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USACE / NAVFAC / AFCESA / NASA **UFGS-04 22 00.00 40 (April 2006)**

Preparing Activity: NASA **Superseding NASA-04225S (December 2005)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are NOT in agreement with UMRL dated 01 April 2006

Revised throughout - changes not indicated by CHG tags
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CONCRETE MASONRY UNITS

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SECTION 04 22 00.00 40

CONCRETE MASONRY UNITS
04/06

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This broadscope section covers standard hollow load bearing, concrete masonry units.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.
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PART 1 GENERAL

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the

reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI/MCP 605	(2005) Manual of Concrete Practice Part 6 (2005): 504R-90 to ITG3-04

ASTM INTERNATIONAL (ASTM)

ASTM A 116	(2000) Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
ASTM A 153/A 153M	(2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 575	(2002) Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A 615/A 615M	(2005a) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A 641/A 641M	(2003) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A 82	(2005) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM C 140	(2005) Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
ASTM C 144	(2004) Standard Specification for Aggregate for Masonry Mortar
ASTM C 150	(2005) Standard Specification for Portland Cement
ASTM C 207	(2005) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C 270	(2005a) Standard Specification for Mortar for Unit Masonry
ASTM C 404	(2004) Standard Specification for

	Aggregates for Masonry Grout
ASTM C 476	(2002) Standard Specification for Grout for Masonry
ASTM C 595	(2003) Standard Specification for Blended Hydraulic Cements
ASTM C 618	(2005) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C 90	(2005a) Standard Specification for Loadbearing Concrete Masonry Units
ASTM C 989	(2005) Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

1.2 SUBMITTALS

****
NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.
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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for

the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Certificates shall be submitted for the following items showing conformance with reference standards contained within this section.

Concrete Masonry Units (CMU)
Mortar
Sand
Pea Gravel
Lime
Grout
Reinforcement
Precast Lintels and Precast Concrete Items
Anchors and Ties

1.3 QUALITY ASSURANCE

Comply with the provisions of ACI/MCP 605 and ASTM C 140.

1.4 DELIVERY STORAGE AND HANDLING

Deliver materials in a undamaged condition. Store and handle units off the ground, undercover, and in a dry location to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

Store and protect aggregates to avoid contamination.

Store cementitious materials off the ground and protect by covering materials or storing in a dry location.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS (CMU)

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NOTE: Specifier should determine type unit that is common to local suppliers and region.
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Concrete masonry units shall include all special shapes and sizes required to complete the work. Concrete masonry units shall conform to ASTM C 90, Type [I] [II], Grade N, normal weight.

2.1.1 Recycled/Recovered Materials for Use in Concrete, Grout and Mortar

[Cement used in mortar and grout shall be a blended hydraulic cement conforming to ASTM C 595, Type [_____].]

[Cement used in concrete blocks and lintels shall be a blended hydraulic cement conforming to ASTM C 595, Type [_____].]

[For concrete blocks and lintels, fly ash [is required] [used] as an admixture [and] shall conform to ASTM C 618, Class [C or F] with 4 percent maximum loss on ignition and between 15 to 35 percent maximum cement

replacement by weight.]

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NOTE: Ground granulated blast furnace slag and fly ash are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (http://www.epa.gov/cpg/). If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines would result in inadequate competition, do not meet quality/ performance specifications, are available at an unreasonable price or are not available within a reasonable time frame, the Architect/Engineer may submit written justification and supporting documentation for not procuring designated items containing recovered material. Written justification may be submitted on a Request for Waiver Form to the NASA Environmental Program Manager for approval. The Request for Waiver Form is located in the NASA Procedures and Guidelines (NPG 8830.1) (http://nodis3.gsfc.nasa.gov).

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[For concrete blocks and lintels, ground granulated blast furnace slag [is required] [used] as an admixture [and] shall conform to ASTM C 989, Grade [120] with between 25 to 50 percent maximum cement replacement by weight.]

