

PART V
Chapter 2
Building Materials

2.1 General

Materials used for the construction of buildings shall conform to standard specifications listed in this Part of the Code. Any deviation from the type design or architectural detail from those specified in these standards may be accepted by the Building Official as long as the materials standards specified therein are conformed with.

2.1.1 New or Alternative Materials

The provisions of this Part are not intended to prevent the use of any new and alternative materials. Any such material may be approved provided it is shown to be satisfactory for the purpose intended and at least equivalent of that required in this Part in quality, strength, effectiveness, fire resistivity, durability, safety, maintenance and compatibility.

Approval in writing shall be obtained by the owner or his agent before any new, alternative or equivalent materials are used. The Building Official shall base such approval on the principle set forth above and shall require that specified tests be made as per Sec 2.1.4 or sufficient evidence or proof be submitted, at the expense of the owner or his agent, to substantiate any claim for the proposed material.

2.1.2 Used Materials

The provisions of this Part do not preclude the use of used or reclaimed materials provided such materials meet the applicable requirements as for new materials for their intended use.

2.1.3 Storage of Materials

All building materials shall be stored at the building site(s) in such a way as to prevent deterioration or the loss or impairment of their structural and other essential properties (Part 7 of this Code).

2.1.4 Methods of Test

Every test of material required in this Part, or by the Building Official, for the control of quality and for the fulfillment of design and specification requirements, shall be carried out in accordance with a standard method of test issued by the Bangladesh Standards and Testing Institution (BSTI). In the absence of Bangladesh Standards, the Building Official shall determine the test procedures. Laboratory tests shall be conducted by recognized laboratories acceptable to the Building Official.

If, in the opinion of the Building Official, there is insufficient evidence of compliance with any of the provisions of the Code or there is evidence that any material or construction does not conform to the requirements of this Code, the Building Official may require tests to be performed as proof of compliance. The cost of any such test shall be borne by the owner.

The manufacturer or supplier shall satisfy himself that the materials conform to the relevant standards and if requested shall furnish a certificate or guarantee to this effect.

2.2 Masonry

2.2.1 Aggregates

Aggregates for masonry shall conform to the standards listed as follows: ASTM C144 Aggregates for Masonry Mortar; ASTM C404 Aggregates for Masonry Grout; ASTM C331 Lightweight Aggregates for Concrete Masonry Units (the applicable Standards for masonry are listed at the end of this Section).

2.2.2 Cement

Cement for masonry shall conform to the standards listed as follows: BDS EN 197-1: 2003 Cement Part-1 Composition, specifications and conformity criteria for common cements; or ASTM C150/C150M Portland Cement; ASTM C91 Masonry Cement; ASTM C595/C595M Blended Hydraulic Cements.

2.2.3 Lime

Limes for masonry shall conform to the standards listed as follows: ASTM C5, Quicklime for Structural Purposes; ASTM C207, Hydrated Lime for Masonry Purposes.

2.2.4 Masonry Units

- (a) Clay: Masonry units of clay (or shale) shall conform to the standards listed as follows: BDS 208: 2009, Common building clay bricks; BDS 1249:1989, Acid resistant bricks; BDS 1250: 1990, Burnt clay facing bricks; BDS 1263: 1990, Burnt clay hollow bricks for walls and partitions; BDS 1264 : 1990, Glossary of terms relating to structural clay products; BDS 1432: 1993, Burnt clay perforated building bricks; BDS 1803: 2008, Specification for hollow clay bricks and blocks; ASTM C34 Structural Clay Load-Bearing Wall Tile; ASTM C212 Structural Clay Facing Tile; ASTM C56 Structural Clay Non-Load-Bearing Tile; and IS 7556 Burnt clay jallies.

(b) Concrete: Concrete masonry units shall conform to the standards listed as follows :

BDS EN 771-3	Specification for masonry units-Part: 3 Aggregate concrete masonry units (dense and lightweight aggregates).
BDS EN 772-1	Methods of test for masonry units-Part 1: Determination of compressive strength.
BDS EN 772-2	Methods of test for masonry units-Part 2: Determination of percentage area of voids in masonry units (by paper indentation).
BDS EN 772-6	Methods of test for masonry units-Part 6: Determination of bending tensile strength of aggregate concrete masonry units.
BDS EN 772-11	Methods of test for masonry units-Part 11: Determination of water absorption of aggregate concrete, autoclaved aerated concrete, manufactured stone and natural stone masonry units due to capillary action and the initial rate of water absorption of clay masonry units.
BDS EN 772-13	Methods of test for masonry units-Part 13: Determination of net and gross dry density of masonry units (except for natural stone).
BDS EN 772-14	Methods of test for masonry units-Part 14: Determination of moisture movement of aggregate concrete and manufactured stone masonry units.
BDS EN 772-16	Methods of test for masonry units-Part 16: Determination of dimensions.
BDS EN 772-20	Methods of test for masonry units-Part 20: Determination of flatness of faces of masonry units.
BDS EN 1052-3	Methods of test for masonry-Part 3: Determination of initial shear strength BDS EN 1745: 2009 Masonry and masonry products-Methods for determining design thermal values.
ASTM C55	Concrete Building Bricks.
ASTM C90	Specification for Load-Bearing Concrete Masonry Units.
ASTM C129	Non-Load Bearing Units.

(c) Others

Calcium Silicate	Calcium Silicate Face Brick (Sand-Lime Brick) shall conform to ASTM C73 Standard Specification.
Glazed Masonry Units	Glazed Masonry building units shall conform to the standards listed as follows: ASTM C126, Ceramic-Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units; or ASTM C744 Prefaced Concrete and Calcium Silicate Masonry Units.
Glass Block	Glass block may be solid or hollow and contain inserts; all mortar contact surfaces shall be treated to ensure adhesion between mortar and glass.
Un-burnt Clay Masonry Units	Masonry of un-burnt clay units including cement stabilized and lime stabilized blocks shall not be used, in any building more than one storey in height.
Architectural Terra Cotta	All architectural terra cotta units shall be formed with a strong homogeneous body of hard-burnt weather-resistant clay which gives off a sharp metallic ring when struck. All units shall be formed to engage securely with and anchor to the structural frame or masonry wall.
Natural Stone	Natural stone for masonry shall be sound and free from loose friable inclusions. Natural stone shall have the strength and fire resistance required for the intended use.
Cast Stone	All cast stone shall be fabricated of concrete or other approved materials of required strength, durability and fire resistance for the intended use and shall be reinforced where necessary.
AAC Masonry	AAC (Autoclaved Aerated Concrete) masonry units shall conform to ASTM C1386 for the strength class specified.
Ceramic tile	Ceramic tile shall be as defined in, and shall conform to the requirements of ANSI A137.1.
Second Hand Units	Second hand masonry units shall not be used unless the units conform to the requirements for new units. The units shall be of whole, sound material and be free from cracks and other defects that would interfere with proper laying or use. All old mortar shall be cleaned from the units before reuse.

2.2.5 Mortar

Mortar shall consist of a mixture of cementitious material and aggregates to which sufficient water and approved additives, if any, have been added to achieve a workable, plastic consistency. Cementitious materials for mortar shall be one or more of the following: lime, masonry cement, Portland cement and mortar cement. Mortar for masonry construction other than the installation of ceramic tile shall conform to the requirements of BDS 1303: 1990 Chemical resistant mortars; BDS 1304:1990 Methods of test for chemical resistant mortars; ASTM C270, Mortar for Unit Masonry.

2.2.6 Grout

Grout shall consist of a mixture of cementitious materials and aggregates to which water has been added such that the mixture will flow without segregation of the constituents. Cementitious materials for grout shall be one or both of the following: Lime and Portland cement. Grout shall have a minimum compressive strength of 13 MPa. Grout used in reinforced and unreinforced masonry construction shall conform to the requirements of ASTM C476 Grout for Masonry.

2.2.7 Mortar for Ceramic Wall and Floor Tile

Portland cement mortars for installing ceramic wall and floor tile shall comply with ANSI A 108.1-2005 listed in Sec 2.2.11 and be of the composition specified in Table 5.2.1.

2.2.7.1 Dry-set leveling cement mortars

Premixed prepared leveling cement mortars, which require only the addition of water and are used in the installation of ceramic tile, shall comply with ANSI A118.1. The shear bond strength for tile set in such mortar shall be as required in accordance with ANSI A118.1. Tile set in dry-set Portland cement mortar shall be installed in accordance with ANSI A108.5.

2.2.7.2 Latex-modified leveling cement mortar

Latex-modified leveling cement thin-set mortars in which latex is added to dry-set mortar as a replacement for all or Part of the gauging water that are used for the installation of ceramic tile shall comply with ANSI A118.4. Tile set in latex-modified leveling cement shall be installed in accordance with ANSI A108.5.

2.2.7.3 Epoxy mortar

Ceramic tile set and grouted with chemical-resistant epoxy shall comply with ANSI A118.3. Tile set and grouted with epoxy shall be installed in accordance with ANSI A108.6.

2.2.7.4 Furan mortar and grout

Chemical-resistant furan mortar and grout that are used to install ceramic tile shall comply with ANSI A118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A108.8.

2.2.7.5 Modified epoxy-emulsion mortar and grout

Modified epoxy-emulsion mortar and grout that are used to install ceramic tile shall comply with ANSI A118.8. Tile set and grouted with modified epoxy-emulsion mortar and grout shall be installed in accordance with ANSI A108.9.

2.2.7.6 Organic adhesives

Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A136.1. The shear bond strength after water immersion shall not be less than 275 kPa (40 psi) for Type I adhesive and not less than 138 kPa (20 psi) for Type II adhesive when tested in accordance with ANSI A136.1. Tile set in organic adhesives shall be installed in accordance with ANSI A108.4.

2.2.7.7 Portland cement grouts

Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A108.10.

2.2.7.8 Mortar for Autoclaved Aerated Concrete (AAC) masonry

Thin-bed mortar for AAC masonry shall comply with Article 2.1 C.1 of TMS 602/ACI 530.1/ASCE 6. Mortar used for the leveling courses of AAC masonry shall comply with Article 2.1 C.2 of TMS 602/ACI 530.1/ASCE 6.

2.2.8 Metal Ties and Anchors

Metal ties and anchors shall conform to the standards listed as follows: ASTM A82/A82M, Wire Anchor and Ties; and ASTM A1008/A1008M, Sheet Metal Anchors and Ties.

Table 5.2.1: Ceramic Tile Mortar Compositions

Walls	Scratch coat	1 cement, 0.20 hydrated lime*, 4 dry or 5 damp sand
	Setting bed and leveling coat	1 cement, 0.50 hydrated lime, 5 damp sand to 1 cement, 1 hydrated lime; 7 damp sand
Floors	Setting bed	1 cement; 0.10 hydrated lime; 5 dry or 6 damp sand; or 1 cement; 5 dry or 6 damp sand
Ceilings	Scratch coat and sand bed	1 cement; 0.50 hydrated lime; 2.50 dry sand or 3 damp sand

* Lime may be excluded from the mortar if trial mixes indicate that the desired workability and performance are achieved without lime.

2.2.9 Reinforcement

Reinforcement in masonry shall conform to the standards listed as follows: ASTM A82/A82M, Cold Drawn Steel Wire for Concrete Reinforcement; ASTM A615/A615M, Deformed and Plain Billet Steel Bars; ASTM A996/A996M, Rail-Steel Deformed and Plain Bars; ASTM A996/A996M, Axle-Steel Deformed and Plain Bars; ASTM A706/A706M, Low-Alloy Steel Deformed Bars; ASTM A767/A767M, Zinc-Coated (Galvanized) Steel Bars; and ASTM A775/A775M, Epoxy-Coated Reinforcing Steel Bars.

2.2.10 Water

Water used in mortar or grout shall be clean and free of deleterious amounts of acid, alkalis or organic material or other harmful substances.

2.2.11 Applicable Standards for Masonry

The applicable standards for Masonry are listed below:

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| BDS EN 197-1 | Cement Part-1 Composition, Specifications and Conformity Criteria for Common Cements. |
| BDS 208 | Specification for Common Building Clay Bricks : Specifies the dimensions, quality and strength of common burnt clay bricks, methods of sampling, testing etc. |

BDS 238	Fire Clay Refractory Bricks and Shapes for General Purposes: This Standard specifies the requirements for fireclay refractory bricks and shapes meant for general purpose; the products are classified in four grades according to the duty for which they are suitable.
BDS 1249	Acid Resistant Bricks: It specifies the requirements for acid-resistant bricks, dimensions, tolerances, test etc.
BDS 1250	Burnt Clay Facing Bricks: It specifies the dimensions, quality and strength of burnt clay facing bricks used in building and other structure, physical requirements etc.
BDS 1263	Burnt Clay Hollow Bricks for Walls and Partitions: It covers the dimensions, quality and strength for hollow bricks made from burnt clay and having perforations through and at right angle to the bearing surface tests.
BDS 1264	Glossary of Terms Relating to Structural Clay Products: It covers the definition of common terms applicable to structural clay products, used in building and civil engineering works.
BDS 1432	Burnt Clay Perforated Building Bricks: Specifies the requirements in regard to dimensions, perforations, quality, strength and also for quality of surface in case of special grade for facing bricks of perforated burnt clay building bricks for use in walls and partitions.
BDS 1433	Dimensions quantities in general construction work: Specifies the various dimensional values in SI units used in general construction work.
BDS 1803	Specification for hollow clay bricks and blocks.
BDS EN 1338	Concrete paving blocks-Requirements and test methods.
BDS EN 1339	Concrete paving flags-Requirements and test methods.
BDS EN 1340	Concrete kerb units-Requirements and test methods.
BDS EN 13369	Common rules for precast concrete products.
BDS EN 771-3	Specification for masonry units Part 3: Aggregate concrete masonry units (dense and lightweight aggregates).
BDS EN 772-1	Methods of test for masonry units Part 1: Determination of compressive strength.

BDS EN 772-2	Methods of test for masonry units Part 2: Determination of percentage area of voids in masonry units (by paper indentation).
BDS EN 772-6	Methods of test for masonry units Part 6: Determination of bending tensile strength of aggregate concrete masonry units.
BDS EN 772-11	Methods of test for masonry units Part 11: Determination of water absorption of aggregate concrete, autoclaved aerated concrete, manufactured stone and natural stone masonry units due to capillary action and the initial rate of water absorption of clay masonry units.
BDS EN 772-13	Methods of test for masonry units Part 13: Determination of net and gross dry density of masonry units (except for natural stone).
BDS EN 772-14	Methods of test for masonry units Part 14: Determination of moisture movement of aggregate concrete and manufactured stone masonry units.
BDS EN 772-16	Methods of test for masonry units Part 16: Determination of dimensions.
BDS EN 772-20	Methods of test for masonry units Part 20: Determination of flatness of faces of masonry units.
BDS EN 1052-3	Methods of test for masonry Part 3: Determination of initial shear strength.
BDS EN 1745	Masonry and masonry products: Methods for determining design thermal values.
ANSI A108.1A	Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.
ANSI A108.1B	Installation of Ceramic Tile, Quarry Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex-Portland Mortar.
ANSI A108.1	Specifications for the Installation of Ceramic Tile with Portland Cement Mortar.
ASTM A82/ A82M	Specification for Steel Wire, Plain, for Concrete Reinforcement.

ASTM A1008/ A1008M	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
ASTM A615/A615M	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
ASTM A996/A996M	Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
ASTM A706/A706M	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
ASTM A183	Standard Specification for Carbon Steel Track Bolts and Nuts.
ASTM A775/A775M	Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
ASTM C5	Standard Specification for Quicklime for Structural Purposes.
ASTM C34	Standard Specification for Structural Clay Load-Bearing Wall Tile.
ASTM C55	Standard Specification for Concrete Building Brick.
ASTM C56	Standard Specification for Structural Clay Non load bearing Tile.
ASTM C73	Standard Specification for Calcium Silicate Brick (Sand-Lime Brick).
ASTM C90	Standard Specification for Load bearing Concrete Masonry Units.
ASTM C91	Standard Specification for Masonry Cement.
ASTM C126	Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
ASTM C129	Standard Specification for Non-load bearing Concrete Masonry Units.
ASTM C144	Standard Specification for Aggregate for Masonry Mortar.
ASTM C90	Standard Specification for Load bearing Concrete Masonry Units.
ASTM C150/ C150M	Standard Specification for Portland Cement.

ASTM C207	Standard Specification for Hydrated Lime for Masonry Purposes.
ASTM C212	Standard Specification for Structural Clay Facing Tile.
ASTM C270	Standard Specification for Mortar for Unit Masonry.
ASTM C331	Standard Specification for Lightweight Aggregates for Concrete Masonry Units.
ASTM C404	Standard Specification for Aggregates for Masonry Grout.
ASTM C476	Standard Specification for Grout for Masonry.
ASTM C595/C595M	Standard Specification for Blended Hydraulic Cements.
ASTM C744	Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.

