

BOQ FOR ELECTRICAL WORKS OF AIIMS HOSTEL(1,2,3) - NEW DELHI.

| S.No. | Description. | Unit. | Total Qty | Rate in Figures (in Rs.) | Rate in words (in Rs.) | Amount in Rs. |
|-------|---|-------|-----------|-----------------------------|---------------------------|---------------|
| 1 | 2 | 3 | 5 | 6 | 7 | 8 |
| | SUBHEAD 1: H.T. SUB STATION | | | | | |
| 1.00 | SUBSTATION EQUIPMENTS | | | | | |
| 1.01 | HT Panel, (Main Substation - 1) | | | | | |
| | Supply, erection, testing and commissioning of 8 panel, [800 A (3nos.) and 630 A (5nos.)] ,11 kV, 3 Phase, 50 Hz., metal clad, dead front, 350 MVA rupturing capacity Vacuum Circuit Breaker Incoming & Outgoings as per the detailed specifications and drawings including connections etc. complete with following in-comers and out-goings including door interlocking and expendable as required. | | | | | |
| | A. INCOMER : | | | | | |
| | i) 2 No. VCB having following | | | | | |
| | 1 No. 800A, 11kV, 3 Phase, 50Hz., metal clad, dead front, 350 MVA rupturing capacity, Fully Drawout type, Vacuum Circuit Breaker (VCB) | | | | | |
| | 1 set of 11kV/110V Potential Transformers with HRC fuses | | | | | |
| | 1 Set of Phase indicating lamps with HRC fuses | | | | | |
| | 1 No. 0-15 kV Digital voltmeter with selector switch | | | | | |
| | 1 set of indicating lamps to indicate OPEN, CLOSE, TRIP, SPRING CHARGED, TRIP CIRCUIT HEALTHY | | | | | |
| | Push button for ON, OFF,TRIP&TRIP circuit healthy | | | | | |
| | 1 set of 600/5-5A Current Transformer for metering and protection | | | | | |
| | 1 No. 0-800 digital Amps ammeter with selector switch | | | | | |
| | 1 Set of CDG 61 (2 No. O/C, 1 No. E/F) relay | | | | | |
| | Digital frequency meter,Digital Tri vector meter. | | | | | |
| | 1 Set of undervoltage relay and Overvoltage relay | | | | | |
| | Trip circuit supervision relay,Auxiliary relays with shunt trip coil | | | | | |
| | 1 No. Master Trip relay | | | | | |
| | 1 No. Digital Power factor meter | | | | | |
| | BUSBARS : | | | | | |
| | 11kV, 350 MVA, 1000 Amps Three Phase busbars of aluminium | | | | | |
| | B. OUTGOINGS : | | | | | |
| | 5 No. VCB each having following | | | | | |
| | 1 No. 630A, 11kV, 3 Phase, 50Hz., metal clad, dead front, 350 MVA rupturing capacity, Fully Drawout type, Vacuum Circuit Breaker (VCB) | | | | | |

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| | 1 set of 11kV/110V Potential Transformers with HRC fuses | | | | |
| | 1 Set of Phase indicating lamps with HRC fuses | | | | |
| | 1 No. 0-15 kV Digital voltmeter with selector switch | | | | |
| | 1 set of indicating lamps to indicate OPEN, CLOSE, TRIP, SPRING CHARGED, TRIP CIRCUIT HEALTHY | | | | |
| | Push button for ON, OFF,TRIP&TRIP circuit healthy | | | | |
| | 1 set of current transformers of suitable ratio depending upon the rating of transformer for metering and protection | | | | |
| | 1 No.Digital ammeter with selector switch and one set of C.T. (Rating as per SLD) | | | | |
| | 1 Set of CDG 61 (2 No. O/C, 1 No. E/F) relay | | | | |
| | Digital frequency meter,Digital Tri vector meter. | | | | |
| | 1 Set of undervoltage relay and Overvoltage relay | | | | |
| | Trip circuit supervision relay,Auxiliary relays with shunt trip coil | | | | |
| | 1 No. Master Trip relay | | | | |
| | 1 No. Digital Power factor meter | | | | |
| | Bus Coupler | | | | |
| | <i>1 No. VCB having following:</i> | | | | |
| | 1 No. 800A, 11kV, 3 Phase, 50Hz., metal clad, dead front, 350 MVA rupturing capacity, Fully Drawout type, Vacuum Circuit Breaker (VCB) | | | | |
| | 1 set of 11kV/110V Potential Transformers with HRC fuses | | | | |
| | 1 Set of Phase indicating lamps with HRC fuses | | | | |
| | 1 No. 0-15 kV Digital voltmeter with selector switch | | | | |
| | 1 set of indicating lamps to indicate OPEN, CLOSE, TRIP, SPRING CHARGED, TRIP CIRCUIT HEALTHY | | | | |
| | Push button for ON, OFF,TRIP&TRIP circuit healthy | | | | |
| | 1 set of 600/5-5A Current Transformer for metering and protection | | | | |
| | 1 No. 0-800 digital Amps ammeter with selector switch | | | | |
| | | | | | |
| | HT Panel (Main Substation - 1)as mentioned above | Set | 1 | | |

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| | | TRANSFORMER : | | | | | |
| 1.02 | | Supply, erection, testing and commissioning of Cast Rasin Dry Type 2000 KVA , 11/0.433 kV, 3 Phase, 4 wire, 50 Hz.,Dyn11 vector group, copper wound, class F insulation associated with winding temperature indicator/ controller actuated by means of resistance temperature detector embeded in LV windings, indoor type transformer , tappings for off load operation on HV side from -7.5% to +5% in steps of 2.5%, cable box at primary (HT side) and secondary end (LT side) shall be connected through busduct, complete with all fittings and accessories and confirming to IS 11171 ammended upto date, interconnection of control cables and accessories etc complete. The transformer will be as per detailed CPWD technical specifications and as required. | Each | 2 | | | |
| 1.03 | | BATTERY CHARGER PANEL | | | | | |
| | | Supply, erection, testing and commissioning of the battery charger panel complete with battery, control cabling etc. as required. Capacity of battery charger suitable for above mentioned H.T. Panels. | | | | | |
| | | Sealed Maintenance Free (SMF) battery of suitable ampere hour capacity for above 11kV VCB panels in HT Panel Room of the building as specified above. | | | | | |
| | | Boost and Trickle charger suitable for above items. | | | | | |
| | | 1 No. AC Voltmeter (0-500Volt) | | | | | |
| | | 1 No. DC Voltmeter | | | | | |
| | | 1 No. DC Ammeter | | | | | |
| | | 1 set of AC and DC indicating lamps | | | | | |
| | | 1 No. DC Battery charging position indicator | | | | | |
| | | DC distribution board suitable for above application to incoming & outgoing MCBs include tripping, closing and indication etc. | | | | | |
| | | Control cabling between DC Distribution panel to the HT panel of the Substation with suitable core 1.5 sqmm copper cable | Each | 1 | | | |
| 1.04 | | BUS DUCTS : | | | | | |
| | i) | Supply, Installation, testing and commissioning of 3200 phase and neutral TPN, 415 V, 3 Phase, 4 Wire, sandwich construction Aluminium Bus Duct including bends, flexible joints, earth bus (2 runs of aluminium strips), supports for installation, supporting arrangements, etc. complete as per technical specifications and as required. | Mtrs. | 200 | | | |

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| 1.05 | | H.T. CABLE | | | | | |
| | | Supply of following sizes of 11 kV grade multicore aluminium conductor XLPE armoured power cable as per IS : 7098. | | | | | |
| | i) | 3 Core, 240 sq mm | Mtrs. | 500 | | | |
| | | | | | | | |
| 1.06 | | Laying of one number 3 core XLPE power cable of grade exceeding 1.1 KV but not exceeding 11KV of size exceeding 120 sqmm but not exceeding 240 Sqmm direct into ground including excavation, sand cushioning, protective covering and refilling the trench, supply of route marker complete as required. | Mtrs. | 500 | | | |
| | | | | | | | |
| 1.07 | | Supplying and making end termination with heat shrinkable jointing kit complete with all accessories including lugs suitable for following size 3 | | | | | |
| | i) | Core, XLPE aluminium conductor cable of 11kV grade as required. 240 sqmm | Each | 6 | | | |
| | | | | | | | |
| | | TOTAL FOR SUB HEAD 1: H.T. SUB STATION | | | | | |

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| | | SUB HEAD 2: MAIN LT PANEL. | | | | | |
| 2.01 | | MAIN L.T. PANEL NORMAL | | | | | |
| | | Supply, installation, testing and commissioning of LT Panel, cubicle type, totally enclosed, free standing type, dust, damp and vermin proof Panel made up of 14 SWG CRCA sheet, complete with aluminium busbars, danger notice plate, interconnections with suitable capacity aluminum leads/solid aluminum strips/rods, necessary interlocking, powder coat painted and having incoming and outgoing switchgears with cable alley in front as mentioned below and complete as per technical specifications and as required. The size of cable alley shall be sufficient enough to accommodate the cable sizes as mentioned in the SLD/ specifications/ drawings etc. | | | | | |
| | | Note : | | | | | |
| | | 1. All ACBs shall have 5 NO + 5 NC contacts | | | | | |
| | | 2. All relays to operate at 240Volts, Single phase, 50Hz., AC supply through UPS. UPS is also in the scope of supply. | | | | | |
| | | 3.Digital Multifunction metre should be suitable for true RMS metering.Metre should measure line and phase voltage , current of all three phases and neutral, HZ, PF, KW, KWH, KVAR, KVARH, KVA, KVAH ,voltage and current including one set of CT. Metre should be EMI/ EMC compliant. | | | | | |
| A. | | INCOMER: | | | | | |
| | i) | 2 No. ACB Panels each having following: | | | | | |
| | | 1 No. 3200A, 415/500V, Motorised, Fully Drawout type (EDO), Four Pole, Air Circuit Breaker with microprocessor based overload, short circuit & earth Fault trip including under voltage release and lockable trip push button. ACB should have Icw=Ics = 50 KA for 1 sec. | | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for ACB | | | | | |
| | | Push button to CLOSE the ACB. | | | | | |
| | | R, Y & B Phase indicating lamps (LED type) with 2A control SP MCBs | | | | | |
| | | Restricted earth faulty protection with one set of CT. | | | | | |
| | | Digital multi function meter with one set of suitable CTs, CT shorting links, R/Y/B LED indicating lamps and 2A cobntrol SP MCBs | | | | | |
| | | 3200/5A CTs with CT shorting links for power factor improvement panel suitable for giving signal to APFCR at less than 10% of secondary ratio current | | | | | |
| B. | | BUSBARS : | | | | | |
| | | 4000 Amps Phase TPN busbars of aluminium. | | | | | |

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| C. | | BUS COUPLER : | | | | | |
| | i) | 1 No. ACB Panels each having following: | | | | | |
| | | 1 No. 3200 A, 415/500V, Motorised, Fully Drawout type (EDO), Four Pole, Air Circuit Breaker with microprocessor based overload, short circuit, Instantaneous & earth Fault trip including under voltage release and lockable trip push button. The ACB should have Icw =Ics= 50KA for 1 sec. | | | | | |
| | | 1 set of indicating lamps to indicate OPEN, CLOSE, TRIP. | | | | | |
| | | Push button to CLOSE the ACB. | | | | | |
| | | 1 Set of A meter with ASS and CTs. | | | | | |
| | | | | | | | |
| D. | | OUTGOING. | | | | | |
| | i) | 2 No. ACB Panels each having following: | | | | | |
| | | 1000 A, 415/500V, Fully Motorised, Fully Drawout type (EDO), TPN, Air Circuit Breaker with microprocessor based overload, short circuit, instantaneous & earth Fault trip including under voltage release and lockable trip push button. ACB should have Icw=Ics= 50 KA for 1 sec. | | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for ACB | | | | | |
| | | Push button to CLOSE the ACB | | | | | |
| | | R, Y & B Phase indicating lamps (LED type) with 2A control SP MCBs | | | | | |
| | | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | | Digital energy metre with CT | | | | | |
| | | | | | | | |
| | ii) | 4 No. ACB Panels each having following: | | | | | |
| | | 800 A, 415/500V, Fully Motorised, Fully Drawout type (EDO), TPN, Air Circuit Breaker with microprocessor based overload, short circuit, instantaneous & earth Fault trip including under voltage release and lockable trip push button. ACB should have Icw=Ics= 50 KA for 1 sec. | | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for ACB | | | | | |
| | | Push button to CLOSE the ACB | | | | | |
| | | R, Y & B Phase indicating lamps (LED type) with 2A control SP MCBs | | | | | |
| | | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | | Digital energy metre with CT | | | | | |
| | | | | | | | |
| | iii) | 4 Nos. MCCB as per following details / specifications: | | | | | |

| | | | | | | |
|--|--|---|--|--|--|--|
| | | 500 Amp 415 volts, 50 KA (Ics) TPN MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. | | | | |
| | | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers. | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB | | | | |
| | | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | |
| | | Digital energy metre with CT | | | | |
| | | | | | | |
| | | iv) 2 Nos.MCCB as per following details/ specifications: | | | | |
| | | 400 Amp 415 volts, 50 KA (Ics), TPN microprocessor based MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. | | | | |
| | | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers. | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB | | | | |
| | | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | |
| | | Digital energy metre with CT | | | | |
| | | | | | | |
| | | v) 4 Nos.MCCB as per following details/ specifications: | | | | |
| | | 320 Amp 415 volts, 50 KA (Ics), TPN microprocessor based MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. | | | | |
| | | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers. | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB | | | | |
| | | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | |
| | | Digital energy metre with CT | | | | |
| | | | | | | |
| | | vi) 5 Nos. MCCB as per following details/ specifications: | | | | |
| | | 250 Amp 415 volts, 50 KA (Ics), TPN microprocessor based MCCB with variable settings and having microprocessor based O/L, S/C & E/F protection release. | | | | |
| | | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers. | | | | |

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|-------|--|-----|---|--|--|--|
| | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB | | | | | |
| | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | Digital energy metre with CT | | | | | |
| | | | | | | |
| vii) | 5 Nos. MCCB as per following details/ specifications: | | | | | |
| | 160 Amp 415 volts, 50 KA (Isc), TPN MCCB with thermal magnetic release having variable current settings . | | | | | |
| | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers. | | | | | |
| | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB | | | | | |
| | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | Digital energy metre with CT | | | | | |
| | | | | | | |
| viii) | 3 Nos. 63 Amp MCCB as per following specifications: | | | | | |
| | 100 Amp 415 volts, 50 KA (Isc), TPN MCCB with thermal magnetic release having variable current settings . | | | | | |
| | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers. | | | | | |
| | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB | | | | | |
| | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | Digital energy metre with CT | | | | | |
| | | | | | | |
| | Main LT Panel Normal as mentioned above. | Set | 1 | | | |
| | | | | | | |
| 2.02 | MAIN L.T. PANEL EMERGENCY : | | | | | |
| | Supply, installation, testing and commissioning of LT Panel, cubicle type, totally enclosed, free standing type, dust, damp and vermin proof Panel made up of 14 SWG CRCA sheet, complete with aluminium busbars, danger notice plate, interconnections with suitable capacity aluminum leads/solid aluminum strips/rods, necessary interlocking, powder coat painted and having incoming and outgoing switchgears with cable alley in front as mentioned below and complete as per technical specifications and as required. The size of cable alley shall be sufficient enough to accommodate the cable sizes as mentioned in the SLD/ specifications/ drawings etc. | | | | | |
| | Note : | | | | | |

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|----|----|--|--|--|--|--|
| | | 1. All ACBs shall have 5 NO + 5 NC contacts | | | | |
| | | 2. All relays to operate at 240Volts, Single phase, 50Hz., AC supply through UPS. UPS is also in the scope of supply. | | | | |
| A. | | INCOMER: | | | | |
| | i) | 2 No. ACB Panels each having following: | | | | |
| | | 1 No. 800A, 415/500V, Motorised, Fully Drawout type (EDO), Four Pole, Air Circuit Breaker with microprocessor based overload, short circuit & earth Fault trip including under voltage release and lockable trip push button. ACB should have I _{cw} =I _{cs} = 50 KA for 1 sec. | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for ACB | | | | |
| | | Push button to CLOSE the ACB. | | | | |
| | | R, Y & B Phase indicating lamps (LED type) with 2A control SP MCBs | | | | |
| | | Digital multi function meter with one set of suitable CTs, CT shorting links, R/Y/B LED indicating lamps and 2A control SP MCBs | | | | |
| B. | | BUSBARS : | | | | |
| | | 1200 Amps Phase TPN busbars of aluminium. | | | | |
| C. | | BUS COUPLER : | | | | |
| | i) | 1 No. ACB Panels each having following: | | | | |
| | | 1 No. 800 A, 415/500V, Motorised, Fully Drawout type (EDO), Four Pole, Air Circuit Breaker with microprocessor based overload, short circuit, Instantaneous & earth Fault trip including under voltage release and lockable trip push button. The ACB should have I _{cw} =I _{cs} = 50KA for 1 sec. | | | | |
| | | 1 set of indicating lamps to indicate OPEN, CLOSE, TRIP. | | | | |
| | | Push button to CLOSE the ACB. | | | | |
| | | 1 Set of A meter with ASS and CTs. | | | | |
| D. | | OUTGOING. | | | | |
| | i) | 3 Nos. MCCB as per following details / specifications: | | | | |
| | | 400 Amp 415 volts, 50 KA (I _{cs}) TPN MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. | | | | |
| | | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers. | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB | | | | |

| | | | | | | |
|--|-------------|---|--|--|--|--|
| | | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | |
| | | Digital energy metre with CT | | | | |
| | | | | | | |
| | ii) | 5 Nos.MCCB as per following details/ specifications: | | | | |
| | | 320 Amp 415 volts, 50 KA (Ics), TPN microprocessor based MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. | | | | |
| | | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers. | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB | | | | |
| | | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | |
| | | Digital energy metre with CT | | | | |
| | | | | | | |
| | iii) | 3 Nos. MCCB as per following details/ specifications: | | | | |
| | | 200 Amp 415 volts, 50 KA (Isc), TPN MCCB with thermal magnetic release having variable current settings . | | | | |
| | | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers. | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB | | | | |
| | | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | |
| | | Digital energy metre with CT | | | | |
| | | | | | | |
| | iv) | 1 Nos. MCCB as per following details/ specifications: | | | | |
| | | 160 Amp 415 volts, 50 KA (Isc), TPN MCCB with thermal magnetic release having variable current settings . | | | | |
| | | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers. | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB | | | | |
| | | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | |
| | | Digital energy metre with CT | | | | |
| | | | | | | |
| | v) | 3 Nos. MCCB as per following details/ specifications: | | | | |
| | | 125 Amp 415 volts, 50 KA (Isc), TPN MCCB with thermal magnetic release having variable current settings . | | | | |

| | | | | | | |
|-------------|----|--|-----|---|--|--|
| | | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers. | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB | | | | |
| | | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | |
| | | Digital energy metre with CT | | | | |
| | | Main LT Panel Emergency as mentioned above. | Set | 1 | | |
| | | | | | | |
| 2.03 | | CAPACITOR PANEL | | | | |
| | | Supply, installation, testing and commissioning of M.V. cubicle type totally enclosed free standing type, dust, damp and vermin proof Capacitor Panel complete with busbars, M.V. danger notice plate, ammeter, ammeter selector switch, indicating lamps, CT's, Extra heavy duty Capacitors suitable for non linear loads upto 20% (L&T model MD-XL or equivalent), contactors suitable for capacitor switching (current limiting contactor circuit to suppress switching inrush current) interconnections with suitable capacity aluminium leads/solid aluminium strips, rods, connection of incoming and outgoing cables with thimbles, stove enamelled painted and having following incoming and outgoing switchgears complete as required | | | | |
| | | | | | | |
| | A. | INCOMER : | | | | |
| | | 1 No. 1000A, 415/500V, Motorised, Fully Drawout type (EDO), Four Pole, Air Circuit Breaker with microprocessor based overload, short circuit & earth Fault trip including under voltage release and lockable trip push button. ACB should have $I_{cw}=I_{cs} = 50 \text{ KA}$ for 1 sec. | | | | |
| | | Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP. | | | | |
| | | R, Y & B Phase indicating lamps (LED type) with 2A control SP MCBs | | | | |
| | | 10 steps Intelligent microprocessor based Automatic Power factor Correction relay having measurement sensitivity of 1 %. | | | | |
| | | Extension of incoming busbars for connection of multicore armoured aluminium cables. | | | | |
| | B. | METERING : | | | | |
| | | 1 set of digital Amp. Meter, digital Poper factor meter and Digital voltmeter | | | | |
| | C. | BUSBARS : | | | | |
| | | 1500 Amp FP busbars of aluminum | | | | |
| | D. | OUTGOINGS : | | | | |

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|--|------|--|--|--|--|--|
| | i) | 3 Nos . MCCB as per following details/ specification: | | | | |
| | | 200 Amps, 415 volts, TP, Power Contactor suitable for capacitive switching including current limiting contactor circuit to suppress switching inrush current | | | | |
| | | ON/ OFF delay timers for switching capacitor circuit. | | | | |
| | | "ON" and "OFF" LED indicating lamp and 2A control SP MCBs | | | | |
| | | Push button for CLOSE and TRIP | | | | |
| | | Extended rotary operating mechanism | | | | |
| | | 100 kVAR super heavy duty mix dielectric low loss Capacitors suitable for non linear loads upto 20% (L&T model MD-XL ultra or equivalent) | | | | |
| | | | | | | |
| | ii) | 5 Nos . MCCB as per following details/ specification: | | | | |
| | | 100 Amps, 415 volts, TP, Power Contactor suitable for capacitive switching including current limiting contactor circuit to suppress switching inrush current | | | | |
| | | ON/ OFF delay timers for switching capacitor circuit. | | | | |
| | | "ON" and "OFF" LED indicating lamp and 2A control SP MCBs | | | | |
| | | Push button for CLOSE and TRIP | | | | |
| | | Extended rotary operating mechanism | | | | |
| | | 50 kVAR super heavy duty mix dielectric low loss Capacitors suitable for non linear loads upto 20% (L&T model MD-XL ultra or equivalent) | | | | |
| | | | | | | |
| | iii) | 1 Nos . MCCB as per following details/ specification: | | | | |
| | | 63 Amps, 415 volts, TP, Power Contactor suitable for capacitive switching including current limiting contactor circuit to suppress switching inrush current | | | | |
| | | ON/ OFF delay timers for switching capacitor circuit. | | | | |
| | | "ON" and "OFF" LED indicating lamp and 2A control SP MCBs | | | | |
| | | Push button for CLOSE and TRIP | | | | |
| | | Extended rotary operating mechanism | | | | |
| | | 25 kVAR super heavy duty mix dielectric low loss Capacitors suitable for non linear loads upto 20% (L&T model MD-XL ultra or equivalent) | | | | |
| | | | | | | |
| | iv) | 1 Nos . MCCB as per following details/ specification: | | | | |
| | | 32 Amps, 415 volts, TP, Power Contactor suitable for capacitive switching including current limiting contactor circuit to suppress switching inrush current | | | | |
| | | ON/ OFF delay timers for switching capacitor circuit. | | | | |
| | | "ON" and "OFF" LED indicating lamp and 2A control SP MCBs | | | | |
| | | Push button for CLOSE and TRIP | | | | |
| | | Extended rotary operating mechanism | | | | |

| | | | | | | | |
|-------------|---|--|-----|---|--|--|--|
| | | 10 kVAR super heavy duty mix dielectric low loss Capacitors suitable for non linear loads upto 20% (L&T model MD-XL ultra or equivalent) | | | | | |
| | | | | | | | |
| | | Capacitor panel as mentioned above. | Set | 2 | | | |
| | | | | | | | |
| | | TOTAL SUBHEAD 2: MAIN LT PANEL. | | | | | |
| | | | | | | | |
| 3.00 | | SUB HEAD 3 : DG SET & ACCESSORIES | | | | | |
| | | | | | | | |
| | | SOUND PROOF DG SETS OF 380 KVA. | | | | | |
| 3.01 | | Supply, installation, testing and commissioning of sound proof (silent type) Diesel Generating set having 380 KVA Prime Power Ratings , 415 volt at 1500 RPM, 0.8 power factor suitable for 50 Hz, 3 phase system , suitable bhp, water cooled type diesel engine- alternator set mounted on common base frame, return fuel cooler, battery & battery charger, Anti Vibration mounting pads, Engine alternator safeties, electronic governor including all accessories & their wiring as per technical specification. This includes the following: | | | | | |
| | - | Supplying and fixing of suitable sizes High class MS pipe for DG exhaust complete with bends, elbow, flanges etc including silencer and catalytic convertor exhaust pipe for exhaust of DG sets including pollution control board norms and as required. | | | | | |
| | - | Supply and fixing of 50mm thick compressed mineral wool insulation (Rock wool) for D.G. exhaust pipe with 22 gauge aluminium sheet cladding etc. as required for the under mentioned dia pipe. | | | | | |
| | - | Supply, installation, testing and commissioning of suitable size fuel pipe for connecting diesel engine to individual day service tank including supply and fixing of required valves & filters etc. as required. | | | | | |
| | - | Fabrication of supports for exhaust pipe, fuel pipe or for any other purpose out of suitable M.S. structural steel including supplying and applying of enamel paint of approved shade after one coat of steel primer of reputed company. | | | | | |
| | - | Supplying and fixing of suitable capacity cable adapter box for alternator. | | | | | |
| | - | Providing and fixing oil tank of 990 litres capacity complete with suitable M.S. fabricated MS stand oil level indicator gauge tank and stand duly painted, complete with float switches etc. as required. | | | | | |

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|--|----|--|--|--|--|--|
| | - | Factory assembled Sound proof Canopy as per pollution control board requirement to achieve noise level desired during night condition, with base frame, doors, inspection window, fresh air supply fans, light fixtures for illumination with switch, wiring for light fixtures and power sockets, etc. | | | | |
| | - | Any other item required for completion of system above (D.G. set) | | | | |
| | | DG AMF PANEL | | | | |
| | A. | DG AMF PANEL | | | | |
| | | Supply, installation, testing and commissioning of DG , cubicle type, totally enclosed, free standing type, dust, damp and vermin proof Panel made up of 14/ 16SWG CRCA sheet, (load bearing members 14 SWG and doors 16 SWG) ,complete with aluminium busbars, M.V. danger notice plate, interconnections with suitable capacity aluminum leads/solid aluminum strips/rods, powder coat painted and having incoming and outgoing switchgears as mentioned below and complete as required. | | | | |
| | | Note : | | | | |
| | | 1. All relays to operate at 240Volts, Single phase, 50Hz., AC supply through UPS | | | | |
| | | 2. Panel shall be suitable for manual and automatic operation (AMF) and shall be complete as required. | | | | |
| | B. | Automatic Change over switch in suitable panel as a incomer : | | | | |
| | | One no. 800 A auto change over switch for changeover between State Electricity Board power & DG set power as approved by the Engineer In charge. | | | | |
| | C. | 1 No.MCCB as per following details/ specification: | | | | |
| | | 1 No. 800A, 415/500V, Motorised, Fully Drawout type (EDO), Four Pole, Air Circuit Breaker with microprocessor based overload, short circuit & earth Fault trip including under voltage release and lockable trip push button. ACB should have Icw=Ics = 50 KA for 1 sec. | | | | |
| | | "ON" LED indicating lamp and 2A control SP MCB | | | | |
| | | Digital energy meter with one set of suitable CTs, CT shorting links. | | | | |
| | | Digital Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | |
| | | Digital Volt meter with VSS & HRC fuse | | | | |
| | | Digital multifunction meter to show, KWH, KVAH, P.F.and frequency meter one set of suitable CTs, CT shorting links. | | | | |

| | | | | | | | |
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| | D. | PROTECTION AND AMF COMPONENTS for above mentioned DG set. | | | | | |
| | | Over Voltage relay | | | | | |
| | | Under Voltage relay | | | | | |
| | | Battery charger (with trickle and boost charging). | | | | | |
| | | DC voltmeter and ammeter. | | | | | |
| | | DC ammeter. | | | | | |
| | | 8 window Alarm annunciator with separate hooter, accept, reset and rest push button. | | | | | |
| | | Hooter. | | | | | |
| | | Engine Cranking Relay. | | | | | |
| | | Main supply voltage monitor, alternator voltmeter monitor and Engine Starting Relays. | | | | | |
| | | Auxillary relays, timer, push button and control fuses. | | | | | |
| | | Phase sequence relay | | | | | |
| | | | | | | | |
| | E. | ENCLOSURE : | | | | | |
| | | Fabrication, PVC Sleeving, Control/Power Wiring and necessary electrical/mechanical interlocking etc any other item required for proper functioning of the system complete as required. | | | | | |
| | | DG SET WITH AMF PANEL as mentioned above | Set | 2 | | | |
| | | TOTAL SUBHEAD 3: DG SETS | | | | | |
| | | SUB HEAD 4 : EARTHING FOR SUBSTATIONS | | | | | |
| 4.00 | | EARTHING FOR SUBSTATION : | | | | | |
| | 4.01 | Earthing with copper plate 600mmX600mmX3mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. (but without charcoal or coke and salt) complete as required | Set | 10 | | | |
| | 4.02 | Earthing with GI plate 600mmX600mmX6mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. (but without charcoal or coke and salt) complete as required | Set | 18 | | | |
| | 4.03 | Extra for using charcoal and salt for GI or copper plate earth electrode as required. | Set | 28 | | | |
| | 4.04 | Supplying and laying 25mmX5mm GI strip at 0.5m below ground level as strip earth electrode, including soldering etc. as required. | Metre | 200 | | | |
| | 4.05 | Providing and fixing 25mmX5mm GI strip on surface/on existing cable trench/RCC pipe/GI pipe or in recess for earth electrode as required. | Metre | 220 | | | |

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| | | | | | | | |
| 4.06 | Providing and fixing 25mmx5mm G.I. strip in 40mm dia G.I. pipe from earth electrode as required. | Metre | 100 | | | | |
| 4.07 | Providing and fixing 25mmX5mm Copper strip on surface/on existing cable trench/RCC pipe/GI pipe or in recess for earth electrode as required. | Metre | 200 | | | | |
| 4.08 | Supplying and laying 25mmX5mm Copper strip at 0.5m below ground level as strip earth electrode, including soldering etc. as required. | Metre | 100 | | | | |
| 4.09 | Providing and fixing 25mmx5mm copper strip in 40mm dia G.I. pipe from earth electrode as required. | Metre | 75 | | | | |
| 4.10 | Providing and laying of following sizes non pressure NP2 class (light duty) RCC pipe with collar joint with stiff mixture of cement (1 cement : 2 fine sand) including testing the joints etc. as required. | | | | | | |
| i | 150mm dia | Metre | 100 | | | | |
| ii | 300mm dia | Metre | 150 | | | | |
| 4.11 | Providing and fixing M.V. danger notice plate of 200mmX150mm made of mild steel, atleast 2mm thick and vitreous enamelled white on both sides and with inscription in signal red colour on front side as required. | Each | 5 | | | | |
| 4.12 | Supplying and laying of 1.1kV grade 1 metre wide anti skid chequered type rubber mat. | Metre | 30 | | | | |
| 4.13 | Supplying and laying of 12kV grade 1 metre wide anti skid chequered type rubber mat. | Metre | 20 | | | | |
| 4.14 | Supply and fixing shock treatment chart in English, Hindi and local language mounted on 5mm thick Plywood and 3mm thick plain glass front complete as required. | Set | 6 | | | | |
| 4.15 | Supplying and fixing CO2 type 9 Kg capacity trolley mounted fire extinguishers as approved by ISI complete as required. | Set | 8 | | | | |
| 4.16 | Supplying and fixing Foam type 9 ltrs capacity fire extinguishers as approved by ISI complete as required. | Set | 4 | | | | |
| 4.17 | Supplying and fixing Foam type 10 ltrs capacity fire extinguishers trolley mounted as approved by ISI complete as required. | Set | 2 | | | | |

