

Guide Specification 05410

Lateral (Wind) Load-Bearing Lightweight Steel Framing System

This guide specification is intended as an aid to the design professional and should not be used to replace the judgment of a qualified engineer or architect. It is written on the assumption that structural design of the framing is the responsibility of the Contractor. It also assumes that division of the work between subcontractors is the responsibility of the contractor alone, and done without reliance on the specifications.

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We trust the information given herein is helpful. Please refer to Bailey Metal Products website for additional information, or contact a Bailey Metal Products Technical Sales Representative in your area.

Division 5

05410 - Lateral (Wind) Load-Bearing Lightweight Steel Framing System

For use as a contract document:

- Delete Specifier Notes
- Choose appropriate selections in square brackets
- Delete selections in square brackets that do not apply
- Make any other project specific amendments that are appropriate

Part 1 – General

1.1 System Descriptions

Wind bearing steel studs includes:

- .1 Wall studs subjected to lateral loads (no axial loads other than self-weight and the weight of applied finishes)
- .2 Steel Bridging
- .3 Top and bottom track
- .4 Head, sill and jamb members for wall openings
- .5 Stud, bridging and track connections
- .6 Top and bottom connections to the main structure including detailing to accommodate floor and/or roof deflections.

✓ **Specifier Note: Non-load bearing interior partition studs are outside the scope of this specification.**

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1.2 Related Work

- ✓ **Specifier Note:** *In the applicable related sections, reference this section for the specification of wind bearing steel studs.*
 - .1 Section [01 _____] Allowances for independent inspection or testing.
 - .2 Section [03 _____] Concrete.
 - .3 Section [04 _____] Masonry.
- ✓ **Specifier Note:** *Reference the section where masonry ties connecting to steel studs is specified.*
 - .4 Section [06 _____] Wood Sheathing.
 - .5 Section [07 _____] Building Insulation.
- ✓ **Specifier Note:** *Reference the section(s) where insulation in the stud space and exterior insulation are specified.*
 - .6 Section [_____] [_____]
- ✓ **Specifier Note:** *List section(s) where other exterior cladding or finishes attached to the wind bearing studs are specified.*
 - .7 Section [07 _____] Air Barriers and/or vapour barriers.
 - .8 Section [08 _____] Doors and Windows.
 - .9 Section [09 _____] Non Load-Bearing Steel Stud framing.
 - .10 Section [09 _____] Gypsum Board
- ✓ **Specifier Note:** *Reference the section(s) where gypsum board finish attached to framing and exterior gypsum sheathing is specified. If the gypsum board/sheathing is to function as an air barrier ensure that screw spacing, board thickness and orientation required by wind loads are covered there.*
 - .11 Section [_____] [_____]

1.3 References

Where referenced standards conflict with this specification, this specification governs. Referenced standards refer to the latest edition.

- ✓ **Specifier Note:** *As an alternative to specifying the "latest edition", add current dates to the standards listed below.*
 - .1 National Building Code of Canada
 - .2 [Ontario] [_____] Building Code
 - .3 CAN/CSA-S16 Limit States Design of Steel Structures
 - .4 CAN/CSA-S136 North American Specification for the Design of Cold-Form Steel Structural Members
 - .5 CSA W47.1 Certification of Companies for Fusion Welding of Steel Structures
 - .6 CSA W59 Welded Steel Construction (Metal Arc Welding)
 - .7 ANSI/AWS D1.3 Structural Welding Code – Sheet Steel
 - .8 CSA A370 Connectors for Masonry
 - .9 CSA A371 Masonry Construction for Buildings
 - .10 CSA S304.1 Masonry Design for Buildings (Limit States Design)
 - .11 ASTM A307 Standard Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength
 - .12 ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - .13 ASTM A653/A653M Standard Specification for Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
 - .14 ASTM A792/A792M Standard Specification for Sheet Steel, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process
 - .15 ASTM C1007 Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

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- .16 ASTM C955 Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
- .17 CAN/CGSB-1.181 Ready-Mixed Organic Zinc-Rich Coating
- .18 CAN/ULC-S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials
- .19 [_____]

✓ **Specifier Note:** List standards referenced elsewhere in this specification.