2.3 Cement and Concrete

2.3.1 General

Materials used to produce concrete, and admixtures used for concrete shall comply with the requirements of this Section and those of Chapter 5 Part 6 of this Code.

2.3.2 Aggregates

Concrete aggregates shall conform to the following standards:

BDS 243: 1963, Coarse and Fine Aggregates from Natural Sources for Concrete; ASTM C33/C33M Concrete Aggregates; ASTM C330/C330M Lightweight Aggregates for Structural Concrete; ASTM C637 Aggregates for Radiation-Shielding Concrete; ASTM C332 Lightweight Aggregate for Insulating Concrete; IS: 9142 Artificial lightweight aggregates for concrete masonry units.

2.3.2.1 Special tests

Aggregates failing to meet the specifications listed in Sec 2.4.2 shall not be used unless it is shown by special test or actual service experience to produce concrete of adequate strength and durability and approved by the Building Official.

2.3.2.2 Nominal size

Nominal maximum size of coarse aggregate shall not be larger than:

- (a) One-fifth of the narrowest dimension between sides of forms; or
- (b) One-third the depth of slabs; or
- (c) Three fourths the minimum clear spacing between individual reinforcing bars or wires, bundles of bars, or pre-stressing tendons or ducts.

Exception:

The above limitations regarding size of coarse aggregate may be waived if, in the judgment of the Engineer, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids.

2.3.3 Cement

Cement shall conform to the following standards: BDS EN 197-1:2003 Cement Part-1 Composition, specifications and conformity criteria for common cements, BDS 612 Sulphate resisting Portland cement-type A, ASTM C150/C150M Standard Specification for Portland Cement, BDS 232 Portland cement, ASTM C595/C595M Blended Hydraulic Cements, and to other such cements listed in ACI 318.

2.3.4 Water

Water used in mixing concrete shall be clean and free from injurious amounts of oils, alkalies salts, organic materials or other substances that may be deleterious to concrete or reinforcement. Water shall conform to the following standards: BDS ISO 12439:2011 Mixing water for concrete.

2.3.4.1 Chloride ions

Mixing water for pre-stressed concrete or for concrete that will contain aluminium embedment, including the portion of mixing water contributed in the form of free moisture on aggregates shall not contain deleterious amounts of chloride ion. The maximum water-soluble chloride ion concentration in concrete shall not exceed the limitations specified in Sec 5.5.3 Part 6.

2.3.4.2 Potability

Nonpotable water shall not be used in concrete unless the following are satisfied:

- (a) Selection of concrete proportions shall be based on concrete mixes using water from such source.
- (b) Mortar test cubes made with non-potable mixing water shall have 7 days and 28 days strengths equal to at least 90 percent of strengths of similar specimens made with potable water.

2.3.5 Admixtures

Admixtures to be used in concrete shall be subject to prior approval by the Building Official and shall comply with Sections 2.4.5.1 to 2.4.5.5. Admixtures shall conform following standards:

- BDS EN 934-1 Admixtures for Concrete, Mortar and Grout-Part 1: Common Requirements.
- BDS EN 934-2 Admixtures for Concrete, Mortar and Grout-Part 2: Concrete Admixtures Definitions, Requirements, Conformity, Marking and Labelling.

2.3.5.1 Chloride

Calcium chloride or admixtures containing chloride from admixture ingredients shall not be used in prestressed concrete, concrete containing embedded aluminium in concrete cast against permanent galvanized metal forms, or in concrete exposed to severe or very severe sulphate-containing solutions (Sec 5.5.2.1 Part 6).

2.3.5.2 Standards

Air-entraining admixtures shall conform to ASTM C260 Standard Specification for Air-entraining Admixtures for Concrete. Water-reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and retarding admixtures, and water-reducing and accelerating admixtures shall conform to ASTM C494/C494M Chemical Admixtures for Concrete, or ASTM C1017/C1017M Chemical Admixtures for Use in Producing Flowing Concrete.

2.3.5.3 Pozzolanas

Fly ash (Pulverized Fuel Ash) or other Pozzolanas used as admixtures shall conform to ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolanas for Use in Concrete.

2.3.5.4 Blast furnace slag

Ground granulated blast-furnace slag used as an admixture shall conform to ASTM C989 Standard Specification for Slag Cement for Use in Concrete and Mortars.

2.3.5.5 Pigment for coloured concrete

Pigment for integrally coloured concrete shall conform to ASTM C979 Standard Specification for Pigments for Integrally Colored Concrete.

2.3.6 Metal Reinforcement

Reinforcement and welding of reinforcement to be placed in concrete shall conform to the requirements of this Section.

- (a) Deformed Reinforcement: Deformed reinforcing bars shall conform to the following Standards; BDS ISO 6935-2:2010, Steel for the reinforcement of concrete-Part-2: Ribbed bars; Reinforcement conforming to the ASTM, Standards: A615/A615M Deformed and Plain Billet-Steel Bars; A616M, Rail-Steel Deformed and Plain Bars; A617M Axle-Steel Deformed and Plain Bars; A706M Low-Alloy Steel Deformed Bars; A767M Zinc Coated (Galvanized) Steel Bars; and A775M Epoxy-Coated Reinforcing Steel.

Deformed reinforcing bars with a specified yield strength f_y exceeding 410 MPa may be used, provided f_y shall be the stress corresponding to a strain of 0.35 percent and the bars otherwise conform to ASTM standards noted above. Fabricated deformed steel bar mats conforming to ASTM A184/A184M and deformed steel wire complying with ASTM A496/A496M may be used. Deformed wire for concrete reinforcement shall not be smaller than size D4 (nominal diameter: 5.72 mm), and for wire with a specified yield strength, f_y exceeding 410 MPa, f_y shall be the stress corresponding to a strain of 0.35 percent.

Welded deformed steel wire fabric conforming to ASTM A497/A497M may be used; for a wire with specified yield strength f_y exceeding 410 MPa, f_y shall be the stress corresponding to a strain of 0.35 percent. Welded intersections shall not be spaced farther apart than 400 mm in direction of calculated stress, except for wire fabric used as stirrups.

- (b) Plain Reinforcement: Plain reinforcement shall conform to the following BDS and ASTM Standards. BDS ISO 6935-1:2010; ASTM A615/A615M; ASTM A996/A996M and ASTM A996/A996M. Steel welded wire, fabric plain reinforcement conforming to ASTM A185/A185M may be used, except that for wire with specified yield strength f_y exceeding 410 MPa, f_y shall be the stress corresponding to a strain of 0.35 percent. Welded intersections shall not be spaced farther apart than 300 mm in direction of calculated stress, except for wire fabric used as stirrups.

Smooth steel wire conforming to ASTM A182/A182M may be used in concrete; except that for a wire with specified yield strength f_y exceeding 410 MPa, f_y shall be the stress corresponding to a strain of 0.35 percent.

- (c) Cold-worked Steel Reinforcement: Cold-worked steel high strength bars shall conform to IS 1786 or BS 4461: 1978.
- (d) Pre-stressing Tendons: Wire, strands and bars for tendons in pre-stressed concrete shall conform to BDS: 240 Plain cold drawn steel wire; ASTM A416/A416M Steel Strand Uncoated Seven-Wire Stress Relieved; ASTM A421/A421M: Uncoated Stress Relieved Steel Wire; and ASTM A722/A722M: Uncoated High-Strength Steel Bar.

Wires, strands and bars not specifically listed in the above standards may be used, provided they conform to minimum requirements of these specifications and do not have properties that make them less satisfactory than those listed.

- (e) Structural Steel, Steel Pipe or Tubing: Structural steel used with reinforcing bars in composite compression members meeting the requirements of the Code shall conform to ASTM A36/A36M Structural Steel; ASTM A242/A242M High Strength Low-Alloy Structural Steel; ASTM A572/A572M High-Strength Low-Alloy Columbium-Vanadium Steel; and ASTM A588/A588M High-Strength Low-Alloy Structural Steel.

Steel pipe or tubing for composite compression members composed of a steel-encased concrete core meeting the requirements of this Code shall conform to ASTM A53/A53M Pipe, Steel, Black and Hot Dipped Zinc Coated Welded and Seamless; ASTM A500/A500M Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; and ASTM A501 Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

2.3.7 Applicable Standards

Materials used in concrete shall comply with the applicable standards listed below.

BDS 279	Specification for Abrasion of Coarse Aggregates by Use of Los Angeles Machine (under revision).
BDS 281	Specification for Organic Impurities in Sands for Concrete (under revision).
BDS 921	Specification for Standard Sand for Testing of Cement.
BDS 240	Specification for Plain Cold Drawn Steel Wire for Pre-stressed Concrete.
BDS 243	Specification for Coarse and Fine Aggregates from Natural Sources for Concrete.
BDS ISO 1920-8	Testing of Concrete-Part 8: Determination of Drying Shrinkage of Concrete for Samples Prepared in the Field or in the Laboratory.
BDS ISO 1920-9	Testing of Concrete-Part 9: Determination of Creep of Concrete Cylinders in Compression.
BDS ISO 1920-10	Testing of Concrete-Part 10: Determination of Static Modulus of Elasticity in Compression.
BDS ISO 22965-1	Concrete-Part 1: Methods of Specifying and Guidance for the Specifier.

BDS ISO 22965-2	Concrete-Part 2: Specification of Constituent Materials, Production of Concrete and Compliance of Concrete.
ASTM C31/C31M	Standard Practice for Making and Curing Concrete Test Specimens in the Field.
ASTM C39/C39M	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C42/C42M	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
ASTM C78	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C94/C94M	Standard Specification for Ready-Mixed Concrete.
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete.
ASTM C192/C192M	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
ASTM C317/C317M	Standard Specification for Gypsum Concrete.
ASTM C496/C496M	Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
ASTM C617	Standard Practice for Capping Cylindrical Concrete Specimens.
ASTM C685/C685M	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
ASTM C989	Standard Specification for Slag Cement for Use in Concrete and Mortars.

2.3.8 Concrete Pipe and Precast Sections

Concrete pipes and precast sections shall conform to the Standards listed below:

BDS 1626	Concrete pipes (with and without) reinforcement.
ASTM C14M	Standard Specification for Non-reinforced Concrete Sewer, Storm Drain, and Culvert Pipe (Metric).
ASTM C76M	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric).

ASTM C361M	Standard Specification for Reinforced Concrete Low-Head Pressure Pipe (Metric).
ASTM C444M	Standard Specification for Perforated Concrete Pipe (Metric).
ASTM C478M	Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
ASTM C507M	Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe (Metric).
ASTM C654M	Standard Specification for Porous Concrete Pipe (Metric).
ASTM C655M	Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe (Metric).
ASTM C1433M	Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers (Metric).
ASTM C858	Standard Specification for Underground Precast Concrete Utility Structures.
ASTM C891	Standard Practice for Installation of Underground Precast Concrete Utility Structures.
ASTM C913	Standard Specification for Precast Concrete Water and Wastewater Structures.
ASTM C924M	Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method (Metric).
IS 458	Specification for precast concrete pipes with and without reinforcement.
IS 784	Specification for pre-stressed concrete pipes.
IS 1916	Specification for steel cylinder pipe with concrete lining and coating.
IS 3597	Methods of test for concrete pipes.
IS 4350	Specification for concrete porous pipes for under drainage.
IS 7319	Specification for perforated concrete pipes.
IS 7322	Specification for specials for steel cylinder reinforced concrete pipes.

2.4 Pre-Stressed Concrete

2.4.1 Concrete for Pre-stressed Concrete

Cement and concrete required for pre-stressed concrete are elaborately described in Sec 2.3 of this Part. BDS and other standards for concrete as a material are also contained in the same section.

2.4.2 Steel for Pre-stressed Concrete

Steel and tendons for pre-stressed concrete along with the BDS and other standard requirements are included in Sec 2.8 of this Part.

Steel material for pre-stressed concrete shall also conform following Standards.

BDS ISO 6934-1	Steel for the prestressing of concrete-Part 1: General requirements.
BDS ISO 6934-2	Steel for the prestressing of concrete-Part 2: Cold-drawn wire.
BDS ISO 6934-3	Steel for the prestressing of concrete-Part 3: Quenched and tempered wire.
BDS ISO 6934-4	Steel for the prestressing of concrete-Part 4: Strand.
BDS ISO 6934- 5	Steel for the Prestressing of concrete-Part 5: Hot-rolled steel bars with or without subsequent processing.
BDS ISO 6935 (Part-1)	Steel for the reinforcement of concrete-Part-1: Plain bars.
BDS ISO 6935 (Part-2)	Steel for the reinforcement of concrete-Part-2: Ribbed bars.
BDS ISO 6935 (Part-3)	Steel for the reinforcement of concrete-Part-3: Welded fabric. Specifies technical requirements for factory made sheets or rolls welded fabric manufacture from steel wires or bars with diameters from 4 mm to 16 mm and designed for reinforcement in ordinary concrete structured and for non-prestressed reinforcement in prestressed concrete structures.
BDS ISO 10065	Steel bars reinforcement of concrete bend and re-bend tests.
BDS ISO 15835-1	Steel for the reinforcement of concrete-Reinforcement couplers for mechanical splices of bars-Part 1: Requirements.

BDS ISO 15835-2	Steel for the reinforcement of concrete-Reinforcement couplers for mechanical splices of bars-Part 2: Test methods.
BDS ISO 10144	Certification scheme for steel bars and wires for the reinforcement of concrete structures.
BDS ISO 15630-1	Steel for the reinforcement and Prestressing of concrete-Test methods-Part 1: Reinforcing bars, wire rod and wire.
BDS ISO 15630-2	Steel for the reinforcement and prestressing of concrete-Test methods-Part 2: Welded fabric.
BDS ISO 15630-3	Steel for the Reinforcement and prestressing of concrete-Test methods-Part 3: Prestressing steel.
BDS ISO 16020	Steel for the reinforcement and prestressing of concrete-Vocabulary.

2.5 Building Limes

2.5.1 Types of Lime

According to the degree of calcinations, slaking and setting actions and depending upon the nature and amount of foreign matters associated with, the limes are classified as: (i) High calcium, fat, rich, common or pure lime; (ii) Lean, meager or poor lime; and (iii) Hydraulic or water lime

2.5.2 Properties of Lime

A good lime should slake readily in water, dissolve in soft water, free from fuel ashes and unburnt particles and have good setting power under water.

Building limes shall comply with the following ASTM standard specifications: ASTM C206 Finishing Hydrated Lime; ASTM C207 Hydrated Lime for Masonry Purposes; ASTM C141/C141M Hydraulic Hydrated Lime for Structural Purposes; ASTM C977 Quicklime and Hydrated Lime for Soil Stabilization; and ASTM C5 Quicklime for Structural Purposes.

The following Indian Standards may also be accepted for lime concrete and testing of building limes:

IS712	Specification for building limes.
IS1624	Method of field testing of building lime.
IS 2686	Specification for cinder aggregates for use in lime concrete.

IS 3068	Specification for broken brick (burnt clay) coarse aggregates for use in lime concrete.
IS 3115	Specification for lime-based blocks.
IS 3182	Specification for broken brick (burnt clay) fine aggregates for use in lime mortar.
IS 4098	Specification for lime-pozzolana mixture.
IS 4139	Specification for sand-lime bricks.
IS 6932 (Parts I to XI)	Method of tests for building limes.
IS 10360	Specification for lime-pozzolana concrete blocks for paving.
IS 10772	Specification for quick setting lime pozzolana mixture.
IS12894	Specification for pulverized fuel ash lime bricks.

2.6 Gypsum Based Materials and Plaster

2.6.1 Gypsum Board

Gypsum wallboard, gypsum sheathing, gypsum base for gypsum veneer plaster, exterior gypsum soffit board, pre-decorated gypsum board or water resistant gypsum backing board complying with the standards listed below.

2.6.2 Gypsum Plaster

A mixture of calcined gypsum or calcined gypsum and lime and aggregate and other approved materials as specified in this Code.

2.6.3 Gypsum Veneer Plaster

Gypsum plaster applied to an approved base in one or more coats normally not exceeding 1/4 inch (6.4 mm) in total thickness.

2.6.4 Cement Plaster

A mixture of Portland or blended cement, Portland cement or blended cement and hydrated lime, masonry cement or plastic cement and aggregate and other approved materials as specified in this Code.

Gypsum building materials shall conform to the Standards listed below.

