



Project Specification Manual

Volume 3

Sierra Madre Library Redesign and Improvements Sierra Madre, CA Project Number: FC82306



SUBMITTAL TYPE: BIDDING DOCUMENTS

ISSUE DATE: JULY 17, 2024



316 West 2nd Street | Penthouse | Los Angeles, CA 90012
TSK Project Number: 23-025.00

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END OF SECTION 000110

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Project No. W1817-06-01

April 3, 2024

City of Sierra Madre
232 W. Sierra Madre Blvd.
Sierra Madre, CA 91024

c/o Arnulfo Yanez

Subject: ADDENDUM TO GEOTECHNICAL INVESTIGATION
 UPDATED GEOTECHNICAL RECOMMENDATIONS
 PROPOSED SIERRA MADRE LIBRARY IMPROVEMENTS
 440 W. SIERRA MADRE BOULEVARD, SIERRA MADRE, CALIFORNIA

Reference: *Geotechnical Investigation*, prepared by Geocon West, Inc., Project No. W1817-06-01,
 dated October 20, 2023.

Dear Ladies and Gentlemen:

Per your request, we have prepared this addendum letter to provide updated recommendations based on the information provided to us by the project structural engineer. Where differing, the recommendations presented herein supersede the previous recommendations and may be utilized for design and construction. All other recommendations provided in the referenced report remain applicable.

In our original report we assumed that column loads for the proposed structure would be up to 200 kips, and wall loads will be up to 2 kips per linear foot. Based on the foundation loading diagram provided by the project structural engineer, see Figure 1, column loads will range between 31 kips and 85 kips and wall loads will range from 0.3 kips/ft to 1.8 kips/ft. Updated bearing pressures and estimated settlement values based on the loads provided to us are provided below.

In order to minimize settlements to less than ½ inch between existing and proposed foundations, it is recommended that a reduced bearing capacity used. Continuous and isolated spread footings may be designed for an allowable bearing capacity of 3,500 pounds per square foot (psf). Continuous footings should be a minimum of 12 inches in width, 18 inches in depth below the lowest adjacent grade, and 12 inches into the recommended bearing materials. Isolated spread foundations should be a minimum of 24 inches in width, 18 inches in depth below the lowest adjacent grade, and 12 inches into the recommended bearing materials.

The soil bearing pressures above may be increased by 250 psf and 500 psf for each additional foot of foundation width and depth, respectively. Where settlements up to ¾ inch are acceptable, a maximum allowable soil bearing pressure of 4,500 psf may be utilized.

It is recommended that a modulus of subgrade reaction of 150 pounds per cubic inch (pci) be used for the design of foundations bearing in either newly placed engineered fill or in the undisturbed alluvial soils found at and below a depth of 5 feet. These values are unit values for use with a one-foot square footing. The modulus should be reduced in accordance with the following equation when used with larger foundations:

For Square Footings:

$$K_{sf} = K \left[\frac{B+1}{2B} \right]^2$$

For Rectangular/Continuous Footings:

$$K_{sfr} = K_{sf} \frac{\left[1 + 0.5 \frac{B}{L} \right]}{1.5}$$

where: K_{sfr} = reduced subgrade modulus for rectangular footing
 K_{sf} = reduced subgrade modulus for square footing
 K = unit subgrade modulus
 B = foundation width (in feet)
 L = foundation length (in feet)

This office should be provided with a copy of the final plans so that the recommendations presented herein could be properly reviewed and revised if necessary.

If you have any questions regarding this letter, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON WEST, INC.



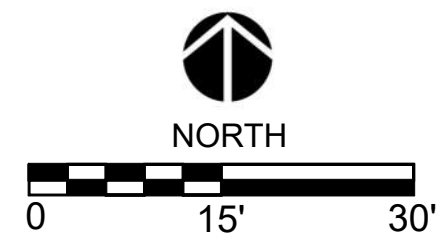
Joe Hicks, M.S.
PE 93183



Jelisa Thomas Adams
GE 3092

(EMAIL) Addressee

Enclosures Figure 1, Foundation Loading Diagram



LEGEND



Limits of Addition



Limits of Recommended Grading

GEOCON
WEST, INC.



ENVIRONMENTAL GEOTECHNICAL MATERIALS
500 N. VICTORY BOULEVARD, BURBANK, CA 91502
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CHECKED BY: JTA

FOUNDATION LOADING DIAGRAM

440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

APRIL 2024

PROJECT NO. W1817-06-01

FIG. 1

GEOTECHNICAL INVESTIGATION

PROPOSED ADDITION AND RENOVATION OF EXISTING LIBRARY 440 WEST SIERRA MADRE BOULEVARD SIERRA MADRE, CALIFORNIA



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GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

**CITY OF SIERRA MADRE
SIERRA MADRE, CALIFORNIA**

PROJECT NO. W1817-06-01

OCTOBER 20, 2023



Project No. W1817-06-01

October 20, 2023

Mr. Arnulfo Yanez
City of Sierra Madre
232 West Sierra Madre Boulevard
Sierra Madre, California 91024

Subject: GEOTECHNICAL INVESTIGATION
 PROPOSED ADDITION AND RENOVATION OF EXISTING LIBRARY
 440 WEST SIERRA MADRE BOULEVARD
 SIERRA MADRE, CALIFORNIA

Dear Mr. Yanez:

In accordance with your authorization of our proposal dated July 18, 2023, we have performed a geotechnical investigation for the proposed building addition and renovation of the existing library located at 440 West Sierra Madre in the City of Sierra Madre, California. The accompanying report presents the findings of our study, and our conclusions and recommendations pertaining to the geotechnical aspects of proposed design and construction. Based on the results of our investigation, it is our opinion that the proposed improvements can be constructed as proposed, provided the recommendations of this report are followed and implemented during design and construction.

If you have any questions regarding this report, or if we may be of further service, please contact the undersigned.

Very truly yours,

GEOCON WEST, INC.



Joe Hicks, M.S.
PE 93183



Petrina Zen
GE 3217



Susan F. Kirkgard
CEG 1754

(Email) Addressee

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GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of a geotechnical investigation for the proposed building addition and renovation of the existing library located at 440 West Sierra Madre Boulevard in the City of Sierra Madre, California (see Vicinity Map, Figure 1). The purpose of the investigation was to evaluate subsurface soil and geologic conditions underlying the area of the proposed improvements and, based on conditions encountered, to provide conclusions and recommendations pertaining to the geotechnical aspects of design and construction.

The scope of this investigation included a site reconnaissance, field exploration, laboratory testing, engineering analysis, and the preparation of this report. The site was explored on September 11, 2023, by excavating four 8-inch diameter borings to depths of approximately 15½ and 50½ feet below the existing ground surface using a truck-mounted, hollow-stem auger drilling machine. The site was further explored on September 12, 2023, by excavating two test pits to expose and verify the dimensions of the foundation system for the existing library building. Borings were advanced in the test pits to a maximum depth of approximately 5½ feet using hand auger equipment and digging tools. The approximate locations of the exploratory borings and test pits are depicted on the Site Plan (see Figure 2). A detailed discussion of the field investigation, including boring and test pit logs, is presented in Appendix A.

Laboratory tests were performed on selected soil samples obtained during the investigation to determine pertinent physical and chemical soil properties. Appendix B presents a summary of the laboratory test results.

The recommendations presented herein are based on analysis of the data obtained during the investigation and our experience with similar soil and geologic conditions. References reviewed to prepare this report are provided in the *List of References* section.

If project details vary significantly from those described herein, Geocon should be contacted to determine the necessity for review and possible revision of this report.

2. SITE AND PROJECT DESCRIPTION

The subject site is located at 440 West Sierra Madre Boulevard in the City of Sierra Madre, California. The site is currently occupied by a one- to two-story library structure, associated asphalt-paved parking lot, and a dirt lot. Due to the gently sloping nature of the site, the north side of the existing library building is on-grade and the lower level of the existing library building on the south side is tucked into the site topography. The site is bounded by West Sierra Madre Boulevard to the north, by Mariposa Avenue to the south, and by single-story and two-story residential structures to the west and east, respectively. The topography at the site and in the general site vicinity slopes downward towards the south with approximately 6 feet of vertical relief from the front of the structure to the rear, and approximately 20 feet of vertical relief across the site from Sierra Madre boulevard to Mariposa Avenue. Surface water drainage at the site appears to be by sheet flow along the existing ground contours to the city streets. Vegetation consists of some trees and shrubs in isolated planter areas.

Based on the information provided by the Client, it is our understanding that the proposed project will consist of renovating the existing library structure, constructing an addition at the south portion of the structure, constructing miscellaneous exterior improvements, and constructing new LID systems for stormwater management. The proposed project is illustrated on the Site Plan (see Figure 2).

Due to preliminary nature of the design at this time, wall and column loads were not available. It is anticipated that column loads for the proposed improvements will be up to 200 kips, and wall loads will be up to 2 kips per linear foot.

Once the design phase and foundation loading configuration proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Any changes in the design, location or elevation of any structure, as outlined in this report, should be reviewed by this office. Geocon should be contacted to determine the necessity for review and possible revision of this report.

3. GEOLOGIC SETTING

The site is located in the north-central San Gabriel Valley, approximately 0.8 mile south of the southern flank of the San Gabriel Mountains. The San Gabriel Valley is an alluvium-filled valley bounded by the Sierra Madre Fault Zone and San Gabriel Mountains on the north, by the Puente Hills on the south, by the Covina and Indian Hills on the east, and by the Raymond Basin on the west. The alluvial deposits are derived from erosion of the San Gabriel Mountains to the north and subsequent deposition by the San Gabriel River, Santa Anita Wash, Eaton Canyon Wash and other local drainages. The alluvium is estimated to be approximately 200 feet thick at the base of the mountains, extending to hundreds of feet thick in the central portion of the valley.

Regionally, the site is located within the southern portion of the Transverse Ranges geomorphic province. This geomorphic province is characterized by east-west trending physiographic and geologic features such as the active Raymond Fault, located approximately 1.5 miles to the south-southeast of the site. The Raymond Fault forms the local boundary between the Peninsular Ranges geomorphic province (south of the fault) and the Transverse Ranges geomorphic province to the north of the fault.

4. SOIL AND GEOLOGIC CONDITIONS

Based on our field investigation and published geologic maps of the area, the site is underlain by artificial fill and Pleistocene age older alluvial deposits (California Geological Survey [CGS], 2012). Detailed stratigraphic profiles of the materials encountered at the site are provided on the boring and test pit logs in Appendix A.

4.1 Artificial Fill

Artificial fill was encountered in the exploratory borings and test pits to a maximum depth of approximately 5½ feet below existing ground surface. The artificial fill generally consists of brown silty sand that is characterized as primarily fine- to medium-grained, dry to slightly moist, and loose. The fill is likely the result of past grading or construction activities at the site. Deeper fill may exist between excavations and in other portions of the site that were not directly explored.

Research was performed using the County of Los Angeles Department of Public Works online portal for soils and geology reports. The purpose of this research was to determine if the artificial fill encountered within our investigation had been documented and placed under the observation of a registered design professional.

No compaction reports or documentation of the existing fill at the subject site was found.

4.2 Older Alluvium

Pleistocene age alluvium was encountered beneath the artificial fill and consists primarily of light brown to brown silty sand that is primarily fine- to medium-grained with trace clay and varying amounts of fine to coarse gravel. The alluvium is characterized as dry to slightly moist and loose to very dense.

5. GROUNDWATER

Review of the Seismic Hazard Evaluation Report for the Mount Wilson 7.5-Minute Quadrangle (California Division of Mines and Geology [CDMG], 1998) indicates that the historically highest groundwater level in the immediate area is greater than 100 feet beneath the ground surface. Groundwater information presented in this document is generated from data collected in the early 1900's to the late 1990s. Based on current groundwater basin management practices, it is unlikely that groundwater levels will ever exceed the historic high levels.

Groundwater was not encountered in our borings drilled to a maximum depth of 50½ feet beneath the existing ground surface. Considering the lack of groundwater in the current borings, the reported depth of the historic high groundwater level (CDMG, 1998), and the depth of the proposed construction, static groundwater is not anticipated to be encountered during construction, nor have a detrimental effect on the project. However, it is not uncommon for groundwater levels to vary seasonally or for groundwater seepage conditions to develop where none previously existed, especially in impermeable fine-grained soils which are heavily irrigated or after seasonal rainfall. In addition, recent requirements for stormwater infiltration could result in shallower seepage conditions in the immediate site vicinity. Proper surface drainage of irrigation and precipitation will be critical for future performance of the project. Recommendations for drainage are provided in the *Surface Drainage* section of this report (see Section 7.19).

6. GEOLOGIC HAZARDS

6.1 Surface Fault Rupture

The numerous faults in Southern California include Holocene-active, pre-Holocene, and inactive faults. The criteria for these major groups are based on criteria developed by the California Geological Survey (CGS, formerly known as CDMG) for the Alquist-Priolo Earthquake Fault Zone Program (CGS, 2018). By definition, a Holocene-active fault is one that has had surface displacement within Holocene time (about the last 11,700 years). A pre-Holocene fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years) but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive.

The site is not within a state-designated Alquist-Priolo Earthquake Fault Zone for surface fault rupture hazards (CGS, 2017; 2023b). No Holocene-active or pre-Holocene faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low. However, the site is located in the seismically active Southern California region and could be subjected to moderate to strong ground shaking in the event of an earthquake on one of the many active Southern California faults. The faults in the vicinity of the site are shown in Figure 3, Regional Fault Map.

The closest Holocene-active fault to the site is the Sierra Madre Fault Zone located approximately 0.8 mile to the north (CGS, 2017). Other nearby Holocene-active faults are the Raymond Fault, the East Montebello Fault, the Hollywood Fault, and the Whittier Fault located approximately 1.5 miles south-southeast, 7.3 miles south-southwest, 10.5 miles southwest, and 10.5 miles southeast of the site, respectively. (USGS, 2006; Ziony and Jones, 1989). The active San Andreas Fault Zone is located approximately 23 miles northeast of the site (Ziony and Jones, 1989).

Several buried thrust faults, commonly referred to as blind thrusts, underlie the Los Angeles Basin at depth. These faults are not exposed at the ground surface and are typically identified at depths greater than 3.0 kilometers. The October 1, 1987 M_w 5.9 Whittier Narrows earthquake and the January 17, 1994 M_w 6.7 Northridge earthquake were a result of movement on the Puente Hills Blind Thrust and the Northridge Thrust, respectively. These thrust faults and others in the greater Los Angeles area are not exposed at the surface and do not present a potential surface fault rupture hazard at the site. However, these deep thrust faults are considered active features capable of generating future earthquakes that could result in moderate to significant ground shaking at the site.

6.2 Seismicity

As with all of Southern California, the site has experienced historic earthquakes from various regional faults. The seismicity of the region surrounding the site was formulated based on research of an electronic database of earthquake data. The epicenters of recorded earthquakes with magnitudes equal to or greater than 5.0 in the site vicinity are depicted on Figure 4, Regional Seismicity Map. A partial list of moderate to major magnitude earthquakes that have occurred in the Southern California area within the last 100 years is included in the following table.

LIST OF HISTORIC EARTHQUAKES

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Miles)	Direction to Epicenter
Near Redlands	July 23, 1923	6.3	48	ESE
Long Beach	March 10, 1933	6.4	38	S
Tehachapi	July 21, 1952	7.5	79	NW
San Fernando	February 9, 1971	6.6	26	NW
Whittier Narrows	October 1, 1987	5.9	7	S
Sierra Madre	June 28, 1991	5.8	8	NE
Landers	June 28, 1992	7.3	93	E
Big Bear	June 28, 1992	6.4	71	E
Northridge	January 17, 1994	6.7	27	W
Hector Mine	October 16, 1999	7.1	107	ENE
Ridgecrest	July 5, 2019	7.1	114	NNE

The site could be subjected to strong ground shaking in the event of an earthquake. However, this hazard is common in Southern California and the effects of ground shaking can be minimized if the proposed structure is designed and constructed in conformance with current building codes and engineering practices.

6.3 Site-Specific Ground Motion Hazard Analysis

A site-specific ground motion hazard analysis was performed in accordance with ASCE 7-16 Chapter 21, ASCE 41-17 Chapter 2, and Section 1613 of the 2022 CBC using online applications developed by USGS.

6.3.1 Probabilistic Seismic Hazard Analysis

The risk-targeted Maximum Considered Earthquake (MCE_R) probabilistic response spectrum consists of the spectral response accelerations which are expected to achieve a 1 percent probability of collapse within a 50-year period, evaluated at 5 percent damping.

The median spectral response accelerations having a 2 percent chance of exceedance in 50 years were evaluated at 5 percent damping using the USGS PSHA hazard platform used in the National Seismic Hazard Mapping Project, NSHMP-HAZ. The soil underlying the site was modeled as a Site Class “D” with a corresponding average shear wave velocity (V_{S30}) of 259 meters per second.

NSHMP-HAZ uses the ground motion prediction equations (GMPEs) from the NGA-West project: Abrahamson and Silva (2008) NGA, Boore and Atkinson (2008) NGA USGS 2008 MRC, and Chiou-Youngs (2008) NGA USGS 2008 MRC. Each GMPE was assigned an equal weight and the median value of the GMPEs was evaluated. The median spectral accelerations were rotated to maximum direction using the period specific ratios from Shahi et al. (2013 & 2014).

The GMPE of Campbell and Borzorgnia requires that the depth at which the shear wave velocity reaches 2.5 kilometers per second ($Z_{2.5}$) to be defined. Additionally, the GMPEs of Abrahamson-et al., Boore et al. and Chiou-Youngs require that the depth at which the shear wave velocity reaches 1 kilometer per second ($Z_{1.0}$) to be defined. The values of $Z_{2.5}$ and $Z_{1.0}$ were estimated using data from the Community Velocity Model (CVM) Version 4, Iteration 26 developed by Southern California Earthquake Data Center (SCEDC) accessed by the OpenSHA Site Data Application (v1.5.2).

The MCE uniform hazard response spectrum was adjusted to risk-targeted spectral accelerations corresponding to a 1 percent chance of collapse in 50 years by using the values of C_{RS} and C_{RI} obtained from Figures 22-18 and 22-19 of ASCE 7-16 Chapter 22.

The risk-targeted Maximum Considered Earthquake (MCE_R) probabilistic response spectrum is provided on Figure 5.

6.3.2 Deterministic Seismic Hazard Analysis

In order to define the deterministic scenario events, deaggregation of the uniform hazard probabilistic response spectrum was performed using the USGS Uniform Hazard Tool. The inversion approach used by UCERF-3 allows for a large number of variations for each source scenario, including multi-fault ruptures. Therefore, deaggregation of UCERF-3 consists of the contributions from multi-fault ruptures rather than individual source contributions. To address this, the USGS Unified Hazard Tool aggregates the contributions on a per-fault-section basis, with rupture contributions only ever counted once. The Unified Hazard Tool deaggregation contributor list shows the fault sections which contribute most to hazard at a site and reports a mean earthquake magnitude for each section identified by a 'parent' fault name and section index. Based on the deaggregation, we have considered scenario events with the greatest contribution to the deterministic ground motions.

The magnitudes of the deterministic scenario events were based on the BSSC 2014 Scenario Event Catalog which includes the parent fault identified in the deaggregation and which has the largest earthquake magnitude. Other fault source parameters were defined by the values in the BSSC2014 Scenario Catalog. The values of $Z_{2.5}$ and $Z_{1.0}$ were estimated using data from the Community Velocity Model (CVM) Version 4 developed by Southern California Earthquake Data Center (SCEDC) accessed by the OpenSHA Site Data Application (v1.5.2).

The input values used to evaluate the deterministic scenarios are provided in Figure 11. The deterministic median and standard deviation (sigma) for the scenario events were evaluated using the USGS NSHMP-HAZ-WS Response Spectra online application. The deterministic analysis used the same four GMPEs, equally weighted, to generate the median and standard deviation of the ground motion which were then used to calculate the 84th percentile at 5% damping. The median spectral accelerations were rotated to maximum direction using the period specific ratios from Shahi et al. (2013 & 2014).

The deterministic scenarios were compared, and a magnitude 7.16 event occurring on the Sierra Madre fault is considered the controlling deterministic event.

The 84th percentile maximum rotated component deterministic response spectrum is provided on Figure 6.

6.3.3 Site-Specific Response Spectrum

The lesser of the probabilistic and deterministic MCE_R response spectra is the Site-Specific MCE_R . Two thirds of the Site-Specific MCE_R is the Design Earthquake (DE) Response Spectrum, provided the results are not less than 80 percent of the modified General Design Response Spectrum determined by ASCE 7-16 Section 11.4.6 with F_a and F_v determined as specified in Section 21.3.

Graphical representations of the analyses are presented on Figures 5 and 6. The Site-Specific Design Earthquake response spectrum at 5 percent damping is presented on Figure 6 and in tabular form on Figure 7.

The lesser of the Site-Specific MCE_R (equivalent to BSE-2N) and the probabilistic BSE-2E is the Site-Specific BSE-2E, provided the results are not less than 80 percent of the modified General Design Response Spectrum determined by ASCE 41-17 Section 2.4.1. A graphical representation of the analysis is presented on Figure 8. The Site-Specific BSE-2E response spectrum at 5 percent damping is presented in tabular form on Figure 9.

The lesser of the Site-Specific Design Earthquake (equivalent to BSE-1N) and the probabilistic BSE-1E is the Site-Specific BSE-1E, provided the results are not less than 80 percent of the modified General Design Response Spectrum determined by ASCE 41-17 Section 2.4.1. A graphical representation of the analysis is presented on Figure 8. The Site-Specific BSE-1E response spectrum at 5 percent damping is presented in tabular form on Figure 10.

6.3.4 Site-Specific Seismic Design Criteria

Based the site-specific ground motion hazard analysis performed, and in accordance with the ASCE 7-16 Section 21.4, and ASCE 41-17 Section 2.4.2, site-specific design acceleration parameters shall be derived using the results of the site-specific ground motion hazard analysis.

The parameter S_{DS} shall be taken as equal to 90 percent of the maximum spectral acceleration obtained from the site-specific analysis at any period within the range from 0.2 to 5 seconds, inclusive. The parameter S_{D1} shall be taken as the maximum value of the product of the spectral acceleration and period for periods from 1 to 5 seconds, inclusive. The values of S_{MS} and S_{M1} shall be taken as 1.5 times the site-specific values of S_{DS} and S_{D1} . The site-specific design acceleration parameters shall not be less than 80 percent of the general seismic design values determined by ASCE 7-16 Section 11.4.

The following tables presents the site-specific seismic design parameters based on the site-specific ground motion hazard analysis.

SITE-SPECIFIC DESIGN ACCELERATION PARAMETERS

Parameter	Value
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	2.200g
Site Class Modified MCE_R Spectral Response Acceleration – (1 sec), S_{M1}	1.584g
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.467g
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	1.056g

ASCE 41-17 SITE-SPECIFIC SEISMIC DESIGN PARAMETERS

Parameter	Value
Spectral Response Acceleration (short) $S_{XS, BSE-2N}$	2.200g
Spectral Response Acceleration (1 sec) $S_{X1, BSE-2N}$	1.584g
Spectral Response Acceleration (short) $S_{XS, BSE-1N}$	1.467g
Spectral Response Acceleration (1 sec) $S_{X1, BSE-1N}$	1.056g
Spectral Response Acceleration (short) $S_{XS, BSE-2E}$	1.777g
Spectral Response Acceleration (1 sec) $S_{X1, BSE-2E}$	1.178g
Spectral Response Acceleration (short) $S_{XS, BSE-1E}$	0.978g
Spectral Response Acceleration (1 sec) $S_{X1, BSE-1E}$	0.543g

Conformance to the criteria in the above tables for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

6.3.5 Site-Specific Peak Ground Acceleration

The site-specific Maximum Considered Earthquake (MCE_G) peak ground acceleration was evaluated in accordance with ASCE 7-16 Section 21.5. The significant difference between the MCE_G peak ground acceleration and the analysis presented above is that the MCE_G is calculated without the risk-targeted adjustment factors.

The probabilistic and deterministic 84th percentile peak ground accelerations were analyzed using the same approaches as described above. The analysis used the same Site Class and scenario earthquake. However, within the probabilistic calculation, the risk-targeted adjustment factor was not applied.

The deterministic MCE_G shall not be less than $0.5F_{PGA}$, where F_{PGA} is determined from ASCE 7-16 Table 11.8-1 with the value of PGA taken as 0.5g. The site-specific MCE_G peak ground acceleration is taken as the lesser of the probabilistic and deterministic MCE_G , provided the value is not less than 80 percent of the value of PGA_M as determined by ASCE 7-16 Equation 11.8.1.

ASCE 7-16 SITE-SPECIFIC PEAK GROUND ACCELERATION

Parameter	Value	ASCE 7-16 Reference
Site-Specific MCE_G Peak Ground Acceleration, PGA_M	0.862g	Section 21.5

6.4 Liquefaction Potential

Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground motion, gradation characteristics of the subsurface soils, in-situ stress conditions, and the depth to groundwater. Liquefaction is typified by a loss of shear strength in the liquefied layers due to rapid increases in pore water pressure generated by earthquake accelerations.

The current standard of practice, as outlined in the “Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California” and “Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California” requires liquefaction analysis to a depth of 50 feet below the lowest portion of the proposed structure. Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine to medium-grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction.

The Seismic Hazards Zone Map for the Mount Wilson Quadrangle (CDMG, 1999; CGS, 2017) indicates that the site is not located within a zone of required investigation for liquefaction. In addition, the City of Sierra Madre Safety Element (2022) and the County of Los Angeles Safety Element (Leighton, 1990), indicate that the site is not located within an area designated as having a potential for liquefaction. Groundwater was not encountered in our borings drilled to a maximum depth of 50½ feet beneath the existing ground surface and the historic high groundwater level in the area is reported to be approximately greater than 100 feet beneath the existing ground surface (CDMG, 1998). Based on these considerations, it is our opinion that the potential for liquefaction and associated ground deformations beneath the site is very low.

6.5 Slope Stability

The site gently slopes downward to the south and the topography in the site vicinity slopes downward towards the south. The County of Los Angeles Safety Element (Leighton, 1990) indicates that the site is located in a “hillside area,” an area identified as having a potential for slope stability hazards. However, the State of California (CDMG, 1999; CGS, 2017) indicates that the site is not located within a zone of required investigation for earthquake-induced landslides. There are no known landslides near the site, nor is the site in the path of any known or potential landslides (City of Sierra Madre, 2022; USGS, 2023a). Therefore, the potential for slope stability hazards to adversely impact the site is considered low.

6.6 Earthquake-Induced Flooding

Earthquake-induced flooding is inundation caused by failure of dams or other water-retaining structures due to earthquakes. The Los Angeles County Safety Element (Leighton, 1990) and the City of Sierra Madre Safety Element (2022) indicate that the site is not located within the potential inundation area for any up-gradient dams or reservoirs. Therefore, the potential for inundation at the site as a result of an earthquake-induced dam failure is considered low.

6.7 Tsunamis, Seiches, and Flooding

The site is not located within a coastal area. Therefore, tsunamis are not considered a significant hazard at the site.

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up-gradient from the project site. Therefore, flooding resulting from a seismically induced seiche is considered unlikely.

The site is located within a Flood Zone X, designated by FEMA as an area of minimal flooding (FEMA, 2023; LACDPW, 2023). Therefore, flooding is not anticipated to impact the site.

6.8 Oil Fields & Methane Potential

Based on a review of the California Geologic Energy Management Division (CalGEM) Well Finder website, the site is not located within the boundaries of an oil field and no oil or gas wells are located in the immediate site vicinity. However, due to the voluntary nature of record reporting by the oil well drilling companies, wells may be improperly located or not shown on the location map and undocumented wells could be encountered during construction. Any wells encountered during construction will need to be properly abandoned in accordance with the current requirements of the CalGEM.

Since the site is not located within the boundaries of a known oil field, the potential for the presence of methane or other volatile gases is considered low. However, should it be determined that a methane study is required for the proposed development it is recommended that a qualified methane consultant be retained to perform the study and provide mitigation measures as necessary.

6.9 Subsidence

Subsidence occurs when a large portion of land is displaced vertically, usually due to the withdrawal of groundwater, oil, or natural gas. Soils that are particularly subject to subsidence include those with high silt or clay content. The site is not located within an area of known ground subsidence (USGS, 2023b). No known large-scale extraction of groundwater, gas, oil, or geothermal energy is occurring or planned at the site or in the general site vicinity. Therefore, the potential for ground subsidence due to withdrawal of fluids or gases at the site is considered low.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

- 7.1.1 It is our opinion that neither soil nor geologic conditions were encountered during the investigation that would preclude the construction of the proposed improvements provided the recommendations presented herein are followed and implemented during design and construction.
- 7.1.2 Up to 5½ feet of existing artificial fill was encountered during the site investigation; however, the contractor should be aware that the test pit excavations did not penetrate through the artificial fill. The existing fill encountered is believed to be the result of past grading and construction activities at the site. Deeper fill may exist in other areas of the site that were not directly explored. The depth of existing artificial fill should be field verified by Geocon during foundation excavations and construction activities. It is our opinion that the existing fill, in its present condition, is suitable for continued support of the existing foundations and slabs-on-grade as well as replacement slab sections. However, the existing fill is not considered suitable for direct support of new foundations and slabs. The existing fill and site soils are suitable for re-use as engineered fill provided the recommendations in the *Grading* section of this report are followed (see Section 7.4).
- 7.1.3 The project structural engineer should evaluate the existing foundations, existing building loads, and proposed improvement loads. Where excess foundation capacity remains, the existing foundations may be utilized to support additional loads associated with the proposed improvements (see Section 7.6). However, adding heavier loads to existing foundations could induce settlements which could be detrimental to existing structural connections.
- 7.1.4 Based on these considerations, it is recommended that the upper 5 feet of existing earth materials in the proposed building addition footprint areas be excavated and properly compacted for foundation and slab support. Deeper excavations should be conducted as needed to remove any encountered fill or soft soils as necessary at the direction of the Geotechnical Engineer (a representative of Geocon). The excavation should extend laterally a minimum distance of three feet beyond the building footprint areas, including building appurtenances, or a distance equal to the depth of fill below the foundation, whichever is greater. The limits of existing fill and/or soft soil removal will be verified by the Geocon representative during site grading activities. Recommendations for earthwork are provided in the *Grading* section of this report (see Section 7.4).

- 7.1.5 Where lateral overexcavation cannot be performed, such as adjacent to the existing structure or the property line, foundations should be deepened as necessary to derive support in the competent alluvial soils generally found at and below a depth of 5 feet. Excavations should be sequenced such that lateral support of the existing footings is not removed. Recommendations for footing construction adjacent to existing footings have been provided in Section 7.15 of this report.
- 7.1.6 Subsequent to the recommended grading, the proposed building addition may be supported on conventional shallow spread foundations deriving support in newly placed engineered fill and/or in competent alluvial soils generally found at and below a depth of 5 feet. It is the intent of the Geotechnical Engineer to allow building foundations to derive support in both engineered fill and competent alluvium for this project if conditions warrant such an occurrence. Recommendations for the design of a conventional foundation system are provided in Section 7.7.
- 7.1.7 All foundation excavations must be observed and approved in writing by the Geotechnical Engineer prior to placement of steel or concrete.
- 7.1.8 Where proposed foundations will be deeper than an existing adjacent foundation, the proposed foundation must be designed to resist the surcharge imposed by the existing foundation. The surcharge area may be defined by a 1:1 projection down and away from the bottom of the existing foundation. Proposed foundations that are situated immediately adjacent to existing foundations should be deepened as necessary to match the depth of the existing foundation and derive support in the recommended bearing material.
- 7.1.9 Excavations up to 6 feet in vertical height are anticipated during grading and foundation construction. Due to the granular nature of the soils, caving is expected in unshored excavations and formwork will likely be required. Performing open excavations adjacent to or deeper than the existing foundation system could potentially remove lateral support and/or undermine the existing foundations. Excavations for construction of new foundations immediately adjacent to existing foundations may require special excavation measures in order to provide a stable excavation and to maintain lateral support of existing foundations. Excavation recommendations are provided in the *Temporary Excavations* section of this report (Section 7.14).

- 7.1.10 Foundations for small outlying structures, such as block walls less than 6 feet in height, planter walls or trash enclosures, which will not be tied to the proposed structure, may be supported on conventional foundations deriving support on a minimum of 12 inches of newly placed engineered fill which extends laterally at least 12 inches beyond the foundation area. Where excavation and compaction cannot be performed, foundations may derive support directly in the competent, undisturbed alluvial soils, and should be deepened as necessary to maintain a minimum 12 inch embedment into the recommended bearing materials. If the soils exposed in the excavation bottom are soft or loose, compaction of the soils will be required prior to placing steel or concrete. Compaction of the foundation excavation bottom is typically accomplished with a compaction wheel or mechanical whacker and must be observed and approved by a Geocon representative.
- 7.1.11 Where new paving is to be placed, it is recommended that all existing fill and soft alluvial soils be excavated and properly compacted for paving support. The client should be aware that excavation and compaction of all existing fill and soft alluvial soils in the area of new paving is not required; however, paving constructed over existing uncertified fill or unsuitable alluvial soil may experience increased settlement and/or cracking and may therefore have a shorter design life and increased maintenance costs. As a minimum, the upper 12 inches of subgrade soil should be scarified and properly compacted for paving support. Paving recommendations are provided in *Preliminary Pavement Recommendations* section of this report (see Section 7.11).
- 7.1.12 Based on the results of the percolation testing performed at the site, a stormwater infiltration system is considered feasible for this project. Preliminary recommendations are provided in the *Stormwater Infiltration* section of this report (Section 7.18)
- 7.1.13 Once the design and foundation loading configuration for the proposed structures proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Based on the final foundation loading configurations, the potential for settlement should be reevaluated by this office.
- 7.1.14 Any changes in the design, location or elevation, as outlined in this report, should be reviewed by this office. Geocon should be contacted to determine the necessity for review and possible revision of this report.

7.2 Soil and Excavation Characteristics

- 7.2.1 The in-situ soils can be excavated with moderate effort using conventional excavation equipment. Due to the granular nature of the soils, moderate to excessive caving is anticipated in unshored excavations. The contractor should be aware that formwork will likely be required to prevent caving of shallow spread foundation excavations.

- 7.2.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable OSHA rules and regulations to maintain safety and maintain the stability of adjacent existing improvements.
- 7.2.3 All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and existing foundation supports are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load. Penetrations below this 1:1 projection will require special excavation measures. Excavation recommendations are provided in the *Temporary Excavations* section of this report (see Section 7.14).
- 7.2.4 The upper 5 feet of existing site soils encountered during the investigation are considered to have a “very low” expansive potential ($EI = 0$) and are classified as “non-expansive” in accordance with the 2022 California Building Code (CBC) Section 1803.5.3. The recommendations presented herein assume that the building foundations and slabs will derive support in these materials.

7.3 Minimum Resistivity, pH, and Water-Soluble Sulfate

- 7.3.1 Potential of Hydrogen (pH) and resistivity testing as well as chloride content testing were performed on representative samples of soil to generally evaluate the corrosion potential to surface utilities. The tests were performed in accordance with California Test Method Nos. 643 and 422 and indicate that the soils are considered “mildly corrosive” with respect to corrosion of buried ferrous metals on site. The results are presented in Appendix B (Figure B17) and should be considered for design of underground structures.
- 7.3.2 Laboratory tests were performed on representative samples of the site materials to measure the percentage of water-soluble sulfate content. Results from the laboratory water-soluble sulfate tests are presented in Appendix B (Figure B17) and indicate that the on-site materials possess a sulfate exposure class of “S0” to concrete structures as defined by 2022 CBC Section 1904 and ACI 318 Table 19.3.1.1.
- 7.3.3 Geocon West, Inc. does not practice in the field of corrosion engineering and mitigation. If corrosion sensitive improvements are planned, it is recommended that a corrosion engineer be retained to evaluate corrosion test results and incorporate the necessary precautions to avoid premature corrosion of buried metal pipes and concrete structures in direct contact with the soils.

7.4 Grading

- 7.4.1 Grading is anticipated to include preparation of the building pad, excavation of site soils for proposed foundations and utility trenches, preparation of paving subgrade, and placement of backfill for walls and trenches.
- 7.4.2 A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer, geotechnical engineer, and building official in attendance. Special soil handling requirements can be discussed at that time.
- 7.4.3 Earthwork should be observed, and compacted fill tested by representatives of Geocon West, Inc. The existing fill and older alluvial soils encountered during exploration is suitable for re-use as an engineered fill, provided any encountered oversize material (greater than 6 inches) and any encountered deleterious debris is removed.
- 7.4.4 Grading should commence with the removal of all existing vegetation and existing improvements from the area to be graded. Deleterious debris such as wood and root structures should be exported from the site and should not be mixed with the fill soils. Asphalt and concrete should not be mixed with the fill soils unless approved by the Geotechnical Engineer. All existing underground improvements planned for removal should be completely excavated and the resulting depressions properly backfilled in accordance with the procedures described herein. Once a clean excavation bottom has been established it must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon West, Inc.).
- 7.4.5 As a minimum, it is recommended that the upper 5 feet of existing earth materials in the proposed building addition footprint areas be excavated and properly compacted for foundation and slab support. The contractor should be aware that up to 5½ feet of artificial fill was encountered in the test pits, and the test pit excavations did not penetrate through the artificial fill. Deeper excavations should be conducted as needed to remove any encountered fill or soft soils as necessary at the direction of the Geotechnical Engineer (a representative of Geocon). The limits of existing fill and/or soft soil removal will be verified by the Geocon representative during site grading activities. The engineered fill blanket should extend laterally at least 3 feet beyond the edge of foundations or for a distance equal to the depth of fill below the foundations, whichever is greater.
- 7.4.6 Where lateral overexcavation cannot be performed, such as adjacent to the existing structure or property line, foundations should be deepened as necessary to derive support in the competent alluvial soils generally found at and below a depth of 5 feet. Excavations should be sequenced such that lateral support of the existing footings is not removed. Recommendations for footing construction adjacent to existing footings has been provided in Section 7.15 of this report.

- 7.4.7 Subsequent to the recommended grading, the proposed building addition may be supported on conventional shallow spread foundations deriving support in newly placed engineered fill and/or in competent alluvial soils generally found at and below a depth of 5 feet. It is the intent of the Geotechnical Engineer to allow building foundations to derive support in both engineered fill and competent alluvium for this project if conditions warrant such an occurrence.
- 7.4.8 All fill and backfill soils should be placed in horizontal loose layers approximately 6 to 8 inches thick, moisture conditioned to near optimum moisture content, and properly compacted to 90 percent of the laboratory maximum dry density in accordance with ASTM D 1557 (latest edition).
- 7.4.9. Where new paving is to be placed, it is recommended that all existing fill and soft alluvium be excavated and properly compacted for paving support. As a minimum, the upper 12 inches of soil should be scarified, moisture conditioned to near optimum moisture content, and compacted to at least 95 percent relative compaction, as determined by ASTM Test Method D 1557 (latest edition). Paving recommendations are provided in *Preliminary Pavement Recommendations* section of this report (see Section 7.11).
- 7.4.10 Performing open excavations adjacent to and deeper than existing foundations could potentially remove lateral support and/or undermine the existing foundations and are not acceptable. Excavation for grading and/or construction of new foundations adjacent to existing foundations will require special excavation measures. Excavation recommendations are provided in the *Temporary Excavations* section of this report (Section 7.14).
- 7.4.11 Foundations for small outlying structures, such as block walls less than 6 feet high, planter walls or trash enclosures, which will not be tied to the proposed building, may be supported on conventional foundations deriving support on a minimum of 12 inches of newly placed engineered fill which extends laterally at least 12 inches beyond the foundation area. Where excavation and proper compaction cannot be performed, foundations may derive support directly in the competent, undisturbed alluvial soils, and should be deepened as necessary to maintain a minimum 12 inch embedment into the recommended bearing materials. If the soils exposed in the excavation bottom are soft or loose, compaction of the soils will be required prior to placing steel or concrete. Compaction of the foundation excavation bottom is typically accomplished with a compaction wheel or mechanical whacker and must be observed and approved by a Geocon representative.

- 7.4.12 All imported fill shall be observed, tested, and approved by Geocon West, Inc. prior to bringing soil to the site. Rocks larger than 6 inches in diameter shall not be used in the fill. If necessary, import soils used as structural fill should have an expansion index less than 20 and corrosivity properties that are equally or less detrimental to that of the existing onsite soils (see Figure B17). Import soils placed in the building area should be placed uniformly across the building pad or in a manner that is approved by the Geotechnical Engineer (a representative of Geocon).
- 7.4.13 Utility trenches should be properly backfilled in accordance with the following requirements. The pipe should be bedded with clean sands (Sand Equivalent greater than 30) to a depth of at least 1 foot over the pipe, and the bedding material must be inspected and approved in writing by the Geotechnical Engineer (a representative of Geocon). The use of gravel is not acceptable unless used in conjunction with filter fabric to prevent the gravel from having direct contact with soil. The remainder of the trench backfill may be derived from onsite soil or approved import soil, compacted as necessary, until the required compaction is obtained. The use of minimum 2-sack slurry as backfill is also acceptable. Prior to placing any bedding materials or pipes, the excavation bottom must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon).
- 7.4.14 All trench and foundation excavation bottoms must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon), prior to placing bedding materials, fill, steel, gravel, or concrete.

7.5 Shrinkage

- 7.5.1 Shrinkage results when a volume of material removed at one density is compacted to a higher density. A shrinkage factor between 10 and 20 percent should be anticipated when excavating and compacting the artificial fill to an average relative compaction of 92 percent.
- 7.5.2 If import soils will be utilized in the building pad, the soils must be placed uniformly and at equal thickness at the direction of the Geotechnical Engineer (a representative of Geocon West, Inc.). In order to maintain uniformity in the building pad, soils can be borrowed from non-building pad areas and later replaced with imported soils.

7.6 Existing Foundations

- 7.6.1 Observed footing dimensions during the test pit explorations (see Figure 12) are provided in the table below. Based on the laboratory direct shear testing from the borings and test pits, estimated bearing pressures are provided for the observed foundation dimensions. The observed footing widths assume equal footing widths on either side of the existing wall or column.

TP ID	TP Location	FOOTING WIDTH (IN.)	DEPTH BELOW ADJACENT GRADE (IN.)	ALLOWABLE BEARING CAPACITY (PSF)
TP 1	South Library Wall (Continuous Perimeter Footing)	18*	38	2,000
TP 2	South Library Wall (Continuous Perimeter Footing)	18*	24	2,000

*Assumed minimum 6-inch wall thickness

7.6.2 Additional bearing capacity may be feasible; however, increasing the bearing capacity beyond the maximum allowable bearing capacity may induce additional settlement of the existing foundations.

7.6.3 Where existing foundations will be utilized for support of the proposed renovations, the project structural engineer should evaluate the existing foundations, existing building loads and proposed building loads. Where excess capacity remains, the existing foundations may be utilized for support of the proposed improvements. However, adding heavier loads to existing foundations could induce settlements on the existing foundations which could be detrimental to existing structural connections. Once existing and proposed load configurations become available, they should be provided to Geocon for additional settlement analyses.

7.6.4 The structural engineer should evaluate the anticipated load configuration and resulting settlements, and determine the necessity for new foundations. Recommendations for new foundations are provided in the following section. The project structural engineer should verify the suitability and reinforcement design for all existing and proposed footings.

7.7 Foundation Design

7.7.1 Subsequent to the recommended grading, the proposed building addition may be supported on conventional shallow spread foundations deriving support in newly placed engineered fill and/or in competent alluvial soils generally found at and below a depth of 5 feet. Foundations should be deepened as necessary to penetrate through soft, unsuitable alluvium at the direction of the Geotechnical Engineer. It is the intent of the Geotechnical Engineer to allow building foundations to derive support in both engineered fill and competent alluvium for this project if conditions warrant such an occurrence.

7.7.2 Proposed foundations that are situated immediately adjacent to the existing foundations should be deepened as necessary to match the depth of the existing foundation to prevent a surcharge on the existing foundation.

- 7.7.3 Where proposed foundations will be deeper than the existing foundation, the proposed foundation must be designed to resist the surcharge imposed by the existing foundation. The surcharge area may be defined by a 1:1 projection up and away from the bottom of an existing foundation.
- 7.7.4 The client should be aware that special excavation measures, such as shoring, will be required to construct foundations along the existing structure. Recommendations for footing construction adjacent to existing foundations has been provided in Section 7.15 of this report.
- 7.7.5 In order to minimize settlements to less than ½ inch between existing and proposed foundations, a reduced bearing capacity is being recommended. Continuous and isolated spread footings may be designed for an allowable bearing capacity of 2,000 pounds per square foot (psf). Continuous footings should be a minimum of 12 inches in width, 18 inches in depth below the lowest adjacent grade, and 12 inches into the recommended bearing materials. Isolated spread foundations should be a minimum of 24 inches in width, 18 inches in depth below the lowest adjacent grade, and 12 inches into the recommended bearing materials. The maximum allowable soil bearing pressure should be limited to 2,000 psf to reduce induced settlements to less than ½ inch.
- 7.7.6 The soil bearing pressures above may be increased by 250 psf and 500 psf for each additional foot of foundation width and depth, respectively. Where settlements up to 1 inch are acceptable, a maximum allowable soil bearing pressure of 3,000 psf may be utilized.
- 7.7.7 The allowable bearing pressures may be increased by one-third for transient loads due to wind or seismic forces.
- 7.7.8 If depth increases are utilized for the exterior wall footings, this office should be provided a copy of the final construction plans so that the excavation recommendations presented herein could be properly reviewed and revised if necessary.
- 7.7.9 Continuous footings should be reinforced with four No. 4 steel reinforcing bars, two placed near the top of the footing and two near the bottom. Reinforcement for spread footings should be designed by the project structural engineer.
- 7.7.10 The above foundation dimensions and minimum reinforcement recommendations are based on soil conditions and building code requirements only, and are not intended to be used in lieu of those required for structural purposes.

- 7.7.11 No special subgrade presaturation is required prior to placement of concrete. However, the moisture in the foundation subgrade should be sprinkled as necessary to maintain a moist condition at the time of concrete placement.
- 7.7.12 Foundation excavations should be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to the placement of reinforcing steel and concrete to verify that the excavations and exposed soil conditions are consistent with those anticipated. If unanticipated soil conditions are encountered, foundation modifications may be required.
- 7.7.13 This office should be provided a copy of the final construction plans so that the excavation recommendations presented herein could be properly reviewed and revised if necessary.

7.8 Lateral Design

- 7.8.1 Resistance to lateral loading may be provided by friction acting at the base of foundations, slabs and by passive earth pressure. An allowable coefficient of friction of 0.45 may be used with the dead load forces in the competent, undisturbed alluvial soils or properly compacted engineered fill.
- 7.8.2 The passive earth pressure for the sides of foundations and slabs poured against competent, undisturbed alluvial soils or properly compacted engineered fill may be computed as an equivalent fluid having a density of 300 pcf with a maximum earth pressure of 3,000 pcf. When combining passive and friction for lateral resistance, the passive component should be reduced by one-third.

7.9 Miscellaneous Foundations

- 7.9.1 Foundations for small outlying structures, such as block walls up to 6 feet in height, planter walls or trash enclosures, which will not be tied to the proposed structure, may be supported on conventional foundations deriving support on a minimum of 12 inches of newly placed engineered fill which extends laterally at least 12 inches beyond the foundation area. Where excavation and compaction cannot be performed, foundations may derive support directly in the competent, undisturbed alluvial soils, and should be deepened as necessary to maintain a minimum 12-inch embedment into the recommended bearing materials.

- 7.9.2 If the soils exposed in the excavation bottom are soft, compaction of the soft soils will be required prior to placing steel or concrete. Compaction of the foundation excavation bottom is typically accomplished with a compaction wheel or mechanical whacker and must be observed and approved by a Geocon representative. Miscellaneous foundations may be designed for a bearing value of 1,500 psf, and should be a minimum of 12 inches in width, 18 inches in depth below the lowest adjacent grade, and 12 inches into the recommended bearing material. The allowable bearing pressure may be increased by up to one-third for transient loads due to wind or seismic forces.
- 7.9.3 Foundation excavations should be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to the placement of reinforcing steel and concrete to verify that the excavations and exposed soil conditions are consistent with those anticipated.

7.10 Concrete Slabs-on-Grade

- 7.10.1 Concrete slabs-on-grade subject to vehicle loading should be designed in accordance with the recommendations in the *Preliminary Pavement Recommendations* section of this report (Section 7.11).
- 7.10.2 Subsequent to the recommended grading, concrete slabs-on-grade for structures, not subject to vehicle loading, should be a minimum of 4 inches thick and minimum slab reinforcement should consist of No. 4 steel reinforcing bars placed 16 inches on center in both horizontal directions. Steel reinforcing should be positioned vertically near the slab midpoint.
- 7.10.3 Where replacement concrete slabs-on-grade are to be constructed within the existing structure, it is recommended that any soils disturbed during construction activities be properly compacted for slab support. Recommendations for earthwork are provided in the *Grading* section of this report (see Section 7.4).

- 7.10.4 Slabs-on-grade at the ground surface that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder placed directly beneath the slab. The vapor retarder and acceptable permeance should be specified by the project architect or developer based on the type of floor covering that will be installed. The vapor retarder design should be consistent with the guidelines presented in Section 9.3 of the American Concrete Institute's (ACI) Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials (ACI 302.2R-06) as well as ASTM E1745 and should be installed in general conformance with ASTM E 1643 (latest edition) and the manufacturer's recommendations. A minimum thickness of 15 mils extruded polyolefin plastic is recommended; vapor retarders which contain recycled content or woven materials are not recommended. The vapor retarder should have a permeance of less than 0.01 perms demonstrated by testing before and after mandatory conditioning. The vapor retarder should be installed in direct contact with the concrete slab with proper perimeter seal. If the California Green Building Code requirements apply to this project, the vapor retarder should be underlain by 4 inches of clean aggregate. It is important that the vapor retarder be puncture resistant since it will be in direct contact with angular gravel. As an alternative to the clean aggregate suggested in the California Green Building Code, it is our opinion that the concrete slab-on-grade may be underlain by a vapor retarder over 4 inches of clean sand (sand equivalent greater than 30), since the sand will serve as a capillary break and will minimize the potential for punctures and damage to the vapor barrier.
- 7.10.5 For seismic design purposes, a coefficient of friction of 0.45 may be utilized between concrete slabs and subgrade soils without a moisture barrier, and 0.15 for slabs underlain by a moisture barrier.
- 7.10.6 Exterior slabs for walkways or flatwork, not subject to traffic loads, should be at least 4 inches thick and reinforced with No. 3 steel reinforcing bars placed 18 inches on center in both horizontal directions, positioned near the slab midpoint. Prior to construction of slabs, the upper 12 inches of subgrade should be moistened to near optimum moisture content and properly compacted to at least 95 percent relative compaction, as determined by ASTM Test Method D 1557 (latest edition). Crack control joints should be spaced at intervals not greater than 10 feet and should be constructed using saw-cuts or other methods as soon as practical following concrete placement. Crack control joints should extend a minimum depth of one-fourth the slab thickness. The project structural engineer should design construction joints as necessary.

- 7.10.7 The recommendations of this report are intended to reduce the potential for cracking of slabs due to settlement. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade may exhibit some cracking due to minor soil movement and/or concrete shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

7.11 Preliminary Pavement Recommendations

- 7.11.1 Where new paving is to be placed, it is recommended that all existing fill and soft alluvium materials be excavated and properly compacted for paving support. The client should be aware that excavation and compaction of all existing artificial fill and soft alluvium in the area of new paving is not required; however, paving constructed over existing uncertified fill or unsuitable alluvium material may experience increased settlement and/or cracking, and may therefore have a shorter design life and increased maintenance costs. As a minimum, the upper 12 inches of paving subgrade should be scarified, moisture conditioned to near optimum moisture content, and properly compacted to at least 95 percent relative compaction, as determined by ASTM Test Method D 1557 (latest edition).
- 7.11.2 The following pavement sections are based on an assumed R-Value of 20. Once site grading activities are complete an R-Value should be obtained by laboratory testing to confirm the properties of the soils serving as paving subgrade, prior to placing pavement.
- 7.11.3 The Traffic Indices listed below are estimates. Geocon does not practice in the field of traffic engineering. The actual Traffic Index for each area should be determined by the project civil engineer. If pavement sections for Traffic Indices other than those listed below are required, Geocon should be contacted to provide additional recommendations. Pavement thicknesses were determined following procedures outlined in the *California Highway Design Manual* (Caltrans). It is anticipated that the majority of traffic will consist of automobile and large truck traffic.

PRELIMINARY PAVEMENT DESIGN SECTIONS

Location	Estimated Traffic Index (TI)	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Automobile Parking and Driveways	4.0	3.0	4.0
Trash Truck & Fire Lanes	7.0	4.0	12.0

- 7.11.4 Asphalt concrete should conform to Section 203-6 of the “*Standard Specifications for Public Works Construction*” (Green Book). Class 2 aggregate base materials should conform to Section 26-1.02A of the “*Standard Specifications of the State of California, Department of Transportation*” (Caltrans). The use of Crushed Miscellaneous Base (CMB) in lieu of Class 2 aggregate base is acceptable. Crushed Miscellaneous Base should conform to Section 200-2.4 of the “*Standard Specifications for Public Works Construction*” (Green Book).
- 7.11.5 Unless specifically designed and evaluated by the project structural engineer, where exterior concrete paving will be utilized for support of vehicles, it is recommended that the concrete be a minimum of 6 inches of concrete reinforced with No. 3 steel reinforcing bars placed 18 inches on center in both horizontal directions. Concrete paving supporting vehicular traffic should be underlain by a minimum of 4 inches of aggregate base and a properly compacted subgrade. As a minimum, the upper 12 inches of paving subgrade should be scarified, moisture conditioned to near optimum moisture content, and properly compacted to at least 95 percent relative compaction, as determined by ASTM Test Method D 1557 (latest edition). The base material should be compacted to 95 percent relative compaction, as determined by ASTM Test Method D 1557 (latest edition).
- 7.11.6 The performance of pavements is highly dependent upon providing positive surface drainage away from the edge of pavements. Ponding of water on or adjacent to the pavement will likely result in saturation of the subgrade materials and subsequent cracking, subsidence and pavement distress. If planters are planned adjacent to paving, it is recommended that the perimeter curb be extended at least 12 inches below the bottom of the aggregate base to minimize the introduction of water beneath the paving.

7.12 Retaining Wall Design

- 7.12.1 The recommendations presented below are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 5 feet. In the event that walls significantly higher than 5 feet are planned, Geocon should be contacted for additional recommendations.
- 7.12.2 Retaining wall foundations should be designed in accordance with the recommendations provided in the *Foundation Design* section of this report (see Section 7.7).

- 7.12.3 Retaining walls with a level backfill surface that are not restrained at the top should be designed utilizing a triangular distribution of pressure (active pressure). Restrained walls are those that are not allowed to rotate more than $0.001H$ (where H equals the height of the retaining portion of the wall in feet) at the top of the wall. Where walls are restrained from movement at the top, walls may be designed utilizing a triangular distribution of pressure (at-rest pressure). The table below presents recommended pressures to be used in retaining wall design.

RETAINING WALL WITH LEVEL BACKFILL SURFACE

HEIGHT OF RETAINING WALL (Feet)	ACTIVE PRESSURE EQUIVALENT FLUID PRESSURE (Pounds Per Cubic Foot)	AT-REST PRESSURE EQUIVALENT FLUID PRESSURE (Pounds Per Cubic Foot)
Up to 5	30	52

- 7.12.4 The wall pressures provided above assume that the proposed retaining walls will support relatively undisturbed alluvium or engineered fill derived from onsite soils. If import soil will be used to backfill proposed retaining walls, revised earth pressures may be required to account for the geotechnical properties of the import soil used as engineered fill. This should be evaluated once the use of import soil is established. All imported fill shall be observed, tested, and approved by Geocon West, Inc. prior to bringing soil to the site.
- 7.12.5 The wall pressures provided above assume that the retaining wall will be properly drained preventing the buildup of hydrostatic pressure. If retaining wall drainage is not implemented, an at-rest equivalent fluid pressure of 90 pcf should be used in design of undrained, restrained walls for the full height of the wall. The value includes hydrostatic pressures plus buoyant lateral earth pressures. If a partially drained wall is proposed, Geocon should be contacted to provide additional recommendations.
- 7.12.6 Additional pressure should be added for a surcharge condition due to sloping ground, vehicular traffic or adjacent structures and should be designed for each condition as the project progresses. Surcharges may be evaluated using Section 7.17 of this report. Once the design becomes more finalized, an addendum letter can be prepared revising recommendations and addressing specific surcharge conditions throughout the project, if necessary.

7.13 Retaining Wall Drainage

- 7.13.1 Retaining walls not designed for hydrostatic pressures should be provided with a drainage system. At the base of the drain system, a subdrain covered with a minimum of 12 inches of gravel should be installed, and a compacted fill blanket or other seal placed at the surface (see Figure 13). The clean bottom and subdrain pipe, behind a retaining wall, should be observed by the Geotechnical Engineer (a representative of Geocon), prior to placement of gravel or compacting backfill.
- 7.13.2 As an alternative, a plastic drainage composite such as Miradrain or equivalent may be installed in continuous, 4-foot-wide columns along the entire back face of the wall, at 8 feet on center. The top of these drainage composite columns should terminate approximately 18 inches below the ground surface, where either hardscape or a minimum of 18 inches of relatively cohesive material should be placed as a cap (see Figure 14). These vertical columns of drainage material would then be connected at the bottom of the wall to a collection panel or a 1-cubic-foot rock pocket drained by a 4-inch subdrain pipe.
- 7.13.3 Subdrainage pipes at the base of the retaining wall drainage system should outlet to an acceptable location via controlled drainage structures.
- 7.13.4 Moisture affecting below grade walls is one of the most common post-construction complaints. Poorly applied or omitted waterproofing can lead to efflorescence or standing water. Particular care should be taken in the design and installation of waterproofing to avoid moisture problems, or actual water seepage into the structure through any normal shrinkage cracks which may develop in the concrete walls, floor slab, foundations and/or construction joints. The design and inspection of the waterproofing is not the responsibility of the geotechnical engineer. A waterproofing consultant should be retained in order to recommend a product or method, which would provide protection to subterranean walls, floor slabs and foundations.

7.14 Temporary Excavations

- 7.14.1 Excavations on the order of 6 feet in height may be required during grading operations. The excavations are expected to expose artificial fill and alluvial soils, which may be subject to excessive caving. Vertical excavations up to 5 feet in height may be attempted where not surcharged by adjacent foundations or traffic; however, the contractor should be prepared for caving sands in open excavations and formwork may be required in foundation excavations.

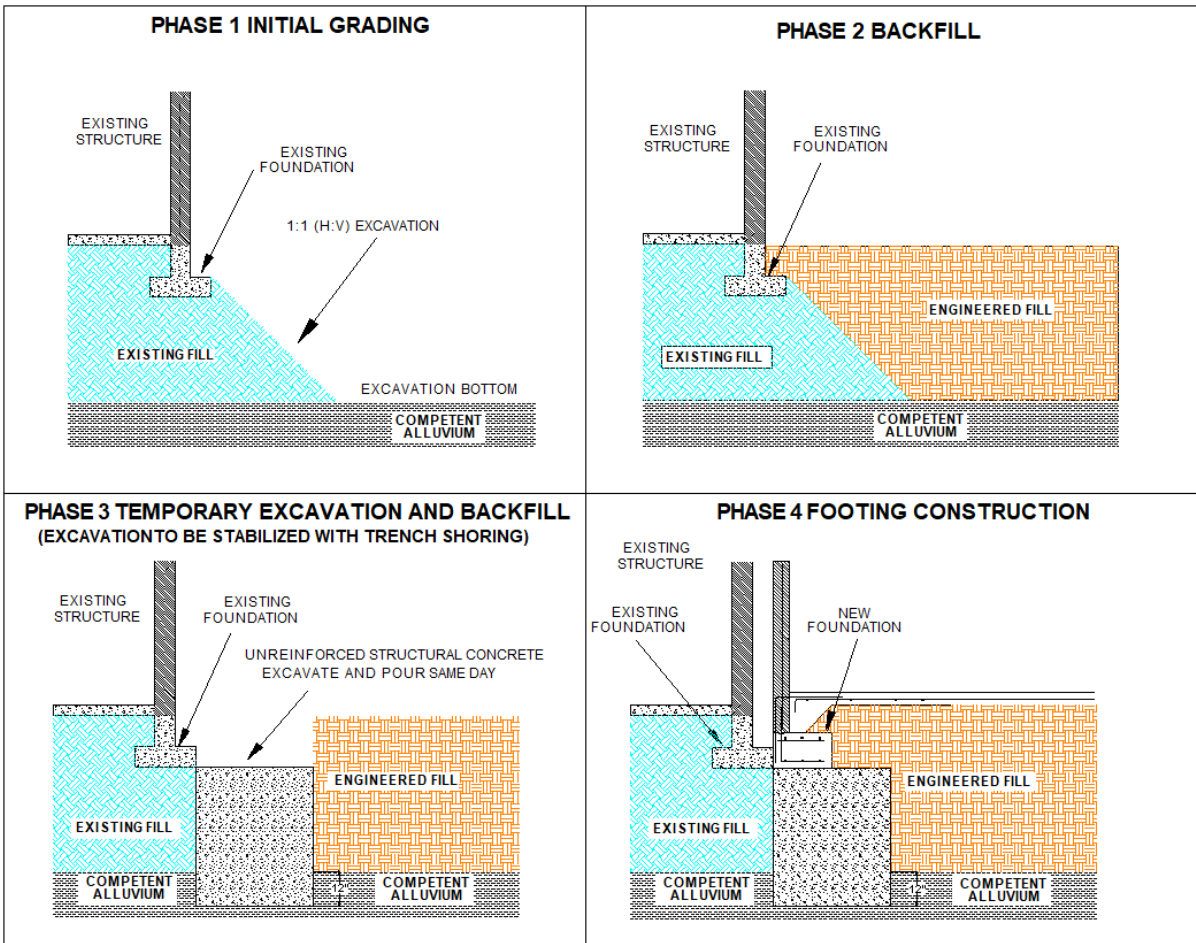
- 7.14.2 Vertical excavations greater than 5 feet or where surcharged by existing structures will require sloping or shoring measures in order to provide a stable excavation. Where sufficient space is available, temporary unsurcharged embankments could be sloped back at a uniform 1:1 slope gradient or flatter up to maximum height of 5 feet. Temporary unsurcharged embankments greater than 5 feet and less than 10 feet may be sloped back at a uniform 1½:1 (H:V) slope gradient or flatter. A uniform slope does not have a vertical portion.
- 7.14.3 If excavations in close proximity to an adjacent property line and/or structure are required, special excavation measures such as slot-cutting or shoring may be necessary in order to maintain lateral support of offsite improvements. Continuous vertical excavation adjacent to and which extend below the existing footings could remove vertical and lateral support from the existing footings and are not recommended. Due to the granular nature of the existing site soils, slot cutting techniques are not recommended. Special excavations measures, such as trench shoring, will be required if excavations will be conducted adjacent to and deeper than an existing footing. Recommendations for special excavation measures are provided in the following sections.
- 7.14.4 Where temporary slopes are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction slopes are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. Geocon personnel should inspect The soils exposed in the cut slopes should be inspected during excavation by our personnel and the contractor's competent person so that modifications of the slopes can be made if variations in the soil conditions occur. All excavations should be stabilized within 30 days of initial excavation.

7.15 Footing Construction Adjacent to Existing Footings

- 7.15.1 It is recommended that this project be mass graded prior to performing any footing excavations adjacent to existing foundations. It is recommended that the initial temporary excavation along the existing structure be sloped back at a uniform 1:1 (H:V) slope gradient to a depth of 5 feet as indicated in Phase 1 of the detail provided on the following page.
- 7.15.2 Once the grading has been completed to the finished pad elevation as indicated in Phase 2 (see detail on the following page), Geocon will produce a certified compaction report for the building pad, which allow for the commencement of foundation excavations.

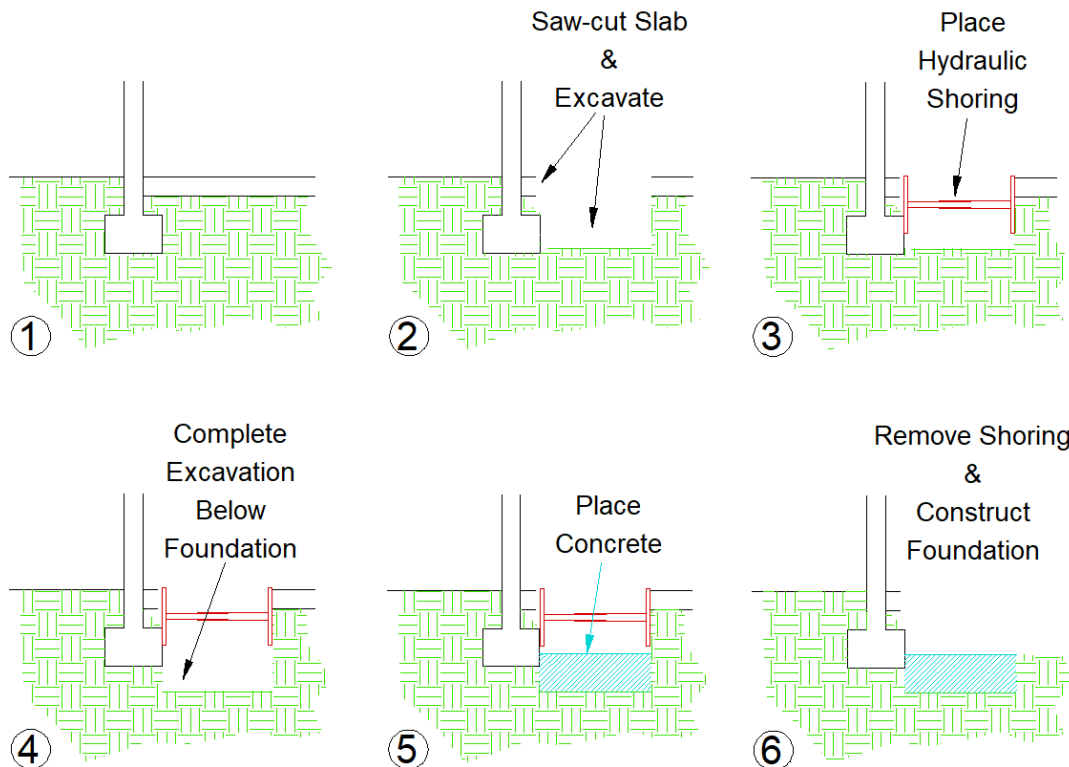
- 7.15.3 Interior foundations will derive support in the newly placed engineered fill; however, perimeter foundations along the existing structure should be deepened to derive support directly in the competent alluvium generally found at and below a depth of 5 feet per the recommendations herein. It is recommended that foundations achieve a minimum embedment of 12 inches into the recommended bearing material. Foundations along the existing structure may be constructed in two phases using special excavation techniques, such as trench shoring, to create temporary excavations and quickly restore the majority of the support of the existing foundations. Recommendations for trench shoring are provided in the following section.
- 7.15.4 The first phase of foundation construction will be to excavate a temporary excavation. The lower portion of the excavation, once approved by Geocon, can be backfilled with structural concrete up to the desired bottom of foundation depth (Phase 3). The concrete should be of greater than or equal strength of the Phase 4 structural foundation concrete. The project structural engineer should determine if the Phase 3 concrete pour requires any reinforcing and/or a key between the two pours. The excavation should be backfilled on the same day the excavation is opened. The upper portion of the excavation will remain open for monolithic construction of the Phase 4 structural foundation atop the initial Phase 3 concrete.
- 7.15.5 The final foundation and slab construction detail is provided as Phase 4 below. A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer, geotechnical engineer, and building official in attendance. Special soil handling and construction requirements can be discussed at that time.

CONSTRUCTION PHASING DETAIL



7.16 Trench Shoring

7.16.1 To protect the existing footings, hydraulic trench shoring may be implemented where excavations will extend below existing foundations. The new excavation may be conducted adjacent to a foundation but should not extend below the foundation until the shoring is installed. Once shoring is installed the excavation can be completed. Once concrete is placed to an elevation that is slightly above the bottom of the existing adjacent foundation, the shoring may be removed and the new foundation constructed. See illustration below.



7.16.2 It is recommended that an equivalent fluid pressure based on the table below, be utilized for design of hydraulic shoring.

HEIGHT OF SHORED EXCAVATION (FEET)	EQUIVALENT FLUID PRESSURE (Pounds Per Cubic Foot) (ACTIVE PRESSURE)	EQUIVALENT FLUID PRESSURE (Pounds Per Cubic Foot) (AT-REST PRESSURE)
Up to 6	25	52

7.16.3 It is very important to note that active pressures can only be achieved when movement in the soil (earth wall) occurs. If movement in the soil is not acceptable, such as adjacent to an existing structure, the at-rest pressure should be considered for design purposes.

7.16.4 A qualified engineer should be retained to review and prepare a shoring plan in accordance with the shoring manufacture's specifications.

7.16.5 Additional pressure should be added for a surcharge condition due to adjacent structures and should be designed for each condition as the project progresses. Recommendations for the incorporation of surcharges are provided in Section 7.17 of this report.

7.17 Surcharge from Adjacent Structures and Improvements

7.17.1 Additional pressure should be added for a surcharge condition due to sloping ground, vehicular traffic or adjacent structures and should be designed for each condition as the project progresses.

7.17.2 It is recommended that line-load surcharges from adjacent wall footings, use horizontal pressures generated from NAV-FAC DM 7.2. The governing equations are:

$$\begin{aligned} & \text{For } x/H \leq 0.4 \\ & \sigma_H(z) = \frac{0.20 \times \left(\frac{z}{H}\right)}{\left[0.16 + \left(\frac{z}{H}\right)^2\right]^2} \times \frac{Q_L}{H} \\ & \text{and} \\ & \text{For } x/H > 0.4 \\ & \sigma_H(z) = \frac{1.28 \times \left(\frac{x}{H}\right)^2 \times \left(\frac{z}{H}\right)}{\left[\left(\frac{x}{H}\right)^2 + \left(\frac{z}{H}\right)^2\right]^2} \times \frac{Q_L}{H} \end{aligned}$$

where x is the distance from the face of the excavation or wall to the vertical line-load, H is the distance from the bottom of the footing to the bottom of excavation or wall, z is the depth at which the horizontal pressure is desired, Q_L is the vertical line-load and $\sigma_H(z)$ is the horizontal pressure at depth z .

- 7.17.3 It is recommended that vertical point-loads, from construction equipment outriggers or adjacent building columns use horizontal pressures generated from NAV-FAC DM 7.2. The governing equations are:

$$\begin{aligned} & \text{For } x/H \leq 0.4 \\ & \sigma_H(z) = \frac{0.28 \times \left(\frac{z}{H}\right)^2}{\left[0.16 + \left(\frac{z}{H}\right)^2\right]^3} \times \frac{Q_P}{H^2} \\ & \text{and} \\ & \text{For } x/H > 0.4 \\ & \sigma_H(z) = \frac{1.77 \times \left(\frac{x}{H}\right)^2 \times \left(\frac{z}{H}\right)^2}{\left[\left(\frac{x}{H}\right)^2 + \left(\frac{z}{H}\right)^2\right]^3} \times \frac{Q_P}{H^2} \\ & \text{then} \\ & \sigma'_H(z) = \sigma_H(z) \cos^2(1.1\theta) \end{aligned}$$

where x is the distance from the face of the excavation/wall to the vertical point-load, H is distance from the outrigger/bottom of column footing to the bottom of excavation, z is the depth at which the horizontal pressure is desired, Q_P is the vertical point-load, $\sigma_H(z)$ is the horizontal pressure at depth z , θ is the angle between a line perpendicular to the excavation/wall and a line from the point-load to location on the excavation/wall where the surcharge is being evaluated, and $\sigma'_H(z)$ is the horizontal pressure at depth z .

7.18 Stormwater Infiltration

- 7.18.1 During the site exploration on September 12, 2023, borings B2, B3 and B4 were utilized to perform percolation testing. Borings B2 and B4 were over-excavated to collect soil samples and were backfilled to the indicated depth, with a bentonite seal placed at the bottom of the excavation. Slotted casing was placed in the borings, which were then filled with water to pre-saturate the soils. The casings were refilled with water and percolation test readings were performed after repeated flooding of the cased excavation.
- 7.18.2 Based on the test results, the field-measured percolation rate and the design infiltration rate are provided in the following table. The Reduction Factor (Rf), to convert the field-measured percolation rate to an infiltration rate, is also shown in the table below. This value has been calculated in accordance with the Small Diameter Boring Infiltration Test Procedure in the County of Los Angeles Department of Public Works GMED *Guidelines for Design, Investigation, and Reporting Low Impact Development Stormwater Infiltration* (June 2021). Calculations of the percolation rate, reduction factor, and infiltration rate are provided on Figures 15 through 17.

Boring	Infiltration Depth (ft)	Field Measured Percolation Rate (in/hour)	Reduction Factor (Rf)	Design Infiltration Rate (in / hour)
B2	30 – 40	0.29	3.0	0.10
B3	10 – 15	1.09	3.0	0.36
B4	30 – 40	0.43	3.0	0.13

- 7.18.3 The results of the percolation testing in borings B2 and B4 indicate that the infiltration rate within the alluvial soils at depths of approximately 30 to 40 feet is less than the minimum accepted infiltration rate of 0.3 inches per hour. Therefore, based on the results of percolation testing performed at the site, a deep stormwater infiltration system is not recommended for this project.
- 7.18.4 The results of the percolation testing in boring B3 indicate that the soils at the depths in the above table are conducive to infiltration. It is our opinion that the soil zone encountered at the depth and location of boring B3 as listed in the table above are suitable for infiltration of stormwater.
- 7.18.5 It is our further opinion that infiltration of stormwater and will not induce excessive hydro-consolidation (see Figures B6 through B14), will not create a perched groundwater condition, will not affect soil structure interaction of existing or proposed foundations due to expansive soils, will not saturate soils supported by existing or proposed retaining walls, and will not increase the potential for liquefaction. Resulting settlements are anticipated to be less than ¼ inch, if any.
- 7.18.6 The infiltration system must be located such that the closest distance between an adjacent foundation is at least 15 feet in all directions from the zone of saturation. The zone of saturation may be assumed to project downward from the discharge of the infiltration facility at a gradient of 1:1. Additional property line or foundation setbacks may be required by the governing jurisdiction and should be incorporated into the stormwater infiltration system design as necessary.
- 7.18.7 Where the 15-foot horizontal setback cannot be maintained between the infiltration system and an adjacent footing, and the infiltration system penetrates below the foundation influence line, the proposed stormwater infiltration system must be designed to resist the surcharge from the adjacent foundation. The foundation surcharge line may be assumed to project down away from the bottom of the foundation at a 1:1 gradient. The stormwater infiltration system must still be sufficiently deep to maintain the 15-foot vertical offset between the bottom of the footing and the zone of saturation.

- 7.18.8 Subsequent to the placement of the infiltration system, it is acceptable to backfill the resulting void space between the excavation sidewalls and the infiltration system with minimum two-sack slurry provided the slurry is not placed in the infiltration zone. It is recommended that pea gravel be utilized adjacent to the infiltration zone so communication of water to the soil is not hindered.
- 7.18.9 Due to the preliminary nature of the project at this time, the type of stormwater infiltration system and location of the stormwater infiltration systems has not yet been determined. The design drawings should be reviewed and approved by the Geotechnical Engineer. The installation of the stormwater infiltration system should be observed and approved by the Geotechnical Engineer (a representative of Geocon).

7.19 Surface Drainage

- 7.19.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change in the original designed engineering properties. Proper drainage should be maintained at all times.
- 7.19.2 All site drainage should be collected and controlled in non-erosive drainage devices. Drainage should not be allowed to pond anywhere on the site, and especially not against any foundation or retaining wall. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2022 CBC 1804.4 or other applicable standards. In addition, drainage should not be allowed to flow uncontrolled over any descending slope. Discharge from downspouts, roof drains and scuppers are not recommended onto unprotected soils within 5 feet of the building perimeter. Planters which are located adjacent to foundations should be sealed to prevent moisture intrusion into the soils providing foundation support. Landscape irrigation is not recommended within 5 feet of the building perimeter footings except when enclosed in protected planters.
- 7.19.3 Positive site drainage should be provided away from structures, pavement, and the tops of slopes to swales or other controlled drainage structures. The building pad and pavement areas should be fine graded such that water is not allowed to pond.

- 7.19.4 Landscaping planters immediately adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. Either a subdrain, which collects excess irrigation water and transmits it to drainage structures, or impervious above-grade planter boxes should be used. In addition, where landscaping is planned adjacent to the pavement, it is recommended that consideration be given to providing a cutoff wall along the edge of the pavement that extends at least 12 inches below the base material.

7.20 Plan Review

- 7.20.1 Grading, foundation, and, if necessary, shoring plans should be reviewed by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to finalization to verify that the plans have been prepared in substantial conformance with the recommendations of this report and to provide additional analyses or recommendations.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon West, Inc. should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon West, Inc.
2. This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.
3. The findings of this report are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.
4. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

LIST OF REFERENCES

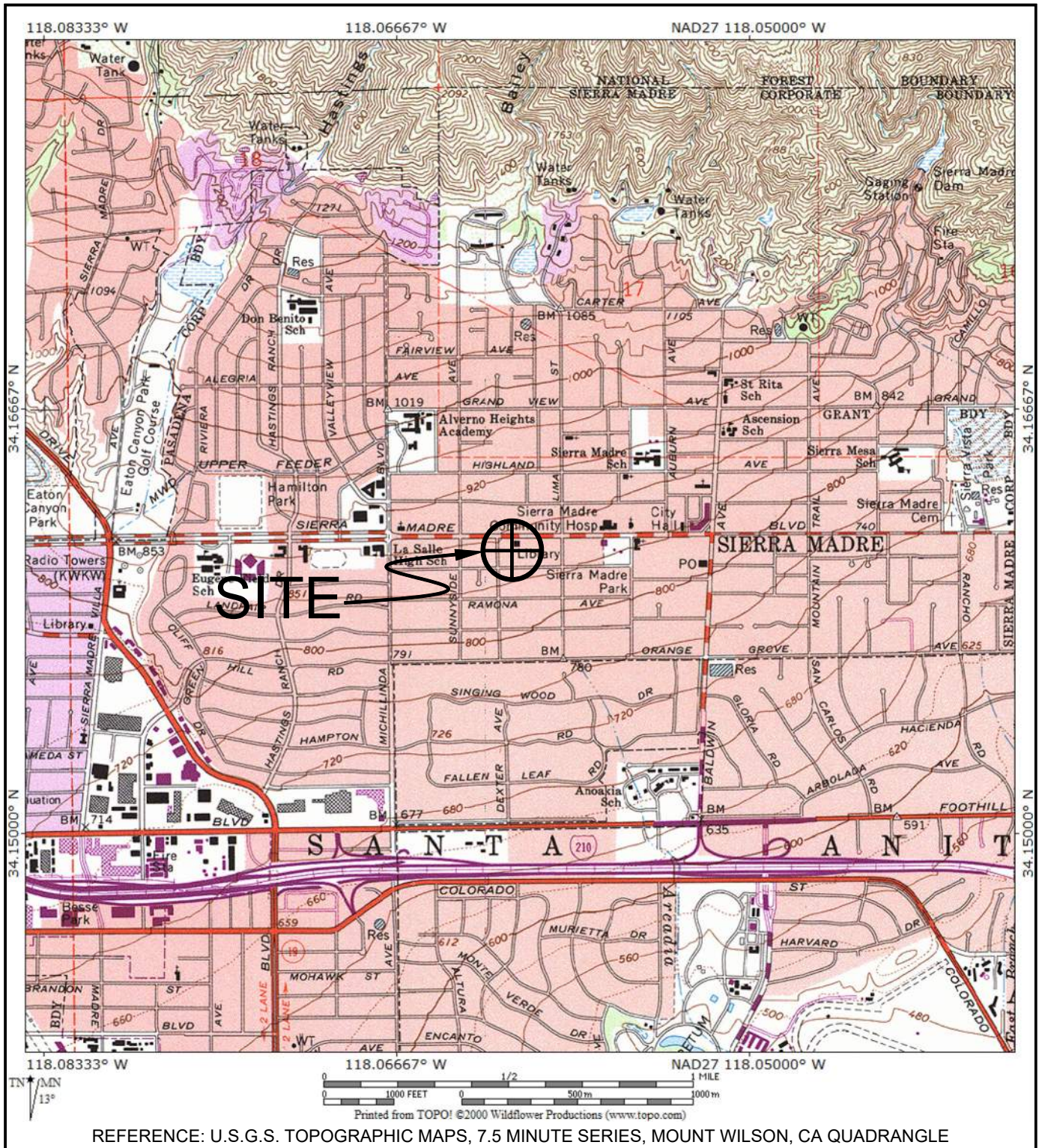
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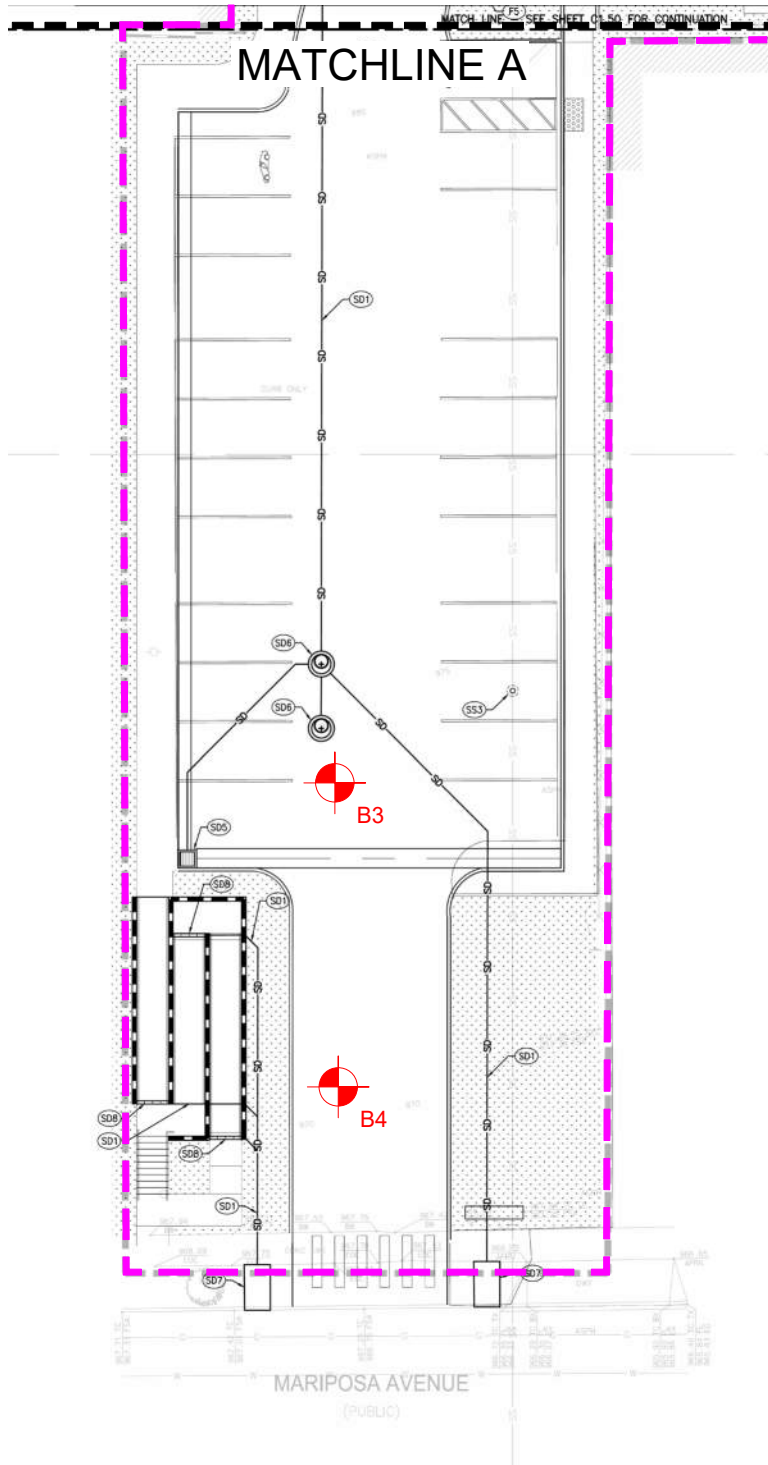
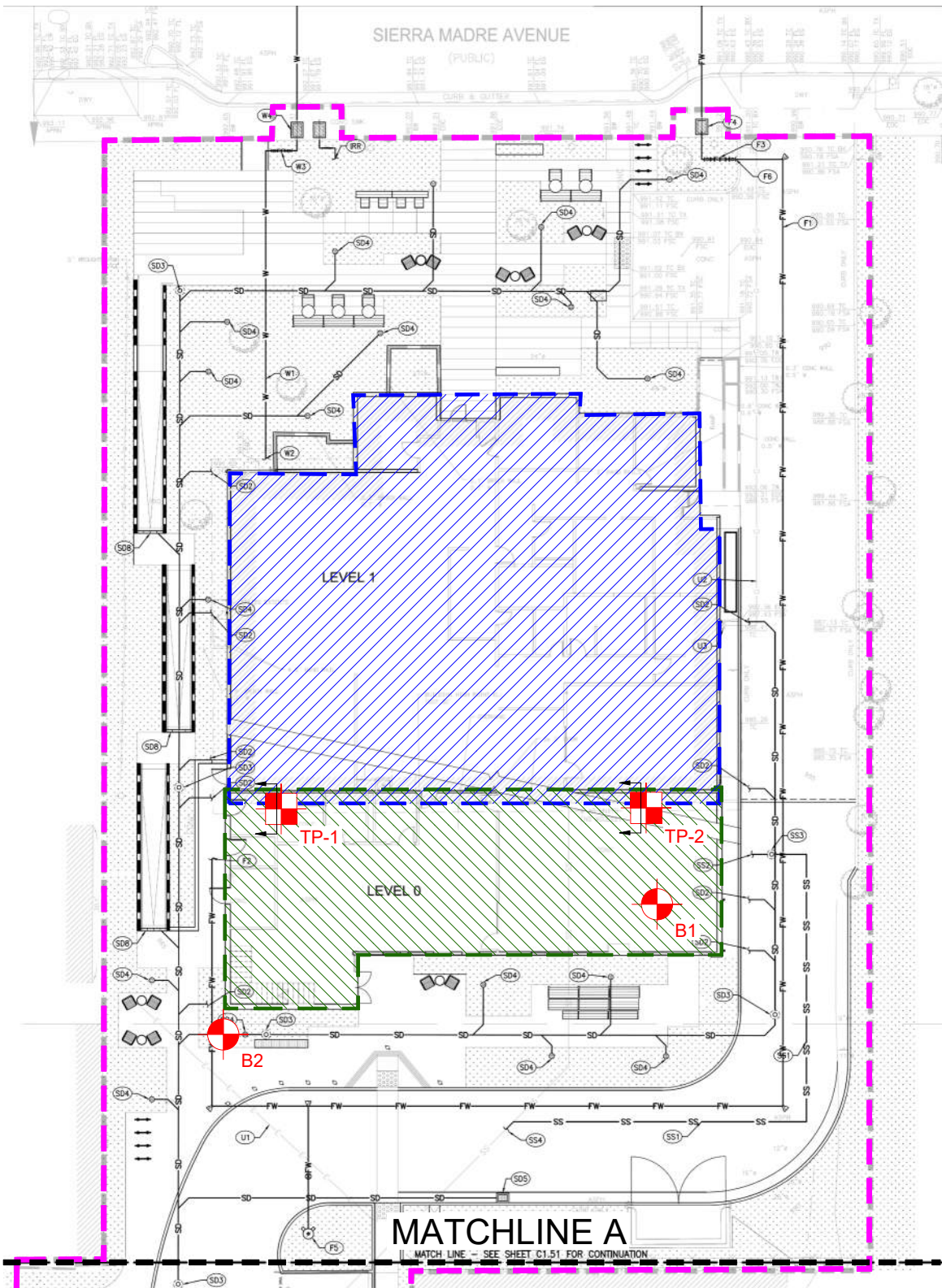
VICINITY MAP

440 WEST SIERRA MADRE BOULEVARD
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OCT 2023

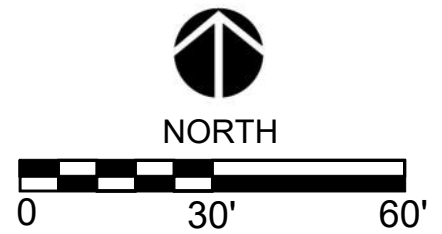
PROJECT NO. W1817-06-01

FIG. 1



LEGEND

-  TP-2 Approximate Test Pit Location and ID
-  B4 Approximate Boring Location and ID
-  Property Line
-  Limits of Existing Structure
-  Limits of Addition
-  Test Pit Section (See Fig 12)



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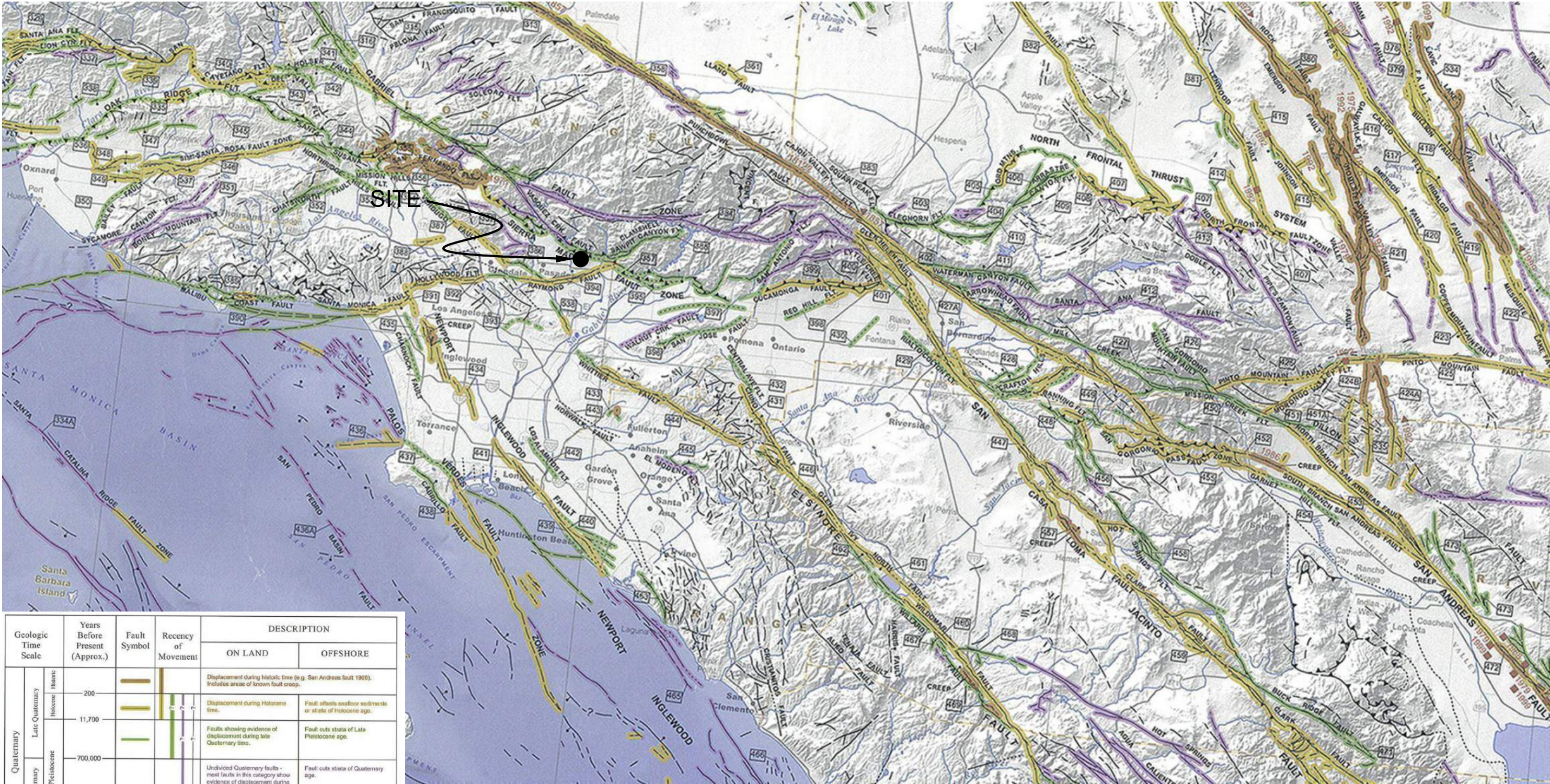
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SITE PLAN

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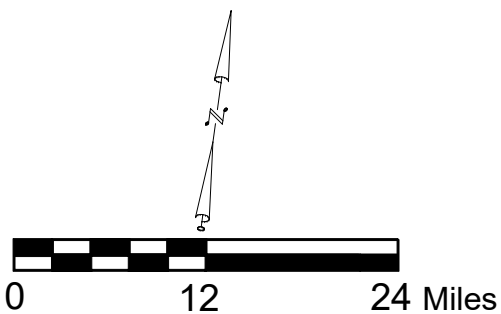
OCT. 2023 PROJECT NO. W1817-06-01 FIG. 2

Reference: Jennings, C.W. and Bryant, W. A., 2010, Fault Activity Map of California, California Geological Survey Geologic Data Map No. 6.



