



**TECHNICAL CELL, EPC MISSION,
PLANNING DEPARTMENT, LUCKNOW,**

**As Executing Agency of
Department of Home**

E-Tender For

**“Design, Engineering and Procurement for Construction of
Residential Buildings for the establishment of 5th Battalion of
Special Security Force at District Saharanpur, Uttar Pradesh,
India on EPC Mode.”**

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SCHEDULE OF FINISH

CONSTRUCTION OF RESIDENTIAL BUILDINGS FOR THE ESTABLISHMENT OF 5TH BATTALION OF SPECIAL SECURITY FORCE AT DISTRICT SAHARANPUR, UTTAR PRADESH, INDIA ON EPC MODE.

| SCHEDULE OF FINISHES FOR RESIDENCE BUILDING | | | | | | | | | | |
|---|--|--|--|---|--|--|---|--|--|--|
| TYPE-5 RESIDENCE | | | | | | | | | | |
| S.NO. | SPACES | FLOORING | SKIRTING/DADO | WALL | CEILING | DOOR | | WINDOW | | D/W FITTINGS |
| | | | | | | FRAME | SHUTTER | FRAME | SHUTTER | |
| 1 | BEDROOM, DRESS, STORE, SERVANT ROOM, GUEST ROOM, DINING ROOM/ DINING | Double charge vitrified tile polished finish of size of Tile 600 x 600 mm with min thickness of 9mm. | 100 mm High Vitrified Tiles machting with the flooring. | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Sal Wood frames with dash fasteners/Hold Fast Lugs of required dia & length. | ISI marked 35 mm thick flush door shutters with 1.5mm decorative high pressure laminated sheet both sides, 25 mm thick minimum lipping. | Sal Wood frames with dash fasteners/Hold Fast Lugs of required dia & length. | Double Shutter, one with Glazed shutters using 5.5 mm thick float glass panes, second wire gauge shutters using stainless steel grade 304wire gauge with wire of dia 0.5 mm and average width of aperture 1.4 mm in both directions with 30mm thick Second-class teak wood including ISI marked M.S. pressed butt hinges bright finished of required size with necessary screws. | All fittings of SS-304 grade (Satin/Matt Finish). Tower Bolt - 300x10 mm Mortice Latch lock - 100 mm mortice latch and lock with 6 levers and a pair of lever handles Door Stopper - Hanging type floor door stopper. |
| 2 | VERANDAH, KITCHEN, PANTRY, BALCONY | Glazed Vitrified tiles Matt/Antiskid finish of size of Tile 600 x 600 mm with min thickness of 9mm. | 100 mm High Vitrified Tiles machting with the flooring. | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm Kitchen - Ceramic Glazed Tiles of size 300x450 with min thickness of 8mm at Dado upto 2100mm height | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Sal Wood frames with dash fasteners/Hold Fast Lugs of required dia & length. | All External Doors (open in Balcony or Verandah), Enterance Doors are double shutter doors one with ISI marked 35 mm thick flush door shutters with 1.5mm decorative high pressure laminated sheet both sides, 25 mm thick minimum lipping. | | | All fittings of SS-304 grade (Satin/Matt Finish). Tower Bolt - 300x10 mm Sliding Door Bolt - 300x16 mm Handle - 125mm Door Stopper - Hanging type floor door stopper. Door Closer - Aluminium extruded section body tubular type universal hydraulic door closer. |
| 3 | ENTRANCE VERNADAH, STPES | 18mm thick Polished Granite in Two Shades (Light And Dark) Pattern | 18mm thick Polished Granite 100mm skirting in rest area. | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications : Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications : Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Sal Wood frames with dash fasteners/Hold Fast Lugs of required dia & length. | Second wire gauge shutters using stainless steel grade 304wire gauge with wire of dia 0.5 mm and average width of aperture 1.4 mm in both directions | | | |
| 4 | TOILETS | Min 300x300mm Anti-Skid Rectified Ceramic Tiles of min 8mm thickness | Ceramic Glazed Tiles of size 300x450 with min thickness of 8mm at Dado upto Ceiling Height | -- | 600X600 G.I. Metal False Ceiling | Sal Wood frames with dash fasteners/Hold Fast Lugs of required dia & length. | ISI marked 35 mm thick flush door shutters with 1.5mm decorative high pressure laminated sheet both sides, 25 mm thick minimum lipping. | | | All fittings of SS-304 grade (Satin/Matt Finish). Tower Bolt - 300x10 mm Mortice Latch lock - 100 mm mortice latch and lock with 6 levers and a pair of lever handles |

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| 5 | GARAGE | Cement concrete flooring 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate) finished with a floating coat of neat cement, including cement slurry, but excluding the cost of nosing of steps etc. complete. 40 mm thick with 20 mm nominal size stone aggregate | 100 mm High CC macthing with the flooring. | 1st Quality Acrylic distemper with wall putty above skirting/dado | 1st Quality Acrylic distemper with wall putty above skirting/dado | Rolling shutters of approved make, made of required size M.S. laths, interlocked together through their entire length and jointed together at the end by end locks, mounted on specially designed pipe shaft with brackets, side guides and arrangements for inside and outside locking with push and pull operation complete, including 27.5 cm long wire springs manufactured from high tensile steel wire of adequate strength conforming to IS: 4454 - part 1 and 80x1.25 mm M.S. laths with 1.25 mm thick top cover. | -- | -- | -- |
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| TYPE-4 RESIDENCE WITH GARAGE | | | | | | | | | | |
|------------------------------|--|--|--|---|---|--|---|---|---|---|
| S.NO. | SPACES | FLOORING | SKIRTING/DADO | WALL | CEILING | DOOR | | WINDOW | | D/W FITTINGS |
| | | | | | | FRAME | SHUTTER | FRAME | SHUTTER | |
| 1 | OFFICE/ GUEST ROOM, DRAWING ROOM, DINING, M. LOBBY, BEDROOM, DRESS, SERVANT ROOM | Double charge vitrified tile polished finish of size of Tile 600 x 600 mm with min thickness of 9mm. | 100 mm High Vitrified Tiles macthing with the flooring. | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Sal Wood frames with dash fasteners/Hold Fast Lugs of required dia & length. | ISI marked 35 mm thick flush door shutters with 1.5mm decorative high pressure laminated sheet both sides, 25 mm thick minimum lipping. | uPVC windows comprising of lead free uPVC multi-chambered frame, sash and mullion/coupler extruded profiles having minimum wall thickness of 2.10 mm. | Three track three panels sliding window with two glazed & one wire mesh panels with Aluminium channel for roller track, wool pile, nylon rollers with SS 304 body, Using R3 series with frame having minimum wall thickness of 2.10 mm. | All fittings of SS-304 grade (Satin/Matt Finish). Tower Bolt - 300x10 mm Mortice Latch lock - 100 mm mortice latch and lock with 6 levers and a pair of lever handles Door Stopper - Hanging type floor door stopper. |
| 2 | VERANDAH, KITCHEN, BALCONY | Glazed Vitrified tiles Matt/Antiskid finish of size of Tile 600 x 600 mm with min thickness of 9mm. | 100 mm High Vitrified Tiles matching with the flooring. | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm Kitchen - Ceramic Glazed Tiles of size 300x450 with min thickness of 8mm at Dado upto 2100mm height | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Sal Wood frames with dash fasteners/Hold Fast Lugs of required dia & length. | All External Doors (open in Balcony or Verandah), Enterance Doors are double shutter doors one with ISI marked 35 mm thick flush door shutters with 1.5mm decorative high pressure laminated sheet both sides, 25 mm thick minimum lipping. Second wire gauge | uPVC windows comprising of lead free uPVC multi-chambered frame, sash and mullion/coupler extruded profiles having minimum wall thickness of 2.10 mm. | Three track three panels sliding window with two glazed & one wire mesh panels with Aluminium channel for roller track, wool pile, nylon rollers with SS 304 body, Using R3 series with frame having minimum wall thickness of 2.10 mm. | All fittings of SS-304 grade (Satin/Matt Finish). Tower Bolt - 300x10 mm Sliding Door Bolt - 300x16 mm Handle - 125mm Door Stopper - Hanging type floor door stopper. Door Closer - Aluminium extruded section body tubular type universal hydraulic door closer. |
| 3 | COMMON CIRCULATION AREA, STAIRCASE | 18mm thick Polished Granite in Two Shades (Light And Dark) Pattern | 18mm thick Polished Granite 100mm skirting in rest area. | 1st Quality Acrylic distemper with wall putty above skirting/dado | 1st Quality Acrylic distemper with wall putty above skirting/dado | Sal Wood frames with dash fasteners/Hold Fast Lugs of required dia & length. | shutters using stainless steel grade 304wire gauge with wire of dia 0.5 mm and average width of aperture 1.4 mm in both directions | uPVC windows comprising of lead free uPVC multi-chambered frame, sash and mullion/coupler extruded | Three track three panels sliding window with two glazed & one wire mesh panels with Aluminium channel for roller track, wool pile, nylon rollers | |

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|--|------------------------|--|---|---|---|---|---|---|--|---|
| | | | | | | | | profiles having minimum wall thickness of 2.10 mm. | with SS 304 body, Using R3 series with frame having minimum wall thickness of 2.10 mm. | |
| 4 | TOILETS | Min 300x300mm Anti-Skid Rectified Ceramic Tiles of min 8mm thickness | Ceramic Glazed Tiles of size 300x450 with min thickness of 8mm at Dado upto 2100mm height | -- | 600X600 G.I. Metal False Ceiling | Sal Wood frames with dash fasteners/Hold Fast Lugs of required dia & length. | ISI marked 35 mm thick flush door shutters with 1.5mm decorative high pressure laminated sheet both sides, 25 mm thick minimum lipping. | uPVC ventilators comprising of lead free uPVC multi-chambered frame, sash and mullion/coupler extruded profiles having minimum wall thickness of 1.90 mm. | Fixed ventilator with 03 partitions, one glazed & one exhaust fan and one with louvers having minimum wall thickness of 1.90 mm. | All fittings of SS-304 grade (Satin/Matt Finish). Tower Bolt - 300x10 mm Mortice Latch lock - 100 mm mortice latch and lock with 6 levers and a pair of lever handles |
| 5 | GARAGE | 52 mm thick cement concrete flooring with concrete hardener topping, under layer 40 mm thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) and top layer 12mm thick cement hardener consisting of mix 1 : 2 (1 cement hardener mix : 2 graded stone aggregate 6 mm nominal size) by volume, hardening compound mixed @ 2 litre per 50 kg of cement or as per manufacturer's specifications. | 100 mm High CC macthing with the flooring. | 1st Quality Acrylic distemper with wall putty above skirting/dado | 1st Quality Acrylic distemper with wall putty above skirting/dado | Rolling shutters of approved make, made of required size M.S. laths, interlocked together through their entire length and jointed together at the end by end locks, mounted on specially designed pipe shaft with brackets, side guides and arrangements for inside and outside locking with push and pull operation complete, including 27.5 cm long wire springs manufactured from high tensile steel wire of adequate strength conforming to IS: 4454 - part 1 and 80x1.25 mm M.S. laths with 1.25 mm thick top cover. | | -- | -- | -- |
| COMMON SPECIFICATION (FOR TYPE-5 & TYPE-4) | | | | | | | | | | |
| 1 | MASONARY WORK | Brickwork with Red Bricks (Class M-150) | | | | | | | | |
| 2 | SAND FILLING | 150mm filling in plinth with sand under floors, including watering, ramming, consolidating and dressing complete | | | | | | | | |
| 3 | EARTH FILLING | As per requirement of site. | | | | | | | | |
| 4 | ANTI-TERMITE TREATMENT | In Foundation and Under Floors etc. | | | | | | | | |
| 5 | BITUMEN PAINT | On plinth Beam/Band applying a coat of residual petroleum bitumen of grade of VG-10 of approved quality using 1.7 kg per square metre on Plinth Beam after cleaning the surface with brushes and finally with a piece of cloth lightly soaked in kerosene oil. | | | | | | | | |
| 6 | GRADE SLAB | RCC Slab with min Grade M-30 at plinth level. | | | | | | | | |

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| 7 | SMOOTH SIDE ON BRICKWORK PLASTER | 12mm thick 1:6 Plaster (1 Cement: 6 Coarse Sand) | |
| 8 | ROUGH SIDE ON BRICKWORK PLASTER | 15mm thick 1:6 Plaster (1 Cement: 6 Coarse Sand) | |
| 9 | UPTO PLINTH PLASTER | 15mm thick 1:4 Plaster (1 Cement: 4 Coarse Sand) | |
| 10 | WATER PROOFING | | |
| A | WATER TANK | Integral Crystalline Slurry of Hydrophilic in Nature. | |
| 11 | EXTERNAL FINISHES | Premium Acrylic Smooth Exterior Paint over Priming coat of Exterior primer over 1 mm Cement based Putty. | |
| 12 | TERRACE | Brick Coba Treatment (With average thickness of 120 mm) | |
| 13 | FIRE DOOR | Glazed Fire Resistant Door as per IS 3614 (Part-II) and Latest version thereof/Latest amendment thereof. | |
| 14 | MAGIC EYE | One in every Main Entrance Door | |
| 15 | WINDOW SILL & JAMBS | 18mm thick Polished Granite at all window/ventilators | |
| 16 | CUPBOARD IN BEDROOM & DRESS | Cup board with teak wood frame and shutters 25 mm thick, with Pre-laminated flat pressed three layer particle board or graded wood particle board IS: 12823 marked, exterior grade (Grade I Type II), having one side decorative lamination and other side balancing lamination, including IInd class teak wood lipping of 25 mm wide x12 mm thick with necessary screws and bright finished stainless steel piano hinges, complete | |
| 17 | M.S. GRILL | MS Grill with min 10x10mm square bar in all windows/ventilators | |
| 18 | RAILING & HANDRAIL | Stainless Steel of grade SS-304 at all Staircase, Ramps, Balcony etc. | |
| 19 | KITCHEN CABINET | 18mm thick both sides Pre-laminated cement bonded wood particle board as per IS : 15786:2008 of approved brand and shade with suitable full threaded steel screws etc. in partitions, boxes, shelves, racks and cupboard, kitchen cabinet under kitchen counter, stainless steel soft closing spring hinges at 0 degree hinges (hydraulic type), fittings etc. all complete as per direction of Engineer-in-charge. | |
| 20 | RAMP | 9.8mm thick Tactile tile (for vision impaired persons as per standards) of size 300 x 300 mm having water absorption less than 0.5% and conforming to IS:15622 laid on 20mm thick base of cement mortar 1:4 (1 cement : 4 coarse sand). | |
| 21 | PUTTY | White cement based putty of average thickness 1 mm, of approved brand and manufacturer, over the plastered wall surface, ceiling, rcc suface to prepare the surface even and smooth complete. | |
| 22 | GROOVES IN PLASTER | Making grooves 10 to 12 mm wide x 8 mm deep in plaster the all or in ceiling vertically of horizontally as required. | |
| 23 | DRIP COURSE | Plaster drip course in plastered surface or moulding to R.C.C. projections. | |
| 24 | CURTAIN RODS | Chromium Plated Brass Curtain Rod having Wall Thickness of 1.25mm & 20mm Dia. On all windows & doors in all rooms except Kitchen, Toilets, Bath/W.C. | |
| 25 | PLATFORM/ COUNTER SLAB | RCC Counter slabs with 18mmThick Polished Granite on Platform. | |
| 26 | CP FITTING | As per CPWD Specifications | |
| 27 | WASH BASIN | White Vitreous China Table Top Wash Basin Size 750x400 mm (Oval/Rectangular as per approved) with a pair of 15 mm C.P. Brass Pillar Taps, 32 mm C.P. Brass Waste of Standard Pattern | |
| 28 | EUROPEAN W.C. | White Vitreous China Pedestal Type Water Closet (European Type W.C. Pan) With Seat and Lid, 10 Litre Low Level White P.V.C. Flushing Cistern, Including Flush Pipe, with Manually Controlled Device (Handle Lever), Conforming to IS : 7231 | |
| 29 | INDIAN W.C. | White Vitreous China Orissa Pattern W.C. Pan of Size 580x440 mm with Integral Type Foot Rests. | |
| 30 | KITCHEN SINKS | Stainless Steel A ISI 304 (18/8) Kitchen Sink with drain board of Size 510x1040 mm bowl depth 250 mm | |
| 31 | TOILET ACCESSORIES | | |
| a | MIRROR | Superior Quality Glass of Required Shape and Size with Plastic Moulded Frame with 12 mm thick Marine Ply Backing. | |
| b | SOAP CONTAINER | Chromium Plated Stainless Steel (SS-304 Grade) | |
| c | TOWEL RING, RAIL & PEGS | Chromium Plated Stainless Steel (SS-304 Grade) | |
| 32 | INTERNAL WATER SUPPLY PIPES | CPVC Pipes / As per CPWD Specification. | |

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| 33 | INTERNAL DRAINAGE PIPES | UPVC Pipes / As per CPWD Specification. |
| 34 | INTERNAL SEWAGE PIPES | UPVC Pipes / As per CPWD Specification. |
| 35 | EXTERNAL WATER SUPPLY | CPVC Pipes / As per CPWD Specification. |
| 36 | EXTERNAL DRAINAGE PIPES | RCC NP2 & RCC NP3 Pipes |
| 37 | EXTERNAL SEWER LINE | RCC NP2 & RCC NP3 Pipes |
| 38 | PLINTH PROTECTION | 50mm thick of Cement Concrete 1:3:6 (1 Cement: 3 Coarse Sand: 6 Stone Aggregate 20mm nominal size) over 75mm thick dry brick ballast 40mm nominal size (900mm wide) |

| TYPE-A & B RESIDENCE WITH GARAGE | | | | | | | | | | |
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| S.NO. | SPACES | FLOORING | SKIRTING/DAD O | WALL | CEILING | DOOR | | WINDOW | | D/W FITTINGS |
| | | | | | | FRAME | SHUTTER | FRAME | SHUTTER | |
| 1 | DRAWING ROOM, DINING, LOBBY, M. BEDROOM, DRESS, SERVANT ROOM | Double charge vitrified tile polished finish of size of Tile 600 x 600 mm with min thickness of 9mm. | 100 mm High Vitrified Tiles matching with the flooring. | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications : Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Min 1.6mm thick M.S. Tubular frame fixing with carbon steel galvanised dash fastener. | ISI marked 35 mm thick flush door shutters with 1.5mm decorative high pressure laminated sheet both sides, 25 mm thick minimum lipping. | uPVC windows comprising of lead free uPVC multi-chambered frame, sash and mullion/coupler extruded profiles having minimum wall thickness of 2.10 mm. | Three track three panels sliding window with two glazed & one wire mesh panels with Aluminium channel for roller track, wool pile, nylon rollers with SS 304 body, Using R3 series with frame having minimum wall thickness of 2.10 mm. | All fittings of SS-304 grade (Satin/Matt Finish). Tower Bolt - 300x10 mm Sliding Door Bolt - 300x16 mm Handle - 125mm Door Stopper - Hanging type floor door stopper. |
| 2 | KITCHEN, BALCONY | Glazed Vitrified tiles Matt/Antiskid finish of size of Tile 600 x 600 mm with min thickness of 9mm. | 100 mm High Vitrified Tiles matching with the flooring. | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm Kitchen - Ceramic Glazed Tiles of size 300x450 with min thickness of 8mm at Dado upto 2100mm height | Finishing with Deluxe Multi surface paint system using Primer as per manufacturers specifications : Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Min 1.6mm thick M.S. Tubular frame fixing with carbon steel galvanised dash fastener. The entrance & Balcony door frame will have double rebate doors with SS 304 wire mesh. | All External Doors (open in Balcony or Verandah), Entrance Doors are double shutter doors one with ISI marked 35 mm thick flush door shutters with 1.5mm decorative high pressure laminated sheet both sides, 25 mm thick minimum lipping. Second wire gauge shutters using stainless steel grade 304wire gauge with wire of dia 0.5 mm and average width of aperture 1.4 mm in both directions | uPVC windows comprising of lead free uPVC multi-chambered frame, sash and mullion/coupler extruded profiles having minimum wall thickness of 2.10 mm. | Three track three panels sliding window with two glazed & one wire mesh panels with Aluminium channel for roller track, wool pile, nylon rollers with SS 304 body, Using R3 series with frame having minimum wall thickness of 2.10 mm. | All fittings of SS-304 grade (Satin/Matt Finish). Tower Bolt - 300x10 mm Sliding Door Bolt - 300x16 mm Handle - 125mm Door Stopper - Hanging type floor door stopper. Door Closer - Aluminium extruded section body tubular type universal hydraulic door closer. |
| 3 | COMMON CIRCULATION AREA, STAIRCASE | 18mm thick Polished Granite in Two Shades | 18mm thick Polished Granite in Two Shades (Light and Dark) Pattern | 18mm thick Polished Granite in Two Shades (Light and Dark) Pattern upto | Finishing with Deluxe Multi surface paint system using Primer as per | Fire Door (Min 120 minutes Fire rating) As Per Is 3614 and Latest Version | | uPVC windows comprising of lead free uPVC multi-chambered frame, | Three track three panels sliding window with two glazed & one wire | |

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|----------------------|----------------------------------|--|---|---|--|---|--|---|--|---|
| | | (Light and Dark) Pattern | upto Ceiling Height. - Lift Facia and 100mm skirting in rest area. | Ceiling Height. - Lift Facia and 1st Quality Acrylic distemper with wall putty above skirting/dado in rest area | manufacturers specifications: Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr/10 sqm | Thereof/ Latest Amendment Thereof. | | sash and mullion/coupler extruded profiles having minimum wall thickness of 2.10 mm. | mesh panels with Aluminium channel for roller track, wool pile, nylon rollers with SS 304 body, Using R3 series with frame having minimum wall thickness of 2.10 mm. | |
| 4 | TOILETS | Min 300x300mm Anti-Skid Rectified Ceramic Tiles of min 8mm thickness | Ceramic Glazed Tiles of size 300x450 with min thickness of 8mm at Dado upto 2100mm height | -- | 600X600 G.I. Metal False Ceiling | FRP Door Frames of cross-section 90mmX45mm having single rebate of 32mm X 15mm to receive shutter of 30mm thickness. | 30mm thick FRP panelled door shutter made with fire retardant grade unsaturated polyester resin, moulded to 3mm thick FRP laminate. | uPVC ventilators comprising of lead-free uPVC multi-chambered frame, sash and mullion/coupler extruded profiles having minimum wall thickness of 1.90 mm. | Fixed ventilator with 03 partitions, one glazed & one exhaust fan and one with louvers having minimum wall thickness of 1.90 mm. | All fittings of SS-304 grade (Satin/Matt Finish). Tower Bolt - 300x10 mm Sliding Door Bolt - 300x16 mm Handle - 125mm |
| COMMON SPECIFICATION | | | | | | | | | | |
| 1 | Masonry Work | Brickwork with Red Bricks (Class M-150) | | | | | | | | |
| 2 | Sand Filling | 150mm filling in plinth with sand under floors, including watering, ramming, consolidating and dressing complete | | | | | | | | |
| 3 | Earth Filling | As per requirement of site. | | | | | | | | |
| 4 | Anti-Termite Treatment | In Foundation and Under Floors etc. | | | | | | | | |
| 5 | Bitumen Paint | On plinth Beam/Band applying a coat of residual petroleum bitumen of grade of VG-10 of approved quality using 1.7 kg per square metre on Plinth Beam after cleaning the surface with brushes and finally with a piece of cloth lightly soaked in kerosene oil. | | | | | | | | |
| 6 | Grade Slab | RCC Slab with min Grade M-30 at plinth level. | | | | | | | | |
| 7 | Smooth Side On Brickwork Plaster | 12mm thick 1:6 Plaster (1 Cement: 6 Coarse Sand) | | | | | | | | |
| 8 | Rough Side On Brickwork Plaster | 15mm thick 1:6 Plaster (1 Cement: 6 Coarse Sand) | | | | | | | | |
| 9 | Upto Plinth Plaster | 15mm thick 1:4 Plaster (1 Cement: 4 Coarse Sand) | | | | | | | | |
| 10 | Water Proofing | | | | | | | | | |
| A | Water Tank | Integral Crystalline Slurry of Hydrophilic in Nature. | | | | | | | | |
| 11 | External Finishes | Premium Acrylic Smooth Exterior Paint over Priming coat of Exterior primer over 1 mm Cement based Putty. | | | | | | | | |
| 12 | Terrace | Brick Coba Treatment (With average thickness of 120 mm) | | | | | | | | |
| 13 | Fire Door | Glazed Fire Resistant Door as per IS 3614 (Part-II) and Latest version thereof/Latest amendment thereof. | | | | | | | | |
| 14 | Magic Eye | One in every Main Entrance Door | | | | | | | | |
| 15 | Window Sill & Jambs | 18mm thick Polished Granite at all window/ventilators | | | | | | | | |
| 16 | Cupboard In Bedroom & Dress | Cupboard with angle iron frame and shutters 25 mm thick, with pre-laminated flat pressed three-layer particle board or graded wood particle board IS: 12823 marked, exterior grade (Grade I Type II), having one side decorative lamination and other side balancing lamination, including IInd class teak wood lipping of 25 mm wide x12 mm thick with necessary screws and bright finished stainless steel piano hinges, complete. | | | | | | | | |
| 17 | M.S. Grill | MS Grill with min 10x10mm square bar in all windows/ventilators | | | | | | | | |
| 18 | Railing & Handrail | Stainless Steel of grade SS-304 at all Staircase, Ramps, Balcony etc. | | | | | | | | |
| 19 | Kitchen Cabinet | 18mm thick both sides pre-laminated cement bonded wood particle board as per IS: 15786:2008 of approved brand and shade with suitable full threaded steel screws etc. in partitions, boxes, shelves, racks and cupboard, kitchen cabinet under kitchen counter, stainless steel soft closing spring hinges at 0-degree hinges (hydraulic type), fittings etc. all complete as per direction of Engineer-in-charge. | | | | | | | | |
| 20 | Ramp | 9.8mm thick Tactile tile (for vision impaired persons as per standards) of size 300 x 300 mm having water absorption less than 0.5% and conforming to IS:15622 laid on 20mm thick base of cement mortar 1:4 (1 cement : 4 coarse sand). | | | | | | | | |
| 21 | Putty | White cement-based putty of average thickness 1 mm, of approved brand and manufacturer, over the plastered wall surface, ceiling, rcc suface to prepare the surface even and smooth complete. | | | | | | | | |
| 22 | Grooves In Plaster | Making grooves 10 to 12 mm wide x 8 mm deep in plaster the all or in ceiling vertically of horizontally as required. | | | | | | | | |