ASTM C22/C22M	Standard Specification for Gypsum.
ASTM C28/C28M	Standard Specification for Gypsum Plasters.
ASTM C35	Standard Specification for Inorganic Aggregates for Use in Gypsum Plaster.
ASTM C59/C59M	Standard Specification for Gypsum Casting Plaster and Gypsum Molding Plaster.
ASTM C317/ C317M	Standard Specification for Gypsum Concrete.
ASTM C471M	Standard Test Methods for Chemical Analysis of Gypsum and Gypsum Products.
ASTM C472	Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete.
ASTM C473	Standard Test Methods for Physical Testing of Gypsum Panel Products.
ASTM C474	Standard Test Methods for Joint Treatment Materials for Gypsum Board Construction.
ASTM C587	Standard Specification for Gypsum Veneer Plaster.
ASTM C1396/C1396M	Standard Specification for Gypsum Board.
IS 2849-1983	Specification for non-load bearing gypsum partition blocks (solid and hollow types).

2.7 Flooring Materials

2.7.1 General

Flooring materials are generally of two types; precast systems like tiles, bricks and cast in-situ.

2.7.2 Concrete/Terrazzo Tiles

Concrete/Terrazzo tiles shall have good abrasion and impact resistance properties. Factors such as the type of cement and the type and grading of aggregate used, influence the resistance of such tiles to chemicals including cleaning agents. Terrazzo tiles shall have a wear layer after grinding at least 6 mm composed of graded marble chipping in white, tinted or grey Portland cement on a layer of fine concrete. They may be ground

after manufacture to expose the marble aggregate and subsequently grouted. Slip resisting grits may be incorporated. These tiles shall conform to BDS EN 13748-1:2008 Terrazzo tiles-Part 1: Terrazzo tiles for internal use; BDS EN 13748-2:2008 Terrazzo tiles-Part 2: Terrazzo tiles for external use; BDS 1262: 1990 Clay flooring tiles; BDS 1248: 1989 Ceramic unglazed vitreous acid resistant tiles or IS: 1237, Specification for cement concrete flooring tile.

2.7.3 Asphalt Tiles/Flooring

Asphalt tiles/floorings are suitable for industrial flooring in areas where they will not be exposed to solvents, grease, oil, corrosive chemicals and excessive heat. Bitumen mastic for flooring shall conform to IS: 1195; IS: 8374 Bitumen Mastic, Anti-static and Electrically Conducting Grade and IS: 9510 Bitumen Mastic Acid Resisting Grade.

2.7.4 Mosaic Tiles

Mosaic tiles of a variety of shapes and sizes may be used. Thickness of the wear layer is dependent on the sizes of marble chips but shall not be less than 6 mm thick. The tiles shall be wet cured for sufficient time before laying so that their surfaces are not damaged during grinding and polishing.

2.7.5 Clay Tile

Clay floor tiles shall have sufficient strength and abrasion resistant characteristics to withstand the impact and abrasion they are likely to be subject to. When glazed earthenware tiles are used in flooring they shall conform to IS: 777 Glazed Earthenware Tiles.

2.7.6 Vinyl Tiles

The vinyl tiles shall consist of a thoroughly blended composition of thermoplastic binder, asbestos fibre, fillers and pigments. The thermoplastic binder shall consist substantially of either or both of the following:

- (a) Vinyl chloride polymer
- (b) Vinyl chloride copolymers.

The polymeric material shall be compounded with suitable plasticizers and stabilizers. The tiles may be plain, patterned or mottled. The thickness shall not be less than 1.5 mm.

2.7.7 Rubber Tiles

These tiles are composed of natural, synthetic or reclaimed rubber, or a combination of these, with reinforcing fibres, pigments, and fillers, vulcanized and molded under pressure. The tiles shall have excellent resilience and resistance to indentation, and good resistance to grease, alkali and abrasion. The thickness shall not be less than 2 mm.

2.7.8 Cast In-situ Floor Coverings

- (a) Terrazzo: Terrazzo is a marble mosaic with Portland cement matrix and is generally composed of two parts marble chips to one part Portland cement. Color pigments may be added. The thickness of terrazzo topping may vary from 13 mm to 19 mm and may be applied to green concrete of the floor or bonded with neat Portland cement, or over a sand cushion placed on the concrete floor.
- (b) Concrete: A concrete topping may be applied to a concrete structural slab before or after the base slab has hardened. Integral toppings may generally be 25 mm to 40 mm thick; independent toppings about 25 mm to 50 mm thick. Aggregate sizes shall not exceed 6 mm.

2.7.9 Other Flooring Materials

Other flooring materials i.e. bricks, natural stone, etc. showing satisfactory performance in similar situations may be allowed. Plastic flooring tile and ceramic unglazed vitreous acid resistant tiles, if used, shall conform to IS: 3464 and IS: 4357 respectively.

Flooring compositions complying with IS: 657, Materials for use in the manufacture of magnesium oxychloride flooring composition; and IS: 9197, Epoxy resin composition for floor topping may be allowed. Linoleum sheets and tiles shall conform to IS: 653.

Flooring materials shall also conform to the standards listed below.

- | | |
|----------|---|
| BDS 1248 | Ceramic unglazed vitreous acid resistant tiles seat covers the requirements for ceramic unglazed vitreous acid resistant tiles used in lying of floors & lining of tanks subjected to corrosive conditions. Manufacture, Finish, Tests etc. |
| BDS 1262 | Clay flooring tiles.

Specifies the requirements for dimensions, quality & strength for clay flooring tiles & different types of tests. |

BDS ISO 10545 - 1	Ceramic tiles, Sampling and basis for acceptance. Specifies rules for batching, sampling, inspection and acceptance/ rejection of ceramic tiles.
BDS ISO 10545 - 2	Ceramic tiles, Determination of dimensions and surface quality. Specifies methods for determining the dimensional characteristics (length, width, thickness, straightness of sides, rectangularity, and surface flatness) and the surface of ceramic tiles.
BDS ISO 10545 - 3	Ceramic tiles, Determination of water absorption, apparent porosity, apparent relative density and bulk density. Specifies methods for determining water absorption, apparent porosity, apparent relative density and bulk density of ceramic tiles.
BDS ISO 10545 - 4	Ceramic tiles, Determination of modulus of rupture and breaking strength Defines a test method for determining the modulus of rupture and breaking strength of all ceramic tiles.
BDS ISO 10545 - 5	Ceramic tiles, Determination of impact resistance by measurement of coefficient of restitution Specifies methods for determining the impact resistance of ceramic tiles by measuring the coefficient of restitution.
BDS ISO 10545 - 6	Ceramic tiles, Determination of resistance to deep abrasion for unglazed tiles.
BDS ISO 10545 - 7	Ceramic tiles, Determination of resistance to surface abrasion for glazed tiles. Specifies a method for determining the resistance to surface abrasion of all glazed ceramic tiles used for floor covering.
BDS ISO 10545 - 8	Ceramic tiles, Determination of linear thermal expansion Defines a test method for determining the coefficient of linear thermal expansion of ceramic tiles.
BDS ISO 10545 - 9	Ceramic tiles, Determination of resistance to thermal shock. Defines a test method for determining the resistance to thermal shock of all ceramic tiles under normal conditions of use.

BDS ISO 10545 - 10	Ceramic tiles, Determination of moisture expansion. Specifies a method for determining the moisture expansion of all ceramic tiles.
BDS ISO 10545 - 11	Ceramic tiles, Determination of crazing resistance for glazed tiles. Defines a test method for determining the crazing resistance of all glazed ceramic tiles except when the crazing is an inherent decorative feature of the product.
BDS ISO 10545 - 12	Ceramic tiles, Determination of frost resistance. Specifies a method for determining the frost resistance of all ceramic tiles intended for use in freezing conditions in the presence of water.
BDS ISO 10545 - 13	Ceramic tiles, Determination of chemical resistance. Specifies a test method for determining the chemical resistance of all ceramic tiles at room temperature. The method is applicable to all types of ceramic tiles.
BDS ISO 10545 - 14	Ceramic tiles, Determination of resistance to stains. Specifies a method for determining the resistance to stains of the proper surface of ceramic tiles.
BDS ISO 10545 - 15	Ceramic tiles, Determination of lead and cadmium given off by glazed tiles. Specifies a method for the determination of lead and cadmium given off by the glaze of ceramic tiles.
BDS ISO 10545 - 16	Ceramic tiles, Determination of small color differences. Describes a method for utilizing color measuring instruments for quantifying the small color differences between plain colored glazed ceramic tiles, which are designed to be uniform and consistent color. It permits the specification of a maximum acceptable value which depends only on the closeness of match and not on the nature of the color difference.

BDS EN 490	Concrete roofing tiles and fittings for roof covering and all cladding-Product specifications.
BDS ISO 13006	Ceramic tiles - Definitions, classification, characteristics and marking. This Standard defines terms and establishes classifications characteristics and marking requirements for ceramic tiles of the best commercial quality (first quality).
BDS EN 491	Concrete roofing tiles and fittings for roof covering and wall cladding-Test methods.
BDS EN 538	Clay roofing tiles for discontinuous laying-Flexural strength test.
BDS EN 539 - 1	Clay roofing tiles for discontinuous laying. Determination of physical characteristics-Part 1: Impermeability test.
BDS EN 1024	Clay roofing tiles for discontinuous laying-Determination of geometric characteristics.
BDS EN 1304	Clay roofing tiles and fittings-Product definitions and specifications.
BDS EN 13748 - 1	Terrazzo tiles-Part 1: Terrazzo tiles for internal use.
BDS EN 13748 - 2	Terrazzo tiles-Part 2: Terrazzo tiles for external use.

2.8 Steel

2.8.1 Reinforcing Steel

Reinforcing steel shall comply with the requirements specified in Sec 2.4.6 in this Part.

2.8.2 Structural Steel

Structural steel shall conform to Bangladesh Standards BDS 878: 1978, Specification for weld able structural steels; BDS 1355: 1992, Dimensions and properties of hot rolled steel beam, column, channel and angle sections. Where Bangladesh standards are not available, the relevant standards listed below shall be applicable.

BDS 1429	Light gauge steel sections.
BDS ISO 2566-1	Steel-Conversion of elongation values-Part 1: Carbon and low alloy steels.

BDS ISO 2566-2	Steel-Conversion of elongation values-Part 2: Austenitic steels.
BDS ISO 657-1	Hot-rolled steel sections-Part 1: Equal-leg angles-Dimensions.
BDS ISO 657-2	Hot-rolled steel sections-Part 2: Unequal-leg angles-Dimensions.
BDS ISO 657-5	Hot-rolled steel sections-Part V Equal-leg angles and unequal leg angles-Tolerances for metric and inch series.
BDS ISO 657-11	Hot-rolled steel sections-Part 11: Sloping flange channel sections (Metric series)-Dimensions and sectional properties.
BDS ISO 657-15	Hot-rolled steel sections-Part 15 Sloping flange beam sections (Metric series)-Dimensions and sectional properties.
BDS ISO 657-16	Hot-rolled steel sections-Part 16: Sloping flange column sections (metric series)-Dimensions and sectional properties.
BDS ISO 657-18	Hot-rolled steel sections-Part 18: L sections for shipbuilding (metric series) 104-Dimensions, sectional properties and tolerances.
BDS ISO 657-19	Hot-rolled steel sections-Part 19: Bulb flats (metric series)-Dimensions, sectional properties and tolerances.
BDS ISO 657-21	Hot-rolled steel sections-Part 21 T-sections with equal depth and flange width-Dimensions.
BDS ISO 10474	Steel and steel products-Inspection documents.
BDS ISO 14284	Steel and iron-Sampling and preparation of samples for the determination of chemical composition.
BDS ISO 9769	Steel and iron-Review of available methods of analysis.
BDS ISO 6929	Steel products-Definition and classification.
BDS ISO 20723	Structural steels-Surface condition of hot-rolled sections-Delivery requirements.
BDS ISO 24314	Structural steels-Structural steels for building with improved seismic resistance-Technical delivery conditions.

BDS ISO 404	Steel and steel products-General technical delivery requirements.
BDS ISO 1127	Stainless steel tubes-Dimensions, tolerances and conventional masses per unit length.
BDS ISO 4200	Plain end steel tubes, welded and seamless-General tables of dimensions and masses per unit length.
BDS ISO 6761	Steel tubes-Preparation of ends of tubes and fittings for welding.
ASTM A27/A27M	Standard Specification for Steel Castings, Carbon, for General Application.
ASTM A36/A36M	Standard Specification for Carbon Structural Steel.
ASTM A48/A48M	Standard Specification for Gray Iron Castings.
ASTM A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
ASTM A148/A148M	Standard Specification for Steel Castings, High Strength, for Structural Purposes.
ASTM A242/A242M	Standard Specification for High-Strength Low-Alloy Structural Steel.
ASTM A252	Standard Specification for Welded and Seamless Steel Pipe Piles.
ASTM A283/A283M	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
ASTM A307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
ASTM A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
ASTM A325M	Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength [Metric].
ASTM A336/A336M	Standard Specification for Alloy Steel Forgings for Pressure and High-Temperature Parts.

ASTM A653/A653M	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
ASTM A449	Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
ASTM A490	Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
ASTM A500/A500M	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
ASTM A501	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
ASTM A514/A514M	Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
ASTM A529/A529M	Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
ASTM A563	Standard Specification for Carbons and Alloy Steel Nuts.
ASTM A563M	Standard Specification for Carbon and Alloy Steel Nuts [Metric].
ASTM A1011/A1011M	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
ASTM A572/A572M	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
ASTM A588/A588M	Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance.
ASTM A606/A606M	Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.

ASTM A1008/A1008M	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Harden able.
ASTM A618/A618M	Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.
ASTM A666	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
ASTM A668/A668M	Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
ASTM A690/A690M	Standard Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments.
ASTM A852/A852M	Standard Specification for Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi [485 MPa] Minimum Yield Strength to 4 in. [100 mm] Thick.

2.8.3 Steel Plate, Sheet and Strips

These shall conform to the following standards.

BDS 868 : 1978	Code of practice for galvanized corrugated sheet roof and wall coverings.
BDS 1122: 1985	Specification for hot-dip galvanized steel sheet and coil.
BDS ISO 9328-1	Steel flat products for pressure purposes-Technical delivery conditions-Part 1: general requirements.
BDS ISO 9328-2	Steel flat products for pressure purposes-Technical delivery conditions-Part 2: Non-alloy and alloy steels with specified elevated temperature properties.
BDS ISO 9328-3	Steel flat products for pressure purposes-Technical delivery conditions -Part 3: Weldable fine grain steels, normalized.
BDS ISO 9328-4	Steel flat products for pressure purposes-Technical delivery conditions-Part 4: Nickel-alloy steels with specified low temperature properties.

BDS ISO 9328-5	Steel flat products for pressure purposes-Technical delivery conditions-Part 5: Weldable fine grain steels, thermo mechanically rolled.
BDS ISO 9328-6	Steel flat products for pressure purposes-Technical delivery conditions-Part 6: Weldable fine grain steels, quenched and tempered.
BDS ISO 9328-7	Steel flat products for pressure purposes-Technical delivery conditions-Part 7: Stainless steels.
BDS ISO 4995	Hot-rolled steel sheet of structural quality.
BDS ISO 7452	Hot-rolled structural steel plates-Tolerances on dimensions and shape.
BDS ISO 7778	Steel plate with specified through-Thickness characteristics.
BDS ISO 7788	Steel-Surface finish of hot-rolled plates and wide flats-Delivery requirements.
BDS ISO 9034	Hot-rolled structural steel wide flats-Tolerances on dimensions and shape.
BDS ISO 9364	Continuous hot-dip aluminum/zinc coated steel sheet of commercial, drawing and structural qualities.
BDS ISO 16160	Continuously hot-rolled steel sheet products-Dimensional and shape tolerances.
BDS ISO 16162	Continuously cold-rolled steel sheet products-Dimensional and shape tolerances.
BDS ISO 16163	Continuously hot-dipped coated steel sheet products-Dimensional and shape tolerances.
IS 412	Specification for expanded metal steel sheets for general purposes.
IS 1079	Specification for hot rolled carbon steel sheet and strip.
IS 4030	Specification for cold-rolled carbon steel strip for general engineering purposes.
IS 7226	Specification for cold-rolled medium, high carbon and low-alloy steel strip for general engineering purposes.

IS 3502	Specification for steel chequered plates.
ASTM A109/A109M	Standard Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled.
ASTM A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A167	Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
ASTM A176	Standard Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip.
ASTM A240/A240M	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
ASTM A263	Standard Specification for Stainless Chromium Steel-Clad Plate.
ASTM A264	Specification for Stainless Chromium-Nickel Steel-Clad Plate.
ASTM A285/A285M	Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength.
ASTM A328/A328M	Standard Specification for Steel Sheet Piling.
ASTM A1008/A1008M	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Harden able.
ASTM A414/A414M	Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy for Pressure Vessels.
ASTM A424/A424M	Standard Specification for Steel, Sheet, for Porcelain Enameling.
ASTM A929/A929M	Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe.
ASTM A463/A463M	Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process.

