



TENUGHAT VIDYUT NIGAM LIMITED
2x210 MW Tenughat Thermal Power Station
Jharkhand
Dry Fly Ash Collection & Disposal System



TECHNICAL RULE FOR CIVIL ENGINEERING WORK

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**TECHNICAL RULE FOR
CIVIL ENGINEERING WORKS**

1.0 GENERAL

1.1 This Technical Rule is meant for Civil Engineering works for the installation of Dry ash collection system and Disposal system of Tenughat Thermal Power station (2X210 MW) of Tenughat Vidyut Nigam Limited at Lalpania Jharkhand. It includes loading standards, permissible stresses, functional requirements, quality standards, architectural guidelines norms etc. to be adopted as a basis for preparation of designs and drawings by the successful Tenderer. These designs and drawings shall cover buildings for Dry Ash conveying compressor house, Main silos, intermediate silos ,utility building, MCC room, auxiliary facilities, foundations for buildings and equipments, and other miscellaneous civil engineering items of works to be provided and/or to be modified/rectified by the successful Tenderer.

1.2 The design prepared by the successful Tenderer shall not only provide for the requirements indicated in this Technical Rule but also consider the overall process requirements, service conditions and provisions to be made for future expansion. The designs shall be compatible with the operating conditions in the plant and the atmospheric conditions prevalent at site.. The dry ash collection and disposal system is being installed within the existing plant area. While designing and preparing new facilities the successful Tenderer shall take into account the structures, foundations, drains, etc. of the existing units and modify them, if found necessary, to match with the new ones.

1.3 Standards and unification shall be carried out to the maximum extent possible and in the interest of standardisation. Owner reserves the right of selecting a particular make of materials and components. The Successful Tenderer shall supply materials/ components of the particular make, if so required.

2.0 STANDARDS

2.1 The design criteria for civil engineering work shall be in accordance with this Technical Rule. Detailed instructions on such aspects as are not indicated herein shall be as per the latest standards, codes and recommendations of the Bureau of Indian Standards(BIS)



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specifications/Indian Road Congress and specifications published by Ministry of Shipping and Transport (MOST). In the absence of suitable IS specification and codes of practices, other recognised international standards and codes such as of International Standards Organisation (ISO), British Standards Institution (BSI), Deutsche Industries Norm (DIN), American concrete Institute (ACI) may be used, with prior approval of the Owner.

2.2 This Technical Rule shall also be read in conjunction with the "Specification for Civil Engineering works **(11-CIVIL-GS-07)** which is included as a part of tender documents.

2.3 In case of anything mentioned in this Technical Rule is at variance with 'Specification for Civil Engineering Works **(11- CIVIL-GS-07)**', BIS or other standards mentioned herein, the provisions of this Technical Rule will prevail.

3.0 **DESIGN PARAMETERS**

3.1 **General**

- i) In addition to the minimum requirements outlined herein, the Successful Tenderer shall design and construct the buildings, structure, foundations and other civil items as required for all equipments and systems and for the operational requirements and maintenance of these equipment and facilities.
- ii) General provisions, material, workmanship, dimensional tolerance, safety requirement for construction works etc. shall be in accordance with the "Specification for Civil Engineering Works **(11-Civil-GS-07)** and latest version of Indian Standards.

3.2 **Load Condition**

- i) All foundations and concrete structures shall be designed to resist full operating dead and live loads, with appropriate combination of wind and seismic forces and with due allowance for impact, vibration etc. as secondary effects of live loads, temperature variation etc. While designing structures and foundations either the effect of seismic forces or wind loads, whichever produces the worst effect, shall be considered along with usual load conditions.



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- ii) Apart from the operating loads indicated by the equipment manufacturers, the design of buildings and structures shall be based on dead and imposed loads calculated according to IS:875, subject to minimum imposed loads indicated in para (iv) below.
- iii) Concentrated and uniformly distributed live load on floors and platforms shall be considered depending upon the usage and in accordance with maximum expected process requirements, to be indicated by the equipment manufacturers. When the loads are movable, they shall be so placed as to get worst effect in moment, shear, axial loads etc. for which the elements shall be designed. Due allowance shall be made, wherever necessary, for installation and operation of any equipment as per equipment manufacturer's data and recommendations. The design shall be based on the maximum loading due to uniform live load and/or equipment loading including impact, vibrations etc.
- iv) The live loads listed hereunder are minimum loads for the areas involved. Special use areas shall be investigated and loading revised upward as necessary. Additional loading due to electrical cables, ventilation and air conditioning, piping etc. shall be considered as per technological requirements. Dust loads of minimum 50 Kg/m² shall be considered additionally for all roofs.

