

DIVISION 04000 - MASONRY WORKS**04200 CEMENT CONCRETE BLOCK MASONRY****04201 GENERAL****A- Scope of Work**

The work covered by this section of the Specifications consists of furnishing all labour, tools scaffolding, hoisting equipment and masonry materials of every kind; and in performing all operations in connection with procurement, transportation and delivery, erection and building in of all work classified as masonry work and/or included as such herein, i.e., concrete masonry units; masonry mortars; and all related items and appurtenances, including all items supplied by other trades and customarily built-in and/or installed under mason work or required to complete mason work, in strict accordance with the requirements of the Drawings and Schedules, as specified herein, and subject to the Terms and Conditions of the Contract Documents.

B- Codes and Standards

Unless otherwise specified or shown, the following codes and standards shall apply:

ASTM C 31	Making and curing concrete test specimen in the field.
ASTM C 39	Compressive strength of Cylindrical concrete specimen.
ASTM C 90	Hollow load bearing concrete masonry units.
ASTM C 144	Aggregate for masonry mortar.
ASTM C 270	Mortar for unit masonry.
ASTM C 404	Aggregate for masonry grout.
ASTM E 119	For tests of Building Construction and Materials.
UBC UL 618	Concrete masonry units, fire resistance index.
ACI 531	Building code requirements for concrete masonry structure.

C. Submittals**(01) Samples**

Submit three samples of each type of block required, and the full range of exposed texture to be used in the completed works. The review will be for texture only.

(02) Test Reports

Reports for compressive strengths of masonry units, grout and mortar.

04202 PRODUCTS**A. Materials for Blocks**

Cement, aggregate and water for concrete blocks shall conform to the requirements as specified in the section for "Plain and Reinforced Concrete".

B. Concrete Block Making

- a) The blocks shall be machine moulded. The block making machines shall be of the standard approved by the Engineer. They shall be operated according to the instructions laid down by the manufactures.
- b) The blocks shall be continuously water cured by sprinkling for a minimum of 10 days and covered between sprinkling operations with 4 mils thick polyethylene sheeting. After 10 days water curing period the blocks shall be air dried. Under no circumstances will blocks be used in the work until they are completely dry. During curing period no surface of the block will be allowed to dry.
- c) Cured concrete blocks shall be stored off the ground, stacked on level platforms which allow air circulation under stacked units. Units shall be covered and protected against wetting.
- d) Care shall be exercised in the handling of all concrete blocks. No damaged blocks shall be used in the work.
- e) The blocks cast on different dates shall be stacked separately and must be labelled showing the date on which they are cast.

C. Properties of Blocks

- a) Block sizes, unless otherwise indicated on drawings, shall be 16" x 8" and 16" x 4". Physical requirements shall comply with relevant ASTM or equivalent approved standards.
- b) For non-load bearing wall the cement, sand and coarse aggregate shall be volume batched in the minimum ratio of one part cement, three parts sand and six parts coarse aggregate and shall be mixed in a concrete mixer.
- c) For load bearing Hollow /Solid block wall the mix unless otherwise stated shall be proportioned to meet the following strength requirements:
 - i) Solid Load Bearing Concrete Masonry Units shall have a 28 days compressive strength of not less than 1800 psi (126 kg/cm.sq) average of 3 units tested or 1500 psi (106 kg/cm. sq) per individual unit tested.
 - ii) Hollow Load Bearing Concrete Masonry Units shall comply with ASMT C 90, grade N-1 (moisture controlled), and shall have a 28 day compressive strength of 1350) PSI (96 kg/cm sq.)

The compressive strengths shall be verified by tests in accordance with UBC section 2404, para 2.

- d) The Contractor shall provide test results proving the average minimum crushing strength of the blocks prior to the commencement of the construction. Further test results shall be provided as required by the

Engineer, to ensure that all batches of blocks have the minimum specified crushing strength.

- e) The test shall be carried out by an authority approved by the Engineer. Evidence shall be produced that the block manufacturer has an efficient method of quality control. The Engineer will require to periodically test samples of blocks, and the Contractor shall make any necessary arrangements.
- f) Hollow concrete block units wherever specified shall have cores with cross sectional area at least equal to the percent of gross area of block given below:

8 in. (200mm)	38 percent
6 in. (150mm)	30 percent
4 in. (100mm)	No requirement
- g) Minimum shell wall thickness be 1-1/4 in. (32mm).
- h) Permissible tolerance in size of block shall be 1/8 in (3mm) each way.
- i) Special shapes for lintels, corners jambs sash, clean outs, control joints and headers, bonding and other particular needs shall be provided where required.

D- Suction Rate

The Contractor shall, at his own cost satisfy the Engineer that the suction rate of the block when determined in accordance with Appendix 'A. of BS 3921 does not exceed 20g/dm.sq/min, or that the Contractor is able to adjust it so that it does not exceed this value on Site.

