ICC-ES Evaluation Report

ESR-3217

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Subject to renewal April 2026

DIVISION: 05 00 00—METALS Section: 05 05 27—Metal Connectors	REPORT HOLDER: LNA SOLUTIONS—A KEE SAFETY LOGISTIC LTD	EVALUATION SUBJECT: BOXBOLT® TYPE C BLIND FASTENERS	

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012 and 2009 *International Building Code®* (IBC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Property evaluated:

- Structural

2.0 USES

BoxBolt® Type C Blind Fasteners are designed for connecting structural steel to hollow structural section (HSS) steel members and other structural steel elements where access is difficult or is restricted to one side only. BoxBolt® Type C fasteners are intended for use with rectangular or square HSS members and are recognized for resisting static dominant tension and shear loads in bearing-type connections, and for resisting static dominant lateral loads in slip-critical connections, where static dominant loads include load combinations with gravity and wind loads for structures assigned to all Seismic Design Categories and load combinations with seismic loads for structures assigned to Seismic Design Category (SDC) A, B or C. The BoxBolt® Type C Blind Fasteners are alternatives to bolts described in Section J3 of AISC 360, which is referenced in Section 2205.1 of the IBC.

BoxBolt® Type C Blind Fasteners may also be used to resist load combinations with seismic loads for structures assigned to Seismic Design Categories (SDCs) D, E and F, based on cyclic test data in accordance with Sections 3.0 and 4.4 of the ICC-ES Acceptance Criteria for Expansion Bolts in Structural Steel Connections (AC437).

3.0 DESCRIPTION

3.1 General:

BoxBolt® Type C Blind Fasteners are assembled from four components, consisting of the core bolt (or set screw), the body (or shell), the shoulder (or collar), and the cone (or conical nut). The steel core bolt features a full-length threaded shank and a hexagonal head. The body is a steel segmented hollow cylinder, with four slits along the length of the cylinder, and are located at 90 degrees from each other. The collar is a steel flat hexagonal element with a circular hole at its center. The cone is a steel circular internally threaded nut with knurling on one end for interacting with the body. Nominal BoxBolt® diameters include $^1/_2$ inch (12.0 mm),

$^5/_8$ inch (16.0 mm), and $^3/_4$ inch (20.0 mm), with each diameter of bolt available in three lengths. Figure 1 provides a picture of the BoxBolt®. Table 1 provides part codes, dimensions and installation information. Table 2 provides BoxBolt® Type C fastener strength information.

3.2 Materials:

3.2.1 Core Bolt: The core bolt is manufactured from steel complying with ISO 4017, Class 8.8 in accordance with ISO 898-1, having a specified tensile strength, F_u, of 116,030 psi (800 MP_a) for the M12 and M16 bolts, and 120,380 psi (830 MP_a) for the M20 bolts.

3.2.2 Body, Collar and Cone: The body, collar, and cone are manufactured from steel complying with BS EN 10083 Grade C22E (1.1151).

3.2.3 Finish: All components are hot dip galvanized in accordance with BS EN ISO 1461 with a mean coating thickness of 2.2 mil (55 μm), as described in the report holder's quality documentation.

4.0 DESIGN AND INSTALLATION

4.1 Design:

The BoxBolt® Type C Blind Fasteners are alternatives to bolts described in Section J3 of AISC 360, which is referenced in Section 2205.1 of the IBC, for bearing-type connections and for slip-critical connections.

The design of the BoxBolt® Type C Blind Fasteners must comply with this report, Section J3 of AISC 360 and the information for the BoxBolt® provided in Tables 1 and 2 of this report.

For BoxBolt® Type C Blind Fasteners used in structures assigned to Seismic Design Categories (SDCs) D, E and F, the fasteners are intended to be used as force-controlled components and are not expected to undergo inelastic deformations. The construction documents (including structural calculations and engineering plans) specifying the BoxBolt® Type C Blind Fasteners, must consider this requirement for a force-controlled behavior, and additional requirements in AISC 341, as applicable.

The load-carrying capacity of a connection utilizing BoxBolt® Type C Blind Fasteners depends on the fasteners' capacities as shown in Table 2, the affected elements of members and connecting elements, and the interaction between the fasteners and the connected elements. All applicable limit states of a connection must be checked to determine the load-carrying capacity of the connection. The available strength of a connection is limited by the governing limit state (or the limit state with the least available strength), which occurs in the weakest component in the connection, typically the steel section itself in the case of thin steel sections, or the BoxBolt® in the case of thick wall steel sections, or a combination of the two.