ASTM A480/A480M	Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
ASTM A505	Standard Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
ASTM A506	Standard Specification for Alloy and Structural Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled.
ASTM A507	Standard Specification for Drawing Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled.
ASTM A568/A568M	Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
ASTM A577/A577M	Standard Specification for Ultrasonic Angle-Beam Examination of Steel Plates.
ASTM A578/A578M	Standard Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Plates for Special Applications.
ASTM A879/A879M	Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
ASTM A599/A599M	Standard Specification for Tin Mill Products, Electrolytic Tin-Coated, Cold-Rolled Sheet.
ASTM A606/A606M	Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
ASTM A635/A635M	Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
ASTM A653/A653M	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
ASTM A666	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

ASTM A690/A690M	Standard Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments.
ASTM A775/A775M	Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
ASTM A792/A792M	Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
ASTM A857/A857M	Standard Specification for Steel Sheet Piling, Cold Formed, Light Gage.
ASTM A875/A875M	Standard Specification for Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot-Dip Process.

2.8.4 Steel Pipe, Tube and Fittings

These items shall conform to the following Standards:

BDS ISO 49	Malleable cast iron fittings threaded to ISO 7-1.
BDS ISO 3419	Non-alloy and alloy steel butt-welding fittings.
BDS ISO 3545-3	Steel tubes and fittings-Symbols for use in specifications-Part 3: Tubular fittings with circular cross-section.
BDS ISO 4144	Pipe work-Stainless steel fittings threaded in accordance with ISO 7-1.
BDS ISO 4145	Non-alloy steel fittings threaded to ISO 7-1.
BDS ISO 5251	Stainless steel butt-welding fittings.
ASTM A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
ASTM A105/A105M	Standard Specification for Carbon Steel Forgings for Piping Applications.
ASTM A106/A106M	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
ASTM A134	Standard Specification for Pipe, Steel, Electric-Fusion (Arc)-Welded (Sizes NPS 16 and Over).

ASTM A139/A139M	Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).
ASTM A181/A181M	Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
ASTM A182/A182M	Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
ASTM A234/A234M	Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
ASTM A252	Standard Specification for Welded and Seamless Steel Pipe Piles.
ASTM A254	Standard Specification for Copper-Brazed Steel Tubing.
ASTM A268/A268M	Standard Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service.
ASTM A269	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
ASTM A270	Standard Specification for Seamless and Welded Austenitic Stainless Steel Sanitary Tubing.
ASTM A312/A312M	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
ASTM A333/A333M	Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service.
ASTM A334/A334M	Standard Specification for Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service.
ASTM A403/A403M	Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.
ASTM A420/A420M	Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service.
ASTM A423/A423M	Standard Specification for Seamless and Electric-Welded Low-Alloy Steel Tubes.

ASTM A450/A450M	Standard Specification for General Requirements for Carbon and Low Alloy Steel Tubes.
ASTM A500/A500M	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
ASTM A50	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
ASTM A522/A522M	Standard Specification for Forged or Rolled 8 and 9% Nickel Alloy Steel Flanges, Fittings, Valves, and Parts for Low-Temperature Service.
ASTM A524	Standard Specification for Seamless Carbon Steel Pipe for Atmospheric and Lower Temperatures.
ASTM A530/A530M	Standard Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.
ASTM A589/A589M	Standard Specification for Seamless and Welded Carbon Steel Water-Well Pipe.
ASTM A618/A618M	Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.
ASTM A632	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service.
ASTM A707/A707M	Standard Specification for Forged Carbon and Alloy Steel Flanges for Low-Temperature Service.
ASTM A733	Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples.
ASTM A778	Standard Specification for Welded, Un-annealed Austenitic Stainless Steel Tubular Products.
ASTM A807/A807M	Standard Practice for Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications.
ASTM A865/A865M	Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints.

2.8.5 Steel Bars, Wire and Wire Rods

These shall conform to the following Standards.

BDS ISO 1035-1	Hot-rolled steel bars-Part 1: Dimensions of round bars.
BDS ISO 1035-2	Hot-rolled steel bars-Part 2: Dimensions of square bars.
BDS ISO 1035-3	Hot-rolled steel bars-Part 3: Dimensions of flat bars.
BDS ISO 1035-4	Hot-rolled steel bars-Part 4: Tolerances.
BDS ISO 4951-1	High yield strength steel bars and sections-Part 1: General delivery requirements.
BDS ISO 4951-2	High yield strength steel bars and sections-Part 2: Delivery conditions for normalized, normalized rolled and as-rolled steels.
BDS ISO 4951-3	High yield strength steel bars and sections-Part 3: Delivery conditions for thermo mechanically-rolled steels.
ASTM A29/A29M	Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for.
ASTM A49	Standard Specification for Heat-Treated Carbon Steel Joint Bars, Micro alloyed Joint Bars, and Forged Carbon Steel Compromise Joint Bars.
ASTM A108	Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
ASTM A116	Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric.
ASTM A185/A185M	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
ASTM A227/A227M	Standard Specification for Steel Wire, Cold-Drawn for Mechanical Springs.
ASTM A228/A228M	Standard Specification for Steel Wire, Music Spring Quality.
ASTM A229/A229M	Standard Specification for Steel Wire, Oil-Tempered for Mechanical Springs.
ASTM A276	Standard Specification for Stainless Steel Bars and Shapes.

ASTM A311/A311M	Standard Specification for Cold-Drawn, Stress-Relieved Carbon Steel Bars Subject to Mechanical Property Requirements.
ASTM A322	Standard Specification for Steel Bars, Alloy, Standard Grades.
ASTM A108	Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
ASTM A368	Standard Specification for Stainless Steel Wire Strand.
ASTM A434	Standard Specification for Steel Bars, Alloy, Hot-Wrought or Cold-Finished, Quenched and Tempered.
ASTM A475	Standard Specification for Zinc-Coated Steel Wire Strand.
ASTM A478	Standard Specification for Chromium-Nickel Stainless Steel Weaving and Knitting Wire.
ASTM A479/A479M	Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
ASTM A492	Standard Specification for Stainless Steel Rope Wire.
ASTM A499	Standard Specification for Steel Bars and Shapes, Carbon Rolled from “T” Rails.
ASTM A510	Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
ASTM A575	Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
ASTM A576	Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
ASTM A580/A580M	Standard Specification for Stainless Steel Wire.
ASTM A586	Standard Specification for Zinc-Coated Parallel and Helical Steel Wire Structural Strand.
ASTM A603	Standard Specification for Zinc-Coated Steel Structural Wire Rope.
ASTM A627	Standard Test Methods for Tool-Resisting Steel Bars, Flats, and Shapes for Detention and Correctional Facilities.

ASTM A663/A663M	Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
ASTM A666	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
ASTM A706/A706M	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
ASTM A764	Standard Specification for Metallic Coated Carbon Steel Wire, Coated at Size and Drawn to Size for Mechanical Springs.
ASTM C933	Standard Specification for Welded Wire Lath.

2.8.6 Steel Fasteners

Steel fasteners shall conform to the following Standards:

BDS 1373	Slotted countersunk flat head tapping screws.
BDS 1374	Slotted raised counter.
BDS 1375	Fasteners hexagon products widths across flats.
BDS 1405	Bolts, screws, nuts and accessories terminology and nomenclature.
BDS 1406	Hexagon nuts style 2 products grades A and B.
BDS 1407	Hexagon nuts style 3 products grades A and B.
BDS 1408	General purpose screw threads general plan.
BDS 1409	General purpose screw threads selected sizes for screws, bolts and nuts.
BDS 1410	Thread run-outs for fasteners thread of BDS 1408: 1995 and BDS 1409: 1993.
BDS 1411	Tapping screws thread.
BDS 1412	Thread undercuts of external metric thread fasteners.
BDS 1413	Head configuration and gauging of countersunk head screws.
BDS 1428	Fasteners-bolts, screws, studs and nuts-symbols and designations of dimensions.

ASTM A31	Standard Specification for Steel Rivets and Bars for Rivets, Pressure Vessels.
ASTM A183	Standard Specification for Carbon Steel Track Bolts and Nuts.
ASTM A193/A193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
ASTM A194/A194M	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
ASTM A307	Standard Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile Strength.
ASTM A320/A320M	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.
ASTM A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
ASTM A354	Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
ASTM A437/A437M	Standard Specification for Stainless and Alloy-Steel Turbine-Type Bolting Specially Heat Treated for High-Temperature Service.
ASTM A449	Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
ASTM A489	Standard Specification for Carbon Steel Lifting Eyes.
ASTM A490	Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
ASTM A502	Standard Specification for Rivets, Steel, Structural.
ASTM A540/A540M	Standard Specification for Alloy-Steel Bolting for Special Applications.
ASTM A563	Standard Specification for Carbons and Alloy Steel Nuts.

ASTM A574	Standard Specification for Alloy Steel Socket-Head Cap Screws.
ASTM C514	Standard Specification for Nails for the Application of Gypsum Board.
ASTM C954	Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
ASTM C955	Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
ASTM C1002	Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
ASTM F436	Standard Specification for Hardened Steel Washers.
ASTM F593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
ASTM F594	Standard Specification for Stainless Steel Nuts.
ASTM F844	Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
ASTM F959	Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.

2.8.7 Welding Electrodes and Wires

Welding electrodes and wires shall conform to the following Standards:

BDS 239	Specification for soft solder.
BDS 1442-1	Filler rods and wire for gas shielded arc-welding-ferric steel.
BDS 1442-2	Filler rods and wire for gas shielded arc-welding-austenitic

	stainless steel.
BDS 1442-3	Filler rods and wires for gas shielded arc welding-copper and copper alloy.
BDS 1442-4	Filler rods and wires for gas shielded arc welding-aluminum and aluminum alloy and magnesium alloys.
BDS 1442-5	Filler rods and wires for gas shielded arc welding-nickel and nickel alloys.
IS 814	Specification for covered electrodes for manual metal arc welding of carbon and carbon manganese steel.
IS 815	Classification and coding of covered electrodes for metal arc welding of structural steels.
IS 1278	Specification for filler rods and wires for gas welding.
IS 1395	Specification for low and medium alloy steel covered electrodes for manual metal arc welding.
IS 3613	Acceptance tests for wire flux combinations for submerged-arc welding of structural steel.
IS 4972	Specification for resistance spot-welding electrodes.
IS 6419	Specification for welding rods and bare electrodes for gas shielded arc welding of structural steel.
IS 6560	Specification for molybdenum and chromium-molybdenum low alloy steel welding rods and bare electrodes for gas shielded arc welding.
IS 7280	Specification for base wire electrodes for submerged-arc welding of structural steels.
IS 8363	Specification for bare wire electrodes for electro slag welding of steels.
ISO 9453	Soft solder alloys-chemical compositions and forms.
ISO 9454	Soft soldering fluxes-classification and requirements. Part 1: Classification, labeling and packaging.
ISO 9455-1	Soft soldering fluxes- test methods.

	Part 1: Determination of non-volatile matter, gravimetric method.
ISO 9455-8	Soft soldering fluxes-test methods.
	Part 8: Determination of zinc content.
ISO 9455-11	Soft soldering fluxes-test methods.
	Part 11: Solubility of flux residues.
ISO 9455-14	Soft soldering fluxes-test methods.
	Part 14: Assessment of tackiness of flux residues.

2.9 Timber & Wood Products

2.9.1 Timber Types and Properties

Timber types for the structural purpose with their engineering characteristics are contained in Table 6.11.1 Part 6 of this Code. Details of the uses of timber in structures or elements of structures including terminology, material requirements, and moisture content preferred cut sizes of sawn timbers, grading, permissible defects, suitability in respect of durability and treatability, design criteria, and details of joints are also given in Chapter 11 Part 6. Timber and timber constructions shall satisfy the requirements of that Chapter and conform to the following Standards:

BDS 142	Specification for wood doors.
BDS 173	Specification for wood windows.
BDS 230	Glossary of terms applicable to timber, plywood and joinery.
BDS 803	Trade names and abbreviated symbols for timber species.
BDS 819	Code of practice for preservation of timber.
BDS 820	Recommendation for maximum permissible moisture content of timber used for different purposes in Bangladesh.
BDS 857	Specification for grading rules for logs and sawn timbers.
BDS 1090	Methods of test for plywood.

BDS 1256 Classification of commercial timber.

BDS 1311 Key for identification of commercial timber.

2.9.2 Plywood

A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers. The plies are bonded with waterproof adhesive that cures on application of heat and pressure.

Plywood shall conform to the following Standards:

BDS 799 Specification for plywood for general purposes.

BDS 1158 Specification for veneered decorative plywood.

For sampling and testing of plywood, the following Standards are applicable:

BDS 1087 Specification for method of sampling of plywood.

BDS 1090 Methods of test of plywood.

IS 4990 Specification for plywood for concrete shattering work.

IS 5509 Specification for fire retardant plywood.

IS 5539 Specification for Preservative Treated Plywood.

2.9.3 Particle Boards and Fibre Boards

A panel primarily composed of cellulosic materials (usually wood), generally in the form of discrete pieces or particles, as distinguished from fibers. The cellulosic material is combined with synthetic resin or other suitable bonding system by a process in which the inter-particle bond is created by the bonding system under heat and pressure.

Fiber boards are fibrous, homogeneous panel made from lingo-cellulosic fibers (usually wood or cane) and having a density of less than 497 kg per cubic meter but more than 160 kg per cubic meter.

These materials shall conform to the following standards:

BDS 619 Specification for particle board (medium density).

BDS 620	Specification for hardboard.
BDS EN 316	Wood fiberboards-Definition, classification and symbols.
ISO 820	Particle boards-Definition and classification.
ISO 821	Particle boards-Determination of dimensions of test pieces.
ISO 822	Particle boards-Determination of density.
ISO 823	Particle boards-Determination of moisture content.
ISO 766	Fibre building boards-Determination of dimensions of test pieces.
ISO 767	Fibre building boards-Determination of moisture content.
ISO 768	Fibre building boards-Determination of bending strength.
ISO 769	Fibre building boards-Hard and medium boards-determination of.

Water Absorption and of Swelling in Thickness after Immersion in Water;

ISO 818	Fibre building boards-Definition-Classification.
ISO 819	Fibre building boards-Determination of density.
ISO 2695	Fibre building boards-Hard and medium boards for general.

Purposes-Quality Specifications-Appearance, Shape and Dimensional Tolerances;

ISO 2696	Fibre building boards-Hard and medium boards-Quality.
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Specifications- Water Absorption and Swelling in Thickness;

ISO 3340	Fibre building boards-Determination of sand content.
ISO 3346	Fibre building boards-Determination of surface finish (roughness).
ISO 3729	Fibre building boards-Determination of surface stability.
ISO/TR 7469	Dimensional stability of hardboards.

Wood based Laminates

Laminated boards having a core of strips, each not exceeding 7 mm in thickness, glued together face to face to form a slab which in turn is glued between two or more veneers, with the direction of the grain of the core strips running at right angles to that of the adjacent outer veneers.

Wood based laminates shall conform to the following Standards:

IS 3513	Specification for resin treated compressed wood laminates (compregs). Part 3 For general purposes.
IS 3513	Specification for resin treated compressed wood laminates (compregs). Part 4 Sampling and Tests.
IS 9307 (Parts I to VIII)	Methods of tests for wood-based structural sandwich construction. Part I Flexure test. Part II Edgewise compression test. Part III Flatwise compression test. Part IV Shear test. Part V Flatwise tension test. Part VI Flexure creep test. Part VII Cantilever vibration test. Part VIII Weathering test.

2.9.4 Adhesives and Glues

Adhesives and glues are used to join two or more parts so as to form a single unit. Adhesives shall conform to the following Standards:

IS 848	Specification for synthetic resin adhesives for plywood (phenolic and aminoplastic).
IS 849	Specification for cold setting case in glue for wood.
IS 851	Specification for synthetic resin adhesives for construction work (nonstructural) in wood.

IS 852	Specification for animal glue for general wood-working purposes.
IS 4835	Specification for polyvinyl acetate dispersion-based adhesives for wood.
IS 9188	Specification for adhesive for structural laminated wood products for use under exterior exposure condition.

