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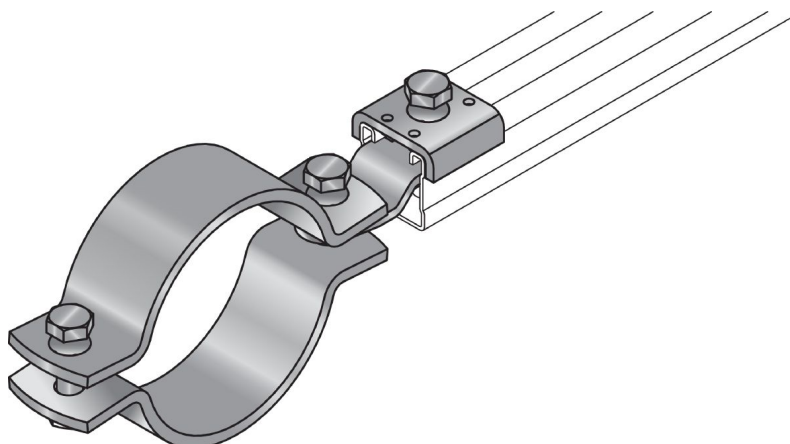
RESEARCH REPORT: RR 26176

REEVALUATION DUE  
DATE: June 1, 2024  
Issued Date: September 1, 2022  
Code: 2020LABC

**GENERAL APPROVAL** – Renewal – Hilti MQS-SP Pipe Clamp, MQS-SP-L Longitudinal Base Connector, MQS-SPL-T Transverse Base Connector, MQS-IB Mounting Bracket, and Seismic Brace System

## DETAILS

**MQS-SP:** Hilti Seismic Pipe Clamp attaches directly to the pipe and to a brace comprised of Hilti strut. The connection between the clamp and the pipe is through a clamp which is wrapped around then tightened onto the pipe with a bolt. The connection from the clamp to the bracing member, comprised of Hilti strut, is through a proprietary serrated connection. The clamp can accommodate the following pipe sizes: 2-in., 2.5-in., 3-in., 4-in., 5-in., 6-in., 8-in., 10-in., and 12-in.

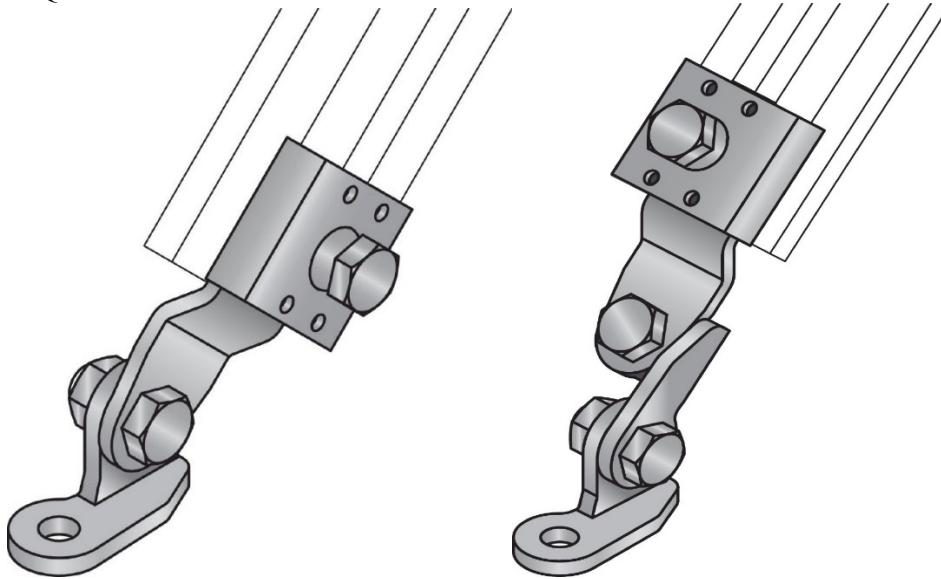


RR 26176  
Page 1 of 9

Hilti, Inc.

