

## **03 00 00 – Concrete**

### **General**

Construction documents shall show compressive strength of all grades and types of concrete, size, grade, type and location of reinforcement and anchors, rebar to be welded, and the size and location of structural elements. Construction documents shall show provisions for dimensional changes resulting from elastic deformation, creep, shrinkage, temperature and moisture (per CBC, latest Office of State Fire Marshal adopted edition).

All shop drawings shall be reviewed and signed by a California licensed Architect or California Professional Engineer (PE) prior to submittal.

Expansion and contraction/control joints shall be detailed on the design drawings. Control-joint spacing guidelines per ACI shall be followed. Provide expansion joint details with slip dowels allowing horizontal movement, but preventing differential vertical movement. Deep tooled contraction/control joints are preferred over saw-cut control joints so that crack control is initiated during plastic shrinkage of concrete. Cut alternate reinforcing bars running through contraction/control joints. Isolation joints shall be detailed around columns. "Diamond" block-outs are preferred. A joint plan for all concrete shall be submitted for structural, architectural and site work slabs.

Overhead anchorage into concrete ceilings or soffits with adhesive anchors is not allowed.

### **Products**

Fly ash may be substituted for Portland cement. The following recommendations apply to concrete mix designs available in the area and consider the quality of locally available aggregate. 15% fly ash substitution may be made without impacting strength for concrete with up to  $f'c = 5$  ksi. At this level of substitution, it improves the workability of the concrete and is less expensive than the Portland cement it replaces. Up to 25% substitution for  $f'c$  less than or equal to 5 ksi may be used although concrete quality begins to degrade because it is harder to work and strength is impacted. 35% may be used in foundations or retaining walls where there is little need to work the concrete but strength is limited to  $f'c = 4$  ksi and is determined based on 56 days rather than the traditional 28 days.

### ***Reinforcing Steel***

Use ASTM A615/A615M, Grade 60, deformed bars for #5 and larger sizes. Use STAM A706 rebar when welding is required. Traceable mill certificates shall be provided with all rebar delivered to the jobsite.

### ***Cast-in-Place Concrete***

Cast-in-place concrete will utilize cementitious and aggregate materials produced locally.

Contractor shall submit all concrete mixes for approval. Maximum specified shrinkage of concrete mixes based upon current laboratory testing shall be submitted by the contractor and supplier. Fly ash and/or pozzolan replacement of cement may be allowed. Concrete admixes shall not contain chloride.

Concrete mix designs with accelerating admixes for concrete placement in cold weather, shaded areas, etc. may be considered. Concrete mix designs with set retarding admixes for concrete placement in hot weather may be considered. Concrete mix designs with air entraining admixes for freeze-thaw resistance, resistance to chemical attack, water-tightness, workability, and pumpability may be considered. Shrinkage compensating admixes intended to counteract the effects of plastic shrinkage may be considered.

Corrosion inhibiting admixes and/or minimum water cement ratios per ACI are required for concrete mixes exposed to the marine environment.

Spray-on evaporation retarding finishing aids (e.g. "Confilm, Eucobar, or equal) may be used for hot weather concreting. Contractor to confirm compatibility of finishing aids with floor covering adhesives and finishes.

Concrete aggregates shall be graded per ASTM C 33 so that coarse aggregate nominal size is not larger than 1/5 of the narrowest dimension between form faces; nor  $\frac{3}{4}$  of the minimum clear spacing between individual reinforcing bars or bundles of bars, whichever is less, but never greater than  $\frac{3}{4}$  inch in any dimension for slabs 4 inch thick or less.

Minimum concrete coverage for reinforcing steel shall conform to ACI structural concrete building code.

### **Execution**

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The slump of concrete delivered to the jobsite shall be adjusted to within one inch of the specified slump prior to delivery on-site. Final slump shall be adjusted to conform to approved plans and specifications by contractor/supplier at time of discharge. After addition of water in the field, each concrete batch shall receive a minimum 2 minutes of mixing to produce a uniform slump and W/C ratio. Concrete slump shall be fully adjusted prior to discharge; further adjustments of slump after discharge has started are discouraged. Concrete batches exceeding specified slump shall not be incorporated into the work.

All concrete placed, including sidewalks and flatwork, shall be vibrated to produce dense uniform concrete free of voids and honeycombs. Existing concrete shall be protected from damage during placement of new concrete. Cast in place dowels or adhesive bonded (2-part epoxy or equal) dowels inserted into drilled holes shall be installed where fresh concrete is placed against hardened concrete, typical.

Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Reinforcing steel and pre-stressing tendons shall be placed and securely anchored against moving prior to concrete placement. "Web-setting" of embedded items is not allowed.