E- Soluble Salt Content

For exposed block work, the contents by weight percent of soluble sulphate, calcium magnesium, potassium and sodium radicals, shall not exceed 0.30, 0.10, 0.03 and 0.03 percent respectively, when ascertained in accordance with BS 3921 at the cost of the Contractor.

F- Mortar Constituents

(01) Cement

Cement shall conform to ASTM C-150, type II low alkali non-staining without air entertainment.

(02) Sand (Aggregate)

Sand and its grading shall comply with the requirements of ASTM C-144 (100% passing the U.S equivalent No. 16 sieve). Sand that has been in contact with seawater shall not be used unless it has been thoroughly washed to the satisfaction of the Engineer.

(03) Water

Water shall conform to the specifications set forth in Section of Plain and Reinforced Concrete.

(04) Lime

Hydrated lime shall conform to ASTM C-207 type S. If it is not available use quick lime according to ASTM C-5

(05) Mortar Proportion and Mixing

a) Cement, Lime and Sand shall be mixed in proportion, by volume, as follows: -

Type (1) 1:1:6 (Cement: Lime: Sand)

Type (2) Alternatively use 1:4 (Cement: sand) mix subject to the prior approval of the Engineer.

b) Mix only as much mortar in a mortar mixture as can be used in one hour for Type-1 and 30 minutes for Type-11 after water has been first mixed into the batch.

c) Do not retemper the mortar.

d) Where cement lime mortar is used, sand and lime shall be mixed first and cement to be added later on.

e) Compressive strength of mortar specimen tested in accordance with ASTM C 39 shall not be less than 3000 psi (210 kg/cm sq.).

G- Reinforcing and Anchors

a) Vertical and horizontal reinforcement, shall be as indicated on the drawing.

b) Block masonry anchors and ties required to connect masonry with structural member shall be 3/8" dia (9.5mm dia) bars every 3rd course, anchored 12" (300mm) in each jointing element.

c) Additional details of anchors, if any, are shown on drawings.

d) Alternate compatible anchoring system may be used subject to the approval of the Engineer.

e) All Reinforcing steel shall conform to ASTM A 615 Grade 40 M.S bars.

04203 EXECUTION**A- Installation**

a) Blocks shall be laid true to line, level and laid in accurately spaced courses in stretcher bond with vertical joints of each course located at centre of units in alternate courses below. Each course shall be properly bonded at corners and intersections of walls. Courses of block shall be kept plumb throughout, and corners reveals shall be true and in plumb.

b) Standard width of mortar joints for both horizontal and vertical joints shall be 1/2" (12.5mm) maximum. Mortar joints in walls shall have full mortar coverage on vertical and horizontal faces between the blocks. Mortar joints on wall including

struck joints, shall be thoroughly compacted and pressed tight against the edges of the blocks with proper tools. Block terminating against soffits of beam or slab construction shall be wedged tight with wedges and the joint shall be packed solidly with mortar between the top of the block and the bottom of slab or beam. Expansion joints shall be kept free from mortar or other debris.

Unless otherwise shown on the drawings or specified by the Engineer, the spaces around door frames and other material or built in items shall be solidly filled with mortar. Spaces around the door and window holdfasts shall be filled in with 3 ksi concrete. Work required to be built in with masonry including door frame anchors, wall plugs, dovetail anchors and accessories shall be built in as the erection progresses.

- c) The block work shall be carried up in uniform manner and no portion shall be carried more than 3. ft (1 metre) above the adjoining one at any time. All masonry shall be kept strictly true and square and the whole properly bonded together and leveled round each floor.
- d) Sleeves, chases and holes etc shall be built in as construction proceeds. Chasing of completed walls or the formation of holes shall only be carried out with the approval of the Engineer.
- e) Walls of blocks indicated as being non-load bearing shall not be constructed on the insitu concrete floor slab unit until the floor shuttering is struck and the concrete has obtained sufficient strength to support their weight. Toothing into load bearing walls shall not be permitted.

B- Curing

Masonry wall shall be cured by keeping it moist with water for at least 10 days after its construction. Engineer may direct additional curing if required.

C- Scaffolding

Contractor shall provide safe scaffolding of adequate strength for use of workmen at all levels and heights at his own expense. Scaffolding which is unsafe in the opinion of the Engineer shall not be used until it has been strengthened and made safe for use of workmen. Cost of scaffolding etc. shall be included by the Contractor in the unit rate for masonry items.

Damage to masonry from scaffolding or from any other object shall be repaired by the Contractor at his own cost.

