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**BUTTONHEAD BNH AND BNX HEADED
 DEVICE FOR REINFORCEMENT BARS IN
 TENSION**

CSI Section:

03 21 00 Reinforcing Steel

1.0 RECOGNITION

The ButtonHead BNH and BNX Headed Devices for reinforcing bars in tension are recognized in this report for use as mechanical anchorage in concrete. The structural properties of the ButtonHead BNH and BNX Headed Devices were evaluated for compliance with the following codes and regulations:

- 2021, 2018, 2015, and 2012 International Building Code® (IBC)
- 2021, 2018, 2015, and 2012 International Residential Code® (IRC)
- 2020 City of Los Angeles Building Code (LABC) – attached Supplement
- 2020 City of Los Angeles Residential Code (LARC) – attached Supplement

2.0 LIMITATIONS

Use of the ButtonHead BNH and BNX Headed Devices recognized in this report is subject to the following limitations:

- 2.1** The ButtonHead BNH and BNX Headed Devices shall be installed in accordance with the applicable code, the manufacturer's installation instructions, and this report. In the event of a conflict, the more restrictive governs.
- 2.2** The use of headed and mechanical anchored deformed reinforcement for lap splices is outside the scope of this criteria.
- 2.3** Anchorage system calculations and installation details shall be designed in conformance with the IBC and ACI 318 by the registered design professional and approved by the building official.

2.4 For structures regulated by ACI 318-19 and ACI 318-14 Chapter 18 (2021, 2018, and 2015 IBC), or ACI 318-11 Chapter 21 (2012 IBC), where the ButtonHead BNH and BNX headed reinforcing bars are designed to resist earthquake-induced flexure, axial forces, or both, in special moment frames, special structural walls, and all components of special structural walls including coupling beams and wall piers, mill certificates shall be submitted to the building official as evidence that the steel reinforcing bars comply with Section 20.2.2.5 of ACI 318-19 and ACI 318-14, or Section 21.1.5.2 of ACI 318-11, as applicable.

2.5 Special inspections shall be provided in accordance with Section 3.4 of this report.

2.6 Minimum concrete cover shall be in accordance with Section 20.6 of ACI 318-19 and ACI 318-14, or Section 7.7 of ACI 318-11 or -08, as applicable, and IBC Section 721. Concrete cover shall be measured from the outer surface of the ButtonHead reinforcing bar's head.

2.7 For use in foundation walls, minimum concrete cover, and spacing between bars or sleeves shall be provided in accordance with Section 1808.8.2 of the IBC. Concrete cover and spacing shall be measured from the outer surface of the ButtonHead reinforcing bar's head.

2.8 The ButtonHead BNH and BNX Headed Devices recognized in this report are produced in Dayton, OH.

3.0 PRODUCT USE

3.1 General: The ButtonHead BNH and BNX Headed Devices for reinforcing bars in tension are Class HA headed deformed bars complying with Sections 25.4.4 or 25.4.5 of ACI 318-19 and ACI 318-14, or Section 12.6 of ACI 318-11, as applicable, for use as mechanical anchorage to develop steel reinforcing bars in tension in normalweight concrete as an alternative to standard hooks or development lengths of straight deformed reinforcing bars in reinforced concrete.

3.2 Design:

3.2.1 Development Length: Development lengths shall be determined in accordance with Section 25.4.4 of ACI 318-19 and ACI 318-14, or Section 12.6 of ACI 318-11, as applicable, only for bar sizes No.4 through No.11.

The development length, l_{dt} , shall be measured from the critical section as shown in Figure R25.4.4.2a of ACI 318-19 and ACI 318-14, or Figure R12.6(a) of ACI 318-11, as applicable.

The product described in this Uniform Evaluation Service (UES) Report has been evaluated as an alternative material, design or method of construction in order to satisfy and comply with the intent of the provisions of the code, as noted in this report, and for at least equivalence to that prescribed in the code in quality, strength, effectiveness, fire resistance, durability and safety, as applicable, in accordance with IBC Section 104.11. This report shall only be reproduced in its entirety.





