTION PROPERTIES. (SEE PAGE 13-17, 13-18, 13-19, 13-20).
3.) STRUCTURAL ENGINEER OF RECORD TO VERIFY ADEQUACY OF THE STRUCTURE FOR THE APPLIED LOADS.
4.) NO ATTACHMENTS SHALL BE IN PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)
5.) WELDING SHALL BE DONE BY ELECTRIC SHIELDED ARC PROCESS USING E-70XX ELECTRODES.
6.) ALL WELDING SHALL BE PREFORMED BY A CERTIFIED WELDER.
7.) ALL WELDS SHAL BE IN CONFORMANCE WITH 2013 CALIFORNIA BUILDING CODE. (CBC)
8.) CONTINUOUS INSPECTION IS REQUIRED FOR AL WELDING.
9.) LOADS ARE BASED ON ALLOWABLE STRENGTH DESIGN.
10.) ECCENTRIC LOADING IS NOT ALLOWED.

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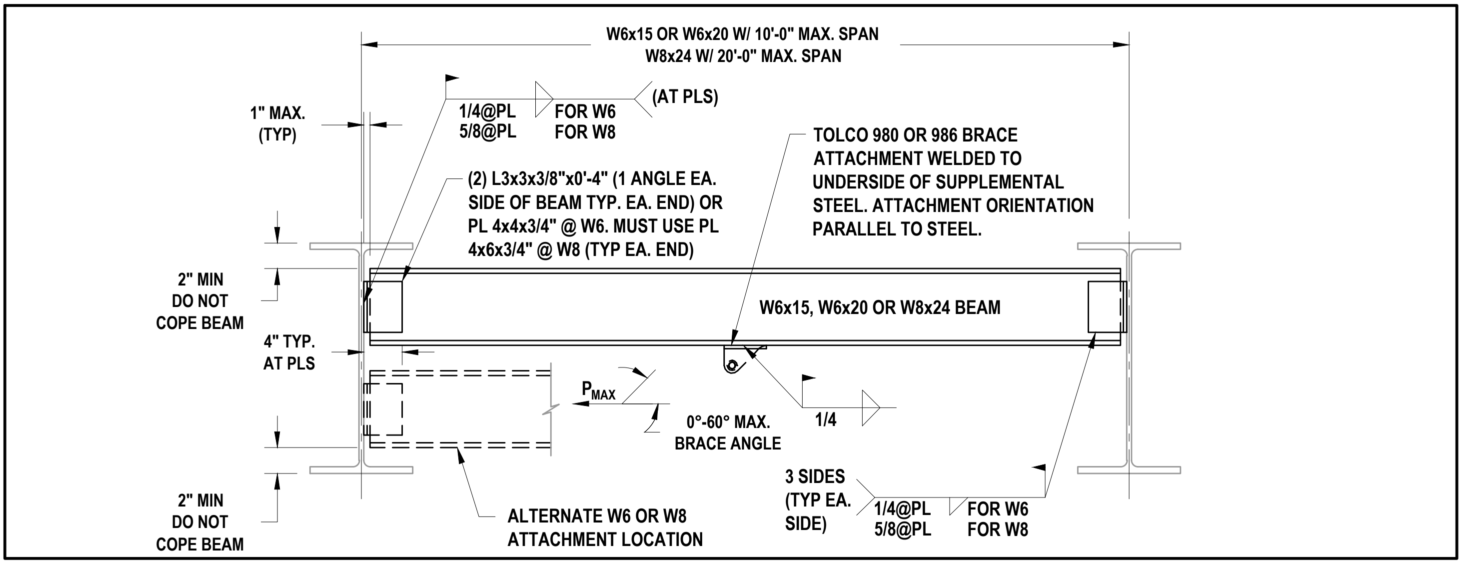
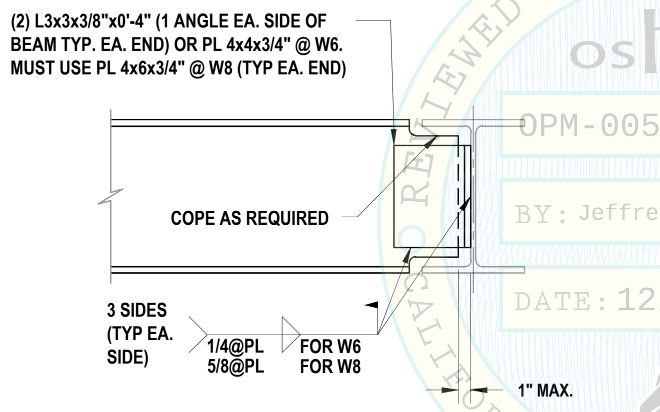
BRACE ATTACHMENT TO SUPPLEMENTAL STEEL BEAM



OPTIONAL ATTACHMENT



NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STRUCTURE TO RESIST ALL BRACE LOADS.
2.) W6x15 OR W6x20 W/ SPAN = 10'-0" MAX., MAXIMUM TOTAL HORIZONTAL ALLOWABLE LOAD - 1,590 LBS.
3.) W8x24 W/ SPAN = 20'-0" MAX., MAXIMUM TOTAL HORIZONTAL ALLOWABLE LOAD - 1,590 LBS.
4.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)
5.) WELDING SHALL BE DONE BY ELECTRIC SHIELDED ARC PROCESS USING E-70XX ELECTRODES.
6.) ALL WELDING SHALL BE PERFORMED BY A CERTIFIED WELDER.
7.) ALL WELDS SHALL BE IN CONFORMANCE WITH 2013 CALIFORNIA BUILDING CODE. (CBC)
8.) CONTINUOUS INSPECTION IS REQUIRED FOR ALL WELDING.
9.) LOADS ARE BASED ON ALLOWABLE STRENGTH DESIGN.

BEAM SIZE	MAXIMUM BEAM SPAN	P_{MAX} MAX. HORIZONTAL ALLOWABLE LOAD (LB)(ASD) (TOTAL OF ALL APPLIED INDIVIDUAL LOADS SHALL NOT EXCEED P_{MAX})
W6x15 W6x20	10'-0"	1,590
W8x24	20'-0"	1,590

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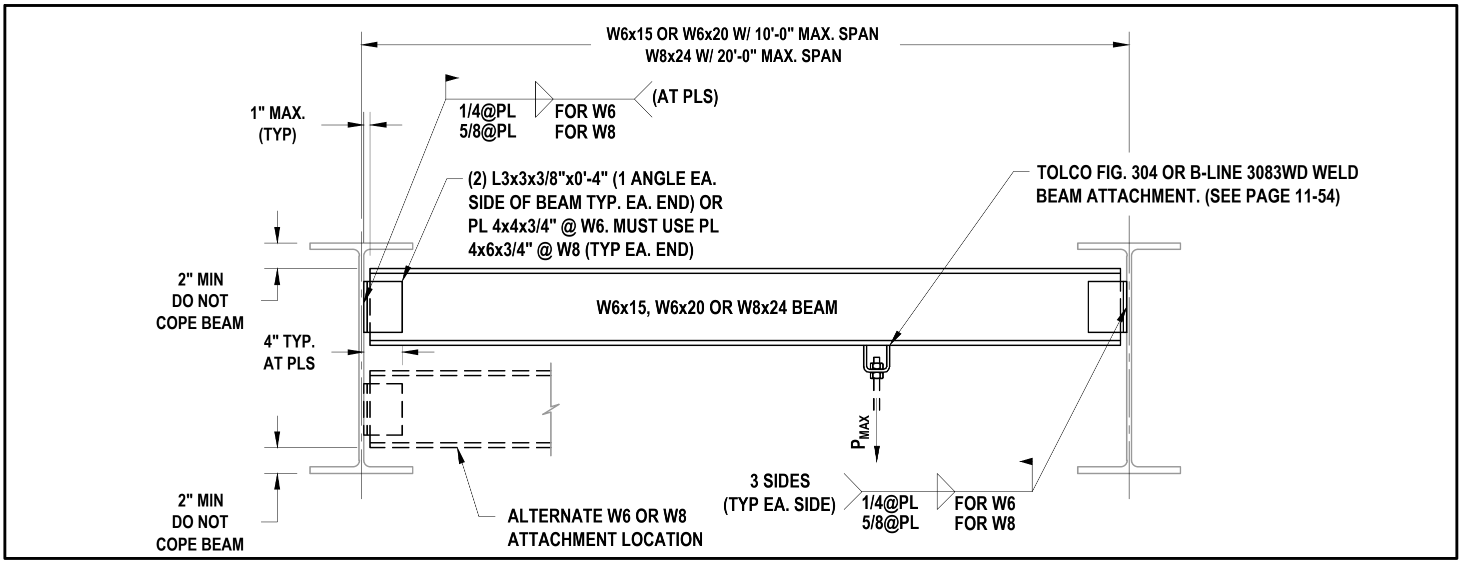
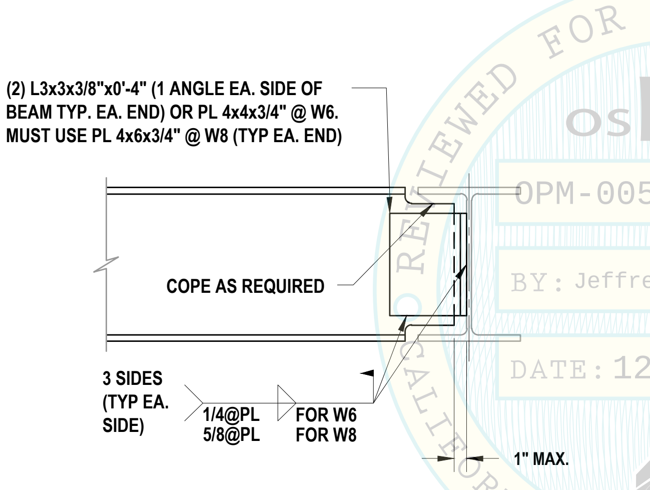
BRACE ATTACHMENT TO SUPPLEMENTAL STEEL BEAM



OPTIONAL ATTACHMENT



NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STRUCTURE TO RESIST ALL BRACE LOADS.
2.) W6x15 OR W6x20 W/ SPAN = 10'-0" MAX., MAXIMUM TOTAL VERTICAL ALLOWABLE LOAD - 1,590 LBS.
3.) W8x24 W/ SPAN = 20'-0" MAX., MAXIMUM TOTAL VERTICAL ALLOWABLE LOAD - 1,590 LBS.
4.) NO ATTACHMENT SHALL BE MADE IN THE PROTECTION ZONES. (SEE AISC 341, SECTION 7.4)
5.) WELDING SHALL BE DONE BY ELECTRIC SHIELDED ARC PROCESS USING E-70XX ELECTRODES.
6.) ALL WELDING SHALL BE PERFORMED BY A CERTIFIED WELDER.
7.) ALL WELDS SHALL BE IN CONFORMANCE WITH 2013 CALIFORNIA BUILDING CODE. (CBC)
8.) CONTINUOUS INSPECTION IS REQUIRED FOR ALL WELDING.
9.) LOADS ARE BASED ON ALLOWABLE STRENGTH DESIGN.

BEAM SIZE	MAXIMUM BEAM SPAN	P_{MAX} MAX. VERTICAL ALLOWABLE LOAD (LB)(ASD) (TOTAL OF ALL APPLIED INDIVIDUAL LOADS SHALL NOT EXCEED P_{MAX})
W6x15 W6x20	10'-0"	1,590
W8x24	20'-0"	1,590

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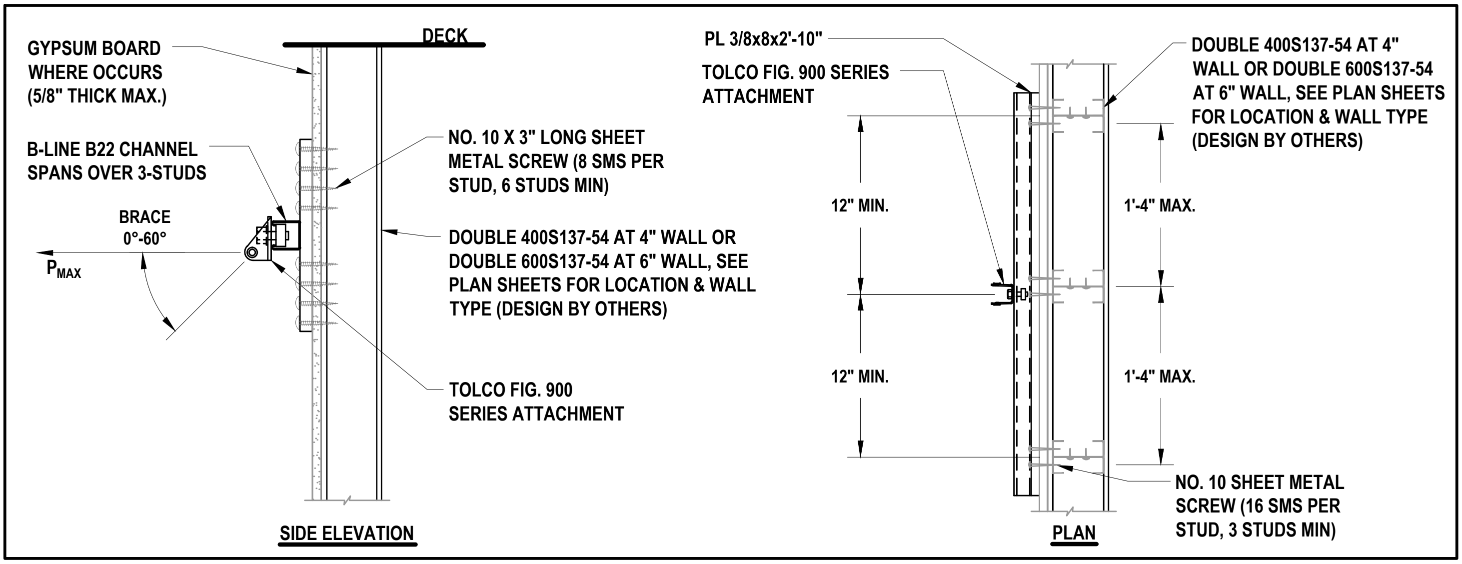
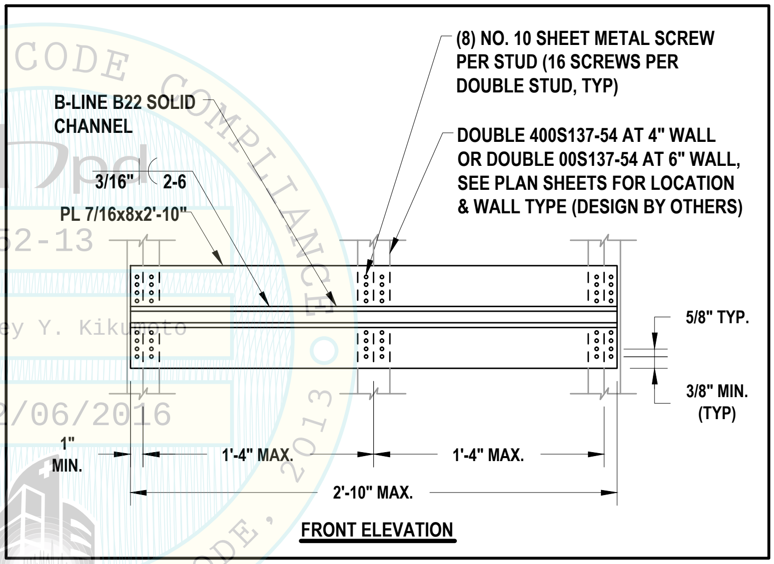
BRACE ATTACHMENT TO STUD WALL



P_{MAX} MAXIMUM HORIZONTAL ALLOWABLE LOAD (LB)(ASD) (TOTAL OF ALL APPLIED INDIVIDUAL LOADS SHALL NOT EXCEED P_{MAX})
500



NOTES:

1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF STRUCTURE TO RESIST ALL BRACE LOADS.
2.) ALLOWABLE HORIZONTAL SEISMIC LOAD = 500 LBS AT 0°-60° ANGLE MEASURED FROM HORIZONTAL.
3.) LOADS ARE BASED ON ALLOWABLE STRENGTH DESIGN.

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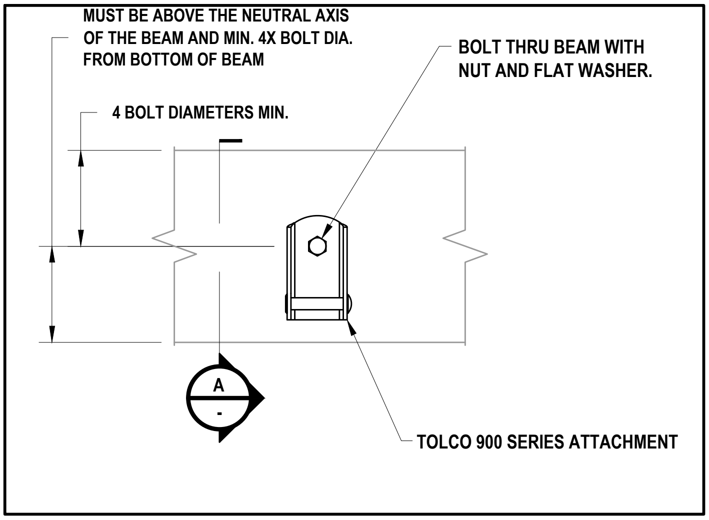
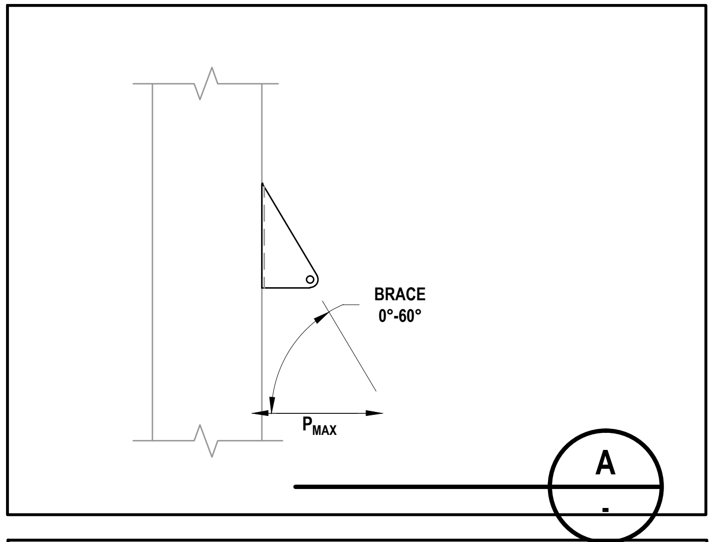
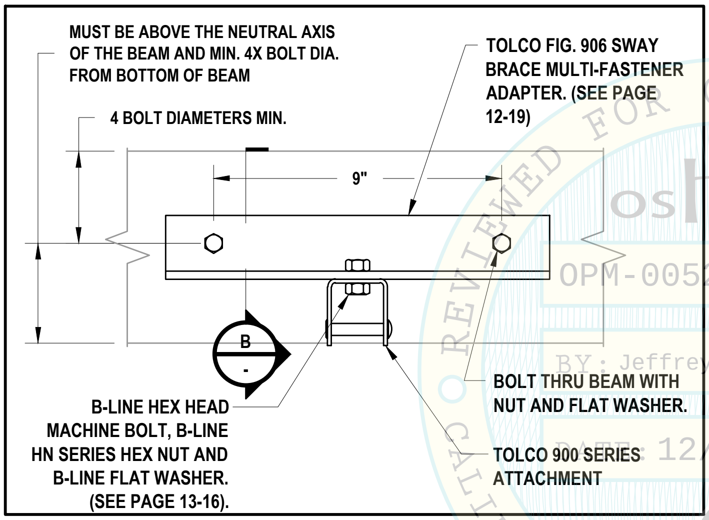
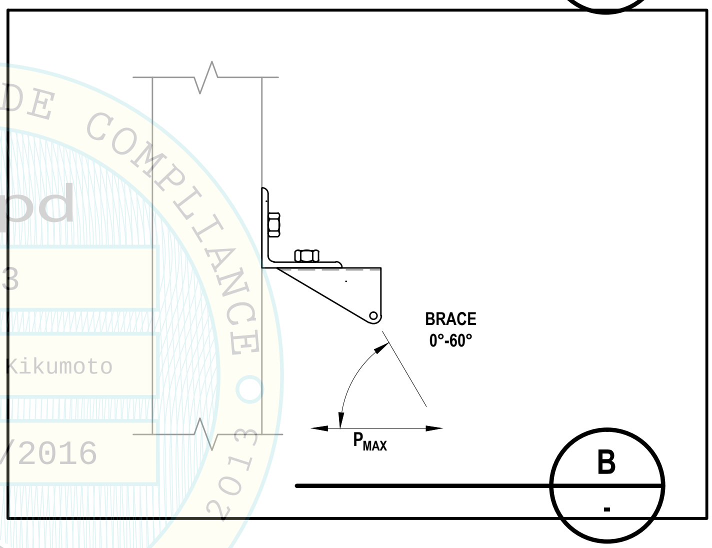
THRU-BOLT STRUCTURAL ATTACHMENTS PERPENDICULAR TO WOOD BEAM









BOLT DIAMETER	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD (P_{MAX}) BRACE ANGLE MEASURED FROM HORIZONTAL (LB)					
	1 BOLT			2 BOLT		
	0° - 30°	31° - 45°	46° - 60°	0° - 30°	31° - 45°	46° - 60°
1/2"	300	300	300	600	600	460
5/8"	360	360	360	720	720	460
3/4"	400	400	400	800	800	460

NOTES:

1.) BOLT HOLES SHALL BE BORED 1/16" LARGER THAN THE NOMINAL BOLT DIAMETER.
2.) LOADS FOR THRU-BOLT ATTACHMENTS WERE DERIVED FROM CCR TITLE 24, PART 2, HOLDING POWER OF BOLTS FOR DOUGLAS FIR, LARCH, CALIFORNIA REDWOOD (CLOSE GRAIN) AND SOUTHERN PINE.
3.) MINIMUM BEAM SIZE = 4x
4.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIREMENTS.

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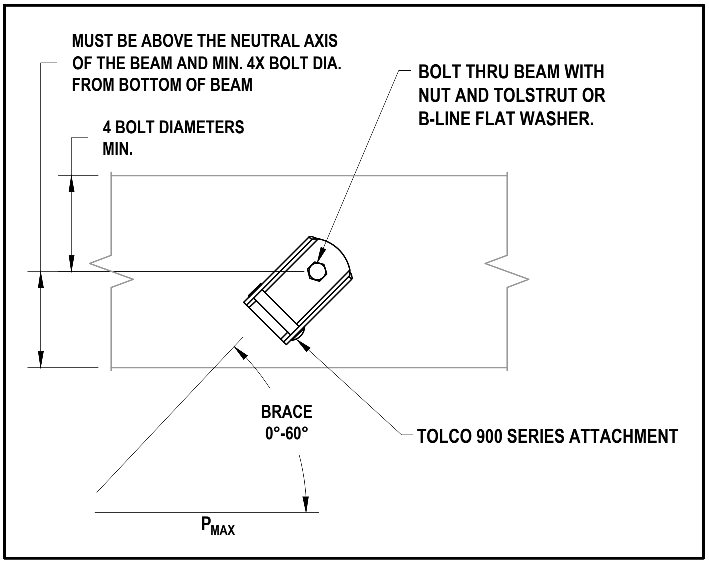
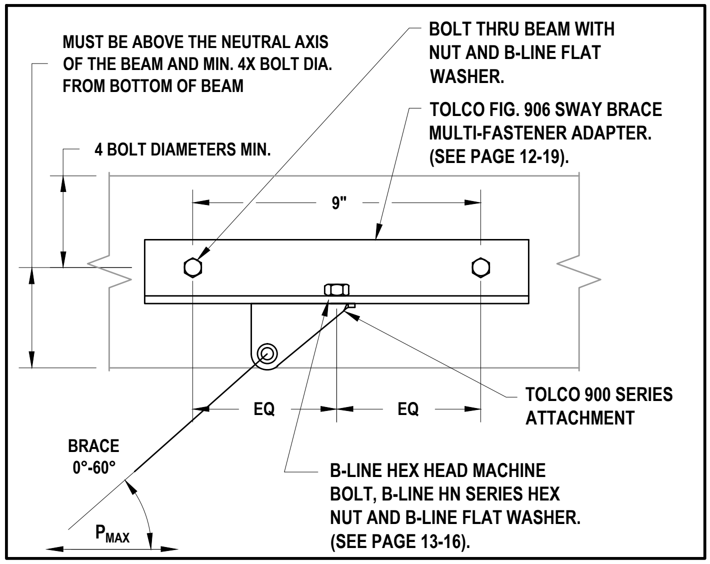
THRU-BOLT STRUCTURAL ATTACHMENTS PARALLEL TO WOOD BEAM





BOLT DIAMETER	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD (P_{MAX}) BRACE ANGLE MEASURED FROM HORIZONTAL (LB)					
	1 BOLT			2 BOLT		
	0° - 30°	31° - 45°	46° - 60°	0° - 30°	31° - 45°	46° - 60°
1/2"	260	260	260	440	440	440
5/8"	320	320	320	540	540	460
3/4"	380	380	380	600	600	460

NOTES:

1.) BOLT HOLES SHALL BE BORED 1/16" LARGER THAN THE NOMINAL BOLT DIAMETER.
2.) LOADS FOR THRU-BOLT ATTACHMENTS WERE DERIVED FROM CBC 2013 AND NDS 2005 FOR DOUGLAS FIR-LARCH [S.G. = 0.50], CALIFORNIA REDWOOD (CLOSE GRAIN) [S.G. = 0.44] AND SOUTHERN PINE [S.G. = 0.55].
3.) MINIMUM BEAM SIZE = 4x
4.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIREMENTS.
5.) FASTENERS SHALL BE A307 BOLTS OR BETTER.

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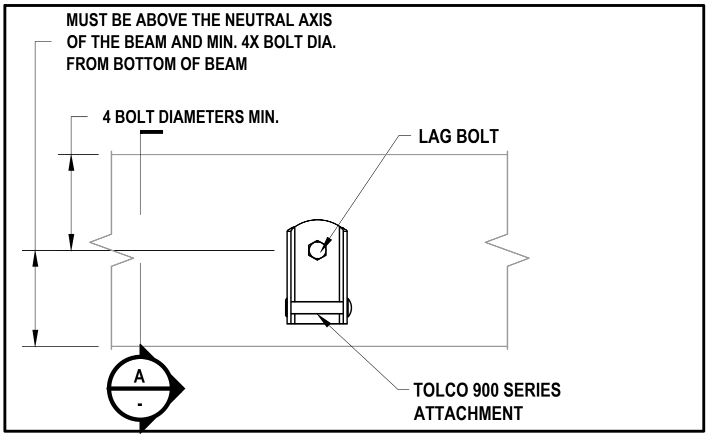
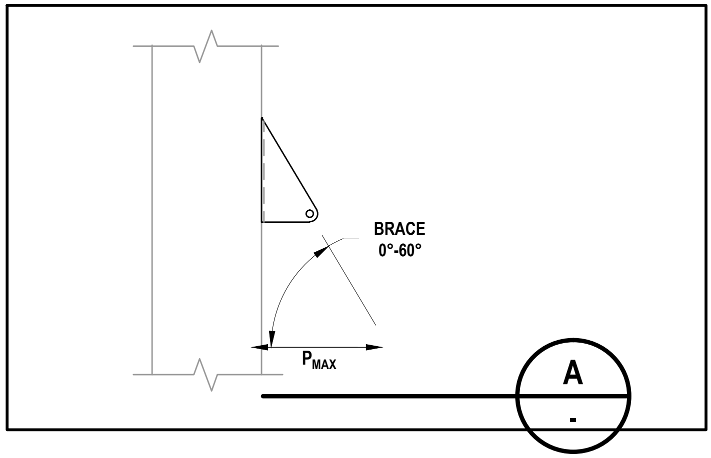
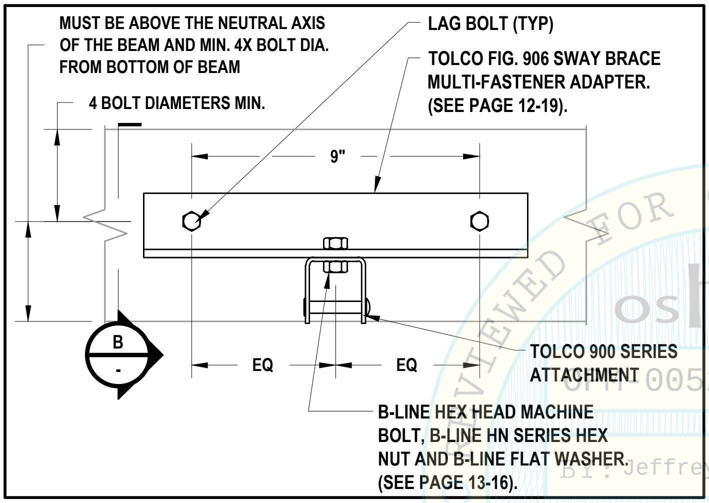
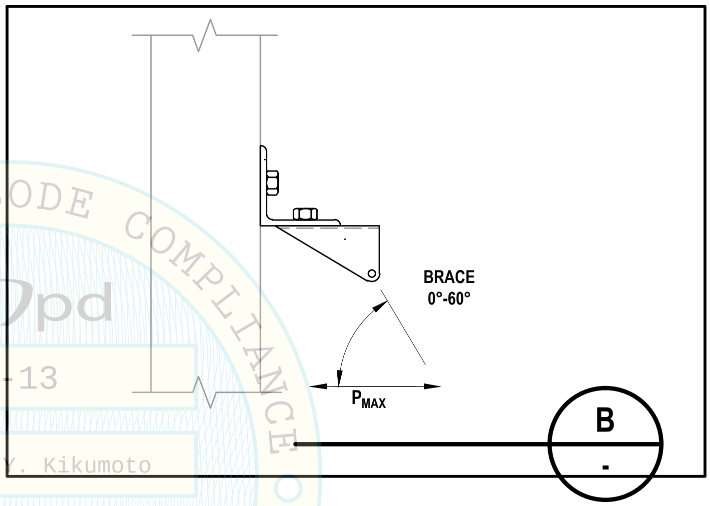
LAG BOLT STRUCTURAL ATTACHMENTS PERPENDICULAR TO WOOD BEAM









BOLT DIAMETER	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD (P_{MAX}) BRACE ANGLE MEASURED FROM HORIZONTAL (LB)					
	1 BOLT			2 BOLT		
	0° - 30°	31° - 45°	46° - 60°	0° - 30°	31° - 45°	46° - 60°
1/2" x 3"	83	89	89	169	151	136
5/8" x 4"	102	102	102	174	174	174
3/4" x 5"	178	193	193	327	327	298

LAG BOLT PILOT HOLE SIZES			
BOLT (in)	PILOT HOLE SIZES		
	SHANK (in)	THREADED SECTION	
		SOFT WOOD GROUPS III (in)	MEDIUM WOOD GROUP II (in)
1/2"	1/2"	5/16	5/16
5/8"	5/8"	7/16	7/16
3/4"	3/4"	1/2	1/2

NOTES:

1.) LAG BOLT HOLE SHALL BE BORED TO THE MIN. SIZE LISTED ON LAG BOLT PILOT HOLE SIZES TABLE.
2.) LOADS FOR THRU-BOLT ATTACHMENTS WERE DERIVED FROM CBC 2013 AND NDS 2005 FOR DOUGLAS FIR-LARCH [S.G. = 0.50], CALIFORNIA REDWOOD (CLOSE GRAIN) [S.G. = 0.44] AND SOUTHERN PINE [S.G. = 0.55].
3.) MINIMUM BEAM SIZE FOR 1/2" = 4x; FOR 5/8" AND 3/4" BOLTS = 6x
4.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIREMENTS.
5.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
6.) ADAPTER HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
7.) HHMB FASTENERS SHALL BE A307 BOLTS OR BETTER.
8.) LAG BOLT SHALL MEET ANSI/ASME STANDARD B18.2.1 MINIMUM MATERIAL SPECIFICATIONS, Fy = 45,000 PSI (MIN.).

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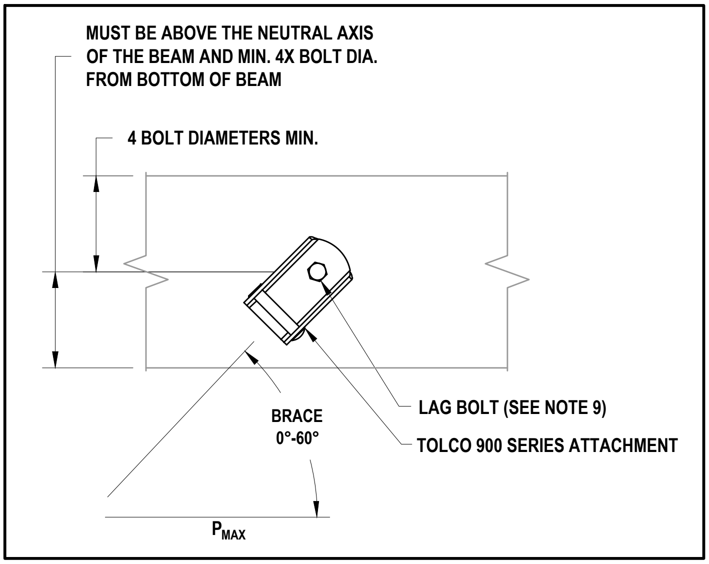
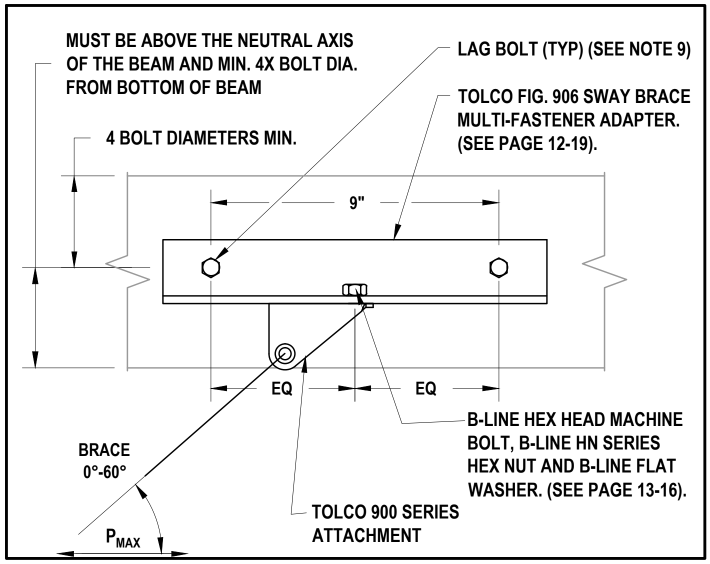
LAG BOLT STRUCTURAL ATTACHMENTS PARALLEL TO WOOD BEAM





LAG BOLT SIZE DIA. X LENGTH	ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD (P_{MAX}) BRACE ANGLE MEASURED FROM HORIZONTAL (LB)					
	1 BOLT			2 BOLT		
	0° - 30°	31° - 45°	46° - 60°	0° - 30°	31° - 45°	46° - 60°
1/2" X 3"	122	87	55	150	100	58
5/8" X 4"	190	134	84	237	154	89
3/4" X 5"	279	194	119	347	222	127

LAG BOLT PILOT HOLE SIZES			
BOLT (in)	PILOT HOLE SIZES		
	SHANK (in)	THREADED SECTION	
		SOFT WOOD GROUPS III (in)	MEDIUM WOOD GROUP II (in)
1/2"	1/2"	5/16	5/16
5/8"	5/8"	7/16	7/16
3/4"	3/4"	1/2	1/2

NOTES:

1.) LAG BOLT HOLE SHALL BE BORED TO THE MIN. SIZE LISTED ON LAG BOLT PILOT HOLE SIZES TABLE.
2.) LOADS FOR THRU-BOLT ATTACHMENTS WERE DERIVED FROM CBC 2013 AND NDS 2005 FOR DOUGLAS FIR-LARCH [S.G. = 0.50], CALIFORNIA REDWOOD (CLOSE GRAIN) [S.G. = 0.44] AND SOUTHERN PINE [S.G. = 0.55].
3.) MINIMUM BEAM SIZE FOR 1/2" = 4x; FOR 5/8" AND 3/4" BOLTS = 6x
4.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS, INCLUDING BUT NOT LIMITED TO ANY BLOCKING REQUIREMENTS.
5.) LAG BOLTS SHALL NOT BE USED FOR BRACING FIRE SPRINKLER SYSTEMS.
6.) ADAPTER HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
7.) HHMB FASTENERS SHALL BE A307 BOLTS OR BETTER.
8.) LAG BOLT SHALL MEET ANSI/ASME STANDARD B18.2.1 MINIMUM MATERIAL SPECIFICATIONS, Fy = 45,000 PSI (MIN.).

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TESTING NOTES FOR NORMAL WEIGHT OR SAND LIGHTWEIGHT CONCRETE & TORQUE VALUES

TESTING NOTES:

1.) ANCHOR DIAMETER REFERS TO THE THREAD SIZE FOR THE WEDGE ANCHORS.
2.) REACTION LOADS FROM TEST FIXTURES MAY BE APPLIED CLOSE TO THE ANCHOR BEING TESTED, PROVIDED THE ANCHOR IS NOT RESTRAINED FROM WITHDRAWING BY THE FIXTURE(S).
3.) TEST EQUIPMENT (INCLUDING TORQUE WRENCHES) IS TO BE CALIBRATED BY AN APPROVED TESTING LABORATORY IN ACCORDANCE WITH STANDARD RECOGNIZED PROCEDURES.
4.) THE FOLLOWING CRITERIA APPLY FOR THE ACCEPTANCE OF INSTALLED ANCHORS:

HYDRAULIC RAM METHOD :
ANCHORS TESTED WITH A HYDRAULIC JACK OR SPRING LOADED DEVICES SHALL MAINTAIN THE TEST LOAD FOR A MINIMUM OF 15 SECONDS AND SHALL EXHIBIT NO DISCERNIBLE MOVEMENT DURING THE TENSION TEST, E.G., AS EVIDENCED BY LOOSENING OF TEH WASHER UNDER THE NUT.

TORQUE WRENCH METHOD :
ANCHORS TESTED WITH A CALIBRATED TORQUE WRENCH MUST ATTAIN THE SPECIFIED INSTALLATION TORQUE WITHIN 1/2 TURN OF THE NUT.

5.) TESTING SHALL OCCUR A MINIMUM OF 24 HOURS AFTER INSTALLATION OF THE SUBJECT ANCHORS.
6.) TEST AND TEST LOADS FOR POST-INSTALLED ANCHORS IN CONCRETE MUST COMPLY WITH CBC 1913A.7 AND MANUFACTURER'S ICC REPORT. TEST ACCEPTANCE CRITERIA MUST COMPLY WITH CBC 1913A.7.4.
7.) ALL TESTS SHALL BE PERFORMED IN THE PRESENCE OF THE INSPECTOR OF RECORD.

TORQUE VALUES PER ICC-ESR REPORTS

HILTI KB-TZ WEDGE ANCHOR	
ANCHOR DIAMETER	INSTALLATION TORQUE (FT-LB)
3/8"	25
1/2"	40
5/8"	60
3/4"	110

POWERS POWER-STUD+ SD2 WEDGE ANCHOR	
ANCHOR DIAMETER	INSTALLATION TORQUE (FT-LB)
3/8"	20
1/2"	40
5/8"	60
3/4"	110

SIMPSON STRONG BOLT 2 WEDGE ANCHOR	
ANCHOR DIAMETER	INSTALLATION TORQUE (FT-LB)
3/8"	30
1/2"	60
5/8"	90
3/4"	150
1"	230

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BOLT AND STRUT NUT TIGHTENING REQUIREMENTS

TORQUE FOR A307 AND A36 THREADED ROD

SIZE	TORQUE (FT-LB)
1/4"	6
3/8"	20
1/2"	49
5/8"	97
3/4"	173
7/8"	200
1"	250

TORQUE FOR STRUT NUTS

SIZE	TORQUE (FT-LB)
1/4"	6
3/8"	19
1/2"	50
5/8"	100
3/4"	125
7/8"	166
1"	250

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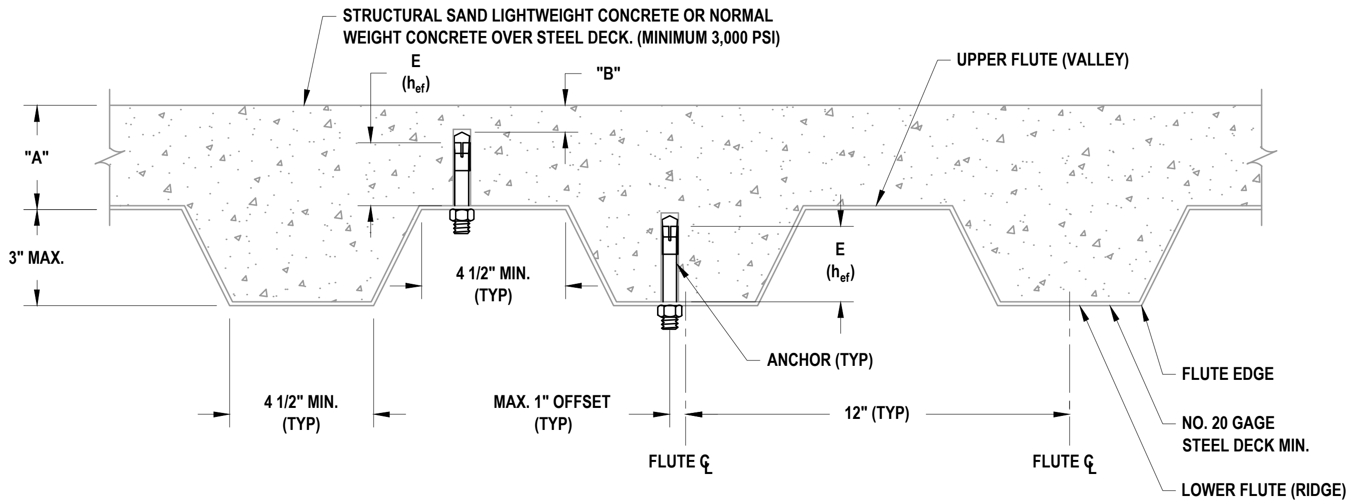
W3 TYPE DECKS INFORMATION



WEDGE ANCHOR TYPE	MIN. CONCRETE FILL COVER "A"	ICC-ES ESR #	ANCHOR DIA.	COVER "B"
HILTI KB-TZ	3 1/4"	1917	3/8", 1/2", 5/8"	5/8"
SIMPSON STRONG BOLT SB-2	3 1/4"	3037	1/2", 5/8"	1/2"
POWERS POWER-STUD+ SD2	3 1/4"	2502	3/8", 1/2", 5/8", 3/4"	3/4"

SECTION 12

SEISMIC BRACE SUPPORTS & ATTACHMENTS

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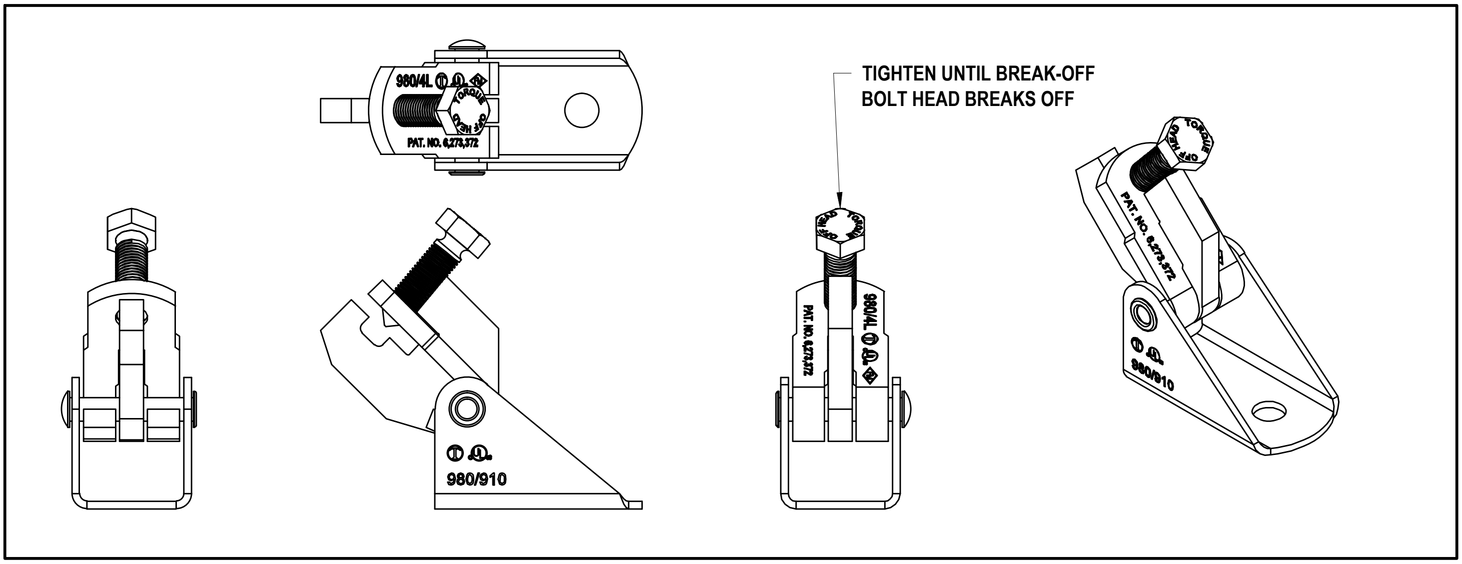
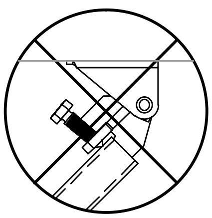
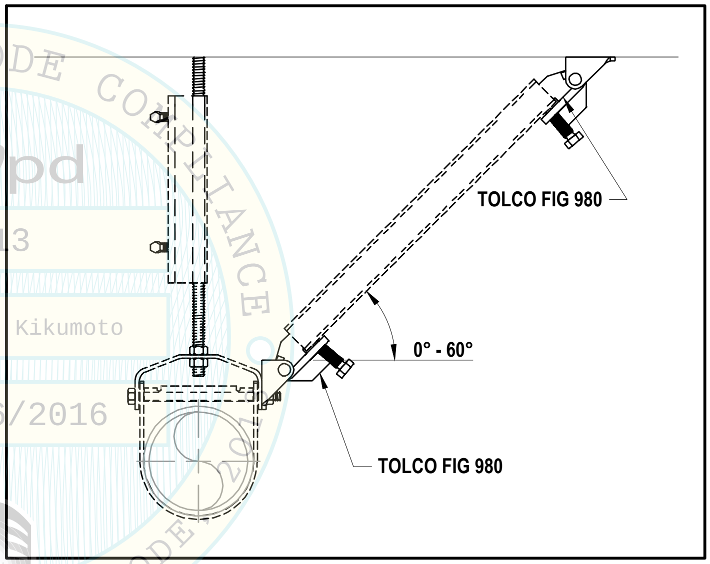
TOLCO FIG. 980 UNIVERSAL SWIVEL SWAY BRACE ATTACHMENT





DO NOT BEND
BRACE PAST 90°



COMPONENT ALLOWABLE LOAD (LBS)(ASD)			
BRACE ANGLE MEASURED FROM HORIZ.	0° - 30°	31° - 45°	46° - 60°
ALLOWABLE HORIZONTAL LOAD (LBS)	1790	1819	1021

NOTES:

1.) MAX. ROD SIZE 3/4", FOR LARGER ROD DIAMETERS USE FIG. 980H.
2.) BRACE MAY BE B-LINE B22 SOLID CHANNEL, SCH. 40 STEEL PIPE, OR OTHER APPROVED MEMBER. SEE PAGE 12-20.
3.) MAY BE INSTALLED AT THE STRUCTURE OR AT THE HANGER LOCATION.

