

**DEPARTMENT OF HEALTH AND FAMILY WELFARE
GOVERNMENT OF ODISHA**



**AFFORDABLE HEALTHCARE FACILITIES IN THE STATE OF ODISHA
UNDER PPP FRAMEWORK**

ANNEXURE I of SCHEDULE 4

of

SCHEDULES OF THE DRAFT CONCESSION AGREEMENT

HOSPITAL BUILDING SPECIFICATION

GENERAL TECHNICAL SPECIFICATIONS

The Specifications for Building & Road Works shall be as per NBC, IS-456, IS-800 and other relevant IS/ BIS codes /latest approved guidelines for a particular requirement in hospital settings shall be deemed to be bound into these specifications mentioned hereunder.

In the absence of any definite provisions on any particular issue in the aforesaid specifications, reference may be made to the specifications of BIS Codes, where even the above codes are silent, the specifications of ODISHA P.W.D., Irrigation Department or Rural Development specification approved from time to time by the concerned Chief Engineers shall apply. If none of the foregoing applies, the construction and completion of works shall conform to sound Engineering practice as approved by the Independent Engineer/Monitoring Agency. In case of any dispute arising out of the interpretations of the above, the decision of the Independent Engineer/ Monitoring Agency shall be final and binding on the Concessionaire.

It shall be the Concessionaire's responsibility to obtain any clarification on the specifications and/or contents contained within this document for development of specific Design Basis Report (DBR) and Bills of Quantities (BOQ) prior to design/development and commencement of the work(s) to avoid dispute arising out of any possible misinterpretation.

Quality Control: The Independent Engineer/Monitoring Agency appointed by Authority shall check the Concessionaire's work regularly and notify him of any Defects that are found. Such checking shall not affect the Concessionaire's responsibilities. The Independent Engineer/Monitoring Agency may instruct the Concessionaire to search for defects and to uncover and test any work that the Independent Engineer/ Monitoring Agency consider may have a Defect. If the Independent Engineer/Monitoring Agency instruct the Concessionaire to carry out a test not specified in the Specification/schedule(s) to check whether any work has a Defect and the test shows that it does, the Concessionaire shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

Correction of Defects: The Independent Engineer/Monitoring Agency shall give notice to the Concessionaire of any Defects before the end of the Defects Liability Period as per the provision of the agreement.

I. Technical Specifications of General Works

a. Planning & designing:

- i. The facility shall be planned keeping in mind the maximum peak hour patient load and shall have the scope for future expansion.
- ii. Waiting space: Waiting area with adequate seating arrangement shall be provided. Main entrance, general waiting and subsidiary waiting spaces are required adjacent to each consultation and treatment room in all the clinics.
- iii. The patient care/consultation area for infectious and communicable diseases should be located in isolation, preferably, in remote corner of the building preferably with restricted/barrier access.
- iv. All ICU beds must be separable through temporary partitions such as hanging retractable curtains and should be constructed in such a manner that each bed in the ICU can be easily observed from the nursing station;

- v. Nursing station should have enough space for adequate number of nurses, a computer terminal & working desk/bench;
- vi. Head end of each bed should have stable electrical supply (at least 3 outlets of 5/15 amps), oxygen & vacuum outlet, preferably in a bed head panel or pendant;
- vii. Infrastructure should be disabled and physically handicapped friendly;
- viii. Ramp, hand railing, proper lightening, anti-skid tiles must be provided in the hospital;
- ix. HVAC filters (heating, ventilation, air conditioning) should be properly installed;
- x. The entrance point should have good access with adequate space for wheel chairs, stretchers, ramps etc.

b. Materials of following specification are to be used in work.

- i. Cement - Will be as per I.S. 269/255 (However the grade of cement to be selected by the Independent Engineer of work and compressive cube test before commencement of work in each batch).
- ii. Steel - I.S. 432 (Plain) and 1786 (Tor)
- iii. Vibrator - I.S. 7246
- iv. Aggregate - I.S. 383, I.S. 515
- v. Water for mixing and curing - Shall be clean, free from injurious amount of oil, salt, acid, vegetable materials and other substances and harmful to concrete in conformity to I.S. 456 and I.S. 2025.
- vi. Sand/ Fine Aggregate - I.S. 2116, 383
- vii. Binding wire - I.S. 280 (galvanised minimum 1 mm)
- viii. Rain water pipe - I.S. 2527
- ix. Construction joints - I.S. 3414
- x. Steel Window Frame - I.S. 1038/83
- xi. Steel Door Frame - I.S. 4351/75
- xii. Fitting & Fixtures for joinery works - Conforming to I.S. 7452/82 strictly conform to I.S. specification and as per direction of Independent Engineer.

Note : For road work (Approach Road) specification as per road and bridges (latest edition) published by I.R.C & M.O.S.T. shall be followed. In case of any doubt and absence of provision, regarding specification latest I.S. shall be referred (Indian standard).

c. ITEM OF WORK

- i. Concrete shall be with conformity to I.S.456.
- ii. Foundation shall be with conformity to I.S.1080.
- iii. Stone masonry (R.R.) shall be with conformity to I.S.1597 (Part-I)
- iv. C.R. Masonry shall be with conformity to I.S.1597.

- v. Brick masonry shall be with conformity to I.S.2212.
- vi. Cement plastering shall be with conformity to I.S.9103 & 6925.
- vii. Mortar shall be with conformity to I.S.2250
- viii. White and colour washing shall be with conformity to I.S.6278.
- ix. CC in foundation shall be with conformity to I.S.2571.
- x. Anti-Termite Treatment shall be with conformity to I.S.6813. (Part – I & Part – II)
- xi. Painting to all surfaces shall be with conformity to I.S.2395 (Part – I & Part – II)
- xii. DPC shall be with conformity to I.S.3067
- xiii. Tarfelt treatment shall be with conformity to I.S.1346
- xiv. Mosaic flooring with conformity to I.S.2114
- xv. Steel painting shall be with conformity to I.S.1477 (Part – I & Part – II) I.S.1661
- xvi. Door & Door Frame: As per requirement the type of door for Hospital use will be finalized during approval of DBR.
- xvii. Floor, Wall & Roof FINISH of OTs: As per the requirement of NABH and IPHS and as per approved DBR.
- xviii. Swing Door: Swing Door of approved make to be fabricated from roll formed sections made of pre-painted steel (base steel as per IS-513 of 0.6 mm thick “D” quality, galvanized as per IS-277 with zinc of 120 Gm/Sq.mtr) with paint specification being with primer of 5-7 microns and finished paint with polyster paint of 12-16 microns along with the alkyd backer at the back of 5-7 microns and the sizes of outer frame being of 33 x 57 mm and shutter being of 46 x 52 mm and 46 x 46 mm and lock rail should be of 23 x 130mm. Accessories / gaskets are to be used as per the manufacturer’s supply and specification like handle, lock and floor spring of approved quality. Gasket will be made of EPDM. All corner brackets are to be made of CRCA with zinc phosphating. The sections are to be cut to length, meter joined with corner bracket and frames are fixed to the concrete/masonry walls by means of self-expanding screws and glass to be used of 6 mm.
- xix. Fenesta/NCL/Duroplast Window (UPVC): Un-plasticized Poly Vinyl Chloride (UPVC) sliding windows of FENESTA - only two glass shutters sliding duly manufactured using UPVC reinforced profiles of 80mm x 52mm x 2.25mm or equivalent for outer frames, 54mm x 38mm x 2.25mm or equivalent for sliding shutter frames capable of mounting single glazing system, structurally reinforced with hot dip galvanized up to 50 microns of minimum thickness of 1.2mm prefabricated & welded through fusion welding the window sash shall be fitted with 5mm thick clear float glass (toughened) of reputed make duly fixed with EPDM weathering seal resistant accessories like clipping locking system made of aluminium 1 no., per set of sashes and the system is to be installed at the site using anchor fasteners, silicon rubber sealant, easy glazing / deglazing at site with 10

years manufactures warranty for discoloration, wrapping, mechanical failures, shrinkages, rotting, corrosion etc. with a quality certificate from relevant department of Govt. of India.

- xx. Vitrified Fully Stain free: Vitrified (Fully) Stain free, Sandmist, Tropicana, fully charged Tile of make Johnson, RAK, Kajaria or Somany of floors of size 1000mm x1000mm / 1200mm x 600mm having thickness not less than 12mm conforming to IS : 15622 -2006 laid on 20 mm thick cement mortar (1:4) and filling joints with white cement of approved quality including cost of all materials, labour T&P etc. required for the work all complete as per specification and direction of the Independent Engineer.
- xxi. Germ Free Wall Tile: Vitrified (Fully) Stain free, Sandmist, Tropicana, fully charged Tile of make Johnson, RAK, Kajaria or Somany of floors of size 1000mm x1000mm / 1200mm x 600mm having thickness not less than 12mm conforming to IS : 15622 -2006 laid on 20 mm thick cement mortar (1:4) and filling joints with white cement of approved quality.
- xxii. Ultra Eurocon Tile in Floor: Pre polished cement concrete tiles (floor) confirm to IS 1237:1980 (Reaffirmed in 1996) for heavy duty tiles (Exterior Grade) of 22-25mm thick of make Ultra Eurocon or Duracrete, Abrasion and wear resistant, as per parten, size and colour as specified to be used in floor laid over cement mortar (1:4) 20 mm thick.
- xxiii. Ultra Eurocon Tile in Dado: Pre polished cement concrete tiles (floor) confirm to IS:1237:1980 (Reaffirmed in 1996) for heavy duty tiles (Exterior Grade) of 22-25mm thick of make Ultra Eurocon or Duracrete, Abrasion and wear resistant, as per pattern, size and colour or equivalent make in dados / skirting and risers of steps on 12mm thick cement plaster (1:3) jointed with neat cement slurry mixed with pigments to match the shade of the tiles.
- xxiv. Structural Glazing / ACP Combination: Structural Glazing of approved make to be fabricated from roll formed sections made of pre-painted steel (base steel as per IS-513 of 0.6mm thick 'D' quality galvanized as per IS-277 with zinc of 120gm per sqm.) with primer of 5 – 75.7microns thick and finished paint with polyester paint of 12-16microns along with the alkyd backer at the back of 5-7 microns and the sizes of outer frame being 46 x 52mm and with all vertical & horizontal mullions are of 46 x 70mm and fixed beading are of 18 x 25mm. Sections for internal top and bottom frames in the louvered area should be 18 x40mm. Top hung shutter should be 46x46mm. Accessories/ed beadings are of 18x25mm. Accessories/ gaskets are to be used as per the manufacturer's supply and specification like handle being made of high grade aluminum powder coated and with nylon receiver and gasket will be made of EPDM. All corner brackets are to be made of CRCA with zinc phosphating. The mullion caps and louvered-clips should be glass filled nylon. The sections are to be cut to length jointed and assembled by means of corner bracket and frames are fixed to the concrete / masonry walls by means of self-expanding screws and glass to be used

with safety laminated glass of 12.38 mm thick with 0.76 mm inter layer Poly Vinyl Butyral (PVB) lamination between two glass with outer being 6 mm thick toughened reflective of Reflectsol series of Saint Gobain & inner glass being of 6mm thick toughened clear of Saint Gobain make.

- xxv. Aluminium Composite Panel (ACP): Aluminum composite panel of Alvcobond Durabuild or equivalent make coated with polyvinylidene fluoride (PVDF) resin cold coating on top and auto corrosive primer on the black aluminum panel.
- xxvi. Gypsum Board: Plain Gypsum board ceiling suspended from roof by adjustable G.I ceiling angle with spread at a distance not more than 600 mm fixed to roof by Row plug & stiff cleat, Gypsum board 12.5mm thick held by G.I perimeter channel MF-3 & intermediate channel MF-7 framing, boarding, jointing & finishing with special type of gypsum compound etc.
- xxvii. Armstrong Ceiling: False ceiling made out of Armstrong acoustical fine fissured RH-99 board NRC 0.55 sound attention 34 db fixed with frame made of G.I. perimeter channel runners (GYP steel make or equivalent boarded company) etc. and hanged from R.C.C. roof slab on 600mm x 600mm grid.
- xxviii. Cornice for Gypsum Board: Fixing and fitting of cornice for gypsum board ceiling 4'' wide of approved quality and approved make conferring to I.S with necessary bend etc. complete fixed to wall with screw etc.
- xxix. Sikadur: Sikadur combiflex treatment SG 20P 200 and sealed by Sikadur 31C @ 1.4kg. Per meter over the expansion joint after cleaning the joints and applying of Sikadur 32 @ 200gms per meter epoxibonding agent and leveled by Sikagrout 214 @ 8kg. per meter and covered with 300 mm wide, 16 gauge Aluminum Sheet.
- xxx. Anti-Termite Treatment: Anti-termite treatment using approved quality of chemical emulsion, spraying the mixture uniformly by sprayer as pre-constructional anti termite treatment and creating a chemical barrier under and around the column pits, wall trenches, top surface of plinth filling, junction of walls & floors along with external perimeter of the building, expansion joints, surrounding the pipes and conduits etc. as directed by the manufacturer confirming to IS:6313 (Part-II)
- xxxi. Flush Door: Factory made 32mm thick B.W.P. I.S.I, marked flush door / window of Century / Mayur make or similar type with seven years guarantee against termite and borer etc. by using 25mm thick BWP ply with vinior laminated with two sides complete with wooden hinged cleats Stainless Steel fittings like Tower Bolt, Handel, Aldrop, Hinges, Screw etc.
- xxxii. Fixed Glazing with part top hung: Glazing with part Top hung of approved make to be fabricated from roll formed sections made of pre-painted steel (base steel as per IS-513 of 0.6 mm thick "D" quality, galvanized as per IS-277 with zinc of 120 Gm/Sq.mtr) with paint specification being with primer of 5-7 microns and finished paint with polyester paint of 12-16 microns along with the alkyd backer at the back of 5-7 microns and the sizes of outer

frame being of 46x52 mm and with all vertical and horizontal mullions are of 46x70 mm and fixed beadings are of 18x25 mm. Top hung shutter should be of 46 x 46 mm. Accessories / gaskets are to be used as per the manufacturer's supply and specification like handle being made of high grade aluminum powder coated and with nylon receiver and gasket will be made of EPDM. All corner brackets are to be made of CRCA with zinc phosphating. The mullion caps and louvered-clips should be of glass filled nylon. The sections are to be cut to length, miter joined with corner bracket and frames are fixed to the concrete/masonry walls by means of self-expanding screws and glass to be used of 5 mm reflective.

- xxxiii. Ventilator: Fixed Ventilators of approved make to be fabricated from roll formed sections made of pre-painted steel (base steel as per IS-513 of 0.6 mm thick "D" quality, galvanized as per IS-277 with zinc of 120 Gm/Sq.mtr) with paint specification being with primer of 5-7 microns and finished paint with polyester paint of 12-16 microns along with the alkyd backer at the back of 5-7 microns and the sizes of outer frame being of 46x52 mm and with all vertical and horizontal mullions are of 46x70 mm and fixed beadings are of 18x25 mm. Accessories / gaskets are to be used as per the manufacturer's supply and specification like handle being made of high grade aluminum powder coated and with nylon receiver and gasket will be made of EPDM. All corner brackets are to be made of CRCA with zinc phosphating. The mullion caps and louvered-clips should be of glass filled nylon. The sections are to be cut to length, miter joined with corner bracket and frames are fixed to the concrete/masonry walls by means of self-expanding screws and glass to be used of 5 mm reflective.
- xxxiv. Anti-skid Vitrified Floor Tiles: Anti-skid Vitrified floor tiles of premium grade having thickness 8mm to 10mm confirming to IS 13756 of size 60cm x 60cm coloured / printed series in floors, Trades of steps & Landing over 20mm thick bed of cement mortar 1:4 jointed with cement slurry mixed with pigments to match the shade of the tiles, including rubbing & polishing etc
- xxxv. Chequered Floor Tile: Chequered tiles of premium grade having thickness 7mm to 8mm confirming to IS 13755 of size 30cm x 30cm special plain / printed series in floors over 20mm thick bed of cement mortar 1:4 jointed with cement slurry mixed with pigments to match the shade of the tiles, including rubbing & polishing etc.
- xxxvi. Ceramic Wall Tile: Ceramic wall tiles of premium grade having thickness 6.5mm to 6.7mm confirming to IS 13753 of size 30cm x 20cm special plain / printed series in dados skirting & riser of steps on 12mm thick cement plaster 1:3 jointed with neat cement slurry mixed with pigments to match the shade of the tiles, including rubbing & polishing etc.
- xxxvii. Stainless Steel Railing: Stainless steel Staircase Handrail of 1200mm high +(150~200) mm with Top hand rail of 50mm dia Hollow SS pipe of 16 gauge to be welded to 19mm wide 8mm thick brushed finish ss flat to shape and size as railing to the verticals made of 50x6 mm SS flats with 8mm

spacer welded to SS brackets pipe which is connected with verticals 10mm dia SS pipe bent to profile and placed as per the architectural drawing and verticals are connected by 50mm wide 10mm thick brushed finish ss flat vertical supports to be grouted on to the slab .Verticals should be fixed to the concrete slabs with 75mm x 75mm, 10mm SS plate anchored with 4 Nos. of 10mm dia 75mm long SS brush finished Expansion bolts as per the detail drawings. All SS sections shall be 304 grade with brush finish.