Re: MQS-SP, MQS-SP-L, MQS-SP-T, MQS-IB Bracing, and Seismic Brace System

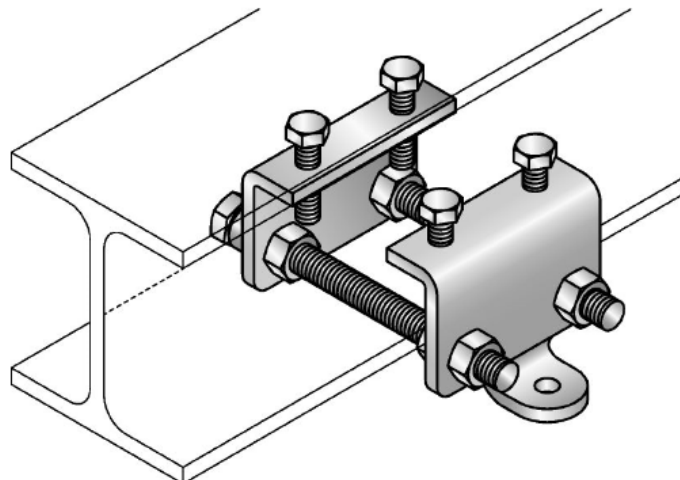
**MQS-SP-L and MQS-SP-T:** Hilti seismic base connectors, Longitudinal (MQS-SP-L) and Transverse (MQS-SP-T). Attaches to Hilti strut on one end via the proprietary Hilti serrated connection and provides a drilled hole on the other end for attachment directly to the structure. The hole accommodates a  $\frac{1}{2}$ " anchor for direct anchorage to concrete or a  $\frac{1}{2}$ " threaded rod or bolt, for direct attachment to the steel structure, or a steel mounting bracket, such as a Hilti MQS-IB.



**Hilti MQS-SP-L**

**Hilti MQS-SP-T**

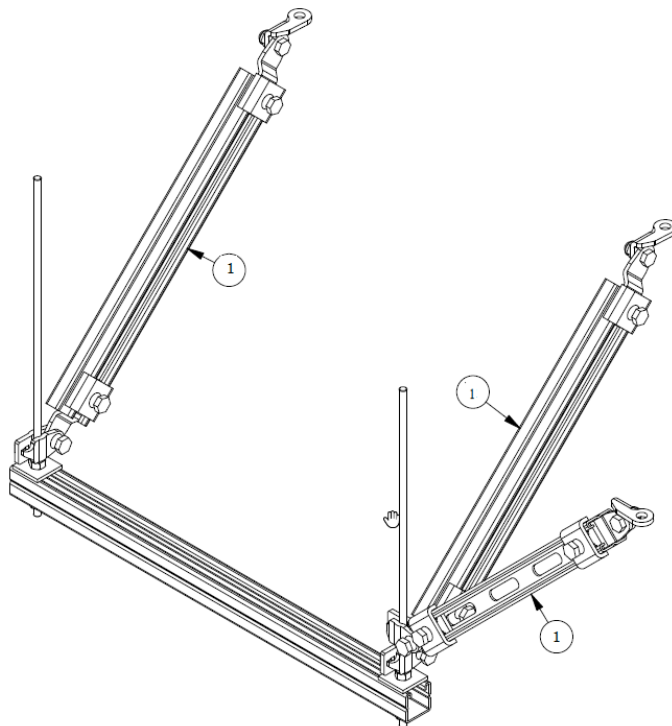
**MQS-IB:** Hilti mounting bracket for attachment to steel beams. This bracket attaches to the flange of a beam and clamps around the flange. The bracket is closed tight onto the flange with 2 bolts which run below the flange. There are 2 bolts on the top of each half of the bracket which tighten down onto the top of the flange. The tab is drilled to accommodate a  $\frac{1}{2}$ " hanger rod or  $\frac{1}{2}$ " bolted connection from a brace, such as the MQS-SP-L or MQS-SP-T.



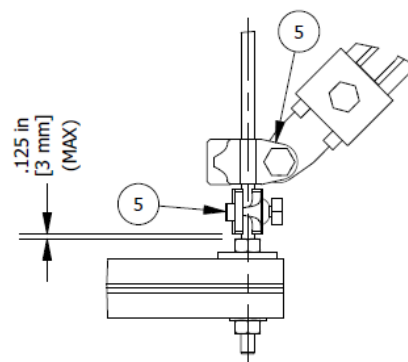
Hilti, Inc.