2.10 Doors, Windows and Ventilators

2.10.1 Wooden Doors, Windows and Ventilators

These shall conform to the following Standards:

BDS 142	Specification for wood door.
BDS 173	Specification for wood windows.
BDS 820	Recommendation for maximum permissible moisture content of timber used for different purposes in Bangladesh.
BDS 1504	Timber door window and ventilator frames
IS 1003	Specification for timber panelled and glazed shutters. Part 1- 2003 Door shutters. Part 2- 1994 Window and ventilator shutters.
IS 1826	Specification for venetian blinds for windows.
IS 2191	Specification for wooden flush door shutters (cellular and hollow core type). Part 1 Plywood face panels. Part 2 Particle board face panels and hardboard face panels.
IS 2202	Specification for wooden flush door shutters (solid core type). Part 1 Plywood face panels. Part 2 Particle board face panels and hardboard face panels.
IS 4020	Method of tests for door shutters. (Part 1): 1998 General.

	(Part 2): 1998	Measurement of dimensions and squareness.
	(Part 3): 1998	Measurement of general flatness.
	(Part 4): 1998	Local planeness test.
	(Part 5): 1998	Impact indentation test.
	(Part 6): 1998	Flexure test.
	(Part 7): 1998	Edge loading test.
	(Part 8): 1998	Shock resistance test.
	(Part 9): 1998	Buckling resistance test.
	(Part 10):1998	Slamming test.
	(Part 11):1998	Misuse test.
	(Part 12):1998	Varying humidity test.
	(Part 13):1998	End immersion test.
	(Part 14):1998	Knife test.
	(Part 15):1998	Glue adhesion test.
	(Part 16):1998	Screw withdrawal resistance test.
IS 4021		Specification for timber door, window and ventilator frames.
IS 4962		Specification for wooden side sliding doors.
IS 6198		Specification for ledged, braced and battened timber shutters.

2.10.2 Metal Doors, Windows Frames and Ventilators

These shall conform to the following Standards:

BDS 1270	Specification for strong room door
BDS 1273	Specification for vault doors.
IS 1038	Specification for steel doors, windows and ventilators.
IS 1361	Specification for steel windows for industrial buildings.
IS 1948	Specification for aluminum doors, windows and ventilators.
IS 1949	Specification for aluminum windows for industrial buildings.

IS 4351	Specification for steel door frames.
IS 6248	Specification for metal rolling shutters and rolling grills.
IS 7452	Specification for hot rolled steel sections for doors, windows and ventilators.
IS 10451	Specification for steel sliding shutters (top hung type).
IS 10521	Specification for collapsible gates.

2.10.3 Plastic Doors and Windows

These shall conform to the following Standards:

BDS EN 477	Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors-Determination of the resistance to impact of main profiles by falling mass.
BDS EN 478	Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors-Determination of appearance after exposure at 150°C.
BDS EN 479	Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors-Determination of heat reversion.
BDS EN 513	Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors-Determination of the resistance to artificial weathering.
BDS EN 514	Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors-Determination of the strength of welded corners and T-joints.
BDS EN 12608	Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors-Classification, requirements and test methods.
BDS ISO 1163-1	Plastics-Unplasticized polyvinylchloride (PVC-U) molding and extrusion materials-Part 1: Designation system and basis for specifications.

BDS ISO 1163-2	Plastics-Unplasticized polyvinylchloride (PVC-U) molding and extrusion materials-Part 2: Preparation of test specimens and determination of properties.
IS 14856	Specification for glass fibre reinforced (GRP) panel type door shutters for internal use.
IS 15380	Specification for molded raised high density fibre (HDF) panel doors.

2.11 Aluminium and Aluminium Alloys

Aluminum used for structural purposes in buildings and structures shall comply with AA ASM 35 and AA ADM 1.

Aluminium and Aluminium Alloys shall also conform to the following Standards:

BDS EN 755-9	Aluminum and aluminum alloys-Extruded rod/bar, tube and profiles-Part 9: Profiles, tolerances on dimensions and form.
BDS EN 755-2	Aluminum and aluminum alloys-Extruded rod/bar, tube and profiles-Part 2: Mechanical properties.
BDS EN 755-1	Aluminum and aluminum alloys-Extruded rod/bar, tube and profiles-Part 1: Technical conditions for inspection and delivery.
BDS EN 755-3	Aluminum and aluminum alloys-Extruded rod/bar, tube and profiles-Part 3: Round bars, tolerances on dimensions and form.
BDS EN 755-4	Aluminum and aluminum alloys-Extruded rod/bar, tube and profiles-Part 4: Square bars, tolerances on dimensions and form.
BDS EN 755-5	Aluminum and aluminum alloys-Extruded rod/bar, tube and profiles-Part 5: Rectangular bars, tolerances on dimensions and form.
BDS EN 755-6	Aluminum and aluminum alloys-Extruded rod/bar, tube and profiles-Part 6: Hexagonal bars, tolerances on dimensions and form.
BDS EN 755-7	Aluminum and aluminum alloys-Extruded rod/bar, tube and profiles-Part 7: Seamless tubes, tolerances on dimensions and form.

BDS EN 755-8	Aluminum and aluminum alloys-Extruded rod/bar, tube and profiles-Part 8: Porthole tubes, tolerances on dimensions and form.
BDS EN 12020-1	Aluminum and aluminum alloys- Extruded precision profiles in alloys EN AW-6060 and EN AW-6063- Part 1: Technical conditions for inspection and delivery.
BDS EN 12020-2	Aluminum and aluminum alloys-Extruded precision profiles in alloys EN AW-6060 and EN AW-6063-Part 2: Tolerances on dimensions and form.
BDS EN 515	Aluminum and aluminum alloys-Wrought products-Temper designations.
ASTM B26/B26M	Standard Specification for Aluminum-Alloy Sand Castings.
ASTM B85/B85M	Standard Specification for Aluminum-Alloy Die Castings.
ASTM B108/B108M	Standard Specification for Aluminum-Alloy Permanent Mold Castings.
ASTM B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
ASTM B210	Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
ASTM B211	Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
ASTM B241/B241M	Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
ASTM B308/B308M	Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
ASTM B313/B313M	Standard Specification for Aluminum and Aluminum-Alloy Round Welded Tubes.
ASTM B316/B316M	Standard Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods.
ASTM B429/B429M	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

ASTM B483/B483M	Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Pipe for General Purpose Applications.
ASTM B547/B547M	Standard Specification for Aluminum and Aluminum-Alloy Formed and Arc-Welded Round Tube.
ASTM B632/B632M	Standard Specification for Aluminum-Alloy Rolled Tread Plate.
ASTM B745/B745M	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.
ASTM E34	Standard Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys.

2.12 Builders Hardware

The applicable Standards are listed below:

BDS 113	Specification for latches and locks for doors in buildings.
IS 204	Specification for tower bolts. Part 1 Ferrous metals. Part 2 Nonferrous metals.
IS 205	Specification for nonferrous metal butt hinges.
IS 206	Specification for tee and strap hinges.
IS 208	Specification for door handles.
IS 281	Specification for mild steel sliding door bolts for use with padlock.
IS 362	Specification for parliament hinges.
IS 363	Specification for hasps and staples.
IS 364	Specification for fanlight catch.
IS 452	Specification for door springs, rat-tail type.
IS 453	Specification for double acting spring hinges.
IS 729	Specification for drawer locks, cupboard locks and box locks.
IS 1019	Specification for rim latches.
IS 1341	Specification for steel butt hinges.

IS 1823	Specification for floor door stoppers.
IS 1837	Specification for fanlight pivots.
IS 2209	Specification for mortise locks (vertical type).
IS 2681	Specification for nonferrous metal sliding door bolts for use with padlocks.
IS 3564	Specification for door closers (hydraulically regulated).
IS 3818	Specification for continuous (piano) hinges.
IS 3828	Specification for ventilator chains.
IS 3843	Specification for steel back-flap hinges.
IS 3847	Specification for mortise night latches.
IS 4621	Specification for indicating bolts for use in public baths and lavatories.
IS 4948	Specification for welded steel wire fabric for general use.
IS 4992	Specification for door handles for mortise locks (vertical type).
IS 5187	Specification for flush bolts.
IS 5899	Specification for bathroom latches.
IS 5930	Specification for mortise latch (vertical type).
IS 6315	Specification for floor springs (hydraulically regulated) for heavy doors.
IS 6318	Specification for plastic window stays and fasteners.
IS 6343	Specification for door closers (pneumatically regulated) for light doors weighing up to 40 kg.
IS 6602	Specification for ventilator poles.
IS 6607	Specification for rebated mortise locks (vertical type).
IS 7196	Specification for hold fast.
IS 7197	Specification for double action floor springs (without oil check) for heavy doors.
IS 7534	Specification for sliding locking bolts for use with padlocks.

IS 7540	Specification for mortise dead locks.
IS 8756	Specification for ball catches for use in wooden almirah.
IS 8760	Specification for mortise sliding door locks, with lever mechanism.
IS 9106	Specification for rising butt hinges.
IS 9131	Specification for rim locks.
IS 9460	Specification flush drop handle for drawer.
IS 9899	Specification for hat, coat and wardrobe hooks.
IS 10019	Specification for steel window stays and fasteners.
IS 10090	Specification for numerical.
IS 10342	Specification for curtain rail system.
IS 12817	Specification for stainless steel butt hinges.
IS 12867	Specification for PVC hand rails covers.
IS 14912	Specification for door closers concealed type (hydraulically regulated)

2.13 Roof Coverings

2.13.1 Scope

The provisions of this Section shall govern the materials used for roof coverings.

2.13.2 Compatibility of Materials

All roofs and roof coverings shall be of materials that are compatible with each other and with the building or structure to which the materials are applied.

2.13.3 Material Specifications and Physical Characteristics

All materials to be used in the construction of roofs and roof coverings shall conform to the applicable standards listed in this Section. In the absence of applicable standards or when materials are of questionable suitability, testing by an approved testing agency may be required by the building official to determine the character, quality and limitations of use of the materials.

2.13.4 Weather Protection

All roofs shall be covered with approved roof coverings properly secured to the building or structure to resist wind and rain. Roof coverings shall be designed, installed and maintained in accordance with approved manufacturer's recommendations such that the roof covering shall serve to protect the building or structure.

2.13.5 Wind Resistance

All roofs and roof coverings shall be secured in place to the building or structure to withstand the wind loads.

2.13.6 Structural and Construction Loads

The structural roof components shall be capable of supporting the roof covering system and the material and equipment loads that will be encountered during installation of the roof covering system.

2.13.7 Impact Resistance

Roof coverings shall resist impact damage based on the results of tests conducted in accordance with ASTM D4272 or ASTM D3746.

2.13.8 Metal-Sheet Roof Coverings

Metal-sheet roof coverings installed over structural framing and decking shall comply with BDS 868, Galvanized corrugated sheet roof and wall coverings; BDS 1122, Hot-dip galvanized steel sheet and coil; ASTM A755/A755M or ASTM B101. Metal-sheet roof coverings shall be installed in accordance with approved manufacturer's installation instructions.

2.13.9 Interlocking Clay or Cement Tile

Interlocking clay or cement tile shall be installed only over solid sheathing or spaced structural sheathing boards. Interlocking clay or cement tile shall not be installed on roof slopes below one unit vertical in three units horizontal (1:3). Horizontal battens shall be required on roof slopes over one unit vertical in two units horizontal (1:2). Single layer underlayment is required over solid sheathing on all roof slopes. Reinforced underlayment shall be required when spaced sheathing is used. Regardless of roof slope, the first three tile courses and all tiles within 900 mm of roof edges, tiles at changes in roof slope or changes in slope direction, shall be fastened to the roof. For the field of the roof, fastening is not required on roof slopes below one unit vertical in two units horizontal (1:2). Every other tile course shall be fastened on roof slopes 1:2 to less than

1:1; and every tile shall be fastened on roof slopes 1:1 and over. Tile overlap shall be in accordance with approved manufacturer's installation instructions.

2.13.10 Non-interlocking Clay or Cement Tile

Non-interlocking clay or cement tile shall not be installed on roof slopes below one unit vertical in five units horizontal (1:5). Double layer underlayment is required on roof slopes below one unit vertical in four units horizontal (1:4). Single layer underlayment is required on all other roof slopes. Non-interlocking clay or cement tile shall be secured to the roof with two fasteners per tile. The minimum tile overlap shall be 75 mm.

2.13.11 Roof Insulation

Rigid combustible roof insulation shall be permitted, provided the insulation is covered with approved roof coverings directly applied thereto. In-situ lime concrete may be used on flat roofs of buildings. Minimum compacted thickness of such a layer shall be 75 mm and have adequate slope for drainage. The materials used in lime concrete shall conform to the standards specified in Sec 2.5 of this Part.

2.13.12 Recovering and Replacement of Roof Coverings

New roof coverings shall not be installed without first removing existing roof coverings when the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not acceptable as a base for additional roofing.

2.13.13 Reuse of Materials

Existing slate, clay or cement tile shall be permitted for reuse, except that damaged, cracked or broken slate or tile shall not be reused. Existing vent flashings, metal edgings, drain outlets, collars and metal counter flashings shall not be reused where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reused.

2.13.14 Applicable Standards

The applicable Standards for materials used in roofs and roof coverings are listed below:

BDS 868	Code of practice for galvanized corrugated sheet roof and wall coverings.
BDS 1122	Specification for hot-dip galvanized steel and coil.
BDS EN 490	Concrete roofing tiles and fittings for roof covering and all cladding-Product specifications.
BDS EN 491	Concrete roofing tiles and fittings for roof covering and wall cladding-Test methods.

BDS EN 538	Clay roofing tiles for discontinuous laying-Flexural strength test.
BDS EN 539-1	Clay roofing tiles for discontinuous laying Determination of physical characteristics-Part 1: Impermeability test.
BDS EN 1024	Clay roofing tiles for discontinuous laying-Determination of geometric characteristics.
BDS EN 1304	Clay roofing tiles and fittings-Product definitions and specifications.
ASTM A755/A755M	Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Pre-painted by the Coil-Coating Process for Exterior Exposed Building Products.
ASTM B101	Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction.
ASTM C406	Standard Specification for Roofing Slate.
ASTM C836/C836M	Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
ASTM C1029	Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
ASTM D225	Standard Specification for Asphalt Shingles (Organic Felt) Surfaced With Mineral Granules.
ASTM D226/D226M	Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
ASTM D227	Standard Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing.
ASTM D312	Standard Specification for Asphalt Used in Roofing.
ASTM D450	Standard Specification for Coal-Tar Pitch Used in Roofing, Damp proofing, and Waterproofing.
ASTM D1227	Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
ASTM D1863	Standard Specification for Mineral Aggregate Used on Built-Up

	Roofs.
ASTM D2178	Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
ASTM D2626	Standard Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing.
ASTM D2898	Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
ASTM D3161	Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method).
ASTM D3747	Standard Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation.
ASTM D3909	Standard Specification for Asphalt Roll Roofing (Glass Felt) Surfaced With Mineral Granules.
ASTM D4272	Standard Test Method for Total Energy Impact of Plastic Films By Dart Drop.
ASTM D4434/D4434M	Standard Specification for Poly (Vinyl Chloride) Sheet Roofing.
ASTM D4601	Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
ASTM D4637	Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane.
ASTM D4897/D4897M	Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing.
ASTM D6380	Standard Specification for Asphalt Roll Roofing (Organic Felt).
ASTM E108	Standard Test Methods for Fire Tests of Roof Coverings.
ASTM G90	Standard Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight.
ASTM G154	Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.
ASTM G155	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

CGSB (Canadian General Standards Board)	Membrane, modified bituminous, prefabricated, and reinforced for roofing.
37-GP-56M-80	
FM 447-86	Approval standard for class I roof coverings.
FM (Factory Manual) 4450-89	Standard laboratories department approved standard for class I insulated steel deck roofs.
RMA (Rubber Manufacturer Association, USA)	Wind design guide for ballasted single-ply roofing systems.
RP-4-88	
SPRI (Single Ply Roofing Institute, USA) -86	Wind design guide for ballasted single-ply roofing systems.