| | | |
|----|--------------------------------|---|
| 23 | Drip Course | Plaster drip course in plastered surface or moulding to R.C.C. projections. |
| 24 | Curtain Rods | Chromium Plated Brass Curtain Rod having Wall Thickness of 1.25mm & 20mm Dia. On all windows & doors in all rooms except Kitchen, Toilets, Bath/W.C. |
| 25 | Platform/ Counter Slab | RCC Counter slabs with 18mmThick Polished Granite on Platform. |
| 26 | Cp Fitting | As per CPWD Specifications |
| 27 | Wash Basin | White Vitreous China Table Top Wash Basin Size 750x400 mm (Oval/Rectangular as per approved) with a pair of 15 mm C.P. Brass Pillar Taps, 32 mm C.P. Brass Waste of Standard Pattern |
| 28 | European W.C. | White Vitreous China Pedestal Type Water Closet (European Type W.C. Pan) With Seat and Lid, 10 Litre Low Level White P.V.C. Flushing Cistern, Including Flush Pipe, with Manually Controlled Device (Handle Lever), Conforming to IS : 7231 |
| 29 | Indian W.C. | White Vitreous China Orissa Pattern W.C. Pan of Size 580x440 mm with Integral Type Foot Rests. |
| 30 | Kitchen Sinks | Stainless Steel an ISI 304 (18/8) Kitchen Sink with drain board of Size 510x1040 mm bowl depth 250 mm |
| 31 | Toilet Accessories | |
| a | Mirror | Superior Quality Glass of Required Shape and Size with Plastic Moulded Frame with 12 mm thick Marine Ply Backing. |
| b | Soap Container | Chromium Plated Stainless Steel (SS-304 Grade) |
| c | Towel Ring, Rail & Pegs | Chromium Plated Stainless Steel (SS-304 Grade) |
| 32 | Internal Water Supply Pipes | CPVC Pipes / As per CPWD Specification. |
| 33 | Internal Drainage Pipes | UPVC Pipes / As per CPWD Specification. |
| 34 | Internal Sewarage Pipes | UPVC Pipes / As per CPWD Specification. |
| 35 | External Water Supply | CPVC Pipes / As per CPWD Specification. |
| 36 | External Drainage Pipes | RCC NP2 & RCC NP3 Pipes |
| 37 | External Sewer Line | RCC NP2 & RCC NP3 Pipes |
| 38 | Plinth Protection | 50mm thick of Cement Concrete 1:3:6 (1 Cement: 3 Coarse Sand: 6 Stone Aggregate 20mm nominal size) over 75mm thick dry brick ballast 40mm nominal size (900mm wide) |

A. DBR - ARCHITECTURE

“Construction Of Residential Buildings for The Establishment Of 5th Battalion Of Special Security Force At District Saharanpur, Uttar Pradesh, India On EPC Mode”

1. INTRODUCTION

The UP Government is determined to provide most up to date, diversified and efficient police force for maintenance of law and order and effective check on crime and other unlawful activities. Law and order are a state subject and, therefore modernization and strengthen of state police is the primary responsibility of the state government.

This Architectural Design Basis Report (DBR) presents development of a modern operational campus for the Uttar Pradesh Special Security Force (UPSSF) 5th Battalion at Saharanpur. The project will provide secure administrative buildings, operational facilities, and essential infrastructure services required for efficient functioning of the battalion. The campus includes Residential & Non-residential buildings, support buildings, utility infrastructure and external development works. The design aims to create a secure, functional and efficient campus environment suitable for operational requirements of security forces.

The architectural planning has been prepared considering climatic conditions, security requirements, operational efficiency, safety, and compliance with applicable Indian standards including NBC 2016 and CPWD/UPPWD guidelines.



Fig 1a : Saharanpur, Uttar Pradesh

Fig 1b : Satellite image

The project comprises an integrated security-force campus with both residential and non-residential components. This scope of this contract includes construction of residential building i.e. Type-5, Type-4, Type-A and Type-B residential blocks. The residential complex shall be developed with all requisite facilities and services necessary for functional occupancy, including internal water supply, sanitary and drainage systems, electrification, fire-fighting provisions, rainwater disposal, road connectivity within the residential zone, landscaping, and other allied infrastructure works as specified in the tender documents.

2. SITE ANALYSIS

The proposed project site is strategically located in District Saharanpur, within a predominantly agricultural and semi-rural setting. The site has convenient access from the Saharanpur–Chilkana Road, ensuring efficient regional connectivity to adjoining towns, nearby habitations, and important administrative centres.

The geographical coordinates of the project site are approximately:

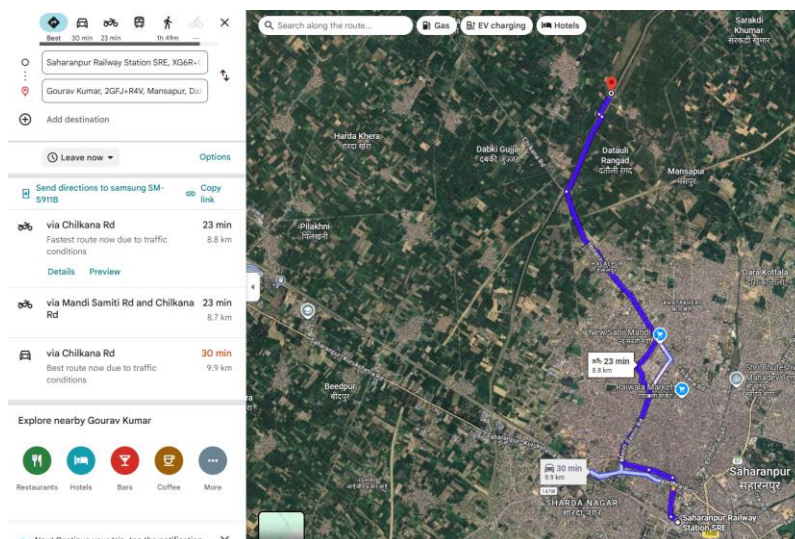


Fig 2a: Satellite image showing connectivity

Latitude: 30°01'31.1" N

Longitude: 77°31'46.9" E

The proposed project site encompasses an approximate land parcel measuring 50.02 acres, offering ample area for the comprehensive development of the proposed campus. The available land is adequately sized to accommodate the planned residential and non-residential infrastructure, along with associated support facilities and utility services.

The site planning allows sufficient provision for internal road networks, vehicular and pedestrian circulation, parking areas, landscaped green spaces, open recreational zones, water supply and drainage infrastructure, electrical services, security installations, and other essential site development components. In addition, the extent of the land parcel provides flexibility for phased development and future expansion requirements, ensuring long-term functional sustainability of the campus.

Accessibility and Connectivity

- The proposed project site is well connected through an established local and regional road network, ensuring convenient accessibility for construction activities as well as future operational use.
- Direct access to the site is available from an existing Road of approximately 5.5 m width running along the site boundary.
- Internal approach to the site is facilitated through a kaccha road of approximately 5.0 m width, providing connectivity within the project area.
- The approach road further links to the Chilkana–Saharanpur Road, an important district-level corridor offering seamless connectivity to Saharanpur and adjoining areas.
- A small culvert (puliya) is located near the project site, supporting local drainage and improving accessibility across the adjoining stretch.



Fig 2b: Existing Site Photos

3. MASTER PLAN

The overall master plan of the campus has been conceived on well-defined zoning principles to ensure efficient functioning of various institutional activities and to facilitate systematic campus development. The planning framework envisages segregation of residential, administrative, training, and utility/service zones in order to minimize conflict of movement, enhance operational efficiency, and ensure functional integration across the campus.

However, it is specifically clarified that the scope of work under the present tender is limited only to the construction of Residential Buildings and associated appurtenant works. The development of administrative buildings, training infrastructure, utility installations, external development works, and other non-residential components of the campus shall be undertaken separately under different tender packages by the department.

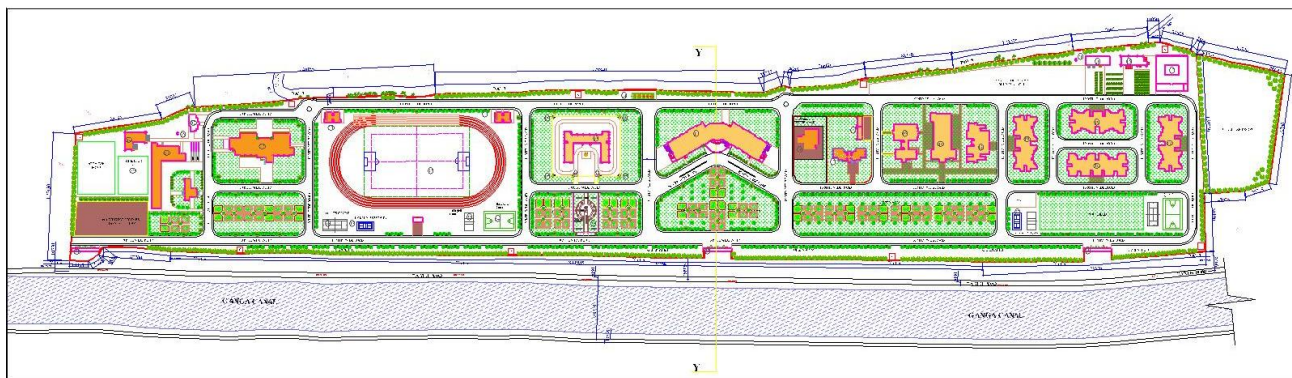


Fig 3a: Master plan

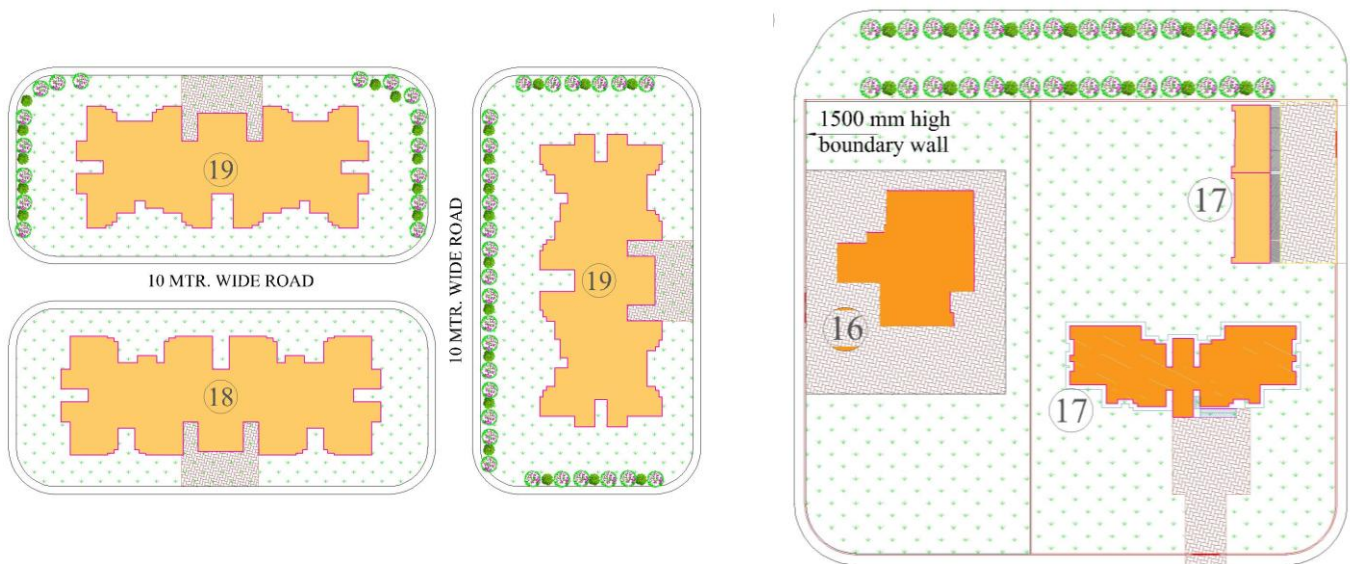


Fig 3b: Residences Blocks

LEGEND-

| S.N. | RESIDENTIAL BUILDINGS |
|------|---|
| 16 | Type 5 (G) 1 Quarter |
| 17 | Type 4 (G+3) 7 Quarters with Garage |
| 18 | Type A (G+13) 112 Quarters |
| 19 | Type B (G+13) 112 Quarters – 03 Blocks (336 Quarters) |

- Residential towers and lower-rise residential blocks create a separate domestic neighbourhood within the secured campus.

The façade language visible in the proposal uses a restrained institutional vocabulary with vertical banding, recessed windows, symmetrical massing and warm-toned accent panels. This gives the campus a formal government character while remaining economical and repeatable in execution.







4. CONCEPT

The architectural concept of the proposed development is based on creating a **functional, efficient, secure, and sustainable campus** that responds to the operational requirements of the Special Security Force while ensuring durability, ease of maintenance, and future expansion capability.

The proposed campus provides a comprehensive infrastructure for personnel deployed for Special Security Force. The design integrates accommodation, administration and infrastructure facilities within a well-planned and secure campus environment.

Fire safety provisions have been planned as per NBC Part 4 guidelines. Accessibility standards follow the Harmonized Guidelines for Barrier Free Built Environment.

The design envisages provision of barrier-free accessibility for persons with disabilities in accordance with the principles of universal accessibility. All accessible features and facilities proposed under the project shall conform to the provisions and standards stipulated in the Government of India publication titled “Harmonized Guidelines and Standards for Universal Accessibility in India, 2021,” including requirements related to accessible circulation, ramps, handrails, signage, toilets, pathways, and other user-friendly infrastructure for persons with disabilities.

- These architectural elements create a dignified institutional character while maintaining harmony with the cultural context.
- Orientation of the building is kept to facilitate maximum natural light and ventilation.
- Modular Building design.
- Smooth accessibility for the differently abled persons.
- Natural light to all the rooms has been externally provided with windows in corridor for additional lighting.
- Air conditioning, firefighting and detection system.
- Energy efficient Building.

- Planning and allocation of services as per the National Building Code-2016 and applicable by-laws.

5. EXTERNAL DEVELOPMENT

5.1 SITE LEVELS

The proposed level of internal roads and Building Plinths shall be maintained as follows:

| Parameter | Level / Observation |
|---------------------------------------|---------------------|
| Average existing ground level | 97.10 |
| Benchmark at canal bridge culvert top | 100.00 |
| Formation ground level | 99.30 |
| Plinth level | 99.90 |
| Average Earth filling required | 2.20 m |

Architecturally, these level differences imply that all principal buildings should be conceived on a controlled raised formation with proper internal road grading, storm-water runoff strategy, plinth protection and moisture control at the building perimeter.

The average earth filling level within the campus is approximately 2.20 metres. Filling of earth within the building areas (upto plinth), complete as required for achieving the finished formation levels, shall be deemed to be included in the scope of this contract. Reinforced cement concrete grade slabs shall be provided in all buildings as per approved structural drawings and specifications.

5.2 CONNECTIVITY TO INTERNAL ROADS/PATHWAY

It is proposed to construct the paver block roads/pathway as per tender drawings to be connected with the internal roads developed by the other contractor who develops the non-residential buildings and external development works. The Interlocking pavers of required size and thickness 80 mm thick, factory made of cement concrete mix of M-30 manufactured in joint less moulds on vibrator table finished smooth as per required shape size and pattern, colour and to be laid over sub grade etc. as per CPWD specification.

6. LANDSCAPES

It is proposed to carry out landscaping and allied horticulture works in an area extending approximately 3.0 metres around the residential buildings, complete as per approved drawings and specifications. The remaining external landscaping and campus development works outside the aforesaid zone shall be executed under the other tender package.

7. Seepage Treatment for Canal Edge

Since the project site is located adjacent to a canal, suitable seepage control measures shall be incorporated in the site development design. The treatment shall include provision of an interceptor drain along the canal-side boundary, an impervious cut-off trench to restrict lateral seepage, sub-soil drainage in vulnerable areas, and embankment protection by turfing, stone pitching, gabions or equivalent measures. Site grading shall be planned to drain stormwater away from buildings and toward designated drainage channels. All foundations, plinths, roads, and external development works in the canal influence zone shall be protected against moisture ingress and soil softening. The final design of seepage treatment shall be based on geotechnical investigation, contour survey, canal water level data, and seasonal groundwater conditions.

8. SIGNAGES

Signages of different sizes are to be provided at different locations inside the campus based on NBC standards and functional requirements. Design basis of the signage is readability at vehicular movement & pedestrian movement. In general, wherever required signages will be bilingual. The signage scheme has been developed to enable way finding for the patients, students, visitors. Signage will be consistent across the campus.

The entrance signage shall be made of Stainless-steel alphabets fixed onto concrete base with dash fasteners. The building signages shall be made of Non backlit acrylic panels of approved pantone shades, mounted onto framework made of square hollow sections.

***Note** – Only Internal signages of Residential Buildings are in the scope of this project.

a. Fire Signage

Fire Signage shall be provided in the complex as per NBC 2016 Part -4. Material of signage shall be of acrylic/aluminium of required dimensions. At every floor near Lift landing diagram showing stairways shall be provided mentioning instructions - 'IN CASE OF FIRE USE STAIRS UNLESS INSTRUCTED OTHERWISE'. The signage shall be above call push button in Lift Lobby. Floor Signage will be provided in each floor within the staircase & should easily readable. Each corridor of every floor will have directional signage indicating Fire Escape route. These Signage will be LED lit with UPS power backup or of photo Luminescent paint. So that they will be visible in dark in case of power failure.

b. Deliverable

The EPC contractor shall provide signage plans, detail drawings, sign schedules. Care shall be taken to co-ordinate signage with the engineering services documentation to avoid gaps and overlaps. Some signages will be connected to a service (e.g. illuminated and exit signs), or required for customer services (e.g. hearing loops), building services and plant.

Checklist

The following checklist is provided to assist tender documentation quality assurance.

- Use NBC 2016 wherever possible to control materials and workmanship.
- Materials Specify the materials to be used in the manufacture of the planks, posts, supports and lettering.
- Finishes Specify the finishes to be used for planks and message, including applied finishes, method of application, paints, gloss level, surface texture, anodising etc.
- Fixing Specify the fixing and attachment methods, materials, finishes and coatings, corrosion resistance, vandal proofing, etc. Inclusions Detail materials and processes that are to be included in the tender price: fixtures, brackets, wire, bolts, screws, tape/adhesives, packaging, transport and handling, storage, installation, insurances and rectification of defects, etc.

c. Standard Sign Lengths

- Lengths (mm) - 600, 800, 1000, 1200, 1600, 2000, Special.

d. Typefaces

The following short list of typefaces are included here for legibility, and are recommended for the signages to be used in this project, Wayfinding, and Sign Systems and Information Graphics. Some are more suited to limited use on smaller projects due to the ornate design of certain characters, e.g. 'g'. Note: Corporate typefaces that are suitable for printed matter may not be suitable for signage.

- Sans Serif:
- Helvetica Neue, Akzidenz Grotesque, Arial, Astra - Frutiger, Avant Garde, Avenir 85, Avenir
- Next Demi, Corporate, Futura, Franklin Gothic, Frutiger 65, Frutiger Next, FF DIN, FF Meta,
- Futura, Geneva Haas, Interstate, Linotype 2000, Metro, MS Sans serif, Polo, News Gothic,
- Syntax, Tahoma, Unica, Universe, Vectora 75, etc.

e. Principal Colour Systems to be used:

- BS British Standard System - Architectural colours etc.
- Commission Internationale de l'Eclairage (C.I.E) - colour matching system.
- DIN (German Standards Institute) System, DIN 6164 Colour Chart.
- Munsell System.
- Natural Colour System (NCS) (Swedish).
- Ostwald Colour System, see DIN.
- OSA/UCS The Optical Society of America's Uniform Colour System, see Munsell.
- Pantone® Matching System (PMS) - Proprietary system for printing industry, paints.
- RAL System - paint industry pigments.

Colour descriptions (Munsell and associated systems) include:

- Hue – basic pure colours from Red to Blue, chromatic colours.
- Value – lightness of a colour, neutral colours (greys) range from black to white (no hue).

Value applies to both chromatic and neutral colours.

- Chroma – saturation or intensity of a colour.

f. Safety Signs

AS 1319: Safety signs for the occupational environment.

g. Background colour Word legend colour

- White (Regulatory) Black
- Yellow (Warning) Black
- Green (Emergency) White
- Red (Fire) White

h. Signage Manufacture Guidelines

Select the appropriate product for use and location:

- Exterior (normal/severe), exposed or covered.
- Interior use (normal/vandal proof/safety/infection control).
- Accessibility (embossed/Braille/voice).
- Typical materials:
 - Backings – sheet material:
 - Safety glass: Clear, opaque, tinted, coated backing,

- Acrylic (Perspex etc), Fibreglass,
- Metal: Aluminium and aluminium composite, steel (coated), brass, bronze etc.
- Composite boards: Fibreboard (MDF), compressed fibre-cement (CFC), laminates (melamine, other), composite bulletin boards (cork etc).
- Backings – finishes:
 - Satin, matt, etched, hammered, sand blasted, gloss not recommended.
 - Reflective and phosphorescent material.
- Frames, end caps, supports:
 - Metal sections extruded or folded, Plastic extruded/moulded, fibreglass moulded,
- Planks, Inserts:
 - Metal, plastic, fibreglass, paper (requires a cover).
- Hardware:
 - Locks, hinges, stays, suspension wire, tamper proof screws, lock pins.
- Graphics:
 - Permanent and non-permanent graphics.
 - For internally illuminated and non-illuminated.
 - Cut and applied – vinyl, acrylic, metal.
 - Transfer tape.
 - Paint – sprayed, screen print, brushed.
 - Positive or negative graphics on clear/opaque backings.
 - Etched, machined or laser/abrasive jet, incised, raised.
 - Reflective and phosphorescent material.
 - Bar code or RFID tagging.
 - Self-illuminated:
 - Backing back or edge lit by light sources (fluorescent), or Neon or LED in graphics.
 - Illuminated:
 - Attached or separate light source.
 - Fixing:
 - Vandal proof.
 - Fasteners, adhesive, magnetic, clip and holding devices.
 - Digital signs:
 - Proprietary variable electronic message display or voice.
 - Digital Information Systems
 - Proprietary systems with various interfaces and user input or activation systems.
 - Visual, voice, phone, Braille, multi-lingual capabilities.

i. Fire Signs

- Fire signs shall be provided for as per NBC 2016. The NBC should be checked for amendments and fire signage.
- proposals should be confirmed or verified with the relevant authorities before implementation.

- Typical recommended sizes (height) 100, 150, 200, 250 mm. Additional background and borders are optional.
- Typical international exit signs - AS/NZS 2293.3: Emergency evacuation lighting for buildings -

Emergency luminaires and exit signs.



Typical Fire equipment pictograms.



Fig 5c: Fire sign

j. Illuminated Signs

- The use of internally illuminated signs in healthcare facilities is less common than in other public buildings.
- There are specific areas where the higher attention factor generated by an illuminated sign may be warranted.
- Examples are Emergency department entrances, enquiry counters and outpatient areas.
- The intensity of the internal lighting of pictograms on translucent background material should be controlled to prevent loss of legibility due to halation.
- In areas with low ceiling heights of 2400mm, the height of suspended sign boxes shall be restricted to 300mm in interior corridor locations, permitting only one- or two-line formats.



- Examples of basic formats for one and two line illuminated messages are shown above.
- Where signage is to be integrated into the interior as a built element, for example as a continuous fascia panel above an enquiry counter, the correct letter height to background height ratio should be maintained.
- Expert advice on graphic layouts, illumination levels and sign box construction techniques should be sought for internally illuminated signs.

k. Sign Maintenance

- The signages shall be guaranteed to be maintenance free apart from routine cleaning by healthcare facility. The EPC contractor shall provide 3-year onsite maintenance involving repair, replacement or relocation as part of their scope.