- xxxviii. Stainless Steel Ramp Railing: Disabled ramp railing of 1000mm high with Top hand rail of 50mm dia Hollow SS pipe of 16 gauge to be welded as railing to the verticals made of 50mm dia SS tubular sections as per the detail architectural drawing and 1 no 30 mm dia SS pipe as mid rails placed as per the detail Architectural drawings. Verticals should be fixed to the concrete slabs with 200mm x 150mm, 6mm thick SS plate anchored with 4 Nos. of 10mm dia 75mm long Expansion bolts with 70mm dia SS capping at the top as per the detail drawings. All SS sections to be of grade 304.
- xxxix. Plywood/ Flexible Plywood: Plywood of 4/6/9/12/19mm thick layered flat pressed teak wood bonded using only phenol formaldehyde synthetic resin confirming IS code 303. All plywood shall be of Boiling Waterproof type. All exposed plywood edged shall have PVC lipping. When decorative plywood is used for panelling, the same shall be of matching grains. All Plywood shall be treated for Termite, Borer proofing and painted with fire retardant paint.
- xl. Particle/ MDF/ HDF Boards: Particle/ MDF/ HDF boards of 6/9/12/18/25/32mm thick particle board of approved make confirming to E1 – Emission Class as European Standards BS EN 13986 or as American Standards ANSI A208.2 – 1994 manufactured without using any formaldehyde resins or if not possible Phenol formaldehyde based resins shall be used with edges to have PVC lipping.
- xli. Wood Work: The Teak wood / Sal Wood should be of best quality available in India. It should be well seasoned and free from gap, knots, wraps, cracks, and other defects. All woodwork shall be planed and neatly, truly finished to the exact dimensions. All joints shall be neat and strong, truly finished to the exact dimensions shown in the drawings. All joints shall be neat and strong, truly and accurately fitted and glued before being fitted together. All screws used in woodwork shall be of steel nettle fold make. All sections shall be treated for Termite / Borer proofing.
- xlii. Aluminium Tube Sections/ Framework: All aluminium work shall be CPWD specifications 2009 or latest published specification.
- xliii. Adhesives: The adhesives used shall be of approved make.
- xliv. Glass/ Mirror: The glass/ Mirror used shall be used as per approved make.
- xlv. Veneer: The veneer used shall be of 4.6mm thickness with minimum of 4mm thick BWP (Boiling Waterproof type) plywood backing of approved make.

- xlvi. Laminate Sheets: All laminate sheets will be of 1.5mm thick of approved make for all External Surfaces, 1.0mm for all internal surfaces and 0.8mm for Post formed tabletops.
- xlvii. Hardware: All hardware like Hinges, Screws, Locks, Door Closure, Floor Springs etc., shall be of approved make
- xlviii. Built In-Joinery: Where joinery work is specified to be built-in, it shall be the responsibility of the concessionaire to ensure that the joinery works are set in plumb and true in line and shall not be damaged or displaced by subsequent operations
- xlix. Exposed Roof: All the exposed roof areas shall be provided with thermal insulation.
 - 1. Battery/UPS room: All battery and UPS room shall be separated with fire wall
 - li. Furniture: All furniture shall be in accordance with the approved drawings and the sample piece as approved by the Independent Engineer. Glue used shall be of superior synthetic quality such as Fevicol /Araldite.

d. List of approved brand and / or Manufacturer of materials:

Material/Items	Approved brand/ Manufacturer
Vitrified tiles	Naveen / bell/ johnson/ euro / kajaria / nitco
Marble	First quality type
Water proofing compound	Roffe/ fosroc/ zypex /ardex/ percept
Cement (white)	JK white/ birla super white
Cement (grey)	Acc/ birla super/ ultra-tech
Concrete block	Apco or equivalent make
Reinforcement steel	TATA/SAIL /RINL/JINDAL
Structural steel	TATA/ SAIL/ VISL
Ss railing	Lock it entp. / q railing
Pvc spacers/ corner beadings / mesh	Arpitha exports/ boss
Cement based polymer grout	Pidilite /laticrete/ bal endura
Water repellent sealer chemicals	Pidilite / laticrete/ bal endura/ auqa mix
Plywoods	Uniply/ sarda ply/ kitply / archid / green ply/century ply
Mdf/ hdf – external grade (hmr)	Action tesa/asis/dura tuff/ nuwood
Aluminium sections	Jindal/ bhoruka/ hindalco
Modular aluminium partition/door sections	Jeb or approved equivalent
Granite slabs (gang saw cut)	First quality, water-cut type
Stainless steel hinges	Lock wood/assa abloy/ dorma/ ir /geze/ hager/hettich/ blum
Aluminium door frame	Agarwanshi
Locks	Dorma/ ir/ geze / hettich/ blum/ lock wood/assaabloy
Door closures/ floor springs	Dorma/ sevox/ ir/ hager/ geze

Material/Items	Approved brand/ Manufacturer
Laminate	Century laminating co ltd (merino)/ formica/ greenlam/ sundek century mica
Flush doors	Kutty
Upvc windows	fenesta/ncl/Duroplast
Vinyl flooring	Tarkett/gerflor/poyfloor
Screws	Nettle fold (gkw)/patta make
Etching, frosting film/ vinyl sheets / graphics	3m / avery
Veneer	Uniply/ duro ply/ durian/ uro ply/ timex/ archid/ green/century plyboards (i) ltd
Handles	Dorma/ d-line/ geze / blum/ hettich
Glass / mirror	Saint gobain/ ashai
Lacquered glass	Saint gobain / ashai
Imported fabric	Milliken/ interface
Indian fabric	Reliance/ vimal/ mayur
Sound synth	Anutone make
Paints	Berger / nerolac / asian/ j&n/skk/jotun
Autocoat paint	Ici – duco/ asian/ berger
Putty for all painting works	Rj london
Texture paints	Zolatone/ oikos/ spectrum/ sk/ jotun
Vinyl/ anti-static floor	Armstrong / gerflor/ tarkett
Rubberised vinyl floor	Armstrong / gerflor / tarkett
Linolieum floor	Forbo / armstrong/ tarkett
Adhesives	Fevicol, jivanjor and araldite
Wheel castors	Renolle / classis / nicholson
Sliding channels	Blum/ hettich
Powder coating paint/ vapour cure powder	Mrf/ marpol/ berger
304/316 grade brush / stainless steel	Salem steel
Grg, plain gypsum board, duraline suspension sym	Saint gobain gyproc india ltd
Punning (gyp plaster)	Saint gobain gyproc india ltd)
Gypsum board partition frame work, all related partition accessories & false ceiling suspension system	Saint gobain gyproc india ltd
Recycled resin glass panel	3 form / lumicor
Pre-printed designer self-adhesive vinyl film	Dinco form 3m
Pvc spacers/ corner beadings	Arpitha exports/ catex specialities building
Water based polyeruthane coat	Ica/asian/ aquvathane
Ceramic tiles	Bell/ somany / kajaria / h & r johnson/ euro
Imported metal laminate	Sibu / homapal
Stainless steel sink	Amc/ nirali/ diamond

Material/Items	Approved brand/ Manufacturer
Interface trims	Cs group/ gradus
Floor mats	3m
Ceramic writing board	Whitemark
Slotted angle racks	Godrej / pan
Compactors	Godrej
Sound soak panels	Ecophone/armstrong/ usg / anutone
Acoustic/fire sealant	Sevax/ hilti/3m/mccoey
Glass manets fittings	Dorma/ ozone/ geze
Self-levelling compound	Roffee/ fosroc/ ardex from bal endura
Wooden framed fire rated doors	Promat/ signum
Steel fire doors	Signum/ shakti met/ mpp shredor (bangalore door tech)
Digital printed vinyl	3m / avery
Calcium silicate board, suspension sym	Hilux - ramco industries ltd /usg
Imported acrylic solid surfaces	Du-pont corian
Imported wall paper	Mayaramanoff / arte / muraspe durafort/muraspec
Modular false ceiling grids	Armstrong/usg/amf
Anchor fasteners/pvc & metal plugs	Hilti/fischer
Wooden flooring	Haro/ bona x/ pergo/ tarkett
Curtain tracks	Walltracts, grorich horivert, hunter douglas
Modular rubberized skirting	Mannington
Modular false ceiling tiles	Armstrong/ usg/amf
Ceiling suspension system	Armstrong/ donn/amf
Modular false ceiling system	Armstrong/ usg/amf
Crash guards & corner guards	Rd plast / vishal ergonomics or equivalent
Nurse call system	Global health care or any Good quality system, working in atleast 5 hospitals in India
Chairs	Godrej, Wipro, Featherlite or equivalent

II. Technical Specifications of Public Health Engineering (PHE) Works- Internal and External

a. General Instructions:

- i. The detailed specifications given hereinafter may be used as guidance for developing DBRs by the concessionaire and proper execution of work to the required standards.
- ii. Unless specifically otherwise mentioned, all the applicable latest codes and standards published by the Indian Standard Institution and all other standards shall govern in all respects of design, workmanship, quality and properties of materials and methods of testing, method of measurements etc. Wherever any reference to any Indian Standard Specification occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued thereto or revisions thereof, if any. In case there is no I.S.I. specification for the particular work, such work shall be carried out in accordance with the instructions in all respects, and requirements of the Independent Engineer/Monitoring Agency appointed by the Authority. The work shall be carried out in a manner complying in all respects with the requirements of relevant bye-laws of the Municipal Committee/ Municipal Corporation/ Development Authority /Improvement Trust etc.
- iii. Samples of various materials, fittings etc. proposed to be incorporated in the work shall be submitted by the concessionaire for approval to the Independent Engineer/ Monitoring Agency before order for bulk supply is placed.
- iv. The Concessionaire shall give a performance test of the entire installation(s) as per standard specifications before the work is finally accepted and nothing extra whatsoever shall be payable for the test.

- b. List of Indian Standards:** The following IS Codes shall be referred during planning and developing the DBRs and final execution of the work(s) for all PHE works:

Indian Standard	Reaffirmation	Subject
27 - 1992	Reaffirmed 2002	Specifications for Pig Lead
269- 1989	Reaffirmed 2004	Specifications for 33 grade Ordinary Portland Cement
407- 1981	Reaffirmed 2001	Brass tubes for General purposes
456- 2000	--	Code of practice for Plain & Reinforced concrete.
458- 2003	--	Specifications for Concrete Pipes.
554- 1999	--	Dimensions for pipe thread where pressure tight joints are required.

Indian Standard	Reaffirmation	Subject
636- 1988	Reaffirmed 2003	Firefighting hose ,rubber lined or fabric reinforced rubber lined woven – jacketed
638- 1979	Reaffirmed 2003	Sheet rubber jointing & rubber insertion jointing
651- 1992	Reaffirmed 2003	Specifications for Salt glazed stoneware pipes & fittings.
771 (Pt. I &VII)		Glazed Fire Clay Sanitary Appliances.
771- 1979(Pt. I)	Reaffirmed 2003	General requirements
771- 1985(Pt. II)	Reaffirmed 2003	Specific requirements of kitchen & laboratory sinks
771- 1979 (Pt. III/ Sec1)	Reaffirmed 2003	Specific requirements of urinals (section 1- Slab urinals)
771- 1985(Pt. III/ Sec2)	Reaffirmed 2000	Specific requirements of urinals (section 2- Stall urinals)
771- 1979(Pt. IV)	Reaffirmed 2003	Specific requirements of postmortem slabs.
771- 1979(Pt. V)	Reaffirmed 2003	Specific requirements of shower trays
771- 1979(Pt. VI)	Reaffirmed 2003	Specific requirements of bed pan sinks
771- 1981(Pt. VII)	Reaffirmed 2003	Specific requirements of slop sinks
774- 1984	Reaffirmed 2000	Flushing cistern for water closet and urinals.
775- 1970	Reaffirmed 2000	Cast iron brackets and supports for wash basin and sink.
778- 1984	Reaffirmed 2000	Specifications for copper alloy gate & Globe check valves for water works
Indian Standard	Reaffirmation	Subject
779- 1994	Reaffirmed 2004	Water meters (domestic type)
781- 1984	Reaffirmed 2001	Specifications for cast copper alloy screw down bib taps & stop cocks for water services
782- 1978	Reaffirmed 2003	Specification for Caulking lead.
783- 1985	Reaffirmed 2001	Code of practice for laying concrete pipes.
784- 2001	Reaffirmed 2002	Pre-stressed concrete pipes.
884- 1985	Reaffirmed 2000	Fire aid hose reel for firefighting (for fixed installation)
901 – 1988	Reaffirmed 2003	Specification for couplings, double males & double female, instantaneous pattern for Fire Fighting

Indian Standard	Reaffirmation	Subject
902 – 1992	--	Specification for suction hose couplings for Fire Fighting purposes.
903 – 1993	Reaffirmed 2003	Couplings for fire hose delivery, branch pipe, nozzles specification
904 – 1983	Reaffirmed 2000	Specification for 2 way and 3 way suction collecting heads for Fire Fighting purposes.
905 -1980	Reaffirmed 2002	Specification for delivery breechings, dividing and collecting instantaneous pattern for Fire Fighting
906 – 1988	Reaffirmed 2000	Specification for revolving branch pipe for Fire Fighting
907 – 1984	Reaffirmed 2000	Specification for suction strainer, cylindrical type for Fire Fighting purposes.
908- 1975	Reaffirmed 2000	Fire Hydrants, Stand post type
909- 1992	Reaffirmed 2002	Specifications for underground fire hydrants, sluice valve type
940 – 1989	--	Portable Fire Extinguisher, water Type (Gas Cartridge) – Specification
941- 1985	Reaffirmed 2000	Specification for Blower and Exhauster for Fire Fighting.
1172- 1993	Reaffirmed 2002	Code of basic requirements for water supply, drainage and sanitation
1200-1979 (Pt. 16)	Reaffirmed 2002	Method of measurements for Laying of water and sewer lines including appurtenant items.
1200-1981 (Pt. 19)	Reaffirmed 2002	Method of measurements for Water supply, plumbing and drains.
1239-2004 (Pt I)		Specifications for Mild steel tubes
1239-1992(Pt. II)	Reaffirmed 2002	Specifications for Mild steel Tubular & other wrought steel pipe fittings
1300- 1994	Reaffirmed 2000	Phenolic moulding material specification
1536- 2001	--	Specifications for Centrifugally cast iron (spun) pressure pipes for water, gas and sewage
1537- 1976	Reaffirmed 2000	Specifications for Vertically cast iron pressure pipes for water, gas and sewage
1538 -1993	Reaffirmed 1999	Cast iron fittings for pressure pipes for water, gas and sewage
1700- 1973	Reaffirmed 2003	Drinking fountains
1701- 1960	Reaffirmed 2003	Combination valve , mixing valves
1703- 2000		Ball valve (horizontal plunger type) including floats for water supply.

