



SPECIFICATION FOR MASONRY STRUCTURES

TEK 1-2C
Codes & Specs (2010)

INTRODUCTION

Specification for Masonry Structures (MSJC Specification) (ref. 1) is a national consensus standard intended to be incorporated by reference into the contract documents of masonry construction projects. Compliance with this Specification is mandatory for structures designed in accordance with *Building Code Requirements for Masonry Structures* (MSJC Code) (ref. 2).

The masonry design and construction provisions in Chapter 21 of the *International Building Code* (IBC) (ref. 3) are based primarily on the MSJC Code and Specification. When adopting the MSJC Code and Specification, the IBC typically amends or modifies some provisions. Because significant changes can be introduced into subsequent editions of both the MSJC and the IBC, the edition referenced by the local building code can be an important consideration when determining the specific requirements to be met. Note that building officials will often accept design and construction standards which are more current than those referenced in the applicable code, as they represent more state-of-the-art requirements for the specific material or system.

This TEK provides a broad overview of the MSJC Specification's content, references other NCMA TEK which describe the various provisions in greater detail, outlines updates incorporated into the 2008 edition of the MSJC Specification, and notes differences between the 2008 MSJC Specification and the 2009 IBC.

THE MSJC SPECIFICATION

The MSJC Specification covers material requirements, storage and handling of materials, construction, and clean-

ing, as well as provisions for quality assurance, testing and inspection. Construction includes requirements for masonry placement, bonding and anchorage, and the placement of grout, reinforcement and prestressing tendons. The document is formatted to allow the designer to modify those provisions which include a choice of alternatives. Thus, the MSJC Specification may be tailored to meet the specific needs of a project. Modifications are considered to be a supplemental specification to the MSJC Specification.

The advantages of a standard specification include consistency, coordination and understanding among all parties involved. A Commentary, which accompanies the MSJC Specification, explains the mandatory requirements and further clarifies the Specification's intent.

The document is written in the three-part section format of the Construction Specifications Institute. Each of the three parts (General, Products and Execution) is described in the following sections.

In addition to these three parts, checklists are included at the end of the MSJC Specification to help the designer prepare the contract documents. The checklists identify the decisions that must be made when preparing any supplemental specifications. They are not a mandatory part of the Specification.

Several articles of the MSJC Specification are prefaced with the phrase "when required..." These articles do not become a part of the contract documents unless action is taken by the designer to include a requirement in the supplemental specifications. Other articles are prefaced with the phrase "unless otherwise required..." These articles are a part of the contract documents unless the designer takes

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specific action to modify the article in the supplemental specifications.

PART 1—GENERAL

Part 1 of the MSJC Specification covers:

- definitions,
- referenced standards,
- system description, which includes:
 1. compressive strength requirements,
 2. compressive strength determination (choice of two methods). See TEK 18-1A, *Compressive Strength Evaluation of Concrete Masonry* (ref. 4), for more detailed information.
 3. adhered veneer requirements (choice of two methods to determine adhesion),
- submittals, which includes a minimum list of required submittals. If the designer wishes to specify a higher level of quality assurance, additional submittals may be required.
- quality assurance, which includes quality control measures as well as testing and inspection. The services and duties of the testing agency, inspection agency and contractor are included here (see TEK 18-3B, *Concrete Masonry Inspection* (ref. 5), for more detailed information),
- delivery, storage and handling requirements, and
- cold weather and hot weather construction requirements (see TEK 3-1C, *All-Weather Concrete Masonry Construction* (ref. 6)).

Updates to 2008 MSJC Specification

From the 2005 edition of the MSJC Specification to the 2008 edition, Tables 3, 4 and 5 which define Level A Quality Assurance, Level B Quality Assurance and Level C Quality Assurance, respectively, were revised. Columns were added to the tables to define the frequency of inspection for the various items. New inspection tasks in the tables are:

- verification of the grade, type and size of anchor bolts prior to grouting for Levels B and C quality assurance, and
- verification of the grade and size of prestressing tendons and anchorages for Level B quality assurance.

Part 1 also includes new provisions addressing the addition of self-consolidating grout to the MSJC specification. See TEK 9-2B, *Self-Consolidating Grout for Concrete Masonry* (ref. 7) for further information.

The 2008 Specification includes minor modifications to the provisions for verifying compliance with the specified compressive strength of masonry, f'_m , using the unit strength method. In prior editions of the MSJC Specification, the unit strength table for concrete masonry implied

that the minimum compressive strength of units could be less than the 1,900 psi (13.1 MPa) required by ASTM C90, *Standard Specification for Loadbearing Concrete Masonry Units* (ref 8). To avoid potential confusion, Table 2 was revised to reflect a minimum unit compressive strength of 1,900 psi (13.1 MPa).

IBC Inspection Requirements

The *International Building Code* inspection requirements are almost identical to the MSJC requirements but are organized a little differently. MSJC Level A requirements correspond to the basic inspection requirements performed by the building official as required in Section 110.3 of the IBC. The special inspection requirements of IBC for masonry are found in Section 1704.5 of that code. MSJC Level B corresponds to IBC Level 1 and MSJC Level C corresponds to IBC Level 2.

IBC Section 2105 addresses quality assurance of masonry. These provisions are essentially the same as those in the MSJC Specification, with the exception that the IBC addresses testing prisms from constructed masonry. Such prisms are addressed only to a minor extent within the MSJC Specification, via one of the referenced standards, ASTM C1314-07, *Standard Test Method for Compressive Strength of Masonry Prisms* (ref.9).