9. ENVIRONMENT IMPACT ASSESSMENT

Common Measures being taken for reducing impact on environment in the proposed campus: -

- STP/ETP facility for treatment of liquid waste generated at proposed site.
- Treatment of Solid Waste & Bio Medical waste generated at proposed site.
- Emission of exhaust gases at suitable height from DG sets as per CPCB norms.
- dB level of equipment chosen will be within limits as per relevant norms.
- Adequate storage provision for operationalization of Hospital Facilities shall be made.
- Solid waste management techniques shall be segregated in the following heads:
 - Municipal solid waste, organic waste composter, inert waste shall hand over to the authorized municipal waste collector.
 - Biomedical waste to be handed over to the authorized common biomedical waste management facility (approved by UP Pollution Control Board).
 - E-waste shall be handed over to authorized e-waste recycler.
- During construction stage following precautions to be taken.
 - Back filters shall be used for batch mixing plant. All provisions as per CPCB shall be provided.
 - Sprinkling of water to avoid dust pollution shall be ensured during construction.

- Temporary hutments shall be constructed for accommodation of constructions workers during construction which shall be demolished and cleared off after completion of the project.

10. GRIHA RATING & CERTIFICATION

- **Project Vision**

This project is envisioned to be designed and constructed based on sustainability and green building principles. The vision is to conserve energy & water; reduce waste; renewable energy generation; reduce urban heat island effect and use sustainable materials.

- **Project Approach & Strategies**

Minimum 3-Star GRIHA rating for all the buildings shall be designed by EPC Contractor with due compliance to various criteria stipulated under GRIHA.

B. DBR - STRUCTURE

1. GENERAL

The EPC Contractor will receive the Master Plan and Concept Plan for the Proposed Construction of **Residential Buildings for 5th Vahini of UPSSF at Saharanpur, UP**. Detailed structural design and drawings are to be prepared by the EPC Contractor and vetted by a recognised institution such as IIT/NIT or any Government Engineering College.

2. SITE CONDITIONS

The project site is located in **Saharanpur, Uttar Pradesh**. Based on the latest seismic zoning map of India (IS 1893 Part 1:2025), the site falls under **Seismic Zone IV**, corresponding to a High Damage Risk.

2.1 Soil Strata Profile

| IS Soil Group | Description | Occurrence | General SPT Range | Consistency |
|---------------|--------------------------------|------------------------------|-------------------|-----------------|
| CI | Silty Clay – Medium Plasticity | Upper layers – all BH | 7 – 15 | Soft to Medium |
| CL | Silty Clay – Low Plasticity | Interbedded with silt layers | 10 – 20 | Medium |
| ML | Sandy Silt | Intermediate depth | 12 – 25 | Medium |
| SM | Silty Sand | Mid to deeper depth | 18 – 35 | Medium to Dense |
| SM/SP | Poorly Graded Silty Sand | Deeper strata (> 15 m) | 30 – 42 | Dense |

2.2 Water Table

The water table was encountered at **14.0 m depth** during boring operations in all five boreholes (February 2024). A post-monsoon rise of **1.0 m** is expected; accordingly, the design water table is assumed at **13.0 m below ground level**.

3. GEO-TECHNICAL INVESTIGATION

Preliminary geo-technical investigation data is provided. The EPC Contractor may carry out additional soil investigations as per codal provisions. Five boreholes (BH-1 to BH-5) were sunk to **40.0 m depth** as per IS 1892:2020. Standard Penetration Tests (SPT) were conducted at 1.5 m intervals or at change of strata per IS 2131:1981.

3.1 Recommended Safe Bearing Capacity

| Sl. | Depth (m) | Foundation Type | Width (m) | SBC Shear (kg/cm ²) | SBC Settlement (t/m ²) | Governing SBC (kN/m ²) |
|-----|-----------|--------------------|-----------|---------------------------------|------------------------------------|------------------------------------|
| 1 | 1.00 | Isolated | 1.00 | 0.924 | 9.24 | 92.4 |
| 2 | 1.50 | Isolated | 1.50 | 0.952 | 9.52 | 95.2 |
| 3 | 2.00 | Isolated | 2.00 | 1.022 | 10.22 | 102.2 |
| 4 | 3.00 | Isolated | 2.00 | 1.172 | 11.72 | 117.2 |
| 5 | 2.00 | RCC Raft (10×10 m) | 10.0 | 0.943 | 9.43 | 94.3 |

Note: Pile foundation is recommended for All Multi-Storey Structures.

4. BUILDING CONFIGURATION

| S. No. | Structure | Storey's | Type | Foundation | Concrete Grade |
|--------|-----------|----------|-------|---------------------|--|
| 1 | Type-5 | G | Frame | Isolated Foundation | M-30 for all Structural Members |
| 2 | Type-4 | G+3 | Frame | Pile Foundation | M-30 for all Structural Members |
| 3 | Type-A | G+13 | Frame | Pile Foundation | M-40 (Columns); M-30 (Foundation, Beams, Slabs & Others) |
| 4 | Type-B | G+13 | Frame | Pile Foundation | M-40 (Columns); M-30 (Foundation, Beams, Slabs & Others) |

Note: All structure shall be designed for one additional floor (future) to accommodate all services. Grade Slab to be provided at Ground Floor Level in all buildings.

5. DESIGN PHILOSOPHY

- Site falls in Seismic Zone IV as per IS 1893 (Part 1):2025. RCC framed structure has been proposed for all structures. If the structural system is changed to Pre-Tension, Post-Tension, Steel or Pre-Engineered type by the EPC Contractor, no extra claim shall be paid.
- 3-D analysis of all building structures is to be carried out by the EPC Contractor using latest versions of modern software packages such as STAAD Pro / ETABS / SAFE. All designs shall strictly conform to NBC 2016 and latest IS codes and shall be proof-checked.
- UPPWD reserves the right to conduct third-party design validation. The EPC Contractor shall provide all data and carry out all modifications suggested by the appointed third party.
- The recommendations of the preceding Geo-Technical Investigation are indicative. The EPC Contractor shall conduct independent soil investigations and shall be responsible for the adequacy of the design.

Statutory compliance shall be maintained with the **National Building Code (NBC) 2016**, local bye-laws, BIS codes (latest revisions), and applicable international codes.

6. LOAD PROPERTIES

6.1 Dead Loads (DL)

As per IS 875 Part 1:1987

| S.N. | Component | Unit Weight (kN/m ³ or kN/m ²) |
|------|--------------------------------|---|
| 1 | RCC (Reinforced Concrete) | 25.0 |
| 2 | Plain Concrete | 24.0 |
| 3 | Brick Masonry | 19.2 |
| 4 | Waterproofing (Brick Bat Coba) | 9.90 |
| 5 | Cement Plaster | 20.4 |
| 6 | Steel | 78.5 |
| 7 | Water | 10.0 |
| 8 | Granite | 27.45 |
| 9 | Marble / Sandstone | 26.7 |
| 10 | Vitrified Tiles | 24.0 |
| 11 | Artificial Ceiling | 0.25 |

| | | |
|----|-------|------|
| 12 | Glass | 26.0 |
|----|-------|------|

6.2 Live Loads (LL)

As per IS 875 Part 2:1987 and NBC 2016

| S.N. | Occupancy / Location | UDL (kN/m ²) | Concentrated Load (kN) |
|------|-----------------------------------|--------------------------|------------------------|
| 1 | Bedrooms / Drawing Room / Kitchen | 2.0 | 1.8 |
| 2 | Corridor, Staircase | 3.0 | 4.5 |
| 3 | Toilets and Bathrooms | 2.0 | — |
| 4 | Balconies | 3.0 | 1.5 / m |

6.3 Wind Loads (WL)

As per IS 875 Part 3:2015

| S.N. | Parameter | Value / Reference |
|------|--|---|
| 1 | Basic Wind Speed (V _b) | 39 m/s |
| 2 | Terrain Category | B |
| 3 | Height Range | 3 – 50 m |
| 4 | Structure Size Factor (k ₁) | 0.67 – 1.08 |
| 5 | Terrain-Roughness & Height (k ₂) | 0.80 – 1.35 |
| 6 | Topography Factor (k ₃) | 1.0 |
| 7 | Importance Factor (k ₄) | 1.0 |
| 8 | Design Wind Velocity (V _z) | $V_z = V_b \times k_1 \times k_2 \times k_3 \times k_4$ |
| 9 | Design Wind Pressure (p _z) | $p_z = 0.6 \times V_z^2$ |

6.4 Seismic Loads (EL)

As per IS 1893 Part 1:2025 and IS 1893 Part 5:2025

| S.N. | Parameter | Value |
|------|--|----------------|
| 1 | Seismic Zone | IV |
| 2 | Zone Factor (Z) | 0.24 |
| 3 | Importance Factor (I) | 1.0 -1.2 |
| 4 | Response Reduction Factor (R) | 3.0, 4.0 & 5.0 |
| 5 | Imposed Load ≤ 3.0 kN/m ² in Seismic Wt. | 25% |
| 6 | Imposed Load > 3.0 kN/m ² in Seismic Wt. | 50% |

6.5 Load Combinations

As per IS 875 and IS 1893

| S.N. | Load Combination | Limit State of Collapse | Limit State of Serviceability |
|------|------------------|---------------------------------|-------------------------------|
| 1 | DL + LL | 1.5 DL + 1.5 LL | 1.0 DL + 1.0 LL |
| 2 | DL + WL | 1.5 DL + 1.5 WL | 1.0 DL + 1.0 WL |
| 3 | DL + LL + WL | 1.2 DL + 1.2 LL + 1.2 WL | 1.0 DL + 0.8 LL + 0.8 WL |
| 4 | DL + EL | 1.2 DL + 1.2 LL \pm EL | 1.0 DL + 1.0 EL |
| 5 | DL + LL + EL | 1.5 DL \pm EL 0.9 DL \pm EL | 1.0 DL + 0.8 LL + 0.8 EL |

Wind Load is considered for X and Y directions. Earthquake Load is considered for X, Y & Z directions.

For non-orthogonal columns, additional combinations shall apply.

7. DESIGN METHODOLOGY

- a) **Structural Modelling:** The entire building is modelled as a 3D space frame using industry-standard software (STAAD Pro, ETABS, or SAFE). The model incorporates accurate member sizes, material properties, and load applications.
- b) **Load Applications:** All loads (DL, LL, WL, EL) are applied in accordance with IS 875 and IS 1893. Load combinations are generated based on Limit State Design philosophy.
- c) **Analysis:** Elastic analysis is performed for serviceability; Limit State analysis for safety against collapse; Modal analysis for dynamic/seismic performance. Results include shear forces, bending moments, axial forces, and displacements.
- d) **Member Design:** Beams, slabs, columns, shear walls, footings, and other elements are designed for governing load combinations per IS 456:2000 and IS 13920:2016. Retaining walls, tanks, staircases, and canopies are addressed under their specific loading conditions.
- e) **Manual Verification:** Critical structural elements are manually verified to cross-check software results and ensure design accuracy.
- f) **Foundation Design:** Based on geo-technical recommendations, the foundation type (isolated, combined, or pile) is finalised and designed for combined vertical and lateral loads.
- g) **Deflection & Crack Checks:** All members are checked against IS 456 Clause 23 deflection limits. Crack widths and long-term deflection are controlled to ensure serviceability.
- h) **Expansion & Construction Joints:** Expansion joints are provided per IS 1893 (Part 5):2025 Clause 7.5 for structures exceeding 45 m in length. Construction joints are planned to minimise cold joints and shrinkage effects.
- i) **Detailing & Documentation:** Reinforcement detailing follows SP 34 and IS 13920, ensuring ductility and ease of construction. Bar bending schedules and construction drawings are prepared and reviewed.
- j) **Proof Checking & Review:** The entire design is vetted by an independent third-party institute (IIT/NIT/Government Engineering College) approved by UPPWD. All feedback is incorporated before final submission.

8. MATERIAL PROPERTIES

8.1 Concrete Grades

As per IS 456:2000 Table 5 and Clause 8.2.4.2

| S.N. | Concrete Grade | Exposure Condition | Max w/c Ratio | Min Cement (kg/m ³) | Reference |
|------|------------------|--------------------|---------------|---------------------------------|---------------------|
| 1 | M25 (Mix Design) | Moderate | 0.50 | 300 | IS 456:2000 Table 5 |
| 2 | M30 (Mix Design) | Moderate | 0.45 | 320 | IS 456:2000 Table 5 |
| 3 | M35 (Mix Design) | Severe | 0.45 | 340 | IS 456:2000 Table 5 |

| | | | | | |
|---|-------------------------|--------|------------|------------|------------------------|
| 4 | M40 (Mix Design) | Severe | 0.40 | 360 | IS 456:2000 Table 5 |
| 5 | M45 (Mix Design) | Severe | Mix Design | Mix Design | IS 456:2000 Table 5 |

8.2 Minimum Material Grades

| S.N. | Material Type | Minimum Grade | IS Code Reference |
|------|------------------------|---------------|----------------------|
| 1 | Concrete (General RCC) | M30 | IS 456:2000, Table 5 |
| 2 | Structural Steel | Fe 350 | IS 800:2007 |
| 3 | Reinforcement Steel | Fe 500D | IS 1786:2008 |

8.3 Deflection Criteria

As per IS 456:2000 Clause 23.2

| S.N. | Structural Element | Deflection Limit | Reference |
|------|-----------------------------|--------------------------------|----------------------|
| 1 | Beams & Slabs (Total) | Span / 250 | IS 456:2000 Cl. 23.2 |
| 2 | Beams & Slabs (Post-Finish) | Lesser of Span/350 or 20 mm | IS 456:2000 Cl. 23.2 |
| 3 | Lateral (Overall Structure) | Height / 500 | IS 456:2000 & IS 875 |

8.4 Minimum Member Dimensions & Cover

As per IS 456:2000 and IS 13920:2016 (2 Hr. fire rating, severe exposure)

| S.N. | Structural Member | Min Size (mm) | Min Cover (mm) | Remarks |
|------|-------------------------|---------------|----------------|------------------------------------|
| 1 | Column (Fully Exposed) | 300 | 40 | IS 456 Cl. 21.2 and Table 16 |
| 2 | Beam (Continuous) | 200 | 30 | — |
| 3 | Beam (Simply Supported) | 200 | 40 | — |
| 4 | Slab (Continuous) | 125 | 25 | Minimum thickness for RCC slab |
| 5 | Slab (Simply Supported) | 125 | 35 | IS 456 Table 16 |
| 6 | RCC Wall | 200 | 25 | Vertical steel in each face |
| 7 | Staircase Waist Slab | 150 | 25 | Based on rise/run and live load |
| 8 | Lintel Beam | 150 | 25 | Designed for wall load and chajja |
| 9 | Footing | Per design | 50 | Based on SBC and axial/moment load |

9. STRUCTURAL CONSIDERATIONS

The structural system comprises various load-resisting elements designed in accordance with IS 456:2000, IS 13920:2016, and relevant Indian Standards:

- a) **Columns:** Primary vertical load-bearing elements. Designed for combined axial load and biaxial bending using Limit State Design per IS 456:2000. Minimum column size: 300 mm.
- b) **Beams:** Horizontal elements carrying loads from slabs to columns. Designed for flexural strength, shear strength, and serviceability per IS 456 and SP 16. Minimum reinforcement criteria apply.
- c) **Slabs:** Designed as one-way or two-way per panel geometry. Curtailed reinforcement and torsional bars at corners as per IS 456 Annex D. Minimum slab thickness: 125 mm.
- d) **Shear Walls:** Provided to enhance lateral load resistance in tall blocks (G+13/G+14). Designed per IS 13920:2016 for ductility under seismic forces.
- Retaining Walls:** Designed for active earth pressure, surcharge loads, and seismic forces where applicable at basement or site boundary conditions.
- f) **Staircases:** Waist slab type; designed for live load and accessibility. Minimum 12 mm diameter bars. Compliant with IS 456 Clause 33.
- g) **Water Tanks:** Both overhead and underground tanks designed for water load, uplift pressure, and seismic impact per IS 3370.
- h) **Plinth Beams & Lintels:** Provided for crack control and wall support across all structures.

9.1 Ductile Detailing & Serviceability

Ductile detailing shall be carried out as per IS 13920:2016. Crack control and deflection shall comply with IS 456:2000 Clause 23. Reinforcement detailing shall follow SP 34 and IS 456:2000.

10. FOUNDATION DESIGN

Foundation type is selected based on Safe Bearing Capacity (SBC) and design loads. The following foundation systems apply:

- a) **Isolated Footings:** For light to medium loads on shallow competent strata (All Single Storey Structures).
- b) **Combined Footings:** Where columns are closely spaced and individual footings would overlap.
- c) **Pile Foundation:** Recommended for All Multi-Storey Structures.

Foundations shall be checked for one-way shear, punching shear, and bending. Design shall account for axial, uplift, and lateral loads.

11. SPECIAL STRUCTURES

- a) **Underground Tanks & Overhead Water Tanks (OHTs):** Designed for hydrostatic pressures in both full and empty conditions, accounting for uplift and seismic effects per IS 3370 (Working Stress Method) and IS 1893.
- b) **Post-Tensioned / Pre-Tensioned Systems:** Where adopted, designed per IS 1343:1980. Minimum concrete grade M30. Pre-stressing is used to reduce structural depth, control deflection, and improve load-carrying efficiency.
- c) **Monolithic RCC Construction:** Adopted in areas requiring superior seismic resistance and continuity. Especially effective in shear wall zones and core areas.
- d) **Steel-RCC Composite Structures:** Where applicable, design shall follow IS 11384.

These special structural systems shall undergo independent proof-checking and UPPWD approval.

Their adoption shall not result in any additional cost implication to the client.

12.REFERENCE CODES & STANDARDS

| Sl. | Code | Description |
|-----|-----------------------------|--|
| 1 | IS 875 (Part 1):1987 | Dead Loads – Unit Weights of Building Materials |
| 2 | IS 875 (Part 2):1987 | Imposed Loads |
| 3 | IS 875 (Part 3):2015 | Wind Loads |
| 4 | IS 875 (Part 5):1987 | Special Loads and Load Combinations |
| 5 | IS 456:2000 | Plain and Reinforced Concrete – Code of Practice |
| 6 | IS 1786:2008 | High Strength Deformed Steel Bars and Wires for Concrete Reinforcement |
| 7 | IS 1904:1986 | Design and Construction of Foundations in Soil – General Requirements |
| 8 | IS 2911 (Part I/Sec 2):2010 | Bored Cast-in-situ Concrete Pile Foundations |
| 9 | IS 2911 (Part III):1980 | Under-reamed Pile Foundations |
| 10 | IS 2950 (Part 1):1981 | Design and Construction of Raft Foundations |
| 11 | IS 3370 (Part 1):2009 | Concrete Structures for Storage of Liquids – General Requirements |
| 12 | IS 3370 (Part 2):2009 | Concrete Structures for Storage of Liquids – RCC Structures |
| 13 | IS 3370 (Part 4):1967 | Concrete Structures for Storage of Liquids – Design Tables |
| 14 | IS 1893 (Part 1):2025 | Earthquake Resistant Design of Structures – General Provisions |
| 15 | IS 1893 (Part 5):2025 | Earthquake Resistant Design of Structures – Buildings |
| 16 | IS 4326:2013 | Earthquake Resistant Design and Construction of Buildings – Code of Practice |
| 17 | IS 1642:1989 | Fire Safety of Buildings – Details of Construction |
| 18 | IS 13920:2016 | Ductile Detailing of RCC Structures Subjected to Seismic Forces |
| 19 | IS 1343:1980 | Code of Practice for Prestressed Concrete |
| 20 | IS 800:2007 | General Construction in Steel – Code of Practice |
| 21 | IS 808:1989 | Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections |
| 22 | SP 16:1980 | Design Aids for Reinforced Concrete to IS 456-1978 |
| 23 | SP 24:1983 | Explanatory Handbook on IS 456 |
| 24 | SP 34:1987 | Handbook on Concrete Reinforcement and Detailing |
| 25 | SP 38 (S&T):1987 | Handbook on Typified Design for Structures with Steel Roof Trusses |
| 26 | NBC 2016 | National Building Code of India (Vol. 1 & 2) |

13. CONCLUSION

All structures shall be designed in accordance with the latest IS codes ensuring safety, stability, and compliance with NBC 2016. All design submissions shall be proof-checked by a third-party institute

and submitted to PMC for final approval.

Important Note: If the structure is changed to Pre-Tensioned, Post-Tensioned, Steel, monolithic or any other system during execution, it shall be accommodated without any additional cost implication to the client.

14.INCLUSIONS IN DESIGN SUBMISSION

- Design calculations
- ETABS / STAAD / SAFE analytical model
- Detailed structural drawings
- Stability report and certification from recognised institution (NIT / IIT) as per SCC Vol-III
- Filled checklist as per UPPWD requirements.

C. DBR - CIVIL WORKS & GENERAL

1. General

The Construction of Residential Buildings for the establishment of 5th Battalion of Special Security Force at District Saharanpur, Uttar Pradesh, India on EPC Basis, shall be done on EPC (Design, Engineering, Procurement & Construction) basis and the EPC Contractor shall be responsible for shortfall of any technical propriety and of upholding prevailing standard of Code of Practice according to NBC 2016 and all other relevant IS-Codes on the way to accomplish the work according to requirement. The work shall in general conform to the Latest CPWD Specifications.

The new facilities shall be completed in conformity with high standards of construction and specification. The Architectural finishes shall be of such quality that will ensure better hygienic conditions. The design of building shall ensure control of noise due to walking, movement of trolleys and banging of doors etc. The architectural design should take in to account the requirements of physically challenged person.

Based on the approved Master Plan & Concept Drawings, the EPC Contractor shall prepare the detailed architectural design and drawing of the Project for approval from the local bodies and statutory authorities. The structural designs of the buildings and structures shall be done by the EPC Contractor and shall be Proof checked/vetted by the IIT/NIT/or any Govt. Engineering College as approved.

2. Site clearance, Excavation & Earth Work:

Site clearance, excavation, and earthwork operations shall be carried out to prepare the project site for construction activities. These works include removal of vegetation, topsoil stripping, excavation for foundations and utilities, filling, compaction, and grading of the site.

All activities shall be carried out in accordance with **CPWD Specifications**, relevant Indian Standards, and approved construction drawings. Proper safety measures and environmental considerations shall be followed during the execution of these works.

Prior to commencement of construction activities, the entire site area shall be cleared of all unwanted materials including vegetation, shrubs, trees, roots, debris, and other obstructions that may interfere with construction.

The site clearance operations shall include:

- Removal of grass, bushes, and vegetation
- Cutting and removal of small trees and roots
- Removal of rubbish, debris, and unsuitable materials
- Stripping of topsoil where required
- Disposal of cleared material at approved dumping locations

The EPC contractor shall under take necessary levelling, back filling/ cutting, if required, to maintain the levels as per Master Plan. The EPC contractor shall bring the good earth from outside, if any required, to maintain the required levels and shall ensure proper compaction before the start of any construction activities.

3. Anti-termite treatment:

Anti-termite treatment of all buildings in the campus with Chlorpyrifos 20EC/ Imidacloprid 30.50 SC as specified in IS-6313 (Part-2) 2013 and shall be got done through approved specialized agencies only.

4. Damp-proof course:

The damp-proof course (DPC) shall be laid at plinth level/ or as per requirement in the brick work walls resting on brick foundations, as per approved drawings and as directed of 50mm thickness with cement concrete 1:1.5:3 (1 cement: 1.5 coarse sand: 3 graded stone aggregate 20mm nominal size) mixed with water proofing material in cement concrete work in doses by weight of cement as per manufacturer 's specification.

5. Plinth Protection:

Plinth protection with 75 mm thick of cement concrete 1:1.5:3 (1 cement :1.5 coarse sand: 3 graded stone aggregate 20mm nominal size) over 100 mm bed by dry brick ballast/ stone aggregates 40mm nominal size well rammed and consolidated and grouted with fine sand including finishing all around the buildings, as per tender drawings and approval of Engineer-in-charge. The width of the plinth protection shall be 900 mm (Minimum). The required brick toe wall/brick on edge shall be provided as per requirements.

6. Brick Work on External Wall:

- i. The bricks used in the brick work shall be class M-150 designation, common burnt clay bricks (Red Bricks) conforming to IS: 1077
- ii. Bricks used in the work shall be obtained from approved kilns and shall be best quality bricks. Their characteristic compressive strength shall be in conformity to the provision in Latest CPWD Specifications for works.
- iii. For mortar, use of PP Cement shall be preferred. The mortar shall be as under:
 1. For brick work cement mortar 1:6 (1 cement: 6 coarse sand)
 2. For half brick masonry cement mortar 1:4 (1 cement: 4 coarse sand)
- iv. The half brick masonry shall be provided with 2 Nos. 6mm dia. M.S. bars at every third course of masonry.
- v. RCC Coping of specified thickness and shape to be carried out over Brick Parapet walls etc. of required Concrete Grade.