Contractor shall monitor ambient temperature, humidity and wind speed before, during, and after concrete placement. Concrete placement techniques per ACI shall accommodate ambient conditions. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

Sidewalks shall have a thickened edge with a depth that is twice the slab thickness, with a width that matches the slab thickness, and where the return slope is 1:1. All sidewalk, curb and gutter shall be constructed on a minimum 6-inch-thick layer of compacted aggregate base.

Set forms and screeds to design grades in order to control strike-off of all concrete. Free hand strike-off is not allowed. Use bull floats or darbies after strike-off to eliminate high and low spots, embed large aggregate and to form a flat, uniform and open textured surface plane. Use wood floats for normal concrete mixes. Magnesium-aluminum alloy floats can be used on air entrained concrete.

Do not use steel finishing tools until bleed water has disappeared. Premature floating and troweling can cause scaling, crazing, or dusting, and will result in a surface with reduced wear resistance.

Concrete slabs shall be level, and flat to within no more than 1/8 inch in 10 feet; flatness shall be measured and confirmed by contractor during and after concrete placement, and check by the University. Concrete walls, columns, pilasters, beams, spandrels, girders and suspended slabs shall be cast plumb, line, plane, and square.  $\frac{3}{4}$  x  $\frac{3}{4}$  inch chamfer strips shall be used at concrete corners, typical, unless otherwise noted. Footing trenches shall be cut neat and square. ACI tolerances shall apply.

Protect concrete from construction traffic, weather or mechanical damage. Avoid use of hydraulic equipment on slabs; diaper equipment if needed. Do not use or locate pipe cutting equipment on exposed slabs. Do not place steel on exposed slabs.

### **03 15 00 Concrete Accessories**

**Specifier Note:** This specification is intended to address the use of anchors for safety-related applications, such as structural connections, earthquake bracing, guard rails, mechanical and electrical equipment support, piping and ductwork support and bracing, cladding and façade connections, or rebar doweling. Light-duty anchors are not included.

#### **1.01 SECTION INCLUDES**

**Specifier Note:** If cast-in anchors are not used, delete reference here and in Sections 2.02 and 3.01.

- A. Cast-in and drilled anchors for concrete.

**Specifier Note:** Revise paragraph below to suit project requirements. Add/delete section numbers and titles per project requirements and specifier's practice.

#### **1.02 RELATED SECTIONS**

- 1. **Division 3 Concrete Sections.**

#### **1.03 SUBMITTALS**

**Specifier Note:** Insert appropriate section for the project as referred to below for shop drawings or submittals

- A. Submit in accordance with *Conditions of the Contract* and Division 1 Submittal Procedures Section.

- B. Product specifications with recommended design values and physical characteristics for epoxy dowels, expansion and undercut anchors.
- C. Samples: Representative lengths and diameters of each type of anchor shown on the Drawings.
- D. Quality Assurance Submittals:
  - 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

**Specifier: Note: Add paragraph below to suit project and local jurisdiction requirements. Two international certifications for drilled-in anchors are listed below. Coordinate with section 1.03.D.**

- 2. Certificates:
  - a. ICC-ES Evaluation Reports.
  - b. Manufacturer's installation instructions.
  - c. Installer Qualifications & Procedures: Submit installer qualifications as stated in Section .B. Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of the personnel to be trained on anchor installation.
- E. Closeout Submittals: Submit the following: Project record documents for installed materials in accordance with Division 1 Closeout Submittals Section.

#### **1.04 QUALITY ASSURANCE**

- A. Installer Qualifications: Drilled-in anchors shall be installed by a [contractor] [installer] with at least [three] [five] years of experience performing similar installations.
- B. Installer Training: Conduct a thorough training with the manufacturer or the manufacturer's representative for the [contractor] [installer] on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:
  - a. hole drilling procedure
  - b. hole preparation & cleaning technique
  - c. Adhesive injection technique & dispenser training / maintenance
  - d. rebar dowel preparation and installation
  - e. proof loading/torquing

**Specifier Note: Revise paragraph below to suit project and local jurisdiction requirements. Two common international certifications for drilled-in anchors are listed. Coordinate with section 1.02.A.3.b. above.**

- C. Certifications: Unless otherwise authorized by the Engineer, anchors shall have one of the following certifications:
  - a. ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.