Re: MQS-SP, MQS-SP-L, MQS-SP-T, MQS-IB Bracing, and Seismic Brace System

**Hilti Seismic Brace System:** This system consists of 3 components, MQS-SP-L as described above, a length of Hilti 1 5/8" 12ga Strut (designated Hilti HS158) and an MQS-RH retrofit hinge attached to any 3/8" or 1/2" threaded rod for bracing an in-situ trapeze or simple threaded rod hanger. The Hilti Seismic Brace can be used individually or used in conjunction, to provide both Transverse AND Longitudinal bracing at any location. The braces may be used for installations between 45° and 90° (measured from vertical). When installed at 90°, the brace must be attached to a vertical surface, such as a wall or column. When transverse and longitudinal braces occur at one location, the longitudinal brace shall be installed beneath the transverse brace.



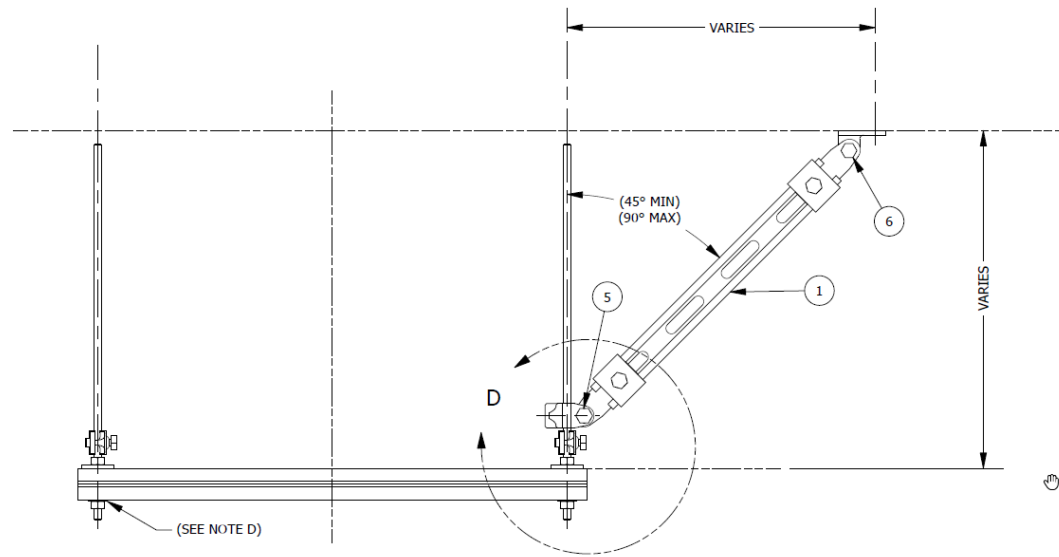
ISOMETRIC



DETAIL D

Hilti, Inc.

Re: MQS-SP, MQS-SP-L, MQS-SP-T, MQS-IB Bracing, and Seismic Brace System



| Piece Mark | Description                        |
|------------|------------------------------------|
| 1          | STRUT HS-158-12/PG *               |
| 2          | STRUT HS-158-12/PGS SOLID *        |
| 5          | MQS-RH 3/8 IN SEISMIC HINGE        |
| 6          | MQS-SP-L 1/2 IN SEISMIC HINGE BASE |

**The approval is subject to the following conditions:**

1. Installation shall comply with this general approval, the manufacturer's published instructions and the 2020 Los Angeles Building Code.
2. The products described in this report shall be identified with the Hilti name engraved in each piece along with the model number and lot number. The box of clamps/braces shall be identified with the Los Angeles Research Report Number, LARR 26176.
3. The design and connection of the clamps, connectors and brackets to the main structure shall be completed by a licensed architect or engineer registered in the State of California.
4. The products are manufactured in Tuzla/Istanbul, Turkey under a quality control program with audits by FM Global.

Hilti, Inc.

Re: MQS-SP, MQS-SP-L, MQS-SP-T, MQS-IB Bracing, and Seismic Brace System

## **DISCUSSION**

This report is in compliance with the 2020 City of Los Angeles Building Code.

The approval is based on tests and analysis on file with the Engineering Research Section.

