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ESR-3196

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DIVISION: 04 00 00—MASONRY
SECTION: 04 05 19.16—MASONRY ANCHORS

REPORT HOLDER:

DEWALT

**701 EAST JOPPA ROAD
TOWSON, MARYLAND 21286**

EVALUATION SUBJECT:

TAPPER+® SCREW ANCHORS IN MASONRY (DEWALT / POWERS)



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DIVISION: 04 00 00—MASONRY
Section: 04 05 19.16—Masonry Anchors

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EVALUATION SUBJECT:

TAPPER+® SCREW ANCHORS IN MASONRY
(DEWALT / POWERS)

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012, 2009, 2006 and 2003 *International Building Code*® (IBC)
- 2015, 2012, 2009, 2006 and 2003 *International Residential Code*® (IRC)

Property evaluated:

Structural

2.0 USES

The Tapper+ screw anchors and additional listees described in Table A of this report are used to resist static, wind and seismic tension and shear loads in fully grout-filled concrete masonry units.

The Tapper+ screw anchors are alternatives to cast-in-place anchors described in Section 8.1.3 (2013 edition), or Section 2.1.4 (2011, 2008 or 2005 edition) of TMS 402/ACI 530/ASCE 5 as referenced in Section 2107.1 of the IBC.

The Tapper+ screw anchors are permitted to be used in structures regulated under the IRC, provided an engineered design is submitted in accordance with Section R301.1.3.

3.0 DESCRIPTION

3.1 Tapper+ Screw Anchors:

The screw anchors are comprised of a one-piece threaded anchor body with a hex head, a slotted hex head, a Phillips flat head or a trim flat head.

Product names for the report holder and the additional listees are presented in Table A of this report. Available nominal diameters are ³/₁₆-inch and ¹/₄-inch. The anchors are manufactured from low-carbon steel that is case-hardened, and they have a Perma-Seal® coating available in various colors. The Tapper+ screw anchor and drill bits are illustrated in Figure 2 of this report.

The anchor body is formed with alternating high-low threads and a gimlet point tip. The anchors are installed in a predrilled hole with a powered tool during which the threads on the anchor body tap into the sides of the predrilled hole and interlock with the base material during installation. Installation specifications are given in Table 1 and Figures 1 and 3 of this report.

3.2 Grout-filled Concrete Masonry:

The specified compressive strength of masonry, f'_m , at 28 days must be a minimum of 1,500 psi (10.3 MPa). Fully grouted masonry walls must be constructed from the following materials:

3.2.1 Concrete Masonry Units (CMUs): Grout-filled concrete masonry walls must be constructed from minimum 6-inch-wide (152 mm), Grade N, Type II, concrete masonry units (CMUs) conforming to ASTM C90.

3.2.2 Grout: Grout-filled concrete masonry units must be fully grouted with grout complying with Section 2103.3 (2015 IBC), 2103.13 of the 2012 IBC, Section 2103.12 of the 2009 and 2006 IBC, Section 2103.10 of the 2003 IBC, or Section R606 (2015 IBC), R609.1.1 of the IRC

(2012, 2009, 2006 or 2003). The grout must have a minimum compressive strength of 2,000 psi (13.8 MPa) at 28 days.

3.2.3 Mortar: Mortar must be Types M, S or N, prepared in accordance with Section 2103 of the IBC, or Section R606 (2015 IRC) or Section R607 of the 2012, 2009, 2006 or 2003 IRC, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Allowable Stress Design:

The design load values for anchors described in this report are based on allowable stress design (ASD) under the codes described in Section 1.0 of this report.

Allowable tension and shear loads for installation in fully grout-filled masonry wall faces are noted in Tables 3 and 4 of this report. The allowable tension and shear loads are for anchors installed in the grouted cells, the center web of the concrete masonry units and horizontal mortared bed joints of the fully grouted CMU construction. Allowable loads for anchors installed within $1\frac{3}{8}$ inches (35 mm) of the vertical (head) joint, as depicted in Figure 4, are beyond the scope of this report.