1.4 Quality Assurance

Retain a Professional Engineer registered in Canada [the province of _____] to design the wind bearing steel stud wall system; to prepare, seal and sign all shop drawings; and to perform field review. Shop drawings shall show both design and installation requirements.

1.5 Design Criteria

- .1 Design shall be based on Limit States Design principles using factored loads and resistances.
- .2 Loads and load factors shall be in accordance with the National Building Code of Canada. For wind load calculations the reference velocity pressure, q , shall be based on a 1 in 50 probability of being exceeded in any one year.
- .3 Resistances and resistance factors shall be determined in accordance with the National Building Code of Canada and CAN/CSA-S136.
- .4 Conform to the requirements of fire rated assemblies [specified], which have been tested in accordance with CAN/ULC-S101 and provide a fire resistance rating of [_____].
- .5 Stud depths are shown on the drawings. Adjust stud material thickness and spacing as required by the design criteria. Use greater or lesser stud and joist depths only if approved by the [Project Engineer] [Architect].

✓ **Specifier Note:** Note that maximum spacings (Section 1.5.6) and minimum design thickness (Section 1.5.7) must also be considered. In addition, to avoid contractual confusion:

- Do not show stud and joist thicknesses or spacing on the Architectural or Structural drawings.
- Do not use gauge as a thickness designation.

- .6 Space wall studs at [300] [400] [480] [600] [_____] mm maximum. Use lesser stud spacing if required by the design criteria.

✓ **Specifier Note:** The structural performance of the collateral facing materials such as gypsum drywall, plywood or OSB and their associated performance as air barriers, vapour retarders, etc. will also limit the spacing of supporting members.

- .7 For studs, conform to the design thicknesses in Table 1. Use greater stud thicknesses if required by the design criteria.

TABLE 1 • Minimum Thicknesses		
Stud Depth (mm)	Minimum Base Steel Thickness Exclusive of Coating (mm)	Design Thickness Exclusive of Coating (mm)
92	0.836	0.879
102	0.836	0.879
152	0.836	0.879
203	1.087	1.146

✓ **Specifier Note:** The minimum base steel thicknesses in Table 1 are 95% of the design thickness as limited by CSA-S136.

[For wall studs supporting brick veneer, the minimum thickness exclusive of coating shall be the greater of the minimum thicknesses in Table 1 or [1.087 mm] [____]

- ✓ **Specifier Note: The minimum design thicknesses in Table 1 satisfy the requirement in S136 web height to thickness ratio not greater than 200 assuming an inside bend radius of 2t.**
- .8 The minimum thickness for bridging channel shall be 1.087 mm. Use greater bridging channel design thickness if required by the design criteria.
- .9 The minimum thickness for clip angles shall be 1.367 mm. Use greater clip angle thickness if required by the design criteria.
- .10 Maximum flexural deflections under specified wind loads shall conform to the following:
 - .1 Wall studs supporting masonry veneer shall meet the requirements of CSA-S304.1 [with stud deflections limited to L/360].
- ✓ **Specifier Note: The deflection and spacing of steel studs supporting masonry veneer is controlled by the requirements of the masonry design standard, CSA S304.1.**
 - .2 Wall studs supporting other finishes, L/360.
- .11 Design connections to accommodate vertical deflection movement of the structure, frame shortening and vertical tolerances without imposing axial loads onto the framing. Leave minimum gap of [12mm] [____]. Larger gaps may be required to accommodate structural movement. Coordinate with the Project Structural Engineer.
- .12 Limit free play in connections perpendicular to the plane of the framing to \pm [0.5] [____] mm relative to the building structure.
- ✓ **Specifier Note: Free play does not include the deflection under applied load. The provisions in 1.5.12 do not apply to masonry ties covered by CSA-A370.**
- .13 Design components and assemblies to accommodate specified erection tolerances of the structure.
- .14 Design bridging to prevent member rotation and member translation perpendicular to minor axis. Provide for secondary stress effects due to torsion between lines of bridging. [Collateral sheathing may be used to help restrain member rotation and translation perpendicular to minor axis]. [Do not rely on collateral sheathing to help restrain member rotation and translation perpendicular to minor axis]. Provide bridging at 1524 mm o.c. maximum. Space bridging at equal intervals over the span length of the member. Closer spacing may be required to satisfy structural requirements.
- ✓ **Specifier Note: Some sheathing materials such as gypsum drywall may lose their structural integrity when subjected to a moist environment or when subjected to a sufficient number of load cycles. Such materials are generally not suitable to act as structural bracing. If the sheathing is utilized for bracing, it is standard practice in the industry to also provide sufficient steel bridging to align members during erection and to provide the necessary structural integrity during construction as well as in the completed structure.**
- .15 Design anchorage and splice details for bridging.
- .16 Design for local loading due to anchorage of cladding and interior wall mounted fixtures where shown.
- .17 Connections between wind bearing steel stud members shall be by bolts, welding or sheet metal screws.
- .18 Provide head, sill and jamb members and connections to frame openings larger than [100] [____] mm in any dimension.
- .19 Anchor top and bottom track to the structure at a maximum spacing of 813 mm o.c. Closer spacing may be required to satisfy structural requirements.