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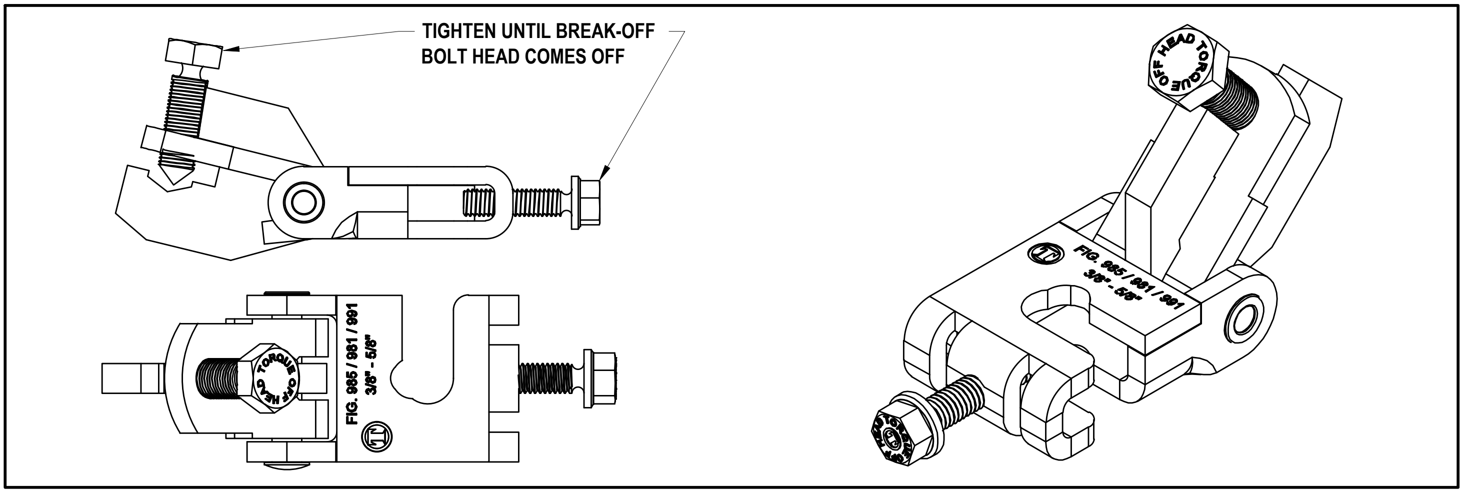
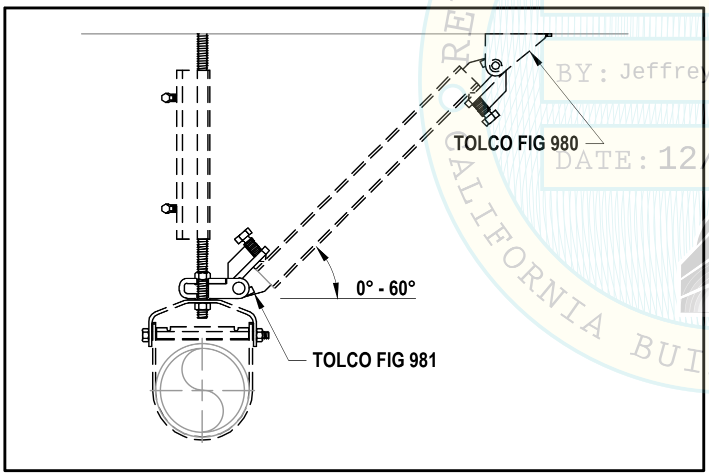
TOLCO FIG. 981 "FAST ATTACH" UNIVERSAL SWIVEL SWAY BRACE ATTACHMENT





MINIMUM ROD SIZE	MAXIMUM ROD SIZE	COMPONENT ALLOWABLE HORIZONTAL LOAD (LBS)(ASD)		
		0° - 30°	31° - 45°	46° - 60°
3/8"	5/8"	1840	1819	1384
3/4"	3/4"	1790	1891	1021

NOTES:

1.) MAX. ROD SIZE 7/8", FOR LARGER ROD DIAMETERS USE FIG. 980H.
2.) BRACE MAY BE B-LINE B22 SOLID CHANNEL, SCH. 40 STEEL PIPE, OR OTHER APPROVED MEMBER. SEE PAGE 12-20.
3.) MAY ONLY BE INSTALLED AT HANGER LOCATION, NOT TO THE STRUCTURE.

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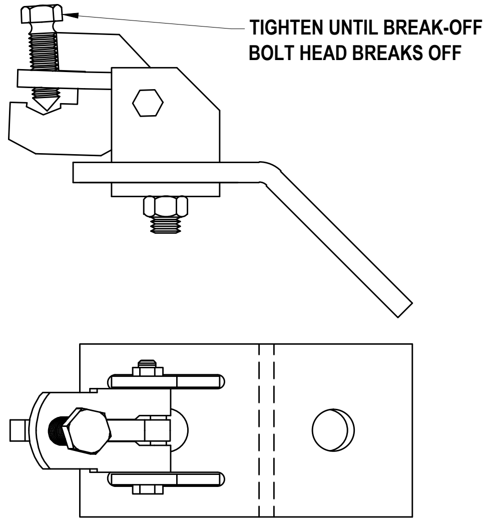
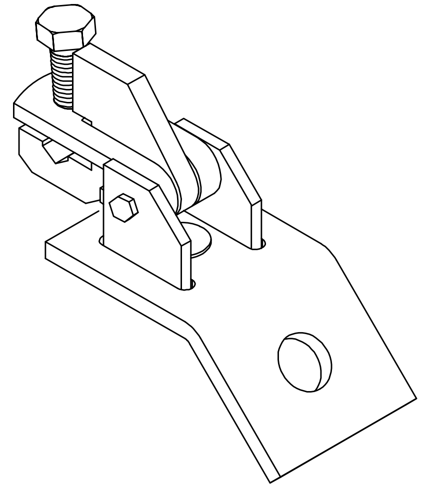
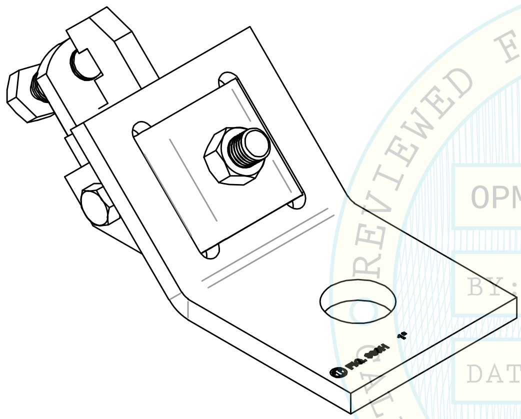
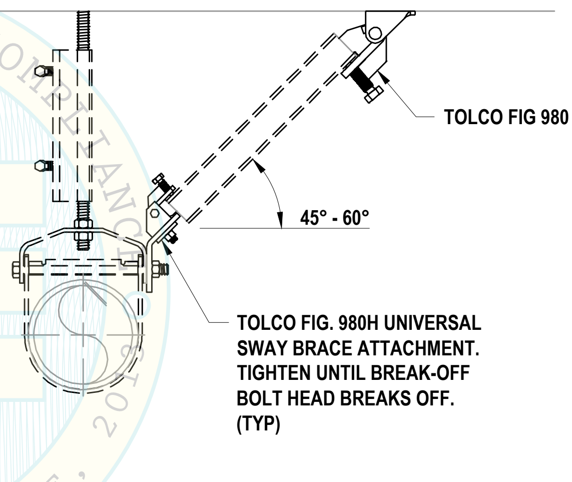
TOLCO FIG. 980H UNIVERSAL SWIVEL SWAY BRACE ATTACHMENT









MINIMUM ROD OR BOLT SIZE	MAXIMUM ROD OR BOLT SIZE	COMPONENT ALLOWABLE HORIZONTAL LOAD (LBS)(ASD)	
		45°	60°
7/8"	1-1/4"	1401	1633

NOTES:

1.) FOR ROD SIZE 7/8" - 1 1/4", FOR SMALLER ROD DIAMETERS USE FIG. 980.
2.) BRACE MAY BE B-LINE B22 SOLID CHANNEL, SCH. 40 STEEL PIPE, OR OTHER APPROVED MEMBER. SEE PAGE 12-20.
3.) MAY BE INSTALLED AT THE STRUCTURE OR AT THE HANGER LOCATION.

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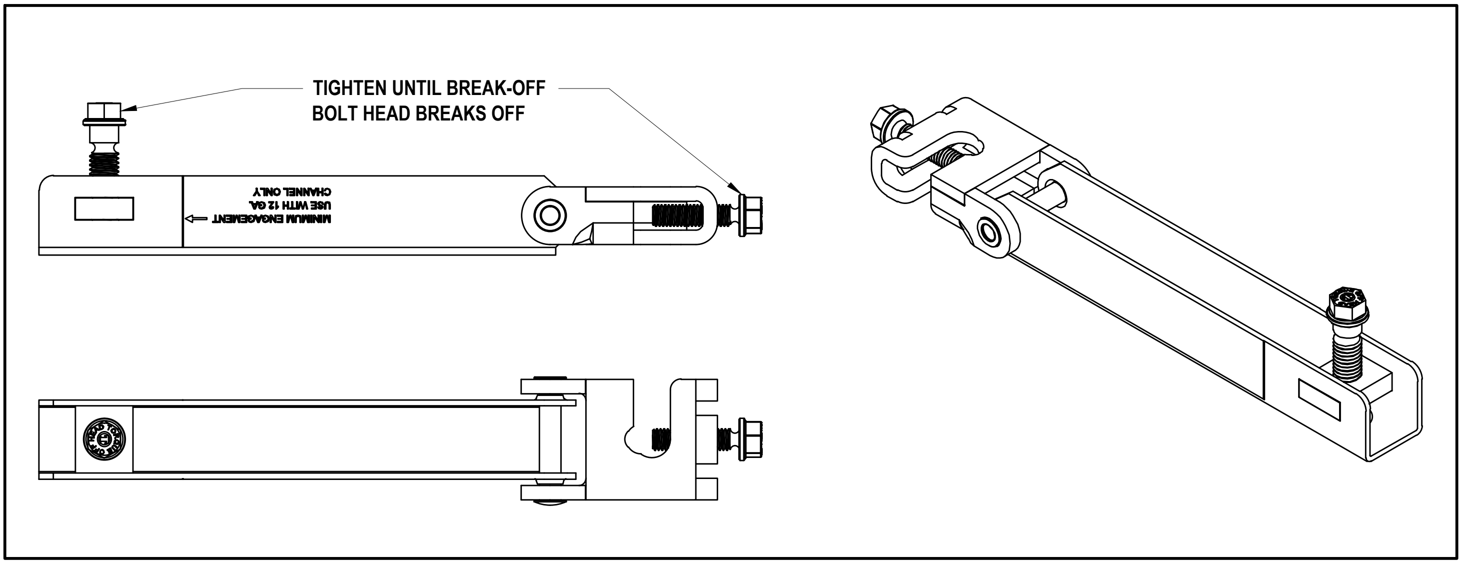
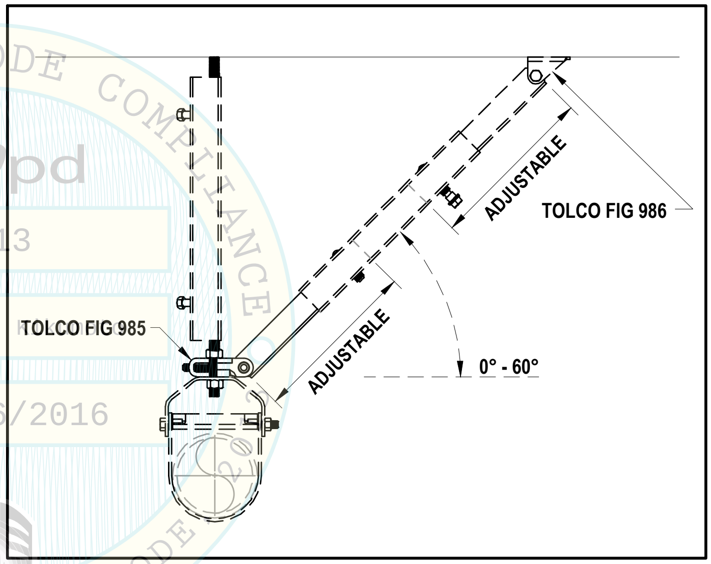
TOLCO FIG. 985 "FAST ATTACH" SWIVEL SWAY BRACE ATTACHMENT





MINIMUM ROD SIZE	MAXIMUM ROD SIZE	COMPONENT ALLOWABLE HORIZONTAL LOAD (LBS)(ASD)		
		0° - 30°	31° - 45°	46° - 60°
3/8"	5/8"	1268	1010	913
3/4"	3/4"	1493	1197	760

NOTES:

1.) FOR ROD SIZE 3/8" THRU 5/8" AND 3/4" THRU 7/8".
2.) FIG. 985 PROVIDES 6" OF ADJUSTABILITY; 12" WHEN USED IN COMBINATION WITH FIG. 986.
3.) BRACE MUST BE B-LINE B22 SOLID CHANNEL. SEE PAGE 12-20.
4.) MAY ONLY BE INSTALLED AT HANGER LOCATION, NOT TO THE STRUCTURE.

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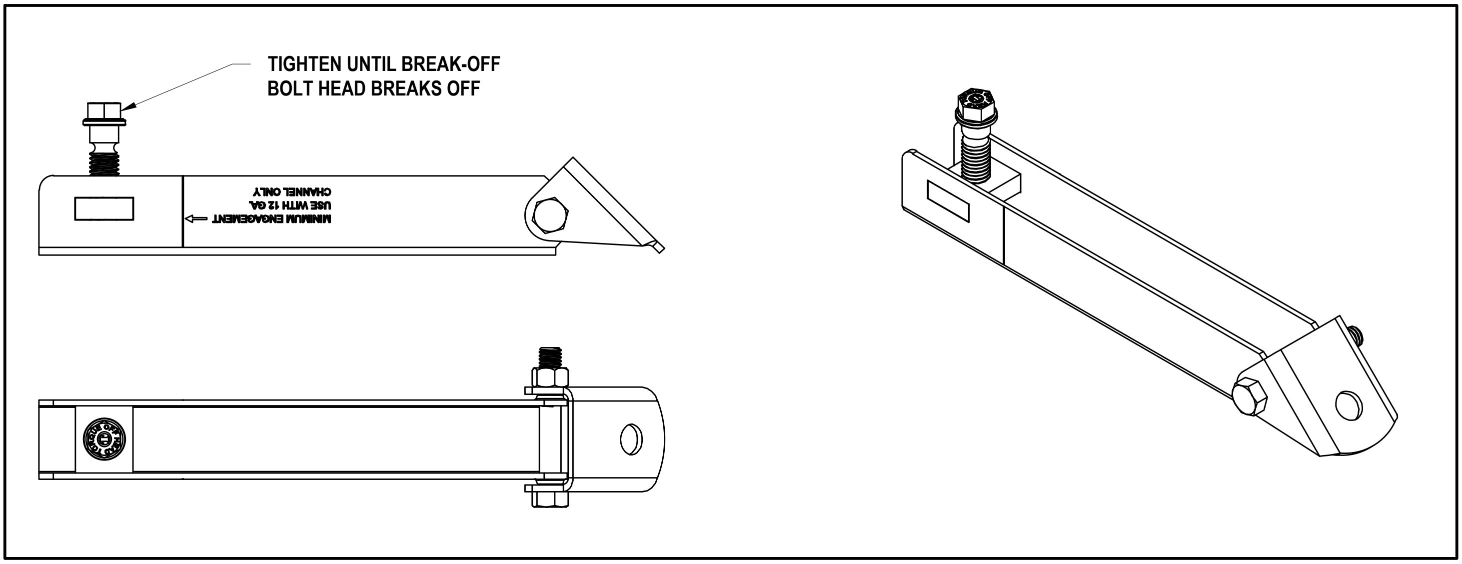
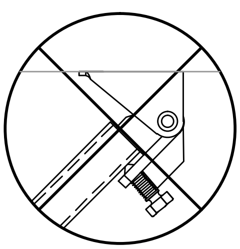
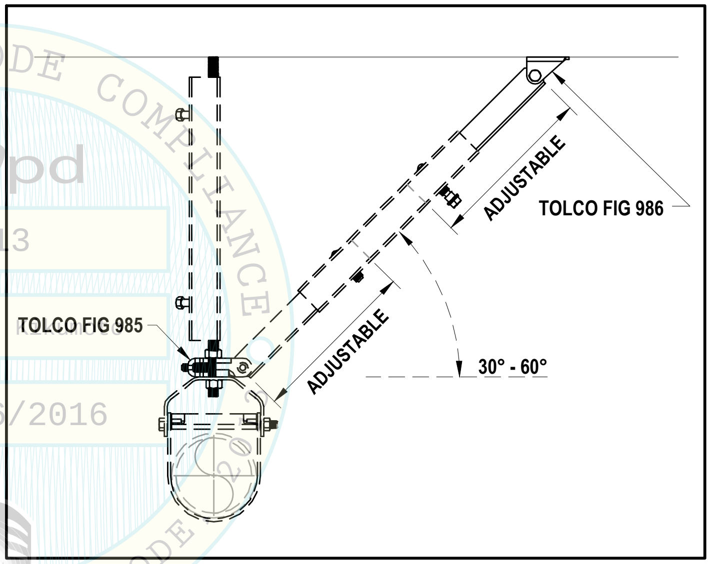
TOLCO FIG. 986 SWIVEL SWAY BRACE ATTACHMENT





DO NOT BEND BRACE PAST 90°



MINIMUM ROD SIZE	COMPONENT ALLOWABLE HORIZONTAL LOAD (LBS)(ASD)		
	30°	31° - 45°	46° - 60°
1/2"	1218	1347	788

NOTES:

1.) FOR ROD SIZE 1/2" THRU 3/4".
2.) FIG. 986 PROVIDES 6" OF ADJUSTABILITY; 12" WHEN USED IN COMBINATION WITH FIG. 985.
3.) BRACE MUST BE B-LINE B22 SOLID CHANNEL. SEE PAGE 12-20.
4.) MAY BE INSTALLED AT THE STRUCTURE OR AT THE HANGER LOCATION.
5.) HOLE FOR FIG. 986 MUST MATCH ROD SIZE.

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TOLCO FIG. 4L OR 4LA "IN-LINE" PIPE CLAMP SWAY BRACE

FIG. 4L - LONGITUDINAL ORIENTATION

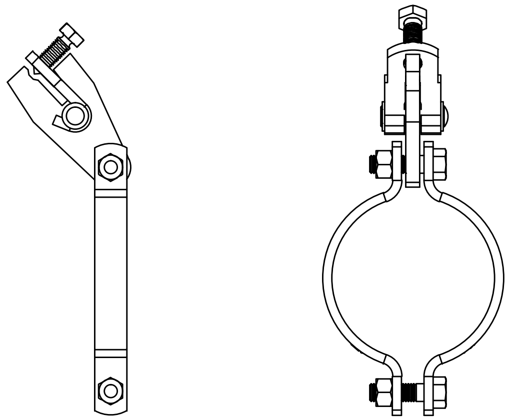


FIG. 4LA - LONGITUDINAL ORIENTATION

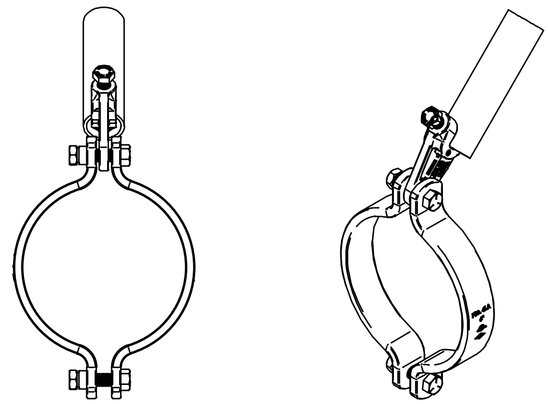
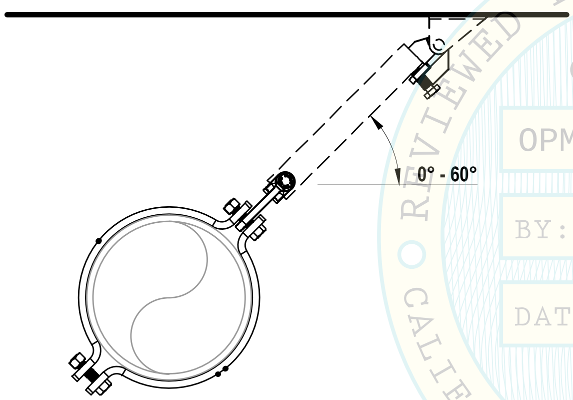


FIG. 4LA - LATERAL ORIENTATION



NOTES:

1.) TIGHTEN BOLTS TO FOLLOWING TORQUE VALUES:

1/4"	6 FT-LBS
5/16"	11 FT-LBS
3/8"	20 FT-LBS
1/2"	49 FT-LBS
5/8"	97 FT-LBS
3/4"	173 FT-LBS
7/8"	200 FT-LBS
1"	250 FT-LBS

2.) REFERENCE PAGE 12-6a FOR ALLOWABLE LONGITUDINAL AND LATERAL LOADS, AND PIPE DIAMETERS PERMITTED.

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TOLCO FIG. 4L OR 4LA "IN-LINE" PIPE CLAMP SWAY BRACE (LOADS) (ASD)

MODEL	PART DESCRIPTION	ORIENTATION	RUN PIPE NOMINAL SIZE, IN.	PIPE RUN REFERENCE	COMPONENT ALLOWABLE HORIZONTAL LOAD (LBS)			REMARKS
					BRACE ANGLE MEASURED FROM HORIZONTAL			
					46°-60°	31°-45°	0°-30°	
4L	LONGITUDINAL IN-LINE ATTACHMENT	LONGITUDINAL	2 1/2	SCHD 10, SCHD 40	1030	1180	1420	b
4L	LONGITUDINAL IN-LINE ATTACHMENT	LONGITUDINAL	3, 4	SCHD 10, SCHD 40	530	730	890	b
4L	LONGITUDINAL IN-LINE ATTACHMENT	LONGITUDINAL	5, 6, 8	0.188, SCHD 40	490	680	830	b, c

REMARKS:

a.) NOT USED
b.) LOAD RATING FOR SCH. 10 ABOVE MAY BE APPLIED TO SCH. 40 STEEL PIPES.
c.) LOAD RATING FOR 0.188 ABOVE REFERS TO 0.188 INCH WALL THICKNESS PIPE AND CAN BE APPLIED TO ANY THICKER WALL.

MODEL	RUN PIPE NOMINAL SIZE, IN.	RUN PIPE REFERENCE	LONGITUDINAL			LATERAL			REMARKS
			COMPONENT ALLOWABLE LOAD (LBS)			COMPONENT ALLOWABLE LOAD (LBS)			
			BRACE ANGLE MEASURED FROM HORIZONTAL			BRACE ANGLE MEASURED FROM HORIZONTAL			
			46°-60°	31°-45°	0°-30°	46°-60°	31°-45°	0°-30°	
4LA	1 1/4	LW, 10, 40	680	970	1190	680	970	1190	a, b, c
4LA	1 1/2	LW, 10, 40	680	970	1190	680	970	1190	a, b, c
4LA	2	LW, 10, 40	680	860	1030	680	860	1030	a, b, c
4LA	2 1/2	LW, 10, 40	680	970	1190	680	970	1190	a, b, c
4LA	3	LW, 10, 40	680	970	1190	680	970	1190	a, b, c
4LA	3 1/2	LW, 10, 40	680	970	1190	680	970	1190	a, b, c
4LA	4	LW, 10, 40	680	970	1190	680	970	1190	a, b, c
4LA	6	LW, 10, 40	1620	2260	2010	1620	2300	2820	a, b, c
4LA	8	.188, 40	1620	1660	1570	1620	2300	2820	a, b, d
4LA	10	40	1620	1660	1570	1620	2300	2820	a
4LA	12	40	1620	1660	1570	1620	2300	2820	a

REMARKS:

a.) FM APPROVED WHEN USED WITH 1", 1 1/4", 1 1/2" OR 2" SCH. 40 STEEL PIPE AS THE BRACE MEMBER.
b.) LOAD RATING FOR LW ABOVE REFERS TO FM APPROVED LIGHTWALL PIPE, COMMONLY REFERRED TO AS "SCHEDULE 7".
c.) LOAD RATING FOR SCHEDULE 10 ABOVE MAY BE APPLIED TO FM APPROVED THINWALL PIPE AND SCHEDULE 40 STEEL PIPES.
d.) LOAD RATING FOR 0.188 ABOVE REFERS TO 0.188 INCH WALL THICKNESS PIPE AND CAN BE APPLIED TO ANY THICKER WALL.

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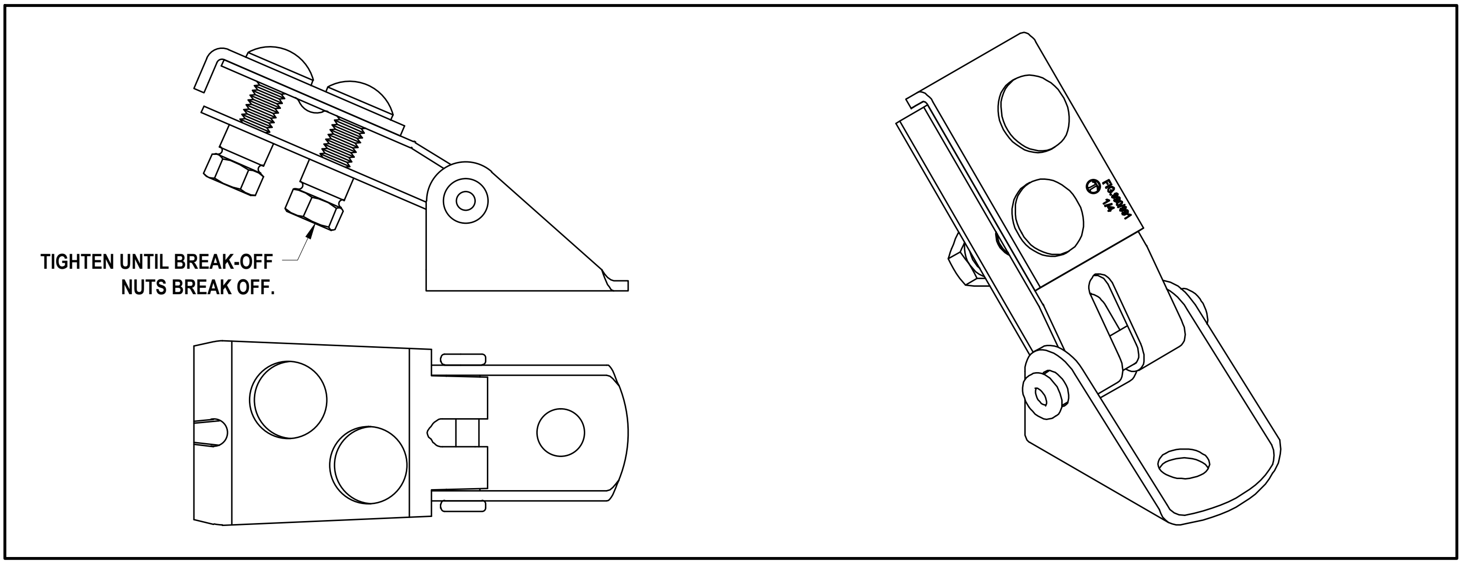
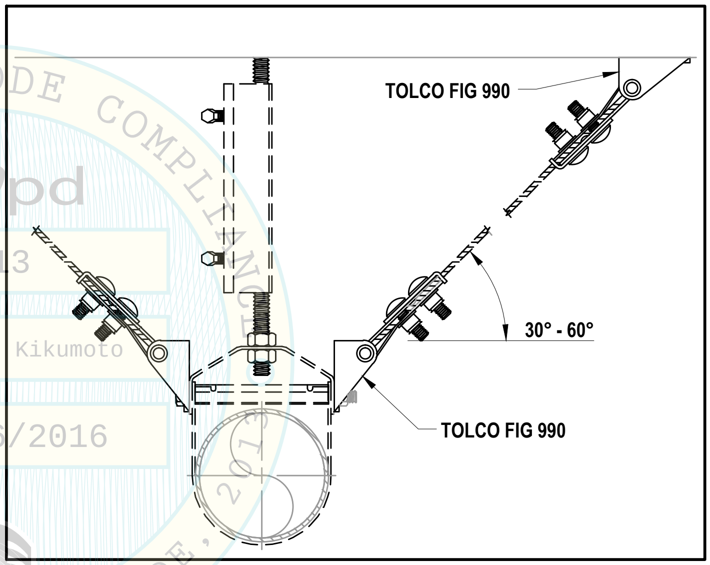
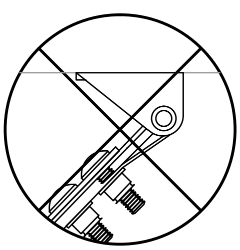
TOLCO FIG. 990 CABLE SWAY BRACE ATTACHMENT



COMPONENT ALLOWABLE HORIZONTAL LOAD (LBS)(ASD)			
BRACE ANGLE MEASURED FROM HORIZ.	30°	31° - 45°	46° - 60°
CABLE 1/8"	303	679	464
CABLE 3/16"	1197	1496	1171
CABLE 1/4"	1570	1864	1444





DO NOT BEND BRACE PAST 90°

NOTES:

1.) MAX. ROD SIZE 3/4", FOR LARGER ROD DIAMETERS USE FIG. 990H.
2.) FOR CABLE BRACE SEE PAGE 12-20.
3.) 1/8" AND 3/16" CABLE REQUIRE A MINIMUM OF 3/8" CONNECTION. 1/4" CABLE REQUIRES A MINIMUM OF 1/2" CONNECTION.
4.) PRE-STRETCHED GALVANIZED, 7 X19, AIRCRAFT CABLE SHALL BE IN COMPLIANCE WITH ASTM A1023..
5.) TOLCO FIG 990 IS NOT ALLOWED TO BE ATTACHED TO CLEVIS HANGER RODS.
6.) FOR FIG 3100, MINIMUM CROSS BOLT SHALL BE 3/8"Ø FOR USE WITH FIG 990.

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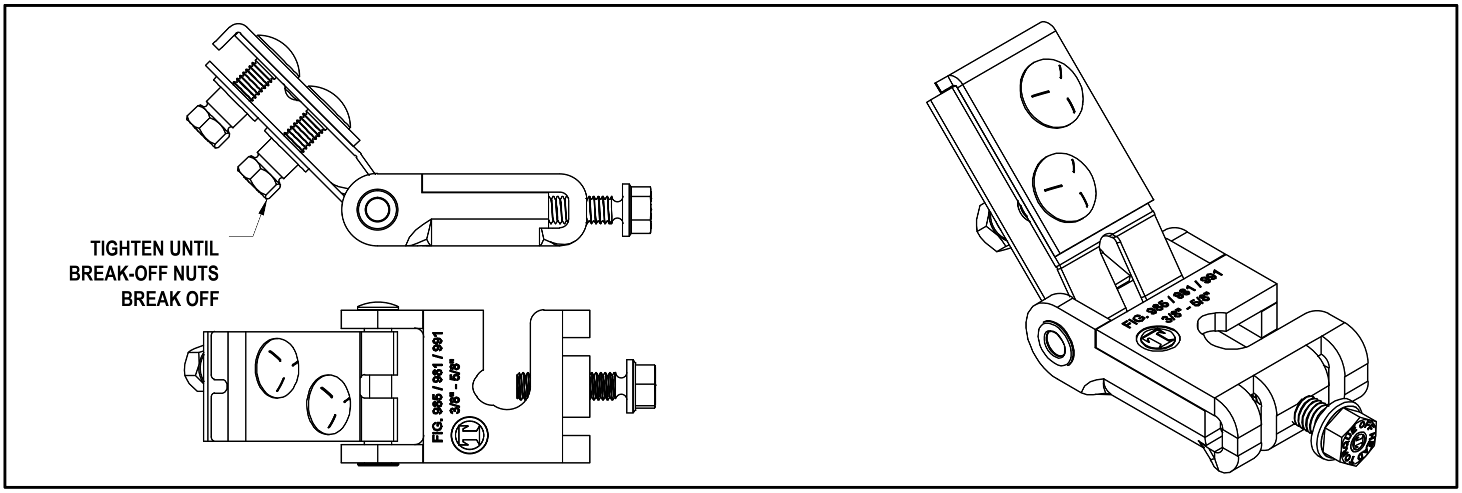
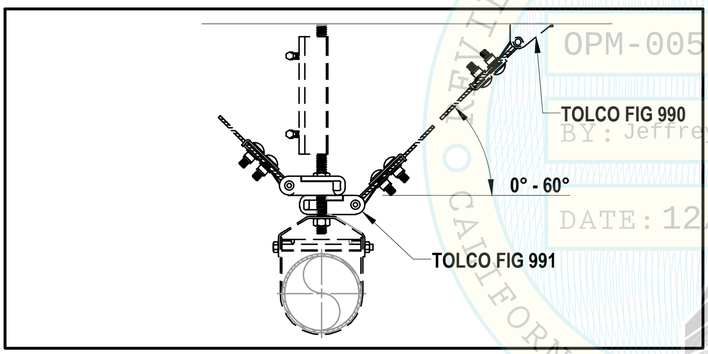
TOLCO FIG. 991 "FAST ATTACH" CABLE SWAY BRACE ATTACHMENT





COMPONENT ALLOWABLE HORIZONTAL LOAD (LBS)(ASD)			
BRACE ANGLE MEASURED FROM HORIZ.	0° - 30°	31° - 45°	46° - 60°
CABLE 1/8"	943	749	564
CABLE 3/16"	1359	1588	1220
CABLE 1/4"	1450	1528	1423

NOTES:

1.) MAX. ROD SIZE 3/4", FOR LARGER ROD DIAMETERS USE FIG. 990H.
2.) FOR CABLE BRACE SEE PAGE 12-20.
3.) MINIMUM 3/8" CONNECTION FOR 1/8" AND 3/16" CABLES. MINIMUM 3/4" CONNECTIONS FOR 1/4" CABLES.
4.) PRE-STRETCHED GALVANIZED, 7 X19, AIRCRAFT CABLE SHALL BE IN COMPLIANCE WITH ASTM A1023.

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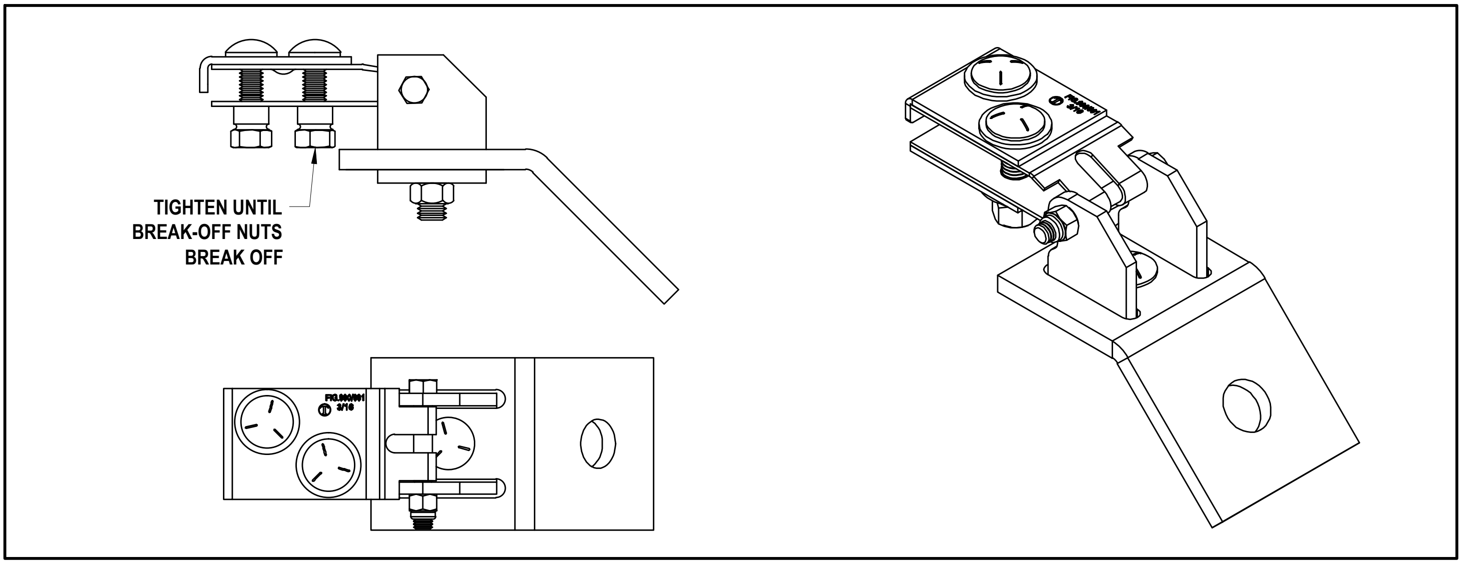
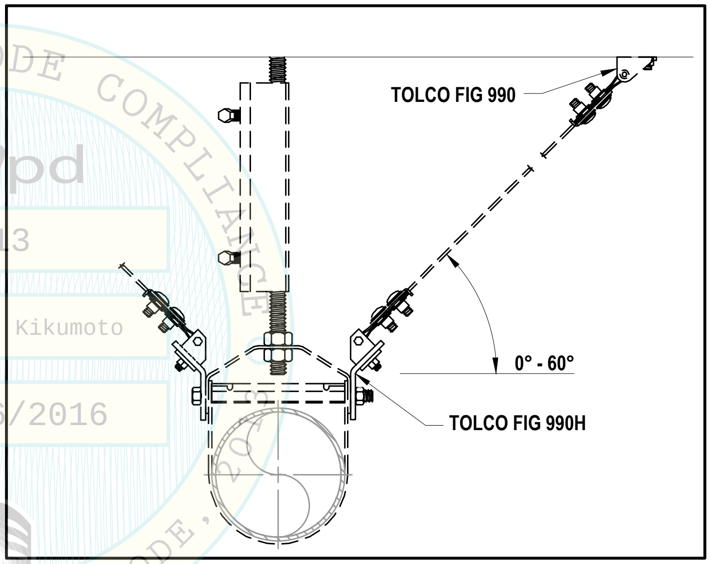
TOLCO FIG. 990H CABLE SWIVEL SWAY BRACE ATTACHMENT





COMPONENT ALLOWABLE HORIZONTAL LOAD (LBS)(ASD)			
BRACE ANGLE MEASURED FROM HORIZ.	0° - 30°	31° - 45°	46° - 60°
CABLE 1/4"	1139	1465	1412

NOTES:

1.) FOR ROD SIZE 7/8", FOR SMALLER ROD DIAMETERS USE FIG. 990.
2.) FOR CABLE BRACE SEE PAGE 12-20.
3.) PRE-STRETCHED GALVANIZED , 7 X19, AIRCRAFT CABLE SHALL BE IN COMPLIANCE WITH ASTM A1023.
4.) 1/4" CABLE REQUIRED A MINIMUM OF 7/8" CONNECTION.