All buildings (except as noted separately) :

Roofs	-	150 kg/m ² (excluding dust load)
floor	-	500 kg/m ²
On ladders	-	120 kg at centre of rung
On removable covers over trenches & manholes	-	1,500 kg/m ²

Electrical Building

On floor slab of	-	1,000 kg/m ²
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- v) Design wind pressure and forces shall be as per the provisions of IS:875. Basic wind speed at Lalpania shall be considered as 50 metres per second. Stresses induced due to dynamic effect of wind shall be considered in design as per relevant IS codes.
- vi) Seismic forces shall be considered according to the provisions of IS:1893. Lalpania falls under seismic zone III.



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- vii) Members subjected to temperature variations shall be designed to withstand the stresses arising out of such temperature variations.
- viii) Design of structures shall provide for temporary loads which may be lifted during erection and maintenance of plant and equipment. Consideration shall be given in the design of structures to the contributing loads from piping and cabling including provisions for piping anchors and dead endings of electrical conductors.
- ix) In case of moving loads, full load under worst operating condition together with minimum 25 per cent vertical impact factor shall be considered for vehicles and machinery travelling on tracks (rails). Horizontal forces along and transverse to the rails as per equipment manufacturers' data and recommendations shall be considered in design of the track supporting structures and foundations.
- x) The design of buildings and structures shall take into account the loadings due to future extension of units and installation of additional equipment, where necessary, in future in the units.

3.3 Permissible Stresses

Allowable stresses for all reinforced concrete structures shall be as per IS:456 and for prestressed concrete structures as per IS:1343.

3.4 Foundations

- i) Foundations for structures and equipment shall be proportioned to resist the worst conditions of loadings and shall be generally designed as per the provisions of IS:1904.
- ii) The depth of foundation shall be determined based on loadings on foundation, safe bearing capacity at the founding level, constructional and technological requirements. The maximum allowable bearing pressure for design of foundation shall correspond to values confirmed by results of detailed soil investigation taking into account limits of allowable settlement considered for design of structures and equipment. Generally the foundation shall be taken down to at least 1000 mm below natural ground level in case of soil and 200 mm in case of rocky strata.



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However, some minor foundations can be laid on well compacted filled up soil with approval of Owner.

- iii) Generally foundation for buildings & equipment shall not be structurally connected to ground floor slab. The top level of the stem for building column foundations shall be so provided that no part of the steel column base assembly protrudes over finished floor level. The column base assemblies shall be encased with concrete upto floor level.
- iv) Foundations of equipment subjected to dynamic loading shall be isolated from adjoining floors/foundations to prevent propagation of vibration to adjoining structures.
- v) Supporting structures and foundations for equipment which may cause vibration, shall be designed for the dynamic effect of equipment together with the direct loads. The dynamic loads and other relevant data required for analysing the dynamic effect shall be taken as per manufacturers' data and recommendations.
- vi) Structures and foundations supporting vibrating, equipment shall be proportioned to avoid resonant frequencies. The dynamic analysis shall be done as per the stipulations as recommended by respective IS codes as well as the stipulations recommended by equipment manufacturer.

3.5 **Underground Structures**

- i) Based on the data on subsoil and underground water, adequate precautions shall be taken for design of foundation and underground structure. All underground structures such as sumps, pits, trenches, etc. shall be designed considering soil, water and surcharge pressure from the surrounding areas. Adequate precautions against floatation shall be taken.
- ii) Water tightness of expansion and construction joints shall be ensured by provision of PVC water bars of approved type with all necessary fittings and clippings to keep it in position during concreting. Water proofing compound as admixture must be used in concrete.
- iii) In case of underground structures, sumps with pumping arrangements shall be provided at suitable location to collect and



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pump out any incidental water collection to nearest storm water drainage outlet.

- iv) For the purpose of design of underground structures, ground water table shall be considered at finished ground level.
- v) Proper considerations in design shall be taken to prevent any possibility of flotation due to upward thrust caused by underground water. Pressure release valves of any form or type which allow ingress of water into the structure shall not be permitted. Special care shall also be taken to prevent flotation during construction period.

3.6 **Chemical Protection to Structures and Foundation**

Concrete structures, floors and foundation coming in contact with acid / alkalies / other corrosive chemicals shall be provided with acid proof treatment / lining as stipulated under finishing details separately.

