



Designation: C1242 – 21

Standard Guide for Selection, Design, and Installation of Dimension Stone Attachment Systems¹

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INTRODUCTION

Natural building stone is chosen as a building's cladding for its beauty which endures with minimal maintenance. Stone is durable when used properly. Exercising good judgment when selecting the particular stone, determining the quarrying and fabrication techniques, designing the method of attachment, and installing all components correctly maximizes these benefits. A properly executed stone cladding is designed and installed within the capabilities and limitations of the stone and support system to resist all forces that work on them.

This guide presents design principles that require consideration when designing anchorages and evaluating exterior stone to be compatible with its proposed use. It is an overview of current techniques and a review of minimum requirements for sound stone engineering and construction. The guide does not list all possible methods of attachment nor does it provide a step-by-step procedure for stone anchor engineering. Knowledge gained from new engineering designs, testing of applications, and the investigation of existing problems are continually reviewed to update this guide. Comment from users is encouraged.

Good judgment by architects, engineers, and contractors when specifying, designing, engineering, and constructing stone and other work that interfaces stone is necessary to use this guide. Users of this guide should combine known performance characteristics of the stone, the building's structural behavior, and knowledge of materials and construction methods with proven engineering practice.

1. Scope

1.1 This guide covers the categories of anchors and anchoring systems and discusses the design principles to be considered in selecting anchors or systems that will resist gravity loads and applied loads.

1.2 This guide sets forth basic requirements for the design of stone anchorage and provides a practical checklist of those design considerations.

1.3 This guide pertains to:

1.3.1 The anchoring of stone panels directly to the building structure for support,

1.3.2 The anchoring of stone panels to subframes or to curtainwall components after these support systems are attached to the building structure,

1.3.3 The anchoring of stone panels to subframes or to curtainwall components with stone cladding preassembled before these support systems are attached to the building structure, and

1.3.4 The supervision and inspection of fabrication and installation of the above.

1.4 Observe all applicable regulations, specific recommendations of the manufacturers, and standards governing interfacing work.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use. (See Tables 1 and 2.)*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the*

¹ This guide is under the jurisdiction of ASTM Committee C18 on Dimension Stone and is the direct responsibility of Subcommittee C18.06 on Attachment Components and Systems.

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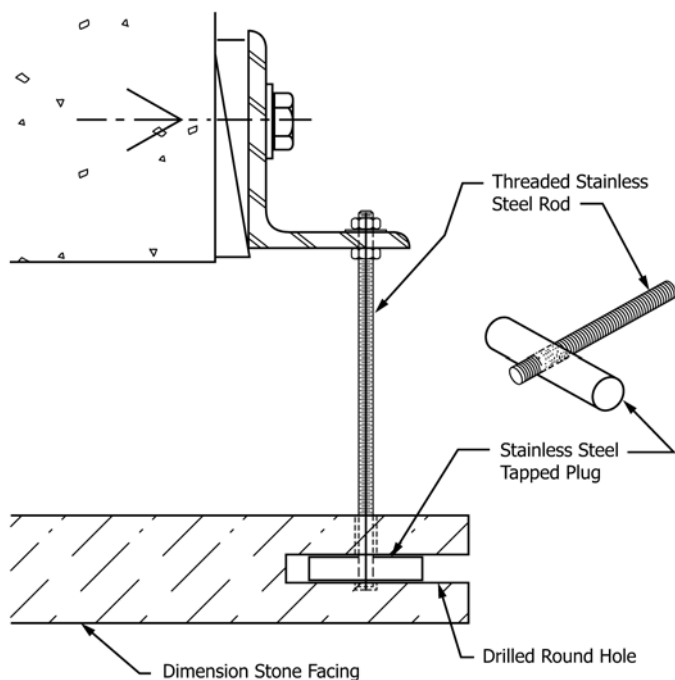


FIG. 1 Rod and Plug Anchor

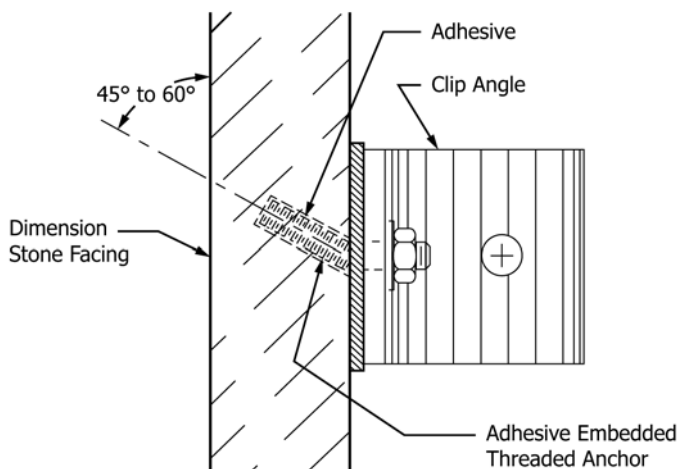


FIG. 2 Adhesive Embedded Threaded Anchor

Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:²

- C97 Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone
- C99 Test Method for Modulus of Rupture of Dimension Stone
- C119 Terminology Relating to Dimension Stone