Indian Standard	Reaffirmation	Subject
1711- 1984	Reaffirmed 2000	Self closing taps.
1726- 1991	Reaffirmed 2003	Cast iron manhole covers and Frames.
1729- 2002	--	Cast iron/ductile iron drainage pipes and fittings for over ground NP pipeline S/S series.
1742- 1983	Reaffirmed 2002	Code of practice for building drainage
1795- 1982	Reaffirmed 2000	Pillar taps for water supply purposes
1978- 1982	Reaffirmed 2002	Specification for line pipe (M S Seamless)
1979- 1985	Reaffirmed 2002	Specification for high test line pipe
2065- 1983	Reaffirmed 2001	Code of practice for water supply in buildings.
2097 – 1983	Reaffirmed 2000	Specification for foam making branch pipe.
2104- 1981	Reaffirmed 2003	Water meter boxes (domestic type)
2171 – 1999	--	Specification for portable fire extinguisher, dry powder (Cartridge Type)
2190- 1992	Reaffirmed 2002	Code of practice for selection ,installation & maintenance of portable first-aid fire extinguishers
2267- 1995	Reaffirmed 2000	Polystyrene moulding and extension materials – specification
2326- 1987	Reaffirmed 03	Automatic flushing cistern for urinals
2379- 1990	Reaffirmed 2000	Colour code for identification of pipe lines.
2401- 1973	Reaffirmed 2003	Code of practice for selection, installation & maintenance of domestic water meters
2470 (Pt. I to II)	--	Code of practice for installation of septic tanks
2470- 1985 (Pt.I)	Reaffirmed 2001	Design criteria & construction
2470- 1985 (Pt.II)	Reaffirmed 2001	Secondary Treatment & disposal of septic tank effluent
2527- 1984	Reaffirmed 2000	Code of practice for fixing rain water gutters and down pipes for roof drainage.
2546 – 1974	Reaffirmed 2000	Specification for galvanized Mild Steel Fire bucket.
2548- 1996(Pt. I)	Reaffirmed 2002	Plastic water closet seats and covers.
2548- 1996(Pt. II)	Reaffirmed 2002	Plastic water closet seats and covers.
2556 (Pt. 1 to XV)	--	Specification for Vitreous (Vitreous China) sanitary appliances.

Indian Standard	Reaffirmation	Subject
2556-1994 (Pt.1)	Reaffirmed 2004	General requirements
2556-1994 (Pt.2)	Reaffirmed 1999	Specific requirements of wash down water- closets
2556- 2004 (Pt.3)	--	Specific requirements of squatting pans
2556- 2004 (Pt.3)	--	Specific requirements of squatting pans
2556-2004 (Pt. 4)	--	Specific requirements of wash basins
2556- 1994 (Pt.5)	Reaffirmed 2004	Specific requirements of laboratory sinks
2556-1995(Pt.6)	Reaffirmed 2003	Specific requirements of urinals & partition plate
2556- 1995 (Pt.7)	Reaffirmed 2003	Specific requirements of accessories for sanitary appliances
2556- 1995 (Pt.8)	Reaffirmed 1998	Specific requirements of pedestal close coupled & wash down and siphonic water closets
2556- 2004 (Pt.9)	--	Specific requirements of pedestal type bidets
2643-1999	--	Type Threads where pressure tight joints are not mase on the threads – dimension, tolerances and designation
2692- 1989	Reaffirmed 2003	Specification for Ferrules for water services.
2871- 1983	Reaffirmed 2000	Specification for Branch pipe, universal, for firefighting purposes
2878 – 2004	--	Fire Extinguisher, Carbon Dioxide Type (Portable and Trolley Mounted) – Specification.
2951 (Pt. I to II)	--	Recommendation for estimate of flow of liquids in closed conduits.
2951- 1965 (Pt. I)	Reaffirmed 2003	Head loss in straight pipes due to frictional resistance
2951- 1965 (Pt. II)	Reaffirmed 2003	Head loss in valves & fittings.
3006-1979	Reaffirmed 2003	Specification for Chemically resistant glazed S.W. pipes and Fitting
3076-1985	Reaffirmed 2003	Low density polyethylene pipes for potable water supply
3114-1994	Reaffirmed 2004	Code of practice for laying of Cast Iron pipes.
3311-1979	Reaffirmed 2003	Waste plug & its accessories for sinks & wash basins.

Indian Standard	Reaffirmation	Subject
3328-1993	Reaffirmd 2003	Quality tolerances for water for swimming pools
3389-1994	Reaffirmd 2000	Urea formaldehyde moulding materials
3486-1966	Reaffirmd 2000	Specification for Cast iron spigot and socket drain pipes
3489-1985	Reaffirmd 2000	Specifications for enameled steel bath tubs
3589-2001	--	Specifications for steel pipes for water & sewage (168.3 to 2540 mm outside dia.)
3597-1998	--	Method of test for concrete pipes.
3844-1989	Reaffirmd 2000	Code of practice for installation and maintenance of internal fire hydrants Hose Reels in premises.
3950-1979	Reaffirmed 03	Specification for Surface boxes for sluice valve.
3989-1984	Reaffirmd 2000	Centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings & accessories.
4038-1986	Reaffirmd 2000	Foot valves for water works purposes.
4111 (Pt. I to V)		Code of practice for ancillary structures in sewage system.
4111- 1986 (Pt. I)	Reaffirmd 2001	Manholes
4111- 1985 (Pt. II)	Reaffirmd 2001	Flushing tanks
4111- 1985 (Pt. III)	Reaffirmd 2001	Inverted siphon
4111- 1968 (Pt. IV)	Reaffirmd 2001	Pumping stations & pumping mains (rising mains)
4111- 1993 (Pt. V)	Reaffirmd 2004	Tidal out-falls
4120-1967	Reaffirmd 2000	Tubs and baths.
4127-1983	Reaffirmd 2001	Code of practice of laying of glazed stone ware pipes.
4308-2003	--	Dry Chemical Powder for Fighting B & C class Fires– Specification.
4350-1967	Reaffirmd 2001	Specification for concrete porous pipes for under drainage.
4733-1972	Reaffirmd 1992	Methods of sampling & test for sewage effluents
4736-1986	Reaffirmd 2001	Specification for hot –dip zinc coating on mild stele tubes.
4854 (Pt. I to III)		Glossary terms for valves and their parts

Indian Standard	Reaffirmation	Subject
4854-1969 (Pt. I)	Reaffirmed 1999	Screw down stop, check & gate valves & their parts
4854-1968 (Pt. II)	Reaffirmed 1999	Plug valves & cocks & their parts
4854-1974 (Pt. III)	Reaffirmed 1999	Butterfly valves
4927-1992	Reaffirmed 2002	Unlined flax canvass hose for fire fighting
4947-1985	Reaffirmed 2000	Specification for gas cartridge for use in Fire extinguishers.
4984-1995	Reaffirmed 2002	Specifications for HDPE pipes for water supply
4985-2000	--	Specifications for unplasticised PVC pipes for potable water supplies
5290-1993	Reaffirmed 2003	Specifications for Landing valves.
5312 (Pt. I)		Swing check type reflux (non return) valves
5312- 1984 (Pt. I)	Reaffirmed 2000	Reflux (non return) valves – single door pattern
5329- 1983	Reaffirmed 2001	Code of Practice for sanitary pipe work above ground for building
5330- 1984	Reaffirmed 2000	Criteria for design for anchor blocks for pen- stocks with expansions joints.
5382- 1985	Reaffirmed 2003	Specifications for rubber sealing rings for water, gas & sewer mains
5455- 1969	Reaffirmed 2003	Cast iron steps for manholes
5600- 2002	--	Specifications for Sewage and drainage pumps
5611- 1987	Reaffirmed 2002	Code of Practice for waste stabilization ponds (Facultative type)
5714- 1981	Reaffirmed 2002	Specifications for Hydrant stand-pipe for firefighting
5822- 1994	Reaffirmed 2004	Code of Practice for laying of welded steel pipes for water supply
5961- 1970	Reaffirmed 2003	Specifications for Cast Iron grating for drainage purposes
6234-2003	-----	Portable fire Extinguisher water Type (Stored Pressure) – Specification
6279- 1971	Reaffirmed 2001	Equipment for grit removal
6280- 1971	Reaffirmed 2001	Sewage screens
6295- 1986	Reaffirmed 2001	Code of practice for water supply & drainage in high altitude & / or sub-zero region
6392- 1971	Reaffirmed 1998	Steel pipe flanges

Indian Standard	Reaffirmation	Subject
6411- 1985	Reaffirmed 2000	Specifications for gel coated glass fiber reinforced polyester resin bath tubs
6418- 1971	Reaffirmed 2000	Cast Iron & malleable flanges for general engg. Purpose
6494- 1988	Reaffirmed 2000	Code of Practice for water proofing of under ground water tanks & swimming pools
6587- 1987	Reaffirmed 2003	Specifications for Spun hemp yarn
7181- 1986	Reaffirmed 2000	Horizontally Cast Iron Double Flanged pipe for water, gas & sewage.
7231- 1994	Reaffirmed 2004	Specifications for Plastic Flushing Cisterns for w.c. & urinals
7558- 1974	Reaffirmed 2001	Code of Practice for domestic hot water installations
7634 (Pt. I to III)		Code of Practice for Plastic pipe work for potable water supplies
7634- 1975 (Pt. I)	Reaffirmed 2002	Choice of materials & general recommendations
7634- 1975 (Pt. II)	Reaffirmed 2002	Laying & jointing polyethylene (PE) pipes
7634- 2003 (Pt. III)	--	Laying & jointing unplasticised PVC pipes
7740- 1985	Reaffirmed 2001	Code of Practice for road gullies
7834 (Pt. I to VIII)		Injection moulded PVC socket fittings with solvent cement joints for water supplies
7834 – 1987(Pt.I)	Reaffirmed 2003	General requirements
7834- 1987 (Pt.II)	Reaffirmed 2003	Specific requirements for 45 elbows 0
7834- 1987 (Pt. III)	Reaffirmed 2003	Specific requirements for 90 elbows 0
7834- 1987 (Pt. IV)	Reaffirmed 2003	Specific requirements for 90 tees 0
7834- 1987(Pt.V)	Reaffirmed 2003	Specific requirements for 45 tees 0
7834- 1987 (Pt. VI)	Reaffirmed 2003	Specific requirements for sockets
7834- 1987(Pt. VII)	Reaffirmed 2003	Specific requirements for unions
7834- 1987 (Pt. VIII)	Reaffirmed 03	Specific requirements for caps
8008 (Pt. I to VII)		Injection moulded HDPE fittings for potable water supplies
8008- 2003 (Pt. I)	--	General requirements for fittings

Indian Standard	Reaffirmation	Subject
8008- 1976 (Pt. II)	Reaffirmed 1997	Specific requirements for 90 bends 0
8008- 2003 (Pt. III)	--	Specific requirements for 90 tees 0
8008- 2003 (Pt. IV)	--	Specific requirements for reducers
8008- 2003 (Pt. V)	--	Specific requirements for ferrule reducers
8008- 2003 (Pt. VI)	--	Specific requirements for pipe ends
8008- 2003 (Pt. VII)	--	Specific requirements for sandwich flanges
8090 – 1976	Reaffirmed 2000	Coupling, branch pipe, nozzle used in hose reel tubing for fire fighting
8329- 2000	--	Centrifugally cast (spun) ductile iron pressure pipes and fittings for water, gas & sewage
8413 (Pt. I)		Requirements for biological treatment equipment
8413- 1977 (Pt. I)	Reaffirmed 2001	Trickling Filter
8718- 1978	Reaffirmed 2000	Specifications for vitreous enameled steel kitchen sinks
8727- 1978	Reaffirmed 2000	Specifications for vitreous enameled steel wash basin
8835- 1978	Reaffirmed 1999	Guideline for planning and design of surface drains.
8931- 1993	Reaffirmed 2003	Specifications for copper alloys Fancy single taps, combination tap assembly & stop valves for water services
9293- 1991	Reaffirmed 1996	Specifications for flax canvas
9338- 1984	Reaffirmed 2000	Specifications for Cast Iron screw down stop valves and stop & check valves for water works purposes
9739- 1981	Reaffirmed 2003	Specifications for Pressure reducing valves for Domestic water supply system.
9758- 1981	Reaffirmed 2003	Flush valves and Fittings for water closets and urinals
9762- 1994	Reaffirmed 2004	Specifications for polyethylene floats for float valves
9763- 2000	--	Specifications for Plastic Bib taps, pillar taps, angle valves and stop valves for hot & cold water service.

Indian Standard	Reaffirmation	Subject
9972 – 2002	--	Specification for Automatic sprinkler Heads for Fire Protection Service.
10221- 1982	Reaffirmed 1997	Code of practice for coating and wrapping of underground M.S. steel pipeline,
11108 - 1984	Reaffirmed 2000	Specification for portable fire Extinguisher Halon 1211 Type.
11606 – 1986	Reaffirmed 2000	Method for sampling of cast iron pipes and fittings.
12183- 1987 (Pt. I)	Reaffirmed 2004	Code of practice for Plumbing in multi- storied buildings (for water supply)
12231 – 1987	Reaffirmed 2003	UPVC pipes for section & delivery lines of agricultural pumps–Specification.
12235 – 1986	Reaffirmed 1998	Method of test for UPVC pipe for potable water supply
12288 – 1987	Reaffirmed 2002	Code of practice for use and laying of Ductile Iron pipes
12469 – 1988	Reaffirmed 2002	Specifications for pumps
12592- 2002	--	Precast concrete frame & cover (SFRC frame & cover)
12701-1996	Reaffirmed 2002	Specifications for rotational moulded polyethylene water storage tanks
12709 - 1994	Reaffirmed 2004	Glassfiber reinforce plastic(GRP) pipes, joints & fittings for use for potablewater supply – Specification.
12820 – 1989	Reaffirmed 1999	Dimensional Requirements of Rubber Gaskets for Mechanical Joints & push in joints for use with Cast Iron Pipes & fittings for carrying water, Gas & sewerage
13095 – 1991	Reaffirmed 2003	Butterfly valves for general purposes
13382-2004	-	Cast Iron specials for mechanical & push-on flexible joints for pressure pipelines for water, gas & sewage
13592- 1992	Reaffirmed 2002	Specifications for PVC soil, waste & rain water (SWR) including ventilation pipes
13593 - 1992	Reaffirmed 2002	UPVC pipes fittings for use with section and delivery lines for Agricultural pumps – Specification.
13916 – 1994	Reaffirmed 2004	Code of practice for installation of GRP piping system.

Indian Standard	Reaffirmation	Subject
13983-1994	Reaffirmed 2004	Specifications for stainless steel kitchen sinks & drain boards for domestic purpose
14333-1996	Reaffirmed 2001	Specification for HDPE pipes for sewerage system.
14402-1996	Reaffirmed 2001	GRP pipes, joints & fittings – Specification.
14735-1999	Reaffirmed 2004	UPVC injection moulded fittings for UPVC – SWR pipes – Specifications.
14845- 2000	Reaffirmed 2004	Resilient seated cast iron air relief valves for water works purposes – Spn
14846- 2000	--	Specifications for sluice valve for water works purposes (50 to 1200 mm size)
15265 – 2003	--	Specifications for flexible PVC pipes or polymer reinforcement thermo plastic hoses for suction and delivery lines for Agricultural pumps.
15328 – 2003	--	UPVC non pressure pipes for use in underground drainage and sewerage system – Specifications.
15450- 2004	--	Polyethylene/Aluminium/Polyethylene composite pressure pipes for hot and cold water supplies – Specifications.

- c. The minimum unit weight of each fitting shall not be less than as given in the following table, which are used in General practice.