Connections subjected to combined static tension loading and static shear-bearing loading must comply with the following:

$$\left(\frac{Tension\ Demand}{Tension\ Capacity}\right)^2 + \left(\frac{Shear\ Demand}{Shear\ Capacity}\right)^2 \leq 1.0$$

4.2 Installation:

The BoxBolt® Type C Blind Fasteners must be installed in accordance with the details noted in this section, the manufacturer's installation instructions and the approved plans. In case of a conflict between this report and the report holder's installation instructions, the most restrictive requirement governs.

1. Holes must be drilled into the sections to be connected, ensuring that the resulting holes have the correct diameter, spacing and edge distance according to the report holder's published specifications, this evaluation report and the correct design requirements for the connection, as indicated in the approved plans. Holes must be standard diameter holes conforming to AISC 360, where the bolt hole diameters must be no greater than the bolt shell diameter plus $^1/_{16}$ inch (1.6 mm).
2. Burrs in the holes must be removed before insertion of the BoxBolt® Type C Blind Fasteners.
3. The structural steel elements to be fastened adjacent to each other must be positioned to ensure:
   a. That the two sections are lined up and rest one against the other without any gap. Clamps must be used as necessary to hold the two sections together and prevent formation of gaps.
   b. That the holes are aligned, using a mandrel if necessary.
4. The core bolts must be positioned in the holes. The collar must rest flat against the section with no gap.
5. The collar must be held in position using a suitable open-ended wrench, and then the core bolt must be tightened to the specified torque, as noted in Table 1 of this report.
6. The tightening tool must then be removed and the tightening torque on the bolt must be verified. If necessary, the tightening torque must be corrected.

4.3 Special Inspection:

Special inspection is required in accordance with 2015 and 2012 IBC Sections 1704.3, 1705.1.1 and 1705.2 (2009 IBC Sections 1704.3, 1704.15 and 1705), as applicable). The report holder must submit inspection procedures to verify proper installation of the BoxBolts® Type C Blind Fasteners. Where BoxBolts® Type C Blind Fasteners are used for seismic or wind load resistance, special inspection must comply with 2015 IBC Sections 1705.11, 1705.12 and 1705.13 (2012 IBC Sections 1705.10, 1705.11 and 1705.12; 2009 IBC Sections 1706, 1707 and 1708; as applicable).

4.4 Packaging:

Each package of the BoxBolt® Type C Blind Fasteners must include the following information: installation and safety instructions, minimum and maximum fixing ranges (or the total thickness of elements to be connected), installation torque, design loads and special inspection requirements.

5.0 CONDITIONS OF USE:

The BoxBolt® Type C Blind Fasteners described in this report comply with, or are suitable alternatives to what is specified in, the codes noted in Section 1.0 of this report, subject to the following conditions:

5.1 Steel structures utilizing BoxBolt® Type C Blind Fasteners must be designed in accordance with the IBC including its referenced standards (such as AISC 360 and AISC 341) and this evaluation report; and must be installed in accordance with this evaluation report and the report holder's installation instructions. In case of a conflict between this evaluation report and the report holder's installation instructions, the most restrictive requirement governs.

5.2 Calculations and details, justifying the use of the BoxBolt® Type C Blind Fasteners is in compliance with the applicable code and this evaluation report, including showing that the BoxBolt® fasteners, the affected elements of members and connecting elements are adequate to resist the applied loads, 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.

5.3 Fire-resistive **Construction:** Where not otherwise prohibited in the code, BoxBolt® Type C Fasteners are permitted for use with fire-resistance-rated construction provided that at least one of the following conditions is fulfilled:

- The BoxBolt® fasteners are used to resist wind or seismic forces only.
- BoxBolt® fasteners that support a fire-resistance-rated envelope or a fire-resistance-rated membrane, are protected by approved fire-resistance-rated materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
- The BoxBolt® fasteners are used to support nonstructural elements.

5.4 Special inspection must be provided as specified in Section 4.3 of this report.

5.5 For BoxBolt® Type C Blind Fasteners used in structures assigned to Seismic Design Categories (SDCs) D, E and F, the fasteners are intended to be used as force-controlled components and are not expected to undergo inelastic deformations, and the design professional must consider this force-controlled behavior in his design.

5.6 The BoxBolt® Type C Fasteners addressed in this evaluation report are manufactured under a quality program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Expansion Bolts in Structural Steel Connections (AC437), dated October 2014 (editorially revised December 2016).