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| 4.18 | Supplying, storing, handling and fixing in position First Aid Medical Box and an 'Artificial Respirator' complete as per technical specifications as required. | Each | 1 | | | |
| 4.19 | Supply and testing of 11kV ISI marked hand gloves | Set | 1 | | | |
| 4.20 | Providing & fixing rigid PVC pipe complete with fittings, clamps including trenching & refilling/ wall cutting & plastering, etc. (for cable entry) with all minor civil & mech. Works complete as required. | | | | | |
| | 50 mm dia nominal bore | Metre | 100 | | | |
| TOTAL SUB HEAD 4: EARTHING FOR SUBSTATION | | | | | | |

| SUB HEAD 5 :MV PANELS | | | | | | | |
|-----------------------|-----------|---|-----|---|--|--|--|
| 5.00 | | Supply, installation, testing and commissioning of following M.V. cubicle type totally enclosed, wall mounted type, dust, damp and vermin proof, indoor type Distribution Board/Panel complete with busbars, M.V. danger notice plate, interconnections with suitable capacity aluminium leads/solid aluminium strips/rods, connection of incoming and outgoing cables with thimbles, powder coat painted and having following incoming and outgoing switchgears complete as required. Panel shall have IP-42 protection. | | | | | |
| | A1 | HOSTEL NO. 1 | | | | | |
| 5.01 | | MV PANEL GROUND FLOOR - NORMAL 1 & NORMAL 2 : (HOSTEL 1) | | | | | |
| | a) | INCOMER: | | | | | |
| | | 500 Amp 415 volts, 35 KA (Ics) FP MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. | | | | | |
| | | R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | | 1 No. 0 to 500 V Digital voltmeter with selector switch. | | | | | |
| | | 1 No. 0 to 500 Amp Digital ammeter with selector switch with one set of 500/5A C.Ts. | | | | | |
| | b) | BUSBARS: | | | | | |
| | | 630 Amp TPN Aluminium busbars | | | | | |
| | c) | OUTGOING: | | | | | |
| | i) | 27 no. 100 Amps , 415 volts, 9 KA ,Four Pole, Miniature Circuit Breaker, with ON/ OFF indication. | | | | | |
| | ii) | 1 no. 63 Amps , 415 volts, 9 KA ,Four Pole, Miniature Circuit Breaker, with ON/ OFF indication. | | | | | |
| | | MV PANEL GROUND FLOOR - NORMAL 1 & NORMAL 2 : (HOSTEL 1) as mentioned above | Set | 2 | | | |
| 5.02 | | MV PANEL GROUND FLOOR - EMERGENCY 1 & EMERGENCY 2 : (HOSTEL 1) | | | | | |
| | a) | INCOMER: | | | | | |
| | | 400 Amp 415 volts, 35 KA (Ics) FP MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. | | | | | |

| | | | | | | | |
|------|-----------|--|-----|---|--|--|--|
| | | R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | | 1 No. 0 to 500 V Digital voltmeter with selector switch. | | | | | |
| | | 1 No. 0 to 400 Amp Digital ammeter with selector switch with one set of 400/5A C.Ts. | | | | | |
| | b) | BUSBARS: | | | | | |
| | | 630 Amp TPN Aluminium busbars | | | | | |
| | c) | OUTGOING: | | | | | |
| | i) | 1 Nos. MCCB as per following details / specifications: | | | | | |
| | | 125 Amps,415 volts, TPN, 35 KA Moulded Case Circuit Breaker with thermal magnetic release having variable current settings | | | | | |
| | | "ON" LED indicating lamp and 2A control SP MCB | | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | ii) | 2 Nos. MCCB as per following details / specifications: | | | | | |
| | | 63Amps,415 volts, TPN, 25 KA Moulded Case Circuit Breaker with thermal magnetic release having variable current settings . | | | | | |
| | | "ON" LED indicating lamp and 2A control SP MCB | | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | iii) | 15 no. 63 Amps , 415 volts, 9 KA ,Four Pole, Miniature Circuit Breaker, with ON/ OFF indication. | | | | | |
| | | MV PANEL GROUND FLOOR - EMERGENCY 1 & EMERGENCY 2 : (HOSTEL 1) as mentioned above | Set | 2 | | | |
| | A2 | HOSTEL NO. 2 | | | | | |
| 5.03 | | MV PANEL GROUND FLOOR - NORMAL 1 & : (HOSTEL 2) | | | | | |
| | a) | INCOMER: | | | | | |
| | | 320 Amp 415 volts, 35 KA (Ics) FP MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. | | | | | |
| | | R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | | 1 No. 0 to 500 V Digital voltmeter with selector switch. | | | | | |

| | | | | | | | |
|--|----|---|-----|---|--|--|--|
| | | 1 No. 0 to 320 Amp Digital ammeter with selector switch with one set of 320/5A C.Ts. | | | | | |
| | b) | BUSBARS: | | | | | |
| | | 500 Amp TPN Aluminium busbars | | | | | |
| | c) | OUTGOING: | | | | | |
| | | | | | | | |
| | i) | 15 no. 100 Amps , 415 volts, 9 KA ,Four Pole, Miniature Circuit Breaker, with ON/ OFF indication. | | | | | |
| | | | | | | | |
| | | MV PANEL GROUND FLOOR - NORMAL 1 & : (HOSTEL 2) as mentioned above | Set | 1 | | | |
| | | | | | | | |

| | | | | | | |
|------|----|---|-----|---|--|--|
| 5.04 | | MV PANEL GROUND FLOOR - EMERGENCY 1 & : (HOSTEL 2) | | | | |
| | a) | INCOMER: | | | | |
| | | 320 Amp 415 volts, 35 KA (Ics) FP MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | 1 No. 0 to 500 V Digital voltmeter with selector switch. | | | | |
| | | 1 No. 0 to 320 Amp Digital ammeter with selector switch with one set of 320/5A C.Ts. | | | | |
| | b) | BUSBARS: | | | | |
| | | 400 Amp TPN Aluminium busbars | | | | |
| | c) | OUTGOING: | | | | |
| | | 1 Nos. MCCB as per following details / specifications: | | | | |
| | | 125 Amps,415 volts, TPN, 25 KA Moulded Case Circuit Breaker with thermal magnetic release having variable current settings. "ON" LED indicating lamp and 2A control SP MCB | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | | | | | |
| | | 2 Nos. MCCB as per following details / specifications: | | | | |
| | | 63Amps,415 volts, TPN, 25 KA Moulded Case Circuit Breaker with thermal magnetic release having variable current settings . "ON" LED indicating lamp and 2A control SP MCB | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | | | | | |
| | i) | 15 no. 63 Amps , 415 volts, 9 KA ,Four Pole, Miniature Circuit Breaker, with ON/ OFF indication. | | | | |
| | | | | | | |
| | | MV PANEL GROUND FLOOR - EMERGENCY 1 & : (HOSTEL 2) as mentioned above | Set | 1 | | |
| 5.05 | | MV PANEL GROUND FLOOR - NORMAL 2 & : (HOSTEL 2) | | | | |
| | a) | INCOMER: | | | | |
| | | 500 Amp 415 volts, 35 KA (Ics) FP MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | |
| | | | | | | |

| | | | | | | | |
|--|----|--|--|--|--|--|--|
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | | 1 No. 0 to 500 V Digital voltmeter with selector switch. | | | | | |
| | | 1 No. 0 to 500 Amp Digital ammeter with selector switch with one set of 500/5A C.Ts. | | | | | |
| | b) | BUSBARS: | | | | | |
| | | 630 Amp TPN Aluminium busbars | | | | | |
| | c) | OUTGOING: | | | | | |
| | | | | | | | |
| | i) | 29 no. 100 Amps , 415 volts, 9 KA ,Four Pole, Miniature Circuit Breaker, with ON/ OFF indication. | | | | | |
| | | | | | | | |

| | | | | | | |
|------|-----------|--|-----|---|--|--|
| | | MV PANEL GROUND FLOOR - NORMAL 2 & : (HOSTEL 2) as mentioned above | Set | 1 | | |
| 5.06 | | MV PANEL GROUND FLOOR - EMERGENCY 2 & : (HOSTEL 2) | | | | |
| | a) | INCOMER: | | | | |
| | | 320 Amp 415 volts, 35 KA (Ics) FP MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | 1 No. 0 to 500 V Digital voltmeter with selector switch. | | | | |
| | | 1 No. 0 to 320 Amp Digital ammeter with selector switch with one set of 320/5A C.Ts. | | | | |
| | b) | BUSBARS: | | | | |
| | | 500 Amp TPN Aluminium busbars | | | | |
| | c) | OUTGOING: | | | | |
| | | | | | | |
| | i) | 29 no. 63 Amps , 415 volts, 9 KA ,Four Pole, Miniature Circuit Breaker, with ON/ OFF indication. | | | | |
| | | | | | | |
| | | MV PANEL GROUND FLOOR - EMERGENCY 2 & : (HOSTEL 2) as mentioned above | Set | 1 | | |
| | | | | | | |
| | A3 | HOSTEL NO. 3 | | | | |
| 5.07 | | MV PANEL GROUND FLOOR - NORMAL : (HOSTEL 3) | | | | |
| | a) | INCOMER: | | | | |
| | | 320 Amp 415 volts, 35 KA (Ics) FP MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | 1 No. 0 to 500 V Digital voltmeter with selector switch. | | | | |
| | | 1 No. 0 to 320 Amp Digital ammeter with selector switch with one set of 320/5A C.Ts. | | | | |
| | b) | BUSBARS: | | | | |
| | | 500 Amp TPN Aluminium busbars | | | | |
| | c) | OUTGOING: | | | | |
| | | | | | | |
| | i) | 15 no. 100 Amps , 415 volts, 9 KA ,Four Pole, Miniature Circuit Breaker, with ON/ OFF indication. | | | | |

| | | | | | | | |
|--|--|---|----------------------|---|--|--|--|
| | | | | | | | |
| | | MV PANEL GROUND FLOOR - NORMAL : mentioned above | (HOSTEL 3) as Set | 1 | | | |
| | | | | | | | |

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|------|----|--|-----|---|--|--|
| 5.08 | | MV PANEL GROUND FLOOR - EMERGENCY : (HOSTEL 3) | | | | |
| | a) | INCOMER: | | | | |
| | | 400 Amp 415 volts, 35 KA (lcs) FP MCCB with variable current settings and having microprocessor based O/L, S/C & E/F protection release. | | | | |
| | | R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | 1 No. 0 to 500 V Digital voltmeter with selector switch. | | | | |
| | | 1 No. 0 to 400 Amp Digital ammeter with selector switch with one set of 400/5A C.Ts. | | | | |
| | b) | BUSBARS: | | | | |
| | | 630 Amp TPN Aluminium busbars | | | | |
| | c) | OUTGOING: | | | | |
| | | 1 Nos. MCCB as per following details / specifications: | | | | |
| | | 125 Amps,415 volts, TPN, 25 KA Moulded Case Circuit Breaker with thermal magnetic release having variable current settings | | | | |
| | | "ON" LED indicating lamp and 2A control SP MCB | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | | | | | |
| | | 2 Nos. MCCB as per following details / specifications: | | | | |
| | | 63Amps,415 volts, TPN, 25 KA Moulded Case Circuit Breaker with thermal magnetic release having variable current settings . | | | | |
| | | "ON" LED indicating lamp and 2A control SP MCB | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | | | | | |
| | i) | 12 no. 100 Amps , 415 volts, 9 KA ,Four Pole, Miniature Circuit Breaker, with ON/ OFF indication. | | | | |
| | | | | | | |
| | | MV PANEL GROUND FLOOR - EMERGENCY : (HOSTEL 3) as mentioned above | Set | 1 | | |
| 5.09 | | LIFT PANEL EMERGENCY : (HOSTEL 1&2) | | | | |
| | a) | INCOMER: | | | | |
| | | 1 no.200Amps , 415 volts, 35 KA (lsc),four pole, Moulded Case Circuit Breaker with thermal magnetic release having variable current settings. | | | | |
| | | R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | |

| | | | | | | |
|------|----|--|-----|---|--|--|
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | 1 No. 0 to 500 V Digital voltmeter with selector switch. | | | | |
| | | 1 No. 0 to 200 Amp Digital ammeter with selector switch with one set of 200/5A C.Ts. | | | | |
| | b) | BUSBARS: | | | | |
| | | 300 Amp TPN Aluminium busbars | | | | |
| | c) | OUTGOING: | | | | |
| | | | | | | |
| | i) | 6 Nos. MCCB as per following details / specifications: | | | | |
| | | 63Amps,415 volts, TPN, 25 KA Moulded Case Circuit Breaker with thermal magnetic release having variable current settings . | | | | |
| | | "ON" LED indicating lamp and 2A control SP MCB | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | | | | | |
| | | LIFT PANEL EMERGENCY : (HOSTEL 1&2) as mentioned above | Set | 2 | | |
| 5.10 | | LIFT PANEL EMERGENCY : (HOSTEL 3) | | | | |
| . | a) | INCOMER: | | | | |
| | | 1 no.125Amps , 415 volts, 35 KA (lsc),four pole, Moulded Case Circuit Breaker with thermal magnetic release having variable current settings . | | | | |
| | | R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | 1 No. 0 to 500 V Digital voltmeter with selector switch. | | | | |
| | | 1 No. 0 to 120 Amp Digital ammeter with selector switch with one set of 120/5A C.Ts. | | | | |
| | b) | BUSBARS: | | | | |
| | | 200 Amp TPN Aluminium busbars | | | | |
| | c) | OUTGOING: | | | | |
| | | | | | | |
| | i) | 4 Nos. MCCB as per following details / specifications: | | | | |
| | | 63Amps,415 volts, TPN, 25 KA Moulded Case Circuit Breaker with thermal magnetic release having variable current settings . | | | | |
| | | "ON" LED indicating lamp and 2A control SP MCB | | | | |
| | | Extended rotary operating mechanism with door interlocking with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | |
| | | LIFT PANEL EMERGENCY : (HOSTEL 3) as mentioned above | Set | 1 | | |

| | | | | | | |
|-------------|-----|---|------|------|--|--|
| | | TOTAL SUB HEAD 5 : MV PANEL | | | | |
| | | | | | | |
| | | SUB HEAD- 6: MCB DISTRIBUTION BOARDS. | | | | |
| 6.00 | | MCB DISTRIBUTION BOARD | | | | |
| 6.01 | | Supplying & fixing following way, three pole and neutral,prewired,sheet steel, MCB distribution board, 415 volts,on recess/surface complete with loose wire box, terminal blocks, tinned copper busbar, neutral link, earth bar,din bar, detachable gland plate, interconnections, phosphatized and powder painted including earthing etc.Before procurement of DB the contractor has to take approval of DB schedule/ drawing of each DB from the Electrical Engineer, HSCC, as per technical specifications and as required.(but without MCB & RCCB), | | | | |
| | i | 8 way (8+24), Double door | Each | 4 | | |
| | ii | 12 way (8+36), Double door | Each | 154 | | |
| | | | | | | |
| 6.02 | | Supplying & fixing 6 Amps to 32 Amps rating, 240 volts,'B' series, miniature circuit breaker suitable for lighting & other loads of following poles in the existing MCB DB complete with connections, testing & commissioning etc. as per technical specifications & as required. | | | | |
| | i | Single pole | Each | 4230 | | |
| | ii | Triple pole & neutral (FP) | Each | 3 | | |
| | | | | | | |
| 6.03 | | Supplying & fixing following rating, four pole, 415 volts, Miniature Circuit Breaker (MCB),in the existing MCB DB complete with connections, testing & commissioning etc. as per technical specifications and as required. | | | | |
| | i | 40 Amps | Each | 3 | | |
| | ii | 63 A mps | Each | 67 | | |
| | iii | 100 A mps | Each | 91 | | |
| | | | | | | |
| 6.04 | | Supplying & fixing following rating, four pole, 415 volts,Residual Current Circuit Breaker (RCCB) having a sensitivity current upto 300 mA in the existing MCB DB complete with connections, testing & commissioning etc. as per technical specifications and as required. | | | | |
| | ii | 32 Amps | Each | 3 | | |
| | iii | 40 Amps | Each | 3 | | |
| | iv | 63 Amps | Each | 67 | | |
| | v | 100 A mps | Each | 91 | | |
| | | | | | | |
| 6.05 | | Supplying and fixing Single pole Blanking plate in the existing MCB DB complete as required. | Each | 1014 | | |
| | | TOTAL SUB HEAD-6: MCB DISTRIBUTION BOARDS. | | | | |

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| | | SUB HEAD 7: WIRING | | | | | |
| 7.00 | | WIRING | | | | | |
| 7.01 | i | Wiring for light point/fanpoint/ exhaust fan point/call bell point with 1.5 sq.mm. PVC insulated, fire retardant low smoke (FRLS) copper conductor cable, single core/ multi strand, in steel conduit (Including supplying & recess laying of MS conduit and accessories) including the following and complete as required. | | | | | |
| | ii | Supplying and Fixing Modular type switches (modular Bell push in case of call bell points) in suitable size modular metal boxes, base plate & modular cover plates, space for fixing electronic fan regulator in case of fan point wiring & space for fixing 5A socket on the board etc. | | | | | |
| | iii | Supplying and fixing Hexagonal fan Boxes with 3 mm thick hylem sheet covers in case of Fan Points | | | | | |
| | iv | Supplying & Fixing Ceiling Rose in case of Exhaust Fan Points etc. | | | | | |
| | | Note : | | | | | |
| | | i) Unless otherwise specified all the conduiting work to be done in recess | | | | | |
| | | Point wiring as mentioned above | Point | 8063 | | | |
| | | | | | | | |
| 7.02 | i | Wiring for twin control light points with 1.5 sq.mm. PVC insulated, FRLS copper conductor cable in MS conduit (including supplying and recess laying of MS conduit) including the following and complete as required. | | | | | |
| | ii | Supplying and Fixing Modular type two numbers 2 Way switches in suitable size modular metal boxes, base plate & modular cover plates etc. | | | | | |
| | | Note : | | | | | |
| | | i) Unless otherwise specified all the conduiting work to be done in recess | | | | | |
| | | Wiring for twin control light points as mentioned above | Point | 208 | | | |
| | | | | | | | |
| 7.03 | | Wiring for 5A light plugs with 1.5 sq.mm. PVC insulated, FRLS copper conductor cable including one number 1.5 sq.mm. PVC insulated, copper conductor cable for earthing in surface/recessed ISI marked MS conduit (including supply and recess laying of ISI marked MS conduit) as per technical specifications and as required. | Point | 1553 | | | |
| | | | | | | | |
| | | 5 A light plug wiring same as above but plug point is in the switch board itself. | Point | 45 | | | |
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| 7.04 | | Wiring for computer points (Three sockets & one switch) with 2.5 sq.mm. PVC insulated, FRLS copper conductor cable including one number 2.5 sq.mm. PVC insulated, copper conductor cable for earthing in surface/recessed MS conduit (including supply and recess laying of conduit) as per technical specifications and as required. | Point | 588 | | |
| 7.05 | | Wiring for 16 amp power plug with 2X4 sqmm PVC insulated, FRLS copper conductor, single core/multi strand cable in surface/recessed MS conduit (including supply and recess laying of MS conduit with all accessories) along with 4 sqmm PVC insulated, copper conductor, single core/multi strand cable for loop earthing etc per technical specifications & as required. | | | | |
| | | Directly from MCB-Distribution Board to the Socket Outlets | Point | 1486 | | |
| 7.06 | | Wiring for 20 amp power plug with 2X4 sq.mm. PVC insulated, copper conductor, single core cable in surface/recessed ISI marked MS conduit (including supply and recess laying of ISI marked MS conduit with all accessories) along with 1X4 sqmm PVC insulated, copper conductor, single core cable for loop earthing, as per technical specifications & as required. | Point | 258 | | |
| 7.07 | | Wiring for submain/ circuit wiring with following sizes of PVC insulated, copper conductor single core/multi strand cable in recessed steel conduit (including supply & laying of recessed conduit) as required. | | | | |
| | i) | 2X2.5 Sqmm with 1 No. 2.5 sqmm PVC insulated, copper conductor for earthing. | Metre | 11042 | | |
| | ii) | 4X16 Sqmm with 2 nos 16 sq mm PVC insulated, copper conductor for earthing. | Metre | 1843 | | |
| | iii) | 4X25 Sqmm with 2 nos 25 sq mm PVC insulated, copper conductor for earthing. | Metre | 2082 | | |
| 7.08 | | Supplying and fixing suitable Module metal box on surface or in recess including providing and fixing 3 pin 5/6 amps. modular socket outlet with shutters and 5/6 amps. modular type switch, base plate, modular cover plate, connections etc. and all civil works 'complete as required. | Each | 1563 | | |
| 7.09 | | Supplying and fixing suitable module modular metal box on surface or in recess including providing and fixing 6 pin 15/16 A modular socket outlet with shutters and 15/16 A modular switch, base plate, modular cover plate, connections, etc. and all civil works complete as required. | Each | 1486 | | |

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| 7.10 | | Supply and fixing following 20 Amps, 240 volts, 2P+E, Industrial Socket Outlet (with plugs) in a metal box with 20 SP MCB in a sheet steel cover on surface or recess complete with all accessories including connections, testing and commissioning etc. as required. | Each | 258 | | |
| 7.11 | | Supply, Installation, Testing & Commissioning 63 Amps, TPN MCCB in a sheet steel enclosure, extended rotary operating mechanism complete with all accessories as required. | Each | 10 | | |
| 7.12 | | Supplying and fixing suitable Module metal box on surface or in recess including providing and fixing three nos 3 pin 5/6 amps. modular socket outlet with shutters and one no. 10 amps. modular type switch, base plate, modular cover plate, connections etc. and all civil works 'complete as required. (For computer Points) | Each | 588 | | |
| 7.13 | | Supplying, providing & fixing cordless musical bell, batteries etc of approved make complete as required. | Each | 236 | | |
| | | | | | | |
| | | TOTAL SUBHEAD: 7- WIRING | | | | |
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| | | SUB HEAD: 8 - LIGHT FIXTURE AND FANS | | | | | |
| 8.00 | | LIGHT FIXTURES AND FANS | | | | | |
| 8.01 | | Supply of following light fixture with high efficiency electronic ballast, starter, capacitor, reflector, diffuser, MS body/housing holder etc. complete with all fixing accessories as required. | | | | | |
| | i | 1X28 watt box type flourescent light fixture (Philips TMS 122M 1XTL5 B8 W EBT or approved equivalent) (136b/136bw) | Each | 1837 | | | |
| | ii | 2X28 watt box type flourescent light fixture with reflector (Philips TMS 122M2XTL528 W EBT or approved equivalent) (236b) | Each | 301 | | | |
| | iii | 1X36watt surface mounted flourescent light fixture (Philips TCS 6051XTLD 36W IC MI or approved equivalent) 136smo1 | Each | 15 | | | |
| | iv | 1X36watt recess mounted flourescent light fixture (Philips TBS 0501XTLD36 W EBE MI or approved equivalent) 136RMO1 | Each | 1336 | | | |
| | v | 2X TL5 28 watt recess mounted mirror optics flourscent light fixture (Philips TBS 669M 2XL528 W EBP D6 or approved equivalent). (236 RMO1) | Each | 25 | | | |
| | vi | 2 X36watt surface mounted flourescent light fixture (Philips TCS 398 2XTLD 36 W EBE HIL D6 or approved equivalent) 236SMO1 | Each | 115 | | | |
| 8.02 | | Supply of following compact flourescent light fixture with electronic ballast, starter, capacitor, yellow light lamps, reflector, diffuser, MS body/housing holder etc. complete with all fixing accessories as required. | | | | | |
| | i | 1x9 watt Bulk Head light fixture (Philips FXC 101 1XPL-S/2P11 W ACO or approved equivalent) BH | Each | 97 | | | |
| | ii | 1X18 watt new drumlight round downlight fixture with CFL lamp (Decon 03UA 01 or approved equivalent) DL1 | Each | 390 | | | |
| | iii | 2 X 11 watt surface mounted mirror optics (Philips FCS 518 2XPLS/2P 11 W I 240 V OR EQUIVALENT) (211CFLRECT) | Each | 451 | | | |
| | iv | 2X10 watt Mirror top (Decon 05UB or approved equivalent) (w toilet) | Each | 588 | | | |

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| | v | Surface mounted Batten holder (Plastic) with 13 watt CFL | Each | 15 | | | |
| | vi | 1x15 watt GLS lamp in wall recessed fixture (Decon 54VW, in die cast aluminium or approved equivalent) used as a night lamp NLWM | Each | 230 | | | |
| | vii | 2X42 watt recessed mounted down light fixture with decorative PBT housing (Philips FBH225 2XPLT/4P42WHFP 240V or approved equivalent) | Each | 12 | | | |
| | viii | 1X13 watt wall bracket with polycarbonate diffuser and CFL lamp (Decon 05UK RIB or approved equivalent) WB1/WB2 | Each | 544 | | | |
| 8.03 | | Supply of following ceiling fans (Crompton Greaves High Breeze or approved equivalent) complete with double ball bearing, motor, blades, downrod, canopies, capacitor, modular type electronic fan regulator, suitable for operation on 230 volts, 50 Hz., 1 phase, AC supply complete as required | | | | | |
| | i | 900 mm sweep | Each | 10 | | | |
| | ii | 1200 mm sweep | Each | 1411 | | | |
| 8.04 | | Supply of 900 RPM, 225 mm heavy duty exhaust fan suitable for single phase 230 volts, 50 Hz., AC supply complete with motor, louvers/shutters etc. complete as required. | Each | 566 | | | |
| 8.05 | | Supply of 450 mm sweep, crompton greaves model high flow 18" wall mounted fan complete with double ball bearing, motor, blades, capacitor etc suitable for single phase 230 volts, 50 Hz., AC supply, complete as required. | Each | 20 | | | |
| 8.06 | | Installation, testing and commissioning of prewired, fluorescent fittings of all types, complete with all accessories and tube etc. directly on ceiling/wall, including connections with 1.5 sq.mm. PVC insulated, FRLS copper conductor, single core/ multi strand cable etc. as required. | Each | 3629 | | | |
| 8.07 | | Installation, testing and commissioning of prewired, compact fluorescent lamp fixture (CFL fixtures) of all types, complete with all accessories and lamp etc. directly on ceiling/wall, including connections with 1.5 sq.mm. PVC insulated, FRLS copper conductor, single core/ multi strand cable etc. as required. | Each | 2327 | | | |

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| 8.08 | | Installation, testing and commissioning of ceiling fan and modular type electronic fan regulator(Electronic regulator to be fixed in switch board) including wiring the down rod and connection with 1.5 sqmm FR PVC insulated, copper conductor single core/multi strand cable including providing & fixing phenolic laminated sheet cover on the fan box, etc. as required. | Each | 1421 | | |
| 8.09 | | Installation, testing and commissioning of exhaust fan up to 450 mm sweep in the opening, including making the hole to suit the size of the above fan including , fixing of louvers/ shutters with frame making good the damages etc. as required. | Each | 566 | | |
| 8.10 | | Installation, testing and commissioning of wall mounted fan up to 450 mm sweep including supply and fixing wall bracket arrangement complete as required. | Each | 20 | | |
| | | | | | | |
| | | TOTAL SUBHEAD 8 : LIGHT FIXTURE & FANS | | | | |
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|-------------|-----|--|-------|------|--|--|--|
| | | SUB HEAD 9 : TELEPHONE SYSTEM | | | | | |
| 9.00 | | TELEPHONE SYSTEM | | | | | |
| 9.01 | | Wiring for telephone point with Supply & laying two pair 0.5 Sq. mm solid, annealed copper conductor insulated with high density polythlene. The insulated cores twisted to form pairs, helically wrapped with polyester tape, over all insulation of FR PVC, unarmoured telephone cable in MS conduit (including supply & recessed laying of M.S. conduit), including providing & fixing of two module modular metal box on recess with following pair cord outlet, connections etc. complete as required. This also includes conduiting, wiring from floor Tag blocks to individual telephone outlets. | | | | | |
| | i | 1 pair cord outlet (Jack Type) | Point | 700 | | | |
| | ii | 2 pair cord outlet (Jack Type) | point | 85 | | | |
| 9.02 | | Supplying, Installation, testing and commissioning of following sizes of telephone distribution board in M.S. hinged type lockable box duly painted complete with Krone type tag block etc. including terminations of cable as required. | | | | | |
| | i | 500 Pair | Each | 2 | | | |
| | ii | 250 Pair | Each | 4 | | | |
| | iii | 150 Pair | Each | 1 | | | |
| | iv | 30 Pair | Each | 5 | | | |
| | v | 20 Pair | Each | 40 | | | |
| 9.03 | | Supplying and drawing of following pairs .5 mm dia annealed bare copper conductor Polythene insulated, core twisted into pairs armoured telephone cable on surface/ tray with saddels etc. complete as required. | | | | | |
| | i | 100 Pair | Metre | 110 | | | |
| | ii | 30 Pair | Metre | 120 | | | |
| | iii | 20 Pair | Metre | 1560 | | | |
| 9.04 | | Supplying and drawing of following pairs .5 mm dia annealed bare copper conductor Polythene insulated, core twisted into pairs armoured jelly filled telephone cable in the existing trench/ hume pipe/ GI pipe etc with saddels etc. complete as required. | | | | | |
| | i | 100 Pair | Metre | 8500 | | | |
| | ii | 50 Pair | Metre | 500 | | | |
| | | TOTAL : SUB HEAD 9:TELEPHONE SYSTEM | | | | | |
| | | SUB HEAD 10:CONDUITING FOR COMPUTER SYSTEM . | | | | | |
| 10.00 | | CONDUITING FOR COMPUTER SYSTEM . | | | | | |

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| 10.01 | | Supply and fixing of following sizes of rigid PVC conduit alongwith the accessories in recess including painting in case of surface conduit, or cutting the wall and making good the same in case of recessed conduit as required | | | | |
| | i | 20 mm dia | Metre | 11760 | | |
| | ii | 25 mm dia | Metre | 2940 | | |
| 10.02 | | Supplying and fixing two module modular plate (suitable for RJ-45 computer socket) with GI box complete as required. | Each | 588 | | |
| | | TOTAL SUB HEAD: 10 CONDUITING FOR COMPUTER SYSTEM | | | | |
| | | SUB HEAD 11: CONDUITING FOR TV OUTLETS | | | | |
| 11.00 | | CONDUITING FOR TV OUTLETS | | | | |
| 11.01 | | Supply and fixing of following sizes of MS conduit alongwith the accessories in surface/recess including painting in case of surface conduit, or cutting the wall and making good the same in case of recessed conduit as required | | | | |
| | i | 20 mm dia | Metre | 5280 | | |
| | ii | 25 mm dia | Metre | 1056 | | |
| 11.02 | | Supplying and fixing 2 module modular metal box in recess with modular cover plate including fixing 1 no. coaxial TV outlet connection and all accessories complete as required | Each | 528 | | |
| 11.03 | | Supply and drawing Coaxial TV Cable RG - 6 grade, 0.7 mm solid copper conductor PE insulated, shielded with fine tinned copper braid and potected with PVC sheath in the existing surface/ recessed steel/ PVC coduit as required. | Metre | 100 | | |
| | | TOTAL SUB HEAD 11: CONDUITING FOR TV OUTLETS | | | | |
| | | SUB HEAD 12 : FIRE DETECTION AND ALARM | | | | |
| 12.00 | | FIRE DETECTION AND ALARM SYSTEM | | | | |
| 12.01 | | Supply and drawing of following sizes of PVC insulated FRLS copper conductor single core cable in surface/recessed MS conduit (including Supplying and fixing of MS Conduit) complete as required. | | | | |
| | i | 2X1.5 sqmm | Metre | 26690 | | |

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| 12.02 | | Supply, installation, testing and commissioning of the following addressable type fire detection and alarm accessories as per technical specification & complete with connections etc. as required. | | | | |
| | i | Optical type Smoke Detector | Each | 1110 | | |
| | ii | Heat Detector | Each | 25 | | |
| | iii | Manual Break Glass Unit in MS enclosure | Each | 64 | | |
| | iv | Fire Alarm Bell / Hooter of suitable range to cover the complete floor, in MS enclosure. | Each | 64 | | |
| | v | Response indicator | Each | 518 | | |
| 12.03 | | Supply, Installation, testing and commissioning of 6 loop microprocessor based addressable type networkable Fire Detection & Alarm Panel complete with inbuilt power supply, battery charger with SMF batteries for minimum 24 hours back-up. The panel shall have a communication module and HI 485 network card. The panel should have rectifier, loop card, minimum 80 character LCD unit to indicate fire/ fault signals with address including external/ internal printer to print the details complete as per technical specifications and requirement of Local Fire Authority and as required. | Set | 2 | | |
| 12.04 | | Supply, Installation, testing and commissioning of 3 loop microprocessor based addressable type networkable Fire Detection & Alarm Panel complete with inbuilt power supply, battery charger with SMF batteries for minimum 24 hours back-up. The panel shall have a communication module and HI 485 network card. The panel should have rectifier, loop card, minimum 80 character LCD unit to indicate fire/ fault signals with address including external/ internal printer to print the details complete as per technical specifications and requirement of Local Fire Authority and as required. | Set | 1 | | |
| 12.05 | | Supply testing and commissioning of isolator module as per specifications. | Set | 297 | | |
| 12.06 | | Supply, Installation, testing and commissioning of addressable control modules. | Each | 24 | | |
| 12.07 | | Supply, Installation, testing and commissioning of addressable monitor modules. | Each | 6 | | |
| 12.08 | | Supply, Installation, testing and commissioning of flow switch | Each | 3 | | |

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| 12.09 | Supplying, drawing, connecting, testing & commissioning of 4 core, 1.5 sq. mm ,1100 volts FRLS copper conductor with PVC armoured cable with steel brading for mechanical protection and over all shielded with aluminium myler tape complete as required. | Metre | 1000 | | | |
| 12.10 | Supply, installation, testing and commissioning of 24 zone microprocessor based talkback master control panel with LCD display , inbuilt battery charger and battery space .The panel should have LCD and LED display for zone wise calling , & fabricated with 16 SWG sheet metal housing with red paint . | Each | 2 | | | |
| 12.11 | Supply, installation, testing and commissioning of 8 zone microprocessor based talkback master control panel with LCD display , inbuilt battery charger and battery space .The panel should have LCD and LED display for zone wise calling , & fabricated with 16 SWG sheet metal housing with red paint . | Each | 1 | | | |
| 12.12 | Supply, installation, testing and commissioning talkback unit with telephone handset in 16 SWG red body housing with locking protection. | Each | 56 | | | |
| | TOTAL SUB HEAD 12 : FIRE DETECTION AND ALARM | | | | | |
| | SUB HEAD 13: LIGHTENING PROTECTION | | | | | |
| 13.00 | LIGHTENING PROTECTION | | | | | |
| 13.01 | Earthing with 600 mm X 600 mm X 6 mm thick GI plate including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. (but without charcoal or coke and salt) complete as required. | Set | 20 | | | |
| 13.02 | Extra for using charcoal and salt for GI or copper plate earth electrode as required. | Set | 20 | | | |
| 13.03 | Providing and fixing of lightening conductor finial, made of 25mm. dia. 300mm., long GI tube, having single prong at top, with 85 mm. dia. 6 mm. thick GI base plate including holes etc. complete as required. | Each | 40 | | | |
| 13.04 | Providing and and fixing GI tape 20mm X 3 mm thick on parapet or surface of wall for lightning conductor as required. (For horizontal runs). | Metre | 584 | | | |

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| 13.05 | Providing and and fixing GI tape 20mm X 3 mm thick on parapet or surface of wall for lightning conductor as required. (For vertical runs). | Metre | 672 | | | |
| 13.06 | Providing and fixing testing joint, made of 20mmX3mm thick GI strip, 125 mm. long, with 4 no.'s of GI bolts, nuts, check nuts, bar shaddles, and spring washers etc. complete as required. | Each | 20 | | | |
| 13.07 | Providing and laying GI tape, 32 mm X 6 mm thick, from test joint upto earth electrode directly in ground as required. | Metre | 300 | | | |
| TOTAL SUB HEAD 13: LIGHTENING PROTECTION | | | | | | |