S.N.	Description of items	Nominal size / thickness	Minimum Unit Weight
1	C.P. brass fancy Shower rose	15mm	125 Grams
2	C.P. brass bottle trap	32mm.	500 Grams
3	C.P. brass bottle trap	40mm	550 Grams
4	C.P. brass Liquid soap dispenser		250 Grams
5	C.P. brass coat and hat hook		150 Grams
6	C.P. brass Towel rod bracket [pair]		100 Grams
7	C.P. brass Towel rod [600 mm long]	20mm	150 Grams
8	G.I. Clamps thickness for GI piping	2 MM	
9	MS Clamps thickness for CI piping	3 MM	

S.N.	Description of items	Nominal size / thickness	Minimum Unit Weight
10	Rain water lead sheet flashing		38.00 kg/sqm
11	C.I. frame and cover for Gully Trap		7.50 kg.
12	S.S. grating for Nahani Trap		50 Grams
13	C.P. brass grating for Nahani Trap		190 Grams
14	C.P. Brass Dome shape grating		275 Grams
15	Cast Iron surface box for sluice valve (circular shape)		14 kg.

d. Mandatory Tests / Optional Tests:

- i. The following mandatory tests shall be carried out when the qty. of materials to be incorporated in the work exceeds the minimum qty. specified in column 5 of the table below irrespective of whether the materials are with I.S. mark, or otherwise. Authority/Independent Engineer/ Monitoring Agency reserves the right to add and/or delete or amend any of the mandatory/ optional tests and suggest any alternate testing method at its discretion. Any such amendments / revisions shall be communicated to the Concessioner prior to execution of work.
- ii. Optional tests specified or any other tests shall be carried out in case of specialized work/ important structure at the instruction of Independent Engineer/Monitoring Agency.
- iii. Testing charges including incidental charge and cost of sample for testing shall be borne by the Concessionaire for all mandatory tests.
- iv. Testing charges for optional tests and/or additional tests (if any) as and when requested by the Independent Engineer/Monitoring Agency shall be paid by the Authority.
- v. In case of non-I.S. materials, it shall be the responsibility of the Concessionaire to establish the conformity of material with relevant I.S. specification by carrying out necessary tests. Testing charges including incidental charge and cost of sample for testing shall be borne by the Concessionaire for such tests.
- vi. It shall be the responsibility of the Concessionaire to obtain any clarification with regard to the mandatory tests from the Independent Engineer / Monitoring Agency for avoidance of any doubt prior to the commencement of work(s).
- vii. Mandatory Tests for PHE Works:

Material	Test	Field/Lab Test	Test Procedure	Minimum quantity of material/ work for carrying out the test	Frequency of sampling	Remarks
1	2	3	4	5	6	7
GI pipes	<p>Physical: Dimensional Nominal unit wt. Tensile, Elongation</p> <p>Chemical: Mass of inc coating sulphur prosperous</p>	Field/Lab Field/Lab	IS 4736 IS 228 IS 228	<p>>20tubes >20tubes >100 / 500 upto 25 mm bore >25 mm respectively.</p> <p>Up to bore 25 mm tube /1000 or part tehereof> 25 mm bore 1 tube/500 tube</p>	Sampling & Criteria for conformity as per 4711	
C.I. pipes Water Quality “LA/A/B” class	Dimensional unit weight hammer test Hydrostatic test Hydrostatic test Hardness & grade	Field/Lab		>20 copies	Sampling & conformity as per IS 1536/ 2001 IS 1500	Hardness & grade shall be optional
C.I. pipes Soil Quality	Dimensional unit weight hammer test Hydrostatic test Hardness & grade	Field/Lab		>20 copies	Sampling & conformity as per IS 3981, IS 1729, IS 1500	Hardness & grade shall be optional
Pig Lead	Chemical analysis	Lab	IS 1817	Lot>1000 Kg, if less Mfr Test report to be furnished	Each Lot>1000 Kg.	

Material	Test	Field/Lab Test	Test Procedure	Minimum quantity of material/ work for carrying out the test	Frequency of sampling	Remarks
1	2	3	4	5	6	7
Store ware pipes	Hydraulic Test, Absorption Test, Test for Acid Resistance, Test for Alkali Resistance, Crushing strength	Lab	IS 651	3 nos. for lot of 150 5 nos. for 151 to 1200 8 nos. for 1201 to 10000		
Cement Bricks	As per Civil Specification					
Precast concrete man hole frame & covers / gratings	Dimension load test	Lab	IS 12592 (Part I)	>20 frame & covers / gratings	Sampling as per IS 12592 (Part I)	
CI man hole frame & covers	Dimension Load test	Lab	IS 1726	>50 Frame & Covers / gratings	Sampling as per IS 1726	
Hume pipe NP class	Dimension Hydrostatic Test Three-edge bearing Absorption test	Field/Lab Lab	IS 458 IS 3597 IS 3597 IS 3597	>50 pipes	As per IS 458	
Sanitary fittings	Manufacturer's Test Certificate to be produced					
CP Brass fittings Bib taps / stop cocks	Manufacturer's Test Certificate to be produced					

e. Key Sanitary Installations:

- i. **Indian Water Closet: Squatting Pan (Orissa Pattern)** of white or colour glazed vitreous China conforming IS 2556 Part III. Pan shall have flushing rim and are inlet of self-draining type. It shall have weep hole at the following inlet to the Pan. The flushing inlet shall be in front unless otherwise specified. The inside of the bottom of the pan shall have sufficient slope from the front to the outlet and surface shall be uniform and smooth to enable easy and quick disposal while flushing. The water closet pan shall be placed in position as shown in the approved drawing The pan, trap and C.I. pipe shall be jointed in 1:1 Cement Mortar with hemp yarn caulked. The gap between W.C. and floor shall be finished with white/matching cement as directed.
- ii. **European / Anglo India Water Closet:** It shall be white colour glazed vitreous chinaware European or Anglo Indian water closet. It shall be wash down pattern unless otherwise specified. Water closet shall be vitreous china conforming to IS 2556 (Part-I & II). The closet shall be of one-piece construction and shall have minimum two hole of 6.5 mm diameter for fixing closet to floor. Closet shall have an integral flushing rims of self-draining type. Each water closet shall have an integral trap with either `S` or `P` outlet with and trap shall be uniform and smooth in order to enable an efficient flush. Plastic seat and cover shall have conformity to IS2548 Part I & II.
- iii. **Wash Basin:** Fixing of white glazed chinaware wash basin with/without pedestal conforming to IS 2556 (Part IV) of flat back or angle back of one-piece construction including combined over flow, basin shall be provided with single or double tap holes of size 28 mm square or 30 mm rounded. Each basin shall have circular waste hole, or 5 sq.cm slot type over flow. Pedestals for wash basin shall be exactly same glazing that of basin. Pedestal shall be capable of supporting the basin and completely recessed at the back to accommodate supply and waste pipes and fittings. The basin shall be supported on pan of C.I cantilever brackets conforming to IS 775. Use of MS angle or Tee Section as bracket is not permitted.
- iv. **Urinal (with flushing rim):** White coloured glazed vitreous chinaware bowl type with flushing system urinals conforming to IS 2556 (Part VI). Urinal shall have integral flushing rim and inlet or supply horn for connecting flush pipe. Flushing rim and inlet shall be of the self-draining type. At bottom of basin and outlet horn for connecting outlet shall be provided. The inside surface of the urinal shall be uniform and smooth throughout to ensure efficient flushing. The flushing arrangement to urinals for single or in range shall be of CP brass with CP brass spreader of 15 mm dia. conforming to IS:407 along with adequate capacity of flush tank.
- v. **Urinal (without flushing rim):** It shall be of vitreous china conforming to IS:2556 (Part-VI) constructed in one piece with providing slot or alternative fixing arrangement at flat back and where the integral flushing rim is not provided, they shall be provided with ridges inside the bowl to divert towards the front line of the urinal. The flushing arrangement to urinals for single or in range shall be of CP brass with CP brass spreader of 15 mm dia. conforming to IS:407 along with adequate capacity of flush tank.

- vi. **Urinal Squatting Plate:** The squatting plates shall be of white vitreous china conforming to IS:2556 (Part-I), IS : 2556 (Part-VI) with internal flushing rim with front or side inlet. Each squatting plat shall have integral longitudinal flush pipe. There shall be of 100 mm dia. white glaze vitreous china channel with slope and outlet piece in front.
- vii. **Marble/ Granite Partition:** Fixing of marble/ granite slab partition of adequate size and thickness as per the approved DBR Slab shall be polished on both sides with exposed to proper shape the exposed edges of Marble/granite shall be made smooth corners rounded. Cracked or damaged marble/granite slab shall not be used.
- viii. **Toilet Paper Roll Holder:** It includes providing white or colour glazed vitreous chinaware toilet roll holder of CP brass or vitreous china of specified size and design as per approved DBR. Toilet paper roll holder shall conform as per IS standard and should have ISI mark.
- ix. **Sink (Glazed Fire Clay/ Vitreous China):** White or colour glazed -fire clay sink for kitchen and vitreous china sink for lab as specified and approved in the DBR. Laboratory sink shall be of vitreous china confirming to IS 2556 (PART-V) and kitchen sink shall be of glazed fire-clay conforming to IS 771 (Part-II) and shall have combined over flow of the weir type and invert shall be 30 mm below the top edge. These shall be of one-piece construction and floor of sink shall gently slope towards the outlet. C.I brackets for supporting sink shall confirm to IS: 775.
- x. **Stainless Steel Sink:** Stainless steel sinks with drain board of Salem or equivalent steel conforming to IS: 13983. Stainless steel sink shall be of one-piece construction moulded out of 19 SWG (1mm) stainless steel sheet of grade AISI 304 (18/8) with stainless steel choke – stop strainer (waste coupling) check nuts conforming to IS 13983.
- xi. **Soap Dish:** Soap dish shall be of CP brass or vitrious China of specified size and design as per approved DBR. It shall confirm to relevant IS standard and have ISI certified mark.
- xii. **Glass mirror:** The mirror shall be of superior sheet glass with edges rounded off or beveled, size 600 x450 mm. It shall be free from flaws, specks or bubbles and thickness plated and should not be less than 5.0 mm. The back of mirror shall be uniformly silver plated and should be free from silvering defects. Silvering shall have a protective uniform covering of red lid paint, where beveled edge mirror are not available. The backing of mirror shall be provided with 6mm thick marine plywood or environmentally friendly material other than asbestos cement sheet.
- xiii. **Glass Shelf:** Glass shelf shall consist of an assembly of glass shelf frame of size 600 x 125 mm or as approved in the DBR. It shall be with a pair of CP Brass brackets fixed to the wall with CP screws and CP brass rails around with guard bar of 6 mm diameter fixed to the glass shelf frame with five numbers CP brass brackets. The glass shall not be less than 5 mm thick. The

complete accessories shall be fixed to proper line and level as indicated in drawing.

- xiv. **Liquid Dispenser:** Liquid Soap Dispenser shall be of C.P brass of heavy quality and from list of approved make shall be fixed at appropriate height as per drawing.
- xv. **Towel Rod/ Ring:** Towel rail shall be of C.P brass with two CP brass bracket coated with chromium plating of thickness not less than grade No.2 of IS 4827. The size of rail shall be 600 mm x 20 mm dia unless otherwise specified. Towel ring of CP brass with one CP brass bracket with thickness not less than Grade No.2 of IS 4827. The diameter of the ring shall be 175 mm unless otherwise specified in the schedule. The diameter of ring rod shall not be less than 8 mm. The towel rod/ ring shall be fixed to proper line and level as indicated in drawing with CP brass screws.
- xvi. **Shower Rose:** The shower rose shall be CP brass of approved and heavy quality. It shall be fixed to be water supply pipe line with necessary G.I fittings etc. Jointing shall be done with the zinc, spun yarn etc. A few turns of fine hemp yarn dipped in linseed oil shall be taken over the threaded ends to obtain complete water tightness.
- xvii. **Bib Tap, Stop Cock & Angle Stop Cocks:** Chromium plated brass bib tap and stop cock and angle stop cocks, free flanges (if joined to concealed pipe). Bib cock (Bib tap) is drawn off tap with a horizontal inlet and free out let and a stop cock is a valve with a suitable means of connections for insertion in a pipe line for controlling or stopping the flow. These shall be of 15 mm size or as per approved DBR and shall be of screw down type. Brass bib taps and stop cocks and angle stop cocks shall conform to IS 781. They shall be sound and free from taps, blow hole and fitting. Every tap complete with its component shall with stand an internally applied hydraulic pressure of 2 MPa (20 kg/sq.cm) maintained for a period of 2 minutes during the period it shall neither leak nor sweat.
- xviii. **Combination Tap Assembly (wall / pillar mounted):** Chromium plated brass combination tap assembly, wall mounted hot & cold mixing for bath, pillar mounted hot & cold mixing for sink, basin, tub etc. The combination tap assembly shall be 15 mm nominal size or as approved in the DBR. It shall be of C.P. brass approved and heavy quality, and shall conform to I.S. 8931. Combination tap assembly shall be chromium plated-brass and shall conform to IS 8931. Thickness of C.P coating shall not be less than service grade no.2 of IS 4827 and plating should be capable of taking high polish which shall not easily tarnish or scale. Combination tap assembly shall withstand and internally applied hydraulic pressure of 1.6Mpa (16 kg/sq.cm) for period of 1 minutes during which, it shall neither leak nor sweat.
- xix. **Pillar Tap:** The pillar tap shall be 15 mm nominal size or as specified in the schedule. Pillar tap shall be of C.P. brass approved quality and shall conform to I.S. 8931. Casting of Pillar tap shall be sound and free from laps, blow hole and pitting. External and internal surface shall be clean, smooth and free from sand and be neatly dressed. All the parts fitted to pillar tap shall

be axial, parallel and cylindrical with surfaces smoothly finished. Pillar tap shall withstand and internally applied hydraulic pressure of 2 MPa (20 kg/sq.cm) for period of 2 minutes during which period, it shall neither leak nor sweat.

- xx. **Flush Valve:** Chromium plated brass flush valve or brass concealed type flush valve with necessary accessories including flanges if joined to concealed pipes. The flush valve shall be on nominal diameters as approved in the DBR and should conform to IS: 9758. The flush valve shall have working pressure of 0.15 to 0.5 MPa. The valve shall be tested to a Hydraulic pressure of 2 MPa for 2 minutes
- xxi. **Waste Coupling:** Waste Coupling shall conform to IS 3311. Waste fittings shall be of CP with thickness of CP coating not less than service Grade No.2 of IS 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect to IS 2963 and shall sound, free from laps below, holes and fittings and other manufacturing defects. Waste coupling shall be fixed to wash basin, sink or urinal as ordered with necessary specials. Jointing shall be done with white zinc, yarn etc.
- xxii. **Bottle Trap:** Bottle trap shall be of C.P with thickness of CP coating not less than service grade No. 2 of IS 4827 which is capable of receiving polish and will not easily scale off. The fitting shall conform in all respect of IS 2963 and shall be sound, free from laps below, holes and fittings and other manufacturing defects. Bottle trap shall be fixed to wash basin, sink or urinal as indicated in the drawing with necessary specials.
- xxiii. **Flushing Cistern:** White or colour glazed chinaware / PVC cistern with all inside syphonic fitting and fixing. The flushing cistern shall be automatic or manually. Cistern shall be mosquito proof. All working parts shall be designed to operate smoothly and efficiently. It shall have removable covers which shall fit closely on it and be screwed against top displacement where operating mechanism is attached to the cover. The outlet fitting of the cistern shall be securely connected to the cistern. Over flow pipe shall not be less than +/- 5mm `B` diameter. It shall be of G.I valve with mosquito proof jalli of 1.25 mm dia.
- xxiv. **Bracket:** Brackets shall be embedded into or fixed to the wall with plugs, screws, nails etc. Hole shall be made in the wall, if they are not left for fixing the brackets and shall be made good after fixing. The gap shall be filled with 1:2 cement mortar and finishing shall be done with white / matching colour cement.

f. Water Supply System:

- i. **G.I. Piping Works (exposed):** G.I. pipes with G.I. fitting of specified nominal bore and class. They shall conform to IS 1239 (Part- I 2004). All the pipes and fitting shall have ISI certification mark. The specified nominal bore of the pipe shall refer to inside approximate bore according to the thickness corresponding to outside fixed diameter. The pipe and fittings shall be smooth, sound, free from any imperfections and neatly dressed. The

pipe and fitting shall be able to withstand a hydrostatic test pressure of 5 MPa (50 Kg/cm²) maintained for at least 3 seconds at manufacturing works (lab test). Laying and fixing of all pipes shall conform to the bye-laws.

- ii. **G.I. Piping Works (concealed):** G.I. pipes with G.I. pipes with concealed type fittings of specified nominal bore and class. The pipes and fittings shall be of M.S. galvanised and shall conform to IS 1239 (Part- I 2004). All the pipes and fitting shall have ISI certification mark. The specified nominal bore of the pipe shall refer to inside approximate bore according to the thickness corresponding to outside fixed diameter. The pipe and fittings shall be smooth, sound, free from any imperfections and neatly dressed. The pipe and fitting shall be able to withstand a hydrostatic test pressure of 5 MPa (50 Kg/cm²) maintained for at least 3 seconds at manufacturing works (lab test). Laying and fixing of all pipes shall conform to the bye-laws. All the concealed piping work shall be thoroughly painted with two coats of anti-corrosive black bitumastic paint of approved quality shade over a coat of approved primer before concealing and filling the mortar. The hot water pipe line concealed on the wall, floor etc. after painting shall be insulated with 2.5 mm thick 95% asbestos magnesia compound of approved make all round the pipe and fittings. After painting the cold water pipe line, it shall be wrapped with two layers of hessian cloth of approved quality.
- iii. **Underground G.I. Piping Works:** Provision of G.I. pipes with G.I. pipes with concealed type fittings of specified nominal bore and class as approved in the DBR including laying, fixing, wrapping with hessian cloth, painting and testing. The pipes and fittings shall be of M.S. galvanised and shall conform to IS 1239 (Part- I 2004). All the pipes and fitting shall have ISI certification mark. The specified nominal bore of the pipe shall refer to inside approximate bore according to the thickness corresponding to outside fixed diameter. The pipe and fittings shall be smooth, sound, free from any imperfections and neatly dressed. The pipe and fitting shall be able to withstand a hydrostatic test pressure of 5 MPa (50 Kg/cm²) maintained for at least 3 seconds at manufacturing works (lab test). The galvanised iron pipes and fittings are to be laid in trenches. When excavation is done in rock, it shall be cut deep enough to permit the pipes to be laid on a cushion of sand of min. 7.5 cm. G.I. pipes and fittings shall be painted with two coat of anticorrosive paint before pipe line is laid and wrapping the pipe and fitting with jute or hessian cloth in the form of bandage.
- iv. The widths and depths of the trenches for different diameter of the pipes shall be as given below:

Diameter of pipe (mm)	Min. Width of trench (mm)	Min. Depth of trench (mm)
15 to 50	300	600
65 to 100	450	750

- v. **High Density Polyethylene (HDPE) Piping Works for Water Supply:** HDPE pipes with fittings of specified diameter including laying, fixing, cutting, jointing to be done. The pipes and fittings shall conform to series IV of IS 4984. HDPE pipes and fittings shall be free from cracks, flaws,

defects and entire length of pipe shall be evenly supported on bed of the trench throughout. The pipes shall be carefully laid straight and fixed to the correct alignment in gradients as indicated in the drawing.