Addressee to whom this Research Report is issued is responsible for providing copies of it, complete with any attachments indicated, to architects, engineers and builders using items approved herein in design or construction which must be approved by Department of Building and Safety Engineers and Inspectors.

This general approval of an equivalent alternate to the Code is only valid where an engineer and/or inspector of this Department has determined that all conditions of this approval have been met in the project in which it is to be used.

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DC  
LARR 26176  
TLB2200116  
R08/22/2022  
104.2.6

**DESIGN VALUES:** Summarizes the design values per FM 1950-16. The strength reduction factor ( $\phi$ ) is 0.7 and the factor of safety ( $\Omega$ ) is 2.0.

| Component Part                                            | Orientation  | Brace Orientation Angle ( $\theta$ ) <sup>1</sup> | $R_{Hn}$ | LRFD Value <sup>2</sup> | ASD Value <sup>3</sup> |
|-----------------------------------------------------------|--------------|---------------------------------------------------|----------|-------------------------|------------------------|
|                                                           |              |                                                   | (lbf.)   | (lbf.)                  | (lbf.)                 |
| MQS SP 2-in.<br>(Pipe Clamp)                              | Lateral      | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                                                           |              | $30^\circ \leq \theta < 45^\circ$                 | 291      | 204                     | 146                    |
|                                                           |              | $45^\circ \leq \theta < 60^\circ$                 | 482      | 337                     | 241                    |
|                                                           |              | $60^\circ \leq \theta < 90^\circ$                 | 1074     | 752                     | 537                    |
|                                                           |              | $\theta = 90^\circ$                               | 2293     | 1605                    | 1147                   |
|                                                           | Longitudinal | $0^\circ \leq \theta < 20^\circ$                  | 0        | 0                       | 0                      |
|                                                           |              | $20^\circ \leq \theta < 30^\circ$                 | 977      | 684                     | 489                    |
|                                                           |              | $30^\circ \leq \theta < 45^\circ$                 | 1108     | 776                     | 554                    |
|                                                           |              | $45^\circ \leq \theta < 60^\circ$                 | 1368     | 958                     | 684                    |
|                                                           |              | $60^\circ \leq \theta < 90^\circ$                 | 1766     | 1236                    | 883                    |
|                                                           |              | $\theta = 90^\circ$                               | --       | --                      | --                     |
| MQS SP 2 <sup>1</sup> / <sub>2</sub> -in.<br>(Pipe Clamp) | Lateral      | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                                                           |              | $30^\circ \leq \theta < 45^\circ$                 | 334      | 234                     | 167                    |
|                                                           |              | $45^\circ \leq \theta < 60^\circ$                 | 353      | 247                     | 177                    |
|                                                           |              | $60^\circ \leq \theta < 90^\circ$                 | 732      | 512                     | 366                    |
|                                                           |              | $\theta = 90^\circ$                               | 2151     | 1506                    | 1076                   |
|                                                           | Longitudinal | $0^\circ \leq \theta < 20^\circ$                  | 0        | 0                       | 0                      |
|                                                           |              | $20^\circ \leq \theta < 30^\circ$                 | 1148     | 804                     | 574                    |
|                                                           |              | $30^\circ \leq \theta < 45^\circ$                 | 788      | 552                     | 394                    |
|                                                           |              | $45^\circ \leq \theta < 60^\circ$                 | 1126     | 788                     | 563                    |
|                                                           |              | $60^\circ \leq \theta < 90^\circ$                 | 2307     | 1615                    | 1154                   |
|                                                           |              | $\theta = 90^\circ$                               | --       | --                      | --                     |
| MQS SP 3-in.<br>(Pipe Clamp)                              | Lateral      | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                                                           |              | $30^\circ \leq \theta < 45^\circ$                 | 459      | 321                     | 230                    |
|                                                           |              | $45^\circ \leq \theta < 60^\circ$                 | 592      | 414                     | 296                    |
|                                                           |              | $60^\circ \leq \theta < 90^\circ$                 | 812      | 568                     | 406                    |
|                                                           |              | $\theta = 90^\circ$                               | 2804     | 1963                    | 1402                   |
|                                                           | Longitudinal | $0^\circ \leq \theta < 20^\circ$                  | 0        | 0                       | 0                      |
|                                                           |              | $20^\circ \leq \theta < 30^\circ$                 | 867      | 607                     | 434                    |
|                                                           |              | $30^\circ \leq \theta < 45^\circ$                 | 1023     | 716                     | 512                    |
|                                                           |              | $45^\circ \leq \theta < 60^\circ$                 | 1199     | 839                     | 600                    |
|                                                           |              | $60^\circ \leq \theta < 90^\circ$                 | 1744     | 1221                    | 872                    |
|                                                           |              | $\theta = 90^\circ$                               | --       | --                      | --                     |