Allowable tension and shear loads for installation in fully grout-filled masonry wall tops are noted in Tables 5 and 6 of this report. The allowable tension and shear loads are for anchors installed at a minimum end distance of 3 inches (76 mm) and a minimum edge distance of $1\frac{1}{2}$ inches (38 mm). Allowable loads for anchors installed within $1\frac{1}{2}$ inches (38 mm) of the vertical (head) joint are beyond the scope of this report.

The allowable loads for anchors installed in fully grout-filled concrete masonry subjected to combined tension and shear forces must be determined by the following equation:

$$\left(\frac{P_s}{P_t}\right) + \left(\frac{V_s}{V_t}\right) \leq 1$$

where:

- P_s = Applied service tension load.
- P_t = Allowable service tension load.
- V_s = Applied service shear load.
- V_t = Allowable service shear load.

4.2 Installation:

Anchors must be installed in accordance with this report (Figure 3) and the manufacturer's published installation instructions (MPII). Anchor locations must comply with the approved plans and specifications. The anchors must not be installed until the base material has reached its minimum designated compressive strength. The Tapper+ drill bit size, hole diameter, hole depth, embedment depth, spacing, edge distance and base material must comply with the requirements of this report. Installation procedures and locations must be in accordance with Tables 1 and 3 through 6 as well as Figures 1, 3 and 4 of this report.

4.3 Special Inspections:

Anchors must be installed with special inspection. Special inspection must be in accordance with Section 1704 and 1705 of the IBC. For fasteners installed under special inspection, the following items must be inspected: fastener type, fastener dimensions, masonry dimensions and compressive strength, grout and mortar compliance with Section 3.2 of this report, drill bit size, fastener spacing, edge distances and fastener embedment (as applicable). The special inspector must verify that anchor installation is

in compliance with this report and in accordance with the manufacturer's published installation instructions.

5.0 CONDITIONS OF USE

The Tapper+® Screw Anchors described in this report are suitable alternatives to what is specified in the codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1** The anchors must be identified and installed in accordance with this report and the manufacturer's published installation instructions. In the event of a conflict between the instructions in this report and the manufacturer's instructions, this report must govern.
- 5.2** Tapper+ anchor sizes, dimensions, and allowable loads must be as set forth in this report.
- 5.3** Anchors resisting static, seismic and wind tension and shear loads in concrete masonry must be designed in accordance with Section 4.1 of this report.
- 5.4** For installations in concrete masonry, anchors are recognized to static, seismic and wind tension and shear load applications. When using the basic load combinations in accordance with IBC Section 1605.3.1, allowable loads are not permitted to be increased for seismic or wind loading. When using the alternative basic load combinations in 2009 and 2006 IBC Section 1605.3.2 that include seismic or wind loads, the allowable shear and tension loads for anchors are permitted to be increased by $33\frac{1}{3}$ percent, or the alternative basic load combinations may be reduced by a factor of 0.75. For the 2015 or 2012 IBC, the allowable loads or load combinations must not be adjusted.
- 5.5** Anchors must be installed in holes predrilled in substrates described in this report, using only Tapper+ carbide-tipped drill bits complying with the dimensions in Table 1 of this report.
- 5.6** Calculations demonstrating that the applied loads are less than the allowable loads described in this report must be submitted to the code official for approval. The calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is being constructed.
- 5.7** Since an ICC-ES acceptance criteria for evaluating data to determine the performance of screw anchors subjected to fatigue and shock loading is unavailable at this time, the use of these anchors under these conditions is beyond the scope of this report.
- 5.8** Where not otherwise prohibited by the code, anchors are permitted for installation in fire-resistance-rated construction provided at least one of the following conditions is fulfilled:
 - Anchors are used to resist wind or seismic forces only.
 - Anchors that support fire-resistance-rated construction or gravity load-bearing structural elements are within 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.
 - Anchors are used to support nonstructural elements.