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| | | SUB HEAD 14 : LIFTS | | | | |
| 14.01 | | Design, manufacture, supply, installation, testing and commissioning of following 8 passenger (544 kg) lift , serving different floors in the lift shaft including lift well pressurization. The lift should be BMS compatible ie; it should have modbus/ BACnet output. The lift should be as per detailed specification/ drawing enclosed as required and as under: | | | | |
| | - | Speed : 1.5 MPS | | | | |
| | - | Travel: As per architectural drawing. | | | | |
| | - | Controller: A.C. variable voltage & variable frequency | | | | |
| | - | Automatic rescue device complete with dry maintenance free batteries as required. | | | | |
| | - | Operation: Microprocessor based single automatic push button/ simplex selective collective/duplex collective selective with / without attendant. | | | | |
| | - | 415 V, 3 phase, 50 Hz, 4 wire system | | | | |
| | - | Type of doors: a) Car : Power operated, centre opening for passenger lift horizontal sliding stainless steel scratch proof. (b) Landing doors: Stainless steel scratch proof. Lift car door and landing doors shall have a fire resistance of one hour. | | | | |
| | - | A hand rail guide not less than 600 mm long at 900 mm above floor level . | | | | |
| | - | Mirror of suitable size to be fixed inside the lift car. | | | | |
| | - | Voice announcement system in the car to announce the position of the elevator in the hoistway as the car passes or stops at a floor served by the elevator. | | | | |
| | - | Telephone with minimum two connections one at operator's room and other at guard/ security room and the emergency signal with re-chargeable batteries as source of supply be made in the lift car. | | | | |
| | - | Toe guard, PA speaker, IR curtain on full height, two phase fireman's drive control/ switch and potential free contacts etc to be provided in the lift. | | | | |
| | | Various 8 Passenger Lift serving following floors , stops & openings as mentioned below: | | | | |
| | i | Floors : B+G+10 (Total twelve floors) , 12 stops & 12 openings | Each | 4.00 | | |
| | ii | Floors : G+10 (Total eleven floors) , 11 stops & 11 openings | Each | 4.00 | | |
| | iii | Floors : B1+B2+G+5 (Total eight floors), 8 stops & 8 openings | Each | 2.00 | | |
| | | | | | | |
| | | TOTAL SUB HEAD 14: LIFTS | | | | |
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| | | SUB HEAD 15: LT CABLES | | | | |
| 15.00 | | LT CABLES | | | | |

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| 15.01 | | Supply of following sizes of 1.1 kV grade multicore aluminium conductor PVC sheathed armoured AYFY cable as per IS 1554. | | | | | |
| | i | 3.5 Core 25 Sqmm. | Metre | 155 | | | |
| | ii | 3.5 Core 50 Sqmm. | Metre | 145 | | | |
| | iii | 3.5 Core 70 Sqmm. | Metre | 146 | | | |
| | iv | 3.5 Core 95 Sqmm. | Metre | 1147 | | | |
| | v | 3.5 Core 150 Sqmm. | Metre | 347 | | | |
| | vi | 3.5 Core 185 Sqmm. | Metre | 1022 | | | |
| | vii | 3.5 Core 240 Sqmm. | Metre | 1110 | | | |
| | viii | 3.5 Core 300 Sqmm. | Metre | 1250 | | | |
| | ix | 3 Core 4 Sq mm | Metre | 146 | | | |
| | x | 2 Core 10 Sq mm | Metre | 1000 | | | |
| | xi | 2 Core 16 Sq mm | Metre | 900 | | | |
| 15.02 | | Laying of one number PVC insulated and PVC sheathed power cable 1.1kV grade direct in ground including excavation, sand cushioning, protective covering and refilling the trench etc. as required | | | | | |
| | i | Size not exceeding 25 sq.mm | Metre | 1301 | | | |
| | ii | Size exceeding 25 sq.mm but not exceeding 120 sq.mm | Metre | 1438 | | | |
| | iii | Size exceeding 120 sq.mm but not exceeding 300 sq.mm | Metre | 3729 | | | |
| 15.03 | | Laying of one number PVC insulated and PVC sheathed power cable 1.1kV grade direct in the existing RCC/ Hume/Stoneware/Metal pipe as required | | | | | |
| | i | Size not exceeding 25 sq.mm | Metre | 200 | | | |
| | ii | Size exceeding 25 sq.mm but not exceeding 120 sq.mm | Metre | 270 | | | |
| | iii | Size exceeding 120 sq.mm but not exceeding 300 sq.mm | Metre | 240 | | | |
| 15.04 | | Laying of one number PVC insulated and PVC sheathed power cable 1.1kV grade on surface or on existing cable tray complete as required. | | | | | |
| | i | Size not exceeding 25 sq.mm | Metre | 45 | | | |
| | ii | Size exceeding 25 sq.mm but not exceeding 120 sq.mm | Metre | 85 | | | |
| | iii | Size exceeding 120 sq.mm but not exceeding 300 sq.mm | Metre | 95 | | | |
| 15.05 | | Supplying and making end termination with suitable size Copper lugs including double compression glands of following sizes of 1.1. kv grade multicore aluminium conductor PVC insulated and PVC sheathed | | | | | |

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|--------------|------|---|-------|-----|--|--|--|
| | i | 3.5 Core 25 Sqmm. | Each | 18 | | | |
| | ii | 3.5 Core 50 Sqmm. | Each | 16 | | | |
| | iii | 3.5 Core 70 Sqmm. | Each | 6 | | | |
| | iv | 3.5 Core 95 Sqmm. | Each | 8 | | | |
| | v | 3.5 Core150 Sqmm. | Each | 4 | | | |
| | vi | 3.5 Core 185 Sqmm. | Each | 12 | | | |
| | | 3.5 Core 240 Sqmm. | Each | 12 | | | |
| | vii | 3.5 Core 300 Sqmm. | Each | 10 | | | |
| | viii | 3 Core 4 Sq mm | Each | 34 | | | |
| | ix | 2 Core 10 Sq mm | Each | 18 | | | |
| | x | 2 Core 16 Sq mm | Each | 30 | | | |
| | | | | | | | |
| 15.06 | | Fabricating and installing following size of perforated M.S. cable trays including horizontal and vertical bends, reducers, tees, cross members and other accessories as required and duly suspended from the ceiling with M.S. suspenders and including painting etc. as required :- | | | | | |
| | i | 150 mm. width x 50 mm. depth x 1.6 mm. thickness | Metre | 300 | | | |
| | ii | 300 mm. width x 62.5 mm. depth x 2.0 mm. thickness | Metre | 60 | | | |
| | iii | 450 mm. width x 62.6 mm. depth x 2.0 mm. thickness | Metre | 150 | | | |
| | iv | 600 mm. width x 62.6 mm. depth x 2.0 mm. thickness | Metre | 150 | | | |
| | | | | | | | |
| | | TOTAL SUB HEAD 15 : LT CABLES | | | | | |
| | | | | | | | |
| | | SUB HEAD 16: EARTHING SAFETY EQUIPMENT AND MISC. ITEMS | | | | | |
| 16.00 | | EARTHING, SAFETY EQUIPMENTS AND MISC. ITEMS | | | | | |
| 16.01 | | Earthing with copper plate 600mmX600mmX3mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. (but without charcoal or coke and salt) complete as required | Set | 6 | | | |
| 16.02 | | Earthing with GI plate 600mmX600mmX6mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. (but without charcoal or coke and salt) complete as required | Set | 16 | | | |
| 16.03 | | Extra for using charcoal and salt for GI or copper plate earth electrode as required. | Set | 22 | | | |
| 16.04 | | Earthing with GI earth pipe 4.5 mtr long, 40 mm dia including accessories and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. (but without charcoal or coke and salt) as required. | Set | 3 | | | |
| | | | | | | | |

| | | | | | | | |
|-------|----|--|-------|-----|--|--|--|
| 16.05 | | Earthing with GI earth pipe 4.5 mtr long, 40 mm dia including accessories and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. with charcoal and salt as required. | Set | 3 | | | |
| 16.06 | | Supplying and laying 25mmX5mm GI strip at 0.5m below ground level as strip earth electrode, including soldering etc. as required. | Metre | 330 | | | |
| 16.07 | | Providing and fixing 25mmX5mm GI strip on surface/on existing cable trench/RCC pipe/GI pipe or in recess for earth electrode as required. | Metre | 60 | | | |
| 16.08 | | Providing and fixing 25mmx5mm G.I. strip in 40mm dia G.I. pipe from earth electrode as required. | Metre | 20 | | | |
| 16.09 | | Providing and fixing 25mmX5mm Copper strip on surface/on existing cable trench/RCC pipe/GI pipe or in recess for earth electrode as required. | Metre | 330 | | | |
| 16.10 | | Supplying and laying 25mmX5mm Copper strip at 0.5m below ground level as strip earth electrode, including soldering etc. as required. | Metre | 90 | | | |
| 16.11 | | Providing and fixing 25mmx5mm copper strip in 40mm dia G.I. pipe from earth electrode as required. | Metre | 60 | | | |
| 16.12 | | Providing and laying of following sizes non pressure NP2 class (light duty) RCC pipe with collar joint with stiff mixture of cement (1 cement : 2 fine sand) including testing the joints etc. as required. | | | | | |
| | i | 150mm dia | Metre | 310 | | | |
| | ii | 300mm dia | Metre | 450 | | | |
| 16.13 | | Providing and fixing M.V. danger notice plate of 200mmX150mm made of mild steel, atleast 2mm thick and vitreous enamelled white on both sides and with inscription in signal red colour on front side as required. | Each | 10 | | | |
| 16.14 | | Supplying and laying of 1.1kV grade 1 metre wide anti skid chequered type rubber mat. | Metre | 85 | | | |
| 16.15 | | Supply and fixing shock treatment chart in English, Hindi and local language mounted on 5mm thick Plywood and 3mm thick plain glass front complete as required. | Set | 10 | | | |

| | | | | | | |
|--------------|-----|---|-------|-----|--|--|
| 16.16 | | Supplying and fixing CO2 type 4.5 Kg capacity fire extinguishers as approved by ISI complete as required. | Set | 14 | | |
| 16.17 | | Supplying, storing, handling and fixing in position First Aid Medical Box and an 'Artificial Respirator' complete as per technical specifications as required. | Each | 3 | | |
| 16.18 | | Supply and testing of 11kV ISI marked hand gloves | Set | 3 | | |
| 16.19 | | Providing & fixing rigid PVC pipe complete with fittings, clamps including trenching & refilling/ wall cutting & plastering, etc. (for cable entry) with all minor civil & mech. Works complete as required. | | | | |
| | | 50 mm dia nominal bore | Metre | 370 | | |
| | | TOTAL SUB HEAD 16: EARTHING, SAFETY EQUIPMENT AND MISC. ITEMS | | | | |
| | | SUB HEAD 17: OUT DOOR LIGHTING | | | | |
| 17.00 | | OUT DOOR LIGHTING | | | | |
| 17.01 | | Supply, erection, testing and commissioning of external swaged steel tubular pole with following specifications & items : | | | | |
| | i | 9.0 Mtrs. high swaged steel tubular pole (Single arm of suitable length each around 1.5 Metre), the construction of the pole shall be as per IS 410 SP-33 with base plate 450mmX450mmX6mm complete as per requirement with two coats of spray paints (shade as approved) | | | | |
| | ii | 1X150 watts street light fixture with 150watts high pressure sodium vapour (HPSV) lamp complete with control gear, acrylic cover cover etc. and its wiring with 2X4 sq.mm. PVC insulated, FRLS copper conductor and 1,5 sqmm PVC insulated, FRLS copper earth wire from control box complete as required - 1 No. (Philips SPX 086/150 or approved equivalent) | | | | |
| | iii | Suitable size 32 A DP MS Control box with 2 no. incoming and outgoing terminals and 2 nos. tap-out terminal with 6A DP MCB complete as required - 1 Set | | | | |
| | iv | Suitable number(s) 40mm dia Class-B GI Pipe(s) from above control box to upto 0.5 metre below ground level for power cable entry | | | | |
| | v | <i>Providing foundation including excavation, shuttering, alingment of poles, casting etc. including lean concrete at the bottom as per CPWD/ BIS specifications.</i> | | | | |
| | vi | The above installations shall be completed as CPWD specifications and as required | | | | |
| | A. | Steet Tubular Poles(9M) Single Arm as mention above | Set | 50 | | |

| | | | | | | | |
|-------|------|---|------|----|--|--|--|
| | | | | | | | |
| | B. | Steet Tubular Poles (9M) same as above but for Double Arm as mention above | Set | 25 | | | |
| 17.02 | | Supply, installation, testing and commissioning of external post top lantern with following accessories and complete as required : | | | | | |
| | i) | 4m high (3.3m above ground) 50mm dia GI pole as approved, adopting socket at top for fixture mentioned below, base plate 300 x 300 x 6mm and provision for mounting junction box etc. - 1 set. | | | | | |
| | ii) | Supply, installation, testing and commissioning of Post top lantern with 70W HPSV lamp (Philips SPC 106/70(I) HPF or equivalent) and its wiring with 2 x 2.5 sq.mm PVC insulated copper wire and 1.5 sqmm PVC insulated copper earth wire from control box - 1 set. | | | | | |
| | iii) | Suitable size 20A DP MS Control box with 2 no. incoming and outgoing terminals and 2 nos. tap-out terminal with 1 nos. 5A HRC fuses complete 1 set. | | | | | |
| | iv) | Suitable number(s) 40mm dia Class-B GI Pipe(s) from above control box to upto 0.5 metre below ground level for power cable entry | | | | | |
| | v) | Providing 400x400x1000mm deep 1:3:6 ratio cement concrete including excavation shuttering alignment of poles casting etc. including 100mm thick lean concrete shall be provided at the bottom | | | | | |
| | | Supply, installation, testing and commissioning of external post top lantern as mentioned above | Set | 10 | | | |
| | | | | | | | |
| 17.03 | | Supply, installation, testing and commissioning of bollard lamps 1X18 watts CFL (Philips HCS360 1XPL-C/2P 18W GR Sonara bollard in gree color or equivalent) control box - 1 set. | Each | 50 | | | |

| | | | | | | |
|-------|--|------|----|--|--|--|
| 17.04 | Supply, installation, testing and commissioning of bollard lamps 1X18 watts CFL (Philips HCS 370 1XPL-L 18W GR Lumos bollard in green color or equivalent) control box - 1 set. | Each | 50 | | | |
| 17.05 | Road Lighting Panel | | | | | |
| | Supply, installation, testing and commissioning of following outdoor type with canopy, IP-54 protected M.V. cubicle type totally enclosed, free standing type, dust, damp and vermin proof, MV Panel, busbars, M.V. danger notice plate, interconnections with suitable capacity aluminium leads/solid aluminium strips/rods, connection of incoming and outgoing cables with thimbles, stove enamelled painted and having following incoming and outgoing switchgears complete as required. | | | | | |
| | INCOMER: | | | | | |
| | 1 No. 63 Amp 415 volts, TPN Switch Disconnecter Fuse Unit with HRC Fuses | | | | | |
| | 1 Set of phase indicating lamp with HRC fuses | | | | | |
| | 1 Set of photo sensor & 100A TP contactor with neutral link (for street lights control) . | | | | | |
| | BUSBARS: | | | | | |
| | 100 Amp TPN Aluminium busbars | | | | | |
| | OUTGOING: | | | | | |
| | 10 Nos. 32 Amp 415 volts, DP MCB | | | | | |
| | Feeder Pillar as mention above | Set | 5 | | | |
| 17.06 | Spiral earthing made out of 6 SWG GI wire , 50mm Dia, 115 turns closely wound ,1.5 mtr below ground, earth pit of 350 Dia., 1.5 mtr depth including providing charcoal and salt for earthing at alternate layers of 300 mm depth (total 3 layers),connections etc. complete as required. | Set | 25 | | | |
| | TOTAL SUB HEAD 17: OUTDOOR LIGHTING | | | | | |
| | GRAND TOTAL FOR ALL ELECTRICAL WORKS | | | | | |

| Bill of Quantities - For Hostel-1, Hostel-2, Hostel-3 ventilation works at AIIMS NEW DELHI | | | | | | |
|---|---|----------|-----------|------------------------------|----------------------------|-------------------|
| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
| The prices are to be quoted in the below mentioned form and shall include the supply, installation, testing & commissioning at site of all the equipments, ancillary materials as specified and all such items what so ever which may be required to fulfill the intent and purpose as laid down in the specifications and or the drawings. | | | | | | |
| The tenderer shall quote rates in figures and in words under column 5&6 and extend amount to column 7 | | | | | | |
| 1.0 | Centrifugal Fans | | | | | |
| | Supply, installation, testing and commissioning of double width double inlet class I CENTRIFUGAL FANS for ventilation system. Each fan shall be complete with TEFC type IP 55 motor with class F insulation, belt drive, pulley mounted on motor & fan shaft, belt guard, motor mount, casing and vibration isolators as per specifications and shop drawings. All expose fan shall be covered with GI housing as per approved shop drawings to protect fan and motors from weather. Fan motor shall be suitable for 3 Phase, 415+/- 10% V, 50Hz AC supply . Fan shall be complete with gravity louvers. | | | | | |
| | (for Hostel -1) | | | | | |
| | For Basement (Fresh Air Fans) | | | | | |
| 1.1 | Air Quantity : 10000 CFM (for normal ventillation) Static Pressure :40 mm wg | 1 | Nos. | | | |
| 1.2 | Air Quantity : 15000 CFM (for emergency) Static Pressure :40 mm wg | 1 | Nos. | | | |
| | (for Hostel -2) | | | | | |
| | For Basement (Fresh Air Fans) | | | | | |
| 1.3 | Air Quantity : 11800 CFM (for normal ventilation) Static Pressure :40 mm wg | 1 | Nos. | | | |
| 1.4 | Air Quantity : 17700 CFM (for emergency) Static Pressure :40 mm wg | 1 | Nos. | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|---|----------|-----------|------------------------------|----------------------------|-------------------|
| | | | | | | |
| | <i>(for Hostel -3)</i> | | | | | |
| | For Basement (Fresh Air Fans) | | | | | |
| 1.5 | Air Quantity : 51500 CFM (for normal ventilation) Static Pressure :40 mm wg | 2 | Nos. | | | |
| 1.6 | Air Quantity : 77200CFM (for emergency) Static Pressure :40 mm wg | 2 | Nos. | | | |
| 2.0 | Axial Flow fans (Fire rated) | | | | | |
| | Supply, installation,testing and commisioning of axial flow fans to provide mechanical ventilation, Each fan shall be complete with permanent split capacitor or shaded pole IP55 TEFC motor with class H insulation motor , mounting plate and accessories like belt guard, drive packages etc as required. All expose fan shall be covered with GI housing as per approved shop drawings to protect fan and motors from weather.Quoted rate shall be including of vibration isolators as per specifications. Fan motor shall be suitable for 3 Phase, 415+/-10% V, 50Hz AC supply . Fan shall be complete with gravity louvers. | | | | | |
| | <i>(for Hostel -1)</i> | | | | | |
| 2.1 | Duty: Smoke Spill / Ventilation Fan Air Quantity : 10000 CFM (fresh air) Static Pressure : 40 mm wg Fan shall be 250 deg C, 2 hours fire rated. | 1 | Nos. | | | |
| 2.2 | Duty: Smoke Spill / Ventilation Fan Air Quantity : 15000 CFM (in case of fire) Static Pressure : 40 mm wg Fan shall be 250 deg C, 2 hours fire rated. | 1 | Nos. | | | |
| | | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|---|----------|-----------|------------------------------|----------------------------|-------------------|
| | <u>(for Hostel -2)</u> | | | | | |
| 2.3 | Duty: Smoke Spill / Ventilation Fan Air Quantity : 11800 CFM (Normal ventilation) Static Pressure : 40 mm wg Fan shall be 250 deg C, 2 hours fire rated. | 1 | Nos. | | | |
| 2.4 | Duty: Smoke Spill / Ventilation Fan Air Quantity : 17700 CFM (in case of fire) Static Pressure : 40 mm wg Fan shall be 250 deg C, 2 hours fire rated. | 1 | Nos. | | | |
| | <u>(for Hostel -3)</u> | | | | | |
| 2.5 | Duty: Smoke Spill / Ventilation Fan Air Quantity : 25750 CFM (in normal condition)) Static Pressure : 40 mm wg Fan shall be 250 deg C, 2 hours fire rated. | 4 | Nos. | | | |
| 2.6 | Duty: Smoke Spill / Ventilation Fan Air Quantity : 38600 CFM (in case of fire) Static Pressure : 40 mm wg Fan shall be 250 deg C, 2 hours fire rated. | 4 | Nos. | | | |
| 3.0 | Tube Axial Flow fans Supply, installation,testing and commisioning of tube axial flow fans as shown in drawings, Each fan shall be direct driven.. Fan motor shall be suitable for 3 Phase, 415+/- 10% V, 50Hz AC supply . Fan shall be complete with gravity louvers. | | | | | |
| | <u>(for Hostel -1)</u> | | | | | |
| 3.1 | Duty: Lift well pressurisation Air Quantity : 9000 CFM Static Pressure : 30 mm wg | 2 | Nos. | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|---|----------|-----------|------------------------------|----------------------------|-------------------|
| 3.2 | Duty: Lift well pressurisation Air Quantity : 8250 CFM Static Pressure : 30 mm wg | 2 | Nos. | | | |
| 3.3 | Duty: Lift lobby pressurisation Air Quantity : 9000 CFM Static Pressure : 30 mm wg | 1 | Nos. | | | |
| 3.4 | Duty: Lift lobby pressurisation Air Quantity : 10000 CFM Static Pressure : 30 mm wg | 1 | Nos. | | | |
| | <u>(for Hostel -2)</u> | | | | | |
| 3.5 | Duty: Lift well pressurisation Air Quantity : 9000 CFM Static Pressure : 30 mm wg | 2 | Nos. | | | |
| 3.6 | Duty: Lift well pressurisation Air Quantity : 8250 CFM Static Pressure : 30 mm wg | 2 | Nos. | | | |
| 3.7 | Duty: Lift lobby pressurisation Air Quantity : 9000 CFM Static Pressure : 30 mm wg | 1 | Nos. | | | |
| 3.8 | Duty: Lift lobby pressurisation Air Quantity : 10000 CFM Static Pressure : 30 mm wg | 1 | Nos. | | | |
| | <u>(for Hostel -3)</u> | | | | | |
| 3.9 | Duty: Lift well pressurisation Air Quantity : 6000 CFM Static Pressure : 30 mm wg | 2 | Nos. | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|---|----------|-----------|------------------------------|----------------------------|-------------------|
| 3.10 | Duty: Lift lobby pressurisation Air Quantity : 4000 CFM Static Pressure : 30 mm wg | 1 | Nos. | | | |
| 4.0 | Inline Fans/ Propeller Fans Supply, installation, testing and commissioning of Inline Fans as shown in drawings and as per equipment schedule . Each fan shall be complete with centrifugal blowers, totally enclosed fan cooled motor. Fan motor shall be suitable for single phase, 220 +/- 6% V, 50 Hz AC supply. Item shall be complete with starter & cabling. | | | | | |
| | Inline Fans | | | | | |
| | <u>(for Hostel -1)</u> | | | | | |
| 4.1 | Air Quantity :100 CFM Static Pressure :15 mm wg | 20 | Nos. | | | |
| | <u>(for Hostel -2)</u> | | | | | |
| 4.2 | Air Quantity :100 CFM Static Pressure :15 mm wg | 2 | Nos. | | | |
| 5.0 | Propeller fans Supplying, installing, testing and commissioning of direct driven Propeller fan for exhaust air as shown in drawings. Each fan shall be complete with permanent split capacitor or shaded pole motor, mounting plate, accessories like wire guard, bird screen and fixed louvers for weather protection as required. Fan selection arrangement and Electrical characteristics shall be as follows: | | | | | |
| | <u>(for Hostel -1)</u> | | | | | |
| 5.1 | 150 mm dia 900 RPM fan suitable for 220 +/- 10% volts, 50 Cycles, 1 Phase AC Supply | 170 | Nos | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|---|----------|-----------|------------------------------|----------------------------|-------------------|
| 5.2 | 225 mm dia 900 RPM fan suitable for 220 +/- 10% volts, 50 Cycles, 1 Phase AC Supply | 18 | Nos | | | |
| | <u>(for Hostel -2)</u> | | | | | |
| 5.3 | 150 mm dia 900 RPM fan suitable for 220 +/- 10% volts, 50 Cycles, 1 Phase AC Supply | 330 | Nos | | | |
| | <u>(for Hostel -3)</u> | | | | | |
| 5.4 | 150 mm dia 900 RPM fan suitable for 220 +/- 10% volts, 50 Cycles, 1 Phase AC Supply | 60 | Nos | | | |
| 5.5 | 225 mm dia 900 RPM fan suitable for 220 +/- 10% volts, 50 Cycles, 1 Phase AC Supply | 10 | Nos | | | |
| 6.0 | GSS DUCTING Supply, installation, testing and balancing of G.S.S ducting of following thickness including necessary supports, hangers, nut bolts, gaskets, splitter dampers, vanes canvass connections etc.Firerated ducts shall be fabricated from 1.25 mm thk GI sheets of 275 GSM irrespective of duct size.(All accessories shall be suitably fire rated for 250 deg C for 2 hrs)complete as per specifications & drawings: | | | | | |
| 6.1 | 1.25 mm (18 G) GSS | 2500 | Sqm. | | | |
| 6.2 | 1.0 mm (20 G) GSS | 500 | Sqm. | | | |
| 6.3 | 0.80 mm (22 G) GSS | 800 | Sqm. | | | |
| 6.4 | 0.63 mm (24 G) GSS | 1000 | Sqm. | | | |
| 7.0 | VOLUME CONTROL DAMPERS | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|--|----------|-----------|------------------------------|----------------------------|-------------------|
| 7.1 | Supply, installation and testing of volume control dampers of GI sheet, box type to be provided in ducts complete with suitable links, levers and quadrants for manual control of air volume and air balancing as per specifications and drawings. | 24 | Sqm. | | | |
| 8.0 | GRILLES | | | | | |
| 8.1 | Supply, installation, testing and balancing of powder coated extruded M.S. Air Grilles with / without volume control dampers. | | | | | |
| 8.1.1 | Supply air grilles in single louvers with volume control dampers. | 50 | Sqm. | | | |
| 8.1.2 | Exhaust air grilles in single louvers without volume control dampers. | 50 | Sqm. | | | |
| 8.1.3 | Painted metal jali with M.S. frames for the duct termination in the blower room. | 15 | Sqm. | | | |
| 9.0 | Fresh Air Louvers with bird screen | | | | | |
| 9.1 | Supply, installation, testing and commissioning of fresh air opening comprising of powder coated extruded aluminium louvers with bird screen, projection with frame and volume control damper with lever mounting arrangement etc. as per specifications and drawings. | 10 | Sqm. | | | |
| 10.0 | VENTILATION FAN DISTRIBUTION PANELS | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|--|----------|-----------|------------------------------|----------------------------|-------------------|
| | Supply, installation, testing and commissioning of AHU panel suitable for 415 V, 3 phase, 4 wires, 50 Hz power distribution system. The panel shall be cubicle non draw out type free standing floor mounting sheet metal enclosed flush front with aluminium busbars, separate earth bus bars to be provided throughout the length of the panel. The incoming & outgoing feeder breakers, fuses, indicating lamps etc. shall be accommodated in a modular multitier arrangement. The painting shall be done as per relevant codes as specified in the specifications. Adequate size cable alley shall be provided all round the panel and in the back for each cable bending and termination. The outgoing feeders inside the panel shall be connected through solid bus bar. Flexible cable links are not acceptable. Bus bars shall be provided with sleeves or heat resistant insulated paint. The panel shall be suitable for cable entry from top. The panel shall be fabricated after the approval of fabrication drawings. All the panels shall have minimum 20% spare capacity. | | | | | |
| | i) All doors to have pad locking and shrouding arrangement. | | | | | |
| | ii) All switches to be heavy duty type base mounted having operating handle. | | | | | |
| | <i>(for Hostel -1)</i> | | | | | |
| 10.1 | AHP B1 | | | | | |
| | INCOMER | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|---|----------|-----------|------------------------------|----------------------------|-------------------|
| | 1 Nos. 160 Amp 415 volts, 36 KA (Isc), FP MCCB with thermal magnetic release having variable current settings of 0.8 to 1.0 In.Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers.Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB.Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | 1 set phase indication lamps with control fuses. | | | | | |
| | 1 no. voltmeter with VSS. | | | | | |
| | 1 no. ammeter with ASS and CTs. | | | | | |
| | 250 A TPN Aluminium conductor bus bar dully sleeved. | | | | | |
| | OUTGOING | | | | | |
| | 9 Nos. 32 Amp 415 volts, 30 KA (Isc), FP MCCB with thermal magnetic release having variable current settings of 0.8 to 1.0 In.Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers.Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB.Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | 2 Nos. 32 Amp 415 volts, 9 KA FP MCB with on-off indication. | | | | | |
| | Complete panel as above | 1 | Nos. | | | |
| | (for Hostel -2) | | | | | |
| 10.2 | AHP B2 | | | | | |
| | INCOMER | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|---|----------|-----------|------------------------------|----------------------------|-------------------|
| | 1 Nos. 200 Amp 415 volts, 36 KA (Isc), FP MCCB with thermal magnetic release having variable current settings of 0.8 to 1.0 In.Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers.Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB.Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | 1 set phase indication lamps with control fuses. | | | | | |
| | 1 no. voltmeter with VSS. | | | | | |
| | 1 no. ammeter with ASS and CTs. | | | | | |
| | 250 A TPN Aluminium conductor bus bar dully sleeved. | | | | | |
| | OUTGOING | | | | | |
| | 9 Nos. 30 Amp 415 volts, 35 KA (Isc), FP MCCB with thermal magnetic release having variable current settings of 0.8 to 1.0 In.Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers.Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB.Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | 2 Nos. 32 Amp 415 volts, 9 KA FP MCB with on-off indication. | | | | | |
| | 18 Nos. 16 Amp 415 volts, 15 KA (Isc), FP MCCB with thermal magnetic release having variable current settings of 0.8 to 1.0 In.Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers.Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB.Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|---|----------|-----------|------------------------------|----------------------------|-------------------|
| | Complete panel as above | 1 | Nos. | | | |
| | <u>(for Hostel -3)</u> | | | | | |
| 10.3 | AHP B3 | | | | | |
| | INCOMER | | | | | |
| | 1 Nos. 250 Amp 415 volts, 50 KA (Isc), FP MCCB with thermal magnetic release having variable current settings of 0.8 to 1.0 In.Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers.Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB.Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | 1 set phase indication lamps with control fuses. | | | | | |
| | 1 no. voltmeter with VSS. | | | | | |
| | 1 no. ammeter with ASS and CTs. | | | | | |
| | 300 A TPN Aluminium conductor bus bar dully sleeved. | | | | | |
| | OUTGOING | | | | | |
| | 3 Nos. 125 Amp 415 volts, 36 KA (Isc), FP MCCB with thermal magnetic release having variable current settings of 0.8 to 1.0 In.Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers.Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB.Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|--|----------|-----------|------------------------------|----------------------------|-------------------|
| | 4 Nos. 63 Amp 415 volts, 30 KA (Isc), FP MCCB with thermal magnetic release having variable current settings of 0.8 to 1.0 In.Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers.Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB.Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | 4 Nos. 16 Amp 415 volts, 15 KA (Isc), FP MCCB with thermal magnetic release having variable current settings of 0.8 to 1.0 In.Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should be with spreader link and phase barriers.Indicating lamps with 2A protection MCBs to indicate OPEN, CLOSE, TRIP for MCCB.Ampere Metre of suitable range with suitable set of CT's and ASS. | | | | | |
| | Complete panel as above | 2 | Nos. | | | |
| 11.0 | FAN STARTER PANELS | | | | | |
| 11.1 | (for Hostel -1) | | | | | |
| 11.1.1 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |
| | 1 No. 32 Amps TP+NL MCCB 10 KA for 10 HP Motor with Star Delta Starters for motor with thermal overload protection, single phase preventor, spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button, ammeter with ASS and CTs for fan motor as required. | 3 | Nos | | | |
| 11.1.2 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|--|----------|-----------|------------------------------|----------------------------|-------------------|
| | 1 No. 32 Amps TP+NL MCCB 10 KA for 7.5 HP Motor with Star delta Starters for motor with thermal overload protection,single phase preventor,spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button,ammeter with ASS and CTs for fan motor as required. | 1 | Nos | | | |
| 11.1.3 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |
| | 1 No. 32 Amps TPN MCCB 10 KA for 5 HP Motor with DOL Delta Starters for motor with thermal overload protection,single phase preventor,spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button,ammeter with ASS and CTs for fan motor as required. | 4 | Nos | | | |
| 11.2 | <i>(for Hostel -2)</i> | | | | | |
| 11.2.1 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |
| | 1 No. 32 Amps TP+NL MCCB 10 KA for 10 HP Motor with Star Delta Starters for motor with thermal overload protection,single phase preventor,spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button,ammeter with ASS and CTs for fan motor as required. | 3 | Nos | | | |
| 11.2.2 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|--|----------|-----------|------------------------------|----------------------------|-------------------|
| | 1 No. 32 Amps TP+NL MCCB 10 KA for 7.5 HP Motor with Star delta Starters for motor with thermal overload protection,single phase preventor,spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button,ammeter with ASS and CTs for fan motor as required. | 1 | Nos | | | |
| 11.2.3 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |
| | 1 No. 32 Amps TPN MCCB 10 KA for 5 HP Motor with DOL Delta Starters for motor with thermal overload protection,single phase preventor,spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button,ammeter with ASS and CTs for fan motor as required. | 4 | Nos | | | |
| 11.2.4 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |
| | 1 No. 32 Amps TPN MCCB 10 KA for 1/5 HP Motor with DOL Delta Starters for motor with thermal overload protection,single phase preventor,spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button,ammeter with ASS and CTs for fan motor as required. | 3 | Nos | | | |
| 11.3 | (for Hostel -3) | | | | | |
| 11.3.1 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|--|----------|-----------|------------------------------|----------------------------|-------------------|
| | 1 No. 125 Amps TP+NL MCCB 30 KA for 40 HP Motor with Star Delta Starters for motor with thermal overload protection,single phase preventor,spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button,ammeter with ASS and CTs for fan motor as required. | 1 | Nos. | | | |
| 11.3.2 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |
| | 1 No. 125 Amps TP+NL MCCB 30 KA for 30 HP Motor with Star delta Starters for motor with thermal overload protection,single phase preventor,spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button,ammeter with ASS and CTs for fan motor as required. | 1 | Nos | | | |
| 11.3.3 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |
| | 1 No. 63 Amps TP+NL MCCB 30 KA for 20 HP Motor with Star delta Starters for motor with thermal overload protection,single phase preventor,spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button,ammeter with ASS and CTs for fan motor as required. | 2 | Nos | | | |
| 11.3.4 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|--|----------|-----------|------------------------------|----------------------------|-------------------|
| | 1 No. 63 Amps TP+NL MCCB 30 KA for 15 HP Motor with Star delta Starters for motor with thermal overload protection, single phase preventor, spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button, ammeter with ASS and CTs for fan motor as required. | 2 | Nos | | | |
| 11.3.5 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |
| | 1 No. 16 Amps TP+NL MCCB 10 KA for 3 HP Motor with DOL delta Starters for motor with thermal overload protection, single phase preventor, spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button, ammeter with ASS and CTs for fan motor as required. | 2 | Nos | | | |
| 11.3.6 | FAN STARTER PANEL | | | | | |
| | OUTGOING : | | | | | |
| | 1 No. 16 Amps TP+NL MCCB 10 KA for 2 HP Motor with DOL delta Starters for motor with thermal overload protection, single phase preventor, spare NO_NC contacts for interlocking, ON-OFF indication lamps with push button, ammeter with ASS and CTs for fan motor as required. | 1 | Nos | | | |
| 12.0 | CABLING | | | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|--|----------|-----------|------------------------------|----------------------------|-------------------|
| | Supplying, laying, effecting proper connections, testing & commissioning of following size of 1.1 kv PVC insulated aluminium conducting armoured cables as per BS :7846 (Fire Survival Cable) laid underground/cable tray/on surface of wall/hume pipe etc. & termination with brass compression glands as required. | | | | | |
| 12.1 | 3.5 C X 25 sq. mm Cable | 150 | Metre | | | |
| 12.2 | 4 C X 16 sq. mm. Cable | 600 | Metre | | | |
| 12.3 | 4 C X 10 sq. mm. Cable | 800 | Metre | | | |
| 12.4 | 4 C X 6 sq. mm. Cable | 800 | Metre | | | |
| 12.5 | 3 C X 6 sq. mm. Cable | 500 | Metre | | | |
| 12.6 | 4C X 4 sq. mm. Cable | 1000 | Metre | | | |
| 12.7 | 3C X 4 sq. mm. Cable | 500 | Metre | | | |
| 12.8 | 3C X 2.5 sq. mm. Cable | 320 | Metre | | | |
| 13.0 | CABLE TRAYS | | | | | |
| | Supply & installation of following sizes of perforated MS cable trays including horizontal & vertical bends, reducers, tees, cross members and other accessories as required and duly supported from the ceiling/wall/floor with MS suspenders/supports and including painting etc. as required | | | | | |
| 13.1 | 150 mm widthx50 mm deep x1.6 mmthickness | 250 | Metre | | | |
| 13.2 | 100 mm widthx50 mm deep x1.6 mmthickness | 150 | Metre | | | |
| 14.0 | EARTHING | | | | | |
| 14.1 | Earth pits with GI earth plate of size 600mmx600mmx6mm thick including all accessories , down watering GI pipes 40mm dia and providing masonry enclosure with cover plate having interlocking arrangement and watering pipe etc. with charcoal (of or coke and salt) complete as required | 5 | Set | | | |

| Item No. 1 | Description 2 | Qty 3 | Unit 4 | Rate In Rs (in Figure) 5 | Rate in Rs (in Words) 6 | Amount (Rs.) 7 |
|---------------|---|----------|-----------|------------------------------|----------------------------|-------------------|
| 14.2 | Providing & fixing GI earth strip 40mm x 6mm on surface or in recess for earth connections etc. as required | 100 | Metre | | | |
| 14.3 | Providing and fixing GI earth strip on walls/ trenches complete as per specifications and as required. | | | | | |
| 14.3.1 | 38mmx 6mm | 40 | Metre | | | |
| 14.3.2 | 25mm x 3mm | 30 | Metre | | | |
| 14.4 | Providing and fixing earth wire of complete as per specifications as required. | | | | | |
| 14.4.1 | 8 SWG wire | 250 | Metre | | | |
| 15.0 | CONTROL CABLING | | | | | |
| | Supply, laying, effecting proper connections, testing & commissioning of 1.5 sq.mm. PVC insulated copper multicore cables (fire survival) from Fan's and AC equipments to related areas | | | | | |
| 15.1 | 27 core cable | 200 | Metre | | | |
| 15.2 | 19 core cable | 100 | Metre | | | |
| 15.3 | 14 core cable | 200 | Metre | | | |
| 15.4 | 10 core cable | 100 | Metre | | | |
| 15.5 | 6 core cable | 120 | Metre | | | |
| 15.6 | 5 core cable | 120 | Metre | | | |
| | TOTAL FOR HVAC WORKS | | | | | |