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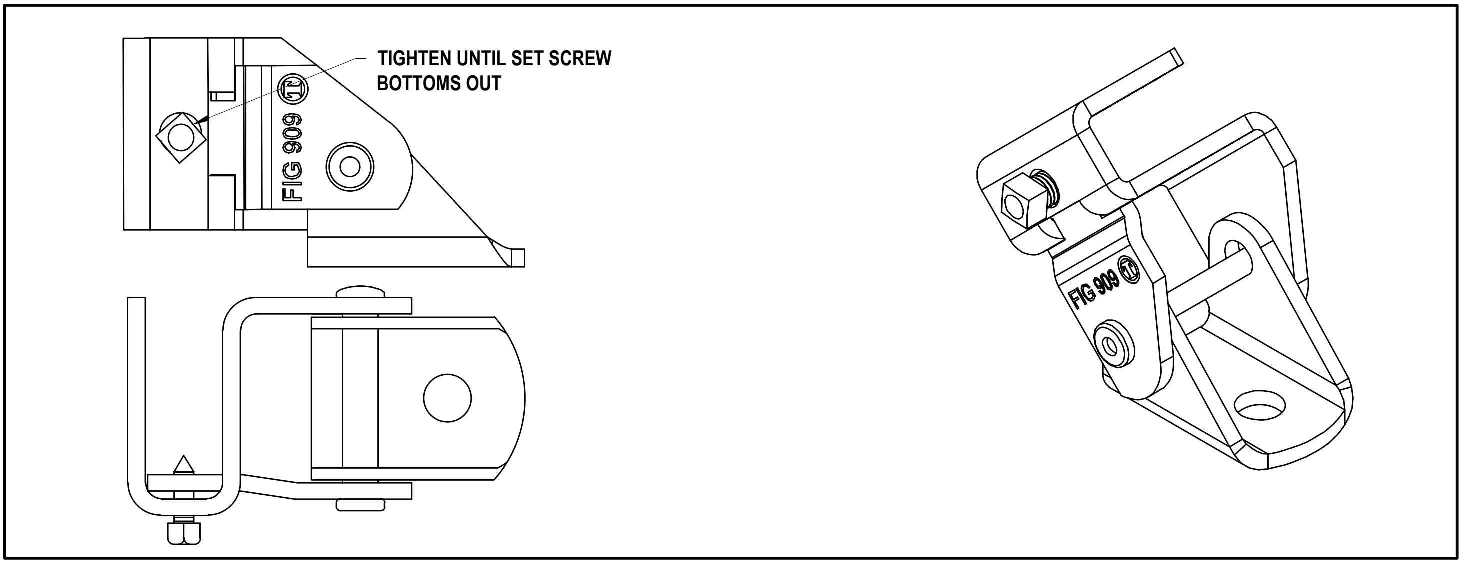
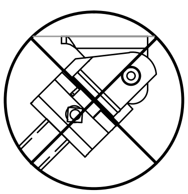
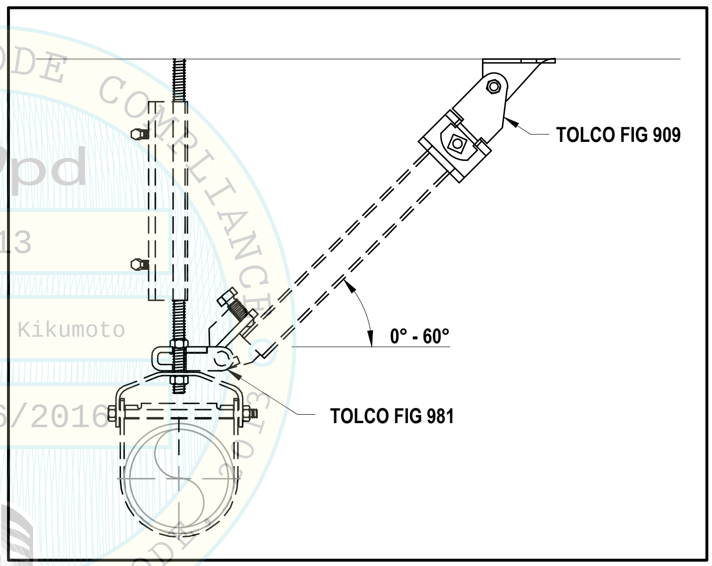
TOLCO FIG. 909 NO THREAD SWIVEL SWAY BRACE ATTACHMENT





DO NOT BEND
BRACE PAST 90°



MINIMUM ROD SIZE	COMPONENT ALLOWABLE HORIZONTAL LOAD (LBS)(ASD)		
	0° - 30°	31° - 45°	46° - 60°
1/2"	1525	1286	886

NOTES:

1.) MAX. ROD SIZE 3/4", FOR LARGER ROD DIAMETERS USE FIG. 980H.
2.) BRACE MEMBER, 1" STEEL PIPE, MUST BE SCH10 OR SCH40. SEE PAGE 12-20

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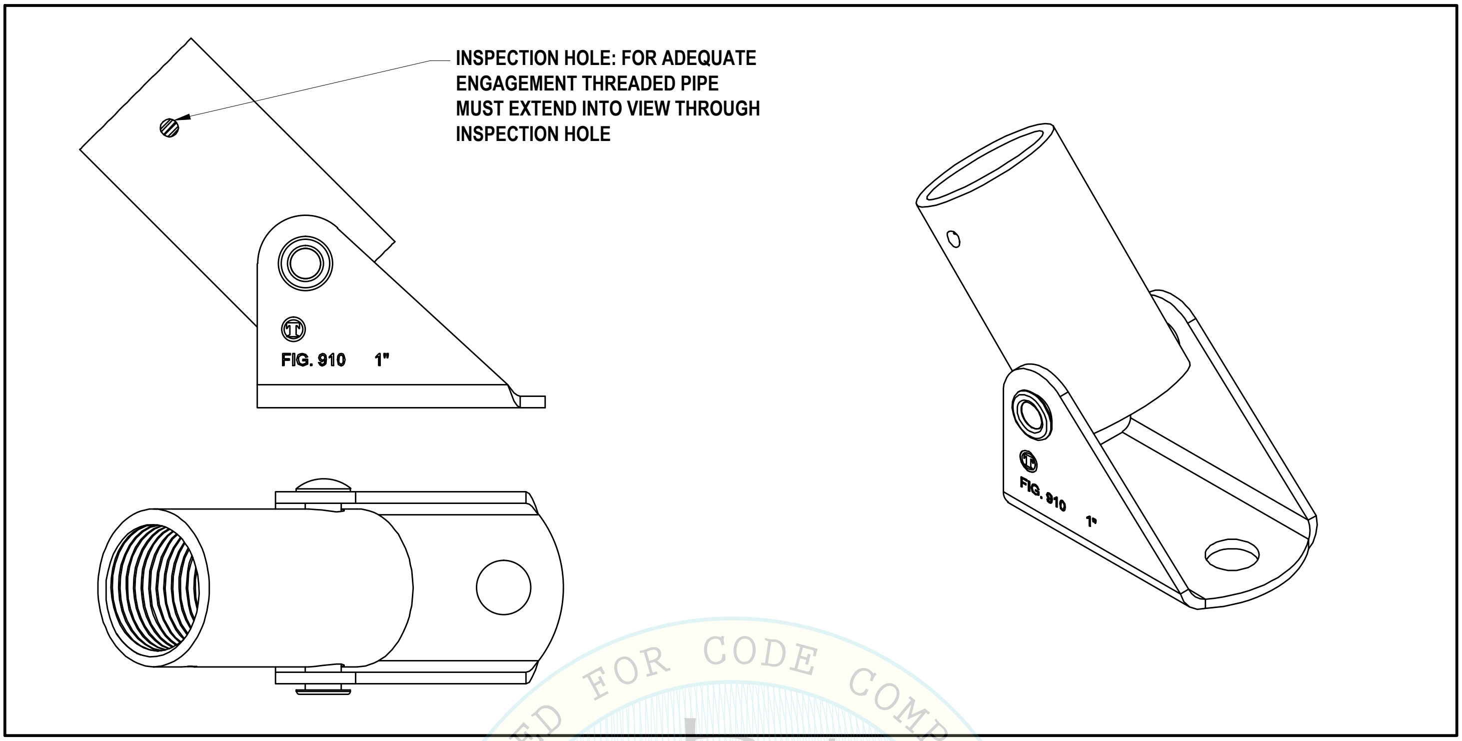
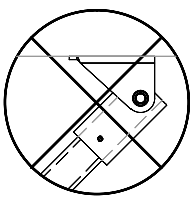
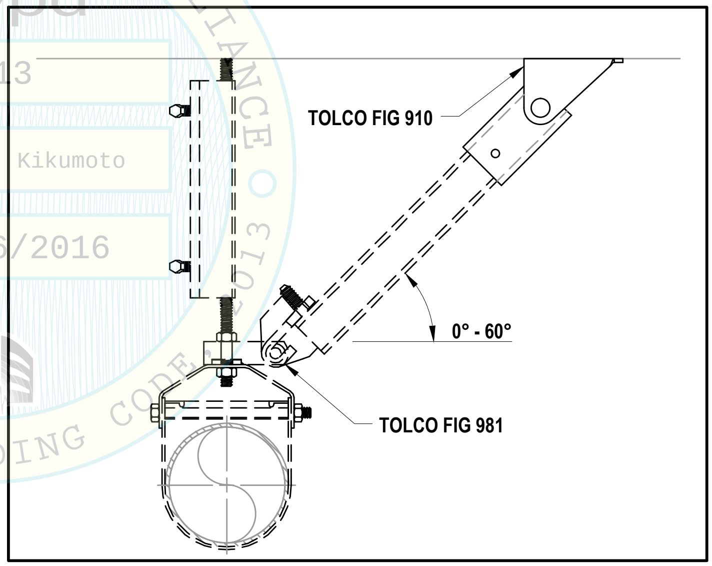
TOLCO FIG. 910 SWIVEL SWAY BRACE FITTING





DO NOT BEND
BRACE PAST 90°



MINIMUM ROD SIZE	COMPONENT ALLOWABLE HORIZONTAL LOAD (LBS)(ASD)		
	0° - 30°	31° - 45°	46° - 60°
1/2"	4137	3848	1845

NOTES:

1.) MAX. ROD SIZE 3/4", FOR LARGER ROD DIAMETERS USE FIG. 980H.
2.) BRACE MEMBER, 1" OR 1-1/4" STEEL PIPE, MUST BE SCH10 OR SCH40 SEE PAGE 12-20.

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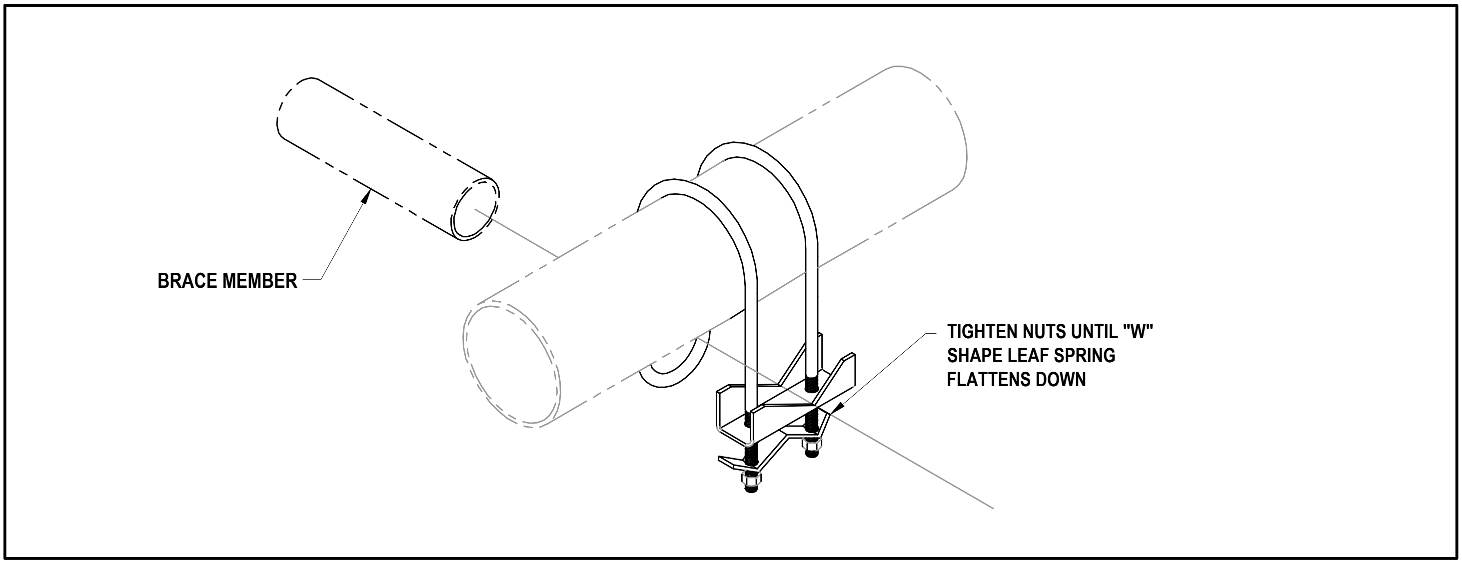
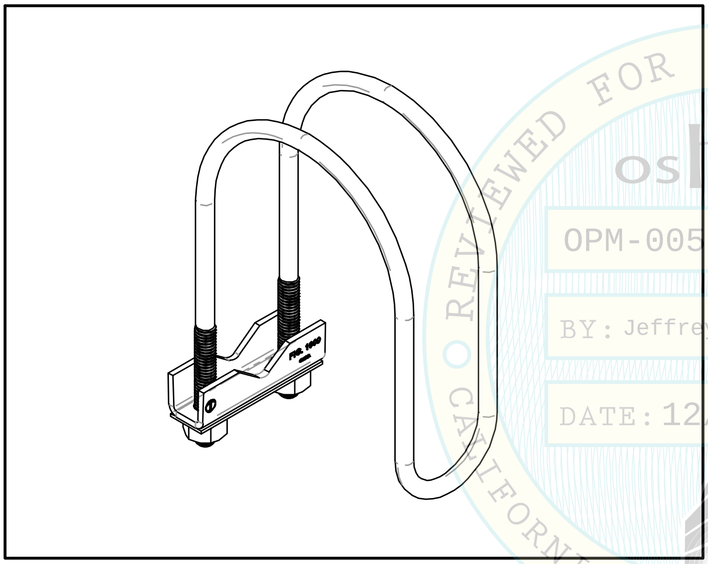
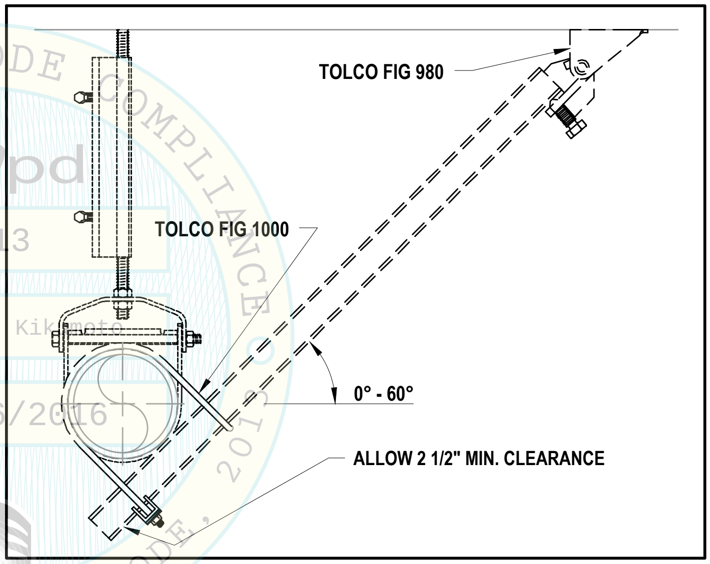
TOLCO FIG. 1000 FAST CLAMP







COMPONENT ALLOWABLE LOAD (LBS)(ASD)					REMARKS
BRACE ANGLE MEASURED FROM HORIZ.		0° - 30°	31° - 45°	46° - 60°	
ALLOWABLE HORIZONTAL LOAD (LBS)	RUN PIPE 1 1/4" THRU 2 1/2" LW, SCHEDULE 10/40	340	280	200	a, b
	RUN PIPE 3" THRU 4" LW, SCHEDULE 10/40	400	320	230	a, b

FOOTNOTES:

a.) FM APPROVED WHEN USED WITH 1-1/4, 1-1/2, OR 2 INCH SCHEDULE 40 STEEL PIPE AS THE BRACE MEMBER.

b.) LOAD RATING FOR SCHEDULE 10 ABOVE MAY BE APPLIED TO FM APPROVED THINWALL PIPE AND SCHEDULE 40 STEEL PIPES.

NOTES:

1.) FIG. 1000 MAY BE POSITIONED ABOVE OR BELOW BRACE MEMBER.
2.) FIG. 1000 MAY BE INSTALLED SUCH THAT NUTS ARE ON THE OPPOSITE SIDE THAN AS SHOWN.

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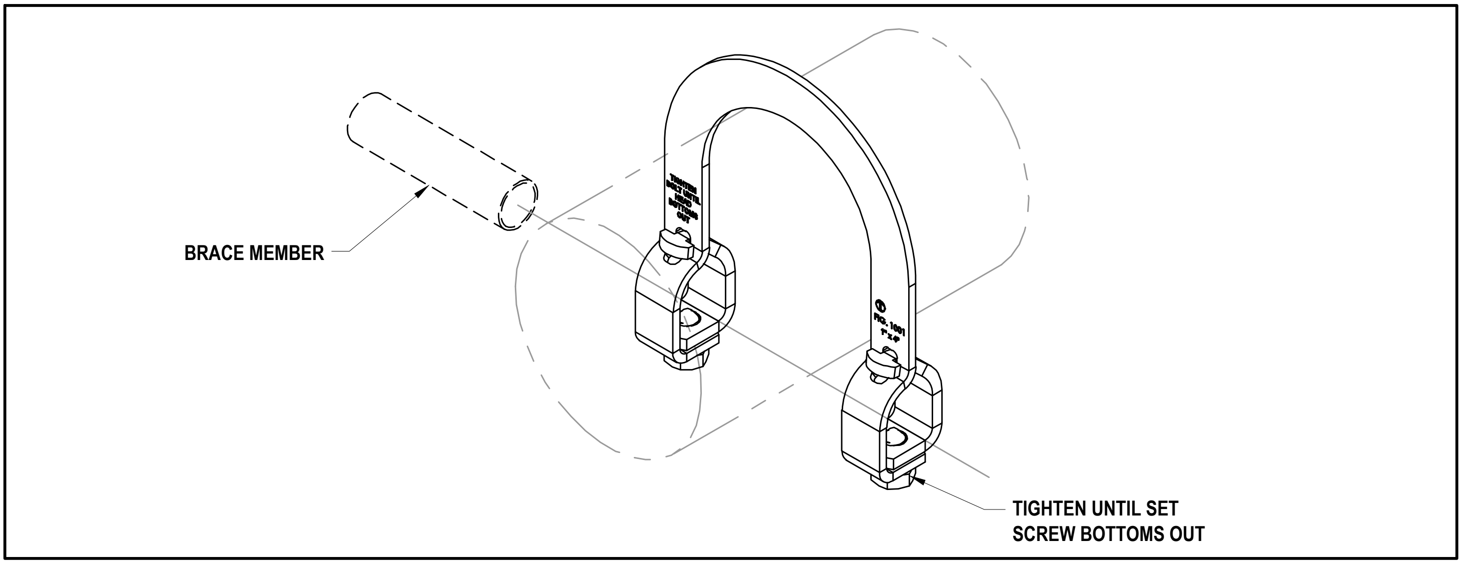
TOLCO FIG. 1001 SWAY BRACE ATTACHMENT

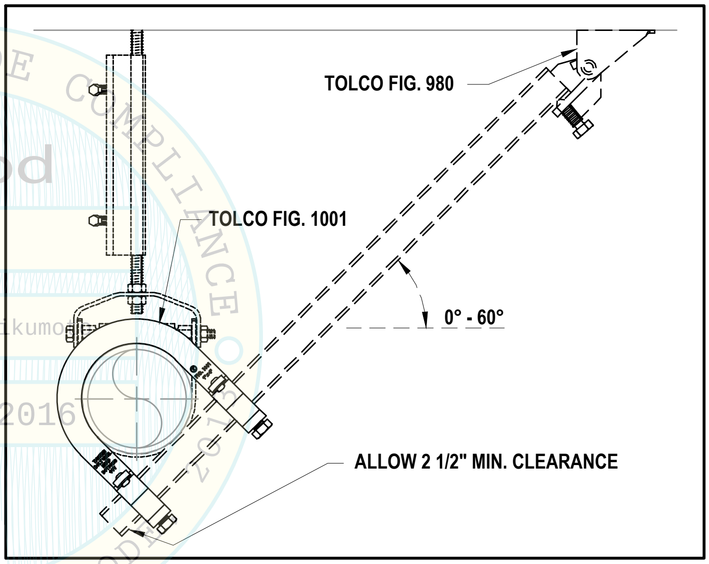


COMPONENT ALLOWABLE LOAD (LBS)(ASD)					REMARKS
BRACE ANGLE MEASURED FROM HORIZ.		0° - 30°	31° - 45°	46° - 60°	
ALLOWABLE HORIZONTAL LOAD (LBS)	RUN PIPE 1" LW, SCHEDULE 10/40	3120	2550	1800	a, b
	RUN PIPE 1 1/4" - 2" LW, SCHEDULE 10/40	2140	1740	1230	a, b
	RUN PIPE 2 1/2" LW, SCHEDULE 10/40	1380	1130	800	a, b
	RUN PIPE 3" THRU 4" LW, SCHEDULE 10/40	1470	1200	850	a, b
	RUN PIPE 5" THRU 8" LW, SCHEDULE 10/40	890	730	510	a, b

NOTES:

a.) FM APPROVED WHEN USED WITH 1, 1-1/4, 1-1/2, OR 2 INCH SCHEDULE 40 STEEL PIPE AS THE BRACE MEMBER.

b.) LOAD RATING FOR SCHEDULE 10 ABOVE MAY BE APPLIED TO GB/T 3091, GB/T 3092, EN 10255M AND H, JIS G3454, FM APPROVED THINWALL PIPE AND SCHEDULE 40 STEEL PIPES.



NOTES:

1.) FIG. 1001 MAY BE POSITIONED ABOVE OR BELOW BRACE MEMBER.

2.) FM APPROVED WHEN USED WITH 1, 1-1/4, 1-1/2, OR 2 INCH SCHEDULE 40 STEEL PIPE AS THE BRACE MEMBER.

3.) LOAD RATING FOR SCHEDULE 10 ABOVE MAY BE APPLIED TO FM APPROVED THIN WALL PIPE AND SCHEDULE 40 STEEL PIPES.

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California SE No. S3545

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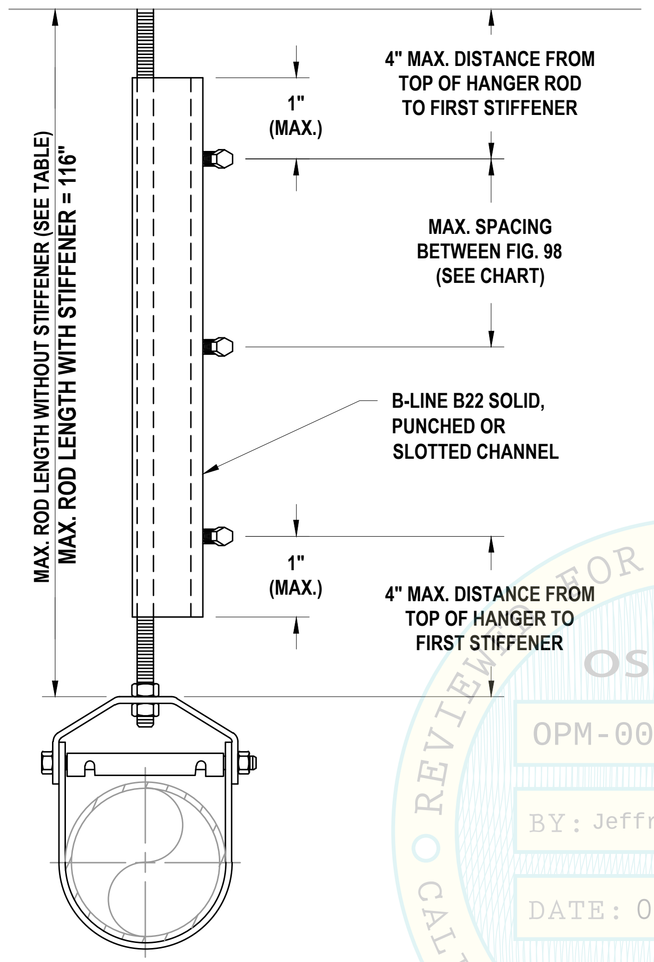
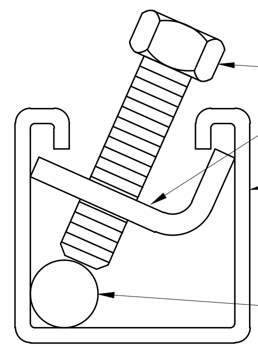
TOLCO FIG. 98 ROD STIFFENER





ROD SIZE	MAX. ROD LENGTH WITHOUT ROD STIFFENER	MAX. COMPRESSION FORCE WITHOUT STIFFENER	MAX. SPACING BETWEEN TOLCO FIG. 98	MAX. COMPRESSION FORCE WITH STIFFENER
3/8"	18"	410	13"	1246
1/2"	25"	730	18"	2105
5/8"	31"	1160	23"	3187
3/4"	37"	1690	28"	4493
7/8"	43"	2320	33"	6021

NOTES:

1.) ROD STIFFENERS ARE REQUIRED ONLY ON VERTICAL STRUT COMPONENT OF THE SEISMIC BRACE SYSTEM ON HANGER AND TRAPEZE ASSEMBLIES THAT HAVE SEISMIC BRACING BRACING ATTACHED AT OR WITHIN 6" OF THE ROD. A MINIMUM OF TWO ROD STIFFENERS (TOLCO FIG. 98) MUST BE INSTALLED.
2.) DETAIL APPLIES TO ALL HUNG UTILITIES INCLUDING SINGLE HUNG UTILITIES, TRAPEZE HUNG UTILITIES, AND HUNG EQUIPMENT.
3.) AN EXCEPTION IS THE USE OF TWO OPPOSING RIGID BRACES AT THE SAME LOCATION. FOR INDIVIDUALLY HUNG PIPE THE TWO OPPOSING RIGID BRACES MUST BE AT THE SAME HANGER ROD; TOTAL OF TWO (2) FOR TRANSVERSE, OR TWO (2) FOR LONGITUDINAL. FOR A TRAPEZE HANGER THE TWO OPPOSING RIGID BRACES MUST BE AT THE SAME HANGER ROD; TOTAL OF TWO (2) FOR TRANSVERSE, OR FOUR (4) FOR LONGITUDINAL. THE TWO OPPOSING BRACES MUST BE AT THE SAME ANGLE FROM HORIZONTAL AND WITHIN 5-DEGREES OF 180 DEGREES FROM EACH OTHER. IN THIS CASE NO STIFFENING OF VERTICAL ROD IS NECESSARY.
4.) MATERIAL SPECIFICATIONS FOR TOLCO FIG. 98, BODY: ASTM A-1011-CS TYPE B SAE 1006, BOLT: HEX BOLT GRADE 5

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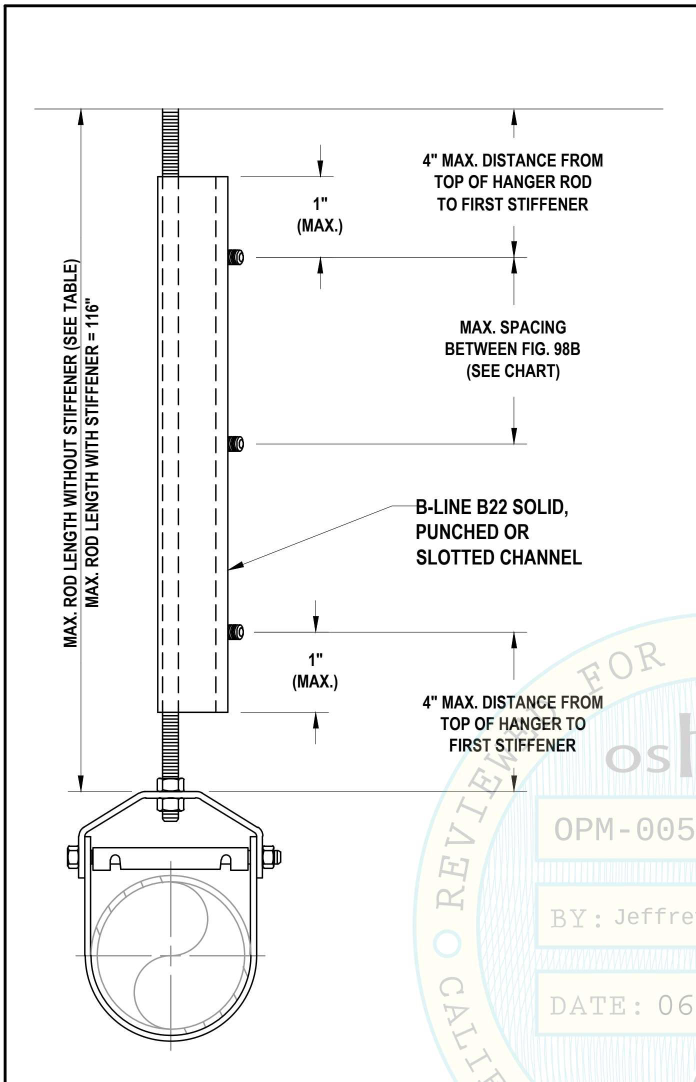
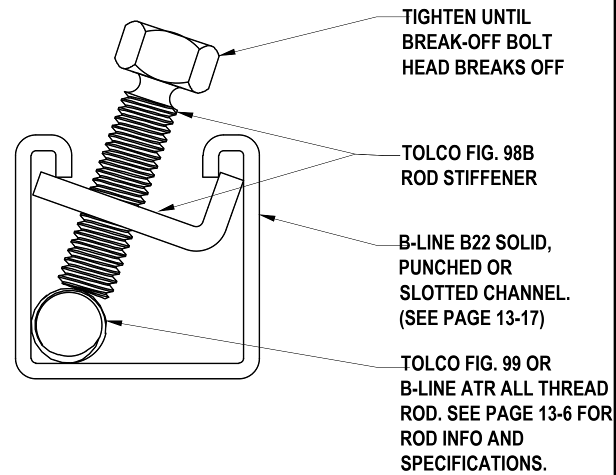
TOLCO FIG. 98B ROD STIFFENER



3/8" THRU 7/8" ROD SIZE



ROD SIZE	MAX. ROD LENGTH WITHOUT ROD STIFFENER	MAX. COMPRESSION FORCE WITHOUT STIFFENER	MAX. SPACING BETWEEN TOLCO FIG. 98	MAX. COMPRESSION FORCE WITH STIFFENER
3/8"	18"	410	13"	1246
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3/4"	37"	1690	28"	4493
7/8"	43"	2320	33"	6021

NOTES:

1.) ROD STIFFENERS ARE REQUIRED ONLY ON VERTICAL STRUT COMPONENT OF THE SEISMIC BRACE SYSTEM ON HANGER AND TRAPEZE ASSEMBLIES THAT HAVE SEISMIC BRACING BRACING ATTACHED AT OR WITHIN 6" OF THE ROD. A MINIMUM OF TWO ROD STIFFENERS (TOLCO FIG. 98B) MUST BE INSTALLED.
2.) DETAIL APPLIES TO ALL HUNG UTILITIES INCLUDING SINGLE HUNG UTILITIES, TRAPEZE HUNG UTILITIES, AND HUNG EQUIPMENT.
3.) AN EXCEPTION IS THE USE OF TWO OPPOSING RIGID BRACES AT THE SAME LOCATION. FOR INDIVIDUALLY HUNG PIPE THE TWO OPPOSING RIGID BRACES MUST BE AT THE SAME HANGER ROD; TOTAL OF TWO (2) FOR TRANSVERSE, OR TWO (2) FOR LONGITUDINAL. FOR A TRAPEZE HANGER THE TWO OPPOSING RIGID BRACES MUST BE AT THE SAME HANGER ROD; TOTAL OF TWO (2) FOR TRANSVERSE, OR FOUR (4) FOR LONGITUDINAL. THE TWO OPPOSING BRACES MUST BE AT THE SAME ANGLE FROM HORIZONTAL AND WITHIN 5-DEGREES OF 180 DEGREES FROM EACH OTHER. IN THIS CASE NO STIFFENING OF VERTICAL ROD IS NECESSARY.
4.) MATERIAL SPECIFICATIONS FOR TOLCO FIG. 98B, BODY: ASTM A-1011 CS TYPE B SAE; BREAK-OFF BOLT: 1035 (AISI-SAE) CASE HARDENED TO 0.015 MIN. DEPTH THRU HARDENED @ 45-55 RC FROM ANNEALED CONDITION.

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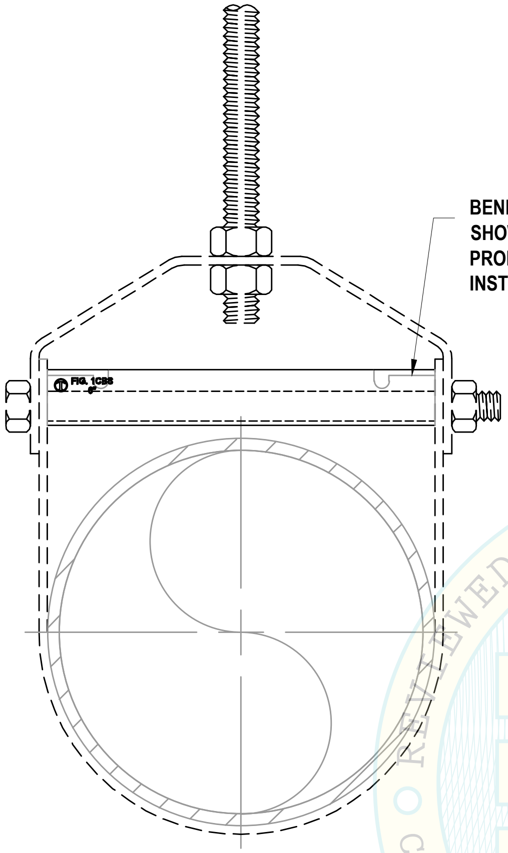
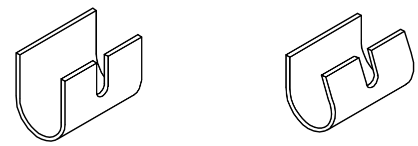
TOLCO FIG. 1CBS CROSS BOLT SPACER



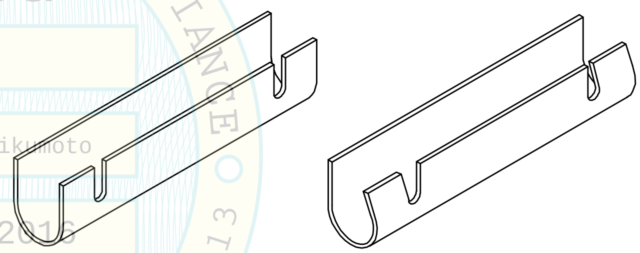
FOR PIPE SIZES UP TO 1 1/2"

UNINSTALLED INSTALLED



FOR PIPE SIZES 2" AND UP

UNINSTALLED INSTALLED



NOTES:

1.) CROSS BOLT SPACER ONLY REQUIRED AT SEISMIC BRACING LOCATIONS.
2.) COSS BOLT SPACER ONLY TO BE USED WITH TOLCO FIG. 1 OR B-LINE B3100

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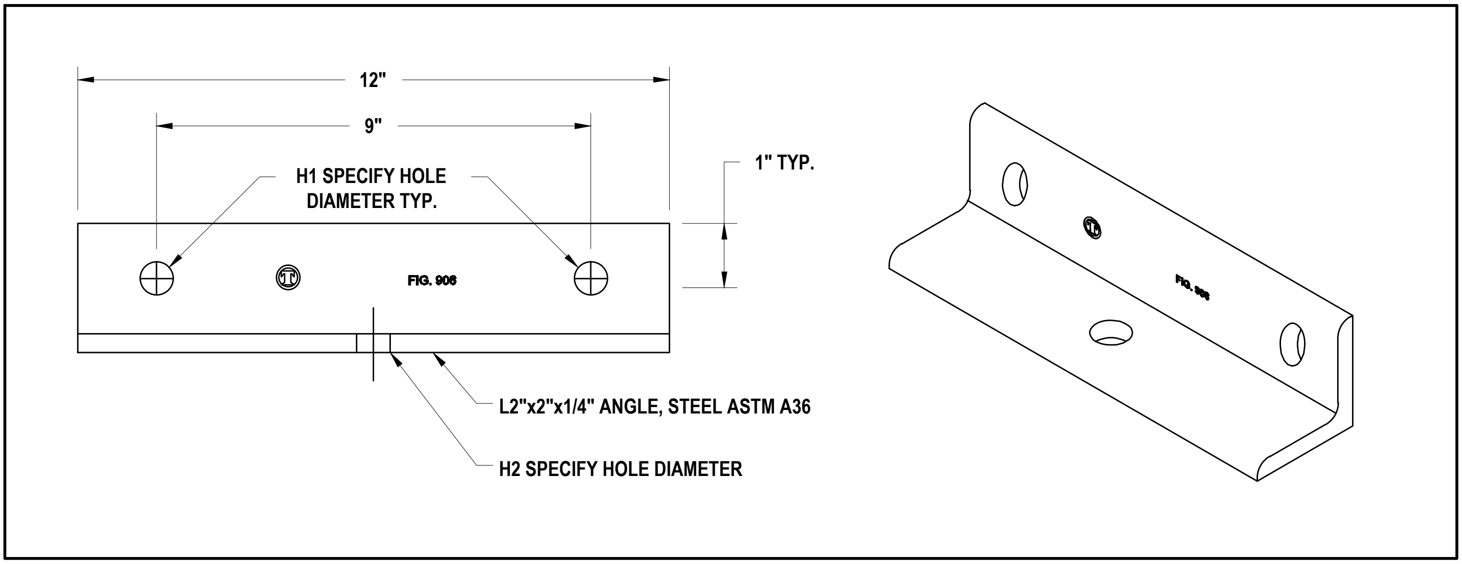
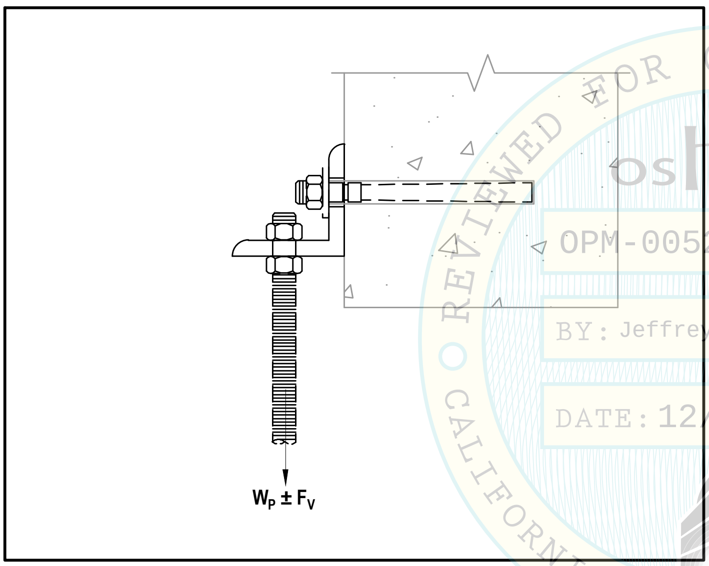
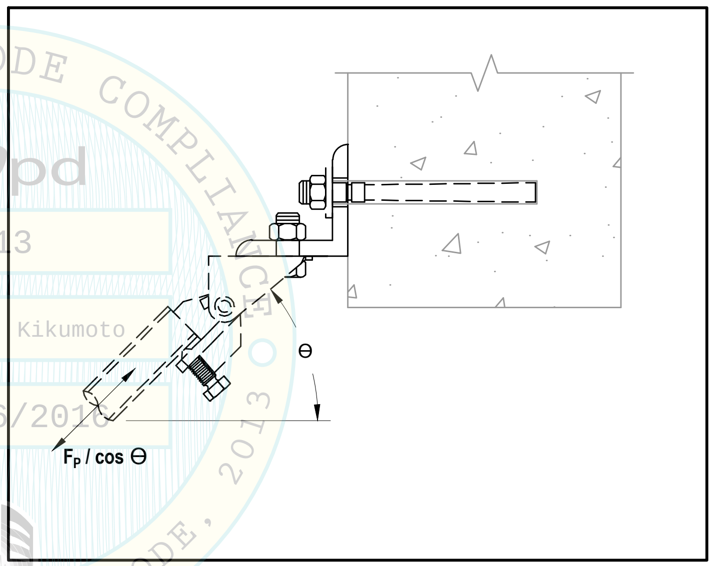
TOLCO FIG. 906 SWAY BRACE MULTI-FASTENER ADAPTER







NOTES:

1.) FOR DESIGN LOADS SEE STRUCTURAL ATTACHMENT SECTION 11.
2.) HOLE DIAMETER TO BE 1/16" MAX. GREATER THAN BOLT DIAMETER, PER AISC 360-10.
3.) H1 AND H2 13/16" DIAMETER MAX.

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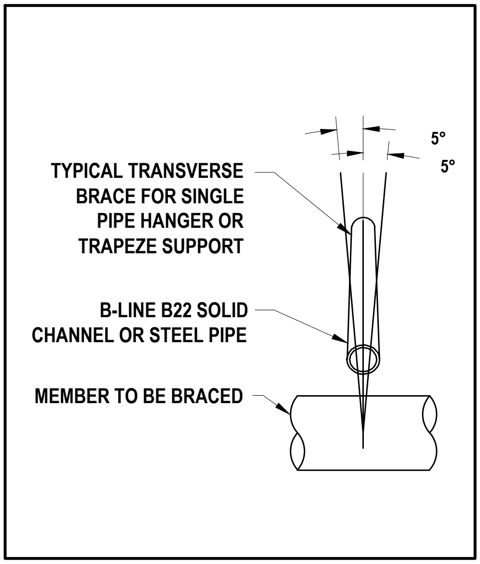
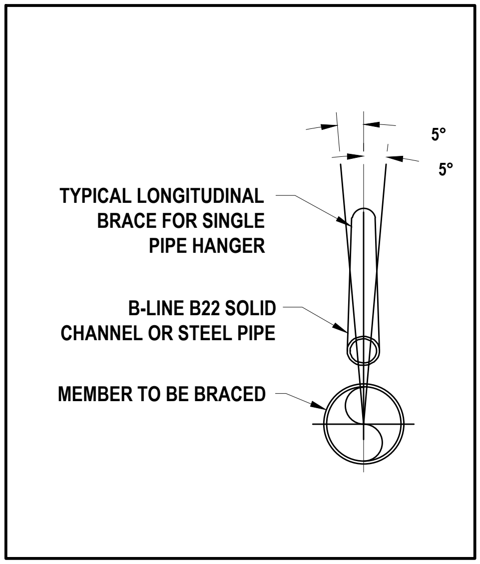
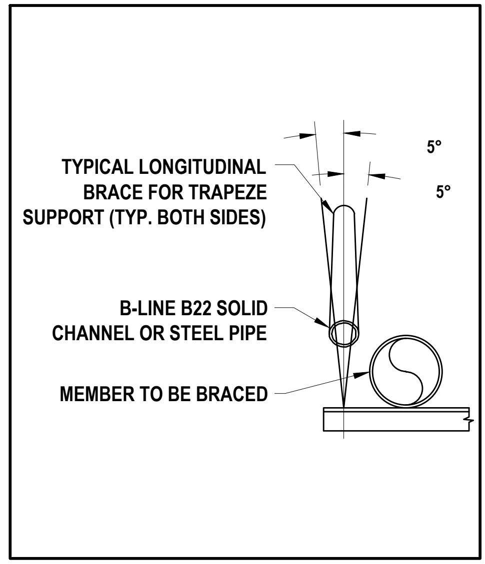
MAXIMUM ALLOWABLE LENGTHS AND AXIAL LOADS FOR BRACE MEMBERS







BRACING MEMBER					
PIPE DIAMETER	MAXIMUM LENGTH	SCHED.	ALLOWABLE HORIZ. SEISMIC LOAD (LBS)(ASD) BRACE ANGLE MEASURED FROM HORIZ.		
			0° - 30°	31° - 45°	46° - 60°
SEISMIC BRACING KL/R = 200					
1"	7'-0"	40	970	792	560
1 1/4"	9'-0"	40	1307	1067	755
1 1/2"	10'-4"	40	1594	1301	920
2"	13'-1"	40	2126	1735	1227
3"	19'-6"	10	4330	3535	2500
3 1/2"	22'-4"	10	5284	4285	3030
4"	25'-0"	10	6235	5091	3600

BRACING MEMBER				
STRUT SIZE	MAXIMUM LENGTH	ALLOWABLE HORIZ. SEISMIC LOAD (LBS)(ASD) BRACE ANGLE MEASURED FROM HORIZ.		
		0° - 30°	31° - 45°	46° - 60°
SEISMIC BRACING K/R = 200				
B-LINE B22	9'-6"	1900	1552	1097
B-LINE B24	9'-6"	1488	1215	859

BRACING MEMBER				
PRE STRETCHED GALVANIZED, 7X19, AIRCRAFT CABLE DIAMETER	MAXIMUM LENGTH	ALLOWABLE HORIZ. SEISMIC LOAD (LBS)(ASD) BRACE ANGLE MEASURED FROM HORIZ.		
		0° - 30°	31° - 45°	46° - 60°
SEISMIC BRACING KL/R = N/A				
1/8"	∞	873	689	487
3/16"	∞	1774	1449	1024
1/4"	∞	2727	2227	1574

NOTES:

1.) ALL LONGITUDINAL AND TRANSVERSE BRACING UTILIZING PIPE OR CHANNEL AS THE BRACING MEMBER HAS A TOLERANCE OF 5° FROM CENTER IN ANY PLANE WITHOUT AFFECTING THE ALLOWABLE LOADS.
2.) TABULATED LOADS ARE SUBJECT TO LIMITS GOVERNED BY THE CAPACITY OF THE PRIMARY STRUCTURE, INCLUDING BUT NOT LIMITED TO, THE CONCRETE FILL OVER METAL DECK. CAPACITY PER THE CONTRACT DOCUMENTS.
3.) STEEL PIPE PER ASTM A53 TYPE E GRADE B.
4.) "MAXIMUM LENGTH" IS MEASURED FROM ENDS OF PIPE, OR ENDS OF STRUT, OR FROM ATTACHMENTS OF CABLE.
5.) PRE-STRETCHED GALVANIZED , 7 X19, AIRCRAFT CABLE SHALL BE IN COMPLIANCE WITH ASTM A1023.

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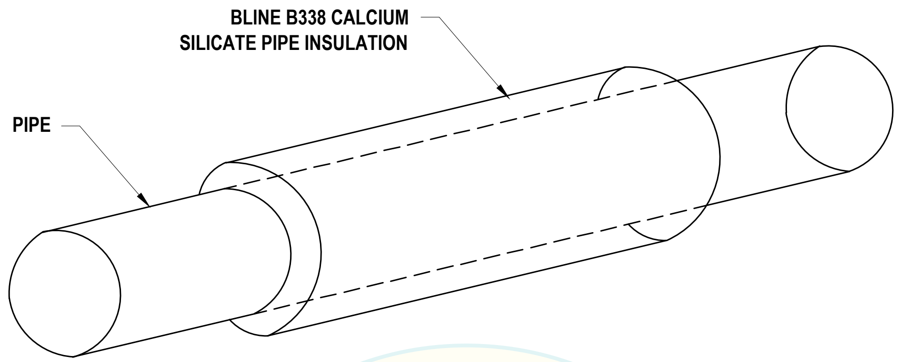
BLINE B338 CALCIUM SILICATE PIPE INSULATION



NOTES:

1.) PIPE SIZE 1" - 4" B-LINE B338 ASTM C533 1" MAX THICKNESS.
2.) PIPE SIZE 5" B-LINE B338 ASTM C533 1.5" MAX THICKNESS.
3.) PIPE SIZE 6" AND LARGER: B-LINE B338 ASTM C533 2" MAX THICKNESS.

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SECTION 13

SEISMIC HANGER COMPONENTS

NOTES:

1.) ALL SEISMIC HANGER COMPONENTS INCLUDED HERE HAVE BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
2.) THESE COMPONENTS CANNOT BE REPLACED BY ANY OTHER COMPONENTS, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
3.) DESIGN IS CONTROLLED BY SEISMIC FORCES. NON-SEISMIC FORCES SUCH AS GRAVITY ARE OUTSIDE THE SCOPE OF THIS OPM.

