

GRANITE

1.0 GENERAL

1.1 Related Documents

Drawings and general provisions, including General and Supplementary Conditions of the Contract and Division I Specification sections, apply to this section.

1.2 Applicable Publications

The following publications listed here and referred to thereafter by alphanumeric code designation only, form a part of this specification to the extent indicated by the references thereto:

1) **ASTM International (ASTM):**

C615-99 Standard Specification for Granite Dimension Stone

A666-00 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

B221-00 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

C97-02 Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone

C99-87(2000) Standard Test Method for Modulus of Rupture of Dimension Stone

C119-03 Standard Terminology Relating to Dimension Stone

C170-90(1999) Standard Test Method for Compressive Strength of Dimension Stone

C241-90(1997)e1 Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic

C270-03 Standard Specification for Mortar for Unit Masonry

C295-03 Standard Guide for Petrographic Examination of Aggregates for Concrete

C880-98 Standard Test Method for Flexural Strength of Dimension Stone

C1028-96 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

C1201-91(1996) Standard Test Method for Structural Performance of Exterior Dimension Stone Cladding Systems by Uniform Static Air Pressure Difference

C1242-02a Standard Guide for Selection, Design, and Installation of Exterior Dimension Stone Anchors and Anchoring Systems

C1352-96(2002) Standard Test Method for Flexural Modulus of Elasticity of Dimension Stone

C1353-98e1 Standard Test Method Using the Taber Abraser for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic

C1354-96 Standard Test Method for Strength of Individual Stone Anchorages in Dimension Stone

C1515-01 Standard Guide for Cleaning of Exterior Dimension Stone, Vertical and Horizontal Surfaces, New or Existing

C1528-02 Standard Guide for Selection of Dimension Stone for Exterior Use

2) **Marble Institute of America (MIA):**

Membership, Products and Services Directory, Dimension Stone Design Manual, Dimension Stones of the World, Volumes I and II (includes color plates, ASTM test data, and other technical information). Additional publications may be available from the MIA Bookstore – go online at www.marble-institute.com.

3) National Building Granite Quarries Association (NBGQA) Specifications for Architectural Granite

1.3 Scope of Included Work

The work to be completed under this contract includes all labor and materials required for the furnishing and installation of all granite work shown or called for on the contract drawings, specifications, and addenda.

1.4 Definition of Terms

The definitions of trade terms used in this specification shall be those published by the MIA, BGQA, or ASTM International.

1.5 Source of Supply

All granite shall be obtained from quarries having adequate capacity and facilities to meet the specified requirements, and from a firm equipped to process the material promptly on order and in strict accord with specifications. The Specifying Authority (architect, designer, engineer, contracting officer, end user, etc.) reserves the right to approve the Material Supplier prior to the award of this contract. Stone and workmanship quality shall be in accordance with Industry Standards and Practices as set forth by the MIA.

1.6 Samples

The Granite Contractor shall submit through the General Contractor, for approval by the Specifying Authority, at least two full range sets of samples of the various kinds of granite specified. Sample submittals shall represent the full range of color and markings inherent in the material proposed for fabrication of the project. Full range sample sets must be reviewed and approved as a complete set and not as individual pieces. Full range sample sets shall be indicative of the true character, including any natural variation in background and foreground color, veining or graining, of the material currently available and proposed for use on the project. The sample size shall be 1'-0" x 1'-0" minimum, 2'-0" x 2'-0" minimum for heavily veined or varied stones, and shall represent approximately the finish, texture, and anticipated range of colors to be supplied. One set of approved samples shall be retained by the Specifying Authority, and one set shall be returned to the Granite Supplier for his record and guidance. It is noted herein that granite is a natural material and will have intrinsic variations in color, markings, and other characteristics. Depending on granite selected and quantity required, a range mockup may be used to further define the characteristics of the material. Cost of mockup, if required, shall not be included in this section. Prior to fabrication, and to assure the end user's needs will ultimately be met and to fully understand the finish and full range of the material, an inspection and approval by the Specifying Authority and/or General Contractor and/or End User of the material is recommended. Costs for an initial inspection of the quarried blocks before slabbing, and a second inspection of the finished material slabs before fabrication shall be stipulated and included in the overall contract requirements.

