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Early Age Concrete and its Effect on Adhesive Anchor Bond Strength in Concrete

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 installed in concrete having a minimum age of 21 days at the time of installation. DEWALT currently publishes bond strengths that are based on concrete which has achieved its 28 day compressive strength and has cured for a minimum of 21 days. Concrete that is less than 21 days old is considered early age (i.e. 'green') and may have an effect on the performance of adhesive anchors. Occasionally, waiting a minimum of 21 days to install adhesive anchors is not feasible, often due to scheduling and jobsite logistics.

As a result and by request, DEWALT has conducted progressive laboratory testing at various concrete ages and adhesive cure time intervals starting with 7 day old concrete and at minimum adhesive cure times. The table below shows the concrete age at the time of anchor installation crossed with the adhesive cure times following anchor installation along with the corresponding reduction factor derived from testing that should be applied to the bond strength when calculating the bond strength capacity for the given anchor and conditions.

| Adhesive Anchor System | Concrete Age at Time of Anchor Installation | Adhesive Cure Time | Concrete Age at Time of Testing | Bond Strength Reduction Factor, α_{age} |
|--|---|--------------------|---------------------------------|--|
| DEWALT Pure110+ standard cure epoxy | 7 days | Published Minimum | 7 days | 1.0 |
| | | 7 days | 14 days | |
| | | 14 days | 21 days | |
| | 14 days | Published Minimum | 14 days | 1.0 |
| | | 7 days | 21 days | |
| | 21 days | Published Minimum | 21 days | 1.0 |
| DEWALT AC200+ fast cure acrylic | 7 days | Published Minimum | 7 days | 0.7 |
| | | 7 days | 14 days | 0.8 |
| | | 14 days | 21 days | 1.0 |
| | 14 days | Published Minimum | 14 days | 0.8 |
| | | 7 days | 21 days | 1.0 |
| | 21 days | Published Minimum | 21 days | |
| DEWALT Pure50+ standard cure epoxy | 7 days | Published Minimum | 7 days | 1.0 |
| | | 7 days | 14 days | |
| | | 14 days | 21 days | |
| | 14 days | Published Minimum | 14 days | 1.0 |
| | | 7 days | 21 days | |
| | 21 days | Published Minimum | 21 days | 1.0 |
| DEWALT AC100+ Gold fast cure acrylic | 7 days | Published Minimum | 7 days | 1.0 |
| | | 7 days | 14 days | |
| | | 14 days | 21 days | |
| | 14 days | Published Minimum | 14 days | 1.0 |
| | | 7 days | 21 days | |
| | 21 days | Published Minimum | 21 days | 1.0 |
| DEWALT PE1000+ standard cure epoxy (3:1 mixing ratio) | 7 days | Published Minimum | 7 days | 0.75 |
| | | 7 days | 14 days | 0.9 |
| | | 14 days | 21 days | |
| | 14 days | Published Minimum | 14 days | 0.9 |
| | | 7 days | 21 days | |
| | 21 days | Published Minimum | 21 days | 1.0 |

1. Installing adhesive anchors in concrete having a minimum age of less than 21 days at the time of anchor installation is not in compliance with ACI 318 and must be approved by the engineer of record and AHJ, as applicable.
2. Actual concrete compressive strength at the time of installation must be used for design. It is not recommended to install anchors into concrete which has cured for less than 7 days.
3. Results from static tension tests conducted in dry uncracked normal weight concrete; holes were drilled with a hammer drill and an ANSI carbide drill bit installed in accordance with published instructions.
4. Tabulated values for adhesive cure time are based on tested anchors prior to application of torque or loading.
5. See published literature for the specific adhesive anchor system for minimum cure times and additional design information which is available at www.DEWALT.com.