The development length, l_{dt} , in inches, (including modification factors) shall not be less than the larger of $8d_b$ or 6-inches in accordance with Section 25.4.4.2 of ACI 318-19.

The concrete cover for the reinforcement shall be at least $2d_b$ and the center-to-center spacing between bars shall be at least $3d_b$, in accordance with Section 25.4.4.1 of ACI 318-19.

The concrete cover for the reinforcement shall be at least $2d_b$ and the clear spacing between bars shall be at least $4d_b$, in accordance with Section 25.4.4.1 of ACI 318-14 or Section 12.6 of ACI 318-11, as applicable.

For design in accordance with ACI 318-19 and ACI 318-14 Chapter 17, or ACI 318-11 Appendix D, as applicable the use of BNH headed deformed bars No.14 and No.18, Grade 75 and Grade 80 for development length is outside the scope of this report. The anchorage of No.14 and No.18, Grade 75 and Grade 80 bars shall be designed in accordance with ACI 318-19 and ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, as applicable, or otherwise to the satisfaction of the registered design professional and approved by the building official. When utilizing the equation in Section 25.4.4.2 of ACI 318-19 and ACI 318-14, or Section 12.6.2 of ACI 318-11, as applicable to calculate the development length of deformed bars in tension, the proposed heads conform with ASTM A970.

For only ACI 318-14 and ACI 318-11, the maximum compressive design strength of the concrete used in the calculation is 6,000 psi (41.4 MPa), and those conditions referenced in Section 25.4.4.1 of ACI 318-14, or Section 12.6.1 of ACI 318-11 have been achieved.

Development lengths specified for the development and splices of reinforcement shall not be subject to a strength reduction factor in accordance with Section 25.4.1.3 of ACI 318-19 and ACI 318-14, or Section 9.3.3 of ACI 318-11, as applicable.

When designed in accordance with Section 25.4.4.2 of ACI 318-19 and ACI 318-14, or Section 12.6.2 of ACI 318-11, as applicable, longitudinal headed deformed bars extending from a beam or a slab terminating at a support member, such as a column shall extend through the joint to the far face of the confined supporting member in accordance with Figure R25.4.4.2b of ACI 318-19 and ACI 318-14, or Figure R12.6(b) of the ACI 318-11, as applicable.

Splices of reinforcement to headed deformed reinforcing bars in tension shall comply with Sections 25.5.1 and 25.5.2 of ACI 318-19 and ACI 318-14, or Sections 12.14 and 12.15 of ACI 318-11, as applicable.

3.2.2 Design of Anchorage to Concrete: For compliance with Section 1901.3 of the 2021 and 2018 IBC, or Section 1909 of the 2015 and 2012 IBC, as applicable, ACI 318-19 and ACI 318-14 Chapter 17, or ACI 318-11 Appendix D as anchorage, additional data shall be prepared by a registered design professional and approved by the building official to justify how the No.14 and No.18 headed bars are substantiated in accordance with Section 17.1.2 of ACI 318-19, Section 17.1.3 of ACI 318-14, or Section D.2.3 of ACI 318-11, or comply with ANSI/ASME B1.1, B18.2.1 and B18.2.6, as applicable.

3.3 Installation: The ButtonHead BNH and BNX Headed Devices shall be installed in accordance with the IBC, ACI 318, this evaluation report, and the manufacturer's installation instructions. Where conflicts occur the more restrictive shall govern.

The ButtonHead BNH and BNX Headed Device Systems consist of two general components: one piece of reinforcing bar and a donut-shaped headed end. One end of the reinforcing bar is fully inserted into the central hole of the headed end. Final assembly takes place either in a shop, or in the field, by swaging the headed end on the reinforcing bar using the required hydraulically-actuated press.