| Component Part               | Orientation  | Brace Orientation Angle ( $\theta$ ) <sup>1</sup> | $R_{Hn}$ | LRFD Value <sup>2</sup> | ASD Value <sup>3</sup> |
|------------------------------|--------------|---------------------------------------------------|----------|-------------------------|------------------------|
|                              |              |                                                   | (lbf.)   | (lbf.)                  | (lbf.)                 |
| MQS SP 4-in.<br>(Pipe Clamp) | Lateral      | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                              |              | $30^\circ \leq \theta < 45^\circ$                 | 1131     | 792                     | 566                    |
|                              |              | $45^\circ \leq \theta < 60^\circ$                 | 1316     | 921                     | 658                    |
|                              |              | $60^\circ \leq \theta < 90^\circ$                 | 1688     | 1182                    | 844                    |
|                              |              | $\theta = 90^\circ$                               | 3209     | 2246                    | 1605                   |
|                              | Longitudinal | $0^\circ \leq \theta < 20^\circ$                  | 0        | 0                       | 0                      |
|                              |              | $20^\circ \leq \theta < 30^\circ$                 | 1149     | 804                     | 575                    |
|                              |              | $30^\circ \leq \theta < 45^\circ$                 | 837      | 586                     | 419                    |
|                              |              | $45^\circ \leq \theta < 60^\circ$                 | 1495     | 1047                    | 748                    |
|                              |              | $60^\circ \leq \theta < 90^\circ$                 | 2058     | 1441                    | 1029                   |
|                              |              | $\theta = 90^\circ$                               | --       | --                      | --                     |
| MQS SP 5-in.<br>(Pipe Clamp) | Lateral      | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                              |              | $30^\circ \leq \theta < 45^\circ$                 | 297      | 208                     | 149                    |
|                              |              | $45^\circ \leq \theta < 60^\circ$                 | 360      | 252                     | 180                    |
|                              |              | $60^\circ \leq \theta < 90^\circ$                 | 660      | 462                     | 330                    |
|                              |              | $\theta = 90^\circ$                               | 2928     | 2050                    | 1464                   |
|                              | Longitudinal | $0^\circ \leq \theta < 20^\circ$                  | 0        | 0                       | 0                      |
|                              |              | $20^\circ \leq \theta < 30^\circ$                 | 1035     | 725                     | 518                    |
|                              |              | $30^\circ \leq \theta < 45^\circ$                 | 1499     | 1049                    | 750                    |
|                              |              | $45^\circ \leq \theta < 60^\circ$                 | 1353     | 947                     | 677                    |
|                              |              | $60^\circ \leq \theta < 90^\circ$                 | 2028     | 1420                    | 1014                   |
|                              |              | $\theta = 90^\circ$                               | --       | --                      | --                     |
| MQS SP 6-in.<br>(Pipe Clamp) | Lateral      | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                              |              | $30^\circ \leq \theta < 45^\circ$                 | 648      | 454                     | 324                    |
|                              |              | $45^\circ \leq \theta < 60^\circ$                 | 770      | 539                     | 385                    |
|                              |              | $60^\circ \leq \theta < 90^\circ$                 | 1229     | 860                     | 615                    |
|                              |              | $\theta = 90^\circ$                               | 3242     | 2269                    | 1621                   |
|                              | Longitudinal | $0^\circ \leq \theta < 20^\circ$                  | 0        | 0                       | 0                      |
|                              |              | $20^\circ \leq \theta < 30^\circ$                 | 557      | 390                     | 279                    |
|                              |              | $30^\circ \leq \theta < 45^\circ$                 | 781      | 547                     | 391                    |
|                              |              | $45^\circ \leq \theta < 60^\circ$                 | 1414     | 990                     | 707                    |
|                              |              | $60^\circ \leq \theta < 90^\circ$                 | 2545     | 1782                    | 1273                   |
|                              |              | $\theta = 90^\circ$                               | --       | --                      | --                     |

