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## PE1000+® Adhesive Anchoring System and Installations into Oversized Drilled Holes

ACI 318-14, Chapter 17 and ACI 318-11 Appendix D (and by reference to the 2015 IBC and 2012 IBC, respectively) requires that adhesive anchors for concrete be tested and qualified with drill hole specifications for each anchor diameter. This is because the influence of the size of the drilled hole in concrete can have a significant effect on the bond strength of installed adhesive anchors.

However, there are cases where an allowance for oversizing the drill hole is desirable (e.g. repairing existing anchorage in the same location, ability for final adjustment of the anchoring points, unintentional mistakes). The ACI qualification standard also has provisions for oversized drill hole specifications provided testing is conducted to determine effects of increasing the annular gap between the threaded rod or reinforcing bar and the drilled hole.

Up until now, DEWALT published bond strengths for PE1000+ adhesive anchors that are based on typical standard drill hole specifications that are nominally 1/16-inch or 1/8-inch larger than the threaded rod or reinforcing bar (table below provided for baseline reference):

Typical Standard Drill Holes	Nominal threaded rod / reinforcing bar size									
	3/8" or #3	1/2"	#4	5/8" or #5	3/4" or #6	7/8" or #7	1" or #8	#9	1 1/4"	#10
Threaded rod outside diameter (in.)	0.375	0.500	0.625	0.750	0.875	1.000	-	1.250	-	
Nominal rebar diameter (in.)	0.375	0.500	0.625	0.750	0.875	1.000	1.125	-	1.250	
Nominal ANSI drill bit size (in.)	7/16	9/16	5/8	11/16 or 3/4	7/8	1	1 1/8	1 3/8	1 3/8	1 1/2

Fortunately, additional drill hole specifications are now available for end users. DEWALT has conducted supplemental laboratory testing on PE1000+ adhesive anchors installed in holes approximately 150% larger than the nominal size of the threaded rod or reinforcing bar (up to a maximum annular gap of 1/2-inch):

Oversized Drill Holes	Nominal threaded rod / reinforcing bar size									
	3/8" or #3	1/2"	#4	5/8" or #5	3/4" or #6	7/8" or #7	1" or #8	#9	1 1/4"	#10
Threaded rod outside diameter (in.)	0.375	0.500	0.625	0.750	0.875	1.000	-	1.250	-	
Nominal rebar diameter (in.)	0.375	0.500	0.625	0.750	0.875	1.000	1.125	-	1.250	
Nominal ANSI drill bit size (in.)	9/16	3/4	7/8	1 1/8	1 1/4	1 1/2	1 5/8	1 3/4	1 3/4	

The table below shows the results of the testing adhesive anchor system in typical standard drill holes and oversized holes crossed with the drilling and cleaning method. The corresponding reduction factor derived from oversized drill hole testing is provided that should be applied to the bond strength when calculating the bond strength capacity for the given adhesive anchor and relevant conditions.

Adhesive Anchor System	Drill Hole Size	Drilling Method	Hole Cleaning Method	Bond Strength Reduction Factor, $\alpha_{oh}$
<b>DEWALT PE1000+</b>	Typical standard	Hammer-drilling	See published instructions	N/A (baseline values)
	Oversized	Hammer-drilling	See published instructions	1.0 (no reduction)

N/A = Not applicable.

- Results shown are based on tension tests conducted in accordance with ACI 355.4/ASTM E488 in dry uncracked normal weight concrete.
- Holes were drilled with a hammer drill and standard carbide drill bit and cleaned following published instructions for the PE1000+ adhesive anchor system. Hollow drill bits (DustX+ System) may be used, as applicable.
- Standard carbide drill bits and hollow drill bits must meet the requirements of ANSI B212.15; ANSI compliance for hole drilling is required by ICC-ES ESR-2583.
- See published literature for the specific adhesive anchor system for additional design and installation information which is available at [anchors.DEWALT.com](http://anchors.DEWALT.com).
- The maximum annular gap between the threaded rod or reinforcing bar is limited to 1/2-inch.
- The bond strength reduction factor determined for oversized holes is applicable for short-term loading only; this reduction factor is a supplement to all other relevant design considerations for the specific application.

PE1000+ adhesive anchors will achieve published design strengths for short-term loading conditions (e.g. seismic loading) when the product is properly installed into oversized drill holes drilled in dry concrete. The adhesive anchors must be installed in accordance with all other published installation instructions specific to the application.