3.4 Special Inspection: Special inspection of the headed bars shall be provided at the job site as required by Sections 1704.2 and 1705.3 of the IBC. The special inspector is responsible for verifying the identification of the headed deformed reinforcing bars, grade, and size of reinforcing bars, installation of reinforcing bar splices to the headed deformed reinforcing bars, as well as placement of the headed bars.

4.0 PRODUCT DESCRIPTION

4.1 Product Information: The ButtonHead BNH and BNX Headed Devices for reinforcing bars in tension are Class HA headed deformed bars complying with the requirements ASTM A970 Annex A1. The BNH headed devices are composed of No. 4 through No.18 size reinforcing steel bars and the BNX are composed of No. 4 through No. 11 size reinforcing steel bars with cold-swaged headed devices that are factory assembled at one end or both ends of the reinforcing bar using the hydraulically-actuated press. Use of other headed devices that fit onto deformed bar ends in lieu of the cold-swaging process shall comply with Section 5.1.8 of EC 006-2021.

The net bearing area of the BNH and BNX headed systems exceed four times the nominal cross-sectional area of the reinforcing bar. Dimensions and illustrations are shown in Table 1 and Figure 1 of this report.



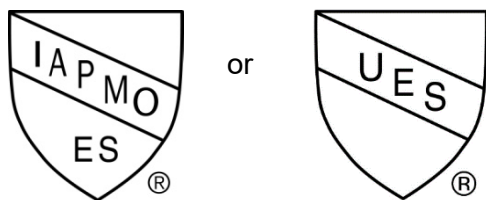
4.2 Material information

4.2.1 Headed Ends: The ButtonHead BNH and BNX headed devices are made from steel conforming to ASTM A108 or ASTM A576.

4.2.2 Steel Reinforcing Bars: Steel reinforcing bars shall be uncoated, deformed reinforcing bars complying with ASTM A615 Grades 60, 75 or 80, or ASTM A706 Grades 60 or 80.

5.0 IDENTIFICATION

All ButtonHead BNH and BNX Headed Devices are packaged with a label bearing the manufacturer's name (Barsplice Products, Inc.), address, model, size, the IAPMO Uniform ES Mark of Conformity, and the Uniform Evaluation Report Number (ER-331). The heads are permanently marked with the letter "H" to indicate that the product has been produced to the ASTM A970 Annex A1 specification. Products prepared by officially licensed fabricators, may have additional unique identifiers that correspond to the fabricator. Either Mark of Conformity may be used as shown below:



IAPMO UES ER-331

6.0 SUBSTANTIATING DATA

6.1 Data in accordance with IAPMO UES Evaluation Criteria for Headed and Mechanically Anchored Deformed Reinforcement Bars in Tension (EC 006-2021), approved August 2021.

6.2 Test reports are from laboratories in compliance with ISO/IEC 17025.

7.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research completed by IAPMO Uniform Evaluation Service on ButtonHead BNH and BNX Headed Devices for reinforcing bars in tension to assess conformance to the codes shown in Section 1.0 of this report, and serves as documentation of the product certification. Products are manufactured at locations noted in Section 2.8 of this report under a quality control program with periodic inspection under the supervision of IAPMO UES.

For additional information about this evaluation report please visit www.uniform-es.org or email at info@uniform-es.org