7. Partition/ Internal Wall:

a. Drywall:

Drywall is a high-performance light weight partition system consisting of Aluminium frame encased with bison panel on either side attached through self-drilling drywall screws. The joints are then taped and finished with bison jointing compounds. Bison Panel is a cement bonded particle board made out of 62% cement 28% wood. The wood used is of fast growing species like Eucalyptus and Poplar. Due to adoption of special manufacturing process, the panel acquires the strength, the durability of cement and easy workability of wood - a combination of qualities absent in other boards.

Density 1250 Kgs/m³ (1100 Kgs minimum as per BIS)

Moisture content 9% + 3% at Factory Point.

Modules of Elasticity (bending) 3000 N/mm

Bending strength 9N/mm

Transverse tensile strength (perpendicular to surface) 0.4 N/mm²

Compressive strength (perpendicular to surface) 15 N/mm²

Surface Alkalinity pH Between 11 and 13

Nail holding power perpendicular to surface. 205 Kgs

Screw holding power perpendicular to surface 312 Kgs

b. AAC Blocks:

AAC Block shall conform to IS:2185(Part-III) and shall be of grade-I of minimum density 551 to 650 kg/cum with minimum compressive strength 4.0 N/sqmm. Providing and laying autoclaved aerated cement blocks masonry with 100 mm/ 200mm/300mm thick AAC blocks in super structure above plinth level up to all level in block laying polymer modified adhesive mortar, with required thickness of RCC at sill level and lintel level or every 1.2m as directed by Engineer-in-charge.

Notes: Brickwork shall be used in All staircase, kitchen, toilet/wet areas, & Common waiting area as per requirement and approval by Engineer-in-Charge.

8. Finishing:

The surfaces of brick work, etc. shall be treated and finished with Cement Plaster. The use of PP Cement shall be preferred. The cement plaster shall be provided as under:

- a. Plane wall faces: 12mm thickness (minimum) cement plaster 1:6 (1 cement: 6 Coarse sand).
- b. Rough wall faces: 15mm thickness (minimum) cement plaster 1:6 (1 cement: 6 Coarse sand).
- c. In respect of RCC works, in continuation with the brick work, plastering as per brick work shall be continued over RCC works.
- d. All External faces including wall faces behind dry cladding and structural glazing: 18mm thickness (minimum) cement plaster in two coats, under layer 12mm thick cement plaster 1:5 (1 cement: 5 coarse sand) finish with a top layer of 6mm thickness (minimum) cement plaster 1:6 (1 cement: 6 Coarse sand).
- e. The junction of RCC work and brick walls shall be covered with 24-gauge chicken wire mesh fixed with screws/washers to avoid cracks in plaster work. And also where ever cutting of brick work is done for conduits.
- f. The trenches / open drains: 15mm plaster finished with cement plaster 1:4 (1 cement: 4 Coarse sand) with floating coat of neat cement & adding of Water proof compound.
- g. Provide drip course/ groove in plastered surface or moulding to R.C.C. projections.

9. Painting:

The plastered surfaces shall be finished as per the finishing schedule/tender drawings. This shall include Antibacterial Paint/textures paint and other paints as per finishing schedule. The ceiling area below where false ceiling is carried out shall be finished with white wash coat(s) as per requirement. The false ceiling, as required, shall also be finished as per the finishing schedule appended to the tender document.

All paints shall meet the GRIHA requirements for minimum 3 Star Rating. Painting on doors, windows, Grills, MS work, structural steel, rolling shutters, railing and other members requiring painting and polishing etc., wherever required, shall be treated with primer coat and finished with painting/polishing of approved shade and manufacture, as per CPWD Specifications, to meet the functional requirements.

Textured Exterior Paint over Priming coat of Exterior primer over 1 mm Cement based Putty & Structure Glazing with hermetically-sealed 6-12-6 mm insulated glass (double glazed) and Aluminium Extruded Tubular Sections.

- a. All paint work on concrete and plaster surfaces shall include application of white cement-based putty as base preparation, application of primer in compatibility with the respective type of paint and painting with 2 or more coats of paint as per technical specifications.
- b. All paint work on structural components (excluding Stainless steel) shall include application of primer in compatibility with the respective type of paint and painting with 2 or more coats of paint as per technical specifications.
- c. The wood work shall be painted / polished (melamine finish) as per requirements.
- d. Premium Acrylic Smooth Exterior Paint over Priming coat of Exterior primer over 1 mm Cement based Putty in residential buildings or as per specified in Schedule of Finishes.

10. Door & Windows

The doors and windows shall be provided as per the requirements indicated in the finishing schedules / tender drawings / MOUD Norms for residential buildings and technical specifications. In case of variance, the decision of UPPWD/CONSULTANT shall prevail. However, the various types of Doors and Windows shall be as under:

- **Wooden**

- i. Flush doors (Decorative)- laminated (factory Pressed), veneered, commercial
- ii. Hardware: All hardware for doors and windows shall be of stainless steel (SS-304) or as specified.

- **Aluminium Works**

- i. Doors, windows, ventilators and partitions with Powder coated aluminium extruded built up standard tubular sections/ appropriate Z sections/built up sections and/or other sections with minimum thickness of powder coating 50 micron of approved make conforming to IS: 733 and IS: 1285 as per CPWD specification.
- ii. Hardware: All hardware for doors and windows shall be of Powder coated aluminium or as specified.
- iii. The aluminium sections shall be infilled with hardwood insert.
- iv. Fly proof SS wire mesh doors/ windows with Aluminium Grill (Outside) for Residential/Hostel etc. units as specified.
- v. All the aluminium works shall be of 3mm minimum thickness.

- **Rolling Shutter (Powder Coated)**

- i. With mechanical operation system.

- **Fire Rated Doors and Partition**

- i. All fire rated door shall be of mild steel.
- i. Fire rated doors of 120 minutes fire rating confirming to BS : 476 part 22 & IS : 3614 Part II . These doors shall be provided at all fire exit points, firefighting shafts, Service Duct and shafts. The MV panel room shall be provided with fire resistance wall and doors. The fire doors shall be of Metal (M.S.), as specified. The fittings such as Mortise Lock, Flush Bolts, Automatic Door Closer, Pull Handle, Fire Rated Panic exit device shall also be of 120 minutes fire rating. Smoke Seals, Acoustic Seals shall also be provided.
- ii. Fire Resistant Glazed Doors, Windows & Partitions, as per requirements, 120 minutes fire rating shall be provided.
- iii. The shafts and /or ducts, if penetrating multiple floors, shall be of masonry construction with fire damper in connecting ductwork or shall have fire rated ductwork with fire dampers at floor crossing. Alternatively, the duct and equipment shall be installed in room having walls, doors and fire damper in duct existing/entering the room of 120 min fire

resistance rating. Such shafts and ducts shall have all passive fire control meeting 120min fire resistance rating requirement to meet the objective of isolation of the floor from spread of fire to upper and lower floors through shaft/duct work.

11. Structural Steel

MS Ladder: Provision of suitable size MS Ladders finished with Epoxy paint as per CPWD Specification shall be provided for approach to terraces of single Storied Buildings, Mumtias, Lift Machine Rooms, Water Tanks, Pump Rooms etc. as per requirements.

12. Flooring

- a. In order to keep the floor finish as per Architectural drawings and to provide required thickness of the flooring as per specification, the level of top surface of deck slab shall be accordingly adjusted at the time of its centring, shuttering and casting. Alternatively, for maintaining the floor finish, grading with cement concrete with nominal mix 1:2:4 (1 cement: 2 coarse sands: 4 graded stone aggregate 10mm nominal size) shall be provided.
- b. Protective layer to be provided for all types of flooring, during construction.
- c. The edges of steps in the staircases, counters, kitchen platform, window sills, facias and similar location shall be edge moulded as required. Staircase Tread should have Anti- Skid Grooves as specified in the tender drawing or as directed by Engineer-in charge.
- d. Minimum Bed mortars for various types of flooring
 - i. Chequered tiles/stone flooring/kota stone flooring/granite flooring/ Ceramic glazed floor tile flooring/vitrified flooring - 20mm thick bed of cement mortar 1:4 (1 cement: 4 coarse sand).
 - ii. For dado, skirting and risers of steps in Chequered tiles/stone /kota stone /granite / Ceramic glazed floor tile /vitrified tiles- 12mm thick bed of cement mortar 1:3 (1 cement: 3 coarse sand).
 - iii. The vertical facia and drops shall be finished with epoxy resin-based adhesive.

e. Types of flooring

The types of flooring shall be as per finishing schedule / tender drawings. However, these are brief as under:

- i. Concrete Flooring
- ii. Kota Stone Flooring
- iii. Granite Flooring
- iv. Vinyl Flooring
- v. Vitrified Tile (Multy-Charged) Flooring
- vi. Min 300x300mm Anti-Skid Ceramic Tiles of min 8mm thickness.
- vii. 400x400mm Anti-Skid Pavit Pavement Tile (min 9.8mm thick) and 600x600 tactile tile in two shades (Yellow and Red) as per design
- viii. Glazed Vitrified tiles Matt/Antiskid finish of size 600x600 with min thickness of 9mm
- ix. Tactile strips & studs
- x. Skirting/Dado: -
 - a. Skirting in respect of above shall be of the same material and specifications and the height as specified.
 - b. The dado work in the toilets/washroom/kitchen/pantry or as specified shall be with ceramic tiles and of height as specified.
 - c. The dado work in the lifts, entrance halls and other similar locations shall be in granite/marble stone as specified.

- d. The dado work in the corridors of hospitals shall be as specified.

13.False Ceiling

The types of false ceiling shall be as per finishing schedule / tender drawings. However, these are brief as under:

- False ceiling with Powder coated metal false ceiling tiles (Seamless/ Perforated)
- False ceiling with gypsum board
- Combination of above type of false ceilings
- Under Deck Insulation System - Polystyrene Rigid Insulation Board
- Metal planks 1200x300x8 with wooden finish & strip lighting

14. Roofing

The OTS as per Tender Drawing, shall be covered by Polycarbonate Sheet Roofing as per requirement & technical specifications. The support structure shall be designed in MS tubular sections with suitable foundation system.

15.Water Proofing Treatment

- i. All items for water proofing treatment with integral cement-based water proofing treatment for Roof Slab, sunken portion, Basement, Water Tanks shall be guaranteed for TEN YEARS, to be reckoned from the date of expiring of the Defect Liability period prescribed in the contract.
- ii. The Water proofing treatment of terrace shall be done with Integral Cement Based water proofing treatment (brick bat coba) as per CPWD specification with Khurras, Golas etc. complete.
- iii. Integral Cement Based Water Proofing Treatment for Roof /Sunken Floors of W.C'S/ Bathrooms etc. by applying cement slurry mixed with water proofing cement compound consisting of applying:
 - First layer of slurry of cement @ 0.488 kg/sqm mixed with water proofing cement compound @ 0.253 kg/ sqm. This layer will be allowed to air cure for 4 hours.
 - Second layer of slurry of cement @ 0.242 kg/sqm mixed with water proofing cement compound @ 0.126 kg/sqm. This layer will be allowed to air cure for 4 hours followed with water curing for 48 hours. The rate includes preparation of surface, treatment and sealing of all joints, corners, junctions of pipes and masonry with polymer mixed slurry complete as per CPWD Specifications.
- iv. The water proofing of basement, all tanks, LINAC room, ETP, WTP, STP etc. shall be done by Chemical Injection System (Pre-Construction) as per CPWD Specification or as specified.
- v. The work shall be got executed from the approved specialized agency.

16. SAFETY CODE

1. Suitable scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used, an extra mazdoor shall be engaged

for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and handhold shall be provided on the ladder and the ladder shall be given an inclination not steeper than $\frac{1}{4}$ to 1 ($\frac{1}{4}$ horizontal and 1 vertical.)

2. Scaffolding of staging more than 4.0 m above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached or bolted, braced and otherwise secured at least 90 cm. (3ft.) high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such opening as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
3. Working platforms, gangways and stairways should be so constructed that they should not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.6 m (12ft.) above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (2) above.
4. Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 90 cm. (3ft.)
5. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9m. (30ft.) in length while the width between side rails in rung ladder shall in no case be less than 29 cm. (11½") for ladder upto and including 3 m. (10 ft.) in length. For longer ladders, this width should be increased at least $\frac{1}{4}$ " for each additional 30 cm. (1 foot) of length. Uniform step spacing of not more than 30 cm shall be kept. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites or work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lights to protect the public from accident and shall be bound to bear the expenses of defence of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in any such suit; action or proceedings to any such person or which may, with the consent of the contractor, be paid to compensate any claim by any such person.
6.
 - a. Excavation and Trenching - All trenches 1.2 m. (4ft.) or more in depth, shall at all times be supplied with at least one ladder for each 30 m. (100 ft.) in length or fraction thereof, Ladder shall extend from bottom of the trench to at least 90 cm. (3ft.) above the surface of the ground. The side of the trenches which are 1.5 m. (5ft.) or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5 m. (5ft.) of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances, undermining or undercutting shall be done.
 - b. Safety Measures for digging bore holes:
 - i. If the bore well is successful, it should be safely capped to avoid caving and collapse of the bore well. The failed and the abandoned ones should be completely refilled to avoid caving and collapse;
 - ii. During drilling, Sign boards should be erected near the site with the address of the drilling contractor and the Engineer in-charge of the work;

- iii. Suitable fencing should be erected around the well during the drilling and after the installation of the rig on the point of drilling, flags shall be put 50m around the point of drilling to avoid entry of people;
 - iv. After drilling the borewell, a cement platform (0.50m x 0.50m x 1.20m) 0.60m above ground level and 0.60m below ground level should be constructed around the well casing;
 - v. After the completion of the borewell, the contractor should cap the bore well properly by welding steel plate, cover the bore well with the drilled wet soil and fix thorny shrubs over the soil. This should be done even while repairing the pump;
 - vi. After the borewell is drilled the entire site should be brought to the ground level.
7. All necessary personal safety equipment as considered adequate by the Engineer-in-Charge should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate use, and the contractor should take adequate steps to ensure proper use of equipment by those concerned:- The following safety equipment shall invariably be provided.
- i. Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
 - ii. Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes, shall be provided with protective goggles.
 - iii. Those engaged in welding works shall be provided with welder's protective eye shields.
 - iv. Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
 - v. When workers are employed in sewers and manholes, which are in active use, the contractors shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public. In addition, the contractor shall ensure that the following safety measure are adhered to :-
- a. Entry for workers into the line shall not be allowed except under supervision of the JE or any other higher officer.
 - b. At least 5 to 6 manholes upstream and downstream should be kept open for at least 2 to 3 hours before any man is allowed to enter into the manhole for working inside.
 - c. Before entry, presence of Toxic gases should be tested by inserting wet lead acetate paper which changes colour in the presence of such gases and gives indication of their presence.
 - d. Presence of Oxygen should be verified by lowering a detector lamp into the manhole. In case, no Oxygen is found inside the sewer line, workers should be sent only with Oxygen kit.
 - e. Safety belt with rope should be provided to the workers. While working inside the manholes, such rope should be handled by two men standing outside to enable him to be pulled out during emergency.
 - f. The area should be barricaded or cordoned off by suitable means to avoid mishaps of any kind. Proper warning signs should be displayed for the safety of the public whenever cleaning works are undertaken during night or day.
 - g. No smoking or open flames shall be allowed near the blocked manhole being cleaned.
 - h. The malba obtained on account of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on account of slippery nature of the malba.

- i. Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Engineer-in-Charge shall decide the time up to which a worker may be allowed to work continuously inside the manhole.
 - j. Gas masks with Oxygen Cylinder should be kept at site for use in emergency.
 - k. Air-blowers should be used for flow of fresh air through the manholes. Whenever called for, portable air blowers are recommended for ventilating the manholes. The Motors for these shall be vapour proof and of totally enclosed type. Non sparking gas engines also could be used but they should be placed at least 2 metres away from the opening and on the leeward side protected from wind so that they will not be a source of friction on any inflammable gas that might be present.
 - l. The workers engaged for cleaning the manholes/sewers should be properly trained before allowing to work in the manhole.
 - m. The workers shall be provided with Gumboots or non-sparking shoes bump helmets and gloves non sparking tools safety lights and gas masks and portable air blowers (when necessary). They must be supplied with barrier cream for anointing the limbs before working inside the sewer lines.
 - n. Workmen descending a manhole shall try each ladder stop or rung carefully before putting his full weight on it to guard against insecure fastening due to corrosion of the rung fixed to manhole well.
 - o. If a man has received a physical injury, he should be brought out of the sewer immediately and adequate medical aid should be provided to him.
 - p. The extent to which these precautions are to be taken depend on individual situation but the decision of the Engineer-in-Charge regarding the steps to be taken in this regard in an individual case will be final.
- vi. The Contractor shall not employ men and women below the age of 18 years on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, the following precaution should be taken:-
 - a. No paint containing lead or lead products shall be used except in the form of paste or readymade paint.
 - b. Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint is dry rubbed and scrapped.
 - c. Overalls shall be supplied by the contractors to the workmen and adequate facilities shall be provided to enable the working painters to wash during and on the cessation of work.
 - vii. Workmen executing work on scaffolds or other structures above specified height shall be provided with full body harness and fall arresters.
8. An additional clause (viii)(i) of Central Public Works Department Safety Code (iv) the Contractor shall not employ women and men below the age of 18 on the work of painting with product containing lead in any form, wherever men above the age of 18 are employed on the work of lead painting, the following principles must be observed for such use :
- i. White lead, sulphate of lead or product containing this pigment, shall not be used in painting operation except in the form of pastes or paint ready for use.
 - ii. Measures shall be taken, wherever required in order to prevent danger arising from the application of a paint in the form of spray.
 - iii. Measures shall be taken, wherever practicable, to prevent danger arising out of from dust caused by dry rubbing down and scraping.

- iv. Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.
 - v. Overall, shall be worn by working painters during the whole of working period.
 - vi. Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.
 - vii. Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by medical man appointed by competent authority.
 - viii. Authority may require, when necessary medical examination of workers.
 - ix. Instructions with regard to special hygienic precautions to be taken in the painting trade shall be distributed to working painters.
9. When the work is done near any place where there is risk of drowning, all necessary equipment's should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision, should be made for prompt first aid treatment of all injuries likely to be obtained during the course of the work.
10. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions:
- i. (a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defects and shall be kept repaired and in good working order.
 - (b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.
 - ii. Every crane driver or hoisting appliance operator, shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding winch or give signals to operator.
 - iii. In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load each safe working load and the condition under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
 - iv. In case of departmental machines, the safe working load shall be notified by the Electrical Engineer-in Charge. As regards contractor's machines the contractors shall notify the safe working load of the machine to the Engineer-in-Charge whenever he brings any machinery to site of work and get it verified by the Electrical Engineer concerned.
11. Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Hoisting appliances should be provided with such means as will reduce to the minimum the risk of accidental descent of the load. Adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided. The worker should not wear any rings, watches and carry keys or other materials which are good conductors of electricity.
12. All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or

removed while it is in use. Adequate washing facilities should be provided at or near places of work.

13. These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.
14. To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Labour Officer or Engineer-in-Charge of the department or their representatives.
15. Notwithstanding the above clauses from (1) to (15), there is nothing in these to exempt the contractor from the operations of any other Act or Rule in force in the Republic of India.

Model Rules for the Protection of Health and Sanitary Arrangements for Workers Employed Contractors

1. APPLICATION

These rules shall apply to all buildings and construction works in charge in which twenty or more workers are ordinarily employed or are proposed to be employed in any day during the period during which the contract work is in progress.

2. DEFINITION

Work place means a place where twenty or more workers are ordinarily employed in connection with construction work on any day during the period during which the contract work is in progress.

3. FIRST-AID FACILITIES

- i. At every work place, there shall be provided and maintained, so as to be easily accessible during working hours, first-aid boxes at the rate of not less than one box for 150 contract labour or part thereof ordinarily employed.
- ii. The first-aid box shall be distinctly marked with a red cross on white back ground and shall contain the following equipment:
 - a. The first-aid box shall be distinctly marked with a red cross on white back ground and shall contain the following equipment
 1. 6 small sterilised dressings.
 2. 3 medium size sterilised dressings.
 3. 3 large size sterilised dressings.
 4. 3 large sterilised burn dressings.
 5. 1 (30 ml.) bottle containing a two per cent alcoholic solution of iodine.
 6. 1 (30 ml.) bottle containing salvolatile having the dose and mode of administration indicated on the label.
 7. 1 snakebite lancet.
 8. 1 (30 gms.) bottle of potassium permanganate crystals.
 9. 1 pair scissors.
 10. 1 copy of the first-aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.
 11. 1 bottle containing 100 tablets (each of 5 gms.) of aspirin.
 12. Ointment for burns.
 13. A bottle of suitable surgical antiseptic solution.
 - b. For work places in which the number of contract labour exceed 50. Each first-aid box shall contain the following equipments.
 1. 12 small sterilised dressings.

2. 6 medium size sterilised dressings.
 3. 6 large size sterilised dressings
 4. 6 large size sterilised burn dressings.
 5. 6 (15 gms.) packets sterilised cotton wool.
 6. 1 (60 ml.) bottle containing a two per cent alcoholic solution iodine.
 7. 1 (60 ml.) bottle containing salvolatile having the dose and mode of administration indicated on the label.
 8. 1 roll of adhesive plaster.
 9. 1 snake bite lancet.
 10. 1 (30 gms.) bottle of potassium permanganate crystals.
 11. 1 pair scissors.
 12. 1 copy of the first-aid leaflet issued by the Director General Factory Advice Service and Labour Institutes /Government of India.
 13. A bottle containing 100 tablets (each of 5 gms.) of aspirin.
 14. Ointment for burns.
 15. A bottle of suitable surgical antiseptic solution.
- iii. Adequate arrangements shall be made for immediate recoument of the equipment when necessary.
 - iv. Nothing except the prescribed contents shall be kept in the First-aid box.
 - v. The first-aid box shall be kept in charge of a responsible person who shall always be readily available during the working hours of the work place.
 - vi. A person in charge of the First-aid box shall be a person trained in First-aid treatment in the work places where the number of contract labour employed is 150 or more.
 - vii. In work places where the number of contract labour employed is 500 or more and hospital facilities are not available within easy distance from the works. First-aid posts shall be established and run by a trained compounder. The compounder shall be on duty and shall be available at all hours when the workers are at work.
 - viii. Where work places are situated in places which are not towns or cities, a suitable motor transport shall be kept readily available to carry injured person or person suddenly taken ill to the nearest hospital.

4. DRINKING WATER

- i. In every work place, there shall be provided and maintained at suitable places, easily accessible to labour, a sufficient supply of cold water fit for drinking.
- ii. Where drinking water is obtained from an Intermittent public water supply, each work place shall be provided with storage where such drinking water shall be stored.
- iii. Every water supply or storage shall be at a distance of not less than 50 feet from any latrine drain or other source of pollution. Where water has to be drawn from an existing well which is within such proximity of latrine, drain or any other source of pollution, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with a trap door which shall be dust and waterproof.
- iv. A reliable pump shall be fitted to each covered well, the trap door shall be kept locked and opened only for cleaning or inspection which shall be done at least once a month.

5. WASHING FACILITIES

- i. In every work place adequate and suitable facilities for washing shall be provided and maintained for the use of contract labour employed therein.
- ii. Separate and adequate cleaning facilities shall be provided for the use of male and female workers.

- iii. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition.

6. LATRINES AND URINALS

- i. Latrines shall be provided in every work place on the following scale namely
 - (a) Where female are employed, there shall be at least one latrine for every 25 females.
 - (b) Where males are employed, there shall be at least one latrine for every 25 males.Provided that, where the number of males or females exceeds 100, it shall be sufficient if there is one latrine for 25 males or females as the case may be upto the first 100, and one for every 50 thereafter.
- ii. Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings.
- iii. Construction of latrines: The inside walls shall be constructed of masonry or some suitable heat-resisting non-absorbent materials and shall be cement washed inside and outside at least once a year, Latrines shall not be of a standard lower than borehole system.
- iv. (a) Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men only" or "For Women Only" as the case may be.
 - (b) The notice shall also bear the figure of a man or of a woman, as the case may be.
- v. There shall be at least one urinal for male workers upto 50 and one for female workers upto fifty employed at a time, provided that where the number of male or female workmen, as the case may be exceeding 500, it shall be sufficient if there is one urinal for every 50 males or females upto the first 500 and one for every 100 or part thereafter.
- vi. (a) The latrines and urinals shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times.
 - (b) Latrines and urinals other than those connected with a flush sewage system shall comply with the requirements of the Public Health Authorities.
- vii. Water shall be provided by means of tap or otherwise so as to be conveniently accessible in or near the latrines and urinals.
- viii. Disposal of excreta: - Unless otherwise arranged for by the local sanitary authority, arrangements for proper disposal of excreta by incineration at the work place shall be made by means of a suitable incinerator. Alternately excreta may be disposed of by putting a layer of night soil at the bottom of a pucca tank prepared for the purpose and covering it with a 15 cm. layer of waste or refuse and then covering it with a layer of earth for a fortnight (when it will turn to manure).
- ix. The contractor shall at his own expense, carry out all instructions issued to him by the Engineer-in-Charge to effect proper disposal of night soil and other conservancy work in respect of the contractor's workmen or employees on the site. The contractor shall be responsible for payment of any charges which may be levied by Municipal or Cantonment Authority for execution of such on his behalf.