1.6 Submittals

- .1 Make submittals in accordance with Section [01 ____] Submittals.
- .2 Submit [____] copies of shop drawings.
 - .1 Each shop drawing submitted shall bear the stamp and signature of a qualified

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- Professional Engineer registered [in Canada] [in the Province of _____].
- .2 Include all necessary shop details and erection diagrams. Indicate member sizes, locations, thicknesses exclusive of coating, coatings, and material types. Include connection details for attaching framing to itself and for attachment to the structure. Show splice details where permitted. Indicate dimensions, openings, requirements of related work and critical installation procedures. Show temporary bracing required for erection purposes.
 - .3 Indicate design loads.
 - .3 Submit [____] certified copies of mill reports covering chemical and mechanical properties, and coating designation of steel used in this work.
 - .4 Submit product data for mechanical fasteners indicating sizes, load capacities and type of corrosion protection.
 - .5 Submit [on request] [____] representative pieces of all framing component parts including mechanical fasteners if used.
 - .6 Submit [on request] [____] copies of engineering calculations or data verifying the capacity of the members, including masonry connectors if specified, and the ability of the assemblies to meet the design requirements.
 - .7 Do not fabricate or construct until submittals other than field review reports are reviewed and approved.
 - .8 Submit [____] copies of field review reports.

Part 2 - Products

2.1 Acceptable Manufacturers

- .1 Provide lateral (wind) load-bearing steel stud framing and accessories [including lateral bracing components, deflection connectors and brick connectors] as manufactured by Bailey Metal Products, or approved equal.

2.2 Materials

- .1 Wind Bearing Steel Stud Framing Members and Accessories
 - .1 Steel shall conform to the requirements of CAN/CSA-S136 and shall be identified as to specification, grade, mechanical properties, coating type and thickness.
 - .2 Steel shall have metallic coatings that conform to one of the following ASTM Standards:
 - ASTM A653/A653M Standard Specification for Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
 - ASTM A792/A792M Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process
 - ASTM A1003/A1003M Standard Specification for Sheet Steel, Carbon, Metallic and Non-Metallic Coated for Cold-Formed Steel Framing Members
 - .3 Wind bearing steel studs shall have a minimum coating of Z180 galvanizing in accordance with ASTM-A653/A653M. Other coatings (e.g. aluminum-zinc alloy to ASTM A792/A792M) providing equal or better corrosion protection may be used.
- ✓ **Specifier Notes: The coatings specified in 2.2 are recommended minima. None are intended to provide long-term protection where the light steel framing members are exposed directly to a corrosive environment.**

The Specifier is responsible for the compatibility of the specified coatings. Some materials may require separation. As a guide to determining equivalence of zinc versus aluminum-zinc alloy

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coatings, the Canadian Sheet Steel Building Institute recommends that AZM150 (aluminum-zinc) be considered equivalent to Z275 (zinc).