| Component Part                | Orientation  | Brace Orientation Angle ( $\theta$ ) <sup>1</sup> | $R_{Hn}$ | LRFD Value <sup>2</sup> | ASD Value <sup>3</sup> |
|-------------------------------|--------------|---------------------------------------------------|----------|-------------------------|------------------------|
|                               |              |                                                   | (lbf.)   | (lbf.)                  | (lbf.)                 |
| MQS SP 8-in.<br>(Pipe Clamp)  | Lateral      | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                               |              | $30^\circ \leq \theta < 45^\circ$                 | 452      | 316                     | 226                    |
|                               |              | $45^\circ \leq \theta < 60^\circ$                 | 517      | 362                     | 259                    |
|                               |              | $60^\circ \leq \theta < 90^\circ$                 | 650      | 455                     | 325                    |
|                               |              | $\theta = 90^\circ$                               | 3118     | 2183                    | 1559                   |
|                               | Longitudinal | $0^\circ \leq \theta < 20^\circ$                  | 0        | 0                       | 0                      |
|                               |              | $20^\circ \leq \theta < 30^\circ$                 | 822      | 575                     | 411                    |
|                               |              | $30^\circ \leq \theta < 45^\circ$                 | 1012     | 708                     | 506                    |
|                               |              | $45^\circ \leq \theta < 60^\circ$                 | 1512     | 1058                    | 756                    |
|                               |              | $60^\circ \leq \theta < 90^\circ$                 | 1754     | 1228                    | 877                    |
|                               |              | $\theta = 90^\circ$                               | --       | --                      | --                     |
| MQS SP 10-in.<br>(Pipe Clamp) | Lateral      | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                               |              | $30^\circ \leq \theta < 45^\circ$                 | 1021     | 715                     | 511                    |
|                               |              | $45^\circ \leq \theta < 60^\circ$                 | 466      | 326                     | 233                    |
|                               |              | $60^\circ \leq \theta < 90^\circ$                 | 930      | 651                     | 465                    |
|                               |              | $\theta = 90^\circ$                               | 2829     | 1980                    | 1415                   |
|                               | Longitudinal | $0^\circ \leq \theta < 20^\circ$                  | 0        | 0                       | 0                      |
|                               |              | $20^\circ \leq \theta < 30^\circ$                 | 771      | 540                     | 386                    |
|                               |              | $30^\circ \leq \theta < 45^\circ$                 | 1011     | 708                     | 506                    |
|                               |              | $45^\circ \leq \theta < 60^\circ$                 | 1276     | 893                     | 638                    |
|                               |              | $60^\circ \leq \theta < 90^\circ$                 | 2531     | 1772                    | 1266                   |
|                               |              | $\theta = 90^\circ$                               | --       | --                      | --                     |
| MQS SP 12-in.<br>(Pipe Clamp) | Lateral      | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                               |              | $30^\circ \leq \theta < 45^\circ$                 | 846      | 592                     | 423                    |
|                               |              | $45^\circ \leq \theta < 60^\circ$                 | 450      | 315                     | 225                    |
|                               |              | $60^\circ \leq \theta < 90^\circ$                 | 518      | 363                     | 259                    |
|                               |              | $\theta = 90^\circ$                               | 3099     | 2169                    | 1550                   |
|                               | Longitudinal | $0^\circ \leq \theta < 20^\circ$                  | 0        | 0                       | 0                      |
|                               |              | $20^\circ \leq \theta < 30^\circ$                 | 838      | 587                     | 419                    |
|                               |              | $30^\circ \leq \theta < 45^\circ$                 | 1035     | 725                     | 518                    |
|                               |              | $45^\circ \leq \theta < 60^\circ$                 | 1569     | 1098                    | 785                    |
|                               |              | $60^\circ \leq \theta < 90^\circ$                 | 1875     | 1313                    | 938                    |
|                               |              | $\theta = 90^\circ$                               | --       | --                      | --                     |

