

ICC-ES Evaluation Report

ESR-3976

Reissued April 2024

This report also contains:


- CBC Supplement

Subject to renewal April 2025

- LABC Supplement

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<p>DIVISION: 05 00 00—METALS</p> <p>Section: 05 05 27—Metal Connectors</p>	<p>REPORT HOLDER:</p> <p>LINDAPTER INTERNATIONAL LLP</p>	<p>EVALUATION SUBJECT:</p> <p>TYPE AF AND AAF GIRDER CLAMP ASSEMBLIES</p>	
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1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018 and 2015 [International Building Code® \(IBC\)](#)
- 2021, 2018 and 2015 [International Residential Code® \(IRC\)](#)

For evaluation for compliance with codes adopted by [Los Angeles Department of Building and Safety \(LADBS\)](#), see [ESR-3976 LABC and LARC Supplement](#).

For evaluation for compliance with codes adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architects (DSA), see [ESR-3976 CBC and CRC Supplement](#).

Property evaluated:

Structural

2.0 USES

The Lindapter Type AF and AAF Girder Clamp Assemblies are alternatives to high-strength bolt assemblies (high-strength bolts with matching nuts and washers) prescribed in AISC 360.

The Girder Clamp Assemblies may be used to resist axial tension loads and slip (lateral) loads due to load combinations that include wind and/or seismic loading. The Girder Clamp Assemblies may also be used to resist gravity loads resulting from supporting nonstructural components.

The Lindapter Type AF and AAF Girder Clamp Assemblies may be used in Seismic Design Categories (SDC) A through F, but must not be part of the lateral-force-resisting system for the primary structure, designated in ASCE 7-16 Table 12.2-1.

The Lindapter AF and AAF Girder Clamp Assemblies subject to tension loading only have been evaluated for fatigue resistance and may be used in steel connections subjected to high-cycle loading.

The AF and AAF Girder Clamp Assemblies may be used in structures regulated under the IRC when addressed in an engineered design in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 General:

Type AF and AAF Girder Clamp Assemblies consist of Type AF or Type AAF Girder Clamps; tension-controlled high-strength bolt assemblies; a steel location plate or end plate; packing pieces, if applicable; and the connected structural steel members.

Evaluated connections are made with four replicate Girder Clamp Assemblies. A connection with a location plate consists of four identical Girder Clamp Assemblies with two opposing Girder Clamps; the location plate; and two connected structural steel components. A connection with an end plate consists of four identical Girder Clamp Assemblies, each with one clamp; the end plate, which is welded to the end of a structural steel member; and the structural steel component that is to be clamped to the end plate. See [Figures 3, 4 and 5](#) for illustrations of connections with Girder Clamp Assemblies.

3.2 Girder Clamp Assembly Components:

3.2.1 Girder Clamps: Type AF and Type AAF Girder Clamps are cast from spheroidal graphite (SG) iron complying with BS EN 1563 Grade EN-GJS-600-3 and Grade EN-GJS-400-18LT respectively, with hot dip galvanization conforming to BS EN ISO 1461 (ASTM A123).

The Type AF Girder Clamps are available for use with $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$ and 1 inch bolts. The clamps are available with a short or medium height tail. A filler washer, supplied with each clamp, must be used. See [Figure 1](#) for images of the Type AF Girder Clamp and [Table 1](#) for dimensional information.

Type AAF Girder Clamps consist of two parts packaged together – a clip and a rocking washer. See [Figure 2](#) for images of the Type AAF Girder Clamp and [Table 2](#) for dimensional information.

3.2.2 Tension-controlled High Strength Bolt Assemblies: The tension-controlled high strength bolt assemblies are not supplied by Lindapter. Either of the tension-controlled high strength bolt assemblies described in Sections 3.2.2.1 and 3.2.2.2 may be used with the Girder Clamps.

3.2.2.1 DTI Bolt Assemblies: These high strength bolt assemblies consist of high-strength heavy hex bolts conforming to ASTM F3125 Grade A325 or Grade A490; matching heavy hex nuts complying with ASTM A563 Grade DH; ASTM F436 Type 1 hardened, galvanized washers; and galvanized direct tension indicators (DTIs) conforming to ASTM F959.