Geologic Time Scale	Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION	
				ON LAND	OFFSHORE
Quaternary	Late Quaternary Holocene Heavier			Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
	11,700			Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
	Pleistocene			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
Pre-Quaternary	700,000			Undisplaced Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
	1,600,000*			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.
	4.5 billion (Age of Earth)				

* Quaternary now recognized as extending to 2.6 Ma (Walker and Geissman, 2009). Quaternary faults in this map were established using the previous 1.8 Ma criterion.



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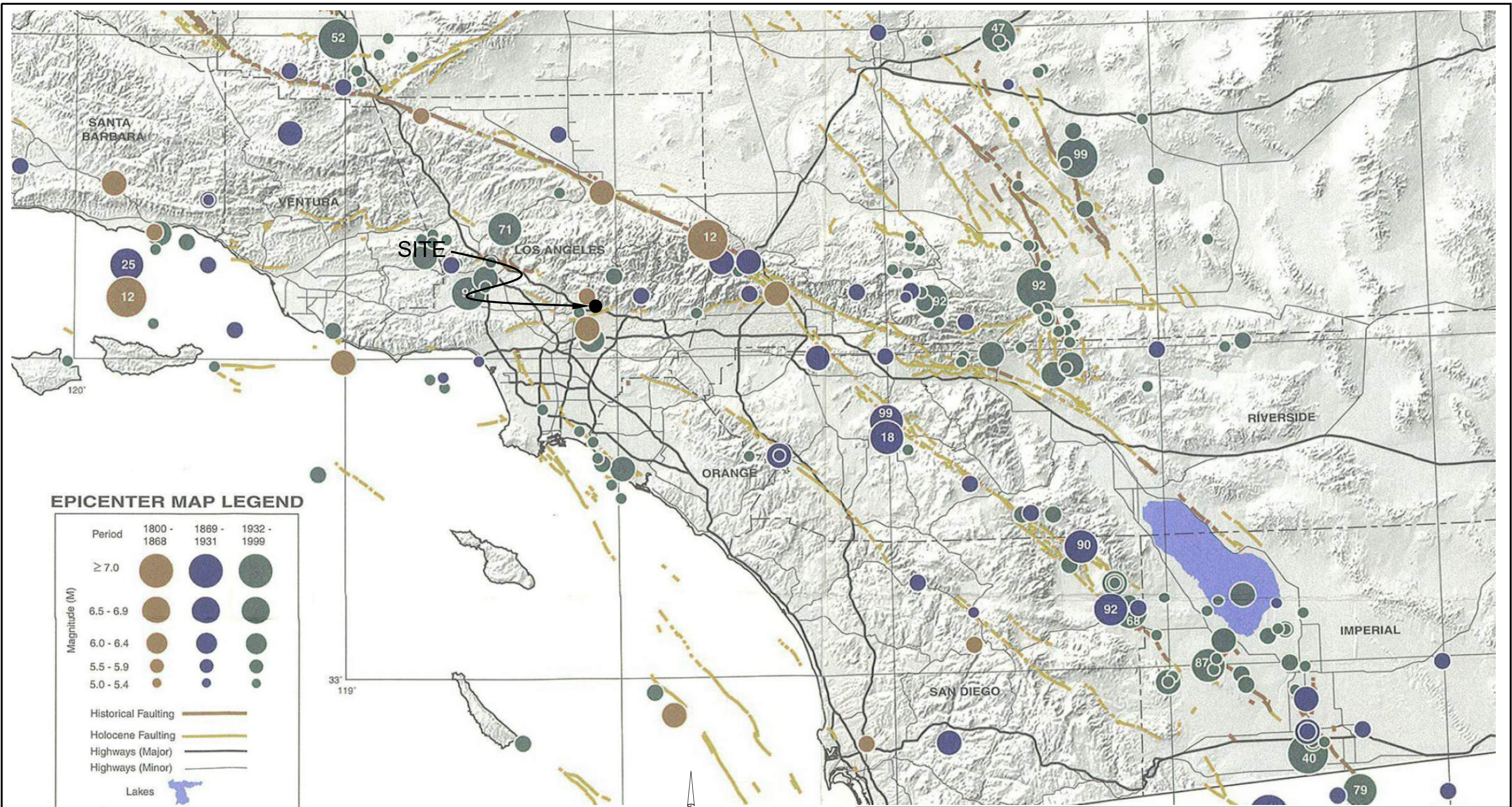
REGIONAL FAULT MAP

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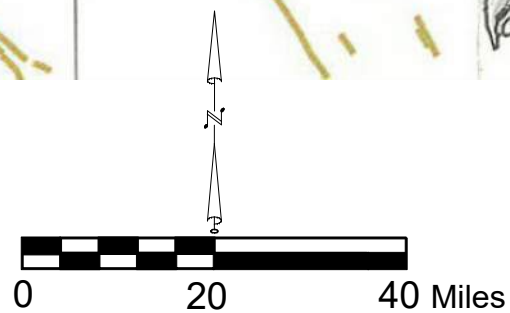
FIG. 3



EPICENTER MAP LEGEND

Period	1800 - 1868	1869 - 1931	1932 - 1999
≥ 7.0			
6.5 - 6.9			
6.0 - 6.4			
5.5 - 5.9			
5.0 - 5.4			
Historical Faulting			
Holocene Faulting			
Highways (Major)			
Highways (Minor)			
Lakes			
	Last two digits of M ≥ 6.5 earthquake year		

Reference: Topozada, T., Branum, D., Petersen, M., Hallstrom, C., Cramer, C., and Reichle, M., 2000, Epicenters and Areas Damaged by M≥5 California Earthquakes, 1800 - 1999, California Geological Survey, Map Sheet 49.



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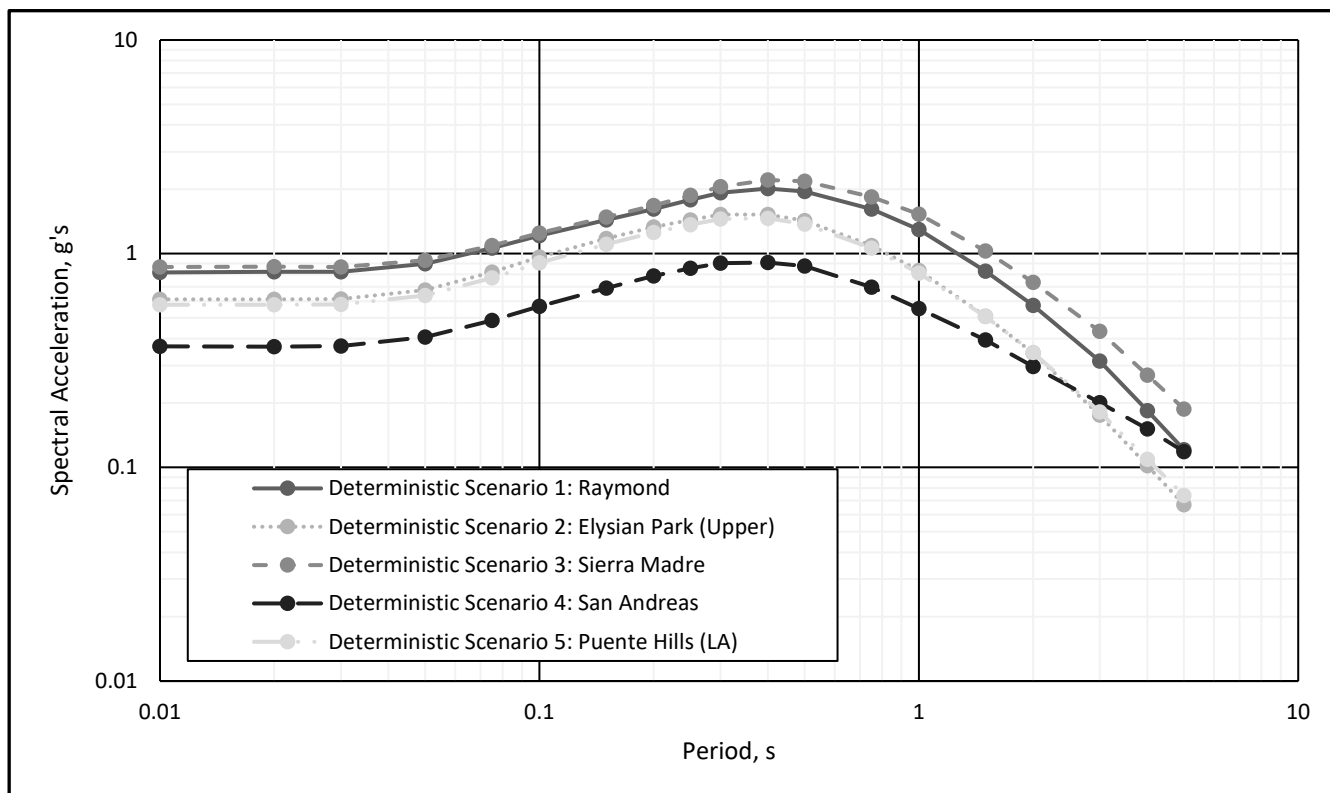
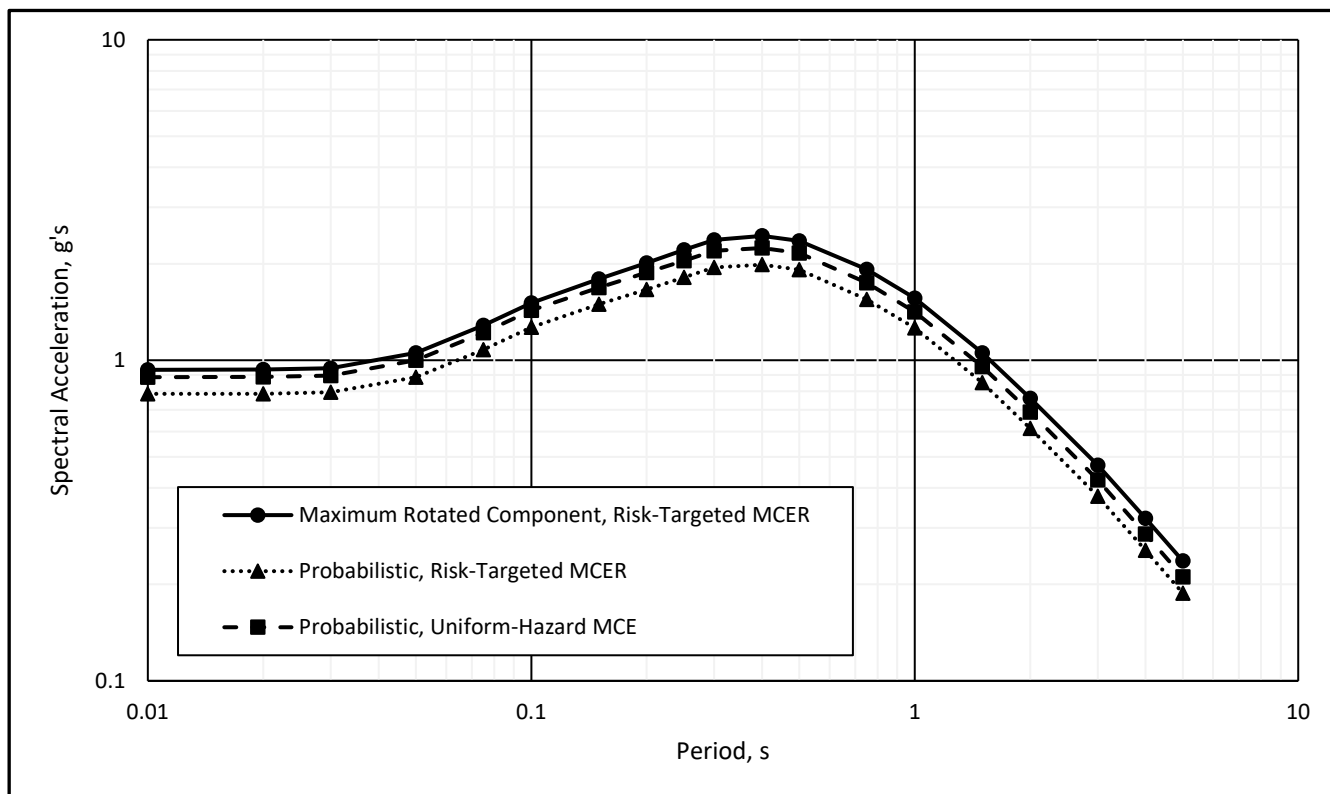
REGIONAL SEISMICITY MAP

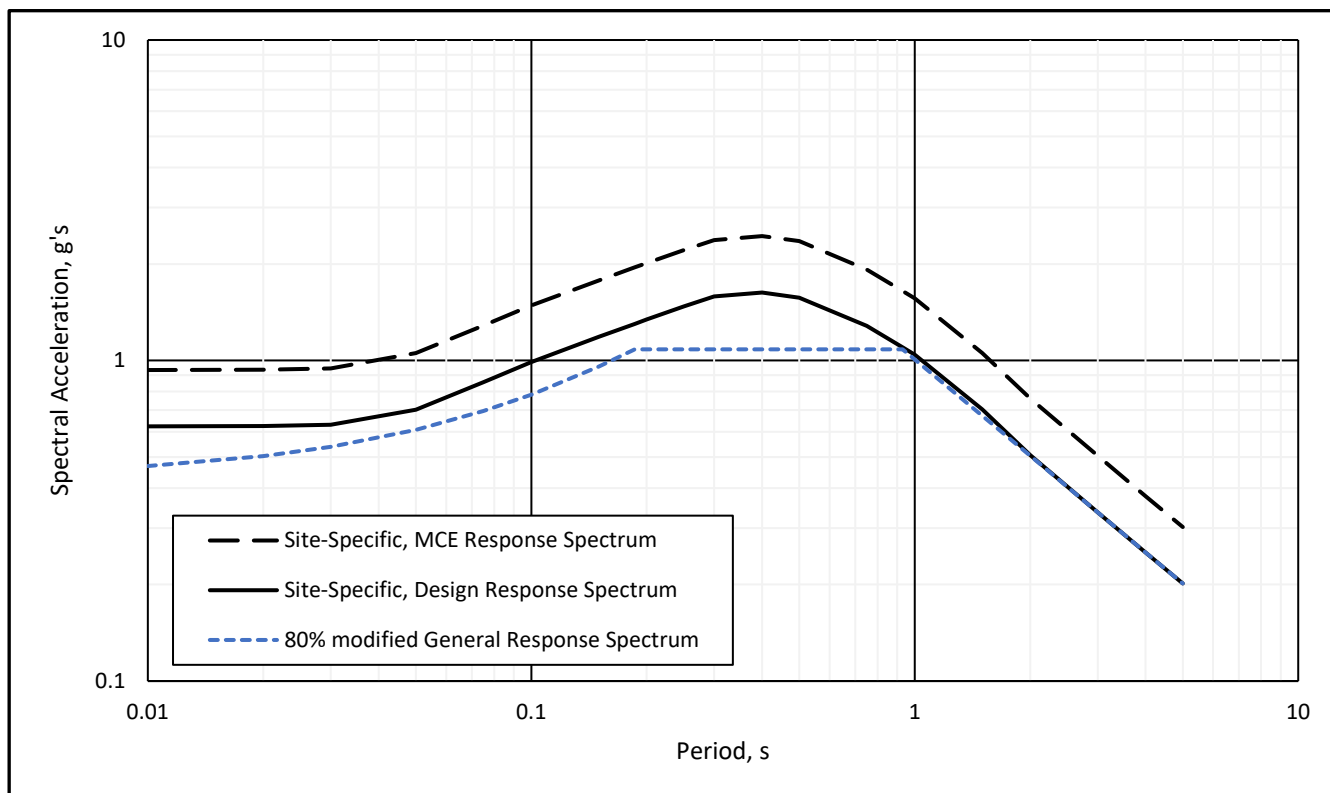
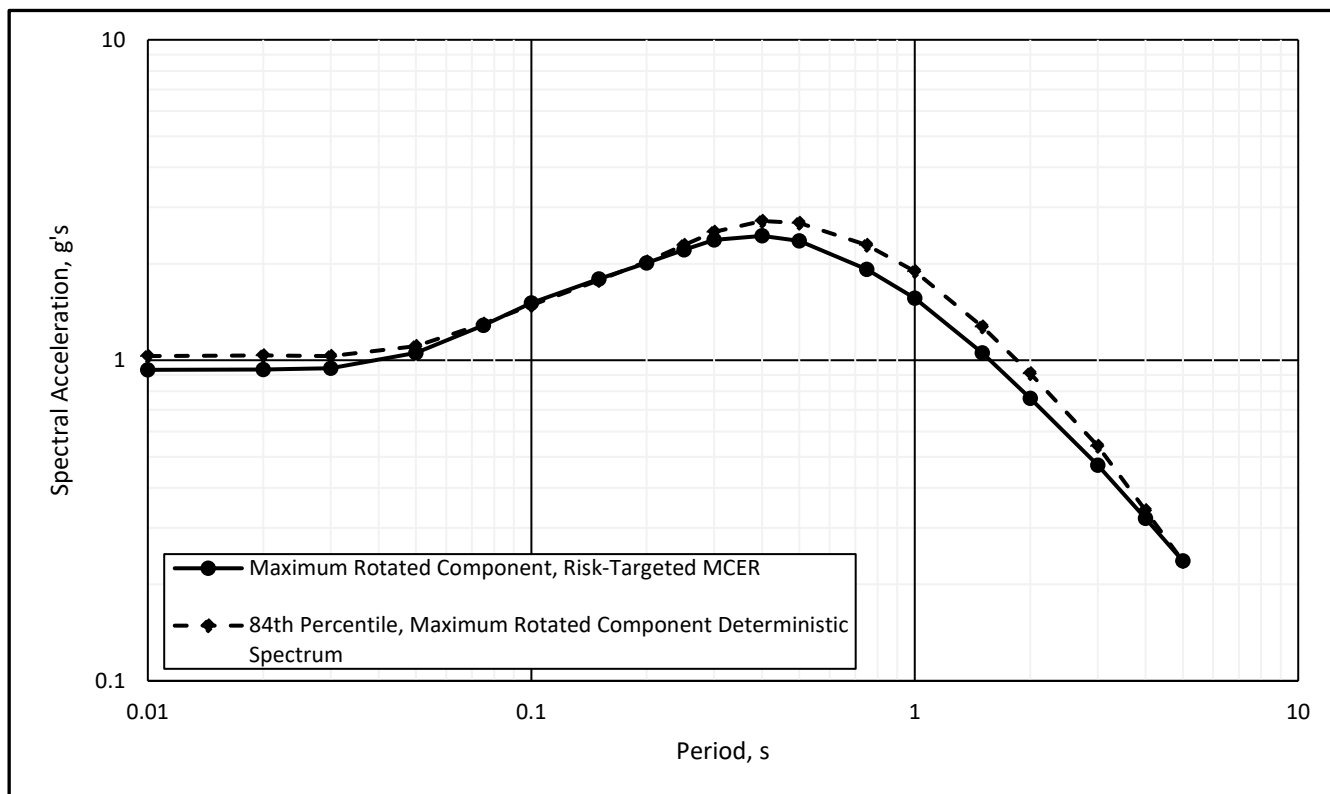
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FIG.4





DESIGN RESPONSE SPECTRUM

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Figure 6

Spectral Period (seconds)	Probabilistic Uniform-Hazard	Risk-Targeted, Probabilistic	Risk Factor, Cr	Maximum-Rotated Component Scale Factor	MRC, Risk-Targeted Probabilistic	84th Percentile, Deterministic	Site-Specific Design Earthquake	80% Modified General Response Spectrum	Site-Specific Maximum Considered Earthquake
0.01	0.887	0.785	0.886	1.19	0.935	1.032	0.623	0.468	0.935
0.02	0.888	0.787	0.886	1.19	0.936	1.035	0.624	0.503	0.936
0.03	0.897	0.795	0.886	1.19	0.946	1.031	0.630	0.538	0.946
0.05	1.000	0.886	0.886	1.19	1.054	1.108	0.703	0.608	1.054
0.08	1.218	1.080	0.886	1.19	1.285	1.301	0.856	0.696	1.285
0.10	1.432	1.268	0.886	1.19	1.509	1.484	0.990	0.783	1.484
0.15	1.688	1.495	0.886	1.20	1.794	1.779	1.186	0.958	1.779
0.19	--	--	--	--	--	--	1.302	1.084	1.953
0.20	1.879	1.665	0.886	1.21	2.015	2.032	1.343	1.084	2.015
0.25	2.048	1.815	0.886	1.22	2.214	2.292	1.476	1.084	2.214
0.30	2.197	1.948	0.887	1.22	2.376	2.513	1.584	1.084	2.376
0.40	2.241	1.988	0.887	1.23	2.445	2.721	1.630	1.084	2.445
0.50	2.159	1.916	0.888	1.23	2.357	2.684	1.571	1.084	2.357
0.75	1.745	1.550	0.889	1.24	1.923	2.287	1.282	1.084	1.923
0.93	--	--	--	--	--	--	1.099	1.084	1.648
1.0	1.418	1.262	0.890	1.24	1.564	1.896	1.043	1.008	1.564
1.5	0.957	0.851	0.890	1.24	1.056	1.275	0.704	0.672	1.056
2.0	0.689	0.613	0.890	1.24	0.761	0.912	0.507	0.504	0.761
3.0	0.423	0.377	0.890	1.25	0.471	0.541	0.336	0.336	0.504
4.0	0.287	0.255	0.890	1.26	0.322	0.340	0.252	0.252	0.378
5.0	0.211	0.188	0.890	1.26	0.237	0.236	0.202	0.202	0.302

$$SM_5 = \frac{2.200}{1} \text{ g}$$

$$SM_1 = \frac{1.584}{1} \text{ g}$$

$$SD_5 = \frac{1.467}{1} \text{ g}$$


$$SD_1 = \frac{1.056}{1} \text{ g}$$

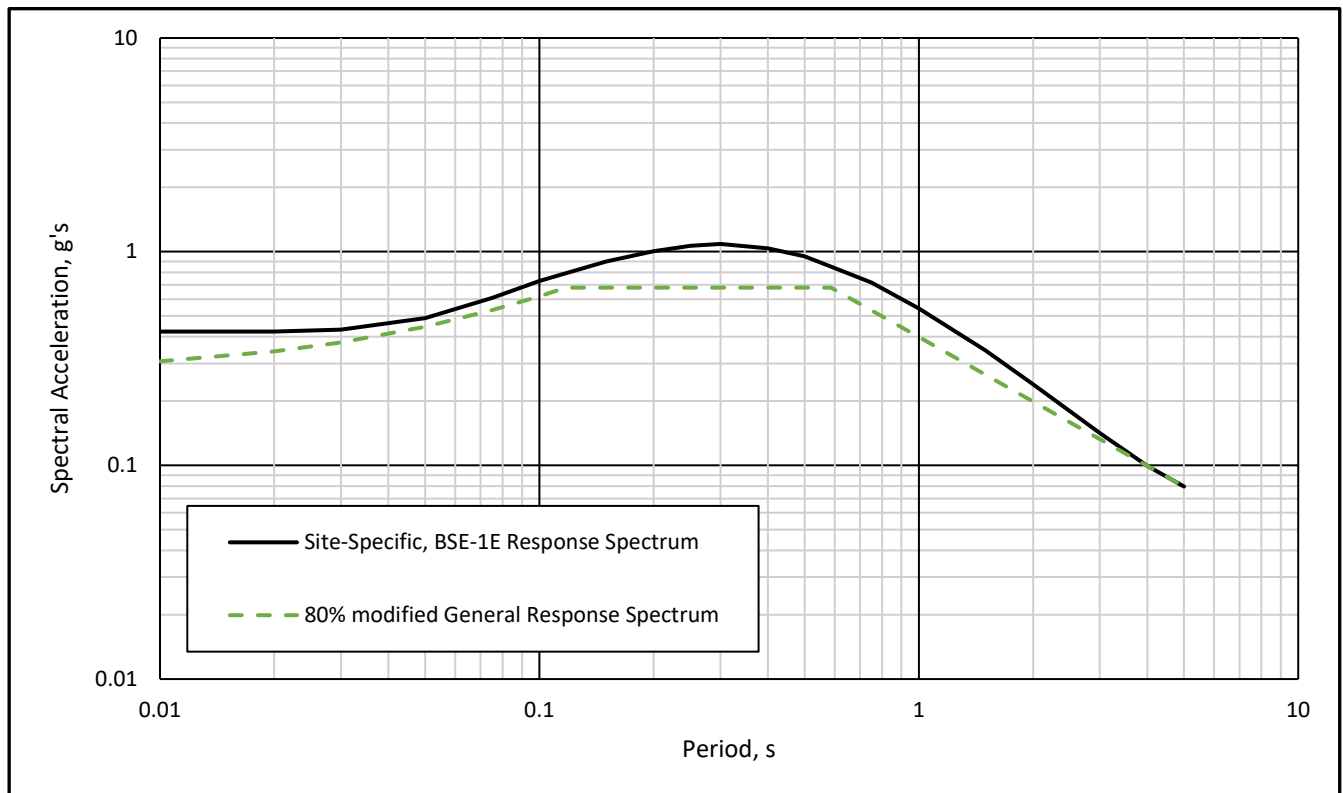
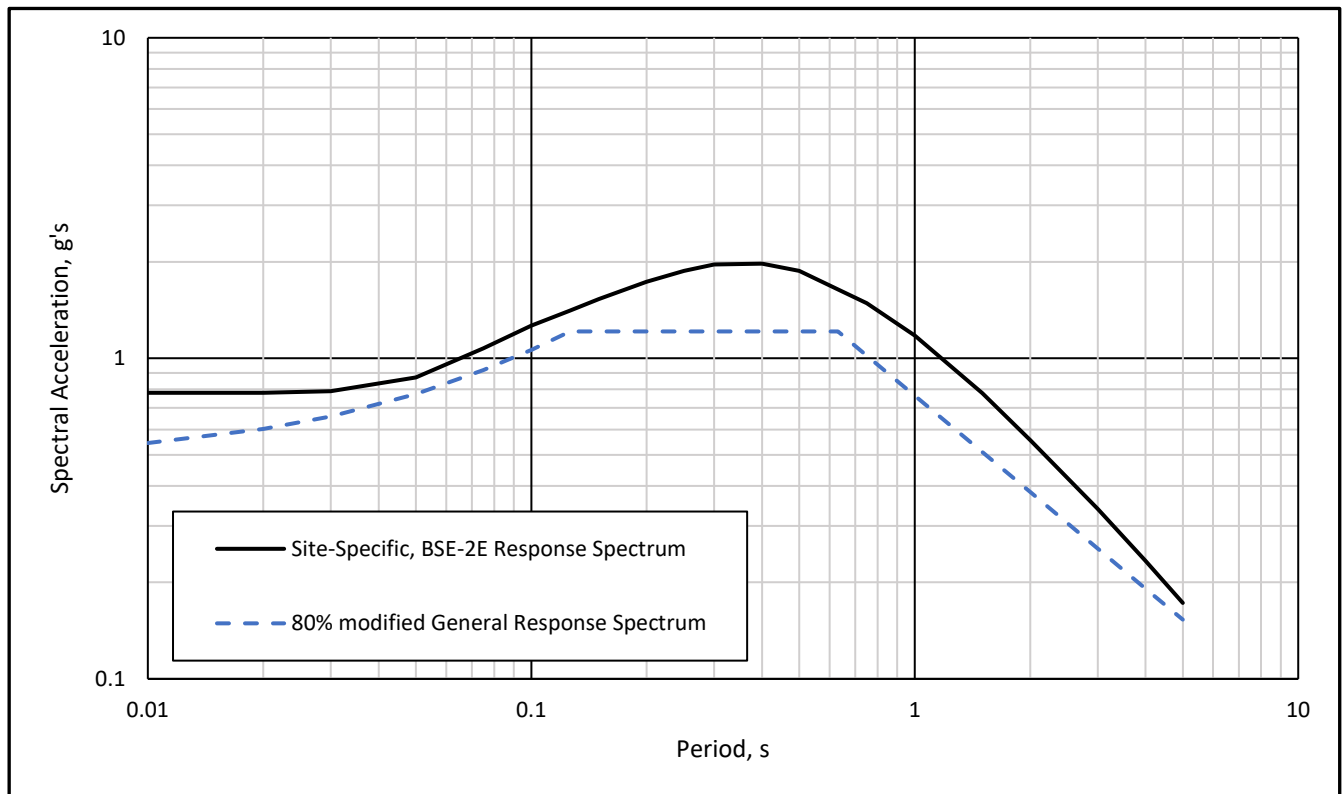
Reference: ASCE 7-16 21.4 DESIGN ACCELERATION PARAMETERS

Where the site-specific procedure is used to determine the design ground motion in accordance with Section 21.3, the parameter S_{D5} shall be taken as 90% of the maximum spectral acceleration, S_a , obtained from the site-specific spectrum, at any period within the range from 0.2 to 5 s, inclusive. The parameter S_{D1} shall be taken as the maximum value of the product, TS_a , for periods from 1 to 2 s for sites with $V_{s,30} > 1,200$ ft/s ($v_{s,30} > 365.76$ m/s) and for periods from 1 to 5 s for sites with $V_{s,30} \leq 1,200$ ft/s ($v_{s,30} \leq 365.76$ m/s). The parameters S_{M5} and S_{M1} shall be taken as 1.5 times S_{D5} and S_{D1} , respectively. The values so obtained shall not be less than 80% of the values determined in accordance with Section 11.4.3 for S_{M5} and S_{M1} and Section 11.4.5 for S_{D5} and S_{D1} .

Spectral acceleration values reported in units of "g".

"--" Indicates that spectral period was not used at that calculation step

	DESIGN RESPONSE SPECTRUM		Project No.:	W1817-06-01
			440 WEST SEIRRA MADRE BOULEVARD SIERRA MADRE, CALIFORNIA	
	Checked by: JJK		OCT. 2023	Figure 7



DESIGN RESPONSE SPECTRUM

Checked by: JJK

Project No.: W1817-06-01

440 WEST SEIRRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

Figure 8


Spectral Period (seconds)	Probabilistic Uniform- Hazard	Maximum- Rotated Component Scale Factor	MRC, Probabilistic	80% Modified General Response Spectrum	Site-Specific BSE-2E Earthquake
0.000	--	--	--	--	--
0.010	0.656	1.190	0.781	0.544	0.781
0.020	0.656	1.190	0.781	0.602	0.781
0.030	0.664	1.190	0.790	0.659	0.790
0.050	0.733	1.190	0.873	0.774	0.873
0.075	0.903	1.190	1.075	0.918	1.075
0.100	1.062	1.190	1.264	1.062	1.264
0.126	--	--	--	1.213	1.410
0.150	1.275	1.200	1.530	1.213	1.530
0.200	1.434	1.210	1.735	1.213	1.735
0.250	1.536	1.220	1.874	1.213	1.874
0.300	1.609	1.220	1.963	1.213	1.963
0.400	1.605	1.230	1.974	1.213	1.974
0.500	1.524	1.230	1.874	1.213	1.874
0.631	--	--	--	1.213	1.640
0.750	1.197	1.240	1.485	1.020	1.485
1.000	0.950	1.240	1.178	0.765	1.178
1.500	0.628	1.240	0.779	0.510	0.779
2.000	0.448	1.240	0.556	0.383	0.556
3.000	0.271	1.250	0.339	0.255	0.339
4.000	0.185	1.260	0.234	0.191	0.234
5.000	0.137	1.260	0.173	0.153	0.173

$$\text{BSE-2E } SX_s = \frac{1.777}{g}$$

$$\text{BSE-2E } SX_1 = \frac{1.178}{g}$$

Spectral acceleration values reported in units of "g"

"--" Indicates that spectral period was not used at that calculation step

	RESPONSE SPECTRUM	Project No.:	W1817-06-01
		440 WEST SEIRRA MADRE BOULEVARD SIERRA MADRE, CALIFORNIA	
	Checked by: JJK	OCT. 2023	Figure 9


Spectral Period (seconds)	Probabilistic Uniform- Hazard	Maximum- Rotated Component Scale Factor	MRC, Probabilistic	80% Modified General Response Spectrum	Site-Specific BSE-1E Earthquake
0.00	--	--	--	--	--
0.01	0.356	1.190	0.423	0.307	0.423
0.02	0.356	1.190	0.423	0.341	0.423
0.03	0.362	1.190	0.431	0.376	0.431
0.05	0.411	1.190	0.489	0.445	0.489
0.08	0.510	1.190	0.607	0.532	0.607
0.10	0.613	1.190	0.730	0.619	0.730
0.12	--	--	--	0.679	0.793
0.15	0.750	1.200	0.900	0.679	0.900
0.20	0.831	1.210	1.006	0.679	1.006
0.25	0.875	1.220	1.067	0.679	1.067
0.30	0.891	1.220	1.087	0.679	1.087
0.40	0.843	1.230	1.037	0.679	1.037
0.50	0.77	1.23	0.953	0.679	0.953
0.59	--	--	--	0.679	0.852
0.75	0.58	1.24	0.717	0.531	0.717
1.00	0.44	1.24	0.543	0.398	0.543
1.50	0.28	1.24	0.345	0.265	0.345
2.00	0.19	1.24	0.240	0.199	0.240
3.00	0.11	1.25	0.142	0.133	0.142
4.00	0.08	1.26	0.097	0.100	0.100
5.00	0.06	1.26	0.071	0.080	0.080


$$\text{BSE-1E } SX_s = \frac{0.978}{1} g$$

$$\text{BSE-1E } SX_1 = \frac{0.543}{1} g$$

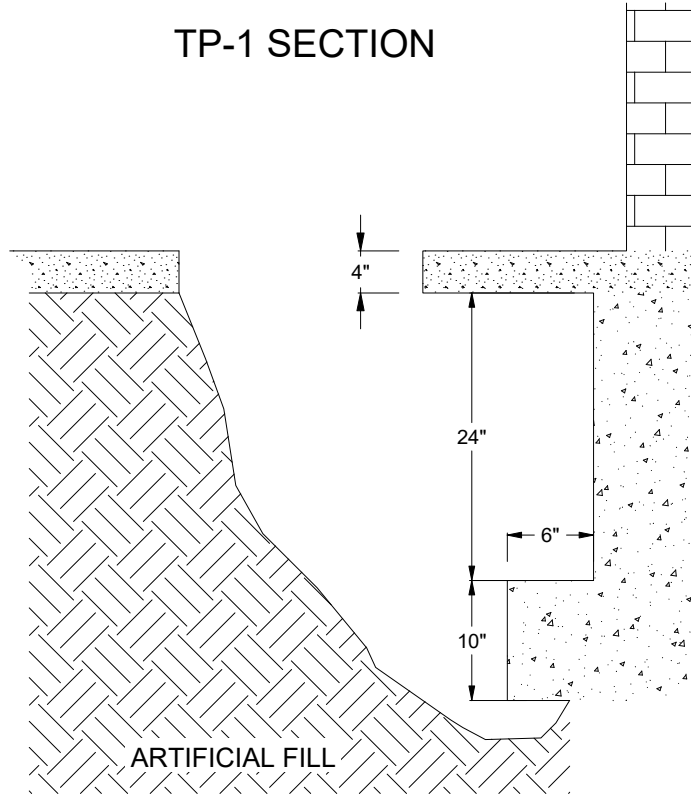
Spectral acceleration values reported in units of "g"

"--" Indicates that spectral period was not used at that calculation step

	RESPONSE SPECTRUM		Project No.:	W1817-06-01
			440 WEST SEIRRA MADRE BOULEVARD SIERRA MADRE, CALIFORNIA	
	Checked by: JJK		OCT. 2023	Figure 10

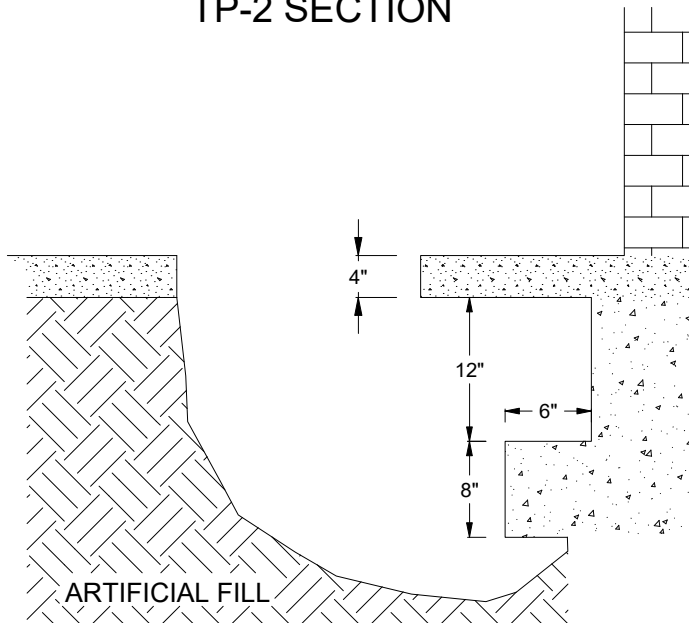
Parameter	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Reference
Parent Fault Name	Raymond	Elysian Park (Upper)	Sierra Madre	San Andreas	Puente Hills (LA)	--
Scenario Name	Raymond	Elysian Park (Upper)	Sierra Madre	San Andreas PK+CH+CC+BB+NM+ SM+NSB+SSB+BG+C	Puente Hills (LA)	BSSC Online Scenario Catalog
Earthquake Magnitude	6.71	6.65	7.16	8.18	6.95	BSSC Online Scenario Catalog
Fault Mechanism	Left Lateral	Reverse	Reverse	Right Lateral	Thrust	--
Fault Dip (°)	79	50	53	86.4	27	BSSC 2014 ¹
Fault Width	14.3	14.1	16	13.1	25.57	BSSC 2014 ¹
Rake (°)	60	90	90	180	90	BSSC 2014 ¹
Z _{TOR} (km)	0	3	0	0	2.1	BSSC 2014 ¹
Rrup (km)	2.44	10.62	1.58	36.56	14.33	--
Rjb (km)	0	5.72	1.58	36.56	9.31	--
Rx (km)	2.49	9.16	1.58	36.56	19.89	--
V _{s30} (m/s)	259	259	259	259	259	Average Site Class
Z _{1.0} (km)	0.15	0.15	0.15	0.15	0.15	SCEC Community Velocity Model Version 4, Iteration 26, Basin Depth
Z _{2.5} (km)	1.5	1.5	1.5	1.5	1.5	SCEC Community Velocity Model Version 4, Iteration 26, Basin Depth
1 - BSSC 2014, aka. UCERF3_EventSet_All on GitHub						
				DETERMINISTIC SCENARIO EVENTS		Project No.: W1817-06-01
						440 WEST SEIRRA MADRE BOULEVARD SIERRA MADRE, CALIFORNIA
				Checked by: JJK		OCT. 2023 Figure 11

TP-1 SECTION



Not To Scale

TP-2 SECTION



Not To Scale

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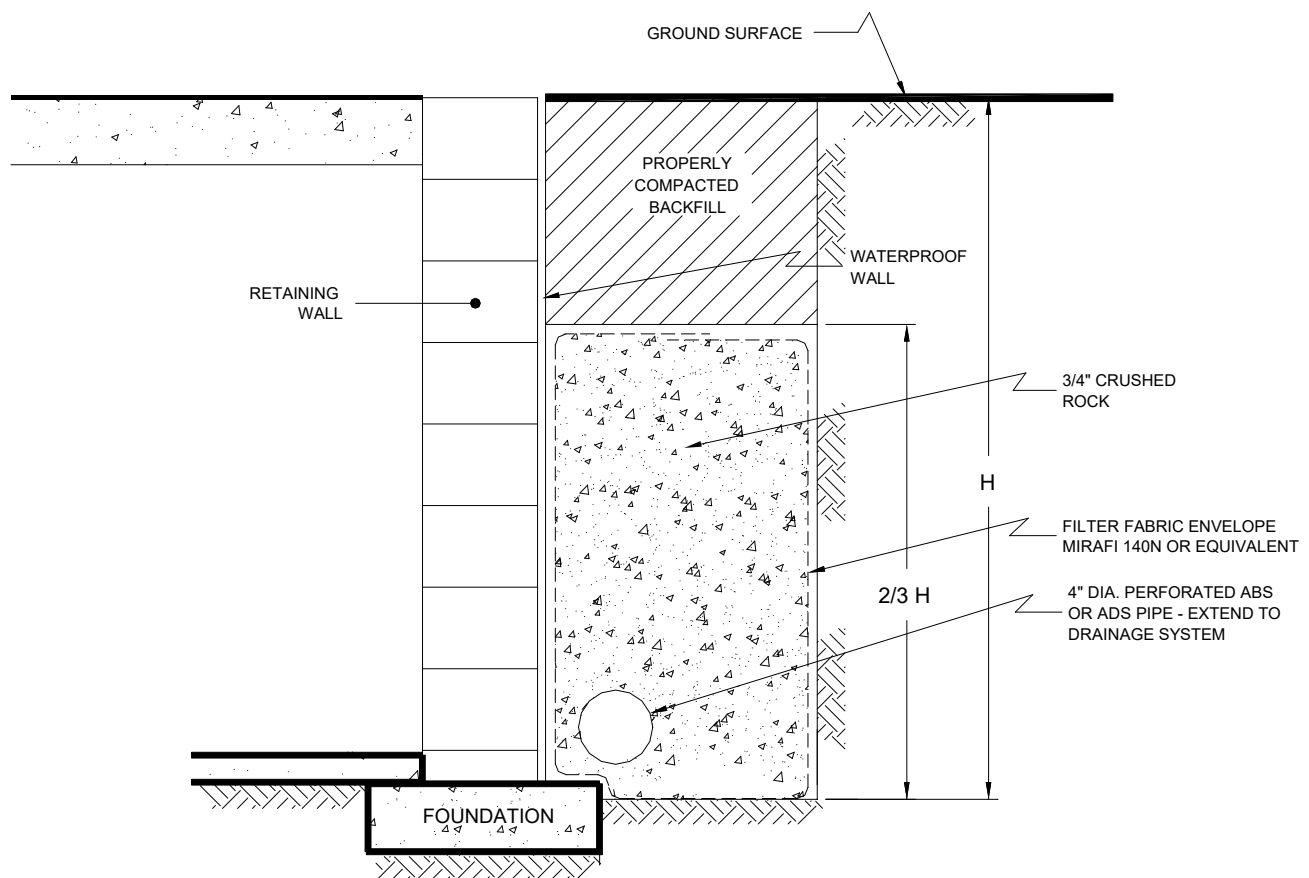
TEST PIT SECTIONS

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FIG. 12



NO SCALE

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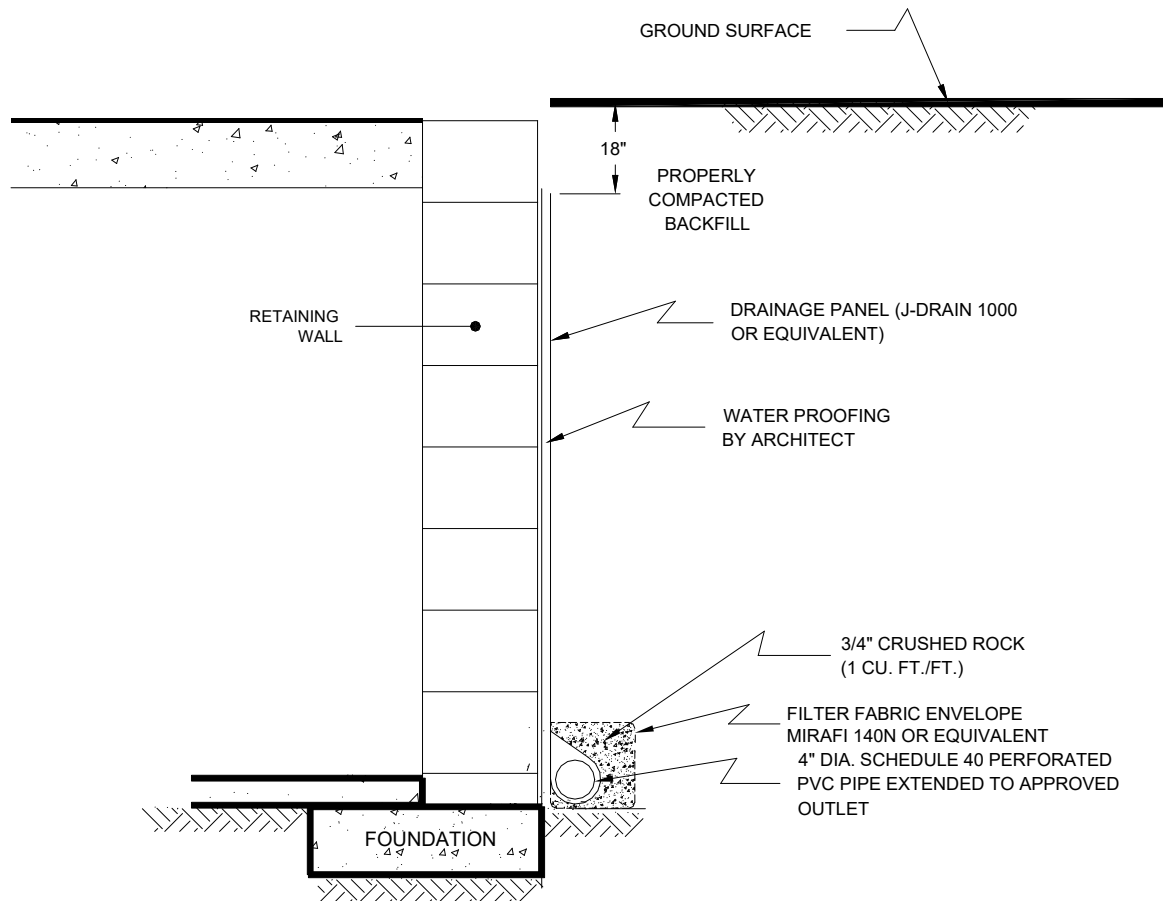
RETAINING WALL DRAIN DETAIL

440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

PROJECT NO. W1817-06-01

FIG. 13



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ENVIRONMENTAL GEOTECHNICAL MATERIALS
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PHONE (818) 841-8388 - FAX (818) 841-1704

DRAFTED BY: JMH

CHECKED BY: JTA

RETAINING WALL DRAIN DETAIL

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SIERRA MADRE, CALIFORNIA

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PROJECT NO. W1817-06-01

FIG. 14

BORING PERCOLATION TEST FIELD LOG

Date: <u>9/12/2023</u> Project Number: <u>W1817-06-01</u> Project Location: <u>Sierra Madre</u> Earth Description: <u>SM</u> Tested By: <u>JC</u> Liquid Description: <u>Water</u> Measurement Method: <u>Sounder</u> Start Time for Pre-Soak: <u>10:35 AM</u> Start Time for Standard: <u>11:35 AM</u>	Boring/Test Number: <u>B2</u> Diameter of Boring: <u>8</u> inches Diameter of Casing: <u>2</u> inches Depth of Boring: <u>40</u> feet Depth to Invert of BMP: <u>30</u> feet Depth to Water Table: <u>100</u> feet Depth to Initial Water Depth (d _i): <u>360</u> inches Water Remaining in Boring (Y/N): <u>Yes</u> Standard Time Interval Between Readings: <u>30 min</u>
---	---

Reading Number	Start Time (hh:mm)	Time End (hh:mm)	Elapsed Time Δtime (min)	Water Drop During Standard Time Interval, Δd (in)	Soil Description Notes Comments
1	11:35 AM	12:05 PM	30	11.4	
2	12:05 PM	12:35 PM	30	10.3	
3	12:35 PM	1:05 PM	30	8.9	
4	1:05 PM	1:35 PM	30	9.0	
5	1:35 PM	2:05 PM	30	8.9	
6	2:05 PM	2:35 PM	30	8.9	Stabilized Readings
7	2:35 PM	3:05 PM	30	8.9	Achieved with Readings
8	3:05 PM	3:35 PM	30	8.9	6, 7, and 8

MEASURED PERCOLATION RATE AND DESIGN INFILTRATION RATE CALCULATIONS*

* Calculations Below Based on Stabilized Readings Only

Boring Radius, r: 4 inches
 Test Section Height, h: 120 inches

$$\text{Test Section Surface Area, } A = 2\pi rh + \pi r^2$$

$$A = \underline{3066} \text{ in}^2$$

$$\text{Discharged Water Volume, } V = \pi r^2 \Delta d$$

$$\text{Percolation Rate} = \left(\frac{V/A}{\Delta T} \right)$$

Reading 6 V = 446 in³
 Reading 7 V = 446 in³
 Reading 8 V = 446 in³

Percolation Rate = 0.29 inches/hour
 Percolation Rate = 0.29 inches/hour
 Percolation Rate = 0.29 inches/hour

Measured Percolation Rate = 0.29 inches/hour

Reduction Factors

Small Diameter Boring, RF_t = 1
 Site Variability, RF_v = 1
 Long Term Siltation, RF_s = 1

$$\text{Total Reduction Factor, } RF = RF_t + RF_v + RF_s$$

Total Reduction Factor = 3

Design Infiltration Rate

Design Infiltration Rate = 0.10 inches/hour

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PERCOLATION TEST RESULTS AND CALCULATIONS

440 WEST SIERRA MADRE BOULEVARD
 SIERRA MADRE, CALIFORNIA

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PROJECT NO. W1817-06-01

FIG. 15

BORING PERCOLATION TEST FIELD LOG

Date: <u>9/12/2023</u> Project Number: <u>W1817-06-01</u> Project Location: <u>Sierra Madre</u> Earth Description: <u>SM</u> Tesed By: <u>JC</u> Liquid Description: <u>Water</u> Measurement Method: <u>Sounder</u> Start Time for Pre-Soak: <u>10:22 AM</u> Start Time for Standard: <u>11:22 AM</u>	Boring/Test Number: <u>B3</u> Diameter of Boring: <u>8</u> inches Diameter of Casing: <u>2</u> inches Depth of Boring: <u>15.5</u> feet Depth to Invert of BMP: <u>10</u> feet Depth to Water Table: <u>100</u> feet Depth to Initial Water Depth (d_i): <u>120</u> inches Water Remaining in Boring (Y/N): <u>Yes</u> Standard Time Interval Between Readings: <u>30 min</u>
---	--

Reading Number	Start Time (hh:mm)	Time End (hh:mm)	Elapsed Time Δtime (min)	Water Drop During Standard Time Interval, Δd (in)	Soil Description Notes Comments
1	11:22 AM	11:52 AM	30	19.2	
2	11:52 AM	12:22 PM	30	19.2	
3	12:22 PM	12:52 PM	30	19.1	
4	12:52 PM	1:22 PM	30	18.8	
5	1:22 PM	1:52 PM	30	18.7	
6	1:52 PM	2:22 PM	30	18.6	Stabilized Readings
7	2:22 PM	2:52 PM	30	18.6	Achieved with Readings
8	2:52 PM	3:22 PM	30	18.6	6, 7, and 8

MEASURED PERCOLATION RATE AND DESIGN INFILTRATION RATE CALCULATIONS*

* Calculations Below Based on Stabilized Readings Only

Boring Radius, r: 4 inches
 Test Section Height, h: 66 inches

Discharged Water Volume, $V = \pi r^2 \Delta d$

Reading 6 V = 935 in³
 Reading 7 V = 935 in³
 Reading 8 V = 935 in³

Test Section Surface Area, $A = 2\pi rh + \pi r^2$

A = 1709 in²

Percolation Rate = $\left(\frac{V/A}{\Delta T} \right)$

Percolation Rate = 1.09 inches/hour
 Percolation Rate = 1.09 inches/hour
 Percolation Rate = 1.09 inches/hour

Measured Percolation Rate = 1.09 inches/hour

Reduction Factors

Small Diameter Boring, RF_t = 1
 Site Variability, RF_v = 1
 Long Term Siltation, RF_s = 1

Total Reduction Factor, RF = RF_t + RF_v + RF_s

Total Reduction Factor = 3

Design Infiltration Rate

Design Infiltration Rate = 0.36 inches/hour

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PERCOLATION TEST RESULTS AND CALCULATIONS

440 WEST SIERRA MADRE BOULEVARD
 SIERRA MADRE, CALIFORNIA

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OCT. 2023

PROJECT NO. W1817-06-01

FIG. 16

BORING PERCOLATION TEST FIELD LOG

Date: <u>9/12/2023</u> Project Number: <u>W1817-06-01</u> Project Location: <u>Sierra Madre</u> Earth Description: <u>SM</u> Tested By: <u>JC</u> Liquid Description: <u>Water</u> Measurement Method: <u>Sounder</u> Start Time for Pre-Soak: <u>10:25 AM</u> Start Time for Standard: <u>11:25 AM</u>	Boring/Test Number: <u>B4</u> Diameter of Boring: <u>8</u> inches Diameter of Casing: <u>2</u> inches Depth of Boring: <u>40</u> feet Depth to Invert of BMP: <u>30</u> feet Depth to Water Table: <u>30</u> feet Depth to Initial Water Depth (d_1): <u>360</u> inches Water Remaining in Boring (Y/N): <u>Yes</u> Standard Time Interval Between Readings: <u>30 min</u>
---	--

Reading Number	Start Time (hh:mm)	Time End (hh:mm)	Elapsed Time Δ time (min)	Water Drop During Standard Time Interval, Δd (in)	Soil Description Notes Comments
1	11:25 AM	11:55 AM	30	16.0	
2	11:55 AM	12:25 PM	30	13.1	
3	12:25 PM	12:55 PM	30	13.9	
4	12:55 PM	1:25 PM	30	13.4	
5	1:25 PM	1:55 PM	30	13.4	
6	1:55 PM	2:25 PM	30	13.2	Stabilized Readings
7	2:25 PM	2:55 PM	30	13.2	Achieved with Readings
8	2:55 PM	3:25 PM	30	13.2	6, 7, and 8

MEASURED PERCOLATION RATE AND DESIGN INFILTRATION RATE CALCULATIONS*

* Calculations Below Based on Stabilized Readings Only

Boring Radius, r : 4 inches
 Test Section Height, h : 120 inches

$$\text{Test Section Surface Area, } A = 2\pi rh + \pi r^2$$

$$A = \underline{3066} \text{ in}^2$$

$$\text{Discharged Water Volume, } V = \pi r^2 \Delta d$$

$$\text{Percolation Rate} = \left(\frac{V/A}{\Delta T} \right)$$

Reading 6 $V = \underline{664} \text{ in}^3$
 Reading 7 $V = \underline{664} \text{ in}^3$
 Reading 8 $V = \underline{664} \text{ in}^3$

Percolation Rate = 0.43 inches/hour
 Percolation Rate = 0.43 inches/hour
 Percolation Rate = 0.43 inches/hour

Measured Percolation Rate = 0.43 inches/hour

Reduction Factors

Small Diameter Boring, $RF_t = \underline{1}$
 Site Variability, $RF_v = \underline{1}$
 Long Term Siltation, $RF_s = \underline{1}$

$$\text{Total Reduction Factor, } RF = RF_t + RF_v + RF_s$$

Total Reduction Factor = 3

Design Infiltration Rate

Design Infiltration Rate = 0.14 inches/hour

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PERCOLATION TEST RESULTS AND CALCULATIONS

440 WEST SIERRA MADRE BOULEVARD
 SIERRA MADRE, CALIFORNIA

DRAFTED BY: JMH

CHECKED BY: JTA

OCT. 2023

PROJECT NO. W1817-06-01

FIG. 17

APPENDIX

A

APPENDIX A

FIELD INVESTIGATION


The site was explored on September 11, 2023, by excavating four 8-inch diameter borings to depths of approximately 15½ and 50½ feet below the existing ground surface using a truck-mounted, hollow-stem auger drilling machine. The site was further explored on September 12, 2023, by excavating two test pits to expose and verify the dimensions of the foundation system for the existing library building. Borings were advanced in the test pits to a maximum depth of approximately 5½ feet using hand auger equipment and digging tools. Representative and relatively undisturbed samples were obtained by driving a 3 inch, O. D., California Modified Sampler into the “undisturbed” soil mass with blows from a 140-pound auto-hammer falling 30 inches or with a slide hammer. The California Modified Sampler was equipped with 1-inch high by 2⅜-inch diameter brass sampler rings to facilitate soil removal and testing. Bulk samples were also obtained.

The soil conditions encountered in the borings and test pits were visually examined, classified and logged in general accordance with the Unified Soil Classification System (USCS). The logs of the borings and test pits are presented on Figures A1 through A6. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, penetration rates, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the logs were revised based on subsequent laboratory testing. The locations of the borings and test pits are shown on Figure 2.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING 1 ELEV. (MSL.) -- DATE COMPLETED <u>09/11/2023</u> EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ACS</u>	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				MATERIAL DESCRIPTION			
2					ASPHALT: 3" BASE: 2.5" ARTIFICIAL FILL Silty Sand, medium dense, slightly moist, brown, fine- to medium-grained.			
4	B1@3'				OLDER ALLUVIUM Silty Sand, loose, medium dense, slightly moist, brown, fine- to medium-grained, trace clay.	17	114.1	6.7
6	B1@6'				- medium dense, some gravel	44	127.3	3.9
8				SM				
10	B1@9'					35	124.2	10.7
12	B1@12'				- light brown	41	114.2	7.9
14								
	B1@15'					46	117.0	6.1
					Total depth of boring: 15.5 feet Fill to 3 feet. No groundwater encountered. Backfilled with soil cuttings and tamped. Asphalt patched. *Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer. NOTE: The stratification lines presented herein represent the approximate boundary between earth types; the transitions may be gradual.			

Figure A1,
Log of Boring 1, Page 1 of 1

W1817-06-01 BORING & TEST PIT LOGS.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED.
IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

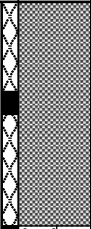
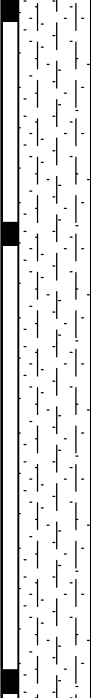






DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING 2 ELEV. (MSL.) -- DATE COMPLETED <u>09/11/2023</u> EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ACS</u>	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				MATERIAL DESCRIPTION			
2	B2@2'				ASPHALT: 3" BASE: 2.5" ARTIFICIAL FILL Silty Sand, dry, brown, fine- to medium-grained. - loose	5	106.1	8.1
4	B2@5'							
6	B2@10'			SM	OLDER ALLUVIUM Silty Sand, loose, dry, light brown to brown, medium- to coarse-grained.	7	93.8	9.5
8								
10	B2@10'				- medium dense, slightly moist, light brown, trace clay	36	124.0	12.1
12								
14								
16								
18								
20	B2@20'				- dry, trace fine gravel	27	111.3	9.5
22								
24								
26								
28								

Figure A2,
Log of Boring 2, Page 1 of 2

W1817-06-01 BORING & TEST PIT LOGS.GPJ


SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED.
IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING 2 ELEV. (MSL.) -- DATE COMPLETED <u>09/11/2023</u> EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ACS</u>	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B2@30'				MATERIAL DESCRIPTION	45	123.4	7.5
32								
34								
36								
38				SM				
40	B2@40'				- very dense, trace fine to coarse gravel	50 (6")	117.6	5.8
42								
44								
46								
48								
50	B2@50'				- dense	68	119.2	5.7
					Total depth of boring: 50.5 feet Fill to 5 feet. No groundwater encountered. Backfilled with soil cuttings and tamped. Asphalt patched. *Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer. NOTE: The stratification lines presented herein represent the approximate boundary between earth types; the transitions may be gradual.			

Figure A2,
Log of Boring 2, Page 2 of 2

W1817-06-01 BORING & TEST PIT LOGS.GPJ







SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED.
IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING 3 ELEV. (MSL.) -- DATE COMPLETED <u>09/11/2023</u> EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ACS</u>	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					MATERIAL DESCRIPTION			
2					ARTIFICIAL FILL Silty Sand, medium dense, slightly moist, brown, fine-grained.			
4	B3@3'				OLDER ALLUVIUM Silty Sand, loose, dry, light brown to brown, fine- to medium-grained, some coarse gravel. - medium dense, decrease in gravel	16	117.0	2.6
6	B3@6'					36	116.0	8.8
8								
10	B3@9'			SM		33	122.1	8.2
12	B3@12'					39	113.7	5.7
14								
	B3@15'				- dense	56	113.2	6.1
					Total depth of boring: 15.5 feet Fill to 3 feet. No groundwater encountered. Backfilled with soil cuttings and tamped. *Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer. NOTE: The stratification lines presented herein represent the approximate boundary between earth types; the transitions may be gradual.			

Figure A3,
Log of Boring 3, Page 1 of 1

W1817-06-01 BORING & TEST PIT LOGS.GPJ







SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED.
IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	<div>BORING 4</div> <div>ELEV. (MSL.) -- DATE COMPLETED 09/11/2023</div> <div>EQUIPMENT HOLLOW STEM AUGER BY: ACS</div>	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					MATERIAL DESCRIPTION			
					ARTIFICIAL FILL Silty Sand, medium dense, moist, brown, fine-grained.			
2	B4@2'				OLDER ALLUVIUM Silty Sand, medium dense, slightly moist, brown, fine- to medium-grained, coarse gravel.	22	110.8	8.9
4								
6	B4@5'				- loose, decrease in gravel	15	95.9	6.1
8								
10	B4@10'				- medium dense	28	116.0	7.4
12				SM				
14								
16								
18								
20	B4@20'				- dense	55	122.1	6.6
22								
24								
26								
28								

Figure A4,
Log of Boring 4, Page 1 of 2

W1817-06-01 BORING & TEST PIT LOGS.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED.
IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.








DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING 4 ELEV. (MSL.) - - DATE COMPLETED <u>09/11/2023</u> EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ACS</u>	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B4@30'				MATERIAL DESCRIPTION			
32					- medium dense	43	119.9	7.5
34								
36								
38				SM				
40	B4@40'				- very dense	96	116.8	6.2
42								
44								
46								
48								
50	B4@50'					93	110.3	6.5
					Total depth of boring: 50.5 feet Fill to 1 foot. No groundwater encountered. Backfilled with soil cuttings and tamped. *Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer. NOTE: The stratification lines presented herein represent the approximate boundary between earth types; the transitions may be gradual.			

Figure A4,
Log of Boring 4, Page 2 of 2

W1817-06-01 BORING & TEST PIT LOGS.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED.
IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TEST PIT TP1 ELEV. (MSL.) - - DATE COMPLETED 09/12/2023 EQUIPMENT HAND AUGER BY: MR	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					MATERIAL DESCRIPTION			
2					CONCRETE: 3.5" ARTIFICIAL FILL Silty Sand, loose, slightly moist, brown, fine- to medium-grained.			
4	TP1@3'				- moist, yellowish brown			
	TP1@5'				- increase in sand			
					Total depth of boring: 5.5 feet All fill. No groundwater encountered. Backfilled with soil cuttings and tamped. Patched with concrete. NOTE: The stratification lines presented herein represent the approximate boundary between earth types; the transitions may be gradual.			

Figure A5,
Log of Test Pit TP1, Page 1 of 1

W1817-06-01 BORING & TEST PIT LOGS.GPJ







SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED.
IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TEST PIT TP2		PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.)	DATE COMPLETED			
						09/12/2023			
					EQUIPMENT	BY:			
					HAND AUGER	MR			
					MATERIAL DESCRIPTION				
0					CONCRETE: 3.5" ARTIFICIAL FILL Silty Sand, loose, slightly moist, brown, fine- to medium-grained.				
2									
4									
	TP2@4.5'				- increase in sand				
					Total depth of boring: 5 feet All fill. No groundwater encountered. Backfilled with soil cuttings and tamped. Patched with AC.				
					NOTE: The stratification lines presented herein represent the approximate boundary between earth types; the transitions may be gradual.				

Figure A6,
Log of Test Pit TP2, Page 1 of 1

W1817-06-01 BORING & TEST PIT LOGS.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED.
IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

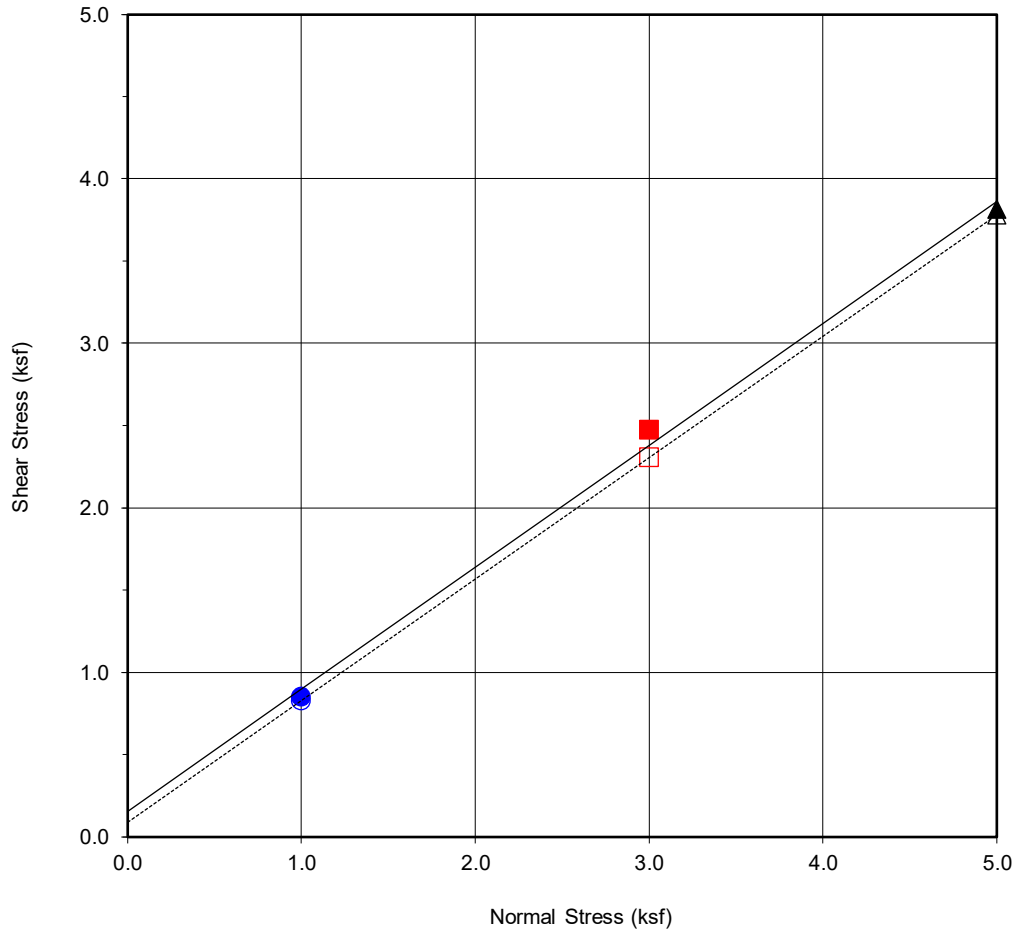
APPENDIX

B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the “American Society for Testing and Materials (ASTM)”, or other suggested procedures. Selected samples were tested for direct shear strength, consolidation, corrosivity, and in-place dry density and moisture content. The results of the laboratory tests are summarized in Figures B1 through B17. The in-place dry density and moisture content of the samples tested are presented on the boring logs, Appendix A.



Boring No.	B1
Sample No.	B1@3
Depth (ft)	3
<u>Sample Type:</u>	Ring

<u>Soil Identification:</u>		
Silty Sand (SM)		
Strength Parameters		
	C (psf)	ϕ ($^{\circ}$)
Peak	157	37
Ultimate	90	36

Normal Stress (kip/ft ²)	1	3	5
Peak Shear Stress (kip/ft ²)	● 0.85	■ 2.47	▲ 3.82
Shear Stress @ End of Test (ksf)	○ 0.83	□ 2.30	△ 3.78
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	7.5	7.5	7.3
Initial Dry Density (pcf)	110.8	112.5	112.5
Initial Degree of Saturation (%)	38.8	40.5	39.4
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	15.3	13.7	13.3



DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

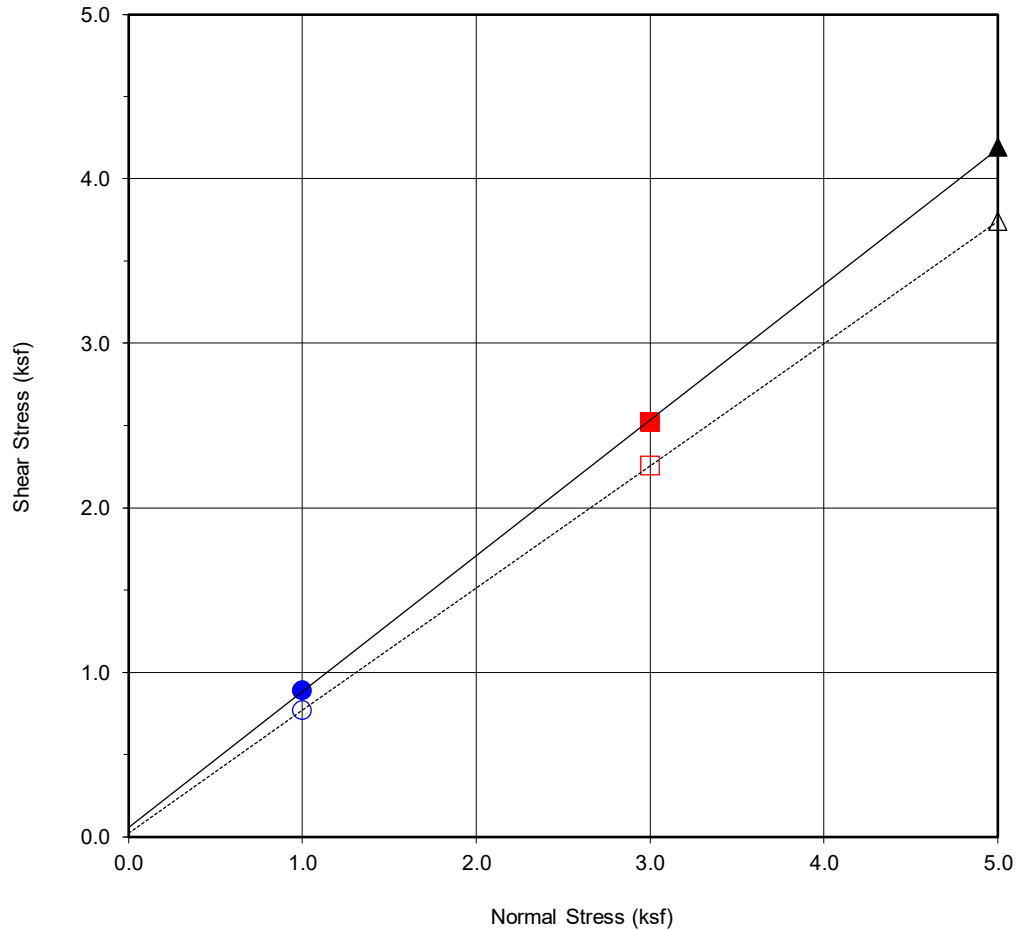
Checked by: JMH

Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

Figure B1



Boring No.	TP1
Sample No.	TP1@3
Depth (ft)	3'
<u>Sample Type:</u>	Ring

<u>Soil Identification:</u>		
Silty Sand (SM)		
Strength Parameters		
	C (psf)	ϕ ($^{\circ}$)
Peak	58	40
Ultimate	26	37

Normal Stress (kip/ft ²)	1	3	5
Peak Shear Stress (kip/ft ²)	● 0.89	■ 2.52	▲ 4.19
Shear Stress @ End of Test (ksf)	○ 0.77	□ 2.26	△ 3.74
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	12.7	13.9	14.1
Initial Dry Density (pcf)	118.2	116.9	119.1
Initial Degree of Saturation (%)	80.1	84.9	91.5
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	14.1	14.7	13.6



DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

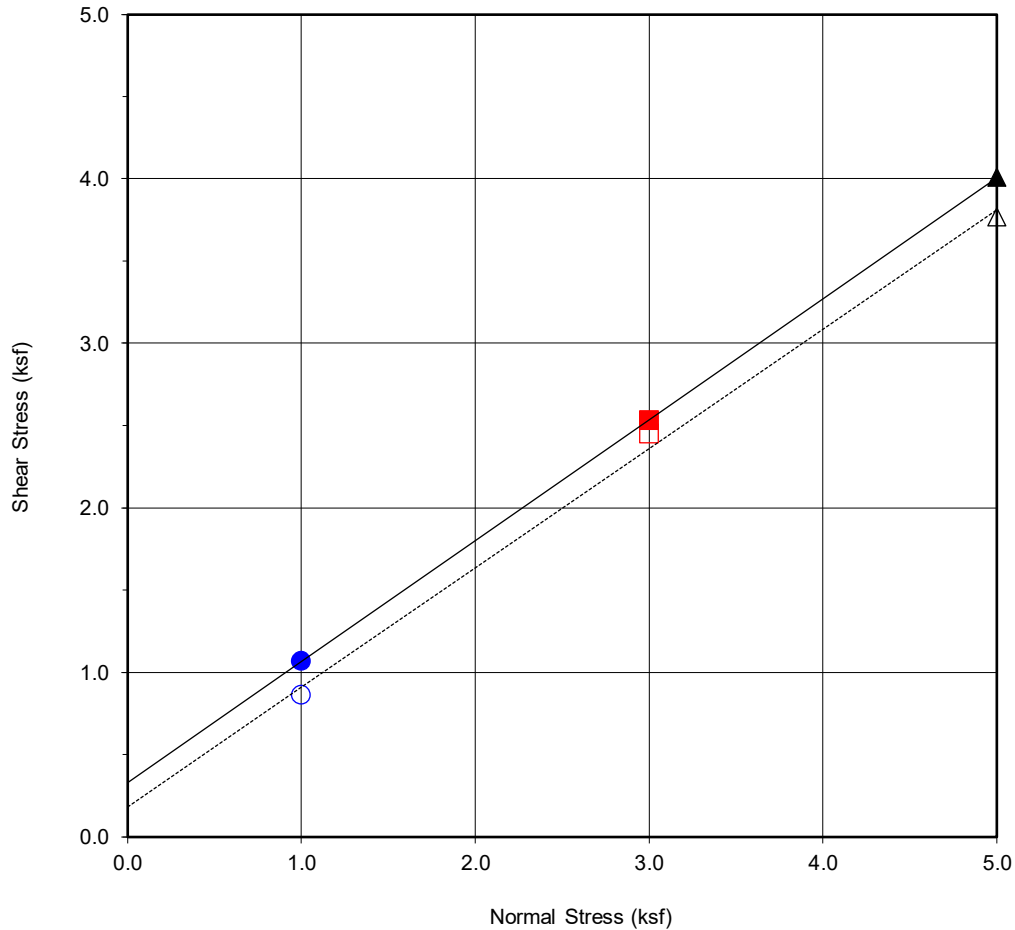
Checked by: JMH

Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

Figure B2



Boring No.	TP1
Sample No.	TP1@5
Depth (ft)	5
<u>Sample Type:</u>	Ring

<u>Soil Identification:</u>		
Silty Sand (SM)		
Strength Parameters		
	C (psf)	ϕ ($^{\circ}$)
Peak	331	36
Ultimate	182	36

Normal Stress (kip/ft ²)	1	3	5
Peak Shear Stress (kip/ft ²)	● 1.07	■ 2.53	▲ 4.01
Shear Stress @ End of Test (ksf)	○ 0.86	□ 2.45	△ 3.77
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	14.4	14.1	13.8
Initial Dry Density (pcf)	117.3	116.3	114.3
Initial Degree of Saturation (%)	89.3	84.5	78.4
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	14.8	14.9	14.3



DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

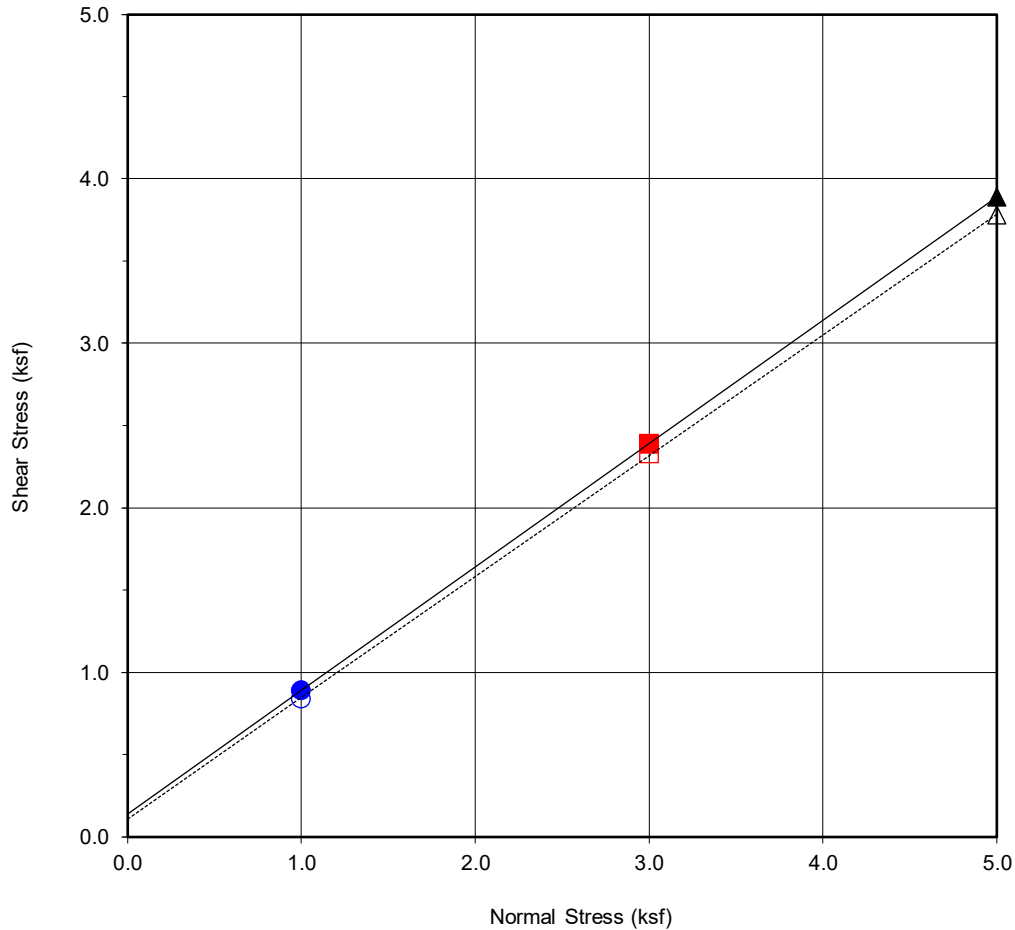
Checked by: JMH

Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

Figure B3



Boring No.	TP2
Sample No.	TP2@4.5
Depth (ft)	4.5
<u>Sample Type:</u>	Ring

<u>Soil Identification:</u>		
Silty Sand (SM)		
Strength Parameters		
	C (psf)	ϕ ($^{\circ}$)
Peak	139	37
Ultimate	111	36

Normal Stress (kip/ft ²)	1	3	5
Peak Shear Stress (kip/ft ²)	● 0.89	■ 2.39	▲ 3.89
Shear Stress @ End of Test (ksf)	○ 0.84	□ 2.33	△ 3.78
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	10.6	9.8	11.2
Initial Dry Density (pcf)	98.6	99.8	101.2
Initial Degree of Saturation (%)	40.4	38.5	45.5
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	16.3	15.3	14.8



DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

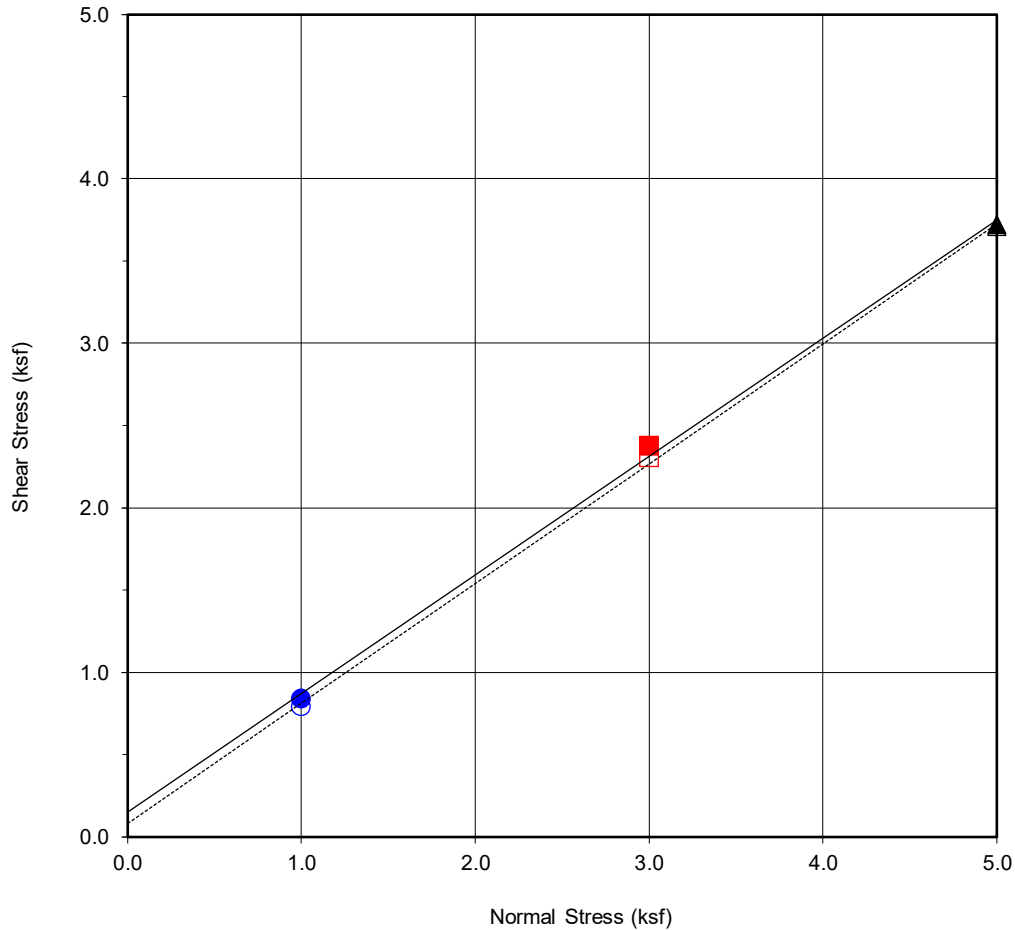
Checked by: JMH

Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

Figure B4



Boring No.	MIX B1+B2
Sample No.	MIX B1+B2@0-5'
Depth (ft)	0-5'
<u>Sample Type:</u>	Bulk

<u>Soil Identification:</u>		
Silty Sand (SM)		
Strength Parameters		
	C (psf)	ϕ ($^{\circ}$)
Peak	152	36
Ultimate	81	36

Normal Stress (kip/ft ²)	1	3	5
Peak Shear Stress (kip/ft ²)	● 0.84	■ 2.38	▲ 3.72
Shear Stress @ End of Test (ksf)	○ 0.79	□ 2.30	△ 3.71
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	7.7	8.0	7.7
Initial Dry Density (pcf)	119.2	119.0	119.3
Initial Degree of Saturation (%)	50.5	52.0	50.1
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	14.0	13.5	12.6



DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

Checked by: JMH

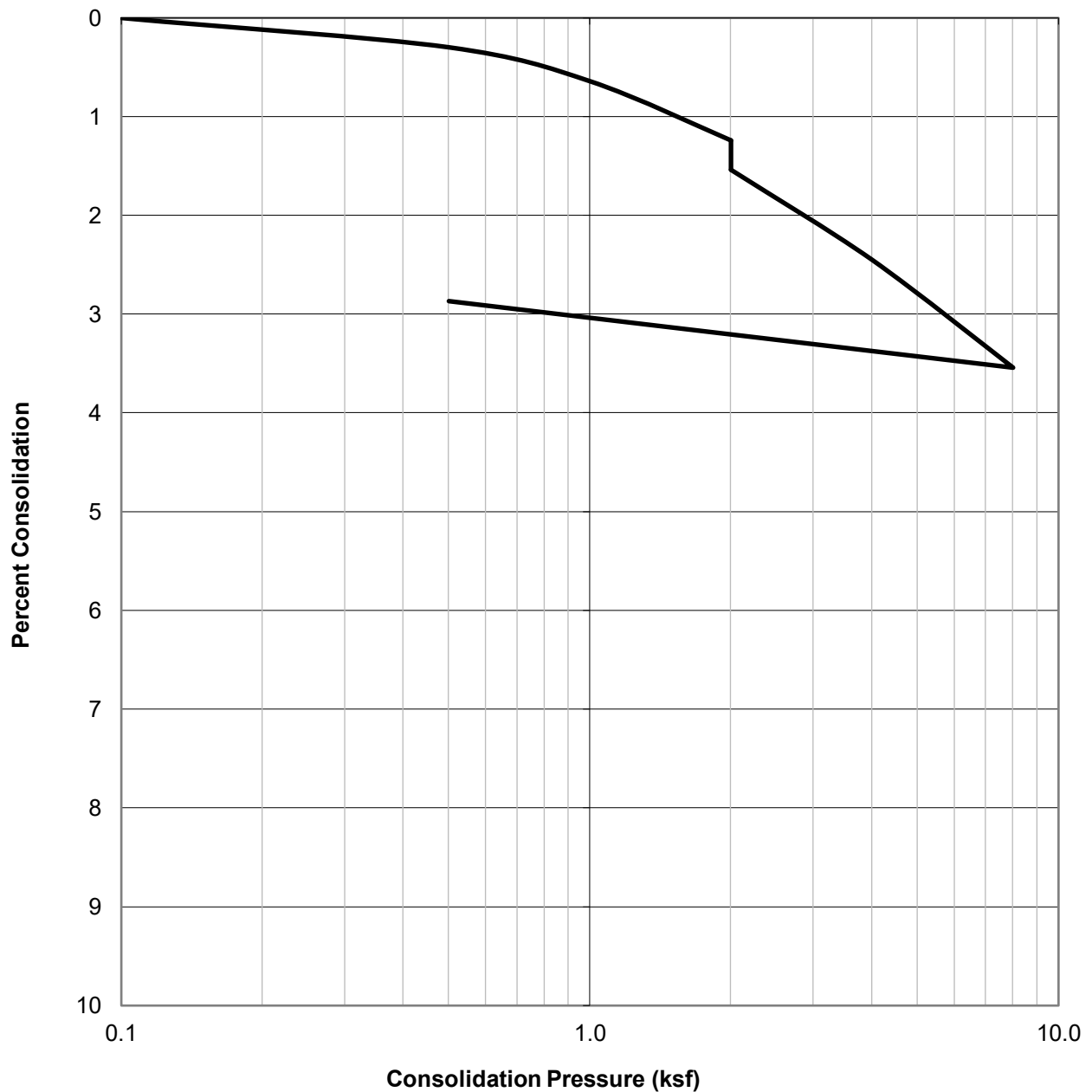
Project No.: W1817-06-01

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440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

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Figure B5

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@3	Silty Sand (SM)	106.9	6.7	16.5



CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: JMH

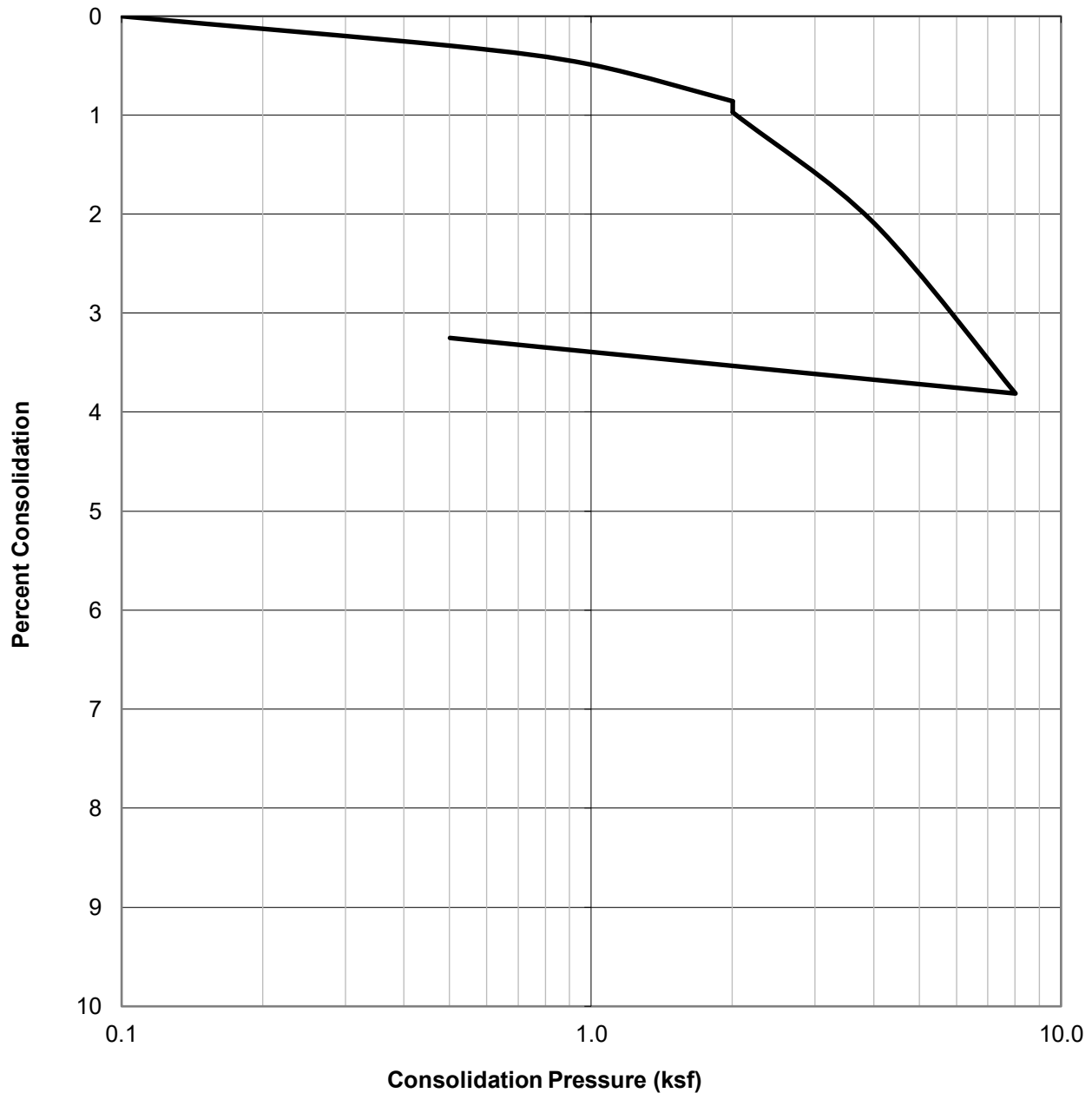
Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

Figure B6

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2@5	Silty Sand (SM)	93.5	9.4	19.5



CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: JMH

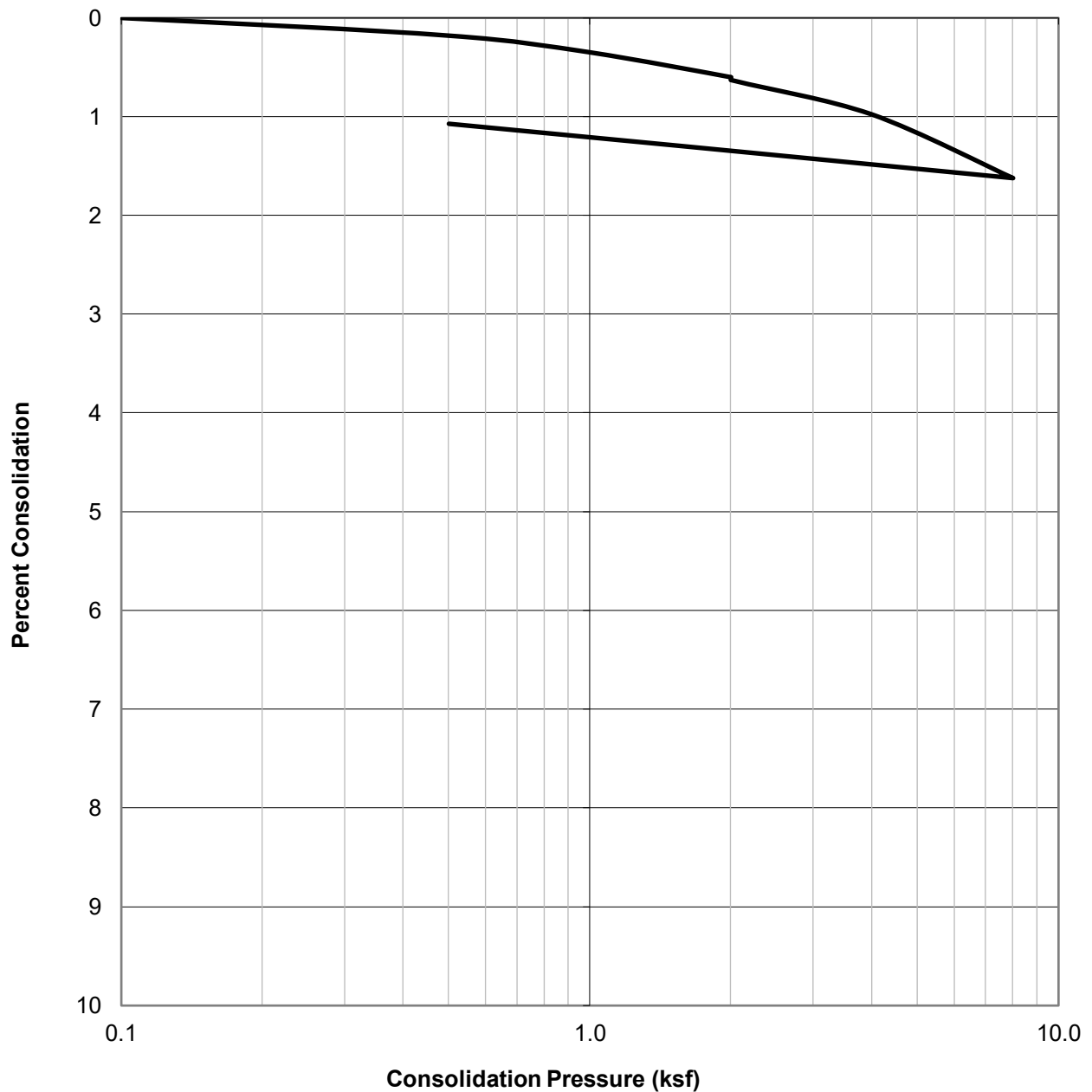
Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