TABLE 1 – BUTTONHEAD® BNH DIMENSIONS

BAR SIZE	INCH SYSTEM						A _{brg} > 4 A _b	SI UNITS SYSTEM							
	REBAR		HEAD					A _{brg} > 4 A _b	REBAR		HEAD				A _{brg} > 4 A _b
	DIA d _b (in)	AREA A _b (in ²)	SWAGE B _{min} (in)	DIA D ₁ (in)	AREA A _{brg} (in ²)	DIA d _b (mm)			AREA A _b (mm ²)	SWAGE B _{min} (mm)	DIA D ₁ (mm)	AREA A _{brg} (mm ²)			
#4	0.500	0.20	7/8	1 3/8	1.28	YES	13	12.7	129	22.5	35.0	829	YES		
#5	0.625	0.31	1 1/16	1 3/4	2.10	YES	16	15.9	199	28.5	44.5	1,352	YES		
#6	0.750	0.44	1 3/8	1 7/8	2.32	YES	19	19.1	284	35.0	48.0	1,498	YES		
#7	0.875	0.60	1 1/2	2 3/8	3.83	YES	22	22.2	387	40.0	60.5	2,471	YES		
#8	1.000	0.79	1 11/16	2 3/4	5.15	YES	25	25.4	510	43.5	70.0	3,322	YES		
#9	1.128	1.00	1 15/16	2 7/8	5.49	YES	29	28.7	645	50.0	73.0	3,543	YES		
#10	1.270	1.27	2 3/16	3 3/8	7.68	YES	32	32.3	819	55.5	85.5	4,952	YES		
#11	1.410	1.56	2 3/8	3 13/16	9.86	YES	36	35.8	1,006	62.0	99.0	6,359	YES		
#14 ^{1,2}	1.693	2.25	2 7/8	3 7/8	9.54	YES	43 ^{1,2}	43.0	1,452	73.0	99.0	6,157	YES		
#18 ^{1,2}	2.257	4.00	4 3/8	5 1/16	16.0	YES	57 ^{1,2}	57.3	2,581	110	128	10,325	YES		

1 For compliance with the IBC, and either ACI 318-19 and ACI 318-14 Chapter 17, or ACI 318-11 Appendix D as anchorages, additional data needs to be prepared by the registered design professional and approved by the building official to justify how the No.14 and No.18 headed bars are substantiated in accordance with Section 17.1.2 of ACI 318-19, Section 17.1.3 of ACI 318-14, or Section D.2.3 of ACI 318-11, or comply with ANSI/ASME B1.1, B18.2.1 and B18.2.6. Further details are in Section 3.2.1 of this report.

2 In accordance with Section 25.4.4 of ACI 318-19 and ACI 318-14 (Section 12.6 of ACI 318-11) the use of the No.14 and No.18 bars for development length is outside the scope of this report. Further details are in Section 3.2.1 of this report.

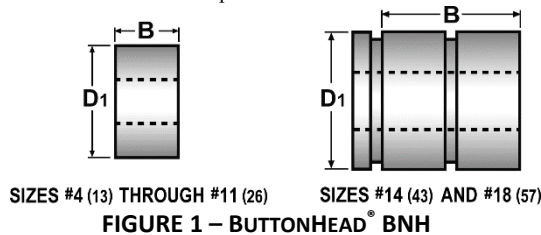
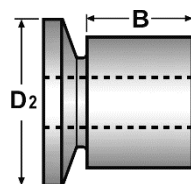


TABLE 2 – BUTTONHEAD® BNX DIMENSIONS

BAR SIZE	INCH SYSTEM						A _{brg} > 9 A _b	SI UNITS SYSTEM							
	REBAR		HEAD					A _{brg} > 9 A _b	REBAR		HEAD				A _{brg} > 9 A _b
	DIA d _b (in)	AREA A _b (in ²)	SWAGE B _{min} (in)	DIA D ₁ (in)	AREA A _{brg} (in ²)	DIA d _b (mm)			AREA A _b (mm ²)	SWAGE B _{min} (mm)	DIA D ₁ (mm)	AREA A _{brg} (mm ²)			
#4	0.500	0.20	7/8	1 3/4	2.21	YES	13	12.7	129	22.5	44.5	1,423	YES		
#5	0.625	0.31	1 1/16	2 3/16	3.45	YES	16	15.9	199	28.5	55.5	2,227	YES		
#6	0.750	0.44	1 3/8	2 3/8	3.99	YES	19	19.1	284	35.0	60.5	2,574	YES		
#7	0.875	0.60	1 1/2	2 7/8	5.89	YES	22	22.2	387	40.0	73.5	3,801	YES		
#8	1.000	0.79	1 11/16	3 1/4	7.51	YES	25	25.4	510	44.5	82.5	4,842	YES		
#9	1.128	1.00	1 15/16	3 5/8	9.75	YES	29	28.7	645	50.0	94.0	6,292	YES		
#10	1.270	1.27	2 3/16	4	11.5	YES	32	32.3	819	55.5	102	7,374	YES		
#11	1.410	1.56	2 3/8	4 1/2	14.3	YES	36	35.8	1,006	62.0	114	9,255	YES		