- 5.9 Since an ICC-ES acceptance criteria for evaluating data to determine the performance of screw anchors in cracked masonry is unavailable at this time, the use of screw anchors is limited to installation in uncracked masonry. Cracking occurs when $f_t > f_r$ due to service loads or deformations.
- 5.10 Special inspection, when required, must be provided in accordance with Section 4.3 of this report.
- 5.11 Anchors are limited to dry, interior use.
- 5.12 The Tapper+ screw anchors are manufactured under an approved quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry (AC106), dated November 2015.

7.0 IDENTIFICATION

The screw anchors and additional listee names described in Table A of this report must be identified in the field by labels on the packaging bearing the company name, the product name (Tapper+), the anchor diameter and length, and the evaluation report number (ESR-3196). In addition, the anchor length code (see Table 2) is stamped on the head of each screw anchor.

TABLE A—PRODUCT NAMES BY COMPANY

COMPANY NAME	PRODUCT NAME
DEWALT	Tapper+®
Powers Fasteners	Tapper-PRO
All Points Screw, Bolt & Specialty	AP Tapper+
L.H. Dottie	Dottie Tapper+
The Hillman Group	Hillman Tapper+

TABLE 1—TAPPER+ SCREW ANCHOR INSTALLATION SPECIFICATIONS¹

Anchor Property / Setting Information	Symbol	Units	Nominal Anchor Size, <i>d</i> (inch)	
			³ / ₁₆	¹ / ₄
Nominal outside anchor diameter	$d_a (d_o)^1$	in. (mm)	0.145 (3.7)	0.185 (4.7)
Nominal drill bit diameter	d_{bit}	in.	³ / ₁₆ Tapper+ bit	¹ / ₄ Tapper+ bit
Tapper+ bit tolerance range	-	in.	0.170 to 0.176	0.202 to 0.207
Hex head wrench / socket size	d_h	in.	¹ / ₄	⁵ / ₁₆
Hex head Height	-	in.	⁷ / ₆₄	⁹ / ₆₄
Phillips flat head bit tip size	-	No.	2	3

For SI: 1 inch = 25.4 mm, 1 ft-lb = 1.356 N-m.

¹The notation in parenthesis is for the 2006 IBC.

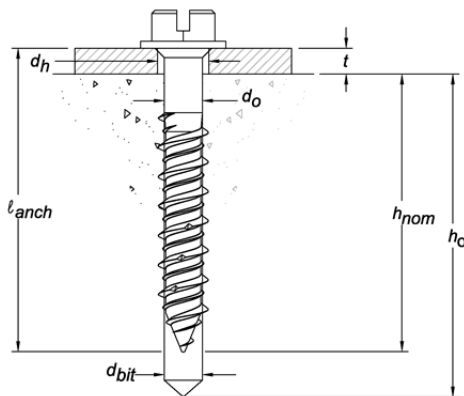


FIGURE 1—TAPPER+ ANCHOR DETAIL
(slotted hex head version pictured)

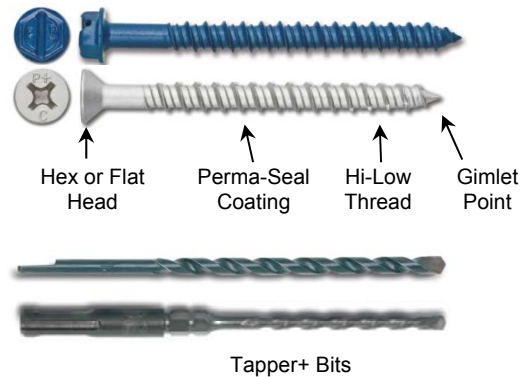


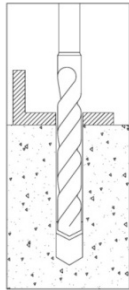
FIGURE 2—TAPPER+ ANCHOR AND TAPPER+ BITS
(slotted hex head and flat head versions pictured)

TABLE 2—FASTENER SPECIFICATIONS – TAPPER+ SCREW

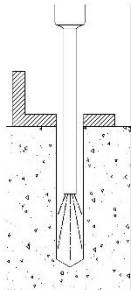
Length ID marking on head ¹	□	A	B	C	D	E	F	G	H	I	J	
Overall anchor length, l_{anch} (inches)	From	1	1½	2	2½	3	3½	4	4½	5	5½	6
	Up to but not including	1½	2	2½	3	3½	4	4½	5	5½	6	6½

For SI: 1 inch = 25.4 mm; 1 psi = 6.9 kPa.