1.7 Shop Drawings

The Granite Contractor shall submit through the General Contractor, for approval by the Specifying Authority, sufficient sets of shop drawings, showing general layout, jointing, anchoring, stone thickness, and other pertinent information. These drawings shall show all bedding, bonding,

jointing, setting spaces and anchoring details along with the net piece dimensions of each granite unit. Due to tight fabrication tolerances of dimensional stone (see “Dimensional Tolerances” in this section) special attention must be paid to those areas where associated trade’s work abuts or is integral with the stone installation. Additional notes calling out required set backs, setting space allowances below and behind floor and wall installations, critical “hold-too” dimensions, or any other specific conditions requiring strict coordination with other trades work should be incorporated into the shop drawings. Coordination of approved shop drawings with all affected trades is the responsibility of the General Contractor. One copy of the approved shop drawings shall be retained by the Specifying Authority, one copy shall be retained by the General Contractor, and one copy returned to the Granite Contractor for fabrication. NO FABRICATION OF GRANITE SHALL BE STARTED UNTIL SUCH DRAWINGS HAVE BEEN FULLY APPROVED AND MARKED AS SUCH. The Granite Contractor shall not be responsible for determining, making, or verifying (1) design, structural, wind, seismic, or other design loads; (2) engineering estimates; (3) plans or specifications; or (4) the types, sizes, or locations of anchors, unless specifically added to the scope of work.

1.8 Defective Work

Any piece of granite showing flaws or imperfections upon receipt at the storage yard or building site shall be referred to the Specifying Authority for determination as to responsibility and decision as to whether it shall be rejected, patched, or redressed for use.

1.9 Repairing Damaged Stone

Chips at the edges or corners may be patched, provided the structural integrity of the stone is not affected and the patch matches the color and finish of the natural stone so that it does not detract from the stone’s appearance.

2.0 MATERIALS

2.1 Granite

General: All granite shall be of standard architectural grade, free of cracks, seams, starts, or other traits which may impair its structural integrity or function. Inherent color variations characteristic of the quarry from which it is obtained will be acceptable. Texture and finish shall be within the range of samples approved by the Specifying Authority. ASTM C615 [C97] [C99] [C170] [C241] [C880]. See the chart of applicable ASTM standards and tests in the Appendix.

Schedule: Granite shall be provided as follows:

- 1) For *(state location on building) (state name and color) granite with a (type) finish, supplied by (name company or list several approved suppliers).*
- 2) Provide information as in (1) for each different granite/finish combination in the project.

Finishes: Finishes listed in the schedule shall conform with definitions by MIA, NBGQA, or ASTM International.

2.2 Setting Mortar

Mortar for setting shall be Type N, as defined in ASTM C270-03 (Standard Specification for Mortar for Unit Masonry). All mixing, handling, and pacing procedures shall be in accordance with ASTM C270-03.

2.3 Pointing Mortar

Mortar for pointing shall be Type N, as defined in ASTM C270-03 (Standard Specification for Mortar for Unit Masonry). All mixing, handling, and pacing procedures shall be in accordance with ASTM C270-03.

2.4 Sealants and Backup Material (if applicable)

Where specified, (*state type or name of sealant*) shall be used for the pointing of joints. The backup material used with the sealant shall be (*identify material*).

2.5 Anchors, Cramps, and Dowels

All anchorage components shall be of 300 Series stainless steel (refer to ASTM A666) or aluminum (refer to ASTM B221) with strength and durability properties meeting or exceeding those of 6063-T6. Anchor types and assemblies shall comply with ASTM C1242-02a. Reliance on adhesives alone for material attachment will not be permitted. The granite contractor shall be responsible for all anchorage attached to the stone and directly related to stone installation. The granite contractor shall not be responsible for any additional support elements required for proper attachment of stone anchorage to the structure of the building.