3.2.2.2 Twist-off Bolt Assemblies: These high strength bolt assemblies consist of high-strength twist-off bolts conforming to ASTM F3125 Grade F1852 or F2280; matching heavy hex nuts complying with ASTM A563 Grade DH; and ASTM F436 Type 1 hardened, galvanized washers.

3.2.3 Steel Location and End Plates: Steel location and end plates must be fabricated with the dimensions and holes specified by Lindapter. Holes must be standard, oversized or slotted holes conforming to Table J3.3 of AISC 360. The plates must be fabricated from carbon steel conforming to ASTM A572 Grade 50. The plates may be left bare or may be hot-dip galvanized in accordance with ASTM A123.

3.2.4 Packing Pieces: Packing pieces are steel plates or shims with cut-outs for the bolts. They are supplied by Lindapter for use with both the Type AF and Type AAF Girder Clamps. The packing pieces are fabricated from carbon steel conforming to BS EN 10025 and are hot-dip galvanized in accordance with BS EN ISO 1461 (ASTM A123).

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: The available tension and slip (lateral) strengths shown in [Tables 3 and 4](#) are for connections made with four Girder Clamp Assemblies. Testing for tensile strength relied upon a test member that ensured failure in the girder clamp assemblies. The capacities of the connected steel elements, considering global and local effects of the connections, are outside the scope of this report and must be justified to the satisfaction of the code official.

Combined tension and slip loading must be considered for LRFD and ASD in accordance with the following equation:

$$\left(\frac{\text{Tension Demand}}{\text{Tension Capacity}}\right)^2 + \left(\frac{\text{Slip Demand}}{\text{Slip Capacity}}\right)^2 \leq 1.0 \quad (\text{Eq. 1})$$

4.1.2 Design for Fatigue: Girder Clamp connections with four A325 bolt Girder Clamp Assemblies have been evaluated for fatigue resistance when subject to tension loads only. For tension connections which are subject to 10,000 or more cycles of live load application, the connection must be designed in accordance with Appendix 3 of AISC 360 and Equation 2, below. Service category G applies, with $C_f = 0.39$ and $F_{TH} = 7$ ksi (48 MPa), in accordance with Table A-3.1 of AISC 360.

$$T_{a,fat} = F_{SR}(4A_{eb})(R_{gr}) \quad (\text{Eq. 2})$$

where:

- $T_{a,fat}$ = Allowable tensile fatigue load, kips (N)
- F_{SR} = Allowable stress range determined in accordance with Equation A-3-1 of AISC 360, ksi (MPa)
- A_{eb} = Cross-sectional area of the four bolts in the connection, determined at the minor thread location, in² (mm²)
- R_{gr} = Group action factor = 0.60

4.2 Installation:

4.2.1 General: The Type AF and Type AAF Girder Clamp Assemblies must be installed in accordance with this report, the manufacturer's published installation instructions and the approved construction documents. The manufacturer's published installation instructions must be included in the packages of Girder Clamps and must be available at the jobsite at all times during installation, together with the approved construction documents.

4.2.2 Components Supplied by Others: Components not supplied by the report holder, including the steel elements to be connected, the location or end plates, and the bolt assemblies, must comply with the Lindapter specifications, the requirements in this evaluation report and the approved construction documents.

4.2.3 Erection of Steel Elements: Structural steel elements must be aligned and in contact with the steel location plate or end plate as specified in this evaluation report and the approved construction documents.

4.2.4 Installation of Girder Clamp Assemblies: The Girder Clamp Assemblies must be installed with the shank of the bolt in contact with the connected flange material. After installation, the axis of each bolt must be at 90 degrees to the top of the Type AF Girder Clamp or the top of the rocking washer component of the Type AAF Girder Clamp.

4.2.5 Requirements for DTI Bolt Assemblies: DTI bolt assemblies described in Section 3.2.2.1 must be used and installed in accordance with Sections 2.6, 7.2.4 and 8.2.4 of the Specification for Structural Joints Using High-strength Bolts date June 11, 2020, published by the Research Council on Structural Connections (AISC 348).

4.2.6 Requirements for Twist-off Bolt Assemblies: Twist-off bolts described in Section 3.2.2.2 must be used and installed in accordance with Sections 2.4, 7.2.3 and 8.2.3 of AISC 348.