2.2 MORTAR

Mortar shall be mixed in proportions as specified in ASTM C 270 and ACI/MCP 605 [color mortar shall be in accordance with ASTM C 270].

2.3 GROUT

Grout shall conform to ASTM C 476. Compressive strength at 28 calendar days shall be [____] 13790 kilopascal [2,000] pounds per square inch (psi) minimum.

[Grouts produced with blends of Portland cement and ground granulated blast furnace slag shall have the minimum compressive strength specified by ASTM C 476.]

2.4 PORTLAND CEMENT

[Portland cement shall conform to ASTM C 150, Type [_____].]

[Blended hydraulic cement shall conform to ASTM C 595, Type [_____].]

One brand and type of cement shall be used for formed concrete having exposed-to-view finished surfaces.

2.5 AGGREGATE

Sand for mortar shall conform to ASTM C 144. Pea Gravel for grout shall conform to ASTM C 404.

2.6 LIME

Hydrated lime shall conform to ASTM C 207, Type S.

2.7 WATER

Water shall be potable.

2.8 REINFORCEMENT

2.8.1 Joint Reinforcement

Joint reinforcement shall be fabricated from steel wire conforming to ASTM A 82. Longitudinal wires shall be not lighter than 3.8 millimeter 0.1495 inch nominal diameter. Cross wires shall be not lighter than 3.8 millimeter 0.1495 inch nominal diameter. Joint reinforcement shall be hot-dipped galvanized in accordance with ASTM A 641/A 641M, Class B2.

2.8.2 Reinforcing Steel Bars

Reinforcing steel bars shall conform to ASTM A 615/A 615M, Grade [40,][50,][60,] deformed, free of loose rust and scale.

2.9 ANCHORS AND TIES

2.9.1 Zinc Coating

Zinc coating of all anchors and ties shall conform to ASTM A 153/A 153M, Class [B-1] [B-2] [B-3] as required. Zinc coating of wire for joint reinforcing shall conform to ASTM A 116, Class 1.

2.9.2 Dovetail Slots, Anchors, and Ties

Dovetail slots hall be 1.0 millimeter 20 gage galvanized steel, 1 inch 25 millimeter 1 inch wide by 16 millimeter 5/8 inch face by 25 millimeter 1 inch deep.

Dovetail-type anchors for use with embedded slots or inserts shall be sheet steel not lighter than 1.6 millimeter 0.0598 (16 gage) thick 25 millimeter 1 inch wide, flat anchors for block masonry units.

2.9.3 Column Anchors, Beam Anchors, and Ties

Column anchors hall be steel bars, formed by merchant quality hot-rolled carbon steel conforming to ASTM A 575 6 by 19 millimeter 1/4 by 3/4 inch, galvanized in accordance with ASTM A 153/A 153M, Class B2, length as required by wall thickness.

Column and anchors shall be galvanized steel rods, 6 millimeter 1/4 inch in diameter, in [triangular] [rectangular] shape.

Beam anchors shall be steel bar shapes, formed from carbon steel conforming to ASTM A 575, 5 by 25 millimeter 3/16 by 1 inch, shop painted, length as required by wall thickness.

Column clips for ties between units and steel columns shall be 3.5 millimeter 10 gage galvanized steel wire clips. Install clips for wire ties 24 inch 600 millimeter on center.

2.10 PRECAST LINTELS AND PRECAST CONCRETE ITEMS

Precast lintel units shall be cast with cement and aggregates similar to

that used for masonry units and shall have a 28-calendar day compressive strength of 3,000 psi 21 megapascal or more. Lintels shall be of length sufficient to bear [4] [8] inches [100] [200] millimeter minimum of each side of the opening. Trims, lintels, copings, door/window sills, shall be factory-made units from a plant regularly engaged in producing precast concrete.

PART 3 EXECUTION

3.1 MORTAR

Mortar shall be thoroughly machine mixed for a period of 3 to 5 minutes after all materials are in a mixer designed for this purpose.