### **1.05 DELIVERY, STORAGE, AND HANDLING**

A. General: Comply with Division 1 Section–Product Storage and Handling Requirements.

**Specifier Note: Coordinate with inspection requirements as required. Injection adhesive anchor cartridges and capsule anchors have special requirements with respect to temperature and sunlight exposure as well as shelf life.**

1. Store anchors in accordance with manufacturer’s recommendations.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

A. Fasteners and Anchors:

**Specifier Note: Add paragraph below to suit project requirements. Coordinate terminology with designations used on the Drawings for high-strength bolts, stainless steel, etc.**

1. Bolts and Studs: ASTM A307; ASTM A449 where “high strength” is indicated on the Drawings.
2. Carbon and Alloy Steel Nuts: ASTM A563.
3. Carbon Steel Washers: ASTM F436.
4. Carbon Steel Threaded Rod: ASTM F1554 Grade 36, or ASTM F1554 Grade 55; or ASTM F1554 Grade 105
5. Wedge Anchors: ASTM A510; or ASTM A108.
6. Stainless Steel Bolts, Hex Cap Screws, and Studs: ASTM F593.
7. Stainless Steel Nuts: ASTM F594.
8. Zinc Plating: ASTM B633.
9. Hot-Dip Galvanizing: ASTM A153.
10. Metric Anchor Bolts, Screws, and Studs: ISO 898 Part 1.
11. Metric Anchor Nuts: EN 24033.
12. Metric Anchor Stainless Steel Bolts, Screws, and Studs: ISO 3506 Part 1.
13. Metric Anchor Stainless Steel Nuts: ISO 3506 Part 2.
14. Reinforcing Dowels: ASTM A615

### **2.02 CAST-IN-PLACE BOLTS**

**Specifier Note: Expand or replace with project specific specification for CIP anchors and inserts as required.**

- A. Anchors, Bolts, Nuts, and Washers: Bolts and studs, nuts, and washers shall conform to ASTM A307, Grade A, and ASTM A449, ASTM A563, and ASTM F436, as applicable. Hot-dip galvanized bolts and studs including associated nuts and washers in accordance with ASTM A153.

### 2.03 DRILLED-IN ANCHORS

Specifier Note: Verify the anchor types indicated on the Drawings and add specific anchor types used.

- A. Anchors:

Specifier Note: The following paragraph applies to interior applications in a non-corrosive environment. If the interior environment is potentially corrosive, or if galvanically dissimilar metals are in contact with one another in a moist atmosphere, consider alternatives to zinc electroplated carbon steel fasteners.

1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1). If the interior environment is potentially corrosive, or if galvanically dissimilar metals are in contact with one another in a moist atmosphere, provide alternatives to zinc electroplated carbon steel fasteners.

Specifier Note: Verify the type (304 and/or 316) of stainless-steel anchors indicated on the Drawings. Proper consideration should be given to contact between galvanically dissimilar metals. AISI 316 should not be used where pitting corrosion is a concern.

2. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI [Type 304] [and] [Type 316] stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Contact between galvanically dissimilar metals shall not be permitted. AISI 316 shall not be used where potential for pitting corrosion.
3. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
  - a. Hilti Kwik Bolt 3, ICC ESR-1385 and ESR-2302.
  - b. Hilti Kwik Bolt TZ, ICC ESR-1917 and ESR-3785 (carbon steel and AISI Type 304 or 316 Stainless Steel).

- B. Screw Anchors: Screw type. Pre-drilling of the hole per the manufactures' installation instructions. Provide anchors with a diameter and anchor length marking on the head. Type and size as indicated on Drawings.

**Specifier Note: The following paragraph applies to interior applications in a non-corrosive environment. If the interior environment is potentially corrosive, or if galvanically dissimilar metals are in contact with one another in a moist atmosphere, consider alternatives to zinc electroplated carbon steel fasteners.**

1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating equivalent to DIN EN ISO 4042 (8µm min.). If the interior environment is potentially corrosive, or if galvanically dissimilar metals are in contact with one another in a moist atmosphere, provide alternatives to zinc electroplated carbon steel fasteners.
  2. Exterior Use: As indicated on the Drawings, provide mechanically galvanized or stainless-steel anchors. Mechanically galvanized steel anchors shall meet ASTM B695 Class 55 specifications. Stainless steel anchors shall be AISI [Type 316] stainless steel. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
  3. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
    - a. Hilti Kwik HUS-EZ (KH-EZ), KH-EZ C, KH-EZ E, KH-EZ I, KH-EZ P, ICC ESR-3027 (carbon steel).
    - b. Hilti KH-EZ CRC, ICC ESR-3027 (mechanically galvanized carbon steel).
    - c. Hilti KH-EZ SS316, ICC ESR-3027 (stainless steel).
    - d. Hilti Kwik HUS.
- C. Heavy Duty Metric Sleeve Anchors: Torque-controlled, exhibiting follow-up expansion under load, with provision for rotation prevention during installation. Type and size as indicated on Drawings.