4.3 Special Inspection:

Special inspection in accordance with IBC Sections 1705.1.1 and 1705.2 must be performed during and after field installation of the girder clamp assemblies. The special inspector must verify the following:

- That the identification and labeling of Girder Clamp Assembly components that are supplied by the report holder, including product name, type, grade, size, and coating designation, are as specified in this evaluation report;
- That Girder Clamp Assembly components which are not supplied by the report holder comply with this evaluation report, the approved construction documents, and the Lindapter specifications;
- That the finish and surface conditions of the steel elements are as specified in this evaluation report and the approved construction documents;
- That the bolts have been tensioned as required by AISC 348.
- That installations of girder clamp assemblies conform to the installation provisions in this evaluation report and the manufacturer's published installation instructions.

5.0 CONDITIONS OF USE:

The Lindapter Type AF and Type AAF Girder Clamp Assemblies described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Calculations and details demonstrating that the use of the Girder Clamp Assemblies is in compliance with the applicable code and this evaluation report must be submitted to the code official for approval. The calculations and details must be signed and sealed by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.2 Steel structures utilizing girder clamp assemblies addressed in this evaluation report must be designed in accordance with the IBC, AISC 360 and this evaluation report, and must be installed in accordance with this evaluation report and the manufacturer’s published installation instructions. In cases of a conflict between this evaluation report and the manufacturer’s published installation instructions, the more restrictive requirement governs.
- 5.3 Special inspection must be provided as specified in Section 4.3 of this report.
- 5.4 The Girder Clamps are manufactured under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with [ICC-ES Acceptance Criteria for Girder Clamp Assemblies in Structural Steel Connections \(AC469\)](#), approved June 2022.

7.0 IDENTIFICATION

- 7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-3976) along with the name, registered trademark, or registered logo of the report holder must be included in the product label.
- 7.2 In addition, the Lindapter Type AF and Type AAF Girder Clamp packaging is identified with the product type (AF Short, AF Medium or AAF), the product code, quantity, batch number and an image of the product. Each girder clamp is stamped with the report holder name (Lindapter).
- 7.3 The report holder’s contact information is the following:

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LINDSAY HOUSE, BRACKENBECK ROAD
BRADFORD, WEST YORKSHIRE BD7 2NF
UNITED KINGDOM
+44(0) 1274 521444
www.lindapter.com
www.lindapterusa.com

TABLE 1—TYPE AF GIRDER CLAMP DIMENSIONAL INFORMATION

PRODUCT CODE	BOLT SIZE, Z (inch)	DIMENSIONAL INFORMATION (inches)						
		Tail length, V		Y	X	T1	T2	Width
		Short	Medium					
LAF050	1/2	3/16	1/2	1 1/8	1 1/16	1 1/16	7/8	1 9/16
LAF062	5/8	5/16	9/16	1 3/8	1 1/2	7/8	1 1/16	1 15/16
LAF075	3/4	3/8	1 1/16	1 9/16	1 9/16	1	1 1/4	2 3/16
LAF100	1	9/16	1 1/8	1 7/8	2 3/8	1 1/4	1 5/8	3 1/4

For SI: 1 inch = 25.4 mm.

TABLE 2—TYPE AAF GIRDER CLAMP DIMENSIONAL INFORMATION

PRODUCT CODE	BOLT SIZE, Z (inch)	DIMENSIONAL INFORMATION (inches)					
		Clamping Range, V		Y ¹	X ¹	T ¹	Width
		Min	Max				
LAAF050	1/2	3/16	1	1 – 1 5/16	1 1/16 – 1 15/16	1 1/32 – 1 3/8	1 5/8
LAAF062	5/8	1/4	1 3/16	1 5/16 – 2	1 1/4 – 2 5/16	1 3/8 – 1 13/16	2 3/16
LAAF075	3/4	1/4	1 9/16	1 7/8 – 3 1/16	1 15/16 – 2 1/2	2 1/16 – 2 1/2	3

For SI: 1 inch = 25.4 mm.

¹Dimension varies with the thickness of the clamped plate and the rotation of the clip about the rocking washer.