3.7 **Concrete and Reinforced Concrete for Structures and Foundations**

3.7.1 **General**

- i) Concrete work shall secure a dense, homogeneous, smooth mass including required finishes, possessing required strength and resistance to weathering and abrasion for the structures and foundations.
- ii) Design of all reinforced concrete structures shall be as per the IS:456 and of prestressed concrete structures as per IS:1343. The structural safety of all foundations on soil shall, in general, be based on IS:1904. The design of water retaining structures shall be according to IS:3370.
- iii) For calculation purpose "Working Stress Design" or "Limit State Design" methods may be adopted, but design shall be consistent throughout.
- iv) Unless otherwise specified, minimum grades of concrete to be used shall be as follows:

Blinding concrete (mudmat)

M7.5



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Reinforced cement concrete for roads, M25
pavements, column foundations, precast
covers etc.
floors, trenches, channels, pits M20
All other reinforced concrete structures M25

3.7.2 Grouting below machine/equipment bases and pockets shall be of non-shrinking grout of adequate thickness and strength and as approved by owner/consultant.

4.0 EXTERNAL CLADDING, INTERNAL PARTITIONS AND FINISHES

4.1 This section deals with cladding, internal partitions and finishes for conveying air Compressor House, MCC Room Utility Building and auxiliary buildings.

4.2 External cladding for buildings shall be constructed of brick masonry with bricks of IS class 10. The thickness of brick masonry walls shall be minimum 230 mm. Design of masonry walls shall conform to IS:1905. External cladding shall be made of brick masonry.

4.3 Internal non load bearing partition walls shall be minimum 125 mm. thick brick masonry for store office, toilet etc..

4.4 Masonry walls of thickness 230 mm. or more shall be constructed in cement-sand mortar not leaner than 1:6. Partition walls of half brick walls of 115 mm. thick shall be constructed in 1:4 cement-sand mortars with suitable reinforcement.

4.5 All brick shall be plastered on both sides. Thickness of plaster shall be minimum 20 mm. in two layers for unfair faces and for all external surfaces and 15 mm. for internal walls with fair faces. Thickness of plaster for ceiling shall be minimum 6 mm.

4.6 Cement sand mortar mix for plasters shall be 1:4. 20 mm thick plastering shall be done in two layers.

4.7 All outside plastered surfaces of masonry walls shall be applied with snowcem or equivalent cement based paint and to be applied as per manufacturer's specification.



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- 4.8 Painting on ceilings shall be of oil bound distemper or plastic emulsion paint matching with wall finish.
- 4.9 Inside surfaces of masonry walls shall be treated with oil bound distemper (with wall putty) or plastic emulsion paint of approved quality, make and colour, or to be tiled as the case may be, on the basis of technological and/or aesthetic requirements. Wherever plastic emulsion paint is used, the walls shall be treated with putty. Unless mentioned in Technical Rule, the internal finishes to be provided are as follows :
- i) Ash conveying compressor house/blower room : Two coats of oil bound distemper over a coat of primer
 - ii) MCC room : Two coats of oil bound distemper over a coat of primer
 - iii) Control rooms : Two finishing coats of 1 st. quality plastic emulsion paint of approved shade over a coat of primer and wall putty of minimum thickness 3 mm (other than those subject to acid spillage)
 - iv) Battery rooms subject to acid/alkali spillage : Minimum two coats of acid/alkali resistant paint over a coat of primer
 - iv) Officer room : Two coats of plastic emulsion paint over a coat of primer and wall putty of minimum thickness 3 mm.
 - v) Toilet : Two coats of oil bound distemper over a coat of primer except the portion of glazed tiles in walls of minimum height of 2.1 m.
- 4.10 In premises subject to attack due to acid emissions, the walls shall be faced with acid proof tiles of approved make to a minimum height of 2.1 m. and acid resistant paint above 2.1 m level including ceiling.



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- 4.11 200 mm high skirting shall be provided in all rooms except where there is a provision for dado.
- 4.12 Depending on technological considerations, walls of some premises may be made of reinforced concrete and finished appropriately.
- 4.13 **Internal Flexible Partitions**
- 4.13.1 Internal flexible partitions shall be made of anodised aluminium box section framing of suitable dimensions depending on the design requirement. The partition may be partly glazed and partly solid or fully glazed depending on the architectural design of the interior.
- 4.13.2 The solid panels for the partitions shall be of decorative laminated particle boards in designs matching with the interior decoration of the particular room.
- 4.13.3 Fixing of glass/particle board panels to aluminium framing shall be with snap on aluminium fixing clips beveled or squared depending on architectural designs of the portions.
- 4.13.4 Generally finish of all the aluminium members of the partition shall be satin mat finish. However, other anodised finish may be provided, if required, from interior decoration point of view.
- 4.14 **False Ceilings**
- 4.14.1 Standard aluminum false ceiling with anodised aluminum T-bars inter-locking ceiling system.
- i) In control room and other areas where false ceilings are required, standard aluminum false ceiling system in modular grids shall be provided.
- ii) The false ceiling shall consist of standard anodised aluminum main and cross T-runners of size 38 mm x 38 mm x 1.5mm thick spaced 610mm centers both ways with 12 mm thick (approx.) E-board classic or similar material (termite proof, moisture resistant and fire resistant) of approved shade along with necessary suspension arrangement for the false ceiling system.