2.14 Paints and Varnishes

2.14.1 Water Based Paints and Pigments

Water based paints shall conform to the following Standards:

BDS 500	Specification for distemper dry.
BDS 1097	Specification for plastic emulsion paint. Part 1 for Interior use. Part 2 for Exterior use.
IS 427	Specification for distemper, dry, color as required.
IS 428	Specification for distemper, washable.
IS 5410	Specification for cement paint, color as required.
IS 5411	Specification for plastic emulsion paint. Part 1: For interior use. Part 2: For exterior use

2.14.2 Ready Mixed Paints, Enamels and Powder Coatings

Ready mixed paints and enamels shall conform to the following Standards:

BDS 13	Specification for ready mixed paints, varnish, lacquers and related products.
BDS 14	Specification for black bituminous paint, brushing for general purposes.
BDS 397	Specification for ready mixed paint, brushing, red oxide zinc chrome, priming.
BDS 398	Specification for ready mixed paint, spraying, red oxide zinc chrome, priming.
BDS 399	Specification for aluminum paint, spraying for general purposes, in dual container.
BDS 400	Specification for aluminum paint, brushing, for general purposes in dual container.
BDS 401	Specification for varnish, finishing, exterior, type-I, (synthetic).
BDS 402	Specification for ready mixed paint, brushing, finishing, semi-gloss, for general purposes.
BDS 499	Specification for ready mixed paints, brushing, for road marking (white, yellow and black).
BDS 616	Specification for enamel, brushing, exterior (i) undercoating, (ii) finishing, color as required.
BDS 617	Specification for enamel, brushing, interior (i) undercoating, (ii) finishing, color as required.
BDS 926	Specification for ready mixed paint, brushing, petrol resisting, air drying, for exterior painting of containers, color as required.
BDS 927	Specification for ready mixed paint, brushing, petrol resisting, air drying, for interior painting of tanks and containers, red oxide (color unspecified).
BDS 928	Specification for ready mixed paint, brushing, acid resisting, for protection against acid fumes, color as required.
BDS 973	Specification for specification and methods of test for linseed stand oil for paints and varnishes.

BDS 974	Specification and methods of test for raw tung oils for paints and varnishes.
BDS 1005	Specification for ready mixed paint, brushing, finishing, stoving, enamel, color as required.
BDS 1141	Specification for ready mixed aluminum priming paints for woodwork.
BDS 1151	Specification for pavement marking paints.
IS 101	Methods of sampling and test for paints, varnishes and related products: (Part 1/Sec 1): Test on liquid paints (general and physical), Section 1 Sampling. (Part 1/Sec 2): Test on liquid paints (general and physical), Section 2 Preliminary examination and preparation of samples for testing. (Part 1/Sec 3): Test on liquid paints (general and physical), Section 3 Preparation of panels. (Part 1/Sec 4): Test on liquid paints (general and physical), Section 4 Brushing test. (Part 1/Sec 5): Test on liquid paints (general and physical), Section 5 Consistency. (Part 1/Sec 6): Test on liquid paints (general and physical), Section 6 Flash point. (Part 1/Sec 7): Test on liquid paints (general and physical), Section 7 Mass per 10 litres. (Part 2/Sec 1): Test on liquid paints (chemical examination), Section 1 Water content. (Part 2/Sec 2): Test on liquid paints (chemical examination), Section 2 Volatile matter. (Part 3/Sec 1): Tests on paint film formation, Section 1 Drying time. (Part 3/Sec 2): Tests on paint film formation, Section 2 Film thickness. (Part 3/Sec 4): Tests on paint film formation, Section 4 Finish. (Part 3/Sec 5): Tests on paint film formation, Section 5 Fineness of

grind

(Part 4/Sec 1): Optical test, Section 1 Opacity.

(Part 4/Sec 2): Optical test, Section 2 Color.

(Part 4/Sec 3): Optical test, Section 3 Light fastness test.

(Part 4/Sec 4): Optical test, Section 4 Gloss.

(Part 5/Sec 1): Mechanical test on paint films, Section 1 Hardness tests.

(Part 5/Sec 2): Mechanical test on paint films, Section 2 Flexibility and adhesion.

(Part 5/Sec 3): Mechanical test on paint films, Section 3 Impact resistance.

(Part 5/Sec 4): Mechanical test on paint films, Section 4 Print free test.

(Part 6/Sec 1): Durability tests, Section 1 Resistance to humidity under conditions of condensation.

(Part 6/Sec 2): Durability tests, Section 2 Keeping properties.

(Part 6/Sec 3): Durability tests, Section 3 Moisture vapour permeability.

(Part 6/Sec 4): Durability tests, Section 4 Degradation of coatings (pictorial aids for evaluation).

(Part 6/Sec 5): Durability tests, Section 5 Accelerated weathering test.

(Part 7/Sec 1): Environmental tests on paint films, Section 1 Resistance to water.

(Part 7/Sec 2): Environmental tests on paint films, Section 2 Resistance to liquids.

(Part 7/Sec 3): Environmental tests on paint films, Section 3 Resistance to heat.

(Part 7/Sec 4): Environmental tests on paint films, Section 4 Resistance to bleeding of pigments.

(Part 8/Sec 1): Tests for pigments and other solids, Section 1 Residue on sieve.

(Part 8/Sec 2): Tests for pigments and other solids, Section 2 Pigments and nonvolatile matter.

(Part 8/Sec 3): Tests for pigments and other solids, Section 3 Ash content.

(Part 8/Sec 4): Tests for pigments and other solids, Section 4 Phthalic anhydride.

(Part 8/Sec 5): Tests for pigments and other solids, Section 5 Lead restriction test.

(Part 8/Sec 6): Tests for pigments and other solids, Section 6 Volume solids.

(Part 9/Sec 1): Tests for lacquers and varnish, Section 1 Acid value.

(Part 9/Sec 2): Tests for lacquers and varnish, Section 2 Rosin test.

IS 104	Specification for ready mixed paint, brushing, zinc chrome, priming.
IS 109	Specification for ready mixed paint, brushing, priming, plaster to Indian Standard colors No. 361 and 631.
IS 123	Specification for ready mixed paint, brushing, finishing, semi-gloss, for general purposes, to Indian Standard colors No. 445, 446, 448, 449, 451 and 473; and red oxide (color unspecified).
IS 133	Specification for enamel, interior (a) undercoating, (b) finishing.
IS 137	Specification for ready mixed paint, brushing, matt or egg-shell flat, finishing, interior, to Indian Standard color, as required.
IS 158	Specification for ready mixed paint, brushing, bituminous, black, lead-free, acid, alkali, and heat resisting.
IS 168	Specification for ready mixed paint, air-drying semi-glossy/matt, for general purposes.
IS 341	Specification for black Japan, Types A, B and C.
IS 2074	Specification for ready mixed paint, air drying red oxide-zinc chrome, priming.
IS 2075	Specification for ready mixed paint, stoving, red oxide-zinc chrome, priming.

IS 2339	Specification for aluminum paint for general purposes, in dual container.
IS 2932	Specification for enamel, synthetic, exterior, (a) undercoating, (b) finishing.
IS 2933	Specification for enamel, exterior, (a) undercoating, (b) finishing.
IS 3536	Specification for ready mixed 'paint, brushing, wood primer.
IS 3537	Specification for ready mixed paint, finishing, interior for general purposes, to Indian Standard colors No. 101, 216, 217, 219, 275, 281, 352, 353, 358 to 361, 363, 364, 388, 410, 442, 444, 628, 631, 632, 634, 693, 697, white and black.
IS 3539	Specification for ready mixed paint, undercoating, for use under oil finishes, to Indian Standard colors, as required.
IS 3585	Specification for ready mixed paint, aluminum, brushing, priming, water resistant, for wood work.
IS 3678	Specification for ready mixed paint, thick white, for lettering.
IS 8662	Specification for enamel, synthetic, exterior, (a) undercoating, (b) finishing, for railway coaches.
IS 9862	Specification for ready mixed paint, brushing, bituminous black lead free, acid, alkali, water and chlorine resisting.
IS 11883	Specification for ready mixed paint, brushing, red oxide, priming for metals.
IS 13183	Specification for aluminum paints, heat resistant.
IS 13213	Specification for polyurethane full gloss enamel (two pack).
IS 13607	Specification for ready mixed paint, finishing, general purposes, synthetic.
IS 13871	Specification for powder coatings.

2.14.3 Thinners and Solvents

These shall conform to the following Standards:

IS 324	Specification for ordinary denatured spirit.
IS 82	Methods of sampling and test for thinners and solvents for paints.

IS 324	Specification for ordinary denatured spirit.
IS 533	Specification for gum spirit of turpentine (oil of turpentine).
IS 14314	Specification for thinner general purposes for synthetic paints and varnishes.

2.14.4 Varnishes and Lacquers

These materials shall conform to the following Standards:

BDS 401	Specification for varnish, finishing, exterior, type-I, (synthetic).
BDS 1064	Specification for varnish, stoving.
BDS 1065	Specification for varnish, acid resisting.
BDS 1066	Specification for varnish, finishing, interior.
IS 337	Specification for varnish, finishing, interior.
IS 347	Specification for varnish, shellac for general purposes.
IS 348	Specification for french polish.
IS 524	Specification for varnish, finishing, exterior, synthetic.
IS 525	Specification for varnish, finishing, exterior and general purposes.
IS 642	Specification for varnish medium for aluminum paint.

2.15 Sanitary Appliances and Water Fittings

2.15.1 Sanitary Appliances

Sanitary appliances shall conform to the following Standards:

ASHRAE 90A	Energy conservation in new building design.
ASHRAE 90B	Energy Conservation in New Building Design.
AWWA C700	Cold-Water Meters-Displacement type, bronze main case.
AWWA C701	Cold-Water Meters-Turbine type, for customer service.
AWWA C702	Cold-Water Meters-Compound type.
BDS 1162	Ceramic wash basin and pedestal, ceramic wash basin and pedestals dimension, design & construction, type, permissible deviation

BDS 1163	Specification for Vitreous Sanitary Appliances, Part-1, General requirements. Part-2, Specific requirements for water closets; Part-3, Specification requirements for urinal (bowl type). Part-4, Specific requirements for foot rest. Part-5, Specific requirements for integrated squatting pans.
BDS 1361	Faucets.
BDS 1593	Plastic sanitary squatting pan.
BS 1125	Specification for WC flushing cisterns (including dual flash cisterns and flush pipes).
BS 1244	Metal Sink for domestic purposes.
BS 1254	Specification for C seats (plastics).
BS 1329	Specification for metal hand rinse basins.
BS 1876	Specification for automatic flushing cistern for urinals.

2.15.2 Pipes and Pipe Fittings for Water Supply and Sanitation

Pipes and pipe fittings for water supply and sanitation shall comply with the following Standards :

BDS 1111	Centrifugally cast (spun) iron pressure pipes for water, gas and sewage.
BDS 1356	Specification for ferrules for water services.
BDS 1357	Specification for washers with fittings for water service.
BDS 1361	Faucets. This standard specifies the technical requirements of various types of Faucets.
BDS 1562	Solvent cements for polyvinylchloride (PVC) plastic pipe and fitting.

BDS 1593	Plastic sanitary squatting pan. Pan lays down the requirement for material, dimension physical requirements and testing for power flush type injection molded high density polyethylene (HDPE) or polypropylene (PP) squatting pan.
BDS EN 1254-2	Copper and copper alloys - Plumbing fittings-Part 2: Fittings with compression ends for use with copper tubes.
BDS EN 1717	Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow.
BDS EN 14506	Devices to prevent pollution by backflow of potable water-Automatic diverter-Family H, type C.
BDS ISO 3419	Non-alloy and alloy steel butt-welding fittings.
BDS ISO 5251	Stainless steel butt-welding fittings.
BDS ISO 6761	Steel tubes-Preparation of ends of tubes and fittings for welding.
BDS ISO 3822-1	Acoustics: Laboratory tests on noise emission from appliances and equipment used in water supply installations-Part 1: Method of measurement.
BDS ISO 3822 -2	Acoustics: Laboratory tests on noise emission from appliances and equipment used in water supply installations-Part 2: Mounting and operating conditions for draw-off taps and mixing valves.
BDS ISO 3822 -4	Acoustics: Laboratory tests on noise emission from appliances and equipment used in water supply installations-Part 4: Mounting and operating conditions for special appliances.
BDS ISO 161-1	Thermoplastics pipes for the conveyance of fluids Nominal outside diameters and Nominal Pressures- Part 1: Metric series.

BDS ISO 161-2	Thermoplastics pipes for the conveyance of fluids- Nominal outside diameters and Nominal Pressures- Part 2: Inch-based series.
BDS ISO 265-1	Pipes and fittings of plastics materials- fittings for domestic and industrial waste pipes- Basic dimensions: Metric series- Part 1: Un-plasticized Poly (Vinyl chloride) (PVC-U).
BDS ISO 1167-1	Thermoplastics pipes fittings and assemblies for the conveyance of fluids-Determination of the resistance to internal pressure- Part 1: General method.
BDS ISO 1167-2	Thermoplastics pipes fittings and assemblies for the conveyance of fluids- Determination of the resistance to internal pressure- Part 2: Preparation of pipe test pieces.
BDS ISO 1746	Rubber or Plastics hoses and tubing-bending tests.
BDS ISO 2505	Thermoplastics pipes- Longitudinal reversion-Test method and parameters.
BDS ISO 2507-2	Thermoplastics pipes and fittings-Vista softening temperature- Part 2: Test conditions for Un-plasticized polyvinylchloride (PVC-U) or chlorinated polyvinylchloride (PVC-C) pipes and fittings and for high impact resistance polyvinylchloride (PVC-HI) pipes.
BDS ISO 3114	Unplasticized polyvinylchloride (PVC) pipes for potable water supply-Extractability of lead and tin- Test method.
BDS ISO 3126	Plastics piping systems-Plastics components- Determination of dimensions.
BDS ISO 3127	Thermoplastics pipes-Determination of resistance to external blows-round-the-clock method.
BDS ISO 3501	Assembled joints between fittings and polyethylene (PE) pressure pipes-Test of resistance to pull-out.
BDS ISO 3503	Assembled joints between fittings and polyethylene (PE) pressure pipes-Test of leak proofness under internal pressure when subjected to bending.

BDS ISO 3633	Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings-Specifications.
BDS ISO 6964	Polyolefin pipes and fittings-Determination of carbon black content by calcinations and pyrolysis-Test method and basic specification.
BDS ISO 4065	Thermoplastics pipes- Universal wall thickness table.
BDS ISO /TR 4191	Unplasticized polyvinylchloride (PVC-U) pipes for water supply- Recommended practice for laying.
BDS ISO 4422-1	Pipes and fittings made of unplasticized polyvinylchloride (PVC-U) for water supply-Specifications-Part 1: General.
BDS ISO 4422-2	Pipes and fittings made of unplasticized polyvinylchloride (PVC-U) for water supply-Specifications-Part 2: Pipes (with or without integral sockets).
BDS ISO 4422-3	Pipes and fittings made of unplasticized polyvinylchloride (PVC-U) for water supply- Specifications-Part 3: Fittings and joints.
BDS ISO 4422-4	Pipes and fittings made of unplasticized polyvinylchloride (PVC-U) for water supply- Specifications- Part 4: Valves and ancillary equipment.
BDS ISO 4422-5	Pipes and fittings made of unplasticized polyvinylchloride (PVC-U) for water supply- Specifications- Part 5: Fitness for purpose of the system.
BDS ISO 4433-3	Thermoplastics pipes- Resistance to liquid chemicals-Classification-Part 3: Unplasticized polyvinylchloride (PVC-U), high- impact polyvinylchloride (PVC-HI) and chlorinated polyvinylchloride (PVC -C) pipes.
BDS ISO 4435	Plastic piping systems for non- pressure underground drainage and sewerage- Unplasticized polyvinylchloride (PVC-U).
BDS ISO 4439	Unplasticized polyvinylchloride (PVC) pipes and fittings-Determination and specification of density.
BDS ISO 6259-1	Thermoplastics pipes-Determination of tensile properties-Part 1: General test method.