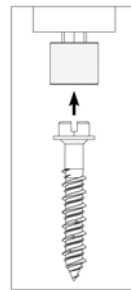
¹For purposes of measuring overall fastener length, the hex head versions are measured from the underside of the head to the bottom of the tip; flat head versions of the Tapper+ are measured from the top of the head to the tip of the anchor.



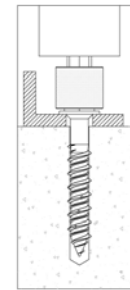
1.) Using the proper Tapper+ drill bit size, drill a hole into the base material to the required depth, h_o , which is a ¼-inch deeper than the minimum embedment depth, h_{nom} . The tolerances of the Tapper+ bit used must meet the requirements of the published range in Table 1.



2.) Remove dust and debris from hole using a hand pump, compressed air or a vacuum to remove loose particles left from drilling.



3.) Attach a Tapper 1000 installation socket tool for the selected anchor size to a percussion drill and set the drill to rotary only mode. Mount the screw anchor head into the socket. For flat head versions a phillips bit tip must be used with the socket tool.



4.) Place the point of the Tapper+ anchor through the fixture into the predrilled hole and drive the anchor until it is fully seated at the proper embedment. The socket tool will automatically disengage from the head of the Tapper+.

FIGURE 3—TAPPER+ INSTALLATION INSTRUCTIONS

TABLE 3—ALLOWABLE TENSION LOADS FOR TAPPER+ SCREW ANCHORS INSTALLED IN THE FACE OF GROUT-FILLED CONCRETE MASONRY^{1,2,3,4,5}

ANCHOR INSTALLED INTO GROUTED MASONRY WALL FACE					
NOMINAL ANCHOR SIZE d (inch)	MINIMUM EMBEDMENT h_{nom} (inches)	MINIMUM EDGE / END DISTANCE, c_{min} (inches)	MINIMUM SPACING, s_{min} (inches)	TENSION (pounds)	
				Minimum Masonry Compressive Strength, f'_m	
				1,500 psi	2,000 psi
3/16	1½	3	1½	80	95
¼	1½	3	2	130	150

For SI: 1 inch = 25.4 mm; 1 lbs = 0.0044 kN.

¹The tabulated allowable loads are for anchors installed in minimum 6-inch-wide (152 mm) grout-filled concrete masonry units described in Section 3.2 of this report and must have reached the minimum indicated masonry compressive strength at the time of installation.

²The minimum embedment, h_{nom} , is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor.

³Anchor may only be installed in the grouted cells and in cell webs and bed joints not closer than 1⅜ inches from head joints. The minimum edge and end distances, c_{min} , must be maintained.

⁴The tabulated minimum edge and end distances, c_{min} , are equal to the critical edge distance, c_{cr} , for the anchors. The tabulated minimum spacing s_{min} , is also equal to the critical spacing, s_{cr} , for the anchors.

⁵The tabulated allowable loads are based on a safety factor of 5.0.

TABLE 4—ALLOWABLE SHEAR LOADS FOR TAPPER+ SCREW ANCHORS INSTALLED IN THE FACE OF GROUT-FILLED CONCRETE MASONRY^{1,2,3,4,5}

ANCHOR INSTALLED INTO GROUTED MASONRY WALL FACE						
NOMINAL ANCHOR SIZE d (inch)	MINIMUM EMBEDMENT h_{nom} (inches)	MINIMUM EDGE / END DISTANCE, c_{min} (inches)	MINIMUM SPACING, s_{min} (inches)	SHEAR (pounds)		
				Direction of Loading	Minimum Masonry Compressive Strength, f'_m	
					1,500 psi	2,000 psi
3/16	1½	3	1½	Towards edge	115	135
				Towards end	130	150
¼	1½	3	2	Any	200	235

For SI: 1 inch = 25.4 mm; 1 lbs = 0.0044 kN.