Figure B7

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@9	Silty Sand (SM)	121.8	10.6	12.6



CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: JMH

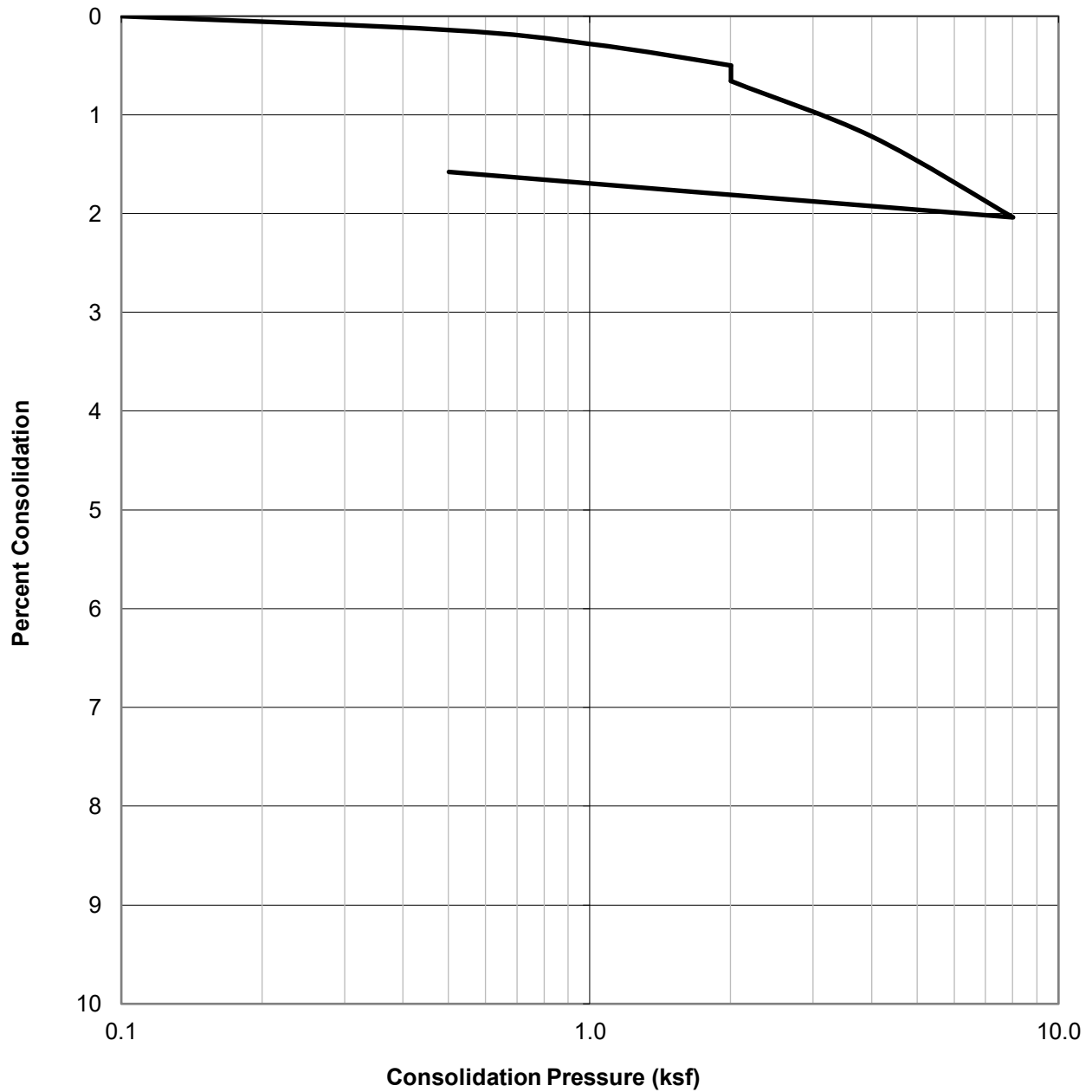
Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

Figure B8

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@12'	Silty Sand (SM)	116.3	7.9	14.9



CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: JMH

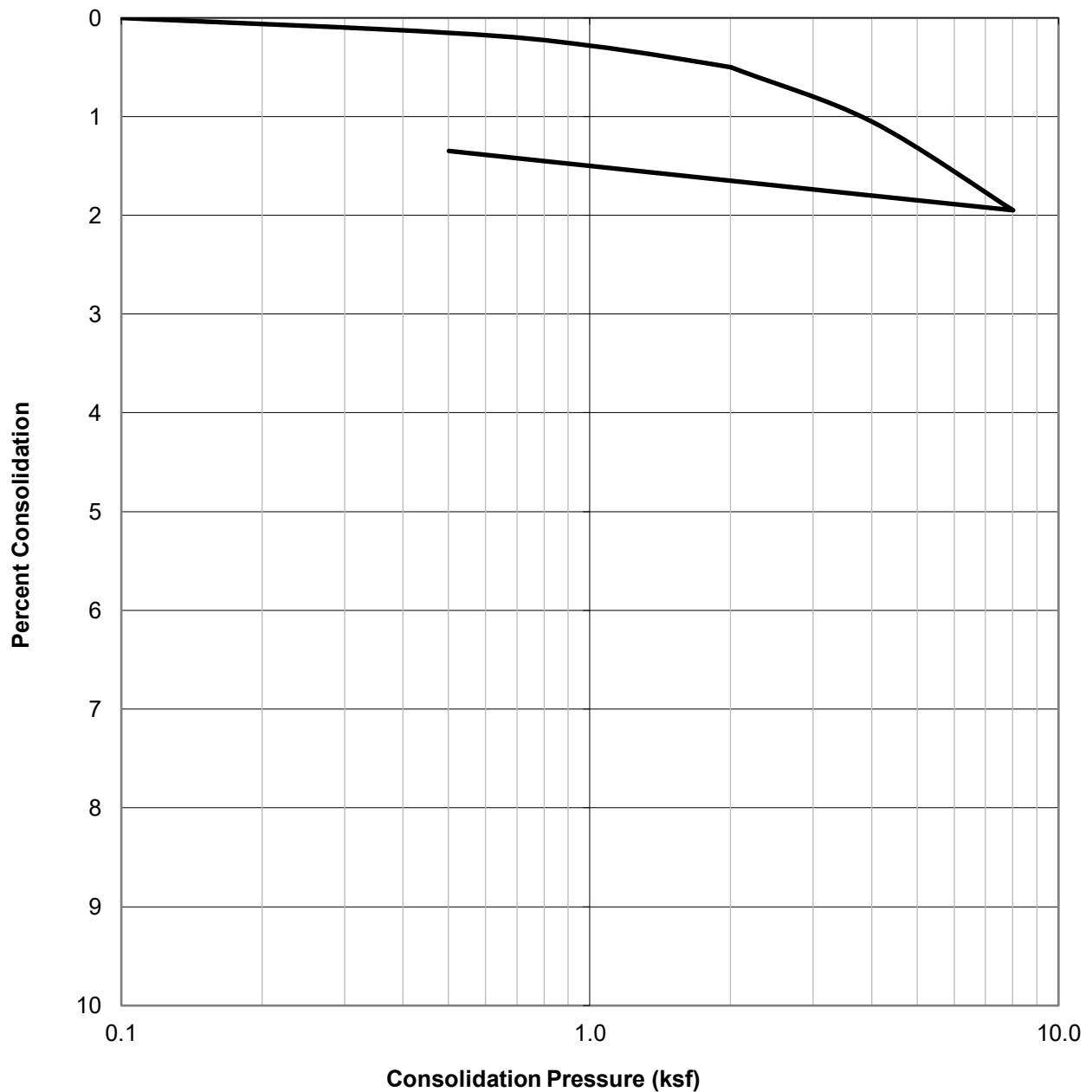
Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

Figure B9

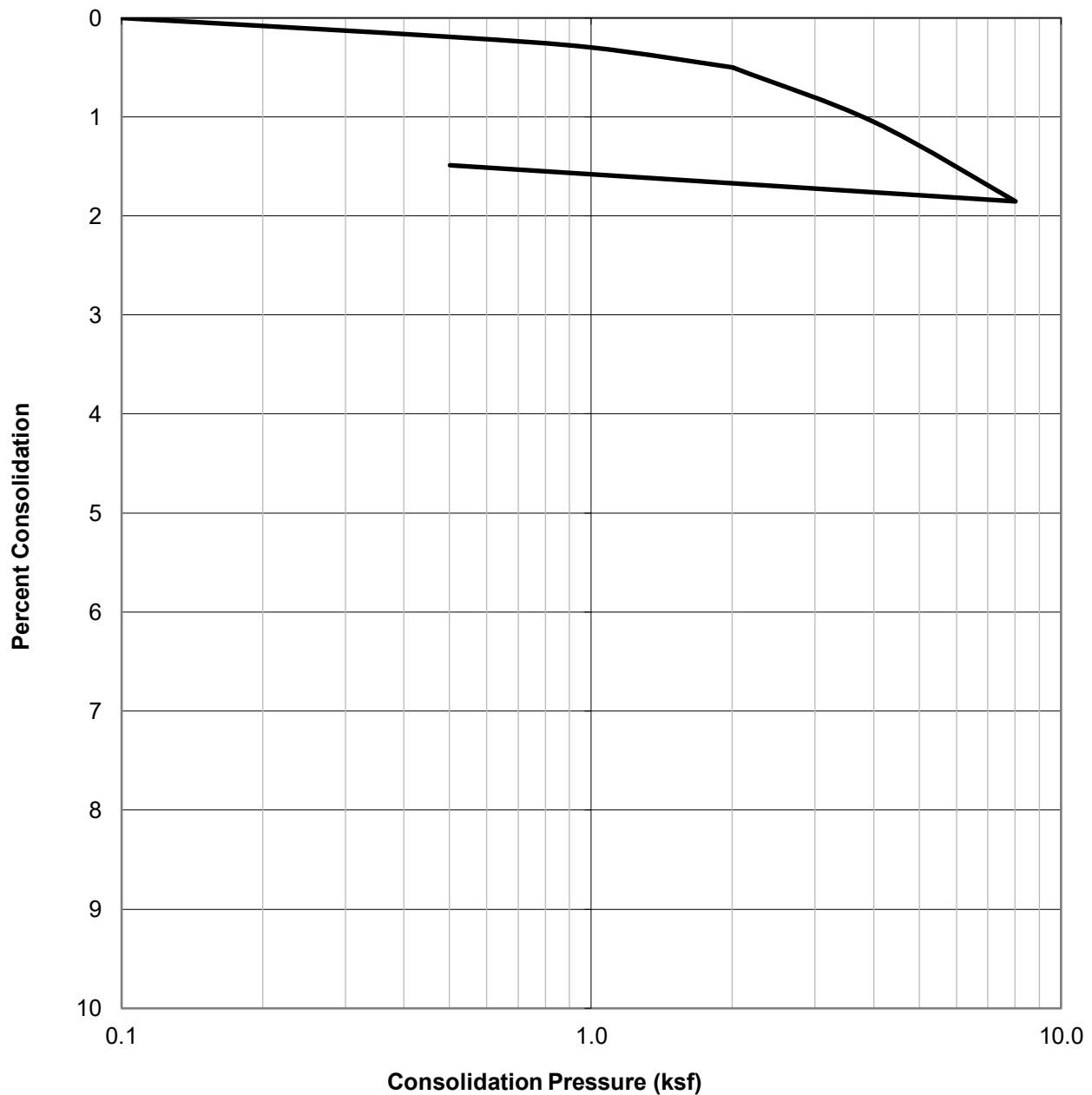
WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@15'	Silty Sand (SM)	115.5	6.1	13.9

	CONSOLIDATION TEST RESULTS ASTM D-2435	Project No.: W1817-06-01
		SIERRA MADRE LIBRARY 440 WEST SIERRA MADRE BOULEVARD SIERRA MADRE, CALIFORNIA
	Checked by: JMH	OCT. 2023 Figure B10

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2@40'	Silty Sand (SM)	112.9	5.8	14.8



CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: JMH

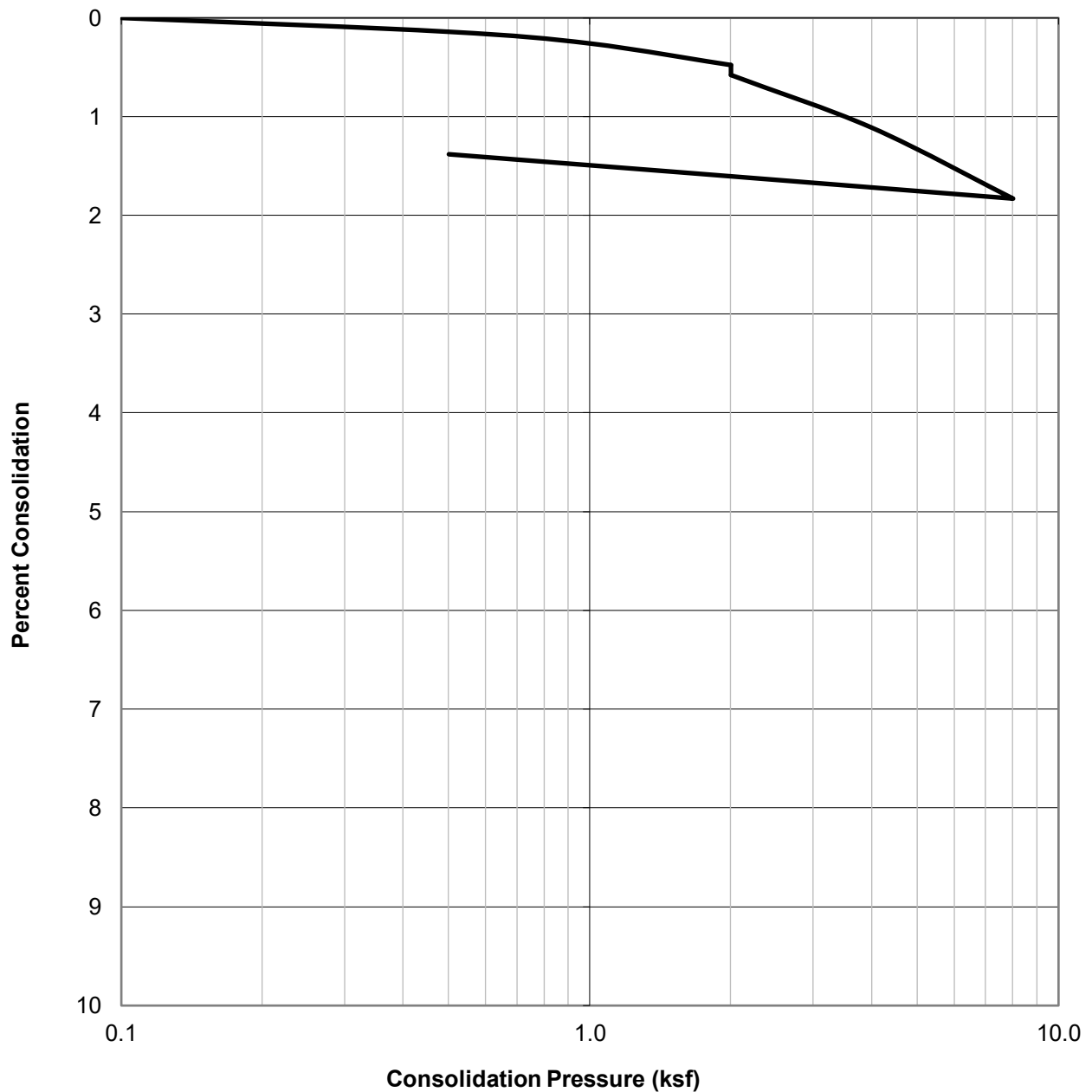
Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

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Figure B11

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2@50'	Silty Sand (SM)	113.1	5.7	14.7



CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: JMH

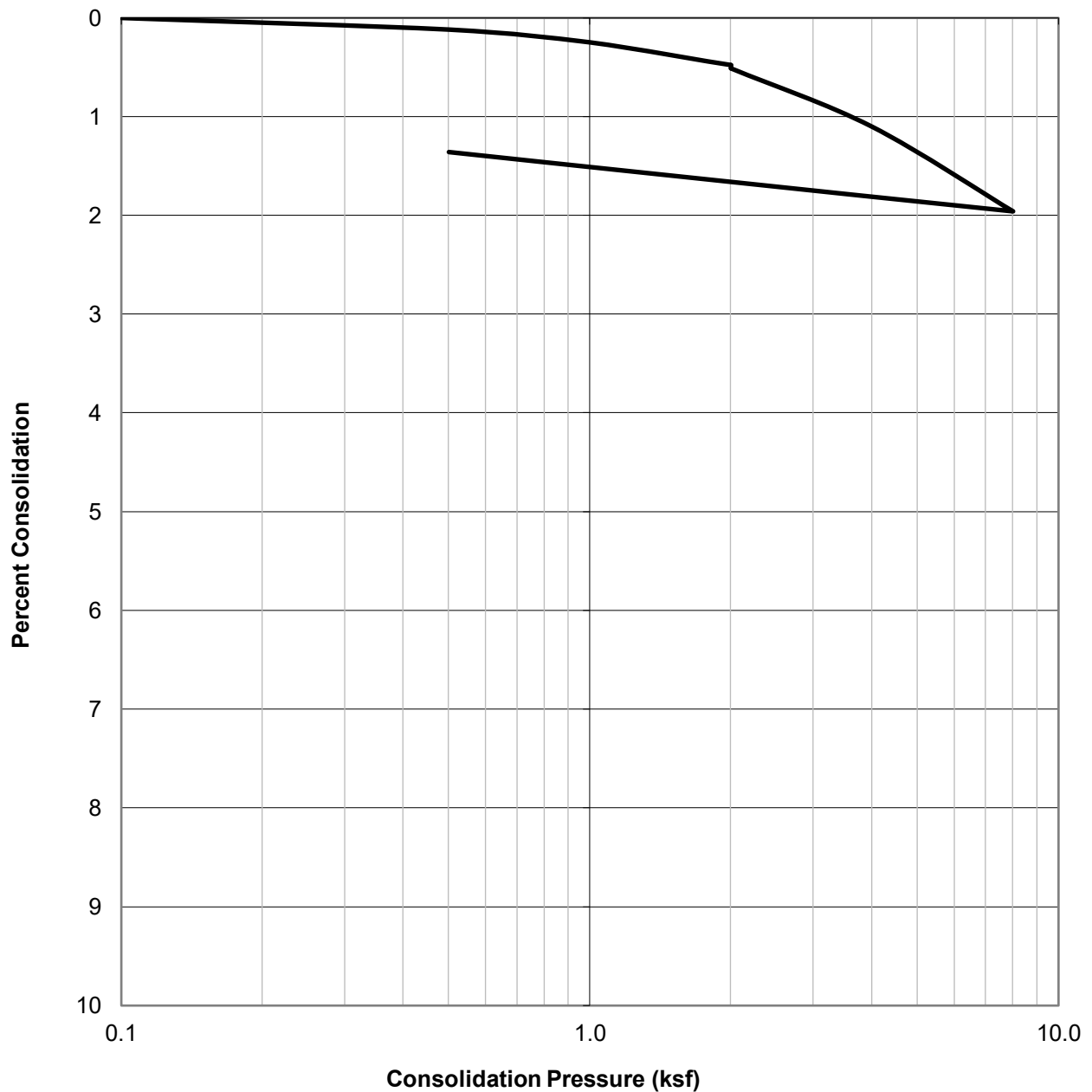
Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

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Figure B12

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B4@30'	Silty Sand (SM)	116.3	7.6	14.2



CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: JMH

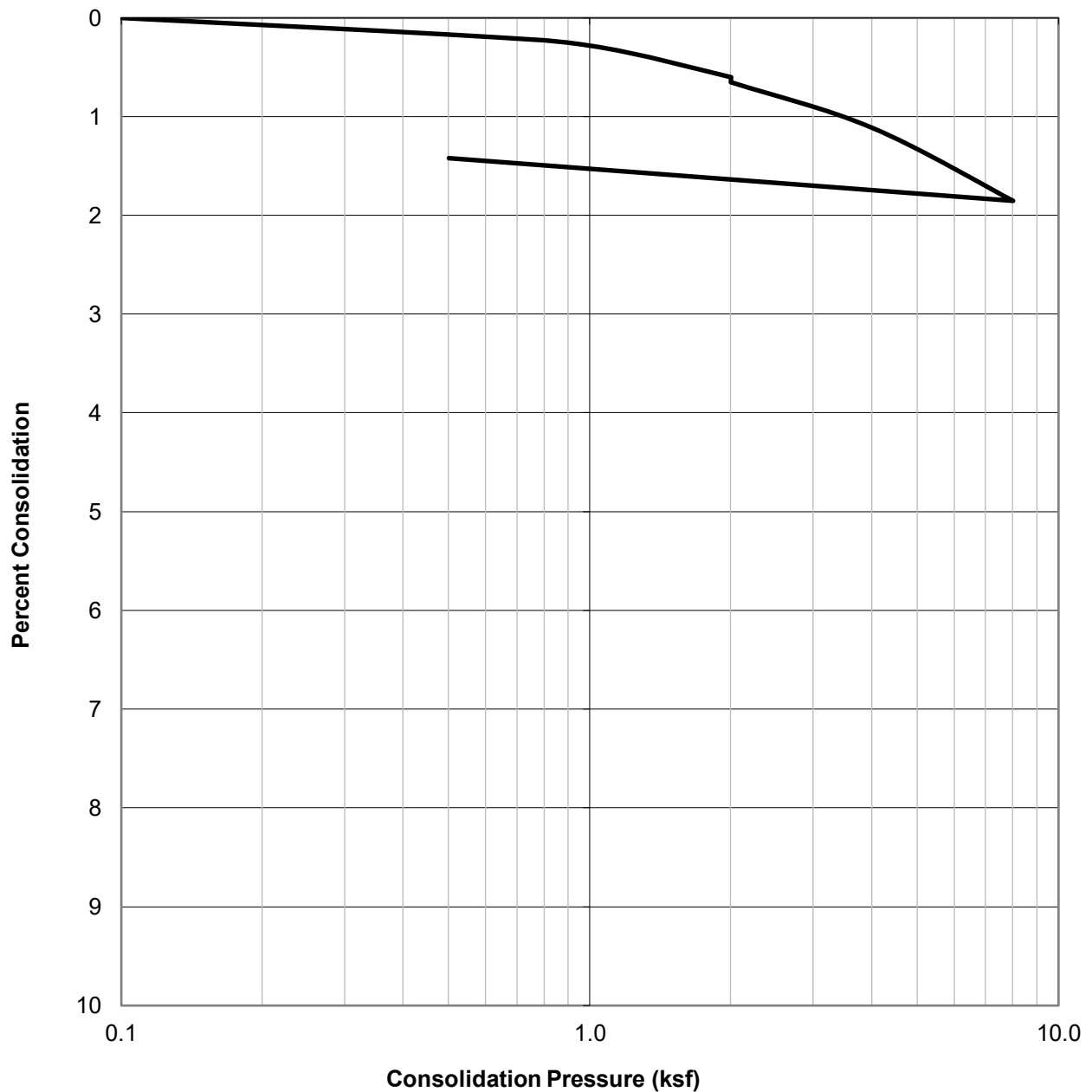
Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

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Figure B13

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B4@50'	Silty Sand (SM)	113.5	6.5	14.4



CONSOLIDATION TEST RESULTS ASTM D-2435

Checked by: JMH

Project No.: W1817-06-01
 SIERRA MADRE LIBRARY
 440 WEST SIERRA MADRE BOULEVARD
 SIERRA MADRE, CALIFORNIA
 OCT. 2023 Figure B14

MIX B1+B2@0-5'

MOLDED SPECIMEN		BEFORE TEST	AFTER TEST
Specimen Diameter	(in.)	4.0	4.0
Specimen Height	(in.)	1.0	1.0
Wt. Comp. Soil + Mold	(gm)	788.0	795.9
Wt. of Mold	(gm)	368.2	368.2
Specific Gravity	(Assumed)	2.7	2.7
Wet Wt. of Soil + Cont.	(gm)	487.3	795.9
Dry Wt. of Soil + Cont.	(gm)	465.6	389.4
Wt. of Container	(gm)	187.3	368.2
Moisture Content	(%)	7.8	9.8
Wet Density	(pcf)	126.6	128.8
Dry Density	(pcf)	117.5	117.3
Void Ratio		0.4	0.4
Total Porosity		0.3	0.3
Pore Volume	(cc)	62.8	61.9
Degree of Saturation	(%) [S_{meas}]	48.8	61.8


Date	Time	Pressure (psi)	Elapsed Time (min)	Dial Readings (in.)
9/25/2023	10:00	1.0	0	0.3095
9/25/2023	10:10	1.0	10	0.3085
Add Distilled Water to the Specimen				
9/26/2023	10:00	1.0	1430	0.3045
9/26/2023	11:00	1.0	1490	0.3045

Expansion Index (EI meas) =	-4
Expansion Index (Report) =	0

Expansion Index, EI_{50}	CBC CLASSIFICATION *	UBC CLASSIFICATION **
0-20	Non-Expansive	Very Low
21-50	Expansive	Low
51-90	Expansive	Medium
91-130	Expansive	High
>130	Expansive	Very High

* Reference: 2022 California Building Code, Section 1803.5.3

** Reference: 1997 Uniform Building Code, Table 18-I-B.

	EXPANSION INDEX TEST RESULTS ASTM D-4829	Project No.: W1817-06-01
		SIERRA MADRE LIBRARY 440 WEST SIERRA MADRE BOULEVARD SIERRA MADRE, CALIFORNIA
	Checked by: JMH	OCT. 2023 Figure B15

Sample No:

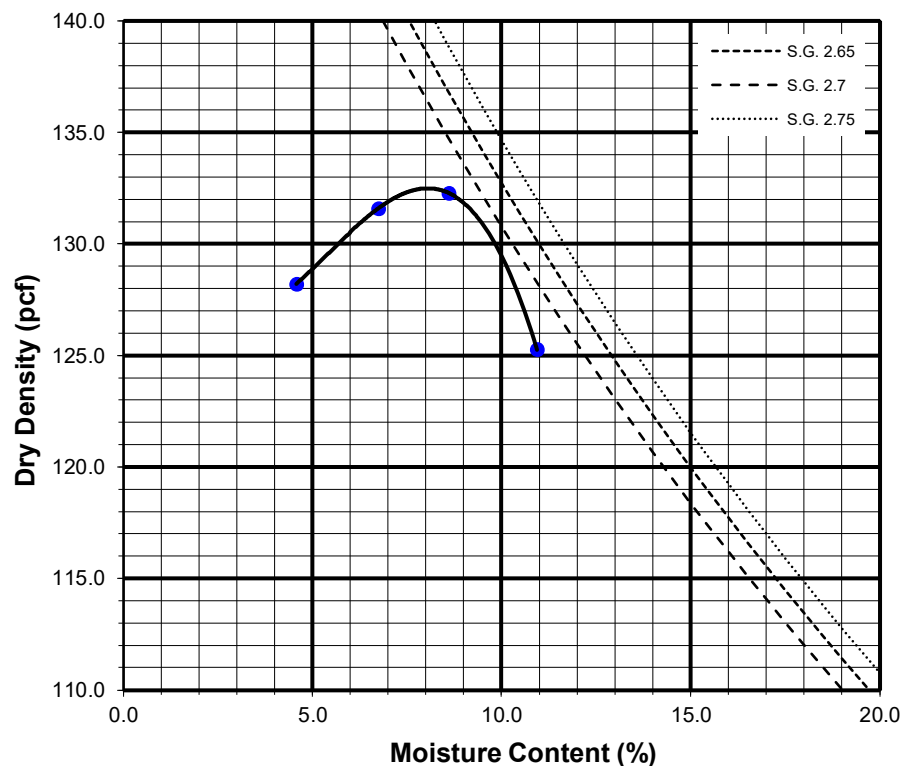
MIX B1+B2@0-5'

Brown Silty Sand (SM)

TEST NO.		1	2	3	4	5	6
Wt. Compacted Soil + Mold	(g)	6112	6209	6257	6186		
Weight of Mold	(g)	4087	4087	4087	4087	4087	
Net Weight of Soil	(g)	2025	2122	2170	2099	-4087	
Wet Weight of Soil + Cont.	(g)	673.2	699.4	656.3	700.1		
Dry Weight of Soil + Cont.	(g)	650.2	664.5	614.4	645.7		
Weight of Container	(g)	147.8	147.5	127.1	148.2		
Moisture Content	(%)	4.6	6.8	8.6	10.9		
Wet Density	(pcf)	134.1	140.5	143.7	139.0	-270.6	
Dry Density	(pcf)	128.2	131.6	132.3	125.3		

Maximum Dry Density (pcf) 132.5

Optimum Moisture Content (%) 8.0



Preparation Method: A



**COMPACTION CHARACTERISTICS USING
MODIFIED EFFORT TEST RESULTS**

ASTM D-1557

Checked by: JMH

Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

Figure B16

SUMMARY OF LABORATORY
POTENTIAL OF HYDROGEN (pH) AND RESISTIVITY TEST RESULTS
AASHTO T289 ASTM D4972 and AASHTO T288 ASTM G187

Sample No.	pH	Resistivity (ohm centimeters)
MIX B1+B2@0-5'	8.1	14000 (Mildly Corrosive)

SUMMARY OF LABORATORY CHLORIDE CONTENT TEST RESULTS
AASHTO T291 ASTM C1218

Sample No.	Chloride Ion Content (%)
MIX B1+B2@0-5'	0.006

SUMMARY OF LABORATORY WATER SOLUBLE SULFATE TEST RESULTS
AASHTO T290 ASTM C1580

Sample No.	Water Soluble Sulfate (% SO ₄)	Sulfate Exposure
MIX B1+B2@0-5'	0.003	S0



CORROSIVITY TEST RESULTS

Checked by: JMH

Project No.: W1817-06-01

SIERRA MADRE LIBRARY
440 WEST SIERRA MADRE BOULEVARD
SIERRA MADRE, CALIFORNIA

OCT. 2023

Figure B17

RE: Fire flow test report



Serj Margaryan

To ○ Randy Metz



Reply



Reply All

Serj Margaryan

Sr. Fire Protection Designer

Budlong

An MBE | SBE | DBE | LSBE Firm

Glendale | Downtown LA | Camarillo

Phone: 805-946-1049

Mobile: 818-321-7612

Email: serj@budlong.com

Web: www.budlong.com

65TH
ANNIVERSARY

From: Randy Metz <RMetz@willdan.com>

Sent: Monday, August 28, 2023 8:37 PM

To: Serj Margaryan <serj@budlong.com>

Subject: Re: Fire flow test report

Good afternoon Serj. The flow from the nearest hydrant to this project is **710 gpm at 90 PSI.**

Let me know if you have any additional questions.

Regards,

Randy Metz

Randy Metz, EFO, CFO, FM, MIFireE

Fire Marshal

City of Sierra Madre

Willdan Engineering

(626) 536-6677

rmetz@willdan.com

From: Serj Margaryan <serj@budlong.com>

Sent: Wednesday, August 23, 2023 9:45 AM

Schedule-10®/Schedule-40®

Submittal Data Sheet

Stamp Here

Fully Listed and FM Approved Sprinkler Pipe

When you specify Schedule-10/Schedule-40 sprinkler pipe from Allied Tube & Conduit, you get UL listed and FM approved products. Although these products do not require separate approvals, Schedule-10/Schedule-40 gives you the extra quality assurance you demand. Our Sch-10 (1-1/4" – 8") pipe and Sch-40 (1" – 2-1/2") pipe have passed the same thorough lab testing as our other listed pipe products, and receive periodic mill inspections from both UL and FM agents to ensure consistent quality.

Galvanized Pipe Schedule-10/Schedule-40 product can be "hot-dip" galvanized to meet FM requirements.

Superior Coating Our advanced formula mill coating offers a clean, durable surface that is also paintready for custom color applications without special preparation.

The internal surface of all black Fire Sprinkler pipe up to 4.5000" in diameter shall be coated with Allied Tube & Conduit Antibacterial Formula "ABF".

American Made Meets "Buy American" requirement and is available through distributors in the USA, Canada and Mexico.

Specifications & Approvals Schedule-10/Schedule-40 pipe are in compliance with the following: **ASTM A135 and NFPA 13**. Both pipe products have a working pressure rating of 300 psi maximum and also meet the stringent requirement for the following tests: Welded Outlets, Hydrostatic Pressure, Side Wall Rupture, Vibration Test.

Sch-40 Specifications				
NPS	Nominal I.D.	Wt.	Wt. (H2O Filled)	CRR
In; mm	In; mm	Lbs/Ft; kg/m	Lbs/Ft; kg/m	—
1"	1.049	1.680	2.05	1
25	26.6	2.5	3.05	—
1¼"	1.380	2.270	2.93	1
32	35.1	4.36	4.36	—
1½"	1.610	2.720	3.61	1
40	40.9	4.0	5.37	—
2"	2.067	3.650	5.13	1
50	52.5	5.4	7.63	—
2½"	2.469	5.790	7.86	1
65	62.7	8.6	11.73	—

Sch-10 Specifications				
NPS	Nominal I.D.	Wt.	Wt. (H2O Filled)	CRR
In; mm	In; mm	Lbs/Ft; kg/m	Lbs/Ft; kg/m	—
1¼"	1.442	1.810	2.525	7.0955
32	36.6	2.7	3.75	—
1½"	1.682	2.080	3.04	5.6570
40	42.7	3.1	4.52	—
2"	2.157	2.640	4.22	4.5827
50	54.8	3.9	6.28	—
2½"	2.635	3.530	5.89	3.5196
65	66.9	5.3	8.77	—
3"	3.260	4.330	7.94	2.5550
80	82.8	6.4	11.82	—
4"	4.260	5.610	11.78	1.6020
90	108.2	8.3	17.53	—
5"	5.295	7.77	17.33	1.4874
125	134.5	11.56	25.80	—
6"	6.357	9.290	23.03	1.0251
150	161.5	13.8	34.27	—
8"	8.249	16.490	40.15	1.8365
200	209.5	24.5	59.75	—



Project: _____	Sprinkler Contractor: _____	Date: _____
Engineer: _____	Specification Reference: _____	System Type: _____
Locations: _____	Comments: _____	



Fig. 200
"Trimline" Adjustable Band Hanger

Size Range – 1/2 thru 8 inch pipe.

Material – Carbon Steel, Mil. Galvanized to G-90 specifications.

Function – For fire sprinkler and other general piping purposes. Knurled swivel nut design permits hanger adjustment after installation.

Features

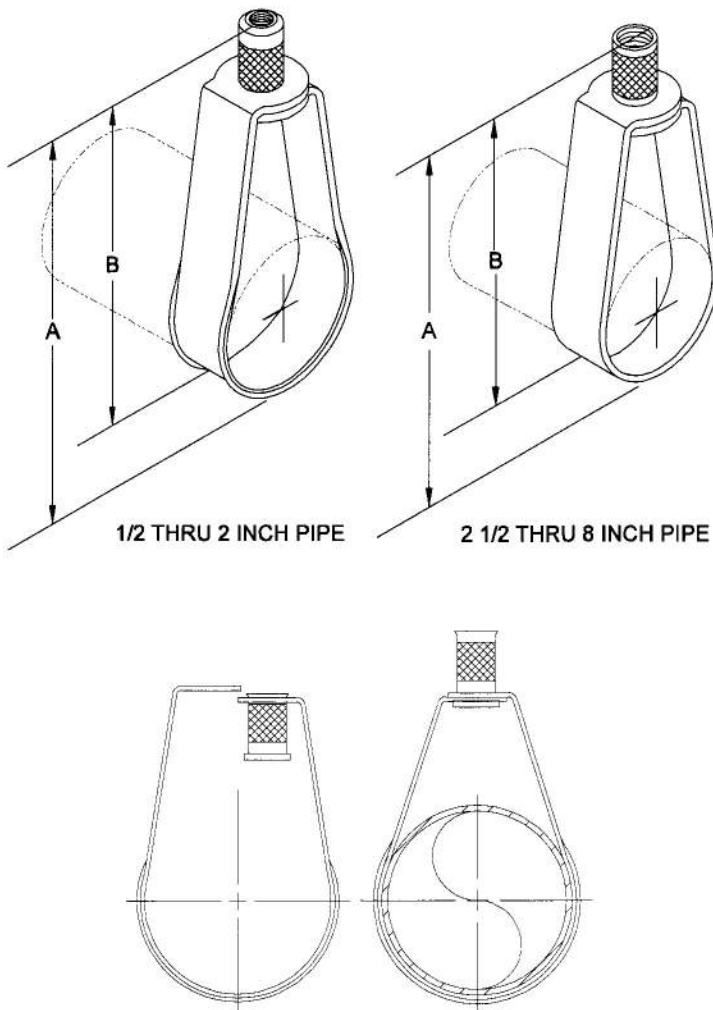
- (1/2 thru 2 inch) Flared edges ease installation for all pipe types and protect CPVC plastic pipe from abrasion. Captured design keeps adjusting nut from separating with hanger. Hanger is easily installed around pipe.
- (2-1/2 thru 8 inch) Spring tension on nut holds it securely in hanger before installation. Adjusting nut is easily removed.

Approvals – Underwriters' Laboratories Listed (1/2" thru 8") in the USA (**UL**) and Canada (**cUL**) for steel and CPVC plastic pipe and Factory Mutual Engineering Approved (3/4" thru 8"). Conforms to Federal Specifications WW-H-171E, Type 10, and Manufacturers Standardization Society SP-69, type 10.

Maximum Temperature - 650°F.

Finish – Mil. Galvanized, for Stainless Steel materials order TOLCO™ Fig. 200WON.

Order By – Figure number and pipe size.



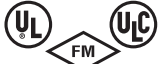
Pipe Size	Inch	Rod Size Metric*	A	B	Max. Rec. Load Lbs.	Approx. Wt./100
1/2	3/8	8mm or 10mm	3-1/8	2-5/8	400	11
3/4	3/8	8mm or 10mm	3-1/8	2-1/2	400	11
1	3/8	8mm or 10mm	3-3/8	2-5/8	400	12
1-1/4	3/8	8mm or 10mm	3-3/4	2-7/8	400	13
1-1/2	3/8	8mm or 10mm	3-7/8	2-7/8	400	14
2	3/8	8mm or 10mm	4-1/2	3	400	15
2-1/2	3/8	10mm	5-5/8	4-1/8	600	27
3	3/8	10mm	5-7/8	4	600	29
3-1/2	3/8	10mm	7-3/8	5-1/4	600	34
4	3/8	10mm	7-3/8	5	1000	35
5	1/2	12mm	9-1/8	6-1/4	1250	66
6	1/2	12mm	10-1/8	6-3/4	1250	73
8	1/2	12mm	13-1/8	8-3/4	1250	136

*Order Fig. 200M

FIG. 360 Straight Cross



Cast Iron Threaded Fittings Class 125 (Standard) Submittal Sheet



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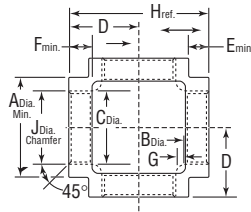


FIGURE 360 STRAIGHT CROSS

Size	A	B	Weight black
NPS/DN	in/mm	in/mm	lbs/kg
1/2 15	1 3/16 22	9/16 14	2.8 1.3
3/4 20	1 5/16 33	1 3/16 22	1 0.47
1 25	1 1/2 38	1 5/16 24	1.6 0.72
1 1/4 32	1 3/4 44	1 7/8 29	2.4 1.1
1 1/2 40	1 11/16 49	1 5/8 33	3.2 1.5
2 50	2 1/4 57	1 9/16 40	5.1 2.3
2 1/2 65	2 11/16 68	1 11/16 47	8.1 3.7
3 80	3 1/8 79	2 3/16 56	12 5.4
4 100	3 13/16 98	2 3/4 70	20 8.9
5 125	4 1/2 114	3 5/16 84	31 14
6 150	5 1/8 130	3 7/8 98	48 22

MATERIAL SPECIFICATIONS

Anvil standard and extra heavy cast iron threaded fittings are manufactured in accordance with ASME-B16.4 (except plugs and bushings, ASME B16.14). Dimensions also conform to Federal Specifications, WW-P-501 (except plugs and bushings WW-P-471).

Anvil standard and extra heavy fittings in this section, sizes 1/4 NPS - 12NPS (8 - 300 DN), are included in the "List of Inspected Fire Protection Equipment and Materials" issued by the Underwriters' Laboratories, Inc.

NOTE: See the Technical Data section for pressure-temperature ratings. See AnvilStar Web site for the most current Listings and approvals.

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Architect / Engineer:		
Contractor:		
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Notes 1:		
Notes 2:		

FIG. 352 90° Reducing Elbow



Cast Iron Threaded Fittings Class 125 (Standard) Submittal Sheet



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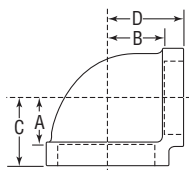


FIGURE 352 90° REDUCING ELBOW

Size		A	B	C	D	Weight block
NPS/DN	NPS/DN	In./mm	In./mm	In./mm	In./mm	lbs./kg
1/2 15	1/4	5/8 16	3/4 19	1 1/16 27	1 1/16 27	0.4 0.18
	3/8	5/8 16	1 1/16 17	1 1/16 27	1 1/16 27	0.34 0.15
	1/2	1 1/16 17	1 3/16 22	1 1/4 32	1 1/4 32	0.51 0.23
3/4 20	1/2	1 1/16 17	1 5/16 24	1 3/8 35	1 3/8 35	0.67 0.3
	3/4	1 3/16 22	1 5/16 24	1 1/16 37	1 1/16 37	0.76 0.34
	1	1 1/16 17	1 1/2 27	1 1/2 38	1 1/2 38	1.1 0.49
1 1/4 32	3/4	1 3/16 22	1 1/2 29	1 3/8 41	1 3/8 41	1 0.46
	1	1 5/16 24	1 1/2 29	1 1/16 43	1 1/16 43	1.2 0.55
	1 1/2	1 1/2 25	1 1/2 25	1 1/2 47	1 1/2 47	1.4 0.65
1 1/2 40	1 1/4	1 3/16 30	1 1/4 32	1 3/8 48	1 3/8 48	1.7 0.79
	1 1/2	1 1/2 32	1 1/2 32	1 1/2 51	1 1/2 51	2.2 1
	2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
2 50	1 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	2 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
2 1/2 65	2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	2 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	3	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
3 80	2 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	3	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	3 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
3 1/2 90	3	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	3 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	4	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
4 100	3 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	4	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	4 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
4 1/2 110	4	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	4 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	5	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
5 125	4 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	5	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	5 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
5 1/2 135	5	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	5 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	6	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
6 150	5 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	6	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	6 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
6 1/2 160	6	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	6 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	7	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
7 175	6 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	7	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	7 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
7 1/2 185	7	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	7 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	8	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
8 200	7 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	8	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1
	8 1/2	1 1/2 33	1 1/2 38	2 51	2 51	2.2 1

MATERIAL SPECIFICATIONS

Anvil standard and extra heavy cast iron threaded fittings are manufactured in accordance with ASME-B16.4 (except plugs and bushings, ASME B16.14). Dimensions also conform to Federal Specifications, WW-P-501 (except plugs and bushings WW-P-471).

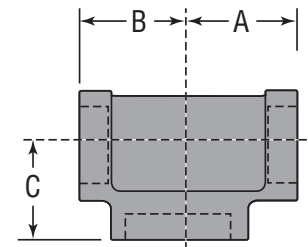
Anvil standard and extra heavy fittings in this section, sizes 1/4 NPS - 12NPS (8 - 300 DN), are included in the "List of Inspected Fire Protection Equipment and Materials" issued by the Underwriters' Laboratories, Inc.

NOTE: See the Technical Data section for pressure-temperature ratings. See AnvilStar Web site for the most current Listings and approvals.

PROJECT INFORMATION:		APPROVAL STAMP:
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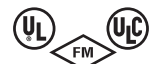
BULL HEAD TEE							
Nominal Size	Anvil Item Number	Universal Number	Max. Working Pressure	Dimensions			Approx. Wt. Each
				A	B	C	
In. (mm)	In. (mm)	PSI (kPa)	PSI (kPa)	In. (mm)	In. (mm)	In. (mm)	Lbs. (kg)
1 x 1 x 1 1/4 25 x 25 x 32	800004285	CT334	300 2065	1.67 42.418	1.67 42.418	1.58 40.132	1.52 0.69
1 x 1 x 1 1/2 25 x 25 x 40	800004293	CT335	300 2065	1.8 45.72	1.8 45.72	1.65 41.91	1.73 0.78
1 1/4 x 1 x 1 1/2 32 x 25 x 40	800004343	CT435	300 2065	1.88 47.752	1.8 45.72	1.82 46.228	2.05 0.93
1 1/4 x 1 1/4 x 1 1/2 32 x 32 x 40	800004384	CT445	300 2065	1.88 47.752	1.88 47.752	1.82 46.228	2.21 1.00
1 1/4 x 1 1/4 x 2 25 x 25 x 40	800004392	CT446	300 2065	2.1 53.34	2.1 53.34	1.9 48.26	2.55 1.16
1 1/2 x 1 1/4 x 2 40 x 32 x 40	800004509	CT546	300 2065	2.16 54.864	2.1 53.34	2.02 51.308	2.80 1.27
1 1/2 x 1 1/2 x 2 40 x 40 x 50	800004558	CT556	300 2065	2.16 54.864	2.16 54.864	2.02 51.308	3.28 1.41
2 x 2 x 2 1/2 50 x 50 x 60	800004699	CT667	300 2065	2.6 66.04	2.6 66.04	2.39 60.706	5.10 2.31



MATERIAL SPECIFICATIONS

Cast iron threaded fittings are UL & ULC Listed & Factory Mutual Approved for 300 psi service.
Gray iron per ASTM A126 Class B.

Dimensions conform to ANSI B16.4 Class 125.
Threads are NPT per ANSI/ASME B1.20.1.



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FIG. 381 Cap



Cast Iron Threaded Fittings Class 125 (Standard) Submittal Sheet



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FIGURE 381 CAP

Size	Weight	
	black	galv.
<i>NPS/DN</i>	<i>lbs./kg</i>	<i>lbs./kg</i>
2½	2.5	—
65	1.2	—
3	4.1	—
80	1.9	—
4	6.4	—
100	2.9	—
5	11	—
125	4.9	—
6	14	15
150	6.4	6.6
8	27	28
200	12	13

MATERIAL SPECIFICATIONS

Anvil standard and extra heavy cast iron threaded fittings are manufactured in accordance with ASME-B16.4 (except plugs and bushings, ASME B16.14). Dimensions also conform to Federal Specifications, WW-P-501 (except plugs and bushings WW-P-471).

Anvil standard and extra heavy fittings in this section, sizes ¼ NPS - 12NPS (8 - 300 DN), are included in the "List of Inspected Fire Protection Equipment and Materials" issued by the Underwriters' Laboratories, Inc.

NOTE: See the Technical Data section for pressure-temperature ratings. See AnvilStar Web site for the most current Listings and approvals.

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Project:	
Date:	Phone:
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Contractor:	
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Notes 1:	
Notes 2:	

APPROVAL STAMP:

FIG. 352 90° Reducing Elbow



Cast Iron Threaded Fittings Class 125 (Standard) Submittal Sheet



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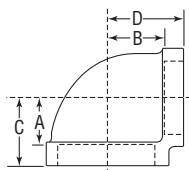


FIGURE 352 90° REDUCING ELBOW

Size		A	B	C	D	Weight block
NPS/DN	NPS/DN	In./mm	In./mm	In./mm	In./mm	lbs./kg
1/2 15	1/4	5/8 16	3/4 19	1 1/16 27	1 1/16 27	0.4 0.18
	3/8	5/8 16	1 1/16 17	1 1/16 27	1 1/16 27	0.34 0.15
	1/2	1 1/16 17	1 3/16 22	1 1/4 32	1 1/4 32	0.51 0.23
3/4 20	1/2	1 1/16 17	1 5/16 24	1 3/8 35	1 3/8 35	0.67 0.3
	3/4	1 3/16 22	1 5/16 24	1 1/16 37	1 1/16 37	0.76 0.34
	1	1 1/16 17	1 1/2 27	1 1/2 38	1 1/2 38	1.1 0.49
1 1/4 32	3/4	1 3/16 22	1 1/2 29	1 3/8 41	1 3/8 41	1 0.46
	1	1 5/16 24	1 1/2 29	1 1/16 43	1 1/16 43	1.2 0.55
	1 1/2	1 1/2 25	1 1/2 25	1 1/2 47	1 1/2 47	1.4 0.65
1 1/2 40	1 1/4	1 3/16 30	1 1/4 32	1 3/8 48	1 3/8 48	1.7 0.79
	1 1/2	1 1/2 32	1 1/2 32	1 1/2 51	1 1/2 51	2.2 1
	2	1 1/2 32	1 1/2 32	2 51	2 51	2.2 1
2 50	1 1/2	1 1/2 32	1 1/2 32	2 51	2 51	2.1 0.9
	2 1/2	1 1/2 32	1 1/2 32	2 1/2 52	2 1/2 52	2.3 1.1
	3	1 1/2 32	1 1/2 32	2 1/2 54	2 1/2 54	2.6 1.2
2 1/2 65	2	1 1/2 32	1 1/2 32	2 51	2 51	2.2 1
	2 1/2	1 1/2 32	1 1/2 32	2 1/2 52	2 1/2 52	2.3 1.1
	3	1 1/2 32	1 1/2 32	2 1/2 54	2 1/2 54	2.6 1.2
3 80	2 1/2	1 1/2 32	1 1/2 32	2 1/2 52	2 1/2 52	2.3 1.1
	3	1 1/2 32	1 1/2 32	2 1/2 54	2 1/2 54	2.6 1.2
	3 1/2	1 1/2 32	1 1/2 32	3 57	3 57	2.9 1.3
3 1/2 90	3	1 1/2 32	1 1/2 32	3 57	3 57	2.9 1.3
	3 1/2	1 1/2 32	1 1/2 32	3 1/2 60	3 1/2 60	3.4 1.5
	4	1 1/2 32	1 1/2 32	3 1/2 60	3 1/2 60	3.4 1.5
4 100	3 1/2	1 1/2 32	1 1/2 32	3 1/2 60	3 1/2 60	3.4 1.5
	4	1 1/2 32	1 1/2 32	4 63	4 63	3.7 1.7
	4 1/2	1 1/2 32	1 1/2 32	4 1/2 65	4 1/2 65	4 1.8
4 1/2 110	4	1 1/2 32	1 1/2 32	4 63	4 63	3.7 1.7
	4 1/2	1 1/2 32	1 1/2 32	4 1/2 65	4 1/2 65	4 1.8
	5	1 1/2 32	1 1/2 32	5 68	5 68	4.4 2
5 125	4 1/2	1 1/2 32	1 1/2 32	4 1/2 65	4 1/2 65	4 1.8
	5	1 1/2 32	1 1/2 32	5 68	5 68	4.4 2
	5 1/2	1 1/2 32	1 1/2 32	5 1/2 70	5 1/2 70	4.8 2.2
5 1/2 135	5	1 1/2 32	1 1/2 32	5 68	5 68	4.4 2
	5 1/2	1 1/2 32	1 1/2 32	5 1/2 70	5 1/2 70	4.8 2.2
	6	1 1/2 32	1 1/2 32	6 73	6 73	5.1 2.3
6 150	5 1/2	1 1/2 32	1 1/2 32	5 1/2 70	5 1/2 70	4.8 2.2
	6	1 1/2 32	1 1/2 32	6 73	6 73	5.1 2.3
	6 1/2	1 1/2 32	1 1/2 32	6 1/2 76	6 1/2 76	5.5 2.5
6 1/2 160	6	1 1/2 32	1 1/2 32	6 73	6 73	5.1 2.3
	6 1/2	1 1/2 32	1 1/2 32	6 1/2 76	6 1/2 76	5.5 2.5
	7	1 1/2 32	1 1/2 32	7 79	7 79	5.9 2.7
7 180	6 1/2	1 1/2 32	1 1/2 32	6 1/2 76	6 1/2 76	5.5 2.5
	7	1 1/2 32	1 1/2 32	7 79	7 79	5.9 2.7
	7 1/2	1 1/2 32	1 1/2 32	7 1/2 82	7 1/2 82	6.3 2.9
7 1/2 190	7	1 1/2 32	1 1/2 32	7 79	7 79	5.9 2.7
	7 1/2	1 1/2 32	1 1/2 32	7 1/2 82	7 1/2 82	6.3 2.9
	8	1 1/2 32	1 1/2 32	8 86	8 86	6.7 3.1
8 200	7 1/2	1 1/2 32	1 1/2 32	7 1/2 82	7 1/2 82	6.3 2.9
	8	1 1/2 32	1 1/2 32	8 86	8 86	6.7 3.1
	8 1/2	1 1/2 32	1 1/2 32	8 1/2 89	8 1/2 89	7.1 3.2

MATERIAL SPECIFICATIONS

Anvil standard and extra heavy cast iron threaded fittings are manufactured in accordance with ASME-B16.4 (except plugs and bushings, ASME B16.14). Dimensions also conform to Federal Specifications, WW-P-501 (except plugs and bushings WW-P-471).

Anvil standard and extra heavy fittings in this section, sizes 1/4 NPS - 12NPS (8 - 300 DN), are included in the "List of Inspected Fire Protection Equipment and Materials" issued by the Underwriters' Laboratories, Inc.

NOTE: See the Technical Data section for pressure-temperature ratings. See AnvilStar Web site for the most current Listings and approvals.

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Project:		
Date:	Phone:	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

FIG. 351 90° Elbow – Straight



Cast Iron Threaded Fittings Class 125 (Standard) Submittal Sheet



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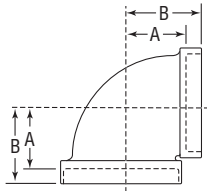


FIGURE 351 90° ELBOW STRAIGHT

Size	A	B	Weight	
			black	galv.
NPS/DN	In./mm	In./mm	lbs./kg	lbs./kg
1/4	1/2	1 3/16	0.16	0.17
8	13	22	0.07	0.08
3/8	9/16	1 5/16	0.25	0.26
10	14	24	0.11	0.12
1/2	1 1/16	1 7/8	0.4	0.41
15	17	29	0.18	0.19
3/4	1 3/16	1 5/8	0.6	0.61
20	22	33	0.27	0.28
1	1 5/16	1 1/2	0.92	0.95
25	24	38	0.42	0.43
1 1/4	1 7/8	1 3/4	1.4	1.5
32	29	44	0.65	0.66
1 1/2	1 5/8	1 11/16	2	2
40	33	49	0.88	0.91
2	1 7/8	2 1/4	3.1	3.2
50	40	57	1.4	1.5
2 1/2	1 3/4	2 1/16	4.9	5.1
65	47	68	2.2	2.3
3	2 3/16	3 1/8	7.2	7.4
80	56	79	3.3	3.4
4	2 1/16	3 13/16	12	13
100	68	98	5.5	5.7
5	3 5/16	4 1/2	21	—
125	84	114	10	—
6	3 7/8	5 1/8	31	33
150	98	130	14	15
8	5 3/16	6 7/16	65	67
200	132	167	29	30

MATERIAL SPECIFICATIONS

Anvil standard and extra heavy cast iron threaded fittings are manufactured in accordance with ASME-B16.4 (except plugs and bushings, ASME B16.14). Dimensions also conform to Federal Specifications, WW-P-501 (except plugs and bushings WW-P-471).

Anvil standard and extra heavy fittings in this section, sizes 1/4 NPS - 12NPS (8 - 300 DN), are included in the "List of Inspected Fire Protection Equipment and Materials" issued by the Underwriters' Laboratories, Inc.

NOTE: See the Technical Data section for pressure-temperature ratings. See AnvilStar Web site for the most current Listings and approvals.

PROJECT INFORMATION:		APPROVAL STAMP:
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Date:	Phone:	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

FIG. 356A 22¹/₂° Elbow



Cast Iron Threaded Fittings Class 125 (Standard) Submittal Sheet



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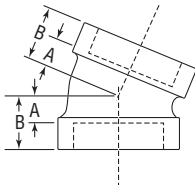


FIGURE 356A 22¹/₂° ELBOW

Size	A	B	Weight black
NPS/DN	In./mm	In./mm	lbs./kg
3/4 20	3/8 10	7/8 22	0.52 0.24
1 25	7/16 11	1 25	0.8 0.36
1 1/4 32	1/2 13	1 1/8 29	1.4 0.64
1 1/2 40	5/8 16	1 1/4 32	1.6 0.74
2 50	3/4 19	1 7/16 37	2.5 1.1
2 1/2 65	3/4 19	1 5/8 41	4 1.8

Galvanized-Not Steel

MATERIAL SPECIFICATIONS

Anvil standard and extra heavy cast iron threaded fittings are manufactured in accordance with ASME-B16.4 (except plugs and bushings, ASME B16.14). Dimensions also conform to Federal Specifications, WW-P-501(except plugs and bushings WW-P-471).

Anvil standard and extra heavy fittings in this section, sizes 1/4 NPS - 12NPS (8 - 300 DN), are included in the "List of Inspected Fire Protection Equipment and Materials" issued by the Underwriters' Laboratories, Inc.

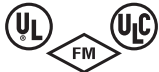
NOTE: See the Technical Data section for pressure-temperature ratings. See AnvilStar Web site for the most current Listings and approvals.

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FIG. 367 Concentric Reducers



Cast Iron Threaded Fittings Class 125 (Standard) Submittal Sheet



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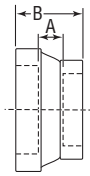


FIGURE 367 CONCENTRIC REDUCERS

Size		A	B	Weight black
NPS/DN	NPS/DN	In./mm	In./mm	lbs./kg
3/4 20	1/2 15	5/8 16	1 1/16 40	0.4 0.18
1 25	1/2 15	1 1/16 17	1 11/16 43	0.54 0.24
	3/4 20	7/16 11	1 1/2 38	0.63 0.29
1 1/4 32	1/2 15	9/16 14	1 5/8 41	0.84 0.38
	3/4 20	1 25	2 1/8 54	1.1 0.49
	1 25	1 1/16 24	2 1/8 54	1.1 0.49
	1 1/2 40	1 1/2 13	1 5/8 41	1 0.45
1 1/2 40	3/4 20	1/2 13	1 5/8 41	1.2 0.54
	1 25	1/2 13	1 3/4 44	1.5 0.68
	1 1/4 32	1 25	2 1/4 57	1.5 0.66
	1/2 15	5/8 16	2 51	2 0.91
	3/4 20	3/4 19	2 51	1.9 0.86
	1 25	3/4 19	2 51	1.8 0.83

Size		A	B	Weight black
NPS/DN	NPS/DN	In./mm	In./mm	lbs./kg
2 50 (cont.)	1 1/4 32	1 3/16 22	2 1/8 54	1.8 0.81
	1 1/2 40	7/8 22	2 3/16 56	2 0.9
2 1/2 65	1 1/2 40	3/4 19	2 51	3.1 1.4
	2 50	1 25	2 9/16 65	3 1.4
3 80	3/4 20	1 5/16 24	2 1/2 64	4.3 2
	2 50	1 1/16 27	2 3/4 70	4 1.8
	2 1/2 65	1 5/16 24	2 13/16 73	4.4 2
	2 50	1 3/16 30	2 15/16 75	6.5 2.9
4 100	2 1/2 65	1 3/16 30	3 1/8 79	7.8 3.5
	3 80	1 1/16 27	3 1/8 79	7 3.2
	4 100	1 1/16 27	3 5/16 84	10 4.8
5 125	4 100	1 1/8 29	3 7/16 87	14 6.3
6 150	5 125	1 1/8 29	3 9/16 90	16 7
	6 150	1 1/4 32	3 7/8 98	29 13

■ hex end

MATERIAL SPECIFICATIONS

Anvil standard and extra heavy cast iron threaded fittings are manufactured in accordance with ASME-B16.4 (except plugs and bushings, ASME B16.14). Dimensions also conform to Federal Specifications, WW-P-501 (except plugs and bushings WW-P-471).

Anvil standard and extra heavy fittings in this section, sizes 1/4 NPS - 12NPS (8 - 300 DN), are included in the "List of Inspected Fire Protection Equipment and Materials" issued by the Underwriters' Laboratories, Inc.

NOTE: See the Technical Data section for pressure-temperature ratings. See AnvilStar Web site for the most current Listings and approvals.

PROJECT INFORMATION:		APPROVAL STAMP:
Project:		
Date:	Phone:	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

FIG. 383 Hex Bushing



Cast Iron Threaded Fittings Class 125 (Standard) Submittal Sheet



APPROVED
For Listing / Approval
details contact your
AnvilStar™ Representative.



FIGURE 383 HEX BUSHING

Size			Weight	
			black	galv.
NPS/DN	Hex	NPS/DN	lbs./kg	lbs./kg
1/4 8		1/8	0.02*	0.02
		6	0.01*	0.01
3/8 10		1/8	0.05	0.05
		6	0.02	0.02
		1/4	0.04	0.04
		8	0.02	0.02
1/2 15		1/8	0.06	0.06
		6	0.03	0.03
		1/4	0.07	0.07
		8	0.03	0.03
		3/8	0.05	0.05
		10	0.02	0.02
3/4 20		1/8	0.09	0.09
		6	0.04	0.04
		1/4	0.1	0.11
		8	0.05	0.05
		3/8	0.12	0.12
		10	0.05	0.05
		1/2	0.1	0.11
		15	0.05	0.05
1 25	■	1/8	0.21	0.22
		6	0.09	0.1
	■	1/4	0.19	0.19
		8	0.08	0.09
	■	3/8	0.18	0.19
		10	0.08	0.09
		1/2	0.21	0.22
		15	0.1	0.1
		3/4	0.17	0.17
		20	0.08	0.08

MATERIAL SPECIFICATIONS

Anvil standard and extra heavy cast iron threaded fittings are manufactured in accordance with ASME-B16.4 (except plugs and bushings, ASME B16.14). Dimensions also conform to Federal Specifications, WW-P-501 (except plugs and bushings WW-P-471).

Anvil standard and extra heavy fittings in this section, sizes 1/4 NPS - 12NPS (8 - 300 DN), are included in the "List of Inspected Fire Protection Equipment and Materials" issued by the Underwriters' Laboratories, Inc.

NOTE: See the Technical Data section for pressure-temperature ratings. See AnvilStar Web site for the most current Listings and approvals.

PROJECT INFORMATION:		APPROVAL STAMP:	
Project:			
Date:	Phone:		
Architect / Engineer:			
Contractor:			
Address:			
Notes 1:			
Notes 2:			

FIG. 383 Hex Bushing



Cast Iron Threaded Fittings Class 125 (Standard) Submittal Sheet

FIGURE 383 HEX BUSHING (CONT.)

Size			Weight	
			black	galv.
NPS/DN	Hex	NPS/DN	lbs./kg	lbs./kg
2 50	■	1/4	0.75	0.8
		8	0.34	0.36
		3/8	0.75	0.78
		10	0.34	0.35
		1/2	0.77	0.78
		15	0.35	0.35
		3/4	0.71	0.75
		20	0.32	0.34
		1	0.73	0.76
		25	0.33	0.34
2 1/2 65	■	1 1/4	0.81	0.83
		32	0.37	0.38
		1 1/2	0.67	0.68
		40	0.3	0.31
		1/2	1.3	—
		15	0.58	—
		3/4	1.3	1.3
		20	0.57	0.59
		1	1.2	1.2
		25	0.53	0.56
3 80	■	1 1/4	1.2	1.3
		32	0.56	0.57
		1 1/2	1.3	1.3
		40	0.59	0.61
		2	0.92	0.95
		50	0.42	0.43
		1/2	1.9	2
		15	0.88	0.9
		3/4	1.9	2
		20	0.87	0.88
3 1/2 90	■	1	1.9	1.9
		25	0.86	0.87
		1 1/4	1.8	1.8
		32	0.8	0.82
		1 1/2	1.8	1.8
		40	0.81	0.83
		2	1.9	1.9
		50	0.86	0.88
		2 1/2	1.6	1.7
		65	0.74	0.75
4 100	■	1	2.6	2.8
		25	1.2	1.2
		1 1/4	2.5	2.6
		32	1.2	1.2
		1 1/2	2.3	2.4
		40	1.1	1.1
		2	2.4	2.5
		50	1.1	1.1
		2 1/2	2.6	2.6
		65	1.2	1.2
5 125	■	3	2	2
		80	0.89	0.9
		1	3.6	3.6
		25	1.6	1.6
		1 1/4	3.5	3.6
		32	1.6	1.6
		1 1/2	3.4	3.5
		40	1.6	1.6
		2	3.1	3.2
		50	1.4	1.5
6 150	■	2 1/2	3.3	3.3
		65	1.5	1.5
		3	3.1	3.2
		80	1.4	1.5
		3 1/2	2.5	2.6
		90	1.1	1.2
8 200	■	2	8	8.3
		50	3.6	3.8
		2 1/2	7.7	7.8
		65	3.5	3.5
		3	7.8	8.1
		80	3.5	3.7
		3 1/2	7.1	7.4
		90	3.2	3.4
		4	6.8	7.1
		100	3.1	3.2
10 250	■	5	5.2	5.5
		125	2.4	2.5
		3	16	16
		80	7	7.2
		4	14	15
		100	6.3	6.8
		5	14	14
		125	6.2	6.4
		6	13	14
		150	6	6.1
12 300	■	4	28	—
		100	12	—
		5	—	—
		125	—	—
		6	25	—
		150	11	—
		8	22	—
		200	10	—
		4	33	*
		100	15	*
12 300	■	10	33	33
		250	15	15

- * POA
- Not Stocked
- Inside Hex

NOTE: Hexagon head or octagon head bushings 2 1/2 NPS/DN (65 DN) and smaller Reducing one size may be made of malleable iron, ductile iron or steel. Other sizes may be made of cast iron, ductile iron, malleable iron or steel. Face bushings 2 1/2 NPS/DN (65 DN) and smaller may be made of malleable iron, ductile iron or steel. Face bushings 3 NPS/DN (80 DN) and larger Reducing one size may be made of malleable iron, ductile iron or steel. Face bushings 3 NPS/DN (80 DN) and larger Reducing two sizes or more may be made of cast or malleable iron, ductile iron, or steel.

According to specifications, hex bushings and cored plugs should be used with 150# malleable iron and 125# cast iron. Solid plugs and face bushings should be used with #250 and #300 Fittings.

NOTE: See page PF-5 and page PF-5 for pressure-temperature ratings. Pressure/temperature ratings vary with material



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details contact your
AnvilStar™ Representative.

FIG. 387 Square Head Plugs (Cored)



Cast Iron Threaded Fittings Class 125 (Standard) Submittal Sheet



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details contact your
AnvilStar™ Representative.



**FIGURE 387◇
SQUARE HEAD PLUGS (CORED)**

Size	Weight	
	black	galv.
<i>NPS/DN</i>	<i>lbs/kg</i>	<i>lbs/kg</i>
3/4	0.13	0.14
20	0.06	0.06
1	0.25	0.28
25	0.11	0.13
1 1/4	0.39	0.41
32	0.18	0.18
1 1/2	0.5	0.52
40	0.23	0.23
2	0.81	0.83
50	0.37	0.38
2 1/2	1.3	1.3
65	0.6	0.61
3	1.9	1.9
80	0.85	0.87
3 1/2	2.5	2.6●
90	1.1	1.2●
4	4	4
100	1.8	1.8

* POA

● Not stocked

◇ 1/8, 1/4, 3/8 NPS/DN (6, 8 & 10 DN) plugs furnished in steel.

▲ 1/2 and 3/4 NPS/DN (15 & 20 DN) countersunk plugs furnished in malleable iron.

MATERIAL SPECIFICATIONS

Anvil standard and extra heavy cast iron threaded fittings are manufactured in accordance with ASME-B16.4 (except plugs and bushings, ASME B16.14). Dimensions also conform to Federal Specifications, WW-P-501 (except plugs and bushings WW-P-471).

Anvil standard and extra heavy fittings in this section, sizes 1/4 NPS - 12NPS (8 - 300 DN), are included in the "List of Inspected Fire Protection Equipment and Materials" issued by the Underwriters' Laboratories, Inc.

NOTE: See the Technical Data section for pressure-temperature ratings. See AnvilStar Web site for the most current Listings and approvals.

PROJECT INFORMATION:		APPROVAL STAMP:
Project:		
Date:	Phone:	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

FIG. 358 Straight Tee



Cast Iron Threaded Fittings Class 125 (Standard) Submittal Sheet



APPROVED
For Listing / Approval
details contact your
AnvilStar™ Representative.

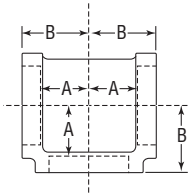


FIGURE 358 STRAIGHT TEE

Size	A	B	Weight	
			black	galv.
NPS/DN	in./mm	in./mm	lbs./kg	lbs./kg
1/4	1/2	13/16	0.22	0.23
8	13	22	0.1	0.1
3/8	3/8	1	0.35	0.36
10	16	25	0.16	0.16
1/2	11/16	1 1/8	0.56	0.58
15	17	29	0.25	0.26
3/4	13/16	1 5/16	0.84	0.85
20	22	33	0.38	0.39
1	1 3/16	1 1/2	1.3	1.3
25	24	38	0.57	0.59
1 1/4	1 1/8	1 3/4	2	2.1
32	29	44	0.9	0.9
1 1/2	1 5/16	1 5/16	2.7	2.7
40	33	49	1.2	1.2
2	1 7/16	2 1/4	4.2	4.3
50	40	57	1.9	2
2 1/2	1 13/16	2 11/16	6.7	6.8
65	47	68	3	3.1
3	2 3/16	3 1/8	10	10
80	56	79	4.5	4.6
3 1/2	2 7/16	3 7/16	13	14
90	62	87	6	6.3
4	2 11/16	3 3/4	16	17
100	68	95	7.4	7.7
5	3 5/16	4 1/2	27	28
125	84	114	12	13
6	3 7/8	5 1/8	41	41
150	98	130	19	19
8	5 3/16	6 9/16	79	81
200	132	167	36	37

MATERIAL SPECIFICATIONS

Anvil standard and extra heavy cast iron threaded fittings are manufactured in accordance with ASME-B16.4 (except plugs and bushings, ASME B16.14). Dimensions also conform to Federal Specifications, WW-P-501 (except plugs and bushings WW-P-471).

Anvil standard and extra heavy fittings in this section, sizes 1/4 NPS - 12NPS (8 - 300 DN), are included in the "List of Inspected Fire Protection Equipment and Materials" issued by the Underwriters' Laboratories, Inc.

NOTE: See the Technical Data section for pressure-temperature ratings. See AnvilStar Web site for the most current Listings and approvals.

PROJECT INFORMATION:		APPROVAL STAMP:
Project:		
Date:	Phone:	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

Flexible Coupling

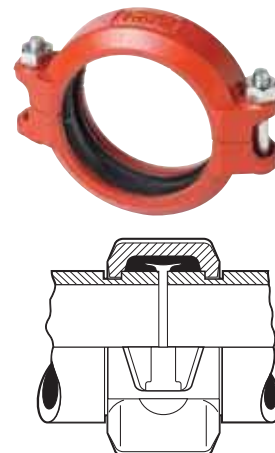
STYLE 75



Style 75 is available where moderate pressures are expected or weight considerations are a factor. Up to 50% lighter in weight than the Style 77, the Style 75 coupling is recommended for service up to 500 psi/3450 kPa depending on size. Housings are cast in two identical pieces in all sizes. Hot-dip galvanized and special coatings are available for all sizes.

The Victaulic standard flexible coupling offering for grade “EHP” or “T” gaskets is the Style 177 installation-ready flexible coupling. For all available sizes, the Style 177 is the standard flexible coupling Victaulic supplies in North America for piping systems using Grade “EHP” or “T” gaskets. Contact Victaulic for further details.

Performance data presented in this document is based on use with standard wall, carbon steel pipe. For use with stainless steel pipe, please reference document 17.09 for pressure ratings and end loads. When used on light wall stainless steel pipe, the Victaulic RX roll set must be used to roll groove the pipe. For further information regarding roll grooving stainless steel, refer to document 17.01.



Exaggerated for clarity

MATERIAL SPECIFICATIONS

Housing: Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

Housing Coating: Orange enamel.

- **Optional:** Hot dipped galvanized and others.

Gasket: (specify choice*)

- **Grade “E” EPDM**
EPDM (Green color code). Temperature range -30°F to $+230^{\circ}\text{F}$ / -34°C to $+110^{\circ}\text{C}$. Recommended for hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. UL classified in accordance with ANSI/NSF 61 for cold $+86^{\circ}\text{F}$ / $+30^{\circ}\text{C}$ and hot $+180^{\circ}\text{F}$ / $+82^{\circ}\text{C}$ potable water service. NOT RECOMMENDED FOR PETROLEUM SERVICES.
- **Grade “T” nitrile**
Nitrile (Orange color code). Temperature range -20°F to $+180^{\circ}\text{F}$ / -29°C to $+82^{\circ}\text{C}$. Recommended for petroleum products, air with oil vapors, vegetable and mineral oils within the specified temperature range; except hot, dry air over $+140^{\circ}\text{F}$ / $+60^{\circ}\text{C}$ and water over $+150^{\circ}\text{F}$ / $+66^{\circ}\text{C}$. NOT RECOMMENDED FOR HOT WATER SERVICES.

* Services listed are General Service Recommendations only. It should be noted that there are services for which these gaskets are not recommended. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service recommendations and for a listing of services which are not recommended.

NOTE: Additional gasket styles are available. Contact Victaulic for details.

Bolts/Nuts: Heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.

JOB/OWNER

System No. _____

Location _____

CONTRACTOR

Submitted By _____

Date _____

ENGINEER

Spec Sect _____ Para _____

Approved _____

Date _____

Flexible Coupling

STYLE 75

DIMENSIONS

Size		Max. Work Pressure *	Max. End Load *	Allow. Pipe End Sep. †	Deflect. Fr. C _L †		Bolt/Nut@ No – Size	Dimensions – Inches/mm			Approx. Wgt. Each
Nominal Size Inches mm	Actual Outside Diameter Inches mm	psi kPa	Lbs. N	Inches mm	Per Cplg. Deg.	Pipe In./Ft. mm/m	Inches	X	Y	Z	Lbs. kg
1 25	1.315 33.4	500 3450	680 3025	0 – 0.06 0 – 1.6	2° – 43'	0.57 48	2 – 3/8 x 2	2.38 61	4.27 108	1.77 45	1.3 0.6
1 1/4 32	1.660 42.2	500 3450	1080 4805	0 – 0.06 0 – 1.6	2° – 10'	0.45 38	2 – 3/8 x 2	2.68 68	4.61 117	1.77 45	1.4 0.6
1 1/2 40	1.900 48.3	500 3450	1420 6320	0 – 0.06 0 – 1.6	1° – 56'	0.40 33	2 – 3/8 x 2	2.91 74	4.82 122	1.77 45	1.5 0.6
2 50	2.375 60.3	500 3450	2215 9860	0 – 0.06 0 – 1.6	1° – 31'	0.32 26	2 – 3/8 x 2	3.43 87	5.22 133	1.88 48	1.7 0.8
2 1/2 65	2.875 73.0	500 3450	3245 14440	0 – 0.06 0 – 1.6	1° – 15'	0.26 22	2 – 3/8 x 2	3.88 98	5.68 144	1.88 48	1.9 0.9
76.1 mm	3.000 76.1	500 3450	3535 15730	0 – 0.06 0 – 1.6	1° – 12'	0.26 22	2 – 3/8 x 2	4.00 102	5.90 150	1.88 48	1.9 0.9
3 80	3.500 88.9	500 3450	4800 21360	0 – 0.06 0 – 1.6	1° – 2'	0.22 18	2 – 1/2 x 2 3/4	4.50 114	7.00 178	1.88 48	2.9 1.3
3 1/2 90	4.000 101.6	500 3450	6300 28035	0 – 0.06 0 – 1.6	0° – 54'	0.19 16	2 – 1/2 x 2 3/4	5.00 127	7.50 191	1.88 48	2.9 1.3
4 100	4.500 114.3	500 3450	7950 35380	0 – 0.13 0 – 3.2	1° – 36'	0.34 28	2 – 1/2 x 2 3/4	5.80 147	8.03 204	2.13 54	4.1 1.9
108.0mm	4.250 108.0	450 3100	6380 28395	0 – 0.13 0 – 3.2	1° – 41'	0.35 29	2 – 12 x 70.0	5.55 141	7.79 198	2.13 54	3.7 1.7
4 1/2 120	5.000 127.0	450 3100	8820 39250	0 – 0.13 0 – 3.2	1° – 26'	0.25 21	2 – 5/8 x 3 1/4	6.13 156	9.43 240	2.13 54	5.5 2.5
5 125	5.563 141.3	450 3100	10935 48660	0 – 0.13 0 – 3.2	1° – 18'	0.27 23	2 – 5/8 x 3 1/4	6.88 175	10.07 256	2.13 54	5.8 2.6
133.0mm	5.250 133.0	450 3100	9735 43325	0 – 0.13 0 – 3.2	1° – 21'	0.28 24	2 – 16 x 82.5	6.55 166	9.37 238	2.13 54	6.0 2.7
139.7 mm	5.500 139.7	450 3100	10665 47460	0 – 0.13 0 – 3.2	1° – 18'	0.28 24	2 – 5/8 x 3 1/4	6.80 173	9.59 244	2.13 54	6.3 2.9
152.4 mm	6.000 152.4	450 3100	12735 56670	0 – 0.13 0 – 3.2	1° – 12'	0.21 18	2 – 5/8 x 3 1/4	7.38 187	10.48 266	1.88 48	6.2 2.8
6 150	6.625 168.3	450 3100	15525 69085	0 – 0.13 0 – 3.2	1° – 5'	0.23 18	2 – 5/8 x 3 1/4	8.00 203	11.07 281	2.13 54	7.0 3.2
159.0mm	6.250 159.0	450 3100	13800 61405	0 – 0.13 0 – 3.2	1° – 9'	0.24 20	2 – 16 x 82.5	7.63 194	10.49 266	2.13 54	6.8 3.1
8 200	8.625 219.1	450 3100	26280 116945	0 – 0.13 0 – 3.2	0° – 50'	0.18 14	2 – 3/4 x 4 1/4	10.34 263	13.97 355	2.32 59	12.4 5.6

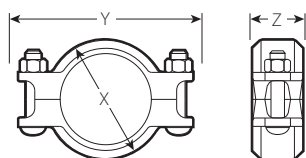
* Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard roll or cut grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe.

WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1 1/2 times the figures shown.

† Allowable Pipe End Separation and Deflection figures show the maximum nominal range of movement available at each joint for standard roll grooved pipe. Figures for standard cut grooved pipe may be doubled. These figures are maximums; for design and installation purposes these figures should be reduced by: 50% for 3/4 – 3 1/2"/20 – 90 mm; 25% for 4"/100 mm and larger.

@ Number of bolts required equals number of housing segments.

Metric thread size bolts are available (color coded gold) for all coupling sizes upon request. Contact Victaulic for details.



Flexible Coupling

STYLE 75

WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

NOTE

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

INSTALLATION

Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

Zero-Flex® Rigid Coupling

STYLE 07



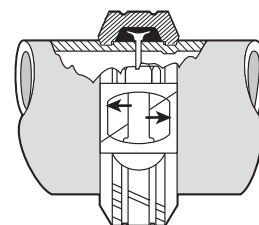
The unique angle-pad design of the Zero-Flex® Style 07 coupling adjusts to standard pipe and roll or cut groove tolerances, positively clamping the pipe to resist flexural and torsional loads. The wider key section fills more of the groove area.

The Victaulic standard rigid coupling offering for grade “EHP” or “T” gaskets is the Style 107 installation-ready rigid coupling. For all available sizes, the Style 107 is the standard rigid coupling Victaulic supplies in North America for piping systems using Grade “EHP” or “T” gaskets. Contact Victaulic for further details.

Style 07 couplings are rated up to 750psi/5175kPa, dependant on size, for 1 – 12”/25 – 300mm piping systems. Rigid couplings provide rigidity for valve connections, machinery rooms, fire mains, and long straight runs. Support and hanging requirements correspond to ASME B31.1 Power Piping Code, ASME B31.9 Building Services Code and NFPA 13 Sprinkler Systems. Angle-pad design permits assembly by removing one nut/bolt and scissoring housing over gasket. This reduces the number of components to handle during assembly, speeds and eases installation.

Performance data presented in this document is based on use with standard wall, carbon steel pipe. For use with stainless steel pipe, please reference document 17.09 for pressure ratings and end loads. When used on light wall stainless steel pipe, the Victaulic RX roll set must be used to roll groove the pipe. For further information regarding roll grooving stainless steel, refer to document 17.01.

For 14 – 24”/350 – 600mm sizes Victaulic offers the Advanced Groove System (AGS) line of products. Request publication 20.02 for information on the rigid W07 AGS coupling.



Exaggerated for clarity

MATERIAL SPECIFICATIONS

Housing: Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

Housing Coating: Orange enamel.

- **Optional:** Hot dipped galvanized and others.

Coupling Gasket: (specify choice‡)

- **Grade “E” EPDM**

EPDM (Green color code). Temperature range –30°F to +230°F/–34°C to +110°C.

Recommended for cold and hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. UL classified in accordance with ANSI/NSF 61 for cold +86°F/+30°C and hot +180°F/+82°C potable water service. NOT RECOMMENDED FOR PETROLEUM SERVICES.

- **Grade “T” nitrile**

Nitrile (Orange color code). Temperature range –20°F to +180°F/–29°C to +82°C.

Recommended for petroleum products, air with oil vapors, vegetable and mineral oils within the specified temperature range. Not recommended for hot water services over +150°F/+66°C or for hot dry air over +140°F/+60°C.

‡ Services listed are General Service Recommendations only. It should be noted that there are services for which these gaskets are not recommended. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service recommendations and for a listing of services which are not recommended.

NOTE: Additional gasket styles are available. Contact Victaulic for details.

Bolts/Nuts: Heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.

JOB/OWNER

System No. _____

Location _____

CONTRACTOR

Submitted By _____

Date _____

ENGINEER

Spec Sect _____ Para _____

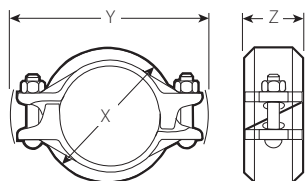
Approved _____

Date _____

Zero-Flex® Rigid Coupling

STYLE 07

DIMENSIONS



TYPICAL 1 – 12"

Size		Max. Work Pressure *	Max. End Load *	Allow. Pipe End Sep. †	Bolt/Nut@ No – Size	Dimensions – Inches/mm			Approx. Wgt. Each
Nominal Size Inches mm	Actual Outside Diameter Inches mm	psi kPa	Lbs. N	Inches mm	Inches	X	Y	Z	Lbs. kg
1 25	1.315 33.7	750 5175	650 2890	0.05 1.2	2 – 3/8 x 2	2.36 60	4.22 107	1.84 47	1.6 0.7
1 1/4 32	1.660 42.4	750 5175	1,620 7210	0.05 1.2	2 – 3/8 x 2	2.69 68	4.62 117	1.84 47	1.6 0.7
1 1/2 40	1.900 48.3	750 5175	2,130 9480	0.05 1.2	2 – 3/8 x 2	2.94 75	5.81 148	1.84 47	1.6 0.7
2 50	2.375 60.3	750 5175	3,320 14775	0.07 1.7	2 – 1/2 x 2 1/2	3.35 85	5.78 147	1.84 47	2.3 1.0
2 1/2 65	2.875 73.0	750 5175	4,875 21695	0.07 1.7	2 – 1/2 x 2 3/4	3.88 98	6.38 162	1.84 47	2.6 1.2
76.1 mm	3.000 76.1	750 5175	5,300 23585	0.07 1.7	2 – 12 x 70.0	4.21 107	6.61 168	1.84 47	3.6 1.6
3 80	3.500 88.9	750 5175	7,215 32105	0.07 1.7	2 – 1/2 x 2 1/2	4.54 115	6.81 173	1.84 47	3.0 1.4
4 100	4.500 114.3	750 5175	11,925 53065	0.16 4.1	2 – 1/2 x 2 3/4	5.81 148	8.21 209	2.07 53	5.3 2.4
108.0 mm	4.250 108.0	750 5175	10,635 47325	0.16 4.1	2 – 12 x 70.0	5.56 141	7.98 203	2.07 53	5.2 2.4
5 125	5.563 141.3	750 5175	18,225 81100	0.16 4.1	2 – 5/8 x 3 1/4	7.03 179	9.89 251	2.07 53	7.4 3.4
133.0 mm	5.250 133.0	700 4825	15,145 67395	0.16 4.1	2 – 16 x 82.5	6.69 170	9.60 244	2.07 53	7.4 3.4
139.7 mm	5.500 139.7	700 4825	16,625 73980	0.16 4.1	2 – 16 x 82.5	6.94 176	9.82 249	2.07 53	7.6 3.4
6 150	6.625 168.3	700 4825	24,130 107380	0.16 4.1	2 – 5/8 x 3 1/4	8.26 210	10.83 275	2.07 53	8.3 3.8
159.0 mm	6.250 159.0	700 4825	21,465 95520	0.16 4.1	2 – 16 x 82.5	7.84 199	10.54 268	2.07 53	9.2 4.2
165.1 mm	6.500 165.1	700 4825	23,225 103305	0.16 4.1	2 – 5/8 x 3 1/4	8.13 207	10.84 275	2.07 53	8.3 3.8
8 5 200	8.625 219.1	600 4130	35,000 155750	0.19 4.8	2 – 3/4 x 4 1/4	10.54 268	13.74 349	2.51 64	15.1 6.8
10 5 250	10.750 273.0	500 3450	45,400 202030	0.13 3.3	2 – 7/8 x 6 1/2	12.86 327	16.98 431	2.56 65	23.5 10.7
12 5 300	12.750 323.9	400 2750	51,000 226950	0.13 3.3	2 – 7/8 x 6 1/2	14.86 377	18.88 480	2.56 65	28.2 12.8
14 – 24 350 – 600	AGS For 14 – 24"/350 – 600 mm sizes Victaulic offers the Advanced Groove System (AGS) line of products. Request publication 20.02 for information on the rigid W07 AGS coupling.								

§ Couplings 8, 10, 12"/200, 250, 300 mm sizes available to JIS standard. Refer to section 06.17 for details.

* Working Pressure and End Load are total, from all internal and external loads, based on standard weight (ANSI) steel pipe, standard **roll** or **cut** grooved in accordance with Victaulic specifications. Contact Victaulic for performance on other pipe.

WARNING: FOR ONE TIME FIELD TEST ONLY, the Maximum Joint Working Pressure may be increased to 1 1/2 times the figures shown.

† For field installation only on roll grooved pipe or cut grooved pipe. Zero-Flex Style 07 couplings are essentially rigid and do not permit expansion/contraction.

@ Number of bolts required equals number of housing segments.

Metric thread size bolts are available (color coded gold) for all coupling sizes upon request. Contact Victaulic for details.

Style 07 couplings must **not** be used to join PVC pipe.

Zero-Flex® Rigid Coupling

STYLE 07

INSTALLATION

Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

NOTE

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

Grooved End Fittings



Victaulic offers a broad line of fittings in sizes through 60"/1500mm in a variety of straight and reducing styles. Most standard fittings are cast of durable ductile iron to precise tolerances. Victaulic standard fittings pressure ratings conform to the ratings of Victaulic Style 77 couplings.

All fittings are supplied with grooves to permit fast installation without field preparation. The grooved design permits flexibility for easy alignment. *These fittings are not intended for use with Victaulic couplings for plain end pipe (refer to Section 14.04 for fittings available for plain end applications).*

Fittings are provided in various materials including ductile iron, steel or segmentally welded steel depending on styles and size. Fittings are painted orange enamel with a galvanized finish available as an option, contact Victaulic for details.

Victaulic fittings are designed specifically for use in grooved piping systems. Fittings are provided grooved conforming to standard steel pipe outside diameters. When connecting wafer or lug-type butterfly valves directly to Victaulic fittings with 741 or 743 Vic-Flange® adapters, check disc clearance dimensions with I.D. dimension of fitting.

Note: The following Victaulic fittings are VdS approved: No.10 90° Elbow, No.11 45° Elbow, No.20 Tee and No.60 Cap.

Note: The following Victaulic fittings are LPCB approved: No.10 90° Elbow, No.11 45° Elbow, No.12 22 ½° Elbow, No.13 11 ¼° Elbow, No.30 45° Lateral, No.30-R Reducing Lateral, No.100 Long Radius Elbow, No.110 Long Radius Elbow, No.20 Tee, No.35 Cross, No.60 Cap, No.25 Reducing Tee, No.33 True Wye, No.50 Concentric Reducer, No.51 Eccentric Reducer and No.29M Tee with Threaded Branch.



NO. 20 TEE



NO. 10 ELBOW



AGS – ADVANCED GROOVE SYSTEM

Advanced Groove System – For 14 – 60"/350 – 1500mm piping systems, Victaulic now offers the Advanced Groove System (AGS). Refer to Section 20.05 for AGS fitting details.

Stainless Steel – Grooved end fittings are available in Schedule 10 Type 316 stainless steel (Schedule 5, 40 and Type 304 available as an option) in various sizes. Fitting center-to-end dimensions will vary depending upon type and schedule. Refer to Section 17.04 and 17.16 for details.

Aluminum – Grooved end fittings are available in aluminum alloy 356 T6, in sizes from 1 – 8"/25 – 200mm. Refer to Section 21.03 or contact Victaulic for details.

Fabricated Steel – A full range of fabricated segmentally welded steel or full flow grooved end fittings are available refer to section 07.04.

Fabricated Steel with AGS Vic-Rings – A full range of full flow fabricated fittings with Vic-Rings are also available.

ALTERNATE STYLES



Extra Heavy EndSeal® "ES" Fittings – EndSeal fittings are available in 2 – 12"/50 – 300mm for use with "ES" grooved pipe and HP-70ES EndSeal couplings. "ES" fittings are painted black for easy identification. EndSeal (and standard) fittings may be easily internally coated (by others) for severe service requirements. Always specify "ES EndSeal fittings" when ordering. See Section 07.03 for information on EndSeal fittings.

Fittings Machined for Rubber or Urethane Lining (MRL) – For severe abrasive services, Victaulic fittings may be rubber or urethane lined (by others). Lining may be inside diameter/end (abrasion resistance) or wrap-around (corrosion and/or abrasion) machined. Refer to Section 25.03 or contact Victaulic for specific details.

Note: Fittings are available with a variety of coatings upon request such as hot dip galvanized, epoxy, glass lined and others.

JOB/OWNER

System No. _____

Location _____

CONTRACTOR

Submitted By _____

Date _____

ENGINEER

Spec Sect _____ Para _____

Approved _____

Date _____

Grooved End Fittings

MATERIAL SPECIFICATIONS

Fitting: Ductile iron conforming to ASTM A-536, grade 65-45-12. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

- **Or:** Segmentally welded steel as shown under nipples

Nipples: (adapter, swaged & hose)

- ¾ – 4"/20 – 100mm: Carbon steel, Schedule 40, conforming to ASTM A-53, Type F
- 5 – 6"/125 – 150mm: Carbon steel, Schedule 40, conforming to ASTM A-53, Type E or S, Gr. B
- 8 – 12"/200 – 300mm: Carbon steel, Schedule 30 or 40, conforming to ASTM A-53, Type E or S, Gr. B

Flanged Adapter Nipples: (Nipple – see above)

- Class 125 Flange: Cast iron conforming to ANSI B-16.1
- Class 150 Flange: Carbon steel conforming to ANSI B-16.5, raised or flat face
- Class 300 Flange: Carbon steel conforming to ANSI B-16.5, raised or flat face

Fitting Coatings: Orange enamel

- **Optional:** Hot dip galvanized and others. Some fittings supplied electroplated as standard – see product specifications.

Flanged Adapter Nipple Coating: None (Unfinished)

- **Optional:** Orange enamel, hot dip galvanized and others.