3.0 FABRICATION

3.1 Dimensional Tolerances

Panel thickness of 3/8" or 1/2"..... $\pm 1/32$ "

Panel thickness of 3/4" to 1-5/8" $\pm 1/8$ "

Panel thickness >1-5/8" $\pm 1/4$ "

Panel face dimension $\pm 1/16$ "

Face variation from rectangular $\pm 1/16$ "

(maximum out of square) (noncumulative)

Heads/calibrated edges $\pm 1/16$ "

Quirk miters (width of nose):

Up to 1/4"-0; +25% of dim

Over 1/4"-0, +1/16"

Location of back anchors..... $\pm 1/8$ "

Depth of back anchors.....-0, +1/16"

Location of holes for precast anchors $\pm 1/4$ "

Hole depth for precast anchors $\pm 1/16$ "

Anchor Slots:

From face to C/L of slot $\pm 1/16$ "

Lateral placement..... $\pm 1/4$ "

Width $\pm 1/16$ "

Depth at maximum..... $\pm 1/8$ "

Anchor Holes:

From face to C/L of slot $\pm 1/16$ "

Lateral placement..... $\pm 1/8$ "

Diameter $\pm 1/16$ "

Depth $\pm 1/8$ "

Anchor Sinkages:

Depth.....-0, +1/8"
 Continuous Kerfs:
 From face to C/L of kerf..... ±1/16"
 Maximum bow in 4'-0" ±1/16"
 Width..... ±1/16"
 Depth.....-1/16"; +1/8"
Rebated Kerf:
 Elevation of bearing surface.. ±1/16"
Bearing Checks:
 Elevation of bearing surface . ±1/16"
 Bearing/Clearance Checks:
 Lateral location ±1/2"
 Setback from face..... ±1/16"

3.1.1 Typical Unit Sizes

Tile stock- 12" x 12", 18" x 18", & 24" x 24" nominal. Thickness of tile stock is typically 3/8" thick for most polished and honed surfaces (see "6.2 Protection of Finished Work" in this section), and 1/2" thick for most thermal, or pointed finishes. Large format tile stock (18" x 18" and larger) may only be available in 1/2" thickness and is dependant on the specific stone's properties and the material supplier.

Dimension Stone Slab Stock- Industry standard slab stock available in 2 cm & 3 cm (3/4" & 1 1/4" nominal) thickness. Typical slab sizes vary by material, but average 6'-0" x 9'-0" for granite and 4'-0" x 8'-0" for marble. For specialty thicknesses or extremely large piece size requirements, the granite contractor or granite fabricator should be consulted in the design phase to assure the design intent can be met. Typical maximum finished piece size is 4'-0" x 4'-0" +/-.

3.2 Flatness Tolerances

Variation from true plane, or flat surfaces, shall be determined by a 4' dimension in any direction on the surface. Such variations on polished, honed, and fine rubbed surfaces shall not exceed tolerances listed below, or 1/3 of the specified joint width, whichever is greater. On surfaces having other finishes, the maximum variation from true plane shall not exceed the tolerance listed below, or 1/2 of the specified joint width, whichever is greater.

Flatness Tolerances by Finish.

Polished, honed, or fine rubbed.....1/16"
 Sawn, 4-cut, 6-cut, and 8-cut1/8"
 Thermal and coarse stippled3/16"
 Pointed or other rough cut.....1"
 Split face....dependent on piece size & stock

3.3 Beds and Joints

Bed and joint width shall be determined by analysis of anticipated building movements and designed to accommodate such movements without inducing undue stresses in the stone panels or joint filler materials. Expansion joints shall be designed and located to accommodate larger movements.

3.4 Backs Of Pieces

Backs of pieces shall be sawn or roughly dressed to approximately true planes. Back surfaces shall be free of any matter that may create staining

3.5 Moldings, Washes, and Drips

Moldings, washes, and drips shall be constant in profile throughout their entire length, in strict conformity with details shown on approved shop drawings. The finish quality on these surfaces shall match the finish quality of the flat surfaces on the building.