TECHNICAL SPECIFICATIONS

1.00 GENERAL SCOPE OF WORK

The scope of work shall cover internal and external electrical works for **AIIMS Hostels at AIIMS New Delhi**. The scope of work covers major electrical equipments as per BOQ. Also, supply, installation, testing and commissioning of electrical works of the project including the following main items/systems:

- i. H.T. Sub-station including VCB panel, Transformers, bus ducts, HT cables etc
- ii. Main LT , Capacitor panels (APFC), Rising mains, MV Panels.
- iii. DG sets including AMF panels etc.
- iv. MCB Distribution Boards.
- v. Internal electrification through concealed MS conduit and provide light points, fan points, socket outlets etc. including supplying, installation, testing and commissioning of light fixtures, fans etc.
- vi. Conduiting and wiring for telephone points including Main Telephone Distribution Boards (Tag Blocks), telephone outlets etc. complete with telephone cabling from tag blocks to telephone outlets including EPABX, telephone instruments etc..
- vii. Addressable Fire Detection & Alarm System consisting of Main Fire Control & Indicator Panel, Smoke & Heat Detectors, Manual Call Points Hooter etc. including conduiting/wiring & cabling complete.
- viii. Conduiting and wiring for Cable TV system
- ix. Conduiting for computer networking
- x. Lightning protection system consisting of lightning arrestor, finial, horizontal and vertical strips, test joints, earth electrodes etc.
- xi. Lifts
- xii. LT Cabling.
- xiii. Earthing, safety equipments and misc items required for electrical installation complete in all respect.
- xiv. Out door lighting

- xv Testing and commissioning of all electrical installations
- xvi Any other items/ works required for the completion of electrical works.
- xvii Enhancement/Sanctioning Electrical Load from State Electricity Board.
- xviii Submission of GA drawings of electrical equipments and getting approvals from Client/ Owner before manufacturing/fabrication.
- xix Obtaining approvals from Chief Electrical Inspectors, Local Electricity Supply Authority, Telecom Department, and any other statutory authorities for the complete scope.
- xx Approval from CCE Nagpur for Diesel tank and pollution control for DG set.
- . Contractor shall submit equipment drawing from manufacturer along with the layout etc. and working drawings for approval from HSCC Electrical Engineer before manufacture / commencement of work at site.
- xxi Contractor has to submit the working drawing of internal as well as external electrification based on our tender drawings for the approval of HSCC Electrical Engineer before commencement of work.
- xxii Contractor has to take the approval of DB schedule/drawing of each DB from HSCC.
- xxiii Incase, details of any electrical item/ system are left out, then kindly refer the CPWD specifications & approval from Engineer.

2.0 REGULATIONS AND STANDARDS

2.1 **All equipments their installation, testing and commissioning shall conform latest CPWD/ IS specifications in all respects.** Indian Standard Code of Practice for Electrical Wiring Installation IS:732-1989. It shall also be in conformity with Indian electricity Rules and the Regulations, National Electric Code, National Building Code, latest CPWD specifications amended up to date and requirements of the Local Electric Supply Authority. In general, all materials equipment and workmanship shall conform to the Indian Standards specifications and code. Mode of all measurement will be as per latest CPWD norms/ specifications Some of the applicable codes/standards are as under:

- | | | |
|----|---|------------------------------------|
| a) | CPWD General specifications for electrical works | Part-I (Internal)- 2005 |
| b) | CPWD General specifications for electrical works | Part-II (External)-1995 |
| c) | CPWD General specifications for electrical works | Part-III (Lifts & Escalators)-2003 |
| d) | CPWD General specifications for electrical works | Part-IV (Substation)-2007 |
| e) | CPWD General specifications for electrical works | Part VII (DG Sets) 2006 |
| f) | CPWD Specification/norms for measurement | Latest revision |
| g) | Guide for marking of insulated conductors | IS 5578 |
| h) | Guide for uniform system of marking and identification of conductor and apparatus terminals. | IS 11353 |
| i) | Low voltage switchgear and control gear assemblies | S 8623 Part-1 to 3 |
| j) | Specification for low voltage switchgear and control gear | IS 13947 |
| k) | Enclosed distribution fuse boards and cutouts for voltages not exceeding 1000V AC and 1200 V DC | IS 2675 |
| l) | Code of practice for selection, Installation and maintenance of switchgear and control gear. | ISI 10118 Part – 1 - 4 |
| m) | Low-voltage fuses for voltages not exceeding 1000V AC or 1500V DC | ISI13703 Part-1&2 |
| n) | PVC insulated (heavy duty) electric cables | IS 1554 |

| | | |
|-----|--|-----------------------|
| o) | PVC insulated cables for working voltages upto and including 1100V. | IS 694 |
| p) | Conduit for electrical installations | IS 9537 |
| q) | Accessories for rigid steel conduits for electrical wiring | IS 3837 |
| r) | Boxes for the enclosure of electrical accessories | IS 14772 |
| s) | General and safety requirements for luminaries | IS 1913 |
| t) | Code of practice for earthing | IS 3043 |
| u) | Electrical accessories – circuit breakers for over current protection for household and similar installations. | IS 8828 |
| v) | Low voltage switchgear and control gear | IS 13947 part 1 – 5 |
| w) | Residual current operated circuit breakers | IS 12640 |
| x) | Current Transformers | IS 2705 |
| y) | Voltage Transformers | IS 3156 |
| z) | Direct acting indicating analogue electrical measuring instruments and their accessories | IS 1248 part – 1 to 9 |
| A1) | Control Switches (switching device for control and auxiliary circuits including contactor relays) for voltages upto and including 1000V ac and 1200V DC. | IS 13947 & IS 1336 |
| B1) | Dry type power transformer | IS 11171 |

In case of contradiction in specification the priority of the documents shall be as follows:

CPWD/ IS specification, BOQ, drawings, Technical specifications.

3.0 H.T. SUBSTATION

3.1 11 KV VACUUM CIRCUIT BREAKER PANEL BOARD

3.1.1 GENERAL:

Vacuum Circuit Breaker shall be incorporated in H.T. Panel wherever specified. VCB's shall conform to IEC 298 and 694 IS 3427, BS 5227 and VDE 0670, part 6 as well as the regulations mentioned therein. VCB's shall be suitable for operation on 11kV, 3 phase, 50Hz, AC supply.

3.1.2 TYPE AND CONSTRUCTION:

The metal clad panel shall be fully extensible and compartmentalized to give.

- a. Circuit Breaker Compartment
- b. Busbar Compartment
- c. CT and Cable Compartment

3.1.2.1 The compartments shall be safe to touch and compartments thus formed shall be dust proof & vermin proof. A separate metering chamber for fixing the necessary instrumentation metering and protective equipment shall provided.

3.1.2.2. The VCB shall consist of three air insulated poles incorporating mechanism of interrupters. The body of interrupters shall be made of nickel chromium steel supported on insulators made out of metalised aluminum oxide. The contacts shall be of chromium copper and butt shaped.

3.1.2.3 Vacuum circuit breaker shall be mounted on truck or a carriage mechanism. In case of truck mechanism, the breaker shall be on a trolley while in a carriage mechanism, shall be separate door and it shall be possible to perform all operations with front door closed. The draw out carriage shall have two positions for the circuit breaker viz isolated/test & service position. Bus bars shall be insulated type made of high conductivity copper supported on cast epoxy monobloc designed to withstand full short circuit currents and shall be provided all along the length of the H.T. board.

3.1.2.4 It shall be horizontal isolation, horizontal draw out type, fully interlocked, with dust and vermin proof construction, suitable for indoor installation. The panel shall be supplied with the manufacturer's test certificates.

3.1.2.5 Certificates with date of manufacture and shall be complete in all respects as per details in the schedule of quantities. The steel work should have undergone a rigorous rust proofing process comprising alkaline degreasing, descaling in dilute sulphuric

acid and recognized phosphate process and shall then be given power coating (Electrostatic) paint of manufacturer's standard shade.

- 3.1.2.6 The switchgear constructions shall be such that breaker operation and internal explosions do not endanger the operating personnel, and the front of the panel shall be specially designed to withstand these. Pressure relief flaps shall be provided for safely venting out gases produced inside the high voltage compartment, bus bar compartment and termination compartment. These flaps shall be vented upwards and cannot be opened from outside. These relief flaps shall be of such construction as not to permit ingress of dust/water in harmful quantities under normal working conditions. Enclosure shall be constructed with sheet steel of at least 2.0mm thickness. It shall have a rigid, smooth, leveled, flawless finish.
- 3.1.2.7 Voltage transformer of burden not less than 100 VA and a proper ratio as specified shall be provided in the incoming panel. The accuracy class for the VT shall be 0.5 as per IS 3156 parts I to III for incomers and class 1 for outgoing panels. The transformer shall be of cast epoxy resin construction. It shall be fixed/ withdraw able type. HRC fuses/ MCBs shall be provided on both HV and LV side.
- 3.1.2.8 The making contact arms (upper & lower) of the circuit breaker shall be encased in polypropylene tubes. Penetration type bushings shall be provided in the busbars & cable compartment for the fixed contacts.
- 3.1.2.9 Safety shutters shall be provided to cover up the fixed high voltage contacts on busbar and cable sides when the carriage is moved to Isolated/Disconnected position. The shutters shall move automatically with the movement of the draw out carriage. It shall, however, be possible to open the shutters of busbars side and cable side individually.
- 3.1.2.10 Mechanically operated circuit breaker auxiliary switches of minimum 5 NO + 5 NC ways, shall be provided for control and indication purposes. Control wiring shall be done by 1.5 sq. mm; 1.1kV grade stranded copper PVC insulated cable. All control fuses shall be HRC link type.
- 3.1.2.11 Terminal blocks shall be clamp type suitable for connection of only 2 wires per terminal and shall be 650 V grade. The L.T. control circuit shall be routine tested to withstand 1.5kV for one minute.
- 3.1.2.12 Busbar compartment shall be provided at the rear. Electrolytic copper busbars shall be of rectangular cross section and insulated. Busbars shall be supported properly by cast epoxy resin insulators so as to withstand thermal and dynamic stresses during system short circuits. Busbars shall be provided with necessary color coding for phases indication. The busbars shall be designed to withstand a temperature rise of 60 deg. C above and ambient temperature of 45 deg. C.

3.1.3 BUSBAR AND REGULATORS

- 3.1.3.1 All busbars and jumper connections shall be of electrolytic copper conforming to relevant IS standards. They shall be adequately supported on epoxy insulators to withstand electrical and mechanical stresses due to specified short circuit currents. Busbar cross section shall be uniform throughout the length of switch board.
- 3.1.3.2 Contact surface at all joints shall be properly cleaned and No-oxide grease applied to ensure an efficient and trouble free connections. All bolted joints shall have necessary washers for maintaining adequate contact pressure. All connection hardware shall have high corrosion resistance.
- 3.1.3.3 Busbar insulators shall be of track-resistance, high strength, and non-hygroscopic, non-combustible type & shall be suitable to withstand stresses due to over voltages and short circuit current. Busbar shall be supported on the insulator such that the conductor expansion and contraction are allowed without straining the insulators. The temperatures of the busbars and all other equipments, when carrying the rated of relevant Indian Standards, duly considering the specified ambient temperature.

3.1.4 EARTHING AND PROTECTIVE EARTHING

- 3.1.4.1 Copper earthing bus shall be provided. It shall be bolted/ welded to the framework of each panel. The earth bus shall have sufficient cross time fault currents to earth without exceeding the allowable temperature rise. Suitable arrangement shall be provided at each end of the earth for bolting. Earthing conductors and earth bus shall run inside at the back of the panel for entire length. Facilities shall be provided for integral earthing of busbars & feeder circuit. Earthing rod consisting of 16 Sq.mm. stranded/flexible copper cable 15 Mtr. long and connectors shall be supplied. Cost of this earthing rod is deemed to be included in the cost of VCB Panel.

3.1.5 METERING AND PROTECTION

- 3.1.5.1 The VCB Panel Board shall be provided with epoxy resin current transformers for metering and protection. The protection CTs shall be of accuracy class 5 P 10 of IS 2705- Part-III-1992. The metering CTs shall conform to the metering ratio and accuracy class 0.5 of IS 2705-1992 for incomer and class 1 for outgoing feeders. Ammeter and voltmeter to be installed on panel shall be of moving iron type or as specified in the BOQ. All meters shall be 96mm square pattern, flush mounting type with necessary selector switches. Necessary indicating lamps of low voltage type with built in resistors shall be provided (maximum wattage 2.5W).

3.1.6 OPERATING MECHANISM

- 3.1.6.1 Vacuum Circuit Breaker shall be equipped with motorized spring charge. These operating mechanisms shall be of the stored energy type. In the closed state of the breaker, the energy stored in the springs shall be suitable for O-C-O duty.

3.1.6.2 Interlocking and Safety Arrangement

3.1.6.3 Vacuum Circuit Breaker shall be provided with the following safety and interlocking arrangements:

- i. The draw out carriage cannot be moved from either test/disconnected to service position or vice versa, when the circuit breaker is 'On'.
- ii. The circuit breaker cannot be switched 'ON' when the carriage is in any position between test & service position.
- iii. The front door of the panel cannot be opened when the breaker is in service position or in an intermediated position.
- iv. The low voltage plug & socket cannot be disconnected in any position except test/isolated position.
- v. The door cannot be closed unless the LV plug has been fitted.
- vi. It shall be possible to mechanically close and trip the circuit breaker through push buttons with the circuit breaker in service position and the door closed.
- vii. Individual explosion vents shall be provided for breaker, busbar, cable chambers on the top of the panel to let out the gases under pressure generated during an unlikely event of a fault inside the panel.
- viii. Circuit Breaker & sheet metal enclosure shall be fully earthed.
- ix. Self locking shutters shall be provided which close automatically and shall be interlocked with the movement of the draw out carriage mechanism.

3.1.7 Rating:

3.1.7.1 The rating of the vacuum circuit breaker shall be as per the drawings and schedule of quantities. The rated/breaking capacity of the breaker shall be 350 MVA (18.37 KA RMS) at 11 kV. The rated making capacity shall be as per the relevant standards.

3.1.8 Accessories:

3.1.8.1 Circuit Breakers shall be provided with the following accessories.

- i. Auxiliary Switch with minimum 5 NO+ 5 NC auxiliary contacts.
- ii. Tripping Coil
- iii. Mechanical Operation Counter
- iv. Spring Charging Handle

3.1.9 Additional Accessories

3.1.9.1 The loose items to be supplied with the 11kV VCB Panel Board shall comprise of the following:

- a. Instruction Book.
- b. Maintenance Manual.
- c. Reaching in/out handle.
- d. Handle for spring charging mechanism.
- e. Foundation bolts.
- f. Busbar Earthing & Circuit Earthing Trolley.

3.1.10 Mounting

3.1.10.1 Vacuum Circuit Breakers shall be mounted as per manufacturer's standard practice.

3.1.11 Auxiliary Supply

- a. The tripping shall be at 24 Volt D.C. through a power pack unit.
- b. Space heater indication & other auxiliary supply requirement shall be at 230 V AC. Necessary termination arrangements complete with isolating switch, control fuse & link shall be provided at one place in the panel for receiving the purchaser's cable.

3.1.12 TESTS

3.1.12.1 Factory Tests

The circuit breakers panel shall be subjected to routine tests at manufacturer's works in accordance with the details specified in the relevant IS specifications. These shall however necessarily comprise of the following.

- a. Power frequency voltage test on the main power circuit.
- b. Verification of the correct wiring/Functional Test.
- c. Dielectric test at 1.5kV on the control circuit. Apart from above, the vendor shall submit the routine test certificates for the following equipment.
 - i. Circuit Breakers
 - ii. Current Transformers
 - iii. Voltage TransformersThe vendor shall submit the type test certificate for following along with the offer.
 - a. Temperature rise test.
 - b. Impulse & power frequency voltage test

- c. Short time current test on circuit breaker.

3.1.13 Site Test

3.1.13.1 General

1. Verification for completion of equipment, physical damage/deformities.
2. Alignment of panel, interconnection of busbars & tightness of bolts & connection etc.
3. Interconnection of panel earth busbar with plant earthing grid.
4. Inter panel wiring between transport sections.
5. Cleanliness of insulators and general Cleanliness of panel to remove traces of dust, water etc.

3.1.13.2 Circuit Breaker & Panel

1. Check for free movement of circuit breaker, lubrication of moving part & other parts as per manufacturers manual.
2. Manual/Electrical operations of the breaker and Functional test as per drawings.
3. Meggar before the Hi Pot test.
4. H.T. Test - Hi Pot test (Power frequency withstand test for one minute at 28kV RMS). At site Hi Pot test is carried out at 80% of 28kV RMS value.
5. Meggar after the Hi Pot test.
6. CT/PT ratio/polarity primary injection test.
7. Secondary injection test on relays to practical characteristics.

3.2 HT CABLES

3.2.1 Construction

All H.T cables shall be of 11kv grade XLPE earthed insulated & PVC sheathed flat steel wires (strips) armored electrical purity aluminum conductor cables shall be manufactured & tested in accordance with IS Specification.

3.2.2 TERMINATION JOINTS

Terminal joints shall be carried out as per IS specifications. Heat shrink cable termination kit shall be used for terminations.

3.2.3 INSTALLATION OF CABLES

Cable laying shall be carried out as per CPWD specifications.

3.4 DRY TYPE TRANSFORMER

The transformer shall comply with the following Indian Standards as amended upto date:

- i. IS 11171:1985-Dry type power transformers.
- ii. IS 10028 (Part II & III)- Installation and maintenance of transformers
- iii. IS 2099- Bushing
- iv. IS 2705- current transformers.

Detailed technical specifications shall be as per CPWD General Specifications for Electrical Works Part IV Sub-Station- 2007

3.5 CABLE TRAY

Cable tray is manufactured at Indian Standard Specification. Laying is done as per IS & cpwd specification.

3.6 EARTHING

Earthing specified in BOQ is done as per IS & CPWD specification.

4.0 L.T. PANELS AND M.V. PANELS

4.1 GENERAL

Main/Sub Distribution Panels shall be indoor type, metal clad, floor mounted, free standing, totally enclosed, extensible type, air insulated, cubicle type for use on 415 Volts, 3 phase, 50 cycles system.

4.2 CONSTRUCTION

Main/Sub Panels shall be:

- i. Of metal enclosed, indoor, floor mounted, free standing construction (unless otherwise specified) type.
- ii. Made up of the requisite vertical sections, which when coupled together shall form continuous dead front switchboards.
- iii. Provide dust and damp protection.
- iv. Be readily extensible on both sides by the addition of vertical sections after removal of the end covers in case of Main Panels.
- v. All panels shall be front access type.

Main/Sub Panels shall be constructed only of materials capable of withstanding the mechanical, electrical and thermal stresses, as the effects of humidity, which are likely to be encountered in normal service.

Each vertical section shall comprise of the following:

- i. A front-framed structure of rolled/folded sheet steel channel section, of minimum 2 mm thickness, rigidly bolted together. This structure shall house the components contributing to the major weight of the equipment, such as circuit breaker cassettes, moulded case circuit breaker, main horizontal busbars, vertical risers and other front mounted accessories. The structure shall be mounted on a rigid base frame of folded sheet steel of minimum 2 mm thickness and 100 mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.
- ii. A cable chamber housing the cable end connections, and power/control cable terminations. 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 in an adjacent section.

- iii. A cover plate at the top of the vertical section, provided with a ventilating hood where necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1 mm diameter perforations to prevent entry of vermin.
- iv. Front and rear doors fitted with dust excluding neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust.

The height of the panels should not be more than 2400 mm for MV Panels. Operating handle of breaker in top most compartments shall not be higher than 1800 mm. The total depth of the panel should be adequate to cater to proper cabling space and should not be less than 350mm.

Doors and covers shall be of minimum 2mm thick sheet steel. Sheet steel shrouds and partitions shall be of minimum 1.6 mm thickness. All sheet panels shall be smoothly finished, leveled and free from flaws. The corners should be rounded. The apparatus and circuits in the power control centers (panels) shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary degree of safety.

Apparatus forming part of the Main/Sub Panels shall have the following minimum clearances.

- i. Between phases - 32 mm
- ii. Between phases and neutral - 26 mm
- iii. Between phases and earth - 26 mm
- iv. Between neutral and earth - 26 mm

When, for any reason, the above clearances are not available, suitable insulation shall be provided. Clearances shall be maintained during normal service conditions.

Creepage distances shall comply with those specified in relevant standards.

All insulating material used in the construction of the equipment shall be of non-hygroscopic material, duly treated to withstand the effects of the high humidity, high temperature tropical ambient service conditions.

Functional units such as circuit breakers and moulded case circuit breakers shall be arranged in multi-tier formation, except that not more than two air circuit breakers shall be housed in a single vertical section. Cable entry for various feeders shall be from the rear. Panel shall be suitable for termination of bus duct for incoming breakers.

Metallic/insulated barriers shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with:

- i. Main busbars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.
- ii. Cable termination of one functional unit, when working on those of adjacent unit/units.

All doors/covers providing access to live power equipment/ circuits shall be provided with tool operated fasteners to prevent unauthorized access.

Provision shall also be made for permanently earthing the frames and other metal parts of the switchgear by two independent connections.

4.3 METAL TREATMENT & FINISH

All steel work used in the construction of the Main/Sub Panels should have undergone a rigorous metal treatment process as follows:-

- i. Effective cleaning by hot alkaline degreasing solution followed by cold water rinsing to remove traces of alkaline solution.
- ii. Pickling in dilute sulphuric acid to remove oxide scales & rust formation, if any, followed by cold water rinsing to remove traces of acidic solution.
- iii. A recognized phosphating process to facilitate durable coating of the paint on the metal surfaces 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.
- iv. Passivating in de-oxalite solution to retain and augment the effects of phosphating.
- v. Drying with compressed air in a dust free atmosphere.
- vi. Panel shall be powder coated with epoxy based powder paint after the above process so as to render the material suitable for corrosive environment.
- vii. Paint shade shall be Pebble (light) grey, shade no RAL 7032 unless otherwise specified.

4.4 BUSBARS

The busbars shall be air insulated and made of high conductivity, high strength aluminum alloy complying with the requirement of IS-5082.

The busbars shall be suitable braced with non-hygroscopic SMC supports to provide a through fault withstand capacity of 50 kA RMS symmetrical for one second. The neutral as well as the earth bar should be capable of withstanding the above level. Ridges shall be provided on the SMC supports to prevent tracking between adjacent busbars. Large clearances and Creepage distances shall be provided on the busbar system to minimize possibilities of fault.

The Main/Sub Panels shall be designed that the cables are not directly terminated on the terminals of breaker etc. but on cable termination links. Capacity of aluminum busbars shall be considered as 0.8 Amp per sqmm. of cross sectional area of the busbar. The main busbars shall have continuous current rating throughout the length of Panels. The cross section of neutral busbars shall be same as that of phase busbar for busbars of capacity up to 200Amp; for higher capacity the neutral busbar shall not be less than half (50%) the cross section of that the phase busbars. The busbar system shall consist of main horizontal busbar and auxiliary vertical busbars run in busbar alley/chamber on either side in which the circuit could be arranged/connected with front access.

Connections from the main busbars to functional circuit shall be arranged and supported to withstand without any damage or deformation the thermal and dynamic stresses due to short circuit currents. Busbars to be colour coded with PVC sleeves.

4.5 SWITCHGEARS

Refer subhead 5.00 – LT switchgears

4.6 CABLE TERMINATIONS

Cable entries and terminals shall be provided in the Main/Sub Distribution Panels to suit the number, type and size of aluminium conductor power cables and copper conductor control cable specified.

Provision shall be made for top or bottom entry of cables as required. A cable chamber 150 mm. high shall be provided at the bottom through out the length and depth of the MDB/SDB. Generous size of cabling chambers shall be provided, with the position of cable gland and terminals such that cables can be easily and safely terminated.

Barriers or shrouds shall be provided to permit safe working at the terminals of one circuit without accidentally touching that of another live circuit.

Cable risers shall be adequately supported to withstand the effects of rated short circuit currents without damage and without causing secondary faults.

4.7 LABELS

Labels shall be anodised aluminium with white engraving on black background shall be provided for each incoming and outgoing feeder of Main/Sub Distribution and all Panels.

4.8 TEST AT MANUFACTURES WORK

All routine tests specified in IS: 8623-1977 shall be carried out and test certificates submitted.

4.9 TESTING AND COMMISSIONING

Commissioning checks and tests shall be included all wiring checks and checking up of connections. Primary/secondary injection tests for the relays adjustment/setting shall be done before commissioning in addition to routine meggar test. Checks and tests shall include the following.

- a) Operation checks and lubrication of all moving parts.
- b) Interlocking function check.
- c) Insulation test: As per CPWD Specifications.
- d) Trip tests & protection gear test.

5.00 L.T. SWITCHGEARS

5.01 AIR CIRCUIT BREAKERS

5.01.1 GENERAL

Air circuit breakers shall be incorporated in Main Distribution Panels wherever specified. ACBs shall conform to IS 13947 (Part 2) & IEC 947 (2) in all respects. ACBs shall be suitable for operation on 415 volts, 3 phase, 50Hz, AC supply.

5.01.2 Technical Specifications:

The Air circuit breakers shall conform to the requirements of IS13947-2 and IEC 60947-2 & their latest amendments and should be type tested & certified for compliance to Indian standards from CPRI/ERDA. Manufacturer shall submit test report for combined sequence tests from CPRI/ERDA. The breakers shall be suitable for isolation and should be clearly indicated on the front facia. The Air circuit breakers shall be suitable for following system conditions:

- 1) The ACBs shall have $I_{cs} = I_{cu} = I_{cw}$ for 1 sec for short circuit breaking capacity of not less than 50 KA rms at 415 Volts 50Hz ac.
- 2) Rated Operational Voltage (V) & Frequency : 415 Volts, 3 phase, 4wire 50 Hz.
- 3) Rated insulation voltage (U_i): 1000 volts AC
- 4) Ambient temperature: designed at 40 degree C ambient temperature. ACB shall be fully rated at inside panel temperature of 50 deg C.
- 5) Rated impulse voltage 8 KV for Main circuit.
- 7) Utilization Category: B

All ACBs shall be of electrically operated and draw out type (EDO) unless otherwise stated. The circuit breakers shall be 3/4 pole (as specified in BOQ) with quick make/break, trip free operating mechanism.

All current carrying parts shall be silver plated and suitable arcing contacts with proper arc chutes shall be provided to protect the main contacts.

The ACBs shall be fitted with detachable arc chutes on each pole designed to permit rapid dispersion, cooling and extinction of the arc. It should be possible to remove arc chutes without using any tool & without removing the breaker from the panel.

The ACBs shall have minimum mechanical life of 20000 operations for ratings up to 2500A & 5000 operations for higher ratings. It should be possible to extend electrical life of the ACB to mechanical life by replacing the arcing contacts at site.

It shall be possible to directly terminate Aluminum links / bus bars as specified in IS13947-2. All 4 Pole ACBs should have fully neutral Pole.

Auxiliary switches directly operated by the breaker operating mechanism and having 6NO and 6NC contacts, shall be provided on each breaker. The auxiliary switch contacts shall have a minimum rated thermal current of 10 Amps at 230V ac.

All the ACB ratings shall have a uniform panel door cut-out, on left or right side of the panel for allowing maximum utilization of panel space. The ACB with Panel should meet IP53 protection on breaker front.

Cradle:

The cradle shall be so designed and constructed as to permit smooth withdrawal and insertion of the breaker into it. Draw out ACBs shall have 4 distinct and separate positions wrt cradle ie Service Position, Test Position, Isolated Position and Maintenance. ACB should have facilities for carrying out maintenance without physically removing the breaker from panels.

For ease of maintenance, it should be possible to replace jaw contacts without disturbing the busbar links for draw-out type ACBs.

Protection Release

The protection release of **Incomer level ACBs (except APFC Panels)** should be microprocessor based release having inbuilt adjustable protections against overload, short circuit, instantaneous and earth fault protection with adjustable time delay settings for all protections except instantaneous zone. The release should have separate indication by LEDs for Power ON, Overload, Short Circuit, Instantaneous and Earth Fault, Trip & Alarm. The release should provide following additional protection with necessary modules apart from basic protections:

- Undercurrent
- Current Unbalance
- Reverse power
- Under and over voltage
- Under and over frequency
- Phase sequence

- Maximum demand exceed

The parameterization should be possible through communication and menu. The release must provide a password protection to access the protection configurations. The release shall meet the EMI / EMC requirements.

The release should have high resolution LCD for comprehensive metering with the following parameters:

- Phase and Neutral currents (running, avg & max), percentage loading etc
- Phase voltages (P-P & P-N) (running, avg & max)
- Energy & power parameters (active, reactive and apparent)
- Maximum demand in KW
- Power Factor
- System Frequency
- Harmonic- Voltage & current

The release should be able to communicate on MODBUS RTU protocol using inbuilt RS485 port.

The release of **APFC Panels incomer ACB and Outgoing ACBs** shall be microprocessor based with following inbuilt protections and features :

- Protection against Overload, Short circuit, Instantaneous & Earth faults
- Short circuit & Earth fault protection zones shall have time based selectivity
- Self-diagnostic to indicate healthiness of microprocessor.
- Individual fault annunciation by LEDs without using external power supply
- On line change of settings shall be possible
- It should be possible to carry out On Line testing of release without tripping the ACB
- Switch selectable thermal memory to reduce thermal stresses
- The release shall trip the breaker directly
- Shall sense true RMS value of current
- The release shall be self powered and draw its power from the main breaker CTs and shall require no external power supply for its operation.
- The release shall meet the EMI / EMC requirements.