.2 Fasteners and Welds

- .1 Bolts and nuts shall conform to the requirements of ASTM A307 or ASTM A325. Provide washers. [Hot-dip galvanized bolts, nuts and washers].
- .2 Sheet metal screws shall have a minimum coating thickness of .008 mm of zinc. Other coatings providing equal or better corrosion protection may be used.
- .3 Welding materials shall conform to the requirements of CSA W59.
- .4 Welding electrodes shall be of the 490 MPa minimum tensile strength series (e.g. E49XX).
- .5 Zinc rich paint for touching up welds and damaged metallic coatings shall conform to CAN/CGSB-1.181.
- .6 Concrete anchors shall have a minimum coating thickness of .008 mm of zinc. Other coatings providing equal or better corrosion protection may be used.
- .7 [Powder actuated/low velocity fasteners are not permitted [for fastening to structural steel] [for fastening to concrete]]. [Powder actuated/low velocity fasteners shall have a minimum coating thickness of .008 mm of zinc. Other coatings providing equal or better corrosion protection may be used].

Part 3 – Execution

3.1 General

- .1 Fabrication and erection shall conform to the approved shop drawings. Modifications required to accommodate as-built conditions (other than minor dimensional changes) shall be submitted to [Project Engineer] [Architect] for approval.

3.2 Fabrication

- .1 Where specified, provide cut-outs centred in the webs of members to accommodate services and through-the-knockout style bridging. Unreinforced cut-outs shall be limited to the dimensions in Table 2. The effect of cut-outs on the strength and stiffness of the member shall be considered.

TABLE 2: Allowable Dimensions for Unreinforced Cut-outs

Member Depth (mm)	Perpendicular to the Length of the Member (mm)	Parallel to the Length of the Member (mm)	*Centre to Centre Spacing (mm)
92,102	40 max.	114 max.	610 min.
≥152	64 max.	114 max.	610 min.

*The distance from the centreline of the last unreinforced cut-out to the end of the member shall be not less than 305 mm.

- .2 Length tolerances for members shall conform to Table 3.

TABLE 3: Length Tolerances	
Member Type	Length Tolerance (mm)
Tracks	+12.7 / -6.4
Wind Bearing Studs	± 2.83 mm

- .3 Cross sectional geometry tolerances for members shall conform to Table 4.

TABLE 4: Cross Sectional Geometry Tolerances					
Member Type	Member Depth A (mm)	Flange Width B (mm)	Lip Length C (mm)	Thickness t (mm)	Corner Angles
Track or Stud	± 0.79	1, +2 **	0, +4	*	+0,-3°

* The tolerance on delivered steel thickness shall conform to the requirements of CAN/CSA S136.

** Where sheathings are attached directly to the flange, the minimum flange width shall be 31 mm.

- .4 The minimum steel thickness exclusive of coating shall be marked on each member by embossing, stamping with indelible ink or by colour coding.

3.3 Fasteners and Welds

- .1 Ensure that connected parts are in contact. Provide clamping before welding or installing screws as required.
- .2 Companies engaged in welding shall be certified by the Canadian Welding Bureau to CSA W47 .1. Companies shall have welding procedures approved and welders qualified for the base material types and thicknesses that are to be welded.
- .3 Welds shall conform to CAN/CSA S136, CSA W59 and ANSI/AWS D1.3, whichever is applicable.
- .4 For material less than 3 mm thick, shop drawings may show nominal weld leg sizes. For such material, the effective throats of welds shall not be less than the thickness of the thinnest connected part.
- .5 Touch-up welds and coatings damaged by welding with zinc rich paint. Prior to touching-up prepare surface in accordance with paint manufacturer's recommendations.
- .6 Sheet metal screws shall be of the minimum diameter indicated on the shop drawings, but not less than a #8.
- .7 Penetration of sheet metal screws beyond joined materials shall be not less than three exposed threads.
- .8 Sheet metal screw thread types, drilling capability and installation shall conform to the manufacturer's recommendations.
- .9 Sheet metal screws covered by sheathing materials shall have low profile heads.
- .10 Install concrete anchors in accordance with manufacturer's recommendations.

3.4 Storage of Materials

- .1 Products shall be protected from conditions that may cause physical damage or corrosion.