- vi. **PVC Piping works for Water Supply:** PVC pipes with fittings of specified diameter for vent, over flow, waste water pipe line etc.. The pipes and fittings shall conform to series IV of IS 4985-1978, PVC pipes and fittings shall be free from cracks, flaws and defects and shall be able to withstand a pressure. The pipes shall be carefully laid straight to the correct alignment in gradients. The pipe line shall be fixed in position as shown in the drawing or as directed by the Independent Engineer/Monitoring Agency. The pipe shall be fixed with G.I. clamps not less than 2 mm thick or with suitable PVC clamps,
- vii. **Gun Metal / Brass Full Way Valve:** Provision of full way (gate or globe) valve of specified diameter. Full way valve shall be of either Brass fitted with a cast iron hand wheel or Gun metal fitted with a C.I. hand wheel as the case may be and shall be of Gate valve type opening full way and of the size as specified conforming to IS 778.
- viii. **Water Meter:** Water Meter shall conform to IS 779 and should have ISI certification mark. Non return valve and strainer shall be of the same diameter as that of water meter. Strainer, sockets, flange, union nuts, rubber packing etc.
- ix. **Pressure Reducing Valve:** Provision of pressure reducing valve. Valve shall be of brass and shall be vertical flow type, conforming to IS 9739-1981.
- x. **Cast Iron Water Quality Piping Work:** The pipes shall be centrifugally cast (spun) Iron Pressure pipe conforming to IS 1536-2001 and shall be of class "LA", 'A' or "B". These shall be of socket and spigot or double flanged. All the pipes shall be cylindrical reasonably true with inner and outer surfaces and nearly concentric as practicable. The outer surface shall be smooth, sound, free from pin holes, cracks and other imperfections. The pipes shall be treated with solution of Dr. Angus Smith's solution. The coated surface shall give glossy finish.
- xi. **Specials for C.I. Water Supply Line:** The specials for cast iron water quality pipe shall be conforming to IS 1538 & 13382 with socket and spigot or monolithic double flanged. All the fittings shall be cylindrical, reasonably true with inner and outer surfaces and nearly concentric as practicable. The outer surface shall be smooth, sound, free from pin holes, cracks and other imperfections. M.S. specials shall be made out of M.S. plate of thickness of 6 mm for pipes upto 8 mm thick for pipes above 100 mm to 300. 10 mm thick for pipe above 300 mm. M.S. Specials shall be treated with Anticorrosive coating of Bituminous based coro coat. The specials shall be fixed by means of lead or flanged joint on C.I. Pipe line wherever required and as shown in the approved drawings. Joints shall be tested to a hydraulic pressure of 10 kg/cm² along with testing of pipe line and shall be maintained for minimum two hours.

- xii. **Lead Joint:** The item includes making lead joints for C.I. water quality pipes and fittings/specials. Lead shall be conforming to IS 782 and of good quality manufactured by Hindustan zinc or equivalent. Fine hemp yarn shall be the best available in the market.
- xiii. **Flanges & Flanged Joint (screwed/welded flanges):** The CI flanges shall be conforming to IS 3516 or IS 1536. The heavy quality G.I./ M.S. flanges shall be conforming to I.S.6392 having thickness not less than 20 mm for pipes having diameter beyond 80 mm and 12 mm for pipes having diameter below 80 mm including drilling holes in new flanges, jointing with the pipe by means of welding or screwed joint. Rubber insertion shall be of three ply not less than 3 mm thick of approved make or fiber board impregnated with chemically neutral mineral oil having smooth & hard surface weighing not less than 112 gm/mm thickness. Bolts, nuts and washers used shall be of good quality.
- xiv. **Flexible Purg Joint (Tyton/Ring Joint):** Rubber ring shall be moulded or tubular natural or synthetic rubber gasket conforming IS 12820.
- xv. **C.I. Sluice Valve:** The Sluice valve shall be of Class or pressure rating as specified in the schedule of quantities and conforming to I.S. 14846. The valve shall be of cast iron and / or spheroidal iron having non-rising spindle with hand wheel & spindle of stainless steel.
- xvi. **C.I. Non Return Valve:** Non-return valve shall be conforming to IS 9338 or IS 5312.
- xvii. **Foot Valve:** Foot-Valve shall be conforming to IS 4038 and with C.I. body not less than of grade FG200 and strainer with internal gun metal working parts.
- xviii. **Air Valve:** The Air Valve shall be of heavy quality conforming to IS 14845 with IS certification mark and isolation valve. The body, domes, covers, stuffing box, thrust plates, wedges, gland and cap shall be of cast iron not less than of grade 20 and inside working parts should be of any non-ferrous or ferrous materials.
- xix. **Butterfly Valve:** The butterfly valve shall be flanged type or as specified conforming to IS 13095 & BS -5155. The valve shall be bubble tight, resilient sealed suitable for flow in either direction with accompanying flanges and steel handle.
- xx. **Drainage System:**
 - 1. **Cast Iron Soil Quality Piping Work:** Cast Iron soil quality pipes and fittings shall have ISI certification mark. Sand -Cast, Cast Iron Soil quality or rain water pipes and fittings shall confirm to IS 1729 and centrifugally cast (Spun Cast) cast iron soil quality pipe shall confirm to IS 3989. All the pipes and fittings shall be cylindrical reasonably true with inner and outer surfaces and nearly concentric as practicable. The outer surface of the pipe and fitting shall be

finished well, sound, free from pin hole, cracks and other imperfections. The pipes & fittings shall be treated with solution of Dr. Angus Smith's solution. The dimensions, weight of Sand-Cast Iron/ Ductile Iron pipes and fittings shall be as per IS 1729 – 2002 or its latest revision. Spacing between clamps for fixing internal piping shall be as per IS 2065 – 1983.

2. **UPVC-SWR Piping Work:** UPVC soil, waste and rain water (SWR) and ventilation pipes. The pipes shall conform to IS 13592, UPVC - SWR and fittings conforming to IS 13591. Rubber sealing rings conforming to IS 5382 with lubricant for sliding socket joints. In case of underground piping, the pipe line shall be painted with two coats of approved oil paint of matching colour over a coat of primer.
3. **High Density Polyethylene Piping Work for Drainage:** The pipes and fittings shall conform to IS 14333. HDPE pipes and fittings shall be free from cracks, flaws and defects. The HDPE pipes shall be used for anti-syphonage including provision, cutting, wastage, bending, dressing, jointing with cement solution, necessary plugs, brass fittings such as brass thimbles, brass union, brass cleaning caps and other brass fittings as required.
4. **Drop Connection:** Concreting, mortar for jointing the pipes, hemp yarn, salt glazed stoneware pipes and specials like bends, tees, crosses (double tees), plugs caps etc. of specified diameter shall be of grade 'A' or 'AA' conforming to IS 651.
5. **CI Frame and Covers for Manholes:** C.I. Frame and cover shall conform to IS 1720 and shall have IS certification mark with grade LD/MD/HD/EHD. The frame and cover shall be painted with two coats of approved black bitumastic anticorrosive paint over a coat of primer.
6. **Precast Concrete Frame and Cover for Manhole:** The precast frame and cover shall be of steel fiber reinforced concrete (SFRC) conforming to IS 12592 and shall be of approved make. The frame and cover shall be of LD/ MD/ HD/ EHD grade, size and thickness as per approved DBR.
7. **Salt Glazed Stone Ware Piping Work:** Salt glazed stoneware pipes and specials shall be of grade "A" or "AA" conforming to IS 651. All the pipes and fitting shall be free from pin holes, cracks and other imperfections and should have the glossy finish of salt glazing.
8. **Sewer Trap:** Sewer trap shall be salt glazed of stoneware of specified diameter as per DBR and shall be of grade "A" or "AA" conforming to IS 651. Sewer trap should be free from pin holes, cracks and other imperfections and should have the glossy finish of salt glazing.

xxi. **Water Tank, Septic Tank, Up-flow Filter and Soak pit:**

1. **Frame and Cover:** The frame and cover of M.S. or C.I. shall be of mild steel or cast iron as specified in the schedule. The weight of frame and cover shall not be less than 50 kilograms'. They should have locking arrangement. The frame and cover shall be of mosquito proof condition.
2. **Ball Valve:** Horizontal plunger type ball valve with PVC or copper float shall be conforming to IS 1703.
3. **Polyethylene Water Tank:** The water tank shall be made out of best moulded Polyethylene plastic. It shall be vertical or horizontal type as specified, watertight and non-absorbent and shall not contaminate water. Adhesives shall not be used in joints. The cover shall be of polyethylene / M.S. / C.I. as approved.
4. **Water Tank and Septic Tank:** Construction of water tank, septic tank and up flow filter is required to be done very carefully with good quality materials. Dense, well compacted concrete of required strength has to be achieved in order to make water tight compartment. The slope in the bed of tank, invert levels of insert, and also the levels of partition and baffle walls should be properly maintained for proper flow of liquid. After construction of all water and septic tank, it shall be tested for leakproof-ness. The water level should not drop more than 50 mm within 48 hours.
5. **Soak Pit:** Provision of Soak pit of specified size as mentioned in the approved DBR including filling with brick bats and coarse sand filling around the honey comb brick wall. The brick bats shall be from properly burnt bricks and not from over burnt bricks, coarse sand filling. Brick work and plastering shall be as per general specifications

xxii. **List of approved brand and / or Manufacturer of materials:**

1	CPVC Pipes	Ashirvad / Astral / Ajay
2	Sanitary ware	ROCA / Hindware / Parry ware
2a	Wash Basin - Corian	Mojo / Roca
3	Toilet Accessories	Bobrick / Toto
4	CP fittings	Kohler/Roca/American Standard
5	Gate valves/Non-return Valves	Audco/L & T /RB/Leader /Legris
6	Submersible Pumps	Lubi/Darling.
7	Liquid level controllers	Sridhan International / Filpro electronics
8	Kitchen sink	Frankee / Jayna
9	UPVC pipes & fittings	Finolex / Supreme
10	Pipe protection tape	Tapex
11	Concealed / Buried	Pipe coat
12	Hot water insulation	Vidoflex / Armaflex
13	Butterfly valve	Audco/L &T/Saunders
14	Urinal flushing sensor	Kohler/Roca/American Standard
15	Soap dispenser	Bobrick

16	Hand Dryer	Bobrick
17	Water Heater	AO Smith
18	UPVC pressure pipes (schedule 40) & fittings	Astral/ Supreme/Ajay
19	Ball Valve	Leader /RB
20	Water meters	Shenitech / Forbes Marshall
21	GRP Tank	Devi polymers
22	Dosing pumps	Grundfos / Asia LMI
23	Cast Iron Hubless pipe	Neco /Saintgobain
24	Floor trap frame & grating	Neer (Material :SS)
25	Manhole frame & cover	Crescent Foundry / ACO / Neco
26	Water hammer arrester	CPP / Zum Wilkins
27	RCC Hume pipes	Indian Hume pipes/RBBR
28	Y-strainer	Leader / equivalent
29	C I Class pipes & Fittings	Saint Gobain/ Neco
30	Grease Separator , Kitchen drainage Gratings	ACO/Claire Fontaine
31	HDPE pipe and Fittings	Supreme
32	Flow Restrictor	Neoperl
33	PRV	Singer
34	Foot valves	Leader / Legris
35	Filters	Ion exchange / Thermax / approved make
36	Dosing Units	Asia LMI/Approved
37	RO Membrane	INGE
38	Heat Pump	Energen/AO smith/
39	Solar collectors	Energen/AO Smith
40	Hot water tank	Energen/AO smith
41	Pump station	Resol/Caleffi
42	Expansion tank	Baymak/Caleffi/zilmate
43	Butterfly valve	Audco
44	Copper Pipes	Rajco
45	Hot water circulation pump	Grundfos/Wilo
46	G.I pipes	Tata / Jindal hissar
47	sensors	'Resol/Caleffi
48	Insulation	Vidoflex / Armaflex
49	Hot water control panel	Century / Resol
50	Guage	Forbesmarshall / H Guru
51	Pilot Float Operated valve	Singer
52	Hydro pneumatic Pump	Grundfos/Xylem/Armstrong.

III. Technical Specifications of Internal Electrification Works:

This section of the document deals with minimum key specifications for the purpose of general understanding of concessionaire. The services systems for the project shall be conceptualized based on acceptable national and international design standards.

- a. Concessionaire shall make all efforts to conceal all services and still provide access to these for accommodating changes in requirement in future. Conservation of energy, optimisation of resources, Eco friendliness and state of art Technology shall be key factor in the design concept to ensure least downtime and reduce maintenance hassles. Design, layout and installation of equipment shall be such that it will tend to encourage routine preventive maintenance by providing easy access by operation personnel.
- b. All electrical installations will be carried out as per local codes, regulations and practices. The equipment will be procured meeting the requirements of Indian Standards (BIS) and as per international standards where no Indian standards exists or the guidelines defined in the Indian standards are insufficient to carry out the engineering and design activities. Below are the applicable Codes, standards and regulations for electrical installations:
 - i. Bureau of Indian Standards (BIS)
 - ii. National Electrical Code (NEC)
 - iii. Indian Electricity rules (IER)
 - iv. National building code (NBC)
 - v. Local codes and standards
- c. **Source of power supply:** The maximum power demand for proposed hospital is to be calculated by the Concessionaire based on the consumption load.
- d. **HV distribution:**
 - i. HT Panels should be of VCB upto 33KV & SF6 above 33KV
 - ii. Underground HT cable should be XLPE insulated.
 - iii. End terminations should be heat shrinkable.
 - iv. Earthing conductors should be Hot Dip G.I. Calculation for earth conductors for fault level for main grid, sub-grid, etc.
 - v. Earth electrodes should be as per IS 3043.
- e. **LT distribution:**
 - i. LT Power panels should be as close as possible to load centres. It should be supplied from an authorized vendor as per the approved makes.
 - ii. It should be segregated into two units in such a way that anyone can be taken for preventive maintenance with hospital in running condition.
 - iii. All panels should be equipped with ACB/ MCCB of adequate KA rating. MCCB to be restricted upto 800A rating & above should preferably be of ACB.
 - iv. All MCCB/ACB controlling the input power supply should be of electronic/ microprocessor based with site tuneable O/C, E/F, etc. Rating less than 250A should be with thermo magnetic releases.