TABLE 3—TYPE AF GIRDER CLAMP CONNECTION STRENGTHS¹

PRODUCT CODE & DESCRIPTION			AVAILABLE STRENGTH FOR STATIC LOADING (lbf)				AVAILABLE STRENGTH FOR SEISMIC LOADING IN SDC A, B & C (lbf)				AVAILABLE STRENGTH FOR SEISMIC LOADING IN SDC D, E & F (lbf)			
Product Code	Bolt Size (inches)	Bolt Grade	LRFD		ASD		LRFD		ASD		LRFD		ASD	
			Tension	Slip (Lateral)	Tension	Slip (Lateral)	Tension	Slip (Lateral)	Tension	Slip (Lateral)	Tension	Slip (Lateral)	Tension	Slip (Lateral)
LAF050	1/2	A325 or F1852	24,100	2,700	15,000	1,690	19,500	2,700	12,200	1,690	18,200	2,120	11,400	1,330
LAF062	5/8		36,400	5,400	22,800	3,490	30,200	5,400	18,900	3,490	27,200	4,250	17,000	2,660
LAF075	3/4		61,200	8,140	38,300	5,080	44,600	8,140	27,900	5,080	40,600	8,140	25,400	5,080
LAF100	1		103,000	12,700	64,500	7,960	86,700	12,700	54,300	7,960	80,300	11,700	50,300	7,310
LAF050	1/2	A490 or F2280	30,400	4,770	19,000	2,970	23,000	4,770	14,400	2,970	22,000	4,250	13,800	2,660
LAF062	5/8		39,700	6,300	24,800	3,930	37,200	6,300	23,300	3,930	35,600	5,670	22,300	3,450
LAF075	3/4		67,400	13,300	42,100	8,300	52,600	13,300	32,900	8,300	50,800	11,300	31,800	7,080
LAF100	1		137,000	18,100	85,700	11,300	119,000	18,100	74,400	11,300	116,000	18,100	72,800	11,300

For SI: 1 inch = 25.4mm, 1 lbf = 4.45N.

¹Tabulated values apply to connections made with four replicate Type AF Girder Clamp assemblies.

TABLE 4—TYPE AAF GIRDER CLAMP CONNECTION STRENGTHS¹

PRODUCT CODE & DESCRIPTION			AVAILABLE STRENGTH FOR STATIC LOADING (lbf)				AVAILABLE STRENGTH FOR SEISMIC LOADING IN SDC A, B & C (lbf)				AVAILABLE STRENGTH FOR SEISMIC LOADING IN SDC D, E & F (lbf)			
Product Code	Bolt Size (inches)	Bolt Grade	LRFD Design Strength		ASD Allowable Strength		LRFD Design Strength		ASD Allowable Strength		LRFD Design Strength		ASD Allowable Strength	
			Tension	Slip (Lateral)	Tension	Slip (Lateral)	Tension	Slip (Lateral)	Tension	Slip (Lateral)	Tension	Slip (Lateral)	Tension	Slip (Lateral)
LAAF050	1/2	A325 or F1852	24,100	2,700	15,000	1,690	19,500	2,700	12,200	1,690	18,200	2,120	11,400	1,330
LAAF062	5/8		36,400	5,400	22,800	3,490	30,200	5,400	18,900	3,490	27,200	4,250	17,000	2,660
LAAF075	3/4		61,200	8,140	38,300	5,080	44,600	8,140	27,900	5,080	40,600	8,140	25,400	5,080
LAAF050	1/2	A490 or F2280	30,400	4,770	19,000	2,970	23,000	4,770	14,400	2,970	22,000	4,250	13,800	2,660
LAAF062	5/8		39,700	6,300	24,800	3,930	37,200	6,300	23,300	3,930	35,600	5,670	22,300	3,450
LAAF075	3/4		67,400	13,300	42,100	8,300	52,600	13,300	32,900	8,300	50,800	11,300	31,800	7,080

For SI: 1 inch = 25.4mm, 1 lbf = 4.45 N.

¹Tabulated values apply to connections made with four replicate Type AAF Girder Clamp assemblies.