Grooved End Fittings

FLOW DATA

(Frictional Resistance)

The chart expresses the frictional resistance of various Victaulic fittings as equivalent feet of straight pipe. Fittings not listed can be estimated from the data given, for example, a 22½° elbow is approximately one-half the resistance of a 45° elbow. Values of mid-sizes can be interpolated.

Size		Dimension – Feet/meters					
Nominal Size In./mm	Actual Outside Dia. In./mm	Elbows				Tees	
		90° Elbows		45° Elbows		Branch	Run
		No. 10 Std. Radius	No. 100 1½ D Long Radius	No. 11 Std. Radius	No. 110 1½ D Long Radius		
1	1.315	1.7	—	0.8	—	4.2	1.7
25	33.7	0.5	—	0.2	—	1.3	0.5
2	2.375	3.5	2.5	1.8	1.1	8.5	3.5
50	60.3	1.1	0.8	0.5	0.3	2.6	1.1
76.1 mm	3.000	4.3	—	2.1	—	10.8	4.3
	76.1	1.3	—	0.7	—	3.3	1.3
3	3.500	5.0	3.8	2.6	1.6	13.0	5.0
80	88.9	1.5	1.2	0.8	0.5	4.0	1.5
108.0 mm	4.250	6.4	—	3.2	—	15.3	6.4
	108.0	2.0	—	0.9	—	4.7	2.0
4	4.500	6.8	5.0	3.4	2.1	16.0	6.8
100	114.3	2.1	1.5	1.0	0.6	4.9	2.1
133.0 mm	5.250	8.1	—	4.1	—	20.0	8.1
	133.0	2.5	—	1.2	—	6.2	2.5
139.7 mm	5.500	8.5	—	4.2	—	21.0	8.5
	139.7	2.6	—	1.3	—	6.4	2.6
5	5.563	8.5	—	4.2	—	21.0	8.5
125	141.3	2.6	—	1.3	—	6.4	2.6
159.0 mm	6.250	9.4	—	4.9	—	25.0	9.6
	159.0	2.9	—	1.5	—	7.6	2.9
165.1 mm	6.500	9.6	—	5.0	—	25.0	10.0
	165.1	2.9	—	1.5	—	7.6	3.0
6	6.625	10.0	7.5	5.0	3.0	25.0	10.0
150	168.3	3.0	2.3	1.5	0.9	7.6	3.0
8	8.625	13.0	9.8	6.5	4.0	33.0	13.0
200	219.1	4.0	3.0	2.0	1.2	10.1	4.0
10	10.750	17.0	12.0	8.3	5.0	41.0	17.0
250	273.0	5.2	3.7	2.5	1.5	12.5	5.2
12	12.750	20.0	14.5	10.0	6.0	50.0	20.0
300	323.9	6.1	4.4	3.0	1.8	15.2	6.1
14	14.000	24.5 §	15.8	18.5 §	11.0	70.0	23.0
350	355.6	7.5	4.8	5.6	3.4	21.3	7.0
16	16.000	28.0 §	18.0	21.0 §	13.0	80.0	27.0
400	406.4	8.5	5.5	6.4	4.0	24.4	8.2
18	18.000	31.0 §	20.0	23.5 §	14.0	90.0	30.0
450	457.0	9.5	6.1	7.2	4.3	27.4	9.1
20	20.000	34.0 §	22.5	25.5 §	16.0	100.0	33.0
800	508.0	10.4	6.9	7.8	4.9	30.5	10.1
24	24.000	42.0 §	27.0	29.5 §	19.0	120.0	40.0
600	610.0	12.8	8.2	9.0	5.8	36.6	12.2
Fittings available up to 60"/1500 mm. Contact Victaulic for details.							

Contact Victaulic for details.

For roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales office.

§ Fitting flow data for 14-24"/350-600 mm size No. 10 and No. 11 Elbows is based on fittings for Style 07 and 77 couplings. For flow data on AGS fittings (No. W10 and No. W11 Elbows), refer to submittal 20.05.

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Grooved End Fittings

DIMENSIONS

Elbows

NO. 10 90° Elbow

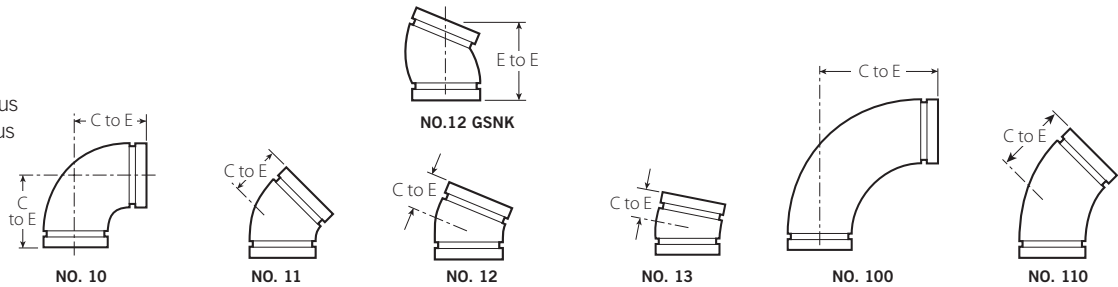
NO. 11 45° Elbow

NO. 12 22½° Elbow

NO. 13 11¼° Elbow

NO. 100 90° Long Radius

NO. 110 45° Long Radius



Size		No. 10 90° Elbow		No. 11 45° Elbow		No. 12 22½° Elbow		No. 13 11¼° Elbow		No. 100† 90° Long Radius Elbow (S)		No. 110† 45° Long Radius Elbow (S)	
Nominal Size Inches mm	Actual Outside Dia. Inches mm	C to E Inches mm	Approx. Wgt. Each Lbs. kg	C to E Inches mm	Approx. Wgt. Each Lbs. kg	C to E Inches mm	Approx. Wgt. Each Lbs. kg	C to E Inches mm	Approx. Wgt. Each Lbs. kg	C to E Inches mm	Approx. Wgt. Each Lbs. kg	C to E Inches mm	Approx. Wgt. Each Lbs. kg
¾ 20	1.050 26.9	2.25 57	0.5 0.2	1.50 38	0.5 0.2	1.63 sw 41	—	1.38sw 35	—	2.50sw 64	0.4 0.2	1.81 sw 46	0.3 0.1
1 25	1.315 33.7	2.25 57	0.6 0.3	1.75 44	0.6 0.3	3.25 83	0.6 0.3	1.38sw 35	0.3 0.1	2.88sw 73	0.6 0.3	2.25 sw 57	0.5 0.2
1¼ 32	1.660 42.4	2.75 70	1.0 0.5	1.75 44	0.9 0.4	1.75 44	0.8 0.4	1.38sw 35	0.5 0.2	3.25 sw 83	1.1 0.5	2.38 sw 60	0.7 0.3
1½ 40	1.900 48.3	2.75 70	1.2 0.5	1.75 44	0.9 0.4	1.75 44	0.8 0.4	1.38sw 35	0.5 0.2	3.63 sw 92	2.2 1.0	2.50sw 64	1.3 0.6
2 50	2.375 60.3	3.25 83	1.8 0.8	2.00 51	1.3 0.6	3.75 @ 95	1.4 0.6	1.38 35	1.0 0.5	4.38 111	2.5 1.1	2.75 70	1.8 0.8
2½ 65	2.875 73.0	3.75 95	3.2 1.5	2.25 57	2.2 1.0	4.00 @ 102	2.3 1.0	1.50 38	1.1 0.5	5.13 130	3.4 1.5	3.00 76	2.8 1.3
76.1 mm	3.000 76.1	3.75 95	3.7 1.7	2.25 57	3.4 1.5	2.24 57	—	1.50 38	—	—	—	—	—
3 80	3.500 88.9	4.25 108	4.5 2.0	2.50 64	3.1 1.4	4.50 @ 114	3.1 1.4	1.50 38	2.1 1.0	5.88 149	6.0 2.7	3.38 86	4.9 2.2
3½ 90	4.000 101.6	4.50 114	5.6 2.5	2.75 70	4.3 2.0	2.50 sw 64	4.0 1.8	1.75sw 44	2.7 1.2	—	—	—	—
4 100	4.500 114.3	5.00 127	7.1 3.2	3.00 76	5.6 2.5	2.88 73	5.6 2.5	1.75 44	3.6 1.6	7.50 191	12.3 5.6	4.00 102	7.3 3.3
108.0 mm	4.250 108.0	5.00 127	11.0 5.0	3.00 76	5.6 2.5	—	—	—	—	—	—	—	—
4½ 120	5.000 127.0	5.25 sw 133	10.0 4.5	3.13 sw 79	6.0 2.7	3.50sw 89	6.6 3.0	1.88sw 48	4.2 1.9	—	—	—	—
5 125	5.563 141.3	5.50 140	11.7 5.3	3.25 83	8.3 3.8	2.88sw 73	7.8 3.5	2.00sw 51	5.0 2.2	9.25 sw 235	18.2 8.3	4.88 sw 124	14.8 6.7
133.0 mm	5.250 133.0	5.50 140	11.7 5.3	3.25 83	8.3 3.8	—	—	—	—	—	—	—	—
139.7 mm	5.500 139.7	5.50 140	11.7 5.3	3.25 83	8.3 3.8	2.87 73	—	2.00 51	—	—	—	—	—
6 150	6.625 168.3	6.50 165	17.2 7.8	3.50 89	10.8 4.9	6.25 @ 159	12.2 5.5	2.00 51	7.0 3.2	10.75 273	30.4 13.8	5.50 140	17.4 7.9
159.0 mm	6.250 159.0	6.50 165	18.6 8.4	3.50 89	10.8 4.9	—	—	—	—	—	—	—	—
165.1 mm	6.500 165.1	6.50 165	15.5 7.0	3.50 89	9.8 4.4	3.13 79	11.4 5.2	2.00 51	7.4 3.4	10.75sw 273	29.0 13.2	5.50sw 140	19.0 8.6

@ Gooseneck design- end-to-end dimension fittings in this size- contact your nearest Victaulic sales office

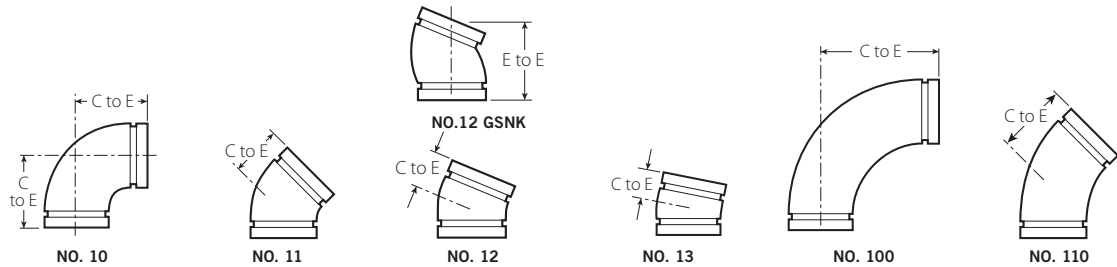
† Chinese standard sizes

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Grooved End Fittings



Size		No. 10 90° Elbow		No. 11 45° Elbow		No. 12 22½° Elbow		No. 13 11¼° Elbow		No. 100† 90° Long Radius Elbow (S)		No. 110† 45° Long Radius Elbow (S)	
Nominal Size Inches mm	Actual Outside Dia. Inches mm	C to E Inches mm	Approx. Wgt. Each Lbs. kg	C to E Inches mm	Approx. Wgt. Each Lbs. kg	C to E Inches mm	Approx. Wgt. Each Lbs. kg	C to E Inches mm	Approx. Wgt. Each Lbs. kg	C to E Inches mm	Approx. Wgt. Each Lbs. kg	C to E Inches mm	Approx. Wgt. Each Lbs. kg
8 200	8.625 219.1	7.75 197	29.9 13.6	4.25 108	20.4 9.3	7.75 @ 197	20.0 9.1	2.00 51	10.1 4.6	14.25 362	66.0 30.0	7.25 184	36.0 16.3
10 250	10.750 273.0	9.00 229	63.3 28.7	4.75 121	37.5 17.0	4.38sw 111	30.0 13.6	2.13 54	11.8 5.3	15.00 381	107.0 48.5	6.25 159	57.0 25.9
12 300	12.750 323.9	10.00 254	74.0 33.6	5.25 133	66.7 30.3	4.88sw 124	40.0 18.1	2.25 57	29.3 13.3	18.00 457	156.0 70.8	7.50 191	90.0 40.8
14 # 350	14.000 355.6	14.00 355.6	136.0 61.7	5.75 146	65.0 29.5	5.00sw 127	46.0 20.9	3.50sw 89	32.0 14.5	21.00 s 533	164.0 74.4	8.75 s 222	82.0 37.2
377.0mm †	14.843 377.0	14.84 376.9	149.3 67.7	6.15 156.2	82.0 37.2	—	—	—	—	—	—	—	—
16 # 400	16.000 406.4	16.00 406.4	171.0 77.6	6.63 168	88.0 39.9	5.00sw 127	58.0 26.3	4.00sw 102	42.0 19.1	24.00 s 610	210.0 95.3	10.00 s 254	100.0 45.4
426.0mm †	16.772 426.0	16.77 426.0	198.6 90.1	6.95 176.5	101.3 45.9	—	—	—	—	—	—	—	—
18 # 450	18.000 457.0	18.00 457.2	228.0 103.4	7.46 189	108.0 50.0	5.50sw 140	65.0 29.5	4.50sw 114	53.2 24.1	27.00 s 686	273.0 123.8	11.25 s 286	135.0 61.2
480.0mm †	18.898 480.0	18.90 480.0	291.0 132.0	7.83 198.8	141.7 64.3	—	—	—	—	—	—	—	—
20 # 500	20.000 508.0	20.00 508.0	298.0 135.2	8.28 210	138.0 62.6	6.00sw 152	78.6 36.0	5.00sw 127	65.0 29.5	30.00 s 762	343.0 155.6	12.50 s 318	174.0 78.9
530.0mm †	20.866 530.0	20.87 530.0	355.0 161.0	8.64 219.4	179.0 81.2	—	—	—	—	—	—	—	—
24 # 600	24.000 610.0	24.00 609.6	438.0 198.7	9.94 252	221.0 100.2	7.00sw 178	140.0 63.5	6.00sw 152	60.0 27.2	36.00 s 914	516.0 234.1	15.00 s 381	251.0 113.9
630.0mm †	24.803 630.0	24.80 630.0	545.0 247.2	10.27 261.0	255.2 115.7	—	—	—	—	—	—	—	—
14 – 60" 350–1500mm	AGS For AGS fitting information, see publication 20.05												

@ Gooseneck design (GSNK), end-to-end dimension fittings in this size, contact your nearest Victaulic sales office.

For roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales office.

† Chinese standard sizes

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s"

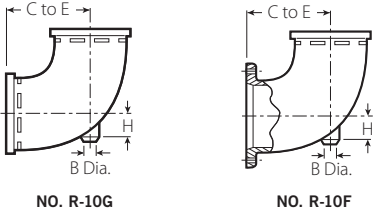
S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Grooved End Fittings

Reducing Base Support Elbow

NO. R-10G Grv. x Grv.
NO. R-10F Grv. x Flange



Size			No. R-10 Reducing Base Support Elbow			Approx. Weight Each	
Nominal Size Inches mm			C to E Inches mm	H Inches mm	B Diameter Inches mm	Grv. × Grv. Lbs. kg	Grv. × Flange Lbs. kg
6 150	×	4 100	9.00 229	1.25 32	1.50 38	19.0 8.6	33.0 15.0
		5 125	9.00 229	1.50 38	1.50 38	23.0 10.4	38.0 17.2
8 200	×	6 150	10.50 267	2.13 54	1.50 38	33.0 15.0	52.0 23.6
10 250	×	8 200	12.00 305	2.40 61	1.50 38	61.0 27.7	88.0 39.9

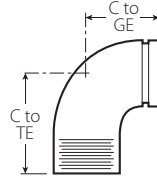
Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".
S= Carbon Steel Direct Roll Groove (OGS)
SW= Carbon Steel Segmentally Welded

Grooved End Fittings

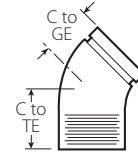
Adapter Elbow

NO. 18 90° Adapter Elbow

NO. 19 45° Adapter Elbow



NO. 18



NO. 19

Size		No. 18 90° Adapter Elbow @			No. 19 45° Adapter Elbow @		
Nominal Size Inches mm	Actual Outside Diameter Inches mm	C to GE Inches mm	C to TE Inches mm	Approx. Weight Each Lbs. kg	C to GE Inches mm	C to TE Inches mm	Approx. Weight Each Lbs. kg
¾ 20	1.050 26.9	2.25 57	2.25 57	0.5 0.2	1.50 38	1.50 38	0.5 0.2
1 25	1.315 33.7	2.25 57	2.25 57	0.5 0.2	—	—	—
1 ¼ 32	1.660 42.4	2.75 70	2.75 70	0.9 0.4	—	—	—
1 ½ 40	1.900 48.3	2.75 70	2.75 70	1.1 0.5	1.75 44	1.75 44	0.9 0.4
2 50	2.375 60.3	3.25 83	4.25 108	2.5 1.1	—	—	—
2 ½ 65	2.875 73.0	3.75 95	3.75 95	3.0 1.4	2.25 57	2.25 57	2.3 1.0
3 80	3.500 88.9	4.25 108	6.00 152	5.8 2.6	2.50 64	4.25 108	5.0 2.3
3 ½ 90	4.000 101.6	4.50 114	6.25 159	8.0 3.6	5.25 133	5.25 133	8.8 4.0
6 150	6.625 168.3	6.50 165	6.50 165	17.6 8.0	3.50 89	3.50 89	12.7 5.8

@ Available with British Standard Pipe Threads: specify "BSP" clearly on order.

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Grooved End Fittings

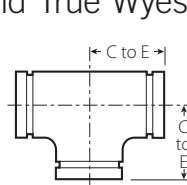
Tees, Crosses and True Wyes

NO. 20 Tee

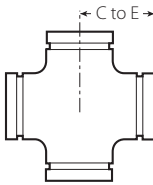
NO. 35 Cross

NO. 33 True Wye

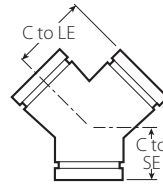
NO. 29M Tee with
Threaded Branch



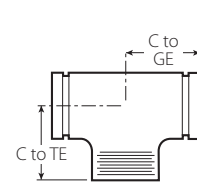
NO. 20



NO. 35



NO. 33



NO. 29M

Size		No. 20 Tee		No. 35 Cross (sw)		No. 33 True Wye (sw)			No. 29M Tee with Threaded Branch		
Nominal Size Inches mm	Actual Outside Dia. Inches mm	C to E Inches mm	Approx. Weight Each Lbs. kg	C to E Inches mm	Approx. Weight Each Lbs. kg	C to LE Inches mm	C to SE Inches mm	Approx. Weight Each Lbs. kg	C to GE Inches mm	C to TE Inches mm	Approx. Weight Each Lbs. kg
¾ 20	1.050 26.9	2.25 57	0.6 0.3	2.25 57	0.9 0.4	2.25 57	2.00 51	0.7 0.3	2.25 57	2.25sw 57	0.6 0.3
1 25	1.315 33.7	2.25 57	1.0 0.5	2.25 57	1.3 0.6	2.25 57	2.25 57	1.1 0.5	2.25 57	2.25 57	1.0 0.5
1 ¼ 32	1.660 42.4	2.75 70	1.5 0.7	2.75 70	2.1 1.0	2.75 70	2.50 64	1.5 0.7	2.75 70	2.75 70	1.5 0.7
1 ½ 40	1.900 48.3	2.75 70	2.0 0.9	2.75 70	2.5 1.1	2.75 70	2.75 70	1.8 0.8	2.75 70	2.75 70	2.0 0.9
2 50	2.375 60.3	3.25 83	3.0 1.4	3.25 83	3.8 1.7	3.25 83	2.75 70	2.5 1.1	3.25 83	4.25 108	3.00 1.4
2 ½ 65	2.875 73.0	3.75 95	4.3 2.0	3.75 95	6.1 2.8	3.75 95	3.00 76	4.3 2.0	3.75 95	3.75 95	4.3 2.0
76.1 mm	3.000 76.1	3.75 95	5.2 2.4	—	—	—	—	—	3.75 95	3.75sw 95	5.2 2.4
3 80	3.500 88.9	4.25 108	6.8 3.0	4.25 108	10.5 4.8	4.25 108	3.25 83	6.1 2.8	4.25 108	6.00 152	6.8 3.1
3 ½ 90	4.000 101.6	4.50sw 114	7.9 3.6	4.50 114	11.5 5.2	4.50 114	3.50 89	9.6 4.4	4.50 114	4.50sw 114	7.9 3.6
108.0mm	4.250 108.0	5.00 127	15.5 7.0	—	—	—	—	—	5.00 127	5.00sw 127	15.5 7.0
4 100	4.500 114.3	5.00 127	11.9 5.4	5.00 127	15.8 7.2	5.00 127	3.75 95	10.0 4.5	5.00 127	7.25 184	11.9 5.4
4 ½ 120	5.000 127.0	5.25sw 133	15.0 6.8	5.25 133	18.5 8.4	—	—	—	5.25 133	5.25sw 133	15.0 6.8
133.0mm	5.250 133.0	5.50 140	17.8 8.1	—	—	—	—	—	5.50 140	5.50sw 140	17.8 8.1
139.7mm	5.500 139.7	5.50 140	17.8 8.1	—	—	—	—	—	5.50 140	5.50sw 140	17.8 8.1
5 125	5.563 141.3	5.50 140	17.8 8.1	5.50 140	20.0 9.1	5.50 140	4.00 102	15.0 6.8	5.50 140	5.50sw 140	17.8 8.1
159.0 mm	6.250 159.0	6.50 165	27.1 12.3	—	—	—	—	—	6.50 165	6.50sw 165	27.1 12.3
165.1 mm	6.500 165.1	6.50 165	22.0 10.0	6.50 165	28.0 12.7	—	—	—	6.50 165	6.50sw 165	22.0 10.0
6 150	6.625 168.3	6.50 165	25.7 11.7	6.50 165	28.0 12.7	6.50 165	4.50 114	22.3 10.1	6.50 165	6.50sw 165	25.7 11.7
8 200	8.625 219.1	7.75 197	47.6 21.6	7.75 197	48.0 21.8	7.75 197	6.00 152	36.0 16.3	7.75 197	7.75sw 197	47.6 21.6
10 250	10.750 273.0	9.00 229	99.0 44.9	9.00 229	121.5 55.1	9.00 229	6.50 155	69.9 31.7	9.00 229	9.00sw 229	99.0 44.9
12 300	12.750 323.9	10.00 254	133.0 60.3	10.00 254	110.0 49.9	10.00 254	7.00 178	80.0 36.3	10.00 254	10.00sw 254	99.0 44.9

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Grooved End Fittings

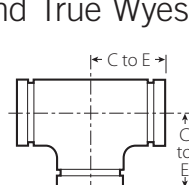
Tees, Crosses and True Wyes

NO. 20 Tee

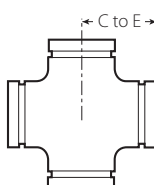
NO. 35 Cross

NO. 33 True Wye

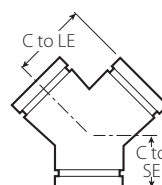
NO. 29M Tee with
Threaded Branch



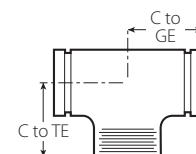
NO. 20




NO. 35



NO. 33



NO. 29M

Size		No. 20 Tee		No. 35 Cross (sw)		No. 33 True Wye (sw)			No. 29M Tee with Threaded Branch (sw)		
Nominal Size Inches mm	Actual Outside Dia. Inches mm	C to E Inches mm	Approx. Weight Each Lbs. kg	C to E Inches mm	Approx. Weight Each Lbs. kg	C to LE Inches mm	C to SE Inches mm	Approx. Weight Each Lbs. kg	C to GE Inches mm	C to TE Inches mm	Approx. Weight Each Lbs. kg
14 # 350	14.000 355.6	11.00sw 279	145.0 65.8	11.00 279	198.0 89.8	11.00 279	7.50 191	134.2 60.8	11.00 sw 279	11.00 279	145.0 65.8
377.0mm	14.000 355.6	11.50 292	145.0 65.8	—	—	—	—	—	—	—	—
16 # 400	16.000 406.4	12.00sw 305	186.0 84.4	12.00 305	250.0 113.4	12.00 305	8.00 203	167.0 75.7	12.00 sw 305	12.00 305	186.0 84.4
426.0mm †	16.000 406.4	13.00 300	186.0 84.4	—	—	—	—	—	—	—	—
18 # 450	18.000 457.0	15.50sw 394	260.0 117.9	15.50 394	350.0 158.8	15.50 394	8.50 216	234.0 106.1	15.50 sw 394	15.50 394	117.9
480.0mm†	18.000 457.0	14.57 370	256.0 116.1	—	—	—	—	—	—	—	—
20 # 500	20.000 508.0	17.25 sw 438	336.0 152.4	17.25 438	452.0 205.0	17.25 438	9.00 229	281.0 127.5	17.25 sw 438	17.25 438	336.0 152.4
530.0mm †	20.000 508.0	15.39sw 391	339.0 153.8	—	—	—	—	—	—	—	—
24 # 600	24.000 610.0	20.00sw 508	592.0 268.5	20.00 508	795.0 360.6	20.00 508	10.00 254	523.0 237.2	20.00 sw 508	20.00 508	592.0 268.5
630.0mm †	24.000 610.0	17.37 sw 441	473.0 214.5	—	—	—	—	—	—	—	—
14 – 60" 350 – 1500 mm	 For AGS fitting information, see publication 20.05										

For roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales office.

† Chinese standard sizes

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

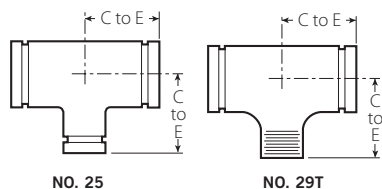
S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Grooved End Fittings

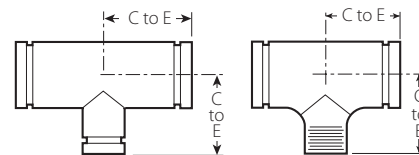
Reducing Tee

NO. 25 Grooved Branch
NO. 29T Threaded Branch



NO. 25

NO. 29T



NO. 25-SW

NO. 29T-SW

Size	No. 25 Std.	No. 29T w/ Thd. Branch	Approx. Weight Each
Nominal Size Inches mm	C to E Inches mm	C to E Inches mm	Lbs. kg
1 25 × 1 × 3/4 20	2.25 sw 57	2.24 sw 57	1.0 0.5
1 1/4 32 × 1 1/4 × 1 32 25	2.75 sw 70	2.75 sw 70	1.3 0.6
1 1/2 40 × 1 1/2 × 3/4 40 20	2.75 sw 70	2.75 sw 70	1.5 0.7
	1 25	2.75 sw 70	1.5 0.7
	1 1/4 32	2.75 sw 70	1.7 0.8
	2 50	3.25 83	2.5 1.1
2 50 × 2 × 1 50 20	3.25 83	3.25 83	2.7 1.2
	1 1/4 32	3.25 sw 83	1.8 0.8
	1 1/2 40	3.25 sw 83	3.0 1.4
	2 1/2 65 × 2 1/2 × 3/4 65 20	3.75 sw 95	3.9 1.8
2 1/2 65 × 2 1/2 × 1 65 20	3.75 95	3.75 sw 95	3.8 1.7
	1 1/4 32	3.75 sw 95	4.2 1.7
	1 1/2 40	3.75 95	3.9 1.8
	2 50	3.75 sw 95	4.5 2.0
3 80 × 3 × 3/4 80 20	4.25 sw 108	4.25 sw 108	5.7 2.6
	1 25	4.25 108	6.1 2.8
	1 1/4 32	4.25 sw 108	8.0 3.6
	1 1/2 40	4.25 108	6.5 2.9
	2 50	4.25 sw 108	6.2 2.8
	2 1/2 65	4.25 sw 108	6.4 2.9
4 100 × 4 × 3/4 100 20	5.00 sw 127	5.00 sw 127	8.0 3.6
	1 25	5.00 127	7.8 3.5

Size	No. 25 Std.	No. 29T w/ Thd. Branch	Approx. Weight Each
Nominal Size Inches mm	C to E Inches mm	C to E Inches mm	Lbs. kg
4 100 × 4 × 1 1/4 100 32	5.00 sw 127	5.00 sw 127	9.6 4.4
	1 1/2 40	5.00 127	10.2 4.6
	2 50	5.00 127	11.2 5.1
	2 1/2 65	5.00 127	11.4 5.2
	3 80	5.00 127	11.6 5.3
	4 100	5.50 sw 140	14.0 6.4
5 125 × 5 × 1 125 25	5.50 sw 140	5.50 sw 140	14.3 6.5
	1 1/2 40	5.50 sw 140	14.5 6.6
	2 50	5.50 sw 140	15.2 6.9
	2 1/2 65	5.50 sw 140	16.6 7.5
	3 80	5.50 sw 140	16.7 7.6
	4 100	6.50 sw 165	23.0 10.4
6 150 × 6 × 1 1/2 150 40	6.50 sw 165	6.50 sw 165	24.0 10.9
	2 50	6.50 165	21.6 9.8
	2 1/2 65	6.50 165	21.4 11.7
	14 – 60" 350 – 1500 mm	AGS For AGS fitting information, see publication 20.05	

+ Contact Victaulic for details.

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s"

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

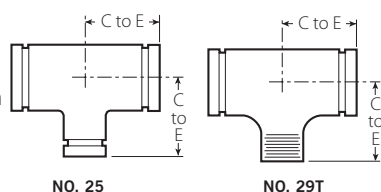
IMPORTANT NOTE:

No. 29T Threaded Outlet Reducing Tees are supplied NPT and are available with British Standard threads. For British Standard specify "BSP" clearly on order.

Grooved End Fittings

Reducing Tee

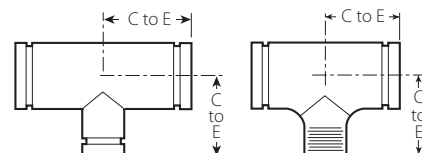
NO. 25 Grooved Branch
NO. 29T Threaded Branch



NO. 25

NO. 29T

Size	No. 25 Std.	No. 29T w/ Thd. Branch	Approx. Weight Each
Nominal Size Inches mm	C to E Inches mm	C to E Inches mm	Lbs. kg
6 150 × 6 150 × 3 80	6.50 165	6.50 165	26.5 12.0
	4 100	6.50 165	25.0 11.3
	5 125	6.50 165	23.2 10.5
6½ 165.1 × 6½ 165.1 × 3 80	6.50 165	6.50sw 165	24.0 10.9
	4 100	6.50sw 165	25.0 11.3
8 200 × 8 200 × 1½ 40	7.75sw 197	7.75sw 197	33.0 15.0
	2 50	7.75sw 197	33.5 15.2
	2½ 65	7.75sw 197	39.0 17.7
	3 80	7.75sw 197	33.6 15.2
	4 100	7.75 197	41.8 19.0
	5 125	7.75sw 197	34.0 15.4
	6 150	7.75 197	42.3 19.2
	165.1	7.75sw 197	48.0 21.8
10 250 × 10 250 × 1½ 40	9.00 229	9.00 229	62.0 28.1
	2 50	9.00sw 229	62.0 28.1
	2½ 65	9.00sw 229	62.4 28.3
	3 80	9.00sw 229	60.0 27.2
	4 100	9.00sw 229	61.0 27.7
	5 125	9.00sw 229	52.0 23.6
	6 150	9.00sw 229	59.0 26.8
	8 200	9.00sw 229	64.7 29.3



NO. 25-SW

NO. 29T-SW

Size	No. 25 Std.	No. 29T w/ Thd. Branch	Approx. Weight Each
Nominal Size Inches mm	C to E Inches mm	C to E Inches mm	Lbs. kg
12 300 × 12 300 × 1 25	10.00sw 254	10.00sw 254	77.0 34.9
	2 50	10.00sw 254	80.0 36.3
	2½ 65	10.00sw 254	78.0 35.4
	3 80	10.00sw 254	82.0 37.2
	4 100	10.00sw 254	80.0 36.3
	5 125	10.00sw 254	75.0 34.0
	6 150	10.00sw 254	75.0 34.0
	8 200	10.00sw 254	80.0 36.3
	10 250	10.00sw 254	84.0 38.1
	12 300	10.00sw 254	84.0 38.1
# 14 350 × 14 350 × 4 100	11.00sw 279	11.00sw 279	102.0 46.3
	6 150	11.00sw 279	108.2 49.1
	8 200	11.00 279	112.0 50.8
	10 300	11.00 279	120.0 54.4
	12 300	11.00 279	129.1 58.6
# 16 400 × 16 400 × 4 100	+	+	130.0 59.0
14 – 60" 350 – 1500 mm	AGS For AGS fitting information, see publication 20.05		

+ Contact Victaulic for details.

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s"

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

IMPORTANT NOTE:

No. 29T Threaded Outlet Reducing Tees are supplied NPT and are available with British Standard threads. For British Standard specify "BSP" clearly on order.

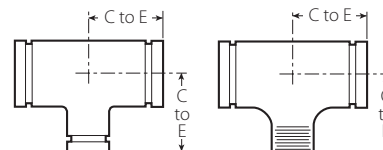
For roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales office.

Grooved End Fittings

Reducing Tee

NO. 25 Grooved Branch

NO. 29T Threaded Branch



NO. 25

NO. 29T

Size				No. 25 Std.	No. 29T w/ Thd. Branch	Approx. Weight Each
Nominal Size Inches mm				C to E Inches mm	C to E Inches mm	Lbs. kg
# 16 400	x	16 400	x	6 150	12.00sw 305	133.5 60.6
				8 200	12.00 305	145.0 65.8
				10 250	12.00 305	149.5 67.8
				12 300	12.00 305	154.0 69.9
				14 350	12.00sw 305	167.0 75.8
# 18 450	x	18 450	x	4 100	15.50sw 394	194.0 88.0
				6 150	15.50sw 394	200.0 90.7
				8 200	15.50sw 394	202.0 91.6
				10 250	15.50 394	212.0 96.2
				12 300	15.50 394	222.6 101.0
				14 350	15.50 394	230.1 104.4
				16 400	15.50 394	247.6 112.3
# 20 500	x	20 500	x	6 150	17.25 438	240.0 108.9
				8 200	17.25 438	244.0 110.7
				10 250	17.25 438	256.0 116.1
				12 300	17.25 438	264.0 119.8
				14 350	17.25 438	275.0 124.7

Size			No. 25 Std.	No. 29T w/ Thd. Branch	Approx. Weight Each	
Nominal Size Inches mm			C to E Inches mm	C to E Inches mm	Lbs. kg	
# 20 500	×	20 500	16 400	17.25 438	—	288.6 130.9
			18 450	17.25 438	—	297.0 134.7
# 24 600	×	24 600	8 200	20.00 508	20.00 508	340.0 154.2
			10 250	20.00 508	20.00 508	343.9 156.0
			12 300	20.00 508	20.00 508	352.8 160.0
			14 § 350	20.00 508	—	360.0 163.3
			16 400	20.00 508	—	378.0 171.5
			18 § 450	20.00 508	—	380.0 172.4
			20 500	20.00 508	—	373.0 169.2
14 – 60" 350 – 1500 mm			AGS ™ For AGS fitting information, see publication 20.05			

+ Contact Victaulic for details.

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s"

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

IMPORTANT NOTE:

No. 29T Threaded Outlet Reducing Tees are supplied NPT and are available with British Standard threads. For British Standard specify "BSP" clearly on order.

For roll grooved systems, Victaulic offers the Advanced Groove System (AGS).

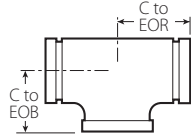
For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales office.

§ Cast fitting available. Contact Victaulic for details.

Grooved End Fittings

Bullhead Tee

NO. 21



NO. 21

Size				No. 21 Bullhead Tee			
Nominal Size Inches mm				C to EOR Inches mm	C to EOB Inches mm	Approx. Weight Each Lbs. kg	
5 125	×	5 125	×	8 200	7.75 197	5.50 140	28.7 13.0
6 150	×	6 150	×	8 200	7.75 197	6.50 165	37.5 17.0

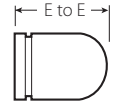
Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Bull Plug

NO. 61



NO. 61

Size		No. 61 Bull Plug (S)	
Nominal Size Inches mm	Actual Outside Diameter Inches mm	E to E Inches mm	Approx. Weight Each Lbs. kg
2	2.375	4.00	2.5
50	60.3	102	1.1
2½	2.875	5.00	3.0
65	73.0	127	1.4
3	3.500	6.00	4.5
80	88.9	152	2.0
4	4.500	7.00	7.5
100	114.3	178	3.4
5	5.563	8.00	12.0
125	141.3	203	5.4
6	6.625	10.00	17.0
150	168.3	254	7.7

IMPORTANT NOTES:

Steel dish caps available through 24"/600mm, contact Victaulic.

No. 61 Bull Plugs should be used in vacuum service with Style 72 or 750 couplings

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s"

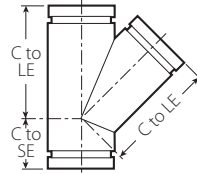
S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Grooved End Fittings

45° Lateral

NO. 30



NO. 30

Size		No. 30 45° Lateral (SW)		
Nominal Size Inches mm	Actual Outside Diameter Inches mm	C to LE Inches mm	C to SE Inches mm	Approx. Weight Each Lbs. kg
¾ 20	1.050 26.9	4.50 114	2.00 51	1.0 0.5
1 25	1.315 33.7	5.00 127	2.25 57	1.7 0.8
1 ¼ 32	1.660 42.4	5.75 146	2.50 64	2.5 (d) 1.1
1 ½ 40	1.900 48.3	6.25 159	2.75 70	3.5 1.6
2 50	2.375 60.3	7.00 178	2.75 70	4.6 (d) 2.1
2 ½ 65	2.875 73.0	7.75 197	3.00 76	9.0 94.1
76.1 mm	3.000 76.1	8.50 216	3.25 83	11.0 5.0
3 80	3.500 88.9	8.50 216	3.25 83	11.7 (d) 5.4
3 ½ 90	4.000 101.6	10.00 254	3.50 89	17.8 8.1
4 100	4.500 114.3	10.50 267	3.75 95	22.2 (d) 10.1
5 125	5.563 141.3	12.50 318	4.00 102	21.8 9.9
165.1 mm	6.500 165.1	14.00 356	4.50 114	43.6 19.8

Size		No. 30 45° Lateral (SW)		
Nominal Size Inches mm	Actual Outside Diameter Inches mm	C to LE Inches mm	C to SE Inches mm	Approx. Weight Each Lbs. kg
6 150	6.625 168.3	14.00 356	4.50 114	43.6 19.8
8 200	8.625 219.1	18.00 457	6.00 152	72.0 32.7
10 250	10.750 273.0	20.50 521	6.50 165	105.0 47.6
12 300	12.750 323.9	23.00 584	7.00 178	165.0 74.8
14 # 350	14.000 355.6	26.50 673	7.50 191	276.0 125.2
16 # 400	16.000 406.4	29.00 737	8.00 203	344.2 156.1
18 # 450	18.000 457.0	32.00 813	8.50 216	429.0 194.6
20 # 500	20.000 508.0	35.00 889	9.00 229	500.0 226.8
24 # 600	24.000 610.0	40.00 1016	10.00 254	715.0 324.3
14 – 60" 350 – 1500 mm	AGS For AGS fitting information, see publication 20.05			

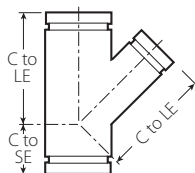
For roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales office.

Note: All fittings are segmentally welded steel unless otherwise noted with a (d) for ductile iron.

Grooved End Fittings

45° Reducing Lateral

NO. 30-R



NO. 30-R

Size			No. 30-R 45° Reducing Lateral (SW)		
Nominal Size Inches mm			C to LE Inches mm	C to SE Inches mm	Approx. Weight Each Lbs. kg
3 80	x	3 80	2 50	8.50 216	3.25 83
			2½ 65	8.50 216	3.25 83
			2 50	10.50 267	3.75 95
4 100	x	4 100	2½ 65	10.50 267	3.75 95
			3 80	10.50 267	3.75 95
			2 50	12.50 318	4.00 102
5 125	x	5 125	3 80	12.50 318	4.00 102
			4 100	12.50 318	4.00 102
			5 125	14.00 356	4.50 114
6 150	x	6 150	5 125	14.00 356	4.50 114
			4 100	18.00 457	6.00 152
			5 125	18.00 457	6.00 152
8 200	x	8 200	6 150	18.00 457	6.00 152
			4 100	20.50 521	6.50 165
			5 125	20.50 521	6.50 165
10 250	x	10 250	6 150	20.50 521	6.50 165
			8 200	23.00 584	7.00 178
			5 125	23.00 584	7.00 178
12 300	x	12 300	6 150	23.00 584	7.00 178
			8 200	23.00 584	7.00 178
			10 250	23.00 584	7.00 178

Size			No. 30-R 45° Reducing Lateral (SW)				
Nominal Size Inches mm			C to LE Inches mm	C to SE Inches mm	Approx. Weight Each Lbs. kg		
# 14 350	x	14 350	x	4 100	26.50 673	7.50 191	172.0 78.0
				6 150	26.50 673	7.50 191	187.0 84.8
				8 200	26.50 673	7.50 191	205.8 93.4
				10 250	26.50 673	7.50 191	235.0 106.6
				12 300	26.50 673	7.50 191	250.0 113.4
# 16 400	x	16 400	x	6 150	29.00 737	8.00 203	215.0 97.5
				8 200	29.00 737	8.00 203	252.5 114.5
				10 250	29.00 737	8.00 203	265.0 120.2
				12 300	29.00 737	8.00 203	295.0 133.8
				14 350	29.00 737	8.00 203	305.0 138.3
# 18 450	x	18 450	x	6 150	32.00 813	8.50 216	274.0 124.3
				8 200	32.00 813	8.50 216	275.0 124.7
				12 300	32.00 813	8.50 216	347.0 157.4
				14 350	32.00 813	8.50 216	350.0 158.8
				16 400	32.00 813	8.50 216	362.0 164.2
# 20 500	x	20 500	x	12 300	35.00 889	9.00 229	415.0 188.2
				14 350	35.00 889	9.00 229	420.0 190.5
				16 400	35.00 889	9.00 229	425.0 192.8
# 24 600	x	24 600	x	16 400	40.00 1016	10.00 254	425.0 192.8
				20 600	40.00 1016	10.00 254	570.0 258.6
14 – 60" 350 – 1500 mm			AGS For AGS fitting information, see publication 20.05				

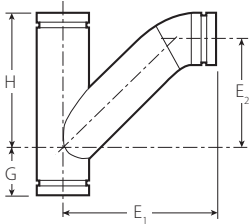
For roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales office.

Note: All fittings are segmentally welded steel unless otherwise noted a (d) for ductile iron.

Grooved End Fittings

Tee Wye

NO. 32



NO. 32

Size			No. 32 Tee Wye (SW)				
Nominal Size Inches mm			G Inches mm	H Inches mm	E ₁ Inches mm	E ₂ Inches mm	Approx. Wgt. Each Lbs. kg
2	×	2	2.75	7.00	9.00	4.63	6.4
50	×	50	70	178	229	118	2.9
2½	×	2½	3.00	7.75	10.50	5.75	11.5
65	×	65	76	197	267	146	5.2
3	×	3	3.25	8.50	11.50	6.50	14.3
80	×	80	83	216	292	165	6.5
3½	×	3½	3.25	10.00	13.00	7.75	22.9
90	×	90	89	254	330	197	10.4
4	×	4	3.75	10.50	13.63	8.13	26.0
100	×	100	95	267	346	207	11.8

Size			No. 32 Tee Wye (SW)				
Nominal Size Inches mm			G Inches mm	H Inches mm	E ₁ Inches mm	E ₂ Inches mm	Approx. Wgt. Each Lbs. kg
5	×	5	4.00	12.50	16.13	10.00	48.0
125	×	125	102	318	410	254	21.8
6	×	6	4.50	14.00	18.25	11.50	60.5
150	×	150	114	356	464	292	27.4
8	×	8	6.00	18.00	23.25	15.25	127.1
200	×	200	152	457	591	387	57.7
10	×	10	6.50	20.50	27.25	18.00	190.0
250	×	250	165	521	692	457	186.2
12	×	12	7.00	23.00	31.00	20.50	240.0
300	×	300	178	584	787	521	108.9

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s"
 S= Carbon Steel Direct Roll Groove (OGS)
 SW= Carbon Steel Segmentally Welded

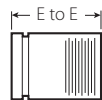
Grooved End Fittings

Adapter Nipple

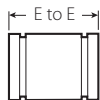
NO. 40 Grv. × Thd.

NO. 42 Grv. × Bev.

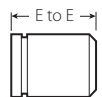
NO. 43 Grv. × Grv.



NO. 40 *



NO. 43



NO. 42

Size		No. 40, 42, 43 Adapter Nipple (s)	
Nominal Size Inches mm	Actual Outside Diameter Inches mm	E to E Inches mm	Approx. Weight Each Lbs. kg
¾ 20	1.050 26.9	3.00 76	0.3 0.1
1 25	1.315 33.7	3.00 76	0.4 0.2
1¼ 32	1.660 42.4	4.00 102	0.8 0.4
1½ 40	1.900 48.3	4.00 102	0.9 0.4
2 50	2.375 60.3	4.00 102	1.2 0.5
2½ 65	2.875 73.0	4.00 102	1.9 0.9
3 80	3.500 88.9	4.00 102	2.5 1.1
3½ 90	4.000 101.6	4.00 102	2.1 0.9
4 100	4.500 114.3	6.00 152	5.5 2.5
5 125	5.563 141.3	6.00 152	7.4 3.4

Size		No. 40, 42, 43 Adapter Nipple (s)	
Nominal Size Inches mm	Actual Outside Diameter Inches mm	E to E Inches mm	Approx. Weight Each Lbs. kg
6 150	6.625 168.3	6.00 152	9.5 4.3
8 200	8.625 219.1	6.00 152	14.2 6.4
10 250	10.750 273.0	8.00 203	27.0 12.2
12 300	12.750 323.9	8.00 203	33.0 15.0

* Available with British Standard Pipe Threads, specify "BSP" clearly on order.

IMPORTANT NOTES:

For pump package nipples with 1 ½"/40 mm hole cut to receive Style 923 Vic-Let or Style 924 Vic-O-Well request special No. 40, 42 or 43 nipples and specify No. 40-H, 42-H or 43-H on order. NOTE: 4 – 12"/100 – 300 mm diameter – 8"/200 mm minimum length required.

For roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales office.

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s"

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Grooved End Fittings

Cap

NO. 60



NO. 60

Size		No. 60 Cap	
Nominal Size Inches mm	Actual Outside Diameter Inches mm	T Thickness Inches mm	Approx. Weight Each Lbs. kg
¾	1.050	0.88	0.2
20	26.9	22	0.1
1	1.315	0.88	0.3
25	33.7	22	0.1
1 ¼	1.660	0.88	0.3
32	42.4	22	0.1
1 ½	1.900	0.88	0.5
40	48.3	22	0.2
2	2.375	0.88	0.6
50	60.3	22	0.3
2 ½	2.875	0.88	1.0
65	73.0	22	0.5
76.1 mm	3.000	0.88	1.2
	76.1	22	0.5
3	3.500	0.88	1.2
80	88.9	22	0.5
3 ½	4.000	0.88	2.5
90	101.6	22	1.1
108.0 mm	4.250	1.00	2.3
	108.0	25	1.0
4	4.500	1.00	2.5
100	114.3	25	1.1
133.0 mm	5.250	1.00	4.5
	133.0	25	2.0
139.7 mm	5.500	1.00	4.5
	139.7	25	2.0
5	5.563	1.00	4.6
125	141.3	25	2.1
159.0 mm	6.250	1.00	6.8
	159.0	25	3.1
165.1 mm	6.500	1.00	7.3
	165.1	25	3.3

Size		No. 60 Cap	
Nominal Size Inches mm	Actual Outside Diameter Inches mm	T Thickness Inches mm	Approx. Weight Each Lbs. kg
6	6.625	1.00	6.1
150	168.3	25	2.8
8	8.625	1.19	13.1
200	219.1	30	5.9
10	10.750	1.25	21.0
250	273.0	32	9.5
12	12.750	1.25	35.6
300	323.9	32	16.2
14 # (s)	14.000	9.50	*
350	355.6	241	
16 # (s)	16.000	10.00	*
400	406.4	254	
18 # (s)	18.000	11.00	*
450	457.0	279	
20 # (s)	20.000	12.00	*
500	508.0	305	
24 # (s)	24.000	13.50	*
600	610.0	343	
14 – 60" 350 – 1500 mm		AGS For AGS fitting information, see publication 20.05	

IMPORTANT NOTES:

* Steel dish caps available through 24"/600 mm, contact Victaulic.

No. 60 cap is not suitable for use in vacuum service with Style 72 or 750 couplings.

No. 61 bull plugs should be used, see pg. 35.

For roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales office.

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Grooved End Fittings

Flanged Adapter Nipple

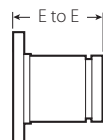
NO. 41 ANSI Class 125 (Cast Iron)

NO. 45F ANSI Class 150 Flat Face

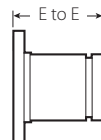
NO. 45R ANSI Class 150 Raised Face

NO. 46F ANSI Class 300 Flat Face

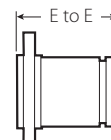
NO. 46R ANSI Class 300 Raised Face



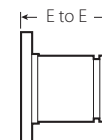
NO. 41



NO. 45F



NO. 45R



NO. 46F



NO. 46R

Size		No. 41 ANSI 125 Flange Adapter Nipple		No. 45F and No. 45R ANSI 150 Flange Adapter Nipple (S)		No. 46F and No. 46R ANSI 300 Flange Adapter Nipple (S)	
Nominal Size Inches mm	Actual Outside Diameter Inches mm	E to E Inches mm	Approx. Weight Each Lbs. kg	E to E Inches mm	Approx. Weight Each Lbs. kg	E to E Inches mm	Approx. Weight Each Lbs. kg
¾ 20	1.050 26.9	3 76	—	3 76	2.3 1.0	3 76	3.3 1.5
1 25	1.315 33.7	3 76	2.5 1.1	3 76	2.7 1.2	3 76	3.9 1.8
1¼ 32	1.660 42.4	4 102	3.0 1.4	4 102	3.3 1.5	4 102	4.8 2.2
1½ 40	1.900 48.3	4 102	3.5 1.6	4 102	3.9 1.8	4 102	6.9 3.1
2 50	2.375 60.3	4 102	5.5 2.5	4 102	6.2 2.8	4 102	8.2 3.7
2½ 65	2.875 73.0	4 102	8.0 3.6	4 102	9.9 4.5	4 102	11.9 5.4
3 80	3.500 88.9	4 102	9.5 4.3	4 102	11.4 5.2	4 102	16.5 7.5
3½ 90	4.00 101.6	4 102	12.0 5.4	4 102	15.1 6.8	4 102	20.1 9.1
4 100	4.500 114.3	6 152	16.7 7.6	6 152	18.4 8.3	6 152	27.4 12.4
5 125	5.563 141.3	6 152	21.5 9.8	6 152	21.3 9.7	6 152	35.3 16.0
6 150	6.625 168.3	6 152	26.5 12.0	6 152	27.5 12.5	6 152	47.5 21.5
8 200	8.625 219.1	6 152	39.0 17.7	6 152	41.3 18.8	6 152	70.3 31.9
10 250	10.750 273.0	8 203	57.0 25.9	8 203	59.8 27.1	8 203	100.8 45.7
12 300	12.750 323.9	8 203	41.0 18.6	8 203	88.2 40.0	8 203	146.2 66.3
14 # 350	14.000 355.6	8 203	—	8 203	+	8 203	+
16 # 400	16.000 406.4	8 203	—	8 203	+	8 203	+
18 # 450	18.000 457.0	8 203	—	8 203	+	8 203	+
20 # 500	20.000 508.0	8 203	—	8 203	+	8 203	+
24 # 600	24.000 610.0	8 203	—	8 203	+	8 203	+
14 – 60" 350 – 1500 mm	AGS For AGS fitting information, see publication 20.05						

IMPORTANT NOTES:

+ Contact Victaulic for details.

Flanged adapter nipples are supplied with standard rolled grooves.

Standard cut grooves or machining for rubber lining are optionally available. Contact Victaulic for details.

For roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales office.

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

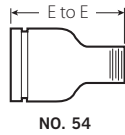
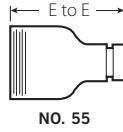
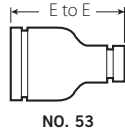
S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Grooved End Fittings

Swaged Nipple

NO. 53 Grv. × Grv.
NO. 54 Grv. × Thd.
NO. 55 Thd. × Grv.



Size		No. 53, 54 and 55 Swaged Nipples (S)	
Nominal Size		E to E	Approx. Weight Each
Inches		Inches	Lbs.
mm		mm	kg
2	×	1	2.0
50		25	0.9
		1 1/4	2.0
		32	0.9
		1 1/2	2.0
		40	0.9
2 1/2	×	1	3.0
65		25	1.4
		1 1/4	3.0
		32	1.4
		1 1/2	3.0
		40	1.4
		2	3.0
		50	1.4
3	×	1	4.5
80		25	2.0
		1 1/4	4.5
		32	2.0
		1 1/2	4.4
		40	2.0
		2	4.5
		50	2.0
		2 1/2	4.5
		65	2.0
3 1/2	×	3	6.8
90		80	3.1
4	×	1	7.5
100		25	3.4
		1 1/4	7.5
		32	3.4
		1 1/2	7.5
		40	3.4
		2	7.5
		50	3.4
4	×	2 1/2	7.5
100		65	3.4

Size		No. 53, 54 and 55 Swaged Nipples (S)	
Nominal Size		E to E	Approx. Weight Each
Inches		Inches	Lbs.
mm		mm	kg
4	×	3	7.5
100		80	3.4
		3 1/2	7.5
		90	3.4
5	×	2	11.5
125		50	5.2
		3	11.3
		80	5.1
		4	11.5
		100	5.2
6	×	1	17.0
150		25	7.7
		1 1/4	17.0
		32	7.7
		1 1/2	17.2
		40	7.8
		2	17.4
		50	7.9
		2 1/2	17.4
		65	7.9
		3	17.4
		80	7.9
		3 1/2	17.4
		90	7.9
		4	17.5
		100	7.9
		4 1/2	17.5
		120	7.9
		5	17.5
		125	7.9
8	×	6	20.0
200		150	9.1

+ Contact Victaulic for details.

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

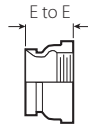
S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

Grooved End Fittings

Female Threaded Adapter

NO. 80



NO. 80

Size		No. 80 Female Threaded Adapter	
Nominal Size Inches mm	Actual Outside Diameter Inches mm	E to E Inches mm	Approx. Weight Each Lbs. kg
¾ 20	1.050 26.9	2.00 51	1.0 0.5
1 25	1.315 33.7	2.06 52	1.0 0.5
1¼ 32	1.660 42.4	2.31 (sw) 59	1.5 0.7
1½ 40	1.900 48.3	2.31 (sw) 59	1.5 0.7
2 50	2.375 60.3	2.50 64	1.4 0.6
2½ 65	2.875 73.0	2.75 70	1.5 0.7
3 80	3.500 88.9	2.75 70	2.9 1.3
4 100	4.500 114.3	3.25 83	4.5 2.0

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

S= Carbon Steel Direct Roll Groove (OGS)

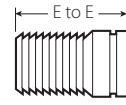
SW= Carbon Steel Segmentally Welded

IMPORTANT NOTE:

Available with British Standard Pipe threads, specify "BSP" clearly on order.

Hose Nipple

NO. 48



NO. 48

Size		No. 48 Hose Nipple (s)	
Nominal Size Inches mm	Actual Outside Diameter Inches mm	E to E Inches mm	Approx. Weight Each Lbs. kg
¾ 20	1.050 26.9	3.12 79	0.3 0.1
1 25	1.315 33.7	3.38 86	0.4 0.2
1¼ 32	1.660 42.4	3.88 98	0.6 0.3
1½ 40	1.900 48.3	3.88 98	0.8 0.4
2 50	2.375 60.3	4.50 114	1.1 0.5
2½ 65	2.875 73.0	5.38 137	2.0 0.9
3 80	3.500 88.9	5.75 146	3.2 1.5
4 100	4.500 114.3	7.00 178	4.9 2.2
5 125	5.563 141.3	8.75 222	8.0 3.6
6 150	6.625 168.3	10.12 257	14.3 6.5
8 200	8.625 219.1	11.88 302	24.7 11.2
10 250	10.750 273.0	12.50 318	40.1 18.2
12 300	12.750 323.9	14.50 368	62.0 28.1

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

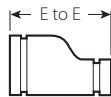
Grooved End Fittings

Concentric/Eccentric Reducer

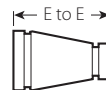
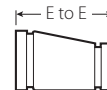
NO. 50 Concentric
NO. 51 Eccentric



NO. 50



NO. 51

Fabricated Steel
No.50Fabricated Steel
No.51

Size		No. 50 Concentric Reducer		No. 51 Eccentric Reducer	
Nominal Size Inches mm		E to E Inches mm	Approx. Weight Each Lbs. kg	E to E Inches mm	Approx. Weight Each Lbs. kg
1 1/4 32	× 3/4 20	+	1.9 0.9	—	—
	1 25	+	1.9 0.9	—	—
1 1/2 40	× 3/4 20	+	1.4 0.6	—	—
	1 25	2.50 64	0.8 0.4	8.50sw 216	4.5 2.0
	1 1/4 32	2.50 64	1.0 0.5	—	—
2 50	× 3/4 20	2.50 64	0.9 0.3	9.00sw 229	2.0 0.9
	1 25	2.50 64	0.7 0.3	9.00sw 229	2.3 1.0
	1 1/4 32	2.50 64	1.2 0.5	9.00sw 229	4.6 2.1
	1 1/2 40	3.50 89	1.0 0.5	3.50 89	1.1 0.5
2 1/2 65	× 3/4 20	+	1.3 0.6	+	3.3 1.5
	1 25	2.50 64	1.1 0.5	9.50 241	3.5 1.6
	1 1/4 32	3.50 89	3.3 1.5	3.50 89	1.4 0.6
	1 1/2 40	2.50 64	3.6 1.6	9.50sw 241	3.7 1.7
	2 50	2.50 64	3.9 1.8	3.50 89	4.3 2.0
3 80	× 3/4 20	+	1.5 0.7	+	4.5 2.0
	1 25	2.50 241	1.3 0.6	9.50sw 241	4.8 2.2
	1 1/4 32	2.50 64	1.4 0.6	+	4.8 2.2
	1 1/2 40	2.50 64	5.1 2.3	9.50sw 241	5.1 2.3
	2 50	2.50 64	1.6 0.7	3.50 89	6.0 2.7
	2 1/2 65	2.50 64	1.8 0.8	3.50 89	7.0 3.2
	76.1	2.50 64	2.1 1.0	—	—

Size		No. 50 Concentric Reducer		No. 51 Eccentric Reducer	
Nominal Size Inches mm		E to E Inches mm	Approx. Weight Each Lbs. kg	E to E Inches mm	Approx. Weight Each Lbs. kg
3 1/2 90	× 3 80	2.50 64	2.0 0.9	9.50sw 241	7.0 3.2
	4 100	3.00 76	3.0 1.4	13.00sw 330	6.5 2.9
4 100	× 1 25	+	4.6 2.1	—	—
	1 1/4 32	3.00sw 76	2.6 1.2	10.00sw 254	8.1 3.7
	1 1/2 40	3.00 76	2.4 1.1	4.00 102	3.3 1.5
	2 50	3.00 76	2.7 1.2	4.00 102	3.4 1.5
	2 1/2 65	3.00 76	3.2 1.4	4.00 102	3.5 1.6
	3 80	3.00 76	2.9 1.3	10.00sw 254	8.0 3.6
	3 1/2 90	11.00sw 279	9.0 4.1	11.00sw 279	5.2 2.4
5 125	× 2 50	4.00 102	4.3 2.0	11.00sw 279	10.8 4.9
	2 1/2 65	4.00 102	5.5 2.5	11.00sw 279	11.1 5.0
	3 80	3.50 89	4.3 1.9	5.00 127	12.0 5.4
	4 100	4.00 102	5.0 2.3	11.50sw 292	14.5 6.6
6 150	× 1 25	+	5.5 2.5	+	+
	1 1/4 32	4.00 102	6.6 3.0	11.50sw 292	14.5 6.6
	1 1/2 40	4.00 102	6.4 2.9	11.50sw 292	14.2 6.4
	2 50	4.00 102	6.4 2.9	5.50 140	15.0 6.8
	2 1/2 65	4.00 102	6.5 2.9	5.50 140	17.0 7.7
	3 80	4.00 102	6.4 2.9	5.50 140	17.0 7.7
	4 100	16.00 406	7.9 3.6	12.00sw 305	26.1 11.8
8 200	× 2 1/2 65	5.00 127	9.3 4.2	12.00sw 305	22.0 10.0

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s"

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

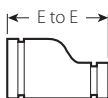
Grooved End Fittings

Concentric/Eccentric Reducer

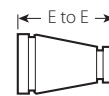
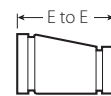
NO. 50 Concentric
NO. 51 Eccentric



NO. 50



NO. 51

Fabricated Steel
No.50Fabricated Steel
No.51

Size		No. 50 Concentric Reducer		No. 51 Eccentric Reducer	
Nominal Size Inches mm		E to E Inches mm	Approx. Weight Each Lbs. kg	E to E Inches mm	Approx. Weight Each Lbs. kg
8 200	4 100	5.00 127	10.4 4.8	12.00sw 305	23.0 10.4
	5 125	5.00 127	11.6 5.2	12.00sw 305	23.0 10.4
	6 150	5.00 127	11.9 5.4	6.00 152	24.0 10.9
10 250	4 100	6.00 152	19.7 8.9	13.00sw 330	32.0 14.5
	5 125	+	34.3 15.6	+	34.6 15.7
	6 150	6.00 152	20.0 9.1	13.00sw 330	36.9 16.7
	8 200	6.00 152	22.0 10.0	7.00 178	21.6 9.8
12 300	4 100	+	44.0 20.0	14.00sw 356	48.0 21.8
	6 150	7.00 178	24.6 11.2	14.00sw 356	50.0 22.7
	8 200	7.00 178	52.0 23.6	14.00sw 356	53.5 24.3
	10 250	7.00 178	39.0 17.7	14.00sw 356	57.0 25.9
# 14 350	6 150	13.00 330	65.0 29.5	13.00 330	60.0 27.2
	8 200	13.00 330	65.0 29.5	13.00 330	60.0 27.2
	10 250	13.00 330	66.0 29.9	13.00 330	65.0 29.5
	12 300	13.00 330	68.0 30.8	13.00 330	66.0 29.9
# 16 400	8 200	14.00 356	73.0 33.1	14.00 355	73.0 33.1
	10 S 250	14.00 356	73.0 33.1	14.00 355	73.0 33.1
	12 300	14.00 356	73.0 33.1	14.00 355	73.0 33.1
	14 350	14.00 356	73.0 33.1	14.00 355	73.0 33.1
# 18 450	10 250	15.00 381	91.0 41.3	15.00 381	91.0 41.3

Size		No. 50 Concentric Reducer		No. 51 Eccentric Reducer	
Nominal Size Inches mm		E to E Inches mm	Approx. Weight Each Lbs. kg	E to E Inches mm	Approx. Weight Each Lbs. kg
# 18 450	12 300	15.00 381	91.0 41.3	15.00 381	91.0 41.3
	14 350	15.00 381	91.0 41.3	15.00 381	91.0 41.3
	16 400	15.00 381	91.0 41.3	15.00 381	91.0 41.3
# 20 500	10 250	20.00 508	110.0 49.9	20.00 508	177.0 80.3
	12 300	20.00 508	120.0 54.4	20.00 508	120.0 54.4
	14 350	20.00 508	149.0 67.9	20.00 508	149.0 67.9
	16 400	20.00 508	120.0 54.4	20.00 508	120.0 54.4
	18 450	20.00 508	136.0 61.7	20.00 508	136.0 61.7
	20 500	20.00 508	151.0 68.5	20.00 508	190.0 86.2
14 – 60" 350 – 1500 mm		AGS For AGS fitting information, see publication 20.05			

+ Contact Victaulic for details.

* Available with male threaded small end No. 52.

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s".

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

IMPORTANT NOTE:

Steel eccentric reducers available through 30"/750mm, contact Victaulic for dimensions.

For roll grooved systems, Victaulic offers the Advanced Groove System (AGS). For pricing and availability of cut groove fittings in this size, contact your nearest Victaulic sales office.

§ Cast fitting available for JIS size. Contact Victaulic for details.

Grooved End Fittings

Small Threaded Reducer

NO. 52



NO. 52



NO. 52F

Size		No. 52 Small Threaded Reducer		No. 52F Concentric Reducer with BSPT Female Threaded End	
Nominal Size Inches mm		E to E Inches mm	Approx. Weight Each Lbs. kg	E to E Inches mm	Approx. Weight Each Lbs. kg
1 1/2 40	×	1 25	2.50 64	0.8 0.4	—
		1 1/4 32	2.50 64	0.9 0.4	—
2 50	×	3/4 20	2.50 64	0.9 0.4	—
		1 25	2.50 64	0.7 0.3	—
		1 1/4 32	2.50 64	1.2 0.5	—
		1 1/2 40	2.50 64	1.0 0.5	—
2 1/2 65	×	1 25	2.50 64	1.1 0.5	—
		1 1/4 32	2.50 (sw) 64	1.2 0.5	—
		1 1/2 40	2.50 (sw) 64	1.3 0.6	—
		2 50	3.00 76	1.4 0.6	—
76.1	×	48.3 60	63.5 —	0.8 —	63.5 0.77 63.5 0.85
3 80	×	3/4 20	—	1.5 0.7	—
		1 25	2.50 64	1.3 0.6	—
		1 1/4 32	2.50 64	1.5 0.7	—
		1 1/2 40	2.50 (sw) 64	1.5 0.7	—
		2 50	2.50 64	1.5 0.7	—
		2 1/2 65	2.50 64	2.4 1.1	—
88.9	×	42.4 48.3 60	63.5 63.5 —	0.9 0.9 —	63.5 0.82 63.5 0.85 63.5 0.89
4 100	×	1 25	3.00 76	2.3 1.0	—
		1 1/2 40	3.00 76	2.7 1.2	—
		2 50	3.00 76	2.6 1.2	—

Size		No. 52 Small Threaded Reducer		No. 52F Concentric Reducer with BSPT Female Threaded End	
Nominal Size Inches mm		E to E Inches mm	Approx. Weight Each Lbs. kg	E to E Inches mm	Approx. Weight Each Lbs. kg
4 100	×	2 1/2 65	3.00 76	2.6 1.2	—
		3 80	3.00 76	2.5 1.1	—
108	×	42.4 48.3 60	76.2 76.2 —	1.3 1.3 —	76.2 1.32 76.2 1.35 76.2 1.39
114.3	×	42.4 48.3 60	76.2 76.2 —	1.3 1.3 —	76.2 1.30 76.2 1.34 76.2 1.40
5 125	×	4 100	—	4.5 2.0	—
133	×	60	—	—	114.3 2.17
139	×	60	—	—	114.3 2.26
6 150	×	1 25	4.00 102	5.5 2.5	—
		2 50	4.00 102	5.7 2.6	—
		2 1/2 65	4.00 102	5.8 2.6	—
		3 80	4.00 102	5.8 2.6	—
		4 100	—	6.5 2.9	—
		5 125	—	2.0 0.9	—
159	×	42.4 48.3 60	114.3 114.3 —	2.2 2.2 —	114.3 2.45 114.3 2.51 114.3 2.60
165.1	×	42.4 48.3 60	101.6 101.6 —	2.4 2.6 —	101.6 2.90 101.6 2.95 101.6 3.00
8 200	×	2 50	16.00 406	1.5 0.7	—
		2 1/2 65	16.00 406	1.7 0.8	—

+ Contact Victaulic for details.

Note: All fittings are ductile iron unless otherwise noted with an "sw" or "s"

S= Carbon Steel Direct Roll Groove (OGS)

SW= Carbon Steel Segmentally Welded

IMPORTANT NOTE:

Available with British Standard Pipe Threads, specify "BSP" clearly on order

Grooved End Fittings

INSTALLATION

Reference should always be made to the I-100 Victaulic Field Installation Handbook for the product you are installing. Handbooks are included with each shipment of Victaulic products for complete installation and assembly data, and are available in PDF format on our website at www.victaulic.com.

WARRANTY

Refer to the Warranty section of the current Price List or contact Victaulic for details.

NOTE

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

Styles 920 and 920N Mechanical-T® Bolted Branch Outlets

PRODUCT DESCRIPTION



Styles 920 and 920N



Style 920 Cross



See Victaulic
publication 10.01
for details.

See chart on page 5
for pressure ratings.

Victaulic Mechanical-T® Outlet provides a direct branch connection at any location a hole can be cut in pipe. The hole is cut oversize to receive a “holefinder” locating collar which secures the outlet in position permanently. A pressure responsive gasket seals on the pipe O.D.

Cross-type connections can be achieved by utilizing two upper housings of the same style and size, with the same or differing branch size connections. NOTE: Style 920 and Style 920N housings **cannot** be mated to achieve a cross connection.

Style 920 and Style 920N Mechanical-T outlets are available with grooved or female threaded outlet. Specify choice on order. Units are supplied painted with plated bolts. Galvanized housings are available, supplied with plated bolts.

All sizes of Style 920 and 920N are rated at 500 psi (3450 kPa) working pressure on Schedule 10 and 40 carbon steel pipe. They may also be used on high density polyethylene or polybutylene (HDPE) pipe. Pressure ratings on HDPE are dependent on the pipe rating. Contact Victaulic for ratings on other pipe.

Style 920 and 920N are not recommended for use on PVC plastic pipe.

Standard piping practices dictate that the Mechanical-T Styles 920 and 920N must be installed so that the main and branch connections are a true 90° angle when permanently attached to the pipeline surface.

MATERIAL SPECIFICATIONS

Housing/Coating: Ductile iron conforming to ASTM A-536, grade 65-45-12, with orange enamel coating. Ductile iron conforming to ASTM A-395, grade 65-45-15, is available upon special request.

• **Optional:** Hot dipped galvanized

Gasket: (Specify choice*)

• **Grade “E” EPDM**

EPDM (Green color code). Temperature range –30°F to +230°F (–34°C to +110°C). Recommended for cold and hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. UL Classified in accordance with ANSI/NSF 61 for cold +86°F (+30°C) and hot +180°F (+82°C) NOT RECOMMENDED FOR PETROLEUM SERVICES.

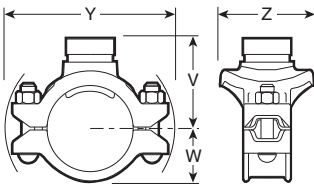
• **Grade “T” nitrile**

Nitrile (Orange color code). Temperature range –20°F to +180°F (–29°C to +82°C). Recommended for petroleum products, air with oil vapors, vegetable and mineral oils within the specified temperature range. Not recommended for hot water services over +150°F (+66°C) or for hot dry air over +140°F (+60°C).

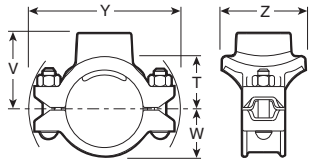
*Services listed are General Service Recommendations only. It should be noted that there are services for which these gaskets are not recommended. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service recommendations and for a listing of services which are not recommended.

Bolts/Nuts: Heat-treated plated carbon steel, trackhead meeting the physical and chemical requirements of ASTM A-449 and physical requirements of ASTM A-183.

DIMENSIONS



**Styles 920 and 920N
w/Grooved Outlet**



**Styles 920 and 920N
w/Female Threaded Outlet**

NOTE: Style 920 and Style 920N housings cannot be mated to achieve cross connections.

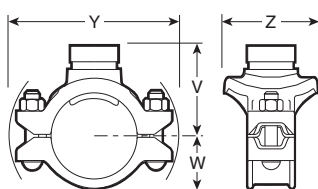
NEW HOLE SIZE

These new size Style 920N products require a different hole size than the Style 920 it replaces, for proper installation. Use caution to assure the proper size hole is prepared for the specific size and style used. Failure to use the proper hole size could result in joint leakage and property damage.

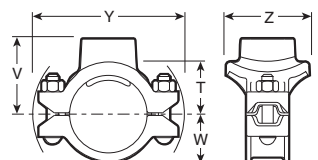
SIZE Run X Branch Nominal Inches mm			Style No.	Max. Work. Press. PSI kPa	Dimensions – Inches/millimeters							Aprx. Wgt. Each Lbs./kg	
					Hole Dia. +0.13 –0.00	T **	Fem. Thd. V #	Grv. V #	W	Y	Z	Fem. Thd.	Grv.
2 50	X	1/2 (a) 15	920N	500 3450	1.50 38,1	2.00 51	2.53 64	– –	1.61 41	5.35 136	2.75 70	3.1 1,5	– –
	X	3/4 (a) 20	920N	500 3450	1.50 38,1	1.97 50	2.53 64	– –	1.61 41	5.35 136	2.75 70	3.1 1,5	– –
	X	1 (a) 25	920N	500 3450	1.50 38,1	1.85 47	2.53 64	– –	1.61 41	5.35 136	2.75 70	3.0 1,4	– –
	X	1 1/4 (a) † 32	920N	500 3450	1.75 44,5	2.05 52	2.75 70	3.00 76	1.61 41	5.35 136	3.00 76	3.5 1,7	3.2 1,5
	X	1 1/2 (a) † 40	920N	500 3450	1.75 44,5	2.03 52	2.75 70	3.12 79	1.61 41	5.35 136	3.25 83	3.6 1,7	3.2 1,5
	X												
2 1/2 65	X	1/2 (a) 15	920N	500 3450	1.50 38,1	2.21 56	2.74 70	– –	1.86 47	5.64 143	2.75 70	3.0 1,4	– –
	X	3/4 (a) 20	920N	500 3450	1.50 38,1	2.18 55	2.74 70	– –	1.86 47	5.64 143	2.75 70	3.0 1,4	– –
	X	1 (a) 25	920N	500 3450	1.50 38,1	2.06 52	2.74 70	– –	1.86 47	5.64 143	2.75 70	2.9 1,4	– –
	X	1 1/4 † (a) 32	920N	500 3450	1.75 44,5	2.30 58	3.00 76	3.25 83	1.86 47	6.29 160	3.00 76	3.5 1,7	3.2 1,5
	X	1 1/2 † (a) 40	920N	500 3450	2.00 50,8	2.28 58	3.00 76	3.25 83	1.86 47	6.26 159	3.25 83	3.6 1,7	3.3 1,6
	X												
76,1 mm	X	1/2 (a) 15	920	300 2065	1.50 38,1	2.22 56	2.75 70	– –	1.88 48	6.46 164	3.16 80	3.9 1,8	– –
	X	3/4 (a) 20	920	300 2065	1.50 38,1	2.19 56	2.75 70	– –	1.88 48	6.46 164	3.16 80	3.9 1,8	– –
	X	1 (a) 25	920	300 2065	1.50 38,1	2.07 53	2.75 70	– –	1.88 48	6.46 164	3.16 80	3.8 1,7	– –
	X	1 1/4 (a) † 32	920N	500 3450	1.75 44,5	2.30 58	3.00 76	3.31 84	1.92 49	6.29 160	3.00 76	3.5 1,6	3.2 1,5
	X	1 1/2 (a) 40	920N	500 3450	2.00 50,8	2.28 58	3.00 76	3.31 84	1.92 49	6.29 160	3.25 83	3.5 1,6	3.3 1,5
	X												
3 80	X	1/2 (a) 15	920N	500 3450	1.50 38,1	2.52 64	3.05 78	– –	2.28 58	6.15 156	2.75 70	3.4 1,6	– –
	X	3/4 (a) 20	920N	500 3450	1.50 38,1	2.49 63	3.05 78	– –	2.28 58	6.15 156	2.75 70	3.4 1,6	– –
	X	1 (a) 25	920N	500 3450	1.50 38,1	2.38 61	3.06 78	– –	2.28 58	6.15 156	2.75 70	3.3 1,6	– –
	X	1 1/4 (a) † 32 (b)	920N	500 3450	1.75 44,5	2.55 65	3.25 83	3.56 90	2.28 58	6.15 156	3.00 76	3.8 1,8	3.7 1,8
	X	1 1/2 (a) † 40 (b)	920N	500 3450	2.00 50,8	2.78 71	3.50 89	3.56 90	2.28 58	6.15 156	3.25 83	4.1 1,9	3.8 1,8
	X	2 (a) 50	920N	500 3450	2.50 63,5	2.75 70	3.50 89	3.56 90	2.28 58	6.75 172	3.88 99	4.9 2,3	4.6 2,1
3 1/2 90	X	2 50	920N	500 3450	2.50 63,5	– –	– –	3.75 95	2.44 62	6.72 171	3.88 99	– –	3.8 1,8
	X												
4 100	X	1/2 (a) 15	920N	500 3450	1.50 38,1	3.03 77	3.56 90	– –	2.69 68	7.01 178	2.75 70	3.7 1,8	– –
	X	3/4 (a) 20	920N	500 3450	1.50 38,1	3.00 76	3.56 90	– –	2.69 68	7.01 178	2.75 70	3.7 1,8	– –
	X	1 (a) 25	920N	500 3450	1.50 38,1	2.88 73	3.56 90	– –	2.69 68	7.01 178	2.75 70	3.6 1,8	– –
	X	1 1/4 (a) † 32 (b)	920N	500 3450	1.75 44,5	3.08 78	3.78 96	4.00 102	2.69 68	7.01 178	3.00 76	4.0 1,9	3.6 1,8
	X	1 1/2 (a) † 40 (b)	920N	500 3450	2.00 50,8	3.28 83	4.00 102	4.00 102	2.69 68	7.01 178	3.25 83	4.2 2,0	3.9 1,9
	X	2 (a) † 50	920N	500 3450	2.50 63,5	3.25 83	4.00 102	4.00 102	2.69 68	7.01 178	3.88 99	5.0 2,3	4.6 2,1
76,1 mm	X	2 1/2 (a) † 65	920	500 3450	2.75 69,9	2.88 73	4.00 102	4.00 102	2.69 68	7.34 186	4.63 118	5.8 2,6	5.0 2,3
	X	76,1 mm	920	500 3450	2.75 69,9	– –	– –	4.00 102	2.69 68	7.34 186	4.63 118	– –	6.4 2,9
3 (a) † 80	X		920	500 3450	3.50 88,9	3.31 84	4.50 114	4.12 105	2.69 68	7.73 196	5.12 130	8.4 3,8	6.4 2,9

Table continued on page 3. See notes on page 4.

DIMENSIONS



**Styles 920 and 920N
w/Grooved Outlet**



**Styles 920 and 920N
w/Female Threaded Outlet**

NOTE: Style 920 and Style 920N housings cannot be mated to achieve cross connections.

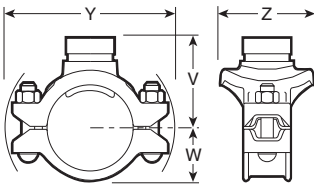
NEW HOLE SIZE

These new size Style 920N products require a different hole size than the Style 920 it replaces, for proper installation. Use caution to assure the proper size hole is prepared for the specific size and style used. Failure to use the proper hole size could result in joint leakage and property damage.

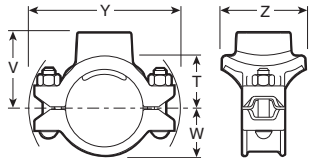
SIZE Run X Branch Nominal Inches mm		Style No.	Max. Work. Press. PSI/kPa	Hole Dia. +0.13 -0.00	Dimensions – Inches/millimeters						Aprx. Wgt. Ea. Lbs./kg	
					T **	Fem. Thd. V ‡ #	Grv. V ‡	W	Y	Z	Fem. Thd.	Grv.
108,0 mm	X	1 1/4 (a)	500	1.75	3.08	3.78	–	2.63	7.64	3.05	5.0	–
	X	32	3450	44,5	78	96	–	67	194	78	2,3	–
	X	1 1/2 (a)	500	2.00	3.28	4.00	–	2.63	7.64	3.25	5.0	–
	X	40	3450	50,8	83	102	–	67	194	83	2,3	–
	X	2 (a)	500	2.50	3.25	4.00	–	2.63	7.64	4.00	4.0	–
	X	50	3450	63,5	83	102	–	67	194	102	1,9	–
	X	76,1 mm	500	2.75	2.88	4.00	4.00	2.63	7.64	4.29	8.0	–
	X		3450	69,9	73	102	102	67	194	109	3,6	–
	X	3 (a)	500	3.50	3.31	4.50	–	2.63	7.63	4.88	6.8	6.5
	X	80	3450	88,9	84	114	–	67	194	124	3,1	3,0
5 125	X	1 1/2 (a) †	500	2.00	4.03	4.75	4.75	3.16	9.70	3.69	7.4	7.6
	X	40	3450	50,8	102	121	121	80	246	94	3,4	3,4
	X	2 (a) †	500	2.50	4.00	4.75	4.75	3.16	9.70	4.38	8.2	8.0
	X	50	3450	63,5	102	121	121	80	246	111	3,7	3,6
	X	2 1/2 (a) †	500	2.75	3.63	4.75	4.75	3.16	9.70	4.63	8.3	7.9
	X	65	3450	69,9	92	121	121	80	246	118	3,8	3,6
	X	3 (a) †	500	3.50	3.81	5.00	4.63	3.16	9.70	5.31	8.4	8.8
	X	80	3450	88,9	97	127	118	80	246	135	3,8	4,0
	X	2	500	2.50	3.75	4.50	–	3.17	8.00	3.88	8.0	–
	X	50	3450	63,5	95	114	–	81	203	99	3,6	–
133,0 mm	X	3	500	3.50	3.81	5.00	–	3.00	9.46	5.31	8.0	–
	X	80	3450	88,9	97	127	–	76	240	135	3,6	–
139,7 mm	X	1 1/2 †	500	2.00	3.78	4.50	–	3.30	8.23	3.25	7.0	–
	X	40	3450	50,8	96	114	–	84	209	83	3,2	–
	X	2 †	500	2.50	3.75	4.50	–	3.30	8.23	3.88	9.0	–
	X	50	3450	63,5	95	114	–	84	209	99	4,1	–
	X	76,1 mm (a)(b)	500	2.75	3.63	4.75	–	3.13	9.85	4.63	8.8	–
	X		3450	69,9	92	121	–	80	250	118	4,0	–
	X	76,1 mm	500	3.50	–	–	4.63	3.16	9.70	5.31	11.0	–
	X		3450	88,9	–	–	118	80	246	135	5,0	–
	X	3	500	3.50	3.81	5.00	4.63	3.16	9.85	5.38	14.0	14.2
	X	88,9	3450	88,9	96.80	127	118	80	250	137	6,4	6,4
6 150	X	1 1/4	500	1.75	4.43	5.13	–	3.79	9.15	3.25	–	4.8
	X	32 (b)	3450	44,5	112	130	–	96	232	83	–	2,2
	X	1 1/2 (a) †	500	2.00	4.40	5.12	5.13	3.79	9.15	3.25	5.4	5.1
	X	40 (b)	3450	50,8	112	130	130	96	232	83	2,4	2,3
	X	2 (a) †	500	2.50	4.38	5.13	5.13	3.79	9.15	3.88	6.0	5.6
	X	50	3450	63,5	111	130	130	96	232	99	2,7	2,5
	X	2 1/2 (a) †	500	2.75	4.01	5.13	5.12	3.69	10.51	4.63	8.3	7.6
	X	65	3450	69,9	110	130	130	94	267	118	3,8	3,4
	X	76,1 mm (a)(b)	500	2.75	–	–	5.21	3.69	10.51	4.63	–	8.4
	X		3450	69,9	–	–	132	94	267	118	–	3,8
159,0 mm	X	3 (a) †	500	3.50	4.31	5.50	5.13	3.69	10.51	5.31	9.9	8.4
	X	80	3450	88,9	110	140	130	94	267	135	4,5	3,8
	X	4 (a) †	500	4.50	3.81	5.75	5.38	3.69	10.51	6.25	10.1	10.1
	X	100	3450	114,3	97	146	137	94	267	159	4,6	4,6
	X	1 1/4	500	1.75	4.43	5.13	–	3.63	9.40	3.25	9.0	8.7
	X	32	3450	44,5	113	130	–	92	239	83	4,1	4,0
	X	1 1/2 (a)	500	2.00	4.41	5.13	–	3.63	9.40	3.25	7.8	–
	X	40	3450	50,8	112	130	–	92	239	83	3,5	–
	X	2 (a)	500	2.50	4.38	5.13	–	3.63	9.40	3.88	8.0	–
	X	50	3450	63,5	111	130	–	92	239	99	3,6	–
	X	76,1 mm	500	2.75	4.38	5.50	5.13	3.63	9.40	4.63	9.5	9.5
	X		3450	69,9	111	140	130	92	239	118	4,3	4,3
	X	3	500	3.50	4.31	5.50	5.13	3.63	9.40	5.31	8.1	14.0
	X	80	3450	88,9	110	140	130	92	239	135	3,7	6,4
	X	108,0 mm	500	4.50	–	–	5.38	3.63	9.40	6.12	–	10.0
	X		3450	114,3	–	–	137	92	239	155	–	4,5
	X	4	500	4.50	3.81	5.75	–	3.63	9.40	6.25	18.0	–
	X	100	3450	114,3	96.80	146	–	92	239	159	8,2	–

Table continued on page 4. See notes on page 4.

DIMENSIONS



**Styles 920 and 920N
w/Grooved Outlet**



**Styles 920 and 920N
w/Female Threaded Outlet**

NOTE: Style 920 and Style 920N housings cannot be mated to achieve cross connections.

NEW HOLE SIZE

These new size Style 920N products require a different hole size than the Style 920 it replaces, for proper installation. Use caution to assure the proper size hole is prepared for the specific size and style used. Failure to use the proper hole size could result in joint leakage and property damage.

NOTES

**Center of run to engaged pipe end, female threaded outlet only (Dimensions approximate).

† Available with grooved or female threaded outlet. Specify choice on order.

‡ Center of run to end of fitting.

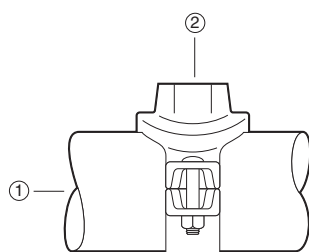
Female threaded outlets are available to NPT and BSPT specifications.

(a) British Standard female pipe threaded outlet is available as listed. Specify "BSPT" clearly on order.

(b) For 76,1 mm threaded outlet, specify 2½" BSPT clearly on order.

SIZE Run X Branch Nominal Inches mm	Style No.	Max. Work. Press. PSI/kPa	Hole Dia. +0.13 -0.00	Dimensions – Inches/millimeters						Aprx. Wgt. Ea. Lbs./kg	
				T **	Fem. Thd. V ‡ #	Grv. V ‡	W	Y	Z		
165,1 mm	X 1	500	1.50	99	116	–	96	237	70	8.0	–
	X 25	3450	38,1							3,6	–
	X 1¼	500	1.75	4.43	5.13	–	3.79	9.34	3.25	8.4	–
	X 32	3450	44,5	113	130	–	96	237	83	3,8	–
	X 1½ (a) †	500	2.00	4.41	5.13	–	3.79	9.34	3.25	8.4	–
	X 40	3450	50,8	112	130	–	96	237	83	3,8	–
	X 2 (a) †	500	2.50	4.38	5.13	–	3.79	9.34	3.88	8.5	–
	X 50	3450	63,5	111	130	–	96	237	99	3,9	–
	X 2½ †	500	2.75	4.01	5.13	–	3.63	10.51	4.63	8.6	7.6
	X 65	3450	69,9	110	130	–	92	267	118	3,9	3,4
	X 76,1 mm (a)(b)	500	2.75	4.01	5.13	5.21	3.63	10.51	4.63	8.6	7.6
	X	3450	69,9	110	130	132	92	267	118	3,9	3,4
	X 3 (a) †	500	3.50	4.31	5.50	5.13	3.63	10.51	5.31	10.2	8.4
	X 80	3450	88,9	110	140	130	92	267	135	4,6	3,8
	X 4 (a) †	500	4.50	3.81	5.75	5.38	3.63	10.51	6.25	10.5	8.4
	X 100	3450	114,3	97	146	137	92	267	159	4,8	3,8
8 200	X 2 (a)	500	2.75	5.44	6.19	–	4.81	12.42	4.50	11.6	–
	X 50	3450	69,9	138	157	–	122	316	114	5,3	–
	X 2½ (a) †	500	2.75	5.07	6.19	6.19	4.81	12.42	4.50	11.6	11.6
	X 65	3450	69,9	129	157	157	122	316	114	5,3	5,3
	X 3 (a) †	500	3.50	5.31	6.50	6.50	4.81	12.42	5.31	12.6	11.6
	X 80	3450	88,9	135	165	165	122	316	135	5,7	5,3
	X 4 (a) †	500	4.50	4.81	6.75	6.38	4.81	12.42	6.25	15.3	12.5
	X 100	3450	114,3	122	171	162	122	316	159	6,9	5,7

FLOW DATA



Exaggerated for Clarity

Flow test data has shown that the total head loss between point (1) and (2) for the Style 920, 900N and 929 Mechanical-T® fittings can best be expressed in terms of the pressure difference across the inlet and branch. The pressure difference can be obtained from the relationship to the right.

C_v Values

Values for flow of water at +60°F (+16°C) are shown in the table at right.

OUTLET SIZE		Equivalent Length Feet/meter of Pipe		OUTLET SIZE		Equivalent Length Feet/meter of Pipe	
Nominal Diameter In./mm	Actual Out. Dia. In./mm	Grooved	Female Threaded	Nominal Diameter In./mm	Actual Out. Dia. In./mm	Grooved	Female Threaded
1/2 15	0.840 21,3	–	2.0 0,6	2 50	2.375 60,3	9.0 2,7	10.5 3,2
3/4 20	1.050 26,7	–	4.0 1,2	2 1/2 65	2.875 73,0	11.0 3,4	12.5 3,8
1 25	1.315 33,7	–	5.0 1,5	3 80	3.500 88,9	13.5 4,1	15.5 4,7
1 1/4 32	1.660 42,4	5.5 1,7	6.0 1,8	4 100	4.500 114,3	20.0 6,1	22.0 6,7
1 1/2 40	1.900 48,3	7.0 2,1	8.0 2,4				

Formulas for C_v Values:

$$\Delta P = \frac{Q^2}{C_v^2}$$

$$Q = C_v \times \sqrt{\Delta P}$$

Where:

Q = Flow (GPM)

C_v = Flow Coefficient

ΔP = Pressure Drop (psi)

Pipe Size		C _v Values	Pipe Size		C _v Values	Pipe Size		C _v Values
Nominal Diameter Inches/mm	Actual Outside Diameter Inches/mm		Nominal Diameter Inches/mm	Actual Outside Diameter Inches/mm		Nominal Diameter Inches/mm	Actual Outside Diameter Inches/mm	
1/2 15	0.840 21,3	17	1 1/4 32	1.660 42,4	45	2 1/2 65	2.875 73,0	135
3/4 20	1.050 26,7	21	1 1/2 40	1.900 48,3	60	3 80	3.500 88,9	200
1 25	1.315 33,7	25	2 50	2.375 60,3	100	4 100	4.500 114,3	400

APPROVED PRESSURE RATINGS

The information provided below is based on the latest listing and approval data at the time of publication. Listings/Approvals are subject to change and/or additions by the approvals agencies. Contact Victaulic for performance on other pipe and the latest listings and approvals.

Run Size		Outlet Size Inches/mm	Pipe Schedule	Rated Working Pressures PSI/kPa		
Nominal Diameter Inches/mm	Actual Outside Diameter Inches/mm			UL	ULC	FM
2 1/2 - 6 65 - 150	2.875 - 6.625 73,0 - 168,3	All	10, 40	400 2755	400 2755	400 2755
2 1/2 - 4 65 - 100	2.875 - 4.500 73,0 - 114,3	All	DF	300 2065	300 2065	300 2065
2 1/2 - 4 65 - 100	2.875 - 4.500 73,0 - 114,3	All	SF	300 2065	300 2065	300 2065
6 150	6.625 168,3	3, 4	10	300 2065	300 2065	250 1724
6 150	6.625 168,3	3, 4	30, 40	300 2065	300 2065	300 2065
8 200	8.625 219,1	2 1/2	10, 40	400 2755	–	–
8 200	8.625 219,1	3, 4	10	300 2065	–	250 1724
8 200	8.625 219,1	3, 4	30, 40	300 2065	–	300 2065

NOTES: 10 refers to Listed/Approved Schedule 10 steel sprinkler pipe.
40 refers to Listed/Approved Schedule 40 steel sprinkler pipe.
DF refers to Listed/Approved Dyna-Flow steel sprinkler pipe manufactured by American Tube Company.
SF refers to Listed/Approved Super-Flo steel sprinkler pipe manufactured by Allied Tube and Conduit Corporation.