7. PROVISION OF SHELTER DURING REST

At every place there shall be provided, free of cost, four suitable sheds, two for meals and the other two for rest separately for the use of men and women labour. The height of each shelter shall not be less than 3 metres (10 ft.) from the floor level to the lowest part of the roof. These shall be kept clean and the space provided shall be on the basis of 0.6 sq.m. (6 sft) per head.

Provided that the Engineer-in-Charge may permit subject to his satisfaction, a portion of the building under construction or other alternative accommodation to be used for the purpose.

8. CRECHES

- i. At every work place, at which 20 or more women worker are ordinarily employed, there shall be provided two rooms of reasonable dimensions for the use of their children under the age of six years. One room shall be used as a play room for the children and the other as their bedroom. The rooms shall be constructed with specifications as per clause 19H (ii) a,b & c.
- ii. The rooms shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision of sweepers to keep the places clean.
- iii. The contractor shall supply adequate number of toys and games in the play room and sufficient number of cots and beddings in the bed room.
- iv. The contractor shall provide one ayaa to look after the children in the creche when the number of women workers does not exceed 50 and two when the number of women workers exceed 50.
- v. The use of the rooms earmarked as creches shall be restricted to children, their attendants and mothers of the children.

9. CANTEENS

- i. In every work place where the work regarding the employment of contract labour is likely to continue for six months and where in contract labour numbering one hundred or more are ordinarily employed, an adequate canteen shall be provided by the contractor for the use of such contract labour.
- ii. The canteen shall be maintained by the contractor in an efficient manner.
- iii. The canteen shall consist of at least a dining hall, kitchen, storeroom, pantry and washing places separately for workers and utensils.
- iv. The canteen shall be sufficiently lighted at all times when any person has access to it.
- v. The floor shall be made of smooth and impervious materials and inside walls shall be lime-washed or colour washed at least once in each year.
Provided that the inside walls of the kitchen shall be lime-washed every four months.
- vi. The premises of the canteen shall be maintained in a clean and sanitary condition.
- vii. Waste water shall be carried away in suitable covered drains and shall not be allowed to accumulate so as to cause a nuisance.
- viii. Suitable arrangements shall be made for the collection and disposal of garbage.
- ix. The dining hall shall accommodate at a time 30 per cent of the contract labour working at a time.
- x. The floor area of the dining hall, excluding the area occupied by the service counter and any furniture except tables and chairs shall not be less than one square metre (10 sft) per diner to be accommodated as prescribed in sub-Rule 9.
- xi. (a) A portion of the dining hall and service counter shall be partitioned off and reserved for women workers in proportion to their number
(b) Washing places for women shall be separate and screened to secure privacy.
- xii. Sufficient tables stools, chair or benches shall be available for the number of diners to be accommodated as prescribed in sub-Rule 9.
- viii. (a) There shall be provided and maintained sufficient utensils crockery, furniture and any other equipments necessary for the efficient running of the canteen.
(b) The furniture utensils and other equipment shall be maintained in a clean and hygienic condition.
(c) Suitable clean clothes for the employees serving in the canteen shall be provided and maintained.
(d) A service counter, if provided, shall have top of smooth and impervious material.

- (e) Suitable facilities including an adequate supply of hot water shall be provided for the cleaning of utensils and equipments.
- ix. The food stuffs and other items to be served in the canteen shall be in conformity with the normal habits of the contract labour.
- x. The charges for food stuffs, beverages and any other items served in the canteen shall be based on 'No profit, No loss' and shall be conspicuously displayed in the canteen.
- xi. In arriving at the price of foodstuffs, and other article served in the canteen, the following items shall not be taken into consideration as expenditure namely:
 - 1. The rent of land and building.
 - 2. The depreciation and maintenance charges for the building and equipments provided for the canteen.
 - 3. The cost of purchase, repairs and replacement of equipments including furniture, crockery, cutlery and utensils.
 - 4. The water charges and other charges incurred for lighting and ventilation.
 - 5. The interest and amounts spent on the provision and maintenance of equipments provided for the canteen.
- xii. The accounts pertaining to the canteen shall be audited once every 12 months by registered accountants and auditors.

10.ANTI-MALARIAL PRECAUTIONS

The contractor shall at his own expense, conform to all anti-malarial instructions given to him by the Engineer in-Charge including the filling up of any borrow pits which may have been dug by him.

The above rules shall be incorporated in the contracts and in notices inviting tenders and shall form an integral part of the contracts.

11. AMENDMENTS

Government may, from time to time, add to or amend these rules and issue directions - it may consider necessary for the purpose of removing any difficulty which may arise in the administration thereof.

12.EPIDEMIC SITUATION

In such situation contractor shall deploy special labour to keep the site, worker's hutments, rest rooms etc. neat and clean including sanitization. Contractor shall provide all epidemic related arrangements (at his cost following the guidelines issued by State/ Central Government in this regard).

D. DBR - SERVICES

PART-‘A’ **(ELECTRICAL-HT, LT & ELV)**

1. INTRODUCTION:

The purpose of this document is to understand and apply the pertinent input in analysis & design criteria for the electrical and MEP services execution.

The EPC contractor shall carry out Entire Design, Engineering, Supply, Installation, Testing & Commissioning of complete Internal & External Electrification works including Extra Low Voltage System (ELV) and allied services as required for smooth functioning of the **Construction of Residential Buildings for 5th Vahini U.P.S.S.F At Saharanpur (U.P.), India on EPC Mode** shall be designed and executed as per latest codes of practice for Electrical installations and meeting the requirements of Indian Electricity Rules/Act, applicable I.S. Codes/Rules and relevant I.S./CPWD/NBC Specifications, Special requirements of Electricity Board latest up to date.

The rating and capacity of equipment indicated herein below are minimum to be provided. However, during detailed designing, if required and found necessary, the capacity / rating of the equipment may be upgraded by the EPC Contractor.

All Electrical & Mechanical equipment shall be provided as per technical specification given. If not specified, it shall be provided as per related latest IS codes & CPWD specifications.

2. SCOPE OF WORK:

The contractor is required to execute all the items as per Scope of Work, Design Basis Report (DBR), Technical Specifications and Drawings etc. after obtaining all the statutory and mandatory Approvals / NOCs from various Government and others Like PMC Departments.

Electrical & Allied Services required for **Construction of Residential for 5th Vahini U.P.S.S.F At Saharanpur (U.P.), India on EPC Mode** covers: -

Internal Electrical Installations, LT Panels, Distribution Boards, External Electrical Installations, LT Building Cables, Solar Photo Voltaic Power Generation System, Geyser, Provisions compatibility in all equipment's for Integrated Building Management System Pressurization (where required) Lifts, Illuminated Signage, with complete functioning etc.

Suitable size shafts, cutouts, Niche, openings etc. shall be provided to facilitate installation of Rising Mains, Pipelines, Cable Trays, Ducts etc. in all floor slabs of various buildings for various service areas, as required. All shafts, cutouts, Niche, openings etc. provided on floor slabs shall be suitably closed after laying of services lines as per fire safety norms as per NBC 2016. Suitable doors shall be provided for all shafts at all floors as per fire safety norms stipulated in NBC 2016.

- **ELECTRICAL SAFETY:-**

The EPC Contractor shall have to insure and required to execute the entire Electrical & Allied Services confirming **BIS Code No. 5216: 1982** (Code of Safety Procedures and Practices in Electrical Works).

- **ELECTRICAL POWER DISTRIBUTION**

The Electrical Power Distribution for electric supply shall be as detailed below.

- Wiring & Conduiting PVC Conduits HMS IS: 9537: PART 3, M.S. for ELV for internal electrification, LV & Allied works.
- Each distribution system shall be with Electrical panels, sandwich/Air insulated rising mains, Floor panels, Double door MCB Type DB's, VTPN DBs etc.
- Various LT Panels & UPS panels shall be interconnected with each other with suitable change over switches / Bus coupler etc.
- Various buildings as required shall have a LT room/space to receive power from the substation

through armoured cable and distribute power to the entire building through a Main LT Panel located in the LT room.

- Each building shall have suitable Nos. of Ducts for Rising Mains catering to loads of Lighting, Power, etc. connected to Main LT Panel, as applicable.
- Each Rising Mains (sandwich/Air Insulated Compact Type) must have double Earth Strip running from bottom to top.
- Sub mains from floor panel to DBs shall be connected with armoured cable on surface/cable tray or concealed in slab inside conduit.
- Hot Dip Galvanized Perforated Type / Ladder Type Cable trays of suitable size with perforation not more than 17.5% shall be provided as required in all the buildings.
- The power cabling shall be sized so that the distribution losses do not exceed 3% (in terms of %voltage drop) of the total power usage in buildings. Voltage drop for feeders shall not exceed 2% at design load and for branch circuit; it shall not exceed 3% at design load as per ECBC norms.
- All Outgoing in Budling Panel must have Multifunction meter with CL 1 CT.
- Gas Based fire suppression system shall be provided in lift Panel.
- *All LT Panel shall be compatible for Grid Connected Roof Top Solar System.*

- **ELECTRIC BUILDING PANEL**

All building Panels with incomers 630A or more shall be as per **IEC 61439-1 & 2** and internal arctests as per **IEC 61641 V2**, 36/50/65kA for 0.5 sec tested at HBB, VBB and Cable termination chambers. Panel shall be **form 4b** design and shall be (Type Tested assembly –TTA) CPRI/ERDA /Independent international test house tested for all the tests and as

Per technical specifications. All tested assemblies shall be smart type having switchgears (ACB, MCCB) communicating their release data over Ethernet/Modbus. All Panels should be Ethernet/Modbus ready for suitable for monitoring and control with BMS system Provisions. Suitable BMS integration cards shall be provided to achieve BMS compatibility of LT Panels.

Suitable size MS Chequer Plates, minimum thickness 12 mm, duly painted shall be provided for trenches inside the panel room as required. Hot Dip Galvanized Cabletrays of suitable size shall be used as required.

All Substation Floor panel Rooms shall be provided with safety equipment/items like Suitable elastomeric mat (as per relevant IS codes), fire buckets, fire extinguishers (trolley mounted), hand gloves, danger Plates (LT rating), safety charts, framed Schematic/SLD etc. Suitable civil foundation/ trenches etc. for all substation equipment shall be provided as per design load of respective equipment.

All LT Panels shall have more than 20% spare outgoing feeders of different rating and Min.1 outgoing should be of higher rating.

The accuracy class of CT & PT, CT & PT ratio of metering panel and as per the state **Electricity Board/ CEIG/CEA** requirements.

PANEL NECESSARY FEATURES

- Panel fabrication shall be done with 2mm CRCA sheet steel for outer body and 3mm thick structure part.
- Breakers (ACB, MCCB, MCB etc.) specification shall have to comply breakers specification mentioned in “**Technical Specification for Electrical works**” Medium voltage panels for all TTA and Non-TTA panels along with VTPN DB & Rising Mains Incomer.

- Minimum 20% spare outgoing in which 1 breaker shall be of higher rating shall be provided with each type panel. All outgoing will have multifunction meter and class 1.0 CT.
- Undrilled gland plates shall be 3mm thick. The gland plates shall have knockable type holes of suitable diameter of cable glands. Minimum 30% extra knockable holes shall be provided on each gland plate. Non-magnetic gland plates shall be used where single core cables are used for three-phase supply.
- The enclosure shall conform to IP65 protection for outdoor panels and IP43 for indoor panels.
- The Panel shall be dust, vermin, corrosion proof and shall be mechanically stable to take the mechanical load of complete assembly with all fixed and moving components.
- The panel shall have appropriate protection against mechanical impact of rating IK 9 or better.
- The panel shall be extendable from both sides.
- The terminal blocks shall be provided at convenient location for cable termination. The distance between the terminal strip and gland plate shall be kept in such a way that the cables can be properly dressed & no cable tension is transferred on the terminal strip /or equipment.
- Proper grouting arrangement shall be made in panel for installation of panel in accordance with seismic requirement.
- Complete panel assembly shall be fixed on **ISM-100**.
- The design shall ensure generous availability of space for ease of installation and maintenance of cabling, and adequate safety for working in one vertical section without coming into accidental contact with live parts.
- Front and rear doors should be fitted with synthetic rubber or neoprene gaskets with fasteners designed to ensure proper compression of gaskets.
- All sheet steel work forming the exterior of switch boards shall be smoothly finished, levelled and free from flaws. The corners should be rounded. The apparatus and circuits in the panels shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary degree of safety.
- Panel shall be constructed in Form-3b.
- All sheet steel work used in construction of panels shall be given for proper shot blasting/surface finish to make it free from all rusts/impurities/deposits.
- It shall be then provided with two primer coat and then/powder coated (electro-statically) with final paint shade **RAL7032 as per IS – 5**.
- It shall be the process of Powder Coating with suitable primer and having total coating thickness of 85-100 micron. The M.S Sheet Steel shall be given for proper shot blasting / surface finish to make it free from all impurities.
- EPDM Gasket or its higher substitute shall be used to make panel & DB dust free.
- Bus Bar shall be electrolytic grade Aluminium material for Building Panel and Rising Mains considering .8 amp/sq mm.
- HFFR wire shall be used for internal wiring.
- All panel outgoing must have shall have multi-function/Tri-vector meter along with LED indication lamp.
- Current transformer shall cast epoxy / resin type with copper windings and good quality ferromagnetic core.

- CT Class shall be 1 for protection & .5 for metering & Burden shall be 15 VA.
 - CT shall be Class F Insulation.
 - ACB shall be EDO & communicational type other specification as per the Technical Specification of the Electrical Works.
 - All panel shall be equipped with station class SPD (surge protection device).
 - Min. IP 43 degree of protection shall be for all indoor panels.
 - All panels shall be based on internal arc test at .1 sec as per IEC-62271.
 - Danger sign board shall be there in front door of panel.
 - All sheet steel work used in construction of panels should have undergone a rigorous metal treatment **9 tank process or better** as mentioned below.
 - a) All sheet steel work shall be phosphate in accordance with the procedure in accordance with relevant standards for phosphatizing iron and steel. Oil, grease and dirt shall be thoroughly removed by emulsion cleaning.
 - b) Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.
 - c) A recognized phosphate process to facilitate durable coating of the paint on the metal surface and also to prevent the spread of rusting in the event of the paint film being mechanically damaged. This again, shall be followed by hot water rinsing to remove traces of phosphate solution.
 - d) After phosphatizing through rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying.
 - e) Passivation in de oxalate solution to retain and augment the effects of phosphatizing.
- All tested assemblies shall be smart type having switchgears (ACB, MCCB) communicating their release data over Ethernet/Modbus. All Panels should be Ethernet/Modbus ready for suitable for monitoring and control with BMS system Provisions. Suitable BMS integration cards shall be provided to achieve BMS compatibility of LT Panels.

Suitable capacity of separate UPS is to be installed for substation critical and auxiliary load requirement.

- All armoured LT power cables, control cables, telephone cables, signal cables etc. shall be laid under Ground preferably along the roads & pathways at suitable depth as per CPWD specifications. Adequate no. of Hume pipes/ DWC HDPE Pipes having suitable diameter with spare shall be laid across the Roads/Pathways etc. All cables for UPS Incoming and outgoing must be copper cable.
- Panel Rooms shall be provided with safety equipment/items like Suitable elastomeric mat (as per relevant IS codes) hand gloves, danger Plates (LT rating), safety charts, framed Schematic/SLD etc.
All LT shall have minimum 20% spare outgoing feeders of different rating and Min.1 outgoing should be of higher rating.
- **EARTHING NETWORK:**

Earthing with GI Plate Earthing System & Copper Plate Earthing system (only), as required, shall be provided for earthing of Electrical Panel Boards, LPS, Solar and other Equipment /installations in each building. Earthing shall be in conformity with provisions of **Indian Electricity Rules 1956 & as per IS-3043 & IEEE 80** as amended up to date. Copper/GI earth strips shall be used for connecting the Electrical equipment's with Earth pits as per prevalent norms. Earth Leakage circuit breakers/RCBO

shall be provided in the DBs for individual units.

Copper Earth strips and Copper Electrode Earth Pits shall be provided for LPS Earthing of roof top solar system. Copper Earth strips and Copper Electrode Earth Pits shall also be provided for all Equipment or as per OEM recommendations.

Earthing shall be carried out for all power distribution system and effectively bonding the equipment. Separate and dedicated earthing (2 Nos.) with copper electrode earthpits and suitable size copper earthing strips (as recommended by OEM) shall be provided for Lighting Protection System.

- **LIGHTNING PROTECTION SYSTEM:**

Lighting protection of various buildings shall be provided as per IS/ IEC-62305- 1:2010 (latest as amended), CPWD Specifications and NBC 2016 norms. The main and most effective measure for protection of structures against physical damage is considered to be the lightning protection system (LPS). An external LPS which consists of air- termination system, down-conductor system and earthing system is intended to:

- a) Intercept a lightning flash to the structure (with an air-termination system),
- b) Conduct the lightning current safely towards earth (using a cu. down-conductor system) and,
- c) Disperse the lightning current into the earth (using an earth-termination system).

Accordingly, a standard lightning protection system will be provided in all the buildings as per NBC 2016 Standards, using single prone finials, horizontal and down corner Copper earthing strips of suitable size, terminating in the Copper Plate Earth Pits. Aviation Obstruction Light (AOL) shall be provided in buildings where it's required as per Civil Aviation regulations, NBC norms & CPWD Specifications as applicable.

- **INTERNAL & EXTERNAL ELEC. WORKS)**

1. Following works shall be carried out in coordination with the civil work within the buildings complete in all respects as per latest IS Codes and CPWD Specifications.

- LED Light fixtures, minimum **BEE-5 Star rated Fans** (BLDC) shall be used.
- All LED Light Fixtures shall be UP PWD **Cat AAA**.
- Fans shall be provided with remote control for premium locations like Chief officer's rooms, room, Meeting rooms, seminar hall etc.
- 6A Light Point /UPS Modular Switch & Socket Outlets.
- 16A/ 20A Power/UPS Modular Switch & Socket Outlets
- L.T. Cables and Sub main wiring, circuit wiring.
- GI perforated Cable Trays
- Floor Panels, Distribution Boards & VTPN DB's. shall have double Earthing.
- All cables /Wires used in Emergency Lighting, Lifts, Fire Alarm and PA System etc shall be Fire Survival Cable.
- Internal electrification covers all Electrical, ELV works/activities up to 1 meter outside of the building works.
- External electrification covers all Electrical, ELV works/activities of entire campus except inside the buildings works.

2. Following points shall be generally followed for internal and external electrification of various areas:

- Internal areas like rooms, corridors, lobbies, staircases, terraces, washrooms etc. of all buildings and blocks shall be adequately illuminated conforming to provisions stipulated in NBC 2016,
- EV Charger Provision (MODE-3, 7.5 kw) shall be provided in car parking area.
- **ECBC and CPWD** technical specifications (TABLE 11, recommended Values of illumination as per **BIS: 3646 Part-II**) maintaining the indicated Lux levels and Light Power Density.
- The maximum number of PVC insulated aluminium /copper conductor cable of 1100 volt grade can be drawn in one conduit of various size shall be as per Table Number **4.1** under **clause 4.3.1** © CPWD General Specifications or Electrical Works Internal Part -1 2023.
- Saddles for fixing conduits shall be heavy gauge its width and thickness/Diameter shall be as per **Table number 5.1, 5.2 CPWD PART -1 Electrical.**
- All accessories shall be ISI marked only and shall confirm **IS 3419 :1988**
- The Internal Electrification work shall be carried out with HMS PVC conduits when recessed & with heavy gauge MS conduit when laid in surface. The Internal Electrification work shall be carried out in accordance with CPWD General Specifications for **Electrical Works Part-I (Internal) -2023 and Part-II (External)** with up-to-date amendments.
- ELV shall be executed in MS conduit only if laid on surface.
- PVC Conduits shall be surface mounted or laid on GI angle/channels with suitable hanging GI supports in areas wherever there is false ceiling provision. In case there is no provision for false ceiling, PVC Conduits shall be concealed in concrete during slab casting. Wiring for lighting/power shall be generally done in PVC Conduits whereas wiring for LV works shall be generally done in PVC conduits unless stated otherwise.
- HFFR PVC insulated Copper conductor wires will be used for Points, Circuit & Sub- main wiring conforming to relevant **IS-694 Codes / CPWD Part-I**. Wiring shall be carried out with following sizes of PVC insulated HFFR multiple stranded single core **class -2 copper** conductor wire/cable satisfying the resistance requirements of **NEC 2023 Part 1 Section 17,**

A. Light Point - 1.5 sq.mm

B. Lighting circuit -2.5 sq.mm

C. Ceiling /Cabin/Exhaust Fan Point - 1.5 sq.mm

D. Call Bell Point - 1.5 sq.mm

E. 6A Plug Point/ UPS Computer outlets (up to 3 outlets on one circuit.) - 4 sq.mm

F. General Power Point - 4 sq.mm

G. Industrial Socket with 20A DP MCB for Geysers - 6 Sq.mm

H. 20A Industrial Socket Outlet - 6 Sq.mm

I. Special Power Point - 6 Sq.mm

J. A/C Industrial Socket with 32A DP MCB - 6 Sq.mm

K. All earthing wire and cable shall be double Run (unless otherwise specified) and in same size of phase conductor.

L. Sub Main wiring from VTPNDB/ Floor Panel to DB: -

- For DB Incomer Size 25 A DP - 2RX6 Sq.mm + 1R X6 Sq.mm
- For DB Incomer Size 32/40 A DP - 2RX10 Sq.mm + 1R X10 Sq.mm
- For DB Incomer Size 63 A DP - 2RX16 Sq.mm + 1R X16 Sq.mm
- For DB Incomer Size 25 A 4 Pole - 4RX6 Sq.mm + 2R X6 Sq.mm / 4CX 6 sq.mm XLPE insulated copper cable
- For DB Incomer Size 32/40 A 4 Pole - 4RX10 Sq.mm + 2R X10 Sq.mm / 4C X 10 sq.mm XLPE insulated copper cable
- For DB Incomer Size 63 A 4 Pole - 4RX16 Sq.mm + 2R X16 Sq.mm / 4C X 10 sq.mm XLPE insulated copper cable
- Colour coding shall be followed in wiring:
 - Phase : Red/Yellow/Blue. (Three Phase wiring)
 - Live : Red (Single phase wiring)
 - Neutral : Black
 - Earth : Yellow/Green.
- Agency shall execute the work after obtaining necessary approval of the layout for internal electrification of buildings. The stair case lighting shall be in group control system.
- Modular type switches, sockets and stepped type electronic fan regulators, bell push button along with matching mounting boxes.
- Colour coding of the conduits, switches, sockets shall be provided for Normal & UPS power supply as per **NBC 2016**.
- TV Outlet point wiring shall be terminated in suitable size of G.I. box along with splitter boxes at every floor. The interconnection of all splitter boxes fixed at all floors shall be done properly with conduits to form proper distribution system with the prior approval of Engineer-in-charge.
- LED Type Lighting Fixtures for internal and external Lighting with inbuilt harmonic suppression mechanism shall be provided.
- Suitable size & capacity Ceiling Fans/ Wall Fans (**White/Off White color 5 Star Rated Energy Efficient as per latest ECBC**) shall be provided in the rooms and areas of various buildings as required, where there is provision neither for air- conditioning nor for forced ventilation as directed by Engineer-In- Charge. Accordingly, Ceiling Fans/ Wall Fans shall be provided in Buildings, all STP/ETP/Fire Fighting Pump Rooms, Security Room etc.
- Separate shafts shall be provided for laying of pipes for Electrical, ELV, Mechanical and Fire Services.
- Laying of DWC HDPE / Hume pipes for road crossing or in pucca portion & CC path etc. for electric / telephone street lighting cables complete with adequate number of cable chambers shall be provided by the agency.
- After completing the work, necessary test results as in latest CPWD General Specifications Part-I (Internal) & Indian Electricity Rules, shall be recorded and submitted. The results shall be within the permissible limits.
- Aviation Lights (LED Type) shall be provided on buildings and structures as per prevalent norms & **IS-& Civil Aviation Codes**.

- PVC Raceways (SS 304 or SS 316) with all accessories shall be provided in ELV Rooms of various buildings as per requirements.
- Suitable illumination with LED light fixture shall be provided on terraces of Building.
- Power Points, Telephone Points (with telephone instrument as required) shall be provided for all work station.
- Requisite size of Raceways/ PVC conduit shall be provided in slabs with suitable size Junction boxes with SS cover plate, fillers, wherever required for drawing the wires and cables (Telephone / Power Points) for the work stations.
- Industrial weather proof sockets (single phase and three phase) shall be provided in the dampness/moisture walls.
- All shafts / ducts carrying service lines shall be provided with access platforms / ladders for easy maintenance.
- Building shall have suitable Nos. of rising mains for catering to loads of Lighting, Power etc. connected to Main/building LT Panel, as applicable.
- Rising main shall be sandwich/Air insulated type and have Tap off at every floor, feeding the floor panels / DBs/VTPV DBs with incoming & outgoing MCCBs of required capacities and number feeding the double door DBs/VTPN DB's.
- All distribution boards shall be made of CRCA sheet of minimum thickness of 1.6 to 2 mm.
- Sub mains from panel to DBs shall be connected with armoured cable on surface / cable tray.
- Hot Dip Galvanized Perforated Type / Ladder Type Cable trays of suitable size with perforation not more than 17% shall be provided as required in the building.
- The power cabling shall be sized so that the distribution losses do not exceed 3% of the total power usage in buildings. Voltage drop for feeders shall not exceed 2% at design load and for branch circuit; it shall not exceed 3% at design load as per ECBC norms.
- Meter Box with energy meters (single / double source) shall be provided to each flat/Residence.
- Contractor must follow the internal views of the project and all the points façade will be provided exactly the same unless otherwise any change is not recommended by PMC/Engineering-In-Charge.
- TV & Telephone points with wiring and rack shall be given in each residence as per the CPWD PAR-2025.