- v. All major loads should have independent feeders like Air Conditioners, Medical equipment, Gas plant, STP, Pumps, Firefighting, etc.
- vi. All loads should be connected with XLPE including armoured cables with aluminium conductor.
- vii. Entire installation should have G.I. ladder type cable trays with supporting system. Suitable GI covers to be provided to avoid damage to cables.
- viii. Earthing conductor should be laid for the entire system to achieve earth resistance not more than 4 Ohm for GI and less than 1 Ohm for copper.
- ix. Auto P.F. Control panel should be provided to maintain minimum P.F. of 0.98. Auto power factor correction can be preferably at sub-station suitable for un-manned operation on EB & D.G. supply to maintain minimum 0.99 & 0.85 respectively.
- x. The entire panel should have auto changeover mechanism with provision for manual operation facility. Aluminium busbar of adequate size not less than 1.2 sqmm per ampere should be used for all power & lighting panels.
- xi. All safety components like surge arresters, electrical and mechanical interlock system, indicating lamp, relays, digital meters, potential & current transformers, power pack, protective devices, etc. shall be built in & accepted to user.

f. Emergency power supply system:

- i. The entire power supply should be backed up with DG sets, essential and emergency systems are taken care.
- ii. For life safety equipment which need less than 10secs interruption, UPS supply should be provided.
- iii. For critical branch circuits like lighting etc, separate lighting UPS/ Inverter should be provided.

g. Uninterrupted power supply (UPS) system: UPS power to be provided for all critical areas like OT's, ICU's, work stations, server loads, emergency lighting, medical equipment's, etc. as per specified norms.

h. Internal electrification:

- i. The details of internal wiring, the position of fittings, fans, switches and plug sockets etc. shall be indicated in the layout drawings which is a part of DBR and shall have to be approved by the Independent Engineer/Monitoring agency appointed by the Authority
- ii. All internal wiring should be done in conformity to the latest Indian standard specification/Rules, code of practice adopted by CPWD and other standard practices prevalent in the part of the country.
- iii. The installation should be carried out in conformity to all requirements of IE Act, 1910 and IE Rules 1956.
 - 1. Ceiling rose in (in case of ceiling and exhaust fan).
 - 2. Ceiling rose or connector (in case of pendants except stiff pendant points)
 - 3. Bank plate (in case of stiff pendant).
 - 4. Socket outlet (in case of socket outlet points)
 - 5. Lamps holder (in case of wall Bracket, batten holder bulk head fitting and similar other fittings)

6. Call bell / buzzer (in case words 'via' the switch shall be read 'via' the ceiling rose / socket outlet for bell push, where no ceiling rose / socket outlet it's provided.
- iv. The following shall be included in the point wiring
1. Switch and ceiling rose are required.
 2. In case of wall brackets, bulk head fittings, cables as required up to the lamp holders]
 3. Bushed conduit for porcelain tubing where cables pass through walls.
 4. All wood or metal blocks, boards and boxes, R.J. Boxes sunks or surface type
 5. Earth wire from 3 pin socket point to the common earth including connection to the earth dolley.
 6. Earth wire of 16SWG/14 SWG/I.G. wire for loop earthing of the fixture.
 7. All fixing accessories such as clips, nails, screw, plug, rawl plug, blocks etc. as required.
 8. Joint for junction boxes and connecting the same as required.
 9. Connections to ceiling rose or connection socket outlet, lamp holders, switch, fan regulators

i. Conduit wiring:

- i. For recessed conduit wiring system the conduit should be placed in the ceiling / columns etc. before the casting of the slab or column.
- ii. The conduit pipes should be properly positioned and fixed so that it will not be displaced at the time of concreting. The conduit pipe shall be fixed by means of staple or saddles not more than 600mm apart.
- iii. The junction boxes provided should be so arranged that its cover will be flushed with the finished surface of the ceiling or column.
- iv. Fixing of standard bends or elbows should be avoided and all curves maintained by bending the conduit itself with a long radius will permit easy drawing of the conductors.
- v. Suitable inspection boxes should be provided to permit periodical inspection and removal or replacement of wires if necessary.
- vi. The switch or regulator box should be made of metal on all sides except on the front where backlight sheet or Perspex cover painted to match the colours of the wall shall be used.
- vii. The entire system of conduit after installation should be tested or mechanical strength and electrical continuity throughout the earthing of the entire installation should be carried out in accordance with I.E. Rules and standards.
- viii. The number of wires drawn in the conduits shall not exceed the numbers those specified in Indian standard specification No.732.

j. Earthing:

- i. Earthing shall generally be carried out in accordance with the requirements of Indian Electricity Rules and Indian Standard Specification No.IS:732 and IS: 3043.

- ii. The work should include earthing of noncurrent carrying metallic parts of all the equipment, light fittings, conduit pipes, cable and cable supports and earth strips (the design to be approved by the purchaser) and all the inter connection between the earthing system to a value mutually agreed upon between the purchasers and the supplier.

k. Lighting protection:

- i. Lightning Protection should be planned based on IS 2309 using conventional type air finals and connected with copper plate earth stations in ground in the open area.
- ii. Earth Resistance value shall be less than 10 Ohm.
- iii. All horizontal air terminations shall be interconnected such that no part of the roof is more than 5 m away from the nearest horizontal conductor.
- iv. Every down conductor is proposed to be connected to a separate earth station.
- v. All Earth stations are proposed to be interconnected as an Equipotential bar.

l. Surge protection:

- i. The switching surges should be arrested at the main panel and also near critical equipment.
- ii. The expensive equipment like MRI/CT Scan/ Cathlab should be protected against Voltage/Current surges.
- iii. The Insulation requirements of various electrical equipment ie 415V/ 240V should be as specified by IEC 60364-4.
- iv. Surge Protection devices should be placed at all the following mentioned locations
 - 1. Main PCC
 - 2. Feeders feeding Critical medical equipment
 - 3. Distribution Boards feeding Critical loads

m. Installation, testing and Commissioning:

- i. The concessionaire shall be responsible for the installation testing the commissioning of all the equipment and materials against standard specification.
- ii. Any discrepancy or defect noticed by the Independent Engineer/ Monitoring Agency in the items after installation, the concessionaire shall replace the same at his own expense.
- iii. In case any addition/ alternations is required to be made in the installation or in the equipment as per the directive of the Government Electrical Inspector, the same will have to be carried out by the concessionaire.

n. Installation and Maintenance tools: The concessionaire shall furnish a complete list of tools, appliances and accessories required for the installations of switch gear, light fittings, pipes cables and wires.

o. Test:

- i. Manufactures standard tests in accordance with Indian Standards and other standards, shall be carried out on all the equipment and accessories covered by this specification so as to ensure efficient and satisfactory performances of all the components and also the equipment as a whole under working conditions at site.
- ii. All equipment shall be tested at site before the commissioning in accordance with the adopted standard and Indian Electricity Rules.
- iii. Voltage test shall be carried out on each circuit on completion of wiring and cabling.
- iv. The concessionaire shall submit a complete list of all such tests reports to the Independent Engineer / Monitoring Agency.

p. PVC insulated cables and wires:

- i. For 415V Distribution system, cables of voltage grade not less than 1000V shall be used. These cables shall be heavy-duty class, PVC insulated and PVC sheathed with aluminium/ copper conductors.
- ii. The wires used in the lighting installation shall be PVC insulated and PVC sheathed copper / aluminium wire in case of conduits wiring and of 660V grade.
- iii. Wires of different colours shall be made use of for quick\ identification of phase wire / neutral wire etc. All cable of wires shall comply with the requirements regarding the manufacture and testing etc as specified in India Standard Specification IS: 1554 and IS:694.
- iv. Fuse switch / switch fuse shall be metal clad dust and vermin proof suitable for use under climatic conditions prevailing at site. Switch fuse / fuse switch units shall comply in general to IS: 1567/4064 with regard to design and constructional / features.
- v. The 'ON' and 'OFF' position of the switch handles shall be distinctly indicated and interlocks shall be provided to ensure that the switch cover cannot be opened unless the switch is in the 'OFF' position. Means shall, however, be provided for releasing the interlock to permit closing of switch with cover open for testing purposes.
- vi. Switch fuse / fuse switch units, distribution boards shall be provided with necessary metal frame work so that they can be mounted on wall / columns structure etc. as desired.
- vii. The arrangements of work boards shall be such that the operational handle of the top mounted switches are within the convenient of operators (about 1.2 M from the finished floor level) and proper space shall be provided for the termination of the cable in the switches provided below the bus-bars.
- viii. The bus-bars within the bus-bar chamber shall be liberally spaced for taking the riser connection. The bus bars with aluminium conductors shall be provided and PVC sleeves of different colour shall be mounted on them for easy identification, Clamped joints for taking the riser connections, instead of bolted type shall be preferred.
- ix. Two bolted type earthing terminals shall be provided on the switch boards. All individual switches shall be connected with suitable size earth wire to the main earthing terminals of the switchboard.

- x. Hanger Board and shock treatment / charts shall be supplied wherever required. At the incoming side of each pen phase, 3-neon type indicating lamps should be provided at the main board.

q. Switches and plug sockets: Switches provided for control of light points should conform to IS: 1087 and shall be rated for 5A/15A 250V.

r. Ceiling Fans and Exhaust Fans:

- i. Ceiling fans should conform to Indian standard specification IS: 374-1960. The fans should be supplied with all standard accessories like regulator and capacitors etc.
- ii. The performances rating of the propeller fans should be in accordance with stipulations of IS: 2312. All fans should be robust in design and construction and should be supplied complete with wall brackets / clamps etc.

s. Luminaires & lamps:

- i. Luminaires and lamps should be of reputed make and high efficiency type.
- ii. Degree of protection of enclosure should be IP-65 for outdoor fixtures. Bulkhead fixture shall be provided with IP-54 protection and all internal lighting fixtures shall be IP20.
- iii. All fixtures should be supplied complete with lamps and accessories, like electronic ballasts, power factor improvement capacitors, etc. Outdoor type fixtures should be provided with weather proof terminal and control gear housing with IP-54 protection.
- iv. Each fixture should have a terminal block suitable for loop-out connection by 1100 V PVC insulated copper conductor wires up to 2.5 sq.mm.
- v. All hardwares used in the fixtures should be suitably treated against corrosion
- vi. Earthing: Each lighting fixtures should be provided with an earthing terminal. All metal parts should be bonded to earth.
- vii. Metal used in body of lighting fixtures should be not less than 22 SWG to comply with specification. Sheet steel reflectors should have a thickness of not less than 20 SWG. The metal parts of the fixtures should be completely free from burrs and tool marks.
- viii. Painting/Finish: All surfaces of the fixtures should be thoroughly cleaned treated and degreased before painting.
- ix. The housing should be powder coated/stove-enameled or anodized as required. The surface should be scratch resistant.
- x. Reflectors should be made of CRCA sheet steel/aluminium /Silvered glass/Chromium plated copper sheet as asked for.
- xi. The thickness of reflectors should be as per relevant standards. Reflectors made of steel should have stove enamelled/ vitreous enamelled/epoxy coating finish. Aluminium used for reflectors should be anodised/epoxy stove enamelled /mirror polished. The reflectors should be free from scratches with smooth and glossy surface having optimum light reflecting coefficient.
- xii. Reflectors should be easily removable from the housing for cleaning and maintenance without use of tools.

t. Internal lightning

- i. General Areas like reception, Nurses Consultation Rooms: concealed/surface mounted LED lights
- ii. Corridors, Toilets, Change rooms, etc.: concealed/surface mounted LED lights
- iii. O.T, ICCU, ICU, equipment rooms, etc: concealed/surface mounted LED lights
- iv. Service rooms like Sub-station, STP, etc.: surface/concealed LED lights
- v. Dimmers/ Occupational sensors: Optional

u. External Lighting:

- i. Street light poles: Extruded M.S. Poles with MH/T5/LED lamps
- ii. Landscape lighting: to be selected by Concessionaire
- iii. Flood lighting: to be selected by Concessionaire

v. Emergency lighting system

- i. Through Centralised Inverter or through Invertors in each floor.
- ii. It should have SMF Batteries to provide minimum 20 minutes back-up time.
- iii. Emergency lighting should cover all areas like lift, sub-station, service rooms, reception, nurse station, ICU, NICU, wards, beds, etc.
- iv. Minimum 10 to 15% of lighting system should be provided for corridors, consultation rooms, waiting areas, lobbies, toilets, etc.
- v. Distribution system should be separate for emergency lighting system.

w. Specification of Lift: Electric Traction Elevator of various capacity to be installed for vertical transmission of patients / officials / public. The elevators shall be of ThyssenKrupp, Johnson, OTIS, Mitsubishi & KONE make with mirror finishing having power operated automatic sliding door with ADR system conducive to be used in hospitals.

x. List of approved makes for electrical works:

Sl. No.	Items Description	Make of the components
1	XLPE Insulated L.T cables	POLYCAB/ HAVELLS/ FINOLEX/ KEI/ UNIVERSAL/ GLOSTER
2	Flexible – Copper Cables / Control Cables / Special Cables	POLYCAB/ HAVELLS/ FINOLEX/ LAPP/ GLOSTER
3	Decorative Luminaries	Philips/ BAJAJ/ WIPRO/ HAVELLS/ CG/ HALONEX
	Fancy Light Fittings	Philips/ BAJAJ/ WIPRO/ HAVELLS/ CG/ HALONEX
4	High efficiency fluorescent lamp	Osram / Philips / CG
5	Outdoor Light Fittings	Philips/ BAJAJ/ WIPRO/ HAVELLS/ CG
6	LED Light Fittings	Philips/ BAJAJ/ WIPRO/ HAVELLS/ CG/ HALONEX
7	LED's	Cree / Luxion / Nichia/OSRAM

Sl. No.	Items Description	Make of the components
8	PIR Sensors – Digital only	Philips / /MK (Honeywel)
9	MCB/ RCDs/Surge suppressors /MCB Type Isolators	Hager/Schneider (MG) / ABB / LEGRAND
10	MCBs and MCBDBs (double shutter)	Hager/Schneider (MG) / ABB / LEGRAND
11	MPCBs	Schneider (NSX) / LEGRAND
12	Decorative type modular switches & Sockets	Great White/ Fiana/Anchor Lira / ANCHOR TRESA / LEGRAND / MK india
13	Heavy duty cable Lugs/ Cable glands	Dowells / SMI / Comet / Jainson
14	Industrial type Switch sockets-Moulded	SCAME /Legrand//Schneider/
15	Industrial switch sockets	SCAME /Legrand//Schneider
16	MS Conduits	GB/Bharat / Supreme
17	FRLS Conduits	VIP/NATIONAL / SUDHAKAR / PRECISION
18	Wires (PVC/FRLS)	Anchor/ POLYCAB / FINOLEX / HAVELLS
19	Exhaust Fans	CROMPTON/GEC/Anchor/Almonard
20	Cable/Earth pit markers	Suraba/SMI
21	Terminals	Elmex / Wago
22	Rubber Mat	Jyothi
23	Push Button Station	Siemens / Teknic / Schneider
24	DOL/Star Delta Starter	Siemens/Schneider /Legrand
25	Earth pit marker	
26	Fire Barriers	3M / Hilti / Viper
27	Cable Trays	Profab / Patny
28	Fabricated Wire ways / Raceways Readymade Wire ways / Raceways	Profab / Patny
29	Inverter With 1 and half Hour battery Backup	DUBAS/Consul neowatt/ Power one
30	Chemical Earthing/ Maintenance Free earthing	Jef Ecosafe /Galaxy
31	Transformers	Crompton Greaves/Kirloskar/Universal /GE/Schneider/ESSENER / VOLTAMP / PETE
32	HT Panels	Schneider / ABB/LEGRAND
33	PVC flexible conduit pipes	As per approval by consultants
34	33 kV HT cables	POLYCAB / FINOLEX / HAVELLS / GLOSTER
35	Lightning system	Erico / Indelec

Sl. No.	Items Description	Make of the components
36	Street Light poles	Bajaj / K-Lites / Bombay Poles
37	Ceiling fans	Polar / Usha / Crompton / ORIENT
38	GI pipes	Jindal / Prakash / BEC
39	MS pipes	Tata / Sail / Jindal
40	MS Steel	Tata / Sail
41	Cable jointing kit	Raychem
42	Transient Voltage Surge Suppressor	ASCO
43	Sandwich/ air insulated Busducts/rising Mains	Godrej/Schneider/L&T/ C&S
44	Battery Charger	AMARON/ HBL-NIFE / DUBAS
45	SMF Battery	AMARON / Rocket /Panasonic/Exide

y. List of approved makes for LT switch boards and components:

S.No.	Items Descriptions	Make of Components
1	Switchboard manufacturer/ Main power centre/ Sub power control centre	Controls /Balaji Electro Controls / Indus electro controls / SV Karanth Techno systems
2	ACB	Mitsubishi/ Schneider—NW series (MG)/ ABB /L&T/LEGRAND Releases : Micrologic 6.0 A or equivalent
3	MCCBs / MPCBs	Mitsubishi/ Schneider –NSX series (MG) / ABB / L&T / LEGRAND
4	Contactors and O/L Relay	Schneider / Siemens
5	Load Monitors / Controller and all Digital meters	CIRCUTOR /INFO NRG
6	Multi Data Meters (MDM) with RS- 485 port	CIRCUTOR /INFO NRG
7	MCBs	Hager/Schneider (MG) / ABB
8	Capacitor(Gas filled Type)	CIRCUTOR /EPCOS / SIEMENS NEPUTUNE / L&T / SCHNIDER
9	CTs and PTs	CIRCUTOR /Kappa /Kalpa
10	Control Switches	Kaycee / Siemens / Salzer
11	ELR / Earth Fault Relay	CIRCUTOR/CSPCL/ PROKDVS/ NUGUBA
12	Protective Relays	Schneider / CSPCL
13	Push Buttons	Siemens / Teknic / Schneider
14	Indicating lamps (LED type)	Siemens / Teknic / Schneider / VAISHNO /BINAY
15	Wires (HHFR)/FRLS/PVC	POLYCAB / FINOLEX / HAVELLS /Anchor
16	Lugs. Glands	Dowells / HMI / Comet / BRACO / HEX
17	Terminals	Elmex / Wago – Finger touch proof
18	Ferrules	Mayfair
19	Bus bar supports	Powermak or approved equivalent