¹The tabulated values are for anchors installed in minimum 6-inch-wide (152 mm) grout-filled concrete masonry units described in Section 3.2 of this report and must have reached the minimum indicated masonry compressive strength at the time of installation.

²The minimum embedment, h_{nom} , is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor.

³Anchor may only be installed in the grouted cells and in cell webs and bed joints not closer than 1⅜ inches from head joints. The minimum edge and end distances, c_{min} , must be maintained.

⁴The tabulated minimum edge and end distances, c_{min} , are equal to the critical edge distance, c_{cr} , for the anchors. The tabulated minimum spacing s_{min} , is also equal to the critical spacing, s_{cr} , for the anchors.

⁵The tabulated allowable loads are based on a safety factor of 5.0.

TABLE 5—ALLOWABLE TENSION LOADS FOR TAPPER+ SCREW ANCHORS INSTALLED INTO THE TOP OF GROUT-FILLED CONCRETE MASONRY^{1,2,3,4,5}

ANCHOR INSTALLED INTO TOP OF GROUTED MASONRY WALLS						
NOMINAL ANCHOR SIZE d (inch)	MINIMUM EMBEDMENT h_{nom} (inches)	MINIMUM EDGE DISTANCE $c_{min,1}$ (inches)	MINIMUM END DISTANCE $c_{min,2}$ (inches)	MINIMUM SPACING s_{min} (inches)	TENSION (pounds)	
					Minimum Masonry Compressive Strength, f'_m	
					1,500 psi	2,000 psi
$\frac{3}{16}$	$1\frac{1}{2}$	$1\frac{1}{2}$	3	3	90	105
$\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	3	2	165	190

For SI: 1 inch = 25.4 mm; 1 lbs = 0.0044 kN.

¹The tabulated allowable loads are for anchors installed in minimum 6-inch-wide (152 mm) grout-filled concrete masonry units described in Section 3.2. of this report and must have reached the minimum indicated masonry compressive strength at the time of installation.

²The minimum embedment, h_{nom} , is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor.

³Anchors may only be installed in the grouted cells not closer than $1\frac{1}{2}$ inches from head joints. The minimum edge and end distances, c_{min} , must be maintained.

⁴The tabulated minimum edge and end distances, c_{min} , are equal to the critical edge distance, c_{cr} , for the anchors. The tabulated minimum spacing s_{min} , is also equal to the critical spacing, s_{cr} , for the anchors.

⁵The tabulated allowable loads are based on a safety factor of 5.0.

TABLE 6—ALLOWABLE SHEAR LOADS FOR TAPPER+ SCREW ANCHORS INSTALLED INTO THE TOP OF GROUT-FILLED CONCRETE MASONRY^{1,2,3,4,5}

ANCHOR INSTALLED INTO TOP OF GROUTED MASONRY WALLS							
NOMINAL ANCHOR SIZE d (inch)	MINIMUM EMBEDMENT h_{nom} (inches)	MINIMUM EDGE DISTANCE, c_{min} (inches)	MINIMUM END DISTANCE, c_{min} (inches)	MINIMUM SPACING, s_{min} (inches)	Direction of Loading	SHEAR (pounds)	
						Minimum Masonry Compressive Strength, f'_m	
						1,500 psi	2,000 psi
$\frac{3}{16}$	$1\frac{1}{2}$	$1\frac{1}{2}$	3	$1\frac{1}{2}$	Any	100	115
$\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	3	2	Any	155	180

For SI: 1 inch = 25.4 mm; 1 lbs = 0.0044 kN.