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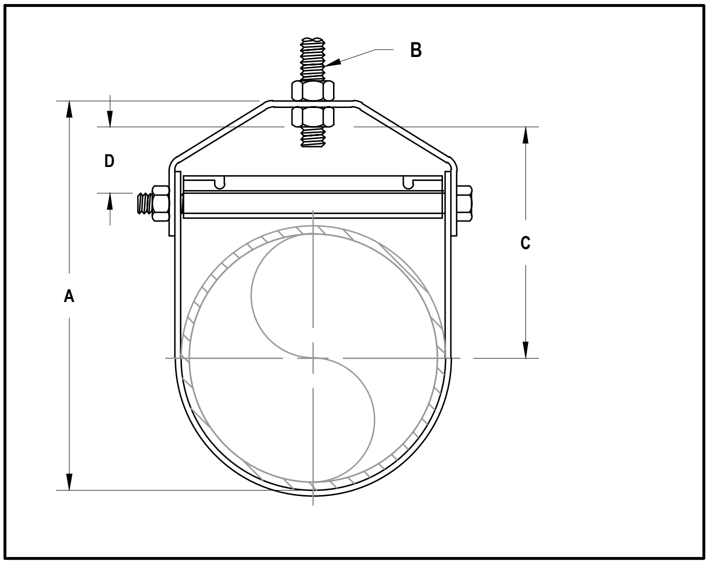
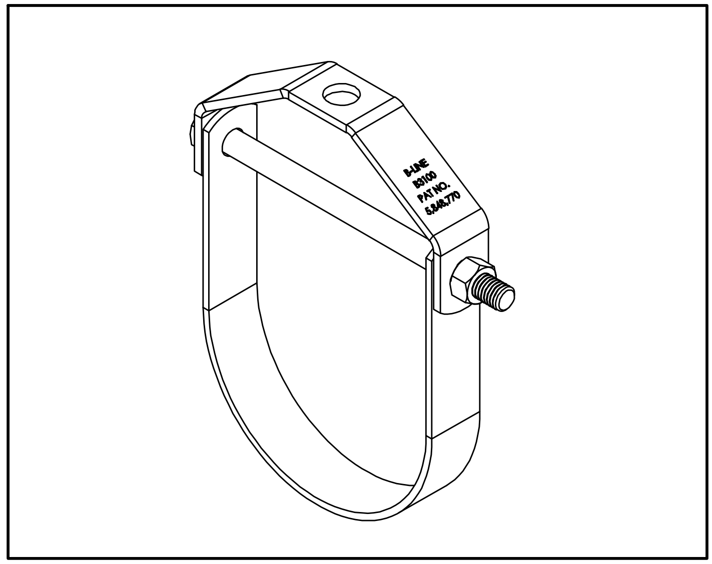
BLINE B3100 STANDARD CLEVIS HANGER





PIPE SIZE	A	B		C	D	CROSS BOLT
		STD	NFPA			
2 1/2"	5 9/16"	1/2"	3/8"	4"	1"	3/8"
3"	6 3/4"	1/2"	3/8"	4 7/8"	1 1/4"	3/8"
3 1/2"	7"	1/2"	3/8"	5"	1 1/4"	3/8"
4"	7 13/16"	5/8"	3/8"	5 1/2"	1 1/2"	3/8"
5"	9 1/16"	5/8"	1/2"	6 1/8"	1 1/2"	1/2"
6"	10 7/16"	3/4"	1/2"	6 15/16"	1 1/2"	1/2"
8"	12 3/4"	3/4"	1/2"	8 3/8"	2"	5/8"

NOTES:

1.) CONFORMS TO FEDERAL SPECIFICATION WWH-171E, TYPE 1 AND MANUFACTURERS STANDARDIZATION SOCIETY SP-58-2009 TYPE 1.
2.) 1CBS CROSS BOLT SPACER IS REQUIRED AT ALL SEISMIC LOCATIONS ONLY. (SEE PAGE 12-18).
3.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
4.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
5.) THE DESIGN LOAD IS GOVERNED BY THE ASSEMBLY. CAN ONLY BE USED WHERE SHOWN IN SECTIONS 2 - 8.

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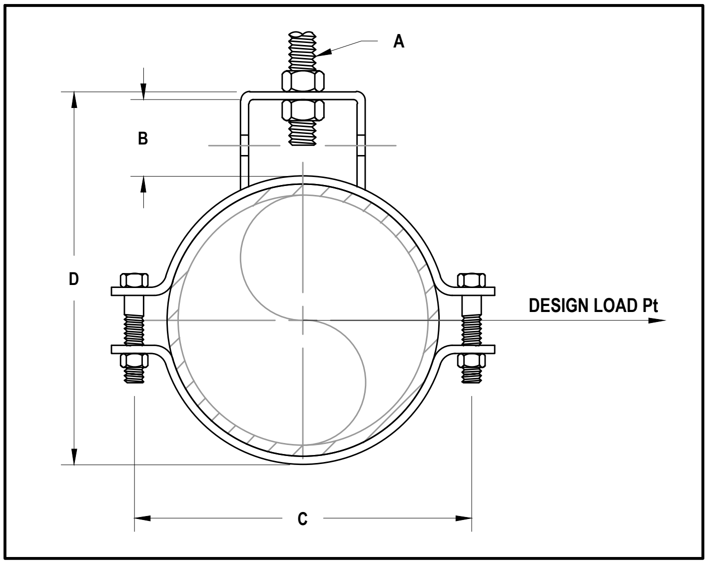
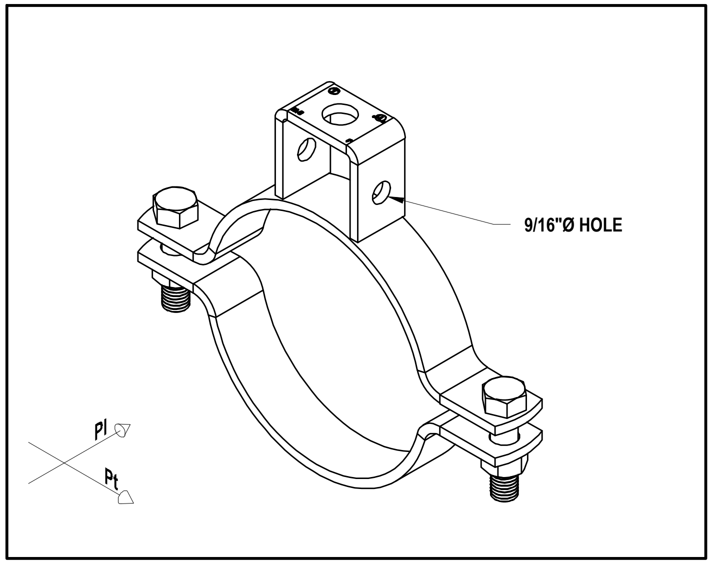
TOLCO FIG. 4B SPECIAL PIPE CLAMP





PIPE SIZE	A	B	C	D	BOLT SIZE	HOLE SIZE	DESIGN LOAD (LBS)(ASD) Pt	Pl
1 1/4"	3/8"	1"	3 9/16"	3 1/4"	5/16"	3/8"	1032	1093
1 1/2"	3/8"	1"	3 13/16"	3 7/16"	5/16"	3/8"	1032	1093
2"	3/8"	1 1/2"	5 1/8"	4 5/8"	5/16"	3/8"	1032	1093
2 1/2"	1/2"	1 3/4"	5 5/8"	5 3/8"	3/8"	7/16"	1032	1093
3"	1/2"	1 7/8"	6 3/4"	6 1/8"	3/8"	7/16"	1032	1093
3 1/2"	1/2"	2"	7 1/4"	6 3/4"	3/8"	7/16"	1032	1093
4"	5/8"	2"	8 5/8"	7 1/4"	1/2"	9/16"	1211	1281
5"	5/8"	2"	9 7/8"	8 5/16"	5/8"	11/16"	1148	1425
6"	3/4"	2 1/8"	10 15/16"	9 1/2"	5/8"	11/16"	1334	1653
8"	7/8"	2 1/8"	13 7/16"	11 1/2"	3/4"	13/16"	1943	1089

NOTES:

1.) CONFORMS TO FEDERAL SPECIFICATION WWH-171E, TYPE 1 AND MANUFACTURERS STANDARDIZATION SOCIETY SP-58 TYPE 1.
2.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
3.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
4.) TIGHTEN BOLTS TO FOLLOWING TORQUE VALUES:
    a.) For 5/16" 11 FT-LBS
    b.) For 3/8" 19 FT-LBS
    c.) For 1/2" 50 FT-LBS
    d.) For 5/8" 65 FT-LBS
    e.) For 3/4" 75 FT-LBS
5.) VERTICAL CAPACITY GOVERNED BY ASSEMBLY. SEE SECTION 2 THRU 8 FOR APPROVED ASSEMBLIES. NOTE, CAN BE USED IN LIEU OF B3100.
6.) MAY BE USED WITH PIPE COMPLYING WITH NOTE 4 AND INSULATED AS SHOWN ON PAGE 12-22. TO SELECT PIPE STRAP SIZE, ADD 2 TIMES INSULATION THICKNESS TO PIPE O.D.

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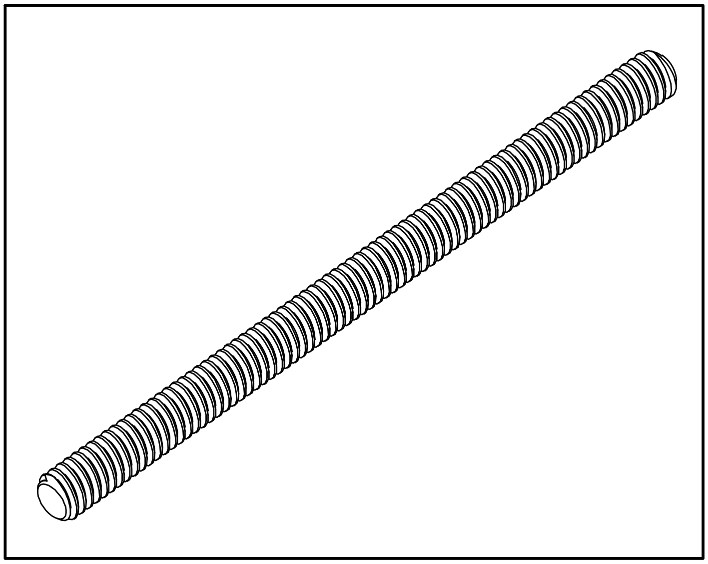
TOLCO FIG. 99 OR B-LINE ATR ALL THREAD ROD CUT-TO-LENGTH OR TOLCO FIG. 100 ALL THREAD ROD



ROD SIZE	DESIGN LOAD (ASD) (LBS)
3/8"	730
1/2"	1350
5/8"	2160
3/4"	3230
7/8"	4480

NOTES:

1.) ROD MEETS ASTM A307 SPECIFICATIONS.
2.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
3.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
4.) DESIGN LOAD (ASD) VALUES FROM MSS SP-58 (2009), TABLE 4 AND ARE INTENDED FOR USE IN DETERMINING VERTICAL HANGER SPACING WHEN CALCULATING MAXIMUM TRANSVERSE SPACING.
5.) SEISMIC CAPACITY GOVERNED BY ASSEMBLY. SEE SECTION 2 THRU 8 FOR APPROVED ASSEMBLIES.

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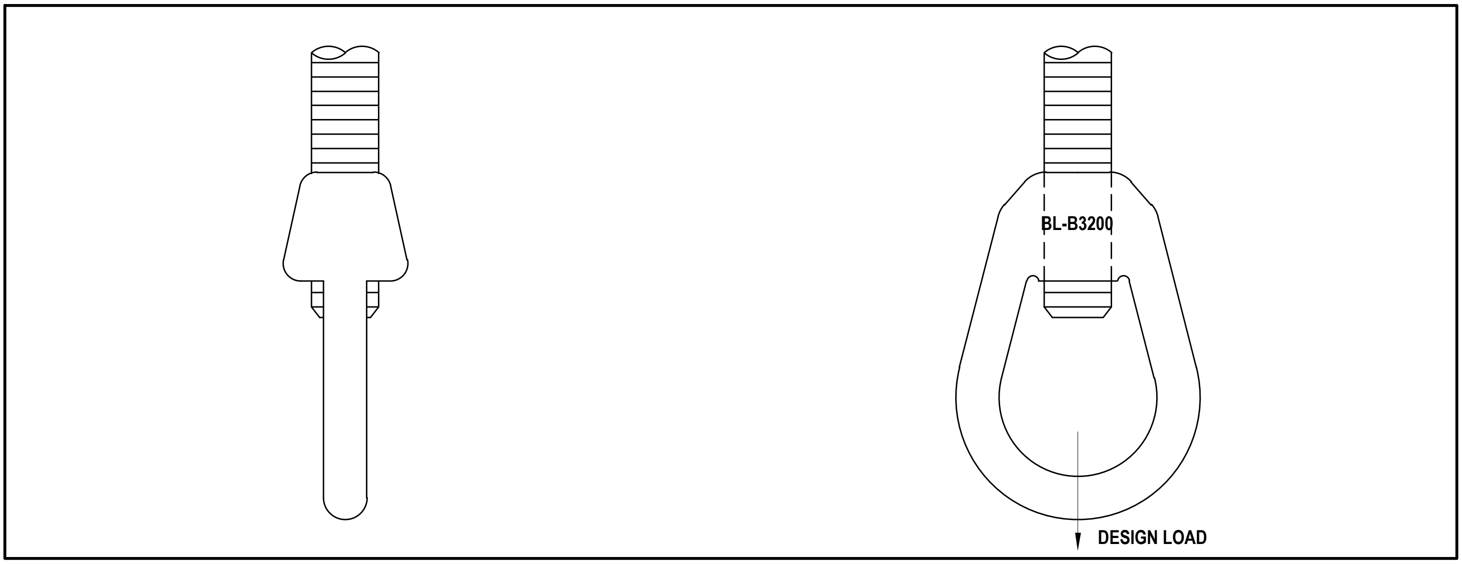
TOLCO FIG. 330 OR B-LINE B3200 WELDLESS STEEL EYE NUT



ROD SIZE	DESIGN LOAD (LBS)(ASD)
3/8"	730
1/2"	1,350
5/8"	2,160
3/4"	3,230
7/8"	4,480

NOTES:

1.) CONFORMS TO MSS SP-58 TYPE 17.
2.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
3.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.

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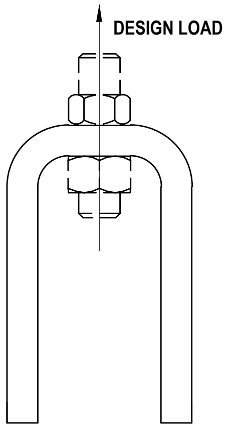
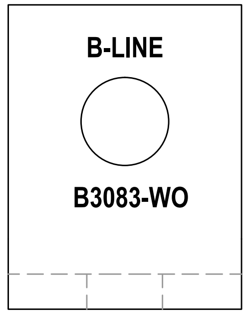
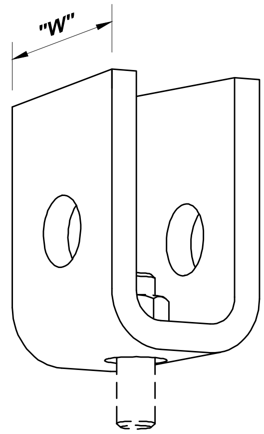
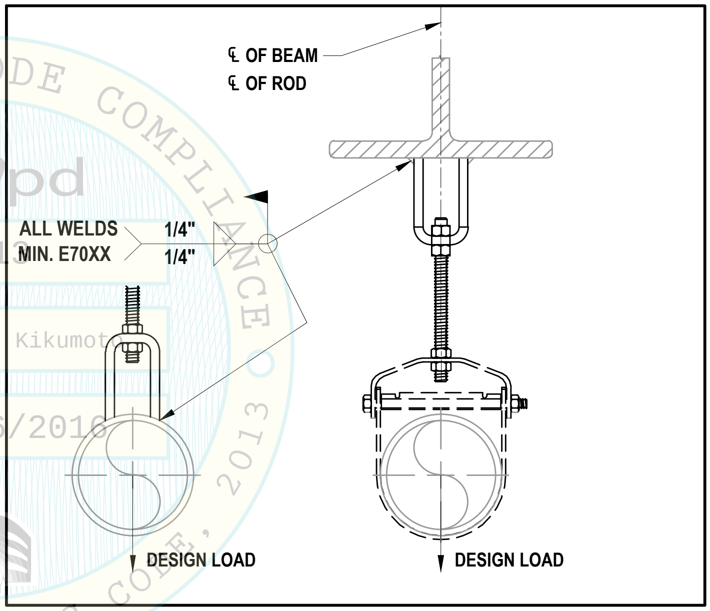
TOLCO FIG. 304 OR B-LINE B3083W0 WELDED STEEL ATTACHMENT







ROD SIZE	DESIGN LOAD (LBS)(ASD)	"W" (IN.)
3/8"	730	2
1/2"	1,350	2
5/8"	2,160	2
3/4"	3,230	2 1/2
7/8"	4,480	2 1/2



NOTES:

1.) CONFORMS TO FEDERAL SPECIFICATION WW-H-171E, TYPE 22 AND MANUFACTURERS STANDARDIZATION SOCIETY MSS SP-58 (2009), TYPE 22
2.) CROSS BOLT SPACER ONLY REQUIRED AT SEISMIC BRACING LOCATIONS AT B3100. (SEE PAGE 12-18).
3.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
4.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
5.) ALL WELDS TO BE MINIMUM OF E70XX ELECTRODE WELDS.
6.) WHEN WELDING TO PIPE, PIPE TO BE OF A WELDABLE MATERIAL, SUCH AS BUT NOT LIMITED TO, ASTM 53 (GR. B) OR ASTM A500 (GR. B).

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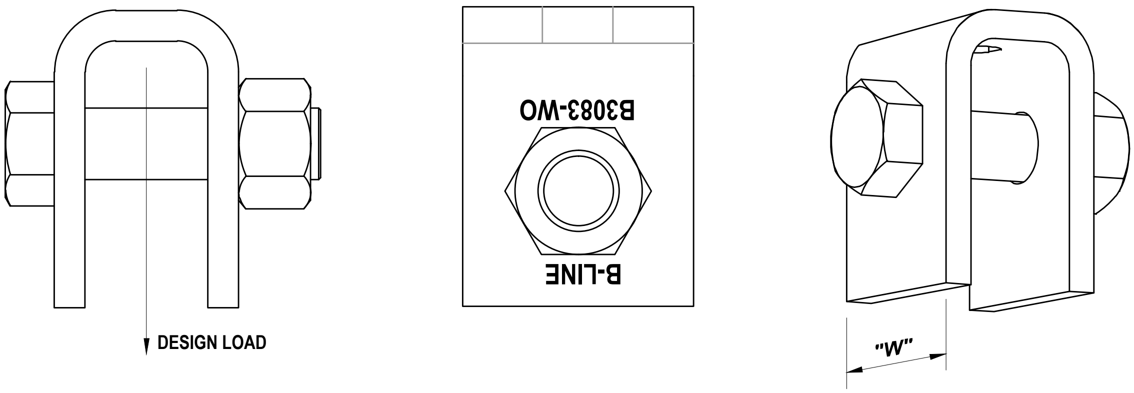
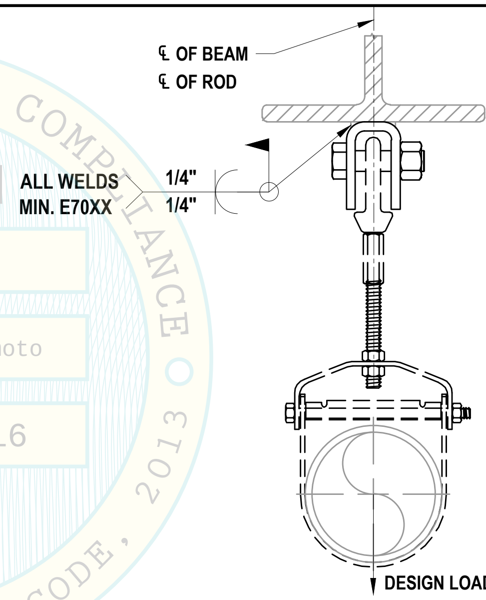
TOLCO FIG. 305 OR B-LINE B3083 WELDED STEEL ATTACHMENT



ROD SIZE	DESIGN LOAD (LBS)(ASD)	"W" (IN.)
3/8"	730	2
1/2"	1,350	2
5/8"	2,160	2
3/4"	3,230	2 1/2
7/8"	4,480	2 1/2



NOTES:

1.) CONFORMS TO FEDERAL SPECIFICATION WW-H-171E, TYPE 22 AND MANUFACTURERS STANDARDIZATION SOCIETY MSS SP-58 (2009), TYPE 22
2.) CROSS BOLT SPACER ONLY REQUIRED AT SEISMIC BRACING LOCATIONS ON B3100. (SEE PAGE 12-18).
3.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
4.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
5.) ALL WELDS TO BE MINIMUM OF E70XX ELECTRODE WELDS.
6.) WHEN WELDING TO PIPE, PIPE TO BE OF A WELDABLE MATERIAL, SUCH AS BUT NOT LIMITED TO, ASTM 53 (GR. B) OR ASTM A500 (GR. B).

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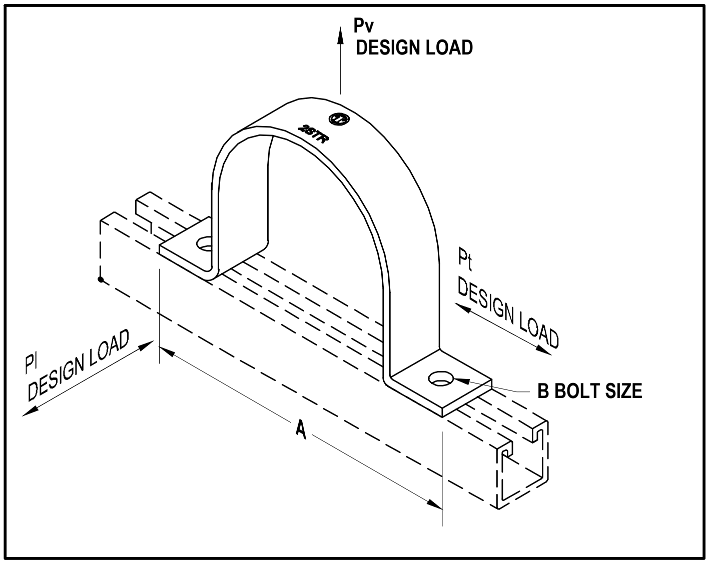
B-LINE B2400 2 HOLE PIPE STRAP (SCHEDULE 40 PIPES)



SCHEDULE 40 PIPES						
PIPE SIZE	PIPE O.D.	A	B BOLT SIZE	DESIGN LOAD Pv (LBS)(ASD)	DESIGN LOAD Pt (LBS)(ASD)	DESIGN LOAD Pl (LBS)(ASD)
3/4"	1.050	3 1/16"	1/4"	2884	1425	581
1"	1.315	3 7/16"	1/4"	2974	1501	755
1 1/4"	1.660	3 3/4"	1/4"	2974	1501	755
1 1/2"	1.900	4 1/8"	1/4"	2974	1501	755
2"	2.375	5 5/8"	3/8"	2974	1501	755
2 1/2"	2.875	6 3/16"	3/8"	2974	1501	755
3"	3.500	6 3/4"	3/8"	2974	1501	755
3 1/2"	4.000	7 7/16"	3/8"	4463	2064	1018
4"	4.500	7 13/16"	1/2"	4463	1325	762
5"	5.563	9 9/16"	1/2"	4463	1325	762
6"	6.625	10 3/8"	1/2"	6723	1865	762
8"	8.625	12 3/8"	1/2"	5923	1325	762
12"	12.75	16"	1/2"	5923	1325	1133

NOTES:

1.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
2.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
3.) MOUNTING HARDWARE SEE BELOW.

USE 1/4" x 1 1/4" HARDWARE ON 1 1/2" PIPE AND SMALLER (TORQUE TO 6 FT./LBS).

USE 3/8" x 1 1/4" HARDWARE ON 2" - 3 1/2" PIPE (TORQUE TO 19 FT./LBS).

USE 1/2" x 1 1/4" HARDWARE ON 4" PIPE AND LARGER (TORQUE TO 50 FT./LBS).

4.) PIPE SIZE PERMITTED FOR SCHEDULE 40 OR HEAVIER WALL PIPES ARE 1"Ø THRU 12"Ø.
5.) IF PIPES WITH A HEAVIER WALL THAN SCHEDULE 40 ARE USED, O.D. OF THAT PIPE MUST MATCH THAT OF SCHEDULE 40 PIPE.
6.) PIPE INSULATION SHALL BE INSTALLED AS SHOWN ON PAGE 12-22 AND SECTION 4 AND 8. USE REDUCTION FACTORS AS INDICATED IN SECTIONS 4 AND 8.
7.) TO SELECT PIPE STRAP SIZES, ADD 2 TIMES INSULATION THICKNESS TO PIPE O.D.

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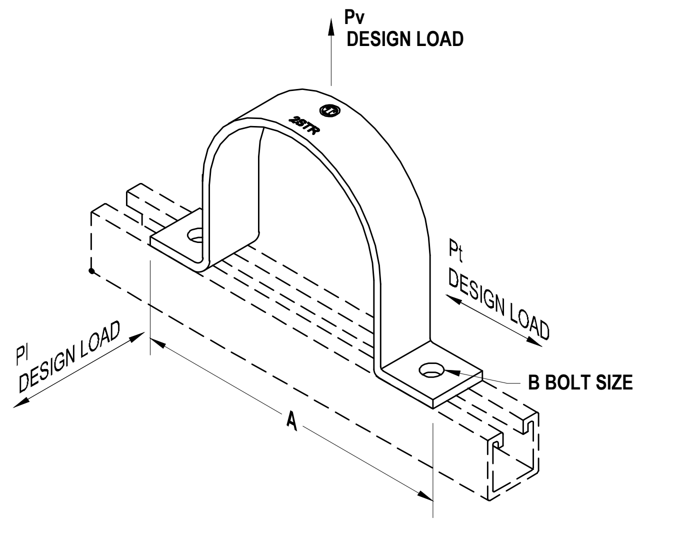
B-LINE B2400 2 HOLE PIPE STRAP (SCHEDULE 10 PIPES)



SCHEDULE 10 PIPES						
PIPE SIZE	PIPE O.D.	A	B BOLT SIZE	DESIGN LOAD Pv (LBS)(ASD)	DESIGN LOAD Pt (LBS)(ASD)	DESIGN LOAD Pl (LBS)(ASD)
3/4"	1.660	3 3/4"	1/4"	2884	1425	581
1"	1.660	3 3/4"	1/4"	2884	1425	581
1 1/4"	1.660	3 3/4"	1/4"	2884	1425	581
1 1/2"	1.900	4 1/8"	1/4"	2884	1425	581
2"	2.375	5 5/8"	3/8"	2884	1425	581
2 1/2"	2.875	6 3/16"	3/8"	2884	1425	581
3"	3.500	6 3/4"	3/8"	2884	1425	581
3 1/2"	4.000	7 7/16"	3/8"	2884	1425	581
4"	4.500	7 13/16"	1/2"	3742	1729	1263
5"	5.563	9 9/16"	1/2"	3733	1118	543
6"	6.625	10 3/8"	1/2"	3733	1118	543

NOTES:

1.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
2.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
3.) MOUNTING HARDWARE SEE BELOW.

USE 1/4" x 1 1/4" HARDWARE ON 1 1/2" PIPE AND SMALLER (TORQUE TO 6 FT./LBS).

USE 3/8" x 1 1/4" HARDWARE ON 2" - 3 1/2" PIPE (TORQUE TO 19 FT./LBS).

USE 1/2" x 1 1/4" HARDWARE ON 4" PIPE AND LARGER (TORQUE TO 50 FT./LBS).

4.) PIPE INSULATION SHALL BE INSTALLED AS SHOWN ON PAGE 12-22 AND SECTIONS 4 AND 8 USE REDUCTION FACTORS AS INDICATED IN SECTIONS 4 AND 8.
5.) TO SELECT PIPE STRAP SIZES, ADD 2 TIMES INSULATION THICKNESS TO PIPE O.D.

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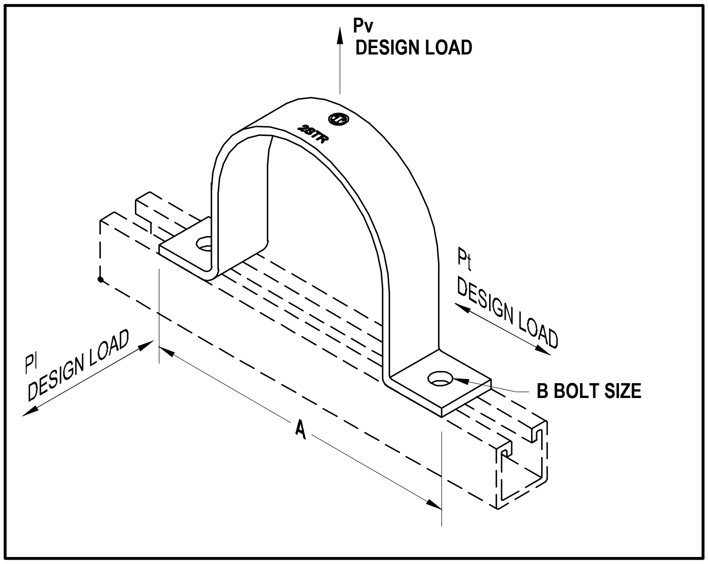
B-LINE B2400 2 HOLE PIPE STRAP (EMT CONDUIT)



SCHEDULE EMT CONDUIT						
PIPE SIZE	PIPE O.D.	A	B BOLT SIZE	DESIGN LOAD Pv (LBS)(ASD)	DESIGN LOAD Pt (LBS)(ASD)	DESIGN LOAD Pl (LBS)(ASD)
2 1/2"	3.000	6 3/4"	3/8"	2799	1643	1409
3"	3.500	6 3/4"	3/8"	2799	1643	1409
3 1/2"	4.000	7 7/16"	3/8"	2418	1643	1409
4"	4.500	7 13/16"	1/2"	2418	1659	1431

NOTES:

1.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
2.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
3.) MOUNTING HARDWARE SEE BELOW.

USE 3/8" x 1 1/4" HARDWARE ON 2 1/2" - 3 1/2" PIPE (TORQUE TO 19 FT./LBS).

USE 1/2" x 1 1/4" HARDWARE ON 4" PIPE AND LARGER (TORQUE TO 50 FT./LBS).

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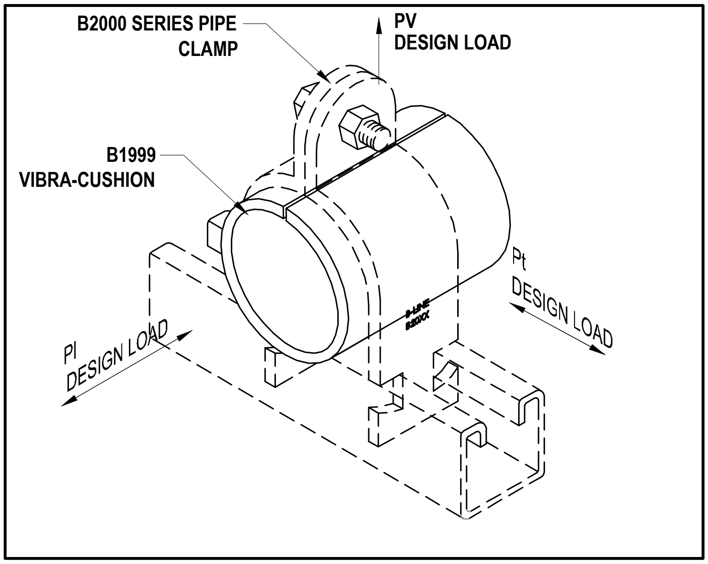
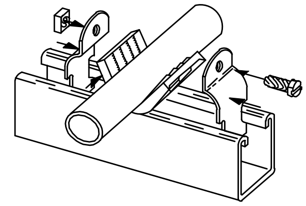
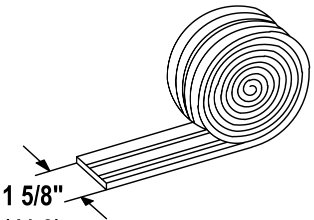
B-LINE B1999 SERIES CUSHION CLAMP







FOR RIGID CONDUIT OR IRON PIPE					UPWARD	LAT	LONG
NOMINAL SIZE		LENGTH OF VIBRA-CUSHION		USE CLAMP NO.	LOAD Pv (LBS)(ASD)	DESIGN LOAD Pt (LBS)(ASD)	DESIGN LOAD Pl (LBS)(ASD)
3/4"	(20)	3 1/4"	(82.5)	B2031	2174	136	261
1"	(25)	4 1/8"	(104.8)	B2004	2174	136	261
1 1/4"	(32)	5 3/16"	(131.8)	B2012	2174	136	261
1 1/2"	(40)	5 15/16"	(150.8)	B2038	2174	70	261
2"	(50)	7 1/2"	(190.5)	B2042	2174	70	261
2 1/2"	(65)	9"	(228.6)	B2046	2433	70	287
3"	(80)	11"	(279.4)	B2051	2871	104	527
3 1/2"	(90)	12 1/2	(317.5)	B2055	2871	57	484
4"	(100)	14 1/2"	(368.3)	B2059	2871	57	484
5"	(125)	17 7/16"	(442.9)	B2067	2871	57	484
6"	(150)	20 3/4"	(527.0)	B2116	3151	57	484

NOTES:

1.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
2.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
3.) MAY BE USED ON SCHEDULE 40 OR THICKER WALLED PIPE.
4.) NOT INTENDED FOR USE WITH CALIUM-SILICATE INSULATION.

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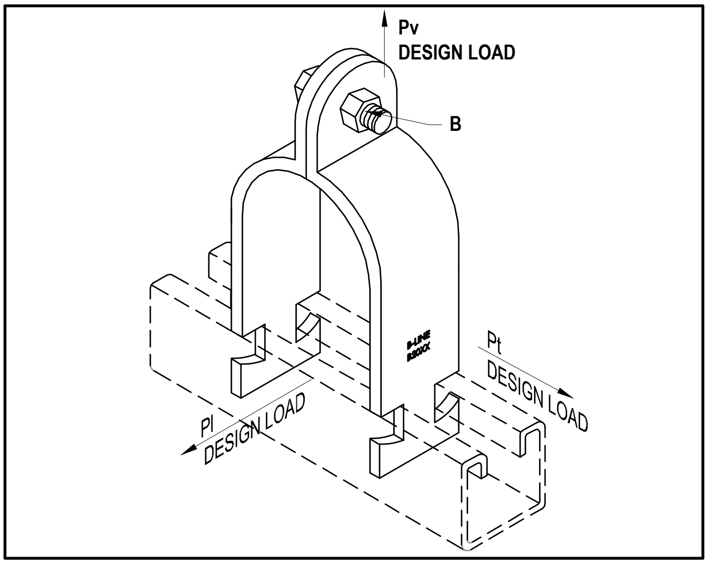
B-LINE B2000 SERIES CLAMP



PIPE SIZE	O.D. SIZE	B BOLT HOLE	BOLT SIZE	DESIGN LOAD Pv (LBS)(ASD)	DESIGN LOAD Pt (LBS)(ASD)	DESIGN LOAD Pl (LBS)(ASD)
3/4"	1.050	5/16"	1/4"	2195	353	612
1"	1.315	5/16"	1/4"	2195	353	612
1 1/4"	1.660	5/16"	1/4"	2195	353	612
1 1/2"	1.900	3/8"	5/16"	2195	353	537
2"	2.375	3/8"	5/16"	2195	353	537
2 1/2"	2.875	3/8"	5/16"	2752	527	537
3"	3.500	3/8"	5/16"	2533	573	504
3 1/2"	4.000	3/8"	5/16"	2533	573	487
4"	4.500	3/8"	5/16"	2533	573	487
5"	5.563	3/8"	5/16"	2533	573	487
6"	6.625	7/16"	3/8"	3695	573	487
8"	8.625	7/16"	3/8"	3919	741	736

NOTES:

1.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
2.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
3.) MOUNTING HARDWARE SEE BELOW.

USE 1/4" x 1" HARDWARE ON 1 1/4" PIPE AND SMALLER (TORQUE TO 6 FT./LBS).

USE 5/16" x 1 1/4" HARDWARE ON 1 1/2" - 5" PIPE (TORQUE TO 19 FT./LBS).

USE 3/8" x 1 1/4" HARDWARE ON 6" PIPE AND LARGER (TORQUE TO 50 FT./LBS).

4.) MAY BE USED ON SCHEDULE 40 OR THICKER WALLED PIPE.
5.) PIPE INSULATION SHALL BE INSTALLED AS SHOWN ON PAGE 12-22 AND SECTIONS 4 AND 8. USE REDUCTION FACTORS AS INDICATED IN SECTIONS 4 AND 8.

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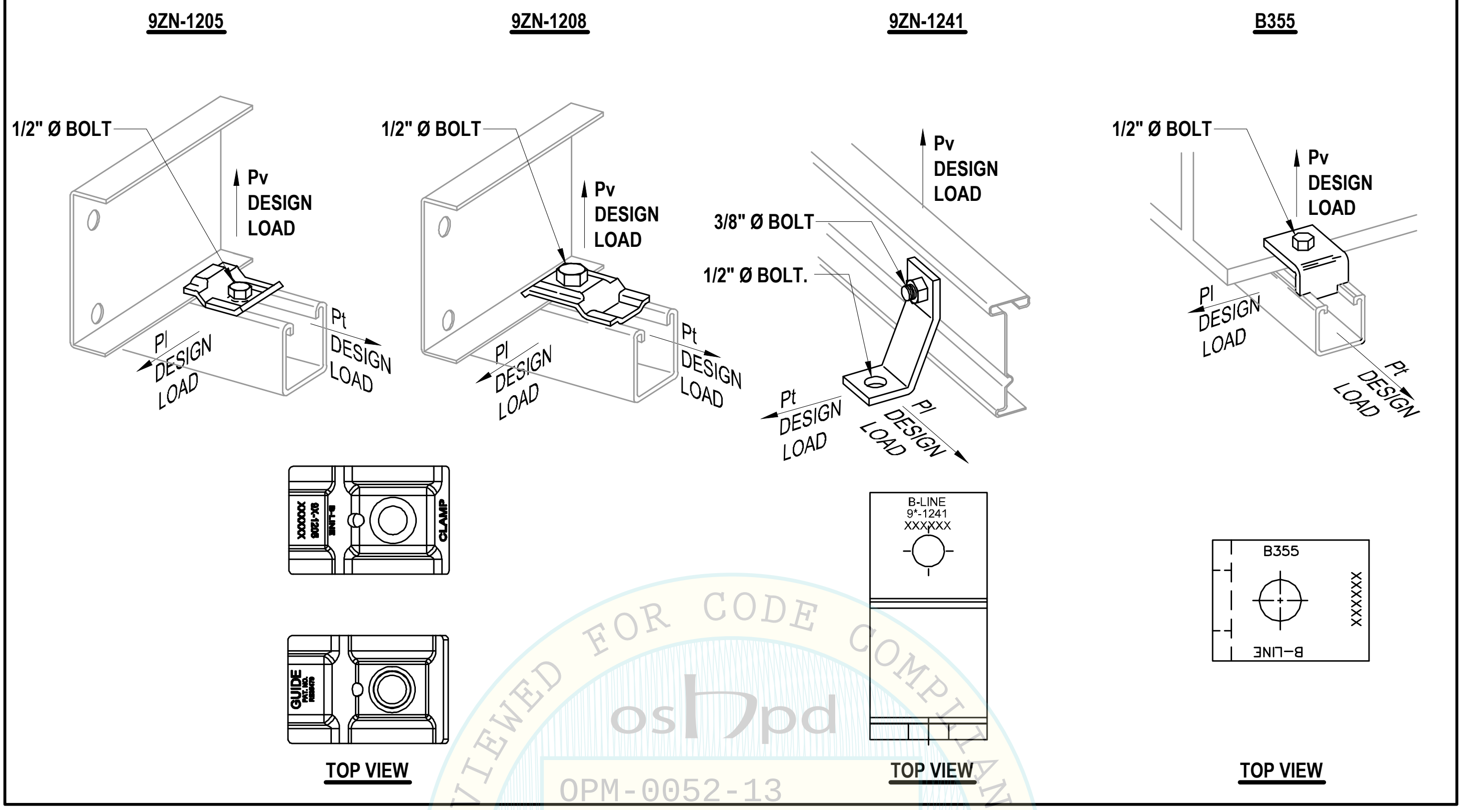
B-LINE 9ZN-1205, 9ZN-1208, 9ZN-1241 & B355 HOLD DOWN CLAMP



PART NUMBER	CLAMP (ASD)		
	ALLOWABLE LOAD Pv (LBS)	ALLOWABLE LOAD Pt (LBS)	ALLOWABLE LOAD Pl (LBS)
9ZN-1205	1069	1527	407
9ZN-1208	791	1096	622
9ZN-1241	1831	949	441
B355	3704	2869	1130

NOTES:

1.) LOADS ARE BASED ON CLAMPS BEING USED IN PAIRS
2.) LOADS APPLICABLE ONLY WITH B-LINE STRUT
3.) TIGHTEN 1/2" BOLTS TO FOLLOWING TORQUE VALUES:
   a.) FOR 9ZN-1205 TORQUE HARDWARE TO 50 FT. LBS.
   b.) FOR 9ZN-1208 TORQUE HARDWARE TO 50 FT. LBS.
   b.) FOR 9ZN-1241 TORQUE HARDWARE TO 50 FT. LBS.
   c.) FOR B355 TORQUE HARDWARE TO 50 FT. LBS.
4.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
5.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
6.) TO CHECK COMBINED TENSION AND SHEAR LOADS FOR UNITY, USE THE FOLLOWING:

$$(Fv/Pv) + (Ft/Pt) + (Fl/Pl) \leq 1.0$$

WHERE Fv, Ft & Fl ARE APPLIED LOADS.

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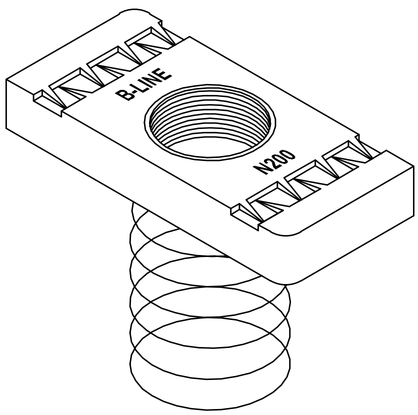
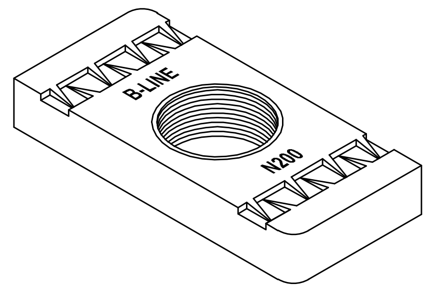
B-LINE N200 SPRING NUT AND B-LINE BN200 CHANNEL NUT WITHOUT SPRING

B-LINE N200 SERIES SPRING NUT



B-LINE BN200 SERIES CHANNEL NUT



DIAMETER	DESIGN LOAD (ASD) RESISTANCE TO SLIP PARALLEL TO 12 GA. CHANNEL- VA1 (LBS)	DESIGN LOAD (ASD) RESISTANCE TO SLIP PERPENDICULAR TO 12 GA. CHANNEL -VA2 (LBS)	DESIGN LOAD (ASD) PULL-OUT STRENGTH 12GA. CHANNEL - TA (LBS)	TORQUE (FT. LBS)	METHOD OF ATTACHMENT
3/8"	1329	632	645	19	980/900 SERIES ATTACHMENTS (WITH PRYING)
1/2" - 3/4"	1342	791	723	50	
3/8"	2179	1261	3959	19	DIRECT ATTACH (WITHOUT PRYING)
1/2" - 3/4"	3115	1412	3737	50	

NOTES:

1.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.

2.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.