3.6 Back-Checking and Fitting to Structure or Frame

The building design should incorporate stone installation requirements such as material thickness, setting space, and anchorage allowances. Maintain a minimum of 1 1/4" between stone backs and adjacent structure and allow for all components of the building structure (waterproofing, flashing, etc.). (Note: many bolted connections will require more space than this; 2" space may be more desirable. Large-scale details should illustrate and control these conditions and be distributed by the General Contractor to the affected trades.)

3.7 Cutting for Anchoring, Supporting, and Lifting Devices

Holes and linkages shall be cut in stones for all anchors, cramps, dowels, and other tieback and support devices per industry standard practice or approved shop drawings. However, additional anchor holes *may* be drilled at job site by Granite Contractor to facilitate alignment. No holes or linkages will be provided for Granite Contractor's handling devices unless arrangement for this service is made by the Granite Contractor with the Granite Fabricator. (NOTE: It is not recommended that Lewis pins be used for stones less than 3-1/2" thick.)

3.8 Cutting and Drilling for Other Trades

Any miscellaneous cutting and drilling of stone necessary to accommodate other trades will be done by the Granite Fabricator only when necessary information is furnished in time to be shown on the shop drawings and details, and when work can be executed before fabrication. Cutting and fitting, due to job site conditions which are contrary to the dimensions and details shown on approved shop drawings are not the responsibility of the granite contractor and will be provided only by arrangement between the General Contractor and Granite Contractor.

3.9 Carving and Models

All carving shall be done by skilled Stone Carvers in a correct and artistic manner, in strict accordance with the spirit and intent of the approved shop drawing, or from models furnished or approved by the Specifying Authority.

4.0 SHIPPING AND HANDLING

4.1 Packing and Loading

Finished granite shall be carefully packed and loaded for shipment using all reasonable and customary precautions against damage in transit. No material which may cause staining or discoloration shall be used for blocking or packing. (See "6.2 Protection of Finished Work" in this chapter.)

4.2 Site Storage

Upon receipt at the building site, stone shall remain in the factory-prepared bundles until beginning of the installation. Bundles shall be staged in an area which is least susceptible to damage from ongoing construction activity. Once unbundled, the granite shall be stacked on timber or platforms at least 2" above the ground, and the utmost care shall be taken to prevent staining or impact damage of the granite. If storage is to be prolonged, polyethylene or other suitable, nonstaining film shall be placed between any wood and finished surfaces of the granite. Polyethylene or other suitable, nonstaining film may also be required as protective covering. Any holes or slots in the granite which are capable of collecting water shall be temporarily covered or plugged to prevent freezing of collected water. Such covers or plugs are to be removed immediately prior to installation of the piece.

5.0 INSTALLATION

5.1 General Installation

Installation shall be accomplished with competent, experienced Stone Setters, in accordance with the approved shop drawings. All granite pieces shall be identified with a unique piece number corresponding with the number on the shop drawings. Interchanging of numbered pieces is not permitted as the pieces are generally blended for color and characteristic markings by the granite fabricator. Granite shall be free of any ice or frost at time of installation. Salt shall not be used for the purpose of melting ice, frost, or snow on the granite pieces. Adequate protection measures shall be taken to ensure that exposed surfaces of the stone shall be kept free of mortar at all times as elements in mortar may etch the polished surfaces of some stones.

5.2 Mortar Setting of Granite

Clean base materials to remove dirt or other foreign matter. Saturate concrete substrate several hours prior to setting granite. Prepare and place mortar in accordance with ASTM C270-03. Thoroughly wet stones prior to setting in mortar bed. Apply neat cement parge of approximate 1/16" thickness to granite units prior to placing on mortar bed. Tamp stones into place using a rubber or plastic mallet to obtain full contact with the setting bed and proper stone unit alignment.