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- iii) Lighting, fittings and ventilation grills, A/C defuser, smoke detector etc. shall be flush mounted with the false ceiling bottom and aesthetically pleasant.
- iv) In computer rooms' and other rooms accommodating electronic equipment and requiring dust-free atmosphere, the wall surfaces shall be painted with two coats of epoxy based paint over a coat of primer, unexposed ceiling boards shall have fire retardant paint and true ceiling shall have minimum 50 mm. thick under deck insulation with phenotherm or equivalent material.
- v) Sides and corners must be finished with garnish and mouldings of approved design.

5.0 FLOORS AND FLOOR FINISHES

5.1 Floors

5.1.1 In general, all floors on ground except in area like offices and toilets shall be made of minimum M-20 reinforced concrete of 150mm thickness. However, for compressor houses proper, the design of floor shall also take into consideration technological requirements imposed loading and other service condition etc. In case of toilet, tea room and offices, floor slab on ground shall be PCC of Grade M-15 with minimum thickness of floor slab of 100mm.

5.1.2 The sub-grade below the floor slab shall be minimum 150 mm thick compacted sand filling. On top of sub-grade building paper shall be provided for plain cement concrete floor & 50 mm. thick blinding concrete shall be provided for reinforced cement concrete floor.

5.1.3 **All sub-grade shall be laid on compacted soil.**

5.1.4 Paving shall generally consist of 125 mm thick cement concrete grade M-20 over 230mm thick boulders (hard granite) soling with and sand admixture 50:50 as filler material. A layer of waterproof paper of approved type shall be laid over granite soling before placing of concrete. Paving shall be laid to slope to drain rain water to nearby surface drain. Specification for hard granite soling shall be as given in section "road work" of "Specification for Civil Engineering Works (11-CIVIL-GS-07)"

5.2 Floor finishes



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Floor finishes for the pump house buildings and auxiliary buildings/areas shall be provided according to technological and functional requirements, service conditions and duty and as per manufacturer's instruction as and when applicable. However, the following types of finishes are suggested for use in the specified areas:

i)	General areas of Ash conveying compressor house, MCC room, Utility Building	40 mm thick granolithic cement concrete flooring with concrete hardener additive of approved make on reinforced concrete floor slabs.
ii)	Control room, Office room	20 mm thick 2.5 m x 1.0 m granite with brass dividers of 25 x 6 mm size at joints of colour as approved by Owner/Consultant fixed with recommended fixing compound/adhesive.
iii)	Toilet	Antiskid ceramic tile finish over a minimum 15 mm thick base of cement mortar 1 : 3 (1 cement : 3 sand)

6.0 DOORS AND WINDOWS

6.1 Relevant provisions of the BIS specification shall be applicable in design and selection of doors and windows (List of IS codes referred in the document) with due consideration of the salient aspect of various buildings, units etc.

6.2 Standard types of doors and windows shall be used to the extent possible. The doors and windows shall be of approved make, quality and colour. Non-standard doors and windows shall be used only where there is a specific requirement for such doors and windows.

6.3 Doors

6.3.1 Main entry doors to the building shall be steel doors or steel rolling shutters of width and height to suit the requirements. Unless otherwise specified, rolling shutters with area upto 8 sq m shall be pull and push type hand operated, between 8 sq m to 12 sq m pull and push type with ball bearings. Rolling shutters with areas larger than 12 sq m shall be mechanical gear type or electrically operated.



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- 6.3.2 Generally in rooms inside the building solid core particle board flush doors shall be used except in places where there is a chance of water/acid spillage, solid core FRP doors shall be used.
- 6.3.3 The control room which is air-conditioned and pressurized, the door shall be glazed type and made of anodized aluminum box section of "INDAL" make or similar approved manufacturer and shall be air tight.
- 6.3.4 Width and height of door shall be decided based on various technical requirements like taking in and out of equipment during erection as well as maintenance purpose. However the minimum height of the door shall be kept at 2100 mm.
- 6.3.5 All door shall be provided with proper hydraulic door closers.