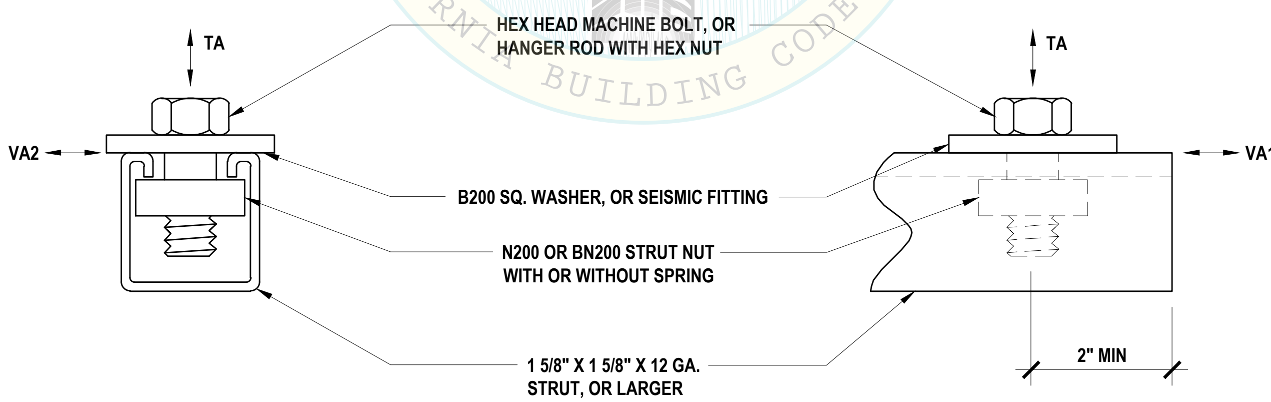
3.) TO CHECK COMBINED TENSION AND SHEAR LOADS FOR UNITY USE THE FOLLOWING:

(a) FOR T & V1 USE $(V1/VA1)^{0.88} + (T/TA)^{0.88} \leq 1.0$

(b) FOR T & V2 USE $(V2/VA2)^{1.66} + (T/TA)^{1.66} \leq 1.0$

(c) FOR T, V1 & V2 USE $(V1/VA1)^{0.88} + (V2/VA2)^{0.88} + (T/TA)^{0.88} \leq 1.0$

4.) MATERIAL SPECIFICATIONS FOR B-LINE N200 SPRING NUT AND B-LINE BN200 CHANNEL NUT WITHOUT SPRING: ASTM A307, SAE J429, OR ASTM A563



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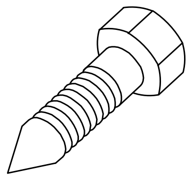
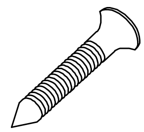
FASTENERS

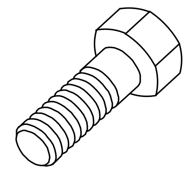
TOLCO FIG. 126 OR B-LINE 3228 LAG BOLT



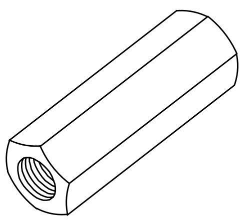
TOLCO FIG. 121 TEK SCREW



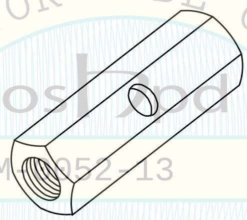
HEX HEAD MACHINE BOLT



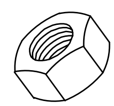
TOLCO FIG. 70 OR B-LINE B655
SERIES ROD COUPLING



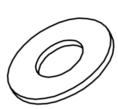
TOLCO FIG. 71 OR B-LINE B3220
SERIES ROD COUPLING



B-LINE HN SERIES HEX NUT



FLAT WASHER



NOTES:

1.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
2.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.

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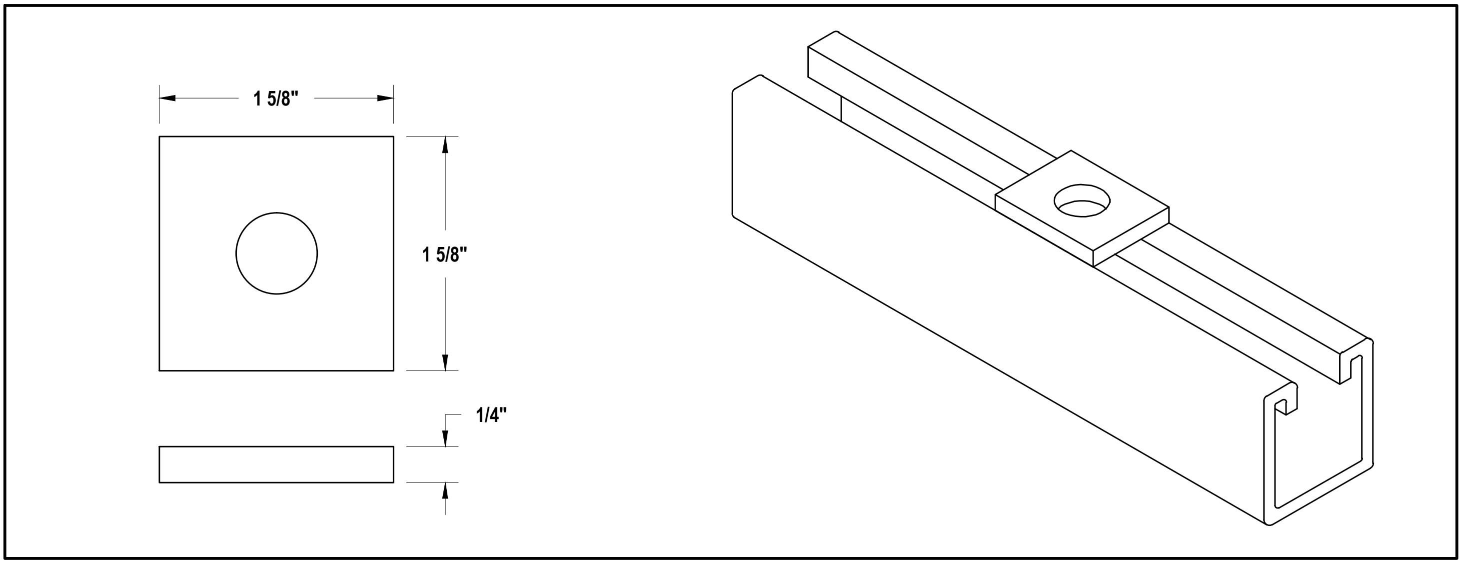
B-LINE B200 SERIES FLAT FITTING



PART NUMBER	BOLT SIZE	HOLE SIZE
B200	1/4"	5/16"
B201	3/8"	7/16"
B202	1/2"	9/16"
B202-1	5/8"	11/16"
B202-2	3/4"	13/16"

NOTES:

1.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
2.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.
3.) MATERIAL SPECIFICATIONS FOR BLINE B200 SERIES FLAT FITTINGS: ASTM A307, SAE J429, OR ASTM A563

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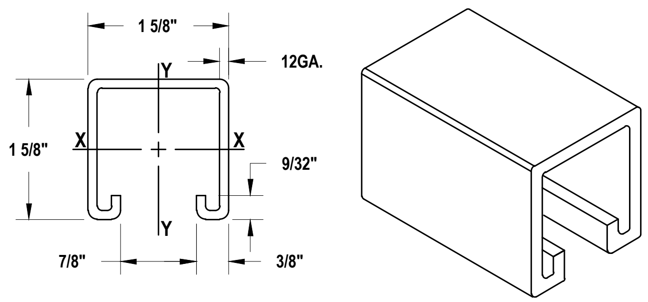
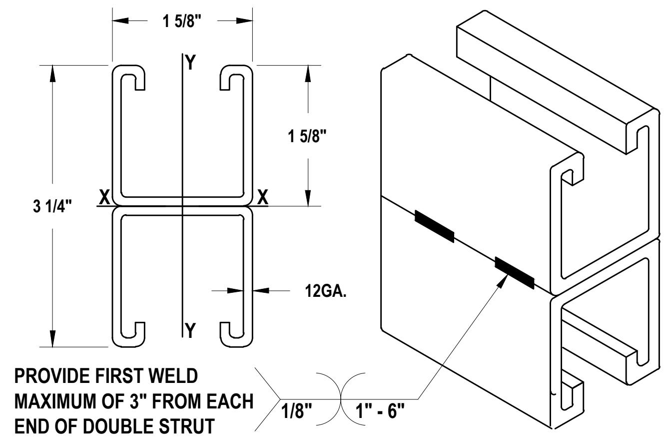
B-LINE B22 AND B22A STITCH-WELDED CHANNEL

B-LINE B22



B-LINE B22A STITCH-WELDED



B-22

BEAM SPAN	UNIFORM BEAM LOAD AND DEFLECTION	
	AXIS X-X	
	LBS (ASD)	INCHES
12"	2,610	.014
18"	2,269	.031
24"	1,702	.056
30"	1,361	.087
36"	1,135	.126
42"	972	.172
48"	851	.224
60"	681	.351
72"	567	.505
84"	486	.687
96"	425	.898
108"	378	1.136
120"	340	1.403

SECTION PROPERTIES

CHANNEL	WEIGHT LBS/FT.	AREA OF SECTION SQ. IN.	AXIS X-X			AXIS Y-Y		
			I IN.^{4}	S IN.^{3}	R IN.	I IN.^{4}	S IN.^{3}	R IN.
B-22	1.91	.562	.191	.213	.583	.240	.295	.653

I = MOMENT OF INERTIA, S = SECTION MODULUS, R = RADIUS OF GYRATION

B22A STITCH-WELDED

BEAM SPAN	UNIFORM BEAM LOAD AND DEFLECTION	
	AXIS X-X	
	LBS (ASD)	INCHES
12"	2,610*	.002
18"	2,610*	.007
24"	2,610*	.017
30"	2,610*	.033
36"	2,610*	.057
42"	2,610*	.091
48"	2,405	.125
60"	1,924	.195
72"	1,603	.281
84"	1,374	.383
96"	1,202	.500
108"	1,069	.633
120"	962	.782

* FAILURE DETERMINED BY WELD SHEAR

SECTION PROPERTIES

CHANNEL	WEIGHT LBS/FT.	AREA OF SECTION SQ. IN.	AXIS X-X			AXIS Y-Y		
			I IN.^{4}	S IN.^{3}	R IN.	I IN.^{4}	S IN.^{3}	R IN.
B-22ASW	3.82	1.124	.973	.599	.931	.480	.591	.653

I = MOMENT OF INERTIA, S = SECTION MODULUS, R = RADIUS OF GYRATION

NOTES:

1.) BEAM LOADS: LOADS LISTED ARE UNIFORMLY DISTRIBUTED. FOR LOADS CONCENTRATED AT CENTER OF SPAN MULTIPLY UNIFORM LOAD AT TABLE BY .5 AND MULTIPLY THE DEFLECTION AT TABLE BY .8. WHEN DEFLECTION IS NOT A FACTOR USE ALLOWABLE STRESS OF 25,000 PSI. WHEN DEFLECTION IS A FACTOR USE DEFLECTION OF (SPAN / 480). ADEQUATE LATERAL BRACING IS PROVIDED BY SUPPORTED PIPES, DUCTS, CONDUITS, OR CABLE TRAYS (PIPES, DUCTS, CONDUITS OR CABLE TRAYS ARE MOUNTED DIRECTLY TO THE TOP OR BOTTOM OF THE STRUT CHANNEL BEAMS. FOR PIPES, DUCTS, CONDUITS OR CABLE TRAYS HANGING FROM STRUT CHANNEL BEAMS WITH HANGER RODS CONSULT FACTORY FOR LOADS).

2.) FOR (P) PUNCHED CHANNEL REDUCE LOAD BY 10%.

3.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.

4.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.

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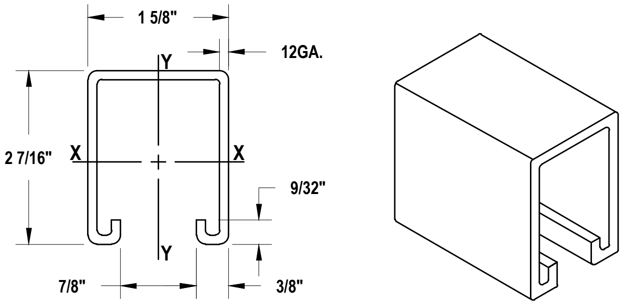
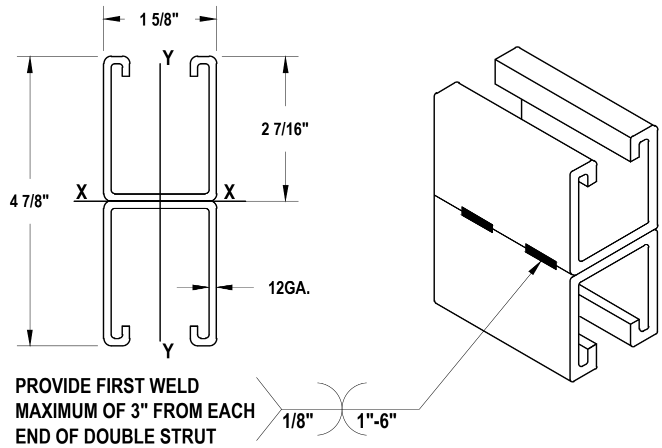
B-LINE B12 AND B12A STITCH-WELDED CHANNEL

B-LINE B12



B-LINE B12A STITCH-WELDED



B12

BEAM SPAN	UNIFORM BEAM LOAD AND DEFLECTION	
	AXIS X-X	
	LBS (ASD)	INCHES
24"	3,273	.038
36"	2,182	.086
48"	1,636	.153
60"	1,309	.240
72"	1,091	.345
84"	935	.470
96"	818	.614
108"	727	.777
120"	655	.959

SECTION PROPERTIES

CHANNEL	WEIGHT LBS/FT.	AREA OF SECTION SQ. IN.	AXIS X-X			AXIS Y-Y		
			I IN.^{4}	S IN.^{3}	R IN.	I IN.^{4}	S IN.^{3}	R IN.
B-12	2.48	.731	.535	.406	.856	.338	.416	.680

I = MOMENT OF INERTIA, S = SECTION MODULUS, R = RADIUS OF GYRATION

B12A STITCH-WELDED

BEAM SPAN	UNIFORM BEAM LOAD AND DEFLECTION	
	AXIS X-X	
	LBS (ASD)	INCHES
24"	3,880*	.008
36"	3,880*	.028
48"	3,880*	.067
60"	3,847*	.130
72"	3,206	.188
84"	2,748	.255
96"	2,404	.334
108"	2,137	.422
120"	1,924	.521

* FAILURE DETERMINED BY WELD SHEAR

SECTION PROPERTIES

CHANNEL	WEIGHT LBS/FT.	AREA OF SECTION SQ. IN.	AXIS X-X			AXIS Y-Y		
			I IN.^{4}	S IN.^{3}	R IN.	I IN.^{4}	S IN.^{3}	R IN.
B-12ASW	4.97	1.462	2.904	1.192	1.409	.676	.832	.680

I = MOMENT OF INERTIA, S = SECTION MODULUS, R = RADIUS OF GYRATION

NOTES:

1.) BEAM LOADS: LOADS LISTED ARE UNIFORMLY DISTRIBUTED. FOR LOADS CONCENTRATED AT CENTER OF SPAN MULTIPLY UNIFORM LOAD AT TABLE BY .5 AND MULTIPLY THE DEFLECTION AT TABLE BY .8. WHEN DEFLECTION IS NOT A FACTOR USE ALLOWABLE STRESS OF 25,000 PSI. WHEN DEFLECTION IS A FACTOR USE DEFLECTION OF (SPAN / 480). ADEQUATE LATERAL BRACING IS PROVIDED BY SUPPORTED PIPES, DUCTS, CONDUITS, OR CABLE TRAYS (PIPES, DUCTS, CONDUITS OR CABLE TRAYS ARE MOUNTED DIRECTLY TO THE TOP OR BOTTOM OF THE STRUT CHANNEL BEAMS. FOR PIPES, DUCTS, CONDUITS OR CABLE TRAYS HANGING FROM STRUT CHANNEL BEAMS WITH HANGER RODS CONSULT FACTORY FOR LOADS).

2.) FOR (P) PUNCHED CHANNEL REDUCE LOAD BY 10%.

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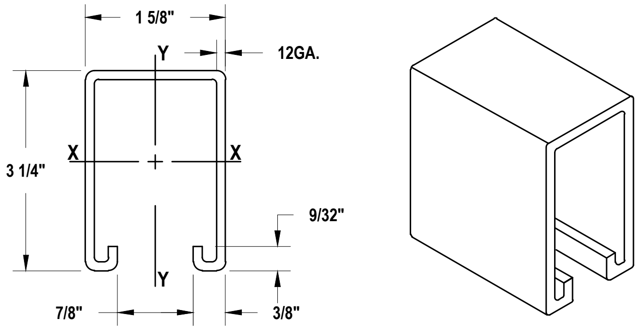
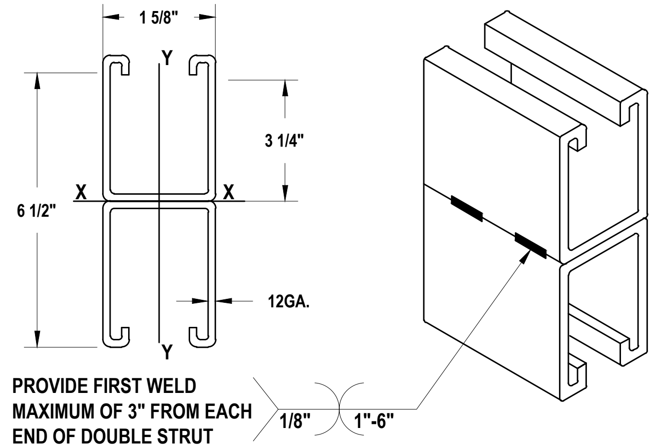
B-LINE B11 AND B11A STITCH-WELDED CHANNEL

B-LINE B11



B-LINE B11A STITCH-WELDED



B11

BEAM SPAN	UNIFORM BEAM LOAD AND DEFLECTION	
	AXIS X-X	
	LBS (ASD)	INCHES
24"	5,130	.029
36"	3,488	.065
48"	2,616	.117
60"	2,093	.183
72"	1,744	.263
84"	1,495	.358
96"	1,308	.468
108"	1,163	.592
120"	1,046	.731

B11A STITCH-WELDED

BEAM SPAN	UNIFORM BEAM LOAD AND DEFLECTION		
	AXIS X-X		
	LBS (ASD)	INCHES	
24"	5,130*	.005	* FAILURE DETERMINED BY WELD SHEAR
36"	5,130*	.017	
48"	5,130*	.040	
60"	5,130*	.079	
72"	5,130*	.136	
84"	4,552	.191	
96"	3,983	.250	
108"	3,541	.317	
120"	3,187	.391	

SECTION PROPERTIES

CHANNEL	WEIGHT LBS/FT.	AREA OF SECTION SQ. IN.	AXIS X-X			AXIS Y-Y		
			I IN.^{4}	S IN.^{3}	R IN.	I IN.^{4}	S IN.^{3}	R IN.
B-11	3.06	.900	1.120	.647	1.116	.436	.536	.696

I = MOMENT OF INERTIA, S = SECTION MODULUS, R = RADIUS OF GYRATION

SECTION PROPERTIES

CHANNEL	WEIGHT LBS/FT.	AREA OF SECTION SQ. IN.	AXIS X-X			AXIS Y-Y		
			I IN.^{4}	S IN.^{3}	R IN.	I IN.^{4}	S IN.^{3}	R IN.
B-11ASW	6.12	1.800	6.393	1.967	1.885	.871	1.073	.696

I = MOMENT OF INERTIA, S = SECTION MODULUS, R = RADIUS OF GYRATION

NOTES:

1.) BEAM LOADS: LOADS LISTED ARE UNIFORMLY DISTRIBUTED. FOR LOADS CONCENTRATED AT CENTER OF SPAN MULTIPLY UNIFORM LOAD AT TABLE BY .5 AND MULTIPLY THE DEFLECTION AT TABLE BY .8. WHEN DEFLECTION IS NOT A FACTOR USE ALLOWABLE STRESS OF 25,000 PSI. WHEN DEFLECTION IS A FACTOR USE DEFLECTION OF (SPAN / 480). ADEQUATE LATERAL BRACING IS PROVIDED BY SUPPORTED PIPES, DUCTS, CONDUITS, OR CABLE TRAYS (PIPES, DUCTS, CONDUITS OR CABLE TRAYS ARE MOUNTED DIRECTLY TO THE TOP OR BOTTOM OF THE STRUT CHANNEL BEAMS. FOR PIPES, DUCTS, CONDUITS OR CABLE TRAYS HANGING FROM STRUT CHANNEL BEAMS WITH HANGER RODS CONSULT FACTORY FOR LOADS).
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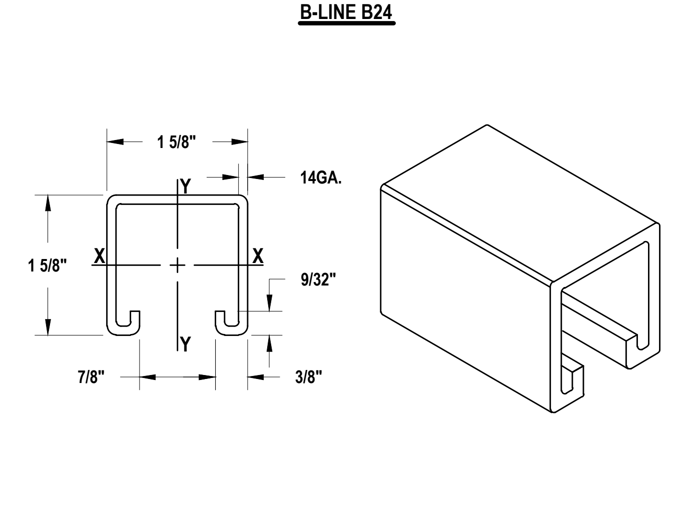
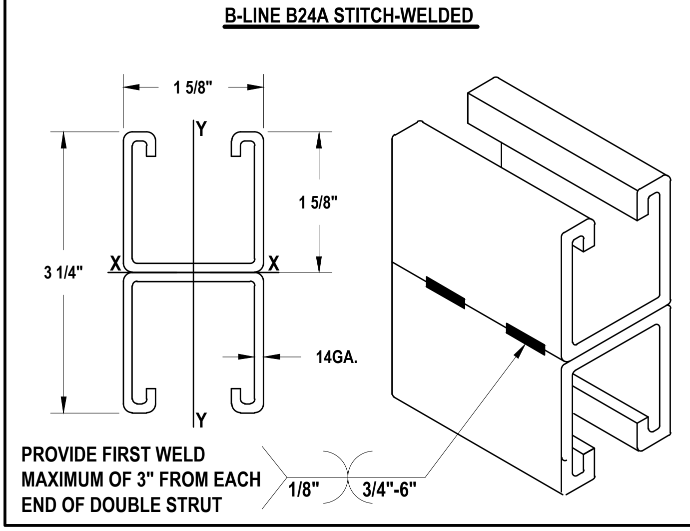
B-LINE B24 AND B24A STITCH-WELDED CHANNEL





B-24

BEAM SPAN	UNIFORM BEAM LOAD AND DEFLECTION	
	AXIS X-X	
	LBS (ASD)	INCHES
12"	1,750	.014
24"	1,379	.057
36"	910	.128
48"	680	.227
60"	550	.355
72"	450	.511
84"	390	.695
96"	340	.908
108"	300	1.149
120"	270	1.419

B24A STITCH-WELDED

BEAM SPAN	UNIFORM BEAM LOAD AND DEFLECTION	
	AXIS X-X	
	LBS (ASD)	INCHES
12"	1,750*	.002
24"	1,750*	.014
36"	1,750*	.048
48"	1,750*	.115
60"	1,518	.195
72"	1,265	.281
84"	1,084	.383
96"	949	.500
108"	843	.633
120"	759	.782

* FAILURE DETERMINED BY WELD SHEAR

SECTION PROPERTIES

CHANNEL	WEIGHT LBS/FT.	AREA OF SECTION SQ. IN.	AXIS X-X			AXIS Y-Y		
			I IN.^{4}	S IN.^{3}	R IN.	I IN.^{4}	S IN.^{3}	R IN.
B-24	1.442	.424	.149	.167	.594	.186	.229	.662

I = MOMENT OF INERTIA, S = SECTION MODULUS, R = RADIUS OF GYRATION

SECTION PROPERTIES

CHANNEL	WEIGHT LBS/FT.	AREA OF SECTION SQ. IN.	AXIS X-X			AXIS Y-Y		
			I IN.^{4}	S IN.^{3}	R IN.	I IN.^{4}	S IN.^{3}	R IN.
B-24ASW	2.884	.848	.751	.462	.941	.371	.457	.662

I = MOMENT OF INERTIA, S = SECTION MODULUS, R = RADIUS OF GYRATION

NOTES:

1.) BEAM LOADS: LOADS LISTED ARE UNIFORMLY DISTRIBUTED. FOR LOADS CONCENTRATED AT CENTER OF SPAN MULTIPLY UNIFORM LOAD AT TABLE BY .5 AND MULTIPLY THE DEFLECTION AT TABLE BY .8. WHEN DEFLECTION IS NOT A FACTOR USE ALLOWABLE STRESS OF 25,000 PSI. WHEN DEFLECTION IS A FACTOR USE DEFLECTION OF (SPAN / 480). ADEQUATE LATERAL BRACING IS PROVIDED BY SUPPORTED PIPES, DUCTS, CONDUITS, OR CABLE TRAYS (PIPES, DUCTS, CONDUITS OR CABLE TRAYS ARE MOUNTED DIRECTLY TO THE TOP OR BOTTOM OF THE STRUT CHANNEL BEAMS. FOR PIPES, DUCTS, CONDUITS OR CABLE TRAYS HANGING FROM STRUT CHANNEL BEAMS WITH HANGER RODS CONSULT FACTORY FOR LOADS).
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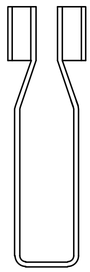
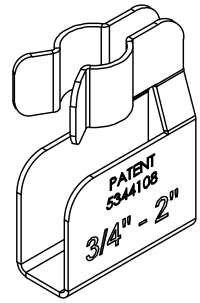
TOLCO FIG. 25 END-OF-LINE RESTRAINT ATTACHMENT





NOTES:

1.) CAN BE USED AS ALTERNATIVE TO RUNNING ROD TO PIPE ON FIRE PROTECTION BRANCH LINE RESTRAINTS.
2.) THIS SEISMIC HANGER COMPONENT HAS BEEN TESTED FOR SEISMIC APPLICATION AS SHOWN IN SECTION 2, 4, 6 AND 8.
3.) THIS COMPONENT CANNOT BE REPLACED BY ANY OTHER COMPONENT, OSHPD APPROVED OR OTHERWISE, UNLESS TESTED PER SECTION 2, 4, 6 AND 8 USING TOLCO SEISMIC COMPONENTS.

SECTION 14

MAXIMUM SEISMIC BRACING SPACING TABLES

MH

STEEL PIPE (STANDARD SCHEDULE)
INSULATED AND FILLED WITH WATER
MAXIMUM SEISMIC BRACE SPACING (ASD)

Pipe Diameter (in)	Pipe Schedule	Max. Weight (plf)	Max Gravity Support Spacing (ft)	Max Transverse Spacing per Lateral g Force (ft)			
				0.5g	0.75g	1.0g	1.31g
3/4	40	2.0	7	21	19	17	15
1	40	2.8	7	25	22	20	18
1-1/4	40	3.8	7	30	26	24	21
1-1/2	40	4.5	9	32	29	26	23
2	40	6.2	10	36	32	30	27
2-1/2	40	9.1	11	40	36	34	31
3	40	12.1	12	44	40	37	34
4	40	18.3	14	50	45	42	39
5	40	26.6	15	54	49	46	42
6	40	34.8	17	59	54	50	46
8	40	55.1	19	67	61	56	52
10	40	80.2	20	75	67	63	58
12	STD	109.0	20	79	72	67	62

NOTES:

1. MAXIMUM BRACE SPACING IS BASED ON ASME B31E DESIGN BY ANALYSIS EQUATION. PIPE SIZE, MATERIALS, PRESSURES, ETC. NOT USED TO DETERMINE THESE TABLES MAY USE ASME B31E DESIGN BY ANALYSIS TO DETERMINE THE MAXIMUM SEISMIC BRACE SPACINGS ON A PROJECT BY PROJECT BASIS.
2. MAXIMUM GRAVITY SUPPORT SPACING IS BASED ON MSS SP- 58- 2009 TABLE 4 LIMITED TO 20 FEET. PIPE WEIGHTS USED ARE BASED ON STANDARD SCHEDULE STEEL PIPES (40S) INCLUDING WATER AND INSULATION (REFER TO APPENDIX). PIPES WITH THICKER WALLS AND / OR FILLED WITH VAPOR OR GAS MAY USE SPACINGS AS TABULATED.
3. BRACE AND / OR CONNECTION CAPACITY MAY GOVERN MAXIMUM SPACING IN SOME CASES. SEE SECTIONS 2, 3, 4, 5, 6, 7, 8, & 9.
4. BRACE SPACINGS ARE BASED ON STEEL PIPE CONFORMING TO ASTM SPECIFICATION A53, TYPE E, GRADE B WITH MINIMUM Fy = 35 ksi AND SA=14.6 ksi AT MAXIMUM OPERATING PRESSURE AND TEMPERATURE OF 400psi AND 650° F, RESPECTIVELY. FOR ASTM A53, TYPE E, GRADE A WITH MINIMUM Fy=30 ksi AND SA= 11.7ksi, REDUCE SPACINGS BY FACTOR BY 1.2 UP TO 14" Ø PIPE, 1.33 UP TO 30"Ø PIPE. STEEL PIPES, INCLUDING STAINLESS, WITH Fy AND SA VALUES MEETING OR EXCEEDING ABOVE STATED MINIMUMS PER ASME B31. APPENDIX A MAY USE TABULATED SPACINGS WITH APPROPRIATE REDUCTION FACTORS, WHERE APPLICABLE.
5. PIPE FITTINGS AS IDENTIFIED IN ASME B31 APPENDIX D MAY INCLUDE THE FOLLOWING: LONG OR SHORT RADIUS ELBOWS, WELDING TEES, BRANCH WELD-ON FITTINGS, WELDED-IN CONTOUR FITTINGS AND CONCENTRIC REDUCERS. FOR FABRICATED TEES REDUCE SPACING BY A FACTOR OF 1.33 UP TO 12"Ø PIPE. (FABRICATED TEES ARE ACCEPTABLE FOR 14"Ø TO 30"Ø PIPE)
6. ACCEPTABLE PIPE CONNECTIONS INCLUDE BUTT WELDS, FILLET WELDS, OR FLANGES AND RIGID GROOVED COUPLINGS. RIGID GROOVED COUPLINGS LISTED FOR UL STANDARD 213 MAY USE LISTED MAXIMUM BRACE SPACINGS (REF. A10.6, NOTES.)
7. FOR VALUES BETWEEN 0.5g, 0.75g AND 1.0g, IT IS ACCEPTABLE TO INTERPOLATE FOR INTERMEDIATE VALUES. IT IS INTENDED THAT 1.31g BE THE MAXIMUM.

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STEEL PIPE (SCHEDULE 10)
INSULATED AND FILLED WITH WATER
MAXIMUM SEISMIC BRACE SPACING (ASD)

Pipe Diameter (in)	Pipe Schedule	Max. Weight (plf)	Max Gravity Support Spacing (ft)	Max Transverse Spacing per Lateral g Force (ft)			
				0.5g	0.75g	1.0g	1.31g
3/4	10	1.7	7	14	12	10	8
1	10	2.5	7	25	22	19	16
1-1/4	10	3.3	7	29	25	21	18
1-1/2	10	3.9	9	30	25	21	18
2	10	5.2	10	32	26	23	20
2-1/2	10	7.1	11	38	31	27	23
3	10	9.2	12	40	32	28	24
4	10	13.6	14	39	32	28	24
5	10	20.2	15	45	37	32	28
6	10	26.3	17	45	36	32	27
8	10	41.1	19	50	41	36	31
10	10	60.9	20	57	47	40	35
12	10	82.4	20	64	52	45	39

NOTES:

1. MAXIMUM BRACE SPACING IS BASED ON ASME B31E DESIGN BY ANALYSIS EQUATION. PIPE SIZE, MATERIALS, PRESSURES, ETC. NOT USED TO DETERMINE THESE TABLES MAY USE ASME B31E DESIGN BY ANALYSIS TO DETERMINE THE MAXIMUM SEISMIC BRACE SPACINGS ON A PROJECT BY PROJECT BASIS.
2. PIPE WEIGHTS USED ARE BASED ON PIPE SCHEDULED WEIGHT INCLUDING WATER AND INSULATION (REFER TO APPENDIX). PIPES WITH THICKER WALLS AND / OR FILLED WITH VAPOR OR GAS MAY USE SPACINGS AS TABULATED.
3. BRACE AND / OR CONNECTION CAPACITY MAY GOVERN MAXIMUM SPACING IN SOME CASES. SEE SECTIONS 2, 3, 4, 5, 6, 7, 8, & 9.
4. BRACE SPACINGS ARE BASED ON STEEL PIPE CONFORMING TO ASTM SPECIFICATION A53, TYPE E, GRADE A WITH MINIMUM Fy = 30 ksi AT A MAXIMUM OPERATING PRESSURE AND TEMPERATURE OF 400psi AND 400° F, RESPECTIVELY. STEEL PIPES, INCLUDING STAINLESS, WITH Fy VALUES MEETING OR EXCEEDING ABOVE STATED MINIMUMS PER ASME B31 APPENDIX A MAY USE TABULATED SPACINGS WITH APPROPRIATE REDUCTION FACTORS, WHERE APPLICABLE.
5. PIPE FITTINGS AS IDENTIFIED IN ASME B31 APPENDIX D MAY INCLUDE THE FOLLOWING: LONG OR SHORT RADIUS ELBOWS, WELDING TEES, BRANCH WELD-ON FITTINGS, WELDED-IN CONTOUR FITTINGS AND CONCENTRIC REDUCERS. FOR FABRICATED TEES CALCULATE BRACE SPACINGS PER NOTE 1.
6. ACCEPTABLE PIPE CONNECTIONS INCLUDE BUTT WELDS, FILLET WELDS, OR FLANGES AND RIGID GROOVED COUPLINGS. RIGID GROOVED COUPLINGS LISTED FOR UL STANDARD 213 MAY USE LISTED MAXIMUM BRACE SPACINGS.
7. FOR VALUES BETWEEN 0.5g, 0.75g,AND 1.0g, IT IS ACCEPTABLE TO INTERPOLATE FOR INTERMEDIATE VALUES. IT IS INTENDED THAT 1.31g BE THE MAXIMUM.

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STEEL PIPE (SCHEDULE 80)
INSULATED AND FILLED WITH WATER
MAXIMUM SEISMIC BRACE SPACING (ASD)

Pipe Diameter (in)	Pipe Schedule	Max. Weight (plf)	Max Gravity Support Spacing (ft)	Max Transverse Spacing per Lateral g Force (ft)			
				0.5g	0.75g	1.0g	1.31g
3/4	80	2.3	7	22	19	17	15
1	80	3.2	7	26	23	20	18
1-1/4	80	4.4	7	30	27	24	22
1-1/2	80	5.3	9	33	29	27	24
2	80	7.3	10	37	33	31	28
2-1/2	80	10.7	11	41	37	34	32
3	80	14.4	12	45	41	38	35
4	80	21.8	14	51	46	43	40
5	80	31.6	15	56	51	47	44
6	80	43.2	17	62	56	52	48
8	80	59.5	19	72	65	61	56
10	80	100.7	20	78	71	66	61
12	80	138.6	20	85	77	72	67

NOTES:

1. MAXIMUM BRACE SPACING IS BASED ON ASME B31E DESIGN BY ANALYSIS EQUATION. PIPE SIZE, MATERIALS, PRESSURES, ETC. NOT USED TO DETERMINE THESE TABLES MAY USE ASME B31E DESIGN BY ANALYSIS TO DETERMINE THE MAXIMUM SEISMIC BRACE SPACINGS ON A PROJECT BY PROJECT BASIS.
2. PIPE WEIGHTS USED ARE BASED ON PIPE SCHEDULED WEIGHT INCLUDING WATER AND INSULATION (REFER TO APPENDIX). PIPES WITH THICKER WALLS AND / OR FILLED WITH VAPOR OR GAS MAY USE SPACINGS AS TABULATED.
3. BRACE AND / OR CONNECTION CAPACITY MAY GOVERN MAXIMUM SPACING IN SOME CASES. SEE SECTIONS 2, 3, 4, 5, 6, 7 ,8, & 9.
4. BRACE SPACINGS ARE BASED ON STEEL PIPE CONFORMING TO ASTM SPECIFICATION A53, TYPE E, GRADE A WITH MINIMUM Fy = 30 ksi AT A MAXIMUM OPERATING PRESSURE AND TEMPERATURE OF 400psi AND 400° F, RESPECTIVELY. STEEL PIPES, INCLUDING STAINLESS, WITH Fy VALUES MEETING OR EXCEEDING ABOVE STATED MINIMUMS PER ASME B31 APPENDIX A MAY USE TABULATED SPACINGS WITH APPROPRIATE REDUCTION FACTORS, WHERE APPLICABLE.
5. PIPE FITTINGS AS IDENTIFIED IN ASME B31 APPENDIX D MAY INCLUDE THE FOLLOWING: LONG OR SHORT RADIUS ELBOWS, WELDING TEES, BRANCH WELD-ON FITTINGS, WELDED-IN CONTOUR FITTINGS AND CONCENTRIC REDUCERS. FOR FABRICATED TEES CALCULATE BRACE SPACINGS PER NOTE 1.
6. ACCEPTABLE PIPE CONNECTIONS INCLUDE BUTT WELDS, FILLET WELDS, OR FLANGES AND RIGID GROOVED COUPLINGS. RIGID GROOVED COUPLINGS LISTED FOR UL STANDARD 213 MAY USE LISTED MAXIMUM BRACE SPACINGS.
7. FOR VALUES BETWEEN 0.5g, 0.75g,AND 1.0g, IT IS ACCEPTABLE TO INTERPOLATE FOR INTERMEDIATE VALUES. IT IS INTENDED THAT 1.31g BE THE MAXIMUM.

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COPPER PIPE (TYPE L)
DRAWN WITH SOLDERED JOINTS
MAXIMUM SEISMIC BRACE SPACING (ASD)

Pipe Diameter (in)	Service	Max. Weight (plf)	Max Gravity Support Spacing (ft)	Max Transverse Spacing per Lateral g Force (ft)			
				0.5g	0.75g	1.0g	1.31g
3/4	Water	1.3	5	13	12	11	9
1	Water	1.7	6	16	14	13	11
1-1/4	Water	2.2	7	19	17	15	13
1-1/2	Water	2.8	8	21	19	17	15
2	Water	4.1	8	26	23	21	18
2-1/2	Water	5.7	9	30	26	24	21
3	Water	7.6	10	33	30	27	24
4	Water	12.4	10	38	34	32	29
5	Water	18.6	10	42	38	35	32
6	Water	25.1	10	45	41	38	35
8	Water	43.7	10	53	48	45	41
10	Water	66.8	10	60	54	50	47
12	Water	91.9	10	65	59	55	51
1/2	Gas	0.3	6	15	13	12	10
3/4	Gas	0.5	7	19	16	15	13
1	Gas	0.7	8	22	20	18	16
1-1/4	Gas	0.9	9	26	22	20	18
1-1/2	Gas	1.1	10	29	25	23	20
2	Gas	1.8	10	33	30	27	25
2-1/2	Gas	2.5	10	37	34	31	28
3	Gas	3.3	10	41	37	34	31
4	Gas	5.4	10	47	42	39	36
5	Gas	7.6	10	52	47	44	40
6	Gas	10.2	10	57X	51	48	44
8	Gas	19.3	10	65	59	55	51
10	Gas	30.1	10	73	66	61	57
12	Gas	40.4	10	80	72	67	62

NOTES:

1. MAXIMUM BRACE SPACING IS BASED ON ASME B31E DESIGN BY ANALYSIS. PIPE SIZE, MATERIALS, PRESSURES, ETC. NOT USED TO DETERMINE THESE TABLES MAY USE ASME B31E DESIGN BY ANALYSIS TO DETERMINE THE MAXIMUM SEISMIC BRACE SPACINGS ON A PROJECT BY PROJECT BASIS.
2. MAXIMUM GRAVITY SPACING IS BASED ON MSS SP- 58- 2009 TABLE 4, LIMITED TO 10 FEET.
3. BRACE AND OR CONNECTION CAPACITY MAY GOVERN MAXIMUM SPACINGS IN SOME CASES. FOR BRACE CAPACITY SEE SECTIONS 2, 3, 4, 5, 6, 7, 8 & 9. TO DETERMINE WHETHER CONNECTION CAPACITY FURTHER LIMITS THE MAXIMUM BRACE SPACINGS ON A PROJECT SPECIFIC BASIS, THE REGISTERED DESIGN PROFESSIONAL SHALL PROVIDE ON THE CONSRUCTION DOCUMENTS THE REQUIREMENTS OR MANUFACTURE'S CERTIFICATION BY ANALYSIS, TESTING OR EXPERIENCE DATA FOR THE NONSTRUCTURAL BRACE COMPONENT IN ACCORDANCE WITH ASCE 7-10 SECTION 13.2.1 ITEM no. 2, WHERE SUCH CERTIFICATION IS REQUIRED BY 2013 CBC SECTION 1705A.12
4. BRACE SPACINGS ARE BASED ON PIPE CONFORMING TO ASTM SPECIFICATION B88 TYPE L DRAWN COPPER PIPE WITH SOLDERED JOINTS AND MAXIMUM OPERATING PRESSURE AND TEMPERATURE OF 100psi AND 250° F, RESPECTIVELY. TYPE L DRAWN COPPER PIPE WITH BRAZED JOINTS MAY USE THESE CHARTS IF THEY OCCUR WITHIN 6" OF A GRAVITY SUPPORT. FOR CASES WHERE THE DISTANCE FROM A BRAZED JOINT TO A GRAVITY SUPPORT EXCEEDS 6", REFER TO SEISMIC BRACE SPACINGS FOR ANNEALED TYPE L COPPER PIPE.
5. FOR VALUES BETWEEN 0.5g, 0.75g, AND 1.0g, IT IS ACCEPTABLE TO INTERPOLATE FOR INTERMEDIATE VALUES. IT IS INTENDED THAT 1.31g BE THE MAXIMUM.

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COPPER PIPE (TYPE L)
ANNEALED
MAXIMUM SEISMIC BRACE SPACING (ASD)

Pipe Diameter (in)	Service	Max. Weight (plf)	Max Gravity Support Spacing (ft)	Max Transverse Spacing per Lateral g Force (ft)			
				0.5g	0.75g	1.0g	1.31g
3/4	Water	1.3	5	12	10	8	7
1	Water	1.7	6	14	11	10	8
1-1/4	Water	2.2	7	15	12	11	9
1-1/2	Water	2.8	8	16	13	12	10
2	Water	4.1	8	21	17	15	12
2-1/2	Water	5.7	9	23	19	16	14
3	Water	7.6	10	25	21	18	15
4	Water	12.4	10	30	25	21	18
5	Water	18.6	10	33	27	24	20
6	Water	25.1	10	37	30	26	22
8	Water	43.7	10	46	37	32	28
10	Water	66.8	10	52	43	37	32
12	Water	91.9	10	57	46	40	35
1/2	Gas	0.3	6	15	13	12	10
3/4	Gas	0.5	7	19	16	15	13
1	Gas	0.7	8	22	20	17	14
1-1/4	Gas	0.9	9	26	22	19	16
1-1/2	Gas	1.1	10	29	23	20	17
2	Gas	1.8	10	33	28	24	20
2-1/2	Gas	2.5	10	37	31	27	23
3	Gas	3.3	10	41	35	30	26
4	Gas	5.4	10	47	41	35	30
5	Gas	7.6	10	52	46	39	34
6	Gas	10.2	10	57	50	43	37
8	Gas	19.3	10	65	58	51	44
10	Gas	30.1	10	73	65	57	49
12	Gas	40.4	10	80	72	62	54

NOTES:

1. MAXIMUM BRACE SPACING IS BASED ON ASME B31E DESIGN BY ANALYSIS. PIPE SIZE, MATERIALS, PRESSURES, ETC. NOT USED TO DETERMINE THESE TABLES MAY USE ASME B31E DESIGN BY ANALYSIS TO DETERMINE THE MAXIMUM SEISMIC BRACE SPACINGS ON A PROJECT BY PROJECT BASIS.
2. MAXIMUM GRAVITY SPACING IS BASED ON MSS SP- 58- 2009 TABLE 4, LIMITED TO 10 FEET.
3. BRACE AND OR CONNECTION CAPACITY MAY GOVERN MAXIMUM SPACINGS IN SOME CASES. FOR BRACE CAPACITY SEE SECTIONS 2, 3, 4, 5, 6, 7, 8 & 9. TO DETERMINE WHETHER CONNECTION CAPACITY FURTHER LIMITS THE MAXIMUM BRACE SPACINGS ON A PROJECT SPECIFIC BASIS, THE REGISTERED DESIGN PROFESSIONAL SHALL PROVIDE ON THE CONSTRUCTION DOCUMENTS THE REQUIREMENTS OR MANUFACTURE'S CERTIFICATION BY ANALYSIS, TESTING OR EXPERIENCE DATA FOR THE NONSTRUCTURAL BRACE COMPONENT IN ACCORDANCE WITH ASCE 7-10 SECTION 13.2.1 ITEM no. 2, WHERE SUCH CERTIFICATION IS REQUIRED BY 2013 CBC SECTION 1705A.12
4. BRACE SPACINGS ARE BASED ON PIPE CONFORMING TO ASTM SPECIFICATION B88 TYPE L DRAWN COPPER PIPE WITH SOLDERED JOINTS AND MAXIMUM OPERATING PRESSURE AND TEMPERATURE OF 100psi AND 250° F, RESPECTIVELY. TYPE L DRAWN COPPER PIPE WITH BRAZED JOINTS MAY USE THESE CHARTS IF THEY OCCUR WITHIN 6" OF A GRAVITY SUPPORT. FOR CASES WHERE THE DISTANCE FROM A BRAZED JOINT TO A GRAVITY SUPPORT EXCEEDS 6", REFER TO SEISMIC BRACE SPACINGS FOR ANNEALED TYPE L COPPER PIPE.
5. FOR VALUES BETWEEN 0.5g, 0.75g, AND 1.0g, IT IS ACCEPTABLE TO INTERPOLATE FOR INTERMEDIATE VALUES. IT IS INTENDED THAT 1.31g BE THE MAXIMUM.