JOINTS IN WIRING:

- No bare conductor in phase and/or neutral or twisted joints in phase, neutral, and/or protective conductors in wiring shall be permitted.
- There shall be no joints in the through-runs of cables. If the length of final circuit or sub main is more than the length of a standard coil, thus necessitating a through joint, such joints shall be made by means of approved mechanical connectors in suitable junction boxes.
- Termination of multi stranded conductors shall be done using suitable crimping type thimbles.

CAPACITY OF CIRCUITS:

- Lighting circuit shall feed light/fan/call bell points. Each circuit shall not have more than **800 watt** connected load or more than **20 points** whichever is less. Power circuit in residential building will have only one outlet per circuit.
- Each power circuit in residential building can feed following outlet as per CPWD specification: -
- Load more than 1 KW shall be controlled by suitable rated MCB and cable size shall be decided as per calculations.

SWITCH BOX:

- Switch box (1.6 mm) shall be hot dip galvanized, factory fabricated, suitable in size for surface/recess mounting and suitable in size accommodating the required number of switches and accessories (where required to be used for application other than modular switches/ sockets).

SWITCH BOX COVER, MODULAR SWITCHES & SOCKETS:

- Modular Type approved shade shall be used for switch box covers **CPWD PART -1 INTERNAL 2023.**

CEILING ROSE:

- A ceiling rose shall not be used on a circuit, the voltage of which normally exceeds 250V.
- Only one flexible cord shall be connected to a ceiling rose. Specially designed ceiling roses shall be used for multiple pendants.
- A ceiling rose shall not embody fuse terminal as an integral part of it.

- **LIGHTING DESIGN & LIGHTING FIXTURE:**

LED lighting fixtures (Cat AAA Only) shall be provided for internal and external Lighting However, Min. 10-20% Light Fixture shall be fed with UPS power in all rooms and areas (except residential).

- **ROOF TOP SOLAR PHOTOVOLTAIC POWER GENERATION SYSTEM:**

Grid Connected Input and Output supply shall be taken from the solar system, civil work shall be extra as mentioned below, and Solar panel must be MNRE approved. The EPC Contractor for approval from department & Engineering In-charge shall provide shop drawing with data sheet. **ECBC latest norms to be followed.**

Design, fabrication, Supply, Installation, Testing and Commissioning of Roof Top Solar Photovoltaic System Power Generation Plant having minimum generation capacity **210 Kw** using suitable rating Multi/Mono Crystalline Silicon PV Cells/ Modules & accessories conforming to IEC 61215 Ed-2 or latest & IEC 61730 part-1 & 2, Grid Connected Solar Power Plant Solar System with all below items. Roof Top Solar can be installed on the roof of the buildings and it can be centrally operated for following buildings and for that all necessities' arrangements are to be done by EPC Contractor. System will IEC comply as per MNRE Guide lines. The Systems include following Items/Equipment, Module Technology-Poly Crystalline, Considered Indian modules SCADA, BMS and Power Management Tool, Module Mounting Structure, civil part. BOS for (200+30) KWp (System Copper Cables, Junction Box, Surge Protection, ACB, MCCB, AC-DC DB, Earthing System etc.) along with Design.

The General assumption for SPVS design shall be as below:

- a) Inverter Efficiency = 95%
- b) Solar Efficiency = 80%
- c) Solar availability = 6 cathrs/day
- d) Latest version of the specification shall be referred to.

| | |
|----------------------------------|--|
| IS: 12834:1988 (reaffirmed 2000) | Solar Photovoltaic Energy Systems – Terminology |
| IEC: 61215 Ed 2 or Latest | Crystalline silicon terrestrial photovoltaic (PV) modules– Design qualification and type approval |
| IEC: 61730 Pt. 1 & 2 | Photovoltaic (PV) module safety’ qualification – Part 1: Requirements for construction Part 2: Requirements for testing |
| IEC: 61701 | Salt mist corrosion testing of photovoltaic (PV) modules. |
| IEC: 60904-1(2006) | Photovoltaic Devices- Part-1S: Measurement Of Current-Voltage Characteristic. Photovoltaic |
| IS: 9000 | Basic environmental testing procedure for electronic Electrical items. |
| IEC 61723 Ed1.0 | Safety Guidelines for grid connected photovoltaic systems mounted on the buildings |
| IEC: 60068 | Environmental testing |

The support structure, design and foundation shall normally be designed to withstand wind speed upto 169 km ph. The module shall perform satisfactorily and withstand gust up to 200 Km/h from backside of panel. Geographical data of data may be considered for design to get optimum generation of Solar PV System. It is proposed to install the solar panel to generate the electrical power. The solar panel shall be provided as per government regulation.

Building Wise Capacity

- Type – A - 50 Kwp.
- Type – B - 50 Kwp. /Tower
- Type – IV - 10 Kwp.

TERRACE FLOOD LIGHTING:

High efficiency LED lighting fixtures (IP-66) -150 WATT (**CAT AAA**) (color temperature – warm white) shall be provided for terrace down lighting, compound/landscape lighting including the lighting control /operation for terrace Lighting shall be automatically controlled with digital timer control switch through outdoor type Feeder Panels.

CABLES:

Supply, installation, storing, laying, fixing, jointing / termination, testing and commissioning of Medium Voltage XLPE insulated extruded PVC inner sheathed PVC overall Sheathed armored aluminum/ copper conductor cables laid in built up trenches, directly buried underground OR laid in shaft, on wire Mesh G.I. cable trays, in pipes, clamped directly to Cable tray /wall or Structures etc. as called for in the drawing. All sizes of Cable & wire testing will be done twice in presence of department & consulting agency in govt. lab as per the Relevant IS Code and the cost for the testing purpose will bear by contractor the contractor will be allowed to install only after getting satisfactory reports. (Sample shall be taken randomly from the Lots.)

a) Rating: -The cables shall be rated for a voltage of **1100 Volts**.

Core Identifications:

Cores shall be provided with the following color scheme of PVC insulation

- Single Core : Green yellow for earthing.
- Two Cores : Red and Black, Blue & Black, Yellow & Black.
- Three Cores : Red, Yellow & Blue
- Four Cores : Red, Yellow, Blue & Black

SELECTION OF CABLE:

Cables sizes shall be selected considering the current carrying capacity, voltage drop, maximum short circuit duty and the period of short circuit to meet the present and future anticipated loads.

While deciding cable sizes, the de-rating factors for type and depth of laying, grouping, ambient temperature, ground temperature and soil resistivity shall be taken into account.

STANDARDS: -

The following standards and rules shall be applicable: -

IS 1554: - PVC insulated (heavy duty) electric cables Part I for working voltages up to and including 1100 V.

IS 8130: - Conductors for insulated electric cables and flexible cords.

IS 3961: - Recommended current ratings for cables :(Part 2) PVC Insulated and PVC sheathed heavy duty cables.

IS 5831: - PVC insulation and sheath of electric cables.

INSPECTION:

All cables shall be tested inspected at manufacturer's works. However, upon receipt at site cables shall be checked for physical damages during transit. Cable shall be tested before laying and before termination.

JOINTING OF CABLES: -

All cable joints shall be made in suitable, approved cable joint boxes, jointing of cables in the joint boxes and the filling in of compound shall be done in accordance with manufacturer's instructions and in an approved manner. All straight joints shall be done in epoxy mould boxes with epoxy resin (Trampoline/M-Seal resin or approved equal). All jointing accessories shall be of CCI/INCAB or approved equal. All terminal leads of conductors shall be heavy soldered up to at least 50mm length. All cables shall be joined color to color and tested for continuity and insulation resistance before jointing commences. The seals of cables shall not be removed until preparations for jointing are completed. Joints shall be finished on the same day as commenced and sufficient protection from the weather shall be arranged. The conductors shall be efficiently insulated with high voltage insulating tape and by using spreaders of approved size and pattern. The joints shall be completely filled with epoxy compound and tapped so as to ensure that the box is properly filled.

Epoxy compound shall be filled as follows:

Equal quantities of resin and hardener shall be mixed thoroughly by hand until the mixture is free

from white patches and has uniform color. No water, oil or any other liquid shall be added to the mixture to make it soft as this will affect the properties of the compound. The mixture shall be used within 30- 40 minutes of mixing. The surface on which epoxy compound is to be used, shall be free from dust, rust, oil, grease and shall be dry. The joint shall neither be disturbed nor moved till the epoxy compound is completely hardened. A smooth surface can be made by rubbing a damp cloth smoothly on the compound before it sets. The joints shall be painted after it has completely hardened.

Alternatively, ***ready mix of epoxy cable jointing compound may also be used.***

All underground cables and cable joints shall be marked on the surface by markers generally manufactured and tested to the requirements of relevant ISS. Approved CI cable markers shall be provided at every 30m along the route of the cables and at both ends of road crossing, indicating cable joints and cables as applicable. Special CI markers shall be provided at all buried cable joints indicating "Electrical Cable Joints". CI plates duly engraved with the size of the cable and the place it serves shall be tied to the cable at regular intervals of 5m for easy identification of cables.

Cable Tags: Cable tags shall be made out of 2 mm thick aluminum sheets, each tag 32 mm in dia. with one hole of 2.5 mm dia. 6 mm below the periphery shall be provided for clamping the same with cables. Cable designation is to be punched with letter/number punches and the tags are to be tied to cables with piano wires of approved quality and size. Tags shall be tied inside the panels beyond the glands as well as below the glands at cable entries. Along trays, tags are to be tied at all bends on straight lengths, tags shall be provided at every 5 meters.

Route markers

- a) Location Route markers shall be provided along the cables at locations approved by the Engineer-in Charge and generally at intervals not exceeding 100m. Markers shall also be provided to identify change in the direction of the cable route and at locations of underground joints.
- b) Plate type marker Route markers shall be made out of 100mm x 5mm GI/aluminum plate welded/bolted on 35mm x 35mm x 6mm angle iron, 60cm long. Such plate markers shall mounted parallel to and at about 0.5m away from edge of the trench.
- c) CC marker Alternatively, cement concrete 1:2:4 (1 cement: 2 sand: 4 graded stone aggregate of 20mm in size) as shown in figure 2 shall be laid flat and centered over the cable. The concrete markers, unless otherwise instructed by the Engineer-in-Charge, shall project over the surrounding surface So as to make the cable route easily identifiable.
- d) Inscription The words 'CPWD-MV/HV CABLE' as the case may be inscribed on the marker

• EXTRA LOW VOLTAGE (ELV) SYSTEM

Telephone System

Provision of telephone system in each room with 4 core annealed copper telephone cable with RJ 11 modular jack & Rack will be given.

Tv System

This specification covers the design, supply, installation, testing, and commissioning of a Cable Television (CATV) distribution system (without TV) for residential buildings.

The system shall distribute RF television signals from the cable service provider to all designated TV outlet points. The Cable TV system shall include:

- Incoming CATV service feed
- Main distribution cabinet
- RF amplifiers

- Splitters/taps box
- RG6 coaxial cable network
- TV outlet points
- Grounding and surge protection

30. LIFTS WORKS

GENERAL

The EPC Contractor shall carry out Design, Engineering, Supply, Installation, and Testing & Commissioning of Lift Works. Passenger Lifts, etc. shall be provided for buildings in the campus. The installation shall be carried out as per rules & regulation of local bodies and IS Codes that governs the requirement of installation of the lift, NBC2016. The voltage and frequency of the supply shall subject to variation permissible under Indian Electricity Act and Rules.

| S.NO. | BUILDING/ BLOCK | 13 Pax (1.5 M/SEC.) (Normal/Fire Lift) | Goods Lift 1500 Kg 0.5 M/Sec. |
|-------|----------------------|--|----------------------------------|
| 1. | TYPE-A (G+13) | 2 | 1 |
| 2. | TYPE-B (G+13)/ BLOCK | 2 | 1 |

Note:

- Lift Well, Car Size, Lift Pit Depth, Overhead, and Clear Entrance Width & Height dimensions shall conform to NBC 2016 or OEM Standards/ recommendations. All lifts shall be Gearless Type with Machine room & Centre Opening.
- Anti-skid SS Chequered plate flooring of suitable thickness shall be provided in all the lifts.
- Car enclosure & doors shall be made out of SS sheet of required thickness.
- All lift shall have necessary provisions & door opening as required for physically challenged person.
- Power supply to each elevator shall be connected with dual source. One elevator from each bank of elevators shall be key operated to be used as fireman's lift as per code.
- Lift Car operating Panel shall be equipped with Braille buttons. Automatic rescue device and emergency lighting shall be provided in each elevator supported by independent rechargeable batteries.
- Lifts shall be complete in all respect as per technical specifications and directions of Engineer-in-Charge.
- All specification should meet out with CPWD Lift Works publication unless otherwise specified.

31. PRESSURIZATION & MECHANICAL VENTILATION SYSTEM

The system shall be provided as per National Building Code of India- 2016 and requirement of the local body, CPWD General Specifications for Heating, Ventilation and air conditioning work-2017 and relevant I.S Codes;

The system shall be designed and provided to achieve rate of air change in various ventilated areas for complete building as prescribed in NBC-2016 and local building bye-laws/ site requirements.

All the fan motors which will operate in normal mode shall have IE-3 efficiency. The fan motors required to be operated during fire mode shall be minimum IE-2 efficiency.

The Staircase, Lift Lobby, Lift Well pressurization & both basement ventilation shall be designed and provided as per provisions given in NBC 2016 and Local by laws. Scope of works include GSS ducting, grills, louvers and all associated works and shall be executed as per CPWD specifications; The pressurization system shall be integrated with fire alarm system for automatic operation on

command from fire detection system. Fresh air supply unit for each toilet shall be provided.

- **EMERGENCY LIGHT & ILLUMINATED SIGNAGE**

Emergency Light and Signage shall be provided in all building and campus.

Exit signs shall not exceed 5 W per phase as per ECBC-2017; Self-contained rechargeable emergency exit light with minimum 6 hours battery backup; IP 20 rated; Confirms to IS: 10322 (part-5 / sec1): 2012, Single side / Double side facia as per requirement of location installed in entire campus & Buildings/Blocks.

- **EV CHARGING STATION:**

EV charging station (**20 Points Provision**) As per specifications and in Compliance to relevant IS codes etc.

Light EV AC Charger (Mode-3) Power : 7.5 kW, Input power supply: 1phase 230 +10% Volt, output supply: 230 Volt AC, Frequency:50 Hz +/-3%, Operational temperature range : -25 to 55 degree C (outdoor), -5 to 55 degree C(Indoor)., RH upto 95%, Charging Device as per IS-17017-22-1 EV-EVSE Communication: as per relevant IS Codes, Bluetooth Low Energy, one Charge Point Plug/ Socket as per IS60309 and IS-17017-2, Vehicle Inlet/ Connector As per EV manufacturer, suitable for 2 Wheelers and 4 wheelers. Indoor use: at least IP41; Outdoor use: at least IP44. Mechanical Strength: protection of the external enclosure against mechanical impact shall be IK08 according to IEC 62262.O/L, S/C protection. Insulation Resistance > 1 M Ω . Cable Length: 7.5 m. RCD having a rated residual operating current not exceeding 30 mA; Separate RCD for multiple outputs. Telecommunication port of the EV supply equipment according to IS 13252 (Part 1): 2010. OCPP (Open charge point protocol) 1.6J upgradable to ocpp 2.0. Device Should follow 17017 series of IS codes in general and the installation of the system shall comply with relevant IS Codes.

- **GEYSER WORKS**

25-litre geyser can handle 8-10 bar pressure effortlessly and should making it ideal for high-rise apartments. Its custom-built anode rod protects against hard water, extending the lifespan of this bathroom geyser by years. Featuring a 2000W heating element and a Blue Diamond glass-lined tank, this 5-star rated geyser offers 2x corrosion resistance for lasting performance and comfort. Long-lasting build for reliability with a glass-coated heating element water heater resists scale and sediment, reducing maintenance needs. Built for longevity with 5-year warrantee.

Building wise Quantity

1. Type – A – 224 Nos.
2. Type – B - 672 Nos.
3. Type – IV - 35 Nos.
4. Type – V - 07 Nos.

- **CODES & STANDARDS**

The design engineering manufacturing and the installation shall be in accordance with established codes, sound engineering, practices, and specifications and shall conform to the statutory regulations applicable in the country. EPC Contractor shall obtain all approvals from statutory authorities' e.g. Electrical inspector, pollution control boards, concerned SEB as applicable before commissioning of electrical/DG sets, Elevators, Indian Electricity Act, Indian Electricity Rules, Factory Act, Pollution Control Act.

- All electrical work shall be governed by CPWD Specifications for electrical works amended till date unless otherwise specifically mentioned separately.
- IS-732: Code of practice for electrical wiring installation system voltage not exceeding 650V.
- IS 3043: 1987 with latest amendments- Earthing.

- IS-2309: Code of practice for the protection of buildings and allied structure against Lightning
- IS-7689: Guide for control of undesirable static electricity.
- IS-3716: Insulation co-ordination application guide.
- IS-8130: Conductors for insulated electrical cables and flexible cords.
- IS-5831: PVC insulation and sheath of electric cables.
- IS-3975: Mild steel wire, strips & tapes for armoring cable.
- IS-3961: Current rating of cables
- IS-694: PVC insulated (heavy-duty) electric cables for working. Voltage up to and including 1100volts.
- IS-424- 1475 (F-3): Power cable flexibility test.
- IEC-439/IS-7098: Specification for cross-linked polyethylene insulated PVC sheathed cable for working voltage up to 1.1KV.
- IS-1554: PVC insulated cables up to 1100volts.
- IS-10810: Test procedures for cables.
- IS-6121: Cable glands.
- IS-10418: Cable drums.IEC-754 (1): XLPE insulated cable.
- ASTM-D-2863: Standard method for measuring minimum oxygen concentration to support candle like combustion of plastic (oxygen index).
- ASTM-D-2843: Standard test method for measuring the density of smoke from burning or decomposition.
- 20. ASTM E-662/IEC 754(A).
- IS 2309: 1989 with latest amendments- Advance Lightning Protection System.
- The 33 H.T. Metering Panel shall comply with the following standards as amended up to date.
- IS:2544: Bus Bar Supports
- IS: 2705 / IEC–185: Current Transformer
- IS: 3516 / IEC–186: Potential Transformer
- BS 5655 Part 1 to Part 13 safety rules for the construction and installation of electric lifts, and hydraulic lifts published by the British Standards Institution (BSI).
- N81 Part1to Part13 safety rules for the construction and install at ion of electric lifts and hydraulic lifts, published by the European Committee for Standardization (CEN).
- BS 7255 Code of Practice for safe working on lifts, published by the British Standards Institution (BSI)
- IS: 3696 (Part I) -1966 Safety code for scaffolds and ladders: Part IS scaffolds.
- IS: 3696 (Part II) -1966 Safety code for scaffolds and ladders: Part II Ladders.

| LOAD SHEET (TRANSFORMER) | | | | |
|--------------------------|------------------------------|--------------------|-----------------------|--------------------|
| S. No. | Location | Total Load (in KW) | Diversity Factor/Qty. | Total Load (in KW) |
| | ESS - 01 | | | |
| 1 | TYPE-A (1 NOS. BLOCK) | | | |
| | Lighting/Power Load | 1554.11 | 0.5 | 777.06 |
| | Common Area | 48.98 | 0.8 | 39.19 |
| | Lift Load | 30.00 | 0.8 | 24.00 |
| 2 | TYPE-B (3NOS. BLOCK) | | | |
| | Lighting/Power Load | 3782.02 | 0.5 | 1891.01 |
| | Common Area | 147.78 | 0.8 | 118.22 |
| | Lift Load | 90.00 | 0.8 | 72.00 |
| 3 | TYPE-4 | | | |
| | Lighting/Power Load | 124.02 | 0.5 | 62.01 |
| | Common Area | 0.41 | 0.8 | 0.33 |
| 4 | TYPE-5 | | | |
| | Lighting/Power Load | 22.53 | 0.5 | 11.26 |
| | TOTAL | 5799.85 | | 2995.07 |
| | Overall Load | | | 2995.07 |
| | TOTAL LOAD- | | KVA | 3743.84 |
| | Add 10 % Future Load. | | | 4118.23 |
| | TAKING TRANS.EFF.90% | | | 4575.81 |
| LOAD SHEET (DG) | | | | |
| S. No. | Location | Total Load (in KW) | Diversity Factor/Qty. | Total Load (in KW) |
| | ESS - 01 | | | |
| 1 | TYPE-A (1 NOS. BLOCK) | | | |
| | COMMON AREA | 4.90 | 0.8 | 3.92 |
| | LIFT LOAD | 30.00 | 0.8 | 24.00 |
| 2 | TYPE-B (3NOS. BLOCK) | | | |
| | COMMON AREA | 14.78 | 0.8 | 11.82 |
| | LIFT LOAD | 90.00 | 0.8 | 72.00 |
| 3 | TYPE-4 | | | |
| | COMMON AREA | 0.41 | 0.8 | 0.33 |
| | TOTAL | 140.09 | | 112.07 |
| | Overall Load | | | 112.07 |
| | TOTAL LOAD- | | KVA | 140.09 |
| | TAKING TRANS.EFF.90% | | | 155.65 |

PART- 'B'
(FIRE-FIGHTING)

FIRE FIGHTING, DETECTION, ALARM AND P.A. SYSTEM

a. Reference Standards

The design and planning of Fire Protection System shall be done keeping in view the following criteria:

- National Building Code 2016: Part IV for Fire & Life safety
- Local Bye-Laws.
- Relevant BIS codes: Specifically, IS: 3044, IS: 5290 and IS: 5312, IS: 908 and IS: 2190, IS: 3844, IS: 15105.
- NFPA & TAC Manual (for reference and guideline).
- Consultation with local Chief Fire Officer.

b. Basis/ Concept of Design

The firefighting arrangement shall be designed as per the requirement of local guidelines, NBC-2016 & engineering design standard.

The entire fire safety installation shall be compliant with the most stringent codes / standard for the entire building/Campus to ensure the highest safety standard and uniformity of system. Further, before property is opened to public, the fire protection shall be fully operated and tested under simulated conditions to demonstrate compliance with the most stringent standards, codes and guidelines.

Following functional system shall be provided; strictly in compliance with the listed reference standards:

Table-F-1

| | |
|------------------------------|---|
| Piping System | Piping system confirming to IS 1239. |
| Fire water static Storage | Fire water static storage has been provided in accordance to NBC-2016 requirement. |
| Fire Pumping system | Pumping system comprising of independent pumps for hydrant, sprinkler & jockey application has been provided. |
| Hydrant system | External & internal hydrant complete with hose reel. |
| Sprinkler system | Sprinkler rating and type shall be selected for respective areas. |
| Hand held fire extinguishers | Strategically placed at designated areas |

c. Scope of contractor (Designing & Complete SITC):

Fire Fighting, Fire Alarm & Public Address System:

- i. Preparing all firefighting drawing as per NBC 2016 and implementation of the same after approval from consultant.
- ii. Fire Extinguisher
- iii. Hydrant system
- iv. Fire pumps and equipment
- v. Fire alarm system
- vi. Fire compartmentation/ containment system (Cl. 2.20 & 2.21 of NBC 2016, Part IV, Life & Safety)
- vii. Public address and talk back system
- viii. All miscellaneous work ex. Water curtain system etc. completes in all respect.
- ix. Generic requirement even though not mentioned in DBR for proper functionality of building has to be adhered.

d. System Description:

I. Fire water storage

Static Underground **fire** water storage tank for Fire Protection System has been provided and Terrace tank of various capacity's as per NBC 2016 Part-IV-Table 7. Fire department connection shall also be provided on the external wall of the property near the main entrance. These shall comprise of 4 Nos. 63 mm dia male outlets capable of directly feeding the ring mains through non return valves or directly filling the static fire storage tanks. These shall be mounted in specially identified boxes.

II. Fire pumping system

The fire pumping system shall comprise of independent electrical pumps for hydrant and sprinkler system, diesel engine driven pump & jockey pump for hydrant & sprinkler system and terrace pump for hydrant system.

- | | |
|-------------------------------|---|
| i. Electric pump | 1 no. Capacity 2280 LPM |
| ii. Diesel engine driven pump | 1 nos. Capacity 2280 LPM |
| iii. Jockey pumps | 1 nos. Capacity 180 LPM |
| iv. Terrace Pump | Capacity 450/900 LPM various capacity's as per NBC 2016 |

Head Calculation will be as per the CPWD Specification.