D- Tolerances

All block work shall be erected plumb and true to line and level with the maximum variation in any storey height or any length of wall being 1/8" (3mm) in 10 feet (3 meter). The maximum tolerance in the length, height or width of any single masonry unit shall be + /- 1/8" (3mm).

04204 MEASUREMENT & PAYMENT

- a) Unless otherwise specifically stated in the Bill of Quantities or herein, all items shall be deemed to be inclusive of, but not limited to the following:
 - i) Labour and all costs in connection therewith.

- ii) Materials, goods and all costs in connection therewith e.g. conveyance; delivery; unloading; storing; returning packing; handling; hoisting; lowering; making curing etc.
- iii) All fixtures and all costs in connection therewith for precast works.
- iv) Fitting and fixing materials and goods in position.
- v) Use of plant and scaffolding.
- vi) Cutting and patching work required for installation of built-in-work.
- vii) Waste of materials.
- viii) Square cutting.
- ix) Establishment charges, overhead charges and profit.
- x) All other expenses, charges and taxes specified in Conditions of Contract.
- b) Works shall be measured net as fixed in position as per Drawings and instructions of the Engineer. Each measurement shall be taken to the nearest 1/2" (12.5mm). This rule shall not apply to any dimensions stated in descriptions.
- c) Masonry work will be paid for according to the actual net area of masonry work in square feet (Sq. M) for the required thickness or the actual net volume of masonry work in cubic feet (Cu. M) as described in the Bill of Quantities. All the openings left in the masonry walls will be deducted.
- d) Providing and fixing all reinforcing bars, reinforcing bar anchors and dovetail anchors shall be deemed to be included in the unit rate for masonry work.
- e) Due to different thicknesses of the slab in different areas or rooms or for any other reason whatsoever, if the chiseling of the masonry is required the Contractor shall do so at his own cost. Where for any reason whatsoever, the height of the wall is short of ceiling height; the remaining height shall be made good with ($f'c = 3000$ psi) concrete. This concrete shall neither be measured nor be paid under item of concrete but will be paid for under the item of masonry of the walls. In case where lintel heights are such that the Contractor has to chisel the masonry or provide cast-in-place concrete to make up the height of the course, no payment will be made for chiseling, but where such cast-in-place concrete is provided, payment for the same will be made at the unit rate for masonry.

04300 BRICK MASONRY**04301 GENERAL****A- Scope of Work**

The work covered by this section of the specifications, consists of furnishing all plant, labour, equipment, applications and materials and in performing all operations in connection with the supply and installation of first class fire-brick masonry including wall ties, anchors, and expansion joints, complete in strict accordance with this section of the specifications and the applicable drawings and subject to the terms and conditions of the contract.

B- Applicable Standards

Latest editions of Pakistani, British and ASTM Standards are relevant to these specifications where applicable.

04302 PRODUCTS**A- GENERAL**

- i) All Portland cement for mortar shall be furnished by the Contractor and shall conform to the applicable requirements specified in the section "Plain and Reinforced Concrete",
- ii) All sand for mortar shall be furnished by the Contractor and shall conform to the applicable requirements for sand specified in the section "Plain and Reinforced concrete",
- iii) All water used in the manufacture of bricks and in the preparation of mortar shall be free from objectionable quantities of silt, organic matter, alkali, salts and other impurities, and will be tested and approved by the Engineer.

B- MORTAR

- i) Mortar for all brick masonry, expected where otherwise directed by the Engineer, shall consist of one part Portland Cement to four parts of damp loose mortar sand by volume and sufficient water to produce the proper consistency for the intended use. Where directed by the Engineer for increased workability, hydrated lime putty, approved by the Engineer, shall be added to the mortar but shall not exceed 25%, by volume of the dry cement.
- ii) Methods and equipment used for mixing mortar shall be such as will accurately determine and control the amount of each separate ingredient entering into the mortar and shall be subject to the approval of the Engineer. Mortar shall be mixed only in sufficient quantities for immediate use and all mortar not used within 30 minutes after addition of the water to the mix shall be wasted. Retempering of mortar will not be allowed. The mixers shall be thoroughly cleaned and washed at the end of each day's work.

C- BRICK

- i) All bricks shall be of first class quality made from good brick earth, free from saline deposits and shall be sand moulded. They shall be thoroughly burnt without being vitrified, shall be regular, uniform in shape and size with sharp and square edges parallel faces and of deep red or copper color. First class bricks shall be homogeneous in texture and emit a clear ringing sound when struck, and shall be free from flaws, cracks, chips, stones and nodules of lime. First class brick in an oven dried condition shall not absorb more than 1/5 of its weight of water immersed one hour in water of 21 to 27 degrees centigrade and shall show no signs of

efflorescence on subsequent drying. The average compressive strength of five representative first class than 5 N/mm.sq. for any individual brick.