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COPPER PIPE (TYPE K)
DRAWN WITH SOLDERED JOINTS
MAXIMUM SEISMIC BRACE SPACING (ASD)

Pipe Diameter (in)	Service	Max. Weight (plf)	Max Gravity Support Spacing (ft)	Max Transverse Spacing per Lateral g Force (ft)			
				0.5g	0.75g	1.0g	1.31g
3/4	Water	1.4	5	14	12	11	10
1	Water	1.9	6	17	15	13	12
1-1/4	Water	2.4	7	19	17	15	14
1-1/2	Water	3.0	8	22	19	17	15
2	Water	4.4	8	27	23	21	19
2-1/2	Water	6.1	9	31	27	25	22
3	Water	8.2	10	34	31	28	25
4	Water	13.4	10	39	35	33	30
5	Water	20.4	10	43	39	36	33
6	Water	28.4	10	47	43	40	37
8	Water	49.6	10	55	50	47	43
10	Water	75.9	10	62	56	52	48
12	Water	107.4	10	68	62	57	53
1/2	Gas	0.3	6	51	13	12	10
3/4	Gas	0.6	7	19	16	15	13
1	Gas	0.8	8	22	19	18	16
1-1/4	Gas	1.0	9	26	22	20	18
1-1/2	Gas	1.4	10	29	25	23	20
2	Gas	2.1	10	33	30	27	24
2-1/2	Gas	2.9	10	37	33	31	28
3	Gas	4.0	10	40	37	34	31
4	Gas	6.5	10	46	42	39	36
5	Gas	9.7	10	52	47	44	40
6	Gas	13.9	10	57	51	48	44
8	Gas	25.9	10	65	59	55	51
10	Gas	40.3	10	73	66	61	57
12	Gas	57.8	10	80	72	67	62

NOTES:

1. MAXIMUM BRACE SPACING IS BASED ON ASME B31E DESIGN BY ANALYSIS. PIPE SIZE, MATERIALS, PRESSURES, ETC. NOT USED TO DETERMINE THESE TABLES MAY USE ASME B31E DESIGN BY ANALYSIS TO DETERMINE THE MAXIMUM SEISMIC BRACE SPACINGS ON A PROJECT BY PROJECT BASIS.
2. MAXIMUM GRAVITY SPACING IS BASED ON MSS SP- 58- 2009 TABLE 4, LIMITED TO 10 FEET.
3. BRACE AND OR CONNECTION CAPACITY MAY GOVERN MAXIMUM SPACINGS IN SOME CASES. FOR BRACE CAPACITY SEE SECTIONS 2, 3, 4, 5, 6, 7, 8 & 9. TO DETERMINE WHETHER CONNECTION CAPACITY FURTHER LIMITS THE MAXIMUM BRACE SPACINGS ON A PROJECT SPECIFIC BASIS, THE REGISTERED DESIGN PROFESSIONAL SHALL PROVIDE ON THE CONSTRUCTION DOCUMENTS THE REQUIREMENTS OR MANUFACTURE'S CERTIFICATION BY ANALYSIS, TESTING OR EXPERIENCE DATA FOR THE NONSTRUCTURAL BRACE COMPONENT IN ACCORDANCE WITH ASCE 7-10 SECTION 13.2.1 ITEM no. 2, WHERE SUCH CERTIFICATION IS REQUIRED BY 2013 CBC SECTION 1705A.12
4. BRACE SPACINGS ARE BASED ON PIPE CONFORMING TO ASTM SPECIFICATION B88 TYPE L DRAWN COPPER PIPE WITH SOLDERED JOINTS AND MAXIMUM OPERATING PRESSURE AND TEMPERATURE OF 100psi AND 250° F, RESPECTIVELY. TYPE L DRAWN COPPER PIPE WITH BRAZED JOINTS MAY USE THESE CHARTS IF THEY OCCUR WITHIN 6" OF A GRAVITY SUPPORT. FOR CASES WHERE THE DISTANCE FROM A BRAZED JOINT TO A GRAVITY SUPPORT EXCEEDS 6", REFER TO SEISMIC BRACE SPACINGS FOR ANNEALED TYPE L COPPER PIPE.
5. FOR VALUES BETWEEN 0.5g, 0.75g, AND 1.0g, IT IS ACCEPTABLE TO INTERPOLATE FOR INTERMEDIATE VALUES. IT IS INTENDED THAT 1.31g BE THE MAXIMUM.

COPPER PIPE (TYPE K)
ANNEALED
MAXIMUM SEISMIC BRACE SPACING (ASD)

Pipe Diameter (in)	Service	Max. Weight (plf)	Max Gravity Support Spacing (ft)	Max Transverse Spacing per Lateral g Force (ft)			
				0.5g	0.75g	1.0g	1.31g
3/4	Water	1.4	5	14	11	10	8
1	Water	1.9	6	15	13	11	9
1-1/4	Water	2.4	7	16	13	12	10
1-1/2	Water	3.0	8	18	15	13	11
2	Water	4.4	8	22	18	16	13
2-1/2	Water	6.1	9	25	20	18	15
3	Water	8.2	10	27	22	19	16
4	Water	13.4	10	33	27	23	20
5	Water	20.4	10	37	30	26	22
6	Water	28.4	10	42	34	29	25
8	Water	49.6	10	51	42	36	31
10	Water	75.9	10	58	47	41	35
12	Water	107.4	10	64	52	45	39
1/2	Gas	0.3	6	15	13	12	10
3/4	Gas	0.6	7	19	16	15	13
1	Gas	0.8	8	22	19	17	14
1-1/4	Gas	1.0	9	26	22	19	16
1-1/2	Gas	1.4	10	29	23	20	17
2	Gas	2.1	10	33	28	24	21
2-1/2	Gas	2.9	10	37	32	27	23
3	Gas	4.0	10	40	35	30	26
4	Gas	6.5	10	46	41	35	30
5	Gas	9.7	10	52	46	40	34
6	Gas	13.9	10	57	51	44	38
8	Gas	25.9	10	65	59	51	44
10	Gas	40.3	10	73	66	57	50
12	Gas	57.8	10	80	72	63	54

NOTES:

1. MAXIMUM BRACE SPACING IS BASED ON ASME B31E DESIGN BY ANALYSIS. PIPE SIZE, MATERIALS, PRESSURES, ETC. NOT USED TO DETERMINE THESE TABLES MAY USE ASME B31E DESIGN BY ANALYSIS TO DETERMINE THE MAXIMUM SEISMIC BRACE SPACINGS ON A PROJECT BY PROJECT BASIS.
2. MAXIMUM GRAVITY SPACING IS BASED ON MSS SP- 58- 2009 TABLE 4, LIMITED TO 10 FEET.
3. BRACE AND OR CONNECTION CAPACITY MAY GOVERN MAXIMUM SPACINGS IN SOME CASES. FOR BRACE CAPACITY SEE SECTIONS 2, 3, 4, 5, 6, 7, 8 & 9. TO DETERMINE WHETHER CONNECTION CAPACITY FURTHER LIMITS THE MAXIMUM BRACE SPACINGS ON A PROJECT SPECIFIC BASIS, THE REGISTERED DESIGN PROFESSIONAL SHALL PROVIDE ON THE CONSTRUCTION DOCUMENTS THE REQUIREMENTS OR MANUFACTURE'S CERTIFICATION BY ANALYSIS, TESTING OR EXPERIENCE DATA FOR THE NONSTRUCTURAL BRACE COMPONENT IN ACCORDANCE WITH ASCE 7-10 SECTION 13.2.1 ITEM no. 2, WHERE SUCH CERTIFICATION IS REQUIRED BY 2013 CBC SECTION 1705A.12
4. BRACE SPACINGS ARE BASED ON PIPE CONFORMING TO ASTM SPECIFICATION B88 TYPE L DRAWN COPPER PIPE WITH SOLDERED JOINTS AND MAXIMUM OPERATING PRESSURE AND TEMPERATURE OF 100psi AND 250° F, RESPECTIVELY. TYPE L DRAWN COPPER PIPE WITH BRAZED JOINTS MAY USE THESE CHARTS IF THEY OCCUR WITHIN 6" OF A GRAVITY SUPPORT. FOR CASES WHERE THE DISTANCE FROM A BRAZED JOINT TO A GRAVITY SUPPORT EXCEEDS 6", REFER TO SEISMIC BRACE SPACINGS FOR ANNEALED TYPE L COPPER PIPE.
5. FOR VALUES BETWEEN 0.5g, 0.75g, AND 1.0g, IT IS ACCEPTABLE TO INTERPOLATE FOR INTERMEDIATE VALUES. IT IS INTENDED THAT 1.31g BE THE MAXIMUM.

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CAST IRON SOIL PIPE
FILLED WITH WATER
MAXIMUM SEISMIC BRACE SPACING (ASD)

Pipe Diameter (in)	Filled With	Max. Weight (plf)	Max Gravity Support Spacing (ft)	Max Transverse Spacing per Lateral g Force (ft)				Max Longitudinal Spacing per Lateral g Force (ft)			
				0.25g	0.5g	0.75g	1.0g	0.25g	0.5g	0.75g	1.0g
3	Water	8.5	8	22	16	13	11	40	32	22	17
4	Water	12.6	8	25	18	14	10	40	36	26	19
5	Water	18.0	8	26	18	12	10	40	40	29	22
6	Water	23.7	8	26	17	11	10	40	40	29	22
8	Water	38.4	8	26	13	10	10	40	25	17	13
10	Water	59.5	8	22	11	10	10	31	16	10	10
12	Water	80.3	8	10	10	10	10	10	10	10	10

NOTES:

1. MAXIMUM BRACE SPACING IS BASED ON ASTM C1540, FM 1680 CLASS I, AND ASCE 7-10 SECTION 13.6.8, NOTE c, 10 PERCENT OF THE MATERIAL MINIMUM SPECIFIED TENSILE STRENGTH FOR CAST IRON.
2. MAXIMUM GRAVITY SUPPORT SPACING IS BASED ON SUPPORT OF STANDARD 10 FOOT MAXIMUM PIPE LENGTH SEGMENTS SUPPORTED 1 FOOT IN EACH DIRECTION FROM JOINT CONNECTION. TRIBUTARY WEIGHT ON EACH SUPPORT IS BASED ON 5 FEET OF PIPE AND WATER. PIPE WEIGHTS CONSIDERED FULL OF WATER.
3. BRACE SPACINGS ARE BASED ON CAST IRON PIPE CONSTRUCTED TO ASTM A 888 OR CISPI 301 STANDARDS WITH A MINIMUM TENSILE STRENGTH OF 21,000 PSI.
4. BRACE SPACING SHALL BE 10 FEET MINIMUM AND 40 FEET MAXIMUM. BRACE AND OR CONNECTION CAPACITY MAY GOVERN MAXIMUM SPACING IN SOME CASES. (SEE SECTION 2, 3, 4, 5, 6, 7, 8 & 9.)
5. CAST IRON PIPE BRACE SPACINGS SHALL NOT EXCEED THE TABULATED SPACINGS. NO-HUB COUPLINGS SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C1540, SHALL BE CERTIFIED IN ACCORDANCE WITH FM 1680 CLASS I, AND GRAVITY HANGERS SHALL BE SPACED PER THE REQUIREMENTS OF TABLE 313.1 OF THE 2013 CALIFORNIA PLUMBING CODE (CPC 2013) FOR NO-HUB CAST IRON PIPE.

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CAST IRON SOIL PIPE
FOR EMPTY SYSTEMS (NO WATER)
MAXIMUM SEISMIC BRACE SPACING (ASD)

Pipe Diameter (in)	Filled With	Max. Weight (plf)	Max Gravity Support Spacing (ft)	Max Transverse Spacing per Lateral g Force (ft)				Max Longitudinal Spacing per Lateral g Force (ft)			
				0.25g	0.5g	0.75g	1.0g	0.25g	0.5g	0.75g	1.0g
3	No Water	5.4	8	22	16	13	11	40	32	26	22
4	No Water	7.1	8	25	18	15	13	40	36	30	26
5	No Water	9.8	8	28	20	16	14	40	40	32	28
6	No Water	11.8	8	30	21	17	15	40	40	34	30
8	No Water	17.1	8	35	25	20	15	40	40	37	28
10	No Water	25.5	8	40	26	17	13	40	37	24	18
12	No Water	31.8	8	10	10	10	10	10	10	10	10

NOTES:

1. MAXIMUM BRACE SPACING IS BASED ON ASTM C1540, FM 1680 CLASS I, AND ASCE 7-10 SECTION 13.6.8, NOTE c, 10 PERCENT OF THE MATERIAL MINIMUM SPECIFIED TENSILE STRENGTH FOR CAST IRON.
2. MAXIMUM GRAVITY SUPPORT SPACING IS BASED ON SUPPORT OF STANDARD 10 FOOT MAXIMUM PIPE LENGTH SEGMENTS SUPPORTED 1 FOOT IN EACH DIRECTION FROM JOINT CONNECTION. TRIBUTARY WEIGHT ON EACH SUPPORT IS BASED ON 5 FEET OF PIPE. PIPE WEIGHTS CONSIDERED EMPTY.
3. BRACE SPACINGS ARE BASED ON CAST IRON PIPE CONSTRUCTED TO ASTM A 888 OR CISPI 301 STANDARDS WITH A MINIMUM TENSILE STRENGTH OF 21,000 PSI.
4. BRACE SPACING SHALL BE 10 FEET MINIMUM AND 40 FEET MAXIMUM. BRACE AND OR CONNECTION CAPACITY MAY GOVERN MAXIMUM SPACING IN SOME CASES. (SEE SECTIONS 2, 3, 4, 5, 6, 7, 8 & 9.)
5. CAST IRON PIPE BRACE SPACINGS SHALL NOT EXCEED THE TABULATED SPACINGS. NO-HUB COUPLINGS SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C1540, SHALL BE CERTIFIED IN ACCORDANCE WITH FM 1680 CLASS I, AND GRAVITY HANGERS SHALL BE SPACED PER THE REQUIREMENTS OF TABLE 313.1 OF THE 2013 CALIFORNIA PLUMBING CODE (CPC 2013) FOR NO-HUB CAST IRON PIPE.

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INTERMEDIATE METAL CONDUIT (IMC)
MAXIMUM SEISMIC BRACE SPACING (ASD)

Pipe Diameter (in)	Max. Weight (plf)	Max Gravity Support Spacing (ft)	Max Transverse Spacing per Lateral g Force (ft)			
			0.5g	0.75g	1.0g	1.31g
3/4	1.09	10	24	21	19	17
1	1.60	12	27	24	22	19
1-1/4	2.29	14	31	27	25	22
1-1/2	2.90	14	33	30	27	24
2	4.13	16	36	33	31	28
2-1/2	6.64	16	41	37	34	31
3	8.86	20	44	40	37	34
3-1/2	10.88	20	47	42	39	36
4	12.89	20	49	44	41	38

NOTES:

1. MAXIMUM BRACE SPACING IS BASED ON ASCE 7-10 SECTION 13.6.8, NOTE b, 70 PERCENT OF THE MATERIAL MINIMUM SPECIFIED TENSILE STRENGTH FOR STEEL TUBING WITH THREADED CONNECTIONS.
2. IMC CONSIDERED FULL OF WATER WHEN DETERMINING WEIGHT.
3. BRACE AND OR CONNECTION CAPACITY MAY GOVERN MAXIMUM SPACING IN SOME CASES. SEE SECTION 2, 3, 4, 5, 6, 7, 8, & 9.
4. BRACE SPACINGS ARE BASED ON INTERMEDIATE METAL CONDUIT (IMC) CONSTRUCTED TO UL-1242 OR ANSI C-80.3 WITH A MINIMUM YIELD STRENGTH OF 30,000 PSI.
5. FOR VALUES BETWEEN 0.5g, 0.75g,AND 1.0g, IT IS ACCEPTABLE TO INTERPOLATE FOR INTERMEDIATE VALUES. IT IS INTENDED THAT 1.31g BE THE MAXIMUM.

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RIGID METAL CONDUIT (RMC)
MAXIMUM SEISMIC BRACE SPACING (ASD)

Pipe Diameter (in)	Max. Weight (plf)	Max Gravity Support Spacing (ft)	Max Transverse Spacing per Lateral g Force (ft)			
			0.5g	0.75g	1.0g	1.31g
3/4	1.33	10	24	21	19	17
1	1.99	12	28	24	22	20
1-1/4	2.84	14	32	28	26	23
1-1/2	3.53	14	34	31	28	25
2	4.98	16	38	34	32	29
2-1/2	7.7	16	41	37	35	32
3	10.52	20	45	41	38	35
3-1/2	13.14	20	48	44	41	37
4	15.72	20	52	47	44	41
5	22.76	20	56	51	47	44
6	31.03	20	61	55	51	47

NOTES:

1. MAXIMUM BRACE SPACING IS BASED ON ASCE 7-10 SECTION 13.6.8, NOTE b, 70 PERCENT OF THE MATERIAL MINIMUM SPECIFIED TENSILE STRENGTH FOR STEEL TUBING WITH THREADED CONNECTIONS.
2. RMC CONSIDERED FULL OF WATER WHEN DETERMINING WEIGHT.
3. BRACE AND OR CONNECTION CAPACITY MAY GOVERN MAXIMUM SPACING IN SOME CASES. SEE SECTIONS 2, 3, 4, 5, 6, 7, 8, & 9.
4. BRACE SPACINGS ARE BASED ON RIGID METAL CONDUIT (RMC) CONSTRUCTED TO UL-6 OR ANSI C-80.3 WITH A MINIMUM YIELD STRENGTH OF 30,000 PSI.
5. FOR VALUES BETWEEN 0.5g, 0.75g,AND 1.0g, IT IS ACCEPTABLE TO INTERPOLATE FOR INTERMEDIATE VALUES. IT IS INTENDED THAT 1.31g BE THE MAXIMUM.

SECTION 15

SPECIAL SEISMIC FLOOR SUPPORT DETAILS

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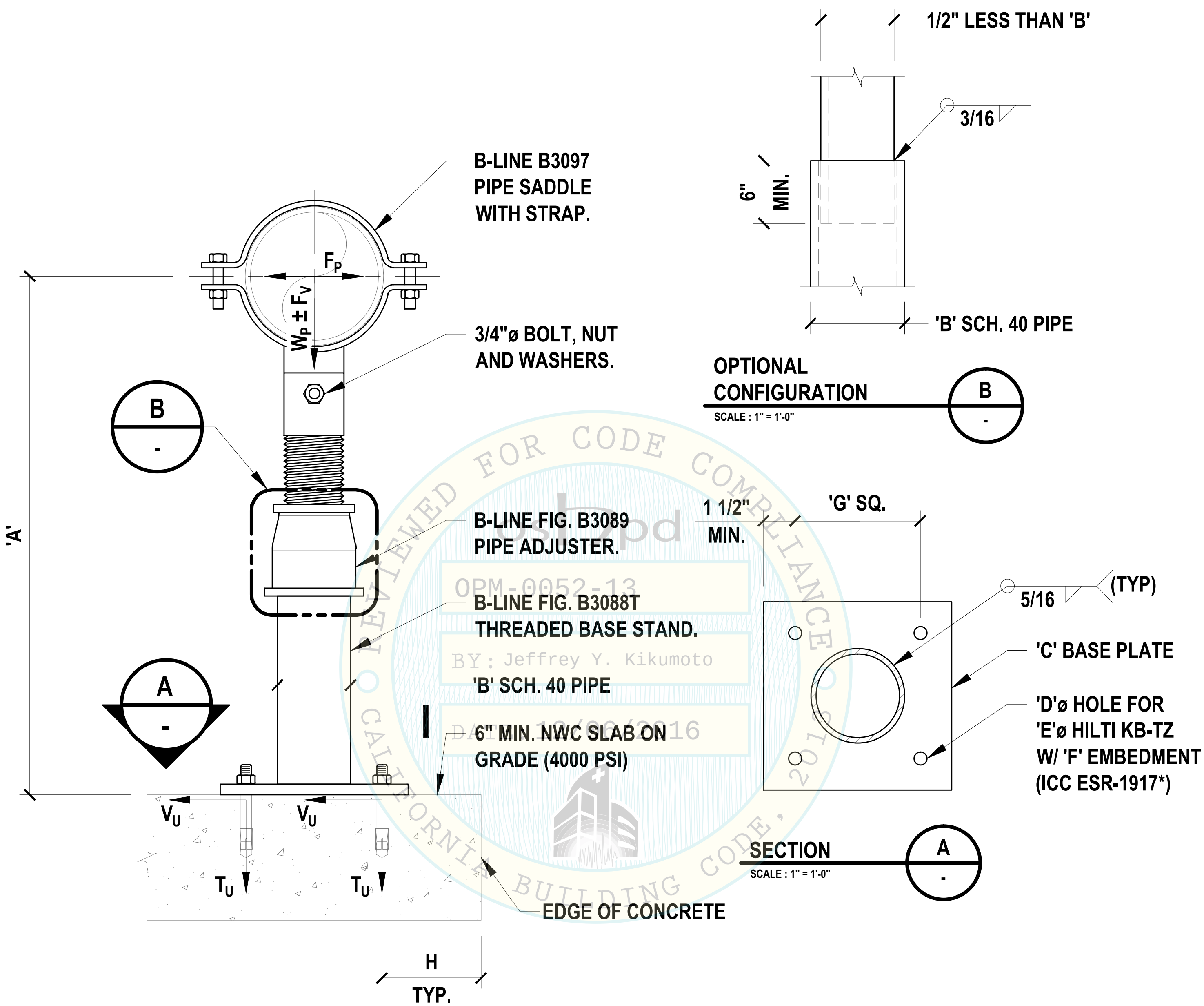
ADJUSTABLE PIPE STAND ON 4000 PSI NWC SLAB

DETAIL
PS-1A



NOTES:
1.) SEE PAGE 15-1A.2 FOR ADDITIONAL DETAIL INFORMATION.

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ADJUSTABLE PIPE STAND ON 4000 PSI NWC SLAB

DETAIL
PS-1A

RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	MAXIMUM VERTICAL LOAD @ CL * (LBS)(ASD)	MAXIMUM HORIZONTAL LOAD @ CL * (LBS)(ASD)	ADJUSTER (B-LINE B3089) (PIPE SIZE-IN.)	"B" STAND PIPE (IN)	"C" BASEPLATE (IN)	"D" HOLE SIZE FOR ANCHOR (IN. DIA.)	"E" HILTI KB-TZ ANCHOR SIZE (IN)	"F" ANCHOR EMBED. (IN) (hef)	"G" ANCHOR SPACING (IN)	"H" MIN ANCHOR TO CONC. EDGE (IN)
4	36	244	192	2-1/2 x 3	3	3/8 x 13-1/2 SQ	5/8	1/2	2	10-1/2	6
4	72	122	96	2-1/2 x 3	3	1/2 x 13-1/2 SQ	5/8	1/2	2	10-1/2	6
6	36	243	192	2-1/2 x 3	3	1/2 x 13-1/2 SQ	5/8	1/2	2	10-1/2	6
6	72	324	255	3 x 4	4	5/8 x 13-1/2 SQ	3/4	5/8	3-1/8	10-1/2	6
8	36	601	473	2-1/2 x 3	3	5/8 x 13-1/2 SQ	3/4	5/8	3-1/8	10-1/2	6
8	72	439	346	3 x 4	4	5/8 x 14-1/2 SQ	3/4	5/8	4	11-1/2	6

* IT IS ACCEPTABLE TO APPLY MAXIMUM HORIZONTAL LOAD CONCURRENTLY WITH MAXIMUM VERTICAL LOAD. THIS CONDITION CORRESPONDS TO A 1.0G HORIZONTAL SEISMIC FORCE AND GRAVITY LOAD WITH 0.27G VERTICAL SEISMIC FORCE.

RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	T_u ** PER ANCHOR (LBS)(LRFD)	V_u ** PER ANCHOR (LBS)(LRFD)
4	36	1130	172
4	72	1128	86
6	36	1130	171
6	72	3118	228
8	36	2814	422
8	72	4231	309

** MAX, LOAD INCLUDES OVER STRENGTH FACTOR Ω_0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI 318-11.

NOTES:

1.) TO DETERMINE MAXIMUM SUPPORT SPACING DIVIDE "MAXIMUM VERTICAL LOAD" BY 1.27* WEIGHT-PER-FOOT OF PIPE. FOR EXAMPLE IF SUPPORTING A 4" PIPE WEIGHING 18.3 BL/FT, AT 72" CL, THEN THE MAXIMUM SPACING IS 123 LB. / (1.27 X 18.3 LB/FT) = 5'-3". MAXIMUM SUPPORT SPACING 10'-0".
2.) DO NOT EXCEED ANY PROJECT LIMITS.
3.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
4.) IF 1.0G IS EXCEEDED, THEN DO NOT USE CAST IRON OR SIMILAR NON-DUCTILE PIPE.

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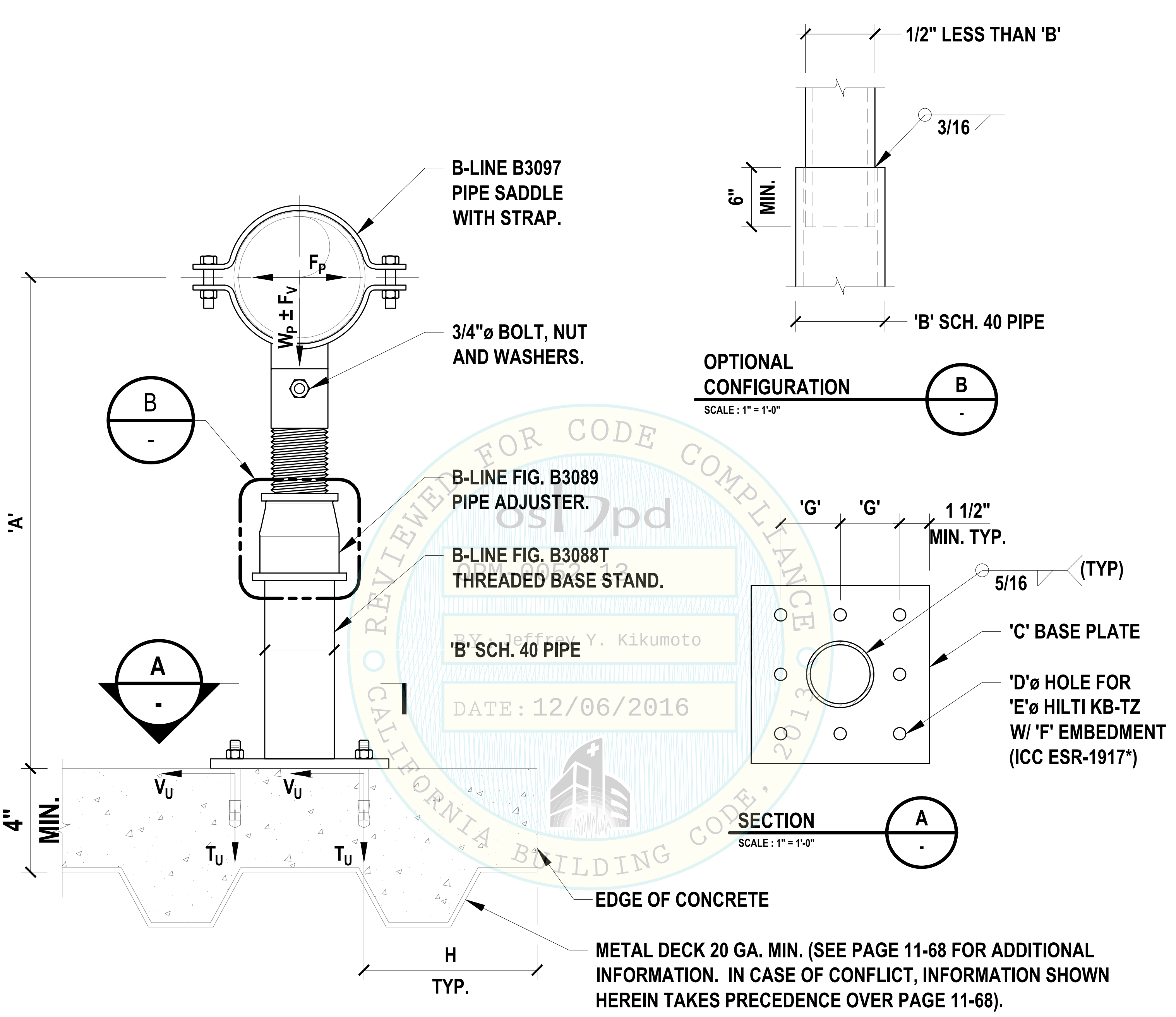
ADJUSTABLE PIPE STAND ON STEEL DECK W/ 3000 PSI STRUCTURAL SAND LWC

DETAIL
PS-1B



NOTES:
1.) SEE PAGE 15-1B.2 FOR ADDITIONAL DETAIL INFORMATION.

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ADJUSTABLE PIPE STAND ON STEEL DECK W/ 3000 PSI STRUCTURAL SAND LWC

DETAIL **PS-1B**

RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	MAXIMUM VERTICAL LOAD @ CL * (LBS)(ASD)	MAXIMUM HORIZONTAL LOAD @ CL * (LBS)(ASD)	ADJUSTER (B-LINE B3089) (PIPE SIZE-IN.)	"B" STAND PIPE (IN)	"C" BASEPLATE (IN)	"D" HOLE SIZE FOR ANCHOR (IN. DIA.)	"E" HILTI KB-TZ ANCHOR SIZE (IN)	"F" ANCHOR EMBED. (IN) (hef)	"G" ANCHOR SPACING (IN)	"H" MIN ANCHOR TO CONC. EDGE (IN)
4	36	127	100	2-1/2 x 3	3	1/2 x 13-1/2 SQ	5/8	1/2 ***	2	10-1/2	6
4	72	166	131	2-1/2 x 3	3	1/2 x 16 SQ	5/8	1/2	2	6-1/2	9
6	36	296	233	2-1/2 x 3	3	1/2 x 16 SQ	5/8	1/2	2	6-1/2	9
6	72	207	163	3 x 4	4	1/2 x 24 SQ	5/8	1/2	2	10-1/2	9
8	36	364	287	2-1/2 x 3	3	1/2 x 24 SQ	5/8	1/2	2	10-1/2	9
8	55	333	262	3 x 4	4	1/2 x 24 SQ	5/8	1/2 ****	2	7	9

* IT IS ACCEPTABLE TO APPLY MAXIMUM HORIZONTAL LOAD CONCURRENTLY WITH MAXIMUM VERTICAL LOAD. THIS CONDITION CORRESPONDS TO A 1.0G HORIZONTAL SEISMIC FORCE AND GRAVITY LOAD WITH 0.27G VERTICAL SEISMIC FORCE.

*** (x4) ANCHORS PER BASE PLATE

**** (x12) ANCHORS PER BASE PLATE

RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	T_u ** PER ANCHOR (LBS)(LRFD)	V_u ** PER ANCHOR (LBS)(LRFD)
4	36	589	89
4	72	739	59
6	36	658	104
6	72	569	73
8	36	503	128
8	55	492	78

** MAX, LOAD INCLUDES OVER STRENGTH FACTOR Ω_0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI 318-11.

NOTES:

1.) TO DETERMINE MAXIMUM SUPPORT SPACING DIVIDE "MAXIMUM VERTICAL LOAD" BY 1.27* WEIGHT-PER-FOOT OF PIPE. FOR EXAMPLE, IF SUPPORTING A 4" PIPE WEIGHING 18.3 LB/FT, AT 72" CL, THEN THE MAXIMUM SPACING IS 168 LB. / (1.27 X 18.3 LB/FT) = 7'-2". MAXIMUM SUPPORT SPACING 10'-0".
2.) DO NOT EXCEED ANY PROJECT LIMITS.
3.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
4.) IF 1.0G IS EXCEEDED, THEN DO NOT USE CAST IRON OR SIMILAR NON-DUCTILE PIPE.

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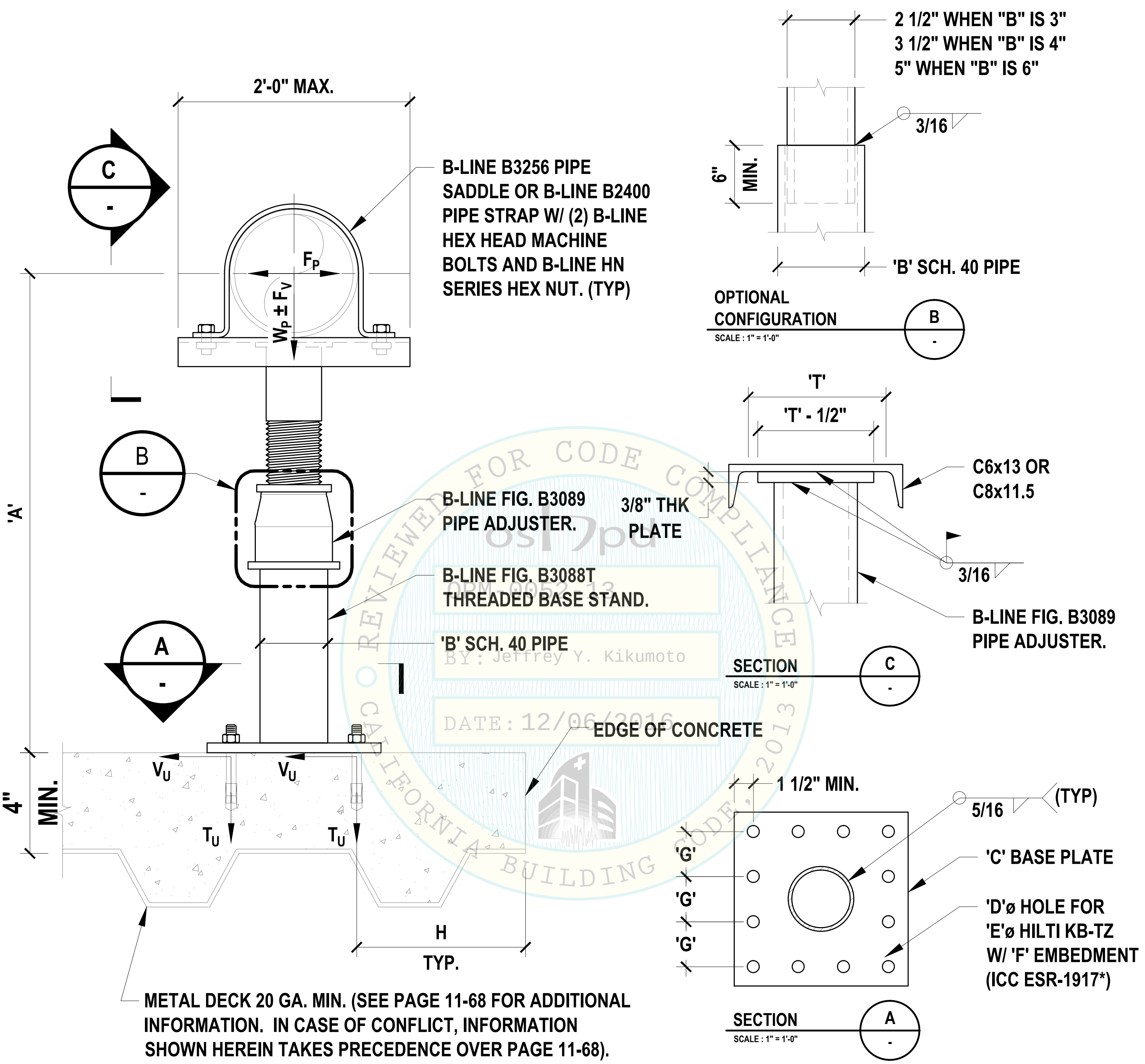
ADJUSTABLE PIPE STAND ON STEEL DECK W/ 3000 PSI STRUCTURAL SAND LWC

DETAIL
PS-2B



NOTES:
1.) SEE PAGE 15-2B.2 FOR ADDITIONAL DETAIL INFORMATION.
2.) SEE AISC FOR 'T' DIMENSION.

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ADJUSTABLE PIPE STAND ON STEEL DECK W/ 3000 PSI STRUCTURAL SAND LWC

DETAIL
PS-2B

RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	MAXIMUM VERTICAL LOAD @ CL * (LBS)(ASD)	MAXIMUM HORIZONTAL LOAD @ CL * (LBS)(ASD)	ADJUSTER (B-LINE B3089) (PIPE SIZE-IN.)	"B" STAND PIPE (IN)	"C" BASEPLATE (IN)	"D" HOLE SIZE FOR ANCHOR (IN. DIA.)	"E" HILTI KB-TZ ANCHOR SIZE (IN)	"F" ANCHOR EMBED. (IN) (hef)	"G" ANCHOR SPACING (IN)	"H" MIN ANCHOR TO CONC. EDGE (IN)
10	36	445	350	2-1/2 x 3	3	1/2 x 24 SQ	5/8	1/2	2	7	9
12	25	540	425	3 x 4	4	1/2 x 24 SQ	5/8	1/2	2	7	9

* IT IS ACCEPTABLE TO APPLY MAXIMUM HORIZONTAL LOAD CONCURRENTLY WITH MAXIMUM VERTICAL LOAD. THIS CONDITION CORRESPONDS TO A 1.0G HORIZONTAL SEISMIC FORCE AND GRAVITY LOAD WITH 0.27G VERTICAL SEISMIC FORCE.

RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	T_u ** PER ANCHOR (LBS)(LRFD)	V_u ** PER ANCHOR (LBS)(LRFD)
10	36	431	104
12	25	364	126

** MAX, LOAD INCLUDES OVER STRENGTH FACTOR Ω_0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI 318-11.

NOTES:

1.) TO DETERMINE MAXIMUM SUPPORT SPACING DIVIDE "MAXIMUM VERTICAL LOAD" BY 1.27* WEIGHT-PER-FOOT OF PIPE. FOR EXAMPLE, IF SUPPORTING A 10" PIPE WEIGHING 80.2 LB/FT, AT 36" CL, THEN THE MAXIMUM SPACING IS 451 LB. / (1.27 X 80.2 LB/FT) = 4'-5". MAXIMUM SUPPORT SPACING 10'-0".
2.) DO NOT EXCEED ANY PROJECT LIMITS.
3.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
4.) IF 1.0G IS EXCEEDED, THEN DO NOT USE CAST IRON OR SIMILAR NON-DUCTILE PIPE.

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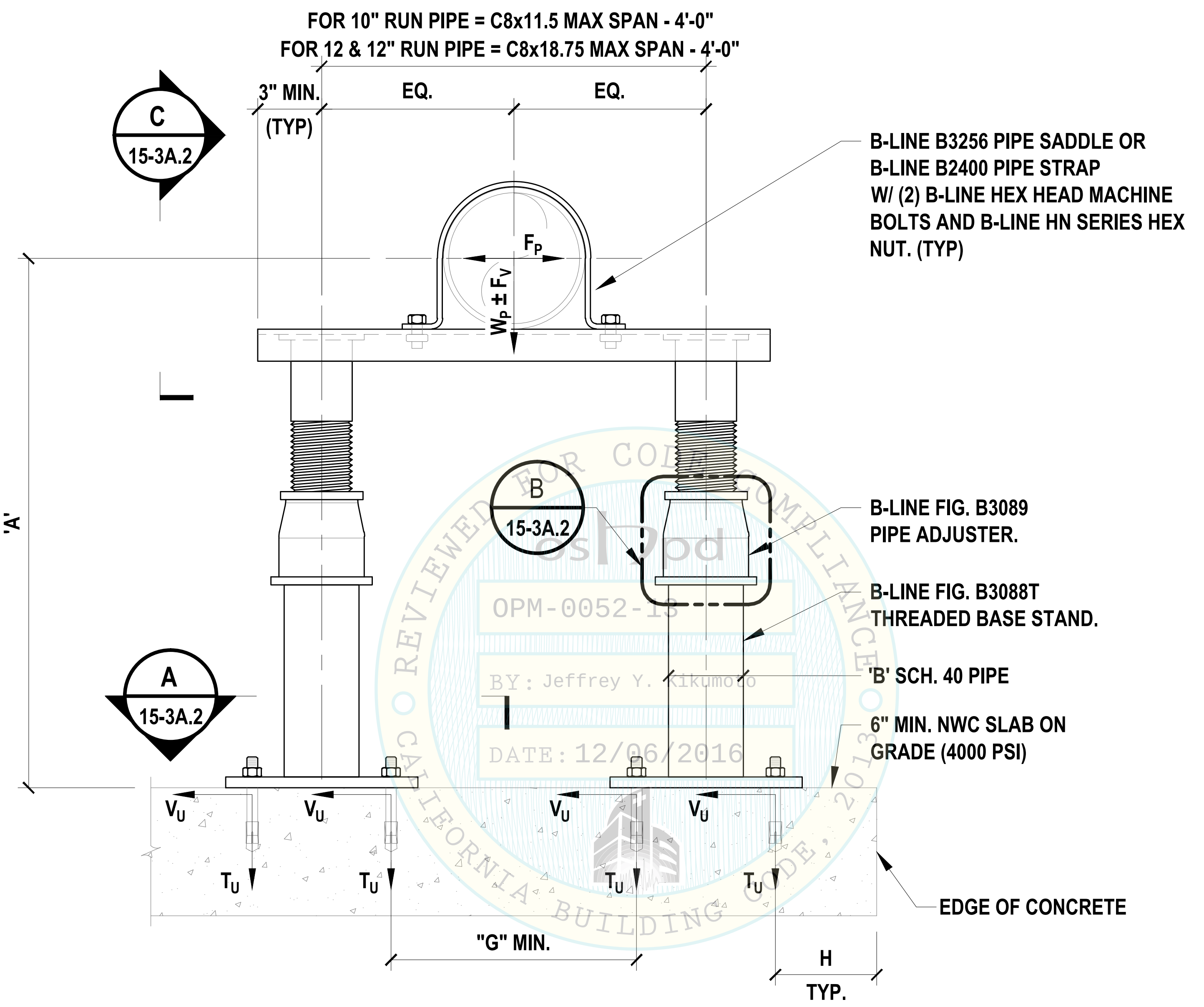
	ADJUSTABLE PIPE STAND ON 4000 PSI NWC SLAB	DETAIL PS-3A



NOTES:
1.) SEE PAGE 15-3A.2 FOR ADDITIONAL DETAIL INFORMATION.

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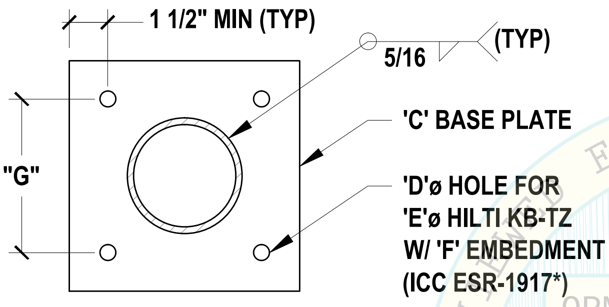
ADJUSTABLE PIPE STAND ON 4000 PSI NWC SLAB

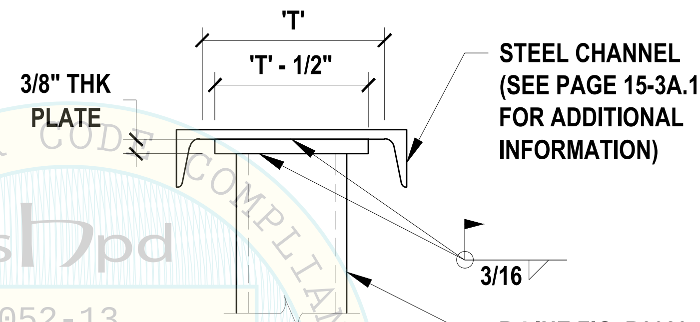
DETAIL
PS-3A

RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	MAXIMUM VERTICAL LOAD @ CL * (LBS)(ASD)	MAXIMUM HORIZONTAL LOAD @ CL * (LBS)(ASD)	ADJUSTER (B-LINE B3089) (PIPE SIZE-IN.)	"B" STAND PIPE (IN)	"C" BASEPLATE (IN)	"D" HOLE SIZE FOR ANCHOR (IN. DIA.)	"E" HILTI KB-TZ ANCHOR SIZE (IN)	"F" ANCHOR EMBED. (IN) (hef)	"G" ANCHOR SPACING (IN)	"H" MIN ANCHOR TO CONC. EDGE (IN)
10	36	714	562	2-1/2 x 3	3	1/2 x 9-1/2 SQ	5/8	1/2	3-1/4	6-1/2	6
10	72	770	606	2-1/2 x 3	3	5/8 x 12-1/2 SQ	3/4	5/8	4	9-1/2	9
12	36	925	728	2-1/2 x 3	3	1/2 x 9-1/2 SQ	3/4	5/8	4	6-1/2	9
12	72	997	785	3 x 4	4	5/8 x 14-1/2 SQ	3/4	5/8	4	11-1/2	9
14	36	1105	870	2-1/2 x 3	3	1/2 x 12-1/2 SQ	5/8	1/2	3-1/4	9-1/2	6
14	72	1118	880	3 x 4	4	5/8 x 16 SQ	3/4	5/8	4	13	9

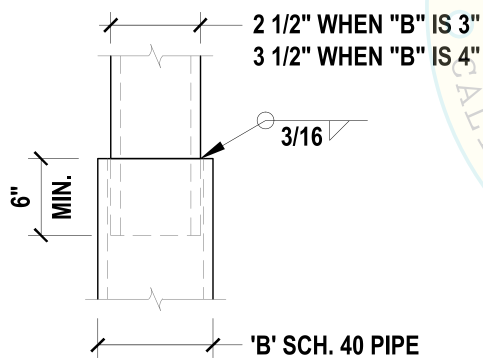
* IT IS ACCEPTABLE TO APPLY MAXIMUM HORIZONTAL LOAD CONCURRENTLY WITH MAXIMUM VERTICAL LOAD. THIS CONDITION CORRESPONDS TO A 1.0G HORIZONTAL SEISMIC FORCE AND GRAVITY LOAD WITH 0.27G VERTICAL SEISMIC FORCE.



