

SECTION 05 05 19 – POST-INSTALLED CONCRETE ANCHORS

PART 1 PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes: Cast-in and drilled in 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.

- B. Related Sections:
1. Division 05 Metals

1.02 SUBMITTALS

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

- A. General: Submit in accordance with *Conditions of the Contract* and Division 1 Submittal Procedures Section.
1. Product specifications with recommended design values and physical characteristics for epoxy dowels, expansion and undercut anchors.
 2. Samples: Representative lengths and diameters of each type anchor shown on the Drawings.
 3. Quality Assurance Submittals:
 - a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

Specifier: Note Revise 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.

- b. Certificates:
 - 1) ICC-ES Evaluation Reports.
 4. Manufacturer's installation instructions.
 5. Installer Qualifications & Procedures: Submit installer qualifications as stated in Section 1.03.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.
- B. Closeout Submittals: Submit the following:
1. Record Documents: Project record documents for installed materials in accordance with Division 1 Closeout Submittals Section.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications:
1. 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:
1. hole drilling procedure
 2. hole preparation & cleaning technique
 3. adhesive injection technique & dispenser training / maintenance
 4. rebar dowel preparation and installation
 5. proof loading/torqueing

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:
1. ICC-ES Evaluation Report indicating conformance with current applicable ICC-ES Acceptance Criteria.

1.04 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 PART 2 – PRODUCTS

2.01 MATERIALS

- A. Fasteners and Anchors:

Specifier Note: Revise 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 specific project 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:
- B. .

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 TZ2, ICC ESR-4266.
 - b. Hilti Kwik Bolt 1, IAMPO ER-678 .
- B. Screw Anchors: screw type. Pre-drilling of the hole requires a standard ANSI drill bit with the same diameter as the anchor and installing the anchor will be done with an impact wrench. 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 (8 μ m 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 (5 μ m 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. 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 HSL, HSLG, HSLB, or HLSK.
 - b. Hilti HSL4, HSL4-G, HSL4-B, or HSL4-SK ICC ESR-4386 (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 (5 μ m 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 (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 μ 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. 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 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-Z 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. Contact between galvanically dissimilar metals shall not be permitted. AISI 316 shall not be used where potential for pitting corrosion.
3. Reinforcing dowels shall be A615 Grade 60.
4. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
 - a. Hilti HAS threaded rods with HIT-HY 200 Safe Set System using Hilti Hollow Drill Bit and VC 150/300 vacuum System for anchor and rebar 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:

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.

5. 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.

1. 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. Contact between galvanically dissimilar metals shall not be permitted. AISI 316 shall not be used where potential for pitting corrosion.
2. 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

PART 4 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: Where anchors are permitted to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Properly clean cored hole per manufacturer's instructions.
 - b. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging

- prestressing tendons, electrical and telecommunications conduit, and gas lines.
- c. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 2. Perform anchor installation in accordance with manufacturer instructions.
 3. Wedge Anchors, Heavy-Duty Sleeve Anchors, and Undercut Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.
 4. Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
 5. Capsule Anchors: Perform drilling and setting operations in accordance with manufacturer instructions. Clean all holes to remove loose material and drilling dust prior to installation of adhesive. Remove water from drilled holes in such a manner as to achieve a surface dry condition. Capsule anchors shall be installed with equipment conforming to manufacturer recommendations. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
 6. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.
 7. For projects meeting IBC 2012 or later, ACI/CRSI Adhesive Anchor Installer Certification is required for all installers of adhesive anchor in horizontal or upwardly inclined orientation. The Hilti Adhesive Anchor Installer Certification Program (HAAICP) is an approved equivalent.

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 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.
- B. MINIMUM ANCHOR EMBEDMENTS, PROOF LOADS AND TORQUES SHALL BE AS SHOWN ON THE DRAWINGS.

END OF SECTION 05 05 19 – POST-INSTALLED CONCRETE ANCHORS

05 55 00 - Metal Stair Treads and Nosings

Exterior stair nosing shall be by Wooster Products Inc., Supergrit Safety Tread Type 321BF, or approved equal. Filler material shall be black in color. Where black is not contrasting to the stair color, a proposed color must be approved by the University.

END OF SECTION 05 55 00 - Metal Stair Treads and Nosings