Safety Features:

Draw out ACBs shall be provided with automatically operated safety shutters to prevent accidental contact with live contacts when breaker is withdrawn from the Cradle.

For Draw-out breakers, an arrangement shall be provided to prevent rating mismatch between breaker and cradle. It shall not be possible to interchange two circuit breakers of different thermal ratings.

Draw out breakers should not close unless in distinct Service/Test/Isolated positions.

Electrically operated ACBs shall be provided with mechanical anti-pumping.

Remote tripping device (Shunt release) should be able to trip the ACB, even at voltages as low as 10%.

The insulation material used shall conform to Glow wire test as per IEC60695.

It should be possible to access racking handle & carry out setting of the release from the front & without opening the cassette door.

5.01.2 TYPE AND CONSTRUCTION

Air Circuit Breakers shall be of enclosed pattern, dead front type with 'trip free' operating mechanism. It shall have microprocessor based electronic release. Air Circuit Breakers shall be EDO type (Electrically drawout type unless otherwise specified) with horizontal drawout carriage. The ACBs shall be strong and robust in construction with suitable arrangements for anchoring when in fully engaged or fully drawn-out positions. The carriage or cradle on which the breakers are mounted shall be robust design made of fabricated steel, supported on rollers. Cradle shall also comprise of main and secondary separable contacts and all draw out mechanism in a completely fig welded assembly. There shall be no dependence upon the switchboard frame for any critical alignment. The withdrawal arrangement shall be such as to allow smooth and easy movement.

All the current carrying parts of the circuit breakers shall be silver plated, suitable arcing contacts shall be provided to protect the main contacts. The contacts shall be of spring loaded design. The sequence of operation of the contacts shall be such that arcing contacts 'make before' and break after' the main contacts. Arcing contacts shall be provided with efficient arc chutes on each pole and these shall be such suitable for being lifted out for inspection of main as well as arcing contacts. The contact tips and arc chutes shall be suitable for ready replacement. Self aligning isolating contacts shall be provided. The design of the breaker shall be such that all the components are easily accessible to inspection, maintenance and replacement. Interphase barriers shall be provided to prevent flashover between phases.

5.01.3 OPERATING MECHANISM.

Air Circuit breaker shall be provided with a quick-make, trip free operating mechanism, the operating mechanism shall be 'strain-free' spring operated. The

operating handle shall be in front of the panel type. The design shall be such that the circuit breaker compartment door need not be opened while moving the breaker from completely connected, through test, into the disconnected position. Electrical operated breakers shall have a motor wound spring charged closing mechanism. Breaker operation shall be independent of the motor, which shall be used solely for charging the closing spring. The operating mechanism shall be such that the breaker is at all times free to open immediately and the trip coil is energised. Mechanical operation indicator shall be provided to show open and closed position of breaker. Electrically operated breakers shall be additionally provided with mechanical indication to show charged and discharged condition of charging spring. 24 volt DC supply through battery backup for closing and opening for tripping circuit.

Means shall be provided for slow closing and opening of the breaker for maintenance purposes and for manual charging and closing of electrically operating breakers during emergencies.

5.01.4 INTERLOCKING AND SAFETY ARRANGEMENT

Air Circuit Breakers shall be provided the following safety and interlocking arrangements:

- i. It shall not be possible for breaker to be withdrawn when in "ON" position.
- ii. It shall not be possible for the breaker to be switched on until it is either in fully inserted position or for testing purposes it is in fully isolated position.
- iii. The breaker shall be capable of being racked into 'testing', 'isolated' and 'maintenance' positions and kept locked in any of these positions.
- iv. A safety catch to ensure that the movement of the breaker, as it is withdrawn is checked before it is completely out of the cubicle.
- v. The operating mechanism shall provide for racking the breaker into connected, test and disconnected positions without operating compartment door. When cubicle door shall be open position, the breaker can be pulled out to a fourth position, maintenance, where free access shall be possible to all parts of the breaker.

5.01.05 RATING

The rating of the circuit breaker shall be as per the drawings and schedule of quantities. Rated service breaking capacity (Ics) of the breakers shall be 50kA unless otherwise specified at 415 volts. The rated making capacity shall be as per the relevant standard.

5.01.06 ACCESSORIES

The breaker shall be equipped with electronic microprocessor based release to provide over current & earth fault protection. The breaker shall be fitted with following accessories for control, signal and interlocking.

- i. Auxillary contacts 6 NO + 6 NC, of rating 16Amp at 415 volts 50Hz.
- ii. Shunt release for tripping the breaker remotely and shall be suitable for 240 volt/415 volt 50Hz with range of operation from 10% to 130% of rated voltage.
- iii. Micro switches shall be mounted on the cradle of draw out breaker to indicate the position of the breaker on the cradle.
 - a. Kit for test/isolated indication.
 - b. Kit for service position indication.
 - c. Kit for shutter assembly.
- iv. Accessories for following interlocking schemes shall be provided.
 - a. Accessory kit for locking the breaker in isolated position. This kit is useful for interlocking scheme as well as keeping personnel and equipment safe.
 - b. Door interlock kit: Panel or cubicle door cannot be opened with the ACB in Test or Service position.
 - c. Lockable trip push button.

5.01.07 MOUNTING

Circuit Breakers shall be mounted as per manufacturers' standard practice.

5.01.08 TESTING

Testing of each circuit breaker shall be carried out at the works as per IS 2516 and the original test certificate shall be furnished in triplicate. The tests shall incorporate at least the following.

- i. Impulse withstand test.
- ii. Power frequency withstand test.
- iii. Short circuit test.
- iv. Temperature - rise test under rated conditions.

5.02 MOULDED CASE CIRCUIT BREAKERS.

5.02.01 GENERAL

Moulded Case Circuit Breaker shall be incorporated in the Main/Sub Distribution Boards wherever specified. MCCBs shall conform to IS 13947 (Part 2) & IEC 947 (2) in all respects. MCCBs shall be suitable either for single-phase AC 230 volts or three phase 415 volts. All MCCBs shall have microprocessor based over current and short circuit releases with adjustable current setting from $0.4I_n$ to $1.0 I_n$.

5.02.02 Technical Specifications

The MCCB should be current limiting type with trip time of less than 10 milli sec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified in BOQ.

MCCB shall comply with the requirements of the relevant standards IS13947 – Part 2 /IEC 60947-2 and should have test certificates for breaking capacities from independent test authorities CPRI / ERDA

MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses.

The breaking capacity of MCCB shall be minimum 35KA / 50 KA or as specified in BOQ. The rated service breaking capacity should be equal to rated ultimate breaking capacities ($I_{cs}=I_{cu}$).

All MCCBs upto 200A ratings should be provided with Thermal Magnetic type release with adjustable Overload and fixed short circuit protections. MCCBs of ratings 250A & above shall be provided with Microprocessor based having inbuilt adjustable protections against Over Load (L), Short Circuit (S) and Ground Faults (G)] with time delay.

All MCCBs should be provided with the Rotary Operating Mechanism. The ROM should be with door interlock (with defeat feature) & padlock facility

MCCB should have Spreader links & Phase barriers as standard feature. Superior quality of engineering grade plastics conforming to glow wire Tests as Per IEC 60695-2-1 should be used for insulation purpose.

The handle position shall give positive indication of 'ON', 'OFF' or 'Tripped' thus qualifying to disconnection as per the IS/IEC indicating the true position of all the contacts.

5.02.02 FRAME SIZES

The MCCBs shall have the following frame sizes subject to meeting the fault level.

- a. Upto 100A rating 100A frame.
- b. Above 100A upto 200A 200A frame.
- c. Above 200A up to 250A 250A frame.
- d. Above 250A up to 400A 400A frame.
- e. Above 400A up to 630Aq 630A frame.
- f. Above 630A to 800A 800A frame.

5.02.03 CONSTRUCTIONS

The MCCB's cover and case shall be made of high strength heat treatment and flame retardant thermo-setting insulating material. Operating handle shall be quick make/quick break, trip-free type. The operating handle shall have suitable "ON", "OFF" "and" "tripped" indicators. Three phase MCCBs shall have common operating handle for simultaneous operation and tripping of all the three phases. MCCBS shall be provided with rotary handle.

Suitable extinguishing device shall be provided for each contact. Tripping unit shall be of thermal magnetic or static release type provided in each pole & connected by a common trip bar such that tripping of any pole operates all three poles to open simultaneously. MCCB shall be current limiting type.

Contact trips shall be made of suitable air resistant, silver alloy for long electrical life. Terminals shall be of liberal design with adequate clearance.

5.02.04 BREAKING CAPACITY

Unless otherwise specified, rated service breaking capacity of the Moulded Case Circuit Breakers shall be minimum 25kA or as mentioned in the BOQ

5.02.05 TESTING

- a. Original test certificate of the MCCB as per Indian Standards (IS) 315-C-8370 shall be furnished.
- b. Pre-commissioning tests on the Main Distribution/Sub Distribution Board incorporating the MCCB shall be done as per standard.

5.03 SWITCH DISCONNECTOR FUSE UNITS

The Switch Disconnecter Fuse Units shall be double break type suitable for load break duty (AC 23) quick make and break action. Hinged doors shall be duly interlocked with operating mechanism so as to prevent opening of the door when the switch is in 'ON' position and also prevent closing of the switch when the door is not properly secured. All contacts incoming and outgoing terminals of switch shall be adequately sized to receive proper size of cables. High rupturing capacity (HRC) fuse links shall be provided with switch fuse units and shall be in accordance with IS 13703-1&2-1993 and having rupturing capacity of not less than 31 MVA at 415 volts. HRC fuse links shall be provided with visible indicators to so that they have operated. The switch disconnecter fuse units shall be manufactured in accordance with IS 13947-3-1993.

FUSE

Fuse shall be of the high rupturing capacity (HRC) fuses links and shall be in accordance with IS 13703-1&2-1993 and having rupturing capacity of not less than 31 MVA at 415 volts. The backup fuse rating for each motor/equipment shall be chosen as the fuse does not operate on starting of motors/equipments.

5.04 MEASURING INSTRUMENTS, METERING & PROTECTION

5.04.01 GENERAL

Direct reading electrical instruments shall be in conformity with IS 1248. The accuracy of direct reading shall be 1.0 for voltmeter and 1.5 for ammeters. Other type of instruments shall have accuracy of 1.5. The errors due to variations in temperature shall be limited to a minimum. The meter shall be suitable for continuous operation between -10 degree Centigrade to + 50 degree Centigrade. All meters shall be of flush mounting type of 96mm square or circular pattern. The meter shall be enclosed in a dust tight housing. The housing shall be of steel or phenolic mould. The design and manufacture of the meters shall ensure the prevention of fogging of instrument glass. Instruments meters shall be sealed in such a way that access to the measuring element and to the accessories within the case shall not be possible without removal of the seal. The meters shall be provided with white dials and black scale markings.

The pointer shall be black in colour and shall have zero position adjustment device which could be operated from outside. The direction of deflection shall be from left to right.

Suitable selector switches shall be provided for all ammeters and voltmeters intended to be used on three-phase supply.

The specifications herein after laid down shall also cover all the meters, instrument and protective devices required for the electrical work. The ratings type and quantity of meters, instruments and protective devices shall be as per the schedule of quantities.

5.04.02 AMMETERS

Ammeters shall be moving iron or moving coil type. The moving part assembly shall be with jewel bearing. The jewel bearing shall be mounted on a spring to prevent damage to pivot due to vibrations and shocks, the ammeters shall be manufactured and calibrated as per the latest edition of IS:1248. Ammeters shall be instrument transformer operated, and shall be suitable for 5A secondary of instrument transformer. The scales shall be calibrated to indicate primary current, unless otherwise specified. The ammeters shall be capable of carrying sustained overloads during fault conditions without damage or loss of accuracy.

5.04.03 VOLTMETERS

Voltmeter shall be of moving iron or moving coil type. The range for 415 volts, 3 phase voltmeters shall be 0 to 500 volts. Suitable selector switch shall be provided for each voltmeter to read voltage between any two lines of the system. The voltmeter shall be provided with protection fuse of suitable capacity.

5.04.04 CURRENT TRANSFORMERS

Current transformers shall be in conformity with IS: 2705 (Part I, II & III) in all respects. All current transformers used for medium voltage applications shall be rated for 1kV. Current transformers shall have rated primary current, rated burden and class of accuracy as required. However, the rated acceptable minimum class of various applications shall be as given below:

Measuring : Class 0.5 to 1

Protection : Class 5P10.

Current transformers shall be capable of withstanding without damage, magnetic and thermal stresses due to short circuit fault of 50KA on medium voltage system. Terminals of the current transformers shall be marked permanently for easy identification of poles. Separate CT shall be provided for measuring instruments and protection relays. Each C.T. shall be provided with rating plate.

Current transformers shall be mounted such that they are easily accessible for inspection, maintenance and replacement. The wiring for CT's shall be copper conductor, PVC insulated wires with proper termination lugs and wiring shall be bunched with cable straps and fixed to the panel structure in a neat manner.

All Current Transformer shall be Cast resin type.

5.05 MISCELLANEOUS

Control switches shall be of the heavy-duty rotary type with escutcheon plates clearly marked to show the operating position. They shall be semi-flush mounting with only the front plate and operating handle projecting.

Indicating lamps shall be of the filament type of low watt consumption, provided with series resistor where necessary, and with translucent lamp covers, bulbs & lenses shall be easily replaced from the front.

Push buttons shall be of the momentary contact, push to actuate type fitted with self-reset contacts & provided with integral escutcheon plates marked with its functions.

6.00 INTERNAL ELECTRIFICATION OF BUILDING

6.1 SCOPE

As specified in subhead 1.00

6.2 GENERAL

The electrical Installation work shall be carried out in accordance with Indian Standard Code of Practice for Electrical Wiring Installation IS: 732-1989 and IS: 2274-1963. It shall also be in conformity with the current Indian Electricity rules and regulations and requirements of the Local Electricity Supply Authority and Fire Insurance regulations, so far as these become applicable to the installation. Electrical work in general shall be carried out as per following CPWD Specifications with up to date amendment.

- Specifications for Electrical Works Part-I (Internal) by CPWD – 2005 or latest revision
- Specifications for Electrical Works Part-II (External) by CPWD – 1994 or latest revision

Wherever these specifications calls for a higher standard of material and or workmanship than those required by any of the above mentions regulations and specification then the specification here under shall take precedence over the said regulations and standards.

6.3 DISTRIBUTION BOARDS.

As a general practice only pre-wired MCB type double door DB shall be used. Pre-wired DB shall have following features:

- i) Recess/ surface type with integral loose wire box.
- ii) Phase/neutral/ earth terminal blocks for termination of incoming & outgoing wires.
- iii) DIN channel for mounting MCBs.
- iv) Arrangement for mounting incomer MCB/RCCB/RCBO/MCCB as required.
- v) Copper bus bar.
- vi) Earthing terminals.
- vii) Wiring from MCBs to terminal block.
- viii) Interconnection between terminal block/ incoming switch/ bus bar/ neutral/ terminal block/ earth terminal connector with specified size of FRLS pre insulated copper conductor cable duly fitted with copper lugs/ thimbles.
- ix) Termination block should be suitable for termination of conductor/ cable of required size but minimum rated cross section of the terminal blocks should be 6 sq. mm.
- x) Terminal block shall be made of flame retardant polyimide material.

- xi) Coloured terminal blocks and FRLS wires for easy identification of RYB phases, Neutral and Earth.
- xii) Pre-wired DB shall be provided with a detachable cassette for safe removal of MCBs, RCCBs. Terminal connectors from the DB without loosening the internal cable connections of phase and neutral circuits.
- xiii) The pre-wired DB shall have peel able poly layer on the cover for protection from cement, plaster, paints etc during the construction period.
- xiv) Detachable plate with knock out holes shall be provided at the top/ bottom of board. Complete board shall be factory fabricated and pre-wired in factory, ready for installation at site. The box and cover shall be fabricated from 1.6 mm sheet steel, properly pretreated, phosphotized with powder coated finish.
- xv) DB shall be of double door construction provided with hinged cover in the front.

Distribution Board shall be standard type. Distribution boards shall contain miniature circuit breakers of rating specified in BOQ/DB Schedule.

Miniature circuit breakers shall be quick make and quick break type with trip free mechanism. MCB shall have thermal and magnetic short circuit protection. All miniature circuit breakers shall be of 9 KA rated rupturing capacity unless otherwise specified.

Neutral busbars shall be provided with the same number of terminals, as there are single ways on the board, in addition to the terminals for incoming mains. An earth bar of similar size as the neutral bar shall also be provided. All live parts shall be screened from the front. Ample clearance shall be provided between all live metal and the earth case and adequate space for all incoming and outgoing cables. A circuit identification card in clear plastic cover shall be provided for each distribution board.

MCB's shall be provided on the phase of each circuit. The individual banks of MCB's shall be detachable. There shall be ample space behind the banks of MCB's to accommodate all the wiring. All the distribution boards shall be completely factory wired, ready for connections. All the terminals shall have adequate current rating and size to suit individual feeder requirements. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram. All the switches and circuits shall be distinctly marked with a small description of the service installed.

Earth Leakage Circuit Breaker shall be current operated type and of 30mA sensitivity unless otherwise specified. It shall also provide over-current and short circuit protection i.e. it shall be MCB-cum-RCCB (Residual Current Circuit Breaker). In case ELCB doesn't have inbuilt short circuit protection, same rating MCB have to be provided for short circuit protection along with ELCB. Cost of this MCB is deemed to be included in the cost of ELCB. ELCB shall be housed within the Distribution Board.

Distribution Boards shall be ready for connections and shall be inspected in the factory by HSCC Electrical Engineer before dispatch.

Before procurement of Distribution Boards, MCB's, ELCB's (incomer and outgoing) etc., the contractor has to take approval of the DB Schedule/Drawings of each DB from the HSCC Electrical Engineer. The whole unit i.e. Distribution Board, MCB's, ELCB's etc. shall come from the manufactures premises/workshop. After inspection and clearance from the HSCC Electrical Engineer the same may be dispatched to site for installation. However if a single component (such as ELCB or MCB or DB) is required for any reason such as replacement, increase in no. of circuits in the DB, change in the load of existing circuit, change in the total load on a particular DB etc., the same may be ordered separately but after the approval of HSCC Electrical Engineer.

6.4 METALLIC CONDUIT WIRING SYSTEM.

6.4.1 TYPE AND SIZE OF CONDUIT.

All conduit pipes shall be of approved gauge (not less than 16 SWG for conduits of sizes up to 32 mm diameter and not less than 14 SWG for conduit of size above 32mm diameter) solid drawn or reamed by welding finished with black stove enameled surface. All conduit accessories shall be of threaded type and under no circumstances pin grip type accessories shall be used. The maximum number of PVC insulated 650/1100 volts grade copper conductor cable that can be drawn in conduit of various sizes shall be as per IS Code. No steel conduit less than 20mm in diameter shall be used.

6.4.2 CONDUIT JOINTS.

Conduit pipes shall be joined by means of threaded couplers, and threaded accessories only. In long distance straight run of conduits, inspection type couplers at reasonable intervals shall be provided or running threads with couplers and jam nuts shall be provided. In the later case the bare threaded portion shall be treated with anti-corrosive preservative. Threads on conduit pipes in all cases shall be between 13 mm to 19 mm long sufficient to accommodate pipes to full threaded portion of couplers or accessories.

Cut ends of conduit pipe shall have neither sharp edges nor any burrs left to avoid damage to the insulation of conductor while pulling them through such pipes.

6.4.3 PROTECTION AGAINST CONDENSATION.

The layout of conduit should be such that any condensation or sweating inside the conduit is drained out. Suitable precaution should also be taken to prevent entry of insects inside the conduit.

6.4.4 PROTECTION OF CONDUIT AGAINST RUST.

The outer surface of conduit including all bends, unions, tees, junction boxes etc. forming part of conduit system shall be adequately protected against rust when such system is exposed to weather by being painted with two coats of oxide paint applied before they are fixed. In all cases, no bare threaded portion of conduit pipe shall be allowed. Unless such bare thread portion of conduit is treated with anticorrosive preservative or covered with approved plastic compound.

6.4.5 PAINTING OF CONDUIT AND ACCESSORIES.

After installation, all accessible surface (if any) of conduit pipes, fittings etc. shall be painted with two coats of approved enameled paint or aluminium paint as required to match the finish of surrounding wall, trusses etc.

6.4.6 RECESS CONDUIT.

The chase in the wall shall be neatly made and of ample dimensions to permit the conduit to be fixed in the manner desired. In the case of building under construction, conduit shall be buried in the wall before plastering and shall be finished neatly after erection of conduit. In case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work. Entire work of chasing the wall, fixing the conduit in chases, and burring the conduit in mortar before plastering shall form part of point wiring work.

The conduit pipe shall be fixed by means of staples or by means of saddles not more than 60cm apart or by any other approved means of fixing. Fixing of standard bends and elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with the long radius, which shall permit easy drawing in of conductors. All threaded joints of conduit pipe shall be treated with some approved preservative compound to secure protection against rust. Suitable inspection boxes to the barest minimum requirements shall be provided to permit periodical inspection and of facilitate replacement of wires, if necessary. These shall be mounted flush with the wall. Suitable ventilating holes shall be provided in the inspection box covers. Wherever the length of conduit run is more than 10 meters, then circular junction box shall be provided.

6.4.7 METAL OUTLET BOXES & COVERS.

The switch box shall be made of modular metal boxes with suitable size modular cover plates. Modular metal box shall be made of mild steel on all sides except on the front.

The metal box (other than modular type) shall be made of metal on all sides except on the front. Boxes shall be hot dip galvanized mild steel. Metal boxes upto 20 x 30 cm size M.S. box shall have wall thickness of 18 SWG and MS boxes above 20 x 30 cm

size shall be of 16 SWG. The metallic boxes shall be painted with anticorrosive paint before erection. Clear depth of the box shall not be less than 60mm. All boxes shall be covered from top with Phenolic laminated sheet of approved shade. These shall be of 3 mm thick synthetic phenolic resin bonded laminated sheet as base material and conform to grade P-I of IS: 2036-1994.

6.4.8 ERECTION AND EARTHING OF CONDUITS.

The conduit of each circuit or section shall be completed before conductors are drawn in. The entire system of conduit after erection shall be tested in presence of HSCC Electrical Engineer for mechanical and electrical continuity throughout and permanently connected to earth conforming to the requirement by means of special approved type of earthing clamp effectively fastened to conduit pipe in a workmen like manner for a perfect continuity between the earth and conduit.

6.4.9 SWITCHES.

All 5 and 15 Amp switches shall be modular type of 240 volts A.C. grade. All switches shall be fixed on modular metal boxes. All 5 Amp socket shall be 5 pin type and 15 Amp socket shall be 6 pin type (unless otherwise specified) suitable for 15/5 Amp. All modular switches, sockets, telephone outlets, TV outlet etc. shall be in off white finish unless otherwise specified. The switches controlling the lights or fans shall be connected to the phase wire of the circuit. Switch boards shall be located at 1200 mm above finished floor level unless otherwise indicated on drawings or directed by Engineer-In-Charge.

In case of computer power points, power points, telephone points etc. to be fixed on laminated partition board (furniture), same shall be fixed on laminated board (portion of laminated board meant for fixing power points) with base plate/cover plate as applicable, duly fixed with screws.

6.4.10 COVER PLATE.

All modular switches, sockets, telephone outlets etc. shall be fixed modular metal boxes with modular base plates and modular cover plates on top.

6.4.11 WALL SOCKET PLATE.

Each outlet shall have a switch located beside the socket preferably on the same cover plate/modular base. The earth terminal of the socket shall be connected to the earth wire.

6.5 WIRING.

All PVC insulated copper conductor wires shall conform to relevant IS Codes. All wires/cables shall be stranded type irrespective of its size. Cable conductor size and material shall be specified in BOQ.

All internal wiring shall be carried out with PVC insulated wires of 650/1100 volts grade. The circuit wiring for points shall be carried out in looping in system and no joint shall be allowed in the length of the conductors. Circuit wiring shall be laid in separate conduit originating from distribution board to switch board for light/fan. A light/fan switchboard may have more than one circuit but shall have to be of same phase. Looping circuit wiring shall be drawn in same conduit as for point wiring. Each circuit shall have a separate neutral wire. Neutral looping shall be carried out from point to point or in light/fan switchboards. A separate earth wire shall be provided along with circuit wiring for each circuit. For point wiring red/yellow/blue colour wire shall be used for phase and black colour wire for neutral. Circuit wiring shall be carried out with red, yellow or blue colour PVC insulated wire for RYB phase wire respectively and black colour PVC insulated wire for the neutral wires. Bare copper wire shall be used as earth continuity conductor and shall be drawn along with other wires. No wire shall be drawn into any conduit until all work of any nature, that may cause injury to wire is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire.

Before the wires are drawn into the conduit, the conduits shall be thoroughly cleaned of moisture, dust and dirt. Drawing and jointing of copper conductor wires and cables shall be as per CPWD specifications.

Maximum number of PVC insulated 650/1100 V grade aluminium/copper conductor cable conforming to IS : 694 - 1990

| Nominal Cross-Sectional area of conductor in Sq.mm. | 25mm | | 32mm | | 38mm | | 51mm | | 64mm | |
|--|------|---|------|----|------|---|------|----|------|----|
| | S | B | S | B | S | B | S | B | S | B |
| 1 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 1.5 | 10 | 8 | 18 | 12 | - | - | - | - | - | - |
| 2.5 | 8 | 6 | 12 | 10 | - | - | - | - | - | - |
| 4 | 6 | 5 | 10 | 8 | - | - | - | - | - | - |
| 6 | 5 | 4 | 8 | 7 | - | - | - | - | - | - |
| 10 | 4 | 3 | 6 | 5 | 8 | 6 | - | - | - | - |
| 16 | 2 | 2 | 3 | 3 | 6 | 5 | 10 | 7 | 12 | 8 |
| 25 | - | - | 3 | 2 | 5 | 3 | 8 | 6 | 9 | 7 |
| 35 | - | - | - | - | 3 | 2 | 6 | 5 | 8 | 6 |
| 50 | - | - | - | - | - | - | 5 | 3 | 6 | 5 |
| 70 | - | - | - | - | - | - | 4 | 3 | 5 | 4 |

NOTE :

1. The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.
2. The columns headed `S' apply to runs of conduits which have distance not exceeding 4.25m between draw in boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns headed `B' apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.
3. Conduit sizes are the nominal external diameters.

6.5.1 JOINTS.

All joints shall be made at main switches, distribution board socket and switch boxes only. No joint shall be made in conduits and junction boxes. Conductors shall be continuous from outlet to outlet.

6.5.2 LOAD BALANCING

Balancing of circuits in three-phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

6.5.3 COLOUR CODE FOR CIRCUIT WIRING.

Colour code for circuit and sub main wiring installation shall be Red, Yellow, and Blue for three phases. Black for neutral and yellow/green or green only for earth incase of insulated earth wire.

6.5.4 CLASSIFICATION OF POINTS.

6.5.4.1 General

Classification and measurement of Point wiring shall be as per CPWD specification for Electrical Works (Part-I-Internal) 1994.

6.5.4.2 Point Wiring (Modular)

Definition of point wiring

A point (other than socket outlet point) shall include all work necessary in complete wiring to the light points/fan/exhaust fan/call bell point from the controlling switch/MCB. The scope of wiring for a point shall, however, include the wiring work necessary in tapping from another point in the same distribution circuit i.e. from first switch board (wiring from distribution board to first switch box is covered in the circuit wiring and is not in the scope of point wiring) to subsequent switch board(s) in

the same distribution circuit. The point wiring includes all materials specified below including chasing the wall (in case of recessed wiring in wall), fixing the conduit and making the wall good as it originally was. It also includes supply, drawing, testing and commissioning of wires.

Scope of point wiring

Following shall be deemed to be included in point wiring.

- (a) Supply & fixing conduit & conduit accessories for the same and wiring cables (including supplying and drawing wires) between the switch box and the point outlet. [See also (i) below]
- (b) All fixing accessories such as clips, nails, screws, phil plug, rawl plug etc. as required.
- (c) Modular Metal boxes for control switches, regulators, sockets etc. recessed or surface type, modular base plates and modular cover plates over the same.
- (d) Outlet boxes, junction boxes, pull-through boxes etc. but excluding modular metal boxes if any, provided the switchboards for loose wires/conduit terminations.
- (e) In case of recessed wiring in wall the scope includes chasing of wall, fixing the conduit and making the wall good as it originally was.
- (f) Control modular switch (5/6A) as specified.
- (g) Ceiling rose or connector (in case of points for ceiling/exhaust fan point, prewired light fittings and call bells).
- (h) Connections to ceiling rose, connector, socket outlet, lamp holder, switch etc.
- (i) Interconnecting wiring between points on the same circuit, in the same switch box or from another. Interconnecting wiring from first switchboard to subsequent switch board(s).
- (j) Protective (loop earthing) conductor (as specified in the BOQ) from one metallic switch box to another in the distribution circuits, and from switchboard to each point (light/fan/exhaust fan/call bell etc).
- (k) Bushed conduit where wiring cables pass through wall etc.
- (l) Ceiling rose (in the case of pendants except stiff pendants).
- b) Lamp holder (in the case of goose neck type wall bracket, batten holder and fittings which are not pre-wired).
- c) Back Plate (in the case of stiff pendants).
- d) MS Fan Boxes with MS hook (as per CPWD specifications) for the erection of Ceiling Fans

Note :- In the case of call bell points the words “from the controlling switch or MCB” shall be read as “from the ceiling rose meant for connection to bell push”.

Measurement of Point Wiring (other than socket outlet points)

- i) There shall be no linear measurement for point wiring for light points, fan points, exhaust fan points and call bell points. These shall be measured on unit basis by counting,
- ii) No separate measurement shall be made for interconnections between points in the same distribution circuit and for the circuit protective (loop earthing) conductors between metallic switch boxes.

6.5.5. Circuit and Submain Wiring

Circuit Wiring

Circuit wiring shall mean the wiring from the distribution board upto the tapping point for the nearest first point of that distribution circuit i.e. up to the nearest first switch box.

Submain Wiring

Submain wiring shall mean the wiring from one main/distribution switchboard to another.

Measurement of circuit wiring and submain wiring

- (i) Circuit and submain wiring shall be measured on linear basis along the run of the wiring. The measurement shall include all lengths from end to end of conduit, exclusive of interconnections inside the switchboard etc. The increase on account of diversion or slackness shall not be included in the measurement.
- (ii) The length of circuit wiring with two wires shall be measured from the distribution board to the first nearest switch box in the circuit irrespective of whether neutral conductor is taken to switch box or not.
- (iii) When wires of different circuits are grouped in a single conduit, the same shall be measured on linear basis depending on the actual number and size of wires run.
- (iv) When circuit wires and wires of point wiring are run in the same conduit, circuit wiring shall be measured on linear basis depending on the actual number and sizes of wires run in the existing conduit.
- (v) Protective (loop earthing) conductors, which are run along the circuit wiring and submain wiring, shall be measured on linear basis and paid separately. This is not applicable if protective conductor is clubbed with the BOQ item of circuit and submain wiring.

6.5.6 Power Plug Wiring

5A Plug Wiring

Wiring for all 5 A Socket Outlets shall be done with 2X1.5 sqmm PVC insulated copper wire in suitable size MS Conduit (including supplying and fixing MS Conduit) along with the earth wire as specified in the BOQ/Drawings, from the switchboard or 15A power point as the case may be.

Measurement of 5A point wiring shall be done on number basis from switchboard/15A power point to 5A point. Conduit of point wiring/power point wiring can also be used for 5A point wiring, but both phase and neutral wires shall come directly from switchboard/power point. Looping of neutral shall not be done.

15A Power Plug Wiring

Wiring for all 15 A Socket Outlets/Gyser point shall be done with 2X4 sqmm PVC insulated copper wire in suitable size MS Conduit (including supplying and fixing MS Conduit) along with the earth wire as specified in the BOQ/Drawings, directly from the MCB-Distribution Board or from one power point to another in case of computer power points. Looping shall not be done in general 15A power points (other than computer power points).

Measurement of power point wiring shall be done on number basis under following two subheads:

- i) Directly from MCB-Distribution Board to the Socket Outlets
- ii) From One power point/computer power point to another (looping)

Wiring for 20A Metal Clad Socket Outlets

Wiring for all 20A Metal Clad Socket Outlets shall be done with 2X6 sqmm PVC insulated copper wire in suitable size MS Conduit (including supplying and fixing MS Conduit) along with the earth wire as specified in the BOQ/Drawings, directly from the MCB-Distribution Board. Measurement of wiring for 20A Metal Clad Socket outlet shall be done on number basis i.e. complete wiring directly from MCB-Distribution Board to the socket outlet.

No extra payment shall be made on account of minor changes in location of power points (15A or 20A or computer power points) due to change in the architectural layout or change due to any other reason. Height of the power socket outlets shall be 300mm from the finished floor level unless otherwise specified.

6.5.7 CONDUCTOR SIZE.

Wiring shall be carried out with following sizes of PVC insulated stranded single core copper conductor wire/cable.

- i. Light point. - 1.5Sq.mm

- ii. Ceiling /Cabin/Exhaust Fan Point - 1.5Sq.mm
- iii. Call Bell Point - 1.5Sq.mm
- iv. Plug Point (5 A Outlet) - 1.5Sq.mm
- v. Circuit Wiring - 1.5Sq.mm
- vi. General Power Point - 4Sq.mm
- vii 20A Industrial Socket Outlet – 6 Sqmm
- viii Special Power Point – 6 Sqmm
- ix A/C Box with 32A MCB- 6 Sqmm

6.5.8 LIGHTING FIXTURE AND FANS

6.5.8.1 GENERAL

- a. The Contractor shall supply and install lighting fixtures including but not limited to lamps, ballasts, accessories fixing hardware necessary for installations, as shown on the Drawings, as required, and as herein specified.
- b. All fixtures shall be delivered to the building complete with suspension accessories, canopies, hanging devices, sockets, holders, reflectors, ballasts, diffusing material, louvers, plaster frames, recessing boxes, etc. all wired and assembled as indicated.
- c. Full size shop detail drawings of special fixture or lighting equipment, where called for in the fixtures schedule, shall be submitted to the HSCC Electrical Engineer for approval.
- d. Fixtures, housing, frame or canopy, shall provide a suitable cover for fixture outlet box or fixture opening.
- e. Fixtures shall comply with all applicable requirements as herein outlined unless otherwise specified or shown on the Drawings.
- f. Manufacturer's name and catalogue number of light fixtures, fans, switchgears etc. shall be strictly adhered.
- g. Fixtures shall bear manufacturer's name and the factory inspection label.
- h. Fixtures shall be completely wired and constructed to comply with the IEE wiring regulations requirements for lighting fixtures, unless otherwise specified.
- i. Revamping the fixture shall be possible without having to remove the fixture from its place.
- j. Lamps of the proper type, wattage and voltage rating shall be furnished and installed in each fixture.