Mortar shall be used and placed in final position within 1-1/2 hours after mixing when air temperature is less than 80 degrees F 27 degrees C. No mortar shall be placed when air temperature is 40 degrees F 4 degrees C and falling.

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NOTE: It is not recommended per industry standard to retemper colored mortars.
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Mortars that have stiffened within the allowable time [may not] be retempered to restore workability by adding water as frequently as needed.

Execution shall conform to ACI/MCP 605.

3.2 LAYING CONCRETE BLOCK

Block shall be laid dry and cut accurately to fit other construction. All cutting of units shall be done with power saws with abrasive blades.

Block work shall be laid plumb, level, and true to line and grade.

[Running bond] [_____] pattern shall be used.

Mortar joints shall be [3/8] inch [10] millimeter [_____] thick. Full mortar coverage of bed joints shall be provided at shells.

[Solid-bottom lintel blocks] [Precast lintels] shall be used over openings.

Masonry erection shall conform to ACI/MCP 605

3.3 GROUT

Grout shall be thoroughly machine mixed for a period of at least 5 minutes after all materials are in a mixer designed for this purpose.

Cells shall be grouted solid in maximum 4 feet 1220 millimeter lifts. The pour shall be stopped 1-1/2 inches 40 millimeter below the top of the block. A cleanout shall be provided at the bottom of cells where the pour of grout is in excess of 4 feet 1220 millimeter. Continuous unobstructed cell area of not less than 2 by 3 inches 50 by 75 millimeter shall be maintained. Anchors, bolts, inserts, reinforcement and other embedded items, shall be solidly grouted in place. Where required, filling of cells that are to remain open shall be prevented by means of a metal lath or a shield and by mortaring cross-webs where adjacent cells or cavities are to

be grouted.

Grouting shall be performed in one continuous operation.

3.4 REINFORCEMENT

Reinforcement shall be placed straight, centered in cells, and tied at laps and intersection of bars. Vertical steel shall be braced at 192 bar diameters maximum spacing and at top and bottom to ensure alignment.

Dowels shall be provided of the same size for each vertical and horizontal bar required on the anchorage.

Steel shall be encased in grout with at least 1/2 inch 13 millimeter between any bar and masonry.

At least one No. 4 5 millimeter (No. 4) bar shall be provided at each vertical side of openings exceeding 24 inches 600 millimeter.

3.5 JOINT REINFORCEMENT

Control joints shall be constructed with [continuous] lengths of joint reinforcing through expansion relief cuts. Reinforcement shall be placed to ensure a minimum of 5/8 inch 16 millimeter mortar cover on the exterior face of the wall and 1/2 inch 13 millimeter mortar cover on interior faces.

3.6 ANCHORS AND TIES

Anchors and ties shall be set in accordance with construction drawings. Anchors and ties shall be completely surrounded by grout having the minimum grout cover as indicated in structural drawings.

3.7 JOINTING AND POINTING EXPOSED MASONRY

Joints shall be pointed and tooled before mortar is set and brushed with a fiber brush after tooling. Exterior joints shall be concave; interior joints shall have flush packed joints.

3.8 EMBEDDED ITEMS

Embedded items shall be set in accordance with the construction drawings. Anchors shall be surrounded by grout.

3.9 METAL DOOR JAMBS

Metal door jambs in masonry walls shall have frames filled solidly with mortar as the work progresses.

3.10 CURING, PROTECTION, AND CLEANING

Curing by saturation with water will not be permitted. Exposed exterior surfaces shall be protected from sun and heat with light fog spray for a period of 3 calendar days.

Exposed masonry surfaces shall be protected from mortar droppings. Sills, ledges, and projecting courses shall be covered with water-repellent covering.

Grout or mortar stains shall be cleaned by removing immediately with clear water, stiff fiber brushes, or wooden scrapers, and rinsed before final acceptance.

-- End of Section --