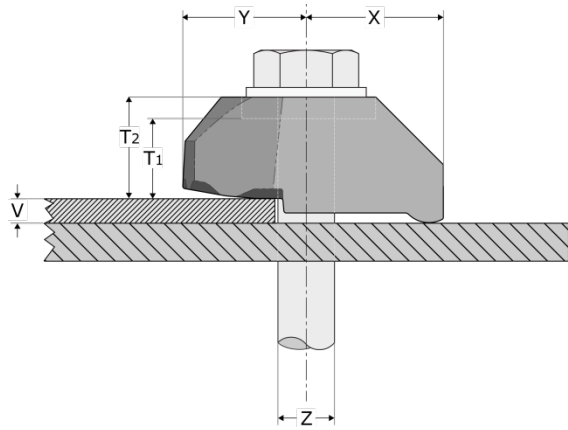
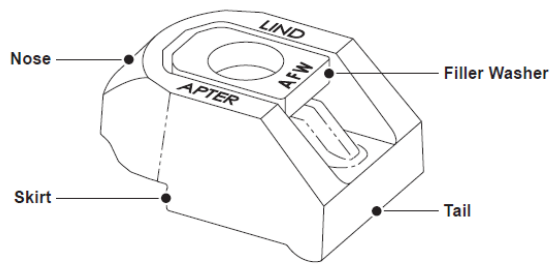


FIGURE 1—TYPE AF GIRDER CLAMP

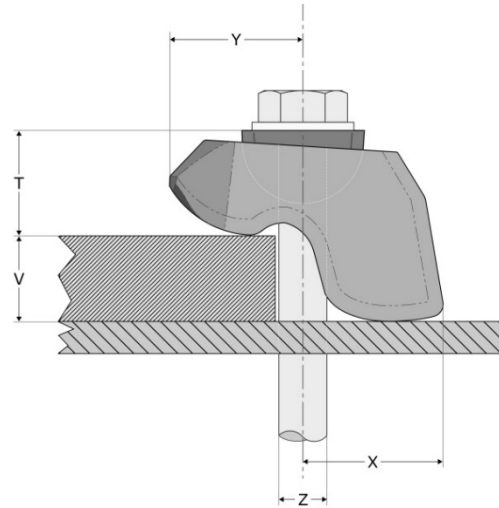
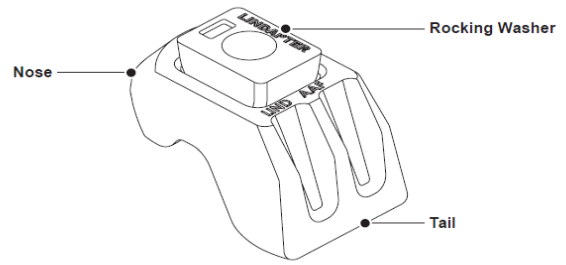


FIGURE 2—TYPE AAF GIRDER CLAMP

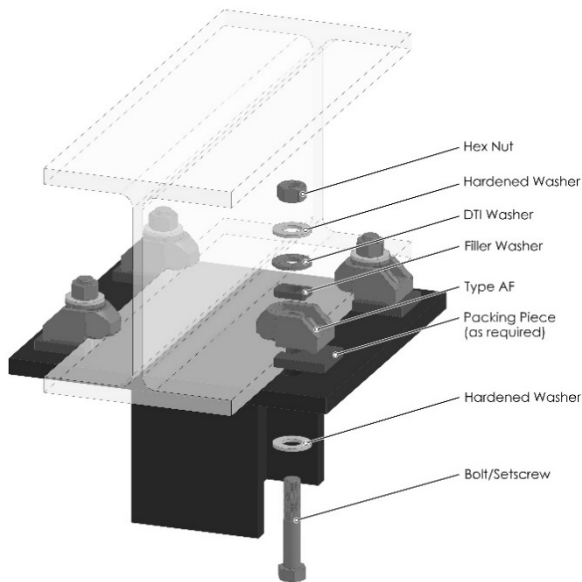


FIGURE 3—GIRDER CLAMP CONNECTION WITH END PLATE (TYPE AF CLAMP / DTI BOLT ASSEMBLY SHOWN)