6.5.9 INSTALLATION

Fixtures shall be installed at mounting heights as detailed on the Drawings or as instructed on site by the Engineer-In-charge.

Pendent fixtures within the same room or area shall be installed plumb and at a uniform height from the finished floor. Adjustment of height shall be made during installation.

Flush mounted recessed fixtures, shall be installed so as to completely eliminate leakage of light within the fixture and between the fixture and adjacent finish.

Fixtures mounted outlet boxes shall be rigidly secured to a fixture stud in the outlet box. Hickeys or extension pieces shall be installed where required to facilitate proper installation.

Fixtures located on the exterior of the building shall be installed with non-ferrous metal screws finished to match the fixtures.

6.5.10 LAMPS-GENERAL

Lamp shall be supplied and installed in all lighting fixtures listed in the BOQ.

Lamp shall be the part of Fitting no extra Payment will be made

Lamps used for temporary lighting service shall not be used in the final fixture units.

Lamps shall be of wattage and type as shown in the BOQ.

Lamps for permanent installation shall not be placed in the fixtures, until so directed by the Engineer In-charge.

6.5.11 BALLASTS-FLUORESCENT

Ballasts shall be electronic type and having high power factor type.

Ballasts shall have manufacturer's lowest sound level and case temperature rise rating.

Ballasts shall be special cool operated type.

Ballasts for indoor fixtures shall be protected by an integral thermal automatic resetting protective unit, which shall disconnect the ballast in the event of overheating.

Ballasts shall be of the same manufacture as the lamps/fixture.

6.5.12 FIXTURE SAMPLES

Detailed catalogue for all fixtures or if so required by the HSCC Electrical Engineer sample fixtures shall be submitted for prior approval of the HSCC Electrical Engineer before orders for the fixtures are placed.

6.5.13 TESTING

After all lighting fixtures are installed and are connected their respective switches, test all fixtures to ensure operation on their correct switch in the presence of the engineer.

All non-operating fixtures or ones connected to the wrong or inconveniently located switch shall be correctly connected as directed by the Engineer In-charge.

6.5.14 CEILING FANS

All ceiling fans shall be provided with suspension arrangement in the concrete/slab/roof members. Contractor to ensure that provision are kept at appropriate stage at locations shown on the drawing. Fan box with MS hook shall be as per CPWD specification. Ceiling fan shall be double ball bearing type, copper wound motor complete with canopy, down rod, blades etc. and shall conform to relevant IS standards ceiling fan shall be white in colour. Ceiling fan shall be provided with electronic regulator. Electronic Regulator shall be suitable for 240 volts A.C supply 50 Hz and shall be of continuous duty type

6.5.15 EXHAUST FANS

Exhaust fans shall be heavy-duty type with double ball bearing and conforming to IS 2312 (latest revision). Exhaust fan shall be complete with copper wound motor, capacitor, Louver/shutter, frame and mounting bracket. Exhaust fan shall be suitable fan operation on 240 volts single phase A.C supply.

7.00 TELEPHONE SYSTEM

7.01 Telephone point wiring

- (a) The point wiring shall be carried out with Double pair telephone wire/cable, unarmoured, PVC insulated, 0.61 mm dia annealed tinned copper conductor (IS: 2532-1965) in suitable size conduit (one pair always remaining spare for one point)

Minimum Dia of Conduit for Internal/External Telephone Wiring - 20mm.

If more than one telephone point has to be provided at one point, multicore, unarmoured telephone cable shall be used (pairs required are equal to 2 No. of points) in suitable size of conduit.

- (b) The point shall commence from the main telephone tag box/sub tag box and would terminate at outlet box of point. Connection at both ends included in point wiring.
- (c) Fixing of conduit, conduit accessories draw out boxes and outlet box etc. in concealed/surface conduit works as that of wiring for light fixtures shall be applicable for telephone wiring conduit system also.
- (d) Joint in telephone wiring (between main tag box/sub tag box and outlet box of point) shall not be allowed and the contractor should bear the wastages of wire if resulted due to this special requirement of telephone system.
- (e) External/Internal telephone and intercom wiring can be drawn in the same conduit, provided after drawing wires, 50% of conduit cross sectional area is free. However, independent PVC insulated telephone wire of suitable pairs shall be used for external, internal and intercom.
- (f) To identify each pair of multipair telephone wire/cable, PVC indication numbers shall be put on both ends of pair just before termination.

7.02 Telephone Tag Boxes

These shall be of MS sheet 2 mm thick with connector suitable for telephone connection (as approved by ITI). It shall have hinged MS sheet cover.

9.00 ADDRESSABLE FIRE DETECTION AND ALARM SYSTEM

9.01 GENERAL

The Contractor shall supply and install the Addressable Fire Detection & Alarm System as per schedule of quantities are as herein specified. The system shall include Addressable Main Fire Alarm Control Panel, battery charger, batteries, addressable heat detectors, addressable smoke detectors, manual fire alarm station, fire alarm bells/hooters, response indicators, conduiting, wiring and all necessary accessories required to complete fire alarm system installation as per IS: 2189-1988. Equipment like control panel, smoke detector, heat detectors etc shall be EN-54/ UL approved.

9.02 FEATURES

The system shall be general alarm electrically supervised type activation of manual fire alarm station or any of the automatic alarm initiating devices shall sound the general alarm bells on all floors and shall give indication on the control panel. The signal shall be continuous until the station from which it is originated is restored to normal and a reset button on the control unit is operated.

The system shall be electrically supervised against open and ground on both the stations and signal device wiring. Open and ground in the system shall cause a trouble bell to ring at the fire alarm control panel and a trouble lamp to light. It shall be possible to silence the bell but the lamp shall remain lit until the fault is rectified. In case of power failure the system shall automatically changeover to the battery standby.

9.03 CONDUITING & WIRING

Conduiting & Wiring for FDA system shall be carried out in M.S Conduit with copper conductor PVC insulated wires.

9.04 CONTROL PANEL

The fire control panel has to be addressable type.

The Main Fire Control Panel shall be constructed to sheet steel of red colour, and provided with windows for the alarm and trouble lights. All components shall be of the plug in type, for simple replacement and extension in the future. Control panel shall be wall mounting type conforming to IS 513-1986.

The number of loops is mentioned in B.O.Q. Each loop shall be able to support at least 128 any device addressable analog/digital (as the case may be) sensors and control module etc. The control panel shall have alphanumeric display. The Main Fire control panel shall be provided with all necessary relays, resistors, fuses, transformers, rectifiers and all other components to assure full and proper functioning of the system. All relays shall conform to the relevant IS Standards. Control panel shall include power on lamps, system trouble lamps, audible trouble signal, trouble silence switch with ring back, alarm silence push button with repeat alarm capability, low battery indicator with reset, ground detection indicator, alarm

reset, milli ammeter, supervised alarm lamps, zone "Open" test pushbutton, zone alarm test push button, end of line resistors etc.

Each zone shall be equipped with an auxiliary contact for control of a remote annunciation.

Main control panel shall include a power supply model to provide a filtered and regulated source of power to provide additional power wherever supplementary power is required within the system. It shall include an output fuse, key reset switch, provision for automatic transfer to standby power upon primary power failure.

Main control panel shall in addition have audible signal and lamp to indicate as failure of the charge of battery.

Two stages general Alarm shall be provided in which a continuous evacuation alarm is immediately given in zone of fire and its adjoining zones. In other zone intermittent alarm signal shall be provided as per IS 2189-1988.

Repeater Panel shall be of same specification as main control panel and shall have fire/fault indication with audio device.

9.05 CHARGER AND BATTERY

Unit shall comprise a ventilated cabinet supplied complete with charger, meters, high rate charge switch and lock and key in a sheet metal enclosure.

9.06 ELECTRONIC HOOTERS

Hooter shall be electronic solid-state speaker type having tone for fire, which shall be wailing. Hooter should be loop powered having an output of approximately 6 watt. The audible range shall be around 100m under normal condition. Cable for this in our system shall be 2 cores. The switching shall be provided on the control panel. The outer enclosure of the speaker shall be of MS sheet and shall be suitably oven baked and painted. The speaker shall be 4" heavy magnet type. All hooters shall be on one or more circuits.

9.07 MANUAL ALARM CALL POINT FOR SURROUNDINGS (ADDRESSABLE)

The manual call point shall be electrically compatible with the standard range of automatic detectors so that it can be connected directly into a supervised two-wire zone of the manufacturer's standard range of control units. The manual call point shall be of pleasant, streamlined and flat appearance permitting its use as flush and surface mounted unit. The manual call point shall consist of base plate, insert and cover. The push button shall have minimum one normally closed plus one normally open contacts. The push button shall not be shrouded and the same shall be projected out from the surface of the MS Box. The whole assembly of push button shall be enclosed in the 16 SWG MS Box except from the front side. The front side shall be sealed with breakable glass covering neoprene or equivalent gasket. The glass cover shall be fixed in such a way that the actuating push button is kept depressed (with NC contact open) so long as the glass cover is in contact. In case

of fire, when the glass cover is broken to give the fire warning the push button shall be released due the spring action hence giving remote fire alarm through the NC contact. The breaking of the glass must release an alarm. All inscriptions, texts and marks must be on the manual call point front plate, not on the glass, so that the glass can easily be replaced anywhere. The alarm contacts shall be of self-cleaning design to prevent failure after a prolonged period of inactivity in unclean environments.

It shall be possible to test the call point without destroying the seal or removing the cover. The manual call point shall be equipped with a self-holding device to maintain the alarm condition until reset by an authorized person. The complete unit and the push button shall be painted signal Red. The internal surface of the MS enclosure of the box shall painted white colour. The external painting shall be of synthetic enameled paint. Aluminium hammer shall be suspended on a hook fixed to the external MS enclosure by means of a non-corrodible easy breaking of the glass cover.

Manual alarm call point located on the outer walls of the building and/or exposed to weather conditions shall be weather proof type and satisfying the requirement of APB.

The manual call point shall be capable of being remotely tested from control panel.

9.08 OPTICAL (PHOTOELECTRIC) TYPE SMOKE DETECTORS (ADDRESSABLE TYPE)

The optical type smoke detectors shall be based on light attenuation by smoke/ or light scattering by smoke particles. Smoke detectors shall have an inherently stable sensor with built-in automatic compensation for changes in ambient conditions. All electronic circuits must be solid-state devices and virtually hermetically sealed to prevent their operation from being impaired by dust, dirt or humidity. All circuitry must be protected against usual electrical transients and electromagnetic interference. Reversed polarity or faulty zone wiring shall not damage the detector. The detector shall have no moving parts or components subject to wear. The response sensitivity of each detector shall be factory set. A built-in barrier shall prevent entry of insects into the sensor. The detector shall be designed for fast and simple laboratory cleaning.

The detector shall be inserted into or removed from the base by a simple push-twist mechanism to facilitate exchange for cleaning and maintenance. The manufacturer shall produce and provide test equipment allowing to test and exchange smoke detectors upto 7m (23ft) above floor level. The detector shall connect to the control unit via a fully supervised two-wire circuit.

The detector shall be capable of being remotely tested from control panel.

9.09 HEAT DETECTOR (ADDRESSABLE TYPE)

Heat detector shall be combined rate of rise and fixed temperature type. Heat detectors shall consist of two independent thermistors, designed to automatically compensate virtually hermetically sealed to prevent their operation from being impaired by dust, dirt of humidity. All circuitry must be protected against usual

electrical transients and protected against usual electrical transients and electromagnetic interference. Reversed polarity or faulty electromagnetic interference. Reversed polarity or faulty zone wiring shall not damage the detector. The detector shall have no moving parts or components subject to wear. It shall be possible to test the detector in the field. The response (activation) of a detector shall be clearly visible from the outside by a flashing light of sufficient brightness. The detector shall be installed into the base by a simple push-twist mechanism to facilitate exchange for cleaning and maintenance. The detector shall connect to the control unit via a fully supervised two-wire circuit.

The manufacturer shall produce and provide test equipment allowing to test and exchange rate-of-rise/fixed temperature heat detectors up to 7m (23ft) above floor level.

The detector shall be capable of being remotely tested from control panel.

9. 10 PLUG-IN BASES

The smoke & heat detectors shall fit into a common type of standard base. Once a base has been installed, it shall be possible to insert, remove and exchange different types of detectors by a simple push-twist movement. The standard base shall be equipped with screw wiring terminals capable of securing wire sizes up to 16 AWG and weakening of contact pressure. The standard base shall be supplied with a sealing plate, preventing dirt, dust, condensation or water from the conduit reaching the wire terminals or the detector contact points. All standard bases shall be supplied with a removable dust cover to protect the contact area during installation and construction phase of the building. It must allow the check out and certification of the zone wiring before insertion of any detectors. The standard base shall feature a built-in mechanism, which allows mechanical locking of an installed detector head, thus preventing unauthorized removal or tampering while maintaining.

The detector contact points shall be designed to retain the detector safely and to ensure uninterrupted contact also when exposed to continuous severe vibration. All electronic components of base and modules must be solid state and virtually hermetically sealed to prevent their operation from being impaired by dust, dirt or humidity. All circuitry must be protected against usual electrical transients and electromagnetic interference. Reversed polarity or faulty zone wiring shall not damage the detector. The standard base shall allow snap-on insertion of an (optional) electronic module, it shall be possible to turn a standard base part into an individually addressable detector base with its own unique identification address at the control unit. The standard base shall have a built in alarm indicator which is repeatable by connecting a simple 2 core wire to the base. No changes in the zone wiring shall be required to operate the additional alarm indicator. Removal and insertion of dust covers or detectors shall be feasible by a simple push twist movement, even if the locking device has been activated. Special base assemblies shall be available for use in air ducts and aspiration air-sampling system wherever required.

Contractor is required to submit samples and get approved from HSCC Electrical Engineer of all above mentioned items including Response Indicators, Hooters, manual call points.

10.00 LIFT INSTALLATION

10.01 The scope of work shall cover design, supply delivery, installation, testing and commissioning of passenger lifts/bed lifts. The scope of work shall also include the following item of civil works.

- a) Necessary scaffolding temporary barricade in the hoistway required during the erection of the elevators.
- b) Minor building work comprising of cutting holes and making good the car and counterweight rail brackets, hall buttons and indicators including laying of sills in position.
- c) Steel items such as machine beams, bearing plates buffer support channels, sill angles and fascia plates etc.
- d) Suitable trap doors with steel chequered plate covers.
- e) Providing and install a suitable vertical iron ladder for access to the pit.
- f) Any other item required for successful completion and commissioning of lifts. (including the hoisting beam in the machine room)

10.02 The work shall be done in accordance with regulations of any local code and following ISI codes which govern the requirements of installations.

IS: 1860-1980 code of practice for installation, operation and maintenance of Electric Passenger and Goods Lifts.

IS: 3534-1976 Outline dimensions of Electric Lifts.

IS: 4666-1980 Specifications for Electric passenger and Goods Elevators.

Indian Electricity Act 1910.

Indian Electricity Rules, 1956.

Delhi Lifts Rules, 1942.

10.03 SHOP DRAWINGS AND APPROVAL OF ELECTRICAL INSTALLATIONS :

The selected tenderer shall prepare a furnish shop drawings for approval by The Client, such shop drawings shall be based on the Architectural drawings and requirements laid down in specifications, local laws and regulations etc.

The detailed drawings shall be submitted within one month of placement of order. The successful tenderer shall obtain the approval of electrical Inspector and other local authorities as per requirements before submitting the drawings to Client/ Engineer. The contractor shall not proceed with in installation work till the drawings are approved by the Engineer-in-Charge. Expenses incurred such as license fee etc.

towards obtaining the approval of Electrical Inspector, local authority shall be reimbursed to the contractor as per actual on production of documentary proof.

Approval of contractor's drawings shall not absolve the contractor of any of his obligations to meet the requirements of specification under this contract

Five sets of completion drawings operation manual, maintenance manual, spare parts details shall be submitted to the Client/ Engineer after completion of work.

10.04 GUARANTEE

The tenderer shall guarantee the equipment against all defects of materials and workmanship for a period of one year from the date of commissioning of the equipment as certified by the owner. Any defects arising during the guarantee period shall be rectified and replaced by the tenderer, at his own expense, to the satisfaction of the owner.

10.05 PERMITS, INSPECTION & LICENSE FEE

The contractor shall arrange all necessary local, provincial or national government permit and shall make arrangements for inspection and tests required thereby. Expenses to be borne by purchaser.

10.06 MAINTENANCE

After the completion of the installation and before handing over of each elevator by the elevator contractor, maintenance service for the equipment furnished shall be provided for a period of twelve (12) months. This service shall include regular examination of the installation by trained employees, and shall include all necessary adjustments, greasing oiling, cleaning supplies and genuine standard parts to keep the equipment in proper operation, except any parts made necessary by misuse, accident or neglect caused by other. Contractor shall provide 24 hours Emergency local call back service facility and shall furnish full details of such facilities available.

10.07 POWER SUPPLY

The apparatus shall be designed to operate on 415 + 5% Volts, 3 Phase, 4 wires, 50 Hz A.C.. Supply for illumination signal equipment shall be 240 Volts + 5% single phase 50Hz A.C..

10.08 ELECTRICAL WIRING

The necessary A.C. supply of 3 Phase, 415 Volts 50 HZ shall be made available in the main control switch unit to be provided by the contractor in the machine room. All the electrical works beyond the main supply switch shall be carried out by the contractor i.e. supply and installations of panels for drive motors, switches and control complete with wiring as per system requirement and approval of the Engineer.

The wiring shall be carried out strictly in accordance with Indian Electricity Rules and Indian code of Practice for Electrical Wiring Installation IS-732-1963 System Voltage not exceeding 650 V). For works not covered under any of the above wiring rules,

the 13th edition of Electrical Engineers (Condense) shall apply. The cable and conduits to be used shall be of suitable size and grade conforming to relevant IS specification. Wiring for LT switchboard to the motor terminal shall be with heavy duty 1.1 KV grade PVC insulated PVC sheathed, FRLS aluminium cable. All the trailing cables used for control and safety device shall conform to IS: 4289-1967, Specifications for lifts cables. The trailing cable circuits for controls, safety devices, lighting and signaling shall be separate and distinct.

Power wiring between controller and main board to various landings shall be drawn in suitable size heavy gauge conduit stove enameled/painted conforming to I.S specifications.

The Voltage and frequency of the supply shall be subjected to variations permissible under Indian Electricity Acts and Rules.

10.09 PARTICULAR SPECIFICATIONS

| | | | |
|----------------|--------------------|---|--|
| 10.09.1 | TYPE | : | Bed Lifts/Passenger Lifts. |
| 10.09.2 | NO. OF ELEVATORS | : | As Per Bill of Quantities. |
| 10.09.3 | CAPACITY | : | As Per Bill of Quantities. |
| 10.09.4 | SPEED | : | As Per Bill of Quantities. |
| 10.09.5 | FLOORS SERVED/RISE | : | As Per Bill of Quantities. |
| 10.09.6 | STOP | : | As Per Bill of Quantities. |
| 10.09.7 | OPENINGS | : | (All Openings on same side). As Per Bill of Quantities. |
| 10.09.8 | OPERATION | : | Duplex/Simplex Collective as per BOQ. |

10.09.9 CAR FRAME:

The car frame, which supports the car platform and enclosures, shall be made of structural steel and equipped with suitable guides and a car safety device mounted underneath the car platform. The hoist ropes shall include adjustable self/ aligning hinges. Walls of lift enclosure shall have a fire rating of two hours.

The car shall be so mounted on the frame that vibration and noise transmitted to the passenger is minimized.

10.09.10 CAR SAFETY AND GOVERNER :

Suitable car safety to stop the car whenever excessive descending speed is attained shall be operated by a centrifugal speed governor connected to the governor through a continuous steel rope.

The governor shall be provided with self tensioning device to keep governor rope in proper tension even after rope stretch. Suitable means shall be supplied to cut off power from the motor and apply the brake on application of the safety.

10.09.11 COUNTER BALANCE :

A Suitable guided structural steel frame with appropriate filler weights of cast iron shall be furnished to promote smooth and economic operation.

10.09.12 TERMINAL AND FINAL LIMITS :

Terminal limit switches shall be provided to slow down and stop the car automatically at the terminal landings within permissible over travel and final limit switches shall be provided to automatically cut off the power and apply the brake, should the car travel beyond the permissible over travel. They shall act independently of the operating devices and buffers.

10.09.13 TERMINAL BUFFERS :

Heavy duty spring buffers shall be installed as a means of stopping the car and counterweight at the extreme limits of travel. Buffers in the pit shall be mounted on steel channels which shall extend between both the car and counterweight rails.

10.09.14 CONTROLLER :

A Controller shall be provided to control starting stopping and speed of the elevator motor and also be automatically able to apply the brake if any of the safety devices operate or if power fails from any cause. In case of power failure and again restore of power the lift shall land to next floor and shall not go to basement/lowest level. Suitable software/hardware or rescue device shall be provided.

10.09.15 REVERSE PHASE RELAY :

A reverse phase relay shall be provided on the controller which is designed to protect the lift equipment against phase reversal and phase failure.

10.09.16 GUIDES :

Machined steel tee guides shall be furnished for the car and counterweight. The guide rails should be of steel solid and shall have tongued and grooved joints. Sliding clips shall be used for fastening the guides to allow building settlement without distorting the guide rails. To keep down the noise level and to reduce wear and tear of the sections, only Nylon Ribs shall be used in the guide shoes, after smoothing of the rails. The flanges shall be machined for the fish plate mounting such that rail alignment at joints almost remain constant.

10.09.17 FOUNDATIONS :

The machine shall be placed directly above the hoistway upon the machine room slab provided by the Owner.

10.09.18 ROPES :

The elevator shall be provided with traction steel ropes. Steel wire rope having a tensile strength of not less than 12.5 Ton/cm² of good flexibility shall be used for lift. The lift rope shall conform to IS: 2365-1963.

10.09.19 MACHINE :

The machine shall be of the single wrap traction type and shall include a motor, electromechanical brake, steel worm, bronze gear, steel sheave shaft and Farrow-Molybdenum sheave all compactly mounted on a single base or bed plate. The worm shaft shall be provided with ball bearings to take the end thrust and roller bearings shall be furnished for the sheave shaft to ensure alignment and long bearing life. The driving sheave shall be grooved to ensure sufficient traction and minimize rope wear. Shall be provided for all bearings and the worm gear.

10.09.20 BRAKE :

The direct current brake shall be spring applied and electrically released and designed to provide smooth stop under variable loads. The brake should be capable of operation automatically by various safety devices, current failure, and by normal stopping of car. It should be possible to release the brake manually, such releases brake manually, such releases requiring the permanent application of manual force so as to move the lift car in short sties. For this purpose one set of brake release equipment shall be supplied.

10.09.21 MOTOR :

The motor shall be suited to the service proposed and arranged for adequate lubrication. The motor shall be class F insulation and one (1) hour rated squirrel cage induction type having high starting torque. It shall also be provided with Thermistors embedded in the stator windings for the highest degree of thermal motor protection.

10.09.22 CONTROL

The control shall be variable voltage variable frequency A.C. variable voltage, closed loop control system using solid state devices and electronic speed pattern generator to command the motor from a velocity transducer and load compensation circuits for a comfortable ride.

In Normal operation, the electromagnetic brake shall only be applied when the lift has come to a complete standstill. The brake shall only be meant for holding the lift in position at every landing, providing stopping without any jerking effect.

Each controller cabinet containing memory equipment shall be properly shielded from the pollution.

MICROPROCESSOR

The control shall employ a microprocessor working on a program such that precision leveling and highly efficient handling of passengers for least possible waiting and reduced travel time is ensured. The microprocessor system should be designed to accept programming with minimum downtime. It should be able to monitor the state of input calls (such as car calls from COP and hall calls from hall fixtures) and output commands such as starting, decelerating and stopping the elevator. It should be able to generate floor location data, thereby, providing a reference position to establish the safety zones for door opening and closing, and also to initiate leveling slowdown.

10.09.23 DUPLEX COLLECTIVE OPERATION

The operation shall be duplex collective with/without attendant for each elevator and shall consist of the following:-

IN THE CAR

There shall be furnished a flush type attractively finished stainless steel panel which contains a series of luminous buttons numbered to correspond to the landings served, an emergency stop switch and an emergency call button connected to a bell which serves as an emergency signal.

AT HOISTWAY LANDINGS

There shall be provided an UP luminous push button and a DOWN luminous push button at each intermediate landing and a single button at the terminal landings.

The car shall not start unless the door is in the closed position and all hoistway doors are closed in the locked position.

If the car is idle and one or more car or landing buttons above the landing at which the car is standing are pressed, the car shall start in the UP direction and proceed to the highest landing for which any button is pressed and stops at intermediate landing for which a car button or up landing button is pressed sufficiently in advance of the car's arrival at such landings to permit these stops to be made. After each stop, the car shall proceed in the UP direction until it reaches the highest landing for which a call is registered. The car shall not stop on the UP trip at any landing in response to a DOWN call.

Similarly, if the car is idle and one or more car or landing buttons below the landing at which the car is standing are pressed, the car shall start in the DOWN direction, proceed to the lowest landing for which any button is pressed and stop at each intermediate landing for which a car button is pressed.

When the car is idle and a button for a landing above the car and a landing below the car are pressed, the car shall start towards the landing corresponding to the button pressed first. The call registered for the landing in the opposite direction from the car shall be answered after the car has responded to the farthest call in the direction established by the button pressed first.

A time relay shall hold the car for an adjustable interval of few seconds at the landings at which stops are made to enable passengers to enter or leave the car.

OPERATION WITH AN ATTENDANT

The regular car operating panel shall include buttons, switches, etc. for the collective-automatic control and shall also include.

A two-position key-operated switch marked to indicate ATT (attendant operation)

A buzzer: UP and DOWN direction light jewels and A non-stop button.

A car operating panel shall also include an UP and DOWN button.

When the key-switch is in the position of WITH ATTENDANT, the direction light and buzzer shall become operative and the UP and DOWN direction button in the regular car operating panel shall be made effective for the attendant operation.

When an attendant operation, the car and hoistway doors shall open automatically at each stop but the closing of the doors shall be subject to the UP or DOWN direction buttons. As a visual signal to the attendant, the UP and DOWN direction jewel shall illuminate upon registration of either car or landing calls to indicate the direction of the travel of the car. The attendant shall operate the elevator normally in the direction indicated by the direction jewel but, if desired, opposite direction travel may be realized by pressure of a car button for a landing in that direction from the car.

The pressure of a direction button shall cause the doors to close and the car to start in the direction desired, provided a call is registered for that direction. If pressure of the direction button is released before the car starts, the doors will re-open and car shall not travel. It shall so arrange the pressure on direction button can be released, once the car has started.

Continuous pressure of the nonstop button shall cause the car to by-pass all landing calls and respond only to registered car calls.

10. 09. 24 CAR ENCLOSURES :

The car enclosures shall be of sheet steel and shall be of an elegant design comprising of the following :

- a) Suspended ceiling with light diffuser Perspex ceiling and fluorescent light.
- b) Concealed pressure fan with grille in suspended ceiling. The lift shall have sensor so that the fan is operation only when if there is at least one person inside the lift.
- c) Ceiling steel painted white.
- d) Complete stainless steel car enclosure in plain finish for passenger and Bed Lifts

- a) PVC flooring (with 3mm thick tiles of approved shade) for Bed Lifts
- b) Mirror on one face (front face when we enter the car)

10.09.25 CAR DOOR

The car entrance shall be provided with stainless steel sliding doors in plain finish giving a clear opening of 1200mm wide by 2000mm high for bed lift and for passenger lift as per CPWD specifications. The lift car door shall have a fire resistance rating of one hour.

10. 09. 26 HOISTWAY DOORS :

At each landing, a center/ telescopic opening , stainless steel sliding door in plain finish giving a clear opening as per CPWD general specifications for electrical works –Part-III – Lifts & Escalators, shall be provided. The hoist way doors shall have a fire resistance rating of one hour.

10. 09. 27 SIGNAL AND OPERATIVE FIXTURES :

The following signal and operative fixtures shall be provided for each lift in stainless steel face plates except in fireman's switch which shall have a glass face plate.

a) CAR OPERATING PANEL

There shall be one (1) No. panel in car, with hinged stainless steel face plate and shall comprise illuminated floor buttons, door open and emergency stop controls emergency call buttons, door open and emergency stop controls emergency call button, two position key operated switch, a Buzzer, UP and DOWN direction light panels, a non stop button, and an integral interphone. The jewels and accentuator shall be of modular construction, face plate mounted, rewired using snap on lugs.

b) HALL BUTTONS AND HALL POSITION INDICATOR

There shall be provided combined signal fixture (one riser) of compact design and of attractive hairline stainless steel face plate at the elevator entrance on each floor which for terminal landings shall have a single luminous push button and for intermediate landings shall have an UP luminous push button and a DOWN luminous push button. The jewels shall be of modular construction mounted on a stainless steel face plate. Whenever a button is pressed, the jewel shall light up to indicate registration of the call and shall remain enlightened till the car arrives.

c) CAR POSITION INDICATOR IN CAR

This shall be of compact design and of attractive hairline finish stainless steel face plate with easy to read digital display of the floors, indicating through which floor the elevator is passing or on which floor the elevator is stopped. This shall also incorporate illuminated arrows showing the direction of travel.

d) BATTERY OPERATED ALARM BELL AND EMERGENCY LIGHT

A solid state siren type alarm unit operated by 2 Nos. 9 volt rechargeable Nickel Cadmium batteries shall be provided which shall give a waxing and waning siren when alarm bell in the car is pressed momentarily.

An emergency light unit using a 9 volt dry battery power pack and incandescent lamp with stainless steel face plate shall be provided inside the car which shall operate automatically in the case of power failure.

e) OVERLOAD WARNING

Overload warning radars with audio-visual indication (visual indication shall show OVERLOADED) with stainless steel face plate shall be installed in the elevator car, so that when there is overload in the car the sign shall light up a flash indicating OVERLOADED and a buzzer shall operate during this period and the doors shall remain open until the overload is removed.

f) FIREMAN'S SWITCH

A toggle switch covered by a glass cover shall be provided on the ground floor for each elevator which shall permit a fireman to call the elevator to the ground floor by canceling all car and landing calls. The elevator shall then stop at the ground floor with the door open to permit the fireman to have exclusive use of the elevator without any interference from the landing calls.

g) INTERPHONE

Interphone shall have one master unit in each machine room, one master unit on the ground floor for each 1 (outside hoistway) and one slave unit in each elevator car.

10. 09. 28 ELECTRIC DOOR OPERATOR FOR CAR DOOR AND HOISTWAY DOOR :

An electric door operator for opening and closing the car door shall be provided. The opening of a car and hoistway doors shall be such that the doors shall start opening meant for so that by the time the elevator stops completely, the elevator and hoistway doors shall be fully open.

The equipment shall consist of a machine on the elevator car operating the car door when the car is stopping at a landing.

The car door and hoistway door shall be mechanically connected and shall move simultaneously in opening and closing.

The car and hoistway doors shall be power opened and closed and shall be checked in opening and closing with an oil cushioning mechanism built into the gear unit.

Each hoistway door shall be provided with an interlock which will prevent movement of the car away from the landing unit.

The doors are closed in the closed position as defined in the ISI codes.

An electric contact for the car door shall be provided which shall prevent car movement from the landing unless the door is in the closed position as defined in the ISI codes. The locking arrangement shall be so designed that the electrical circuit cannot be completed unless the doors are in the closed position and mechanical latching is effected.

Necessary switches shall be provided in the elevator machine room to control the operation of the doors.

The car and hoistway, doors shall open automatically as the car is stopping at a landing. The closing of the car and hoistway door must occur before the car can be started. Doors can be stopped and reversed during their closing motion.

10.09.29 DOOR HANGER AND TRACKS :

For the car and each landing door, sheave type two point suspension hangers complete with tracks shall be provided. Means shall be provided to prevent the door from jumping off the track and for vertical and lateral adjustment of doors.

Sheaves and rollers shall be of steel and shall include shielded ball bearing to retain grease lubrication. Adjustable ball bearings rollers shall be provided to take the upward thrust of the doors. Tracks shall be of suitable steel section with smooth surface. The locking of the two leaf parting type doors should be positive.

10.09.30 SAFETY SHOE :

A safety shoe (one on each door panel) shall extend to the full height of and project beyond the front edge of the car door.

Should this shoe touch a person or an object while the car door is closing, the car and hoistway doors shall return to the open position. The doors shall remain open until the expiration of a pre-determined interval and then close automatically.

10.09.31 LANDING ENTRANCE MATERIAL'S :

These shall consist of headers, extruded aluminium sills and strut angles.

10.09.32 WIRING :

Complete wiring in the equipment.

10.09.33 AUTOMATIC RESCUE DEVICE :

Automatic Rescue Device to be provided for all the lifts with battery backup so that it can land to the nearest level in case of power failure. Automatic Rescue Device shall have suitable battery backup so that it can operate minimum 20 times in 8 hours duration.

10.00 LT CABLES

10.1 GENERAL

L.T. Cables shall be supplied, inspected, laid tested and commissioned in accordance with drawings, specifications, relevant Indian Standards specifications and cable manufacturer's instructions. The cable shall be delivered at site in original drums with manufacturer's name clearly written on the drums. The recommendations of the cable manufacturer with regard to jointing and sealing shall be strictly followed.

10.2 MATERIAL

The L.T. power cable shall be PVC insulated PVC sheathed type aluminium conductor armoured cable and L.T. control cable shall be PVC insulated PVC sheathed type copper conductor unarmoured cable conforming to IS: 1554: 1988 (Part-I) with up to date amendments.