¹The tabulated values are for anchors installed in minimum 6-inch-wide (152 mm) grout-filled concrete masonry units described in Section 3.2 of this report and must have reached the minimum indicated masonry compressive strength at the time of installation.

²The minimum embedment, h_{nom} , is measured from the outside surface of the concrete masonry unit to the embedded end of the anchor.

³Anchors may only be installed in the grouted cells not closer than $1\frac{1}{2}$ inches from head joints. The minimum edge and end distances, c_{min} , must be maintained.

⁴The tabulated minimum edge and end distances, c_{min} , are equal to the critical edge distance, c_{cr} , for the anchors. The tabulated minimum spacing s_{min} , is also equal to the critical spacing, s_{cr} , for the anchors.

⁵The tabulated allowable loads are based on a safety factor of 5.0.

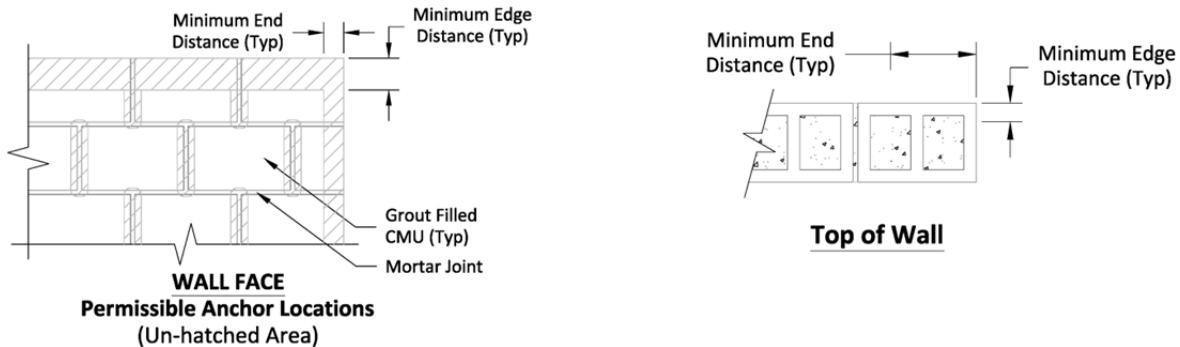


FIGURE 4—TAPPER+ SCREW ANCHORS INSTALLED INTO GROUT-FILLED CONCRETE MASONRY

ICC-ES Evaluation Report

ESR-3196 FBC Supplement

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EVALUATION SUBJECT:

TAPPER+® SCREW ANCHORS IN MASONRY (DEWALT / POWERS)

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that Tapper+ screw anchors in masonry, recognized in ICC-ES master evaluation report ESR-3196, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2014 and 2010 *Florida Building Code—Building*
- 2014 and 2010 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Tapper+ screw anchors in masonry, described in Sections 2.0 through 7.0 of the master evaluation report ESR-3196, comply with the 2014 and 2010 *Florida Building Code—Building* and the 2014 and 2010 *Florida Building Code—Residential*, provided the design and installation are in accordance with the *International Building Code*® provisions noted in the master evaluation report, and under the following conditions:

- Design wind loads must be based on Section 1609 of the 2014 and 2010 *Florida Building Code—Building* or Section 301.2.1.1 of the 2014 and 2010 *Florida Building Code—Residential*, as applicable.
- Load combinations must be in accordance with Section 1605.2 or Section 1605.3 of the 2014 and 2010 *Florida Building Code—Building*, as applicable.

Use of the Tapper+ screw anchors in masonry has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the 2014 and 2010 *Florida Building Code—Building* and the 2014 and 2010 *Florida Building Code—Residential*, under the following additional conditions:

- The design wind loads for use of the anchors in the High-Velocity Hurricane Zone are based on Section 1620 of the *Florida Building Code—Building*.
- Design and installation must meet the requirements of Section 2122.7 of the 2014 and 2010 *Florida Building Code—Building*.

For products falling under Florida Rule 9N-3, verification that the report holder's quality assurance program is audited by a quality-assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the master report reissued October 2016.