S.No.	Items Descriptions	Make of Components
20	Energy Meter with RS-485 Port	CIRCUTOR /INFO NRG
21	Panel Digital Meters	CIRCUTOR /INFO NRG / CONZERV / L&T / AE / SECURE
22	Name plates	Screen printed acrylic
23	Surge Protective Devices	ZOTUP/Schneider / OBO Bettermann
24	Power factor control relay	CIRCUTOR /EPCOS
25	Capacitor (MPP gas filled only), Inductor and Thyristor modules combination	CIRCUTOR /EPCOS
26	Switch fuse/Fuse switch / HRC fuses	EPCOS / Siemens
27	Power pack	Minilec // Hi-rel
28	PLC load management	Allen Bradely / SIEMENS /HONEYWELL / JOHNSON
29	ATS	ASCO 7000 SERIES

z. List of approved makes for 33kV HT panels and accessories

- i. 33kV Breakers : SCHNEIDER / ABB / L&T
- ii. 33kV On load isolator : SCHNEIDER / ABB / L&T
- iii. Indicating Meters : CIRCUTOR /INFO NRG
- iv. Trivector meter : L & T or Approved equivalent
- v. Microprocessor based Numerical relays : Siemens /Schneider / Areva
- vi. CTs & PTs : Kappa /Kalpa/CIRCUTOR
- vii. Indicating Lamps & Push Buttons : Siemens / Schneider / Tecknic
- viii. Terminals : Phoenix/Wago/Elmex
- ix. On-Off switch with lost motion : Kaycee/ Alstom

aa. List of approved makes for 33kV outdoor items / equipments at point of supply shall be generally as per Local EB approved list

- i. 33KV Gang Operated Air Break: southern switchgear / Switchgear manufacturing company / AMEI power Ltd.
- ii. 33KV Lightning Arrestors:Oblum / LAMCO / Jayashree
- iii. 33KV Insulators : Jayashree/BHEL

bb. List of approved make for bus ducts/rising main: The bus ducts / rising mains of following makes shall be offered.

- i. SuperBar, UAE
- ii. Godrej
- iii. Schneider
- iv. L&T
- v. C&S

IV. Technical Specifications of Fire Protection, Detection and Public Address System:

- a. Complete fire and safety shall be designed and installed as per guidelines of NBC 2016 latest version and relevant latest BIS/ IS Codes.
- b. The scope of work includes complete design, Engineering with necessary design calculations, Fit –up details, Supporting details for the water tanks, pumps, fire hydrant system, Hose Reel system, Sprinkler system, automatic fire detection and alarm with P.A system, two way talk back system, first aid fire extinguishers and signage's as per applicable codes and standards. Following are the systems proposed:
 - i. Centralized Fire water tank and Fire pump room equipment.
 - ii. Fire water (Hydrant & Sprinkler) ring mains at natural ground level.
 - iii. Landing Hydrants on all floors near staircase with necessary accessories.
 - iv. Sprinklers system on all floors with floor control valves.
 - v. Addressable analogue type fire detection and alarm system for entire building.
 - vi. Two ways talk back system.
 - vii. Public address system.
 - viii. Fire extinguishers and Signage.
- c. **Fire Water Pumps:** The pumping facility forms the heart of the fire protection system. The pumps are basically used to increase the velocity and the quantity of water required to fight fires. A common compartmentalized control panel for all pumps has been envisaged and located at pump room. Panel is designed to operate pumps automatically on pressure loss basis with timers, contactors, indicators etc. Necessary provisions shall be made in the panel to link the system to BMS (building management system). The power supply to the panel shall be from two sources i.e., Electrical Board supply and Diesel Generator power. The following pumps with adequate capacity are the pumps proposed:
 - i. Electrical motor driven main pump for hydrant system
 - ii. Electrical motor driven main pump for sprinkler system
 - iii. Diesel engines driven common standby pump
 - iv. Electrical motor driven Jockey pump
 - v. Electrical motor booster pump
- d. Extra Low Voltage Systems (ELV) shall be installed such as CCTV systems, Access Control and Attendance Management system, Building Management System. Conduit and wiring network is required for LAV/Data, Voice/ Telephone, Television and Nurse Call System. ELV System shall conform to the following codes that are latest:
 - i. National Building Code (NBC) of India 2016, Fire and Life Safety.
 - ii. NFPA 72: 2013 - National Fire Alarm and Signaling Code (Only applicable NFPA Standards-As per relevant Indian Standards)
 - iii. Stipulations of local authority for Fire compliance, CCTV & others IEC 60849: 1998 - Sound systems for emergency purposes
 - iv. ASHRAE \ ANSI 135 : 2004 - BACnet - A Data Communication Protocol for Building Automation and Control Networks
- e. **CCTV System:** Analogue CCTV system with Cat 6 cable network shall be installed to surveillance / monitor the critical and important areas in the premises. CCTV system allows the facility management and operations personnel to manage the

facilities from single (or) multiple locations through digital video recorder with TCP/IP compatibility. Analogue cameras shall be connected to 8 / 16 channel digital video recorder using Cat 6 cable and same shall be connected to 32” LED display sy. Continuous storage of 30 days to be considered. Capacity & number of Cameras shall be installed all strategic locations/areas like waiting areas, Pharmacy, Main lobby, Entry & exit point of premises and other areas as per approved DBR.

f. Building Management System:

i. Building Management system including conduiting, cabling/ wiring hardware, protocol software is proposed to control and monitoring the HVAC systems, for monitoring electrical system, PHE, and interfacing with fire panel, fire alarm & detection system in order to reduce the running and energy costs and to improve the quality of information on all these aspects. Building Management System shall be with BACnet platform and third party integration at the supervisory level on BACnet, LON works, Modbus, Mbus etc.

ii. Building Management System shall consist of the following

1. Workstation with 32” LED Monitor
2. Software
3. Third Party Integrator / Gateway
4. Direct Digital Controller
5. Field Devices like Temperature Sensor, RH Sensor, Differential Pressure Switch, Level Transmitter etc., Signal and communication cable

iii. System Description

1. BMS shall control and monitor the following HVAC equipment;
2. Air cooled Chillers
3. Primary Pumps
4. Floor Mounted Air Handling Units
5. Vertical Mounted Air Handling Units
6. Ceiling Suspended Air Handling Units
7. CHW & DX Units
8. Ventilation Fans
9. Exhaust Air Fans
10. Pressurization Fans

iv. BMS shall monitor the following PHE equipment such as Raw Water Pump, Soft Water Pump, Submersible Pump, Water Sump & Tanks, Line Pressure and Make-up Water Pumps etc.

v. BMS shall monitor the following FPS equipment such as Main Pump, Sprinkler Pump, Jockey Pump, Diesel pump, Water Tanks, Line Pressure etc.

- vi. BMS shall monitor the following third party systems such as Variable Frequency Drive (VFD), Fire Alarm Control Panel (FACP), Uninterrupted Power Supply (Central UPS), Energy Meters (EM) etc.

g. Codes & Standards:

- i. The equipment and installation work shall conform to latest editions of applicable Indian / International Standards. The standards shall include but not be limited to the following: National Building Code (NBC) of India latest version, Part – 4, Fire and Life Safety.
- ii. Stipulations of local authority -IEC 60849: 1998 - Sound systems for emergency purposes.
- iii. All the security systems shall be installed complying with the following codes and regulations.
1. National and local statutory regulations.
 2. Health & safety at Work Acts.
 3. IEE Regulations
 4. Equipment manufacturer's instructions.
 5. Regulations and conditions of utilities suppliers.
 6. Any statutory Safety Guides.

h. List of Approved Makes:

Fire detection and alarm system:	
Fire Alarm & Control Panel	Bosch / Cooper / Edwards / Schrack
Repeater Panel (Optional)	Bosch / Cooper / Edwards / Schrack
Detectors / Manual Call Point /Hooter / Modules	Bosch / Cooper / Edwards / Schrack
Response Indicator	Agni / Madhushree / Firepro / Protech
Batteries	Amaron / AMCO / Panasonic
Public Address System:	
Controller	Bosch / Heinrich / Honeywell
Router	Bosch / Heinrich / Honeywell
Call Station / Call Station Keypad	Bosch / Heinrich / Honeywell
Amplifier / Speaker	Bosch / Heinrich / Honeywell
Two way talk back system:	
Main Console with Microphone /Amplifier / Talk Back Speaker	Haritasa / Heinrich / e-Building Technologies
CCTV System:	
Camera / Mounting Accessories	Bosch / Honeywell / L&T / Panasonic / Schneider – Pelco / Sony
Digital Video Recorder	Bosch / Honeywell / L&T / Panasonic / Schneider – Pelco / Sony
Display	LG / Panasonic / Samsung / Sony
Access Control System:	
Reader cum Controller	HID
Card	HID

Electromagnetic Lock	Algatec / BEL / Capture
Cables:	
Signal Cable / Power Cable / Control Cable / Communication Cable	Caliplast / Deepanjan Power / Polycab /Varsha / V-cables
CAT6 UTP Cable	Tyco / R&M / Siemon
Building Management system:	
BMS	Seimens/ HoneyWell

V. Technical Specifications of HVAC Works:

a. Standards & Guidelines (latest versions/guidelines to be referred):

- i. The System design & installation will be done with reference to the following:
 1. NBC 2016
 2. American Society for Heating, Air Conditioning & Refrigeration Engineers (ASHRAE).
 3. Indian Society for Heating, Air Conditioning & Refrigeration Engineers (ISHRAE).
 4. Indoor Air Quality as per ASHRAE 62.1-2010.
 5. Latest Addendum 62 by ASHRAE for Fresh Air in the Conditioned Space.
 6. General Specifications for Heating, Ventilation & Air-Conditioning (HVAC) - 2017 (CPWD)IS Standards wherever applicable.
 7. SMACNA Standards for Sheet Metal Ducting.
 8. ASHRAE Guidance on Health Care / Hospital Application.
 9. Energy Conservation Building Code (ECBC) latest version
 10. NABH Guidelines for Healthcare Organization.

b. Design Parameter:

- i. Ambient design conditions: as per local conditions of the project site
- ii. Indoor environmental requirements: The air-conditioning system and services broadly categorised as under to maintain temperature, humidity, pressure, air changes and air quality.
 1. Non 24-hours Zone: OPD, Day-care, Physio/ Rehabilitation, Admin & Back Offices, dining etc.
 2. 24-hours Zones: Emergency/Trauma Room, all ICU's, Radiology & Lab Rooms, Endoscopy, All Wards, and related Nurse Station /corridors, Server Room, Service areas, UPS, registration and operation theatres.
 3. Ventilation Zones: Toilets / Dirty Utility (DU), Kitchen, Staff & Locker Room, Electrical Room, STP & WTP, Plant room.
 4. Indoor Air Quality (IAQ): Filter Efficiency, Temperature, Fresh air & exhaust, Positive & Negative pressure, Rh and Filtration levels etc. shall be as per ASHRAE/NABH standards for Hospitals.

c. Systems requirements and Cooling Load: The cooling load to be calculated on the basis of following assumptions:

- i. Specific requirement for the Critical & General areas of the hospital are as follows

- ii. All AHU's serving OT's, ICUs and other critical areas shall have UVGI incorporated on the delivery side.
- iii. All AHUs, FCUs with motor having capacity more than 5HP shall be fitted with VFDs to enable power savings.
- iv. Isolation rooms shall be provided with terminal fan filter unit with HEPA filter.
- v. Medical equipment loads at various departments. (as per Key Equipment Load table)
- vi. Heat load of lighting and nonmedical equipment to be considered while designing the system.
- vii. Minimum out-door air and air – changes per ASHRAE /NABH guidance on Health Care / Hospital Application.

d. Cooling Plant and Chilled Water System:

- i. On the basis of cooling load & area to be air-conditioned, the chillers capacities need to be designed. The chilled water generation plant may be of the Water -cooled type or Air -cooled type.
- ii. In case of Air-Cooled type, it should comprise multiple screw chillers of required capacity to cater the cooling demand of the building. Each chilling unit shall comprise of semi hermetic, Screw Compressor operating on R134a refrigerant, shall be installed on terrace or in suitable location. Chillers shall be of high efficiency and KW/Tr should be between 1.20 to 1.30 @ 100 % load at peak ambient and NPLV @ site condition should be 0.75 to 0.80
- iii. The chilled water shall be distributed by centrifugal pumps and the capacity will match with proposed chillers. In order to conserve energy, primary chilled water pumps will be provided with variable speed drives, which will modulate the pump speed such that the chilled water flow matches the building load and hence conserve energy.
- iv. The chilled water primary pumping system shall distribute the chilled water to various Air Handling Units (AHUs) / FCUs/CSUs located on floors / terrace. The chilled water supply and return header connection with necessary controls shall be designed and installed for all the AHUs & FCUs. The chilled water piping, valves and fittings shall be insulated and finished as per standards. Design parameters & conditions of air cooled chillers, pumps, ducts, piping; AHUs, etc are to be defined clearly as per standards.

e. Air Distribution System:

- i. The cooling system for various areas shall be provided by Air-Handling Units (AHU) / Fan Coil Units (FCU) comprising of Vertical/ Floor/ Ceiling Mounted Units as per prescribed zoning for different areas.

- ii. Zoning: Separate air distribution with AHU/CSU shall be provided for each OT, each ICU, MRI, Cath, Radiology, Waiting areas, IP rooms, Endoscopy as per zoning. The zoning proposal shall be submitted by Concessionaire for approval of Independent Engineer/Independent Monitoring Agency appointed by Authority.
- iii. The distribution of the conditioned air shall be through sheet metal ducting with Supply diffusers/grilles. For non-priority areas, the return air from the space shall be picked up through return air grille / diffusers and shall be drawn over the void above the suspended ceiling to be taken back to the AHU.
- iv. The Supply / Return air ducting shall be insulated for Thermal & Acoustic purposes as per standards
- v. The air distribution system and their design shall be as per ASHRAE standards and norms of the Industry specially complying health care application for hospitals.
- vi. Fire dampers shall be installed in the supply Air ducting and in return Air opening areas while they enter the respective zone through shaft or AHU / Package Unit Rooms in accordance with the standards norms. With this arrangement, the travel of fire, smoke between the Zones is prevented in case of fire. All Fire Dampers shall be of extended sleeve type so that the Actuators remain outside the wall. Fire dampers shall be fitted with UL rated fusible link with limit switch to monitor damper position.

f. Air Distribution System for Critical Care Areas (ICUS, HDUs, Emergency, OT, CSSD, NICU, Isolation Wards etc.)