All 1st class bricks (i.e. facing bricks) used for external face of cavity walls shall be from Kilns located at Lahore as approved by the Engineer and shall be 9" x 4-1/2" x 3" size having straight / square fine edges parallel faces.

- ii) Fire bricks shall be of best approved quality country made of same size as burnt bricks.
- iii) All bricks shall be manufactured by the Trench Kiln method or other standard methods approved by the Engineer. The earth used In manufacturing bricks shall be carefully selected and shall be free from objectionable quantities of lime, gravel coarse sand, roots, or' other organic matter salts shall not exceed 0.3 % and calcium carbonate shall not exceed 2.0%.
- iv) The moulds used in the manufacture of bricks shall be thoroughly sanded before each use and shall be sufficiently larger than the size of the bricks being manufactured to allow for shrinkage in drying and burning. Over size irregular and worn moulds shall be destroyed. Each finished brick for brick masonry shall be 9" by 4.56" by 3" in size and weigh between 3.2 to 4.2 Kilograms. All bricks shall have a "frog" 1/4" deep on one face.

D- PLACING

- i) The methods and equipment used for transporting the bricks and mortar shall be such as will not damage the brick nor delay the use of mixed mortar. Brick shall not be placed during rains sufficiently heavy or prolonged to wash the mortar from the brick. Mortar already spread, which becomes diluted by rain shall be removed and replaced before continuing with the work. All brick to be used in brick masonry shall be moistened with water from three to four hours before they are used by a method, which will ensure that each is thoroughly and uniformly wetted. All bricks shall be free from water adhering to their surface when they are placed in the brick masonry.
- ii) Bricks shall be laid "Frog" upward with mortar Joints and in english bond as shown on the Drawings or as directed by the Engineer. Both bed and vertical Joints shall be 1/4" in thickness completely filled with cement mortar as specified herein, and each brick shall be bedded by firmly tapping with the handle of the trowel. All horizontal Joints shall be parallel and all vertical Joints in alternate, courses shall be directly over one another. Excess mortar at the outer edges shall be removed and Joints drawn straight with the edge of a trowel and a straight edge. All anchors and similar work required to be embedded in the brick masonry shall be installed as the work progresses. At the completion of the work all holes or defective mortar joints shall be cut out and re-pointed.
- iii) The exterior faces of the walls shall be finished by striking the Joints as the work proceeds. The Joints shall be struck by raking the green mortar after the brick work has been laid and finishing the Joint with a pointing tool. Horizontal Joints shall be struck to form weathered Joints and vertical Joints shall be struck with a V notch. Care shall be taken that the striking tools do not develop a cutting edge, as the object of striking the joint is to compress the mortar into the joints.

E- CURING, REPAIR AND CLEANING

- i) All brick masonry shall be water cured and shall be kept wet for at least seven days by an approved method which will keep all surfaces to be cured

continuously wet. Water used for curing shall meet the requirements of these specifications for water used in the manufacture of bricks.

- ii) If, after the completion of any brick masonry work, the brick is not in alignment or level, or does not conform to the lines and grades shown on the Drawings, or shows a defective surface, it shall be removed and replaced by the Contractor at his expense unless the Engineer grants permission, in writing to patch or replaced the defective area. .
- iii) All finished fair face brick work shall be washed / cleaned with diluted oxalic acid as approved by the Engineer.

F- SCAFFOLDING

Contractor shall provide safe scaffolding of adequate strength for use of workmen at all levels and heights at his own expenses, scaffolding which is unsafe in the opinion of the Engineer shall not be used until it has been strengthened and made safe for use of workmen. Cost of scaffolding etc shall be included by the Contractor in the unit rate for masonry items.

Damaged masonry from scaffolding or from any other objection shall be repaired by the Contractor at his own cost.

G- TOLERANCES

The brick work shall be erected plumb and true to line at level with the maximum variation in any storey height many length of wall being One millimetre in One meter. The maximum tolerance in the length, height or width of any single masonry unit shall be $\pm 1/8"$ / $\pm 3\text{mm}$.

04303 MEASUREMENT AND PAYMENT

A- General

Except otherwise specified herein or else where In the Contract documents, on measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. .

- i) Cutting and Chiseling of masonry wherever required.
- ii) Cement sand mortar used in laying bricks including wastage.
- iii) Curing & repairing the masonry work.
- iv) All joint reinforcing bars, reinforcing anchor bars and dove tail anchors.

B- Measurement

Measurement of acceptable completed works of brick masonry will be made on the basis of number of cu.ft/cubic meter provided & installed in position as shown on the drawing or as directed by the Engineer.

C- Payment

Payment will be made for acceptable measured quantity of brick masonry on the basis of unit rate per cu.ft/cubic meter quoted in the Bill of Quantities & shall constitute full compensation for all the works related to the items