7.0 IDENTIFICATION

7.1 The BoxBolt® Type C fastener package is labeled with the product part number, quantity, batch number, image of the product, report holder's name (LNA Solutions—A Kee Safety Logistic Ltd.), and the evaluation report number (ESR-3217).The fastener is identified by a nine-character alphanumeric part number (BQXGALXXC). The first three characters (BQX) indicate the length of the fastener (Size 1, 2, or 3). The second three characters (GAL) indicate the fasteners are coated with a hot dip galvanized coating. The last three characters (XXC) indicate the diameter and type of fastener, where XX is the numeric diameter in millimeters (12, 16 or 20), and C identifies the fastener as a Type C fastener. Each core bolt is stamped with a head marking of "ATBX". Each collar is stamped with "BOXBOLT" and part number.

7.2 The report holder's contact information is the following:

LNA SOLUTIONS—A KEE SAFETY LOGISTIC LTD
100 STRADTMAN STREET
BUFFALO, NEW YORK 14206
(888) 724-2323
www.LNASolutions.com

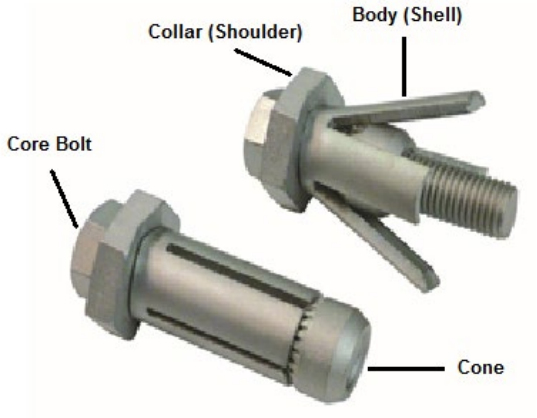

FIGURE 1—TYPICAL BOX BOLT® TYPE C BLIND FASTENER

TABLE 1—BOXBOLT® TYPE C BLIND FASTENER DIMENSIONAL AND INSTALLATION INFORMATION[1]

PART NUMBER AND DESCRIPTION			DIMENSIONAL INFORMATION[3]							INSTALLATION INFORMATION[3]	
BoxBolt® (Part Code)	BoxBolt® (Core Bolt Diameter)	Description[2]	Core Bolt Length	Clamping Range (dim x)		Across Flats of Shoulder	Collar Thickness	Dim A	Dim B	Dim C Drill Dia	Torque (ft-lb)
				Min	Max						
BQ1GAL12C	1/2" (12 mm)	1/2" BoxBolt® Size 1	2 3/16" (55 mm)	1/2"	15/16"	1" (26 mm)	5/16" (8.4 mm)	2 1/16" (52 mm)	1 1/8"	13/16"	60
BQ2GAL12C	1/2" (12 mm)	1/2" BoxBolt® Size 2	3 1/8" (80 mm)	3/4"	1 7/8"	1" (26 mm)	5/16" (8.4 mm)	2 1/16" (52 mm)	1 1/8"	13/16"	60
BQ3GAL12C	1/2" (12 mm)	1/2" BoxBolt® Size 3	4" (100 mm)	1 1/2"	2 11/16"	1" (26 mm)	5/16" (8.4 mm)	2 1/16" (52 mm)	1 1/8"	13/16"	60
BQ1GAL16C	5/8" (16 mm)	5/8" BoxBolt® Size 1	3" (75 mm)	5/8"	1 3/8"	1 7/16" (36 mm)	3/8" (9.4 mm)	2 11/16" (68 mm)	1 3/8"	1 1/16"	140
BQ2GAL16C	5/8" (16 mm)	5/8" BoxBolt® Size 2	4" (100 mm)	1"	2 5/16"	1 7/16" (36 mm)	3/8" (9.4 mm)	2 11/16" (68 mm)	1 3/8"	1 1/16"	140
BQ3GAL16C	5/8" (16 mm)	5/8" BoxBolt® Size 3	4 3/4" (120 mm)	2"	3 1/16"	1 7/16" (36 mm)	3/8" (9.4 mm)	2 11/16" (68 mm)	1 3/8"	1 1/16"	140
BQ1GAL20C	3/4" (20 mm)	3/4" BoxBolt® Size 1	4" (100 mm)	3/4"	1 13/16"	1 13/16" (46 mm)	7/16" (11.4 mm)	3 7/16" (87 mm)	1 3/4"	1 3/8"	220
BQ2GAL20C	3/4" (20 mm)	3/4" BoxBolt® Size 2	5 1/8" (130 mm)	1 5/16"	3"	1 13/16" (46 mm)	7/16" (11.4 mm)	3 7/16" (87 mm)	1 3/4"	1 3/8"	220
BQ3GAL20C	3/4" (20 mm)	3/4" BoxBolt® Size 3	6" (150 mm)	2 9/16"	4"	1 13/16" (46 mm)	7/16" (11.4 mm)	3 7/16" (87 mm)	1 3/4"	1 3/8"	220