This product shall be manufactured by Victaulic or to Victaulic specifications. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

ANVILStar™

Fire Products Division of Anvil® International



www.anvilstar.com



MERIT.

Outlet Fittings for Fire Protection



Weld-Miser™ Tee-Let®

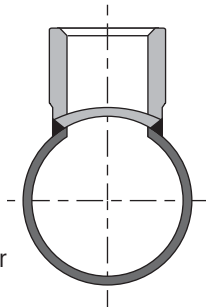
Welding Outlet Fittings

Unified Design™ Series

Merit's Unified Design Series carries all important design considerations into its entire line of welding branch outlet fittings.

Merit® Weld-Miser™ Tee-Lets® are designed and Manufactured to reduce the amount of weld required to install the Tee-Lets on thin wall or proprietary flow pipe. Typically only one weld-pass completes the installation. Merit Tee-Lets install with less weld volume than any other brand of welding outlet fittings for fire sprinkler applications. To accomplish this:

- The contoured end of the fittings employs a reduced outside diameter. Two major advantages are immediately apparent:
- The thinner wall on the contoured end permits welding temperatures to be matched to the thickness of the branch line or main thereby insuring complete penetration without cold welds, weld roll-off, burn-through or excessive distortion.
- On smaller sizes a heavier section is maintained on the threaded end of the fitting. This protects the threads from damage during shipping and handling prior to installation as well as from weld distortion.
- Each outlet size 1½" and larger, whether male or female threaded, cut grooved or beveled requires the same hole size in the header pipe. This simplifies the installation process.



General Specifications

- Tee-Let welding outlet fittings are manufactured from highly weldable steel which conforms to the chemical and physical requirements of ASTM A-53, Grades A or B, Type E. Ease of installation is assured when automatic welding equipment is used to install Merit Tee-Lets.
- Threads are cut in accordance with the requirements of ANSI B1.20.1, national standard for tapered pipe threads, or ISO-7-1 threads are available.
- Tee-Let threaded and grooved welding outlet fittings are UL/ULC Listed and FM Approved for use in the fire sprinkler systems installed in accordance with the requirements of NFPA Bulletin 13. They are rated for 300 PSI operation in fire sprinkler systems, and higher pressures in other non-critical piping systems.
- Tee-Lets are offered in a wide variety of header sizes. The consolidated header sizes shown in the following charts allow the fittings to be installed on more than one header size, permitting the first size listed to fit the header perfectly, while a small gap along the longitudinal center line of the header will appear for the second size listed.
- Merit® Weld-Miser™ Tee-Lets® are identified by a lot number that provides full traceability per ISO 9000 specifications.

For Your Piping Systems Specify Weld-Miser™ Tee-Let®

Branch Outlet Fittings shall be Merit Weld-Miser Tee-Let, Lightweight forged steel, employing low weld volume profile to provide for full penetration welds with minimum burn through and pipe distortion on Schedule 5 thru 10, proprietary thin wall, and standard wall pipe. Threads are to be ANSI B1.20.1, or ISO-7-1, and the bore of the fittings calculated to improve flow. Welding outlets to be UL Listed, FM Approved for use conforming to NFPA, Bulletin 13 and pressure rated for 300 PSI maximum.

How to Order - Use either of the following methods for ordering Merit® Weld-Miser™ Tee-Let®.

Method No. 1

Specify quantity desired followed by the part number shown in the "dimensions" chart for the type and size of outlet desired.

Method No. 2

Use the following system:

Quantity	Part Number	Quantity	Outlet Size	Header Size	Weight	Type End	Merit Tee-Let	Steel Material
		↓	↓	↓	↓	↓		
		Always order a few more than actually required for the job.	Column "A" of Chart	Insert size consolidation from Column "B" of chart.	Sch. 10 Standard	A - Female Thread B - Male Thread C - Cut Groove C/R - Roll Groove		

Weld-Miser™ Tee-Let®

Welding Outlet Fittings



For Fire Protection & Other Low Pressure Piping Systems

Merit Weld-Miser™ Tee-Let® Welding Branch Outlet Fittings offer the user a high strength, low cost forged threaded and grooved line of fittings specifically designed and manufactured to be installed on Schedules 5 thru 10, proprietary thin wall flow pipe and standard wall pipe.

Merit Tee-Lets are forged steel welding outlet fittings. The material used in manufacture meets the chemical and physical requirements of ASTM A 53, Grades A or B, Type E, A-135, A-795, Tee-Lets employ a low weld volume design to provide for either a partial or full penetration weld employing a single pass with minimum burn-through and pipe distortion. Weld Miser Tee-Lets are recommended for use on proprietary thin wall, Schedules 5, 10 and 40 pipe. Threads comply with ANSI B1.20.1 or ISO7/1. They are UL Listed and FM Approved for use conforming to the requirements of Bulletin 13 1999 of the National Fire Protection Association. When used in fire sprinkler systems, Tee-Lets are rated for 300 psi. When used in mechanical systems, maximum pressures are calculated using criteria developed for ASME B31 piping code.



TEE-LET WELDED OUTLET FITTING (UL VIZU — EX6032, FM APPROVAL GUIDE CHAPTER 1 — PIPE FITTINGS)			
Outlet Model	Outlet Pipe Size (Inch)	Header Pipe Size (Inch)	Rated Pressure (psig)
Tee-Let Type A (F-Threaded End)	1/2, 3/4, 1	1/2 - 8 (Sch.10, 40)	300
	1 1/4, 1 1/2, 2, 2 1/2, 3, 4	1/2 - 4 (Sch. 5, DynaFlow)	
	2	4 (EZ-Flow)	
	2, 4	6 (EZ-Flow)	
Tee-Let Type C (Grooved End)	1 1/4 - 8	1 1/4 - 8 (Sch.10, 40)	300
	2 1/2 - 8	1 1/2 - 4 (Sch. 5, DynaFlow)	
Tee-Let Type C/R (Roll Grooved End)	1 1/4 - 6	1 1/4 - 8 (All Schedules)	300

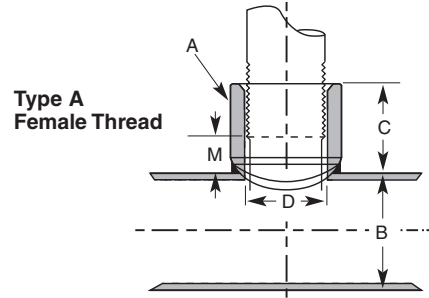
1) Size-on-size (i.e. 2 x 2) Tee-Lets are not FM Approved.

2) FM rated working pressure when welded on Sch. 5 or non-threadable lightwall pipe is 175 psi.



Weld-Miser™ Tee-Let®

Welding Outlet Fittings

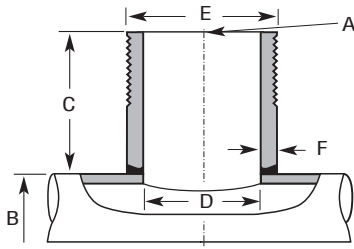


WELD-MISER™ TEE-LET® DIMENSIONS & PART NUMBERS						
Part Number	Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter D	Make Up M	Weight Each
NPT (BSPT)	In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	Lb. (kg)
1002002	1/4 x	1 1/4 - 8				0.080
—	6 x	6 - 200				0.04
1005012	1/2 x	1 1/4 - 1 1/2	1.063	0.700	0.500	0.171
—		32 - 40	27.0	17.8	12.7	0.08
1005015		1 1/2 - 2	1.063	0.700	0.500	0.171
—		40 - 50	27.0	17.8	12.7	0.08
1005020	13 x	2 - 2 1/2	1.063	0.700	0.500	0.171
—		50 - 65	27.0	17.8	12.7	0.08
1005025		2 1/2 - 8	1.063	0.700	0.500	0.169
—		65 - 200	27.0	17.8	12.7	0.08
1007012	3/4 x	1 1/4 - 1 1/2	1.125	0.900	0.500	0.260
—		32 - 40	28.6	22.9	12.7	0.12
1007015		1 1/2 - 2	1.125	0.900	0.500	0.260
—		40 - 50	28.6	22.9	12.7	0.12
1007020	19 x	2 - 2 1/2	1.125	0.900	0.500	0.260
—		50 - 65	28.6	22.9	12.7	0.12
1007025		2 1/2 - 8	1.125	0.900	0.500	0.256
—		65 - 200	28.6	22.9	12.7	0.12
1010012	1 x	1 1/4 - 1 1/2	1.250	1.145	0.500	0.331
1100012		32 - 40	31.8	29.1	12.7	0.15
1010015		1 1/2 - 2	1.250	1.145	0.500	0.331
1100015		40 - 50	31.8	29.1	12.7	0.15
1010020	25 x	2 - 2 1/2	1.250	1.145	0.500	0.320
1100020		50 - 65	31.8	29.1	12.7	0.15
1010025		2 1/2 - 3	1.250	1.145	0.500	0.314
1100025		65 - 80	31.8	29.1	12.7	0.14
1010030		3 - 4	1.250	1.145	0.500	0.309
1100030		80 - 100	31.8	29.1	12.7	0.14
1010050		5 - 8	1.250	1.145	0.500	0.291
1100050		125 - 200	31.8	29.1	12.7	0.13
101012	1 1/4 x	1 1/4 - 1 1/2	1.375	1.490	0.500	0.432
1110012		32 - 40	34.9	37.8	12.7	0.19
101015		1 1/2 - 2	1.375	1.490	0.500	0.421
1110015		40 - 50	34.9	37.8	12.7	0.19
101020	32 x	2 - 2 1/2	1.375	1.490	0.500	0.421
1110020		50 - 65	34.9	37.8	12.7	0.19
101025		2 1/2 - 3	1.375	1.490	0.500	0.411
1110025		65 - 80	34.9	37.8	12.7	0.19
101030		3 - 4	1.375	1.490	0.500	0.389
1110030		80 - 100	34.9	37.8	12.7	0.18
101050		5 - 8	1.375	1.490	0.500	0.389
1110050		125 - 200	34.9	37.8	12.7	0.18
1015015	1 1/2 x	1 1/2	1.625	1.610	0.875	0.477
1115015		40	41.3	40.9	22.2	0.22
1015020		2	1.625	1.610	0.875	0.477
1115020		50	41.3	40.9	22.2	0.22
1015025	40 x	2 1/2	1.625	1.610	0.875	0.477
1115025		65	41.3	40.9	22.2	0.22
1015030		3 - 4	1.625	1.610	0.875	0.477
1115030		80 - 100	41.3	40.9	22.2	0.22
1015040		4	1.625	1.610	0.875	0.477
1115040		100	41.3	40.9	22.2	0.22
1015050		5 - 8	1.625	1.610	0.875	0.477
1115050		125 - 200	41.3	40.9	22.2	0.22

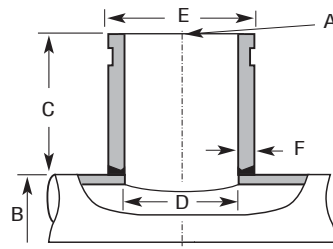
WELD-MISER™ TEE-LET® DIMENSIONS & PART NUMBERS						
Part Number	Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter D	Make Up M	Weight Each
NPT (BSPT)	In (mm)	In (mm)	In (mm)	In (mm)	In (mm)	Lb. (kg)
1020020	2 x	2	1.750	2.067	0.875	0.857
1120020		50	44.5	52.5	22.2	0.38
1020025		2 1/2	1.750	2.067	0.875	0.829
1120025		65	44.5	52.5	22.2	0.38
1020030	50 x	3	1.750	2.067	0.875	0.829
1120030		80	44.5	52.5	22.2	0.39
1020040		4	1.750	2.067	0.875	0.800
1120040		100	44.5	52.5	22.2	0.36
1020050		5	1.750	2.067	0.875	0.743
1120050		125	44.5	52.5	22.2	0.34
1020060		6	1.750	2.067	0.875	0.743
1120060		150	44.5	52.5	22.2	0.34
1020080		8	1.750	2.067	0.875	0.743
1120080		200	44.5	52.5	22.2	0.34
1025025	2 1/2 x	2 1/2	2.215	2.469	1.125	1.250
1125025		65	54.0	62.7	28.6	0.55
1025030		3	2.215	2.469	1.125	1.200
1125030		80	54.0	62.7	28.6	0.55
1025040	65 x	4	2.215	2.469	1.125	1.150
1125040		100	54.0	62.7	28.6	0.52
1025050		5	2.215	2.469	1.125	1.150
1125050		125	54.0	62.7	28.6	0.52
1025060		6	2.215	2.469	1.125	1.150
1125060		150	54.0	62.7	28.6	0.52
1025080		8	2.215	2.469	1.125	1.150
1125080		200	54.0	62.7	28.6	0.52
1030030	3 x	3	2.500	3.068	1.500	1.750
—		80	63.5	77.9	38.1	0.79
1030040		4	2.500	3.068	1.500	1.700
—		100	63.5	77.9	38.1	0.77
1030050	80 x	5	2.500	3.068	1.500	1.700
—		125	63.5	77.9	38.1	0.77
1030060		6	2.500	3.068	1.500	1.650
—		150	63.5	77.9	38.1	0.75
1030080		8	2.500	3.068	1.500	1.650
—		200	63.5	77.9	38.1	0.75
1040040	4 x	4	3.000	4.026	2.000	3.000
—		100	76.2	102.3	50.8	1.36
1040050		5	3.000	4.026	2.000	2.900
—		125	76.2	102.3	50.8	1.32
1040060	100 x	6	3.000	4.026	2.000	2.800
—		150	76.2	102.3	50.8	1.27
1040080		8	3.000	4.026	2.000	2.800
—		200	76.2	102.3	50.8	1.27

Note:
Part #1002002 is not UL Listed or FM Approved.
All size-on-size (i.e. 2 x 2) Tee-Lets are not FM Approved.

Type B
Male Thread
Standard Weight



Type C
Cut Groove
Standard Weight



Weld-Miser™ Tee-Let®

Welding Outlet Fittings

WELD-MISER™ TEE-LET® - DIMENSIONS (NOMINAL SIZES 1" THRU 2")

Male Thread Std. Wt.	Cut Groove Std. Wt.	Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter D	Outside Diameter E	Wall Thickness F
<i>NPT (BSPT)</i>	<i>NPT (BSPT)</i>	<i>In. (mm)</i>	<i>In. (mm)</i>	<i>In. (mm)</i>	<i>In. (mm)</i>	<i>In. (mm)</i>	<i>In. (mm)</i>
1310012	2010012	1 x 25 x	1¼ - 1½ 32 - 40	3 80	1.049 26.6	1.315 33.4	0.133 3.4
1310015	2010015		1½ - 2 40 - 50	3 80	1.049 26.6	1.315 33.4	0.133 3.4
1310020	2010020		2 - 2½ 50 - 65	3 80	1.049 26.6	1.315 33.4	0.133 3.4
1310025	2010025		2½ - 4 65 - 100	3 80	1.049 26.6	1.315 33.4	0.133 3.4
1310050	2010050		5 - 8 125 - 200	3 80	1.049 26.6	1.315 33.4	0.133 3.4
1312012	2012012	1¼ x 32 x	1¼ 32	3 80	1.368 34.7	1.660 42.2	0.140 3.6
1312015	2012015		1½ 40	3 80	1.368 34.7	1.660 42.2	0.140 3.6
1312020	2012020		2 - 2½ 50 - 65	3 80	1.368 34.7	1.660 42.2	0.140 3.6
1312025	2012025		3 - 4 80 - 100	3 80	1.368 34.7	1.660 42.2	0.140 3.6
1312050	2012050		5 - 8 125 - 200	3 80	1.368 34.7	1.660 42.2	0.140 3.6
1315015	2015015	1½ x 40 x	1½ 40	3 80	1.610 40.9	1.900 48.3	0.145 3.7
1315020	2015020		2 50	3 80	1.610 40.9	1.900 48.3	0.145 3.7
1315025	2015025		2½ 65	3 80	1.610 40.9	1.900 48.3	0.145 3.7
1315030	2015030		3 - 4 80 - 100	3 80	1.610 40.9	1.900 48.3	0.145 3.7
1315050	2015050		5 - 8 125 - 200	3 80	1.610 40.9	1.900 48.3	0.145 3.7
1320020	2020020	2 x 50 x	2 50	3 80	2.067 52.5	2.375 60.3	0.154 3.9
1320025	2020025		2½ 65	3 80	2.067 52.5	2.375 60.3	0.154 3.9
1320030	2020030		3 80	3 80	2.067 52.5	2.375 60.3	0.154 3.9
1320035	2020035		4 100	3 80	2.067 52.5	2.375 60.3	0.154 3.9
1320050	2020050		5 125	3 80	2.067 52.5	2.375 60.3	0.154 3.9
1320060	2020060		6 150	3 80	2.067 52.5	2.375 60.3	0.154 3.9
1320080	2020080		8 200	3 80	2.067 52.5	2.375 60.3	0.154 3.9

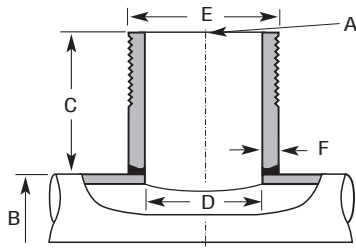
Note: Tee-Lets are manufactured to fit size-on-size, that is the contoured shape on a given Tee-Let is made to fit perfectly on the first listed header size. If installed on the second header size marked on the fitting, a slight gap of approximately 1/32" will appear along the longitudinal centerline of the header. For example, a 1" x 2 - 2½" Tee-Let, is a 1" outlet fitting manufactured to fit perfectly on the 2" header size listed, while leaving a 1/32" gap along the longitudinal centerline of the 2½" size. If a perfect fit is required for a 2½" header pipe, then a 1" x 2½ - 3" Tee-Let would be ordered. Size consolidations are employed to reduce inventory and provide for greater flexibility.



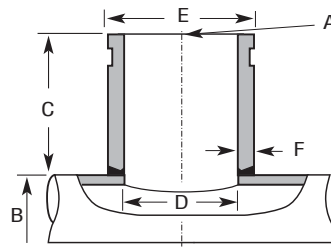
Weld-Miser™ Tee-Let®

Welding Outlet Fittings

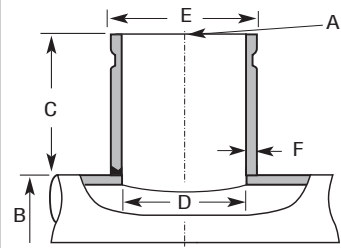
Type B
Male Thread
Standard Weight



Type C
Cut Groove
Standard Weight



Type C/R
Roll Groove
Schedule 10

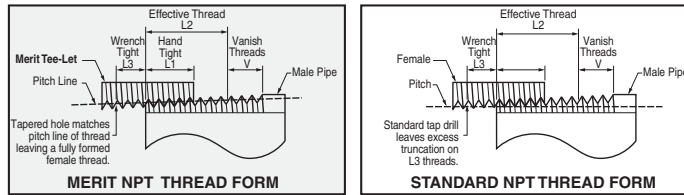


WELD-MISER™ TEE-LET® - DIMENSIONS (NOMINAL SIZES 2½" THRU 8")

Male Thread Std. Wt.	Cut Groove Std. Wt.	Roll Groove Sch. 10	Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter - D		Outside Diameter E	Wall Thickness - F	
						Standard Weight	Schedule 10		Standard Weight	Schedule 10
<i>NPT (ISO-7-1)</i>	<i>NPT (ISO-7-1)</i>	<i>NPT (ISO-7-1)</i>	<i>In.(mm)</i>	<i>In.(mm)</i>	<i>In.(mm)</i>	<i>In.(mm)</i>	<i>In.(mm)</i>	<i>In.(mm)</i>	<i>In.(mm)</i>	<i>In.(mm)</i>
1325025	2025025	2225025	2½ x 65 x	2½	3	2.469	2.635	2.875	0.203	0.120
	2125025			65	80	62.7	67.0	76.2	5.0	3.0
1325030	2025030	2225030		3	3	2.469	2.635	2.875	0.203	0.120
	2125030			80	80	62.7	67.0	76.2	5.0	3.0
1325035	2025035	2225035		4	3	2.469	2.635	2.875	0.203	0.120
	2125035			100	80	62.7	67.0	76.2	5.0	3.0
1325050	2025050	2225050	3 x 80 x	5	3	2.469	2.635	2.875	0.203	0.120
	2125050			125	80	62.7	67.0	76.2	5.0	3.0
1325060	2025060	2225060		6	3	2.469	2.635	2.875	0.203	0.120
	2125060			175	80	62.7	67.0	76.2	5.0	3.0
1325080	2025080	2225080		8	3	2.469	2.635	2.875	0.203	0.120
	2125080			200	80	62.7	67.0	76.2	5.0	3.0
1330030	2030030	2230030	3 x 80 x	3	3	3.068	3.260	3.500	0.216	0.120
				80	80	78.0	83.0	88.0	5.0	3.0
1330035	2030035	2230035		3½	3	3.068	3.260	3.500	0.216	0.120
				85	80	78.0	83.0	88.0	5.0	3.0
1330040	2030040	2230040		4	3	3.068	3.260	3.500	0.216	0.120
				100	80	78.0	83.0	88.0	5.0	3.0
1330050	2030050	2230050	4 x 100 x	5	3	3.068	3.260	3.500	0.216	0.120
				125	80	78.0	83.0	88.0	5.0	3.0
1330060	2030060	2230060		6	3	3.068	3.260	3.500	0.216	0.120
				150	80	78.0	83.0	88.0	5.0	3.0
1330080	2030080	2230080		8	3	3.068	3.260	3.500	0.216	0.120
				200	80	78.0	83.0	88.0	5.0	3.0
1340040	2040040	2240040	4 x 100 x	4	4	4.026	4.260	4.500	0.237	0.120
				100	100	102.0	108.0	114.0	6.0	3.0
1340050	2040050	2240050		5	4	4.026	4.260	4.500	0.237	0.120
				125	100	102.0	108.0	114.0	6.0	3.0
1340060	2040060	2240060	6 x 150 x	6	4	4.026	4.260	4.500	0.237	0.120
				150	100	102.0	108.0	114.0	6.0	3.0
1340080	2040080	2240080		8	4	4.026	4.260	4.500	0.237	0.120
				200	100	102.0	108.0	114.0	6.0	3.0
—	2060060	2260060	6 x 150 x	6	4	6.065	6.357	6.625	0.280	0.134
				150	100	155.0	161.5	168.3	7.1	3.0
—	2060080	2260080	8 x 200 x	8	4	6.065	6.357	6.625	0.280	0.134
				200	100	155.0	161.5	168.3	7.1	3.0
—	2080080	—	8 x 200 x	8	4	7.981	8.329	8.625	0.322	0.148
				200	100	203.0	212.0	213.0	8.0	3.0

Note: Tee-Lets are manufactured to fit size-on-size, that is the contoured shape on a given Tee-Let is made to fit perfectly on the first listed header size. If installed on the second header size marked on the fitting, a slight gap of approximately 1/32" will appear along the longitudinal centerline of the header. For example, a 1" x 2 - 2½" Tee-Let, is a 1" outlet fitting manufactured to fit perfectly on the 2" header size listed, while leaving a 1/32" gap along the longitudinal centerline of the 2½" size. If a perfect fit is required for a 2½" header pipe, then a 1" x 2½ - 3" Tee-Let would be ordered. Size consolidations are employed to reduce inventory and provide for greater flexibility.

Threading Practice



Weld-Miser™ Tee-Let® Installation Welding Outlet Fittings

NPT TAPERED PIPE THREADS									
Drop Nipple or Tee-Let Outlet Size	L1 Hand Tight		L3 Wrench Tight		Total L1 - L3 Length		L2 Effective Threads		
In. (mm)	In. (mm)	Threads	In. (mm)	Threads	In. (mm)	Threads	In. (mm)	Threads	
1/2"	0.320	4.48	0.214	3.00	0.534	7.48	0.534	7.47	
15	8.1		5.4		13.6		13.6		
3/4"	0.339	4.75	0.214	3.00	0.553	7.75	0.546	7.64	
20	8.6		5.4		14.0		13.9		
1"	0.400	4.60	0.261	3.00	0.661	7.60	0.683	7.85	
25	10.2		6.6		16.8		17.3		
1 1/4"	0.420	4.83	0.261	3.00	0.681	7.83	0.707	8.13	
32	10.7		6.6		17.3		18.0		
1 1/2"	0.420	4.83	0.261	3.00	0.697	7.83	0.724	8.32	
40	10.7		6.6		17.7		18.4		
2"	0.436	5.01	0.261	3.00	0.706	8.01	0.757	8.70	
50	11.1		6.6		17.9		19.2		
2 1/2"	0.682	5.46	0.250	2.00	0.932	7.46	1.138	9.10	
65	17.3		6.4		23.7		28.9		
3"	0.766	6.13	0.250	2.00	1.016	8.13	1.200	9.60	
80	19.5		6.4		25.8		30.5		
4"	0.844	6.75	0.250	2.00	1.094	8.75	1.300	10.40	
100	21.4		6.4		27.8		33.0		

Domestic Manufacture

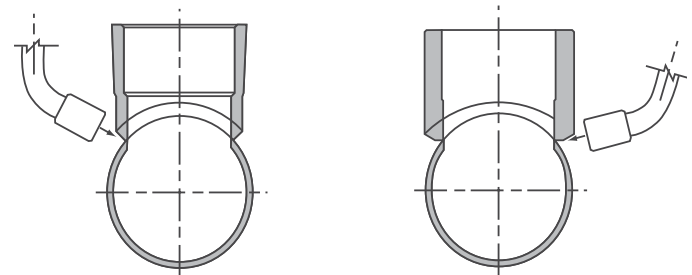
Increasingly, federal, state, municipal, and quasi municipal authorities require domestic content for fire sprinkler systems. Merit® Tee-Lets® meet these requirements. The need to maintain dual inventories; one domestic; one import is eliminated.

Welding Practice

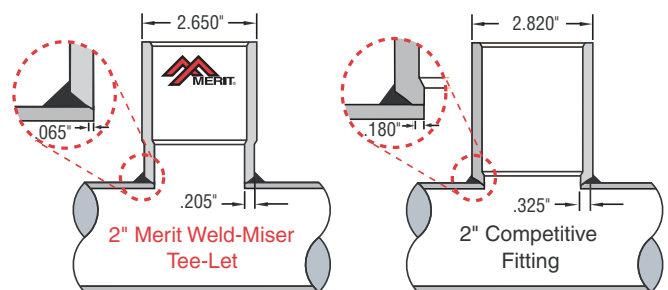
When measured with respect to linear inches of weld required for installation, Tee-Lets require up to 15% less weld than competitive fittings. This reduces time and savings over time are substantial. The diameter of the contoured end of Type A Tee-Lets has been reduced so that the wall thickness more nearly matches the header or branch line pipe wall thickness. Therefore, current and voltage settings required for welding are set to provide for adequate penetration without burn through and cold shutting. Also, weld volume required for installation is lower for Tee-Lets than most other fittings. Typically, Tee-Lets require one-weld pass for attachment.

Tee-Let® thread form is consistent with Aeronautical National Form (ANPT) AS71051. The thread is fully formed over both the L-1 hand tight and L-3 wrench tight threads. NPT tapered threads are typically gauged only over the L-1 threads. This makes Tee-Lets more forgiving of field cut threaded pipe that may only marginally conform to the specification. Fewer leaks translate into lower costs.

Ease of Installation



Merit Manufacturing Tee-Lets are designed to sit higher on the pipe, thereby requiring less weld and eliminating burn through. Tee-Lets sit higher on the header or branch line pipe than competitive fittings. This allows the welding torch to remain in an optimum position for welding. In addition, 1 1/2" and larger Type A female threaded and Type C grooved Tee-Lets require the same hole size for installation. This results in fewer change overs when installed using automatic welders.



WELDING PRACTICE								
Outlet Size	MERIT WELD-MISER TEE-LET				COMPETITIVE FITTING			
	WELD VOLUME*		LINEAR WELDING		WELD VOLUME*		LINEAR WELDING	
In. (mm)	Cross Sec. Area	%less	In. (mm)	%less	Cross Sec. Area	%more	In. (mm)	%less
1"	0.051 sq. in.	12%	2.48	0%	0.058 sq. in.	12%	2.48	0%
25	32.9 sq mm		62.9		37.4 sq mm		62.9	
1 1/4"	0.032"	48%	2.88	4%	0.063	48%	3.01	4%
32	20.6		73.1		40.6		76.4	
1 1/2"	0.036"	40%	3.12	10%	0.060	40%	3.46	10%
40	23.2		79.2		38.7		87.8	
2"	0.040"	62%	3.77	15%	0.106	62%	4.41	15%
50	25.8		95.7		68.3		112.0	



Weld-Miser™ Tee-Let® Installation (cont.)

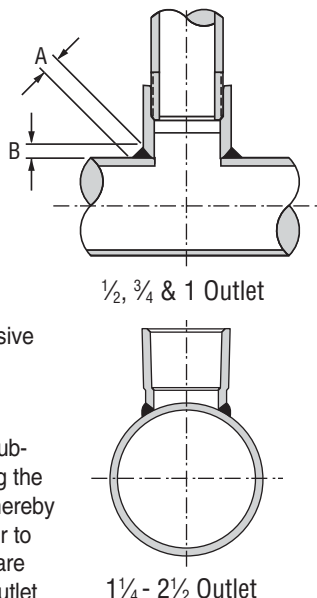
Welding Outlet Fittings

Recommended Installation Procedures

Merit Weld-Miser Tee-Let Welding Outlet Fittings are designed and manufactured to reduce the cost of installation from both the standpoint of labor required and energy consumed. In addition, by following the recommended installation procedures, many of the problems associated with installing welding outlet fittings on standard weight or light weight pipe are eliminated, including burn through and excessive shrinkage resulting in pipe distortion.

Recommended Hole Sizes

The hole cut in the branch or header pipe can be cut prior or subsequent to attachment of the Tee-Let. One advantage of cutting the hole after welding is that the pipe is left intact during welding thereby reducing shrinkage and possible distortion. If holes are cut prior to welding, as some codes require, then the following hole sizes are recommended. Note that the same hole diameter for a given outlet size is required for both Type A and Type C Tee-Lets 1-1½" larger.



RECOMMENDED AMOUNT OF WELD		
Outlet Size	A	B
In./mm	In./mm	In./mm
½	¼	⅜
13	7	5
¾	¼	⅜
19	7	5
1	¼	⅜
25	7	5
1¼	¼	⅜
31	7	5
1½	⅝	¼
38	8	7
2	⅝	¼
50	8	7
2½	⅝	¼
63	8	7
3	¾	⅝
75	10	5
4	¾	⅝
100	10	5

Recommended Welding Procedures

Merit Weld-Miser Tee-Lets are designed to be installed on standard weight or light weight pipe with one weld pass on Type A outlet sizes from ½" through 2½" inclusive, and on Type C outlet sizes through 4". Moreover, the wall thickness at the weld end of the fitting approximately matches standard weight pipe. Accordingly, heat setting can be made to optimize penetration on both the fitting and the pipe which it is being welded. Aside from reducing the likelihood of burn through and distortion resulting from excessive heat, the amount of weld required for adequate penetration is significantly reduced.

Merit Tee-Lets are manufactured from continuous cast aluminum killed steel with a carbon range of from 0.05 to 0.25. Merit specifies that residuals, such as chrome, nickel and other metals resident in the scrap used for production of the steel be reported and kept to a minimum. On the other hand, certain grades of carbon steel pipe are manufactured from skelp whose chemical composition is not specified. When the metal inert gas shield (MIG) welding process is employed, certain residuals may cause excessive porosity, spatter or lack of penetration. Specifically, gases released during the welding process do not escape before the molten puddle sets up. When porosity or lack of penetration occurs, one approach is to slightly increase the heat in order to give the gases time to escape from the puddle. A flux cored wire can also be used. This wire contains scavengers which allow gases in the molten weld puddle to escape before the weld solidifies. The following recommended settings for welding therefore may need to be adjusted slightly higher if any of the above mentioned adverse conditions exist.

As a general rule, the weld should be only as hot as required to allow the weld to penetrate the materials being welded while concomitantly allowing gases developed in the welding process to escape. Every effort must be made to avoid welding too hot or overheating both the pipe and the Tee-Let. **Excessive heat may cause the wrench tight threads (those in the bottom of the Tee-Let near the weld zone) to distort while also causing the branch pipe to bend.** It should be noted that Merit Tee-Lets have been subjected to exhaustive testing and evaluation, and only negligibly distort when subjected to excessive heat. The threads, on the other hand, may not return to their gauged form after cooling if excessive heat causes them to expand. The following is intended only as a guide, and assumes that the welding equipment is properly calibrated and functioning normally and the operator is qualified.

RECOMMENDED TEE-LET HOLE SIZES		
Tee-Let Size	Type	Recommended Hole Size
In./mm		In./mm
½	Type A	⅝
13	Type A	16
¾	Type A	⅞
19	Type A	22
1	Type A	1⅞
25	Type A	28
1¼	Type A	1½
31	Type A	38
1½	Type C	1⅞
31	Type C	35
1½	Type A or C	1⅞
38	Type A or C	41
2	Type A or C	2
50	Type A or C	50
2½	Type A or C	2⅞
63	Type A or C	61
3	Type A or C	3
75	Type A or C	75
4	Type A or C	4
100	Type A or C	100

Holes may be cut employing mechanical means—including hole sawing, mechanical flame cutting (oxy-acetylene or propane), and air plasma cutting (constricted tungsten arc) machines. Merit offers a simple approach to cutting the hole. Hand-held templates are sized to match your plasma cutter.



Weld-Miser™ Tee-Let® Installation (cont.) Welding Outlet Fittings

RECOMMENDED SETTINGS FOR MICROWIRE WELDING PROCESS, CONTINUED ON NEXT PAGE

Header Size	Pipe Wall Thickness	Tee-Let Types A, B, C	Electrode Size	Welding Current	Arc. Volts	Wire Feed	Travel Speed
<i>In./mm</i>	<i>In./mm</i>	<i>In./mm</i>		<i>AMPS-DC</i>	<i>POS.</i>	<i>IPM</i>	<i>IPM</i>
1¼ - 2 31-50	0.065 2	½ - 2 13-50	0.035	100-130	16-20	210	25-30
		2½ - 4 63-100	0.035	115-150	17-21	270	20-25
	0.109 3	½ - 2 13-50	0.035	110-140	18-22	220	25-30
		2½ - 4 63-100	0.035	120-160	19-22	290	20-25
2½ - 4 63-100	0.083 2.5	½ - 2 13-50	0.035	110-140	17-20	210	20-25
		2½ - 4 63-100	0.035	120-150	17-20	270	20-25
	0.120 3	½ - 2 13-50	0.035	120-160	19-22	290	20-25
		2½ - 4 63-100	0.035	130-160	19-22	240	20-25
5-6 125-150	0.109 3	½ - 2 13-50	0.035	120-150	17-20	210	20-25
		2½ - 4 63-100	0.035	130-150	18-20	270	15-20
	0.134 3.5	½ - 2 13-50	0.035	130-160	19-22	290	20-25
		2½ - 4 63-100	0.035	140-160	20-22	270	15-20
		2½ - 4 63-100	0.045	180-205	20-24	245	27-32
		2½ - 4 63-100	0.045	180-205	20-24	245	27-32
8 200	0.109 3	½ - 2 13-50	0.035	120-150	17-20	240	20-25
		2½ - 4 63-100	0.035	130-150	18-20	260	15-20
		2½ - 4 63-100	0.045	170-220	18-22	290	12-18
	0.148 3.5	½ - 2 13-50	0.035	130-160	19-22	240	20-25
		2½ - 4 63-100	0.035	140-160	20-22	260	15-20
		2½ - 4 63-100	0.045	180-225	20-24	290	12-18

Shielding Gas Flow (FOR ALL SIZES) 20-25 CFH

- 1.) Co₂ - Deeper penetration, faster welding, low cost.
- 2.) 25% - Argon, 75% - Co₂, Recommended for .134 wall and lighter, high welding speeds without melt through, minimum distortion and spatter, good penetration.

Merit assumes no liability for any consequential damages resulting from the improper use of its Tee-Let Welding Outlet Fittings, nor for any recommendations made with respect to installation procedures.

Fig. 980 - Universal Swivel Sway Brace Attachment

Size Range — One size fits bracing pipe 1" thru 2", TOLCO 12 gauge channel, and all structural steel up to 1/4" thick.

Material — Carbon Steel

Function — Multi-functional attachment to structure or braced pipe fitting.

Features — This product's design incorporates a **concentric** attachment opening which is critical to the performance of structural seismic connections. NFPA 13 (2010) 9.3.5.8.4 indicates clearly that fastener table load values are based only on concentric loading. Mounts to any surface angle. Break off bolt head assures verification of proper installation.

Installation — The Fig.980 is the structural or transitional attachment component of a longitudinal or lateral sway brace assembly. It is intended to be combined with the "bracing pipe" and TOLCO "braced pipe" attachment, Fig. 1000, 1001, 2002, 4L, 4A or 4B to form a complete bracing assembly. NFPA 13 and/or OSHPD guidelines should be followed.

To Install — Place the Fig. 980 onto the "bracing pipe". Tighten the set bolt until set bolt head breaks off. Attachment can pivot for adjustment to proper brace angle.

Approvals — Underwriters Laboratories Listed in the USA (**UL**) and Canada (**cUL**). Approved by Factory Mutual Engineering (**FM**). Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development (**OSHPD**). For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

Note — The Fig. 980 Swivel Attachment and the Fig. 1001, Fig. 1000, Fig. 2002, Fig. 4A, Fig. 4B or Fig. 4L Pipe Clamp make up a sway brace system of **UL** Listed attachments and bracing materials which satisfies the requirements of Underwriters' Laboratories and the National Fire Protection Association (**NFPA**)

Finish — Plain

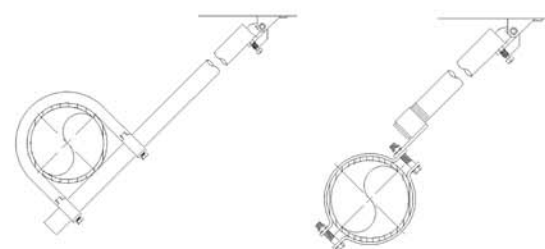
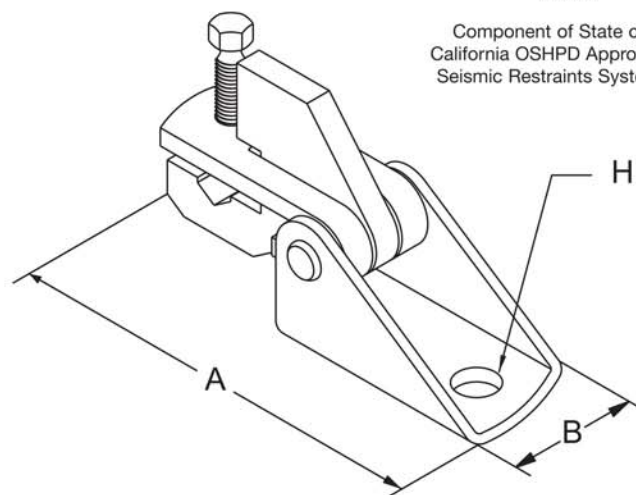
Note — Available in Electro-Galvanized finish.

Order By — Figure number and finish.

**Pat. #6,273,372, Pat. #6,517,030, Pat. #6,953,174,
Pat. #6,708,930, Pat. #7,191,987, Pat. #7,441,730,
Pat. #7,669,806**



Component of State of
California OSHPD Approved
Seismic Restraints System



Lateral Brace

Dimensions • Weights

A	B	H*	Max. Design Load Lbs. (cULus)	Max. Design Load Lbs.** (FM)	Approx. Wt./100
5 1/4	1 7/8	17/32	2765	2800	132

* Available with hole sizes to accommodate up to 3/4" fastener. Consult factory.

** The loads listed are axial loads on the brace. The horizontal load capacity, H, of the brace is: $H = F \times \sin \theta$, where θ is the installation angle measured from the vertical.

TOLCO® brand bracing components are designed to be compatible **ONLY** with other TOLCO® brand bracing components, resulting in a Listed seismic bracing assembly. **DISCLAIMER** — NIBCO does **NOT** warrant against the failure of TOLCO® brand bracing components, in the instance that such TOLCO® brand bracing components are used in combination with products, parts or systems which are not manufactured or sold under the TOLCO® brand. NIBCO shall **NOT** be liable under any circumstance for any direct or indirect, incidental or consequential damages of any kind, including but not limited to loss of business or profit, where non-TOLCO brand bracing components have been, or are used.

Fig. 1001 - Sway Brace Attachment

Size Range — Pipe size to be braced: 2½" thru 8" IPS.* Pipe size used for bracing: 1" and 1¼" Schedule 40 IPS.

Material — Carbon Steel

Function — For bracing pipe against sway and seismic disturbance. The pipe attachment component of a sway brace system: The Fig. 1001 is used in conjunction with a TOLCO 900 Series fitting and joined together with bracing pipe per NFPA 13, forming a complete sway brace assembly.

Features — Can be used to brace schedules 7 through 40 IPS. Field adjustable, making critical pre-engineering of bracing pipe length unnecessary. Unique design requires no threading of bracing pipe. Can be used as a component of a four-way riser brace. Comes assembled and ready for installation. Fig. 1001 has built-in visual verification of correct installation. See installation note below.

Installation Note — Position Fig. 1001 over the pipe to be braced and tighten two hex head cone point set bolts until heads bottom out. A minimum of 1" pipe extension is recommended. Brace pipe can be installed on top or bottom of pipe to be braced.

Approvals — Underwriters Laboratories Listed in the USA (**UL**) and Canada (**cUL**). Approved by Factory Mutual Engineering (**FM**). Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development (**OSHPD**). For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

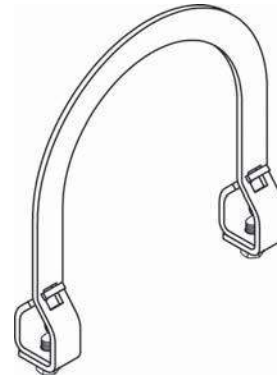
Finish — Plain

Note — Available in Electro-Galvanized and HDG finish.

Order By — Indicate pipe size to be braced followed by pipe size used for bracing, figure number and finish.

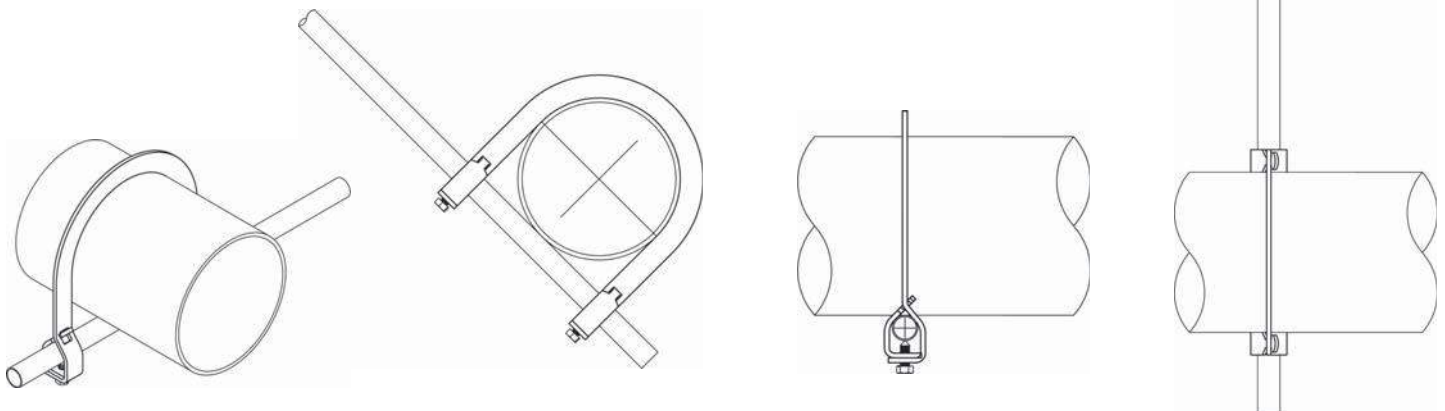
Important Note — The Fig. 1001 is precision manufactured to perform its function as a critical component of a complete bracing assembly. To ensure performance, the UL Listing requires that the Fig. 1001 must be used only with other TOLCO bracing products. The Fig 1001 is not intended for use with the Fig. 907 4-Way Longitudinal Brace Attachment.

Component of State of
California OSHPD Approved
Seismic Restraints System



Maximum Design Load
Sch. 7 - 1600 lbs.
Sch. 10 & 40 w/1" Brace Pipe - 2015 lbs.
Sch. 10 & 40 w/1¼" Brace Pipe - 2765 lbs.

FM Approved Design Loads*
2½" - 2400 lbs.
3" - 4" - 2500 lbs.
5" - 8" - 1500 lbs.



300 lb. WWP UL/FM Butterfly Valves

Fire Protection Valve • Grooved Mechanical Style • Nylon Coated Ductile Iron • Extended Neck • Elastomer Encapsulated Disc • Accepts Internal and External Supervisory Switches

300 PSI/20.7 Bar Non-Shock Cold Water 2½" - 8"

175 PSI/12.1 Bar Non-Shock Cold Water 10"

UL/ULC LISTED • FMRC APPROVED • 2½" - 10" UL LISTED FOR INDOOR AND OUTDOOR SERVICE • CALIFORNIA STATE FIRE MARSHALL APPROVAL NO. 7770-1243:101 • APPROVED BY THE NEW YORK CITY MEA 9-97-E

MATERIAL LIST

PART	SPECIFICATION
1. Upper Stem	Stainless Steel ASTM A 582 Type 416
2. Upper Bushing	PTFE Bronze Sintered on Steel
3. "O" Ring	Buna-N
4. Body	Ductile Iron ASTM A 395 with Polyimide Coating
5. Disc	Ductile Iron ASTM A 395 with EPDM Encapsulation
6. Lower Bushing	PTFE Bronze Sintered on Steel
7. Lower Stem	Stainless Steel ASTM A 582 Type 416
8. Dust Plug	PVC
9. Nameplate	Aluminum
10. Gear Operator	Cast Iron and Steel
11. Indicator Flag	Cast Iron
12. Handwheel	Cast Iron

*-8N version has two factory mounted internal supervisory switches.

-4N version is gear operated only

Uses NIBCO model #TS-4 Switch Kit.

Polyimide coating has NSF certification.

GD-1765-8N

10"
(not shown)

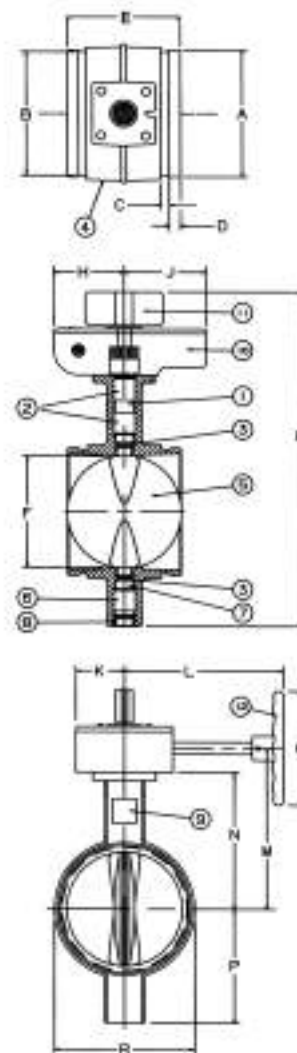
GD-4765-8N*

Grooved
2½" thru 8"

DIMENSIONS—WEIGHTS—QUANTITIES

Size	Dimensions							
	A	B	C	D	E	F	G	H
In. mm.	In. mm.	In. mm.	In. mm.	In. mm.	In. mm.	In. mm.	In. mm.	In. mm.
2½	65 2.88 73	2.72 69	0.31 8	0.63 16	3.85 98	2.42 61	11.94 303	2.91 74
3 O.D.	76.1 3.00 76	2.84 72	0.31 8	0.63 16	3.85 98	2.42 61	11.94 303	2.91 74
3	80 3.50 89	3.34 85	0.31 8	0.63 16	3.85 98	2.86 73	12.48 317	2.91 74
4	100 4.50 114	4.33 110	0.38 10	0.63 16	4.56 116	3.84 98	14.18 360	2.91 74
5	125 5.56 141	5.39 137	0.38 10	0.63 16	5.86 149	4.79 122	15.17 385	2.91 74
6	150 6.63 168	6.45 164	0.38 10	0.63 16	5.86 149	5.73 146	17.54 446	2.91 74
6 O.D.	165.1 6.51 165	6.32 161	0.38 10	0.63 16	5.86 149	5.73 146	17.54 446	2.91 74
8	200 8.63 219	8.44 214	0.44 11	0.75 19	5.26 134	7.71 196	19.42 493	2.91 74
10	250 10.75 273	10.56 268	0.50 13	0.75 19	6.29 160	9.56 243	24.03 610	3.90 99

Size	Dimensions										Weight
	J	K	L	M	N	P	Q	R			
In. mm.	In. mm.	In. mm.	In. mm.	In. mm.	In. mm.	In. mm.	In. mm.	In. mm.	In. mm.	In. mm.	Lbs. Kg.
2½	65 3.54 90	2.13 54	5.82 148	5.67 144	4.19 106	3.25 83	5.9 150	3.46 88	22 10.0		
3 O.D.	76.1 3.54 90	2.13 54	5.82 148	5.67 144	4.19 106	3.25 83	5.9 150	3.46 88	22 10.4		
3	80 3.54 90	2.13 54	5.82 148	5.94 151	4.44 113	3.54 90	5.9 150	3.97 101	23 10.4		
4	100 3.54 90	2.13 54	7.64 194	6.31 173	5.33 135	4.35 110	5.9 150	5.03 128	28 12.7		
5	125 3.54 90	2.13 54	7.64 194	7.32 186	5.83 148	4.84 123	5.9 150	6.27 159	31 14.1		
6	150 3.54 90	2.13 54	7.64 194	8.62 219	7.11 181	5.93 151	5.9 150	7.25 184	41 18.6		
6 O.D.	165.1 3.54 90	2.13 54	7.64 194	8.62 219	7.11 181	5.93 151	5.9 150	7.25 184	41 18.6		
8	200 3.54 90	2.13 54	7.91 201	9.80 249	8.05 204	6.87 174	9.8 250	9.25 235	53 24.1		
10	250 3.98 101	3.03 77	9.49 241	11.61 295	9.86 250	9.17 233	11.8 300	11.25 286	88 40.0		



Model CV-1F Check Valves 2 to 12 Inch (DN50 to DN300)

General Description

The TYCO Model CV-1F Check Valve is a compact and rugged swing-type unit that allows water flow in one direction and prevents flow in the opposite direction. A resilient elastomer seal facing on the spring-loaded clapper ensures a leak-tight seal and non-sticking operation. The Model CV-1F Check Valves are designed to minimize water hammer caused by flow reversal.

The Model CV-1F Check Valve is furnished with grooved ends and can be installed using Grinnell Grooved Couplings or GRINNELL Figure 71 Flange Adapters. The Model CV-1F Check Valves have been designed with a removable cover for ease of field maintenance. These valves can be installed horizontally (with cover in the upward position) or vertically with the flow in the upward direction. Refer to Figure 4.

A Maintenance Check Valve Kit (TFP1555) is available to allow the maintenance procedure of back-flushing through the fire department connection without removing the Model CV-1F Check Valve from the pipe line.

The Model CV-1F Check Valves are a redesign for the Central Figure 590F and GRINNELL Figure 590F.

NOTICE

Never remove any piping component nor correct or modify any piping deficiencies without first de-pressurizing and draining the system. Failure to do so may result in serious personal injury, property damage, and/or impaired device performance.

The Model CV-1F Check Valves described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of this device.

Owners are responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or manufacturer should be contacted with any questions.

Technical Data

Approvals
UL, C-UL, and FM

Sizes
2 to 12 Inch (DN50 to DN300)

Maximum Working Pressure
300 psi (20,7 bar)

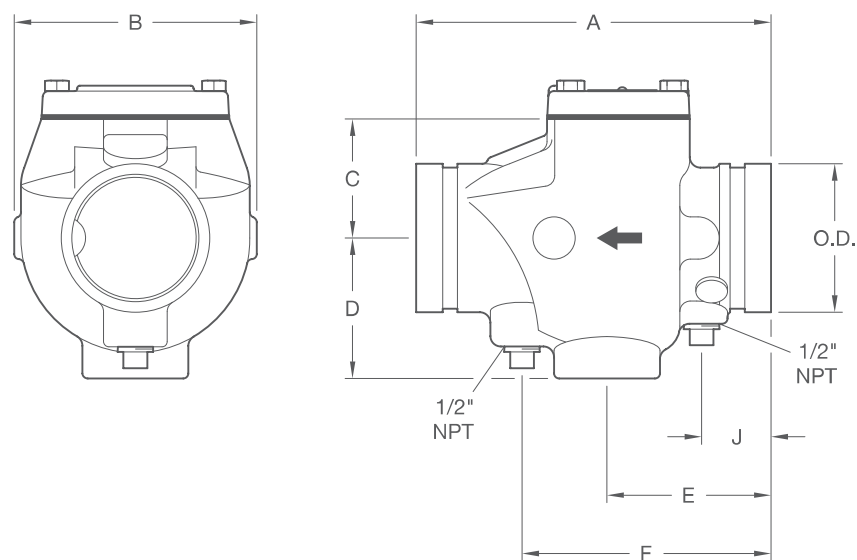
Valve Assembly Finish
Red, non-lead paint



Installation

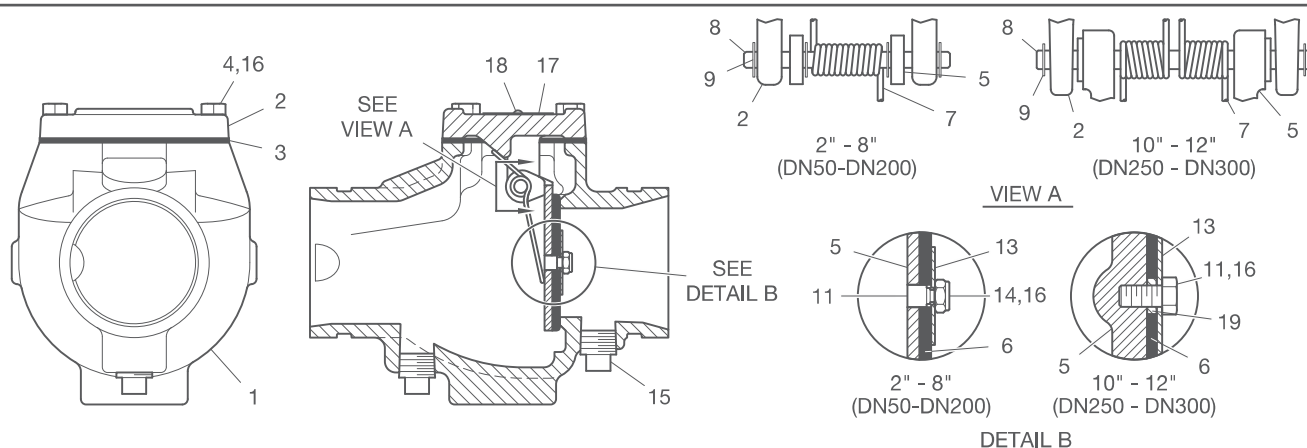
The Model CV-1F Check Valves are to be installed in accordance with the following instructions:

1. The arrow cast on the Body must point in the direction of the flow.
2. Valves installed vertically must be positioned with the flow in the upward direction.
3. Valves installed horizontally must be positioned with the Cover facing up. Refer to Figure 4.
4. Grooved end pipe couplings used with the Model CV-1F Check Valve must be installed in accordance with manufacturer's instructions.



Nominal Pipe Size		Nominal Dimensions Inches (mm)							Cover Bolt Torq. Lbs.-ft. (Nm)	Approx. Weight Lbs. (kg)
ANSI Inches DN	O.D. Inches (mm)	A	B	C	D	E	F	J		
2 DN50	2.375 (60,3)	6.75 (171,5)	4.38 (111,3)	2.55 (64,8)	2.57 (65,3)	3.25 (82,3)	4.75 (120,7)	1.62 (41,5)	18 (25)	9.0 (4,5)
2-1/2 DN65	2.875 (73,0)	8.00 (203,2)	5.80 (147,3)	3.41 (86,6)	3.40 (86,4)	3.88 (98,6)	6.00 (152,4)	1.70 (43,2)	39 (54)	10.0 (4,5)
76,1 DN65	- (76,1)	8.00 (203,2)	5.80 (147,3)	3.41 (86,6)	3.40 (86,4)	3.88 (98,6)	6.00 (152,4)	1.70 (43,2)	39 (54)	10.00 (4,5)
3 DN80	3.500 (88,9)	8.37 (212,6)	5.76 (146,3)	3.60 (91,4)	3.40 (86,4)	3.88 (98,6)	6.00 (152,4)	1.70 (43,2)	39 (54)	11.0 (5,0)
4 DN100	4.500 (114,3)	9.63 (244,6)	6.74 (171,2)	4.61 (117,1)	3.63 (92,2)	4.56 (115,1)	7.13 (181,1)	1.84 (46,7)	50 (69)	25.0 (11,3)
139.7 DN125	- (139,7)	10.50 (266,7)	7.50 (190,5)	5.29 (134,4)	4.20 (106,7)	4.90 (124,5)	7.60 (193,0)	1.90 (48,3)	39 (54)	29.0 (13,2)
5 DN125	5.563 (141,3)	10.50 (266,7)	7.50 (190,5)	5.29 (134,4)	4.20 (106,7)	4.90 (124,5)	7.60 (193,0)	1.90 (48,3)	39 (54)	29.0 (13,2)
165.1 DN150	- (165,1)	11.50 (292,1)	8.05 (204,5)	5.75 (146,1)	4.50 (114,3)	5.00 (127,0)	7.60 (193,0)	1.48 (37,6)	60 (82)	47.0 (21,3)
6 DN150	6.625 (168,3)	11.50 (292,1)	8.05 (204,5)	5.75 (146,1)	4.50 (114,3)	5.00 (127,0)	7.60 (193,0)	1.48 (37,6)	60 (82)	47.0 (21,3)
8 DN200	8.625 (219,1)	14.00 (355,6)	10.25 (260,4)	7.75 (196,9)	5.62 (142,7)	5.45 (138,4)	8.40 (213,4)	2.20 (58,9)	120 (164)	66.0 (29,9)
10 DN250	10.750 (273,1)	18.00 (457,2)	13.00 (330,2)	10.21 (259,3)	6.38 (162,1)	7.50 (190,5)	10.50 (266,7)	3.00 (76,2)	130 (178)	109.7 (49,4)
12 DN300	12.750 (323,9)	21.00 (533,4)	14.28 (362,7)	11.31 (287,2)	7.26 (184,4)	7.62 (193,5)	10.62 (269,7)	2.75 (69,9)	130 (178)	151.0 (68,0)

FIGURE 1
MODEL CV-1F CHECK VALVES
NOMINAL DIMENSIONS



Detail	Part	Material	Qty.	Detail	Part	Material	Qty.	Detail	Part	Material	Qty.
1	Body	Ductile Iron	1	6	Clapper Facing	EPDM Grade "E"	1	14	Locknut	Stainless Steel	1
2	Cover	Ductile Iron	1	7	Spring	Stainless Steel	1	15	Plug-1/2"-14 NPT	Cast Iron	2
3	Cover Gasket	Nitrile Rubber	1	8	Hinge Shaft	Stainless Steel	1	16	Adhesive	Thread Sealer	AR
4	Hex Cap Screw	Steel, Zinc Plated	AR	9	Retaining Ring	Stainless Steel	AR	17	Nameplate	Aluminum	1
5	Clapper 2" - 8" (DN50-200)	Stainless Steel	1	11	Retention Bolt	Stainless Steel	1	18	Rivet	Steel	2
	Clapper 10" - 12" (DN250-300)	Ductile Iron		13	Retaining Disc	Stainless Steel	1	19	Spacer	Stainless Steel	1

FIGURE 2
MODEL CV-1F CHECK VALVES
ASSEMBLY

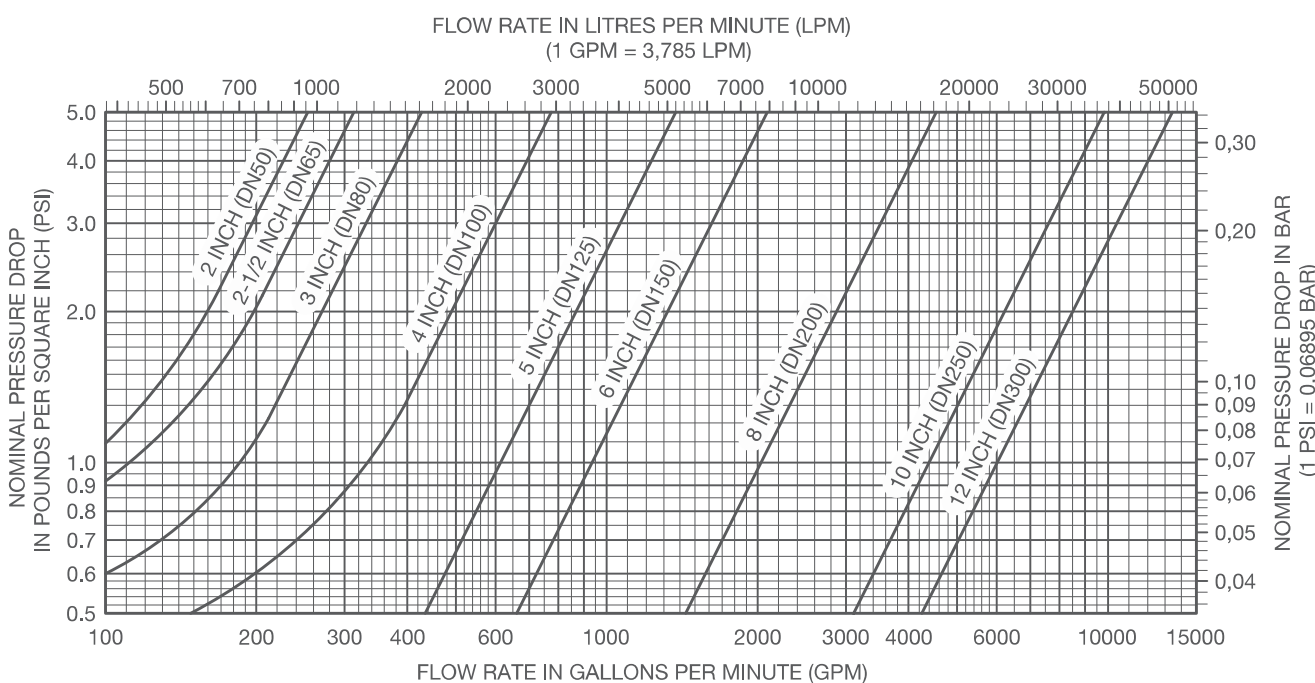


FIGURE 3
MODEL CV-1F CHECK VALVES
PRESSURE LOSS DATA

Care and Maintenance

NOTICE

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection system from the proper authorities and notify all personnel who may be affected by this decision.

After placing a fire protection system in service, notify the proper authorities and advise those responsible for monitoring proprietary and/or central station alarms.

Responsibility lies with owners for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (for example, NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions. Any impairments must be immediately corrected.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

Products manufactured by Tyco Fire Suppression & Building Products (TFSBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFSBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFSBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFSBP to be defective shall be either repaired or replaced, at TFSBP's sole option. TFSBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFSBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFSBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether

TFSBP was informed about the possibility of such damages, and in no event shall TFSBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

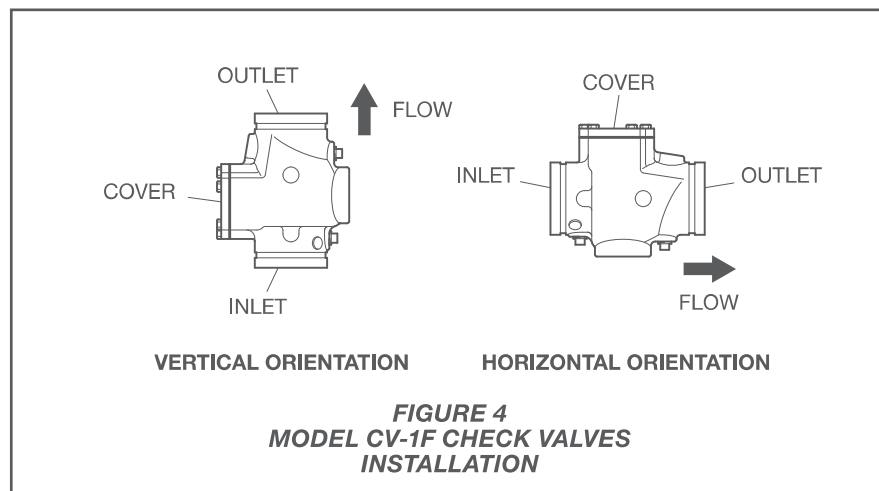
Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

Model CV-1F Check Valves

Specify: size and P/N (below).

2" (DN50)	P/N 59-590-0-020
2-1/2" (DN65)	P/N 59-590-0-025
76,1 mm (DN65)	P/N 59-590-0-076
3" (DN80)	P/N 59-590-0-030
4" (DN100)	P/N 59-590-0-040
139,7 mm (DN125)	P/N 59-590-0-139
5" (DN125)	P/N 59-590-0-050
165,1 mm (DN150)	P/N 59-590-0-165
6" (DN150)	P/N 59-590-0-060
8" (DN200)	P/N 59-590-0-080
10" (DN250)	P/N 59-590-0-100
12" (DN300)	P/N 59-590-0-120





UL, ULC, and FM Approved

Sizes Available: 6" (150mm), 8" (200mm) and 10" (250mm)

Voltages Available: 24VAC
120VAC
12VDC (10.2 to 15.6) Polarized
24VDC (20.4 to 31.2) Polarized

Service Use: Fire Alarm
General Signaling
Burglar Alarm

Environment: Indoor or outdoor use (See Note 1)
-40° to 150°F (-40° to 66°C)
(Outdoor use requires weatherproof backbox.)

Termination: AC Bells - 4 No. 18 AWG stranded wires
DC Bells - Terminal strip

Finish: Red powder coating

Optional: Model BBK-1 weatherproof backbox
Model BBX-1 deep weatherproof backbox

These vibrating type bells are designed for use as fire, burglar or general signaling devices. They have low power consumption and high decibel ratings. The unit mounts on a standard 4" (101mm) square electrical box for indoor use or on a model BBK-1 weatherproof backbox or BBX-1 deep weatherproof backbox for outdoor applications. Weatherproof backbox model BBK-1, Stock No. 1500001.

Notes:

1. Minimum dB ratings are calculated from integrated sound pressure measurements made at Underwriters Laboratories as specified in UL Standard 464. UL temperature range is -30° to 150°F (-34° to 66°C).
2. Typical dB ratings are calculated from measurements made with a conventional sound level meter and are indicative of output levels in an actual installation.
3. ULC only applies to MBA DC bells.

Size inches (mm)	Voltage	Model Number	Stock Number	Current (Max.)	Typical dB at 10 ft. (3m) (2)	Minimum dB at 10 ft. (3m) (1)
6 (150)	12VDC	MBA126	1750070	.12A	85	76
8 (200)	12VDC	MBA128	1750080	.12A	90	77
10 (250)	12VDC	MBA1210	1750060	.12A	92	78
6 (150)	24VDC	MBA246	1750100	.06A	87	77
8 (200)	24VDC	MBA248	1750110	.06A	91	79
10 (250)	24VDC	MBA2410	1750090	.06A	94	80
6 (150)	24VAC	PBA246	1806024*	.17A	91	78
8 (200)	24VAC	PBA248	1808024*	.17A	94	77
10 (250)	24VAC	PBA2410	1810024*	.17A	94	78
6 (150)	120VAC	PBA1206	1806120*	.05A	92	83
8 (200)	120VAC	PBA1208	1808120*	.05A	99	84
10 (250)	120VAC	PBA12010	1810120*	.05A	99	86

All DC bells are polarized and have built-in transient protection.

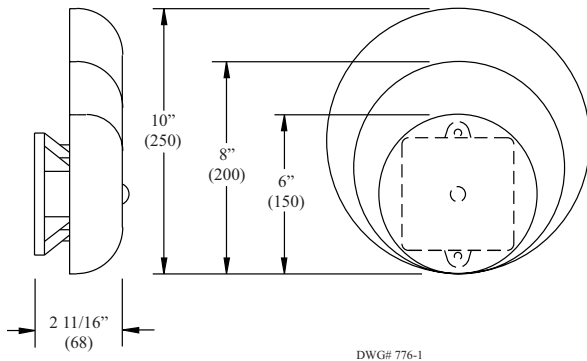
* Does not have ULC listing.

⚠ WARNING

In outdoor or wet installations, bell must be mounted with weatherproof backbox, BBK-1 or BBX-1. Standard electrical boxes will not provide a weatherproof enclosure. If the bell and/or assembly is exposed to moisture, it may fail or create an electrical hazard.

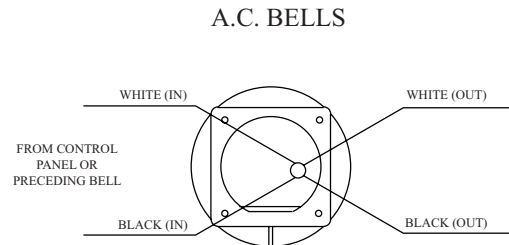
Bells Dimensions Inches (mm)

Fig. 1



Wiring (rear view)

Fig. 3



CAUTION:
WHEN ELECTRICAL SUPERVISION IS REQUIRED USE IN AND OUT LEADS AS SHOWN.

NOTES:

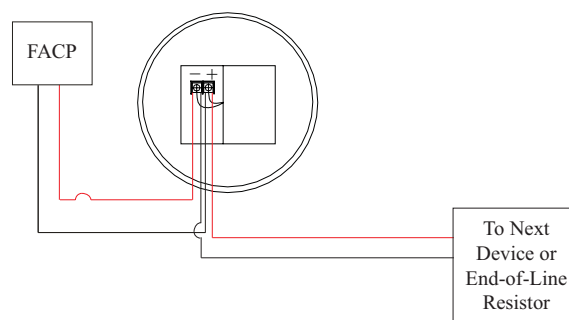
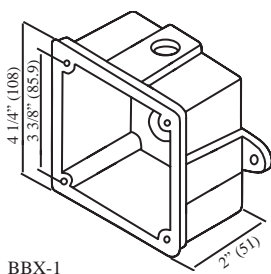
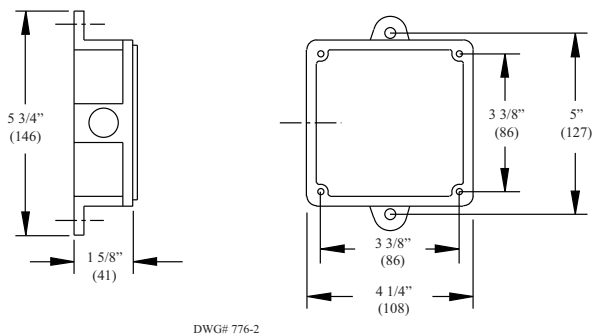
1. WHEN USING AC BELLS, TERMINATE EACH EXTRA WIRE SEPARATELY AFTER LAST BELL.
2. END-OF-LINE RESISTOR IS NOT REQUIRED ON AC BELLS.

DWG# 776-3

Weatherproof Backbox Dimensions Inches (mm)

Fig. 2

Box has one threaded 1/2" conduit entrance



Installation

1. The bell shall be installed in accordance with NFPA 13, 72, or local AHJ. The top of the device shall be no less than 90" AFF and not less than 6" below the ceiling.
2. Remove the gong.
3. Connect wiring (see Fig. 3).
4. Mount bell mechanism to backbox (bell mechanism must be mounted with the striker pointing down).
5. Reinstall the gong (be sure that the gong positioning pin, in the mechanism housing, is in the hole in the gong).
6. Test all bells for proper operation and observe that they can be heard where required (bells must be heard in all areas as designated by the authority having jurisdiction).

WARNING

Failure to install striker down will prevent bell from operating.



Conduit Entrances: Two knockouts for 1/2" conduit provided.

Service Use:

Automatic Sprinkler	NFPA-13
One or two family dwelling	NFPA-13D
Residential occupancy up to four stories	NFPA-13R
National Fire Alarm Code	NFPA-72

UL, ULC, and CSFM Listed, FM Approved, NYMEA Accepted, CE Marked

Dimensions: 4.75"L x 2.25"W x 8.2"H (stem extended)
12,1cm L x 5,7cm W x 18,3cm H

Weight: 1.35 lb. (0,61 kg.)

Enclosure: Cover - Die-cast

Finish - Red Spatter Enamel

Base - Die Cast Zinc

All parts have corrosion resistant finishes.

Cover Tamper: Tamper Resistant Screws,
Optional cover tamper switch kit available

Mounting: 1/2" NPT

Contact Rating: PCVS-1: One set of SPDT (Form C)

PCVS-2: Two sets of SPDT (Form C)

15 Amps at 125/250VAC

2.5 Amps at 30VDC resistive

Environmental Limitations: -40°F to +140°F (-40°C to 60°C)

NEMA 4 and NEMA 6P Enclosure (IP67) when used with appropriate watertight conduit fittings.

Indoor or Outdoor Use (Not for use in hazardous locations. See bulletin no. 5400694 PIVS-U-EX for hazardous locations.)

The Model PCVS is a weather proof and tamper resistant switch for monitoring the open position of fire sprinkler control valves of the post indicator, butterfly and other types. Depending on the model, one or two SPDT (Form C) contacts are provided which will operate when the valve position is altered from an open state.

The unit mounts in a 1/2" NPT tapped hole in the post indicator or butterfly valve housing. The device is engaged by the indicating assembly of the post indicator or the operating mechanism of the butterfly valve, actuating switch(es) when the valve is fully open. The unit should be installed where it is accessible for service.

The cover is held in place by two tamper resistant screws that require a special tool to remove. The tool is furnished with each device and

should be left with the building owner or responsible party. Replacement or additional cover screws and hex keys are available. See ordering information.

Optional Cover Tamper Switch

A field installable cover tamper switch is available as an option which may be used to indicate removal of the cover. See ordering information.

Testing

The PCVS and its associated protective monitoring system should be tested in accordance with applicable NFPA codes and standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently).

Ordering Information

Model	Description	Stock No.
PCVS-1	Potter Control Valve Switch (single switch)	1010107
PCVS-2	Potter Control Valve Switch (double switch)	1010207
--	Cover Screw	5490424
--	Hex Key for Cover Screws and Installation Adjustments	5250062
PBK-S	Pratt Butterfly Valve Kit - Up to 12" (300mm)	0090133
PBK-L	Pratt Butterfly Valve Kit - 14" (355mm) and Up	0090132
PVK	Pratt Valve Kit	1000060
--	Optional Cover Tamper Switch Kit	0090131
KBK	Kennedy Butterfly Valve Kit	0090143

For pressure reducer type valve installation kits (if required) contact valve manufacturer.

Fig. 1 Dimensions

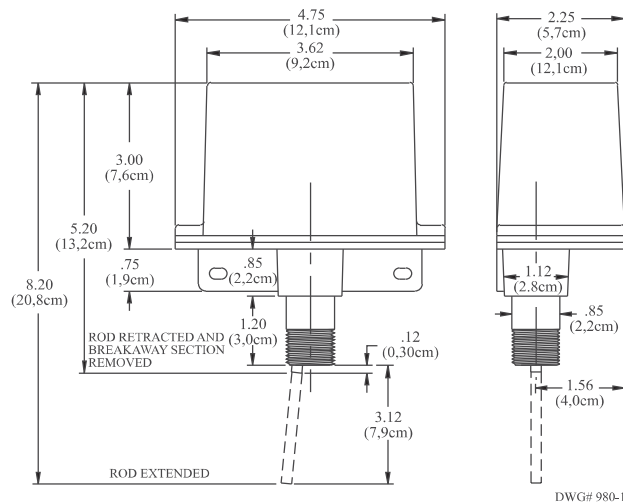
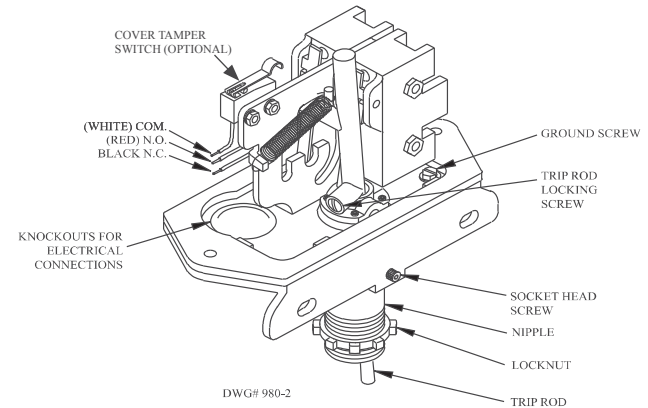


Fig. 2 Parts



Typical Installations On Post Indicator Valve Housings (See Figs. 3 Thru 6)

Refer to Fig. 2 for the location of parts described in the following instructions.

Note: If the sprinkler system is in service the owner or authorized representative should be notified, before any work is done on the system, that the valve controlling the water supply to the system may be closed for periods of time during the installation and testing of this device, resulting in all or portions of the system being inoperative during these periods.

If the system is not in service and valve is closed, be sure that opening the valve will not allow any unwanted water flow due to openings in the system, such as heads off, broken or incomplete piping, etc.

1. Position the valve to fully open ("OPEN" should appear in the window of the housing). Partially close the valve while observing the direction that the target assembly moves. Reopen the valve.

If the valve housing is predrilled with a 1/2" NPT for installation of a monitoring switch, remove the 1/2" plug and fully open the valve. Make sure that "OPEN" appears in the window of the housing. GO TO STEP NO. 6.

2. Remove the head and target assembly (consultation with valve manufacturer is recommended).
3. If the target assembly moved up as the valve was closed, measure the distance from the bottom of the head to the lower part of the target assembly that will contact the trip rod of the PCVS (see Fig. 3). This is usually a plate or bar on the target assembly, on a side adjacent to the "OPEN/SHUT" plates. Subtract 1/8" from the measurement.

If the target moved down as the valve was closed, measure the distance from the bottom of the head to the upper portion of the target assembly that will contact the trip rod of the PCVS (see Fig. 4). Add 1/8" (3,2mm) to this measurement.

4. Mark the housing at the proper location. Using a 23/32" (18,2mm) drill bit, drill and then tap a 1/2" NPT in the housing on the side that coincides with the portion of the target assembly that will engage the trip rod of the PCVS.
5. Replace the head and target assembly.
6. Loosen the socket head screw that holds the nipple in the PCVS and remove the nipple.
7. Screw the locknut that is provided onto the nipple.
8. Screw the nipple into the 1/2" NPT hole in the valve housing - hand tighten. Tighten the locknut against the valve housing to secure the nipple firmly in place.
9. Insert a scale or probe thru the nipple to measure the distance from the

open end of the nipple to the target assembly. Subtract 1/2" (12,5mm) from this measurement.

NOTE: In some cases, it may be necessary to attach an angle bracket to the target assembly to engage the PCVS trip rod.

10. Using the special tool provided, loosen the two cover screws and remove the cover from the PCVS.
11. Loosen the locking screw that holds the trip rod in place and adjust the rod length, from the end of the collar to the end of the rod, using the dimension determined in Step 9. Tighten the locking screw to hold the rod in place.
NOTE: If trip rod length is excessive, loosen the locking screw and remove the trip rod from the trip lever. Using pliers, break off the one (1) inch long notched section (see Fig. 7). Reinstall trip rod and repeat Step 11 procedure.
12. Partially close the valve (3 to 4 revolutions of the handle/hand wheel).
13. Slide the PCVS unit as far as possible onto the nipple, observing which direction the rod will move when the valve is closed. Orient the device to actuate the switches when the valve is open. Tighten the socket head screw in the collar.
14. Carefully open the valve to the fully open position. As the target moves to the open position it should engage the trip rod and actuate the switch(es). There should be a minimum overtravel of 1/2 revolution of the handle/hand wheel after the switch(es) actuate (a continuity meter connected to each set of contacts is one method that could be used to determine this).
15. Slowly close the valve. The switch must operate during the first two revolutions of the handle/hand wheel or during 1/5 of the travel distance of the valve control apparatus from its normal condition.
NOTE: Small adjustments of the target position may be necessary (consultation with valve manufacturer is recommended).
16. Complete the required electrical wiring, connections and tests. The valve should be operated through the entire cycle of fully closed and fully open to determine the integrity of the PCVS installation and the signaling system. Check that all electrical and mechanical connections are secure.
17. When the installation and testing are complete, return valve to its proper position.
18. Alternative installation for other post indicator valve housing shown in Fig. 5 and 6.



Model 1000

TESTANDRAIN®

Sectional Floor Control Test and Drain Valve

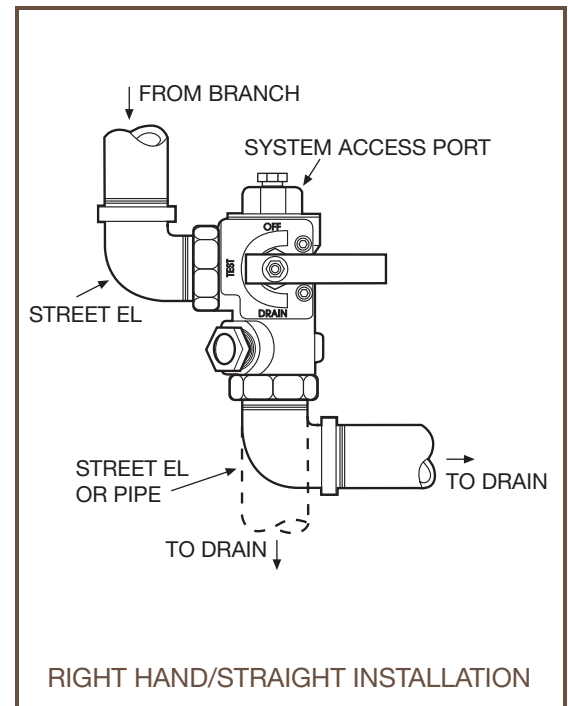


3/4" 1" 1 1/4" 1 1/2" 2"



- The AGF Manufacturing Inc. **Model 1000 TESTANDRAIN®** provides both the test function and the express drain function for a wet fire sprinkler system.
- The **Model 1000** complies with the requirements of NFPA-13, NFPA-13R, and NFPA-13D.
- The **Model 1000 TESTANDRAIN®** is a compact single handle ball valve which includes a tamper resistant test orifice and integral tamper resistant sight glasses, and is 300 PSI rated.
- Available in a full range of sizes from 3/4" to 2" NPT and BSPT, with all specifiable orifice sizes 3/8" (2.8K), 7/16" (4.2K), 1/2" (5.6K), 17/32" (8.0K), 5/8" (11.2K, ELO), 3/4" (14.0K, ESFR), and K25 as required by NFPA 13, 2007 Edition (see reverse).
- The orifice size is noted on the indicator plate and the valve features a tapped and plugged port for system access.
- A locking kit is available and can be ordered with the valve to provide vandal resistance or prevent unintentional alarm activation.
- Repair kits including (1) adapter gasket, (1) ball, (2) valve seats, (1) stem packing, and (1) stem washer are available for all **TESTANDRAIN®** valves. Valve and orifice size must be specified when ordering.

MODEL 1000 - FRONT VIEW, VERTICAL INSTALLATION



Reliability, Versatility, Code Compatibility

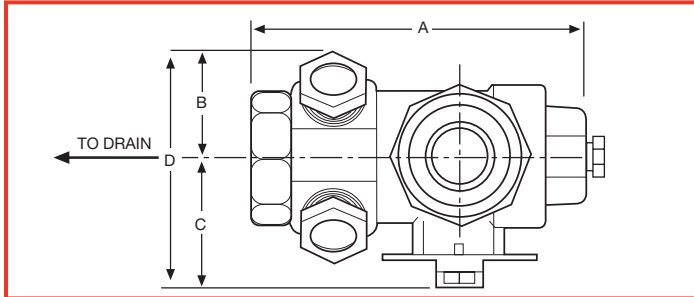


TEST AND DRAIN®

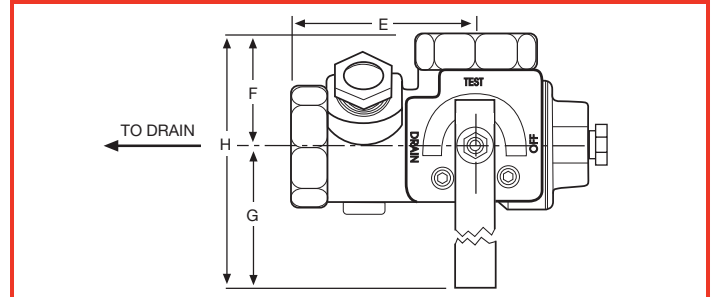
Model 1000

300 PSI Bronze Ball Valve

MODEL 1000 - PLAN VIEW



FRONT VIEW - HORIZONTAL INSTALL



DIMENSIONS

Orifice Size Available: 3/8", 7/16", 1/2", 17/32", ELO (5/8")*, ESFR (3/4")*, & K25**

SIZE	A	B	C	D	E	F	G	H
3/4"	5 1/16" (128 mm)	1 1/2" (37.5 mm)	2 3/16" (57 mm)	3 5/8" (93 mm)	3 3/8" (86 mm)	1 13/16" (46 mm)	4 9/16" (117 mm)	6 3/8" (162.5 mm)
1"	5 1/16" (128 mm)	1 1/2" (37.5 mm)	2 3/16" (57 mm)	3 5/8" (93 mm)	3 3/8" (86 mm)	1 13/16" (46 mm)	4 9/16" (117 mm)	6 3/8" (162.5 mm)
1 1/4"	5 7/16" (163 mm)	1 11/16" (43 mm)	2 9/16" (65 mm)	4 1/4" (108 mm)	3 5/16" (83 mm)	1 15/16" (51 mm)	5 9/16" (141 mm)	5 1/2" (192 mm)
1 1/2"	6 7/16" (163 mm)	1 13/16" (45 mm)	3 1/4" (81.5 mm)	5 1/16" (127 mm)	3 7/8" (99 mm)	2 5/8" (67 mm)	8 1/4" (207 mm)	10 7/8" (274 mm)
2"	6 7/16" (163 mm)	1 13/16" (45 mm)	3 1/4" (81.5 mm)	5 1/16" (127 mm)	3 7/8" (99 mm)	2 5/8" (67 mm)	8 1/4" (207 mm)	10 7/8" (274 mm)

* Available on 1 1/4" to 2" size units only

** Available on 1 1/2" and 2" size units only

THE MODEL 1000 PROVIDES ALL OF THE FOLLOWING...

From the 2007 Edition of NFPA 13

Chapter 8.16.2.4.1*	Provisions shall be made to properly drain all parts of the system.
Chapter 8.16.2.4.2 & 8.16.2.4.3	Drain connections, interior sectional or floor control valve(s) – shall be provided with a drain connection having a minimum size as shown in Table 8.16.2.4.2.
Chapter 8.16.2.4.4	Drains shall discharge outside or to a drain capable of handling the flow of the drain.
Chapter A.8.17.4.2	(Wet Pipe System) test connection is permitted to terminate into a drain capable of accepting full flow... using an approved sight test connection containing a smooth bore corrosion-resistant orifice giving a flow equivalent to one sprinkler...
Chapter 8.17.4.2.2	The test connection valve shall be readily accessible.
Chapter 8.17.4.2.4	shall be permitted to be installed in any location... downstream of the waterflow alarm.
Chapter 8.17.4.3.1	(Dry Pipe System) a trip test connection not less than 1" in diameter, terminating in a smooth bore corrosion-resistant orifice, to provide a flow equivalent to one sprinkler...
Chapter 8.17.4.3.2	The trip test connection... with a shutoff valve and plug not less than 1", at least one of which shall be brass.

MATERIALS

Handle: Steel
 Stem: Rod Brass
 Ball: C.P. Brass
 Body: Bronze
 Valve Seat: Impregnated Teflon®
 Indicator Plate: Steel
 Handle Stop: Steel

APPROVALS

UL and ULC Listed (EX4019)
 FM Approved
 NYC-BSA No. 720-87-SM



USA Patent # 4741361 and Other Patents Pending



AGF Manufacturing Inc.
 100 Quaker Lane, Malvern, PA 19355
 Phone: 610-240-4900
 Fax: 610-240-4906
www.testandrain.com

Job Name: _____
 Architect: _____
 Engineer: _____
 Contractor: _____



TECHNICAL DATA

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

1. DESCRIPTION

The Viking Microfast® Quick Response Upright Sprinkler VK300 is a small, thermosensitive, glass-bulb spray sprinkler available in several different finishes and temperature ratings to meet design requirements. The special Polyester and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in the Approval Charts. (Note: **FM global approves the ENT coating as corrosion resistant.** FM Global has no approval classification Polyester coatings as corrosion resistant.)



2. LISTINGS AND APPROVALS



cULus Listed: Category VNIV

FM Approved: Classes 2002 and 2020

Refer to Approval Charts and Design Criteria for listing and approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Minimum Operating Pressure: 7 psi (0.5 bar)*

Maximum Working Pressure: 175 psi (12 bar) wwp.

Factory tested hydrostatically to 500 psi (34.5 bar)

Testing: U.S.A. Patent No. 4,831,870

Thread size: 1/2" NPT, 15 mm BSP

Nominal K-Factor: 5.6 U.S. (80.6 metric**)

Glass-bulb fluid temperature rated to -65 °F (-55 °C)

Overall Length: 2-3/16" (56 mm)

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

Material Standards:

Frame Casting: Brass UNS-C84400 or QM Brass

Deflector: Brass UNS-C23000 or Copper UNS-C19500

Bulb: Glass, nominal 3 mm diameter

Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape

Screw: Brass UNS-C36000

Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400

For Polyester Coated Sprinklers: Belleville Spring-Exposed

For ENT Coated Sprinklers: Belleville Spring-Exposed, Screw and Pipcap - ENT plated

Ordering Information: (Also refer to the current Viking price list.)

Order Viking Microfast® Quick Response Upright Sprinkler VK300 by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.

Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, and ENT = JN

Temperature Suffix (°F/°C): 135°/57° = A, 155°/68° = B, 175°/79° = D, 200°/93° = E, and 286°/141° = G

For example, sprinkler VK300 with a 1/2" NPT thread, Brass finish and a 155 °F/68 °C temperature rating = Part No. 12978AB

Available Finishes And Temperature Ratings: Refer to Table 1.

Accessories: (Also refer to the Viking website.)

Sprinkler Wrench: Standard Wrench: Part No. 21475M/B (available since 2017)

Sprinkler Cabinets:

A. Six-head capacity: Part No. 01724A (available since 1971)

B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.



TECHNICAL DATA

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking Microfast® Quick Response Upright Sprinkler VK300 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating ¹	Maximum Ambient Ceiling Temperature ²	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, Black Polyester, and ENT

Corrosion-Resistant Coatings³: White Polyester, Black Polyester, and Black PTFE. ENT in all temperature ratings except 135 °F (57 °C)

Footnotes

¹ The sprinkler temperature rating is stamped on the deflector.

² Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

³ The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester, ENT, and PTFE coatings. For ENT coated automatic sprinklers, the waterway is coated.

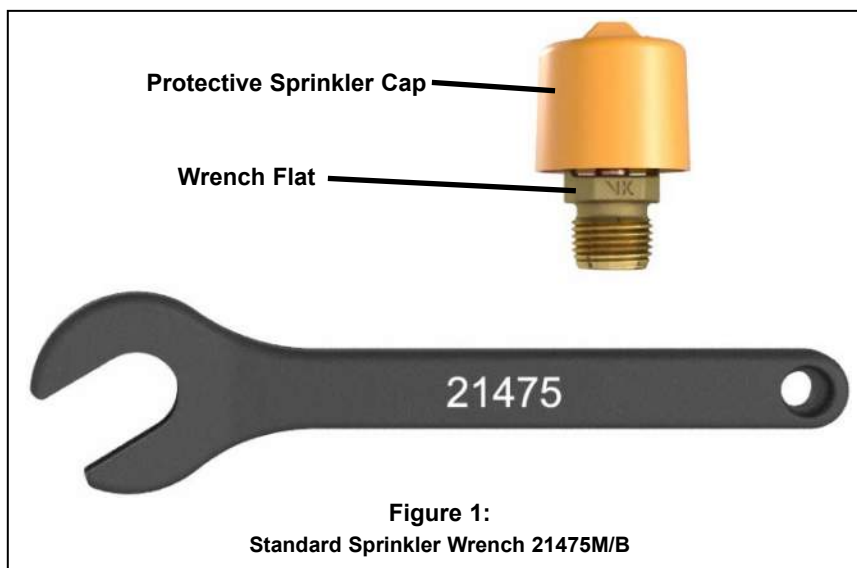


Figure 1:
Standard Sprinkler Wrench 21475M/B



TECHNICAL DATA

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

Approval Chart 1 (UL)

Microfast® Quick Response
Upright Sprinkler VK300
Maximum 175 PSI (12 bar) WWP

	Temperature	KEY
↓	Finish	
A1X ←	Escutcheon (if applicable)	

Base Part Number ¹	SIN	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals ³				
		NPT	BSP	U.S.	metric ²	Inches	mm	cULus	VdS	LPCB	NYC ⁸	CE
12978	VK300	1/2"	15 mm	5.6	80.6	2-3/16	56	A1, B2	--	--	See footnote 7.	--

NOTICE - Product Below - Limited Availability (Contact Local Viking Office)

06661B	VK300	1/2"	15 mm	5.6	80.6	2-3/16	56	A1, B2	--	--	See footnote 7.	--
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Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)

B - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester^{5,6}, and Black Polyester^{5,6}
2 - ENT⁶

Footnotes

¹ Base part number is shown. For complete part number, refer to Viking's current price schedule.

² Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

³ This table shows the listings and approvals available at the time of printing. Check with the manufacturer for any additional approvals.

⁴ Listed by Underwriters Laboratories Inc. for us in the U.S. and Canada

⁵ Other colors are available on request with the same Listings and Approvals as the standard colors.

⁶ cULus Listed as corrosion resistant.

⁷ Meets New York City requirements, effective July 1, 2008

⁸ Accepted for use, City of New York Board of Standards and Appeals, Calendar Number 219-76-SA and City of New York Department of Buildings, MEA 89-92-E, Vol. 16.

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1 above.)

cULus Listing Requirements:

The Viking Microfast® Quick Response Upright Sprinkler VK300 is cULus Listed as indicated in Approval Chart 1 for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers.

- Designed for use in Light and Ordinary Hazard occupancies.
- The sprinkler installation rules contained in NFPA 13 for standard spray upright sprinklers must be followed.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to Form No. F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.



TECHNICAL DATA

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
 Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
 Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

Approval Chart 2 (FM)

Microfast® Quick Response
 Upright Sprinkler VK300
 Maximum 175 PSI (12 bar) WWP

	KEY
Temperature	
Finish	
A1X ← Escutcheon (if applicable)	

Base Part Number ¹	SIN	Thread Size		Nominal K-Factor		Overall Length		FM Approvals ³ (Refer also to Design Criteria below.)
		NPT	BSP	U.S.	metric ²	Inches	mm	
12978	VK300	1/2"	15 mm	5.6	80.6	2-3/16	56	A1, B2
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)								
06661B	VK300	1/2"	15 mm	5.6	80.6	2-3/16	56	A1, B2
Approved Temperature Ratings A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C) B - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)							Approved Finishes 1 - Brass, Chrome, White Polyester ⁵ , and Black Polyester ⁵ 2 - ENT ⁶	
Footnotes ¹ Base part number is shown. For complete part number, refer to Viking's current price schedule. ² Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0. ³ This table shows the FM Approvals available at the time of printing. Check with the manufacturer for any additional approvals. ⁵ Other colors are available on request with the same Approvals as the standard colors. ⁶ FM approved as corrosion resistant.								

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

The Microfast® Quick Response Upright Sprinkler VK300 is FM Approved as a quick response **Non-Storage** upright sprinkler as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to Form No. F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.



TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

The Viking Microfast® Quick Response Pendent Sprinkler VK302 is a small thermosensitive glass bulb spray sprinkler available with various finishes and temperature ratings to meet design requirements. The special Polyester, Polytetrafluoroethylene (PTFE), and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in the Approval Charts. (Note: **FM Global approves ENT finish as corrosion resistant.** FM Global has no approval classification for PTFE and Polyester coatings as corrosion resistant.)



2. LISTINGS AND APPROVALS



cULus Listed: Category VNIV



FM Approved: Class Series 2000



VdS Approved: Certificates G414009 and G414010



LPCB Approved



CE Certified: Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001

Refer to Approval Chart 1 and Design Criteria cULus Listing requirements, and refer to Approval Chart 2 and Design Criteria for FM Approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Minimum Operating Pressure: 7 psi (0.5 bar)
Rated to 175 psi (12 bar) water working pressure
Factory tested hydrostatically to 500 psi (34.5 bar)
Thread size: 1/2" NPT, 15 mm BSP
Nominal K-Factor: 5.6 U.S. (80.6 metric**)
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: 2-1/4" (58 mm)

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

Material Standards:

Frame Casting: Brass UNS-C84400 or QM Brass
Deflector: Phosphor Bronze UNS-C51000 or Copper UNS-C19500
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For PTFE Coated Sprinklers: Belleville Spring-Exposed, Screw-Nickel Plated, Pip Cap-PTFE Coated
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinklers: Belleville Spring-Exposed, Screw and Pipcap - ENT plated.

Ordering Information: (Also refer to the current Viking price list.)

Order Quick Response Pendent Sprinklers by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.

Finish Suffix: Brass = A, Chrome = F, White Polyester = M-W, Black Polyester = M-B, Black PTFE = N, and ENT = JN
Temperature Suffix: 135 °F (68 °C) = A, 155 °F (68 °C) = B, 175 °F (79 °C) = D, 200 °F (93 °C) = E, 286 °F (141 °C) = G
For example, sprinkler VK302 with a Brass finish and a 155 °F (68 °C) temperature rating = Part No. 12979AB

Available Finishes And Temperature Ratings: Refer to Table 1.

Accessories: (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

Viking Technical Data may be found on
The Viking Corporation's Web site at
<http://www.vikinggroupinc.com>.
The Web site may include a more recent
edition of this Technical Data Page.



TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Sprinkler Wrenches:

- A. Standard Wrench: Part No. 10896W/B (available since 2000).
- B. Wrench for Recessed Pendent Sprinklers: Part No. 16036W/B** (available since 2011)
- C. Optional Protective Sprinkler Cap Remover/Escutcheon Installer Tool*** Part No. 15915 (available since 2010)

**A ½" ratchet is required (not available from Viking).

***Allows use from the floor by attaching a length of 1" diameter CPVC tubing to the tool. Ideal for sprinkler cabinets. Refer to Bulletin F_051808.

Sprinkler Cabinets:

- A. Six-head capacity: Part No. 01724A (available since 1971)
- B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking Microfast® Quick Response Pendent Sprinkler VK302 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

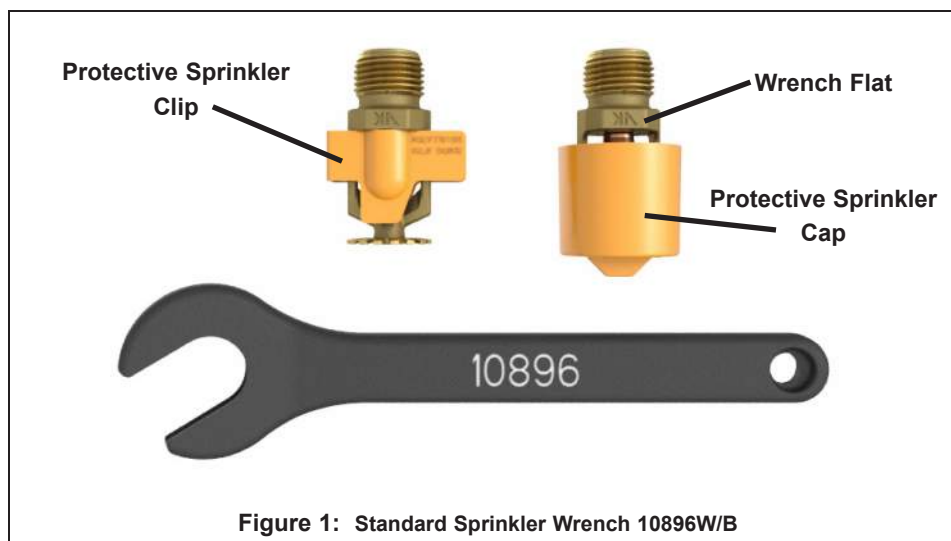


Figure 1: Standard Sprinkler Wrench 10896W/B



TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating ¹	Maximum Ambient Ceiling Temperature ²	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, Black Polyester, Black PTFE, and ENT

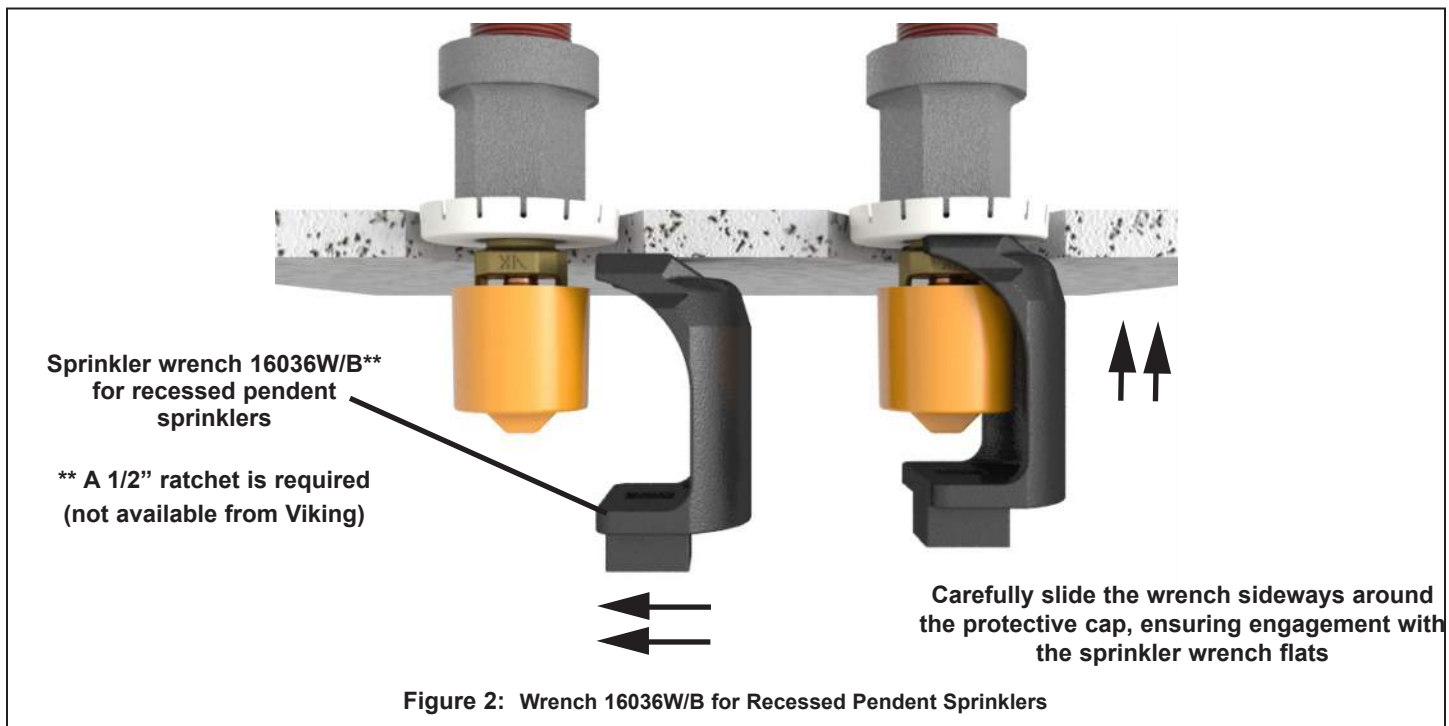
Corrosion-Resistant Coatings³: White Polyester, Black Polyester, and Black PTFE. ENT in all temperature ratings except 135 °F (57 °C)

Footnotes

¹ The sprinkler temperature rating is stamped on the deflector.

² Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

³ The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester, PTFE, and ENT coatings. For ENT coated automatic sprinklers, the waterway is coated





TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 1 (UL) The Viking Microfast® Quick Response Pendent Sprinkler VK302 Maximum 175 PSI (12 Bar) WWP

Temperature	KEY
Finish	
Escutcheon (if applicable)	

Base Part Number ¹	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals ³ (Refer also to Design Criteria.)				
			NPT	BSP	U.S.	metric ²	Inches	mm	cULus ⁴	VdS	LPCB	CE ⁷	
12979	VK302	Pendent	1/2"	15 mm		5.6	80.6	2-1/4	58	A1Z, B1Y, C2X, D2	A3	A3Z, B3Y	D3Z, C3Y
Approved Temperature Ratings					Approved Finishes				Approved Escutcheons				
A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)					1 - Brass, Chrome, White Polyester ^{5,6} , Black Polyester ^{5,6} , and Black PTFE				X - Standard surface-mounted escutcheon or the Viking Micromatic® Model E-1 Recessed Escutcheon				
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)					2 - ENT ⁵				Y - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Viking Micromatic® Model E-1 or E-2 Recessed Escutcheon				
C - 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)					3 - Brass, Chrome, White Polyester ^{5,6} , and Black Polyester ^{5,6}				Z - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon				
D - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)													
Footnotes													
1 Base part number shown. For complete part number, refer to Viking's current price schedule.													
2 Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.													
3 This table shows the listings and approvals available at the time of printing. Other approvals may be in process.													
4 Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.													
5 cULus Listed as corrosion-resistant.													
6 Other colors are available on request with the same Listings and Approvals as the standard colors.													
7 CE Certified. Standard EN 12259-1. EC-certificate of conformity 0832-CPD-2001.													

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1 above.)

cULus Listing Requirements:

The Viking Microfast® Quick Response Pendent Sprinkler VK302 is cULus Listed as indicated in the Approval Chart for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers.

- Designed for use in Light and Ordinary occupancies.
- The sprinkler installation rules contained in NFPA 13 for standard spray pendent sprinklers must be followed.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.



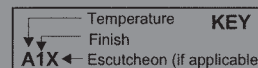
TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Approval Chart 2 (FM) The Viking Microfast® Quick Response Pendent Sprinkler VK302 Maximum 175 PSI (12 Bar) WWP



Base Part Number ¹	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		FM Approvals ³ (Refer also to Design Criteria.)
			NPT	BSP	U.S.	metric ²	Inches	mm	
12979	VK302	Pendent	1/2"	15 mm	5.6	80.6	2-1/4	58	A1Z, B1Y, D2X, C2
Approved Temperature Ratings A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C) B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C) C - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C) D - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C)			Approved Finishes 1 - Brass, Chrome, White Polyester ⁴ , and Black Polyester ⁴ 2 - ENT ⁵			Approved Escutcheons X - Standard surface-mounted escutcheon or the Viking Micromatic® Model E-1 Recessed Escutcheon Y - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Viking Micromatic® Model E-1 or E-2 Recessed Escutcheon Z - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon			

Footnotes

¹ Base part number shown. For complete part number, refer to Viking's current price schedule.

² Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

³ This table shows the FM Approvals available at the time of printing. Other approvals may be in process.

⁴ Other colors are available on request with the same Approvals as the standard colors.

⁵ FM approved as corrosion resistant.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

The Viking Microfast® Quick Response Pendent Sprinkler VK302 is FM Approved as quick response **Non-storage** upright and pendent sprinklers as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

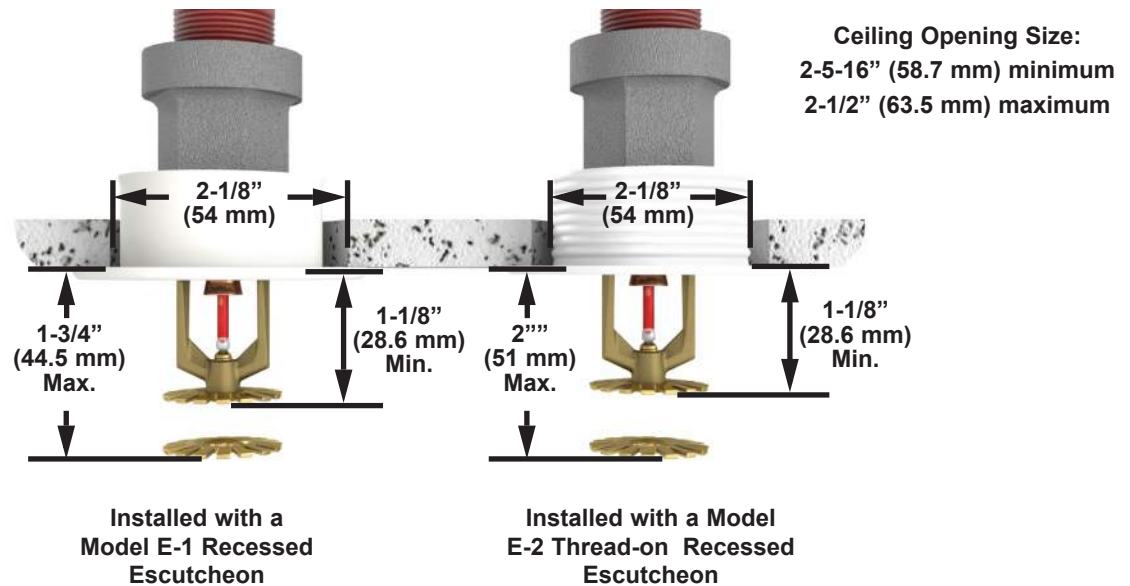
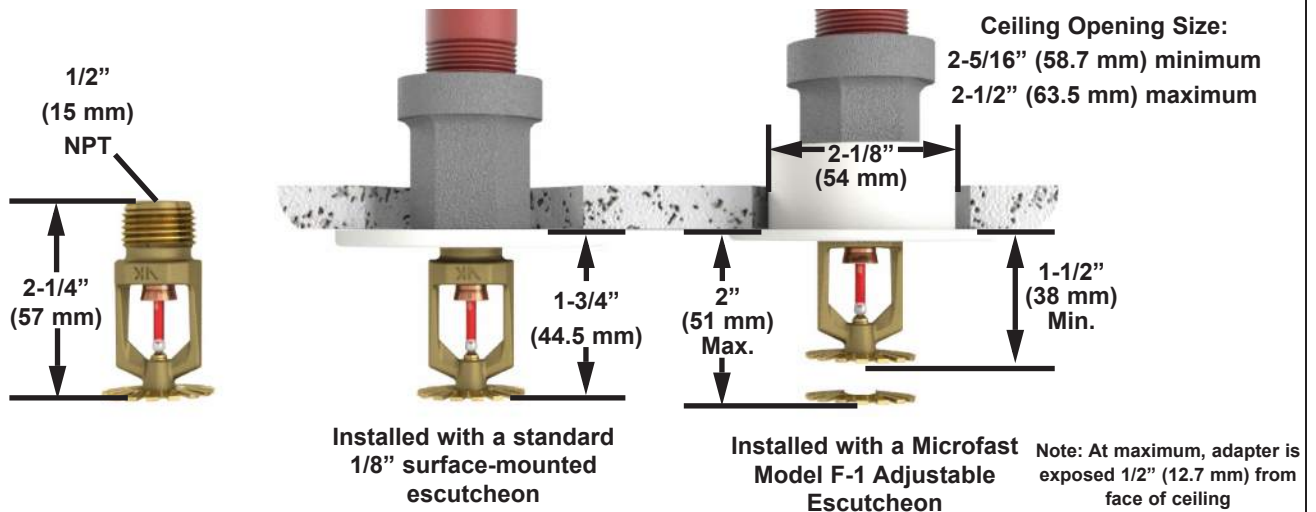
IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.



TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com





TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Visit the Viking website for the latest edition of this technical data page www.vikinggroupinc.com

1. DESCRIPTION

Viking Mirage® Standard and Quick Response Concealed Pendent Sprinkler VK462 and HP Sprinkler VK463 are thermosensitive glass-bulb spray sprinklers designed for installation on concealed pipe systems where the appearance of a smooth ceiling is desired.

The sprinkler is pre-assembled with a threaded adapter for installation with a low-profile cover assembly that provides up to 1/2" (13 mm) of vertical adjustment. The two-piece design allows installation and testing of the sprinkler prior to installation of the cover plate. The "The "push-on" and "thread-on" designs of the concealed cover plate assemblies allow easy installation of the cover plate after the system has been tested and the ceiling finish has been applied. The cover assembly can be removed and reinstalled, allowing temporary removal of ceiling panels without taking the sprinkler system out of service or removing the sprinkler. The Electroless Nickel PTFE (ENT) coating has been investigated for installation in corrosive environments and is listed and approved as indicated in the Approval Charts. The ENT finish is only available for the sprinkler assembly, the cover plate is not plated.

2. LISTINGS AND APPROVALS



cULus Listed: Category VNIV



FM Approval: Class 2015



NYC Approved: MEA 89-92-E, Volume 32



VdS Approved: Certificate G4080021

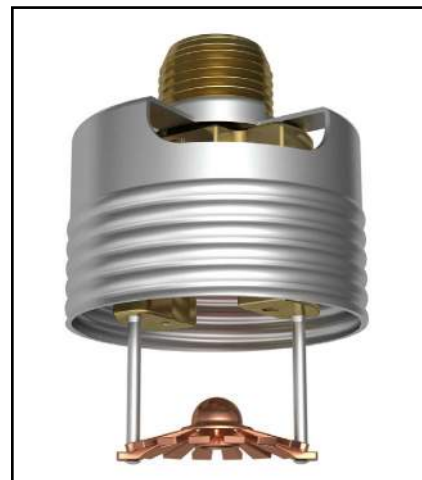


LPCB Approved: Ref. No. 096e/12



CE Certified: Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2032

China Approval: Approved according to China GB Standard



WARNING: Cancer and Reproductive Harm-
www.P65Warnings.ca.gov

Refer to the Approval Charts and Design Criteria listing and approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Available since 2006.

Minimum Operating Pressure: 7 psi (0.5 bar)*

Maximum Working Pressure: Sprinkler VK463 is rated for use with water working pressures ranging from the minimum 7 psi (0.5 bar) up to 250 psi (17.2 bar) for high-pressure systems. High-pressure (HP) sprinklers can be identified by locating "250" stamped on the deflector. Sprinkler VK462 is rated to a maximum 175 psi (12 bar) wwp.

Factory tested hydrostatically to 500 psi (34.5 bar)

Thread size: 1/2" (15 mm) NPT

Nominal K-Factor: 5.6 U.S. (80.6 metric**)

Glass-bulb fluid temperature rated to -65°F (-55°C)

Patents Pending

* cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

** Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

Material Standards:

Sprinkler Body: Brass UNS-C84400

Deflector: Phosphor Bronze UNS-C51000

Deflector Pins: Stainless Steel Alloy

Bulb: Glass, nominal 3 mm diameter

Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400

Button: Brass UNS-C36000

Screws: 18-8 Stainless Steel

Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape

Yoke: Phosphor Bronze UNS-C51000

Cover Adapter: Cold Rolled Steel UNS-G10080, Finish: Clear Chromate over Zinc Plating

Cover Assembly Materials:

Cover: Copper UNS-C11000 or Stainless Steel UNS-S30400

Base: Brass UNS-C26000 or UNS-C26800

Springs: Nickel Alloy

Solder: Eutectic

Ordering Information: The sprinkler and cover plate must be ordered separately. Refer to Tables 1 and 2.



TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Visit the Viking website for the latest edition of this technical data page www.vikinggroupinc.com

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, when the temperature around the sprinkler approaches its operating temperature, the cover plate detaches. Continued heating of the exposed sprinkler causes the heat-sensitive liquid in the glass bulb to expand and the bulb to shatter, releasing the yoke, pip-cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking Sprinklers VK462 and VK463 are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

TABLE 1: SPRINKLER ORDERING INFORMATION

Instructions:

- (1) Select a Sprinkler Base Part Number
- (2) Add the suffix for the desired Finish
- (3) Add the suffix for the desired Sprinkler Temperature Rating
- (4) Order a cover plate (refer to Table 2)

Example:

13503AE = 200 °F (93 °C) Temperature Rated Sprinkler with a standard Brass finish.

SIN	Sprinkler Base Part Number ⁸	Size		1: Finishes		2: Temperature Ratings				
		NPT Inch	BSPT mm	Description	Suffix ¹	Sprinkler Temperature Classification	Nominal Rating	Bulb Color	Max. Ambient Ceiling Temperature ²	Suffix
VK462	13503	1/2	--	Brass	A	Ordinary	155 °F (68 °C)	Red	100 °F (38 °C)	B
VK462	21356 ^{7,9}	--	15	ENT ^{3,4}	JN	Intermediate	175 °F (79 °C)	Yellow	150 °F (65 °C)	D
VK463	13667	1/2	--			Intermediate	200 °F (93 °C)	Green	150 °F (65 °C)	E

Accessories

Sprinkler Wrenches and tools (see Figure 1):

- A. Heavy Duty Part Number: 14047W/B⁵ (available since 2006)
- B. Head Cabinet Wrench Part Number: 14031⁶ (available since 2006)
- C. Optional Concealed Cover Plate Installer Tool Part Number: 14412¹⁰ (available since 2007)
- D. Optional Large Concealed Cover Plate Installer Tool Part No. 14867¹⁰ (available since 2007)

Sprinkler Cabinet:

Holds up to 6 sprinklers: Part number 01731A (available since 1971).

Footnotes

1. Where a dash (-) is shown in the Finish suffix designation, insert the desired Temperature Rating suffix. See example above.
2. Based on NFPA 13, NFPA 13R, and NFPA 13D. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.
3. UL Listed as corrosion resistant.
4. The corrosion resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Chart. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the ENT coating is applied to all exposed exterior surfaces, including the waterway.
5. Requires a 1/2" ratchet (not available from Viking).
6. Also optional for removal of the protective cap. Ideal for sprinkler cabinets.
7. Not available with ENT finish. See approval charts for more information.
8. See approval charts for more information.
9. Approved according to China GB Standard.
10. The installer tool is for push-on style cover plates only.



TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
 Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
 Visit the Viking website for the latest edition of this technical data page www.vikinggroupinc.com

TABLE 2: COVER PLATE ORDERING INFORMATION

Instructions:

- (1) Select a Cover Plate Base Part Number
- (2) Add the suffix for the desired Finish
- (3) Add the suffix for the required Cover Plate Nominal Rating.

Example:

23190MC/W = 165 °F (74 °C) Temperature Rated, 2-3/4" (70 mm) diameter, Thread-On style Round Cover Plate with a Painted White finish.

1: Select a Cover Plate Base Part Number ³						2: Select a Finish	
Thread-On Style			Push-On Style			Description	Suffix ⁵
Base Part Number	Size Inch (mm)	Type	Base Part Number	Size Inch (mm)	Type		
23190	2-3/4 (70)	Round	23447	2-3/4 (70)	Round	Polished Chrome	F
23174	3-5/16 (84)	Round	23463	3-5/16 (84)	Round	Brushed Chrome	F-/B
23179	3-5/16 (84)	Square	23482	3-5/16 (84)	Square	Bright Brass	B
23193 ⁴	2-3/4 (70)	Stainless Steel Round	23455 ⁴	2-3/4 (70)	Stainless Steel Round	Antique Brass	B-/A
						Brushed Brass	B-/B
23183 ⁴	3-5/16 (84)	Stainless Steel Round	23473 ⁴	3-5/16 (84)	Stainless Steel Round	Brushed Copper	E-/B
						Painted White	M-/W
23174-/CR	3-5/16 (84)	Clean Room	23463-/CR	3-5/16 (84)	Clean Room	Painted Ivory	M-/I
23183CR ⁴	3-5/16 (84)	Stainless Steel Round Clean Room	23473CR ⁴	3-5/16 (84)	Stainless Steel Round Clean Room	Painted Black	M-/B

3: Temperature Rating Matrix^{1,2}

Cover Plate Nominal Rating (Required)	Temperature Classification	Sprinkler Nominal Rating	Sprinkler Maximum Ambient Ceiling Temperature ²	Suffix
UL: 139 °F (59 °C) FM: 139 °F (59 °C)	Ordinary	155 °F (68 °C)	100 °F (38 °C)	A
165 °F (74 °C)	Intermediate	175 °F (79 °C)	150 °F (65 °C)	C
165 °F (74 °C)	Intermediate	200 °F (93 °C)	150 °F (65 °C)	C

Footnotes

1. The sprinkler temperature rating is stamped on the deflector.
2. Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.
3. Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.
4. Stainless Steel versions are not available with any finishes or paint.
5. Where a dash (-) is shown in the Finish suffix designation, insert the desired Temperature Rating suffix. See example above.



TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

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Approval Chart 1 (UL)												
Mirage® Concealed Pendent Sprinklers VK462 and VK463												
<div><div><div>Sprinkler Temperature Rating</div><div>Cover Plate Temperature Rating</div><div>AW1</div><div>Cover Plate Finish</div><div>KEY</div></div></div>												
Sprinkler Base Part No. ¹	SIN	Thread Size		Nominal K-factor		Maximum Water Working Pressure	Listings and Approvals ⁴ (Refer also to Design Criteria)					
		NPT Inch	BSPT mm	U.S.	metric ²		cULus ⁵	NYC	VdS ⁷	LPCB	CE	China Approval
Standard Response Applications												
13503A	VK462	1/2"	--	5.6	80.6	175 psi (12 bar)	--	--	AY1, CZ1	AY1, BZ1	AY1, CZ1 ⁸	--
21356A ¹²	VK462	--	15	5.6	80.6	175 psi (12 bar)	--	--	--	--	--	AY1, CZ1
Quick Response Applications												
13503A	VK462	1/2"	15	5.6	80.6	175 psi (12 bar)	AV1, BX1, AS2, BT2	AV1, BX1 ⁶	--	--	--	--
13503JN ¹¹	VK462	1/2"	15	5.6	80.6	175 psi (12 bar)	AV1, BX1, AS2, BT2	AV1, BX1 ⁶	--	--	--	--
21356A ¹²	VK462	--	15	5.6	80.6	175 psi (12 bar)	AY1, CZ1	--	--	--	--	--
13667A	VK463	1/2"	15	5.6	80.6	250 psi (17.2 bar) ³	AV1, BX1	AV1, BX1 ⁶	--	--	--	--
13667JN ¹¹	VK463	1/2"	15	5.6	80.6	250 psi (17.2 bar) ³	AV1, BX1	AV1, BX1 ⁶	--	--	--	--
Approved Sprinkler Temperature Rating Codes			Approved Cover Plate Temperature Rating Codes						Approved Cover Plate Finish Codes			
A = 155 °F (68 °C) B = 175 °F (79 °C) C = 200 °F (93 °C)			S - 139 °F (59 °C) cover 23193, 23445 or 23183, 23473 (large diameter) T - 165 °F (74 °C) cover 23193, 23445 or 23183, 23473 (large diameter) V - 139 °F (59 °C) cover 23190, 23447, 23174, 23463 (large diameter), or 23179, 23482 (square cover plate) X - 165 °F (74 °C) cover 23190, 23447, or 23174, 23463 (large diameter) Y - 139 °F (59 °C) cover 23190, 23447 <i>LPCB Approved as 139 °F (59 °C)</i> Z - 165 °F (74 °C) cover 23190, 23447						1 - Polished Chrome, Brushed Chrome, Bright Brass, Antique Brass, Brushed Brass, Brushed Copper, Painted White, Painted Ivory, or Painted Black 2 - Stainless Steel			
Footnotes												
1. Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.												
2. Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.												
3. The Water Working Pressure rating is stamped on the deflector.												
4. This chart shows the listings and approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.												
5. Listed by Underwriter's Laboratories for use in the U.S. and Canada.												
6. Accepted for use, City of New York Department of Buildings, MEA Number 89-92-E, Vol. 32.												
7. VdS Approved, standards VdS 2344:2005-12, VdS 2100-25:2008-01, and EN 12259-1:1999 + A1:2001 + A2:2004 + A3:2006, Certificate G4080021.												
8. CE Certified, Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2032.												
9. The 139 °F cover has an orange label. The 165 °F (74 °C) cover has a white label.												
10. Painted finish consists of Polyester Baked Enamel. Other paint colors are available on request with the same listings as the standard paint colors. Listings and approvals apply for any paint manufacturer. Contact Viking for additional information.												
11. cULus Listed as corrosion resistant.												
12. Approved according to China GB Standard.												
NOTE: Custom colors are indicated on a label inside the cover assembly. Refer to Figure 1.												



TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

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DESIGN CRITERIA - UL

(Also refer to Approval Chart 1)

cULus Listing Requirements:

Mirage® Concealed Pendent Sprinklers VK462 and VK463 are cULus Listed as quick response for installation in accordance with the latest edition of NFPA 13 for standard coverage pendent spray sprinklers as indicated below.

- For hazard occupancies up to and including Ordinary Hazard, Group II.
- Protection areas and maximum spacing shall be in accordance with the tables provided in NFPA 13. Maximum spacing allowed is 15 ft. (4.6 m).
- Minimum spacing allowed is 6 ft. (1.8 m) unless baffles are installed in accordance with NFPA 13.
- Minimum distance from walls is 4 in. (102 mm).
- Maximum distance from walls shall be no more than one-half of the allowable distance between sprinklers. The distance shall be measured perpendicular to the wall.
- The sprinkler obstruction rules contained in NFPA 13 for standard coverage pendent spray sprinklers must be followed.
- Venting is required.
- Concealed sprinklers must NOT be installed in positive pressure plenums.

VdS Approval Requirements:

Concealed sprinklers must be installed in neutral or negative pressure plenums only.

VdS does not allow the installation of concealed sprinklers in false ceiling where the void above also contains a water based active fire protection system.

Steps of installation:

1. Prepare the sprinkler key.
2. Remove the plastic cover.
3. Hold the sprinkler with the wrench and fasten it.
4. Replace the plastic cover and do not remove until the cover is installed.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to Form No. F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.



All custom color painted cover plates will have an identifying label affixed to the inside of the cover that indicates the custom color and will have a representative sample (a paint dot) of the paint on the label.

Figure 1: Identification of Custom Paint for Concealed Covers



Figure 2: Square Cover Assembly



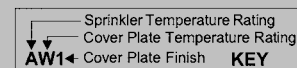
TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

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Approval Chart 2 (FM)

Mirage® Standard Response Concealed Pendent Sprinkler VK462



Sprinkler Base Part No. ¹	SIN	Thread Size		Nominal K-Factor		Maximum Water Working Pressure	FM Approvals ³ (Refer also to Design Criteria below.)
		NPT Inch	BSPT mm	U.S.	metric ²		
13503A	VK462	1/2"	15	5.6	80.6	175 psi (12 bar)	AW1, BX1, AY2, BZ2
21356A ⁶	VK462	--	15	5.6	80.6	175 psi (12 bar)	AU1, CV1
Approved Sprinkler Temperature Rating Codes		Approved Cover Plate Temperature Rating Codes				Approved Cover Plate Finish Codes	
A - 155 °F (68 °C) B - 175 °F (79 °C) and 200 °F (93 °C) C - 200 °F (93 °C)		U - 139 °F (59 °C) cover 23190, 23447 V - 165 °F (74 °C) cover 23190, 23447 W - 139 °F (59 °C) cover 23190, 23447, or 23174, 23463 (large diameter), or 23179, 23482 (square cover plate) X - 165 °F (74 °C) cover 23190, 23447, 23174, 23463 (large diameter), or 23179, 23482 (square cover plate) Y - 139 °F (59 °C) cover, 23183, 23473 or 23193, 23455 Z - 165 °F (74 °C) cover 23183, 23473 or 23193, 23455				1 - Polished Chrome, Brushed Chrome, Bright Brass, Antique Brass, Brushed Brass, Brushed Copper, Painted White, Painted Ivory, or Painted Black 2 - Stainless Steel	

Footnotes

- Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.
- Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
- This chart shows the FM Approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.
- The 139 °F (59 °C) cover has an orange label. The 165 °F (74 °C) cover has a white label.
- Painted finish consists of Polyester Baked Enamel. Other paint colors are available on request with the same listings as the standard paint colors. Listings and approvals apply for any paint manufacturer. Contact Viking for additional information.
- Approved according to China GB Standard.

NOTE: Custom colors are indicated on a label inside the cover assembly. Refer to Figure 1.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

Viking Concealed Pendent Sprinkler VK462 is FM Approved as a standard response **Non-Storage** concealed pendent sprinkler as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to Form No. F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.



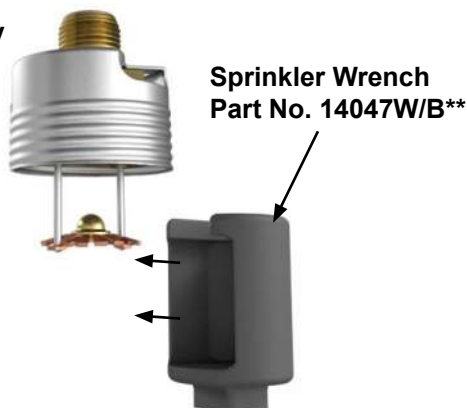
TECHNICAL DATA

MIRAGE® STANDARD AND QR CONCEALED PENDENT SPRINKLER VK462 AND HP SPRINKLER VK463 (K5.6)

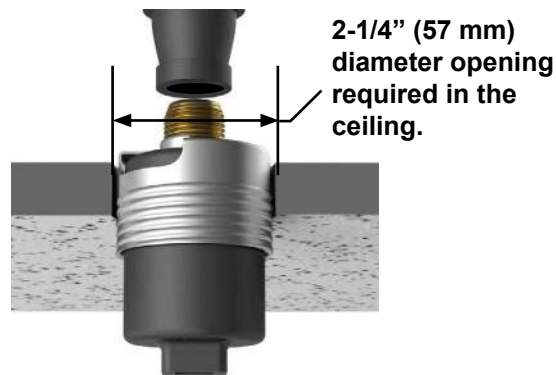
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Sprinkler and Adapter Assembly

- Protective cap removed
- Use wrench 14047W/B**



Step 1:
Carefully slide the wrench sideways around the deflector and pins



Step 2:
Carefully press the wrench upward and turn slightly to ensure engagement with the sprinkler wrench flats.

NEVER install the sprinkler by applying the installation wrench across the frame arms. **DO NOT** overtighten. Use only the designated sprinkler wrenches, Viking Part Numbers 14047W/B** or 14031**. A leak tight seal should be achieved by turning the sprinkler clockwise 1 to 1-1/2 turns beyond finger tight.

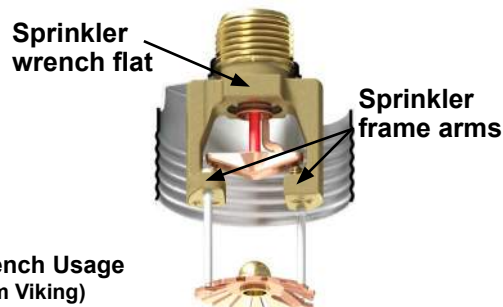
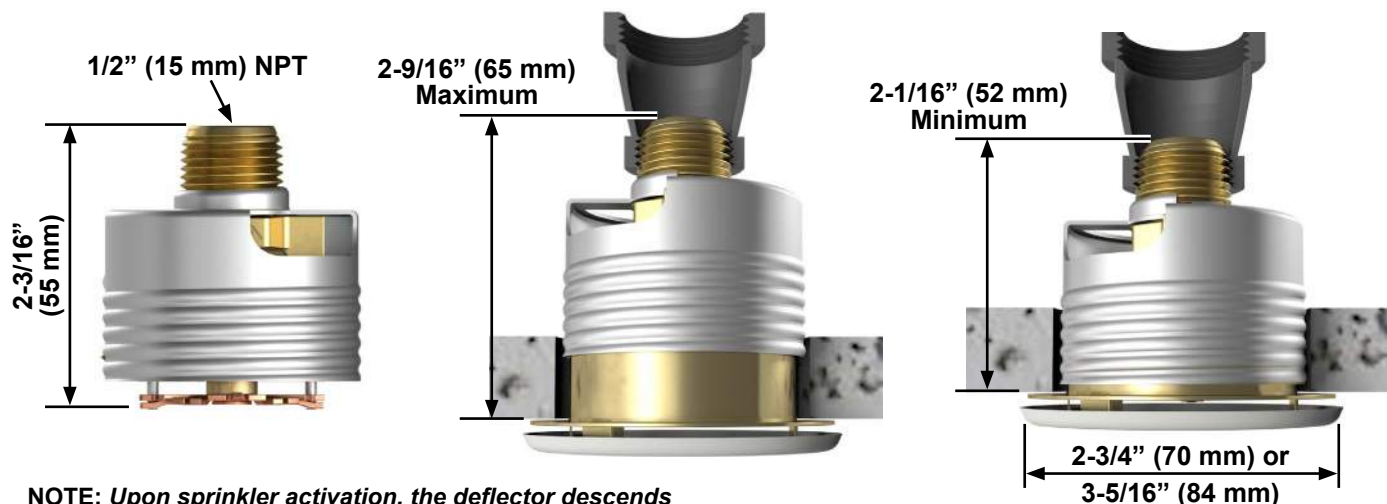


Figure 3: Sprinkler Installation and Proper Wrench Usage
 ** A 1/2" ratchet is required (Not available from Viking)



NOTE: Upon sprinkler activation, the deflector descends to approximately 13/16" (21 mm) below the sprinkler body.

Figure 4: Sprinkler Dimensions and Cover Installation



BULLETIN

CARE AND HANDLING
OF SPRINKLERS

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SPRINKLERS ARE FRAGILE - HANDLE WITH CARE!**General Handling and Storage:**

- Store sprinklers in a cool, dry place.
- Protect sprinklers during storage, transport, handling, and after installation.
- Use the original shipping containers. DO NOT place sprinklers loose in boxes, bins, or buckets.
- Keep sprinklers separated at all times. DO NOT allow metal parts to contact sprinkler operating elements.

For Pre-Assembled Drops:

- Protect sprinklers during handling and after installation.
- For recessed assemblies, use the protective sprinkler cap (Viking Part Number 10364).

Sprinklers with Protective Shields or Caps:

- DO NOT remove shields or caps until after sprinkler installation and there no longer is potential for mechanical damage to the sprinkler operating elements.
- **Sprinkler shields or caps MUST be removed BEFORE placing the system in service!**
- Remove the sprinkler shield by carefully pulling it apart where it is snapped together.
- Remove the cap by turning it slightly and pulling it off the sprinkler.

Sprinkler Installation:

- DO NOT use the sprinkler deflector or operating element to start or thread the sprinkler into a fitting.
- **Use only the designated sprinkler head wrench!** Refer to the current sprinkler technical data page to determine the correct wrench for the model of sprinkler used.
- DO NOT install sprinklers onto piping at the floor level.
- Install sprinklers after the piping is in place to prevent mechanical damage.
- DO NOT allow impacts such as hammer blows directly to sprinklers or to fittings, pipe, or couplings in close proximity to sprinklers. Sprinklers can be damaged from direct or indirect impacts.
- DO NOT attempt to remove drywall, paint, etc., from sprinklers.
- **Take care not to over-tighten the sprinkler and/or damage its operating parts!**

Maximum Torque:

1/2" NPT: 14 ft-lbs. (19.0 N-m)

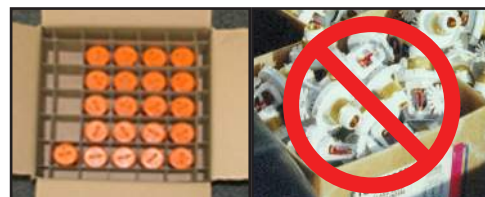
3/4" NPT: 20 ft-lbs. (27.1 N-m)

1" NPT: 30 ft-lbs. (40.7 N-m)



CORRECT
(Original container used)

INCORRECT
(Placed loose in box)



CORRECT
(Protected with caps)

INCORRECT
(Protective caps not used)



CORRECT
(Piping is in place at the ceiling)

INCORRECT
(Sprinkler at floor level)



CORRECT
(Special installation wrenches)

INCORRECT
(Designated wrench not used)



WARNING: Cancer and Reproductive Harm-
www.P65Warnings.ca.gov

! WARNING

Any sprinkler with a loss of liquid from the glass bulb or damage to the fusible element should be destroyed. Never install sprinklers that have been dropped, damaged, or exposed to temperatures exceeding the maximum ambient temperature allowed. Sprinklers that have been painted in the field must be replaced per NFPA 13. Protect sprinklers from paint and paint overspray in accordance with the installation standards. Do not clean sprinklers with soap and water, ammonia, or any other cleaning fluid. Do not use adhesives or solvents on sprinklers or their operating elements.

Refer to the appropriate technical data page and NFPA standards for complete care, handling, installation, and maintenance instructions. For additional product and system information Viking data pages and installation instructions are available on the Viking Web site at www.vikinggroupinc.com.



BULLETIN

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PROTECTIVE SPRINKLER SHIELDS AND CAPS

General Handling and Storage:

Many Viking sprinklers are available with a plastic protective cap or shield temporarily covering the operating elements. The snap-on shields and caps are factory installed and are intended to help protect the operating elements from mechanical damage during shipping, storage, and installation. NOTE: It is still necessary to follow the care and handling instructions on the appropriate sprinkler technical data sheets* when installing sprinklers with bulb shields or caps.

WHEN TO REMOVE THE SHIELDS AND CAPS:

NOTE: SHIELDS AND CAPS MUST BE REMOVED FROM SPRINKLERS BEFORE PLACING THE SYSTEM IN SERVICE!

Remove the shield or cap from the sprinkler only after checking all of the following:

- The sprinkler has been installed*.
- The wall or ceiling finish work is completed where the sprinkler is installed and there no longer is a potential for mechanical damage to the sprinkler operating elements.

SHIELDS AND CAPS MUST BE REMOVED FROM SPRINKLERS BEFORE PLACING THE SYSTEM IN SERVICE!



Figure 1: Sprinkler shield being removed from a pendent sprinkler.



Figure 2: Sprinkler cap being removed from a pendent sprinkler.



Figure 3: Sprinkler cap being removed from and upright sprinkler.

HOW TO REMOVE SHIELDS AND CAPS:

No tools are necessary to remove the shields or caps from sprinklers. DO NOT use any sharp objects to remove them! **Take care not to cause mechanical damage to sprinklers when removing the shields or caps.** When removing caps from fusible element sprinklers, use care to prevent dislodging ejector springs or damaging fusible elements. NOTE: Squeezing the sprinkler cap excessively could damage sprinkler fusible elements.

- To remove the shield, simply pull the ends of the shield apart where it is snapped together. Refer to Figure 1.
- To remove the cap, turn it slightly and pull it off the sprinkler. Refer to Figures 2 and 3.

NOTICE

Refer to the current sprinkler technical data page to determine the correct sprinkler wrench for the model of sprinkler used.



Never install sprinklers that have been dropped, damaged, or exposed to temperatures in excess of the maximum ambient temperature allowed.

* Refer to the appropriate current technical data pages for complete care, handling, and installation instructions. Data pages are included with each shipment from Viking or Viking distributors. They can also be found on the Web site at www.vikinggroupinc.com.



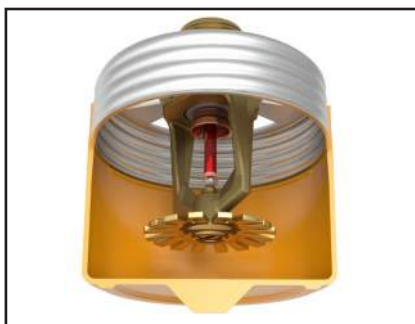
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CONCEALED COVER ASSEMBLIES ARE FRAGILE!
TO ASSURE SATISFACTORY PERFORMANCE OF THE PRODUCT, HANDLE WITH CARE.



Concealed Sprinkler and Adapter
 Assembly with Protective Cap



Concealed Sprinkler and Adapter
 Assembly (Protective Cap Removed)

Cover Plate Assembly
 (Pendent Cover 12381 shown)



GENERAL HANDLING AND STORAGE INSTRUCTIONS:

- Do not store in temperatures exceeding 100 °F (38 °C). Avoid direct sunlight and confined areas subject to heat.
- Protect sprinklers and cover assemblies during storage, transport, handling, and after installation.
 - Use original shipping containers.
 - Do not place sprinklers or cover assemblies loose in boxes, bins, or buckets.
- Keep the sprinkler bodies covered with the protective sprinkler cap any time the sprinklers are shipped or handled, during testing of the system, and while ceiling finish work is being completed.
- Use only the designated Viking recessed sprinkler wrench (refer to the appropriate sprinkler data page) to install these sprinklers. **NOTE:** The protective cap is temporarily removed during installation and then placed back on the sprinkler for protection until finish work is completed.
- Do not over-tighten the sprinklers into fittings during installation.
- Do not use the sprinkler deflector to start or thread the sprinklers into fittings during installation.
- Do not attempt to remove drywall, paint, etc., from the sprinklers.
- Remove the plastic protective cap from the sprinkler before attaching the cover plate assembly. **PROTECTIVE CAPS MUST BE REMOVED FROM SPRINKLERS BEFORE PLACING THE SYSTEM IN SERVICE!**

Refer to the appropriate current technical data pages for complete care, handling, and installation instructions. Data pages are included with each shipment from Viking or Viking distributors. They can also be found on the Web site at www.vikinggroupinc.com.



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Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

USE THE FOLLOWING PRECAUTIONS WHEN HANDLING WAX-COATED SPRINKLERS

Many of Viking's sprinklers are available with factory-applied wax coating for corrosion resistance. These sprinklers **MUST** receive appropriate care and handling to avoid damaging the wax coating and to assure satisfactory performance of the product.

General Handling and Storage of Wax-Coated Sprinklers:

- Store the sprinklers in a cool, dry place (in temperatures below the maximum ambient temperature allowed for the sprinkler temperature rating. Refer to Table 1 below.)
- Store containers of wax-coated sprinklers separate from other sprinklers.
- Protect the sprinklers during storage, transport, handling, and after installation.
- Use original shipping containers.
- Do not place sprinklers in loose boxes, bins, or buckets.

Installation of Wax-Coated Sprinklers:

Use only the special sprinkler head wrench designed for installing wax-coated Viking sprinklers (any other wrench may damage the unit).

- Take care not to crack the wax coating on the units.
- For touching up the wax coating after installation, wax is available from Viking in bar form. Refer to Table 1 below. The coating **MUST** be repaired after sprinkler installation to protect the corrosion-resistant properties of the sprinkler.
- Use care when locating sprinklers near fixtures that can generate heat. Do not install sprinklers where they would be exposed to temperatures exceeding the maximum recommended ambient temperature for the temperature rating used.
- Inspect the coated sprinklers frequently soon after installation to verify the integrity of the corrosion resistant coating. Thereafter, inspect representative samples of the coated sprinklers in accordance with NFPA 25. Close up visual inspections are necessary to determine whether the sprinklers are being affected by corrosive conditions.

TABLE 1

Sprinkler Temperature Rating (Fusing Point)	Wax Part Number	Wax Melting Point	Maximum Ambient Ceiling Temperature ¹	Wax Color
155 °F (68 °C) / 165 °F (74 °C)	02568A	148 °F (64 °C)	100 °F (38 °C)	Light Brown
175 °F (79 °C)	04146A	161 °F (71 °C)	150 °F (65 °C)	Brown
200 °F (93 °C)	04146A	161 °F (71 °C)	150 °F (65 °C)	Brown
220 °F (104 °C)	02569A	170 °F (76 °C)	150 °F (65 °C)	Dark Brown
286 °F (141 °C)	02569A	170 °F (76 °C)	150 °F (65 °C)	Dark Brown

¹ Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.



Never install sprinklers that have been dropped, damaged, or exposed to temperatures in excess of the maximum ambient temperature allowed.

Refer to the appropriate current technical data pages for complete care, handling, and installation instructions. Data pages are included with each shipment from Viking or Viking distributors. They can also be found on the Web site at www.vikinggroupinc.com.



TECHNICAL DATA

SPRINKLER OVERVIEW

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

Viking fire sprinklers consist of a threaded frame with a specific waterway or orifice size and a deflector for distributing water in a specified pattern. A closed or sealed sprinkler refers to a complete assembly, including the thermosensitive operating element. An open sprinkler does not use an operating element and is open at all times. The distribution of water is intended to extinguish a fire or to control its spread.

Viking sprinklers are available in several models and styles. Refer to specific sprinkler technical data pages for available styles, finishes, temperature ratings, thread sizes, and nominal K-Factors for the particular model selected.

2. LISTINGS AND APPROVALS

Refer to the Approval Charts on the appropriate sprinkler technical data page(s) and/or approval agency listings.



WARNING: Cancer and Reproductive Harm-
www.P65Warnings.ca.gov

3. TECHNICAL DATA

Pressure Ratings:

Maximum allowable water working pressure is 175 psig (12 Bar) unless rated and specified for high water working pressure [250 psig (17.2 bar)].

Sprinkler Identification:

Viking sprinklers are identified and marked with the word "Viking", the sprinkler identification number (SIN) consisting of "VK" plus a three digit number*, the model letter, and the year of manufacture.

Available Finishes:

Viking sprinklers are available in several decorative finishes. Some models are available with corrosion-resistant coatings or are fabricated from non-corrosive material. Refer to the sprinkler technical data page for additional information.

Available Temperature Ratings:

Viking sprinklers are available in several temperature ratings that relate to a specific temperature classification. Applicable installation rules mandate the use and limitations of each temperature classification. In selecting the appropriate temperature classification, the maximum expected ceiling temperature must be known. When there is doubt as to the maximum temperature at the sprinkler location, a maximum-reading thermometer should be used to determine the temperature under conditions that would show the highest readings to be expected. In addition, recognized installation rules may require a higher temperature classification, depending upon sprinkler location, occupancy classification, commodity classification, storage height, and other hazards. In all cases, the maximum expected ceiling temperature dictates the lowest allowable temperature classification. Sprinklers located immediately adjacent to a heat source may require a higher temperature rating.

K-Factors:

Viking sprinklers are available in several orifice sizes with related K-Factors. The orifice is a tapered waterway and, therefore, the K-Factor given is nominal. Nominal U.S. K-Factors are provided in accordance with the 1999 edition of NFPA 13, Section 3-2.3. Refer to the specific data page for appropriate K-Factor information.

Available Styles:

Viking sprinklers are available for installation in several positions as indicated by a stamping on the deflector. The deflector style dictates the appropriate installation position of the sprinkler; it breaks the solid stream of water issuing from the sprinkler orifice to form a specific spray pattern. The following list indicates the various styles and identification of Viking sprinklers.

UPRIGHT SPRINKLER: A sprinkler intended to be installed with the deflector above the frame so water flows upward through the orifice, striking the deflector and forming an umbrella-shaped spray pattern downward. Marked "SSU" (Standard Sprinkler Upright) or "UPRIGHT" on the deflector.

PENDENT SPRINKLER: A sprinkler intended to be oriented with the deflector below the frame so water flows downward through the orifice, striking the deflector and forming an umbrella-shaped spray pattern downward. Marked "SSP" (Standard Sprinkler Pendent) or "PENDENT" on the deflector.

CONVENTIONAL SPRINKLER: An "old style" sprinkler intended to be installed with the deflector in either the upright or pendent position. The deflector provides a spherical type pattern with 40 to 60 percent of the water initially directed downward and a proportion directed upward. Must be installed in accordance with installation rules for conventional or old style sprinklers. DO NOT USE AS A REPLACEMENT FOR STANDARD SPRAY SPRINKLERS. Marked "C U/P" (Conventional Upright/Pendent) on the deflector.

Viking Technical Data may be found on
The Viking Corporation's Web site at
<http://www.vikinggroupinc.com>.
The Web site may include a more recent
edition of this Technical Data Page.



TECHNICAL DATA

SPRINKLER OVERVIEW

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

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VERTICAL SIDEWALL (VSW) SPRINKLER: A sprinkler intended for installation near the wall and ceiling. The deflector provides a water spray pattern outward in a quarter-spherical pattern and can be installed in the upright or pendent position with the flow arrow in the direction of discharge. Marked "SIDEWALL" on the deflector with an arrow and the word "FLOW". (Note: Some vertical sidewall sprinklers can only be installed in the upright or pendent position—in this case, the sprinkler will also be marked "UPRIGHT" or "PENDENT".)

HORIZONTAL SIDEWALL (HSW) SPRINKLER: A sprinkler intended for installation near the wall and ceiling. The special deflector provides a water spray pattern outward in a quarter-spherical pattern. Most of the water is directed away from the nearby wall with a small portion directed at the wall behind the sprinkler. The top of the deflector is oriented parallel with the ceiling or roof. The flow arrows point in the direction of discharge. Marked "SIDEWALL" and "TOP" with an arrow and the word "FLOW".

EXTENDED COVERAGE (EC) SPRINKLER: A spray sprinkler designed to discharge water over an area having the maximum dimensions indicated in the individual listings. Maximum area of coverage, minimum flow rate, orifice size, and nominal K-Factor are specified in the individual listings. EC sprinklers are intended for Light-Hazard occupancies with smooth, flat, horizontal ceilings unless otherwise specified. In addition to the above markings, the sprinkler is marked "EC".

QUICK RESPONSE (QR) SPRINKLER: A spray sprinkler with a fast-actuating operating element. The use of quick response sprinklers may be limited due to occupancy and hazard. Refer to the Authority Having Jurisdiction (AHJ) prior to installing.

QUICK RESPONSE EXTENDED COVERAGE (QREC) SPRINKLER: A spray sprinkler designed to discharge water over an area having the maximum dimensions indicated in the individual listing. This is a sprinkler with an operating element that meets the criteria for quick response. QREC sprinklers are only intended for Light Hazard occupancies. The sprinkler is marked "QREC".

FLUSH SPRINKLER: A decorative spray sprinkler intended for installation with a concealed piping system. The unit is mounted flush with the ceiling or wall, with the fusible link exposed. Upon actuation, the deflector extends beyond the ceiling or wall to distribute water discharge. The sprinkler is marked "SSP", "PEND", or "SIDEWALL" and "TOP".

CONCEALED SPRINKLER: A decorative spray sprinkler intended for installation with a concealed piping system. The sprinkler is hidden from view by a cover plate installed flush with the ceiling or wall. During fire conditions, the cover plate detaches, and upon sprinkler actuation, the deflector extends beyond the ceiling or wall to distribute water discharge. The sprinkler is marked "SSP", "PEND", or "SIDEWALL" and "TOP".

RECESSED SPRINKLER: A spray sprinkler assembly intended for installation with a concealed piping system. The assembly consists of a sprinkler installed in a decorative adjustable recessed escutcheon that minimizes the protrusion of the sprinkler beyond the ceiling or wall without adversely affecting the sprinkler distribution or sensitivity. Refer to the appropriate technical data page for allowable sprinkler models, temperature ratings, and occupancy classifications. DO NOT RECESS ANY SPRINKLER NOT LISTED FOR USE WITH THE ESCUTCHEON.

CORROSION-RESISTANT SPRINKLER: A special service sprinkler with non-corrosive protective coatings, or that is fabricated from non-corrosive material, for use in atmospheres that would normally corrode sprinklers.

DRY SPRINKLER: A special-service sprinkler intended for installation on dry pipe systems or wet pipe systems where the sprinkler is subject to freezing temperatures. The unit consists of a sprinkler permanently secured to an extension nipple with a sealed inlet end to prevent water from entering the nipple until the sprinkler operates. The unit MUST be installed in a tee fitting. Dry upright sprinklers are marked with the "B" dimension [distance from the face of the fitting (tee) to the top of the deflector]. Dry pendent and sidewall sprinklers are marked with the "A" dimension [the distance from the face of fitting (tee) to the finished surface of the ceiling or wall].

LARGE DROP SPRINKLER: A type of special application sprinkler used to provide fire control of specific high-challenge fire hazards. Large drop sprinklers are designed to produce an umbrella-shaped spray pattern downward with a higher percentage of "large" water droplets than standard spray sprinklers. The sprinkler has an extra-large orifice with a nominal K-Factor of 11.2. Marked "HIGH CHALLENGE" and "UPRIGHT".

EARLY SUPPRESSION FAST-RESPONSE (ESFR) SPRINKLER: A sprinkler intended to provide fire suppression of specific high-challenge fire hazards through the use of a fast response fusible link, 14.0, 16.8, or 25.2 nominal K-Factor, and special deflector. ESFR sprinklers are designed to produce high-momentum water droplets in a hemispherical pattern below the deflector. This permits penetration of the fire plume and direct wetting of the burning fuel surface while cooling the atmosphere early in the development of a high-challenge fire. Marked "ESFR" and "UPRIGHT" or "PEND".

INTERMEDIATE LEVEL/RACK STORAGE SPRINKLER: A standard spray sprinkler assembly designed to protect its operating element from the spray of sprinklers installed at higher elevations. The assembly consists of a standard or large orifice upright or pendent sprinkler with an integral upright or pendent water shield and guard assembly. Use only those sprinklers that have been tested and listed for use with the assembly. Refer to the technical data page for allowable sprinkler models.

RESIDENTIAL SPRINKLER: A sprinkler intended for use in the following occupancies: one- and two-family dwellings with the fire protection sprinkler system installed in accordance with NFPA 13D; residential occupancies up to four stories in height with the fire protection system installed in accordance with NFPA 13R; and where allowed by the Authority Having Jurisdiction in residential portions of any occupancy with the fire protection system installed in accordance with NFPA 13.



TECHNICAL DATA

SPRINKLER OVERVIEW

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Residential sprinklers have a unique distribution pattern and utilize a “fast response” heat sensitive operating element. They enhance survivability in the room of fire origin and are designed to provide a life safety environment for a minimum of ten minutes. For this reason, residential sprinklers must not be used to replace standard sprinklers unless tested for and approved by the Authority Having Jurisdiction. In addition to standard markings, the unit is identified as “RESIDENTIAL SPRINKLER” or “RES”.

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

Refer to the appropriate sprinkler technical data page(s).

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking sprinklers are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers and the appropriate sprinkler general care, installation, and maintenance guide. Vikings sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable. The sprinkler technical data page may contain installation requirements specific for the sprinkler model selected. The use of certain types of sprinklers may be limited due to occupancy and hazard. Refer to the Authority Having Jurisdiction prior to installation.

**BULLETIN****REGULATORY AND HEALTH
WARNINGS**

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

Visit the Viking website for the latest edition of this technical data page www.vikinggroupinc.com

1. DESCRIPTION

Regulatory and Health Warnings applying to materials used in the manufacture and construction of fire protection products are provided herein as they relate to legally mandated jurisdictional regions.

⚠ WARNING**STATE OF CALIFORNIA, USA**

Installing or servicing fire protection products such as sprinklers, valves, piping etc. can expose you to chemicals including, but not limited to, lead, nickel, butadiene, titanium dioxide, chromium, carbon black, and acrylonitrile which are known to the State of California to cause cancer or birth defects or other reproductive harm.

For more information, go to www.P65Warnings.ca.gov

2. WARRANTY TERMS AND CONDITIONS

For details of warranty, refer to Viking's current list price schedule at www.vikinggroupinc.com or contact Viking directly.

Fig. 828 - Universal Sway Brace Attachment

Size Range — One size accommodates all TOLCO Fig. 900 Series sway brace attachments. Fits from 3/8" to 7/8" thick steel structure. For sizes less than 3/8" thick refer to Fig. 825 or Fig. 825A.

Material — Carbon Steel

Function — To attach sway bracing to various types of steel structural members.

Features — Permits secure non-friction connection without drilling or welding. Unique design allows offset placement on Wide flange beam, I-beam, C-channel, open web, welded steel trusses, etc... Secures brace to structure either across or along the beam. Break-off bolts allow for visual verification of proper installation torque.

Approvals — Underwriters Laboratories Listed in the USA (UL) and Canada (cUL). FM Approvals.

Installation Instructions — The Fig. 828 is the structural attachment component of a longitudinal or lateral sway brace assembly. It is intended to be combined with a TOLCO transitional attachment, "bracing pipe" and a TOLCO "braced pipe" attachment, to form a complete bracing assembly. NFPA 13 and/ or OSHPD guidelines should be followed.

To Install — Place the Fig. 828 on flange of the beam, truss or girder. Be sure the attachment is fully engaged to the rear of the opening. Tighten the cone point set bolts (A) until the heads break off. Tighten the cone point set bolt (B) until the head breaks off. Remove the flange nut from set bolt (B). Install a TOLCO swivel fitting (FG 909, 910, 980, 986). Use flange nut to secure the swivel fitting.

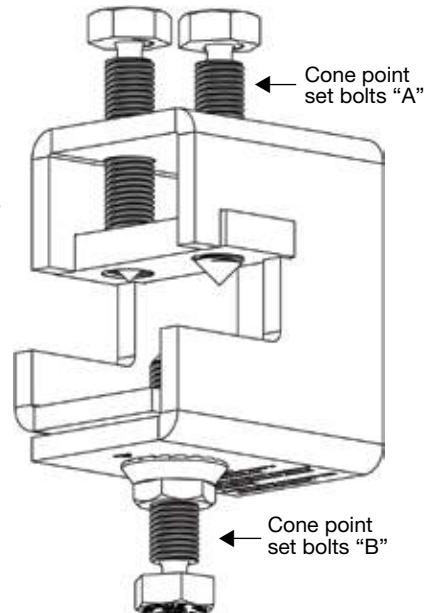
Finish — Plain and Electro-Galvanized

Order By — Figure number and finish

US Patent # 6,098,942

Canada Patent #2,286,659

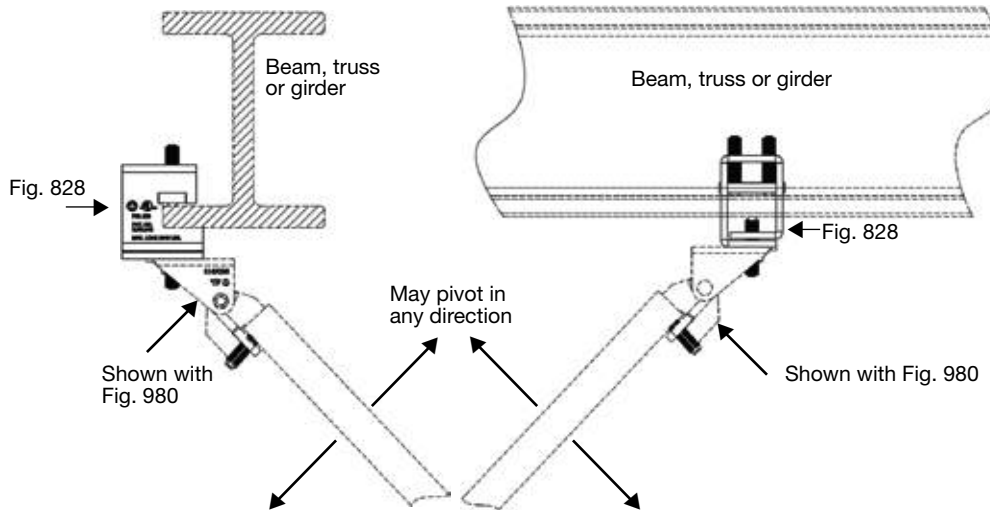
Patent Pending



UL Horizontal Design Load
Maximum Design Load across beam 2015 Lbs.
Maximum Design Load along beam 2015 Lbs.
Weight/100 284 Lbs.

FM Approved Allowable Horizontal Load*				
W/Brace Perpendicular to Beam				
Brace Angle (degrees from vertical)				
30-44	45-59	60-74	75-90	
1570	2220	1210	700	

FM Approved Allowable Horizontal Load*				
W/Brace Parallel to Beam				
Brace Angle (degrees from vertical)				
30-44	45-59	60-74	75-90	
690	970	1210	1330	



Actual design loads at brace angle shown. No need to reduce further based on brace angle per NFPA 13 (2010) Sec 9.3.5.10.3. In all cases, the allowable capacities shown within this section have been determined by resolving the load rating (i.e. the load resulting in failure or exceedence of the deformation limits) to the horizontal direction and dividing by a safety factor of 1.5 to allow the values to be used directly for Allowable Stress Design (ASD). For Load Resistance Factor Design (LRFD) capacities, the values in the table shall be multiplied by 1.5

Cooper B-Line, Inc.'s ("Cooper B-Line") seismic bracing components are designed to be compatible only with other Cooper B-Line bracing components, resulting in a listed seismic bracing assembly. Cooper B-Line's warranty for seismic bracing components will be the warranty provided in Cooper B-Line's standard terms and conditions of sale made available by Cooper B-Line, except that, in addition to the other exclusions from Cooper B-Line's warranty, Cooper B-Line makes no warranty relating to Cooper B-Line's seismic bracing components that are combined with products not provided by Cooper B-Line.

COOPER B-LINE 1375 Sampson Ave • Corona, CA 92879 • 800.786.5266 • FAX: 951.737.0330



City of Sierra Madre Library Redesign & IMPRVs

Structural Calculations



KPFF JOB # 2300079

June 28th , 2023



700 South Flower Street, Suite 2100
Los Angeles, CA 90017
(213) 418-0201

project Sierra Madre Library Redesign

by RM

sheet no.

location

date

client

job no.

Condensing unit Anchorage design

CONDENSING UNIT ANCHOARGE

Calculating Fp Force:

See excel printout(next page)

Wp = 960lbs (For CU-1)

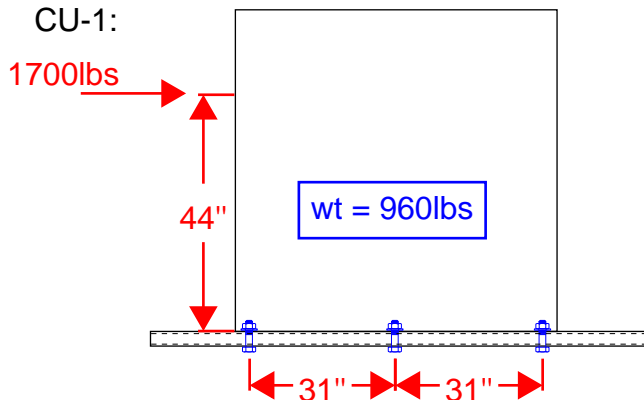
Wp = 790lbs (For CU-2)

Fp = 1.76Wp = 1.76*960lbs = 1689.6lbs (For CU-1)

Fp = 1.76Wp = 1.76*790lbs = 1390.4lbs (For CU-2)

Calculating Overturning forces:

CU-1:

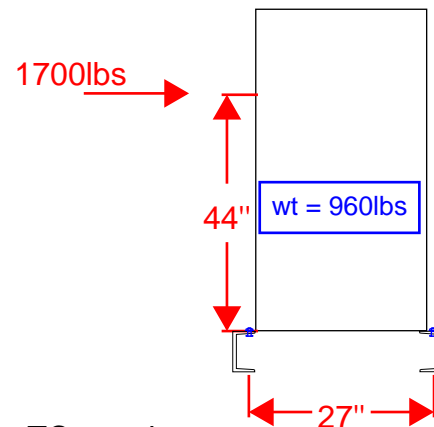


TC couple:

$$P = (1700\text{lbs} \cdot 44\text{in}) / (62\text{in}) = 1206.5\text{lbs}$$

$$1206.5\text{lbs} / 2\text{anchors EA side} =$$

$$603.25\text{lbs(EA anchor)}$$



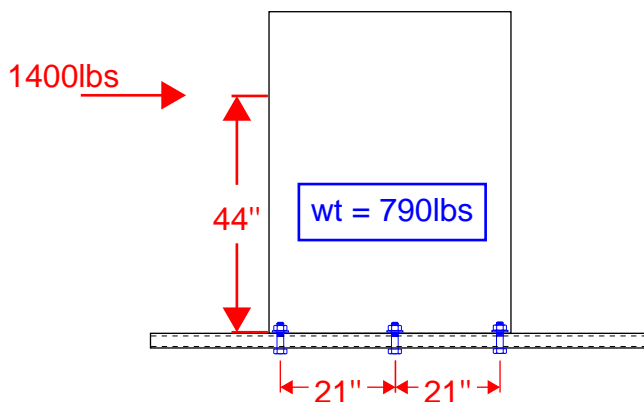
TC couple:

$$P = (1700\text{lbs} \cdot 44\text{in}) / (27\text{in}) = 2770.4\text{lbs}$$

$$2770.4\text{lbs} / 2\text{anchors EA side} =$$

$$1385.2\text{lbs(EA anchor)}$$

CU-2:

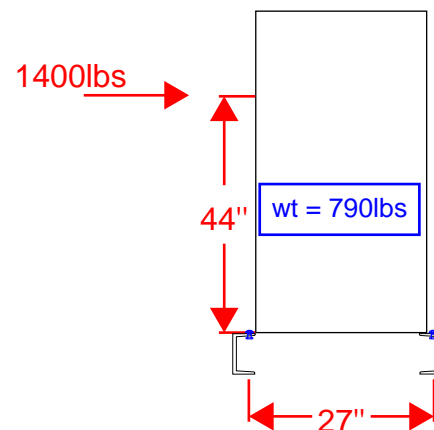


TC couple:

$$P = (1400\text{lbs} \cdot 44\text{in}) / (42\text{in}) = 1466.7\text{lbs}$$

$$1466.7\text{lbs} / 2\text{anchors EA side} =$$

$$733.35\text{lbs(EA anchor)}$$



TC couple:

$$P = (1400\text{lbs} \cdot 44\text{in}) / (27\text{in}) = 2281.5\text{lbs}$$

$$2281.5\text{lbs} / 2\text{anchors EA side} =$$

$$1140.75\text{lbs(EA anchor)}$$

Fp Force Calculations-Mechanical and Electrical Components

ASCE 7-16 Section 13.3, First Printing With Errata 1-3

A. OVERVIEW

A.1 This spreadsheet calculates the coefficient (Fp/Wp) to be multiplied by the weight of the component (Wp) in order to determine a component's horizontal seismic design force (Fp).

B. INPUT

- B.1 Determine Building height (h), and distance of floor from base (z), from building geometry.
B.2 Find S_{DS} (EQ 11.4-3) and determine the Component Importance Factor (I_p, Section 13.1.3)

C. EQUATIONS:

$$F_p/W_p = \frac{0.4 a_p S_{DS}}{(R_p / I_p)} (1+2z/h) \quad \text{EQ (13.3-1)}$$

$$F_p/W_p_{MAX} = 1.6 S_{DS} I_p \quad \text{EQ (13.3-2)}$$

$$F_p/W_p_{MIN} = 0.3 S_{DS} I_p \quad \text{EQ (13.3-3)}$$

Building Height (h) =	25 ft	Level		z	z/h
S _{DS} =	1.35	-		-	-
I _p =	1.5	R			0.00
		5			0.00
		4			0.00
		3			0.00
		2		20 ft	0.80
		1			0.00

ASCE 7-16 TABLE 13.6-1 SEISMIC COEFFICIENTS FOR MECHANICAL AND ELECTRICAL COMPONENTS				z/h						
				1	2	3	4	5	R	-
				0.00	0.80	0.00	0.00	0.00	0.00	-
MECHANICAL AND ELECTRICAL COMPONENTS				F _p /W _p						
	a _p	R _p	Ω _o							
Air-side HVAC, fans, air handlers, air conditioning units, cabinet heaters, air distribution boxes, and other mechanical components constructed of sheet metal framing.	2.5	6	2.00	0.61	0.88	0.61	0.61	0.61	0.61	-
Wet-side HVAC, boilers, furnaces, atmospheric tanks/bins, chillers, water equip., heaters, heat exchangers, evaporators, air separators, manufacturing or process and other mechanical components constructed of high-deformability materials.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Air Coolers (fin fans), air-cooled heat exchangers, condensing units, dry coolers, remote radiators and other mechanical components elevated on integral structural steel or sheet metal supports	2.5	3	1.50	0.68	1.76	0.68	0.68	0.68	0.68	-
Engines, turbines, pumps, compressors, and pressure vessels not supported on skirts and not within the scope of Chapter 15.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Skirt-supported pressure vessels not within the scope of Chapter 15.	2.5	2.5	2.00	0.81	2.11	0.81	0.81	0.81	0.81	-
Elevator and escalator components.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Generators, batteries, inverters, motors, transformers, and other electrical components constructed of high deformability materials.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Motor control centers, panel boards, switch gear, instrumentation cabinets, and other components constructed of sheet metal framing	2.5	6	2.00	0.61	0.88	0.61	0.61	0.61	0.61	-
Communication equipment, computers, instrumentation, and controls.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Roof-mounted chimneys, stacks, cooling and electrical towers laterally braced below their center of mass.	2.5	3	2.00	0.68	1.76	0.68	0.68	0.68	0.68	-
Roof-mounted chimneys, stacks, cooling and electrical towers laterally braced above their center of mass.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Lighting fixtures.	1.0	1.5	2.00	0.61	1.40	0.61	0.61	0.61	0.61	-
Other mechanical or electrical components.	1.0	1.5	2.00	0.61	1.40	0.61	0.61	0.61	0.61	-
VIBRATION ISOLATED COMPONENTS AND SYSTEMS										
Comp. and sys. isolated using neoprene elements and neoprene isolated floors w/built-in or separate elastomeric snubbing devices or resilient perimeter stops.	2.5	2.5	2.00	0.81	2.11	0.81	0.81	0.81	0.81	-
Spring isolated comp. and sys. and vibration isolated floors closely restrained using built-in/separate elastomeric snubb. devices or resilient perimeter stops.	2.5	2	2.00	1.01	2.63	1.01	1.01	1.01	1.01	-
Internally isolated components and systems.	2.5	2	2.00	1.01	2.63	1.01	1.01	1.01	1.01	-
Suspended vibration isolated equipment including in-line duct devices and suspended internally isolated components.	2.5	2.5	2.00	0.81	2.11	0.81	0.81	0.81	0.81	-
DISTRIBUTION SYSTEMS										
Piping in accordance with ASME B31 (2001,2002,2008, and 2010), including in-line components with joints made by welding or brazing.	2.5	12	2	0.61	0.61	0.61	0.61	0.61	0.61	-
Piping in accordance with ASME B31, including in-line components, constructed of high/limited deformability materials, w/ joints made by threading, bonding, compression couplings, or grooved couplings.	2.5	6	2	0.61	0.88	0.61	0.61	0.61	0.61	-



700 South Flower Street, Suite 2100
Los Angeles, CA 90017
(213) 418-0201

project Project Name

location Location

client Client

Sheet Description

by Name

date xx-xx-xx

job no.

10XXXX

sheet no.

SSK-XX

Bolt Strength check:

Over strength factor =1.5

CU-1(worst case):

Worst case loading on 1/2"Φ A325 Bolt

$A_b = .142\text{in}^2$

Tensile Load = $1.5 \times 1385.2\text{lbs} = 2002.8\text{lbs}$

Shear Load = $1700\text{lbs}/6\text{bolts} = 1.5 \times 283.3\text{lbs} = 424.95\text{lbs}$

Per AISC Steel Manual Bolt Strength:

Shear strength = $R_n = F_{nv} \cdot A_b = 54\text{ksi} \cdot .142\text{in}^2 = 7.67\text{kips}$ $7670\text{lbs} > 424.95\text{lbs}$ DCR = 0.055

Tensile strength = $R_n = F_{nt} \cdot A_b = 90\text{ksi} \cdot .142\text{in}^2 = 12.78\text{kips}$ $12,780\text{lbs} > 2002.8\text{lbs}$ DCR = 0.16

Total DCR = 0.215 OK



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C.2. SHEAR WALL DESIGN



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2300079

sheet no.

C.2.1

WALL DEMAND:

← modify this as needed

Base shear = 116kips

Story 1 Force= 116k

Story 2 Force= 82k

ASD Loads:

Demands = $116k/1.4 = 82.8k$

$82k/1.4 = 58.6k$

Per wall = $82.8k/2 = 41.4k$

$58.6k/2 = 29.3k$

Shear wall length required:

First level: $41400lbs/1922plf = 21.5ft$

Second level: $29300lbs/1922plf = 15.3ft$

TABLE 2 FROM ESR 0126:

TABLE 2 – NOMINAL AND ALLOWABLE SHEAR RESISTANCE TO WIND OR EARTHQUAKE FORCES AND DISPLACEMENT (inches) FOR SHEAR WALLS WITH SUREBOARD® SERIES 200W / SERIES 200B STRUCTURAL PANELS ATTACHED TO LIGHT GAGE STEEL C-STUDS AT 16" O.C. WITH NO. 10 SCREWS (pounds per foot) ^{1,10,11}

STEEL FRAMING	No. 10 SCREW SPACING AT PANEL EDGES AND FIELD 2/6, INCHES ON CENTER ⁶		
Minimum Gage ⁵	$V_n^{2,3,4,7}$ (plf)	$V_{asd}^{2,3,8}$ (plf)	ΔV_{asd}^9 (inch)
No. 18-Ga. (0.043 in.)	2,168	703	0.14
No. 16-Ga. (0.054 in.)	2,704	923	0.18
No. 14-Ga. (0.071 in.)	2,755	934	0.15
No. 14-Ga. (0.071 in.) 2 Sided	5,091	1,922	0.29

For SI: 1 inch = 25.4 mm, 1 plf = 0.0146 N/mm.

¹ These values are for short-term loads due to wind or earthquake.

² The screws as described in Section 4.2.2 and installed in accordance with Section 3.3.2.2 of IAPMO ES ER-126.

³ Tabulated values listed in tables are for panels applied to one side or two sides of a wall.

⁴ For load and resistance factor design (LRFD) loads, the tabulated V_n load values shall be multiplied by the resistance factor 0.60 for Seismic or 0.65 for Wind.

⁵ Section 4.3.1 in the evaluation report IAPMO ES ER-126, describes minimum base metal thickness associated with gages.

⁶ All panel edges shall be blocked. Panels are installed vertically or horizontally. Fasteners shall be spaced a maximum of 6 inches on center along intermediate framing members.

⁷ V_n = Nominal Strength.

⁸ V_{asd} = ASD Design Load.

⁹ ΔV_{asd} = Deflection at V_{asd} Design Load.

¹⁰ V_n and V_{asd} for walls with height-to-length ratios (h:b) greater than 2¼:1, but not exceeding 4:1 shall be computed in accordance with Section 3.2.1.4 of this report.

¹¹ Series 200B values are limited to Series 200 values.

USE (1) SIDED SUREBOARD FOR THE WALL BY EXISTING WALL

$41400LBS/934 = 44FT$

$29300LBS/934 = 31.4FT$



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WALL DEMAND:

Table is only applicable if $b > h/2.25$ per section 3.2.1.4 in IAPMO ER 0126

- For $h=12.67\text{ft}$, we need $b > 5.63\text{ft}$ to use table

If $h/4 < b < h/2.25$, calculate V per Section 3.2.1.4.
 $3.17\text{ft} < b < 5.63\text{ft}$

$V_{asd} = 1,922\text{lbs}$ ($2.25 \cdot 5.25\text{ft} / 12.67\text{ft}$)

$V_{asd} = 1,792\text{lbs}$

- For $h = 9.33\text{ft}$, we need $b > 4.14\text{ft}$ to use table

$2.33\text{ft} < b < 4.15\text{ft}$

$V_{asd} = 1,080\text{lbs}$

Summary:

Second level: $29300\text{lbs} / 1922\text{plf} = 15.3\text{ft}$

Second level: $29300\text{lbs} / 1792\text{plf} = 16.35\text{ft}$

$$V_n = V_{nt} (2.25b/h) \quad (\text{Eq. 3.2.1.4-1})$$

$$V_{asd} = V_{asdt} (2.25b/h) \quad (\text{Eq. 3.2.1.4-2})$$

Where:

V_{nt} = nominal shear value from the applicable table,
lb/ft (N/mm)

V_{asdt} = allowable stress design shear value from the
table, lb/ft (N/mm)

In no case shall the height-to-length ratio ($h:b$) for shear walls on wood framing exceed 4:1.

The maximum shear-wall height-to-width ratio (h/b) for shear walls on wood framing is $2\frac{1}{4}:1$.

TOTAL SHEAR LENGTH ON
2ND FLOOR IS 18FT ON
GRIDLINE 7, REDUCED
CAPACITY FOR THE 5'-3" IS OK
BY INSPECTION



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C.2.3

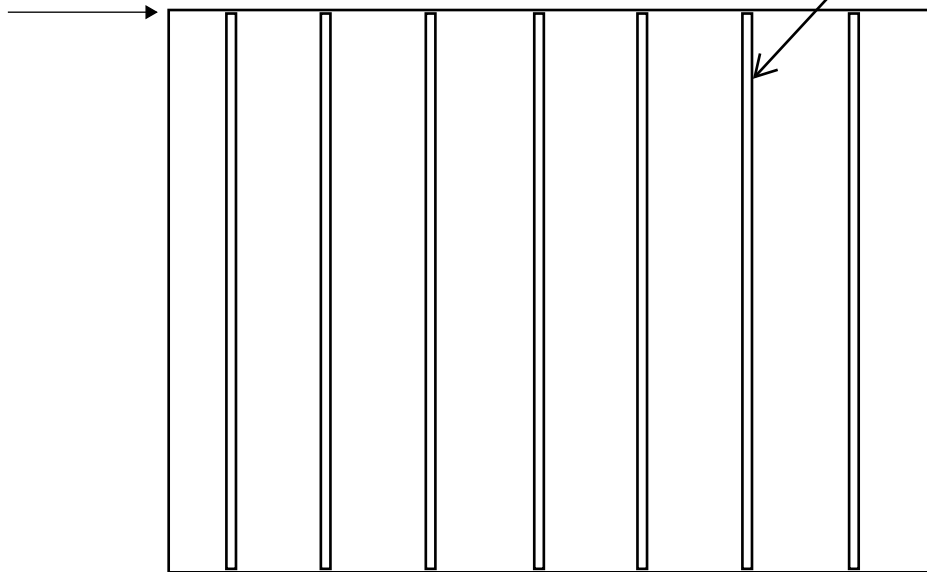
2300079

CFS DESIGN:

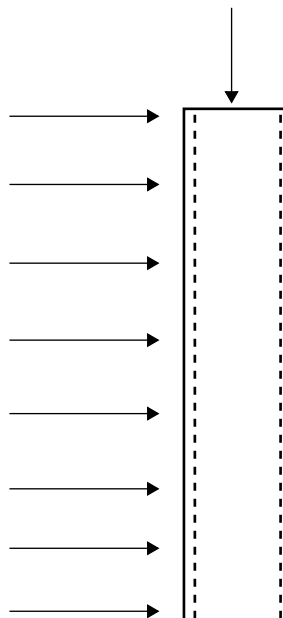
Using ASD Design:

Seismic load= 41.4k

in plane: 41.4k



out of plane:
(wind load)





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CFS DESIGN:

CHECK WALL STUD FOR WIND LOAD:

Using ASD Design:

Wind Load= 27.3psf

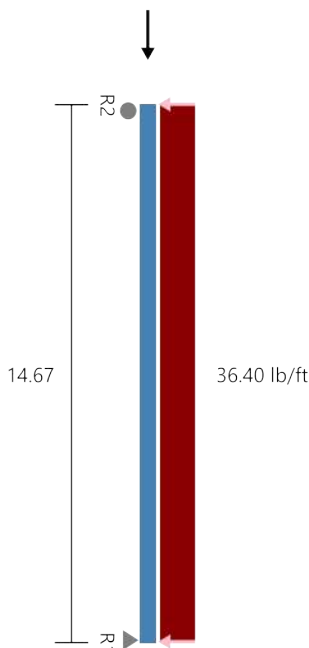
Exterior Wall weight= 48psf

Max height= 14.68ft

Per attached CFS Report,

DCR= 55.3

-> USE SECTION 600S162-68 @ 16" OC



Section : 600S137-68 (50 ksi) @ 16" o.c. Single C Stud (punched)

Maxo = 2570.2 ft-lb **Va =** 5350.3 lb **I =** 3.09 in⁴

Loads have not been modified for strength checks

Loads have been multiplied by 0.70 for deflection calculations

Bridging Connectors - Design Method =AISI S100

Span	Axial KyLy, KtLt	Flexural, Distortional	Connector	Stress Ratio
Span	Sheathed, Sheathed	Full, 176.0"	N/A	-

Web Crippling

Support	Load (lb)	Bearing (in)	Pa (lb)	M (ft-lbs)	Max Int.	Stiffener?
R2	267.0	1.00	914.4	0.0	0.15	NO
R1	267.0	1.00	914.4	0.0	0.15	NO

*** after support means punched near support

Gravity Load

Type	Load (lb)
Uniform	64.00plf

	Code Check	Required	Allowed	Interaction	Notes
Span	Max. Axial, lbs	938.9(c)	3777.8(c)	25%	KΦ=0.00 lb-in/in Max KL/r = 80
	Max. Shear, lbs	267.0	2878.9	9%	Shear (Punched)
	Max. Moment (MaFy, Ma-dist), ft-lbs	979.2	2407.8	41%	Ma-dist (control),KΦ=0.00 lb-in/in
	Moment Stability, ft-lbs	979.2	2570.2	38%	
	Shear/Moment	0.38	1.00	38%	Shear 0.0, Moment 979.2
	Axial/Moment	0.55	1.00	55%	Axial 567.1(c), Moment 936.8
	Deflection Span, in	0.291	--meets L/605--		

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie Connector	Connector Interaction	Anchor Interaction
R2	267.0	0.0	By Others & Anchorage Designed by Engineer	NA	NA
R1	267.0	938.9	By Others & Anchorage Designed by Engineer	NA	NA

* Reference catalog for connector and anchor requirement notes as well as screw placement requirements



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Diaphragm to SW Connection:

N/S direction (deck is perpendicular)

Diaphragm uniform shear is $0.7 \cdot v_x = 0.7 \cdot 0.436 \text{klf} = 305.2 \text{plf}$

Drag_y = 64,92k

DCR = $64.92/63.6 = 1.02$ NOT OK

E/W direction (deck is parallel)

Diaphragm uniform shear is $0.7 \cdot v_y = 0.7 \cdot 1.323 \text{klf} = 926.1 \text{plf}$

Drag_x = 32.41k

DCR = 0.89 OK

if we increase
spacing to 3", we will
have 84.8kip in
parallel, and 48.4kip
in perpendicular

Shear Stud Capacity (AISC 360 Table 3-21)

3/4" x 3" studs at 4" OC

$w_r =$ 5 in

$h_r =$ 2 in

Spacing = 0.33333333 ft

$w_r/h_r =$ 2.5

4000psi

Stud Capacity [kip]			Adjusted Stud Capacity based on Spacing [kip]		
Deck	Type		Deck	Type	
	LWC	NWC		LWC	NWC
Parallel	21.2	21.5	Parallel	63.6	64.5
Perpendicular	12.1	12.1	Perpendicular	36.3	36.3



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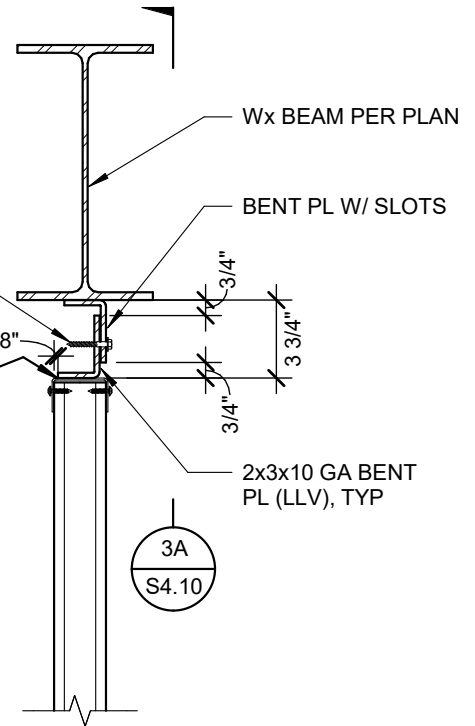
CFS DESIGN:

TOP CONNECTIONS:

1/4-28 x 3" BUILDEX TEK/S
@ 3" OC (ICC ESR 1976).
SCREW HEAD SHALL BE
ON SLOTTED SIDE.

EA SIDE,
TYP @ BP

1/8" 1 1/2 - 3



Worst Condition on Level 0:

$$0.7 * v_{wall} = 0.7 * 1.864 \text{ klf} = 1.3 \text{ klf}$$

Worst Condition on Level 1:

$$0.7 * v_{wall} * L_{max} = 0.7 * 2.469 \text{ klf} = 1.73 \text{ klf}$$

Bent Plate is OK per inspection

Check 1/4 - 28 TEK Screws:

$$\text{On level 0: } 1.3 \text{ klf} * (3"/12") = 0.325 \text{ k}$$

$$\text{On level 1: } 1.73 \text{ klf} * (3"/12") = 0.433 \text{ k}$$

Shear Capacity= 1266lbs (per Table 4 in ESR 1976)

DCR= 0.34 OK

Check weld on both sides:

d= 3" and b= 24" (assuming bent plate is 2ft long)

V= 5k

1/8" fillet weld is OK

	L =	2d	=	6.00	(in)	Rp =	P/L =	0.83	(k/in)
	S =	d ² /3	=	3.00	(in ²)	Rv =	V/L =	0.83	(k/in)
	I _p =	d(3b ² + d ²)/6	=	868.50	(in ³)	Rm =	M/S =	0.00	(k/in)
	r _{max} =	Max Distance to Centroid	=	12.09	(in)	Rt =	T*r _{max} /I _p =	0.00	(k/in)
						Rw =	(Rv ² + (Rp + Rm) ² + Rt ²) ^{1/2} =	1.18	(k/in)
						D =	Rw/1.392 =	1/16	(in)
						(E) =	Rw/1.969 =	(1/16)	(in)

TOP CONNECTIONS:

TABLE 2—ALLOWABLE TENSILE PULL-OUT LOADS (P_{NOT}/Ω), pounds-force^{1, 2, 3, 4, 5}

Steel $F_u = 45$ ksi, Applied Factor of Safety, $\Omega=3.0$												
Screw Designation	Nominal Diameter (in.)	Design Thickness of Member Not in Contact with the Screw Head (in)										
		0.018	0.024	0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250
10-16	0.190	44	58	73	87	116	145	182	254	303	⁶	⁶
12-14, 12-24	0.216	50	66	83	99	132	165	207	289	344	515	689
¹ / ₄ -14, ¹ / ₄ -28	0.250	57	77	96	115	153	191	239	335	398	596	797

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa.