BDS ISO 6259-2	Thermoplastics pipes-Determination of tensile properties- Part 2: Pipes made of unplasticized polyvinylchloride (PVC-U), Chlorinated polyvinylchloride (PVC-C), and high-impact polyvinylchloride (PVC-HI).
BDS ISO 6992	Unplasticized polyvinylchloride (PVC-U) pipes for drinking water supply-Extractability of cadmium and mercury occurring as impurities.
BDS ISO 9624	Thermoplastics pipes for fluids under pressure-Mating dimensions of flange adapters and loose backing flanges.
BDS ISO 11413	Plastics pipes and fittings-Preparation of test piece assemblies between a polyethylene (PE) pipe and an electro fusion fitting
BDS ISO 11414	Plastics pipes and fittings-Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion.
BDS ISO 12176-2	Plastics pipes and fittings-Equipment for fusion jointing polyethylene systems-Part 2: Electro fusion
BDS ISO 12176-3	Plastics pipes and fittings-Equipment for fusion jointing polyethylene systems-Part 3: Operator's badge.
BDS ISO 12176-4	Plastics pipes and fittings-Equipment for fusion jointing polyethylene systems-Part 4: Traceability coding.
BDS ISO 13479	Polyolefin pipes for the conveyance of fluids-Determination of resistance to crack propagation-Test method for slow crack growth on notched pipes (notch test).
BDS ISO 13761	Plastics pipes and fittings-Pressure reduction factors for polyethylene pipeline systems for use at temperatures above 20°C.
BDS ISO 13951	Plastics piping systems-Test method for the resistance of polyolefin pipe/pipe or pipe/fitting assemblies to tensile loading.
BDS ISO 13953	Polyethylene (PE) pipes and fittings-Determination of the tensile strength and failure mode of test pieces from a butt-fused joint.
BDS ISO 13954	Plastics pipes and fittings-Peel de-cohesion test for polyethylene

	(PE) electro fusion assemblies of nominal outside diameter greater than or equal to 90 mm.
BDS ISO 13955	Plastics pipes and fittings-Crushing de-cohesion test for polyethylene (PE) electro fusion assemblies.
BDS ISO 13957	Plastics pipes and fittings-Polyethylene (PE) tapping tees-Test method for impact resistance.
BDS ISO 14236	Plastics pipes and fittings-Mechanical-joint compression fittings for use with polyethylene pressure pipes in water supply systems.
BDS ISO 18553	Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds.
BDS ISO 18553	Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds Amendment 1:2010.
BDS ISO 4427-1	Plastics piping systems-Polyethylene (PE) pipes and fittings for water supply-Part 1: General.
BDS ISO 4427-2	Plastics piping systems-Polyethylene (PE) pipes and fittings for water supply-Part 2: Pipes.
BDS ISO 4427-3	Plastics piping systems-Polyethylene (PE) pipes and fittings for water supply-Part 3: Fittings.
BDS ISO 4427-5	Plastics piping systems-Polyethylene (PE) pipes and fittings for water supply-Part 5: Fitness for purpose of the system.
BDS ISO 4427-1	Plastics piping systems-Polyethylene (PE) pipes and fittings for water supply-Part 1: General Technical corrigendum 1: 2010.
BDS ISO 3458	Assembled joints between fittings and polyethylene (PE) pressure pipes-Test of leak proofness under internal pressure.
BDS ISO 3459	Polyethylene (PE) pressure pipes-Joints assembled with mechanical fittings-Internal under pressure test method and requirement.

ASTM A53/A53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
ASTM A74	Standard Specification for Cast Iron Soil Pipe and Fittings.
ASTM A377	Standard Index of Specifications for Ductile-Iron Pressure Pipe.
ASTM B42	Standard Specification for Seamless Copper Pipe, Standard Sizes.
ASTM B43	Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
ASTM B75	Standard Specification for Seamless Copper Tube.
ASTM B88	Standard Specification for Seamless Copper Water Tube.
ASTM B251	Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
ASTM B302	Standard Specification for Thread-less Copper Pipe, Standard Sizes.
ASTM B306	Standard Specification for Copper Drainage Tube (DWV).
ASTM B429/B429M	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
ASTM B447	Standard Specification for Welded Copper Tube.
ASTM B745/B745M	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.
ASTM C14	Standard Specification for Non-reinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
ASTM C654	Standard Specification for Porous Concrete Pipe.
ASTM C700	Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
ASTM D1527	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80.

ASTM D1785	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
ASTM D2239	Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
ASTM D2241	Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
ASTM D2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications ASTM D2464 Standard Specification for Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
ASTM D2466	Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
ASTM D2609	Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
ASTM D2661	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
ASTM D2665	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
ASTM D2672	Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement.
ASTM D2729	Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
ASTM D2737	Standard Specification for Polyethylene (PE) Plastic Tubing.
ASTM D2751	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
ASTM D2846/D2846M	Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
ASTM D2949	Standard Specification for 3.25-in. Outside Diameter Poly(Vinyl

	Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
ASTM D3034	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
ASTM F405	Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings.
ASTM F409	Standard Specification for Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings.
ASTM F437	Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
ASTM F438	Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
ASTM B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
ASTM F441/F441M	Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
ASTM F442/F442M	Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
ASTM F628	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.
ASTM F891	Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core.
IS 404 (Part-I)	Specification for lead pipes Part I for other than chemical purpose.
ISO 2531	Ductile Iron pipes, fittings and accessories for pressure pipelines.
ASME/ANSI B16.3	Malleable iron threaded fittings: Classes 150 and 300.
ASME/ANSI	Cast Iron threaded fittings.

B16.485

ASME/ANSI Factory made wrought steel butt welding fittings.

B16.9

ASME/ANSI Forged Steel Fittings, Socket-Welding and Threaded.

B16.11

ASME/ANSI Cast-Iron Threaded Drainage Fittings;

B16.12

ASME/ANSI Cast Copper Alloy Threaded Fittings: Classes 125 and 250.

B16.15

ASME/ANSI Cast Copper Alloy Solder Joint Pressure Fittings.

B16.18

ASME/ANSI Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

B16.22

ASME/ANSI Cast Copper Alloy Solder Joint Drainage Fittings (DWV).

B16.23

ASME/ANSI Wrought Steel Butt welding Short radius Elbows and Returns.

B16.28

ASME/ANSI Wrought Copper and Wrought Copper Alloy Solder Joint Fittings for solvent Drainage Systems.

B16.29

ASME/ANSI Cast Copper Alloy Solder Joint Fittings for Solvent Drainage Systems.

B16.32

AWWA C110 Standard for Grey Iron and Ductile Iron Fittings, 76 mm to 1220 mm (3 in. through 48 inches), for Water and Other Liquids.

2.15.3 Joints and Connections Between Pipes and Fittings

Applicable standards for joints and connections between pipes and fittings are listed below:

BDS EN 681-1 Elastomeric seals-Materials requirements for pipe joint seals used in water and drainage applications-Part 1: Vulcanized rubber.

BDS EN 681-2 Elastomeric seals-Materials requirements for pipe joint seals used

	in water and drainage applications-Part 2: Thermoplastic elastomers.
ASTM B42	Standard Specification for Seamless Copper Pipe, Standard Sizes.
ASTM C425	Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
ASTM C564	Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
ASTM D2235	Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
ASTM D2564	Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
ASTM D2657	Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
ASTM D2661	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
ASTM D2846/D2846M	Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
ASTM D2855	Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
ASTM D3139	Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
ASTM D3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
ASTM F402	Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
ASTM F493	Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

ASTM F628	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.
ASTM F656	Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
ASME/ANSI B1.20.1	Pillar taps used in water supply.

2.15.4 Taps and Valves

Taps and valves shall conform to the following Standards:

BDS 987	Sand cast brass screw-down bib taps and stop taps for water services. It covers the requirements regarding materials, dimensions, constructions, workmanship, finish and testing of tapes for water services.
BDS 1507	Bib taps used in water supply.
BDS 1508	Stop taps used in water supply specifies the requirements, dimensions construction, materials and test methods of stop taps used in water supply.
BDS 1509	Pillar taps used in water supply.
BDS EN 200	Sanitary tapware-Single taps and combination taps for water supply systems of type 1 and type 2-General technical specification.
BDS EN 246	Sanitary tapware-General specifications for flow rate regulators.
BDS EN 248	Sanitary tapware-General specification for electrodeposited coatings of Ni-Cr.
BDS EN 1112	Sanitary tapware - Shower outlets for sanitary tapware for water supply systems of type 1 and type 2-General technical specification.

BDS EN 1113	Sanitary tapware-Shower hoses for sanitary tapware for water supply systems of type 1 and type 2-General technical specification.
BS 1212 (3 Parts)	Specification for Float Operated Valves (excluding floats).
BS 1010	Specification for draw-off taps and stop valves for water services.
BS 1968	Specification for floats for ball valves (copper).
BS 5433	Specification for underground stop valves for water services (copper).
BS 2456	Specification for floats for ball valves (plastic) for cold and hot water.
BS 1415 (2 parts)	Mixing valves (manually operated).
BS 5163	Specification for predominantly key-operated cast iron wedge gate valve for water works.
BS 3377	Specification for boilers for use with domestic solid mineral fuel appliances.
BS 843	Specification for thermal storage electric water heaters.
BS 855	Specification for welded steel boilers for central heating and indirect hot water supply.

2.16 Miscellaneous Materials

2.16.1 Ferrocement

Details including material requirements are given in Chapter 12 Part 6.

2.16.2 Plastics

Plastics may be used in buildings or structures as light transmitting materials such as glazing, skylights, lighting lenses, luminous ceilings, roof panels, signs and similar purposes. Foam plastics are also used in buildings.

Applicants for approval of a plastic material shall furnish all necessary technical data required by the Building Official. The data shall include chemical composition; applicable physical, mechanical and thermal properties such as fire resistance, flammability and flame spread; weather resistance; electrical properties; products of combustion; and coefficient of expansion.

The requirements for light transmitting plastics, including roof panels and foam plastics are given below.

2.16.2.1 Light Transmitting Plastics

An approved light transmitting plastic shall be any thermoplastic, thermosetting or reinforced thermosetting plastic material which has a self-ignition temperature of 343°C or greater when tested in accordance with, Test Method for Ignition Properties of Plastics; a smoke density rating not greater than 450 when tested in the manner intended for use in accordance with ASTM E84 Test Method for Surface Burning Characteristics of Building Materials; or not greater than 75 when tested in the thickness intended for use in accordance with ASTM D2843 Test Method for Density of Smoke from the Burning or Decomposition of Plastics; and which conforms to one of the following combustibility classifications:

Class C1 : Plastic materials which have a burning extent of 25 mm or less when tested at a nominal thickness of 1.5 mm, or in the thickness intended for use, in accordance with ASTM D635 Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in Horizontal Position; or

Class C2: Plastic materials which have a burning rate of 63 mm/min or less when tested at a nominal thickness of 1.5 mm, or in the thickness intended for use, in accordance with ASTM D635.

2.16.2.2 Foam Plastics

All foam plastics and foam plastic cores of manufactured assemblies shall have a flame spread rating of not more than 75 and shall have a smoke developed rating of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E84.

All foam plastics, unless otherwise indicated in this Section, shall be separated from the interior of a building by an approved thermal barrier of 13 mm gypsum wall board or equivalent thermal barrier material which will limit the average temperature rise of the unexposed surface to not more than 121°C after 15 minutes of fire exposure complying with the standard time-temperature curve of ASTM E119 Test Methods for Fire Tests of Building Construction and Materials. The thermal barrier shall be installed in such a manner that it will stay in place for a minimum of 15 minutes under the same testing conditions. The thermal barrier is not required when the foam plastic is protected by a 25 mm minimum thickness of masonry or concrete.

2.16.2.3 Applicable Standards

A list of applicable Standards for plastics is given below:

BDS 885	Method for measuring viscosity number and K-value of PVC resins.
BDS 886	Method for direct measuring the specific gravity of plastics.
BDS 887	Method for measuring deformation under heat of flexible rigid PVC compounds.
BDS 888	Method for measuring temperature of deflection under load.
BDS 889	Method for measuring the Vicat Softening Temperature (VST) of thermoplastics.
BDS 890	Method for measuring the water absorption at room temperature and boiling water absorption of plastics.
BDS 891	Method for measuring the flexural modulus of plastics.
BDS 892	Method for measuring the resistance to tear propagation of flexible plastics, film or sheeting.
ASTM D543	Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
ASTM D635	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
ASTM D638	Standard Test Method for Tensile Properties of Plastics.
ASTM D695	Standard Test Method for Compressive Properties of Rigid Plastics.
ASTM D882	Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
ASTM D1003	Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
ASTM D1044	Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion.
ASTM D1204	Standard Test Method for Linear Dimensional Changes of Non-rigid

	Thermoplastic Sheeting or Film at Elevated Temperature.
ASTM D1593	Standard Specification for Non-rigid Vinyl Chloride Plastic Film and Sheeting.
ASTM D2103	Standard Specification for Polyethylene Film and Sheeting.
ASTM D2126	Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
ASTM D2842	Standard Test Method for Water Absorption of Rigid Cellular Plastics.
ASTM D2843	Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
ASTM D3294	Standard Specification for PTFE Resin Molded Sheet and Molded Basic Shapes.
ASTM D3678	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Interior-Profile Extrusions.
ASTM D3679	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Siding.
ASTM D3841	Standard Specification for Glass-Fiber-Reinforced Polyester Plastic Panels.
ASTM D4802	Standard Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet.
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials.
ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials.

2.16.3 Ballies and Wood Poles

Ballies of Sal/Gazari, Sundari and Garjan are used in building construction. These shall be free from rots, knots and sap, and straight and uniform in size. These should conform to the following Standards:

BDS 809	Specification for wood poles for overhead power and telecommunication lines.
ASTM D25	Standard Specification for Round Timber Piles.
IS 3337	Specification for Ballies for general purposes.
IS 1900	Method of testing wood poles.
IS 6711	Code of practice for maintenance of wood poles for overhead power and telecommunications lines.

2.16.4 Bamboos

The following standards shall be applicable for bamboos used for structural and nonstructural purposes:

IS 1902	Code of Practice for Preservation of Bamboo and Cane for Non-structural Purposes;
IS 6874	Method of Tests for Round Bamboos.
IS 8242	Methods of Tests for Split Bamboo.
IS 8295	Specification for Bamboo Chicks, Part I Fine.
IS 9096	Code of Practice for Preservation of Bamboos for Structural Purposes.

2.16.5 Fillers, Stoppers and Putties

These shall conform to the following standards:

IS 110	Specification for ready mixed paint, brushing, grey filler, for enamels, for use over primers.
IS 345	Specification for wood filler, transparent, liquid.
IS 419	Specification for putty for use on window frames.
IS 421	Specification for jointing paste, for bedding moldings on coaching stock.
IS 423	Specification for plastic wood, for joiners' filler.
IS 424	Specification for plastic asphalt.
IS 3709	Specification for mastic cement for bedding of metal windows.

IS 7164 Specification for Stopper.

2.16.6 Wire Ropes and Wire Products

These materials shall conform to the following standards:

ASTM A116	Standard Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.
ASTM A121	Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
ASTM A368	Standard Specification for Stainless Steel Wire Strand.
ASTM A392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
ASTM A475	Standard Specification for Zinc-Coated Steel Wire Strand.
ASTM A492	Standard Specification for Stainless Steel Rope Wire.
ASTM A510	Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
ASTM A586	Standard Specification for Zinc-Coated Parallel and Helical Steel Wire Structural Strand.
ASTM A603	Standard Specification for Zinc-Coated Steel Structural Wire Rope.
ASTM A817	Standard Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric. and Marcellled Tension Wire.
ASTM A824	Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence.
ASTM F1183	Standard Specification for Aluminum Alloy Chain Link Fence Fabric.
IS 2365	Specification for Steel Wire Suspension Ropes for Lifts, Elevators and Hoists.

2.16.7 Waterproofing and Damp-proofing Materials

Waterproofing and damp-proofing materials shall conform to the following standards:

ASTM D41	Standard Specification for Asphalt Primer Used in Roofing, Damp proofing, and Waterproofing.
ASTM D43	Standard Specification for Coal Tar Primer Used in Roofing, Damp proofing, and Waterproofing.
ASTM D146	Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing.
ASTM D173	Standard Specification for Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing.
ASTM D6380	Standard Specification for Asphalt Roll Roofing (Organic Felt).
ASTM D226/D226M	Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
ASTM D227	Standard Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing.
ASTM D449	Standard Specification for Asphalt Used in Damp proofing and Waterproofing.
ASTM D450	Standard Specification for Coal-Tar Pitch Used in Roofing, Damp proofing, and Waterproofing.
ASTM D1327	Standard Specification for Bitumen-Saturated Woven Burlap Fabrics Used in Roofing and Waterproofing.
ASTM D1668	Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing.
ASTM D2178	Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
ASTM D2626	Standard Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing.
ASTM D3468	Standard Specification for Liquid-Applied Neoprene and Chloro-sulfonated Polyethylene Used in Roofing and Waterproofing.

2.16.8 Glazed Tiles and Tile-setting Mortars

Glazed tiles shall conform to the following standards:

BDS 1301	Specification for glazed earthenware wall tiles.
ASTM C126	Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
ANSI A137.1	Specification for Ceramic Tile.
BS 6431	Ceramic floor and wall tiles (Part 1 to 23).