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3.5 Erection

- .1 Methods of construction may be either piece by piece (stick-built) or by fabrication into panels (panelized) either on or off site.
- .2 Wind bearing studs shall be erected true and plumb within the specified tolerances. Temporary bracing shall be employed wherever necessary to withstand all loads to which the steel stud wall system may be subject during erection and subsequent construction. Temporary bracing shall be left in place as long as required for the safety and integrity of the wall system. The erector shall ensure that during erection a margin of safety consistent with the requirements of the National Building Code and CAN/CSA-S136 exists in the uncompleted structure.
- .3 Erection Tolerances
 - ✓ **Specifier Note: These tolerances are intended as minima to insure structural performance only. Architectural considerations such as the visual appearance of a finished surface or joint may require tighter tolerances.**
 - .1 For the purpose of this section, camber is defined as the deviation from straightness of a member or any portion of a member with respect to its major axis, and sweep is defined as the deviation from straightness of a member or any portion of a member with respect to its minor axis.
 - .2 For wind bearing studs, out of plumbness shall not exceed 1/500th of the member length. Out of straightness (camber and sweep) shall not exceed 1/1000th of the member length.
 - .3 For track, camber shall not exceed 1/1000th of the member length.
 - .4 Squareness of prefabricated panels shall be not more than 3 mm out of square within the length of that panel.
- .4 Studs shall seat into top and bottom tracks. The gap between the end of the stud and the web of the track shall not exceed 3.2 mm.
- .5 Align adjacent or abutting members in the same plane to within ± 0.5 mm maximum.
- .6 Spacing of studs shall not be more than ± 3 mm from design spacing. The cumulative error in spacing shall not exceed the requirements of the finishing materials.
- ✓ **Specifier Note: The Specifier may choose to specify lateral bracing systems with inherent features specifically designed to aid installers and ensure the required stud spacing tolerances are met in accordance with ASTM C1007. BMP's BRIDGELock Bridging System is one such product. More detailed information can be found on the BMP website at www.bmp-group.com.**
- .7 Align web cut-outs in stud and joists as required for the installation of the through-the-knockout style bridging and services.
- .8 Make all field measurements necessary to ensure the proper fit of all members.
- .9 Cutting of members may be by saw or shear. Torch cutting is not permitted.
- .10 Reinforce cut-outs where the distance from the centerline of the cut-out to the end of the member is less than 300 mm. Submit the reinforcing detail to the [Project Engineer] [Architect] for approval.
- .11 Holes that are field cut into lightweight steel framing members shall conform to the requirements of Section 3.2.
- .12 Replace members with localized damage.
- .13 Unless a closer spacing is shown on the shop drawings, anchor top and bottom tracks securely to structure at [____] [813 mm] o.c. maximum. Place one additional anchor within 102 mm of the end of each piece of track and additionally as required by the shop drawings.
- ✓ **Specifier Note: The Specifier may choose to specify specific track members incorporating pre-drilled pilot holes designed to facilitate anchor fastening and spacing as determined by design**

requirements, while additionally providing for drainage and evaporation where moisture collection within track members is of concern. Detailed information regarding Bailey's PUNCHED TRACK product can be found on the BMP website at www.bmp-group.com.

- .14 Install additional studs at abutting walls, openings, terminations against other materials and on each side at corners unless explicitly detailed otherwise on the shop drawings.
- .15 Insulation equal to that specified shall be placed in jamb and header assemblies that will be non-accessible after their installation into the wall. Ensure that insulation is kept dry and not compressed.
- .16 Handling and lifting of prefabricated panels shall not cause permanent distortion to any member or collateral material.

3.6 Inspection

- .1 The Lightweight Steel Framing Design Engineer responsible for the production of the shop drawings shall provide periodic field review during construction and shall submit reports in accordance with Section 1.5.

[These field reviews shall include review of mill test reports, welded and screwed connections, connections to the main structure, member sizes, location and material thickness, coating thickness, erection tolerances, and all field cutting.]