¹For tension connections, the least of the allowable pull-out, pullover, and fastener tension strength found in Tables 2, 3, and 5, respectively, must be used for design.

²ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.

³The allowable pull-out capacity for other member thickness can be determined by interpolating within the table.

⁴To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

⁵For $F_u = 58$ ksi, multiply values by 1.29; for $F_u = 65$ ksi, multiply values by 1.44.

⁶Outside drilling capacity limits.

TABLE 4—ALLOWABLE SHEAR (BEARING) CAPACITY (P_{NS}/Ω), pounds-force^{1, 2, 3, 4, 5}

Steel $F_u = 45$ ksi, Applied Factor of Safety, $\Omega=3.0$													
Screw Designation	Nominal Diameter (in.)	Design Thickness of Member Not in Contact with the Screw Head (in)	Design Thickness of Member in Contact with the Screw Head (in)										
			0.018	0.024	0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250
10-16	0.190	0.018	66	66	66	66	66	66	66	66	66	---	---
		0.024	102	102	102	102	102	102	102	102	102	---	---
		0.030	111	143	143	143	143	143	143	143	143	---	---
		0.036	120	152	185	188	188	188	188	188	188	---	---
		0.048	139	168	199	228	289	289	289	289	289	---	---
		0.060	139	185	213	239	327	404	404	404	404	---	---
		0.075	139	185	231	251	337	427	564	564	564	---	---
		0.105	139	185	231	277	356	436	570	808	808	---	---
12-14 12-24	0.216	0.125	139	185	231	277	369	442	571	808	962	---	---
		0.018	71	71	71	71	71	71	71	71	71	71	71
		0.024	109	109	109	109	109	109	109	109	109	109	109
		0.030	125	152	152	152	152	152	152	152	152	152	152
		0.036	136	170	205	200	200	200	200	200	200	200	200
		0.048	157	190	223	253	308	308	308	308	308	308	308
		0.060	157	210	240	266	362	430	430	430	430	430	430
		0.075	157	210	262	282	375	468	601	601	601	601	601
		0.105	157	210	262	315	402	483	624	919	919	919	919
		0.125	157	210	262	315	420	494	629	919	1094	1094	1094
¹ / ₄ -14 ¹ / ₄ -28	0.250	0.187	157	210	262	315	420	525	642	919	1094	1636	1636
		0.250	157	210	262	315	420	525	656	919	1094	1636	2187
		0.018	76	76	76	76	76	76	76	76	76	76	76
		0.024	117	117	117	117	117	117	117	117	117	117	117
		0.030	142	164	164	164	164	164	164	164	164	164	164
		0.036	156	193	215	215	215	215	215	215	215	215	215
		0.048	182	218	253	283	331	331	331	331	331	331	331
		0.060	182	243	276	300	406	463	463	463	463	463	463
		0.075	182	243	304	322	424	521	647	647	647	647	647
		0.105	182	243	304	365	461	544	694	1063	1063	1063	1063
		0.125	182	243	304	365	486	560	703	1063	1266	1266	1266
		0.187	182	243	304	365	486	608	731	1063	1266	1893	1893
		0.250	182	243	304	365	486	608	759	1063	1266	1893	2531

For **SI**: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa.

¹The lower of the allowable shear (bearing) and the allowable fastener shear strength found in Tables 4 and 5, respectively, must be used for design.

²ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.

³The allowable bearing capacity for other member thickness can be determined by interpolating within the table.

⁴To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

⁵For $F_u = 58$ ksi, multiply values by 1.29; for $F_u = 65$ ksi, multiply values by 1.44.



EVALUATION REPORT

Number: 124

Originally Issued: 06/25/2010

Revised: 09/12/2023

Valid Through: 06/30/2024

TABLE 1A – TENSION LOADS AND DISPLACEMENTS FOR S/HDS AND S/HDB SERIES HOLD-DOWNS

Model	Height (in)	Fasteners		Framing Member(s) ⁵ No.-Mil (ga)	ASD		LRFD		Nominal Tension Load ^{8,9} (lbs)
		Anchor Bolt Dia. ^{1,2} (in)	Framing Fasteners		Tension Load (lbs)	Displacement at ASD Load ⁷ (in)	Tension Load (lbs)	Displacement at LRFD Load ⁷ (in)	
S/HD8S	11	7/8	17 - #14 Screws ³	2-33 (2-20ga)	7335	0.120	11715	0.204	13720
				2-43 (2-18ga)	8750	0.086	13975	0.146	21435
				2-54 (2-16ga)	8855	0.106	14145	0.162	21700
				1-97 (1-12ga) PACO ⁶	11030	0.091	17620	0.146	27025
				Steel Fixture	10840	0.053	17335	0.072	32525
S/HD10S	13½	7/8	22 - #14 Screws ³	2-33 (2-20ga)	7400	0.122	11815	0.192	13835
				2-43 (2-18ga)	11120	0.112	17755	0.124	20795
				2-54 (2-16ga)	12220	0.096	19520	0.145	29940
				1-97 (1-12ga) PACO ⁶	14840	0.085	23705	0.148	34135
				Steel Fixture	12375	0.043	19820	0.061	33535
S/HD15S	17	1	30 - #14 Screws ³	2-43 (2-18ga)	12110	0.096	19340	0.164	22645
				2-54 (2-16ga)	13500	0.110	21565	0.130	33075
				1-97 (1-12ga) PACO ⁶	16420	0.078	26230	0.135	40230
				Steel Fixture	15810	0.043	25320	0.065	42845
S/HD8B	11	7/8	2 - ¾" Dia. Bolts ⁴	2-33 (2-20ga)	3895	0.081	5620	0.144	8645
				2-43 (2-18ga)	5345	0.098	7710	0.146	11865
				2-54 (2-16ga)	8950	0.082	14280	0.141	20310
				1-97 (1-12ga) PACO ⁶	8090	0.088	12905	0.167	18370
				Steel Fixture	9080	0.069	14545	0.104	22975
S/HD10B	13½	7/8	3 - ¾" Dia. Bolts ⁴	2-33 (2-20ga)	5840	0.070	8430	0.124	12970
				2-43 (2-18ga)	8015	0.087	11565	0.120	17795
				2-54 (2-16ga)	12090	0.125	19720	0.230	28050
				1-97 (1-12ga) PACO ⁶	13385	0.912	19355	0.119	28905
				Steel Fixture	15635	0.102	24955	0.123	35495
S/HD15B	17	1	4 - ¾" Dia. Bolts ⁴	2-43 (2-18ga)	10690	0.118	15425	0.179	22165
				2-54 (2-16ga)	16020	0.090	25565	0.121	36360
				1-97 (1-12ga) PACO ⁶	17850	0.103	25805	0.130	39700
				Steel Fixture	18690	0.104	29825	0.139	42425

For SI: 1 inch = 25.4 mm, 1 lb = 4.45 N.

- The Designer shall specify the foundation anchor material type, embedment, and configuration. Some of the tabulated hold-down tension loads exceed the tensile strength of typical [ASTM F1554](#) Grade 36 or [A307](#) anchor bolts.
- A foundation anchor bolt washer is not required.
- 1/4-inch diameter self-tapping screws may be substituted for #14 self-tapping screws.
- A round steel standard plate washer conforming to Section [3.1.1](#) of this report is required to be installed between the framing member bolt nut and the framing member for the S/HDB series hold-downs.
- The Designer shall specify and detail the connection of the back-to-back full-height framing members.
- PACO columns are manufactured by PACO Steel & Engineering Corp. Recognition of the column is beyond the scope of this report.
- Hold-down displacement at tabulated ASD and LRFD loads is the difference in the displacement measured between the anchor bolt and back of the hold-down that's attached to the framing member(s) when loaded to the ASD and LRFD static test load, respectively. Deflection includes fastener slip, hold-down elongation, and anchor bolt elongation (L=4 inches).
- The Nominal Tension Load is the average ultimate (peak) load taken from tests in accordance with [AISI S100](#) Chapter F. When hold-downs are used in CFS framed shear walls or diagonal strap braced walls with an R-coefficient greater than 3, the [AISI S213](#) Lateral Design Section C5 requires hold-downs in shear walls have the nominal strength to resist the lesser of the amplified seismic load or the load the system can deliver and hold-downs in diagonal strap braced walls have the nominal strength to resist the lesser of the amplified seismic load or the expected yield strength of the diagonal strap bracing member.
- When used in lateral force-resisting systems, hold-downs shall be designed for the expected strength of designated seismic force-resisting systems as specified in Section B3 and Chapter E of [AISI S400](#).

NOTE: THE PRINTOUTS BELOW ARE USING S/HDU11-54, HOWEVER S/HD15S HAS MORE CAPACITY THEREFORE THE DESIGN STILL WORKS.

Project Name: shear wall

Model: Shear wall Level 0 - 37ft

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

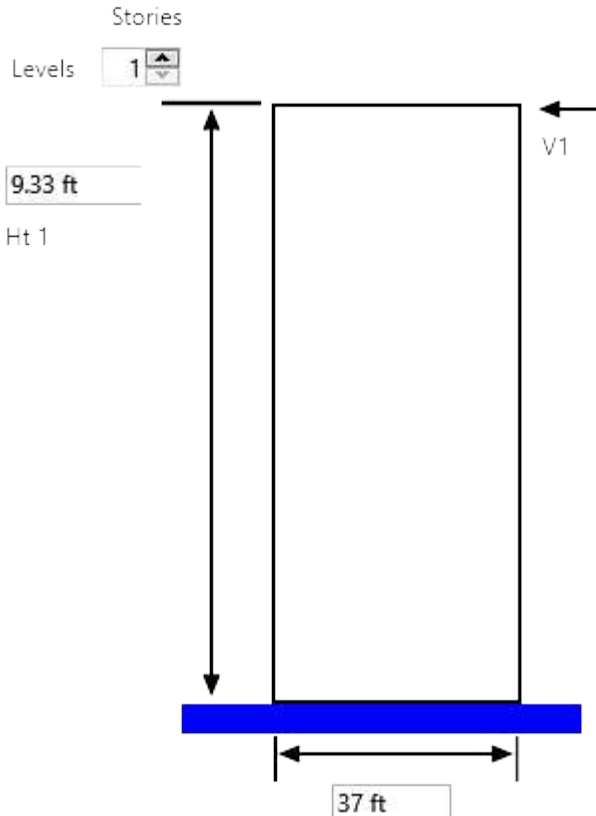
STUDS SIZE
CHANGE TO 6"

C.2.10

Date: 02/12/2024

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report



Load Inputs (All Loads are Unfactored Forces)

Top of Level Shear (lb)

Level	Wind	Seismic	Aspect Ratio
1	10000	18500	0.25

Seismic Design Parameters:

Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? No

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	162.	12950	350

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification Factors

Wind

Seismic

Project Name: shear wall

Model: Shear wall Level 0 - 37ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.084	1	1922	0.182

Chords

					<u>Bracing (in)</u>				
Level	Section	F_y (ksi)	Configuration	Flexural	Axial $K_y L_y$	Axial $K_t L_t$	Flex $K\phi$ (lb-in/in)	Axial $K\phi$ (lb-in/in)	Bracing, L_m (in)
1	600S250-68	50	(2) Boxed	None	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7Ω_oQ_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525Ω_oQ_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	3288	2466	9863	7397

Factored Chord Strong-Axis Bending, M_x (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum		Interactions						
Level	M _a (ft-lb)	P _a (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	6915	23349	0	0	0	0	0.141	0.106	0.422	0.317

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 0 - 37ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - 54	2	Base	4	7665	12265	0.109	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14Sds)D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-1523	-3288	-9863	6000	12950	38850

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.099	0.214	0.643

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement

Floor-Floor				Drift %		
Relative Displacement (in)						
Level	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0	0.01	0.04	0	0.01	0.04

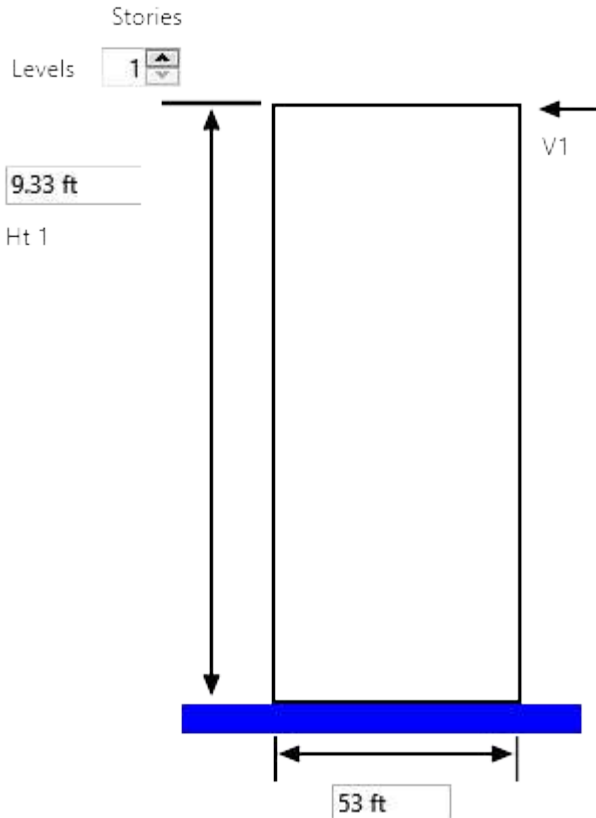
Project Name: shear wall

Model: Shear wall Level 0 - 53ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	26500	0.18

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? No

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	113.	18550	350

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification FactorsWindSeismic

Project Name: shear wall

Model: Shear wall Level 0 - 53ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.059	1	1922	0.182

Chords

					<u>Bracing (in)</u>				
Level	Section	F_y (ksi)	Configuration	Flexural	Axial $K_y L_y$	Axial $K_t L_t$	Flex $K\phi$ (lb-in/in)	Axial $K\phi$ (lb-in/in)	Bracing, L_m (in)
1	600S250-68	50	(2) Boxed	None	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7Ω_oQ_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525Ω_oQ_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	3281	2461	9843	7382

Factored Chord Strong-Axis Bending, M_x (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum		Interactions						
Level	M _a (ft-lb)	P _a (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	6915	23349	0	0	0	0	0.141	0.105	0.422	0.316

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 0 - 53ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - 54	2	Base	4	7665	12265	0.109	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14Sds)D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-1061	-3281	-9843	6000	18550	55650

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.069	0.214	0.642

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement

Floor-Floor				Drift %		
Relative Displacement (in)						
Level	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0	0.01	0.03	0	0.01	0.03

Project Name: shear wall

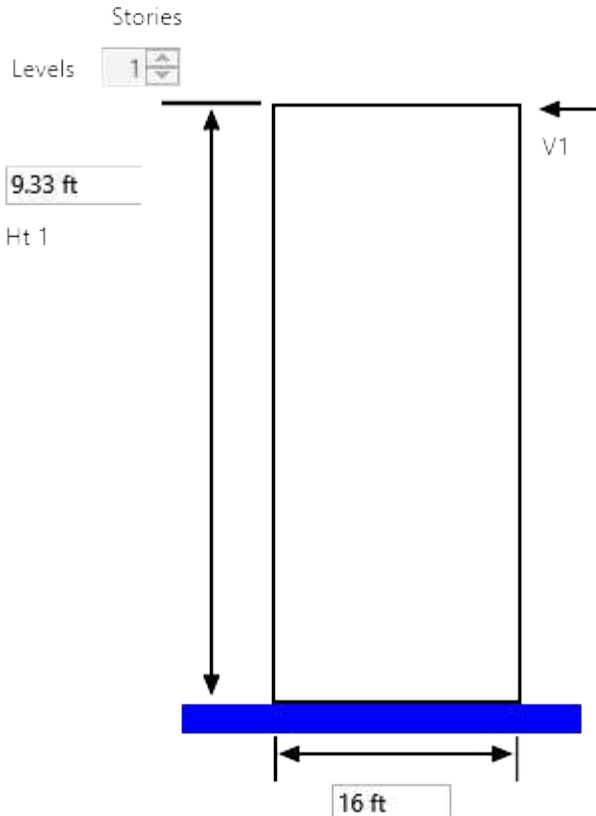
C.2.16

Model: Shear wall Level 0 - 16ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	41000	0.58

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? No

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	375	28700	1793.75

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification FactorsWindSeismic

Project Name: shear wall

Model: Shear wall Level 0 - 16ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.195	1	1922	0.933

Chords

				<u>Bracing (in)</u>					
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	800S250-68	50	(4) Configuration 2	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7 Ω_o Q_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525 Ω_o Q_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	17001	12751	51004	38253

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

<u>Minimum</u>		<u>Minimum</u>	<u>Interactions</u>							
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	20552	51132	0	0	0	0	0.332	0.249	0.997	0.748

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 0 - 16ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14S_{ds})D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-3554	-17001	-51004	6000	28700	53626

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.184	0.879	2.636

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Level	Relative Displacement (in)			Drift %		
	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.03	0.23	0.92	0.02	0.2	0.82

Project Name: shear wall

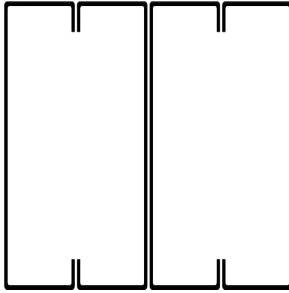
Model: Shear wall Level 0 - 16ft

Date: 02/12/2024

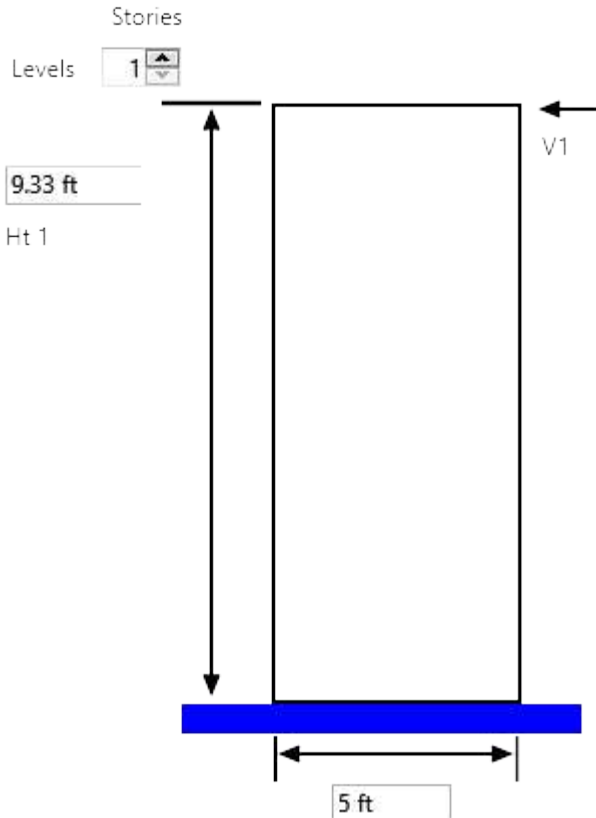
Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

(3) and (4) Chord Configuration Schematics



(4) Configuration 2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	9000	1.87

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? No

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	1200	6300	1260

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification Factors**Wind****Seismic**

Project Name: shear wall

Model: Shear wall Level 0 - 5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.624	1	1922	0.656

Chords

					<u>Bracing (in)</u>				
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	800S250-68	50	(4) Configuration 2	None	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7 Ω_o Q_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525 Ω_o Q_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	12375	9281	37124	27843

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

<u>Minimum</u>		<u>Minimum</u>	<u>Interactions</u>							
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	20552	51132	0	0	0	0	0.242	0.182	0.726	0.545

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 0 - 5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - 54	2	Base	4	7665	12265	0.109	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14S_d)D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-11785	-12375	-37124	6000	6300	16758

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.769	0.807	2.422

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Level	Relative Displacement (in)			Drift %		
	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.34	0.29	1.15	0.3	0.26	1.03

Project Name: shear wall

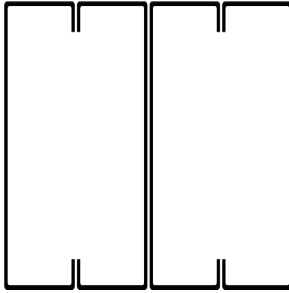
Model: Shear wall Level 0 - 5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

(3) and (4) Chord Configuration Schematics



(4) Configuration 2

Project Name: shear wall

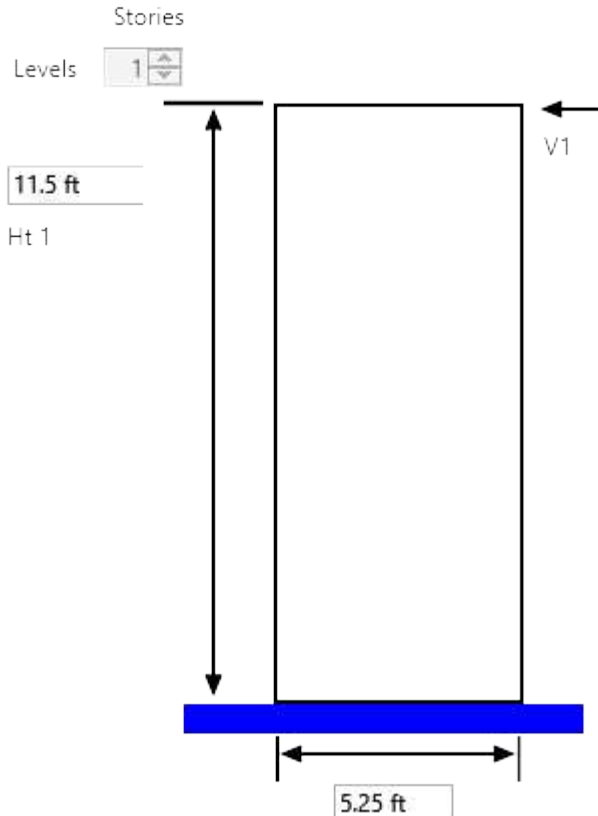
C.2.24

Model: Shear wall Level 1 - 5.25ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	11445	2.19

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? Yes

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	1142.	8011.5	1526

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification Factors**Wind****Seismic**

Project Name: shear wall

Model: Shear wall Level 1 - 5.25ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.595	1	1922	0.794

Chords

				<u>Bracing (in)</u>					
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	800S250-68	50	(4) Configuration 2	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7 Ω_o Q_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525 Ω_o Q_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	18426	13820	55279	41460

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum	Interactions							
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	20552	49928	0	0	0	0	0.369	0.277	0.923	0.692

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 1 - 5.25ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)

LC7 = 0.6D + 0.6W

LC8 = 0.6D + 0.7E

LCO8 = (0.6-0.14S_{ds})D + 0.7 Ω_o Q_e Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-13800	-18426	-55279	6000	8011	17596

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.713	0.952	2.381

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement

Floor-Floor				Drift %		
Level	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.45	0.55	2.18	0.33	0.4	1.58

Project Name: shear wall

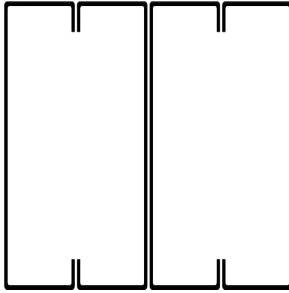
Model: Shear wall Level 1 - 5.25ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

(3) and (4) Chord Configuration Schematics



(4) Configuration 2

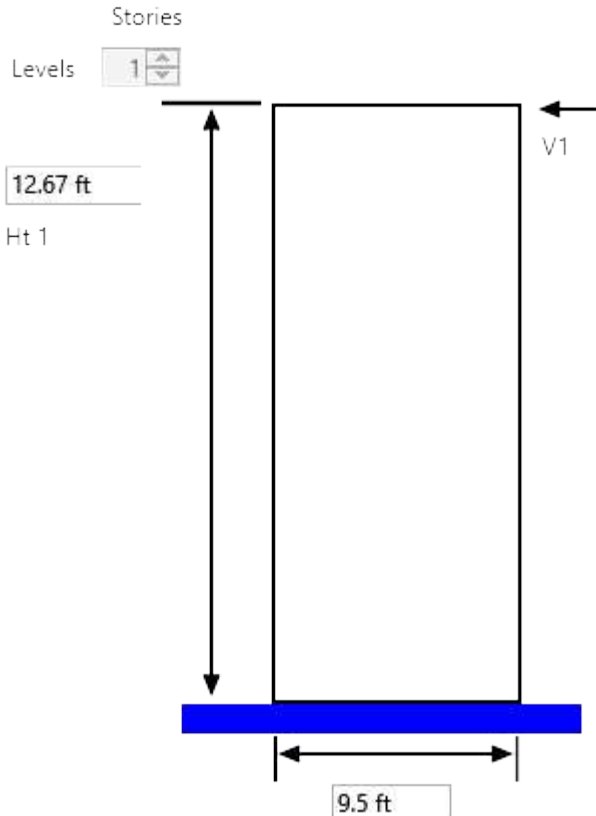
Project Name: shear wall

Model: Shear wall Level 1 - 9.5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	19000	1.33

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? Yes

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	631.	13300	1400

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification FactorsWindSeismic

Project Name: shear wall

Model: Shear wall Level 1 - 9.5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.329	1	1922	0.728

Chords

					<u>Bracing (in)</u>				
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	800S250-68	50	(4) Configuration 2	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14Sds)D + 0.7 Ω_o QeLCO6 = (1.0 + 0.105 Sds)D + 0.525 Ω_o Qe + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	18217	13663	54652	40989

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

<u>Minimum</u>		<u>Minimum</u>	<u>Interactions</u>							
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	20552	49120	0	0	0	0	0.371	0.278	0.927	0.695

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 1 - 9.5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)

LC7 = 0.6D + 0.6W

LC8 = 0.6D + 0.7E

LCO8 = (0.6-0.14S_{ds})D + 0.7 Ω_o Q_e Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-8218	-18217	-54652	6000	13300	31840

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.425	0.941	2.354

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Level	Relative Displacement (in)			Drift %		
	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.14	0.34	1.35	0.09	0.22	0.89

Project Name: shear wall

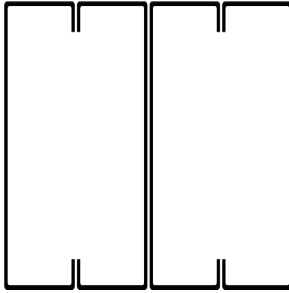
Model: Shear wall Level 1 - 9.5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

(3) and (4) Chord Configuration Schematics



(4) Configuration 2

Project Name: shear wall

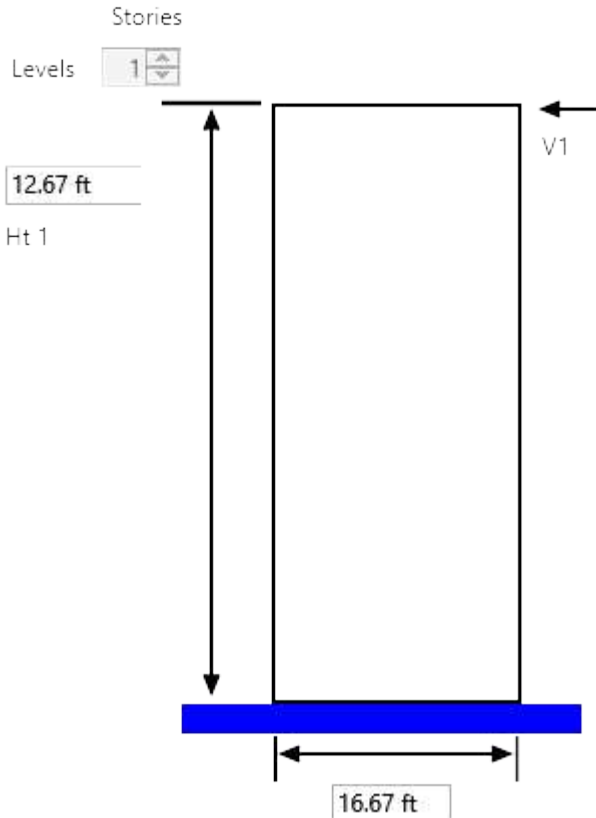
C.2.32

Model: Shear wall - Level 1 - 16.67ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	33340	0.76

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? Yes

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	359.	23338	1400

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification Factors**Wind****Seismic**

Project Name: shear wall

Model: Shear wall Level 1 - 16.67ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.187	1	1922	0.728

Chords

				<u>Bracing (in)</u>					
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	800S250-68	50	(4) Configuration 2	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7 Ω_o Q_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525 Ω_o Q_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	18008	13506	54024	40518

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum	Interactions							
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	20552	49120	0	0	0	0	0.367	0.275	0.917	0.687

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 1 - 16.67ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)

LC7 = 0.6D + 0.6W

LC8 = 0.6D + 0.7E

LCO8 = (0.6-0.14S_{ds})D + 0.7 Ω_o Q_e Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-4630	-18008	-54024	6000	23338	55871

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.239	0.931	2.327

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Level	Relative Displacement (in)			Drift %		
	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.04	0.21	0.86	0.03	0.14	0.56

Project Name: shear wall

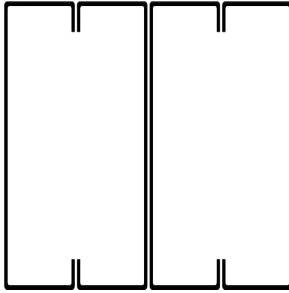
Model: Shear wall Level 1 - 16.67ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

(3) and (4) Chord Configuration Schematics



(4) Configuration 2

Project Name: shear wall

STUDS SIZE
CHANGE TO 6"

C.2.36

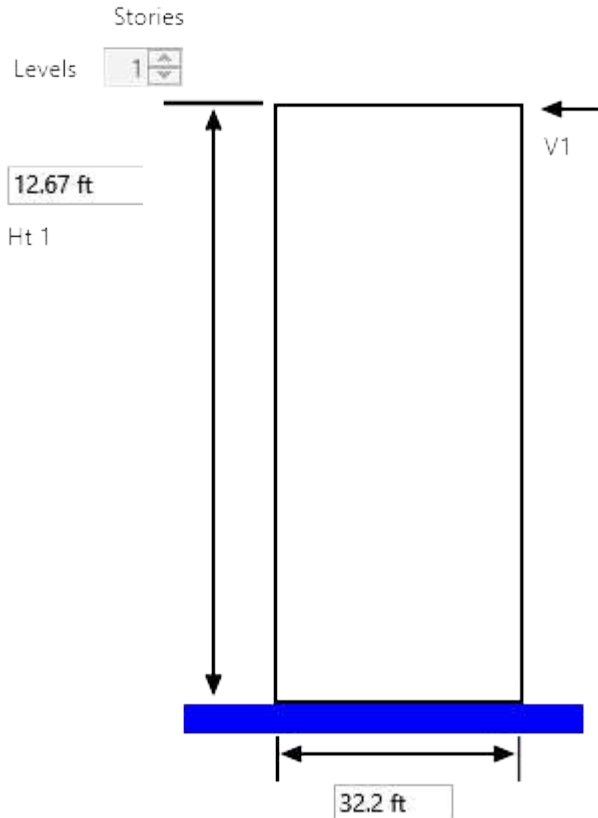
Model: Shear wall Level 1 - 32.2ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report



Load Inputs (All Loads are Unfactored Forces)

Top of Level Shear (lb)

Level	Wind	Seismic	Aspect Ratio
1	10000	16100	0.39

Seismic Design Parameters:

Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? Yes

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	186.	11270	350

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification Factors

Wind

Seismic

Project Name: shear wall

Model: Shear wall Level 1 - 32.2ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.097	1	1922	0.182

Chords

					<u>Bracing (in)</u>				
Level	Section	F_y (ksi)	Configuration	Flexural	Axial $K_y L_y$	Axial $K_t L_t$	Flex $K\phi$ (lb-in/in)	Axial $K\phi$ (lb-in/in)	Bracing, L_m (in)
1	600S250-68	50	(2) Boxed	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7Ω_oQ_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525Ω_oQ_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	4469	3352	13408	10056

Factored Chord Strong-Axis Bending, M_x (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum		Interactions						
Level	M _a (ft-lb)	P _a (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	6915	20362	0	0	0	0	0.219	0.165	0.549	0.412

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 1 - 32.2ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14S_{ds})D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-2379	-4469	-13408	6000	11270	33810

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.123	0.231	0.577

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Relative Displacement (in)				Drift %		
Level	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.01	0.02	0.09	0.01	0.01	0.06

Project Name: shear wall

STUDS SIZE
CHANGE TO 6"

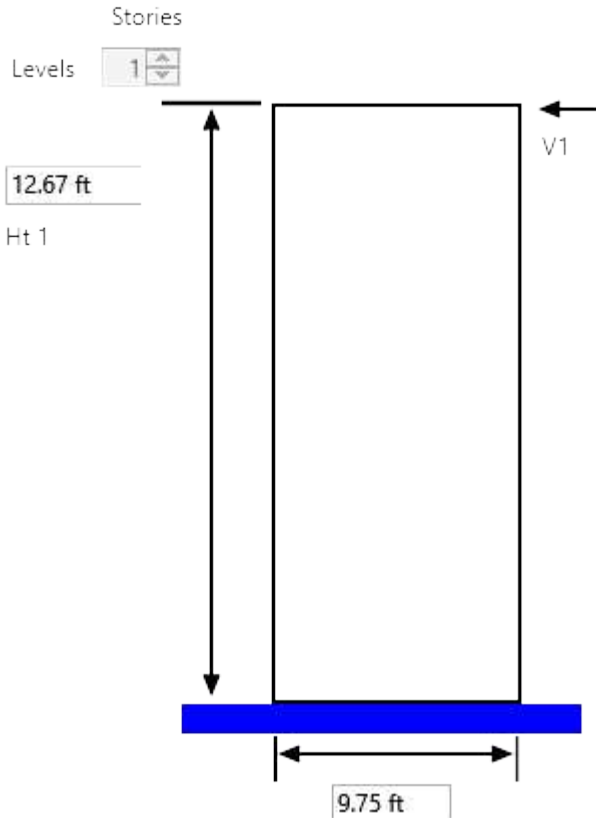
C.2.39

Model: Shear wall Level 1 - 9.75ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	5558	1.3

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? Yes

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	615.	3890.6	399.

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification Factors**Wind****Seismic**

Project Name: shear wall

Model: Shear wall Level 1 - 9.75ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.32	1	1922	0.208

Chords

					<u>Bracing (in)</u>				
Level	Section	F_y (ksi)	Configuration	Flexural	Axial $K_y L_y$	Axial $K_t L_t$	Flex $K\phi$ (lb-in/in)	Axial $K\phi$ (lb-in/in)	Bracing, L_m (in)
1	600S250-68	50	(2) Boxed	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7Ω_oQ_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525Ω_oQ_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	8002	6002	15566	11675

Factored Chord Strong-Axis Bending, M_x (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum		Interactions						
Level	M _a (ft-lb)	P _a (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	6915	20362	0	0	0	0	0.393	0.295	0.637	0.478

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 1 - 9.75ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14Sds)D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-8002	-5189	-15566	6000	3891	11672

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.414	0.268	0.67

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Level	Relative Displacement (in)			Drift %		
	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.15	0.08	0.31	0.1	0.05	0.2



700 South Flower Street, Suite 2100
Los Angeles, CA 90017
(213) 418-0201

project CSM Library Redesign & IMPRVs

location Sierra Madre, CA

client tsk

by SAK

date

job no.

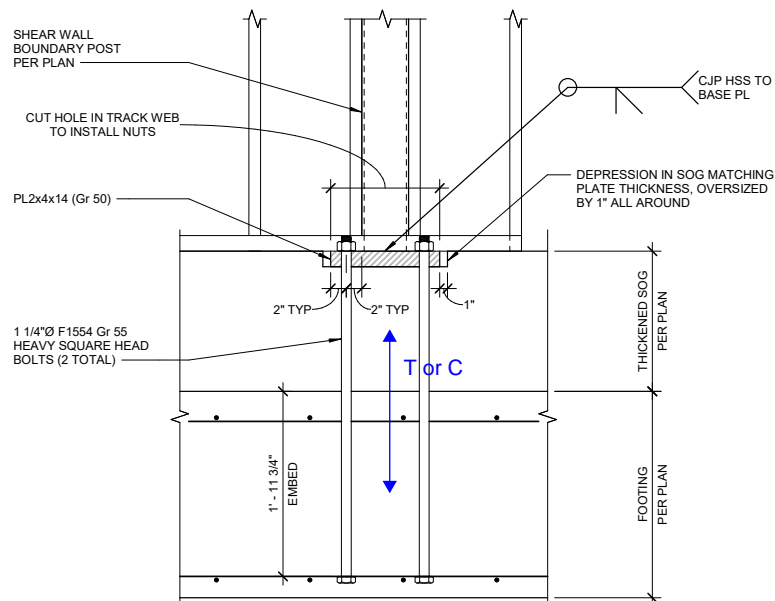
sheet no.

C.2.42

2300079

CFS DESIGN:

BOTTOM CONNECTION:



4 SHEAR WALL HOLD-DOWN

SCALE: 1" = 1'-0"

Check Anchorage for 2 conditions:

Along Gridline 5, where exterior face of wall aligns with the edge of footing:

T/C= 3288lbs

Amplify by Omega= 9864lbs

DCR= 0.83 OK -> width of concrete is 3ft

Typical concentric case:

Governing T/C demand per previous CFS attachment is:

T/C= 17001lbs

Amplify by Omega= 51,003lbs

DCR= 1.02 OK

Converning case is concrete breakout -> width of concrete is increased to 3.5ft

NOTE: MAX HOLD-DOWN DEMAND ON THE SECOND LEVEL IS 55,279lbs (including omega)

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Specifier's comments:

1 Input data

Anchor type and diameter:
Heavy Hex Head ASTM F 1554 GR. 55 1

Item number:

not available

Effective embedment depth:

 $h_{ef} = 18.000$ in.

Material:

ASTM F 1554

Evaluation Service Report:

Hilti Technical Data

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- | -

Proof:

Design Method ACI 318-19 / CIP

Stand-off installation:

 $e_b = 0.000$ in. (no stand-off); $t = 0.500$ in.

Anchor plate^R:

 $l_x \times l_y \times t = 9.000$ in. \times 15.000 in. \times 0.500 in.; (Recommended plate thickness: not calculated)

Profile:

no profile

Base material:

cracked concrete, 4000, $f'_c = 4,000$ psi; $h = 24.000$ in.

Reinforcement:

tension: not present, shear: not present;

edge reinforcement: none or $< \text{No. 4 bar}$

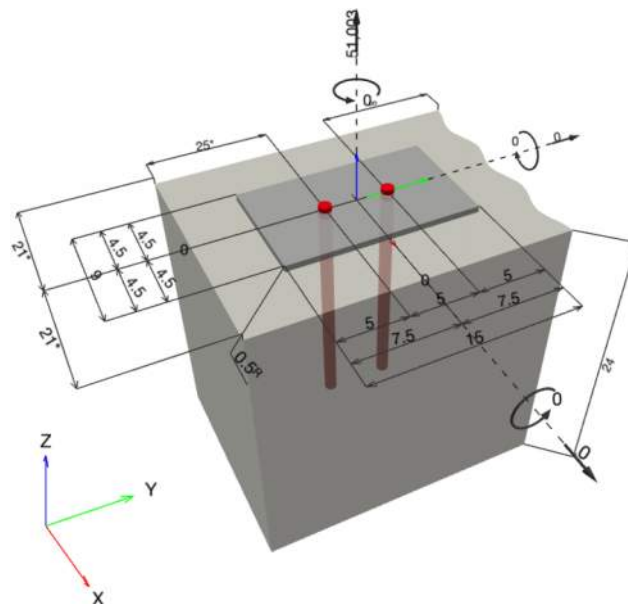
Seismic loads (cat. C, D, E, or F)

Tension load: yes (17.10.5.3 (d))

Shear load: yes (17.10.6.3 (c))


^R - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



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1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 51,003; V _x = 0; V _y = 0; M _x = 0; M _y = 0; M _z = 0;	yes	102

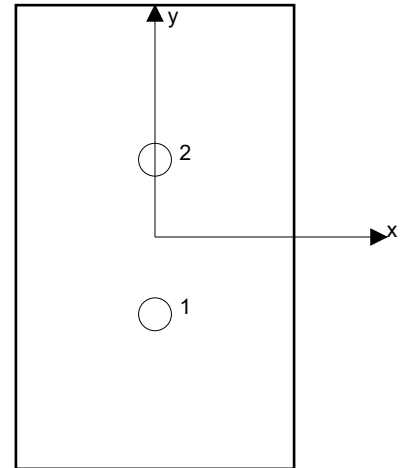
2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	25,502	0	0	0
2	25,502	0	0	0

max. concrete compressive strain: - [%]
max. concrete compressive stress: - [psi]
resulting tension force in (x/y)=(0.000/0.000): 0 [lb]
resulting compression force in (x/y)=(0.000/0.000): 0 [lb]



Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N _{ua} [lb]	Capacity ϕ N _n [lb]	Utilization $\beta_N = N_{ua} / \phi N_n$	Status
Steel Strength*	25,502	34,087	75	OK
Pullout Strength*	25,502	25,217	102	not recommended
Concrete Breakout Failure**	51,003	50,820	101	not recommended
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (anchors in tension)

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3.1 Steel Strength

$$N_{sa} = A_{se,N} f_{uta} \quad \text{ACI 318-19 Eq. (17.6.1.2)}$$

$$\phi N_{sa} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

Variables

$A_{se,N}$ [in. ²]	f_{uta} [psi]
0.61	75,000

Calculations

N_{sa} [lb]
45,450

Results

N_{sa} [lb]	ϕ_{steel}	ϕN_{sa} [lb]	N_{ua} [lb]
45,450	0.750	34,087	25,502

3.2 Pullout Strength

$$N_{pN} = \psi_{c,p} N_p \quad \text{ACI 318-19 Eq. (17.6.3.1)}$$

$$N_p = 8 A_{brg} f'_c \quad \text{ACI 318-19 Eq. (17.6.3.2.2a)}$$

$$\phi N_{pN} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

Variables

$\psi_{c,p}$	A_{brg} [in. ²]	λ_a	f'_c [psi]
1.000	1.50	1.000	4,000

Calculations

N_p [lb]
48,032

Results

N_{pn} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{pn} [lb]	N_{ua} [lb]
48,032	0.700	0.750	1.000	25,217	25,502

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3.3 Concrete Breakout Failure

$$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \quad \text{ACI 318-19 Eq. (17.6.2.1b)}$$

$$\phi N_{cbg} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

$$A_{Nc} \text{ see ACI 318-19, Section 17.6.2.1, Fig. R 17.6.2.1(b)}$$

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-19 Eq. (17.6.2.1.4)}$$

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.3.1)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.4.1b)}$$

$$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.6.1b)}$$

$$N_b = 16 \lambda_a \sqrt{f'_c} h_{ef}^{5/3} \quad \text{ACI 318-19 Eq. (17.6.2.2.3)}$$

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
16.667	0.000	0.000	21.000	1.000
c_{ac} [in.]	k_c	λ_a	f'_c [psi]	
-	16	1.000	4,000	

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
2,310.00	2,500.00	1.000	1.000	0.952	1.000	110,044

Results

N_{cbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{cbg} [lb]	N_{ua} [lb]
96,800	0.700	0.750	1.000	50,820	51,003

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4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	N/A	N/A	N/A	N/A
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength*	N/A	N/A	N/A	N/A
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (relevant anchors)

5 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- For additional information about ACI 318 strength design provisions, please go to <https://submittals.us.hilti.com/PROFISAnchorDesignGuide/>
- "An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-19, Chapter 17, Section 17.10.5.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.10.5.3 (b), Section 17.10.5.3 (c), or Section 17.10.5.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.10.6.3 (a), Section 17.10.6.3 (b), or Section 17.10.6.3 (c)."
- Section 17.10.5.3 (b) / Section 17.10.6.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.10.5.3 (c) / Section 17.10.6.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.10.5.3 (d) / Section 17.10.6.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by ω_0 .

Fastening does not meet the design criteria!

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6 Installation data

Profile: no profile

Hole diameter in the fixture: $d_f = 1.062$ in.

Plate thickness (input): 0.500 in.

Recommended plate thickness: not calculated

Anchor type and diameter: Heavy Hex Head ASTM F 1554
GR. 55 1

Item number: not available

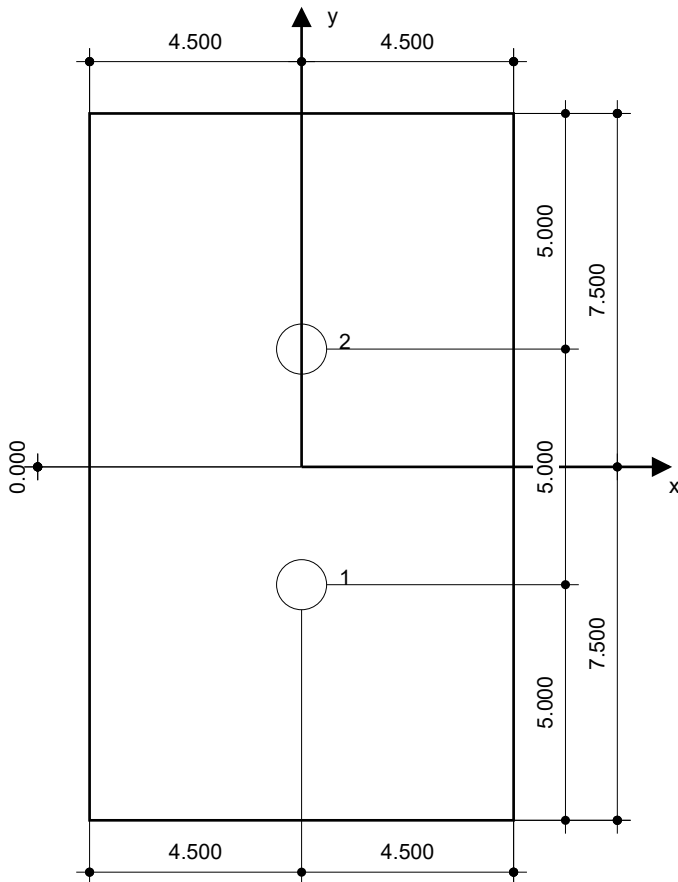
Maximum installation torque: -

Hole diameter in the base material: - in.

Hole depth in the base material: 18.000 in.

Minimum thickness of the base material: 19.172 in.

Hilti Heavy Hex Head headed stud anchor with 18 in embedment, 1, Steel galvanized, installation per instruction for use



Coordinates Anchor [in.]

Anchor	x	y	c _{-x}	c _{+x}	c _{-y}	c _{+y}
1	0.000	-2.500	21.000	21.000	25.000	-
2	0.000	2.500	21.000	21.000	30.000	-

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7 Remarks; Your Cooperation Duties

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Specifier's comments:

1 Input data

Anchor type and diameter:
Heavy Hex Head ASTM F 1554 GR. 55 1

Item number:

not available

Effective embedment depth:

 $h_{ef} = 9.000$ in.

Material:

ASTM F 1554

Evaluation Service Report:

Hilti Technical Data

Issued | Valid:

- | -

Proof:

Design Method ACI 318-19 / CIP

Stand-off installation:

 $e_b = 0.000$ in. (no stand-off); $t = 0.500$ in.

Anchor plate^R:

 $l_x \times l_y \times t = 9.000$ in. \times 15.000 in. \times 0.500 in.; (Recommended plate thickness: not calculated)

Profile:

no profile

Base material:

cracked concrete, 4000, $f'_c = 4,000$ psi; $h = 12.000$ in.

Reinforcement:

tension: not present, shear: not present;

edge reinforcement: none or $< \text{No. 4}$ bar

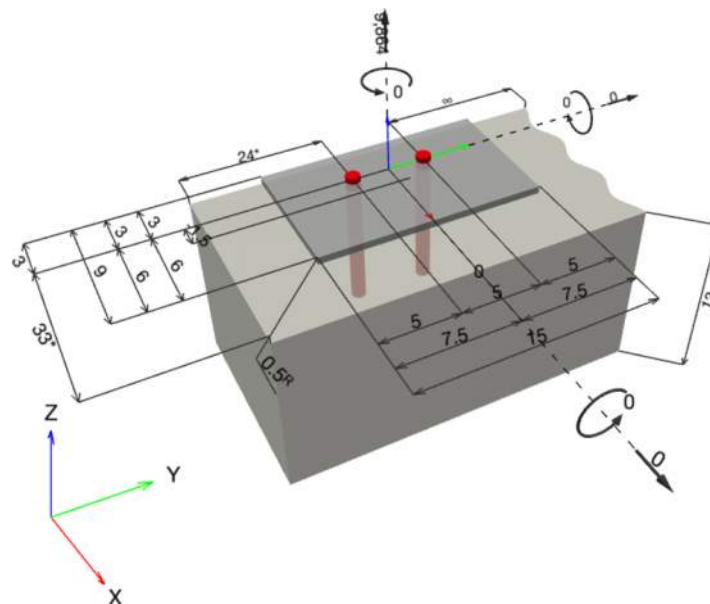
Seismic loads (cat. C, D, E, or F)

Tension load: yes (17.10.5.3 (d))

Shear load: yes (17.10.6.3 (c))


^R - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



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1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 9,864; V _x = 0; V _y = 0; M _x = 0; M _y = 0; M _z = 0;	yes	83

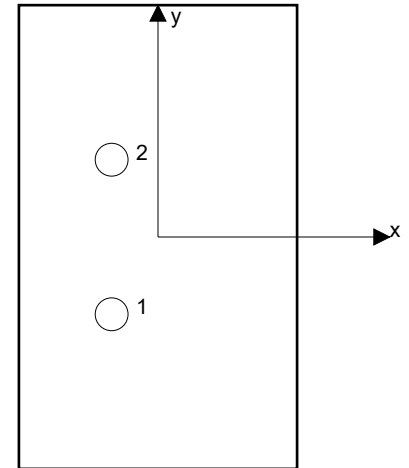
2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	4,932	0	0	0
2	4,932	0	0	0

max. concrete compressive strain: - [%]
max. concrete compressive stress: - [psi]
resulting tension force in (x/y)=(0.000/0.000): 0 [lb]
resulting compression force in (x/y)=(0.000/0.000): 0 [lb]



Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N _{ua} [lb]	Capacity ϕ N _n [lb]	Utilization $\beta_N = N_{ua} / \phi N_n$	Status
Steel Strength*	4,932	34,087	15	OK
Pullout Strength*	4,932	25,217	20	OK
Concrete Breakout Failure**	9,864	11,948	83	OK
Concrete Side-Face Blowout, direction x-**	9,864	24,950	40	OK

* highest loaded anchor **anchor group (anchors in tension)

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3.1 Steel Strength

$$N_{sa} = A_{se,N} f_{uta} \quad \text{ACI 318-19 Eq. (17.6.1.2)}$$

$$\phi N_{sa} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

Variables

$A_{se,N} [\text{in.}^2]$	$f_{uta} [\text{psi}]$
0.61	75,000

Calculations

$N_{sa} [\text{lb}]$
45,450

Results

$N_{sa} [\text{lb}]$	ϕ_{steel}	$\phi N_{sa} [\text{lb}]$	$N_{ua} [\text{lb}]$
45,450	0.750	34,087	4,932

3.2 Pullout Strength

$$N_{pN} = \psi_{c,p} N_p \quad \text{ACI 318-19 Eq. (17.6.3.1)}$$

$$N_p = 8 A_{brg} f'_c \quad \text{ACI 318-19 Eq. (17.6.3.2.2a)}$$

$$\phi N_{pN} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

Variables

$\psi_{c,p}$	$A_{brg} [\text{in.}^2]$	λ_a	$f'_c [\text{psi}]$
1.000	1.50	1.000	4,000

Calculations

$N_p [\text{lb}]$
48,032

Results

$N_{pn} [\text{lb}]$	ϕ_{concrete}	ϕ_{seismic}	$\phi_{\text{nonductile}}$	$\phi N_{pn} [\text{lb}]$	$N_{ua} [\text{lb}]$
48,032	0.700	0.750	1.000	25,217	4,932

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3.3 Concrete Breakout Failure

$$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \quad \text{ACI 318-19 Eq. (17.6.2.1b)}$$

$$\phi N_{cbg} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

$$A_{Nc} \text{ see ACI 318-19, Section 17.6.2.1, Fig. R 17.6.2.1(b)}$$

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-19 Eq. (17.6.2.1.4)}$$

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.3.1)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.4.1b)}$$

$$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.6.1b)}$$

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \quad \text{ACI 318-19 Eq. (17.6.2.2.1)}$$

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
9.000	0.000	0.000	3.000	1.000
c_{ac} [in.]	k_c	λ_a	f'_c [psi]	
-	24	1.000	4,000	

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
528.00	729.00	1.000	1.000	0.767	1.000	40,983

Results

N_{cbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{cbg} [lb]	N_{ua} [lb]
22,757	0.700	0.750	1.000	11,948	9,864

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3.4 Concrete Side-Face Blowout, direction x-

$$N_{sb} = 160 c_{a1} \sqrt{A_{brg}} \lambda_a \sqrt{f'_c} \quad \text{ACI 318-19 Eq. (17.6.4.1)}$$

$$N_{sbg} = \alpha_{group} N_{sb} \quad \text{ACI 318-19 Eq. (17.6.4.2)}$$

$$\phi N_{sbg} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

$$\alpha_{group} = \left(1 + \frac{s}{6 c_{a1}} \right) \quad \text{see ACI 318-19, Section 17.6.4.2, Eq. (17.6.4.2)}$$

Variables

c_{a1} [in.]	c_{a2} [in.]	A_{brg} [in. ²]	λ_a	f'_c [psi]	s [in.]
3.000	24.000	1.50	1.000	4,000	5.000

Calculations

α_{group}	N_{sb} [lb]
1.278	37,193

Results

N_{sbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{sbg} [lb]	$N_{ua,edge}$ [lb]
47,524	0.700	0.750	1.000	24,950	9,864

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4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	N/A	N/A	N/A	N/A
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength*	N/A	N/A	N/A	N/A
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (relevant anchors)

5 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- For additional information about ACI 318 strength design provisions, please go to <https://submittals.us.hilti.com/PROFISAnchorDesignGuide/>
- "An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-19, Chapter 17, Section 17.10.5.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.10.5.3 (b), Section 17.10.5.3 (c), or Section 17.10.5.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.10.6.3 (a), Section 17.10.6.3 (b), or Section 17.10.6.3 (c)."
- Section 17.10.5.3 (b) / Section 17.10.6.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.10.5.3 (c) / Section 17.10.6.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.10.5.3 (d) / Section 17.10.6.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by ω_0 .

Fastening meets the design criteria!

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6 Installation data

Profile: no profile

Hole diameter in the fixture: $d_f = 1.062$ in.

Plate thickness (input): 0.500 in.

Recommended plate thickness: not calculated

Anchor type and diameter: Heavy Hex Head ASTM F 1554

GR. 55 1

Item number: not available

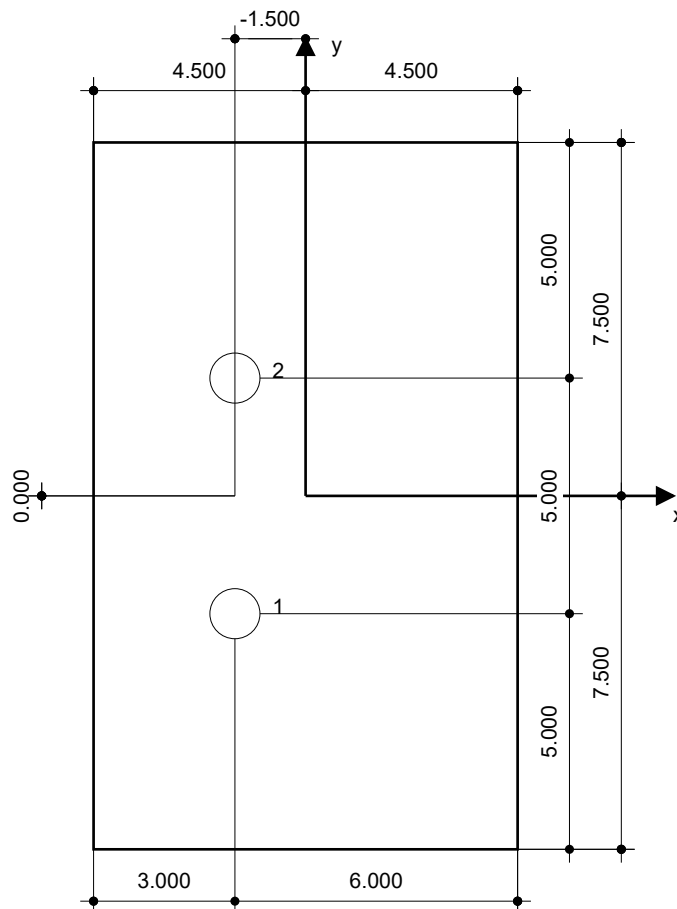
Maximum installation torque: -

Hole diameter in the base material: - in.

Hole depth in the base material: 9.000 in.

Minimum thickness of the base material: 10.172 in.

Hilti Heavy Hex Head headed stud anchor with 9 in embedment, 1, Steel galvanized, installation per instruction for use



Coordinates Anchor [in.]

Anchor	x	y	c _{-x}	c _{+x}	c _{-y}	c _{+y}
1	-1.500	-2.500	3.000	33.000	24.000	-
2	-1.500	2.500	3.000	33.000	29.000	-

Input data and results must be checked for conformity with the existing conditions and for plausibility!

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Design:	Grid 5	Date:	3/13/2024
Fastening point:			

7 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

December 13, 2021

Re: SIMPSON STRONG-TIE S/HDU HOLDOWNS

To Whom It May Concern:

Table 1 provides tension loads for the Simpson Strong-Tie S/HDU holdown series attached to a single stud, as shown in Figure 1 below.

Table 1 – Tension Loads for S/HDU Holdowns attached to a Single Stud

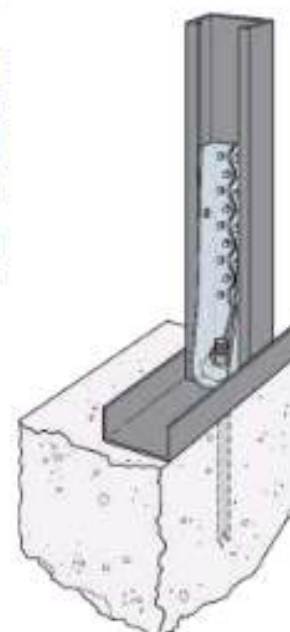
Model	H (in.)	Fasteners		Stud Member Thickness ² mil (ga)	ASD		LRFD		Nominal Tension Load ⁵ (lb.)
		Anchor Bolt Diameter ¹ (in.)	Stud Fasteners		Tension Load (lb.)	Deflection at ASD Load ⁴ (in.)	Tension Load (lb.)	Deflection at LRFD Load ⁴ (in.)	
S/HDU4	7 7/8	5/8	(6) #14	33 (20)	1,195	0.069	1,795	0.116	3,575
				43 (18)	1,780	0.068	2,670	0.106	5,095
				54 (16)	2,550	0.031	4,080	0.053	6,900
S/HDU6	10 3/8	5/8	(12) #14	33 (20)	2,390	0.064	3,590	0.119	6,590
				43 (18)	3,295	0.054	5,270	0.108	8,915
				54 (16)	5,100	0.073	8,160	0.167	13,805
				68 (14)	5,570	0.052	8,915	0.095	15,075
S/HDU9	12 7/8	7/8	(18) #14	33 (20)	2,855	0.029	4,570	0.045	7,730
				43 (18)	3,725	0.037	5,960	0.061	10,080
				54 (16)	6,750	0.071	10,805	0.131	18,270
				68 (14)	8,355	0.087	13,370	0.159	22,610
				97 (12)	8,355	0.087	13,370	0.159	22,610
S/HDU11	16 5/8	7/8	(27) #14	43 (18)	4,225	0.039	6,765	0.062	11,440
				54 (16)	7,665	0.07	12,265	0.109	20,740
				68 (14)	9,655	0.087	15,450	0.143	26,130
				97 (12) ³	14,925	0.129	23,880	0.235	40,385

1. The designer shall specify the foundation anchor material type, embedment, and configuration. Some of the tabulated holdown tension loads exceed the tensile strength of typical ASTM A36 or A307 anchor bolts.
2. Stud design by the specifier. Tabulated loads are based on a minimum stud thickness for fastener connection.
3. A heavy hex nut for the anchor bolt is required to achieve the table loads for S/HDU11 on 97 mil (12 ga) stud.
4. Deflection at ASD or LRFD is the deflection of the fastener slip, holdown deformation, and anchor rod elongation for holdowns installed up to 4 inches above the top of concrete when loaded to the ASD and LRFD load, respectively. Holdowns may be installed raised to 18 inches above the top of concrete, with no load reduction provided that additional elongation of the anchor rod is accounted for. This movement is strictly due to the holdown deformation under a static load test attached to members listed in the table above.
5. The Nominal Tension Load is based on the tested average ultimate (peak) load and is provided for design under section E1 of AISI S400 that categorized the holdowns as capacity-protected components. Based on AISI S400, the nominal load shall be greater than or equal to the required strength.

The information in this letter is valid until **December 31, 2023** when it will be re-evaluated by Simpson Strong-Tie. Please visit strongtie.com for additional pertinent information. If you have questions or need further assistance regarding this matter, please contact the Simpson Strong-Tie engineering department at 800.999.5099.

Sincerely,

SIMPSON STRONG-TIE COMPANY INC.


Figure 1: Typical S/HDU Installation to a Single Stud



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C.2. SHEAR WALL DESIGN



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WALL DEMAND:

← modify this as needed

Base shear = 116kips

Story 1 Force= 116k

Story 2 Force= 82k

ASD Loads:

Demands = $116k/1.4 = 82.8k$

$82k/1.4 = 58.6k$

Per wall = $82.8k/2 = 41.4k$

$58.6k/2 = 29.3k$

Shear wall length required:

First level: $41400lbs/1922plf = 21.5ft$

Second level: $29300lbs/1922plf = 15.3ft$

TABLE 2 FROM ESR 0126:

TABLE 2 – NOMINAL AND ALLOWABLE SHEAR RESISTANCE TO WIND OR EARTHQUAKE FORCES AND DISPLACEMENT (inches) FOR SHEAR WALLS WITH SUREBOARD® SERIES 200W / SERIES 200B STRUCTURAL PANELS ATTACHED TO LIGHT GAGE STEEL C-STUDS AT 16" O.C. WITH NO. 10 SCREWS (pounds per foot) ^{1,10,11}

STEEL FRAMING	No. 10 SCREW SPACING AT PANEL EDGES AND FIELD 2/6, INCHES ON CENTER ⁶		
Minimum Gage ⁵	$V_n^{2,3,4,7}$ (plf)	$V_{asd}^{2,3,8}$ (plf)	ΔV_{asd}^9 (inch)
No. 18-Ga. (0.043 in.)	2,168	703	0.14
No. 16-Ga. (0.054 in.)	2,704	923	0.18
No. 14-Ga. (0.071 in.)	2,755	934	0.15
No. 14-Ga. (0.071 in.) 2 Sided	5,091	1,922	0.29

For SI: 1 inch = 25.4 mm, 1 plf = 0.0146 N/mm.

¹ These values are for short-term loads due to wind or earthquake.

² The screws as described in Section 4.2.2 and installed in accordance with Section 3.3.2.2 of IAPMO ES ER-126.

³ Tabulated values listed in tables are for panels applied to one side or two sides of a wall.

⁴ For load and resistance factor design (LRFD) loads, the tabulated V_n load values shall be multiplied by the resistance factor 0.60 for Seismic or 0.65 for Wind.

⁵ Section 4.3.1 in the evaluation report IAPMO ES ER-126, describes minimum base metal thickness associated with gages.

⁶ All panel edges shall be blocked. Panels are installed vertically or horizontally. Fasteners shall be spaced a maximum of 6 inches on center along intermediate framing members.

⁷ V_n = Nominal Strength.

⁸ V_{asd} = ASD Design Load.

⁹ ΔV_{asd} = Deflection at V_{asd} Design Load.

¹⁰ V_n and V_{asd} for walls with height-to-length ratios (h:b) greater than 2¼:1, but not exceeding 4:1 shall be computed in accordance with Section 3.2.1.4 of this report.

¹¹ Series 200B values are limited to Series 200 values.

USE (1) SIDED SUREBOARD FOR THE WALL BY EXISTING WALL

$41400LBS/934 = 44FT$

$29300LBS/934 = 31.4FT$



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WALL DEMAND:

Table is only applicable if $b > h/2.25$ per section 3.2.1.4 in IAPMO ER 0126

- For $h=12.67\text{ft}$, we need $b > 5.63\text{ft}$ to use table

If $h/4 < b < h/2.25$, calculate V per Section 3.2.1.4.
 $3.17\text{ft} < b < 5.63\text{ft}$

$V_{asd} = 1,922\text{lbs}$ ($2.25 \cdot 5.25\text{ft} / 12.67\text{ft}$)

$V_{asd} = 1,792\text{lbs}$

- For $h = 9.33\text{ft}$, we need $b > 4.14\text{ft}$ to use table

$2.33\text{ft} < b < 4.15\text{ft}$

$V_{asd} = 1,080\text{lbs}$

Summary:

Second level: $29300\text{lbs} / 1922\text{plf} = 15.3\text{ft}$

Second level: $29300\text{lbs} / 1792\text{plf} = 16.35\text{ft}$

$$V_n = V_{nt} (2.25b/h) \quad (\text{Eq. 3.2.1.4-1})$$

$$V_{asd} = V_{asdt} (2.25b/h) \quad (\text{Eq. 3.2.1.4-2})$$

Where:

V_{nt} = nominal shear value from the applicable table,
lb/ft (N/mm)

V_{asdt} = allowable stress design shear value from the
table, lb/ft (N/mm)

In no case shall the height-to-length ratio ($h:b$) for shear walls on wood framing exceed 4:1.

The maximum shear-wall height-to-width ratio (h/b) for shear walls on wood framing is $2\frac{1}{4}:1$.

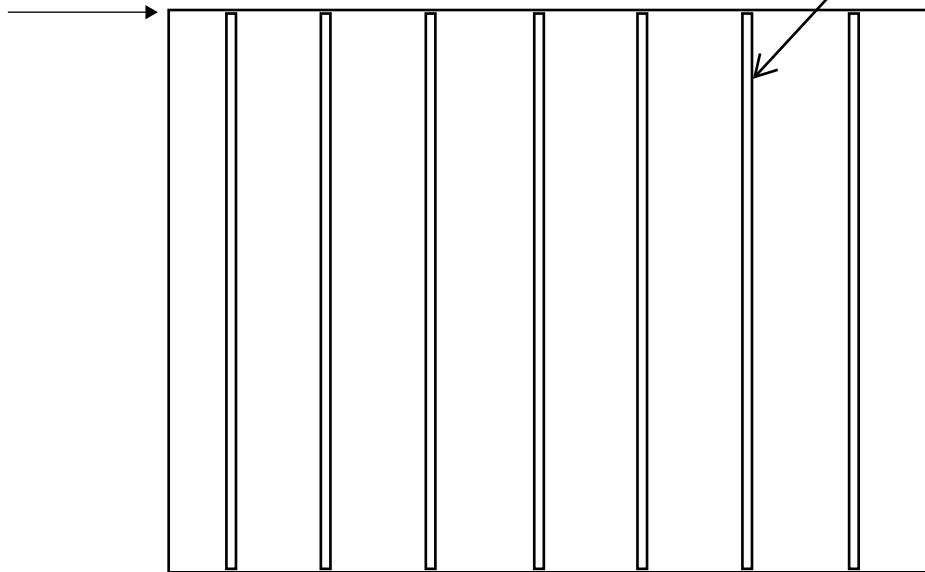
TOTAL SHEAR LENGTH ON
2ND FLOOR IS 18FT ON
GRIDLINE 7, REDUCED
CAPACITY FOR THE 5'-3" IS OK
BY INSPECTION

CFS DESIGN:

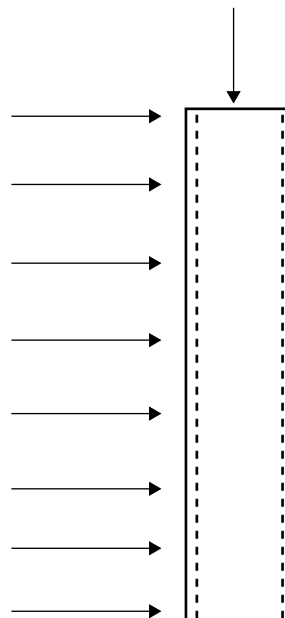
Using ASD Design:

Seismic load= 41.4k

in plane: 41.4k



out of plane:
(wind load)





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CFS DESIGN:

CHECK WALL STUD FOR WIND LOAD:

Using ASD Design:

Wind Load= 27.3psf

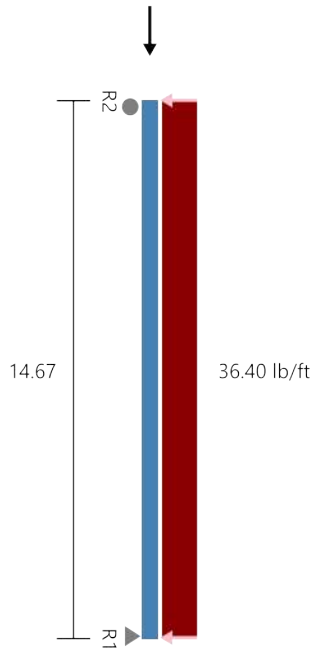
Exterior Wall weight= 48psf

Max height= 14.68ft

Per attached CFS Report,

DCR= 55.3

-> USE SECTION 600S162-68 @ 16" OC



Section : 600S137-68 (50 ksi) @ 16" o.c. Single C Stud (punched)

Maxo = 2570.2 ft-lb **Va =** 5350.3 lb **I =** 3.09 in⁴

Loads have not been modified for strength checks

Loads have been multiplied by 0.70 for deflection calculations

Bridging Connectors - Design Method =AISI S100

Span	Axial KyLy, KtLt	Flexural, Distortional	Connector	Stress Ratio
Span	Sheathed, Sheathed	Full, 176.0"	N/A	-

Web Crippling

Support	Load (lb)	Bearing (in)	Pa (lb)	M (ft-lbs)	Max Int.	Stiffener?
R2	267.0	1.00	914.4	0.0	0.15	NO
R1	267.0	1.00	914.4	0.0	0.15	NO

*** after support means punched near support

Gravity Load

Type	Load (lb)
Uniform	64.00plf

	Code Check	Required	Allowed	Interaction	Notes	
Span	Max. Axial, lbs	938.9(c)	3777.8(c)	25%	KΦ=0.00 lb-in/in Max KL/r = 80	
	Max. Shear, lbs	267.0	2878.9	9%	Shear (Punched)	
	Max. Moment (MaFy, Ma-dist), ft-lbs	979.2	2407.8	41%	Ma-dist (control),KΦ=0.00 lb-in/in	
	Moment Stability, ft-lbs	979.2	2570.2	38%		
	Shear/Moment	0.38	1.00	38%	Shear 0.0, Moment 979.2	
	Axial/Moment	0.55	1.00	55%	Axial 567.1(c), Moment 936.8	
	Deflection Span, in	0.291	--meets L/605--			
Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie Connector		Connector Interaction	Anchor Interaction
R2	267.0	0.0	By Others & Anchorage Designed by Engineer		NA	NA
R1	267.0	938.9	By Others & Anchorage Designed by Engineer		NA	NA

* Reference catalog for connector and anchor requirement notes as well as screw placement requirements



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Diaphragm to SW Connection:

N/S direction (deck is perpendicular)

Diaphragm uniform shear is $0.7 \cdot v_x = 0.7 \cdot 0.436 \text{klf} = 305.2 \text{plf}$

Drag_y = 64,92k

DCR = $64.92/63.6 = 1.02$ NOT OK

E/W direction (deck is parallel)

Diaphragm uniform shear is $0.7 \cdot v_y = 0.7 \cdot 1.323 \text{klf} = 926.1 \text{plf}$

Drag_x = 32.41k

DCR = 0.89 OK

if we increase
spacing to 3", we will
have 84.8kip in
parallel, and 48.4kip
in perpendicular

Shear Stud Capacity (AISC 360 Table 3-21)

3/4" x 3" studs at 4" OC

$w_r =$ 5 in

$h_r =$ 2 in

Spacing = 0.33333333 ft

$w_r/h_r =$ 2.5

4000psi

Stud Capacity [kip]			Adjusted Stud Capacity based on Spacing [kip]		
Deck	Type		Deck	Type	
	LWC	NWC		LWC	NWC
Parallel	21.2	21.5	Parallel	63.6	64.5
Perpendicular	12.1	12.1	Perpendicular	36.3	36.3



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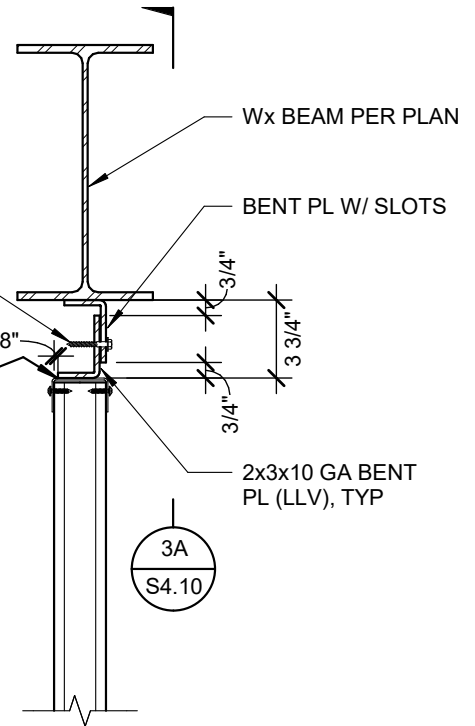
CFS DESIGN:

TOP CONNECTIONS:

1/4-28 x 3" BUILDDEX TEK/S
@ 3" OC (ICC ESR 1976).
SCREW HEAD SHALL BE
ON SLOTTED SIDE.

EA SIDE,
TYP @ BP

1/8" 1 1/2 - 3



Worst Condition on Level 0:

$$0.7 * v_{wall} = 0.7 * 1.864 \text{ klf} = 1.3 \text{ klf}$$

Worst Condition on Level 1:

$$0.7 * v_{wall} * L_{max} = 0.7 * 2.469 \text{ klf} = 1.73 \text{ klf}$$

Bent Plate is OK per inspection

Check 1/4 - 28 TEK Screws:

$$\text{On level 0: } 1.3 \text{ klf} * (3"/12") = 0.325 \text{ k}$$

$$\text{On level 1: } 1.73 \text{ klf} * (3"/12") = 0.433 \text{ k}$$

Shear Capacity= 1266lbs (per Table 4 in ESR 1976)

DCR= 0.34 OK

Check weld on both sides:

d= 3" and b= 24" (assuming bent plate is 2ft long)

V= 5k

1/8" fillet weld is OK

	L =	2d	=	6.00	(in)	Rp =	P/L =	0.83	(k/in)
	S =	d ² /3	=	3.00	(in ²)	Rv =	V/L =	0.83	(k/in)
	I _p =	d(3b ² + d ²)/6	=	868.50	(in ³)	Rm =	M/S =	0.00	(k/in)
	r _{max} =	Max Distance to Centroid	=	12.09	(in)	Rt =	T*r _{max} /I _p =	0.00	(k/in)
						Rw =	(Rv ² + (Rp + Rm) ² + Rt ²) ^{1/2} =	1.18	(k/in)
						D =	Rw/1.392 =	1/16	(in)
						(E) =	Rw/1.969 =	(1/16)	(in)



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TOP CONNECTIONS:

TABLE 2—ALLOWABLE TENSILE PULL-OUT LOADS (P_{NOT}/Ω), pounds-force^{1, 2, 3, 4, 5}

Screw Designation	Nominal Diameter (in.)	Steel $F_u = 45$ ksi, Applied Factor of Safety, $\Omega=3.0$										
		Design Thickness of Member Not in Contact with the Screw Head (in)										
		0.018	0.024	0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250
10-16	0.190	44	58	73	87	116	145	182	254	303	⁶	⁶
12-14, 12-24	0.216	50	66	83	99	132	165	207	289	344	515	689
¹ / ₄ -14, ¹ / ₄ -28	0.250	57	77	96	115	153	191	239	335	398	596	797

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa.

¹For tension connections, the least of the allowable pull-out, pullover, and fastener tension strength found in Tables 2, 3, and 5, respectively, must be used for design.

²ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.

³The allowable pull-out capacity for other member thickness can be determined by interpolating within the table.

⁴To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

⁵For $F_u = 58$ ksi, multiply values by 1.29; for $F_u = 65$ ksi, multiply values by 1.44.

⁶Outside drilling capacity limits.

TABLE 4—ALLOWABLE SHEAR (BEARING) CAPACITY (P_{NS}/Ω), pounds-force^{1, 2, 3, 4, 5}

Screw Designation	Nominal Diameter (in.)	Design Thickness of Member Not in Contact with the Screw Head (in)	Steel $F_u = 45$ ksi, Applied Factor of Safety, $\Omega=3.0$										
			Design Thickness of Member in Contact with the Screw Head (in)										
			0.018	0.024	0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.187	0.250
10-16	0.190	0.018	66	66	66	66	66	66	66	66	66	---	---
		0.024	102	102	102	102	102	102	102	102	102	---	---
		0.030	111	143	143	143	143	143	143	143	143	---	---
		0.036	120	152	185	188	188	188	188	188	188	---	---
		0.048	139	168	199	228	289	289	289	289	289	---	---
		0.060	139	185	213	239	327	404	404	404	404	---	---
		0.075	139	185	231	251	337	427	564	564	564	---	---
		0.105	139	185	231	277	356	436	570	808	808	---	---
12-14 12-24	0.216	0.125	139	185	231	277	369	442	571	808	962	---	---
		0.018	71	71	71	71	71	71	71	71	71	71	71
		0.024	109	109	109	109	109	109	109	109	109	109	109
		0.030	125	152	152	152	152	152	152	152	152	152	152
		0.036	136	170	205	200	200	200	200	200	200	200	200
		0.048	157	190	223	253	308	308	308	308	308	308	308
		0.060	157	210	240	266	362	430	430	430	430	430	430
		0.075	157	210	262	282	375	468	601	601	601	601	601
		0.105	157	210	262	315	402	483	624	919	919	919	919
		0.125	157	210	262	315	420	494	629	919	1094	1094	1094
¹ / ₄ -14 ¹ / ₄ -28	0.250	0.187	157	210	262	315	420	525	642	919	1094	1636	1636
		0.250	157	210	262	315	420	525	656	919	1094	1636	2187
		0.018	76	76	76	76	76	76	76	76	76	76	76
		0.024	117	117	117	117	117	117	117	117	117	117	117
		0.030	142	164	164	164	164	164	164	164	164	164	164
		0.036	156	193	215	215	215	215	215	215	215	215	215
		0.048	182	218	253	283	331	331	331	331	331	331	331
		0.060	182	243	276	300	406	463	463	463	463	463	463
		0.075	182	243	304	322	424	521	647	647	647	647	647
		0.105	182	243	304	365	461	544	694	1063	1063	1063	1063
		0.125	182	243	304	365	486	560	703	1063	1266	1266	1266
		0.187	182	243	304	365	486	608	731	1063	1266	1893	1893
		0.250	182	243	304	365	486	608	759	1063	1266	1893	2531

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 ksi = 6.89 MPa.

¹The lower of the allowable shear (bearing) and the allowable fastener shear strength found in Tables 4 and 5, respectively, must be used for design.

²ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.

³The allowable bearing capacity for other member thickness can be determined by interpolating within the table.

⁴To calculate LRFD values, multiply values in table by the ASD safety factor of 3.0 and multiply again with the LRFD Φ factor of 0.5.

⁵For $F_u = 58$ ksi, multiply values by 1.29; for $F_u = 65$ ksi, multiply values by 1.44.



EVALUATION REPORT

Number: 124

Originally Issued: 06/25/2010

Revised: 09/12/2023

Valid Through: 06/30/2024

TABLE 1A – TENSION LOADS AND DISPLACEMENTS FOR S/HDS AND S/HDB SERIES HOLD-DOWNS

Model	Height (in)	Fasteners		Framing Member(s) ⁵ No.-Mil (ga)	ASD		LRFD		Nominal Tension Load ^{8,9} (lbs)
		Anchor Bolt Dia. ^{1,2} (in)	Framing Fasteners		Tension Load (lbs)	Displacement at ASD Load ⁷ (in)	Tension Load (lbs)	Displacement at LRFD Load ⁷ (in)	
S/HD8S	11	7/8	17 - #14 Screws ³	2-33 (2-20ga)	7335	0.120	11715	0.204	13720
				2-43 (2-18ga)	8750	0.086	13975	0.146	21435
				2-54 (2-16ga)	8855	0.106	14145	0.162	21700
				1-97 (1-12ga) PACO ⁶	11030	0.091	17620	0.146	27025
				Steel Fixture	10840	0.053	17335	0.072	32525
S/HD10S	13½	7/8	22 - #14 Screws ³	2-33 (2-20ga)	7400	0.122	11815	0.192	13835
				2-43 (2-18ga)	11120	0.112	17755	0.124	20795
				2-54 (2-16ga)	12220	0.096	19520	0.145	29940
				1-97 (1-12ga) PACO ⁶	14840	0.085	23705	0.148	34135
				Steel Fixture	12375	0.043	19820	0.061	33535
S/HD15S	17	1	30 - #14 Screws ³	2-43 (2-18ga)	12110	0.096	19340	0.164	22645
				2-54 (2-16ga)	13500	0.110	21565	0.130	33075
				1-97 (1-12ga) PACO ⁶	16420	0.078	26230	0.135	40230
				Steel Fixture	15810	0.043	25320	0.065	42845
S/HD8B	11	7/8	2 - ¾" Dia. Bolts ⁴	2-33 (2-20ga)	3895	0.081	5620	0.144	8645
				2-43 (2-18ga)	5345	0.098	7710	0.146	11865
				2-54 (2-16ga)	8950	0.082	14280	0.141	20310
				1-97 (1-12ga) PACO ⁶	8090	0.088	12905	0.167	18370
				Steel Fixture	9080	0.069	14545	0.104	22975
S/HD10B	13½	7/8	3 - ¾" Dia. Bolts ⁴	2-33 (2-20ga)	5840	0.070	8430	0.124	12970
				2-43 (2-18ga)	8015	0.087	11565	0.120	17795
				2-54 (2-16ga)	12090	0.125	19720	0.230	28050
				1-97 (1-12ga) PACO ⁶	13385	0.912	19355	0.119	28905
				Steel Fixture	15635	0.102	24955	0.123	35495
S/HD15B	17	1	4 - ¾" Dia. Bolts ⁴	2-43 (2-18ga)	10690	0.118	15425	0.179	22165
				2-54 (2-16ga)	16020	0.090	25565	0.121	36360
				1-97 (1-12ga) PACO ⁶	17850	0.103	25805	0.130	39700
				Steel Fixture	18690	0.104	29825	0.139	42425

For SI: 1 inch = 25.4 mm, 1 lb = 4.45 N.

- The Designer shall specify the foundation anchor material type, embedment, and configuration. Some of the tabulated hold-down tension loads exceed the tensile strength of typical [ASTM F1554](#) Grade 36 or [A307](#) anchor bolts.
- A foundation anchor bolt washer is not required.
- 1/4-inch diameter self-tapping screws may be substituted for #14 self-tapping screws.
- A round steel standard plate washer conforming to Section [3.1.1](#) of this report is required to be installed between the framing member bolt nut and the framing member for the S/HDB series hold-downs.
- The Designer shall specify and detail the connection of the back-to-back full-height framing members.
- PACO columns are manufactured by PACO Steel & Engineering Corp. Recognition of the column is beyond the scope of this report.
- Hold-down displacement at tabulated ASD and LRFD loads is the difference in the displacement measured between the anchor bolt and back of the hold-down that's attached to the framing member(s) when loaded to the ASD and LRFD static test load, respectively. Deflection includes fastener slip, hold-down elongation, and anchor bolt elongation (L=4 inches).
- The Nominal Tension Load is the average ultimate (peak) load taken from tests in accordance with [AISI S100](#) Chapter F. When hold-downs are used in CFS framed shear walls or diagonal strap braced walls with an R-coefficient greater than 3, the [AISI S213](#) Lateral Design Section C5 requires hold-downs in shear walls have the nominal strength to resist the lesser of the amplified seismic load or the load the system can deliver and hold-downs in diagonal strap braced walls have the nominal strength to resist the lesser of the amplified seismic load or the expected yield strength of the diagonal strap bracing member.
- When used in lateral force-resisting systems, hold-downs shall be designed for the expected strength of designated seismic force-resisting systems as specified in Section B3 and Chapter E of [AISI S400](#).

NOTE: THE PRINTOUTS BELOW ARE USING S/HDU11-54, HOWEVER S/HD15S HAS MORE CAPACITY THEREFORE THE DESIGN STILL WORKS.