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

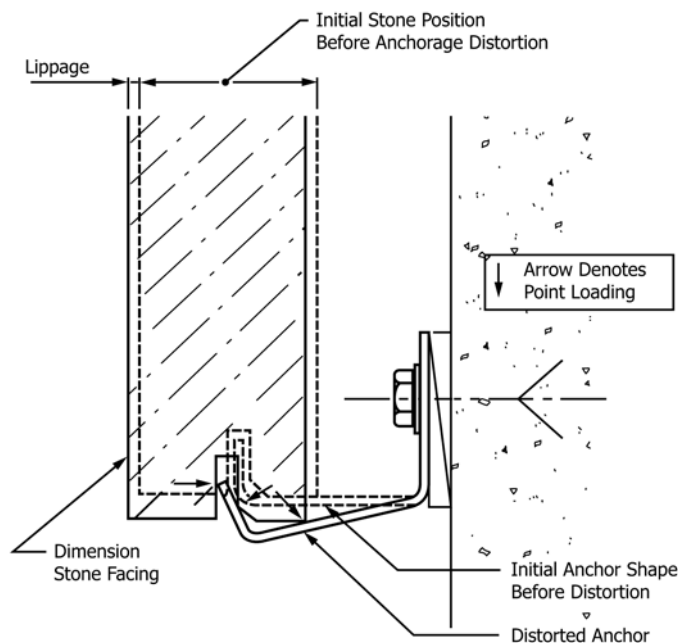


FIG. 3 Point Loading Prevention

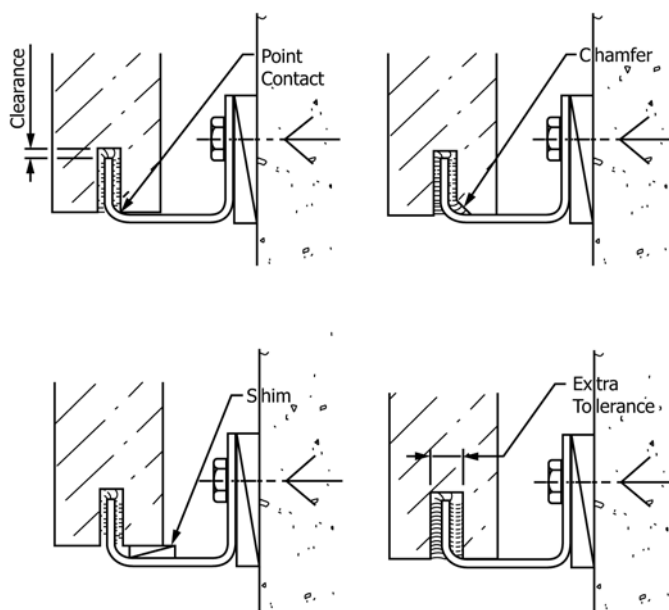


FIG. 3 Point Loading Prevention (continued)

- C170 Test Method for Compressive Strength of Dimension Stone
- C406 Specification for Roofing Slate
- C482 Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste
- C503 Specification for Marble Dimension Stone
- C509 Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
- C568 Specification for Limestone Dimension Stone
- C615 Specification for Granite Dimension Stone
- C616 Specification for Quartz-Based Dimension Stone
- C629 Specification for Slate Dimension Stone