SECTION A
SCALE : 1" = 1'-0"



SECTION C
SCALE : 1" = 1'-0"



OPTIONAL CONFIGURATION B
SCALE : 1" = 1'-0"

RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	T_u ** PER ANCHOR (LBS)(LRFD)	V_u ** PER ANCHOR (LBS)(LRFD)
10	36	2539	251
10	72	4073	271
12	36	3462	325
12	72	4400	350
14	36	2808	388
14	72	4382	393

** MAX, LOAD INCLUDES OVER STRENGTH FACTOR Ω_0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI 318-11.

NOTES:
1.) TO DETERMINE MAXIMUM SUPPORT SPACING DIVIDE "MAXIMUM VERTICAL LOAD" BY 1.27* WEIGHT-PER-FOOT OF PIPE. FOR EXAMPLE, IF SUPPORTING A 10" PIPE WEIGHING 80.2 LB/FT, AT 72" CL, THEN THE MAXIMUM SPACING IS 770 LB. / (1.27 X 80.2 LB/FT) = 7'-6". MAXIMUM SUPPORT SPACING 10'-0".
2.) DO NOT EXCEED ANY PROJECT LIMITS.
3.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
4.) SEE AISC FOR 'T' DIMENSION.
5.) IF 1.0G IS EXCEEDED, THEN DO NOT USE CAST IRON OR SIMILAR NON-DUCTILE PIPE.

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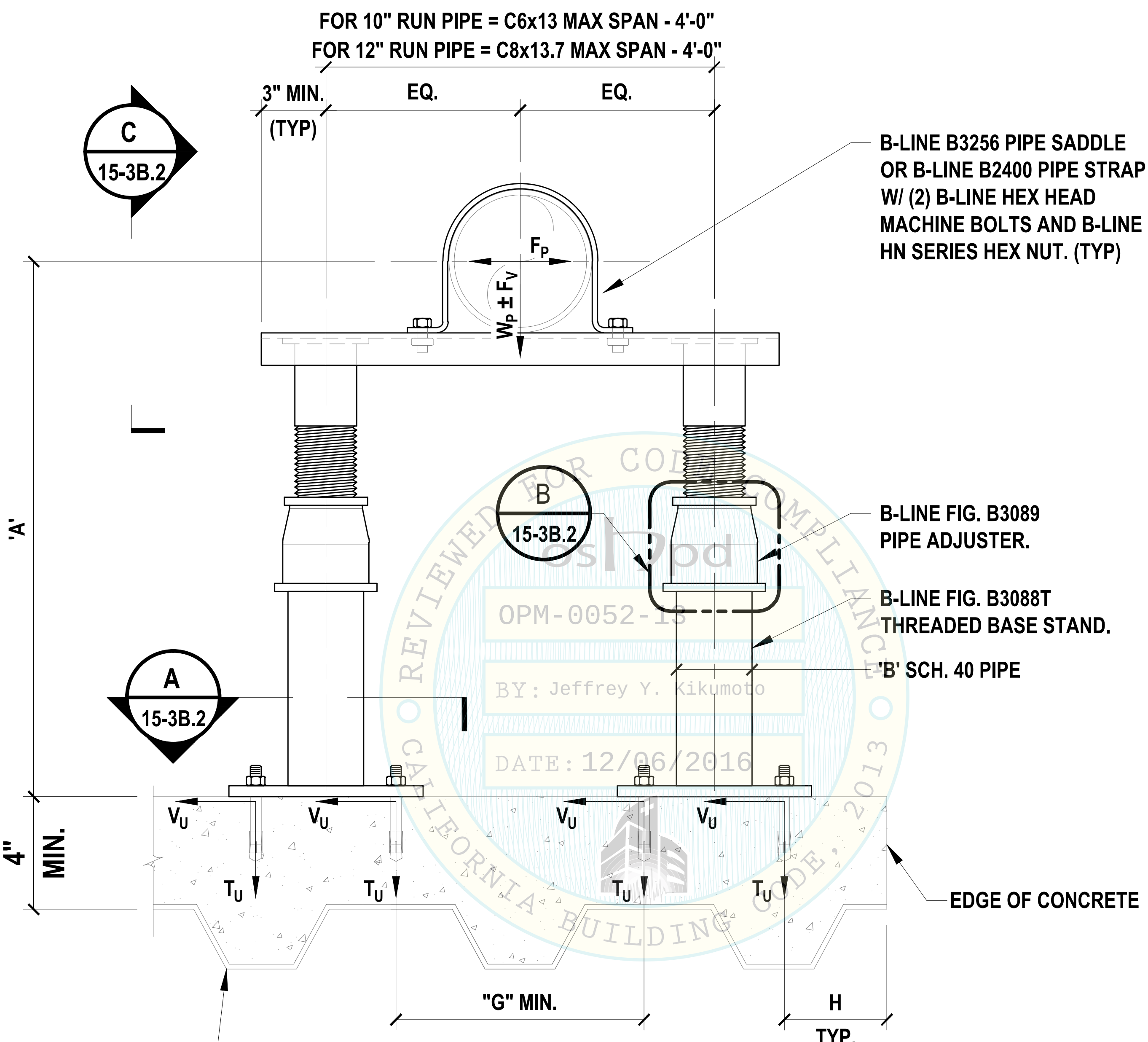
PIPE STAND ON STEEL DECK
W/ 3000 PSI STRUCTURAL SAND LWC

DETAIL
PS-3B



METAL DECK 20 GA. MIN. (SEE PAGE 11-68 FOR ADDITIONAL INFORMATION. IN CASE OF CONFLICT, INFORMATION SHOWN HEREIN TAKES PRECEDENCE OVER PAGE 11-68).

NOTES:
1.) SEE PAGE 15-3B.2 FOR ADDITIONAL DETAIL INFORMATION.

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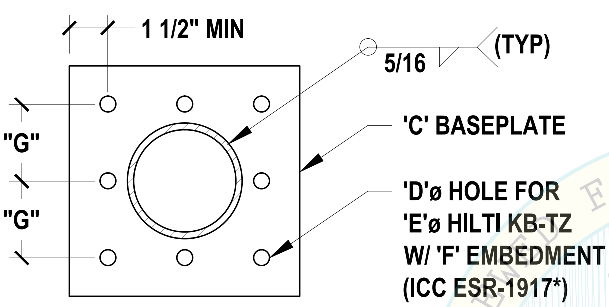
PIPE STAND ON STEEL DECK
W/ 3000 PSI STRUCTURAL SAND LWC

DETAIL
PS-3B

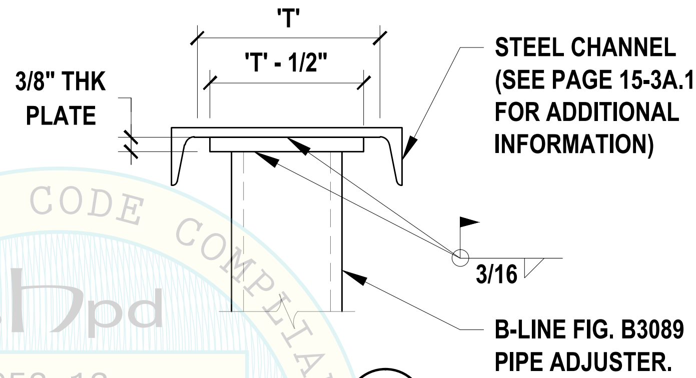
RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	MAXIMUM VERTICAL LOAD @ CL * (LBS)(ASD)	MAXIMUM HORIZONTAL LOAD @ CL * (LBS)(ASD)	ADJUSTER (B-LINE B3089) (PIPE SIZE-IN.)	"B" STAND PIPE (IN)	"C" BASEPLATE (IN)	"D" HOLE SIZE FOR ANCHOR (IN. DIA.)	"E" HILTI KB-TZ ANCHOR SIZE (IN)	"F" ANCHOR EMBED. (IN) (hef)	"G" ANCHOR SPACING (IN)	"H" MIN ANCHOR TO CONC. EDGE (IN)
10	36	591	465	2-1/2 x 3	3	1/2 x 16 SQ	5/8	1/2	2	6-1/2	9
10	72	533	420	2-1/2 x 3	3	1/2 x 24 SQ	5/8	1/2**	2	7	9
12	36	880	693	2-1/2 x 3	3	1/2 x 24 SQ	5/8	1/2**	2	7	9

* IT IS ACCEPTABLE TO APPLY MAXIMUM HORIZONTAL LOAD CONCURRENTLY WITH MAXIMUM VERTICAL LOAD. THIS CONDITION CORRESPONDS TO A 1.0G HORIZONTAL SEISMIC FORCE AND GRAVITY LOAD WITH 0.27G VERTICAL SEISMIC FORCE.

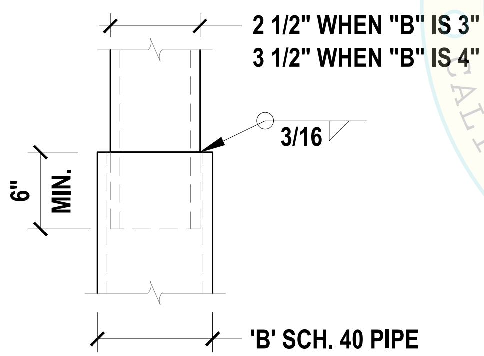
** (x12) ANCHORS PER BASE PLATE.



SECTION A
SCALE : 1" = 1'-0"



SECTION C
SCALE : 1" = 1'-0"



OPTIONAL CONFIGURATION B
SCALE : 1" = 1'-0"

RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	T_u ** PER ANCHOR (LBS)(LRFD)	V_u ** PER ANCHOR (LBS)(LRFD)
10	36	657	104
10	72	512	63
12	36	421	103

** MAX, LOAD INCLUDES OVER STRENGTH FACTOR Ω_0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI 318-11.

NOTES:

1.) TO DETERMINE MAXIMUM SUPPORT SPACING DIVIDE "MAXIMUM VERTICAL LOAD" BY 1.27* WEIGHT-PER-FOOT OF PIPE. FOR EXAMPLE, IF SUPPORTING A 10" PIPE WEIGHING 80.2 LB/FT, AT 72" CL, THEN THE MAXIMUM SPACING IS 533 LB. / (1.27 X 80.2 LB/FT) = 5'-2". MAXIMUM SUPPORT SPACING 10'-0".
2.) DO NOT EXCEED ANY PROJECT LIMITS.
3.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
4.) SEE AISC FOR 'T' DIMENSION.
5.) IF 1.0G IS EXCEEDED, THEN DO NOT USE CAST IRON OR SIMILAR NON-DUCTILE PIPE.

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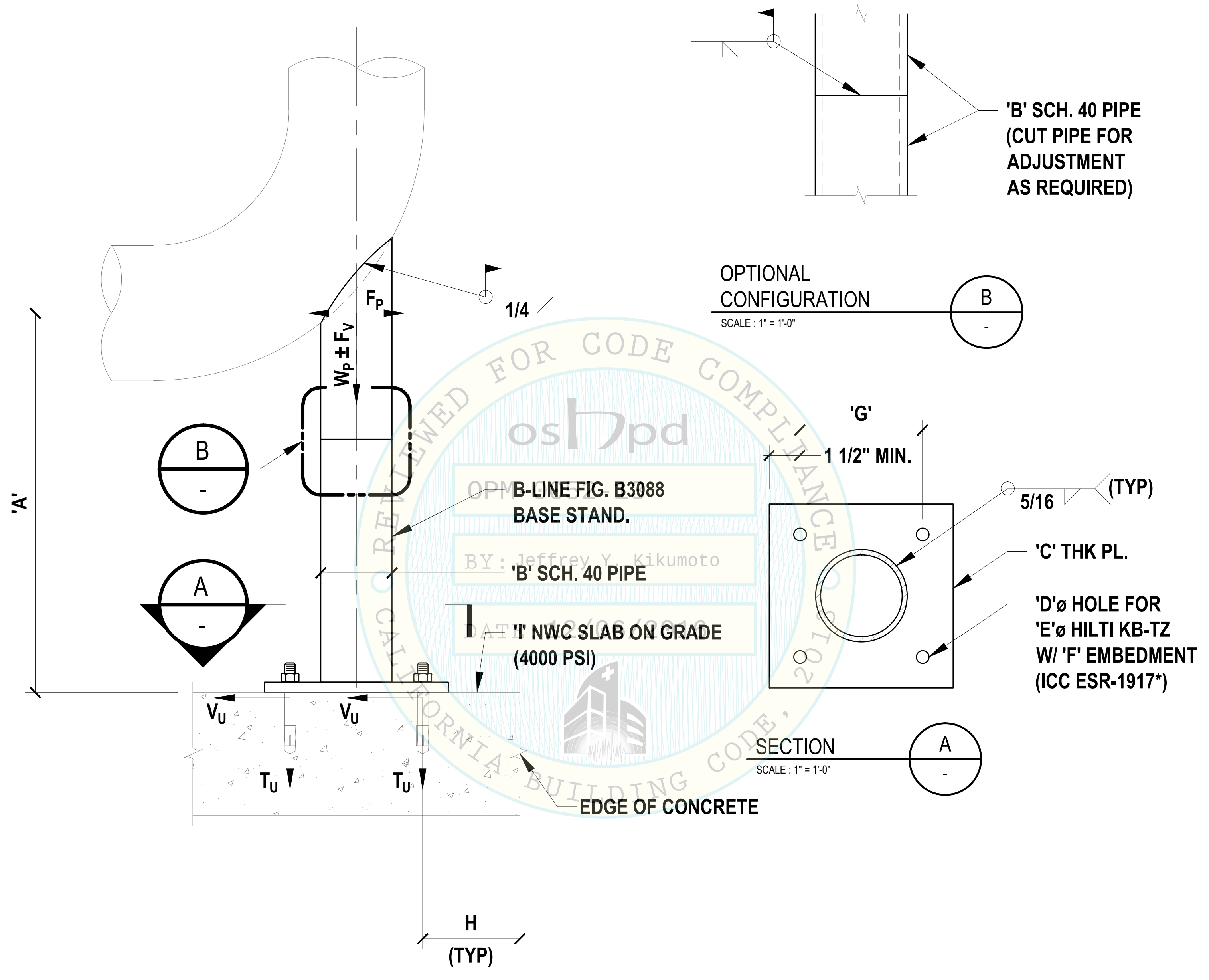
WELDED BASE ELBOW ON 4000 PSI NWC SLAB

DETAIL
PS-4A



NOTES:
1.) SEE PAGE 15-4A.2 FOR ADDITIONAL DETAIL INFORMATION.
2.) CONCRETE THICKNESS IS BASED UPON ANCHOR REQUIREMENT.
3.) CONDITIONS THAT INCLUDE THERMAL LOADING ARE TO BE DESIGNED ON A PROJECT SPECIFIC BASIS.

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WELDED BASE ELBOW ON 4000 PSI NWC SLAB

DETAIL
PS-4A

RUN PIPE (DIA)	"A" RUN PIPE CENTERLINE (IN)	MAXIMUM VERTICAL LOAD @ CL * (LBS)(ADS)	MAXIMUM HORIZONTAL LOAD @ CL * (LBS)(ADS)	"B" STAND PIPE (IN)	"C" BASEPLATE (IN)	"D" HOLE SIZE FOR ANCHOR (IN. DIA.)	"E" HILTI KB-TZ ANCHOR SIZE (IN)	"F" ANCHOR EMBED. (IN) (hef)	"G" ANCHOR SPACING (IN)	"H" MIN ANCHOR TO CONC. EDGE (IN)	"I" MINIMUM CONCRETE THICKNESS (IN)
4	36	207	163	2-1/2	3/8 x 9-1/2 SQ	1/2	3/8	2	6-1/2	6	6
4	72	189	149	2-1/2	1/2 x 13-1/2 SQ	5/8	1/2	3-1/4	10-1/2	6	6
6	36	335	264	2-1/2	1/2 x 13-1/2 SQ	5/8	1/2	3-1/4	10-1/2	6	6
6	72	257	203	3	5/8 x 13-1/2 SQ	3/4	5/8	4	10-1/2	6	6
8	36	456	359	3	5/8 x 13-1/2 SQ	3/4	5/8	4	10-1/2	6	6
8	72	285	225	4	5/8 x 14-1/2 SQ	3/4	5/8	4	11-1/2	6	6
10	36	505	398	3	5/8 x 14-1/2 SQ	3/4	5/8	4	11-1/2	6	6
10	72	417	328	4	5/8 x 16 SQ	7/8	3/4	4-3/4	13	9	8
12	36	451	355	4	5/8 x 14-1/2 SQ	3/4	5/8	4	11-1/2	9	8
12	72	544	428	6	5/8 x 20 SQ	7/8	3/4	4-3/4	17	9	8
14	36	638	502	4	5/8 x 14-1/2 SQ	7/8	3/4	4-3/4	11-1/2	9	8
14	72	597	470	6	5/8 x 22 SQ	7/8	3/4	4-3/4	19	9	8

* IT IS ACCEPTABLE TO APPLY MAXIMUM HORIZONTAL LOAD CONCURRENTLY WITH MAXIMUM VERTICAL LOAD. THIS CONDITION CORRESPONDS TO A 1.0G HORIZONTAL SEISMIC FORCE AND GRAVITY LOAD WITH 0.27G VERTICAL SEISMIC FORCE.

RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	T_u ** PER ANCHOR (LBS)(LRFD)	V_u ** PER ANCHOR (LBS)(LRFD)
4	36	1388	146
4	72	1751	133
6	36	1554	236
6	72	2482	181
8	36	2199	321
8	72	2522	201
10	36	2235	355
10	72	3374	293
12	36	1993	317
12	72	3368	382
14	36	2918	448
14	72	3307	420

** MAX, LOAD INCLUDES OVER STRENGTH FACTOR Ω_0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI 318-11.

NOTES:
1.) TO DETERMINE MAXIMUM SUPPORT SPACING DIVIDE "MAXIMUM VERTICAL LOAD" BY 1.27* WEIGHT-PER-FOOT OF PIPE. FOR EXAMPLE, IF SUPPORTING A 4" PIPE WEIGHING 18.3 LB/FT, AT 72" CL, THEN THE MAXIMUM SPACING IS 190 LB. / (1.27 X 18.3 LB/FT) = 8'-2". MAXIMUM SUPPORT SPACING 10'-0".
2.) DO NOT EXCEED ANY PROJECT LIMITS.
3.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.

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SECTION 16

SPECIAL SEISMIC WALL SUPPORT DETAILS

REVIEWED FOR CODE COMPLIANCE
oshpd
OPM-0052-13
BY: Jeffrey Y. Kikumoto
DATE: 12/06/2016
CALIFORNIA BUILDING CODE, 2013

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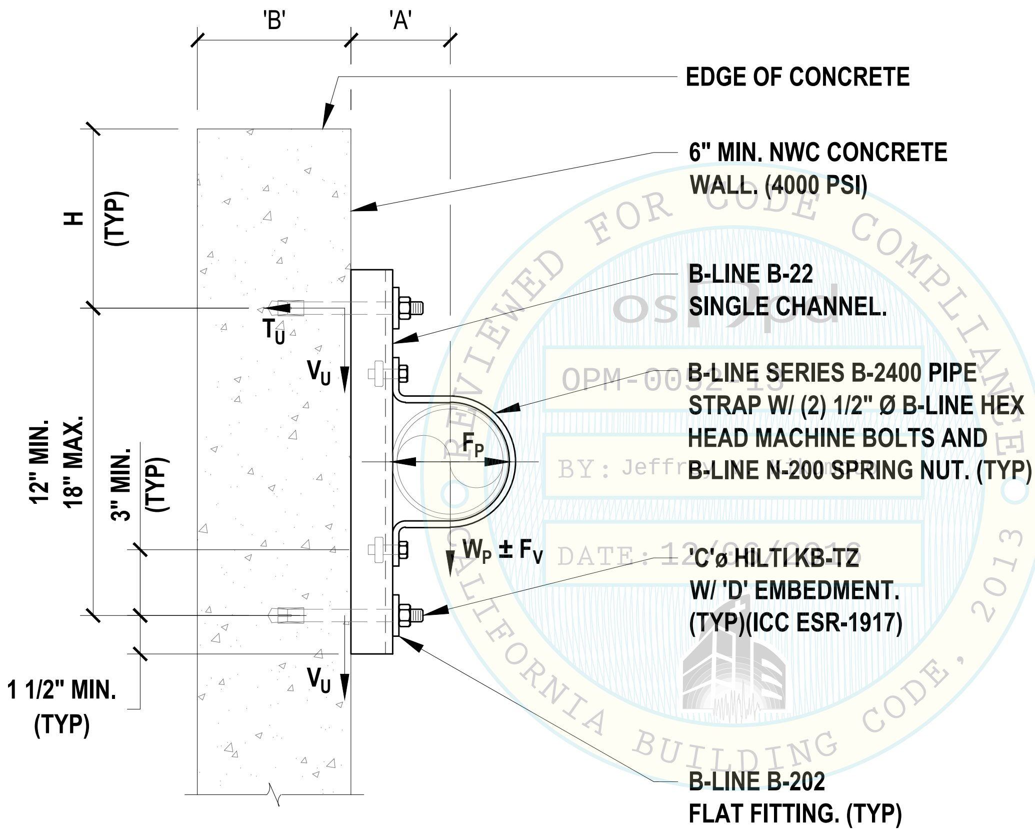
		DETAIL
	WALL SUPPORT IN 4000 PSI NWC WALL	WS-2

MAX. RUN PIPE (IN)	"A" RUN PIPE CENTERLINE (IN)	"B" MIN. CONCRETE THICKNESS (IN)	MAXIMUM VERTICAL LOAD @ CL** (LBS)(ADS)	MAXIMUM HORIZONTAL LOAD @ CL** (LBS)(ADS)	"C" HILTI KB-TZ ANCHOR SIZE (IN)	"D" ANCHOR EMBED. (IN) (hef)	"H" MIN ANCHOR TO CONC. EDGE (IN)	T_u ** PER ANCHOR (LBS)(LRFD)	V_u ** PER ANCHOR (LBS)(LRFD)
1 1/2	2 5/8	4	185	145	3/8	2	6	1323	303
4	3 7/8	6	286	225	1/2	3 1/4	6	3030	470

* IT IS ACCEPTABLE TO APPLY MAXIMUM HORIZONTAL LOAD CONCURRENTLY WITH MAXIMUM VERTICAL LOAD. THIS CONDITION CORRESPONDS TO A 1.0G HORIZONTAL SEISMIC FORCE.

** MAX, LOAD INCLUDES OVER STRENGTH FACTOR Ω_0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI 318-11.



NOTES:

1.) PIPE/STRUT ORIENTATION HORIZONTAL OR VERTICAL ARE BOTH ACCEPTABLE.
2.) TO DETERMINE MAXIMUM SUPPORT SPACING DIVIDE "MAXIMUM VERTICAL LOAD" BY 1.27* WEIGHT-PER-FOOT OF PIPE. FOR EXMAPLE, IF SUPPORTING A 4" PIPE WEIGHING 18.3 LB/FT, AT 3 7/8" CL, THEN THE MAXIMUM SPACING IS 286 LB. / (1.27 X 18.3 LB/FT) = 12'-3", NOT TO EXCEED 10'-0".
3.) DO NOT EXCEED ANY PROJECT LIMITS.
4.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
5.) IF 1.0G IS EXCEEDED, THEN DO NOT USE CAST IRON OR SIMILAR NON-DUCTILE PIPE.

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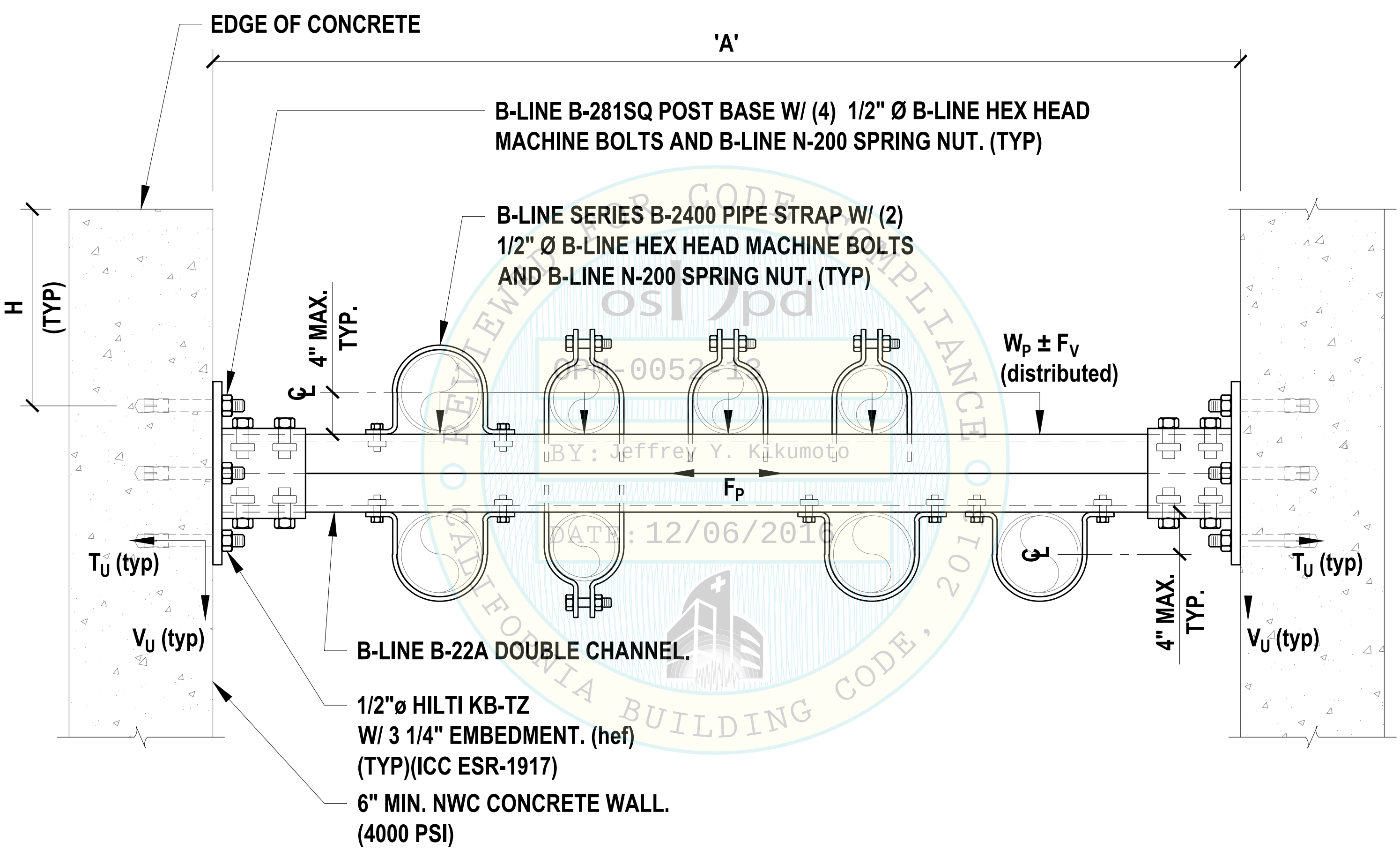
WALL-TO-WALL SUPPORT ON 4000 PSI NWC WALL

DETAIL
WS-3

"A" MAXIMUM (IN)	MAXIMUM VERTICAL DISTRIBUTED LOAD* (LBS)(ASD)	MAXIMUM HORIZONTAL DISTRIBUTED LOAD* (LBS)(ASD)	"H" MIN ANCHOR TO CONC. EDGE (IN)	T_u ** PER ANCHOR (LBS)(LRFD)	V_u ** PER ANCHOR (LBS)(LRFD)
106	762	600	9	536	325
53	1270	1000	9	893	541

* IT IS ACCEPTABLE TO APPLY MAXIMUM HORIZONTAL LOAD CONCURRENTLY WITH MAXIMUM VERTICAL LOAD. THIS CONDITION CORRESPONDS TO A 1.0G HORIZONTAL SEISMIC FORCE.

** MAX, LOAD INCLUDES OVER STRENGTH FACTOR Ω_0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI 318-11.



NOTES:

1.) TO DETERMINE MAX. SUPPORT SPACING DIVIDE "MAXIMUM VERTICAL LOAD" BY 1.27* TOTAL WEIGHT-PER-FOOT OF PIPE. FOR EXAMPLE, IF SUPPORTING (X4) 4" PIPE WEIGHING 18.3 LB/FT X 4 = 73.2 LB/FT, AT A=106", THEN THE MAXIMUM SPACING IS 762 LB. / (1.27 X 73.2 LB/FT) = 8'-2". MAXIMUM SUPPORT SPACING 10'-0".
2.) DO NOT EXCEED PROJECT LIMITS.
3.) DISTRIBUTED LOADS SHOWN.
4.) THIS SUPPORT DOES NOT CONSIDER DEFORMATION COMPATIBILITY BETWEEN WALLS. USE OF THIS DETAIL SHALL BE PENDING SEOR APPROVAL.
5.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
6.) IF 1.0G IS EXCEEDED, THEN DO NOT USE CAST IRON OR SIMILAR NON-DUCTILE PIPE.

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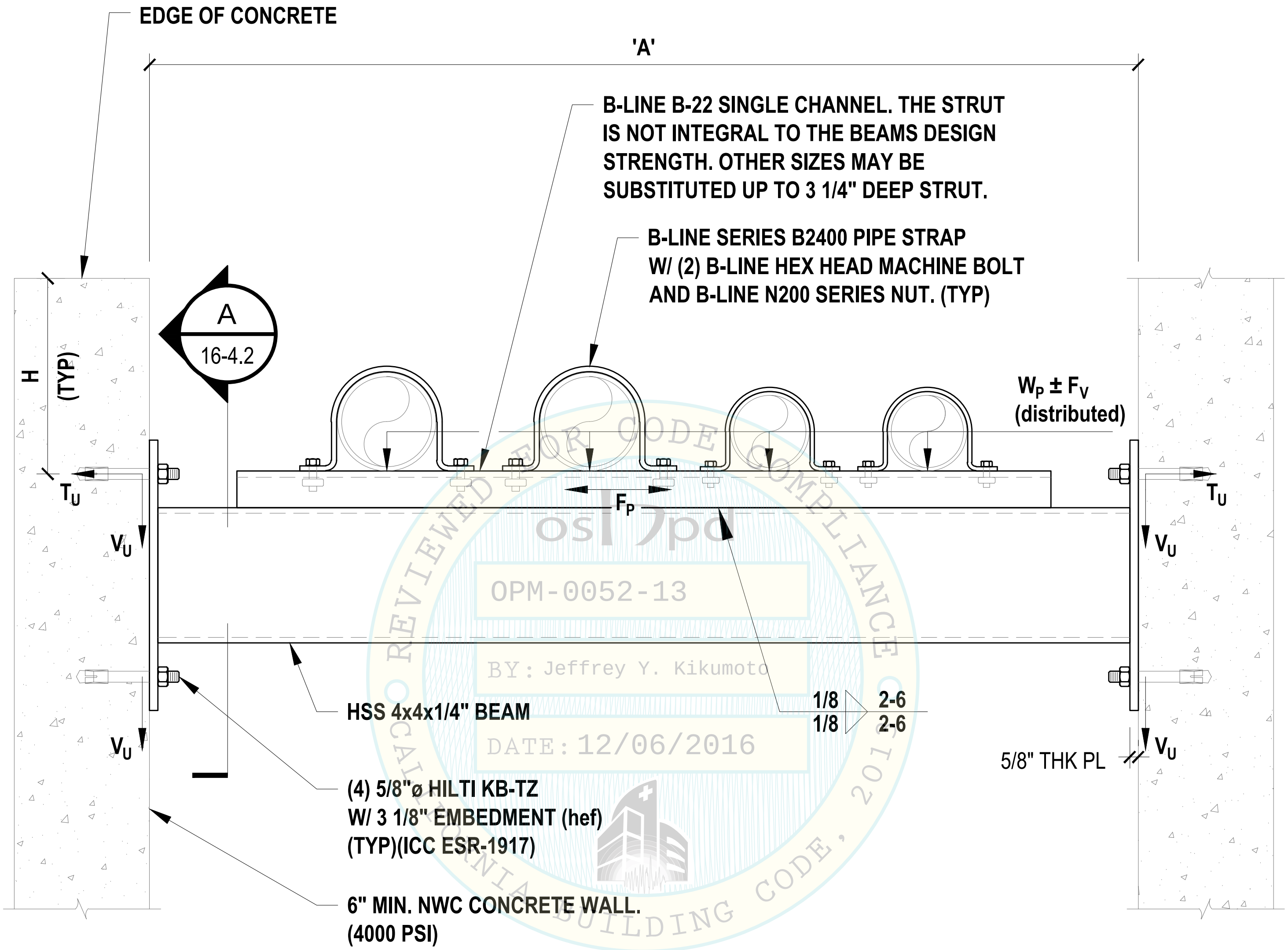
	WALL-TO-WALL SUPPORT ON 4000 PSI NWC WALL	DETAIL **WS-4**



`NOTES:
1.) SEE PAGE 16-4.2 FOR ADDITIONAL INFORMATION.

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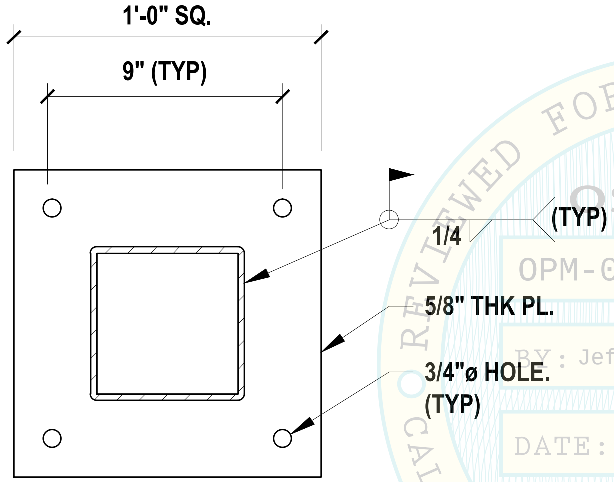
WALL-TO-WALL SUPPORT ON 4000 PSI NWC WALL

DETAIL
WS-4

"A" MAXIMUM (IN)	MAXIMUM VERTICAL DISTRIBUTED LOAD @ CL * (LBS)(ASD)	MAXIMUM HORIZONTAL DISTRIBUTED LOAD @ CL * (LBS)(ASD)	"H" MIN ANCHOR TO CONC. EDGE (IN)	T_u ** PER ANCHOR (LBS)(LRFD)	V_u ** PER ANCHOR (LBS)(LRFD)
120	1535	1535	9	1370	1602

* IT IS ACCEPTABLE TO APPLY MAXIMUM HORIZONTAL LOAD CONCURRENTLY WITH MAXIMUM VERTICAL LOAD. THIS CONDITION CORRESPONDS TO A 1.0G HORIZONTAL TRANSVERSE SEISMIC FORCE.

** MAX, LOAD INCLUDES OVER STRENGTH FACTOR Ω_0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI 318-11.



SECTION A
SCALE : 1" = 1'-0"

NOTES:
1.) TO DETERMINE MAX. SUPPORT SPACING DIVIDE "MAXIMUM VERTICAL LOAD" BY 1.27* TOTAL WEIGHT-PER-FOOT OF PIPE. FOR EXAMPLE, IF SUPPORTING (X6) 4" PIPE WEIGHING 18.3 LB/FT X 4 = 109.8 LB/FT, AT A=120", THEN THE MAXIMUM SPACING IS 1535 LB. / (1.27 X 109.8 LB/FT) = 11'-0", NOT TO EXCEED 10'-0".
2.) DO NOT EXCEED PROJECT LIMITS.
3.) DISTRIBUTED LOADS SHOWN.
4.) THIS SUPPORT DOES NOT CONSIDER DEFORMATION COMPATIBILITY BETWEEN WALLS. USE OF THIS DETAIL SHALL BE PENDING SEOR APPROVAL.
5.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
6.) IF 1.0G IS EXCEEDED, THEN DO NOT USE CAST IRON OR SIMILAR NON-DUCTILE PIPE.

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SECTION 17

SPECIAL SEISMIC RISER SUPPORT DETAILS

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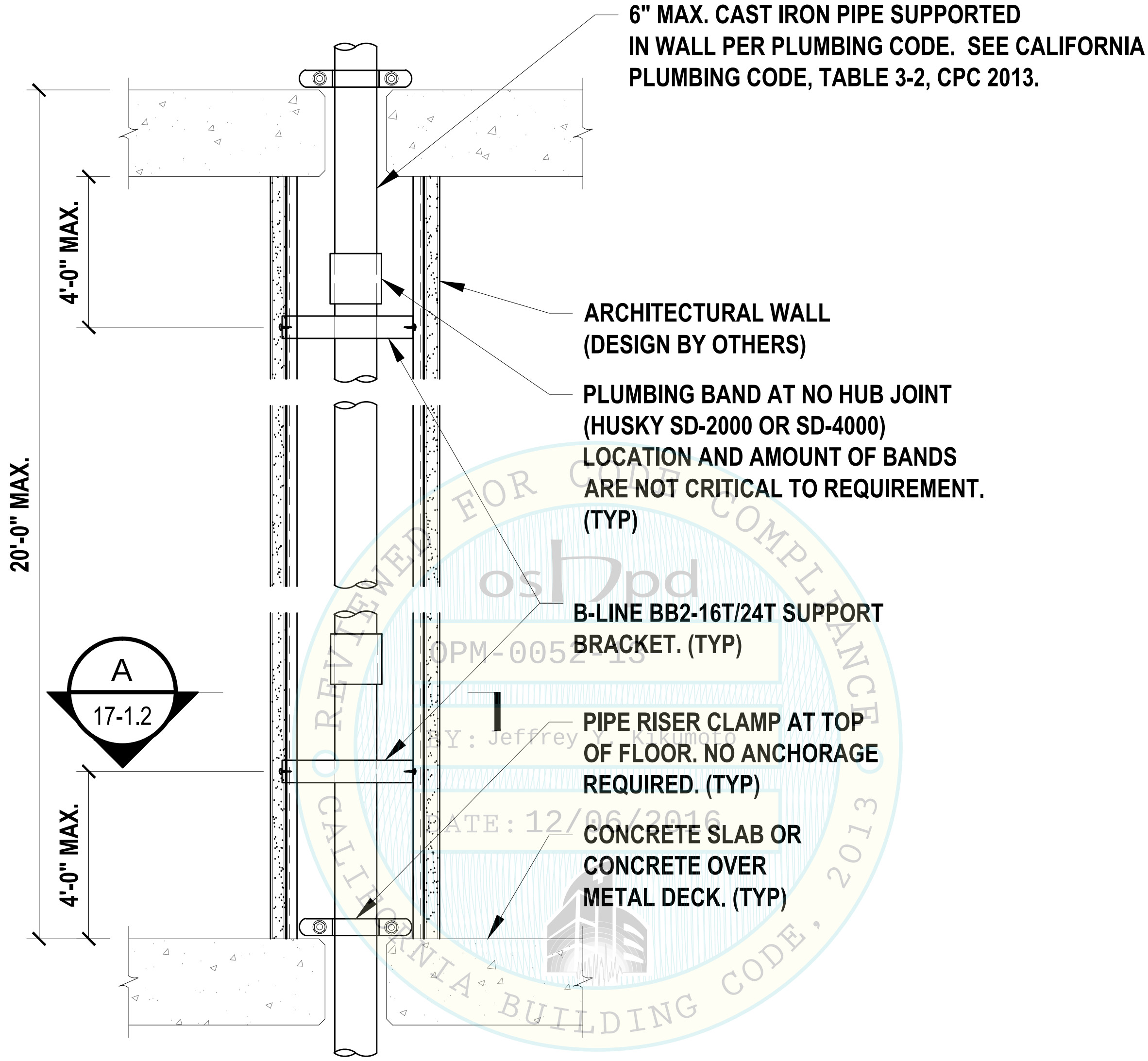
	IN-WALL CAST IRON PIPE RISER	DETAIL PR-1



NOTES:
1.) SEE PAGE 17-1.2 & FOR ADDITIONAL DETAIL INFORMATION.
2.) SEE PAGE 1-8 NOTE XVII.A REGARDING PIPE PENETRATION THRU FLOOR.

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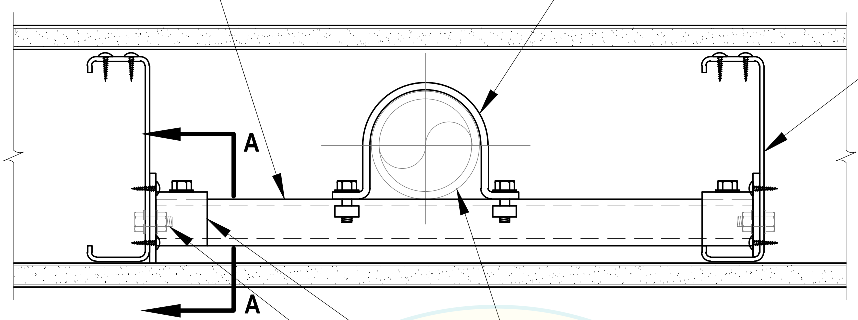
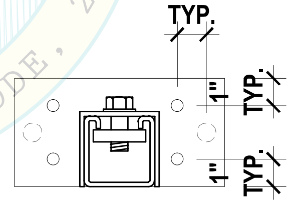
	IN-WALL CAST IRON PIPE RISER	DETAIL PR-1



SECTION A
SCALE : 3/4" = 1'-0"



SECTION A-A
SCALE : N.T.S.

NOTES:

1.) MAX SUPPORT SPACING FOR UP TO 4" PIPE, 10'-0" MAX; FOR UP TO 6" PIPE, 5'-0" MAX. DO NOT EXCEED PROJECT LIMITS.
2.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
3.) HUSKY PLUMBING BAND (WHERE OCCURS) RO CONFORM TO ASTM 1540 AND ASTM C564.

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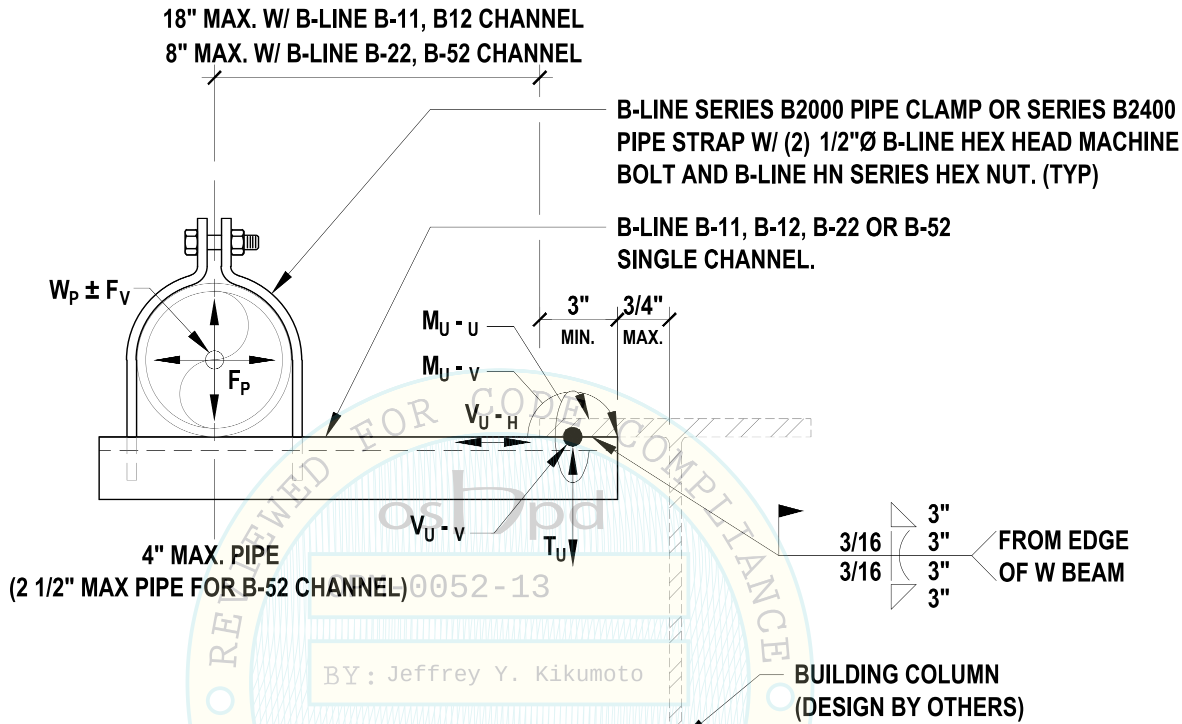
RISER SUPPORT TO BUILDING STEEL

DETAIL
PR-5



MAXIMUM LOADS TO STRUCTURE (ASD)	
V_{U-V}*	250 LBS
V_{U-H}*	200 LBS
T_U*	200 LBS
M_{U-V}*	5000 IN-LB
M_{U-H}*	4000 IN-LB

* THIS CONDITION CORRESPONDS TO 1.0G HORIZONTAL SEISMIC FORCE, GRAVITY VERTICAL FORCE AND 0.27G VERTICAL SEISMIC FORCE.