6.4 Windows

In Buildings

Steel window with side hung shutter shall be generally be used in building and shall be fully glazed. They shall generally be standard type and size conforming to IS 1361. The glazing shall be of 5.5mm thick wired glass fitted with aluminum beading with rubber gasket for fixed type. For openable window 4 mm tick plain sheet glass shall be provided. All openable window, safety bars/ aluminum safety grills shall be provided.

Window for specific areas like control room etc. shall be anodized aluminum designed to suit technological requirement.

In office, toilet and store

Fully glazed steel window of standard sizes and types conforming to IS 1038 shall generally be used. The glazing shall be 5.5mm thick wired glass fitted with aluminum beading with rubber gasket for fixed type. For openable window 4 mm tick plain sheet glass shall be provided. All openable window, safety bars/ aluminum safety grills shall be provided.

Exhaust fans of suitable ventilation capacity shall be provided in toilets etc. and in places where force ventilation is required.



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6.5 Painting

6.5.1 Painting shall conform to General Specification for painting.

6.5.2 In places where there is chance of acid spillage and fumes, the windows shall be painted with acid resistant paint of approved quality and colour.

7.0 WATER-PROOFING AND DAMP-PROOFING

7.1 Water proofing admixtures e.g., 'SEALCON' /or any other approved make has to be added in concrete for all underground RCC structure like pits, trenches. For any leaking underground pits, tunnels or trenches, the successful Tenderer shall rectify the same by means of injection of non-shrink polymeric water proof grouting compound like 'SEAL GROUT' /or any other approved make from inside along with an application of water proof plaster with 'SEALCON' /or similar approved material. In addition, PVC water bars of approved quality and make shall be provided at construction joints and expansions joints.

7.2 Roof shall be water proofed using 'MULTIPLAS – F' or similar material.

7.3 Rain water from the roof shall be laid into rainwater pipes of adequate sizes at suitable intervals/locations and discharged into the plant storm water drainage system. Rain water pipes shall be of cast iron. Minimum diameter of RW pipe shall be 150 mm.

7.4 All ground floor walls shall be provided with damp-proofing course as per specification in Civil Engineering Works (11-CIVIL-GS-07).

8.0 Plinth Protection

Minimum 1200mm wide PCC apron, M-20 in slope around the building with concrete side drains, sump pits etc. shall be provided. Top of apron shall be finished with 15mm thick cement mortar (1:4) with neat cement finish (chequered).

9.0 Cable and Pipe Trenches



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All cable, pipe trenches etc. inside various premises shall be made of reinforced water tight concrete and shall be covered with chequered plate suitably designed taking into account loading conditions etc. The outdoor trenches shall be covered with pre-cast RCC slabs with necessary lifting arrangement.

All electrical cables at road crossing shall be taken through conduit pipes or cable ducts as per electrical specification.

10.0 Roadways and paved areas

- i) All permanent approach road for various premises shall be provided with RCC road within the battery limit and these roads shall be connected to the existing main plant road network. The main plant approach road shall be double lane and the branch approach roads shall be single lane. The road shall have berms on either side with maximum width of 3m. The road surface of double lane shall be 7.0m wide and that for single lane shall be 4.0m wide. The roads shall have camber of 1 in 60.

The Concrete road shall be formed as follows:

- ii) Sub-base shall consist of boulder soling as per Specification for Civil Engineering Works **(11- CIVIL-GS-07)**.
- ii) 50 mm thick concrete mudmat of grade M-7.5 (PCC) shall be laid over sub-base.
- iii) Surfacing shall consist of 250 mm thick RCC of M-25 grade in panels with 8mm dia. High strength deformed bars at a spacing of 250mm both ways at top and bottom and 25 mm dia dowel bars at mid depth at a spacing of 300 mm at all expansion joints with necessary joint fillers and seals.

10.2 For RCC roads, RC pre-cast planks M-20 shall be laid over sand filling 150 mm thick and grouted in berms. Necessary chutes to the adjoining drain shall be provided.

10.3 Surface storm water from the roadways shall be drained by provision of drains beyond the berms within the battery limit and connected to the plant drainage network.

10.4 Sufficient areas shall be paved around plant and service buildings so as to facilitate parking of vehicles.



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11.0 DRAINS

11.1 All drains shall be made of RCC or PCC depending on depth and surcharge loading and provided with pre-cast RCC covers with lifting arrangements as per requirement. All crossing under roads, RCC box culverts or pipe culverts shall be provided.

11.2 All manholes, inspection pits, collection pits etc. shall be of reinforced concrete construction with covers for access.