- i. Independent cooling Air distribution system shall be provided by plug fan type AHU/CSU for each critical care area with minimum of 6-row deep coil with 2-banks of filters etc. with controls. Air delivered to Negative pressure Isolation Room inside the ICU must not be re-circulated and should be exhausted out form the room by a separate exhaust fan.
- ii. Every Isolation room in the ICU area shall be provided with supply air from the main ICU AHU along with booster fan in the supply air duct & Terminal HEPA filter.

g. Key Equipment Load: Load of key equipment

- i. X-ray - 80 KW kick-off load and 30 KW running load;
- ii. CT scan - 150 KW kick-off load and 60 KW running load;
- iii. MRI - 120 KW kick-off load and 80 KW running load;
- iv. Bone Densitometry -- 5 KW;
- v. TMT - 5 KW; (on UPS)
- vi. USG - 2 KW;
- vii. ECHO - 2 KW;
- viii. Cath lab - 150 KW kick-off load and 80 KW running load;
- ix. Endoscopy - 2 KW;

- x. OT - 20 KW per room; 10 KW (out of 20) on UPS;
- xi. Steriliser in Sterile store of OT area - 7 KW;
- xii. ICU - 5 KW per bed; 3 KW (out of 5) on UPS;
- xiii. Laboratories - 25 KW total; 15 KW on UPS;
- xiv. Blood Bank - 25 KW total; 10 KW on UPS;
- xv. Physiotherapy - 10 KW total;
- xvi. Dental - 10 KW total;
- xvii. Eye - 8 KW total;
- xviii. Dialysis - 60 KW total;
- xix. CSSD - 150 KW total.

h. List of Approved Makes for HVAC Works

S. No	Material / Equipment	Manufacturer / Supplier
1	Chiller package	carrier / trane / york / bluestar / kirloskar
2	chiller structural plat form / ismb/ismc	jindal / tata steel / vsp
3	spring isolators	gerb / cori / kunwal
4	water pumps	grundfos / itt-bell & gosset / armstrong
5	cooling tower	bell / advance / paharpur
6	dry coolers	van spall / tcs / bci
7	variable frequency drives for ahus	siemens / abb / danfoss / schneider
8	heat exchanger (plate type)	alfa laval / tranter/ sondex / gea
9	heat exchanger (shel & tube type)	emerald / rc
10	heat exchanger (air & air)	dri / flakt / enventus /
11	air handling units / cooling coils	zeco / flakt / edgetech / systemair
12	centrifugal fans (ahu & all others)	nicotra / kruger / comefri
13	plug fans	flakt / nicotra / kruger
14	duct mounted heater	rc / emerald
15	evaporative cooler / wet scrubber	roots / humidin / hmx
16	dry scrubber	trion/rydair
17	fan filter unit	dyna / envirc / gebhardt
18	hi sensible cooling unit	emerson / voltas / blue star
19	precision unit – imported	emerson / stulz/ blue box
20	precision unit – local	emerson / stulz / blue star
21	dx split & package units	carrier / voltas / bluestar / daikin
22	vrw system – inverter type	daikin / / toshiba-carrier/ mitsubishi / lg
23	vrf system – digital scroll	bluestar / voltas (media) / samsung
24	chilled water cassette units	daikin / carrier / midea
25	fan coil units	flakt / zeco / carrier
26	ventilation ahus – cabinet type	zeco / flakt / edgetech / kruger
27	exhaust units – cabinet type	zeco / flakt / edgetech / kruger
28	jet fans	flakt / system air / aerovent/ nicotra
29	duct inline fans	caryaire / kruger / systemaire
30	propeller fans / axial flow fan	kruger / systemaire / nicotra / humidin
31	water pipes (ms & gi)	jindal / tata steel
32	grooved pipe couplings	victaulic / grinnell

S. No	Material / Equipment	Manufacturer / Supplier
33	butterfly valves	audco / honeywell / danfoss / kitz / advance
34	motorised butterfly valves	siemens / johnson / sauter / honeywel / danfoss/ belimo
35	ball valves / gate valves	audco / zoloto / kitz / advance
36	manual / semi balancing valves	advance / danfoss / flowcon
37	automatic balancing valves	honeywell / danfoss / flowcon
38	2 way / 3 way control valves	siemens / johnson / sauter / honeywell/ belimo
39	dynamic control valves (pr. indp (pibcv)	danfoss / oventrop / flowcon
40	y strainer / pot strainer	sant / ds engg / emerald / kitz / econost
41	check valves	advance / kitz / zoloto / audco
42	pressure guages / thermometers	h.guru / waree / dwyer
43	magna-helic gauge /digital dp gauges	h guru / warre / dwyer / sensocon
44	auto air vents	flameco (anergy) / bell & gosset / honeywell
45	flexible connections- pipe	cori / kunwal
46	gi pipes	jindal / tata steel
47	test points	anergy
48	closed expansion tank (with /without pressure pump)	grundfos / superflow
49	cpvc / hdpe pipes	finolex / supereme / sudhakar
50	water conditioning / treatment	ion exchange / thermax / grundfos / athresale / thermochem corp.
51	disk filter (for tower cleaning)	clarifontaine / azud bell & gossett / hattersley / spirovent /
52	air seperator / dirt separator	armstrong
53	gss sheets	jindal / sail/tata
54	aluminium sheets	jindal / indal
55	factory fabricated ducts	rolastar / zeco / sevenstar / radiant
56	preinsulated gi round ducts	seven star / atco
57	preinsulated duct	pal / alp / twiga
58	duct supports / anchors fastners	hiltti/ hi tech / fisher
59	spiral ducts	gp spiro / spiral tubes / karthila
60	double skin plenums	kc industry / titus / vayhan / theromotech
61	sound attenuators	trox/ruskin/kruger
62	fire dampers (ul-555 certified)	caryaire / ravistar / system air
63	smoke sensors	siemens / johnson / honeywell
64	damper actuators	siemens / johnson / honeywell/ belimo
65	diffusers / grilles / slot diffusers /exhaust / disc valves / vcd /butterfly damper / louvers	caryaire / ravistar / systemair / ruskin
66	diffuser plenum boxes	kc industry / air flow / titus / air master / ravistar /pal (pre-insulated) / twiga

S. No	Material / Equipment	Manufacturer / Supplier
67	flexible ducts	supa flex / karthila / seven star / twiga / titus
68	floor grilles	titus / air master / dynacraft / system air
69	eps insulation	beardsell / coolite / indian packaging services/styrene
70	fibre glass insulation	up twiga / owens corning / kimmco
71	puf insulation	beardsell / lloyd / malanpur / polynate
72	elastomeric nitrile rubber insulation / x-link polyethylene	armaflex / k-flex /thermobreak
73	copper pipes	nippon / rajco
74	filters	dyna / spectrum / aaf / thermodyne
75	fire sealant	promseal / hilti
76	air curtain	almonard . cosmic / mitzvah / system air
77	auto ball tech tube cleaning system	york / trane
78	ozone generator	primus environ / omniscient treatment
79	water flow switches	honeywell / indfoss / danfoss
80	dp switches / dp transmitters / air flow	siemens / sauter / honeywell
81	hepa filters	aaf / thermodyne / spectrum / dyna
82	bms vendor	siemens / johnson / sauter / honeywell/ schneider /trane
83	thermnostat / airstat / controllers/ temp & rh sensors / dp	siemens / johnson / sauter / honeywell/
84	sensors / dp switch /water flow meter	schneider /trane
85	variable air volume units	trane / siemens / johnson / trox /barcolair/honeywell
86	thermal energy (btu) meter	kamstrup / aquametro / schenitech
87	work station (cpu)	hp / compaq / ibm / dell
88	printer	hp / canon / epson
89	monitor	samsung / hp / compaq / ibm /lg
90	mouse	microsoft / logitech
91	motors (except chillers & dx units)	abb / crompton / siemens
92	acb / mccb / mpcb / contactor / relay	abb / schneider / siemens /legrand / l & t
93	timer	siemens
94	load monitors / controller	ducati / electrex / enercon
95	mcbs	schneider / siemens / legrand / l & t
96	capacitor (heavy duty mpp gas filled)	siemens (epcos)
97	cts and pts	kappa / siemens / /calpa
98	control switches	kaycee / siemens / salzer
99	elr / earth fault relay	jvs / alstom / prok dvs
100	protective relays (numeric)	jvs / alstom / segc
101	push buttons / indicating lamps (led type)	siemens / teknic / schneider
102	wires (frls)	ploycab / finolex / havel's / anchor
103	lugs. glands	dowells / smi / comet
104	terminals	elmex / wago – finger touch proof

S. No	Material / Equipment	Manufacturer / Supplier
105	ferrules	mayfair
106	busbar supports	powermat
107	energy meter	electrex / enercon
108	power & control cabling	polycab / finolex / havells
109	660v grade frls flexible cable	polycab / finolex / havells
110	gi conduit (isi mark)	ggb / bharat / supreme
111	pvc –frls conduit (black/ grey) (isi mark)	sudhakar / precision
112	switchboard manufacturer	pragathi / elins / lotus / pace / sv karanth /Indus electro controls(south-india).eap /tracolite / space age (north-india)
113	cable tray	profab / pushpak / patney

VI. Technical Specifications for Finishes:

a. Structure: RCC Framed structure and floor to floor height is 4.0M.

- i. Vitrified Tiles: double charged 12 mm thick & size of 600 x 600 mm of matt finish (WOODEN FINISH / RUSTIC FINISH) with Antiageing / High abrasion resistance glaze composition (Scratch free/Stain free)with water absorption limit between 0.08% to 3% and conforming to IS:15622:2006(Group B lb)
- ii. Skirting: Shall be same material as flooring, for Vinyl flooring the coving as provided by the manufacturer shall be used.
- iii. All external wall shall have 18mm thick plaster mixed with water proofing compound and finished with Exterior Grade Acrylic emulsion paint and Texture paint.

b. Joinery:

- i. Door-All doors are of flush doors with BW kit ply and sun mica pasting in both sides with anodized Aluminum frame.
- ii. Fire door with panic bars shall be provided as per NBC latest version
- i. Window-Fixing of Un-plasticized Poly Vinyl Chloride (UPVC) sliding windows of double glazed shutters, Wood chips bonded with boiled water resistant (BWR) quality phenol thermal dehydrate Resin in a three layered construction with acoustic treatment
- ii. AHU's rooms shall be provided with acoustic insulation
- iii. Trap doors shall be provided as required for ease of maintenance.
- iv. Patient Ramp from ground floor to terrace with a clear width 2.0 m to be provided. Ramps shall have a slope of 1:12 to 1:18. It must be checked for manoeuvrability of beds and trolleys at any turning point.
- v. Ramp flooring - chequered tile flooring
- vi. Vinyl flooring should be over a base on 3mm thick self-leveling compound
- vii. Drinking water facility to be provided in all waiting areas and common area of IP floors
- viii. Lifts: Minimum 3 (three) lifts shall be provided. 2 nos. of passenger lifts of 20 passenger capacity and 1 no. of Bed lift of 26 passenger capacity.
- ix. Nonmedical furniture like Consultant tables, chairs, tables, free standing storages, cath storage, endoscopy storage unit, lockers, slotted angle racks, waiting chairs, attender couch, doctors & nurses rest room couch, examination table etc., shall be designed and installed as per best hospital practices.

c. Others:

- i. Water Supply & Sewage to be provided with pumping from underground water source with overhead storage tank and STP respectively. UG sump also be provided for storage of water.
- ii. External development and Landscaping to be provided.
- iii. Pavements, Roads and Drains to be provided.
- iv. Boundary wall to be provided with gated security arrangement and provision of security cabin.
- v. Power supply & external electrification viz. External lighting system to be provided (Underground cabling to be provided instead of overhead cabling for all buildings).
- vi. Lightening arrester to be provided.
- vii. Rain water harvesting provision to be there.
- viii. Corridor / Circulation area as per norms.
- ix. Green building concept as per GRIHA.

d. Finish Specification of key areas:

Area	Flooring	False Ceiling	Wall Finish	Internal Partition
Entrance/Main Reception	Marble/Granite	12mm thick Mineral Board ceiling with Frame	Marble/Granite	
Emergency Dept.	12mm thick (2'x 2') Vitrified Tiles	12mm thick Mineral Board ceiling with Frame	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	100/150/200mm AAC block
OP consultation	12mm thick (2'x 2') Vitrified Tiles	12mm thick Mineral Board ceiling with Frame	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	100/150/200mm AAC block
Physiotherapy	12mm thick (2'x 2') Vitrified Tiles	12mm thick Mineral Board ceiling with Frame	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	100/150/200mm AAC block
Diagnostics	12mm thick (2'x 2') Vitrified Tiles	12mm thick Mineral Board ceiling with Frame	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	100/150/200mm AAC block
Radiology	12mm thick (2'x 2') Vitrified Tiles	12mm thick Mineral Board ceiling with Frame	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	230mm Red brick
NI Lab	12mm thick (2'x 2') Vitrified Tiles	12mm thick Mineral Board ceiling with Frame	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	100/150/200mm AAC block
OT Rooms	2mm thick PUR Conductive Vinyl Flooring	Puff Panel false ceiling	Antimicrobial Paint	100/150/200mm AAC Block
OT Complex	12mm thick (2'x 2') Vitrified	12mm thick Gypsum Board	12mm thick plaster with putty and	100/150/200mm AAC
(Other than OT Room)	Tiles	ceiling with GI Frame	Antimicrobial Paint	Block
Pre & Post OP	12mm thick (2'x 2') Vitrified Tiles	12mm thick Gypsum Board ceiling with GI Frame	12mm thick plaster with putty and Antimicrobial Paint	100/150/200mm AAC Block

Area	Flooring	False Ceiling	Wall Finish	Internal Partition
CT ICU	12mm thick (2'x 2') Vitrified Tiles	12mm thick Gypsum Board ceiling with GI Frame	12mm thick plaster with putty and Antimicrobial Paint	100/150/200mm AAC Block
MICU	12mm thick (2'x 2') Vitrified Tiles	12mm thick Gypsum Board ceiling with GI Frame	12mm thick plaster with putty and Antimicrobial Paint	100/150/200mm AAC block
ICCU	12mm thick (2'x 2') Vitrified Tiles	12mm thick Gypsum Board ceiling with GI Frame	12mm thick plaster with putty and Antimicrobial Paint	100/150/200mm AAC block
SICU	12mm thick (2'x 2') Vitrified Tiles	12mm thick Gypsum Board ceiling with GI Frame	12mm thick plaster with putty and Antimicrobial Paint	100/150/200mm AAC block
Cath lab	12mm thick (2'x 2') Vitrified Tiles	12mm thick Gypsum Board ceiling with GI Frame	12mm thick plaster with putty and Antimicrobial Paint	230mm Red brick
Post cath	12mm thick (2'x 2') Vitrified Tiles	12mm thick Gypsum Board ceiling with GI Frame	12mm thick plaster with putty and Antimicrobial Paint	100/150/200mm AAC block
Medical Stepdown ICU	12mm thick (2'x 2') Vitrified Tiles	12mm thick Gypsum Board ceiling with GI Frame	12mm thick plaster with putty and Antimicrobial Paint	100/150/200mm AAC block
Stepdown CT ICU	12mm thick (2'x 2') Vitrified Tiles	12mm thick Gypsum Board ceiling with GI Frame	12mm thick plaster with putty and Antimicrobial Paint	100/150/200mm AAC block
IP lab	12mm thick (2'x 2') Vitrified Tiles	12mm thick Mineral Board ceiling with Frame	Ceramic Wall Tiles	100/150/200mm AAC block
Deluxe single rooms	Marble/Granite	6mm thick plaster and Paint. Gypsum False ceiling with trap door in vestibule area	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	100/150/200mm AAC block
IP Rooms	12mm thick (2'x 2') Vitrified Tiles	6mm thick plaster and Paint. Gypsum False ceiling with trap door in vestibule area	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	100/150/200mm AAC block

Area	Flooring	False Ceiling	Wall Finish	Internal Partition
toilets	12mm thick (2'x 2') Vitrified Tiles	12mm thick Calcium silicate Board ceiling with GI Frame	Ceramic Wall Tiles	100/150/200mm AAC block
CSSD	12mm thick (2'x 2') Vitrified Tiles	12mm thick Calcium silicate Board ceiling with GI Frame	Ceramic Wall Tiles	100/150/200mm AAC block
Mortuary	12mm thick (2'x 2') Vitrified Tiles	12mm thick Mineral Board ceiling with Frame	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	100/150/200mm AAC block
Engineering Services Area	25mm thick Kota Stone	6mm thick Plaster and paint	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion	100/150/200mm AAC

e. Finish Specification of key areas:

Area	Flooring	False Ceiling	Wall Finish	Internal Partition
Admission , Registration & Billing	12mm thick (2'x 2') Vitrified Tiles	12mm thick Mineral Board ceiling with Frame	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	100/150/200mm AAC block
Pharmacy	12mm thick (2'x 2') Vitrified Tiles	12mm thick Mineral Board ceiling with Frame	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	100/150/200mm AAC block
Sample Collection	12mm thick (2'x 2') Vitrified Tiles	12mm thick Mineral Board ceiling with Frame	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	100/150/200mm AAC block
Public toilets	12mm thick (2'x 2') Vitrified Tiles	12mm thick Calcium silicate Board ceiling with GI Frame	Ceramic Wall Tiles	100/150/200mm AAC block
Lift lobby	12mm thick (2'x 2') Vitrified Tiles	12mm thick Calcium Gypsum	12mm thick (2'x 2') Vitrified Tiles	

Area	Flooring	False Ceiling	Wall Finish	Internal Partition
		Board ceiling with GI Frame		
Main Staircase	Granite	12mm thick Calcium Gypsum Board ceiling with GI Frame	12mm thick plaster with Cement Based Putty finish and Acrylic Emulsion paint	