NOTES:
1.) MAX SUPPORT SPACING - 10'-0". DO NOT EXCEED PROJECT LIMITS.
2.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
3.) HUSKY PLUMBING BAND (WHERE OCCURS) OR CONFORM TO ASTM 1540 AND ASTM C564.

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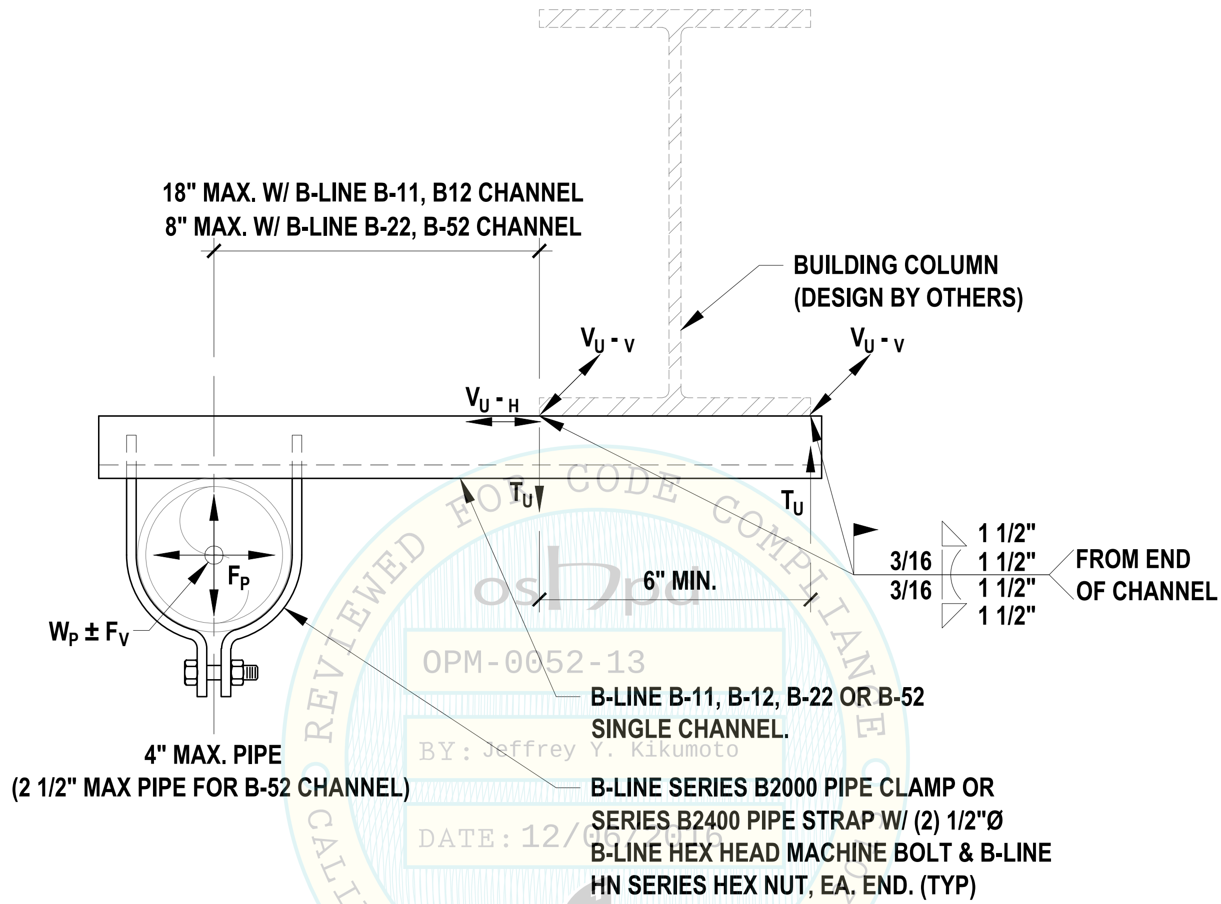
RISER SUPPORT TO BUILDING STEEL

DETAIL
PR-6



MAXIMUM LOADS TO STRUCTURE (ASD)	
V_U - V*	1,000 LBS
V_U - H*	200 LBS
T_U*	800 LBS

* THIS CONDITION CORRESPONDS TO 1.0G HORIZONTAL SEISMIC FORCE, GRAVITY VERTICAL FORCE AND 0.27G VERTICAL SEISMIC FORCE.

NOTES:
1.) MAX SUPPORT SPACING - 10'-0". DO NOT EXCEED PROJECT LIMITS.
2.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
3.) HUSKY PLUMBING BAND (WHERE OCCURS) RO CONFORM TO ASTM 1540 AND ASTM C564.

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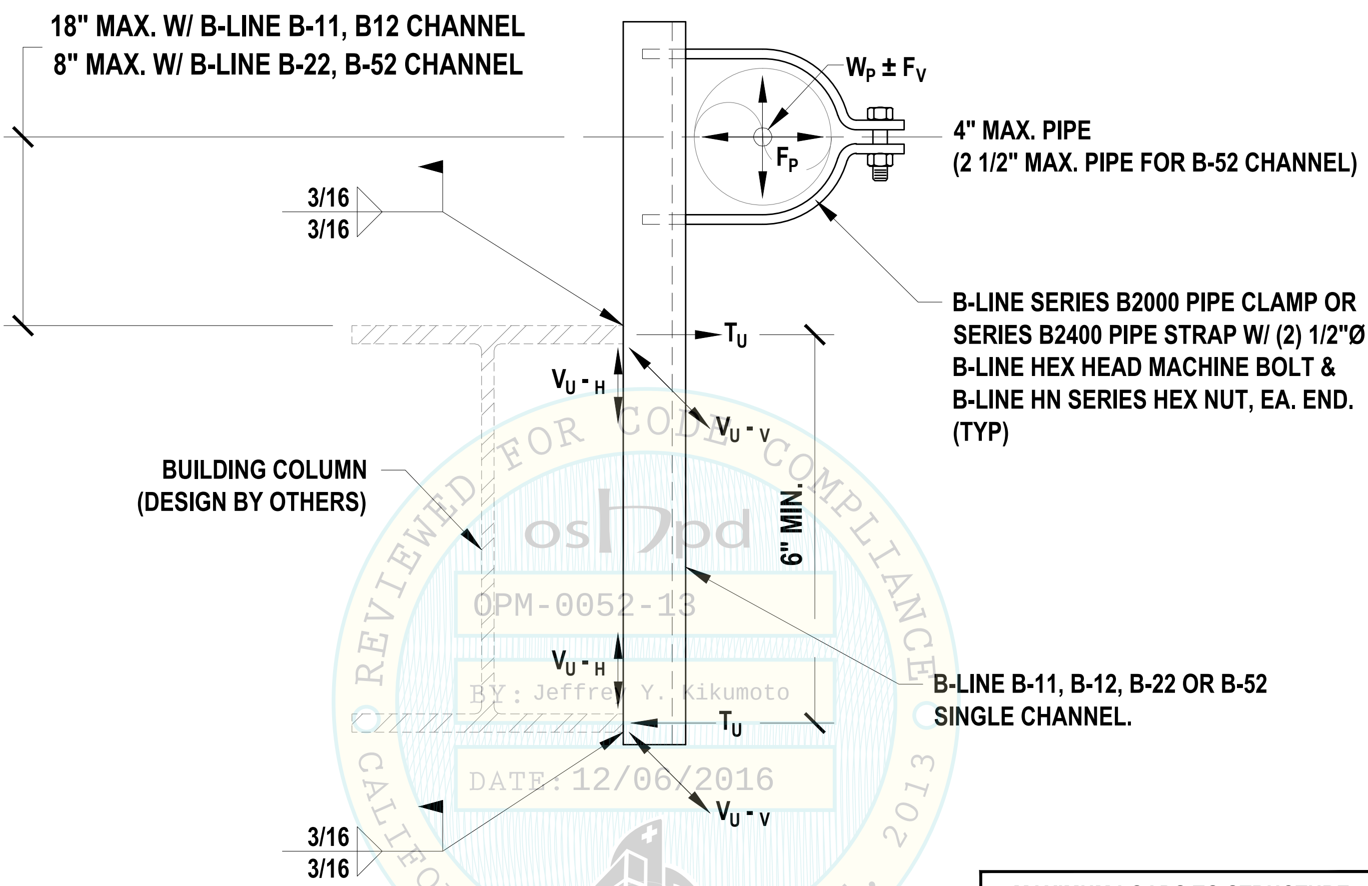
RISER SUPPORT TO BUILDING STEEL

DETAIL
PR-7



MAXIMUM LOADS TO STRUCTURE (ASD)	
V_U - V*	1000 LBS
V_U - H*	200 LBS
T_U*	800 LBS

* THIS CONDITION CORRESPONDS TO 1.0G HORIZONTAL SEISMIC FORCE, GRAVITY VERTICAL FORCE AND 0.27G VERTICAL SEISMIC FORCE.

NOTES:
1.) MAX SUPPORT SPACING - 10'-0". DO NOT EXCEED PROJECT LIMITS.
2.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
3.) HUSKY PLUMBING BAND (WHERE OCCURS) RO CONFORM TO ASTM 1540 AND ASTM C564.

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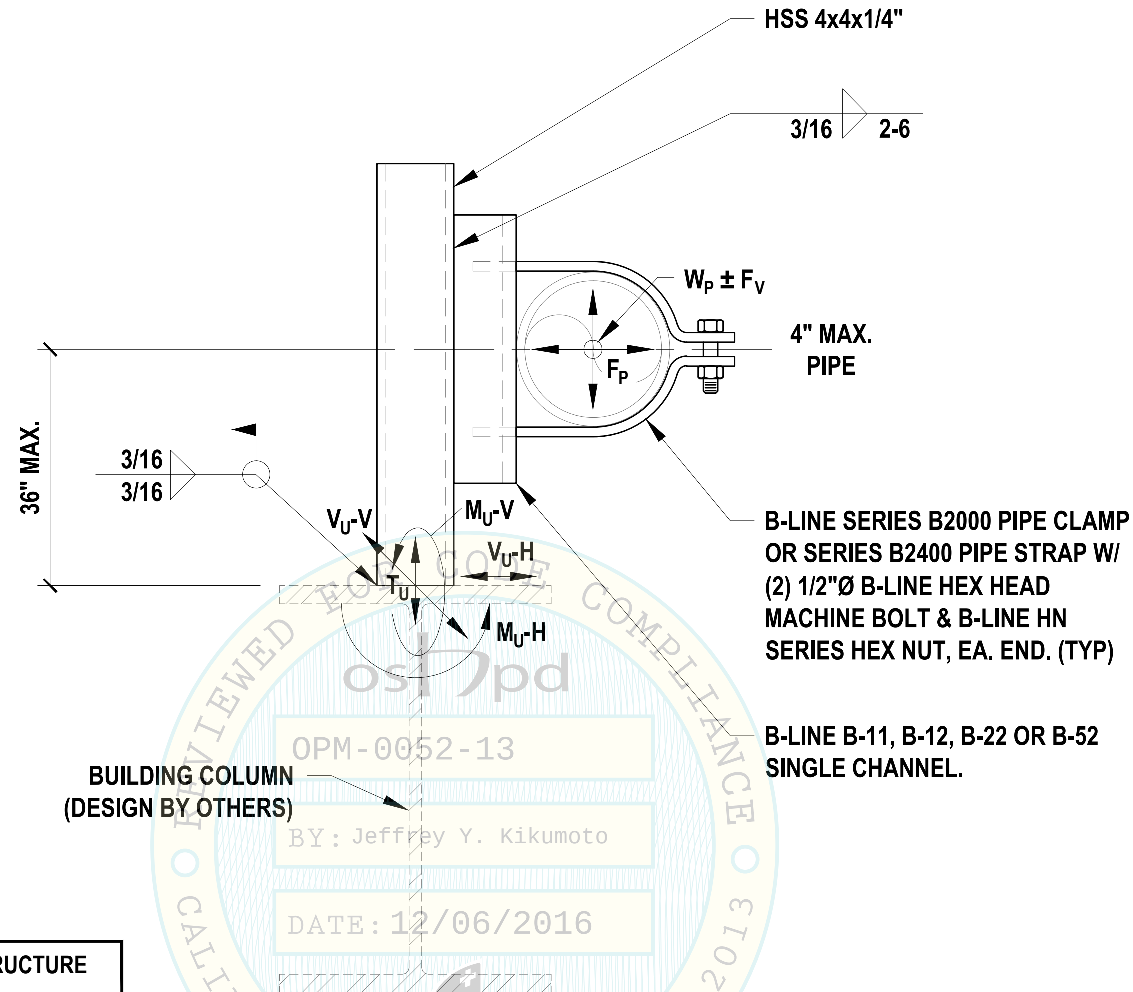
RISER SUPPORT TO BUILDING STEEL

DETAIL
PR-8



MAXIMUM LOADS TO STRUCTURE (ASD)	
V_U - $_V$*	372 LBS
V_U - $_H$*	293 LBS
T_U*	293 LBS
M_U - $_V$*	13400 IN-LB
M_U - $_H$*	10550 IN-LB

* THIS CONDITION CORRESPONDS TO 1.0G HORIZONTAL SEISMIC FORCE, GRAVITY VERTICAL FORCE AND 0.27G VERTICAL SEISMIC FORCE.

NOTES:
1.) MAX SUPPORT SPACING - 10'-0". DO NOT EXCEED PROJECT LIMITS.
2.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
3.) HUSKY PLUMBING BAND (WHERE OCCURS) RO CONFORM TO ASTM 1540 AND ASTM C564.

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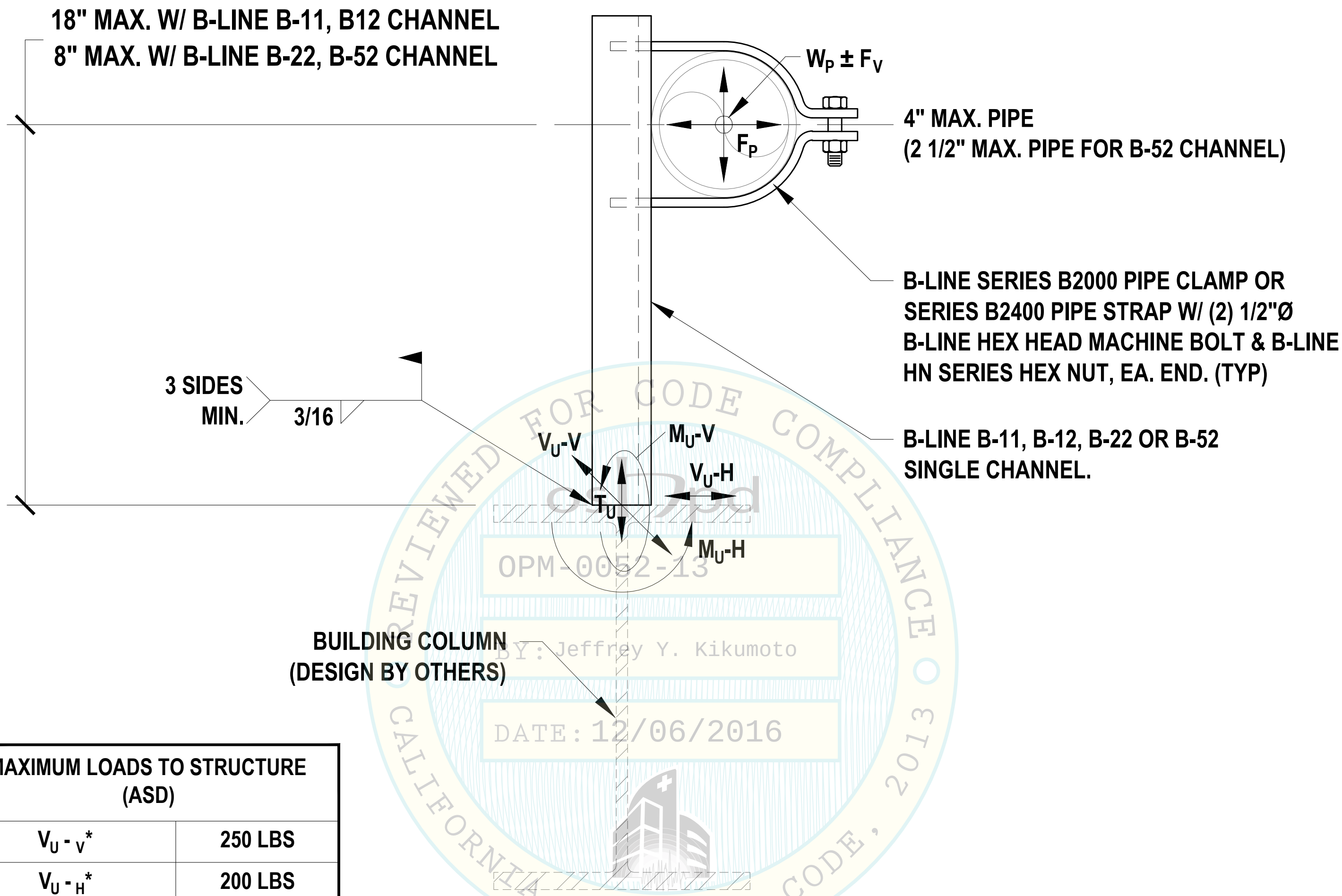
	RISER SUPPORT TO BUILDING STEEL	DETAIL PR-9



MAXIMUM LOADS TO STRUCTURE (ASD)	
V_U - $_V$*	250 LBS
V_U - $_H$*	200 LBS
T_U*	200 LBS
M_U - $_V$*	4500 IN-LB
M_U - $_H$*	3600 IN-LB

* THIS CONDITION CORRESPONDS TO 1.0G HORIZONTAL SEISMIC FORCE, GRAVITY VERTICAL FORCE AND 0.27G VERTICAL SEISMIC FORCE.

NOTES:

1.) MAX SUPPORT SPACING - 10'-0". DO NOT EXCEED PROJECT LIMITS.
2.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
3.) HUSKY PLUMBING BAND (WHERE OCCURS) RO CONFORM TO ASTM 1540 AND ASTM C564.

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MRH
Structural Engineer: Mohammad Hariri
California SE No. S3545

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SECTION 18

SPECIAL SEISMIC SUPPORT DETAILS

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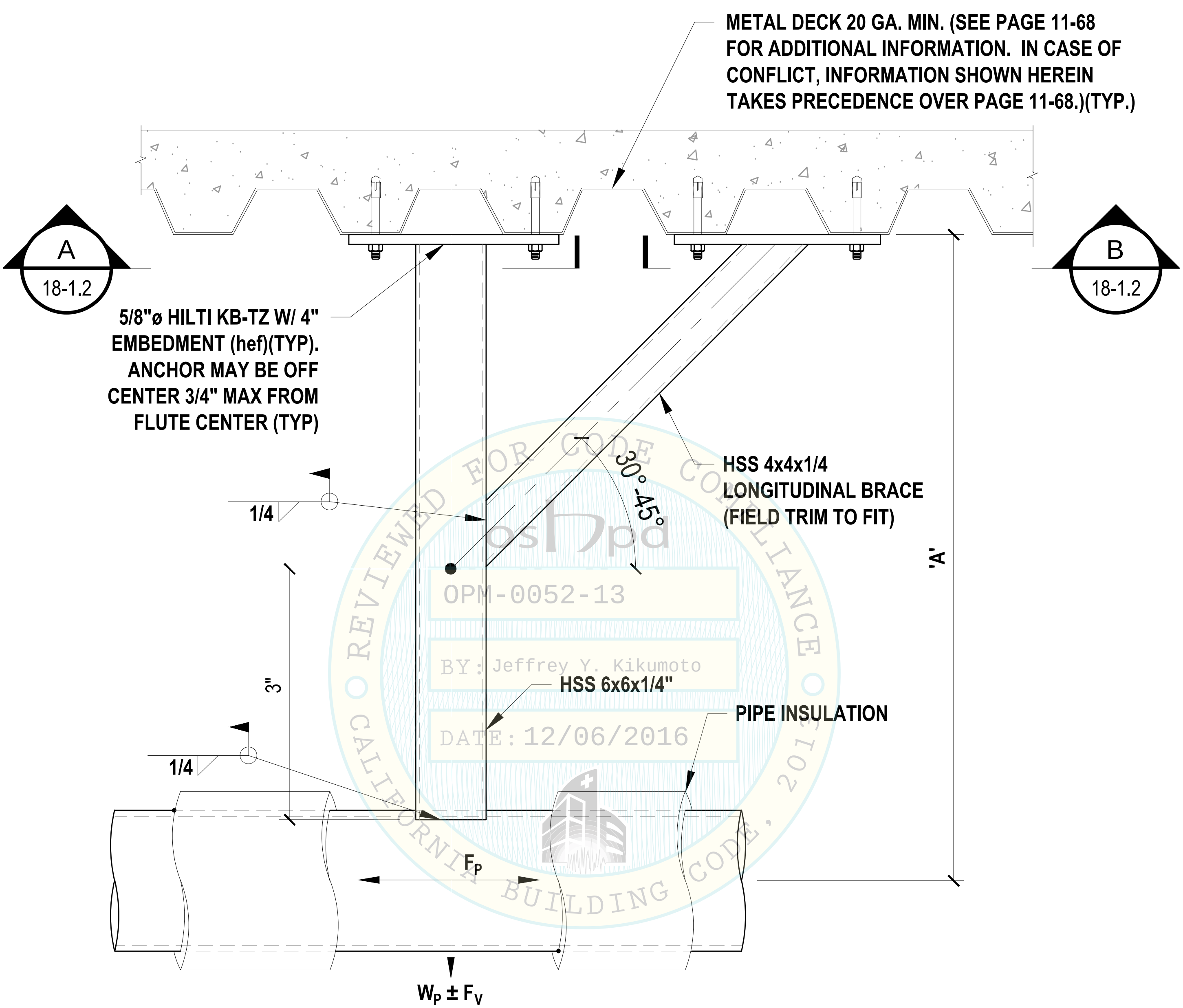
	PIPE ANCHOR IN STEEL DECK W/ 3000 PSI STRUCTURAL SAND LWC	DETAIL PA-1



NOTES:

1.) SEE PAGE 18-1.2 FOR ADDITIONAL DETAIL INFORMATION.
2.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
3.) CONDITIONS THAT INCLUDE THERMAL LOADING ARE TO BE DESIGNED ON A PROJECT SPECIFIC BASIS.

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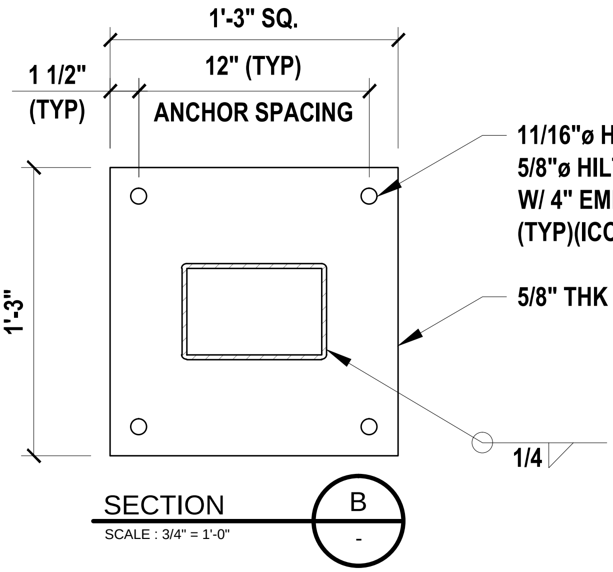
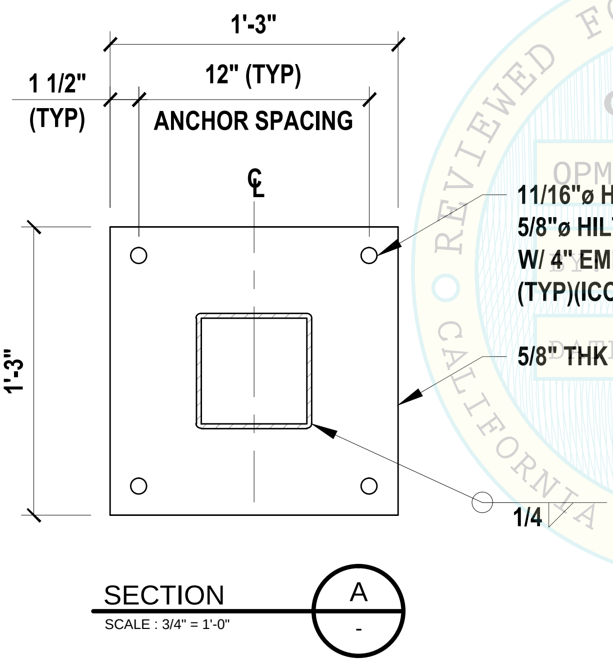
PIPE ANCHOR IN STEEL DECK W/ 3000 PSI STRUCTURAL SAND LWC

DETAIL
PA-1





PIPE SIZE	PIPE TYPE	'A' MAX.	MAX. HORIZ. LOAD (ASD)	MAX. VERT. LOAD (ASD)
≤ 4"	SCH. 40	60"	1500#	1700#

NOTES:
1) WEIGHT OF PIPE INCLUDES, PIPE SELF WEIGHT AND INSULATION ONLY; PIPE ASSUMED TO BE EMPTY FOR STEAM.
2) LATERAL SEISMIC FORCE 1.0G
3) VERTICAL SEISMIC FORCE 0.27G
4) MAX. HORIZ. LOAD DOES NOT INCLUDE THERMAL LOADING
5) MAXIMUM LONGITUDINAL BRACE SPACING: 40'
6) MAXIMUM TRANSVERSE BRACE SPACING: 20'
7) DESIGN OF SUPPORTING STRUCTURE BY OTHERS .

PIPE SIZE	T_U** PER ANCHOR (LB)(LRFD)	V_U** PER ANCHOR (LB)(LRFD)
≤ 4"	2300	491

** MAX, LOAD INCLUDES OVER STRENGTH FACTOR Ω/0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI 318-11.

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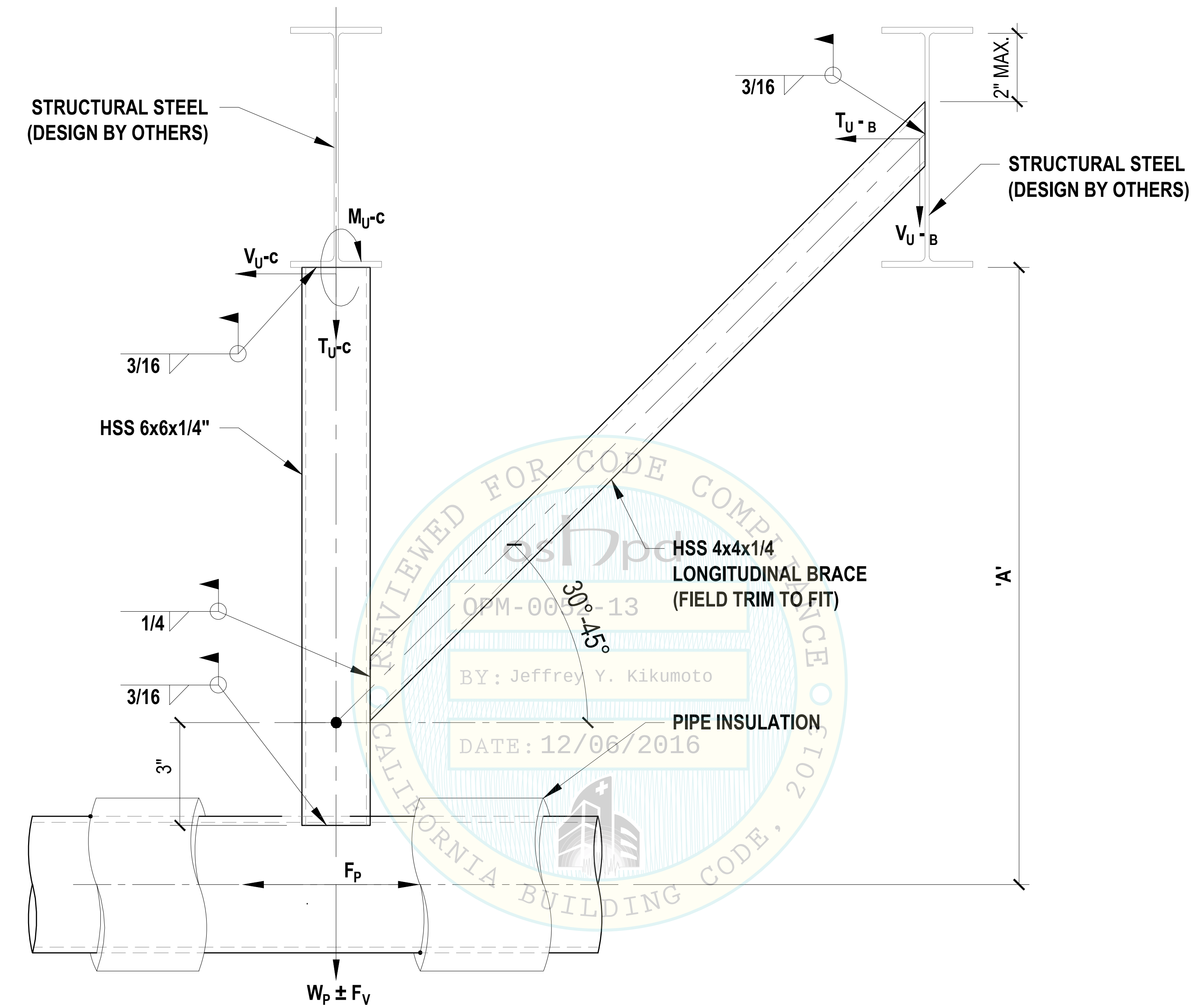
PIPE ANCHOR TO STRUCTURAL STEEL

DETAIL
PA-2



NOTES:

1.) SEE PAGE 18-2.2 & FOR ADDITIONAL DETAIL INFORMATION.
2.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF SUPPORTING STRUCTURE. DESIGN OF SUPPORTING STRUCTURE BY STRUCTURAL ENGINEER OF RECORD.
3.) CONDITIONS THAT INCLUDE THERMAL LOADING ARE TO BE DESIGNED ON A PROJECT SPECIFIC BASIS.

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		DETAIL
	PIPE ANCHOR TO STRUCTURAL STEEL	PA-2

PIPE SIZE	PIPE TYPE	'A' MAX.	MAX. HORIZ. LOAD (ASD)	MAX. VERT. LOAD (ASD)
≤ 4"	SCH. 40	60"	1500#	1700

NOTES:
1) WEIGHT OF PIPE INCLUDES, PIPE SELF WEIGHT AND INSULATION ONLY; PIPE ASSUMED TO BE EMPTY FOR STEAM.
2) LATERAL SEISMIC FORCE 1.0G
3) VERTICAL SEISMIC FORCE 0.27G
4) MAX. HORIZ. LOAD DOES NOT INCLUDE THERMAL LOADING
5) MAXIMUM LONGITUDINAL BRACE SPACING: 40'
6) MAXIMUM TRANSVERSE BRACE SPACING: 20'
7) DESIGN OF SUPPORTING STRUCTURE BY OTHERS.

PIPE SIZE	PIPE TYPE	'A' MAX.	MAX. HORIZ. LOAD (ASD)	MAX. VERT. LOAD (ASD)
≤ 4"	SCH. 40	60"	1500#	1700

PIPE SIZE	T_U-c TENSION @ COL. (LB)(LRFD)	V_U-c ANCHOR @ COL. (LB)(LRFD)	M_U-c MOMENT @ COL. (LB)(LRFD)	T_U-c TENSION @ BRACE (LB)(LRFD)	V_U-c ANCHOR @ BRACE (LB)(LRFD)
≤ 4"	2302	393	1767	2051	2051

*** MOMENT OCCURS IN TRANSVERSE DIRECTION.

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As stated in the ASCE 7-10, the horizontal seismic force (F_P) may be calculated using the formula below.

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

F_p shall not be less than:	$(0.3 S_{DS} I_p)\, W_p$
F_p need not be greater than:	$(1.6 S_{DS} I_p)\, W_p$

F_p = **Seismic Design Force**

R_p = **Component Response Modification Factor**

a_p = **Component Amplification Factor**

I_p = **Component Importance Factor**

S_{DS} = **Design spectral response acceleration at short period**

z = **Element or component attachment elevation with respect to grade**
Note: (z) shall not be taken less than 0.0

h = **Average structure roof elevation with respect to grade.**

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METRIC CONVERSION CHART

Convert From	To	Multiply By
Angle		
degree	radian(rad)	1.745329 x 10-2
radian(rad)	degree	5.729578 x 10+1
Area		
foot^2	square meter (m^2)	9.290304 x 10-2
inch^2	square meter (m^2)	6.451600 x 10-4
circular mil	square meter (m^2)	5.067075 x 10-10
sq. centimeter (cm^2)	square inch (in^2)	1.550003 x 10-1
sq. meter (m^2)	foot^2	1.076391 x 10+1
sq. meter (m^2)	inch^2	1.550003 x 10+3
sq. meter (m^2)	circular mil	1.973525 x 10+9
Temperature		
degree Fahrenheit	degree Celsius	t°C = (t°F-32) /1.8
degree Celsius	degree Fahrenheit	t°F = 1.8t°C + 32
Force		
pounds-force (lbs)	newtons (N)	4.448222
Length		
foot (ft)	meter (m)	3.047000 x 10-1
inch (in)	meter (m)	2.540000 x 10-2
mil	meter (m)	2.540000 x 10-5
inch (in)	micrometer (μm)	2.540000 x 10+4
meter (m)	foot (ft)	3.280840
meter (m)	inch (in)	3.937008 x 10+1
meter (m)	mil	3.937008 x 10+4
micrometer (μm)	inch (in)	3.937008 x 10-5
Volume		
foot^3	cubic meter (m^3)	2.831685 x 10-2
inch^3	cubic meter (m^3)	1.638706 x 10-5
cubic centimeter (cm^3)	cubic inch (in^3)	6.102374 x 10-2
cubic meter (m^3)	foot^3	3.531466 x 10+1
cubic meter (m^3)	inch^3	6.102376 x 10+4
gallon (U.S. liquid)	cubic meter (m^3)	3.785412 x 10-3

Convert From	To	Multiply By
Mass		
pound (avoirdupois)	kilogram (kg)	4.535924 x 10-1
kilogram (kg)	pound (avoirdupois)	2.204622
Mass Per Unit Length		
lb/ft	kilogram/meter (kg/m)	1.488164
lb/in	kilogram/meter (kg/m)	1.785797 x 10+1
kg/m	lb/ft	6.719689 x 10-1
kg/m	lb/in	5.599741 x 10-2
Mass Per Unit Volume		
lb/ft^3	kilogram/meter (kg/m^3)	1.601846 x 10+1
lb/in^3	kilogram/meter (kg/m^3)	2.767990 x 10+4
kg/m^3	lb/ft^3	6.242797 x 10-2
kg/m^3	lb/in^3	3.612730 x 10-5
lbs/ft^3	lbs/in^3	1.728000 x 10+3
Mass Per Area Unit		
lb/ft^2	kilogram/sq.meter(kg/m^3)	1.601846 x 10+1
kg/m^2	kilogram/sq.meter(kg/m^3)	2.767990 x 10+4
Mass Per Unit Volume		
lbf/in^2 (psi)	pascal (Pa)	6.894757 x 10+3
kip/in^2 (ksi)	pascal (Pa)	6.894757 x 10+6
lbf/in^2 (psi)	megapascals (MPa)	6.894757 x 10-3
pascal (Pa)	pound force/sq. inch(psi)	1.450377 x 10-4
pascal (Pa)	kip per sq. inch (ksi)	1.450377 x 10-7
Bending Moment or Torque		
lbf•ft	newton meter (N•m)	1.355818
lbf•in	newton meter (N•m)	1.129848 x 10-1
N•m	lbf•ft	7.375621 x 10-1
N•m	lbf•in	8.850748

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California SE No. S3545

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PIPE AND CONDUIT WEIGHTS

STEEL PIPE						
Pipe Dia.	Pipe Sch.	Insulation Thickness	Weight Per Foot (lbs.)			
			Pipe	Water	Insulation	Total
1"	40	1"	1.7	0.4	0.7	2.8
1-1/4"	40	1"	2.3	0.7	0.8	3.8
1-1/2"	40	1"	2.7	0.9	0.9	4.5
2"	40	1"	3.7	1.5	1.0	6.2
2-1/2"	40	1"	5.8	2.1	1.2	9.1
3"	40	1"	7.6	3.2	1.3	12.1
3-1/2"	40	1"	9.1	4.3	1.5	14.9
4"	40	1"	11.0	5.5	1.6	18.1
5"	40	1-1/2"	16.0	8.7	2.9	26.6
6"	40	1-1/2"	19.0	12.5	3.3	34.8
8"	40	1-1/2"	29.0	22.0	4.1	55.1
10"	40	1-1/2"	41.0	34.0	5.2	80.2
12"	40	1-1/2"	54.0	49.0	6.0	109.0
14"	30	1-1/2"	55.0	60.0	7.0	122.0
16"	30	1-1/2"	63.0	79.0	7.5	150.0
18"	30	1-1/2"	82.0	100.0	8.0	190.0
20"	20	1-1/2"	79.0	126.0	8.5	214.0
24"	20	1-1/2"	95.0	184.0	10.0	289.0

COPPER PIPE - TYPE L		
Pipe Diameter	Weight Per Foot (lbs.)	
	Water	Total Wt. Per Foot
1"	0.357	0.655
1-1/4"	0.546	0.884
1-1/2"	0.767	1.140
2"	1.341	1.75
2-1/2"	2.064	2.480
3"	2.949	3.330
3-1/2"	2.989	4.290
4"	5.188	5.380
5"	8.081	7.610
6"	11.616	10.200

COPPER PIPE - TYPE K		
Pipe Diameter	Weight Per Foot (lbs.)	
	Water	Total Wt. Per Foot
1"	0.337	0.839
1-1/4"	0.527	1.040
1-1/2"	0.743	1.360
2"	1.310	2.050
2-1/2"	2.000	2.920
3"	2.960	4.000
3-1/2"	3.900	5.120
4"	5.060	6.510
5"	8.000	9.670
6"	11.200	13.870

CAST IRON PIPE - CLASS 150			
Pipe Diameter	Weight Per Foot (lbs.)		
	Pipe	Water	Total
3"	12.2	3.7	15.9
4"	16.4	5.7	22.1
5"	25.7	12.8	38.5
7"	36.7	23.1	59.8
10"	48.7	35.5	84.2
12"	62.9	51.0	113.9
14"	78.8	69.3	148.1
16"	95.0	90.3	185.3
18"	114.7	114.0	228.7
20"	135.9	141.5	227.4
24"	190.4	201.0	391.4

CAST IRON SOIL PIPE			
Pipe Diameter	Weight Per Foot (lbs.)		
	Pipe	Water	Total
2"	3.6	1.3	4.9
3"	5.2	2.9	8.1
4"	7.4	5.0	12.4
5"	9.4	7.9	17.3
6"	10.1	11.3	21.4
8"	18.0	19.8	37.8
10"	25.8	31.1	56.9

STEEL CONDUIT				
Conduit Diameter	Wall Thickness	Conduit Weight Per Foot (lbs.)	Max. Wt./Ft. of Conduit And Conductor (lbs.)	
			Lead Covered	Non-Lead Covered
1/2"	0.112	0.852	1.172	1.042
3/4"	0.124	1.134	1.754	1.398
1"	0.124	1.684	2.614	2.347
1-1/4"	0.155	2.281	4.311	3.581
1-1/2"	0.167	2.731	5.891	4.546
2"	0.172	3.678	8.528	7.208
2-1/2"	0.219	5.819	11.509	10.219
3"	0.219	7.616	16.506	14.506
3-1/2"	0.219	9.202	19.052	17.491
4"	0.219	10.889	24.749	21.479
5"	0.367	14.810	35.870	30.830
6"	0.367	19.185	50.685	43.425

EMT CONDUIT			
Conduit Diameter	Conduit Weight Per Foot (lbs.)	Conduit Diameter	Conduit Weight Per Foot (lbs.)
1/2"	0.3	2"	1.48
3/4"	0.46	2-1/2"	2.16
1"	0.67	3"	2.63
1-1/4"	1.01	3-1/2"	3.49
1-1/2"	1.16	4"	3.93

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RECTANGULAR DUCT WEIGHTS - 18 GAGE

	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44
12	9.2	10.0	10.8	11.5	12.3	13.1	13.9	14.6	15.4	16.2	16.9	17.7	18.5	19.2	20.0	20.8	21.6
14	10.0	10.8	11.5	12.3	13.1	13.9	14.6	15.4	16.2	16.9	17.7	18.5	19.2	20.0	20.8	21.6	22.3
16	10.8	11.5	12.3	13.1	13.9	14.6	15.4	16.2	16.9	17.7	18.5	19.2	20.0	20.8	21.6	22.3	23.1
18	11.5	12.3	13.1	13.9	14.6	15.4	16.2	16.9	17.7	18.5	19.2	20.0	20.8	21.6	22.3	23.1	23.9
20	12.3	13.1	13.9	14.6	15.4	16.2	16.9	17.7	18.5	19.2	20.0	20.8	21.6	22.3	23.1	23.9	24.6
22	13.1	13.9	14.6	15.4	16.2	16.9	17.7	18.5	19.2	20.0	20.8	21.6	22.3	23.1	23.9	24.6	25.4
24	13.9	14.6	15.4	16.2	16.9	17.7	18.5	19.2	20.0	20.8	21.6	22.3	23.1	23.9	24.6	25.4	26.2
26	14.6	15.4	16.2	16.9	17.7	18.5	19.2	20.0	20.8	21.6	22.3	23.1	23.9	24.6	25.4	26.2	26.9
28	15.4	16.2	16.9	17.7	18.5	19.2	20.0	20.8	21.6	22.3	23.1	23.9	24.6	25.4	26.2	26.9	27.7
30	16.2	16.9	17.7	18.5	19.2	20.0	20.8	21.6	22.3	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5
32	16.9	17.7	18.5	19.2	20.0	20.8	21.6	22.3	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2
34	17.7	18.5	19.2	20.0	20.8	21.6	22.3	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0
36	18.5	19.2	20.0	20.8	21.6	22.3	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8
38	19.2	20.0	20.8	21.6	22.3	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6
40	20.0	20.8	21.6	22.3	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3
42	20.8	21.6	22.3	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1
44	21.6	22.3	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9
46	22.3	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6
48	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4
50	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2
52	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9
54	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7
56	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5
58	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3
60	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0
62	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8
64	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6
66	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3
68	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1
70	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9
72	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6
74	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4
76	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2
78	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2	46.9

NOTES:
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Structural Engineer: Mohammad Hariri
California SE No. S3545

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RECTANGULAR DUCT WEIGHTS - 18 GAGE (CONT'D)

	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
12	22.3	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6
14	23.1	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4
16	23.9	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2
18	24.6	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9
20	25.4	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7
22	26.2	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5
24	26.9	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3
26	27.7	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0
28	28.5	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8
30	29.2	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6
32	30.0	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3
34	30.8	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1
36	31.6	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9
38	32.3	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6
40	33.1	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4
42	33.9	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2
44	34.6	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2	46.9
46	35.4	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2	46.9	47.7
48	36.2	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2	46.9	47.7	48.5
50	36.9	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2	46.9	47.7	48.5	49.3
52	37.7	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2	46.9	47.7	48.5	49.3	50.0
54	38.5	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2	46.9	47.7	48.5	49.3	50.0	50.8
56	39.3	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2	46.9	47.7	48.5	49.3	50.0	50.8	51.6
58	40.0	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2	46.9	47.7	48.5	49.3	50.0	50.8	51.6	52.3
60	40.8	41.6	42.3	43.1	43.9	44.6	45.4	46.2	46.9	47.7	48.5	49.3	50.0	50.8	51.6	52.3	53.1
62	41.6	42.3	43.1	43.9	44.6	45.4	46.2	46.9	47.7	48.5	49.3	50.0	50.8	51.6	52.3	53.1	53.9
64	42.3	43.1	43.9	44.6	45.4	46.2	46.9	47.7	48.5	49.3	50.0	50.8	51.6	52.3	53.1	53.9	54.6
66	43.1	43.9	44.6	45.4	46.2	46.9	47.7	48.5	49.3	50.0	50.8	51.6	52.3	53.1	53.9	54.6	55.4
68	43.9	44.6	45.4	46.2	46.9	47.7	48.5	49.3	50.0	50.8	51.6	52.3	53.1	53.9	54.6	55.4	56.2
70	44.6	45.4	46.2	46.9	47.7	48.5	49.3	50.0	50.8	51.6	52.3	53.1	53.9	54.6	55.4	56.2	57.0
72	45.4	46.2	46.9	47.7	48.5	49.3	50.0	50.8	51.6	52.3	53.1	53.9	54.6	55.4	56.2	57.0	57.7
74	46.2	46.9	47.7	48.5	49.3	50.0	50.8	51.6	52.3	53.1	53.9	54.6	55.4	56.2	57.0	57.7	58.5
76	46.9	47.7	48.5	49.3	50.0	50.8	51.6	52.3	53.1	53.9	54.6	55.4	56.2	57.0	57.7	58.5	59.3
78	47.7	48.5	49.3	50.0	50.8	51.6	52.3	53.1	53.9	54.6	55.4	56.2	57.0	57.7	58.5	59.3	60.0

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