Project Name: shear wall

Model: Shear wall Level 0 - 37ft

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

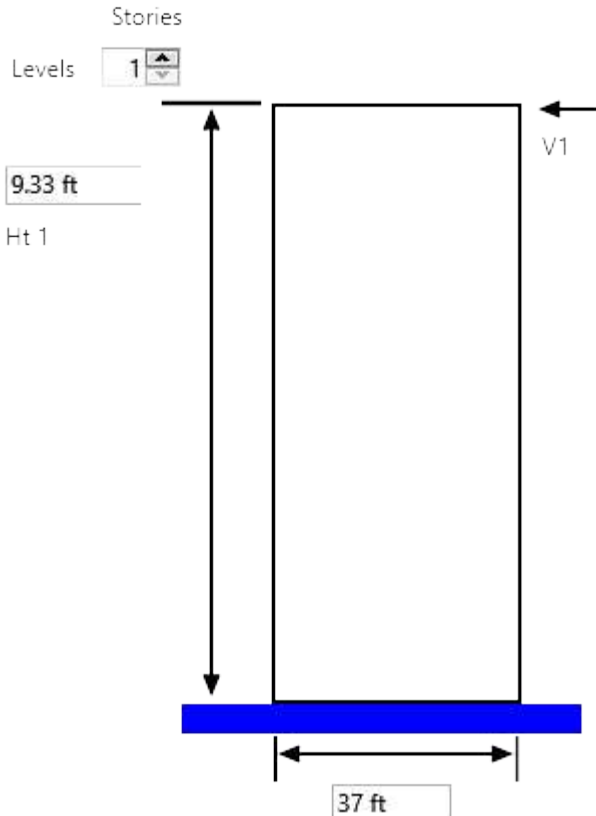
STUDS SIZE
CHANGE TO 6"

C.2.10

Date: 02/12/2024

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report



Load Inputs (All Loads are Unfactored Forces)

Top of Level Shear (lb)

Level	Wind	Seismic	Aspect Ratio
1	10000	18500	0.25

Seismic Design Parameters:

Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? No

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	162.	12950	350

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification Factors

Wind

Seismic

Project Name: shear wall

Model: Shear wall Level 0 - 37ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.084	1	1922	0.182

Chords

					<u>Bracing (in)</u>				
Level	Section	F_y (ksi)	Configuration	Flexural	Axial $K_y L_y$	Axial $K_t L_t$	Flex $K\phi$ (lb-in/in)	Axial $K\phi$ (lb-in/in)	Bracing, Lm (in)
1	600S250-68	50	(2) Boxed	None	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7Ω_oQ_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525Ω_oQ_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	3288	2466	9863	7397

Factored Chord Strong-Axis Bending, M_x (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

	Minimum	Minimum	Interactions							
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	6915	23349	0	0	0	0	0.141	0.106	0.422	0.317

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 0 - 37ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - 54	2	Base	4	7665	12265	0.109	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14Sds)D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-1523	-3288	-9863	6000	12950	38850

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.099	0.214	0.643

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Level	Relative Displacement (in)			Drift %		
	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0	0.01	0.04	0	0.01	0.04

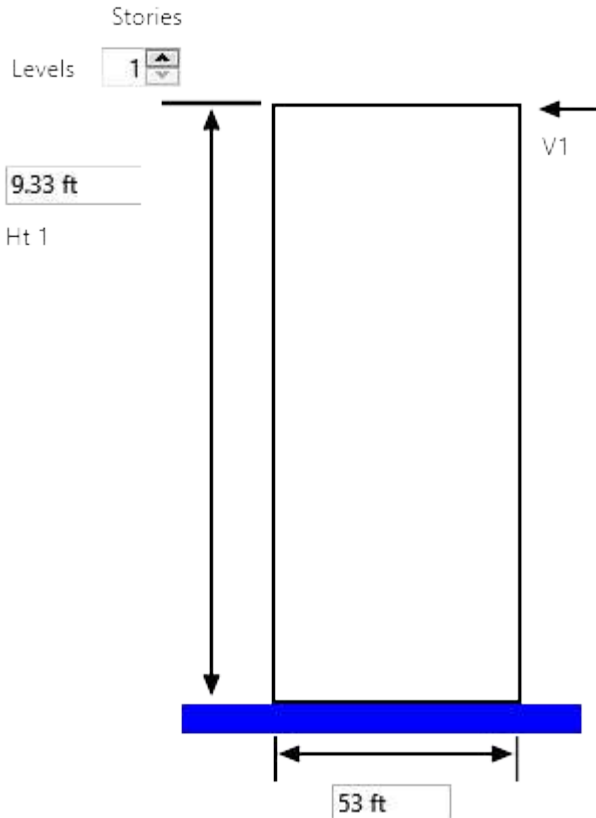
Project Name: shear wall

Model: Shear wall Level 0 - 53ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	26500	0.18

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? No

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	113.	18550	350

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification FactorsWindSeismic

Project Name: shear wall

Model: Shear wall Level 0 - 53ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.059	1	1922	0.182

Chords

					Bracing (in)				
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	600S250-68	50	(2) Boxed	None	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7 Ω_o Q_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525 Ω_o Q_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	3281	2461	9843	7382

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum	Interactions							
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	6915	23349	0	0	0	0	0.141	0.105	0.422	0.316

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 0 - 53ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - 54	2	Base	4	7665	12265	0.109	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14Sds)D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-1061	-3281	-9843	6000	18550	55650

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.069	0.214	0.642

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement

Floor-Floor				Drift %		
Relative Displacement (in)						
Level	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0	0.01	0.03	0	0.01	0.03

Project Name: shear wall

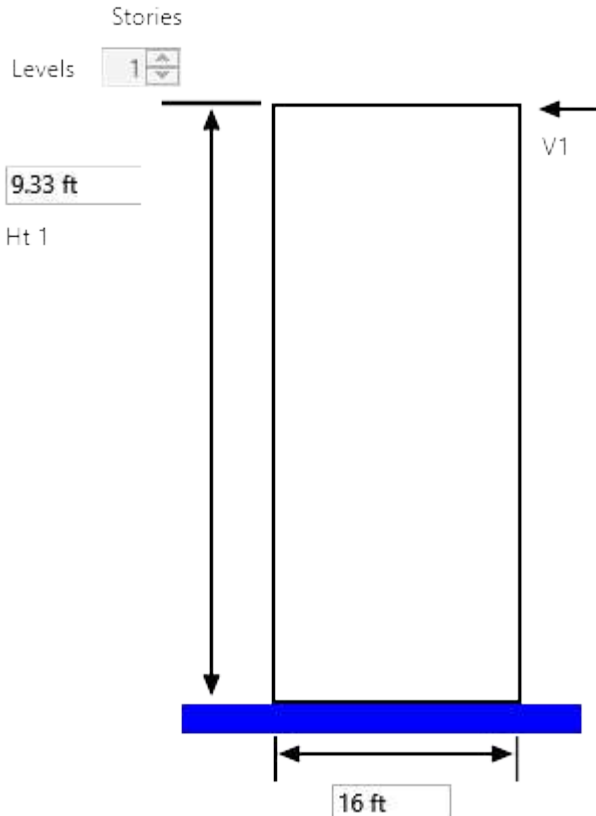
C.2.16

Model: Shear wall Level 0 - 16ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	41000	0.58

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? No

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	375	28700	1793.75

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification FactorsWindSeismic

Project Name: shear wall

Model: Shear wall Level 0 - 16ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.195	1	1922	0.933

Chords

					Bracing (in)				
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	800S250-68	50	(4) Configuration 2	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7 Ω_o Q_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525 Ω_o Q_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	17001	12751	51004	38253

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum		Interactions						
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	20552	51132	0	0	0	0	0.332	0.249	0.997	0.748

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 0 - 16ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14S_{ds})D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-3554	-17001	-51004	6000	28700	53626

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.184	0.879	2.636

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Level	Relative Displacement (in)			Drift %		
	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.03	0.23	0.92	0.02	0.2	0.82

Project Name: shear wall

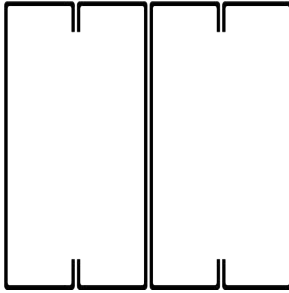
Model: Shear wall Level 0 - 16ft

Date: 02/12/2024

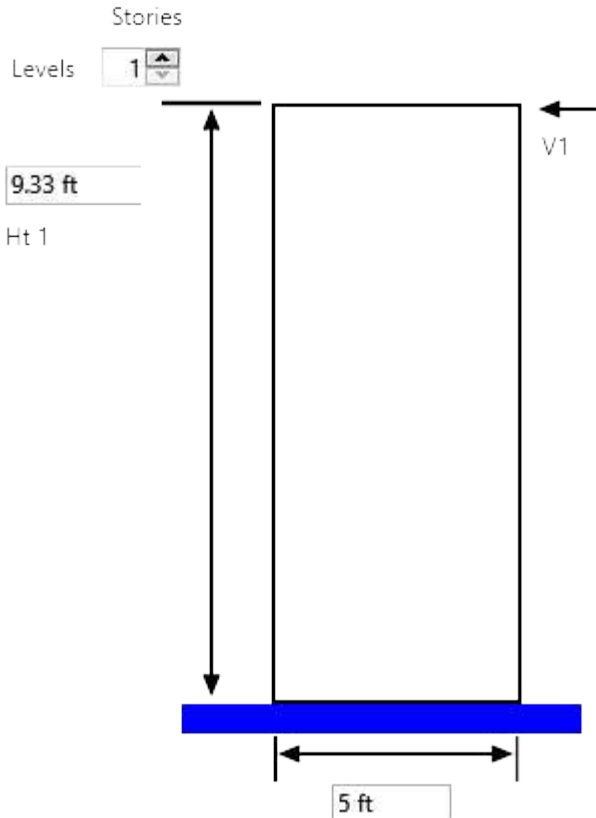
Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

(3) and (4) Chord Configuration Schematics



(4) Configuration 2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	9000	1.87

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? No

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	1200	6300	1260

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification Factors**Wind****Seismic**

Project Name: shear wall

Model: Shear wall Level 0 - 5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.624	1	1922	0.656

Chords

				<u>Bracing (in)</u>					
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	800S250-68	50	(4) Configuration 2	None	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7 Ω_o Q_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525 Ω_o Q_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	12375	9281	37124	27843

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum		Interactions						
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	20552	51132	0	0	0	0	0.242	0.182	0.726	0.545

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 0 - 5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - 54	2	Base	4	7665	12265	0.109	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)

LC7 = 0.6D + 0.6W

LC8 = 0.6D + 0.7E

LCO8 = (0.6-0.14S_{ds})D + 0.7 Ω_o Q_e Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-11785	-12375	-37124	6000	6300	16758

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.769	0.807	2.422

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Level	Relative Displacement (in)			Drift %		
	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.34	0.29	1.15	0.3	0.26	1.03

Project Name: shear wall

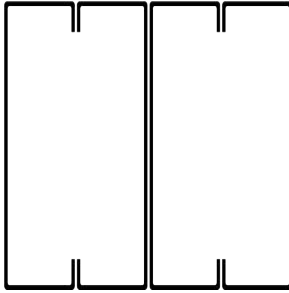
Model: Shear wall Level 0 - 5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

(3) and (4) Chord Configuration Schematics



(4) Configuration 2

Project Name: shear wall

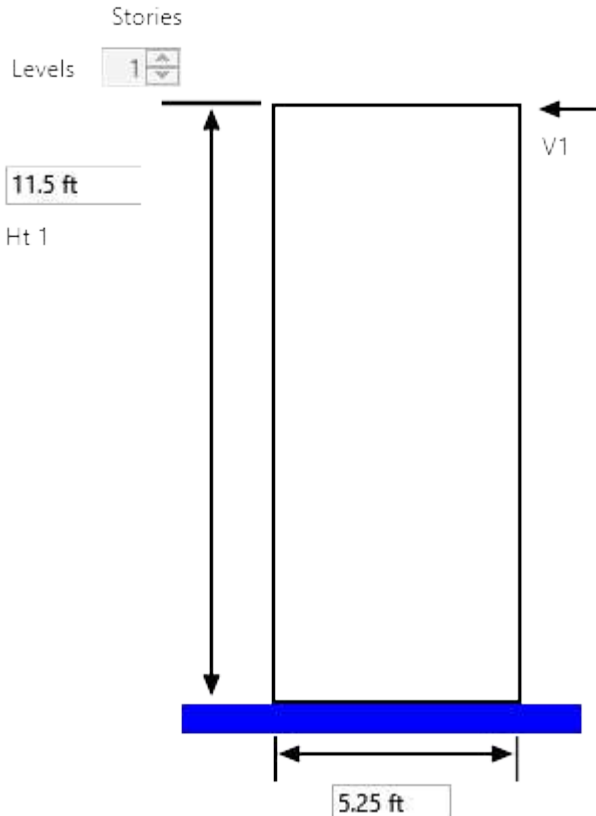
C.2.24

Model: Shear wall Level 1 - 5.25ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	11445	2.19

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? Yes

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	1142.	8011.5	1526

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification Factors**Wind****Seismic**

Project Name: shear wall

Model: Shear wall Level 1 - 5.25ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.595	1	1922	0.794

Chords

				<u>Bracing (in)</u>					
Level	Section	F_y (ksi)	Configuration	Flexural	Axial $K_y L_y$	Axial $K_t L_t$	Flex $K\phi$ (lb-in/in)	Axial $K\phi$ (lb-in/in)	Bracing, Lm (in)
1	800S250-68	50	(4) Configuration 2	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7Ω_oQ_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525Ω_oQ_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	18426	13820	55279	41460

Factored Chord Strong-Axis Bending, M_x (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum		Interactions						
Level	M _a (ft-lb)	P _a (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	20552	49928	0	0	0	0	0.369	0.277	0.923	0.692

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 1 - 5.25ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14S_{ds})D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-13800	-18426	-55279	6000	8011	17596

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.713	0.952	2.381

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement

Floor-Floor				Drift %		
Relative Displacement (in)						
Level	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.45	0.55	2.18	0.33	0.4	1.58

Project Name: shear wall

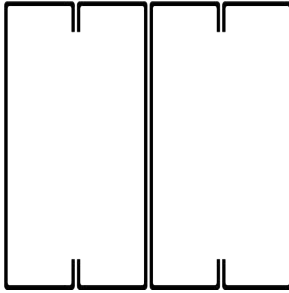
Model: Shear wall Level 1 - 5.25ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

(3) and (4) Chord Configuration Schematics



(4) Configuration 2

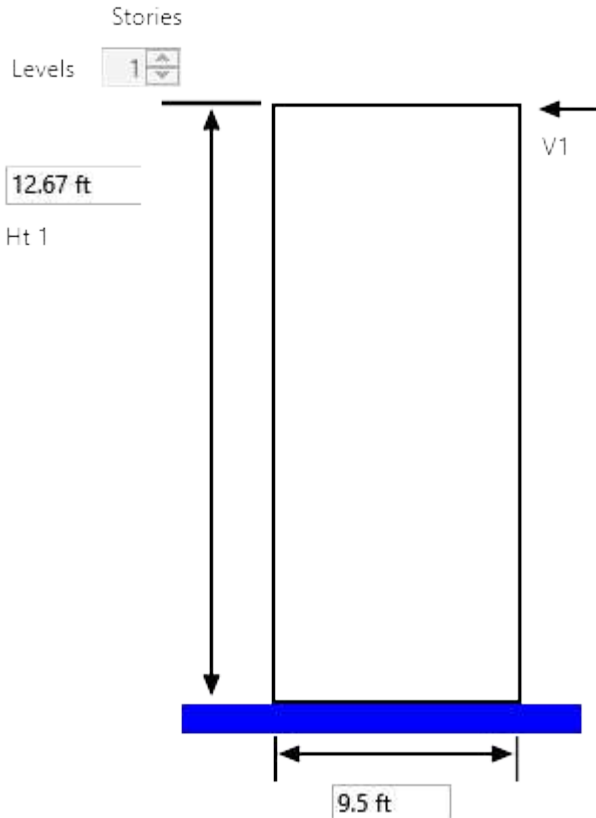
Project Name: shear wall

Model: Shear wall Level 1 - 9.5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	19000	1.33

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? Yes

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	631.	13300	1400

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification FactorsWindSeismic

Project Name: shear wall

Model: Shear wall Level 1 - 9.5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.329	1	1922	0.728

Chords

					<u>Bracing (in)</u>				
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	800S250-68	50	(4) Configuration 2	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14Sds)D + 0.7 Ω_o QeLCO6 = (1.0 + 0.105 Sds)D + 0.525 Ω_o Qe + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	18217	13663	54652	40989

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

<u>Minimum</u>		<u>Minimum</u>	<u>Interactions</u>							
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	20552	49120	0	0	0	0	0.371	0.278	0.927	0.695

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 1 - 9.5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)

LC7 = 0.6D + 0.6W

LC8 = 0.6D + 0.7E

LCO8 = (0.6-0.14S_{ds})D + 0.7 Ω_o Q_e Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-8218	-18217	-54652	6000	13300	31840

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.425	0.941	2.354

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Level	Relative Displacement (in)			Drift %		
	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.14	0.34	1.35	0.09	0.22	0.89

Project Name: shear wall

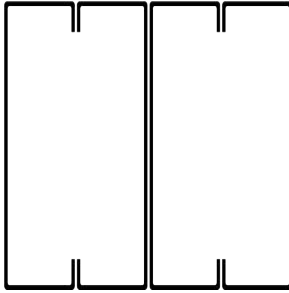
Model: Shear wall Level 1 - 9.5ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

(3) and (4) Chord Configuration Schematics



(4) Configuration 2

Project Name: shear wall

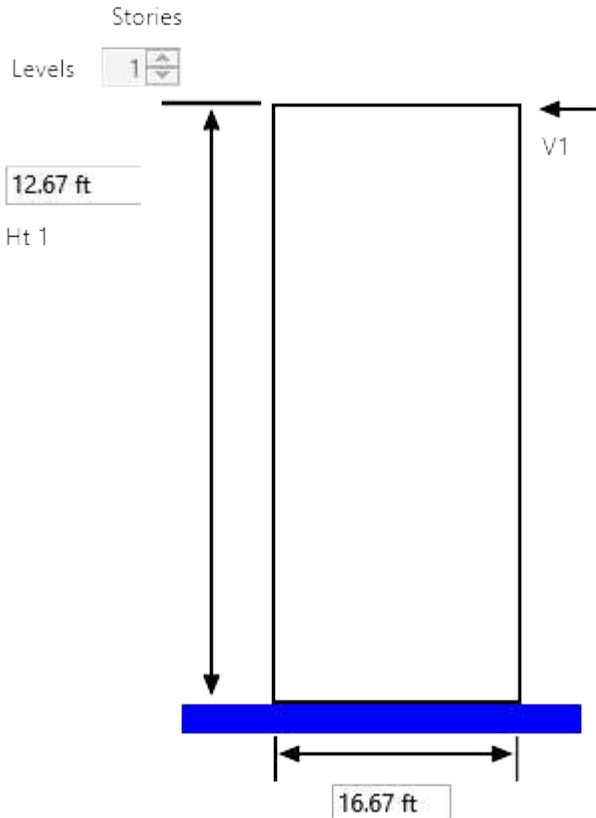
C.2.32

Model: Shear wall - Level 1 - 16.67ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	33340	0.76

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? Yes

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	359.	23338	1400

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification FactorsWindSeismic

Project Name: shear wall

Model: Shear wall Level 1 - 16.67ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.187	1	1922	0.728

Chords

					<u>Bracing (in)</u>				
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	800S250-68	50	(4) Configuration 2	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7 Ω_o Q_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525 Ω_o Q_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	18008	13506	54024	40518

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

<u>Minimum</u>		<u>Minimum</u>	<u>Interactions</u>							
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	20552	49120	0	0	0	0	0.367	0.275	0.917	0.687

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 1 - 16.67ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)

LC7 = 0.6D + 0.6W

LC8 = 0.6D + 0.7E

LCO8 = (0.6-0.14S_{ds})D + 0.7 Ω_o Q_e Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-4630	-18008	-54024	6000	23338	55871

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.239	0.931	2.327

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Level	Relative Displacement (in)			Drift %		
	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.04	0.21	0.86	0.03	0.14	0.56

Project Name: shear wall

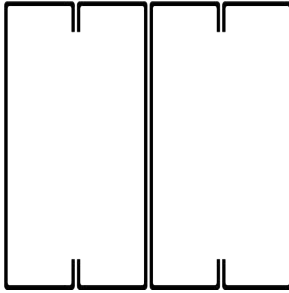
Model: Shear wall Level 1 - 16.67ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

(3) and (4) Chord Configuration Schematics



(4) Configuration 2

Project Name: shear wall

STUDS SIZE
CHANGE TO 6"

C.2.36

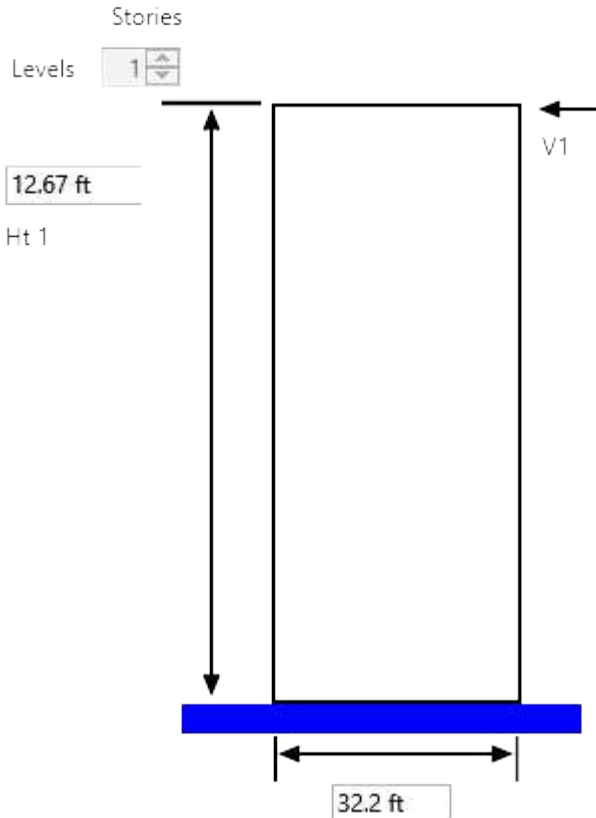
Model: Shear wall Level 1 - 32.2ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report



Load Inputs (All Loads are Unfactored Forces)

Top of Level Shear (lb)

Level	Wind	Seismic	Aspect Ratio
1	10000	16100	0.39

Seismic Design Parameters:

Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? Yes

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	186.	11270	350

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification Factors

Wind

Seismic

Project Name: shear wall

Model: Shear wall Level 1 - 32.2ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.097	1	1922	0.182

Chords

					Bracing (in)				
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	600S250-68	50	(2) Boxed	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7 Ω_o Q_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525 Ω_o Q_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	4469	3352	13408	10056

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum		Interactions						
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	6915	20362	0	0	0	0	0.219	0.165	0.549	0.412

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 1 - 32.2ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14S_{ds})D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-2379	-4469	-13408	6000	11270	33810

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.123	0.231	0.577

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Relative Displacement (in)				Drift %		
Level	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.01	0.02	0.09	0.01	0.01	0.06

Project Name: shear wall

STUDS SIZE
CHANGE TO 6"

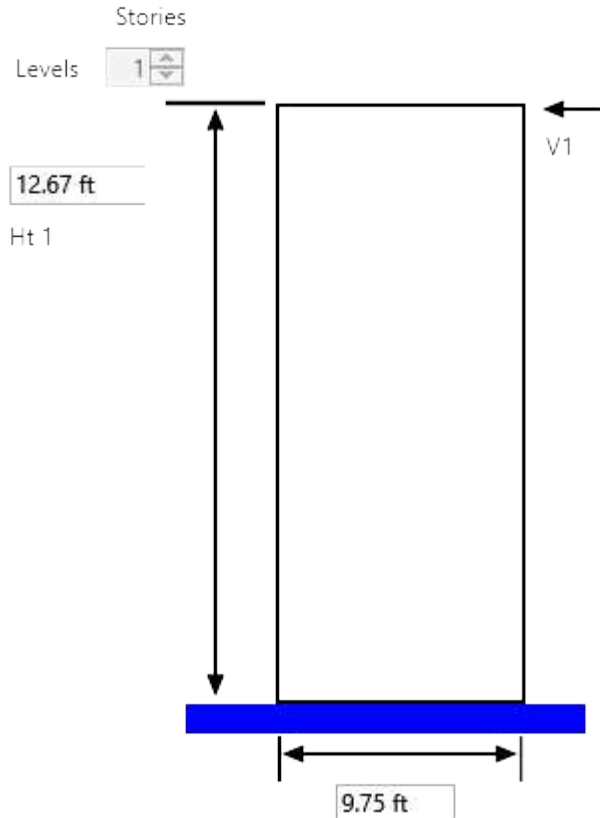
C.2.39

Model: Shear wall Level 1 - 9.75ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report**Load Inputs (All Loads are Unfactored Forces)****Top of Level Shear (lb)**

Level	Wind	Seismic	Aspect Ratio
1	10000	5558	1.3

Seismic Design Parameters:Seismic Design Category = E $S_{DS} = 1.467$ $I_e = 1$

Level	Overstrength Factor, Ω_0	Defl Amplification Factor, C_d
1	3	4

Allowable Strength Increase for Load Combinations w/Overstrength Included? Yes

Additional Applied Chord Axial Loads (lb) - Unfactored

Level	D	L	Lr	S	W
1	0	0	0	0	0

Additional Applied Chord Moments (ft-lb) - Unfactored

Level	D	L	Lr	S	W	E
1	0	0	0	0	0	0

Total and Unit Shear Forces (Factored)

Level	Wind Shear Forces		Seismic Shear Forces	
	V, Total (lb)	v, per ft (lb/ft)	V, Total (lb)	v, per ft (lb/ft)
1	6000	615.	3890.6	399.

Shear Wall Sheathing and Fastener Selection

Level	Sheathing	200B Series?	Fastener Size	Edge/Field Fastener Spac (in)	Framing Thickness (mils)	Max Framing Spac (in)	One or Two Sides
1	Sure-Board® Series 200W/Series	NO	No. 10	2/6	68	16	2

Note: Sure-Board® per IAPMO ER-126

Shear Strength Modification FactorsWindSeismic

Project Name: shear wall

Model: Shear wall Level 1 - 9.75ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Modifiers	Modifiers
1	None	None

Available Shear Strength and Shear Ratios

<u>Wind</u>				<u>Seismic</u>		
Level	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a	Aspect Ratio Factor	Available Shear Strength, v_a (lb/ft)	Shear Ratio v/v_a
1	1	1922	0.32	1	1922	0.208

Chords

					Bracing (in)				
Level	Section	Fy (ksi)	Configuration	Flexural	Axial KyLy	Axial KtLt	Flex K ϕ (lb-in/in)	Axial K ϕ (lb-in/in)	Bracing, Lm (in)
1	600S250-68	50	(2) Boxed	Full	None	None	0	0	None
Interconnection Spacing = 12 in									

Load Combinations ASCE7-16 ASD

LC1 = D

LC2 = D + L

LC3 = D + (Lr or S)

LC4 = D + 0.75L + 0.75(Lr or S)

LC5 = D + (0.6W or 0.7E)

LC6 = D + 0.75(0.6W or 0.7E) + 0.75L + 0.75(Lr or S)

LCO5 = (1.0 + 0.14S_{ds})D + 0.7 Ω_o Q_eLCO6 = (1.0 + 0.105 S_{ds})D + 0.525 Ω_o Q_e + 0.75L + 0.75(Lr or S)Note: LCO5 and LCO6 based on the lower of
Overstrength or Expected Strength**Factored Chord Compression, P (lb)**

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	8002	6002	15566	11675

Factored Chord Strong-Axis Bending, Mx (ft-lb)

Level	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	0	0	0	0	0	0	0	0

Minimum		Minimum		Interactions						
Level	Ma (ft-lb)	Pa (lb)	LC1	LC2	LC3	LC4	LC5	LC6	LC05	LC06
1	6915	20362	0	0	0	0	0.393	0.295	0.637	0.478

Ties and Holdowns

Holdown LRFD Holdown

Project Name: shear wall

Model: Shear wall Level 1 - 9.75ft

Date: 02/12/2024

Code: 2012 NASPEC [AISI S100-2012]
AISI S400-15/S1-16 AISI S240-15

Simpson Strong-Tie® CFS Designer™ 5.0.0.2

LFRS Shearwall Summary Report

Level	Holddown	Quantity	Config	Exposed Rod Length (in)	Capacity Ta (lb/Each)	Capacity Φ Tn (lb)	Disp at Φ Tn (lb)	Holddown height (in)	Rod Dia. (in)
1	S/HDU11 - (2) 54	2	Base	4	9675	15460	0.158	16.625	0.875

Level	Holddown Offset from End of Shear Wall (in)
1	3.0

Load Combinations (ASCE7-16 ASD)LC7 = $0.6D + 0.6W$ LC8 = $0.6D + 0.7E$ LCO8 = $(0.6-0.14Sds)D + 0.7\Omega_o Q_e$ Note: LCO8 based on the lower of Overstrength or Expected Strength**Factored Net Uplift (lb)**(Negative values represent uplift,
Positive values indicate no net uplift)

Level	LC7	LC8	LC08	Wind	Seismic	Seismic w/Overstrength
1	-8002	-5189	-15566	6000	3891	11672

Ratio (Factored Net Uplift)/(Holddown Capacity)

Level	LC7	LC8	LC08
1	0.414	0.268	0.67

HOLDOWN CAPACITY IS NOT
CHECKED FOR OMEGA. PLEASE
DISREGARD LC08 IN ALL
ATTACHMENTS

Displacement**Floor-Floor**

Level	Relative Displacement (in)			Drift %		
	Wind	Seismic	Seismic, Cd	Wind	Seismic	Seismic, Cd
1	0.15	0.08	0.31	0.1	0.05	0.2

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Company:

Address:

Phone | Fax:

Design:

Fastening point:

Typical

Page:

Specifier:

E-Mail:

Date:

1

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Specifier's comments:

1 Input data

Anchor type and diameter:
Heavy Hex Head ASTM F 1554 GR. 55 1

Item number:

not available

Effective embedment depth:

 $h_{ef} = 18.000$ in.

Material:

ASTM F 1554

Evaluation Service Report:

Hilti Technical Data

Issued | Valid:

- | -

Proof:

Design Method ACI 318-19 / CIP

Stand-off installation:

 $e_b = 0.000$ in. (no stand-off); $t = 0.500$ in.

Anchor plate^R:

 $l_x \times l_y \times t = 9.000$ in. \times 15.000 in. \times 0.500 in.; (Recommended plate thickness: not calculated)

Profile:

no profile

Base material:

cracked concrete, 4000, $f'_c = 4,000$ psi; $h = 24.000$ in.

Reinforcement:

tension: not present, shear: not present;

edge reinforcement: none or \leq No. 4 bar

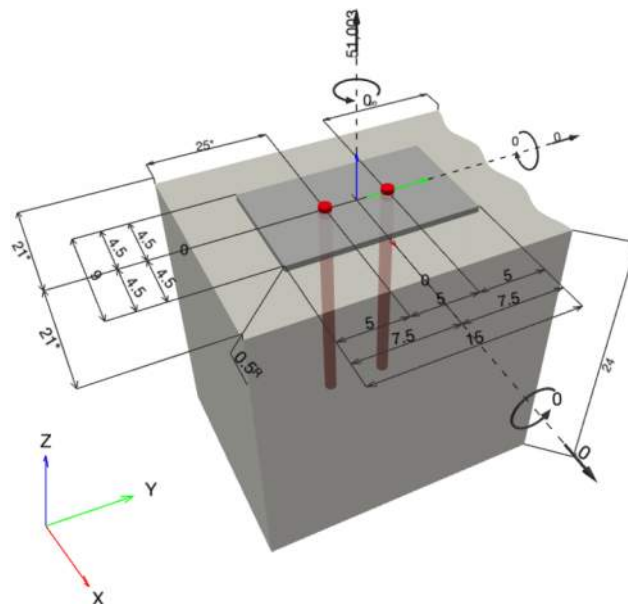
Seismic loads (cat. C, D, E, or F)

Tension load: yes (17.10.5.3 (d))

Shear load: yes (17.10.6.3 (c))


^R - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



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1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 51,003; V _x = 0; V _y = 0; M _x = 0; M _y = 0; M _z = 0;	yes	102

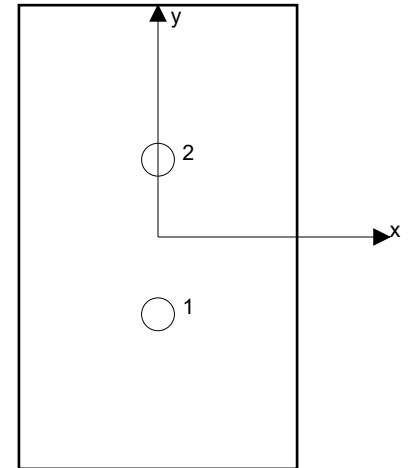
2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	25,502	0	0	0
2	25,502	0	0	0

max. concrete compressive strain: - [%]
max. concrete compressive stress: - [psi]
resulting tension force in (x/y)=(0.000/0.000): 0 [lb]
resulting compression force in (x/y)=(0.000/0.000): 0 [lb]



Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N _{ua} [lb]	Capacity ϕ N _n [lb]	Utilization $\beta_N = N_{ua}/\phi N_n$	Status
Steel Strength*	25,502	34,087	75	OK
Pullout Strength*	25,502	25,217	102	not recommended
Concrete Breakout Failure**	51,003	50,820	101	not recommended
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (anchors in tension)

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Date:

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3.1 Steel Strength

$$N_{sa} = A_{se,N} f_{uta} \quad \text{ACI 318-19 Eq. (17.6.1.2)}$$

$$\phi N_{sa} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

Variables

$A_{se,N}$ [in. ²]	f_{uta} [psi]
0.61	75,000

Calculations

N_{sa} [lb]
45,450

Results

N_{sa} [lb]	ϕ_{steel}	ϕN_{sa} [lb]	N_{ua} [lb]
45,450	0.750	34,087	25,502

3.2 Pullout Strength

$$N_{pN} = \psi_{c,p} N_p \quad \text{ACI 318-19 Eq. (17.6.3.1)}$$

$$N_p = 8 A_{brg} f'_c \quad \text{ACI 318-19 Eq. (17.6.3.2.2a)}$$

$$\phi N_{pN} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

Variables

$\psi_{c,p}$	A_{brg} [in. ²]	λ_a	f'_c [psi]
1.000	1.50	1.000	4,000

Calculations

N_p [lb]
48,032

Results

N_{pn} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{pn} [lb]	N_{ua} [lb]
48,032	0.700	0.750	1.000	25,217	25,502

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Fastening point:

|
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Page:

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3.3 Concrete Breakout Failure

$$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \quad \text{ACI 318-19 Eq. (17.6.2.1b)}$$

$$\phi N_{cbg} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

$$A_{Nc} \text{ see ACI 318-19, Section 17.6.2.1, Fig. R 17.6.2.1(b)}$$

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-19 Eq. (17.6.2.1.4)}$$

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.3.1)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.4.1b)}$$

$$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.6.1b)}$$

$$N_b = 16 \lambda_a \sqrt{f'_c} h_{ef}^{5/3} \quad \text{ACI 318-19 Eq. (17.6.2.2.3)}$$

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
16.667	0.000	0.000	21.000	1.000
c_{ac} [in.]	k_c	λ_a	f'_c [psi]	
-	16	1.000	4,000	

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
2,310.00	2,500.00	1.000	1.000	0.952	1.000	110,044

Results

N_{cbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{cbg} [lb]	N_{ua} [lb]
96,800	0.700	0.750	1.000	50,820	51,003

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Company:		Page:	5
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Typical	Date:	3/13/2024
Fastening point:			

4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	N/A	N/A	N/A	N/A
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength*	N/A	N/A	N/A	N/A
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (relevant anchors)

5 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- For additional information about ACI 318 strength design provisions, please go to <https://submittals.us.hilti.com/PROFISAnchorDesignGuide/>
- "An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-19, Chapter 17, Section 17.10.5.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.10.5.3 (b), Section 17.10.5.3 (c), or Section 17.10.5.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.10.6.3 (a), Section 17.10.6.3 (b), or Section 17.10.6.3 (c)."
- Section 17.10.5.3 (b) / Section 17.10.6.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.10.5.3 (c) / Section 17.10.6.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.10.5.3 (d) / Section 17.10.6.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by ω_0 .

Fastening does not meet the design criteria!

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Design:	Typical	Date:	3/13/2024
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6 Installation data

Profile: no profile

Hole diameter in the fixture: $d_f = 1.062$ in.

Plate thickness (input): 0.500 in.

Recommended plate thickness: not calculated

Anchor type and diameter: Heavy Hex Head ASTM F 1554
GR. 55 1

Item number: not available

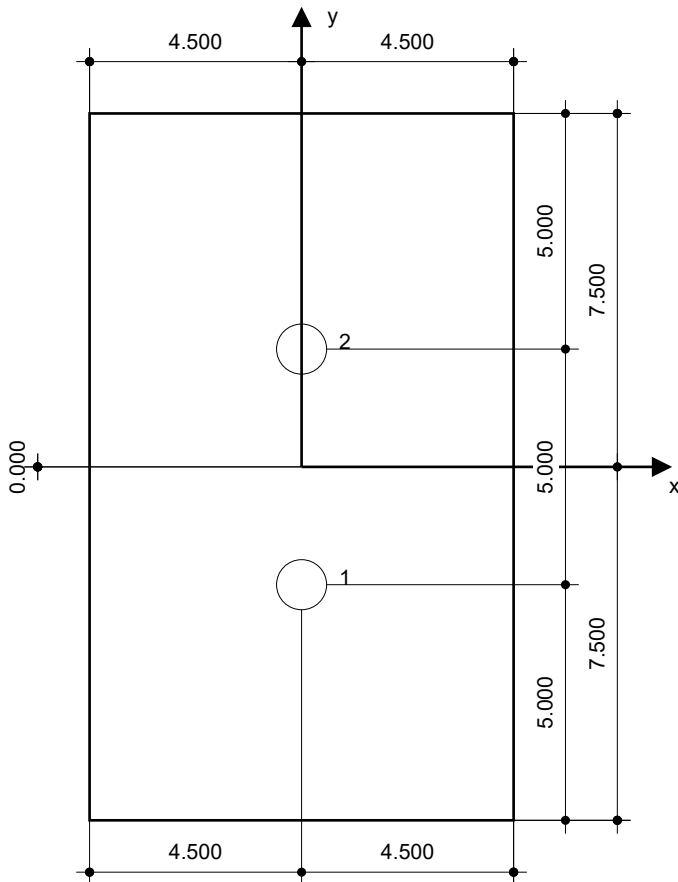
Maximum installation torque: -

Hole diameter in the base material: - in.

Hole depth in the base material: 18.000 in.

Minimum thickness of the base material: 19.172 in.

Hilti Heavy Hex Head headed stud anchor with 18 in embedment, 1, Steel galvanized, installation per instruction for use



Coordinates Anchor [in.]

Anchor	x	y	c _{-x}	c _{+x}	c _{-y}	c _{+y}
1	0.000	-2.500	21.000	21.000	25.000	-
2	0.000	2.500	21.000	21.000	30.000	-

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7 Remarks; Your Cooperation Duties

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Specifier's comments:

1 Input data

Anchor type and diameter:
Heavy Hex Head ASTM F 1554 GR. 55 1

Item number:

not available

Effective embedment depth:

 $h_{ef} = 9.000$ in.

Material:

ASTM F 1554

Evaluation Service Report:

Hilti Technical Data

Issued | Valid:

- | -

Proof:

Design Method ACI 318-19 / CIP

Stand-off installation:

 $e_b = 0.000$ in. (no stand-off); $t = 0.500$ in.

Anchor plate^R:

 $l_x \times l_y \times t = 9.000$ in. \times 15.000 in. \times 0.500 in.; (Recommended plate thickness: not calculated)

Profile:

no profile

Base material:

cracked concrete, 4000, $f'_c = 4,000$ psi; $h = 12.000$ in.

Reinforcement:

tension: not present, shear: not present;

edge reinforcement: none or \leq No. 4 bar

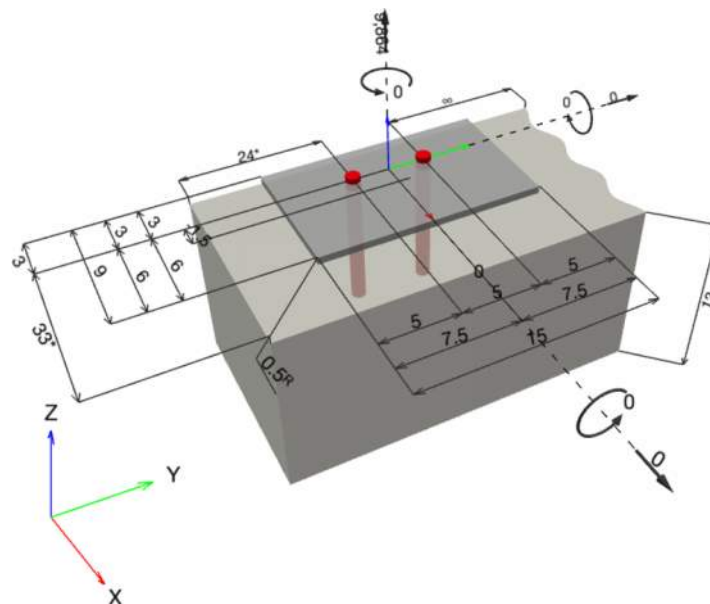
Seismic loads (cat. C, D, E, or F)

Tension load: yes (17.10.5.3 (d))

Shear load: yes (17.10.6.3 (c))


^R - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



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1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 9,864; V _x = 0; V _y = 0; M _x = 0; M _y = 0; M _z = 0;	yes	83

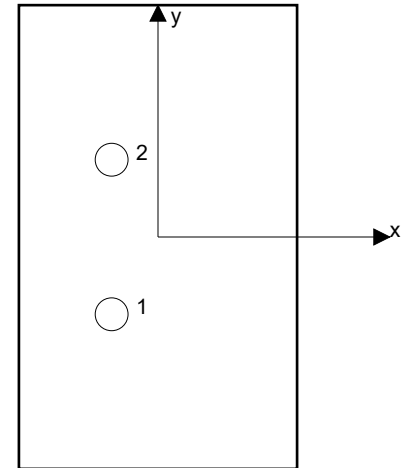
2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	4,932	0	0	0
2	4,932	0	0	0

max. concrete compressive strain: - [%]
max. concrete compressive stress: - [psi]
resulting tension force in (x/y)=(0.000/0.000): 0 [lb]
resulting compression force in (x/y)=(0.000/0.000): 0 [lb]



Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N _{ua} [lb]	Capacity ϕ N _n [lb]	Utilization $\beta_N = N_{ua} / \phi N_n$	Status
Steel Strength*	4,932	34,087	15	OK
Pullout Strength*	4,932	25,217	20	OK
Concrete Breakout Failure**	9,864	11,948	83	OK
Concrete Side-Face Blowout, direction x-**	9,864	24,950	40	OK

* highest loaded anchor **anchor group (anchors in tension)

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3.1 Steel Strength

$$N_{sa} = A_{se,N} f_{uta} \quad \text{ACI 318-19 Eq. (17.6.1.2)}$$

$$\phi N_{sa} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

Variables

$A_{se,N} [\text{in.}^2]$	$f_{uta} [\text{psi}]$
0.61	75,000

Calculations

$N_{sa} [\text{lb}]$
45,450

Results

$N_{sa} [\text{lb}]$	ϕ_{steel}	$\phi N_{sa} [\text{lb}]$	$N_{ua} [\text{lb}]$
45,450	0.750	34,087	4,932

3.2 Pullout Strength

$$N_{pN} = \psi_{c,p} N_p \quad \text{ACI 318-19 Eq. (17.6.3.1)}$$

$$N_p = 8 A_{brg} f'_c \quad \text{ACI 318-19 Eq. (17.6.3.2.2a)}$$

$$\phi N_{pN} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

Variables

$\psi_{c,p}$	$A_{brg} [\text{in.}^2]$	λ_a	$f'_c [\text{psi}]$
1.000	1.50	1.000	4,000

Calculations

$N_p [\text{lb}]$
48,032

Results

$N_{pn} [\text{lb}]$	ϕ_{concrete}	ϕ_{seismic}	$\phi_{\text{nonductile}}$	$\phi N_{pn} [\text{lb}]$	$N_{ua} [\text{lb}]$
48,032	0.700	0.750	1.000	25,217	4,932

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3.3 Concrete Breakout Failure

$$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \quad \text{ACI 318-19 Eq. (17.6.2.1b)}$$

$$\phi N_{cbg} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

$$A_{Nc} \text{ see ACI 318-19, Section 17.6.2.1, Fig. R 17.6.2.1(b)}$$

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-19 Eq. (17.6.2.1.4)}$$

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.3.1)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.4.1b)}$$

$$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.6.1b)}$$

$$N_b = k_c \lambda_a \sqrt{f_c} h_{ef}^{1.5} \quad \text{ACI 318-19 Eq. (17.6.2.2.1)}$$

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
9.000	0.000	0.000	3.000	1.000
c_{ac} [in.]	k_c	λ_a	f_c [psi]	
-	24	1.000	4,000	

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
528.00	729.00	1.000	1.000	0.767	1.000	40,983

Results

N_{cbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{cbg} [lb]	N_{ua} [lb]
22,757	0.700	0.750	1.000	11,948	9,864

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3.4 Concrete Side-Face Blowout, direction x-

$$N_{sb} = 160 c_{a1} \sqrt{A_{brg}} \lambda_a \sqrt{f'_c} \quad \text{ACI 318-19 Eq. (17.6.4.1)}$$

$$N_{sbg} = \alpha_{group} N_{sb} \quad \text{ACI 318-19 Eq. (17.6.4.2)}$$

$$\phi N_{sbg} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

$$\alpha_{group} = \left(1 + \frac{s}{6 c_{a1}} \right) \quad \text{see ACI 318-19, Section 17.6.4.2, Eq. (17.6.4.2)}$$

Variables

c_{a1} [in.]	c_{a2} [in.]	A_{brg} [in. ²]	λ_a	f'_c [psi]	s [in.]
3.000	24.000	1.50	1.000	4,000	5.000

Calculations

α_{group}	N_{sb} [lb]
1.278	37,193

Results

N_{sbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{sbg} [lb]	$N_{ua,edge}$ [lb]
47,524	0.700	0.750	1.000	24,950	9,864

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4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	N/A	N/A	N/A	N/A
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength*	N/A	N/A	N/A	N/A
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (relevant anchors)

5 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- For additional information about ACI 318 strength design provisions, please go to <https://submittals.us.hilti.com/PROFISAnchorDesignGuide/>
- "An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-19, Chapter 17, Section 17.10.5.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.10.5.3 (b), Section 17.10.5.3 (c), or Section 17.10.5.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.10.6.3 (a), Section 17.10.6.3 (b), or Section 17.10.6.3 (c)."
- Section 17.10.5.3 (b) / Section 17.10.6.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.10.5.3 (c) / Section 17.10.6.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.10.5.3 (d) / Section 17.10.6.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by ω_0 .

Fastening meets the design criteria!

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6 Installation data

Profile: no profile

Hole diameter in the fixture: $d_f = 1.062$ in.

Plate thickness (input): 0.500 in.

Recommended plate thickness: not calculated

Anchor type and diameter: Heavy Hex Head ASTM F 1554

GR. 55 1

Item number: not available

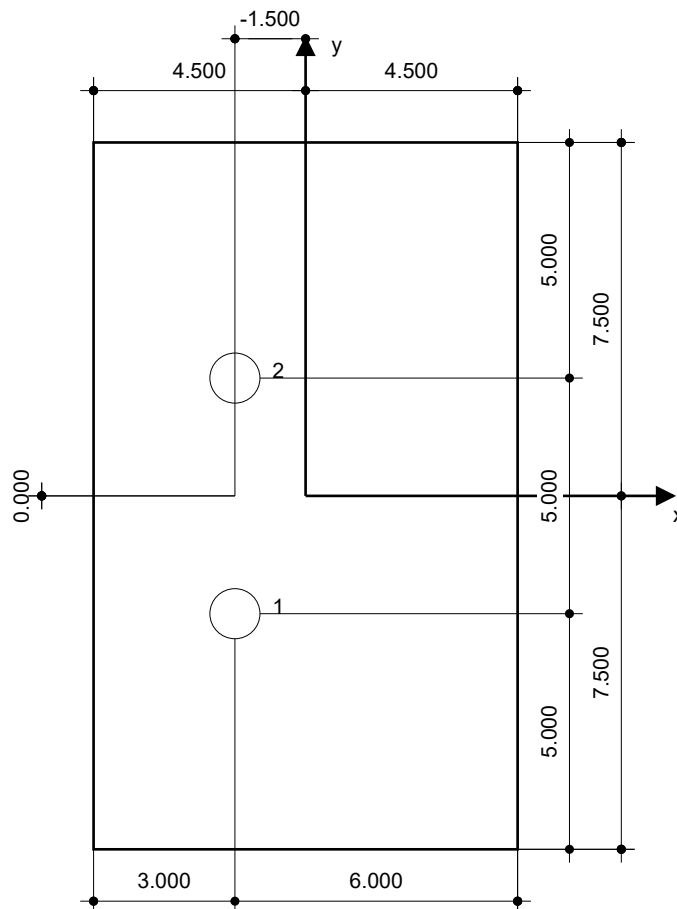
Maximum installation torque: -

Hole diameter in the base material: - in.

Hole depth in the base material: 9.000 in.

Minimum thickness of the base material: 10.172 in.

Hilti Heavy Hex Head headed stud anchor with 9 in embedment, 1, Steel galvanized, installation per instruction for use



Coordinates Anchor [in.]

Anchor	x	y	c _{-x}	c _{+x}	c _{-y}	c _{+y}
1	-1.500	-2.500	3.000	33.000	24.000	-
2	-1.500	2.500	3.000	33.000	29.000	-

Input data and results must be checked for conformity with the existing conditions and for plausibility!

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7 Remarks; Your Cooperation Duties

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- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

December 13, 2021

Re: SIMPSON STRONG-TIE S/HDU HOLDOWNS

To Whom It May Concern:

Table 1 provides tension loads for the Simpson Strong-Tie S/HDU holdown series attached to a single stud, as shown in Figure 1 below.

Table 1 – Tension Loads for S/HDU Holdowns attached to a Single Stud

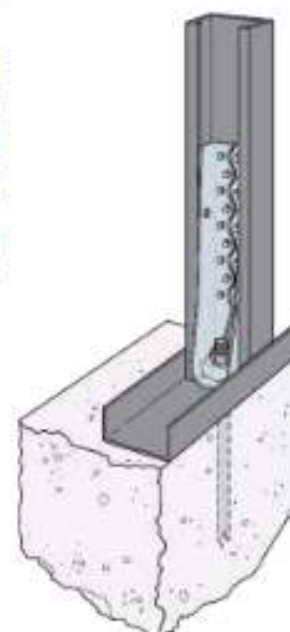
Model	H (in.)	Fasteners		Stud Member Thickness ² mil (ga)	ASD		LRFD		Nominal Tension Load ⁵ (lb.)
		Anchor Bolt Diameter ¹ (in.)	Stud Fasteners		Tension Load (lb.)	Deflection at ASD Load ⁴ (in.)	Tension Load (lb.)	Deflection at LRFD Load ⁴ (in.)	
S/HDU4	7 7/8	5/8	(6) #14	33 (20)	1,195	0.069	1,795	0.116	3,575
				43 (18)	1,780	0.068	2,670	0.106	5,095
				54 (16)	2,550	0.031	4,080	0.053	6,900
S/HDU6	10 3/8	5/8	(12) #14	33 (20)	2,390	0.064	3,590	0.119	6,590
				43 (18)	3,295	0.054	5,270	0.108	8,915
				54 (16)	5,100	0.073	8,160	0.167	13,805
				68 (14)	5,570	0.052	8,915	0.095	15,075
S/HDU9	12 7/8	7/8	(18) #14	33 (20)	2,855	0.029	4,570	0.045	7,730
				43 (18)	3,725	0.037	5,960	0.061	10,080
				54 (16)	6,750	0.071	10,805	0.131	18,270
				68 (14)	8,355	0.087	13,370	0.159	22,610
				97 (12)	8,355	0.087	13,370	0.159	22,610
S/HDU11	16 5/8	7/8	(27) #14	43 (18)	4,225	0.039	6,765	0.062	11,440
				54 (16)	7,665	0.07	12,265	0.109	20,740
				68 (14)	9,655	0.087	15,450	0.143	26,130
				97 (12) ³	14,925	0.129	23,880	0.235	40,385

1. The designer shall specify the foundation anchor material type, embedment, and configuration. Some of the tabulated holdown tension loads exceed the tensile strength of typical ASTM A36 or A307 anchor bolts.
2. Stud design by the specifier. Tabulated loads are based on a minimum stud thickness for fastener connection.
3. A heavy hex nut for the anchor bolt is required to achieve the table loads for S/HDU11 on 97 mil (12 ga) stud.
4. Deflection at ASD or LRFD is the deflection of the fastener slip, holdown deformation, and anchor rod elongation for holdowns installed up to 4 inches above the top of concrete when loaded to the ASD and LRFD load, respectively. Holdowns may be installed raised to 18 inches above the top of concrete, with no load reduction provided that additional elongation of the anchor rod is accounted for. This movement is strictly due to the holdown deformation under a static load test attached to members listed in the table above.
5. The Nominal Tension Load is based on the tested average ultimate (peak) load and is provided for design under section E1 of AISI S400 that categorized the holdowns as capacity-protected components. Based on AISI S400, the nominal load shall be greater than or equal to the required strength.

The information in this letter is valid until **December 31, 2023** when it will be re-evaluated by Simpson Strong-Tie. Please visit strongtie.com for additional pertinent information. If you have questions or need further assistance regarding this matter, please contact the Simpson Strong-Tie engineering department at 800.999.5099.

Sincerely,

SIMPSON STRONG-TIE COMPANY INC.


Figure 1: Typical S/HDU Installation to a Single Stud



700 South Flower Street, Suite 2100
Los Angeles, CA 90017
(213) 418-0201

project Sierra Madre Library Redesign

by RM

sheet no.

location

date

client

job no.

Condensing unit Anchorage design

CONDENSING UNIT ANCHOARGE

Calculating Fp Force:

See excel printout(next page)

Wp = 960lbs (For CU-1)

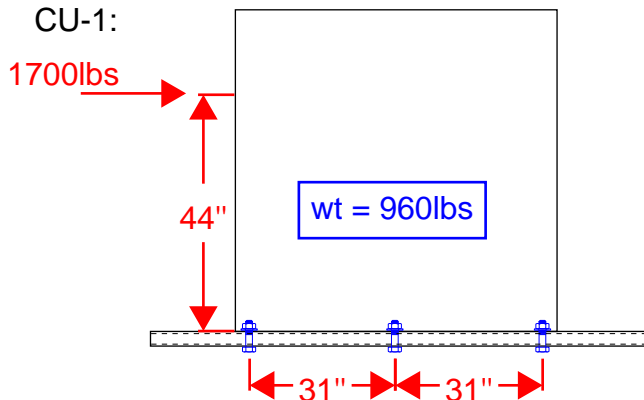
Wp = 790lbs (For CU-2)

Fp = 1.76Wp = 1.76*960lbs = 1689.6lbs (For CU-1)

Fp = 1.76Wp = 1.76*790lbs = 1390.4lbs (For CU-2)

Calculating Overturning forces:

CU-1:

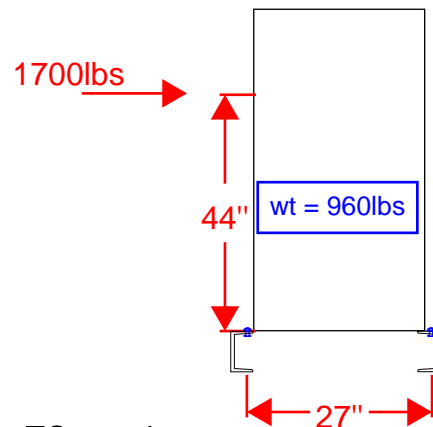


TC couple:

$$P = (1700\text{lbs} \cdot 44\text{in}) / (62\text{in}) = 1206.5\text{lbs}$$

$$1206.5\text{lbs} / 2\text{anchors EA side} =$$

$$603.25\text{lbs(EA anchor)}$$



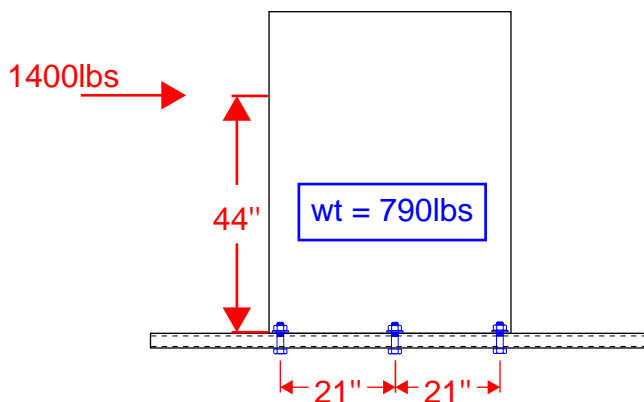
TC couple:

$$P = (1700\text{lbs} \cdot 44\text{in}) / (27\text{in}) = 2770.4\text{lbs}$$

$$2770.4\text{lbs} / 2\text{anchors EA side} =$$

$$1385.2\text{lbs(EA anchor)}$$

CU-2:

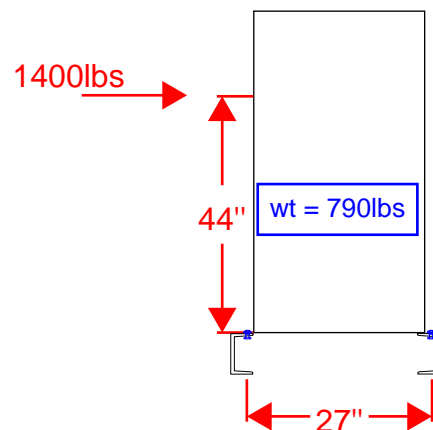


TC couple:

$$P = (1400\text{lbs} \cdot 44\text{in}) / (42\text{in}) = 1466.7\text{lbs}$$

$$1466.7\text{lbs} / 2\text{anchors EA side} =$$

$$733.35\text{lbs(EA anchor)}$$



TC couple:

$$P = (1400\text{lbs} \cdot 44\text{in}) / (27\text{in}) = 2281.5\text{lbs}$$

$$2281.5\text{lbs} / 2\text{anchors EA side} =$$

$$1140.75\text{lbs(EA anchor)}$$

Fp Force Calculations-Mechanical and Electrical Components

ASCE 7-16 Section 13.3, First Printing With Errata 1-3

A. OVERVIEW

A.1 This spreadsheet calculates the coefficient (Fp/Wp) to be multiplied by the weight of the component (Wp) in order to determine a component's horizontal seismic design force (Fp).

B. INPUT

- B.1 Determine Building height (h), and distance of floor from base (z), from building geometry.
B.2 Find S_{DS} (EQ 11.4-3) and determine the Component Importance Factor (I_p , Section 13.1.3)

C. EQUATIONS:

$$F_p/W_p = \frac{0.4 a_p S_{DS}}{(R_p / I_p)} (1+2z/h) \quad \text{EQ (13.3-1)}$$

$$F_p/W_p_{MAX} = 1.6 S_{DS} I_p \quad \text{EQ (13.3-2)}$$

$$F_p/W_p_{MIN} = 0.3 S_{DS} I_p \quad \text{EQ (13.3-3)}$$

Building Height (h) =	25 ft	Level		z	z/h
S_{DS} =	1.35	-	-	-	-
I_p =	1.5	R			0.00
		5			0.00
		4			0.00
		3			0.00
		2		20 ft	0.80
		1			0.00

ASCE 7-16 TABLE 13.6-1 SEISMIC COEFFICIENTS FOR MECHANICAL AND ELECTRICAL COMPONENTS				z/h						
				1	2	3	4	5	R	-
				0.00	0.80	0.00	0.00	0.00	0.00	-
MECHANICAL AND ELECTRICAL COMPONENTS				F_p/W_p						
	a_p	R_p	Ω_o							
Air-side HVAC, fans, air handlers, air conditioning units, cabinet heaters, air distribution boxes, and other mechanical components constructed of sheet metal framing.	2.5	6	2.00	0.61	0.88	0.61	0.61	0.61	0.61	-
Wet-side HVAC, boilers, furnaces, atmospheric tanks/bins, chillers, water equip., heaters, heat exchangers, evaporators, air separators, manufacturing or process and other mechanical components constructed of high-deformability materials.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Air Coolers (fin fans), air-cooled heat exchangers, condensing units, dry coolers, remote radiators and other mechanical components elevated on integral structural steel or sheet metal supports	2.5	3	1.50	0.68	1.76	0.68	0.68	0.68	0.68	-
Engines, turbines, pumps, compressors, and pressure vessels not supported on skirts and not within the scope of Chapter 15.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Skirt-supported pressure vessels not within the scope of Chapter 15.	2.5	2.5	2.00	0.81	2.11	0.81	0.81	0.81	0.81	-
Elevator and escalator components.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Generators, batteries, inverters, motors, transformers, and other electrical components constructed of high deformability materials.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Motor control centers, panel boards, switch gear, instrumentation cabinets, and other components constructed of sheet metal framing	2.5	6	2.00	0.61	0.88	0.61	0.61	0.61	0.61	-
Communication equipment, computers, instrumentation, and controls.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Roof-mounted chimneys, stacks, cooling and electrical towers laterally braced below their center of mass.	2.5	3	2.00	0.68	1.76	0.68	0.68	0.68	0.68	-
Roof-mounted chimneys, stacks, cooling and electrical towers laterally braced above their center of mass.	1.0	2.5	2.00	0.61	0.84	0.61	0.61	0.61	0.61	-
Lighting fixtures.	1.0	1.5	2.00	0.61	1.40	0.61	0.61	0.61	0.61	-
Other mechanical or electrical components.	1.0	1.5	2.00	0.61	1.40	0.61	0.61	0.61	0.61	-
VIBRATION ISOLATED COMPONENTS AND SYSTEMS										
Comp. and sys. isolated using neoprene elements and neoprene isolated floors w/built-in or separate elastomeric snubbing devices or resilient perimeter stops.	2.5	2.5	2.00	0.81	2.11	0.81	0.81	0.81	0.81	-
Spring isolated comp. and sys. and vibration isolated floors closely restrained using built-in/separate elastomeric snubb. devices or resilient perimeter stops.	2.5	2	2.00	1.01	2.63	1.01	1.01	1.01	1.01	-
Internally isolated components and systems.	2.5	2	2.00	1.01	2.63	1.01	1.01	1.01	1.01	-
Suspended vibration isolated equipment including in-line duct devices and suspended internally isolated components.	2.5	2.5	2.00	0.81	2.11	0.81	0.81	0.81	0.81	-
DISTRIBUTION SYSTEMS										
Piping in accordance with ASME B31 (2001,2002,2008, and 2010), including in-line components with joints made by welding or brazing.	2.5	12	2	0.61	0.61	0.61	0.61	0.61	0.61	-
Piping in accordance with ASME B31, including in-line components, constructed of high/limited deformability materials, w/ joints made by threading, bonding, compression couplings, or grooved couplings.	2.5	6	2	0.61	0.88	0.61	0.61	0.61	0.61	-



700 South Flower Street, Suite 2100
Los Angeles, CA 90017
(213) 418-0201

project Project Name

location Location

client Client

Sheet Description

by Name

date xx-xx-xx

job no.

10XXXX

sheet no.

SSK-XX

Bolt Strength check:

Over strength factor =1.5

CU-1(worst case):

Worst case loading on 1/2"Φ A325 Bolt

$A_b = .142\text{in}^2$

Tensile Load = $1.5 \times 1385.2\text{lbs} = 2002.8\text{lbs}$

Shear Load = $1700\text{lbs}/6\text{bolts} = 1.5 \times 283.3\text{lbs} = 424.95\text{lbs}$

Per AISC Steel Manual Bolt Strength:

Shear strength = $R_n = F_{nv} \cdot A_b = 54\text{ksi} \cdot .142\text{in}^2 = 7.67\text{kips}$ $7670\text{lbs} > 424.95\text{lbs}$ DCR = 0.055

Tensile strength = $R_n = F_{nt} \cdot A_b = 90\text{ksi} \cdot .142\text{in}^2 = 12.78\text{kips}$ $12,780\text{lbs} > 2002.8\text{lbs}$ DCR = 0.16

Total DCR = 0.215 OK



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Sheet Description

by Name

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10XXXX

sheet no.

SSK-XX



ENVIRONMENTAL

INSPECTION & LABORATORY

Lead Assessment Performed on 06/12/2024
Report Finalized on 06/17/2024

Project #JL-37248

Property Inspected

**440 West Sierra Madre Blvd
Sierra Madre, CA 91024**

Property Type: Single Story, Commercial Property

Report Prepared By

JLM Environmental
15200 Grevillea Avenue, Suite B
Lawndale, CA 90260-2018
(310) 978-8281 – info@jlmenvironmental.com
www.JLMEnvironmental.com

Comprehensive lead inspection performed of the subject property prior to extensive renovations.

This report details the findings of that survey and gives recommendations for handling lead containing materials. All information contained within must be disclosed to tenants and prospective purchasers in accordance with federal law (24 CFR Part 35 or 40 CFR Part 745).

Introduction

On 06/12/2024, JLM Environmental performed a comprehensive lead survey of suspect building materials and/or debris at the subject property at the request of the City of Sierra Madre, Sierra Madre Library c/o Arnulfo Yanez. The scope of JLM Environmental's inspection was limited to documentation and collection of samples prior to extensive renovations. This report provides a summary of the survey activities and findings as well as recommendations.

Property Information

The subject property is a single story, commercial property built in 1887. The property is currently vacant with personal contents present. At the time of the inspection, no noticeable fire or structural damage was observed.

Property Type:	Commercial Property
Property Size (ft²):	2500
Weather During Inspection:	Cloudy
Children Living at Property:	No
Client Present During Inspection:	No
Inspection Performed on Behalf of:	City of Sierra Madre, Sierra Madre Library c/o Arnulfo Yanez
Foundation Type:	Raised Floor Foundation

Sampling & Analytical Methodology

The lead assessment of the subject areas at the property was performed by Kyle Brown, a California State Department of Public Health Certified Lead Sampling Technician #LRC-00011560, under the guidance of Jonathan Massey, a California State Department of Health Services Certified Lead Inspector/Assessor, #LRC-00002199. All inspection procedures and sample collection were performed in accordance with EPA guidelines and Chapter 7 of the "*HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (1997 Revision)*" and CDPH Title 17 CCR Division 1, Chapter 8.

All lead activities must be performed in accordance with all applicable federal, state, and local regulations including, but not limited to, EPA 40 CFR Part 745; Renovation, Repair, and Painting Program Title X "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing," U.S. Department of Housing and Urban Development, 1997 Revision Title 17, California Code of Regulations (CCR), Division 1, Chapter 8 "Accreditation, Certification and Work Practices in Lead-Related Construction," Final Version: Filed January 8, 1999, Title 8, California Code of Regulations (CCR), Construction Safety Orders (Cal/OSHA) Section 1532.1, Lead in Construction Title 22, CCR Chapter 12.

XRF: The scope of JLM Environmental's survey included the inspection and sampling of all accessible materials as well as all accessible concealed materials (i.e., under carpet, above moveable drop ceilings, etc.) within the area(s) identified by the client. Building materials not identified in this report may be present within hidden or concealed areas of the building. The building was visually inspected and painted components and/or ceramic materials suspect for lead were identified; these items were categorized by substrate (i.e. plaster, wood, metal, ceramic) and their condition noted (intact, deteriorating). Sampling was performed utilizing a Heuresis Pb200i XRF analyzer following the manufacturer's instructions and all applicable regulatory guidelines. The instrument was calibrated to the manufacturer's specifications at the start of the assessment, after the assessment, and periodically every four hours as prescribed by the National Institute of Standards and Technology (NIST). A minimum of one representative surface of each painted component in each area was tested.

The EPA's Renovation, Repair, and Painting Rule (RRP) defines lead-based paint as any paint, varnish, lacquer, putty, plaster, or similar coating material which contains lead or its compounds in excess of 5,000 ppm by dry weight, 1.0 mg/cm² by XRF, or 0.5% by weight. In Los Angeles County, Title 11 (11.28.010) further defines lead-based paint as any paint, varnish, lacquer, putty, plaster, or similar coating or structural material which contains lead or its compounds in excess of 0.7 mg/cm². Regardless if the materials being disturbed are below the Los Angeles County threshold of 0.7 mg/cm², any materials containing varying levels of lead are still lead-containing and their removal are covered under Cal/OSHA worker protection regulations. JLM Environmental recommends that all contractors and workers follow Cal/OSHA's Lead in Construction Standard, Title 8 CCR Section 1532.1 during all lead removal. It is important to note that some painted surfaces may contain level of lead below

the detection limit which could create lead dust or lead contaminated soil hazards if the paint is turned into dust by abrasion, scraping, or sanding. This report shall be kept by the owner and all future owners for the life of the dwelling.

Observations

Scope of Survey:	Comprehensive Survey Performed
Areas Inspected:	Comprehensive
Observations:	Intact lead-based paint detected.
Lead Notes:	Intact lead-based paint was detected on the exterior areas of window components and the roof fascia. No other areas of lead-based paint or lead containing ceramic were detected at the time of the survey.



- Intact lead-based paint detected, response actions required.
- During this inspection, XRF readings of ceramic and porcelain components indicated the presence of lead below the regulatory level.
- Any signs of paint deterioration shall be immediately repaired in accordance with all applicable, Federal, State and local regulations, including, but not limited to, 40 CFR Part 745.
- Any paints/coatings or ceramic materials not identified in this report shall be considered suspect lead-based paint (LBP)/lead containing paint (LCP) and handled as lead-based paint unless sampled and proven to be non-LBP by a CDPH Certified Lead Inspector/Assessor.

XRF RESULTS

Please be advised that measurements are not to be used for bidding purposes. These are only estimates.

Table 1. Lead XRF Results: The materials found to be above the threshold of 0.7 mg/cm² are noted in **bold** below.

Sample #	Location	Material	Condition (Intact/Deteriorated)	Reading
Exterior				
LX-01	Wall	Paint on Stucco	Intact	0.0 mg/cm ²
LX-02	Wall	Paint on Wood	Intact	0.0 mg/cm ²
LX-03	Window	Paint on Wood Approx. 30 sq. ft.	Intact	0.9 mg/cm²
LX-04	Window Casing	Paint on Wood Approx. 80 sq. ft.	Intact	1.0 mg/cm²
LX-05	Windowsill	Paint on Wood Approx. 40 sq. ft.	Intact	1.2 mg/cm²
LX-06	Roof Fascia	Paint on Wood Approx. 400 sq. ft.	Intact	1.1 mg/cm²
LX-07	Side Door	Paint on Wood	Intact	0.0 mg/cm ²
LX-08	Side Door Casing	Paint on Wood	Intact	0.0 mg/cm ²
LX-09	Back Door	Paint on Wood	Intact	0.0 mg/cm ²
LX-10	Back Door Casing	Paint on Wood	Intact	0.1 mg/cm ²
LX-11	Back Door Jamb	Paint on Wood	Intact	0.0 mg/cm ²
Interior				
LX-12	Office East Wall	Paint on Plaster	Intact	0.0 mg/cm ²
LX-13	Office West Wall	Paint on Plaster	Intact	0.0 mg/cm ²
LX-14	Children's Room Wall	Paint on Plaster	Intact	0.0 mg/cm ²
LX-15	Reference Room Wall	Paint on Plaster	Intact	0.0 mg/cm ²
LX-16	California Room Wall	Paint on Plaster	Intact	0.0 mg/cm ²
LX-17	Computer Room Wall	Paint on Plaster	Intact	0.0 mg/cm ²
LX-18	Bathrooms Floor Tile	2x2" White Ceramic	Intact	0.0 mg/cm ²
LX-19	Bathrooms Tile Walls	4x4" White Ceramic	Intact	0.3 mg/cm ²
LX-20	Bathrooms Tile Walls	4x4" Green Ceramic	Intact	0.0 mg/cm ²

LX-21	Bathrooms Tile Walls	4x4" Pink Ceramic	Intact	0.0 mg/cm ²
LX-22	Closet Door	Paint on Wood	Intact	0.0 mg/cm ²
LX-23	Closet Door Casing	Paint on Wood	Intact	0.0 mg/cm ²
LX-24	Closet Door Jamb	Paint on Wood	Intact	0.1 mg/cm ²
LX-25	Children's Room Baseboard	Paint on Wood	Intact	0.0 mg/cm ²
LX-26	Front Entry Floor Tile	4x4" Brown Ceramic	Intact	0.0 mg/cm ²

Condition Definitions

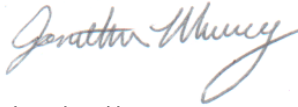
- **Intact:** Paint/ceramic with no visible deterioration or damage.
- **Deteriorated:** Paint/ceramic that is cracking, chipping, chalking, flaking, peeling, failed, or otherwise separating from a component.

JLM Environmental

Limitations

Every effort has been made to ensure that the information and conclusions in this report are accurate. JLM Environmental has exercised professional judgment in collecting, studying, and analyzing the data and formulating recommendations based on the on-going requirements of the site and results of the study. JLM Environmental performed the contracted tasks within the guidelines prescribed by the customer, expected by all applicable agencies (i.e. CDPH, EPA, Cal/OSHA, etc.) and with the quality and diligence expected by the profession. No other warranties expressed or implied, as to the accuracy of the data, information or recommendation is included or intended in this report. JLM Environmental hereby disclaim any liability or responsibility to any unauthorized and/or third parties and/or persons for any loss, damage, expense, fine or penalty which may arise or result from the use of any information, recommendation or action contained or described in this report. We trust that this report fulfills your requirements. If you have any questions or comments, please feel free to contact us at info@jlmenvironmental.com or via text at (310) 930-3355.

Submitted by,



Jonathan Massey

Certified Asbestos Consultant License #11-4813

Contractor State License Board #949259

HCC Surety Group Bond #100128922

Certified Lead Inspector/Assessor #LRC-00002199

OneBeacon Liability Insurance #CL1332001526

EPA RRP #R-1-21649-10-00075

JLM Environmental



ENVIRONMENTAL

INSPECTION & LABORATORY

Asbestos Assessment Performed on 06/12/2024
Report Finalized on 06/17/2024

Project #JL-37248

Property Inspected

**440 West Sierra Madre Blvd
Sierra Madre, CA 91024**

Property Type: Single Story, Commercial Property

Report Prepared By

JLM Environmental
15200 Grevillea Avenue, Suite B
Lawndale, CA 90260-2018
(310) 978-8281 – info@jlmenvironmental.com
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Comprehensive asbestos inspection performed of the subject property prior to extensive renovations.

Introduction

On 06/12/2024, JLM Environmental performed a comprehensive asbestos survey of suspect building materials at the subject property at the request of the City of Sierra Madre, Sierra Madre Library c/o Arnulfo Yanez. The scope of JLM Environmental's inspection was limited to documentation and collection of samples prior to extensive renovations. This report provides a summary of the survey activities and findings as well as recommendations.

Property Information

The subject property is a single story, commercial property built in 1887. The property is currently vacant with personal contents present. At the time of the inspection, no noticeable fire or structural damage was observed.

Property Type:	Commercial Property
Property Size (ft²):	2500
Weather During Inspection:	Cloudy
Children Living at Property:	No
Client Present During Inspection:	No
Inspection Performed on Behalf of:	City of Sierra Madre, Sierra Madre Library c/o Arnulfo Yanez
Foundation Type:	Raised Floor Foundation

Sampling Methodology

The asbestos survey of the subject areas at the property was performed by Kyle Brown (CSST #24-7540) under the direction of Jonathan Massey (CAC #11-4813). Samples were delivered by hand to Pinnacle Laboratory on 06/12/2024 and placed into a locked storage container until they were received by the laboratory staff on 06/13/2024 and entered into the laboratory's system.

BULK: The scope of JLM Environmental's survey included the inspection and sampling of materials within each functional space, assessing all structural/mechanical components and architectural finishes. Intrusive sampling was performed in an effort to identify any concealed but potential materials that could be disturbed during the course of the intended renovation work; while some well-hidden suspect ACM may have escaped evaluation, all layers of suspect building material (to joist- or frame-level) as well as materials above plenums, inside soffits, or other concealed spaces have been evaluated. The physical condition, friability, accessibility, activity and damage of suspect building materials were also assessed and documented.

The building was visually inspected and suspected asbestos-containing materials were identified. These are classified in three ways: surfacing materials, Thermal System Insulation and miscellaneous materials. The materials are further classified as friable or non-friable. Materials were then separated into homogeneous sampling areas. A homogeneous sampling area is one in which the materials exhibit the same characteristics of color, texture, and type of material. Materials were sampled, placed in a leak proof container, and submitted to a laboratory that has been accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for Asbestos Fiber Analysis.

Observations

Purpose of Inspection:	Planned Renovations
Scope of Survey:	Comprehensive Survey Performed
Client was advised AHERA and Code of Federal Regulations (40 CFR Part 763.86, in compliance with AQMD Rule 1403) requires a minimum of 3 samples from each homogeneous building material:	Yes - Sample collection was conducted by the inspector to adhere to AHERA and CFR sample recommendations
Inspection of Property Included:	Comprehensive Survey
Areas of Concern Detected:	No
Samples Collected:	Yes
Prior to survey, renovation activities have been performed?	No

Bulk Samples Recommended at time of Survey:	Client has accepted sample recommendations
Materials Authorized for Sample Collection Include:	Drywall, Plaster, Stucco, Roofing Materials, Vent Pipes, HVAC System Components, Flooring Materials, Window Glazing Compound, Mastic, Ceiling tiles, Vapor Barrier

- A Transite vent pipe is present in the crawlspace, interior walls, and roof. The Transite vent pipe is assumed positive for asbestos as ACM (>1%) by Jonathan Massey, CAC #11-4813 and this material is subject to Rule 1403. If future renovations will affect the material, it is recommended that it be removed by a DOSH certified asbestos abatement contractor prior to disturbance.
- The window glazing compound (represented in the table below as samples AB-62, AB-63, and AB-64) was found to be above the CAL-OSHA regulated limit. **Per SCAQMD Rule 1403, the samples found to contain trace levels of asbestos (less than 1%) must be reanalyzed by 1,000 Point Count to confirm the asbestos content falls below 1%; any samples not reanalyzed by 1,000 Point Count are assumed to be positive for asbestos above 1% by Jonathan Massey (CAC #11-4813) and must be handled by a DOSH certified asbestos abatement contractor as ACM in accordance with SCAQMD Rule 1403.** Please contact JLM Environmental to move forward with the 1,000 Point Count reanalysis process.
- Any materials that have not been identified in this report must first be inspected and sampled by a Certified Asbestos Consultant (CAC) in accordance with SCAQMD Rule 1403 prior to any disturbance of the unidentified materials.
- A DOSH/Cal-OSHA Certified Asbestos Consultant (CAC) shall be contracted to conduct clearance sampling of any disturbance, removal, or abatement of ACM/ACGM.

Heating System

Unit Location:	Basement level boiler room
Heater Type:	HVAC
Heater Vent:	Metal
Fiberglass Insulation Present On:	Ducts
Heating System Insulated With:	Fiberglass
Heating System Samples Collected:	The client has accepted the recommendations
Additional Heating System Notes:	Two HVAC units were observed in the boiler room on the basement level. These units were observed to have bare metal ducts, fiberglass insulated metal ducts, and fiberglass flex ducting that runs throughout the crawlspace, interior walls and drop ceilings. Mechanical mastic was observed on the metal ducts, as well as on components located on the roof system. No Thermal System Insulation (TSI) was observed in the visible areas of the heating system components.



Roof System

Unit Location:	Main Structure
Roof Type:	Pitched with Flat Sections
Composition:	Rolled Asphalt, Felt Underlayment
Vents Visible on Roof:	Metal, Transite
Suspect Building Materials Observed:	Yes – Rolled asphalt, roof felt, penetration mastic, mechanical mastic, Transite vent pipe
Roof Samples Collected:	The client has accepted the recommendations
Additional Roof Notes:	The roof system was observed to be rolled asphalt with felt underlayment. Penetration mastic was observed on the vents and flashings. Mechanical mastic was observed on the heating system components. One intact Transite vent pipe was observed on the roof.
Roof Recommendations:	Asbestos components on the roof system were observed to be intact and in good condition. No response actions required at this time unless future renovations will disturb this material.



Exterior Walls

Exterior Wall Location:	Main Structure
Exterior Wall Composition:	Stucco, Wood Siding, Brick
Suspect Building Materials Observed:	Yes - Stucco, vapor barrier
Exterior Wall Samples Collected:	The client has accepted the recommendations
Additional Exterior Wall Notes:	The exterior walls were observed to be stucco, wood siding, and brick. All exterior wall materials were observed to be intact at the time of the survey.





Windows

Window Type:	Metal Windows, Wood Windows
Window Glazing Compound Present:	Yes
Suspect Building Materials Observed:	Yes – Window glazing compound
Window Samples Collected:	The client has accepted the recommendations
Additional Window Notes:	Window glazing compound was observed to be intact on the original wooden windows.
Window Recommendations:	Glazing compound on the windows is observed to be intact and in good condition. No response actions required at this time unless future renovations will disturb this material.



Attic

Attic Present:	No
-----------------------	----

Crawlspace

Crawlspace Present:	Yes
Crawlspace Access Location:	Basement boiler room
Crawlspace Insulation Type:	No Insulation Present
Suspect Building Materials Observed:	Yes – Transite vent pipe
Crawlspace Samples Collected:	The client has accepted the recommendations

Additional Crawlspace Notes:

The water heater's Transite vent pipe was visible rising through the crawlspace and was observed to be intact. No other suspect materials were observed at the time of the survey.

**Flooring**

Flooring Materials Observed:	Linoleum, Carpet, Vinyl Tiles
Suspect Building Materials Observed:	Yes – Vinyl floor tiles, linoleum, mastic, felt underlayment
Flooring Samples Collected:	The client has accepted the recommendations
Additional Flooring Notes:	A majority of the interior was observed to have carpet with felt underlayment and floor mastic. Vinyl floor tiles were observed in the closet of the children's room. This area was also observed to have a similar felt underlayment. Linoleum was observed in the kitchen, bathroom, and janitor's closet. An unknown grey flooring underlayment was observed below the carpet of the office areas.
Flooring Recommendations:	All flooring materials observed to be intact and in good condition.

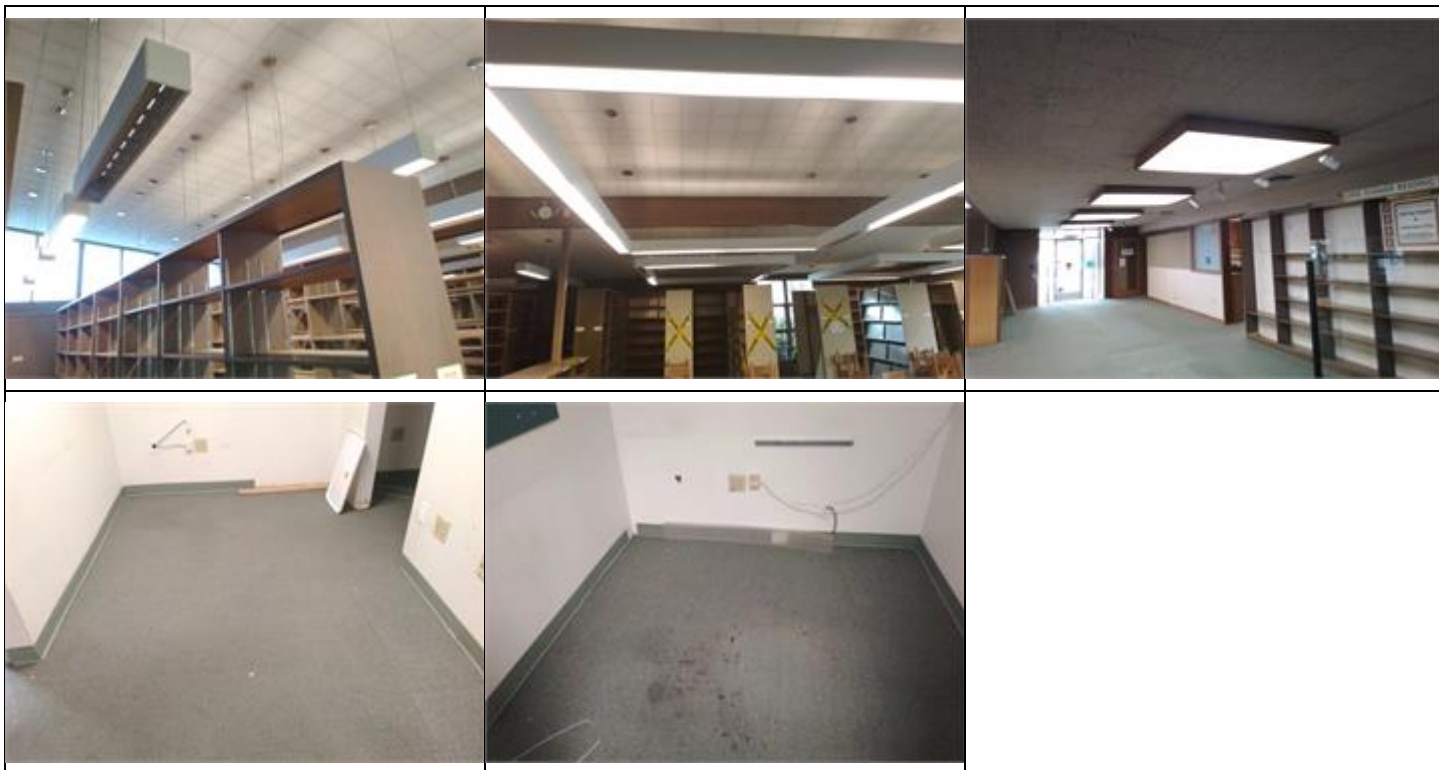




Ceilings and Walls

Ceiling and Wall Materials Observed:	Plaster Over Drywall, Drop Ceiling with Ceiling Tiles, Wood Paneling, Cove base
Suspect Building Materials Observed:	Yes – Plaster, drywall, ceiling tiles, cove base mastic
Ceiling and Wall Samples Collected:	The client has accepted the recommendations
Additional Ceiling and Wall Notes:	Interior walls were observed to be plaster over drywall and wood paneling. Smooth ceiling tiles were observed on the ceilings of the children's room and all main areas of the library. Fissured ceiling tiles were observed on the ceiling of the front entry hall. Cove base with mastic was observed throughout the office areas. All ceiling and wall materials were observed to be intact at the time of the survey.





Water Heater

Water Heater Type:	Conventional storage tank water heater
Water Heater Location:	Basement
Water Heater Vent Type:	Transite
Suspect Building Materials Observed:	Yes – Transite vent pipe
Water Heater Samples Collected:	The client has accepted the recommendations
Additional Water Heater Notes:	The water heater was in the basement and was observed to have a Transite vent pipe that runs through the crawlspace, interior walls, and out through the roof.
Water Heater Recommendations:	Water heater's asbestos containing Transite vent pipe was observed to be in intact and in good condition. No current response actions required unless future renovations will disturb this material.



Environmental

PLM BULK RESULTS

Bulk asbestos samples were analyzed by Polarized Light Microscopy (PLM) using EPA method (EPA/600 R-93/116) "Method for the Determination of Asbestos in Bulk Materials" by Pinnacle Laboratory, (310) 431-9270, located at 15200 Grevillea Avenue, Suite A-1, Lawndale, CA 90260. Pinnacle Laboratory holds a NVLAP accreditation in Asbestos Fiber Analysis (NVLAP Lab Code 600117-0). The quantification limit for this method is 1.0%. If asbestos is detected at levels below 1% then the sample is reported as <1.0% and not quantified. **If a lower limit is desired, then available methods include: 1000 Point Count reanalysis (for a quantification limit of 0.1%).**

Please be advised that measurements are not to be used for bidding purposes; these are only estimates.

Positive Sample Results: CAL/OSHA, the SCAQMD, and the EPA regulate these materials. A State Licensed Asbestos Abatement Contractor must perform all work relating to the disturbance of the asbestos containing materials. A licensed DOSH abatement contractor, using regulated work procedures and properly accredited personnel must remove these materials. The sampled materials that exceeded the EPA level of 1% and the Cal-OSHA level 0.1% for asbestos content were:

Table 1: Positive Sample Results

Sample #	Location	Material	Condition	Friable	Result
AB-23	Vents & Flashings	Penetration Mastic Approx. 50 sq. ft.	Good	No	5% CH**
AB-24	Vents & Flashings	Penetration Mastic Approx. 50 sq. ft.	Good	No	5% CH
AB-25	Vents & Flashings	Penetration Mastic Approx. 50 sq. ft.	Good	No	5% CH
AB-32	Flooring- Children's Room Closet	Vinyl Floor Tile Approx. 12 sq. ft.	Good	No	4% CH
AB-33	Flooring- Children's Room Closet	Vinyl Floor Tile Approx. 12 sq. ft.	Good	No	4% CH
AB-34	Flooring- Children's Room Closet	Vinyl Floor Tile Approx. 12 sq. ft.	Good	No	4% CH
AB-62	Exterior Wood Windows	Window Glazing Compound Approx. 40 sq. ft.	Good	No	<1% CH
AB-63	Exterior Wood Windows	Window Glazing Compound Approx. 40 sq. ft.	Good	No	<1% CH
AB-64	Exterior Wood Windows	Window Glazing Compound Approx. 40 sq. ft.	Good	No	<1% CH
AB-65	Crawlspace, Interior Walls & Roof	Transite Vent Pipe Approx. 25 sq. ft.	Good	No	Assumed Positive

**CH = Chrysotile Asbestos

Negative Sample Results: The sampled materials that did not exceed the EPA level of 1% and the Cal-OSHA level of 0.1% for asbestos content were:

Table 2: Negative Sample Results

Sample #	Location	Material	Condition	Friable	Result
AB-01	Interior Walls & Ceilings	Plaster Approx. 2,000 sq. ft.	Good	No	NAD*
AB-02	Interior Walls & Ceilings	Plaster Approx. 2,000 sq. ft.	Good	No	NAD

AB-03	Interior Walls & Ceilings	Plaster Approx. 2,000 sq. ft.	Good	No	NAD
AB-04	Interior Walls & Ceilings	Plaster Approx. 2,000 sq. ft.	Good	No	NAD
AB-05	Interior Walls & Ceilings	Plaster Approx. 2,000 sq. ft.	Good	No	NAD
AB-06	Interior Walls & Ceilings	Drywall Approx. 2,000 sq. ft.	Good	No	NAD
AB-07	Interior Walls & Ceilings	Drywall Approx. 2,000 sq. ft.	Good	No	NAD
AB-08	Interior Walls & Ceilings	Drywall Approx. 2,000 sq. ft.	Good	No	NAD
AB-09	Exterior Walls	Stucco Approx. 2,000 sq. ft.	Good	No	NAD
AB-10	Exterior Walls	Stucco Approx. 2,000 sq. ft.	Good	No	NAD
AB-11	Exterior Walls	Stucco Approx. 2,000 sq. ft.	Good	No	NAD
AB-12	Exterior Walls	Stucco Approx. 2,000 sq. ft.	Good	No	NAD
AB-13	Exterior Walls	Stucco Approx. 2,000 sq. ft.	Good	No	NAD
AB-14	Exterior Walls	Vapor Barrier Approx. 2,000 sq. ft.	Good	No	NAD
AB-15	Exterior Walls	Vapor Barrier Approx. 2,000 sq. ft.	Good	No	NAD
AB-16	Exterior Walls	Vapor Barrier Approx. 2,000 sq. ft.	Good	No	NAD
AB-17	Roof System	Rolled Asphalt Approx. 2,500 sq. ft.	Good	No	NAD
AB-18	Roof System	Rolled Asphalt Approx. 2,500 sq. ft.	Good	No	NAD
AB-19	Roof System	Rolled Asphalt Approx. 2,500 sq. ft.	Good	No	NAD
AB-20	Roof System	Felt Underlayment Approx. 2,500 sq. ft.	Good	No	NAD
AB-21	Roof System	Felt Underlayment Approx. 2,500 sq. ft.	Good	No	NAD
AB-22	Roof System	Felt Underlayment Approx. 2,500 sq. ft.	Good	No	NAD
AB-26	Heating System Components- Roof & Basement	Mechanical Mastic Approx. 30 sq. ft.	Good	No	NAD
AB-27	Heating System Components- Roof & Basement	Mechanical Mastic Approx. 30 sq. ft.	Good	No	NAD
AB-28	Heating System Components- Roof & Basement	Mechanical Mastic Approx. 30 sq. ft.	Good	No	NAD

AB-29	Cove Base- Interior Walls of Office Areas	Cove Base Mastic Approx. 60 sq. ft.	Good	No	NAD
AB-30	Cove Base- Interior Walls of Office Areas	Cove Base Mastic Approx. 60 sq. ft.	Good	No	NAD
AB-31	Cove Base- Interior Walls of Office Areas	Cove Base Mastic Approx. 60 sq. ft.	Good	No	NAD
AB-35	Flooring- Children's Room Closet	Mastic Approx. 12 sq. ft.	Good	No	NAD
AB-36	Flooring- Children's Room Closet	Mastic Approx. 12 sq. ft.	Good	No	NAD
AB-37	Flooring- Children's Room Closet	Mastic Approx. 12 sq. ft.	Good	No	NAD
AB-38	Flooring- Children's Room Closet	Felt Underlayment Approx. 12 sq. ft.	Good	No	NAD
AB-39	Flooring- Children's Room Closet	Felt Underlayment Approx. 12 sq. ft.	Good	No	NAD
AB-40	Flooring- Children's Room Closet	Felt Underlayment Approx. 12 sq. ft.	Good	No	NAD
AB-41	Flooring- Kitchen, Bathroom & Janitor's Closet	Linoleum Approx. 60 sq. ft.	Good	Yes	NAD
AB-42	Flooring- Kitchen, Bathroom & Janitor's Closet	Linoleum Approx. 60 sq. ft.	Good	Yes	NAD
AB-43	Flooring- Kitchen, Bathroom & Janitor's Closet	Linoleum Approx. 60 sq. ft.	Good	Yes	NAD
AB-44	Flooring- Kitchen, Bathroom & Janitor's Closet	Mastic Approx. 60 sq. ft.	Good	No	NAD
AB-45	Flooring- Kitchen, Bathroom & Janitor's Closet	Mastic Approx. 60 sq. ft.	Good	No	NAD
AB-46	Flooring- Kitchen, Bathroom & Janitor's Closet	Mastic Approx. 60 sq. ft.	Good	No	NAD
AB-47	Flooring- Children's Room, Reference Room, Nonfiction Room & Reading Room	Carpet Mastic Approx. 2,000 sq. ft.	Good	No	NAD
AB-48	Flooring- Children's Room, Reference Room, Nonfiction Room & Reading Room	Carpet Mastic Approx. 2,000 sq. ft.	Good	No	NAD
AB-49	Flooring- Children's Room, Reference Room, Nonfiction Room & Reading Room	Carpet Mastic Approx. 2,000 sq. ft.	Good	No	NAD
AB-50	Flooring- Children's Room, Reference Room, Nonfiction Room & Reading Room	Felt Underlayment Approx. 2,000 sq. ft.	Good	No	NAD
AB-51	Flooring- Children's Room, Reference Room, Nonfiction Room & Reading Room	Felt Underlayment Approx. 2,000 sq. ft.	Good	No	NAD
AB-52	Flooring- Children's Room, Reference Room, Nonfiction Room & Reading Room	Felt Underlayment Approx. 2,000 sq. ft.	Good	No	NAD
AB-53	Flooring- Below Carpet in Offices	Grey Underlayment Approx. 500 sq. ft.	Good	No	NAD
AB-54	Flooring- Below Carpet in Offices	Grey Underlayment Approx. 500 sq. ft.	Good	No	NAD

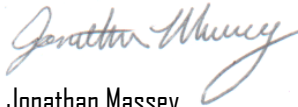
AB-55	Flooring- Below Carpet in Offices	Grey Underlayment Approx. 500 sq. ft.	Good	No	NAD
AB-56	Ceilings- Children's Room, Reference Room, Nonfiction Room & Reading Room	Smooth Ceiling Tiles Approx. 2,000 sq. ft.	Good	Yes	NAD
AB-57	Ceilings- Children's Room, Reference Room, Nonfiction Room & Reading Room	Smooth Ceiling Tiles Approx. 2,000 sq. ft.	Good	Yes	NAD
AB-58	Ceilings- Children's Room, Reference Room, Nonfiction Room & Reading Room	Smooth Ceiling Tiles Approx. 2,000 sq. ft.	Good	Yes	NAD
AB-59	Ceilings- Entry Hall	Fissured Ceiling Tiles Approx. 300 sq. ft.	Good	Yes	NAD
AB-60	Ceilings- Entry Hall	Fissured Ceiling Tiles Approx. 300 sq. ft.	Good	Yes	NAD
AB-61	Ceilings- Entry Hall	Fissured Ceiling Tiles Approx. 300 sq. ft.	Good	Yes	NAD
*NAD = No Asbestos Detected					

JLM Environmental

Limitations

Every effort has been made to ensure that the information and conclusions in this report are accurate. JLM Environmental Consultants has exercised professional judgment in collecting, studying, and analyzing the data and formulating recommendations based on the on-going requirements of the site and results of the study. JLM Environmental performed the contracted tasks within the guidelines prescribed by the customer, expected by all applicable agencies (e.g., SCAQMD, Cal/OSHA, etc.) and with the quality and diligence expected by the profession. No other warranties expressed or implied, as to the accuracy of the data, information or recommendation is included or intended in this report. JLM Environmental hereby disclaim any liability or responsibility to any unauthorized and/or third parties and/or persons for any loss, damage, expense, fine or penalty which may arise or result from the use of any information, recommendation or action contained or described in this report. We trust that this report fulfills your requirements. If you have any questions or comments, please feel free to contact us at info@jlmenvironmental.com or via text at (310) 930-3355.

Submitted by,



Jonathan Massey

Certified Asbestos Consultant License #11-4813

Contractor State License Board #949259

HCC Surety Group Bond #100128922

Certified Lead Inspector/Assessor #LRC-00002199

OneBeacon Liability Insurance #CL1332001526

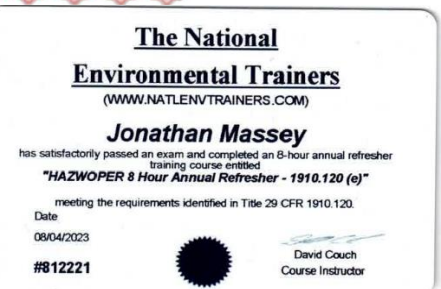
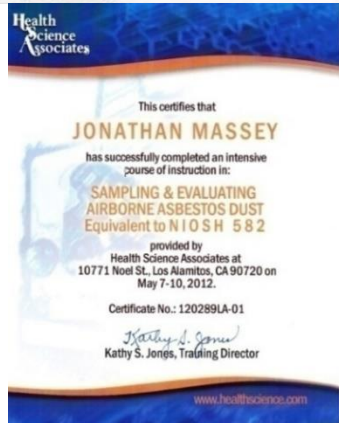
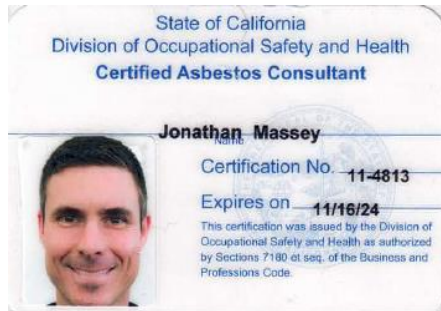
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STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC HEALTH



LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:



Jonathan Massey

CERTIFICATE TYPE:

Lead Inspector/Assessor

Lead Supervisor

NUMBER:

LRC-00002199

LRC-00002198

EXPIRATION DATE:

7/22/2024

7/22/2024

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clppb or calling (800) 597-LEAD

State of California
Division of Occupational Safety and Health
Certified Site Surveillance Technician



Kyle K. Brown
Name

Certification No. **24-7540**

Expires on **01/19/25**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.

**Sampling & Evaluating Airborne
Asbestos Dust
NIOSH 582 Equivalency Course**

KYLE BROWN

has attended and successfully completed the Sampling & Evaluating Airborne Asbestos Dust NIOSH 582 Equivalency Course (32 contact hours) and has passed an examination in that course with a minimum score of 70% and a hands-on practical exam with a minimum score of 95% or results within three standard deviations of the historical means.



10/16/23 - 10/19/23

Course Date(s)

n/a

Date of Expiration

Certificate: 101923-001

Steve Vaughn
Steve Vaughn,
Instructor

Jonathan Massey
Jon Massey,
President

Academy of Environmental Health & Safety · (310) 400-6153 · www.AEHStraining.com
15200 Grevillea Avenue, Lawndale, CA 90260



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC HEALTH



LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:



Kyle Brown

CERTIFICATE TYPE:

Lead Sampling Technician

NUMBER:

LRC-00011560

EXPIRATION DATE:

8/1/2024

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clppb or calling (800) 597-LEAD

**Academy of Environmental
Health & Safety**

KYLE BROWN

has attended and successfully completed an intensive course of instruction in moisture mapping, thermal imagine, and microbial sample collection.



05/15/2023

Issued Date

Jonathan Massey
Jonathan Massey,
President

Certificate: 05152023-001

Academy of Environmental Health & Safety · (310) 400-6153 · www.AEHStraining.com
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