**Specifier Note: The following paragraph applies to interior applications in a non-corrosive environment. If the interior environment is potentially corrosive, or if galvanically dissimilar metals are in contact with one another in a moist atmosphere, consider alternatives to zinc electroplated carbon steel fasteners.**

1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors manufactured from materials conforming to ISO 898 Part 1, with zinc plating equivalent to ASTM B633, Type III Fe/Zn 5 (5µm min.). If the interior environment is potentially corrosive, or if galvanically dissimilar metals are in contact with one another in a moist atmosphere, provide alternatives to zinc electroplated carbon steel fasteners.



**Specifier Note: Verify the type (304 and/or 316) of stainless-steel anchors indicated on the Drawings, if any. Proper consideration should be given to contact between galvanically dissimilar metals. AISI 316 should not be used where pitting corrosion is a concern.**

2. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be manufactured from materials conforming to ISO 3506 Part 1 and having corrosion resistance equivalent to AISI [Type 304] [and] [Type 316] stainless steel. Stainless steel anchors shall be provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ISO 3506 Part 2 unless otherwise specified. Stainless steel anchors shall not be in contact with galvanically dissimilar metals AISI 316 should not be used where there is a potential of pitting corrosion.
3. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
  - a. Hilti HSL, HSLG, or HSLB.
  - b. Hilti HSL-3, HSL-3-G, or HSL-3-B, ICC ESR-1545 (carbon steel).
  - c. Hilti HSL-3-R, ICC ESR-1545 (stainless steel)
- D. Heavy Duty Metric Undercut Anchors: Bearing type. Installed anchor shall have a minimum tension bearing area in the concrete, measured as the horizontal projection of the bearing surface, not less than two times the net tensile area of the anchor bolt. The installed anchor shall exhibit a form fit between the bearing elements and the undercut in the concrete. Type and size as indicated on Drawings.

**Specifier Note: The following paragraph applies to interior applications in a non-corrosive environment. If the interior environment is potentially corrosive, or if galvanically dissimilar metals are in contact with one another in a moist atmosphere, consider alternatives to zinc electroplated carbon steel fasteners.**

1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors manufactured from materials conforming to ISO 898 Part 1, with zinc plating equivalent to ASTM B633, Type III Fe/Zn 5 (50µm min.). If the interior environment is potentially corrosive, alternatives to zinc electroplated carbon steel fasteners shall be provided.

**Specifier Note: Specify the type (316) of stainless-steel anchors indicated on the Drawings, if any. Proper consideration should be given to contact between galvanically dissimilar metals. AISI 316 should not be used where pitting corrosion is a concern.**

2. Exterior Use: As indicated on the Drawings, provide sherardized or stainless-steel anchors. Sherardized anchors shall be manufactured from materials conforming to

ISO 898 Part 1 and having corrosion resistance equivalent to ASTM A153 with sherardized dry diffusion zinc coating (50  $\mu$ m min.). Stainless steel anchors shall be manufactured from materials conforming to ISO 3506 Part 1 and having corrosion resistance equivalent to AISI [Type 316] stainless steel. Stainless steel anchors shall be provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ISO 3506 Part 2 unless otherwise specified. Stainless steel anchors shall not be in contact with galvanically dissimilar metals AISI 316 should not be used where there is a potential of pitting corrosion.

3. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
  - a. Hilti HDA, ICC ESR-1546.
- E. Cartridge Injection Adhesive Anchors: Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Drawings.

**Specifier Note: The following paragraph applies to interior applications in a non-corrosive environment. If the interior environment is potentially corrosive, or if galvanically dissimilar metals are in contact with one another in a moist atmosphere, consider alternatives to zinc electroplated carbon steel fasteners.**

1. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel threaded rods conforming to ASTM F1554 Grade 36, or ASTM F1554 Grade 55; or ASTM F1554 Grade 105 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1) [or carbon steel HIT TZ rods conforming to ASTM A510 with chemical composition of AISI 1038]. If the interior environment is potentially corrosive, or if galvanically dissimilar metals are in contact with one another in a moist atmosphere, provide alternatives to zinc electroplated carbon steel fasteners.

**Specifier Note: Verify the type (304 and/or 316) of stainless-steel anchors indicated on the Drawings, if any. Proper consideration should be given to contact between galvanically dissimilar metals. AISI 316 should not be used where pitting corrosion is a concern.**

2. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI [Type 304] [and] [Type 316] stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Stainless steel anchors shall not be in contact with galvanically dissimilar metals AISI 316 should not be used where there is a potential of pitting corrosion.