10.3 INSTALLATION OF CABLES

Cables shall be laid directly in ground, pipes, masonry ducts, on cable tray, surface of wall/ceiling etc. as indicated on drawings and/or as per the direction of HSCC Electrical Engineer. Cable laying shall be carried out as per CPWD specifications.

10.4 INSPECTION

All cables shall be inspected at site and checked for any damage during transit.

10.5 JOINTS IN CABLES

The Contractor shall take care to see that the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilisation and avoiding of cable joints. This apportioning shall be got approved from Engineer-in-Charge before the cables are cut to lengths.

10.6 LAYING CABLES IN GROUND

Cables shall be laid by skilled experienced workmen, using adequate rollers to minimize stretching of the cables. The cable drums shall be placed on jacks before unwinding the cable. With great care it shall be unrolled on over wooden rollers placed in trenches at intervals not exceeding 2 metre. Cables shall be laid at depth of 0.75 metres below ground level for LT Cables and 1 metre below ground level for HT cable. A cushion of sand total of 250mm shall be provided both above and below the cable, joint boxes and other accessories. Cable shall not be laid in the same trench or along side a water main.

The cable shall be laid in excavated trench over 80mm layer of sand cushion. The relative position of the cables, laid in the same trench shall preserved. At all changes in direction in horizontal and vertical planes, the cables shall be bent smooth with a

radius of bent not less than 12 times the diameter of cables. Minimum 3 metre long loop shall be provided at both end of cable.

Distinguishing marks may be made on the cable ends for identifications of phases. Insulation, tapes of appropriate voltage and in red, yellow and blue colours shall be wrapped just below the sockets for phase identifications.

Cable route marker shall be provided as per CPWD specifications. Cost of cable route markers is deemed to be included in the cost of cables/cable laying.

PROTECTION OF CABLES

The cables shall be protected by bricks laid on the top layer of the sand for the full length of underground cable. Where more than one cable is laid in the same trench, the bricks shall cover all the cables and shall project a minimum of approximately 80mm on either side of the cables. Cable under road crossings and any other places subject to heavy traffic shall be protected by running them through Hume Pipes of suitable size. Pipes for cable crossing the road shall be laid at a depth of 1000 mm.

EXCAVATION & BACK FILL

All excavation and back fill required for the installation of the cables shall be carried out by the Contractor in accordance with the drawings and requirements laid down elsewhere. Trenches shall be dug true to line and grades. Back fill for trenches shall be filled in layer not exceeding 150mm. Each layer shall be properly rammed and consolidated before laying the next layer.

The Contractor shall restore all surfaces, road ways, side walks, curbs, wall or the works cut by excavation to their original condition to the satisfaction of the Engineer-in -Charge.

LAYING OF CABLES ON CABLE TRAY/SURFACE OF WALL/ CEILING

Cable shall be laid on perforated M.S. Cable tray/ladders. Cables shall be properly dressed before cable ties/clamps are fixed. Wherever cable tray is not proposed, cables shall be fixed on surface of wall or ceiling slab by suitable MS clamps/saddles. Care shall be taken to avoid crossing of cable.

CABLES ON HANGERS OR RACKS

The Contractor shall provide and install all iron hangers racks or racks with die cast cleats with all fixings, rag bolts or girder clamps or other specialist fixing as required.

Where hangers or racks are to be fixed to wall sides, ceiling and other concrete structures, the Contractor shall be responsible for cutting away, fixing and grouting in rag bolts and making good.

The hangers or racks shall be designed to leave at least 25mm clearance between the cables and the face to which it is fixed. Multiple hangers shall have two or more fixing holes. All cables shall be saddled at not more than 150mm centres. These shall be designed to keep provision of some spare capacity for future development.

CABLES TAGS

Cable tags shall be made out of 2mm thick aluminium sheets, each tag 1-1/2 inch in dia with one hole of 2.5mm dia, 6mm below the periphery. Cable designations are to be punched with letter/number punches and the tags are to be tied inside the panels beyond the glanding as well as below the glands at cable entries. Tray tags are to be tied at all bends. On straight lengths, tags shall be provided at every 5 metres.

10.7 TESTING OF CABLES

Prior to installation burying of cables, following tests shall be carried out. Insulation test between phases, phase & neutral, phase & earth for each length of cable.

- a. Before laying.
- b. After laying.
- c. After jointing.

Along with the test as prescribed in IS Code, cross sectional area shall also be checked.

On completion of cable laying work, the following tests shall be conducted in the presence of the Engineer in Charge.

- a. Insulation Resistance Test (Sectional and overall).
- b. Continuity Resistance Test.
- c. Earth Test.

All tests shall be carried out in accordance with relevant Indian Standard code of practice and Indian Electricity Rules. The Contractor shall provide necessary instruments, equipments and labour for conducting the above tests & shall bear all expenses of conducting such tests.

11.00 CABLE TRAY

11.01 Ladder Type Cable Tray

Ladder type cable tray shall be fabricated out of double bended channel section longitudinal members with single bended channel section rungs of cross members welded to the base of the longitudinal members at a centre to centre spacing of 250 mm. The channel sections shall be supplied in convenient lengths and assembled at site to the desired lengths. These may be galvanised or painted to the desired lengths.

11.2 Perforated Type Cable Tray

The cable tray shall be fabricated out of slotted/perforated M.S. Sheet as channel section single or double bended. The channel section shall be supplied in convenient length and assembled at site to the desired lengths. These shall be galvanised or painted as specified. Alternatively, where specified, the cable tray may be fabricated by two angle irons of 50mm x 50mm x 6mm as two longitudinal members, with cross-bracings between them by 50mm x 5mm flats welded/bolted to the angles at 1 m spacing. 2mm thick MS perforated sheet shall be suitably welded/bolted to the base as well as on the two sides.

11.3 Typically, the dimensions, fabrication details etc. are shown in CPWD General Specification for Electrical Works - Part II -External, 1994.

11.4 The jointing between the sections shall be made with coupler plates of the same material and thickness as the channel section. Two coupler plates, each of minimum 200mm length, shall be bolted on each of the two sides of the channel section with 8mm dia round headed bolts, nuts and washers. In order to maintain proper earth continuity bond, the paint on the contact surfaces between the coupler plates and cable tray shall be scraped and removed before the installation.

11.5 The maximum permissible uniformly distributed load for various sizes of cables trays and for different supported span are as per CPWD General Specification of Electrical Work Part II -1994. The sizes shall be specified considering the same.

11.6 The width of the cable tray shall be chosen so as to accommodate all the cable in one tier, plus 30 to 50% additional width for future expansion. This additional width shall be minimum 100mm. The overall width of one cable tray shall be limited to 800mm.

11.7 Factory fabricated bends, reducers, tee/cross junctions, etc. shall be provided as per good engineering practice. (Details are typically shown in figure 3 of CPWD General Specification of Electrical Work Part II -1994). The radius of bend,

junctions etc. shall not be less than the minimum permissible radius of bending of the largest size of cable to be carried by the cable tray.

- 11.8** The cable tray shall be suspended from the ceiling slab with the help of 10mm dia MS rounds or 25mm x 5mm flats at specified spacing as per CPWD General Specification of Electrical Work Part II -1994. Flat type suspenders may be used for channels upto 450mm width bolted to cable trays. Round suspenders shall be threaded and bolted to the cable trays or to independent support angles 50mm x 50mm x 5mm at the bottom end as specified. These shall be grouted to the ceiling slab at the other end through an effective means, as approved by the PMC/Consultant to take the weight of the cable tray with the cables.
- 11.9** The entire tray (except in the case of galvanised type) and the suspenders shall be painted with two coats of red oxide primer paint after removing the dirt and rust, and finished with two coats of spray paint of approved make synthetic enamel paint.
- 11.10** The cable tray shall be bonded to the earth Terminal of the switch bonds at both ends.
- 11.11** The cable trays shall be measured on unit length basis, along the center line of the cable tray, including bends, reducers, tees, cross-joints, etc, and paid for accordingly.

12.00 EARTHING

12.01 GENERAL

All the non-current metal parts of electrical installation shall be earthed properly. All metal conduits trunking, switchgear, distribution boards, switch boxes, outlet boxes, and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. Earthing work shall conform to CPWD General Specifications for Earthing work shall conform to Internal) -1994 and Indian Electricity Rules 1956 amended up to date and in the regulations of the local Electricity Supply Authority.

12.02 EARTHING CONDUCTOR

Earth continuity conductor along with submain wiring from Main/Sub Distribution boards to various distribution boards shall be of copper. Earth continuity conductor from distribution board onward up to outlet point shall also be of bare copper. Earth continuity conductor connecting Main & Sub Distribution boards to earth electrode shall be with galvanised MS strip.

12.03 SIZING OF EARTHING CONDUCTOR

Single phase distribution board shall have one earth continuity conductor while three phase distribution board shall be provided with two earth continuity conductors. Earthing of main switch board and sub switch boards shall be earthed with two independent earth electrodes or as indicated elsewhere. Earth conductor laid in ground shall be protected for mechanical injury & corrosion by providing GI pipe.

- 12.04** GI pipe shall be of medium class 40mm dia and 4.5 metre in length. Galvanising of the pipe shall conform to relevant Indian Standards. GI pipe electrode shall be cut tapered at the bottom and provided with holes of 12mm dia drilled not less than 7.5cm from each other upto 2 metre of length from bottom. The electrode shall be buried in the ground vertical with its top not less than 20cm below ground level as per detail enclosed. Earth electrode shall not be situated less than 2metres from the building. The location of the earth electrode will be such that the soil has reasonable chance of remaining moist as far as possible. Masonry chamber of size 300 x 300 x 300mm shall be provided with water funnel arrangement a cast iron or MS frame & cover having locking arrangement at the top.

12.05 PLATE EARTH ELECTRODE

Earthing shall be provided with either GI plate electrode or copper plate electrode of following minimum dimensions.

- i. GI Plate Electrode : 600mm x 600mm x 6mm thick

- ii. Copper Plate Electrode : 600mm x 600mm x 3mm thick

The electrode shall be buried in ground with its faces vertical and not less than 3 metres below ground level. 20mm dia medium class GI pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided on the top of this pipe for watering and earth electrode. Earth electrode the watering funnel attachment shall be housed in masonry enclosure of not less than 300 x 300 x 300mm deep. A cast iron or MS frame with cover having locking arrangement shall be provided at top of metres from the building. Care shall be taken that the excavation for earth electrode may not affect the column footing or foundation of the building. In such cases electrode may be further away from the building.

12.06 ARTIFICIAL TREATMENT OF SOIL

If the earth resistance is too high and the multiple electrode earthing does not give adequate low resistance to earth, then the soil resistivity immediately surrounding the earth electrodes shall be reduced by addition of sodium chloride calcium chloride, sodium carbonates copper sulphate, salt and soft coke or charcoal in suitable proportions.

12.07 RESISTANCE TO EARTH

The resistance of earthing system shall not exceed 5 ohm.

13.00 SAFETY EQUIPMENTS

13.01 DANGER NOTICES

Danger notices shall be affixed permanently in a conspicuous position in Hindi or English and the local language of the district with sign of skull and bones at every overhead lines, transformer, electrical equipments motors, etc.

13.02 FIRST AID BOX

Standard first aid box with all standard contents shall be supplied.

13.03 FIRE BUCKETS

The fire bucket unit shall consist of our galvanised iron baskets, which shall be with round bottom, and of 13 liters capacity. They shall be filled with dry sand. Arrangement shall be made to hang them on GI pipe stand comprising of at least 2 vertical and one horizontal members of 50 mm GI pipe. The stands shall have hooks and locking chain arrangement. The buckets and stand shall be painted with epoxy red paint.

13.04 FIRE EXTINGUISHER

Foam type Fire extinguishers of 9 Kg. capacity and Dry Chemical type Fire Extinguishers of 10 Kg capacity shall be of approved make. It shall be filled with carbon tetrachloride. It shall have horns. Extinguishers shall be fixed on walls/columns with necessary clamps made out of 50 mm x 6mm MS flat and coated bolts and nuts grouted in wall/column.

13.05 RUBBER MAT

Corrugated rubber insulating matting shall be provided in front of all power & motor control centers, push button station and distribution board in the electrical rooms. The width of matting shall be one meter. It shall be as ISI mark.

13.06 INSTRUCTION CHART

Printed instruction chart both in English and Hindi and duly framed with front glass, prescribing treatment to be given to persons having Electric shock, shall be supplied.

14.0 DIESEL GENERATOR SETS

14.1 INTENT OF SPECIFICATION

14.1.1 This specification covers the design, manufacture, assembly, packing, dispatch, transportation supply, erection, testing, commissioning, performance and guarantee testing of **Diesel Gen-Sets with Acoustic Enclosure**, complete in all respects with all equipment, fitting and accessories for efficient and trouble free operation as specified here under.

14.2 SCOPE OF WORK:

14.2.1 Scope of Supply & Services:

General Scope of work shall include, supply, erection, testing and commissioning of the following:

- a) Diesel engine complete with all accessories, an Alternator directly coupled to the engine through flexible/rigid coupling complete with all accessories for starting, regulation and control, including base frame etc. interconnecting piping and accessories, power and control cable glands and lugs.
- b) Diesel Local/Remote control panel including cables between bidders local equipment and special cables if any.
- c) Equipment necessary for engine cooling system, radiators, pumps, valves, inter connecting pipes etc.
- d) Equipment necessary for fuel storing and distribution, day oil tank (990 Lt.), pipings, pumps, valves, level indicators etc.
- e) Flexible connections and residential type silencer of exhaust system, including thermal lagging.
- f) Batteries with iron battery stand and battery charging equipment, including their connections as necessary along with tools & accessories for battery maintenance.
- g) Anti Vibration Mountings etc.
- h) Preparing all related shop drawings for approval from client/consultant and statutory bodies.
- i) Obtaining approval of the installation of Diesel Generators by the Electrical Inspectorate and Pollution Control bodies and any other statutory bodies.

- j) Minor civil works like chasing, grouting etc. for execution of jobs.
- k) Carrying out performance and guarantee test at site available load but not more than the capacity of D.G. Set.
- l) Acoustic enclosure as per CPCB norms and type approved.

14.2.2 Specific Exclusions:

Following items of works are excluded from the scope of works under this specification:

- a) All civil works relating to DG foundation etc.
- b) All cables between contractors and owners equipment other than special cables external to the equipment.

14.3.2 The installation work shall conform to Indian Electricity act and Indian Electricity Rules as amended up to the date of installation.

The fuel oil installation shall meet all statutory requirements of Govt. of India as amended up to the date of installation. Any approval required from statutory authorities shall be obtained by the Contractor. Nothing in this specification shall be construed to relieve the contractor of these responsibilities.

14.3.3 Equipment conforming to any other National/International Standard which ensures equal or better quality may be accepted. In such case the bidder shall furnish copies of the standards in English along with his bid and shall clearly bring out the salient features of comparison with corresponding listed standards.

14.3.4 The equipment furnished under this specification has to operate in a tropical climate and shall be given tropical and fungicidal treatment as per relevant specification

14.3.5 Period of Operation/Duty Cycle:

The sets are intended to supply power only during an emergency for essential services and may be idle for long periods except for periodic routine tests once in a week. When there is a total failure of main power supply, the sets shall be required to operate continuously at full load for a period which at times may exceed even 24 hours.

14.4 ENGINE:

14.4.1 Type:

The diesel engine shall be of stationary type four stroke/two stroke with vertical in line or (V) type cylinder arrangement, Turbo-charged, cooled with radiators.

14.4.2 Rating:

- a) Prime power BHP rating of the engine shall be such that the DG set deliver the specified net electrical output while supplying power/driving all electrical and mechanical auxiliaries connected to alternator terminals and engine shaft at specified site conditions and ambient temperature of 50°C. The bidder shall submit the deration calculations if the engine is not designed for 50deg C. ambient temperature.
- b) It shall also be capable of satisfactorily driving the alternator at 10% over load at the rated speed for one hour in any period of 12 hours of continuous running.

The bidder shall have to furnish copy of deration chart from the original manual of the engine manufacturer and supporting calculations to arrive at diesel engine rating.

14.4.3 Speed and Vibration Levels:

- a) Speed shall be 1500 revolutions per minute. Speed governor/over speed protection shall be provided.

At due running conditions, speed shall be stabilized at plus or minus 2% nominal speed, regardless of load. At transient condition, engine speed shall vary not more than 10% plus or minus. Governor class shall be A1 (4% drop) for normal application unless otherwise specified.

- b) The engine vibration level shall not exceed 100 microns.

14.4.4 Lubrications:

- a) The engine shall have a closed cycle forced & splash lubricating system with positive oil pressure and a crank chamber for collection/storage of the lubricating oil during circulation.
- b) A lubricating oil filter shall be provided for operation under normal conditions for a period of 300 hours without the necessity of its replacement or cleaning.
- c) In case lubricating oil coolers are required it shall be supplied as an integral part of the Diesel Generator Set.
- d) Necessary temperature and pressure gauges and other instruments shall be supplied and fitted on the lubrication system.

- e) A lubricating oil level dipstick suitably graduated shall be provided and located in the accessible position.

14.4.5 Fuel System:

- a) The engine shall be capable of running on all types of diesel fuel oil normally available in India.
- b) The fuel consumption of the engine at full, three quarters and half of its rated power output shall be indicated by the Contractor in the bid.
- c) A fuel service tank of 990 litres capacity with each D.G. Set shall be provided on a suitably fabricated steel platform. The tank shall be complete with level indicator marked in litres, filling inlet with removable screen, an outlet, a drain plug, an air vent and necessary piping. The fuel tank shall be painted with oil resistant paint. All pipe joints should be brazed/welded.

14.4.6 Air Intake System:

The diesel engine shall be provided with special dry type air filters having low resistance to air passage, high dust retaining efficiency and provision for easy cleaning. Filters shall be suitable for achieving satisfactory engine operation and ensuring the engine life under tropical humid conditions, with sulphur dioxide fumes, abrasive dust and coal particles of 5 to 100 microns present in the atmosphere. The minimum efficiency of filters shall be 90% down to 5 micron size.

14.4.7 Cooling:

The diesel engine should be water cooled with radiator heat exchanger system. The cooling system should include temperature gauge with high temp., alarm/trip corrosion resistor etc.

14.4.8 Engine Governor:

The governor shall be Electronic ISO-Chronous type to maintain zero speed rate or regulation and shall be AI type as per BS:5514 in order to take care of heavy motor starting. It shall have necessary characteristics to maintain the speed substantially constant even with sudden variation in load. However, a tripping shall be provided if speed exceeds maximum permissible limit. The governor shall be suitable for operation without external power supply.

14.4.9 Turbo Charger:

It shall be of a robust construction, suitable of being driven by engine exhaust having a common shaft for the turbine and blower. It shall draw air from filter of adequate capacity to suit the requirements of the engine.

14.4.10 Quietness of Operation:

- a) The engine shall be designed to achieve maximum quietness of operation.
- b) Efficient residential silencer shall be provided as per engine manufacturer's approved make only for the exhaust.
- c) Noise level of the set shall not exceed 115-120dbA at one meter distance of the engine.

14.4.11 Engine Starting:

- a) Engine starting shall be by electric starting motor complete with manual/automatic starting arrangement. The starter motor shall conform to IS:4722 and shall be of adequate power for its duty and be of inertia or pre-engaged type. The pinion shall positively disengage when the engine starts up or when the motor is de-energized. The engine cranking shall be only from the panel both for AMF & DG sets (Manual) and any engine starting devices etc. that are given as original fitment on the engine by engine manufacturers shall be either removed or padlocking arrangement given for this so that all normal start/stop operations could be done only from panel whether the set is AMF or manual.

The engine wiring shall be appropriately modified, ferruled to totally match with schematic drawings of the panel.

- b) Time for Run-up to Speed:
From the initial operation of the starting device, the engine shall start, run up to normal speed and be capable of accepting 60% of full load within a maximum time of 20 seconds, and full load within a further 20 second.

14.4.12 Starter Battery:

- a) The battery shall conform to the requirement of IS:1651. Starting battery each of 12 V, heavy duty high performance approved make/quality shall be provided to enable crank & start the engine even in cold/winter morning conditions. Type/voltage/AH capacity of same on 20 hour rated discharge period shall be indicated in the offer. The battery set shall be capable of performing at least (5) five normal starts without recharging.
- b) The battery shall be provided with good quality teakwood stand painted with acid proof black paint with min 3mm thick rubber mat below the batter.

- c) Batteries shall be of load container type only and not with PVC moulded sealed container so that each individual cells are available for individual monitoring during its life span. Each cell shall be provided with electrolyte filling cap with level floats for easy monitoring of electrolytic level.
- d) The battery shall be provided with 2 Nos. cables, minimum 1.5m long heavy duty rubber/PVC insulated cabling with brazed tinned lug at one end and with brazed tinned brass terminal lug at battery end - for connecting batteries to cranking system - with 0.25 m long inter battery connecting cable.
- e) The lugs shall be clearly stamped (+) or (-) and positive cable also red sleeved for easy identification.
- f) The batteries Set shall be supplied fully filled and first charged ready to use.

14.4.13 Battery Charging System:

- a) Float rate charging and quick rate charging system shall be provided at the generator panel with appropriate bridge charger system, LC network, rate selector switch and generously rated charging transformer and silicon one rectifier bridge, so that the cranking battery system can be kept fully charged at all times from E.B. supply network with quick charging rate limited to 0.8 times rated discharge current with provision in control transformer and Si rectifier present to enable boost charging the battery at 2 times rated discharge current in case of emergencies. To this and in the mode selector switch boost charge position shall be present which however shall be kept disconnected at mode selector switch normally.
- b) DC ammeters to clearly indicate float charging current and quick/boost charging current shall be provided.
- c) Dropper resistor network on the load side of battery charger system shall be provided so that higher charger voltages in quick or boost conditions does not get impressed on the I/L and Contactor coils, which voltage shall remain well within +10% of rated voltage.
- d) Battery charging subsystem shall be designed for continuous operation at cubicle ambient of 50^oC corresponding to 45^oC ambient outside and should be designed to operate at 1.5 times rated maximum current corresponding to boost charge current which can reach in practice as high as 2.5 times or 3 times rated discharge current.
- e) Any charger dynamo and dynamo charging current network present on the set shall be made in operative so that both for AMF and manual application the cranking battery system is kept charged from the charger at the panels at all times during or shut down periods of the set.

- f) To the above and in case of manual DG sets, the input to charger subsystem viz., 240 V AC is foreseen to be provided from customer network from the portion that is normally supplied by manual DG Set during DG operation or being fed by E.B. System.

14.4.14 Engine Fitments:

The engine shall be provided with but not limited to following essential basic fitments:

| | | |
|---|---|--|
| Crank case breather | - | Dry type element. |
| Air Cleaner | - | Dry type mounted. |
| Corrosion resistor | - | to control acidity and impurities from coolant. |
| Lubricating Oil Cooler | - | - |
| Filters | - | Lub oil & fuel oil, paper element type. |
| Coolant Pump | - | Gear Driven. |
| Fuel Pumps | - | Priming & Transfer |
| Governor | - | Electronic Class A1. |
| Turbo Charger | - | Exhaust gas driven in case of turbo charged engines. |
| Flywheel with flywheel housing | - | SAE Type |
| Vibration dampers | - | One Set |
| Exhaust/Intake manifolds | - | |
| Oil Sump (crank case) with dip stick | | |
| Engine Supports | | |
| Residential type silencer in exhaust system | | |
| Electrical starter 12 V or 24 V | | |
| Safety controls & instruments | | |

14.4.15 Engine Instrumentation:

The following instruments mounted on instrument panel shall be essentially present as minimum:

- Engine speed tachometer with service hour counter
- Lub oil pressure gauge
- Coolant water temperature gauge

The instrument panel shall be mounted on engine using rubber dampers for vibration isolation.

The gauges shall have clear red marking to identify the limiting dangerous levels, 'Zone Markings' on the scale to indicate the normal healthy & abnormal operating zones for the parameters concerned.

The metering could be either normal electro-mechanical analogue type or electronic digital type, latter being preferred as manufacturers fitment only.

The engine control panel must be supplied by the engine manufacturer only.

14.5 ALTERNATOR:

14.5.1 The alternator shall have brushless type with rotating field and static excitation circuit controlled by field control unit suitably compounded for voltage and load current for a self excited self regulated system.

14.5.2 The alternator shall be in SP-DP enclosure, foot mounted with ball and roller bearings on end shields.

14.5.3 The alternator shall conform to IS:4722/BS:2613 and shall be suitable for tropical conditions.

14.5.4 The alternator shall comply with the following specifications:

| | | |
|----------------|---|---|
| Rating | - | As per BOQ. (Shall be capable of 10 % over loading at the rated speed for one hour of 12 hours continuous running). |
| Voltage | - | 415 V |
| Speed | - | 1500 RPM |
| Frequency | - | 50 Hz. |
| P.F. | - | 0.8 lag |
| Enclosure | - | IP:23 |
| Insulation | - | H |
| Execution | - | -Self excited, self regulated with brushless system and static voltage control unit suitably compounded for voltage and current to maintain terminal voltage constant at $\pm 5\%$ at all load for p.f. not less than 0.8. lag. |
| Terminal Box | - | As per BOQ. |
| Earthing Studs | - | 2 Nos. in each DG |

14.5.5 Neutral Point:

The winding of the alternator shall be star-connected.

14.5.6 Terminal Box and Connection:

The alternator output terminals shall be enclosed in a terminal box mounted in an accessible position on the alternator frame. As far as possible, connections between the exciter and alternator shall be contained within the machine frame and connections carrying A.C. and D.C. shall be segregated from each other. The terminal

box shall be of sufficient size to conveniently terminate the size and number of the Owner's cables, which shall be intimated during detailed engineering. Suitable tinned copper pads shall be provided for power cable termination along with all necessary hardware and cable lugs. Glands and lugs shall be provided for control cables also. For single phase cables, gland plate shall be of non-magnetic material. Gland plate shall be removable type.

14.5.7 The generating set shall be so designed that it is capable of reaching its full voltage and frequency and shall be ready to take full load within 30 seconds of a remote starting impulse being received.

14.5.8 Acoustic Enclosure:

Thickness of Sheet – 14-G:

High Class sheet metal fabricated enclosure for reducing the noise level of DG Set and also acts as weather proof housing. Genset will be an integral part of acoustic enclosure and whole construction will be on multi-fold sheet channels and ISMC sections. Enclosure construction is fully bolted keeping in view the major service requirements all doors are provided with specially designed hinges and lockable handles, battery, fuel tank is housed inside the enclosure.

Acoustic Materials:

Rock wool in the form of slabs of 75 – 100 mm thickness and 48 KG/Metric cube density (Specification of Rock wool conforms to IS:8183).

Further to increase the life of Acoustic material resin coated fiber glass cloth is provided on exposed surface of Rock wool slabs and the panels are supported by perforated sheets.

Ventilation:

Acoustic enclosure is designed in such a way that there are no hot pockets around engine and it is provided with suitable designed engine radiator/or additional axial flow fan and does not allow the temperature to rise more than 7°C.

To achieve optimal output and minimum sound level from the DG Set, suitable openings with acoustic hoods are provide for increasing the inflow of air required for combustion and forced ventilation. Air intake system as per the recommendations and engine requirement are provided.

- Acoustic hoods with noise splitters provided to block and reduce the sound leakage.

- The sound control system designed to suppress the sound level to 75 db maximum at 1 meters distance in open environment.

Silencer:

Specially designed low noise silencer is provided. Silencer & engine exhaust outlet, connected with flexible SS below.

Vibration Isolation:

To avoid transfer of vibration from Genet to enclosure & surrounding specially designed vibration isolators are used.

14.6 AMF PANEL:

14.6.1 General:

- a) The control panel shall be sheet steel enclosed and shall be dust and vermin proof providing a degree of protection of IP-42. Sheet steel used shall be cold rolled and at least 2.0mm thick and properly braced and stiffened.
- b) Control panel shall be provided with hidden hinged door(s) with pad locking arrangement and suitable brackets/channels shall be provided for floor mounting.
- c) All doors, removable covers and plates shall be casketed all around with neoprene gaskets. All accessible live connections shall be shrouded and it shall be possible to change individual switches, fuses, MCCBS without danger of contact with live metal.
- d) All live parts shall be provided with at least phase to phase and phase to earth clearances in air of 25mm and 20mm respectively.
- e) Adequate interior cabling space and suitable removable cable gland plate shall be provided. Necessary number of cable glands shall be supplied and fitted on to this gland plate. Cable glands shall be screwed on type and made of brass.
- f) Two number of earthing terminals shall be provided.
- g) All sheet steel work shall be degreased, pickled, phosphate and then applied with two coats of zinc chromate primer and powder coat finishing both inside and outside of shade 631 (gray).

14.6.2 AMF Control of Diesel Generating Sets:

- a) All DG Sets shall be controlled independently.
- b) Diesel Generator shall be capable of being stopped manually from remote as well as local. However, interlock shall be provided in the DG local control panel to prevent shutting down operations as long as circuit breaker is closed.

c) Auto Operation:

When mains power is available, the healthiness of this power will be monitored through a mains voltage monitor. If voltages on the 3 phases are within limits, the monitor will send a closing signal to the mains breaker and mains power will be connected to the load.

If the voltage drops on any phase or on all phases, the monitor will sense this drop through a timer, and if this drop persists for more than a pre-adjusted period of time (say 1 to 20 seconds) a signal is sent to the engine starting circuit while at the same time opening the mains supply breaker and disconnecting load from mains as voltage is below acceptable limits.

The engine starting control monitor will send a signal to the D.C. battery supply for starting the engine through the starting solenoid. When the engine is healthy, it starts up in a few seconds and the generator develops voltage. The generator voltage monitor, monitors the voltage and when the voltage is developed, this give a signal to the generator breaker which closes and connects the diesel generator to the load. Simultaneously, it sends a signal to de-energize the engine starting circuit and the starter motor is disengaged. The engine protection circuits for high water temperature and low lubricating oil pressure are also energized.

d) Resumption of Supply:

If voltage from mains is resumed, the main voltage monitor will sense this voltage for healthiness, i.e. for maintained correct voltage for a period of time (adjustable up to three minutes) and then send a signal to stop the engine and to change over the breakers from generator to mains and normal supply is resumed to the load. The solenoid operation and closing and tripping of breakers should be done through control voltage 24 V.D.C.

e) Failure to Start:

A three attempt starting facility using two impulse timers and a summation timer for engine shall be provided and if voltage fails to develop within 30 seconds from receiving the first start impulse, the set shall lockout automatically and a visual and audible alarm shall be given in the control panel. The remote panel shall receive "DG Trouble Alarm".

14.6.3 The control panel shall have the following provisions for the control of each DG Set:

1. MCCB's & ACB's as per BOQ.
2. Master engine control which for OFF/AUTO/MANUAL/TEST with a facility for starting and stopping of the set.
3. Voltmeter 144 Sqmm with selector switches for alternator/Mains/Phases complete with protection.
4. Local/Remote selector switch to facilitate remote starting/stopping of the DG Set.
5. Frequency meter 144 Sqmm reed type.

6. Current transformers required for metering.
7. Ammeter 144 Sqmm with C.T. & selector switch, KWH Meter, KW 144 Sqmm.
8. Mains Supply, voltage monitor.
9. Engine control monitor.
10. Alternator voltage monitor.
11. D.C. Control relays, timers.
12. Engine protection system for low oil lubricating pressure and high water temperature.
13. Window type annunciator with static relays, alarm/hooter and accept, test, reset push buttons for all functions.
14. Engine hours run counter.
15. Control fuses.
16. Lifting Hooks.
17. Gland Plates.
18. Power/Control Contactors.
19. Earthing Studs.
20. Antivibration pads.
21. IDMT relays [CDG – 31]
22. Under Voltage Relays
23. Over Voltage Relays

14.6.4 Indication/Annunciation:

Pilot indicating lamps/shall be provided for the following:

1. Charger - ON/OFF
2. Earth Fault
3. Set shutdown due to 'Engine high water temp.'
4. Set shutdown due to 'Low oil pressure'

5. Set shut down due to 'Lock of fuel'
6. Over speed trip

Indicating lamp shall be of the panel mounting filament type with series resistors.

14.6.5 The DG Sets would normally be controlled from remote for which following provisions are being made on the remote control panel. The necessary control devices/contacts for these external connections shall be wired out to the DG control panel terminal blocks.

1. Starting and stopping of the DG Set
2. DG running indication
3. Watt hour meter, Wattmeter, Voltmeter, Ammeter and Frequency meter.

14.7 ENGINE SAFEGUARDS:

Safeguards shall be provided and arranged when necessary to stop the engine automatically by the following:

- a) Energising a solenoid coupled to the stop lever on the fuel injection pump rack.
- b) De-energising the "fuel on" solenoid
- c) Energising the "fuel - cut off" solenoid.

The operation of the safeguard shall at the same time give individual warning of the failure by illuminating an appropriate local visual indicator and remote alarm at generator panel.

The contactors, relays and other devices necessary for signal and control, for above purposes shall be provided at Generator panel.

At the set at a easily accessible place an "EMERGENCY STOP" mushroom head stay put type P.B shall provided to stop the set in emergency mode.

The safe guard to "STOP THE SET" shall stop the set irrespective of mode selection of the set viz Auto, Manual or test for following cases, with simultaneous isolation of alternator ckt.

- a) Emergency stop P.B's operation
- b) Over speed.
- c) Low lube oil pressure.
- d) Earth fault

15.00 PROCUREMENT, INSPECTION OF EQUIPMENT & APPROVALS

Approved list of makes and vendors are given in the end of technical specifications. The makes of equipment/materials supplied shall be strictly as mentioned therein. For items not specially mentioned, prior approval shall be taken before procurement of the same. All equipments/material supplied shall be brand new and shall be procured directly from the manufacturers, dealers or authorised agents.

HSCC Electrical Engineer shall have access to the manufacturer's premises for stage inspection/final inspection of any item during its design, manufacturing, and assembly and testing. After carrying out the necessary factory tests and routine tests as per IS Standards, a copy of the routine test certificate shall be forwarded along with the call for carrying out the inspection at the manufacturer's works.

Based on the inspection certificate, HSCC Electrical Engineer reserves the right to carry out the inspection at a mutually agreed date and/or give inspection waiver. A minimum of two weeks will be needed after receipt of complete shop inspection report and other details to depute our inspector for inspection.