11.3 Generally minimum earth coverage of one metre shall be provided over underground drainage sewer pipe lines.

12.0 ARCHITECTURAL GUIDELINES & NORMS

12.1 The successful Tenderer shall prepare all detailed architectural, internal w/s & sanitary drawings necessary to execute the building works.

12.2 Services and facilities

12.2.1 Fire Protection Facilities

Building shall be provided with fire protection facilities as per technical rules.

12.2.2 Illumination

Buildings shall be provided with illumination facilities as per technical specification of electrics.

12.2.3 Safety measures

Necessary grills, railing, protective paint coatings shall be provided as per requirements.

12.2.4 Toilet facilities

Toilets to be provided in the building as per requirements. Minimum one set of fittings shall be provided in each toilet. Sanitary facilities shall be as per following norms.



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Fittings / facilities

WC (water/closet)	:	1 for 25 persons or part thereof.
Ablution taps	:	1 in each WC; 1 water tap (for every 50 persons or part thereof) in the vicinity of WC & urinals.
Urinals	:	Nil upto 6 persons; 1 for (7 to 20 persons); 2 for (21 to 45 persons); 3 (for 46 to 70 persons) 4 for (71 to 100 persons); and @ 3% for (101 to 200 persons) and @ 2.5% (above 200).
Wash basins	:	1 for every 25 persons or (part thereof).
Drinking water fountain	:	1 for every 100 persons.

1) Wash Basin Set

Coloured glazed ceramic basin of 55cm x 40cm. with CP pillar tap, waste pipe, glass shelf, towel rail, CP brass soap container, 600cm.x 450cm x 5.5mm thick bevelled edged mirror with 6mm thick asbestos backing etc shall be of good quality material with approval of EIC/Owner

2) Water Closet

Coloured glazed ceramic IWC of size 58 cm. long provided in all floors and in ladies toilet along with low level flushing cistern. Coloured glazed ceramic EWC of size 40 cm. long shall be provided at specified locations with low level ceramic flushing cistern including all necessary fittings.

3) Urinal

White glazed vitreous china large flat back lipped urinals with CP brass flush pipe along with other necessary fittings including automatic flushing cistern. Urinal's partitions shall be of 20mm thick marble slab with 1500mm x 600mm.



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- 4) Antiskid ceramic floor tiles of make like Jhonson, Somani, Kajeria or equivalent and approved quality designer's tile on walls upto a height of 2.1 m to be made.

12.2.5 Environmental Norms

The building design has to be evolved taking into account the climatic and environmental factors prevailing in the Project site. The building fenestrations have to be designed to provide adequate protection to window/door openings etc. (like chajjas, fins, roof projections) against sun and rain.

12.2.6 Natural light and ventilations

- (i) Natural lighting

Windows : The area of windows shall be minimum 15% of the area of floor.

- (ii) Ventilations

Electrical fans shall be provided in general offices as per standard norms. Offices of the senior executives (E6 and above) shall be provided with A/C units (window type) as per standard norms. All toilets, printing room, battery rooms shall be provided with exhaust fans for ventilation as per standard requirements. Technical premises requiring air-conditioning shall be provided with unit/central A/C units with cut off lobbies having double doors, wherever required.

12.2.7 Water supply of building

- (i) System

Water from plant main shall be supplied to O.H. tank to be provided in each building through network of rising main. From the O.H. tank provided in the bldg. water shall be supplied to consumer points through the system of distribution mains.

- (ii) Capacity of O.H. Tank : One day's storage with 1500 ltr.

- (iii) Per capita/per day requirements

a) For office = 45 liters



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- b) For firefighting : Separate provision as per norms.
- (iv) Pipes & specials : Galvanised iron pipes & specials shall be used. G.I. pipes in the building wherever concealed shall be of 'C' class and shall be of TATA or equivalent quality.

12.2.8 Internal sanitary works and Storm water drainage

- (i) System

Two stack system (waste stack discharging in Gully and soil stack directly connected to manhole shall be followed. Gully trap shall be connected to manhole. Anti siphonage pipes shall be provided for buildings having more than two storey height.

- (ii) Inspection :

System shall provide for inspection and maintenance facilities of all branch, waste and soil pipes by providing inspection eye on Junction of waste and soil stack and respective branch mains.

- (iii) Ventilation :

The sewerage system shall be provided with adequate ventilation for the pipe work and manhole.

- (iv) Pipes :

All pipes for soil and waste stack shall be of Heavy Cast Iron pipe. The minimum diameter of waste stack shall be 80 mm and for soil stack shall be 100 mm.