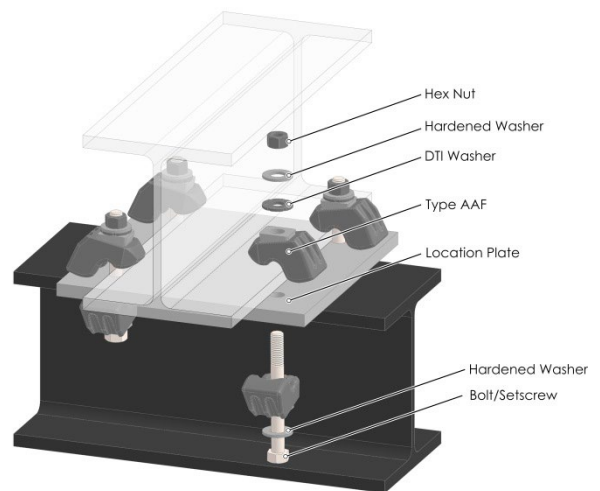


FIGURE 4—GIRDER CLAMP CONNECTION WITH LOCATION PLATE (TYPE AAF CLAMP / DTI BOLT ASSEMBLY SHOWN)

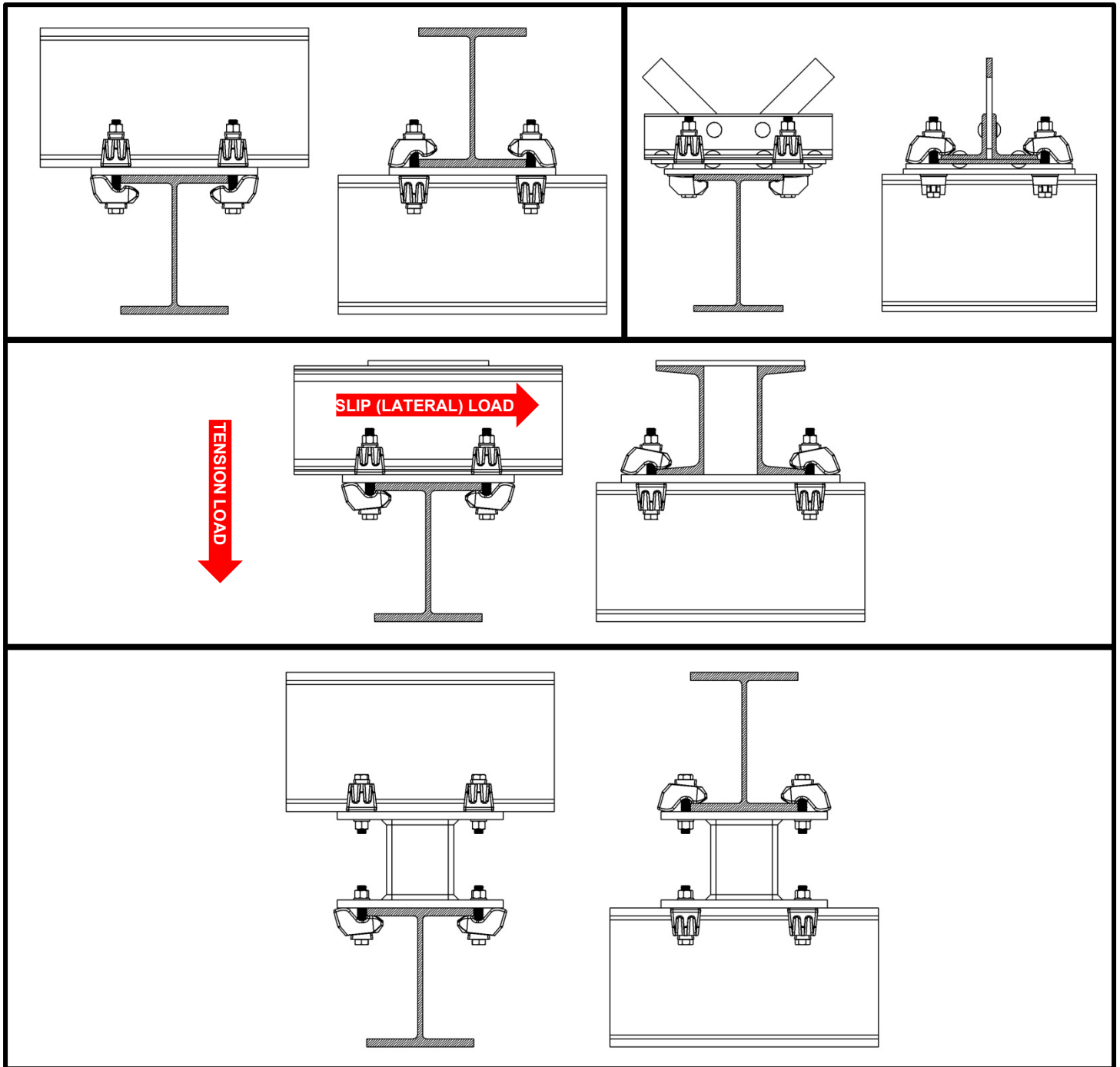


FIGURE 5—TYPICAL GIRDER CLAMP CONNECTIONS

DIVISION: 05 00 00—METALS

Section: 05 05 27—Metal Connectors

REPORT HOLDER:

LINDAPTER INTERNATIONAL LLP

EVALUATION SUBJECT:

TYPE AF AND AAF GIRDER CLAMP ASSEMBLIES

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Type AF and AAF Girder Clamp Assemblies, described in ICC-ES evaluation report [ESR-3976](#), have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2023 *City of Los Angeles Building Code* (LABC)
- 2023 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The Type AF and AAF Girder Clamp Assemblies, described in Sections 2.0 through 7.0 of the evaluation report [ESR-3976](#), comply with the LABC Chapter 22, and the LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Type AF and AAF Girder Clamp Assemblies described in this evaluation report must comply with all of the following conditions:

- All applicable sections in the evaluation report [ESR-3976](#).
- The design, installation, conditions of use and identification of the Type AF and AAF Girder Clamp Assemblies are in accordance with the 2021 *International Building Code*® (2021 IBC) provisions noted in the evaluation report [ESR-3976](#).
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16, 17 and 22 as applicable.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.

This supplement expires concurrently with the evaluation report, reissued April 2024.

DIVISION: 05 00 00—METALS

Section: 05 05 27—Metal Connectors

REPORT HOLDER:

LINDAPTER INTERNATIONAL LLP

EVALUATION SUBJECT:

TYPE AF AND AAF GIRDER CLAMP ASSEMBLIES

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Type AF and AAF Girder Clamp Assemblies, described in ICC-ES evaluation report ESR-3976, have also been evaluated for compliance with the codes noted below.

Applicable code edition(s):

- 2022 California Building Code (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2022 California Residential Code (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The Type AF and AAF Girder Clamp Assemblies, described in Sections 2.0 through 7.0 of the evaluation report ESR-3976, comply with CBC Chapter 22, provided the design and installation are in accordance with the 2021 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of 16 and 17, as applicable.

2.1.1 OSHPD:

The Type AF and AAF Girder Clamp Assemblies, described in Sections 2.0 through 7.0 of the evaluation report ESR-3976, comply with 2022 CBC Chapter 22 and amendments, and Chapter 22A, provided the design and installation are in accordance with the 2021 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements in Sections 2.1.1.1 and 2.1.1.2 of this supplement:

2.1.1.1 Verification Test Requirements: The installation verification tests shall be in accordance with Section 2213.1 [OSHPD 1R, 2 & 5] or 2213A.1 [OSHPD 1 & 4] of the CBC, as applicable.

2.1.1.2 Special Inspection Requirements: The special inspection shall be in accordance with Section 1705.2.6 [OSHPD 1R, 2 & 5] or 1705A.2.6 [OSHPD 1 & 4] of the CBC, as applicable.

2.1.2 DSA:

The Type AF and AAF Girder Clamp Assemblies, described in Sections 2.0 through 7.0 of the evaluation report ESR-3976, comply with 2022 CBC amended Chapter 22, and Chapter 22A, provided the design and installation are in accordance with the 2021 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements in Sections 2.1.2.1 and 2.1.2.2 of this supplement:

2.1.2.1 Verification Test Requirements: The installation verification tests shall be in accordance with Section 2212.6.1 [DSA-SS/CC] or 2213A.1 [DSA-SS] of the CBC and DSA IR-17-8, as applicable.

2.1.2.2 Special Inspection Requirements: The special inspections shall be in accordance with Section 1705A.2.6 [DSA-SS/CC and DSA-SS] of the CBC and DSA IR-17-9, as applicable.

2.2 CRC:

The Type AF and AAF Girder Clamp Assemblies, described in Sections 2.0 through 7.0 of the evaluation report ESR-3976, comply with the CRC, provided the design and installation are in accordance with the 2021 *International Residential Code*[®] (IRC) provisions noted in the evaluation report.

This supplement expires concurrently with the evaluation report, reissued April 2024.