PART 2—PRODUCTS

Part 2 of the MSJC Specification covers:

- required material properties for masonry units, mortar, grout, reinforcement, prestressing tendons, metal accessories and other accessories such as movement joint materials. These material properties are primarily references to applicable ASTM standards. See TEKs 1-1E, *ASTM Specifications for Concrete Masonry Units* (ref. 10), and 12-4D, *Steel Reinforcement for Concrete Masonry* (ref. 11), for further information.
- mortar and grout mixing requirements, found within Article 2.1 A via ASTM C270, *Standard Specification for Mortar for Unit Masonry* (ref. 12), and also within Article 2.6A (see TEK 3-8A, *Concrete Masonry Construction* (ref. 13), for more detailed information), and
- reinforcement fabrication requirements.

Updates to 2008 MSJC Specification

The Part 2 provisions were not greatly modified between the 2005 and 2008 editions of the MSJC Specification. The reinforcement used for stirrups and lateral ties that are terminated with a standard hook is now limited to a maximum reinforcing bar size of No. 5 (M# 16), because of the difficulty of bending, placing and developing larger diameter bars in typical masonry construction.

As in Part 1, Part 2 also includes new provisions addressing the addition of self-consolidating grout to the MSJC Specification. See TEK 9-2B, *Self-Consolidating Grout for Concrete Masonry* (ref. 7) for further information.

IBC Masonry Material Requirements

IBC Section 2103 addresses masonry construction materials, and the requirements are essentially the same as in the corresponding MSJC Specification. The IBC does include a provision for surface bonding mortar however, which is not addressed in the MSJC Specification.

PART 3—EXECUTION

Part 3, *Execution*, covers:

- inspection prior to the start of masonry construction,
- preparation of reinforcement and masonry prior to grouting (see TEK 3-2A, *Grouting Concrete Masonry Walls* (ref. 14)),
- masonry erection, including site tolerances (see TEK 3-8A, *Concrete Masonry Construction* (ref. 13)),
- bracing, which simply requires bracing to be designed and installed to assure stability (see TEK 3-4B, *Bracing Masonry Walls During Construction* (ref. 15) for detailed guidance),
- placement of reinforcement, ties and anchors (see TEK 12-1A, *Anchors and Ties for Masonry* (ref. 16)),
- grout placement (see TEK 3-2A, *Grouting Concrete Masonry Walls* (ref. 14)),
- procedures for prestressing tendon installation and stressing (see TEK 3-14, *Post-Tensioned Concrete Masonry Wall Construction* (ref. 17)),
- field quality control requirements, and
- cleaning (see TEK 8-4A, *Cleaning Concrete Masonry* (ref. 18)).

Updates to 2008 MSJC Specification

In addition to changes addressing self-consolidating grout, several changes have been incorporated into the Part 3 provisions, dealing with foundation dowels and with grouting procedures.

MSJC Specification Article 3.4 B.8(d) is a new provision, allowing foundation dowels that interfere with masonry unit webs to be bent up to 1 in. (25 mm) horizontally for each 6 in. (152 mm) of vertical height. This provision is similar to that used in reinforced concrete construction.

Article 3.5A of the MSJC Specification requires that grout be placed within 1½ hours from the introduction of water into the mix. The 2008 edition exempts transi-mixed grout from this requirement, as long as the grout meets the specified slump.

To help ensure structural continuity between subsequent grout pours, Article 3.5F now requires a 1½-in. (38-mm) grout key (i.e., terminating the grout at least 1½-in. (38-mm) below a mortar joint) when the previous grout lift has set before the next lift is poured. Grout keys may not be formed within masonry bond beams or lintels.

IBC Construction Requirements

IBC Section 2104 addresses masonry construction procedures, which essentially references the MSJC Specification without modification.

In the 2006 IBC, many of the provisions of the 2005 MSJC requirements were reiterated in the IBC. In the 2009 IBC however, most of the text of these requirements was removed from the IBC and a simple reference was made to the 2008 MSJC.

FINISH AND APPEARANCE

The MSJC Specification addresses structural requirements only and not finish or appearance, though several Articles, such as 1.6 D Sample Panels and 3.3 F Site Tolerances certainly may affect such. Additionally, several MSJC reference standards, such as ASTM C90, *Standard Specification for Loadbearing Concrete Masonry Units*, specifically address this topic. Further guidance may be found by including reference to state standards such as Arizona Masonry Guild Standard 107, *Levels of Quality* (ref. 19), as well as to NCMA TEK 1-1E *ASTM Specifications for Concrete Masonry Units* and TEK 8-4A *Cleaning Concrete Masonry*.

REFERENCES

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3. *International Building Code*. International Code Council, 2006 and 2009.
4. *Compressive Strength Evaluation of Concrete Masonry*, TEK 18-1A. National Concrete Masonry Association, 2004.
5. *Concrete Masonry Inspection*, TEK 18-3B. National Concrete Masonry Association, 2006.
6. *All-Weather Concrete Masonry Construction*, TEK 3-1C. National Concrete Masonry Association, 2002.
7. *Self-Consolidating Grout for Concrete Masonry*, TEK 9-2B. National Concrete Masonry Association, 2007.
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11. *Steel Reinforcement for Concrete Masonry*, 12-4D. National Concrete Masonry Association, 2007.
12. *Standard Specification for Mortar for Unit Masonry*, ASTM C270-07a. ASTM International, 2007.
13. *Concrete Masonry Construction*, TEK 3-8A. National Concrete Masonry Association, 2001.
14. *Grouting Concrete Masonry Walls*, TEK 3-2A. National Concrete Masonry Association, 2005.
15. *Bracing Masonry Walls During Construction*, TEK 3-4B. National Concrete Masonry Association, 2005.
16. *Anchors and Ties for Masonry*, TEK 12-1A. National Concrete Masonry Association, 2001.
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