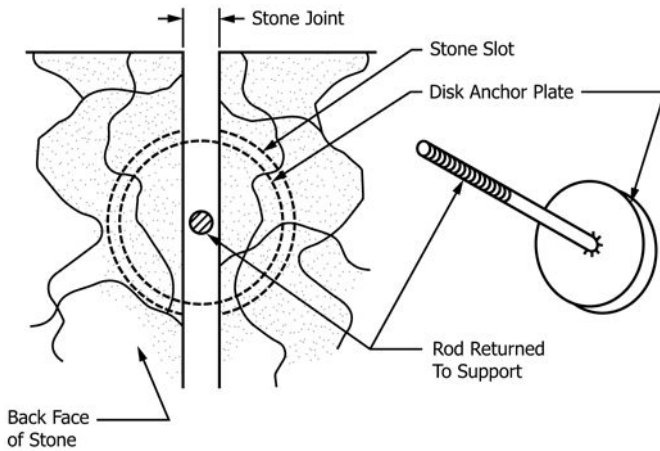


FIG. 4 Disc Anchor

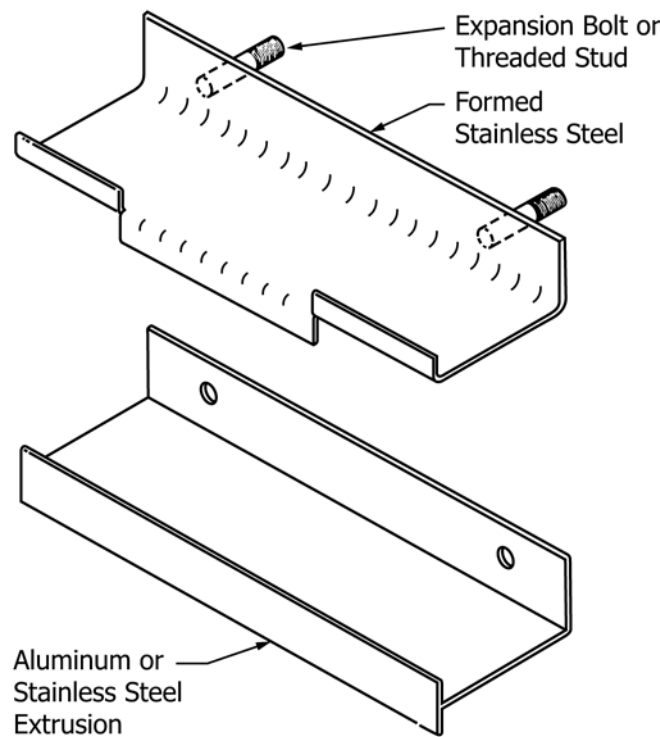


FIG. 5 Combined Anchor

TABLE 1 Dimension Stone Specifications

Stone Type	ASTM Specification
Calcite ^A	C503
Dolomite ^A	C503
Granite	C615
Limestone ^B	C568
Marble (exterior) ^B	C503
Quartz-Based ^B	C616
Quartzite ^A	C616
Quartzitic Sandstone ^A	C616
Sandstone ^A	C616
Serpentine ^A	C503
Serpentine	C1526
Slate (roof)	C406
Slate (walls)	C629
Travertine ^A	C1527

^A This stone type is a subclassification.

^B This stone type has subclassifications or grades.

TABLE 2 Dimension Stone Test Methods

Measures	ASTM Test Method
liquid porosity and relative density	C97
combined shear with tensile unit strength from bending	C99
ultimate crushing unit strength	C170
primary tensile unit strength from bending	C880
capacity and deflections of panels assembled with their anchors onto their supporting backup structure	C1201
individual anchor strength	C1354/C1354M
accelerated production of service life	E632

E632 Practice for Developing Accelerated Tests to Aid Prediction of the Service Life of Building Components and Materials

3. Terminology

3.1 *General Definitions*—For definitions of terms used in this guide, refer to Terminology C119.

3.2 Specific definitions used in the design process are listed in 7.4.

4. Significance and Use

4.1 This guide is intended to be used by architects, engineers, and contractors who either design or install exterior stone cladding for architectural structures.

4.2 This guide is an industry standard for engineering design considerations, documentation, material considerations, anchor type applications, and installation workmanship to assist designers and installers to achieve a proper and durable stone cladding.

4.3 Stone and its support systems are part of a building's skin and shall be compatible with the behavior and performance of other interfacing systems, such as the curtainwall and superstructure frame.

4.3.1 Every stone work application shall comply with applicable building codes.

4.3.2 It is not the intent of this Guide to supersede published recommendations for specific stone types. Provisions of other dimension stone industry publications should be reviewed and considered in addition to this Guide's recommendations. All industry information should be considered with respect to project specifications and requirements. If provisions of such

- C864 Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
- C880 Test Method for Flexural Strength of Dimension Stone
- C1115 Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories
- C1201 Test Method for Structural Performance of Exterior Dimension Stone Cladding Systems by Uniform Static Air Pressure Difference
- C1354/C1354M Test Method for Strength of Individual Stone Anchorages in Dimension Stone
- C1496 Guide for Assessment and Maintenance of Exterior Dimension Stone Masonry Walls and Facades
- C1526 Specification for Serpentine Dimension Stone
- C1527 Specification for Travertine Dimension Stone