12.2.9 Hardware fittings for doors & windows

Doors

Anodised Aluminium :

Fittings for each wooden door	Nos. for Single leaf	Nos. for Double leaf
Tower Bolt 300 mm for top	1	2
Tower Bolt 150 mm for bottom	1	1
Aldrop 300 mm long with 16 mm sliding bolt	1	1



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Doors

Fittings for each wooden door	Nos. for Single leaf	Nos. for Double leaf
Door handles with continuous plate 150 X 38 X 12 mm rod	1	2
Butt hinge (125 X 63 X 4mm) with cadmium plated MS screws	4	8
Butt hinge (75 X 45 X 3.2 mm) for door cleat with cadmium plated MS screws	1	2
Fittings for each Steel Door :		
M.S. Aldrop	1	1
M.S. Tower Bolt for top	1	2
M.S. Tower Bolt for bottom	1	1
M.S. Hinge	3	3
M.S. Door handle (one on each face)	2	4

All doors for officers cubicles shall have hydraulic door closers, mortice lock (4 Levers) with handle and door stopper(heavy type).

All doors except office/cubicle shall be provided with 6 levers mortice latch locks with handle of 'Godrej' make or approved equivalent and door stopper(heavy type).

All openable steel windows and ventilators shall be provided with brass handles and brass peg stays.

13.0 LIST OF RELEVANT I.S CODES

I.S CODE NO.	TITLE
IS:269 – 1989	Specification for 33 grade ordinary portland cement.
IS:383 – 1970	Specification for coarse and fine aggregates from natural sources for concrete.
IS:432 (PART-1) – 1982	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement - mild steel and medium tensile steel bars.
IS:432 (PART-2) – 1982	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement - hard drawn steel wire.
IS:455 – 1989	Specification for portland slag cement.



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I.S CODE NO.	TITLE
IS:456 – 1978	Code of practice for plain and reinforced concrete.
IS:458 – 1988	Specification for precast concrete pipes (with or without reinforcement).
IS:651 – 1992	Specification for salt glazed stone ware pipes and fittings.
IS:783 – 1985	Code of practice for laying of concrete pipes.
IS:814 – 1991	Covered electrodes for manual metal arc welding of carbon and carbon manganese steel.
IS:816 – 1969	Code of practice for use of metal arc welding for general construction in mild steel.
IS:875 (PART-1) – 1987	Code of practice for design loads (other than earthquake) for buildings and structures - dead loads.
IS:875 (PART-2) – 1987	Code of practice for design loads (other than earthquake) for buildings and structures- imposed loads.
IS:875 (PART-3) – 1987	Code of practice for design loads (other than earthquake) for buildings and structures - wind loads.
IS:875 (PART-5) – 1987	Code of practice for design loads (other than earthquake) for buildings and structures - special loads and load combinations.
IS:1003 (PART-1) – 1991	Specification for timber panelled and glazed door shutters door shutters.
IS:1003 (PART-2) – 1983	Specification for timber panelled and glazed shutters – windows and ventilator shutters.
IS:1038 – 1983	Specification for steel doors, windows and ventilators.
IS:1080 – 1986	Code of practice for design and construction of shallow foundations on soil (other than raft, ring and shell).
IS:1081 – 1960	Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.
IS:1172 – 1993	Code of basic requirements for water supply, drainage and sanitation.
IS:1230 – 1979	Cast iron rain water pipes and fittings.
IS:1343 – 1980	Code of practice for prestressed concrete.
IS:1346 – 1991	Code of practice for water proofing of roofs with bitumen felts.
IS:1361 – 1978	Specification for steel windows for industrial buildings.
IS:1609 – 1991	Code of practice for laying damp proofing treatment using bitumen felts.
IS:1742 – 1983	Code of practice for building drainage.
IS:1786 – 1985	Specification for high strength deformed steel bars and wires for concrete reinforcement.