5.3 Mortar Joints

Mortar joints shall be raked out to a depth of 1/2" to 3/4". Apply pointing mortar in layers not exceeding 3/8" and allow each layer to get hard to the touch before the next layer is applied. Tool finished joints with a concave tool having a diameter approximately 1/8" greater than the joint width. Care shall be taken to keep expansion joints free of mortar, which would compromise their function.

5.4 Anchorage

All granite shall be anchored in accordance with the approved shop drawings. Specific anchorage design and details shall be determined by the granite contractor in conjunction with the granite fabricator. To the furthest extent possible, all anchor preparations in granite units shall be shop applied. All anchorage devices and anchor hole/slot fillers shall be in accordance with ASTM C1242-02. Care must be taken to ensure that any holes capable of retaining water are filled after use to prevent water collection and freezing.

5.5 Sealant Joints

Where so specified, joints requiring sealant shall be first filled with a closed-cell ethafoam rope backer rod. The backer rod shall be installed to a depth that provides optimum sealant profile after tooling per manufacturer recommendations. If recommended by the Sealant Manufacturer, primers shall be applied to the substrate surfaces according to the manufacturer's directions prior to application of the joint sealant. A test should be conducted to assure that the specified sealant will not stain the stone. Typically, Sample pieces of stone with kerf cuts applied to the sample face representing the typical joint size (1/4" x 1/4", 3/8" x 3/8", 1/2" x 1/2" etc.) are filled with the specified sealant and allowed to cure for 24 to 48 hours. Any potential staining should be apparent at this point. Fully cured sealant samples will be submitted to demonstrate no staining to stone by the specified sealant.

5.6 Expansion Joints

It is not the intent of this specification to make control or expansion-joint recommendations for a specific project. The Specifying Authority must specify control or expansion joints and show locations and details on drawings. Typically, expansion joints are required at 20'-0" intervals and should be determined by the design professional and the granite contractor.

5.7 Caulking

Where so specified, joints shall be pointed with the sealant(s) specified in Section 2.4, after first installing the specified backup material and applying a primer if required, all in strict accordance with the printed instructions of the Sealant Manufacturer. All sealants shall be tooled to ensure maximum adhesion to the contact surfaces.

5.8 Weep Tubes

Plastic or other weep tubes shall be placed in joints where moisture may accumulate within the wall, such as at base of cavity, continuous angles, flashing, etc., or as shown on architectural drawings.

5.9 Installation Tolerances

The quality of the stone installation relies greatly on the quality and accuracy of those trades preceding stone installation. After review and approval, shop drawings shall be distributed and coordinated by the General Contractor to all trades whose work abuts, or is integral with the stone installation.

Variation in plumb:

Lines and surfaces of walls and columns:

- 1/4" in 10'-0"
- NTE 3/8" in story height
- 1/2" in 40'-0"

Exterior corners or other conspicuous lines:

- 1/4" in 10'-0"
- NTE 1/4" in story height
- 1/2" in 40'-0"

Variation from level:

Lintels, parapets, rustications:

..... 1/2" in column bay

..... 3/4" in 40'-0"

Variation from linear building line:

1/2" in column bay 3/4" in 40'-0"

6.0 CLEANING AND PROTECTION

6.1 Cleaning

All cleaning methods shall be tested on material samples prior to application to the stone installation to assure there are no adverse affects of the cleaning method or products to the stone surface. Granite shall be cleaned after installation and all pointing or caulking is complete. All dirt, excess mortar, weld splatter, stains, and other defacements shall be removed. All cleaning methods shall be in accordance with ASTM C1515-01.

6.2 Protection of Finished Work

Granite installation in progress shall be protected with film or fabric tarps secured over the work **as** required. After the granite is installed, it shall be the responsibility of the General Contractor to properly and adequately protect it from damage until all trades are finished. This responsibility includes the stone cleaning costs prior to the required final inspection. Where lumber is required for protection, care should be taken to protect the granite from staining by the lumber, using plastic film or other suitable materials. Any fasteners used in construction of temporary protection fixtures shall be noncorrosive.