| Component Part               | Orientation  | Brace Orientation Angle ( $\theta$ ) <sup>1</sup> | $R_{Hn}$ | LRFD Value <sup>2</sup> | ASD Value <sup>3</sup> |
|------------------------------|--------------|---------------------------------------------------|----------|-------------------------|------------------------|
|                              |              |                                                   | (lbf.)   | (lbf.)                  | (lbf.)                 |
| MQS-IB<br>(Mount Bracket)    | Lateral      | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                              |              | $30^\circ \leq \theta < 45^\circ$                 | 1872     | 1310                    | 936                    |
|                              |              | $45^\circ \leq \theta < 60^\circ$                 | 5051     | 3536                    | 2526                   |
|                              |              | $60^\circ \leq \theta < 90^\circ$                 | 6030     | 4221                    | 3015                   |
|                              |              | $\theta = 90^\circ$                               | 3457     | 2420                    | 1729                   |
|                              | Longitudinal | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                              |              | $30^\circ \leq \theta < 45^\circ$                 | 4753     | 3327                    | 2377                   |
|                              |              | $45^\circ \leq \theta < 60^\circ$                 | 5431     | 3802                    | 2716                   |
|                              |              | $60^\circ \leq \theta < 90^\circ$                 | 4856     | 3399                    | 2428                   |
|                              |              | $\theta = 90^\circ$                               | 4901     | 3431                    | 2451                   |
| MQS-SP-L<br>(Base Connector) | Longitudinal | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                              |              | $30^\circ \leq \theta < 45^\circ$                 | 2364     | 1655                    | 1182                   |
|                              |              | $45^\circ \leq \theta < 60^\circ$                 | 2450     | 1715                    | 1225                   |
|                              |              | $60^\circ \leq \theta < 90^\circ$                 | 2447     | 1713                    | 1224                   |
|                              |              | $\theta = 90^\circ$                               | 2279     | 1595                    | 1140                   |
| MQS-SP-T<br>(Base Connector) | Transverse   | $0^\circ \leq \theta < 30^\circ$                  | 0        | 0                       | 0                      |
|                              |              | $30^\circ \leq \theta < 45^\circ$                 | 1859     | 1301                    | 930                    |
|                              |              | $45^\circ \leq \theta < 60^\circ$                 | 1729     | 1210                    | 865                    |
|                              |              | $60^\circ \leq \theta < 90^\circ$                 | 1560     | 1092                    | 780                    |
|                              |              | $\theta = 90^\circ$                               | 1561     | 1093                    | 781                    |

<sup>1</sup>Brace angle measured from the vertical plane.<sup>2</sup>Calculated as  $R_{Hn} \cdot \phi$ <sup>3</sup>Calculated as  $R_{Hn}/\Omega$ Horizontal Design Values for Hilti Seismic Brace System<sup>4</sup>

| Component Part   | Orientation  | Brace Orientation Angle ( $\theta$ ) <sup>1</sup> | $R_{Hn}$ | LRFD Value <sup>2</sup> | ASD Value <sup>3</sup> |
|------------------|--------------|---------------------------------------------------|----------|-------------------------|------------------------|
|                  |              |                                                   | (lbf.)   | (lbf.)                  | (lbf.)                 |
| Trapeze Assembly | Transverse   | $45^\circ \leq \theta < 60^\circ$                 | 830      | 581                     | 415                    |
|                  |              | $60^\circ \leq \theta < 90^\circ$                 | 709      | 496                     | 355                    |
|                  |              | $\theta = 90^\circ$                               | 575      | 403                     | 288                    |
|                  | Longitudinal | $45^\circ \leq \theta < 60^\circ$                 | 378      | 265                     | 189                    |
|                  |              | $60^\circ \leq \theta < 90^\circ$                 | 441      | 309                     | 221                    |
|                  |              | $\theta = 90^\circ$                               | 435      | 305                     | 218                    |

<sup>1</sup>Brace angle measured from the vertical plane.<sup>2</sup>Calculated as  $R_{Hn} \times \phi$ , where  $\phi = 0.7$ .<sup>3</sup>Calculated as  $R_{Hn}/\Omega$ , where  $\Omega = 2$ .<sup>4</sup>Allowable loads shown are for individual braces.