✓ **Specifier Note: Use this paragraph for projects where independent inspection is deemed unwarranted.**

- .2 The cost of this field review shall be paid for by the contractor.
- .3 Additional inspection and testing of materials and workmanship shall be carried out by a qualified Independent Inspection Agency appointed by the [Project Engineer] [Architect].
 - .1 The cost of this additional inspection shall be borne by the [Project Engineer] [Architect] and paid for out of the Cash Allowances for Inspection and Testing. Exceptions to this is made when additional inspection and testing is required by the [Project Engineer] [Architect] as a result of contractor error, or due to departure from the contract documents by the contractor, in which case the cost of additional inspection and testing shall be paid for by the contractor.
 - .2 Inspection shall include:
 - .1 Checking that mill test reports are properly correlated to materials.
 - .2 Sampling fabrication and erection procedures for general conformity to the requirements of the specification.
 - .3 Checking that the welding conforms to the requirements of Section 3.3.
 - .4 Checking fabricated members against specified member geometries.
 - .5 Visual inspection of all welded connections including sample checking of joint preparation and fit-up.
 - .6 Sample checking of screwed and bolted joints.
 - .7 Sample checking that tolerances are not exceeded during fit-up or erection.
 - .8 Additional inspection and testing of welded connections as required by CSA W59.
 - .9 General inspection of field cutting and alterations required by other trades.
 - .10 Submission of reports covering the work inspected complete with any details of discovered deficiencies, to the architect, the project engineer, the contractor and the authorities having jurisdiction.
- .4 The contractor shall provide the necessary co-operation and access to ensure that the inspection can proceed.

- .5 The inspection provided in this section does not relieve the contractor of his responsibility for the performance of the contract. The Contractor is solely responsible for quality control and shall implement his own supervisory and quality control procedures.
- .6 The contract cannot rely on timely discovery and reporting defective work. Materials or workmanship not conforming to the requirements of the contract may be rejected at any time during the progress of work at no cost to the owner even if the contractor has to destroy and rebuild other work as a result.

END OF SECTION 05410

The following TABLES 5, 6 and 7 below summarize standard available stud sections, lateral bridging components and brick connectors through Bailey Metal Products. Please refer to Bailey literature or website www.bmp-group.com for additional information including section properties, load tables and engineering notes and details.

TABLE 5: Bailey Lateral (Wind) Load-Bearing Studs				
Depth	Flange	Thickness		Yield Strength
3 5/8", 4", 6", 8"	1.62"	0.097"		50 ksi
3 5/8", 4", 6", 8"	1.62"	0.054", 0.068"		50 ksi
3 5/8", 4", 6", 8"	1.62"	0.044"		33 ksi
3 5/8", 4", 6", 8"	1.62"	0.044"		33 ksi
3 5/8", 4", 6", 8"	1.62"	0.033"		33 ksi
2½", 3 5/8", 6"	1.25"	0.044"		33 ksi
2½", 3 5/8", 6"	1.25"	0.033"		33 ksi
TABLE 6: Bailey Lateral Bridging Components				
Component	Dimensions	Coating	Thickness	Yield Strength
BridgeLock Clip 365/400	1.5"x 3.25"x 1.5"	G60	0.054"	50 ksi
BridgeLock Clip 600	1.5"x 5.5"x 1.5"	G60	0.054"	50 ksi
BridgeLock Clip 800	1.5"x 7.5"x 1.5"	G60	0.054"	50 ksi
BridgeLock Channel (CRC)	1.5"x 0.5"x 144"	G60	0.043"	33 ksi
TABLE 7: Bailey Brick Connectors				
Feature		*ESS-3	**HDG-3	
Meets Requirements of CSA A370-94 Connectors For Masonry		Yes	Yes	
Corrosion Protection		Level III	Level II	
Attaches to web side of stud with fasteners loaded in shear		Yes	Yes	
Plate Height		3" (76mm)	3" (76mm)	
Vertical Adjustment (Slot Size)		2¼" (57mm)	2¼" (57mm)	
Use with 3 5/8", 4", 6" and 8" Studs with 1.62" Flanges		Yes	Yes	
Use with 3 5/8" Studs with 1.25" Flanges		No	Yes	
Use with 4" and 6" Studs with 1.25" Flanges		No	No	

* System **ESS** (Economical Stainless Steel)

** System **HDG** (Hot Dip Galvanized after Fabrication)