2.16.8.1 Mortars for Ceramic Wall and Floor Tile

- (a) Portland Cement Mortars: Portland cement mortars for installing ceramic wall and floor tile shall comply with ANSI A108.1 and be of the compositions indicated in Table 5.2.1.
- (b) Dry-set Portland Cement Mortars: Premixed prepared Portland cement mortars, which require only the addition of water and which are used in the installation of ceramic tile, shall comply with ANSI A 118.1. The shear bond strength for tile set in such mortar shall be as required in accordance with that standard. Tile set in dry-set Portland cement mortar shall be installed in accordance with ANSI A 108.5.
- (c) Electrically Conductive Dry-Set Mortars: Premixed prepared Portland cement mortars, which require only the addition of water and which comply with ANSI A118.2, shall be used in the installation of electrically conductive ceramic tile. Tile set in electrically conductive dry-set mortar shall be installed in accordance with ANSI A 108.7.
- (d) Latex-modified Portland Cement Mortars: Latex-modified Portland cement thin set mortars in which Latex is added to dry-set mortar as a replacement for all or part of the gauging water which are used for the installation of ceramic tile shall comply with ANSI A 118.4. Tile set in latex-modified Portland cement mortar shall be installed in accordance with ANSI A 108.5.
- (e) Epoxy Mortar: Chemical-resistant epoxy for setting and grouting ceramic tile shall comply with ANSI A 118.3-2009. Tile set and grouted with epoxy shall be installed in accordance with ANSI A 108.6.
- (f) Furan Mortar and Grout: Chemical resistant furan mortar and grout which are used to install ceramic tile shall comply with ANSI A 118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A 108.8.
- (g) Modified Epoxy-Emulsion Mortar and Grout: Modified epoxy-emulsion mortar and grout which are used to install ceramic tile shall comply with

ANSI A 118.8. Tile set and grouted with modified epoxy-emulsion mortar and grout shall be installed in accordance with ANSI A 108.9.

- (h) Organic Adhesives: Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A 136.1. The shear bond strength after water immersion shall not be less than 0.25 kN/mm² for Type I adhesive, and not less than 0.13 kN/mm² for Type II adhesive when tested in accordance with ANSI A 136.1. Tile set in organic adhesive shall be installed in accordance with ANSI A 108.4.
- (i) Portland Cement Grouts: Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A 118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A 108.10.

2.16.8.2 Applicable Standards

A list of applicable Standards for tiles, mortars and adhesives is given below:

BDS 1301	Specification for Glazed Earthenware Wall Tiles.
ASTM C126	Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
ANSI A108.1	Specification for the Installation of Ceramic Tile with Portland Cement Mortar.
ANSI A108.4	Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive.
ANSI A108.5	Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
ANSI A108.6	Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy.
ANSI A108.7	Specification for Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar.
ANSI A108.8	Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout.
ANSI A108.9	Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
ANSI A108.10	Installation of Grout in Tile work.

ANSI A118.1	Specification for Dry-Set Portland Cement Mortar.
ANSI A118.2	Specifications for Conductive Dry-set Portland Cement Mortar.
ANSI A118.3	Specifications for Chemical Resistant Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive.
ANSI A118.4	Specifications Furan Latex-Portland Cement Mortar.
ANSI A118.5	Specifications for Chemical Resistant Furan.
ANSI A118.6	Specifications for Ceramic Tile Grouts.
ANSI A118.8	Specifications for Modified Epoxy Emulsion Mortar/Grout.
ANSI A136.1	Organic Adhesives for Installation of Ceramic Tile.
ANSI A137.1	Specifications for Ceramic Tile.
BS 6431	Floor and wall tiles.
BS 6431 Part 1	Specification for classification and making, including definitions and characteristics.
BS 6431 Part 2	Specification for struded ceramic tiles with low water absorption ($E < 3\%$) Group A1.
BS 6431 Part 3	Extruded ceramic tiles with a water absorption of $3\% < E < 6\%$. Group A 11a.
BS 6431 Part 3 Sec 3.1	Specification for general products.
BS 6431 Part 3 Sec 3.2	Specification for products Terre Cuite, Cotto, Baldosion Catalan.
BS 6431 Part 4	Extruded Ceramic Tiles with a Water Absorption of $6\% < E < 10\%$. Group A11b.
BS 6431 Part 4	Specification for General Products.
BS 6431 Part 4 Sec 4.2	Specification for Specific Products (Terre Cuite, Cotto, Baldosion Catalan).

BS 6431 Part 5	Specification for extruded ceramic tiles with a water absorption of $E > 10\%$, Group A111.
BS 6431 Part 6	Specification for dust-pre-stressed ceramic tiles with a low-water absorption ($E < 3\%$) Group B1.
BS 6431 Part 7	Specification for dust-pre-stressed ceramic tiles with a water absorption of $3\% < E \leq 6\%$ Group B11a;
BS 6431 Part 8	Specification for dust-pre-stressed ceramic tiles with water absorption of $6\% < E \leq 10\%$. Group B11b;
BS 6431 Part 9	Specification for dust-pre-stressed ceramic tiles with a water absorption of $E > 10\%$. Group B111.
BS 6431 Part 10	Method for determination of dimensions and surface quality.
BS 6431 Part 11	Method for determination of water absorption.
BS 6431 Part 12	Method for determination of modulus of.
BS 6431 Part 13	Method for determination of scratch hardness of surface according to Mhos.
BS 6431 Part 14	Method for determination of resistance to abrasion of unglazed tiles.
BS 6431 Part 15	Method for determination of linear thermal expansion.
BS 6431 Part 16	Method for determination of resistance to thermal shock.
BS 6431 Part 17	Method for determination of crazing resistance-glazed tiles.
BS 6431 Part 18	Method for determination of chemical resistance-unglazed tiles.
BS 6431 Part 19	Method for determination of chemical resistance-glazed tiles.
BS 6431 Part 20	Method for determination of resistance to surface abrasion-glazed tiles.
BS 6431 Part 23	Specification for sampling and basis for acceptance.

2.16.9 Refractories

Refractories shall conform to the following Standards:

BDS 1493	Glossary of terms used in refractory.
BDS 1494	Dimension of refractory bricks.
BDS 1495	High aluminum refractory bricks.
ISO 528	Refractory products-determination of pyrometric cone equivalent (refractoriness).
ISO 1109	Refractory products-classification of dense shaped refractory products.
ISO 1146	Pyrometric reference cones for laboratory use-specification.
ISO 1893	Refractory products-determination of refractoriness-under-load (differential with rising temperature).
ISO 1927	Prepared unshaped refractory materials (dense and insulating) classification.
ISO 2245	Shaped insulating refractory products-classification.
ISO 2477	Shaped insulating refractory products-determination of permanent change in dimensions on heating.
ISO 2478	Dense shaped refractory products-determination of permanent change in dimensions on heating.
ISO 3187	Refractory products-determination of creep in compression.
ISO 5013	Refractory products-determination of modulus of rupture at elevated temperatures.
ISO 5014	Refractory products-determination of modulus of rupture at ambient temperature.
ISO 5016	Shaped insulating refractory products-determination of bulk density and true porosity.
ISO 5017	Dense shaped refractory products-determination of bulk density, apparent porosity and true porosity.
ISO 5018	Refractory materials-determination of true density.

ISO 5019-1	Refractory bricks-dimensions-Part 1: Rectangular bricks.
ISO 5019-2	Refractory bricks-dimensions-Part 2: Arch bricks;
ISO 5019-3	Refractory bricks-dimensions-Part 3: Rectangular checker bricks for regenerative furnace.
ISO 5419-4	Refractory bricks-dimensions-Part 4: Dome bricks for electric arc furnace roofs.
ISO 5015-6	Refractory bricks-dimensions-Part 6: Basic bricks for oxygen steel making converters.
ISO 5022	Shaped refractory products-sampling and acceptance testing.
ISO 5417	Refractory bricks for use in rotary kilns-dimensions.
ISO 8656	Refractory products-sampling of raw materials and unshaped products- Part 1: Sampling scheme.
ISO 8840	Refractory materials-determination of bulk density of granular materials (grain density).
ISO 8890	Dense shaped refractory products-determination of resistance to sulfuric acid.
ISO 8894-1	Refractory materials-determination of thermal conductivity- Part 1: Hot-wire method (cross-array).
ISO 8894-2	Refractory materials-determination of thermal conductivity- Part 2: Hot-wire method (parallel).
ISO 8895	Shaped Insulating refractory products-determination of cold crushing strength.
ISO 9205	Refractory bricks for use in rotary kilns-hot-face identification marking.
ISO 10080	Refractory products-classification of dense, shaped acid-resisting products.
ISO 10081	Basic refractory products-classification- Part I: Products containing less than 7% residual carbon.

2.16.10 Thermal Insulating Materials

Thermal insulation may be in the following physical forms:

- Loose fill dry granules or nodules poured or below in place;
- Flexible or semi rigid blankets and bolts of wool like material;
- Rigid boards and blocks;
- Membrane reflective insulation;
- Spray applied mineral fibre or insulating concrete;
- Poured in plain-insulating concrete;
- Foamed in place-polyurethane;
- Gypsum plaster.

Thermal insulating materials shall conform to the Standards listed below:

ASTM C167	Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.
ASTM C177	Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
ASTM C195	Standard Specification for Mineral Fiber Thermal Insulating Cement.
ASTM C196	Standard Specification for Expanded or Exfoliated Vermiculite Thermal Insulating Cement
ASTM C208	Standard Specification for Cellulosic Fiber Insulating Board.
ASTM C209	Standard Test Methods for Cellulosic Fiber Insulating Board.
ASTM C1363	Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
ASTM C240	Standard Test Methods of Testing Cellular Glass Insulation Block.
ASTM C335	Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation.

ASTM C411	Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
ASTM C449	Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
ASTM C516	Standard Specification for Vermiculite Loose Fill Thermal Insulation.
ASTM C518	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
ASTM C520	Standard Test Methods for Density of Granular Loose Fill Insulations.
ASTM C533	Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
ASTM C534/C534M	Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
ASTM C547	Standard Specification for Mineral Fiber Pipe Insulation.
ASTM C549	Standard Specification for Perlite Loose Fill Insulation.
ASTM C552	Standard Specification for Cellular Glass Thermal Insulation.
ASTM C553	Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
ASTM C578	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
ASTM C591	Standard Specification for Un-faced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
ASTM C592	Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
ASTM C610	Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
ASTM C612	Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
ASTM C665	Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

ASTM C726	Standard Specification for Mineral Fiber Roof Insulation Board.
ASTM C728	Standard Specification for Perlite Thermal Insulation Board.
ASTM C739	Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation.
ASTM C764	Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation.
ASTM C916	Standard Specification for Adhesives for Duct Thermal Insulation.
ASTM C991	Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings.
ASTM C1014	Standard Specification for Spray-Applied Mineral Fiber Thermal and Sound Absorbing Insulation.
ASTM C1029	Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
ASTM C1071	Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

2.16.11 Screw Threads and Rivets

These shall conform to the following standards:

IS 554	Dimensions for pipe threads where pressure tight joints are required on the threads.
IS 1929	Specification for hot forged steel rivets for hot closing (12 to 36 mm diameter).
IS 2155	Specification for cold-forged solid steel rivets for hot closing (6 to 16 mm diameter).
IS 2643	Dimensions for pipe threads for fastening purposes. Part I-Basic profile and dimensions. Part II-Tolerances. Part III-Limits of sizes.
IS 2907	Specification for non-ferrous rivets (1.6 mm to 10 mm).
IS 2998	Specification for cold forged steel rivets for cold closing (1 to 16 mm diameter).
IS 10102	Technical supply conditions for rivets.

2.16.12 Sealants

Sealants shall conform to the following Standards:

ASTM C509	Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
ASTM C542	Standard Specification for Lock-Strip Gaskets.
ASTM C564	Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
ASTM C716	Standard Specification for Installing Lock-Strip Gaskets and Infill Glazing Materials.
ASTM C719	Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
ASTM C1193	Standard Guide for Use of Joint Sealants.
ASTM C794	Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
ASTM C834	Standard Specification for Latex Sealants.
ASTM C864	Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
ASTM C919	Standard Practice for Use of Sealants in Acoustical Applications.
ASTM C920	Standard Specification for Elastomeric Joint Sealants.
ASTM C1193	Standard Guide for Use of Joint Sealants.
ASTM D2628	Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
ASTM D3406	Standard Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements.
ASTM D3667	Standard Specification for Rubber Seals Used in Flat-Plate Solar Collectors.
ASTM D3771	Standard Specification for Rubber Seals Used in Concentrating Solar Collectors.

ASTM D3832	Standard Specification for Rubber Seals Contacting Liquids in Solar Energy Systems.
ISO 3934	Rubber building gaskets-materials in preformed solid vulcanizates used for sealing glazing and panels-specification.
ISO 4633	Rubber seals-joint rings for water supply, drainage and sewerage pipelines-specifications for materials
ISO 4635	Rubber, vulcanized-preformed compression seals for use between concrete motorway paving sections-specifications for material.
ISO 5892	Rubber Building Gaskets-Materials for Preformed Solid Vulcanized Structural Gaskets-Specification;
ISO 6447	Rubber seals-joint rings used for gas supply pipes and fittings-specification for material.
ISO 9331	Rubber seals joint rings for hot water supply pipelines up to 110° C specifications for the material.

2.16.13 Joints and Jointing Products

Joints and jointing products shall conform to the following Standards:

ISO 2444	Joints in buildings-vocabulary.
ISO 3867	Agglomerated cork-material of expansion joints for construction and building test-methods.
ISO 3869	Agglomerated cork-filler material of expansion joints for construction and buildings -characteristics, sampling and packing.
ISO 3934	Rubber building gaskets-materials in preformed solid vulcanizates used for sealing glazing and panels-specification.
ISO 4633	Rubber seals-joint rings for water supply, drainage and sewerage pipelines-specification for materials.
ISO 4635	Rubber, vulcanized-preformed compression seals for use between concrete motor way paving sections-specification for material.
ISO 5892	Rubber building gaskets-materials for preformed solid vulcanized structural gaskets-specification.

ISO 6447	Rubber seals-joint rings used for gas supply pipes and fittings-specification for material.
ISO 6589	Joints in building-laboratory method of test for air permeability of joints.
ISO 7389	Building construction-jointing products-determination of elastic recovery.
ISO 7390	Building construction-jointing products-determination of resistance to flow.
ISO 7727	Joints in building-principles for jointing of building components-accommodation of dimensional deviations during construction.
ISO 8339	Building construction-jointing products-sealants-determination of tensile properties.
ISO 8340	Building construction-jointing products-sealants-determination of tensile properties at maintained extension.
ISO 8394	Building construction-jointing products-determination of extrudability of one-component sealants.
ISO 9046	Building construction-sealants-determination of adhesion/ cohesion properties at constant temperature.
ISO 9047	Building construction-sealants-determination of adhesion/ cohesion properties at variable temperatures.
ISO 9631	Rubber seals-joint rings for hot water supply pipelines up to 110°C specifications for the material.
ISO 10563	Building construction-sealants for joints-determination of change in mass and volume.
ISO 10590	Building construction-sealants-determination of adhesion/cohesion properties at maintained extension after immersion in water.
ISO 10591	Building construction-sealants-determination of adhesion/cohesion properties after immersion in water.

2.16.14 Glass and Glazing

The applicable Standards for glass and glazing are listed below:

ASTM C1036	Standard Specification for Flat Glass.
ASTM C1048	Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
ANSI Z 97.1	Safety Performance Specifications and Methods of Tests for Transport Safety Glazing Materials Used in Building.
CPSC 16 CFR	Safety Standard for Architectural Glazing Materials. Part 1201A.

2.17 Cgi Sheet Roofing and Walling

Galvanized corrugated steel sheets conforming to BDS 868, Galvanized Corrugated Sheet Roof and Wall Coverings, may be used over structural framing for construction of roofs and walls. Requirements for various roofing materials including CGI sheet have been specified in Sec 2.13 above.

Part VI
Chapter 1
Definitions and General Requirements

1.1 Introduction

1.1.1 Scope

The definitions providing meanings of different terms and general requirements for the structural design of buildings, structures, and components thereof are specified in this Chapter. These requirements shall apply to all buildings and structures or their components regulated by this Code. All anticipated loads required for structural design shall be determined in accordance with the provisions of Chapter 2. Design parameters required for the structural design of foundation elements shall conform to the provisions of Chapter 3. Design of structural members using various construction materials shall comply with the relevant provisions of Chapters 4 to 13. The FPS equivalents of the empirical expressions used throughout Part 6 are listed in Appendix A.

This Code shall govern in all matters pertaining to design, construction, and material properties wherever this Code is in conflict with requirements contained in other standards referenced in this Code. However, in special cases where the design of a structure or its components cannot be covered by the provisions of this Code, other relevant internationally accepted codes referred in this Code may be used.

1.1.2 Definitions

The following definitions shall provide the meaning of certain terms used in this Chapter.

BASE SHEAR	Total design lateral force or shear at the base of a structure.
BASIC WIND SPEED	Three-second gust speed at 10 m above the mean ground level in terrain Exposure-B defined in Sec 2.4.6 and associated with an annual probability of occurrence of 0.02.
BEARING WALL SYSTEM	A structural system without a complete vertical load carrying space frame.
BRACED FRAME	An essentially vertical truss system of the concentric or eccentric type which is provided to resist lateral forces.
BUILDING FRAME SYSTEM	An essentially complete space frame which provides support for loads.