For **SI:** 1 inch = 25.4mm; 1 lbf = 4.448N; 1 ft-lb = 1.356 N-m.

[1]When dimensions are expressed in both US Customary and SI units; BoxBolt® dimensions in US Customary units are converted from the corresponding SI units.

[2]BoxBolt® size is determined by core bolt length.

[3]Dimension “X” is the total thickness of the connected steel elements (or the grip); "A" is the minimum spacing between fasteners; "B" is the minimum edge distance for the fasteners; and “C” is the standard hole diameters for the fasteners.

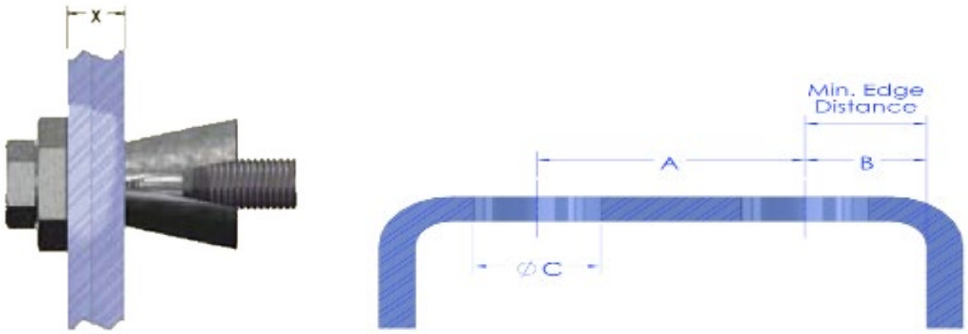

TABLE 2—BOXBOLT® TYPE C BLIND FASTENER STRENGTH INFORMATION

PART CODE	LRFD STRENGTHS[1] (lbf)						ASD STRENGTHS[2] (lbf)					
	Static Dominant Loads[3]			Seismic SDC D, E or F[4]			Static Dominant Loads[3]			Seismic SDC D, E or F[4]		
	Shear-bearing	Shear-slip resistance	Tension	Shear-bearing	Shear-slip resistance	Tension	Shear-bearing	Shear-slip resistance	Tension	Shear-bearing	Shear-slip resistance	Tension
BQ1GAL12C	7680	150	5250	6900	150	4730	4800	90	3280	4320	100	2960
BQ2GAL12C	7680	150	5250	6900	150	4730	4800	90	3280	4230	100	2960
BQ3GAL12C	7680	150	5250	6900	150	4730	4800	90	3280	4320	100	2960
BQ1GAL16C	12200	170	13100	11000	170	11400	7650	110	8230	6870	110	7120
BQ2GAL16C	12200	170	13100	11000	170	11400	7650	110	8230	6870	110	7120
BQ3GAL16C	12200	170	13100	11000	170	11400	7650	110	8230	6870	110	7120
BQ1GAL20C	17600	790	15000	11800	790	13500	11000	490	9400	7380	500	8470
BQ2GAL20C	17600	790	15000	11800	790	13500	11000	490	9400	7380	500	8470
BQ3GAL20C	17600	790	15000	11800	790	13500	11000	490	9400	7380	500	8470

For **SI:** 1 lbf = 4.448N.

[1]Load and Resistance Factor Design (LRFD) strengths are derived in accordance AC437, Sections 3.4, 3.5, 3.7 and 3.8, based on test data per AC437 Section 4.0.

[2]Allowable Strength Design (ASD) strengths are derived in accordance AC437, Sections 3.4, 3.5, 3.9 and 3.10, based on test data per AC437 Section 4.0.

[3]Static dominant loads include load combinations with gravity and wind loads for structures assigned to all Seismic Design Categories and load combinations with seismic loads for structures assigned to Seismic Design Category (SDC) A, B or C.

[4]Seismic SDC D, E or F refer to load combinations with seismic loads for structures assigned to Seismic Design Category (SDC) D, E or F.