Finishes commonly available are defined as follows:

- Polished:** Mirror gloss, with sharp reflections.
- Honed:** Dull sheen, without reflections.
- Fine rubbed:** Smooth and free from scratches; no sheen.
- Rubbed:** Plain surface with occasional slight "trails" or scratches.
- Shot ground:** Plain surface with pronounced circular markings or "trails" having no regular pattern.
- Thermal (Flamed):** Finish produced by application of high-temperature flame to the surface. Large surfaces may have shadow lines caused by overlapping of the torch. This finish will vary in texture and depth between different types of granite, as the finish is largely dependent upon the granite structure of the stone.
- Sandblasted, coarse stippled:** Coarse plain surface produced by blasting with an abrasive; coarseness varies with type of preparatory finish and grain structure of the granite.
- Sandblasted, fine stippled:** Plain surface, slightly pebbled, with occasional slight "trails" or scratches.
- Bush-hammered, 8-cut:** Fine bush hammered finish, interrupted by parallel markings not over 3/32" apart. A corrugated finish, smoother near arris lines and on small surfaces.
- Bush-hammered, 6-cut:** Medium bush-hammered finish, similar to but coarser than 8-cut, with markings not more than 1/8" apart.

- **Bush-hammered, 4-cut:** Coarse bush hammered finish with same characteristics as 6-cut, but with markings not more than 7/32" apart.
- **Sawn:** Relatively plain surface with texture ranging from wire sawn (a close approximation of a rubbed finish) to shot sawn, with scorings 3/32" in depth. Gang saws produce parallel scorings; rotary or circular saws make circular scorings. Shot-sawn surfaces should be cleaned to remove all rust stains.
- **Split faced:** Stone on which the face has been broken to an approximate plane.
- **Rock (pitch) faced:** Similar to split faced, except that the face of the stone is pitched to a given line and plane producing a bold appearance rather than the comparatively straight face obtained in split face.
- **Water Jet:** After certain treatment finishes on stone, such as flaming, a high pressure jet wash can be used to assist in cleaning the stone and bringing back more color to the stone. Some producers have the machinery to use high-pressure water with additives which gives a jet washed finish that looks like a flamed finish, yet maintains the color in the stone.
- **Antique:** Multiple processes similar to those for Water Jet finish to give the appearance of a tumbled or weathered surface. Results and appearance vary according to stone types.

Minimum Thickness: The suggested minimum thickness for all exterior veneer is 1 1/4" and as follows:

Impact-resultant finishes, such as **bush hammered** (sometimes referred to as a **pointed finish**), require a 1 1/4" thick slab minimum to apply. Other finishes can usually be applied to any thickness slab, with the exception of some granites not being able to withstand thermal finishing processes in thicknesses less than 1 1/4". Determination of proper stone thickness must be evaluated using the following criteria:

- 1) Piece Size.
- 2) Final Face Finish.
- 3) Anchoring Detail.
- 4) Structural Design Load Requirements.
- 5) Flexural Strength of the Granite.

Minimum safety factors of 3 to 1 minimum on granite flexural stresses and 4 to 1 minimum on anchorage components in granite are recommended.

Ashlar or veneer used as a facing requires a setting space of at least 1 1/4", as measured from the nominal thickness of the piece to the outermost layer of the building structure (including any required waterproofing, flashing, etc.).

Bed and Joint Width. The minimum recommended bed and joint width is 1/4" for exteriors and 1/8" for interiors due to the relatively tight fabrication and installation tolerances of dimension stone (see "3.1 Dimensional Tolerances" & "5.9 Installation Tolerances" in this section.), but not less than 2 times the specified tolerances for the particular application.

Sawn Backs. Because of physical characteristics, most granites cannot be split to a thickness less than 1/3 of the lesser face dimension. Consequently, sawn backs (see 3.4 in this chapter) should be specified for most veneers, and are frequently specified also for thicker ashlar, because of design considerations.

Staining. Granite should be protected from wet (green) wood, oils, mud, construction waste, and asphalt compounds. Contact Fabricator or Granite Contractor for proper remedies to staining problems that occur.