- **TEFC Electrical pump** horizontal type multistage centrifugal, split casing pump with bronze impeller & stainless-steel shaft suitable for automatic operation shall provide adequate flow for catering requirement of hydrant system.
- **Diesel engine** driven fire pumps horizontal type multistage centrifugal, with bronze impeller & stainless-steel shaft water cooled with radiator shall be provided for ensuring operation & performance of the system in case of total electrical power failure.
- **Jockey pumps** electrical driven pressurization pump suitable for automatic operation shall compensate for pressure drop and line leakage in the hydrant and sprinkler installation horizontal type multistage centrifugal, with bronze impeller & stainless-steel shaft. Provision of PRS/ orifice plate shall be made in sprinkler riser to restrict pressure on sprinkler system. Electrical and jockey pump motor will be squirrel cage induction motor.

Individual suction lines shall be drawn from the fire reserve tank and connected to independent fire suction header. The electric fire pumps, diesel engine driven fire pumps and the jockey pumps shall all draw from this suction header. Delivery lines from various pumps shall also be connected to a common header in order to ensure that maximum standby capacity is available. The sprinkler pump shall be isolated from the main discharge header by a non-return valve so that the hydrant pump can also act as standby for the sprinkler system. The ring main shall remain pressurized at all times and Jockey pump shall make up minor line losses. Automation required to make the system fully functional shall be provided.

III. Fire hydrant system

Internal and external stand pipe fire hydrant system shall be provided with landing valve, hose reel, first aid hose reels, complete with instantaneous pattern short gunmetal pipe in the building. The internal diameter of inlet connection shall be at least 80/100 mm. The outlet shall be of instant spring lock type gunmetal ferrule coupling of 63 mm dia. for connecting to hose pipe. Provision of flow switch on riser shall be made for effective zone monitoring. The flow switch shall be wired to FAP and shall indicate water flow on hydrant of the identified zone. Recessed cupboard/ fire

hydrant cabinet shall be strategically located for firefighting requirement. Location of cabinets shall be accessed as per compartmentation plan in consultation with the Architect. Provision of fireman's axe shall be made for internal hydrant. External hydrant shall be located within 2 m from the building to be protected such that they are accessible and may not be damaged by vehicle movement. A spacing of about 30-45m between hydrants for the building shall be adopted.

IV. Hand held fire extinguishers

Portable fire extinguishers of water (gas pressure), Carbon-di-oxide and foam type shall be provided as first aid fire extinguishing appliances. These extinguishers shall be suitably distributed. The appliances shall be so distributed over the entire floor area, that a person is not required to travel more than 15 m to reach the nearest extinguisher.

The construction of the body shall be of welded type and thickness of the mild steel sheet shall be not less than 1.6mm & full fill IS 10204:2001 specifications.

Each extinguisher shall be painted 'FIRE RED', conforming to shade No. 537 of IS 5 and shall have a warranty of minimum 10 years. The paint shall conform to IS 2932 or epoxy powder coating conforming to IS 13871.

These shall be placed or hanged on wall in a group on several suitable places. Classification of extinguishers shall be as per the following table:

Table-F-2

| Class of Fire | Description | Suitable Type of Appliances |
|---------------|--|--|
| a. | Fire in ordinary combustibles (wood, fibers, rubber plastics, paper and the like) | Gas Expelled Water Type |
| b. | Fires in flammable liquids, paints, grease, solvents and the like. | Chemical extinguishers of carbon Dioxide, dry powder type and buckets. |
| c. | Fire in gaseous substances under pressure including liquefied gases (Class C fire- Not Gases but Electrical Equipment) | Chemical extinguishers of carbon dioxide and dry powder type |

Further, for rooms containing electrical transformers, switchgears, motors and of electrical apparatus, minimum 2 Nos. dry powder or carbon di oxide type/sand buckets extinguishers shall be additionally provided within 15 m of the apparatus.

Brief for Major Equipment Piping

MS pipes (heavy Duty "C Class") as per IS:1239,3589 shall be provided throughout the Complex. Pipes buried below ground shall be suitably protected with anti-rust treatment. All pipe clamps and supports shall be fabricated from MS steel sections and shall be factory galvanized before use at site. Welding of clamps and supports shall not be permitted. Pipes shall be hung by means of expandable anchor fastener of approved make and design. The hangers and clamps shall be fastened by means of galvanized nuts and bolts. The size/diameter of the anchor fastener and the clamps shall be suitable to carry the weight of water filled pipe and dead load normally encountered.

Hangers and supports shall be thoroughly galvanized after fabrication. The selection and design of the hanger & support shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipeline movements as

necessary. All guides, anchors, braces, dampener, expansion joint and structural steel shall be attached to the building/structure.

Flanged joints shall be used for connections for vessels, equipment, flanged valves and also on two straight lengths of pipelines of strategic points to facilitate erection and subsequent maintenance work.

Wrapping & coating is mandatory for External firefighting pipes and shall be done after Zinc Oxide Primer Coating.

Wrapping & coating is mandatory for Exposed Joints of Pipes.

Fire Hydrants

A.1.1 External Hydrants

External hydrants shall be provided all around the Complex. The hydrants shall be controlled by a cast iron sluice valve or butterfly valve. Hydrants shall have instantaneous type 63mm dia outlets. The hydrants shall be double outlet with CI duck foot bend and flanged riser or required height to bring the hydrant to correct level above ground.

For each external fire hydrant two numbers of 63mm dia. 15 m long controlled percolation hose pipe with gunmetal male and female instantaneous type couplings machine wound with GI wire, gunmetal branch pipe with nozzle shall be provided.

Each external hydrant hose cabinet shall be provided with a drain in the bottom plate. Each hose cabinet shall be conspicuously painted with the letters "FIRE HOSE".

Hydrants shall be located at a distance of not less than 5 m from the face of the building. This distance may suitably be increased up to a maximum of 15 m where hydrants are installed to protect hazardous storages or processes, so that the hydrants remain approachable and workable even in the case of a serious fire

Internal Hydrants

Internal hydrant shall be provided on each landing and other locations as required by NBC-2016 with double headed gunmetal & Stainless Steel landing valve with 100 mm dia inlet, with shut off valves having cast iron wheels. Landing valve shall have flanged inlet and instantaneous type outlets. Instantaneous outlets for fire hydrants shall be standard pattern and suitable for fire hoses. For each internal fire hydrant station two numbers of 63 mm dia. 15 m long rubberized fabric lined hosepipes with gunmetal male and female instantaneous type coupling machine wound with GI wire, fire hose reel, gunmetal branch pipe with nozzle shall be provided.

Standard fire hose reels of 20mm dia high pressure rubber hose 30 m & 40m long with gunmetal & Stainless-Steel nozzle, all mounted on a circular hose reel of heavy-duty mild steel construction having cast iron brackets shall be provided. Hose reel shall be connected directly to the wet riser with an isolating valve. Hose reel shall be mounted vertically.

Each internal hydrant hose cabinet shall be provided with a drain in the bottom plate. The drain point shall be led away to the nearest general drain.

Each internal hydrant hose cabinet containing items as above shall also be provided with a nozzle spanner and a Fireman's Axe. The cabinet shall be recessed in the wall.

Each hose cabinet shall be conspicuously painted with the letters "FIRE HOSE". Piping for hydrant system will pass through the central portion of the beam that is in sleeve. No core cutting and piping work under the beam will be allowed.

A.1.2 HOSE REEL:

Hose reel shall be heavy duty, 20 mm dia. length shall be 30 meter long fitted with gun metal chromiumplated nozzle, mild steel pressed reel drum which can swing up to 170 degree with wall brackets of castiron finished with red and black enamel complete.

A.1.3 FLOW REQUIREMENT:

The flow requirement for sprinkler heads shall be specifically approved for the designated area of Installation to ensure compliance to AMAO based upon hazard classification.

Orifice Plates: For restricting pressure at lower levels in the sprinkler system, orifice plates of appropriate sizes shall be fitted at different floor levels, at the branching points from Riser Main. The Diameter of such orifice shall not be less than 50% of the dia. of pipe into which it is to be fitted, which shall not be less than 50mm dia. These orifice plates must be of stainless steel with plain centralhole without burrs, and the thickness shall be 3mm for pipe size up to 80 mm, 6 mm for pipes from 80 to 125 mm dia. and 9 mm for pipes greater than 125 mm dia. Such orifice plate must have a projecting identification tag.

The orifice plate shall be fitted not less than two pipe internal diameters downstream of the outlet from any elbow or bend.

A.1.4 INSTALLATION CONTROL VALVE:

Each installation shall be provided with a set of installation control valves comprising: -

- An Alarm Valve.
- A Water Motor Alarm & Gong.
- Installation valves shall be installed on the sprinkler circuits as shown on the drawings.
- Installation valve shall comprise of a cast iron body with gunmetal trim, and double seated clapper check valves, pressure gauges, test valve and orifice assembly and drain valve with pressure gauges, turbine water gong including all accessories necessary and required and as supplied by original equipment manufacturer and required for full and satisfactory performance of the system. A cast iron isolation valve with lock and chain at the inlet of the installation valve shall be provided.
- Inspection and Test Valve Assembly: Inspection and testing of the automatic starting of the sprinkler system shall be done by providing an assembly consisting of Gunmetal valves, Gunmetal Sight Glass, bye-pass valve and orifice assembly.

A.1.5 FLOW SWITCH

Flow switch shall have a paddle made of flexible and sturdy material of the width to fit within the pipebore. The terminal box shall be mounted over the paddle/ pipe through a connecting socket. The Switch shall be potential free in either NO or NC position as required. The switch shall be able to trip and make/Break contact on the operation of a single sprinkler head. The terminal box shall have connections for wiring to the Annunciation Panel. The flow switch shall have connections for wiring the

seat shall be of S.S to the Annunciation Panel. The flow switch shall have IP: 55 protections.

The flow switches work at a triggering threshold bandwidth (flow rate) of 4 to 10 GPM. Further, it shall have a ‘Retard’ to compensate for line leakage or intermittent flows.

A.2 Fire Pump

- **TEFC Electrical pump** horizontal type multistage centrifugal, split casing pump with bronze impeller & stainless-steel shaft suitable for automatic operation shall provide adequate flow for catering requirement of hydrant system.
- **Diesel engine** driven fire pumps horizontal type multistage centrifugal, with bronze impeller & stainless-steel shaft water cooled with radiator shall be provided for ensuring operation & performance of the system in case of totalelectrical power failure.
- **Jockey pumps** electrical driven pressurization pump suitable for automatic operation shall compensate for pressure drop and line leakage in the hydrant and sprinkler installation horizontal type multistage centrifugal, with bronze impeller & stainless-steel shaft. Provision of PRS/ orifice plate shall be made in sprinkler riser to restrict pressure on sprinkler system. Electrical and jockey pump motor will be squirrel cage induction motor.

It shall have a capacity to deliver and developing adequate head so as to ensure a minimum pressure at the highest and the farthest outlet.

The pump shall be capable of giving a discharge of not less than 150 per cent of the rated discharge, ata head of not less than 65 per cent of the rated head. The shut off head shall be within 120 per cent of the rated head. The pump casing shall be of cast iron and parts like impeller, shaft sleeve, wearing ring etc. shall be ofnon-corrosive metal like bronze/brass/gun metal. Provision of mechanical seal shall also be made.

Bearings of the pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water. The pump shall be provided with a plate indicating the suction lift, delivery head, discharge, speed andnumber of stages. The pump casing shall be designed to withstand 1.5 times the working pressure.

Wet riser system shall be connected with the fire pumps, which will be operated automatically. Therefore, entire system will remain pressurized all the time, so that water is always available with required pressure, for firefighting purpose. There shall be a provision for the fire brigade inlet connectionwith non-return valves to the fire ring main for emergency purpose. Considering the various sensitive activities to be conducted in the campus and importance of the safety of the life of the users, it is proposed to provide a proper firefighting system, keeping in mind the likely loss of human life and colossal damage to sensitive equipment’s in the event of fire.

A.3 Fire Extinguishers:

The following type of portable fire extinguishers (ISI /CE & EN Approved) shall be provided at all levels of all towers, at strategiclocations as per NBC requirements, generally to follow IS – 2190: 1992).

Table-F-3

| Location | Type Of Fire Extinguisher |
|----------|---------------------------|
|----------|---------------------------|

| | |
|--------------|--|
| Every Floor | 4.0 or 6.0 kg ABC & 4.5 or 6.0 Kg CO2 Type |
| Pump room | 4.0 or 6.0 kg ABC & 4.5 or 6.0 Kg CO2 Type |
| Parking Area | 4.0 or 6.0 kg ABC & 4.5 or 6.0 Kg CO2 Type |

A.4 FIRE ALARM SYSTEM

Addressable Intelligent fire detection and Alarm system of latest technology with fire alarm panels, multi-Sensor detectors, smoke detectors, heat detectors, beam detectors, response indicators, manual call point and hooters, light strobe etc. shall be provided. It shall be UL Listed & FM approved and meet the requirement of NBC 2016/State By-laws. License/Approval of Local Fire Authorities shall be provided for the complex.

Printer, modules & Software etc. of latest technology with minimum 1 TB hard disk shall be provided in the Control room. Fire Alarm control Panel shall have 130 devices and 130 detectors in one loop. The details of the system proposed shall be as follows:

- Main fire alarm panel with digital voice command system, Fire fighters' telephone, amplifier, zone selector keypad and announcement console – Ground floor – Near passenger lift lobby.
- Secondary fire alarm panels / Repeater Panel at each level – near lift lobby
- Active repeater panels at security cabin
- Fire survival cables (1010 deg. 2 hours).
- Class - A cabling to loop all detectors, devices & MCP"s to control panel
- Coverage per detector as per NFPA -2015, considering > 60 ACH
- System integration (Soft integration) with all standalone panels such as agent release panels for deluge valves, Pre-action panels, lift switchboard, DG fresh air switchboard, etc.
- Addressable VESDA (Very Early Smoke Detection Apparatus) or equivalent technology with high sensitivity of to be used in all Critical areas.
- Addressable CO+IR Detector to be used in the areas with highly flammable substances such as Chemical Laboratories, Laundries/Washing Areas, DG Rooms, Oil Storage Areas, Lift Mechanical rooms, etc.
- Addressable Duct Detectors high sensitivity to be installed in all the return air ducts.
- Fire alarm system to have inbuilt capability of Addressable Wireless Smoke/Heat/Multi Detectors for use in the areas with low accessibility for cabling /maintenance & also the provision to add in future without the need of cabling.
- Seamlessly Integrated Public Address Voice Alarm (PAVA) system, integral with the Main FACP, including voice alarm system components, microphones, digital amplifiers, 2W UL Speakers, zone selector keypads and tone generators to be provided of same make as of Fire Alarm System.
- Audible Alarm Notifications.
- Fire Alarm Panels shall be integrated with BMS also.
- Fire alarm system to have inbuilt capability to monitor & control the system remotely over cloud. Necessary hardware shall be part of the main FACP.
- Two Way communication Fire Fighters Telephone Jack & Handset with necessary accessories are to be provided in all the buildings as required.

All Fire Alarm Panels shall also be integrated with each other on a peer-to-peer network. A Repeater panel shall be installed in the Main Security Room of whole complex and Guard room in a location clearly visible to the operators and in secured area manned 24 hours a day.

A.5 FIRE CONTROL PANEL AND ANNUNCIATOR:

"SITC of UL 864, 10th Edition 32-bit Microprocessor based Intelligent Addressable, Peer-to-Peer networkable, Expandable for 10 + loops FACP (Fire Alarm Control Panel) with Digital Voice Communication and Fire Telephone System. FACP (Fire Alarm Control Panel) should be capable of redundant CPU & redundant Power supply, if the Main/Primary CPU & power supply fails, FACP should automatically take-over secondary CPU & power supply without any MANUAL INTERVENTION. No degrade mode is allowed. One can provide spare CPU unit in same enclosure if not having redundant CPU. FACP shall accommodate up to 2 nos. of 12V/50AH batteries in its own housing and shall have a battery charging capacity of (up to) 2 nos. of 12V/100 AH housed externally. FACP shall have 8" Colour Touch Screen Display to show 8 simultaneous events at time and at least 10 custom-programmable soft and hard buttons for user-specific programmable functions. Each Detection Loop of FACP shall accommodate up to 250 detectors and devices in any combination. FACP shall accommodate up to 3000 Addresses at 100% capacity in any combination. FACP shall have a supervised electronic provision to store site-related back-up of Auto-CAD As-Built Drawings, Configuration Software Back-Up, Reports, Logs etc.

REPEATER PANEL:

Active Repeater Panel with 80-Character (2x40) display with supervised power supply from FACP. Repeater Panel shall monitor and control (Scroll, Acknowledge, Reset & Mute) all the events of the FACP to which it is connected and it shall have Port Vectoring / Event Filtering capability of showing only ALARMS, TROUBLES or SUPERVISORY or customized combinations of user selected events.

GRAPHIC USER INTERFACE STATION:

PC based Colour Graphic User Interface Station to provide Annunciation, Status display, Monitoring of each and every element connected to Fire Alarm System and Networks. It should support and have future provision for mobile client iOS & Android (as applicable) to access system information. It should support up to 5,00,000 events history logs & 2,50,000 network points or equivalent. The Centralized software should be capable of monitoring up to 687 total Nodes with 100 Mbps Transmission rate on Fibre Optics Network and up to 12 Mbps Transmission on Cu cable. The software should be capable to offer multiple password access levels for different users. It should work on Windows10, 64-bit OS or on latest version accepted.

A.6 TELEPHONE TALK BACK:

Manual Call Point

UL38 listed Intelligent Addressable Double Action Indoor Application Manual Pull Stations with inbuilt isolator. Manual Call Points suitable for wall/column mounting. MCP shall have red coloured housing with molded, raised-letter operating instructions of contrast colour. The MCP shall latch mechanically upon operation and shall remain so until manually reset with its key by an authorized operator. The MCP shall have operating temperature range from 0°C to 50°C and humidity tolerance range up to 93% RH, Non-Condensing. Integrated fireman telephone FFT.

Hooter with Strobe

UL464 and UL1971 listed Addressable Notification Devices (Hooter with Strobe) with built in isolator. Hooter with Strobe unit shall sit directly on addressable NAC (Notification Appliance Circuit) of FACP,

fully supervised and powered from FACP. Hooter and Strobe elements of the combined unit shall have independent activation & deactivation criteria. Hooter shall stop at alarm "Acknowledge" and the Strobe shall stop at panel "Reset". The Hooter and Strobe element of Hooter cum Strobe combined unit shall be selected and triggered independently from FACP for performance check and maintenance. Hooter with Strobe unit shall have provision to be tested by a hand-held field diagnostic tool in "Silent Mode" and "Full Operation Sound Mode". The Strobe shall have multiple selectable candela settings configured and selected from the FACP. The hooter cum Strobe unit shall deliver output up to 94 db at 3m from its installed location. The sounder/strobe unit shall display the voltage received by them at the control panel. The activation & deactivation requirement of Notification devices shall not be deviated. It should support testing of Hooter strobes from FACP for health status as a UL verified feature.

Control Module

UL864 listed Intelligent Addressable Potential-free, Form-C, SPDT contact based control module to trigger 3rd party utilities like AHU shut-off, Pressurization fan activation, Special notification activation etc. The contact shall be rated for 2A@24Vdc. The control module shall have operating temperature range as per NFPA72 and a humidity tolerance of up to 93% RH, Non-Condensing.

Speaker

6W multi-tap (3W; 1.5W; .75W), Ceiling Mount Speaker with Rugged, high impact, flame retardant thermoplastic material and Compliant with NFPA 72, 520 Hz Low Frequency Signal Requirements for Sleeping Areas. They shall be compatible with supplied Amplifiers and shall work on 70.7Vrms.
5-6W multi-tap), Wall Mount, Red speakers with white "FIRE" lettering with Rugged, high impact, flame retardant thermoplastic material and Compliant with NFPA 72, 520 Hz Low Frequency Signal Requirements for Sleeping Areas. The speakers shall be of same make as that of the Control Panel & Amplifiers. They shall be compatible with supplied Amplifiers and shall work on 70.7Vrms.

COMMISSIONING & GUARANTEE

1. SCOPE OF WORK

Work under this section shall be executed without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.

Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.

On award of work, Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.

All tests shall be made in the presence of the Architect or his representative or any inspecting authority. At least five working days' notice in writing shall be given to the inspecting parties before performing any test.

Water flow rates of all equipment and in pipe lines through valves shall be adjusted to design conditions. Complete results of adjustments shall be recorded and submitted.

Contractor shall ensure proper balancing of the hydraulic system and for the pipes / valves installed in his scope of work by regulating the flow rates in the pipe line by valve operation. The contractor shall also provide permanent Tee connection (with plug) in water supply lines for ease of installing pressure gauge, temperature gauge & Rota meters. Contractor shall also supply all required pressure gauge, temperature gauge & rotameter for system commissioning and balancing. The balancing shall

be to the satisfaction of Consultant / Project Manager.

Three copies of all test results shall be submitted to the Engineer in A4 size sheet paper within two weeks after completion of the tests.

2. PRECOMMISSIONING

On completion of the installation of all pumps, piping, valves, pipe connections, insulation etc. the contractor shall proceed as follows:

- a. Prior to start-up and hydraulic testing, the Contractor shall clean the entire installation including all fittings and pipe work and the like after installation and keep them in a new condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating materials. All pipes shall be rodded to ensure clearance of debris, cleaning and flushing shall be carried out in sections as the installation becomes completed.
- b. All strainers shall be inspected and cleaned out or replaced.
- c. When the entire systems are reasonably clean, a pre-treatment chemical shall be introduced and circulated for at least 8 hours. Warning signs shall be provided at all outlets during pre-treatment. The pre-treatment chemical shall:
 - ✓ Remove oil, grease and foreign residue from the pipe work and fittings;
 - ✓ Pre-condition the metal surfaces to resist reaction with water or air.
 - ✓ Establish an initial protective film;
 - ✓ After pre-treatment, the system shall be drained and refilled with fresh water and left until the system is put into operation.
 - ✓ Details and procedures of the pre-treatment shall be submitted to the Architect for approval.
- d. Check all clamps, supports and hangers provided for the pipes.
- e. Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specification. If any leakage is found, rectify the same and retest the pipes.

3. Fire Protection System

Fire protection system shall be designed and executed for passive fire protection system. Fire stop system for all MEP applications should have 2 hours' fire rating when tested in accordance with ASTM E 814/ UL 1479 standards & IS 12458:2019, and all points shall be tested in accordance to ASTM E 1966 & façade joints between Transom and rated flow shall be tested in accordance with ASTM E 2307.

- a. Check all hydrant valves by opening and closing: any valve found to be open shall be closed.
- b. Check all the piping under hydro test.
- c. Check that all suction and delivery connections are properly made for all pump sets.
- d. Check rotation of each motor after decoupling and correct the same if required.
- e. Test run each pump set.
- f. All pump sets shall be run continuously for 8 hours (if required with temporary piping back to the tank).

Commissioning and Testing

- a. Pressurise the fire hydrant system by running the jockey pump and after it attains the shutoff pressure of the pump, then

- b. Open bypass valve and allow the pressure to drop in the system. Check that the jockey pump cuts- in and cuts-out at the preset pressure. If necessary, adjust the pressure switch for the jockey pump. Close by-pass valve.
- c. Open hydrant valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump shall cut-in at the preset pressure and shall not cutout automatically on reaching the normal line pressure. The main fire pump shall stop only by manual push button. However, the jockey pump shall cut-out as soon as the main pump starts,
- d. Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump,
- e. When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant valves simultaneously and allow the hose pipes to discharge water into the fire tank to avoid wastage.
- f. Check each landing valve, male and female couplings and branch pipes, for compatibility with each other. Any fitting which is found to be incompatible and do not fit into the other properly shall be replaced by the Contractor. Each landing valve shall also be checked by opening and closing under pressure.
- g. Check all annunciations by simulating the alarm conditions at site.

STATUTORY AUTHORITIES' TESTS AND INSPECTIONS

As and when notified in writing or instructed by the Architect/Engineer in charge, the Contractor shall submit shop drawing and attend all tests and inspections carried out by Local Fire Authorities, Water Authority and other Statutory Authorities, and shall forthwith execute free of charge any rectification work ordered by the Architect as a result of such tests and inspections where these indicate non-compliance with Statutory Regulations. Some of these tests may take place after the issue of Practical Completion of the Main Contract and the Contractor shall make all allowances in this respect.

The Contractor shall be responsible for the submission of all necessary forms and shop drawings to the Statutory Authorities which shall conform in layout to the latest architectural plans submitted to and kept by these Authorities.

The submission shall comply with the requirements set forth in the current Codes of Practice and circular letters of the Statutory Authorities. The shop drawings to be submitted shall be forwarded to the Architect for checking before submission.

The Contractor shall allow for at least two submissions of complete sets of shop drawings to the Authorities, one to be made within six months after the award of the Contract but not less than six weeks before the inspection. The Architect may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary.

The Contractor shall notify the Architect at least seven days in advance of his application for local Authority tests and inspections. On receipt of a confirmed date for test and inspection the Contractor shall inform the Architect without delay.

1. FINAL ACCEPTANCE TESTS

Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the Architect/Engineer in charge.

Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractor shall

adjust, modify and if necessary, replace the equipment without further payment in order that the required performance is obtained.

Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shall be carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.

2. REJECTION OF INSTALLATION / PLANT

Any item of plant or system or component which fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the Architect/Engineer in charge. either in whole or in part as he considers Necessary/appropriate. Adjustment and/or modification work as required by the Architect so as to comply with the Authority's requirements and the intent of the Specification shall be carried out by the Contractor at his own expense and to the satisfaction of the Authority/Architect.

After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Architect/Employer.

3. WARRANTY AND HANDOVER

The Contractor shall warrant that all plant, materials and equipment supplied and all workmanship performed by him to be free from defects of whatsoever nature before handover to the Owner.

4. HANDING OVER OF DOCUMENTS

All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Owner's site representative and all testing and commissioning documents shall be handed over to the Owner's site representative.

The Contractor shall also hand over all maintenance and operation manuals, all certificates and all other documentation as per the terms of the contract to the Owner's site representative.

CHECK LIST FOR COMMISSIONING

A) Fire Protection System

- Check all hydrant & other valves by opening and closing. Any valve found to be open shall be closed.
- Check all clamps, supports and hangers provided for the pipes.
- All the pump sets shall be run continuously for 30 minutes (with temporary piping back to tank from the nearest hydrant, using canvas hose pipes).
- Fire Hydrant System - Pressurise the fire hydrant system by running the jockey pump and after it attains the shutoff pressure of the pump, then
- Open bypass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts-out at the preset pressure. If necessary adjust the pressure switch for the jockey pump. Close by-pass valve.
- Open hydrant valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump shall cut-in at the preset pressure and shall not cutout automatically

on reaching the normal line pressure. The main fire pump shall stop only by manual push button. However, the jockey pump shall cut-out as soon as the main pump starts.

- Operate booster pump continuously for 30 minutes with piping back to underground tanks from the hydrant nearest to plant room.
- Check each landing valve, male and female couplings and branch pipes, for compatibility with each other. Any fitting which is found to be incompatible and do not fit into the other properly shall be replaced by the Contractor. Each landing valve shall also be checked by opening and closing under pressure.
- Check air cushion tanks on the terrace for proper functioning.

• **BUILDING CLASSIFICATION:**

- As per NBC-2016- this Minimum premises is classified as under:

| <u>FIRE FIGHTING PROVISION FOR</u> | | | | |
|---|-------------------------------------|--------------------------------|----------------------------------|--|
| <u>SSF SAHARANPUR, UP</u> | | | | |
| <u>REQUIRMENTS ACCORDING TO NBC 2016</u> | | | | |
| S.No. | Floor Height (In Meters) | Sub-Heads | Provision as per NBC 2016 | Building Category / Subdivision |
| | | RESIDENTIAL BUILDING | | |
| 1 | 42.60 | <u>TYPE A (G+13)</u> | RESIDENTIAL Building 'A' | A-4 |
| | | | | |
| | | Fire Extinguisher | | |
| | | First aid hose reel | | |
| | | Wet Riser | | |
| | | M.O.E.F.A. (With PA Talk Back) | | |
| | | 75000 Ltr.UG Tank | | |
| | | 5000 Ltr. Terrace Tank | | |
| | | One Diesel Pump 2280 L/MIN | | |
| | | One Electric Pump 2280 L/MIN | | |
| | | One Jockey Pump 180 L/MIN | | |
| | | | | |
| 2 | 42.60 | <u>TYPE-B (G+13)</u> | RESIDENTIAL Building 'A' | A-4 |
| | | | | |
| | | Fire Extinguisher | | |
| | | First aid hose reel | | |
| | | Wet Riser | | |
| | | M.O.E.F.A. (With PA Talk Back) | | |
| | | 75000 Ltr.UG Tank | | |
| | | 5000 Ltr. Terrace Tank | | |
| | | One Diesel Pump 2280 L/MIN | | |
| | | One Electric Pump 2280 L/MIN | | |
| | | One Jockey Pump 180 L/MIN | | |
| | | | | |
| 3 | 13.80 | <u>TYPE-IV (G+3)</u> | RESIDENTIAL Building 'A' | A-4 |

| | | | | |
|--|--|------------------------|--|--|
| | | | | |
| | | Fire Extinguisher | | |
| | | First aid hose reel | | |
| | | 5000 Ltr. Terrace tank | | |
| | | 450 LPM Terrace Pump | | |
| | | | | |

Note: UGT, External Fire Services Wet Riser Pipes (SITC) from UGT to Type -A & Type-B as will be in NR scope whereas pipe connection from out of Residential buildings in Residential scope.

PART- 'C'
(WATER SUPPLY AND SANITARY
INSTALLATION)

1. General

The EPC Contractor shall carry out Design, Engineering, Supply, Installation, testing & commissioning for Plumbing (Hydro pneumatic Water Supply and Sanitary Installation System). The work shall in general conform to the latest CPWD Specifications. The water supply and sewerage demand shall be estimated, based on the population as required by Latest NBC norms, Local bye Laws & statutory norms. The different components related to services are listed as below: -

1.1. Internal Plumbing Works

The Internal Plumbing Works shall include the design and execution of the following systems within the building premises:

- i. Internal domestic water supply system.
- ii. Internal flushing water supply system.
- iii. Soil, waste, vent, and rainwater piping systems.
- iv. Sanitary fixtures, CP brass fittings, and PTMT fittings.
- v. Mixer taps shall be provided at all shower locations in residential units.
- vi. Disposal of soil, waste, and rainwater through internal and external piping networks up to the first inspection chamber/manhole.
- vii. Ventilation arrangements for sanitary drainage systems.
- viii. Pipe supports, sleeves, clamps, insulation, valves, and associated accessories complete as required for proper functioning of the system.

1.2. External Water Supply System

The External Water Supply System shall include the complete infrastructure required for storage and distribution of domestic, flushing, and treated water within the campus.

- i. The water supply to the campus shall be met from the local Municipality/Authority and/Tube Wells/ Bore wells or from the STP treated Water Supply (For Flushing & Landscaping only). The tube wells /Bore wells have been provided, meeting the requirements covering the scope of construction, in the scope of work.
- ii. Providing hydro pneumatic water supply distribution network system of the campus.
- iii. Storage of Water.
- iv. Hydro pneumatic Distribution System

Note – External water supply pipes shall be laid on a min. 100mm thick concrete base of cement mortar of 1:5:10 and Haunching all around the pipes with concrete of cement mortar of 1:5:10.

1.3. Sewerage System

The Sewerage System shall be designed to collect and convey sewage generated from all buildings to the Sewage Treatment Plant (STP) through a properly designed underground sewer network.

The scope shall include:

- i. Collection and conveyance of sewage from all sanitary fixtures.
- ii. Internal and external soil and waste piping systems.
- iii. Inspection chambers, manholes, drop manholes, and associated civil works.

- iv. Underground sewer piping network up to the STP.
- v. Ventilation and cleaning arrangements for the sewer network.
- vi. Disposal and treatment coordination with STP system.

Note – External Sewerage pipes shall be laid on a min. 100mm thick concrete base of cement mortar of 1:5:10 and Haunching all around the pipes with concrete of cement mortar of 1:5:10.

1.4. Storm Water Drainage & Rain Water Harvesting System

The Storm Water Drainage and Rain Water Harvesting System shall be designed for collection, conveyance, recharge, and safe disposal of rainwater from roofs, paved areas, roads, landscaped areas, and open spaces around the proposed buildings.

The scope shall include:

- i. Roof rainwater collection through channels and catch basins in Recharge pits.
- ii. Storm water piping and drain network.

Note – External Storm Water Drainage Pipes shall be laid on a min. 100mm thick concrete base of cement mortar of 1:5:10 and Haunching all around the pipes with concrete of cement mortar of 1:5:10.

1.5. Garden Hydrant System

The Garden Hydrant System shall be provided for supplying water for horticulture and landscaping purposes in all landscaped and green areas around the buildings.

The scope shall include:

- i. External garden hydrant network with necessary piping and valves.
- ii. Garden hydrant outlets at suitable intervals for irrigation and maintenance purposes.
- iii. Connection of the system from treated water/flushing water network wherever applicable.
- iv. Allied accessories, chambers, valves, and fittings complete as required for proper operation of the system.

2. Basic Objectives

The basic objective is to provide all sanitary engineering services and specification in relation to:

- i. High standards of material and workmanship.
- ii. Safe, hygienic and leak-proof plumbing system.
- iii. Reliable and energy efficient engineering systems.
- iv. Ease of operation and maintenance.
- v. Water conservation and sustainability measures.
- vi. Minimum environmental impact.
- vii. Compliance with NBC, CPWD and statutory requirements.
- viii. Efficient reuse of treated water for flushing and horticulture.

3. List of Codes and Manuals

The following codes of practice and design manuals are being referred for designing the Sanitary Plumbing:

- i. National Building Code 2016 PART-9 (PLUMBING SERVICES, SECTION-1 WATER SUPPLY)
- ii. Hand Book on Water Supply & Drainage (with Special Emphasis on Plumbing), Bureau of Indian Standards SP-35
- iii. Manual on Water Supply & Treatment (Ministry of Urban Development)
- iv. Manual on Sewerage & Sewage Treatment (Ministry of Urban Development)
- v. CPWD Specifications.

4. Design for Water Supply/Waste Water Distribution System

For continuous water supply at adequate pressure, complete water supply system is designed with following type of pipe-lines.

The system shall consist of:

- i. Underground Water Storage Tanks.
- ii. Overhead Water Storage Tanks above Buildings Terrace with 2 times Filling.
- iii. Hydro Pneumatic Pumping System.
- iv. Internal and External Distribution Network.
- v. Separate Domestic and Irrigation Water Networks.

The complete water supply network shall be hydraulically balanced and designed to minimize frictional losses and energy consumption.

Pipe Material

- i. Water supply piping shall generally be CPVC Pipes conforming to relevant IS standards and suitable for hot and cold water applications.
- ii. Irrigation piping shall generally be CPVC pressure pipes conforming to relevant IS standards.
- iii. Soil, Waste and Vent Pipes shall be UPVC SWR pipes conforming to relevant IS standards.
- iv. Storm Water Drainage Pipes shall be UPVC SWR pipes as required.
- v. External Sewer Lines shall be RCC NP2 Pipes as per design requirements.

5. SANITARY WORKS

Sanitary Fixtures, C.P Brass & SS Fittings, & PTMT Fittings Plumbing fixtures, Chrome Fittings and accessories will be as per IS: 781-1984 & IS: 763:2000.

Soil, Waste Pipe System

General: -

- Above ground piping shall be designed on the basis of two pipe system as recommended in code of practice for soil and waste. Soil pipes shall carry the wastes from WC's & urinals etc. Soil pipes shall connect directly to the 1st manhole outside the building.
- All vertical stacks will be installed in pipe shafts on the external face of the buildings or in internal shafts within the building according to the architectural planning of the toilets.
- Provision has been made to provide cleanout doors and plugs for Roding and maintenance

where necessary and required.

- All shafts / ducts carrying service lines shall be provided with access platforms / ladders for easy maintenance.

Materials for Soil, Waste & Vent Pipe System

Pipes used for Soil, Waste and Vent system shall be **110mm dia UPVC (SWR)** pipes single socketed with necessary fittings like bends, shoes, offsets etc., and fixtures like clamps hook etc., the pipes are laid in trenches/floors/walls etc., complete.

6. Sewerage System

6.1 Design Parameters

| | | |
|---------------------------------------|---|---|
| a) Velocity | | |
| Minimum velocity at peak Maximum | = | 0.61 m/sec |
| Velocity at peak | = | 2.40 m/sec |
| b) Peak Factor | = | 3 times the average flow |
| c) Interception factor | = | 0.80 |
| d) Manning Constant | = | 0.010 (for C.I. Pipes) 0.011 (for Plastic pipes) |
| e) Design Equation | = | Manning Equation |
| 6.1.1. Flow conditions in pipe | | |
| Pipes up to 300 mm dia | = | 50% full running |
| Pipes from 400-900 mm dia | = | 67% full running |
| 6.1.2. Min. depth for sewers | | |
| For branches | = | 1 M |
| For lateral, main & trunk sewers | | |

a) Type of Distribution

Sewer flow shall be by gravity up to the final disposal point. The external sewer shall be connected to centralized sewage treatment plant.

b) Kitchen Effluent

Kitchen waste shall be passed through grease trap / oil separator before discharging in to the external sewer line.

c) Manholes

The manholes are to be constructed with brick masonry as per standard specifications of NBC 2016 and shall have details as follows:

- Rectangular manhole of size 900 x 800 mm upto 0.89 mtr depth.
- Rectangular manhole of size 1200 x 900 mm from depth upto 0.9mtr to 2.5mtr depth.
- Circular manhole of size 900 mm dia for 0.9 to 1.65 mtr depth.
- Circular manhole of size 1200 mm dia for above 1.65 to 2.30 mtr depth
- Circular manhole of size 1500 mm dia for above 2.3 mtr depth.

The pipe of manhole to S.T.P shall be be RCC NP2 pipe network, as per requirements.

d) Spacing of Manholes

- Manhole shall be provided with all the junctions, change of directions, change in diameters and as per connection requirement from every unit.
- A distance of 20 meters (maximum) on the main sewer line depending on dia of pipes and local conditions.

a. Manholes Covers

- Medium duty S.F.R.C. manhole covers for manholes on service roads, gully traps and manholes / chambers not following in the road / pedestrian ways/side berms / lawn area.
- Heavy duty S.F.R.C. manhole covers for manholes /service chambers / gully traps falling on main roads & service roads.
- Shape and dimensions of Manhole covers shall conform to CPWD specifications & IS 12592

b. Treatment of Sewage

Treatment of sewage shall be through the sewage treatment plant, the details for the same are specifically indicated hereinafter.

7. Storm Water Drainage System

7.1. Planning of Storm Water Drainage System

- The rainwater from the open surface areas, as per design, shall be collected in the clay brick masonry chambers, collection chambers and shall be taken through the internal rain water system (UPVC Pipe) & ultimately connected to the main storm-water open drainage system along the periphery and finally dispose to Local Municipal Drain.
- The network of storm water system shall be mostly catch basins and RCC NP2 Pipes / uPVC pipe network, as per requirements.
- All paved/road/green areas, the run off shall directly connected to the main storm water drains. Irrigation system for lawns and gardens
- The rainwater from the terraces of building shall be collected in catch basin and to be disposed of in Rainwater Harvesting Pits.

7.2. Design Parameters

- The rainfall intensity of 100 mm/hr is considered for designing of system for Rain Water Harvesting Recharge Pits.

Minimum pipe sizes shall be:

- Terrace Rain Water Pipe : 110 mm dia.
 - Balcony Rain Water Pipe : 75 mm dia.
 - Main Storm Water Drain : 150 mm dia.
-
- All construction specifications with respect to the manhole sizes etc. will be respected and followed and as per CPWD specification, NBC-2016 Part 9 (Plumbing Services) and Hand Book on Water Supply & Drainage (with Special Emphasis on Plumbing), Bureau of Indian Standards SP-35.
 - The complete campus storm water drainage system for UPPWD / CONSULTANT designed with uPVC pipes, RCC open drain with cover system, clay brick masonry chambers and manholes etc.

8. Irrigation system

The irrigation system shall utilize treated water from STP for horticulture requirements.

The system shall consist of:

- i. Garden Hydrant Network.
- ii. Irrigation Pumps.
- iii. Control Valves and Accessories.

Garden hydrant outlets shall generally be located at intervals of 45–50 m.

9. Tube-well/Bore well Pump and Pumping System

- i. The Tube well/Bore well shall be constructed by rotary drilling method up to the required depth as per hydrogeological conditions and CPWD specifications.
- ii. The drilling, reaming, casing, slotted pipe installation, gravel packing, development and testing of tube well shall conform to IS: 2800 and relevant CPWD specifications.
- iii. The Tube well shall generally consist of 200 mm dia bore, MS ERW housing pipe, MS ERW slotted pipe, gravel packing, reducer, well cap, centre guide and bail plug complete as specified in BOQ.
- iv. The depth of Tube well shall generally be up to 250 metre below ground level or as finalized based on actual hydrogeological conditions at site.
- v. The pump shall be vertical, submersible, multistage centrifugal type suitable for bore well application complete with stainless steel casing, bronze impeller, stainless steel shaft and water cooled motor.
- vi. The pump shall conform to Indian Standard IS: 8034.
- vii. Pumps and motors shall be mounted on a common MS structural base plate wherever applicable.
- viii. The pump shall be water cooled coupled to induction motor of suitable H.P. and R.P.M. as specified in schedule of quantities.
- ix. Suitable submersible pump set of 800 LPM discharge capacity complete with control panel, cables and accessories shall be provided as per approved BOQ requirements.
- x. Pumping set shall be provided with a Gun Metal “Burden” type pressure gauge with gunmetal isolation cock and connecting piping.
- xi. The pump set shall be provided with gun metal gate valve of appropriate size on delivery and non-return valve of appropriate size complete with pressure gauge and cock on delivery line.

- xii. Development of Tube well shall be carried out by air compressor/O.P. unit till clear water discharge free from sand content within permissible limits is achieved.
- xiii. Water testing for physical, chemical and bacteriological analysis shall be carried out before commissioning of the Tube well system.
- xiv. The discharge pipe line from Tube well to Underground/Overhead water storage tank shall generally comprise 100 mm dia pipeline complete as per BOQ and hydraulic design requirements.

10. Under Ground/Overhead Water Storage: -

The storage capacity of Underground water tanks shall be equal to minimum one day requirement in the case of Domestic/ Irrigation Water Tank. The Over Head Tanks at Terrace level shall be one day / half day capacity. The storage capacity of firefighting tanks shall be as per NBC Code or as per specific provisions of this DBR in the respective head. Internal walls and floors of all underground and overhead water storage tanks are to be finished with Kota Waterproofing Tiles.

Source of Water supply

- The main sources of raw water are from the Municipal Supply/Bore wells. From the surrounding environment it is noted that the bore-wells shall, generally be more than 60 meters in depth with blind and strainer pipes as per CPWD specifications. The yield shall be minimum 80,000 liters per day (considering 10 hrs. operation per day) per bore well. Accordingly, 2 nos. bore wells are sufficient These shall be as per detailed design distribution and requirement at different Zones at the location of bore wells as marked in Layout Plan subject to the confirmation by CGWB by the Contractor at his own cost. MS Pipes & fittings are to be used in bore well as per CPWD specifications and G.I. pipes / CPVC Water supply pipes & fittings with necessary gate valves area to be provided as per requirements from bore wells to the partially over/underground tanks.

Pumps & Water Treatment Equipment

- It is proposed to provide all type of pumps including that for filter feed pumps, domestic water supply pumps, flushing water supply pumps (For flushing pumps will be installed in STP), make up pump to STP treated tank from raw water (in case of failure/maintenance of STP), Plant Room Sump Pump etc. catering to All Buildings.
- Suitable size Sumps with sufficient sized submersible pumps & level indicators to be considered in plant room for drainage. Also, proper slope to be provided in Water Treatment Pump room so that there is no stagnancy of water during any leakage & it is properly channelized to nearest drainage sump.
- Sumps with sufficient sized submersible pumps & level indicators to be considered in basement for drainage. Also, proper slope to be provided in Basement so that there is no stagnancy of water during any leakage & it is properly channelized to nearest drainage sump.

Water Supply System

Water requirements has been estimated on the basis of present acceptable standards, References from various sources such the National Building 2016 Code of India, Public

Water Demand Projection

Water estimation, storage, distribution shall be considered only for the buildings/developments under the scope of work and not for buildings planned for future expansion.

As per the estimated population and water demand norms discussed above, Total water demand for complete campus has been estimated as below: -

- **650 KLD UG TANK** (150 KLD for Fire & 500 KLD for domestic use)
- **450 KLD STP**

It may be noted that the loads and demands are indicative only and may vary as per actual requirements. It is proposed that all the Partial Under/Over ground Tanks shall be constructed in the first phase of execution itself.

STP Treated Water shall be use for gardening.

The Tank Details (OHT & UG sumps) & capacity given as above & elsewhere in Tender documents are minimum to be provided by the EPC Contractor. During detailed designing, if required and found necessary, the capacity / rating of the equipment/tank may be upgraded subject to concurrence of Engineer-In-Charge.

Water meters for measuring water consumption for various purposes like irrigation, flushing, at source, to make up water etc. needs to provided I line with GRIHA requirements & as per directions of E-I-C.

Pump/ Motor placed on Terrace /open area should be weather proof type & required size of canopy also needs to be provided.

All pipes should be placed at fixed support. Pedestals at suitable distance to be provided as per requirements & directions of E-I-C.

Level sensors /switches to be provided for UG sumps/O.H.T.s & to be hooked up to BMS as per requirements & directions of E-I-C.

Sizing of Pumps: -

The Flow Rate of Pumps shall be suitably selected to meet each building's water demand & of Sufficient Head depending upon Building Height, Pipe Friction losses, Bends etc. and other relevant Site Conditions. One Standby Pump to be considered in each & every variant. The Pumps shall be sized so as to ensure approximately 4 hours (2 hrs Morning & 2 hrs Evening) of operation time (approx.) to fill the overhead tanks.

Tentative allocation of water transfer pumps.

The Pump Details, Layout scheme, Position and Application of Pumps given in the above table is indicative only. During detailed designing, if required and found necessary, the capacity / rating of the equipment may be upgraded/ revised with the approval of Engineer-In-Charge.

**As per National Building Code 2016 PART-9
(PLUMBING SERVICES, SECTION -1 WATER SUPPLY) Table no-1**

The detailed water demand calculation for the proposed 2nd SSF Saharanpur Campus has been carried out as per provisions of NBC 2016 Part-9, Section-1, Clause 4.1.2. Domestic water demand, flushing requirement, overhead tank capacity, underground tank capacity, fire water storage and STP capacity have been computed based on occupancy type and population/load of each building.

Basis of Design

- Water demand considered as per NBC norms for respective occupancies.
- Domestic storage considered as approximately 50% of daily requirement for flushing and operational usage.
- Overhead tank capacity considered for 2 times filling per day.
- Fire water storage considered as per fire category and Fire Department requirements.
- STP capacity considered as 85% of total domestic water demand.

| BUILDING NAME | | NO. OF FLOORS | FIRE CATEGORY | NO. OF TOWER | NO. OF UNIT/ DWELLING | Per Capita Demand (As per NBC Part-9, Table-1, Clause 4.1.2 | Water Requirement/ Day (Ltr.) | Tank Required (For Domestic + Flushing) (Ltr.) | O.H. Tank Provided (For Domestic) 2 Times Filling (KLD) | Overhead Fire tank (KLD) | Fire U.G. Tank (KLD) |
|---------------|--------|---------------|-------------------------|--------------|-----------------------|---|-------------------------------|--|---|--------------------------|----------------------|
| 1 | TYPE 4 | G+3 | | 01 | 15 | 135 | 2025 | 1012.5 | 1.5 | | - |
| 2 | TYPE 5 | G | | 01 | 5 | 135 | 675 | 337.5 | 0.5 | | - |
| 3 | TYPE A | G+13 | RESIDENTIAL 35 TO 45 | 01 | 560 | 135 | 75600 | 37800 | 38 | 5 | 75 |
| 4 | TYPE B | G+13 | RESIDENTIAL 35 TO 45 | 03 | 560 | 135 | 226800 | 37800 | 38 | 5 | 75 |
| | | | | | | | 3,05,100 | | | | 75,000 |

| | |
|---|------------------|
| Total Domestic Water Demand (A) | 305 KLD |
| Total Fire Water Demand (B) | 75 KLD |
| Additional 10% Margin (C) | 30.5 KLD |
| Total Underground Tank Requirement (B + C + A) | 410.5 KLD |
| STP Capacity @ 85% of Domestic Demand | 285 KLD |

Proposed Water Storage System

II. Underground Water Tank (UGT)

A common underground water storage tank of **Total 650 KL (Residential - 410 KL) capacity** is proposed for the campus, comprising:

- **500 KL Domestic Water Storage** (335 KL for Residence)
- **150 KL Dedicated Fire Water Storage** (75 KL for Residence)

The underground tank shall cater to domestic consumption, flushing requirement and firefighting reserve as per NBC and Fire Department norms.

Overhead Water Tanks (OHT)

Separate overhead tanks are proposed over individual buildings as per calculated demand. The capacities have been considered based on:

- Domestic consumption
- Flushing requirement
- Two filling cycles per day

III. Sewage Treatment Plant (STP)

An STP of **400 KLD capacity** is proposed against the calculated total requirement of **378 KLD** (285 KLD for Residence).

Treated water from the STP shall be reused for:

- Horticulture
- Landscaping
- Flushing purpose
- Miscellaneous non-potable uses

Landscaping Water Demand

As per NBC Part-9 Clause 4.1.5.2, landscaping water demand is generally considered as:

- **6 to 8 litres/m²/day for lawns**
- Reduced quantity for shrubs and trees

The treated water from the proposed STP shall be utilized for horticulture and landscaping requirements within the campus.

***Note- Construction of all external development including Internal CC Roads, UGT, STP, Sewer, Water supply, drain etc are not scope of this tender unless specified.**