3. Reinforcing dowels Shall be A615 Grade 60.
  - a. HIT-HY 200 Safe Set System using Hilti Hollow Drill Bit and VC 150/300 vacuum System for anchorage to concrete, ICC ESR-3187.
  - b. HIT-RE 500 V3 Safe Set System using Hilti Hollow Drill Bit and VC 150/300 vacuum System for anchorage to concrete, ICC ESR-3814.
4. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
  - a. HIT-HY 200 Safe Set System using Hilti Hollow Drill Bit and VC 150/300 vacuum System for anchorage to concrete, ICC ESR-3187.
  - b. Hilti HIT-Z anchor rods with HIT-HY 200 Safe Set System for anchorage to concrete, ICC ESR-3187.
  - c. Hilti HAS threaded rods with HIT-RE 500 V3 Safe Set System using Hilti Hollow Drill Bit and VC 150/300 vacuum System for anchor and rebar anchorage to concrete, ICC ESR-3814.

Specifier Note: Verify the anchor types indicated on the Drawings and delete those anchor types not used.

- F. Anchors: Type and size as indicated on Drawings.

Specifier Note: The following paragraph applies to interior applications in a non-corrosive environment. If the interior environment is potentially corrosive, or if galvanically dissimilar metals are in contact with one another in a moist atmosphere, consider alternatives to zinc electroplated carbon steel fasteners.

1. Interior Use: Interior Use: Unless otherwise indicated on the Drawings, provide chisel-pointed carbon steel rods conforming to ASTM F1554 Grade 55; or ASTM F1554 Grade 105 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1). If the interior environment is potentially corrosive, or if galvanically dissimilar metals are in contact with one another in a moist atmosphere, provide alternatives to zinc electroplated carbon steel fasteners.

Specifier Note: Verify the type (304 and/or 316) of stainless-steel anchors indicated on the Drawings, if any. Proper consideration should be given to contact between galvanically dissimilar metals. AISI 316 should not be used where pitting corrosion is a concern.

2. Exterior Use: As indicated on the Drawings, provide chisel-pointed stainless-steel anchors. Stainless steel anchors shall be AISI [Type 304] [and] [Type 316] stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar

metals. Stainless steel anchors shall not be in contact with galvanically dissimilar metals. AISI 316 should not be used where there is a potential of pitting corrosion.

3. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Architect, provide the following:
  - a. Hilti HVA Adhesive System with HVU2 capsules.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Cast-In-Place Bolts: Use templates to locate bolts accurately and securely in formwork.
- B. Drilled-In Anchors:

**Specifier Note: Verify if restrictions exist on the type of drilling equipment to be used for the project.**

1. Drill holes with rotary impact hammer drills using [carbide-tipped bits], [hollow drill bit system], [and][or] [core drills using diamond core bits]. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
  - a. Cored Holes:
  - b. Embedded Items:
  - c. Base Material Strength:
2. Perform
3. Wedge Anchors,
4. Cartridge Injection
5. Capsule Anchors:
6. Observe manufacturer recommendations

### **3.02 REPAIR OF DEFECTIVE WORK**

**Specifier Note: Coordinate high-strength, non-shrink, and nonmetallic grout selection with other sections in Division 3.**

- A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

### **3.03 FIELD QUALITY CONTROL**

Specifier Note: Job site testing is a common method of assuring correct installation of anchor systems. In order to achieve the appropriate level of quality control, testing should be performed by the owner's inspector in consultation with the manufacturer representative. Adjust testing requirements to suit job and local jurisdiction conditions. Select percentage of anchors 10 % or 20% to be tested. Smaller or more critical installations may warrant a higher percentage of anchors to be tested and a greater penalty for malfunctioning anchors. Verify that anchor embedment's and proof loads are shown on the Drawings.

- A. Testing: [10%] [25%] \_\_\_\_\_ of each type and size of drilled-in anchor shall be proof loaded by the independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Engineer. If [any] [more than 10%] \_\_\_\_\_ of the tested anchors fail to achieve the specified torque or proof load within the limits as defined on the Drawings, all anchors of the same diameter and type as the failed anchor shall be tested, unless otherwise instructed by the Engineer.
  - 1. Tension testing should be performed in accordance with ASTM E488.
  - 2. Torque shall be applied with a calibrated torque wrench
  - 3. Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed  $D/10$ , where D is the nominal anchor diameter.
- B. Minimum anchor Minimum anchor embedment's, proof loads and torques shall be as shown on the Drawings.

## **END OF SECTION 03 15 00 CONCRETE ACCESSORIES**

### **03 20 00 - Concrete Reinforcing**

Recycled content for reinforcing steel shall be a minimum of 80%.