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I.S CODE NO.	TITLE
IS:1826 – 1961	Specification for Venetian blinds for windows.
IS:1893 – 1984	Criteria for earthquake resistant design of structures.
IS:1904 – 1986	Code of practice for design and construction of foundations in soil : General requirement.
IS:1905 – 1987	Code of practice for structural use of un-reinforced masonry.
IS:1948 – 1961	Specification for aluminium doors, windows and ventilators.
IS:2062 – 1992	Structural steel (fusion welding quality).
IS:2191(PART-1) – 1983	Specification for wooden flush door shutters (cellular and hollow core type)-plywood face panels
IS:2191 (PART-2) – 1983	Specification for wooden flush door shutters (cellular and hollow core type) - particle board and hard board face panels.
IS:2202 (PART-1) – 1991	Specification for wooden flush door shutters (solid core type) - plywood face panels.
IS:2202 (PART-2) – 1983	Specification for wooden flush door shutters (solid core type) - particle board and hard board face panels.
IS:2204 – 1962	Code of practice for construction of reinforced concrete shell roof.
IS:2210 – 1988	Criteria for design of reinforced concrete shell structures and folded plates.
IS:2470 (PART-1) – 1985	Code of practice for installation of septic tanks - design criteria and construction.
IS:2470 (PART-2) – 1985	Code of practice for installation of septic tanks - secondary treatment and disposal of septic tank effluent.
IS:2751 – 1979	Welding of mild steel plain and deformed bars for reinforced concrete construction.
IS:2950 (PART-1) – 1981	Code of practice for design and construction of raft foundations - design.
IS:2974 (PART-1) – 1982	Code of practice for design and construction of machine foundations - foundations for reciprocating type machines.
IS:2974 (PART-2) – 1980	Code of practice for design and construction of machine foundations - foundations for impact type machines (Hammer foundations).
IS:2974 (PART-3) – 1992	Code of practice for design and construction of machine foundations - foundations for rotary type machines (medium and high frequency).
IS:2974 (PART-4) –	Code of practice for design and construction of



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I.S CODE NO.	TITLE
1979	machine foundations - foundations for rotary type machines of low frequency.
IS:2974 (PART-5) – 1987	Code of practice for design and construction of machine foundations - foundations for impact type machines other than hammers (forging and stamping press, pig breakers, drop crusher and jolter).
IS:3006 – 1979	Specification for chemically resistant glazed stone ware pipes and fittings.
IS:3067 – 1988	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.
IS:3114 – 1985	Code of practice for laying of cast iron pipes .
IS:3370 (PART-1) – 1965	Code of practice for concrete structures for the storage of liquids - general requirements.
IS:3370 (PART-2) – 1965	Code of practice for concrete structures for the storage of liquids - reinforced concrete structures.
IS:3370 (PART-4) – 1967	Code of practice for concrete structures for the storage of liquids - design tables.
IS:3414 – 1968	Code of practice for design and installation of joints in buildings.
IS:3614 (PART-1) – 1966	Specification for fire check doors - plate, metal covered and rolling type.
IS:3764 – 1992	Excavation work - code of safety.
IS:4021 – 1983	Specification for timber door, window and ventilator frames.
IS:4111 (PART-1) – 1986	Code of practice for ancillary structures in sewerage system.
IS:4127 – 1983	Code of practice for laying of glazed stone ware pipes.
IS:4326 – 1976	Code of practice for earthquake resistant design and construction of buildings.
IS:4351 – 1976	Specification for steel door frames .
IS:4913 – 1968	Code of practice for selection, installation and maintenance of timber doors and windows.
IS:4962 – 1968	Specification for wooden side sliding doors.
IS:4998 (PART-1) – 1992	Criteria for design of reinforced concrete chimneys - assessment of loads.
IS:6163 – 1978	Centrifugally cast (spun) iron low pressure pipes for water, gas, sewage.
IS:6248 – 1979	Specification for metal rolling shutters and rolling grills.
IS:6494 – 1988	Code of practice for water proofing of underground water reservoirs and swimming pools.



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I.S CODE NO.	TITLE
IS:7452 – 1990	Hot rolled steel sections for doors, windows and ventilators.
IS:11504 – 1985	Structural design of reinforced concrete natural draught cooling towers.
IS:771 – 1963	Specification for glazed earthenware sanitary appliance (line water closets and urinals wash basins, sink etc.)
IS:774 – 1984	Specification for flushing cistern for water closets and urinals (valveless syphonic type).
IS:778 – 1990	Specification for gun metal gate, globe & check valves for water, steam & oil only (not intended for use in Petroleum industry).
IS:781 – 1984	Specification for sand cast brass screw -down bib taps and stop taps for water services.
IS:782 – 1978	Specification for caulking lead.
IS:1239 – 1968	Specification for mild steel tubes, tubulars and other wrought steel fittings (Part-I Mild Steel Tubes).
IS:1580 – 1991	Bituminous compounds for water proofing and caulking purposes.
IS:2326 – 1987	Specification for automatic flushing cistern for urinals.
IS:2548 – 1990	Specification for plastic water closet seats and covers.
IS:13311(Part-1) 1992	– Non-destructive testing of concrete.
IS:1077 – 1992	Specification for common burnt clay building bricks.