CITY OF LOS ANGELES SUPPLEMENT

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BUTTONHEAD BNH AND BNX HEADED DEVICE FOR REINFORCEMENT BARS IN TENSION

CSI Section:

03 21 00 Reinforced Steel

1.0 RECOGNITION

The ButtonHead BNH and BNX Headed Device for reinforcing bars in tension described in ER-331 and this LABC and LARC supplemental report have been evaluated for use as mechanical anchorage in concrete. The ButtonHead BNH and BNX Headed Device for reinforcing bars in tension have been evaluated for structural performance properties, subject to the requirements in ER-331 and this LABC and LARC supplemental report. The ButtonHead BNH and BNX Headed Device for reinforcing bars in tension were evaluated for compliance with the following codes and regulations:

- 2020 City of Los Angeles Building Code (LABC)
- 2020 City of Los Angeles Residential Code (LARC)

2.0 LIMITATIONS

Use of the ButtonHead BNH and BNX Headed Device for reinforcing bars in tension recognized in this supplement is subject to the following limitations in addition to the limitations shown in ER-331:

2.1 Calculations and specifications verifying compliance with the ButtonHead BNH and BNX Headed Device for reinforcing bars in tension shall be submitted to plan check engineer at the time of permit application. The ButtonHead BNH and BNX Headed Devices calculations shall be prepared by a Civil or Structural Engineer registered in the State of California.

2.2 Periodic special inspection shall be provided by The Registered Deputy Inspector in accordance with Section 1705 of the LABC during installations of the ButtonHead BNH and BNX Headed Device for reinforcing bars in tension.

2.3 The use of headed and mechanical anchored deformed reinforcement for lap splices is outside the scope of this report.

2.4 The ButtonHead BNH and BNX Headed Device for reinforcing bars in tension shall be installed in accordance with the LABC or LARC, as applicable, manufacturer's installation instructions, and this supplement. A copy of the manufacturer's installation instructions shall be available on-site for all Registered Deputy Inspectors. Where conflicts occur, the more restrictive shall govern.

2.5 The ButtonHead BNH and BNX Headed Device for reinforcing bars in tension listed in this supplement shall include the unique heat code identification, and the letter "H" to indicate that the product has been produced to the ASTM A970 Annex A1 specification. Products prepared by officially licensed fabricators may have additional unique identifiers that correspond to the fabricator.

2.6 For use in foundation walls, minimum concrete cover, and spacing between bars or sleeves shall be provided in accordance with Section 1808.8.2 of the LABC. Concrete cover and spacing shall be measured from the outer surface of the ButtonHead BNH and BNX Headed Devices.

2.7 Headed steel reinforcing bars shall not be used on compression reinforcement, epoxy, and other coated bars.

2.8 The cold-swaged headed device shall be fabricated by a City of Los Angeles approved fabricator.

2.9 The clear spacing between bars shall be at least $4d_b$ in accordance with Section 25.4.4.1 (g) of ACI 318-14.

2.10 This supplement expires concurrently with ER-331.

For additional information about this evaluation report please visit www.uniform-es.org or email us at info@uniform-es.org