It is the responsibility of the contractor to ensure that all electrical works are carried out as per the IE Rules & regulations, National Building Code and IS Codes & Standards. All necessary drawings and details as required by Electricity Board, Electrical Inspector, Fire Department and other Local Statutory agencies, shall be prepared by the contractor. **The contractor is responsible to submit the drawings and other details as required to the Local Authorities (refer above) and obtain necessary approvals including sanction of load/enhancement of electrical load from SEB before energizing and commissioning.** All official fee required for getting the approval will be reimbursed on account of Client on submission of original documents.

16.00 BUS TRUNKING

16.01 SCOPE

This section covers manufacture, supply, installation, resting and commissioning of sandwich insulated bus trunking. And rising mains, indoor/ out door type.

16.02 Supply voltage

415/ 440 Volt, 3 pahse, 4 wire, 50 Hz AC supply.

16.03 Standards for compliance:

IS:8623/ 1993 I & II and IEC 60439/ I & II.

16.04 Construction:

The enclosure will be made from 16 SWG GI/ CRCA sheet steel powder coated of approved shade. Bus bars would be of high conductivity aluminium in “Sandwich” construction and the conductors will be individually insulated with halogen free, fure retardant class– H – epoxy insulation. No drilling of Bus bar is permitted. Length of the section will be limited to maximum three metre. Bus bar of one section will be connected to bus bar of adjacent section by uni-block joint system removable as separate sub-assembly, so that it can be inserted or removed with out disturbing the adjacent sections.

16.04.1 Technical Parameters:

Bus trunking shall be designed to withstand short circuit current of 50 KA for one second.

Bus bar system should be designed for high temperatures withstand capability of 55 degree Celsius over 50 degree Celsius as normal operating temperature.

Insulation voltage 1.1 KV

Bus trunking will be suitably chosen to give permissible voltage drop.

Rated impulse withstand voltage 12 KV at 1000 volt.

Single bolt bridge system to be incorporated.

Plug in boxes

Plug in boxes will be of draw out type. Contacts will be of silver plated copper and spring loaded. Earth connection will be the first to make and last to break during insertion and withdrawl. Pluf in boxes will be made from 1.6 mm CRCA sheet steel

powder coated. Inside the plug in Boxes MCCB or SFU with the fuses will be located as per requirements. The operating handle will be interlocked with plug in box cover so that MCCB can be operated only with the suitable cover in closed position. The plug in box will be interlocked with bus bar trunking so that it can not be inserted or removed with the plug in box lid open. MCCB/ SFU will be of 4 pole type unless otherwise specified in BOQ. Short circuit breaking capacity of MCCB in PIB should be same as that of bus trunking i.e. 50 KA.

16.05 List of test to be carried out:

16.05.1 Routine tests:

- i. Verification of insulation resistance.
- ii. Inspection of assembly, interlocks, locks etc.
- iii. Dielectric test.

Copies of the following certificate should be submitted:

- i. Verification of temperature rise limits
- ii. Verification of di-electric properties.
- iii. Verification of short circuit strength.
- iv. Verification of degree of protection.
- v. Insulation resistance test with 500 volt megger. The insulation resistance shall be not less than 100 mega ohm.

17.00 CAPACITOR PANEL

17.01 SCOPE

Supply, installation, testing and commissioning of medium voltage capacitors and Automatic Power Factor Correction Panel (APFC) for improvement in power factor of electrical system. It will be connected to main LT panel. It shall improve power factor up to 0.98 lagging from initial power factor. Capacitor panel shall be provided with day/ night mode selector switch and double ratio C.Ts, for day/ night mode. Day/ night mode shall be selected based on estimated day / night load requirement.

17.02 RATING

Capacitor units as specified in the BOQ shall be used to form a bank of capacitors.

17.03 ENCLOSURE

The panel shall be indoor, floor mounted and free standing type with IP-42 degree of protection. It shall be completely made of CRCA sheet steel. The enclosure shall have sturdy support structure and shall be finished with powder coating in the approved colour shade. Suitable provisions shall be made in the panel for proper heat dissipation. Air aspiration louvers for heat dissipation shall be provided. The front portion shall house the switchgear and the rear portion shall house capacitors and series reactors (7%). The enclosure is to be suitably sized to accommodate all the components, providing necessary air clearance between live and non-live parts, providing necessary working clearance.

17.04 APFC Relay

Microprocessor based APFC relay, (intelligent VAR controller) of suitable steps as mentioned in the BOQ, shall sense the PF in the system and automatically switch ON/OFF the capacitor unit or bank to achieve the preset target PF. The controller shall have digital settings of parameters like PF, switching time delay, step limit etc, indication of PF, preset parameter, minimum threshold setting of 1% of CT current.

17.05 CAPACITORS

The capacitor shall generally conform to IS:13341-1992 and 13340-1993 and IEC 60831-1 &2.

General specification: three phase, delta connected, 50 Hz.

- i. **Voltage:** Must be designed to withstand system over voltage, increased voltage due to series reactor and harmonics.
- ii. **Capacitor type:** The capacitor unit shall be super heavy duty mix dielectric type. The dielectric should be made of metalised tissue paper. These elements shall be

- combination of capacitor tissue paper and BOPP film impregnated with non PCB bio-degradable impregnant or film foil capacitor manufactured using Poly Propylene film placed between 2 layers of metal foil and winding. Capacitor should be fitted with safety device like pressure sensitive disconnecter. The capacitor should be low loss type (total losses should not exceed 0.45 W/ KVAR).
- iii. **Temperature category:** -25 degree C to 70 degree C.
 - iv. **Over voltage** +10% (12h in 24 hours), +15% (30 minutes in 24 hours), +20% (5 minutes) and 30% for I minute as per clause 6.1 of IS 13340-1993.
 - v. **Over current:** 2.5x In
 - vi. **Peak inrush current withstand:** 350 x In
 - vii. Capacitor shall be provided with permanently connected discharge resistors so that residual voltage of capacitors is reduced to 50 volts or less within one minute after the capacitors are disconnected from the source of supply.
 - viii. Each capacitor bank shall be provided with a terminal chamber and cable glands suitable for AIFY cable as specified.
 - ix. Two separate earthing terminals shall be provided for earth connection of each bank.

17.06 SWITCHGEAR & PROTECTION:

Incomer switchgear will be as specified in BOQ. Suitable contactor for each step shall be used and must be capable of capacitor switching duty. Busbars shall be suitably colour coded and must be mounted on appropriate insulator supports.

Power cable used shall have superior mechanical, electrical and thermal properties. Internal wiring between main bus bars, contactor, capacitor etc shall be made with 1100 volt grade PVC insulated FRLS copper conductor of appropriate size by using suitable copper crimping terminal ends etc suitable bus links for input supply cable termination shall be provided.

Control circuit shall be duly protected by using suitable rating MCB. An emergency stop push button shall be provided to trip thr entire system (22.5 mm dia, mushroom type, press to stop and turn to reset). 440 Volt caution board shall be provided on the panel.

17.07 TESTS AT AMNUFACTURER’S WORKS:

All routine and type tests as per IS:2834 relevant to capacitor bank s as amended upto date shall be carried out at manufacturer’s works and test certificates to be submitted to HSCC.

17.08 TEST AT SITE:

Insulation resistance with 500 V DC Megger shall be carried out and test results should be recorded.

Residual voltage shall be measured after switching of the capacitors and the same shall not be more than 50 volts after one minute. Each discharge resistor shall be tested for its working.

Drawings and Instruction manual:

17.09 INSTALLATION:

Capacitor bank shall be installed at least 30 CM away from the walls on suitable frame work of welded construction. The earth terminals provided on the body of capacitor bank shall be bonded to main capacitor panel earth bus with 2 nos 8 SWG copper or 6 SWG GI earth wire.

Contractor shall submit four copies of the following certified drawings:

- i. General arrangement of capacitor bank and control panel indicating main dimensions, type of mounting, location of various devices etc., including foundation details.
- ii. Schematic diagram for automatic sequential switching with terminals and ferrules numbers.
- iii. Wiring diagram of control panel indicating terminal blocks and various apparatus.
- iv. Final list of components of control panel.

Contractor shall also submit four sets of installation and maintenance manual.

23.00 LIST OF APPROVED MANUFACTURERS:

1. 11 KV VCB Panel Board - Siemens/Areva/ABB/S&SPower/ Easun/Voltas/
L&T/ Andrew Yule
2. 11 KV XLPE Cable - Incab/ Universal/ NICCO/ CCI
3. Transformer - Areva/ Crompton Greaves/Voltamp/ Kirloskar/
ABB.
4. Bus Duct/rising mains - L&T/ Siemens/ ABB/ GE
5. Diesel Engine - Cummins/Kirloskar/ Caterpillar/Greaves Cotton
6. Alternator - Stamford/ Kirloskar/ Leroy Somer & Control/
Crompton Greaves/ Cater pillar
7. Battery - Exide/ Standard Furrukawa/ Amar Raja
8. L.T. Cables - Universal/ICC/ NICCO/INCAB/Rallison Cables
National/ Skytone / KEI/ Cab Com India
9. PVC insulated Wires/
Telephone wires & cables
Co-axial cables - Finolex/ Havells/ Ploycab/ KEI/ Rallison/
National/ Cab Com/ Skytone/ L&T/ Batra
Henlay
10. Telephone Tag Blocks - Krone Type
11. Modular Range of Switches,
sockets etc - Anchor- Roma/ North West/ Toyama-Wallart/
MK-Standard/ MDS-Mosaic/Havell,s-Crab tree
12. Industrial Sockets & Plugs. - Siemens/Schneider/Crompton/MDS/ BCH/
Havell's
13. M.S. Conduit - BEC/ AKG/ M Kay/ NIC/ Siddarth/ Harsh/Atul
14. Light fixtures.
(Flourescent, CFL, HPMV etc) - Philips/ GE/ Crompton

Light Fixture - Decon/ Ankur/ May Fair
(Down, Fancy & other fixtures)
15. Ceiling Fan/ Exhaust fan - Crompton Greaves/ Alstom/ Usha/ Bajaj.
16. Main LT Panel - Manufactured at the works of L&T, Siemens, GE,

ABB, Schneider only.

- | | | |
|--|---|--|
| 17. MV Panels | - | Adlec Systems Pvt Ltd |
| | - | Advance Panels & Switchgears (P) Ltd |
| | - | Tricolite |
| | - | Jakson Engineers Ltd. |
| | - | Zeta Industrial Corporation Pvt Ltd |
| | - | Ambit Switchgear |
| | - | Venus Controls & Switchgear Pvt Ltd |
| | - | Neptune systems Pvt Ltd |
| | - | Risha Control Engineers Pvt Ltd |
| | - | SPC Electrotech Pvt Ltd.. |
| | - | Nitya Electro Controls |
| 18. Air Circuit Breakers | - | L&T |
| | - | GE Power Controls |
| | - | Siemens |
| | - | ABB |
| | - | Schneider |
| 19. MCCB | - | L&T/ GE Power Controls/ Siemens/ ABB/ Schneider |
| 20. MCB-DB's, MCB, ELCB RCCB/ MCB-Isolator etc. | - | L&T/ GE Power Controls/ Siemens/ MDS/ Schneider |
| 21. SDFU | - | L&T/ GE Power Controls/ Siemens/ Schneider |
| 22. Power Contactors | - | L&T/ GE Power Controls/ Siemens/ Schneider/ ABB |
| 23. LIFTS | - | OTIS/ Kone/ Scheindler/ Mitubshi./ Johnson |
| 24. EPABX | - | Siemens, Ericsson, Alcatel, Avaya |
| 25. Smoke detector/Heat detector etc- | - | Honeywell/ Edwards/ Minimax/ Apollo |
| 26. FDA Panel | - | Honeywell/Edwards/Minimax/Apollo |

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| <u>S.No.</u> | <u>Drawing Number</u> | <u>Description</u> |
|--------------|-----------------------|--------------------|
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GENERAL CONDITIONS OF CONTRACT

Definitions and Interpretation

1.1 Definitions

In the Contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them except where the context otherwise requires:

- (a)
 - i. "Employer/Principal Employer" means the persons named as such in Volume - II of these Conditions and the legal successors in title to such person, but not (except with the consent of the Contractor) any assignee of such person.
 - ii. "Consultant" means the HSCC (India) Ltd. known as Chairman-Cum- Managing Director, HSCC(India) Ltd, and his successors in office and assignees acting for and on behalf of the employer.
 - iii. "Engineer" means the person appointed by HSCC to act as Engineer for the purposes of the contract and named as such in Part II of these Conditions.
 - iv. "Engineer's Representative" means a person appointed from time to time by the Engineer under Sub-Clause 2.2.
 - v. "Contractor" means an individual or firms (proprietary or partnership) whether incorporated or not, that has entered into contract (with the employer) and shall include his / its heirs, legal representatives, successors and assigns, successors in interest of individuals or persons. Composing such firms or successors of such firms or the permitted assigns of such individual or firms. Changes in the constitution of the firm, if any shall be immediately notified to the employer, in writing and approval obtained for continued performance of the contract.
 - vi. "Subcontractor" means any person named in the Contract as a Subcontractor for a part of the Works or any person to whom a part of the Works has been subcontracted by the contractor with the consent of the Engineer and the legal successors in title to such person, but not any assignee of any such person.
- (b)
 - i. "Contract" means these conditions (Volume I and II), the Specification, the Drawings, the Bill of Quantities, the Tender, the Letter of Acceptance, the Contract Agreement (if completed) and such further documents as may be expressly incorporated in the Letter of Acceptance or Contract Agreement (if completed).

- ii. "Specification" means the specification of the Works included in the Contract and any modification thereof or addition thereto made under Clause 51.1 & 51.2 or submitted by the Contractor and approved by the Engineer.
 - iii. "Drawings" means all drawings, calculations and technical information of a like nature provided by the Engineer to the Contractor under the Contract and all drawings, calculations, samples, patterns, models, operation and maintenance manuals and other technical information of a like nature submitted by the Contractor and approved by the Engineer.
 - iv. "Bill of Quantities" means the priced and completed bill of quantities forming part of the Tender.
 - v. "Tender" means the Contractor's priced offer to the Employer for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract, as accepted by the Letter of Acceptance. The word Tender is synonymous with "Bid" and the words "Tender Documents" with "Bidding Documents".
 - vi. "Letter of Acceptance" means the formal acceptance by the HSCC of the Tender.
 - vii. "Contract Agreement" means the contract agreement (if any) referred to in Sub-Clause 9.1.
 - viii. "Appendix to Tender" means the appendix comprised in the form of Tender annexed to these Conditions.
- (c)
 - i. "Commencement Date" means the date upon which the Contractor receives the notice to commence the works as issued by the Engineer pursuant to Clause 41.1.
 - ii. "Time for Completion" means the time for completing the execution of and passing the Tests on Completion of the Works or any Section or part thereof as stated in the Contract (or as extended under Clause 44.1, 44.2 & 44.3) calculated from the Commencement Date.
 - (d)
 - i. "Tests on Completion" means the tests specified in the Contract or otherwise agreed by the Engineer and the Contractor which are to be made by the Contractor before the Works or any Section or part thereof are taken over by the employer.
 - ii. "Taking-Over Certificate" means a certificate issued pursuant to Clause 48.1 to 48.4.

- (e)
 - i. "Contract Price" means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract.
 - ii. "Retention Money" means the aggregate of all monies retained by the Employer pursuant to Sub-Clause 60.1 (h) or 60.5.
- (f)
 - i. "Works" means the Permanent Works and the Temporary Works or either of them to be executed in accordance with the contract .
 - ii. "Permanent Works" means the permanent works to be executed (including Plant) in accordance with the Contract.
 - iii. "Temporary Works" means all temporary works of every kind (other than Contractor's Equipment) required in or about the execution and completion of the Works and the remedying of any defects therein.
 - iv. "Plant" means machinery, apparatus and the like intended to form or forming part of the Permanent Works.
 - v. "Contractor's Equipment" means all appliances and things of whatsoever nature (other than Temporary Works) required for the execution and completion of the Works and the remedying of any defects therein, but does not include Plant, materials or other things intended to form or forming part of the Permanent Works.
 - vi. "Section" means a part of the Works specifically identified in the Contract as a Section.
 - vii. "Site" means the places provided by the Employer where the Works are to be executed and any other places as may be specifically designated in the Contract as forming part of the Site.
- (g)
 - i. "Cost" means all expenditure properly incurred or to be incurred, whether on or off the Site, including over head and other charges properly allowable there but does not include any allowance for profit.
 - ii. "Day" means calendar day.
 - iii. "Foreign Currency" means a currency of a country other than that in which the Works are to be located.
 - iv. "Writing" means any hand-written, type-written, or printed communication, including telex, cable and facsimile transmission.

1.2 Heading and Marginal Notes

The headings and marginal notes in these Conditions shall not be deemed part thereof or be taken into consideration in the interpretation or construction thereof or of the Contract.

1.3 Interpretation

Words importing persons or parties shall include firms and corporations and any organisation having legal capacity.

1.4 Singular and Plural

Words importing the singular only also include the plural and vice versa where the context requires.

1.5 Notices, Consents, Approvals, Certificates and Determinations.

Wherever in the Contract provision is made for the giving or issue of any notice, consent, approval, certificate or determination by any person, unless otherwise specified such notice, consent, approval, certificate or determination shall be in writing and the words "notify", "certify" or "determine" shall be construed accordingly.

ENGINEER AND ENGINEER'S REPRESENTATIVE

2.1 Engineer's Duties and Authority

- (a) The Engineer shall carry out the duties specified in the Contract.
- (b) The Engineer may exercise the authority specified in or necessarily to be implied from the Contract, provided, however, that if the Engineer is required, under the terms of his appointment by the Employer, to obtain the specific approval of the Employer before exercising any such authority particulars of such requirement shall be set out in part II of these Conditions. Provided further that any requisite approval shall be deemed to have been given by the Employer for any such authority exercised by the Engineer.

2.2 Engineer's Representative

- (a) The Engineer's Representative shall be appointed by and be responsible to the Engineer and shall carry out such duties and exercise such authority

as may be delegated to him by the Engineer under Sub-Clause 2.2 (b).

Engineer's Authority to Delegate

- (b) The Engineer may from time to time delegate to the Engineer's Representative any of the duties and authorities vested in the Engineer and he may at any time revoke such delegation. Any such delegation or revocation shall be in writing and shall not take effect until a copy thereof has been delivered to the Contractor.

2.3 Communication Given by Engineer's Representative

Any communication given by the Engineer's Representative to the Contractor in accordance with such delegation shall have the same effect as though it had been given by the Engineer. Provided that :

- (a) any failure of the Engineer's Representative to disapprove any work, materials or Plant shall not prejudice the authority of the Engineer to disapprove such work, materials or Plant and to give instructions for the rectification thereof;
- (b) if the Contractor questions any communications of the Engineer's Representative he may refer the matter to the Engineer who shall confirm, reverse or vary the contents of such communication.

2.4 Appointment of Assistants

The Engineer or the Engineer's Representative may appoint any number of persons to assist the Engineer's Representative in the carrying out of his duties under Sub-Clause 2.2. He shall notify to the Contractor the names, duties and scope of authority of such persons. Such assistants shall have no authority to issue any instructions to the Contractor save in so far as such instructions may be necessary to enable them to carry out their duties and to secure their acceptance of materials, Plant or workmanship as being in accordance with the Contract, and any instructions given by any of them for those purposes shall be deemed to have been by the Engineer's Representative.

2.5 Instructions in Writing

Instructions given by the Engineer shall be in writing, provided that if for any reason the Engineer considers it necessary to give any such instruction orally, the Contractor shall comply with such instruction. Confirmation in writing of such oral instruction given by the Engineer, whether before or after carrying out of the instruction shall be deemed to be an instruction, within the meaning of this Sub-Clause. Provided further that if the Contractor, within 7 days, confirms in writing to the Engineer any oral instruction of the Engineer and such confirmation is not contradicted in writing within 7 days by the Engineer, it shall

be deemed to be an instruction of the Engineer.

The provisions of this Sub-Clause shall equally apply to instructions given by the Engineer's Representative and any assistants of the Engineer or the Engineer's Representative appointed pursuant to Sub-Clause 2.4.

2.6 Engineer to Act Impartiality

Wherever, under the Contract, the Engineer is required to exercise his discretion by :

- (a) giving his decision, opinion or consent, or
- (b) expressing his satisfaction or approval, or
- (c) determining value, or
- (d) otherwise taking action which may affect the rights and obligations of the Employer or the Contractor he shall exercise such discretion impartially within the terms of the Contract and having regard to all the circumstances. Any such decision, opinion, consent, expression of satisfaction, or approval, determination of value or action may be opened up, reviewed or revised as provided in Clause 67.1 to 67.4.

ASSIGNMENT AND SUBCONTRACTING

3.1 Assignment of Contract

The Contractor shall not, without the prior consent of the Consultant (which consent, shall be at the sole discretion of the Consultant), assign the Contract or any part thereof, or any benefit or interest therein or thereunder, otherwise than by:

- (a) a charge in favour of the Contractor's bankers of any monies due or to become due under the Contract, or
- (b) assignment to the Contractor's insurers (in cases where the insurers have discharged the Contractor's loss or liability) of the Contractor's right to obtain relief against any other party liable. The provision of labour as piece work basis shall not deemed to be subcontracting under this clause.

4.1 Sub-Contracting

The Contractor shall not subcontract the whole of the Works. Except where otherwise provided by the Contract, the Contractor shall not subcontract any part of the Works without the prior consent of the Engineer. Any such consent shall not relieve the Contractor from any liability or obligation under the Contract and

he shall be responsible for the acts, defaults and neglects of a Subcontractor, his agents, servants or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents, servants or workmen.

Provided that the Contractor shall not be required to obtain such consent for:

- (a) the provision of labour, or
- (b) the purchase of materials which are in accordance with the standards specified in the Contract, or

4.2 Assignment of Sub-Contractors Obligations

In the event of a Subcontractor having undertaken towards the Contractor in respect of the work executed, or the goods, materials, Plant or services supplied by such Subcontractor, any continuing obligation extending for a period exceeding that of the Defects Liability Period under the Contract, the Contractor shall at any time, after the expiration of such Period, assign to the Employer, at the Employer's request and cost, the benefit of such obligation for the unexpired duration thereof.

CONTRACT DOCUMENTS

5.1 Language/s and Law

- (a) The language in which the Contract documents shall be drawn up, is English.
- (b) The country the law of which shall apply to the Contract and according to which the Contract shall be construed is India.

5.2 Priority of Contract Documents

The several documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies the same shall be explained and adjusted by the Engineer who shall thereupon issue to the Contractor instructions thereon and in such event, unless otherwise provided in the Contract, the priority of the documents forming the Contract shall be as follows:

- (1) Requirements/ Description of Schedule of Quantities/BOQ
- (2) Particular Technical specification
- (3) Additional specifications of contract
- (4) Specific condition of contract
- (5) Drawings
- (6) General conditions of contract
- (7) C.P.W.D Specifications
- (8) Indian standard specifications of B.I.S.

6.1 Custody and Supply of Drawings and Documents

The Drawings shall remain in the sole custody of the Engineer, but two copies thereof shall be provided to the Contractor free of charge. The Contractor shall make at his own cost any further copies required by him. Unless it is strictly necessary for the purposes of the Contract, the Drawings, Specification and other documents provided by the Employer or the Engineer shall not, without the consent of the Engineer, be used or communicated to a third party by the Contractor. Upon issue of the Defects Liability Certificate (Clause 62.1), the Contractor shall return to the Engineer all Drawings, Specifications and other documents provided under the Contract.

The Contractor shall supply to the Engineer four copies of all Drawings, Specifications and other documents submitted by the Contractor and approved by the Engineer in accordance with Clause 7.1 to 7.3, together with a reproducible copy of any material which cannot be reproduced to an equal standard by photocopying. In addition the Contractor shall supply such further copies of such Drawings, Specification and other documents as the Engineer may request in writing for the use of the Employer, who shall pay the cost thereof.

6.2 One Copy of Drawings to be kept on Site

One copy of the Drawings, provided to or supplied by the Contractor as aforesaid, shall be kept by the Contractor on the Site and the same shall at all reasonable times be available for inspection and use by the Engineer and by any other person authorised by the Engineer in writing.

6.3 Disruption of Progress

The Contractor shall give notice to the Engineer, whenever planning or execution of the Works is likely to be delayed or disrupted unless any further drawing or instruction is issued by the Engineer within 60 days or such other reasonable time as may be decided by the Engineer. The notice shall include details of the drawing or instruction required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late.

6.4 Delay and Cost of Delay of Drawings

If, by reason of any failure or inability of the Engineer to issue, within a time reasonable in all the circumstances, any drawing or instruction for which notice has been given by the Contractor in accordance with Sub-Clause 6.3, the Contractor suffers delay then the Engineer shall, after due consultation with the Employer and the Contractor, determine only extension of time to which the Contractor is entitled under Clause 44.1 to 44.3 .

6.5 Failure by Contractor to Submit Drawings

If the failure or inability of the Engineer to issue any drawings or instructions is caused in whole or in part by the failure of the Contractor to submit Drawings,

Specification or other documents which he is required to submit under the Contract, the Engineer shall take such failure by the Contractor into account when making his determination pursuant to Sub-Clause 6.4.

7.1 Supplementary Drawings and Instructions

The Engineer shall have authority to issue to the Contractor, from time to time, such supplementary Drawings and instructions as shall be necessary for the purpose of the proper and adequate execution and completion of the Works and the remedying of any defects therein. The Contractor shall carry out and be bound by the same.

7.2 Permanent Works Designed by Contractor

Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall submit to the Engineer, for approval:

- (a) such drawings, specifications, calculations and other information as shall be necessary to satisfy the Engineer as to the suitability and adequacy of that design, and
- (b) operation and maintenance manuals together with drawings of the relevant part of the Permanent Works as completed, in sufficient detail to enable the Employer to operate, maintain, dismantle, reassemble and adjust the Permanent Works incorporating that design. The Works shall not be considered to be completed for the purposes of taking over in accordance with Clause 48.1 to 48.5 until such operation and maintenance manuals, together with drawings on completion, have been submitted to and approved by the Engineer.

7.3 Responsibility Unaffected by Approval

Approval by the Engineer, in accordance with Sub-Clause 7.2, shall not relieve the Contractor of any of his responsibilities under the Contract.

GENERAL OBLIGATIONS

8.1 Contractor's General Responsibilities

The Contractor shall, with due care and diligence, design (to the extent provided for by the Contract), execute and complete the Works and remedy any defects therein in accordance with the provisions of the Contract. The Contractor shall provide all superintendence, labour, materials, Plant, Contractor's Equipment and all other things, whether of a temporary or permanent nature, required in and for such design, execution, completion and remedying of any defects, so far as the

necessity for providing the same is specified in or is reasonably to be inferred from the Contract. The contractor shall promptly notify the Employer and the Engineer of any error, omission, fault or any other defect in the design of or specifications for the works which he discovers when reviewing the contract documents or in the process of execution of the works.

8.2 Site Operations and Methods of Construction

The Contractor shall take full responsibility for the adequacy, stability and safety of all Site operations and methods of construction. Provided that the Contractor shall not be responsible (except as stated hereunder or as may be otherwise agreed) for the design or specification of Permanent Works, or for the design or specification of any Temporary Works not prepared by the Contractor. Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall be fully responsible for that part of such Works, notwithstanding any approval by the Engineer.

9.1 Contract Agreement

The Contractor shall, if called upon so to do, enter into and execute the Contract Agreement, to be prepared and completed at the cost of the Contractor, in the form annexed to these Conditions with such modification as may be necessary.

10.1 Performance Security

The Contractor shall provide security for his proper performance of the Contract to the Employer within 28 days after the receipt of the Letter of Acceptance. The performance security shall be in the form of bank guarantee. The amount of the bank guarantee shall be 5 percent of the Contract Price. It shall be issued by a Nationalised bank of India. When providing such security to the Employer, the Contractor shall notify the Engineer of so doing.

Without limitation to the provisions of the preceding paragraph, whenever the Engineer determines an addition to the Contract Price as a result of a change in cost and/or legislation or as a result of a variation amounting to more than 25 percent of the Contract Price, the Contractor, at the Engineer's written request, shall promptly increase the value of the performance security by an equal percentage.

Failure of the successful bidder to lodge the required bank guarantee shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security, in which event the Engineer may make the award to the next lowest evaluated bidder or, if there are no other bidders, call for new bids.

10.2 Period of Validity of Performance Security

The performance security shall be valid until the Contractor has executed and

completed the Works and remedied any defects therein in accordance with the Contract. No claim shall be made against such security after the issue of the Defects Liability Certificate in accordance with Sub-Clause 62.1 and such security shall be returned to the Contractor within 14 days of the issue of the said Defects Liability Certificate.

10.3 Costs of Securities

The cost of complying with the requirements of this clause shall be borne by the Contractor.

11.1 Inspection of Site

The Consultant shall have made available to the Contractor, before the submission by the Contractor of the Tender, such data on hydrological and sub-surface conditions as have been obtained by or on behalf of the Employer from investigations undertaken relevant to the Works but the Contractor shall be responsible for his own interpretation thereof.

The Contractor shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself (so far as is practicable, having regard to considerations of cost and time) before submitting his Tender, as to:

- (a) the form and nature thereof, including the sub-surface conditions,
- (b) the hydrological and climatic conditions,
- (c) the extent and nature of work and materials necessary for the execution and completion of the Works and the remedying of any defects therein, and
- (d) the means of access to the Site and the accommodation he may require.

And in general, shall be deemed to have obtained all necessary information, subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Tender.

Data made available by the Employer in accordance with sub-clause 11.1 above shall be deemed to include data listed elsewhere in the contract as open for inspection at the office of the Hospital Services Consultancy Corporation, Plot no. 6A, Block - E, Sector -1, Noida (U.P.)-201 301.

12.1 Sufficiency of Tender

The Contractor shall be deemed to have based his Tender on the data made available by the Consultant and on his own inspection and examination, all as

aforementioned.

The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Tender and of the rates and prices stated in the Bill of Quantities, all of which shall, except insofar as it is otherwise provided in the Contract, cover all his obligations under the Contract (including those in respect of the supply of goods, materials, Plant or services or of contingencies for which there is a Provisional Sum) and all matters and things necessary for the proper execution and completion of the Works and the remedying of any defects therein.

12.2 Adverse Physical Obstructions or Conditions

If, however, during the execution of the Works the Contractor encounters physical obstructions or physical conditions, other than climatic conditions on the Site, which obstructions or conditions were, in his reasonable opinion, not foreseeable by an experienced contractor, the Contractor shall forthwith give notice thereof to the Engineer. On receipt of such notice, the Engineer shall, if in his opinion such obstructions or conditions could not have been reasonably foreseen by an experienced contractor, after due consultation with the Contractor, determine:

- (a) any extension of time to which the Contractor is entitled under Clause 44.1 to 44.3 and
- (b) the amount of any costs which may have been incurred by the Contractor by reason of such obstructions or conditions having been encountered, which shall be added to the Contract Price.

And shall notify the Contractor accordingly. Such determinations shall take account of any instruction which the Engineer may issue to the Contractor in connection therewith, and any proper and reasonable measures acceptable to the Engineer which the Contractor may take in the absence of specific instructions from the Engineer.

13.1 Work to be in Accordance with Contract

Unless it is legally or physically impossible, the Contractor shall execute and complete the Works and remedy any defects therein in strict accordance with the Contract to the satisfaction of the Engineer. The Contractor shall comply with and adhere strictly to the Engineer's instructions on any matter, whether mentioned in the Contract or not, touching or concerning the Works. The Contractor shall take instructions only from the Engineer or subject to the provisions of Clause 2.1 to 2.6, from the Engineer's Representative.

14.1 Programme to be Submitted

The Contractor shall, within 28 days after the date of the Letter of Acceptance,

submit to the Engineer for his consent a programme, in such form and detail as the Engineer shall reasonably prescribe, for the execution of the Works. The Contractor shall, whenever required by the Engineer, also provide in writing for his information a general description of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works.

14.2 Revised Programme

If at any time it should appear to the Engineer that the actual progress of the Works does not conform to the programme to which consent has been given under Sub-Clause 14.1 the Contractor shall produce, at the request of the Engineer, a revised programme showing the modifications to such programme necessary to ensure completion of the Works within the Time for Completion.

14.3 Cash Flow Estimate to be Submitted

The Contractor shall, within 28 days after the date of the Letter of Acceptance, provide to the Engineer for his information a detailed cash flow estimate, in quarterly periods, of all payments to which the Contractor will be entitled under the Contract and the Contractor shall subsequently supply revised cash flow estimates at quarterly intervals, if required to do so by the Engineer.

14.4 Contractor not Relieved of Duties or Responsibilities

The submission to and consent by the Engineer to such programs or the provision of such general descriptions or cash flow estimates shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

15.1 Contractor's Superintendence

The Contractor shall provide all necessary superintendence during the execution of the Works and as long thereafter as the Engineer may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. The Contractor, or a competent and authorised representative approved of by the Engineer, which approval may at any time be withdrawn, shall give his whole time to the superintendence of the Works. Such authorised representative shall receive, on behalf of the Contractor, instructions from the Engineer or, subject to the provisions of Clause 2.1 to 2.6, the Engineer's Representative.

If approval of the representative is withdrawn by the Engineer, the Contractor shall, as soon as is practicable, having regard to the requirement of replacing him as hereinafter mentioned, after receiving notice of such withdrawal, remove the representative from the Works and shall not thereafter employ him again on the Works in any capacity and shall replace him by another representative approved by the Engineer.

If the Contractor's authorised representative is not in the opinion of the Engineer fluent in English, the contractor shall have available at site at all times an interpreter competent to ensure the proper transmission of instructions and information.

16.1 Contractor's Employees

The Contractor shall provide on the Site in connection with the execution and completion of the Works and the remedying of any defects therein :

- (a) only such technical assistants as are skilled and experienced in their respective callings and such foremen and leading hands as are competent to give proper superintendence of the Works, and
- (b) such skilled, semi-skilled and un-skilled labour as is necessary for the proper and timely fulfilling of the Contractor's obligations under the Contract.

16.2 Engineer at Liberty to Object

The Engineer shall be at liberty to object to and require the Contractor to remove forthwith from the Works any person provided by the Contractor who, in the opinion of the Engineer, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose presence on Site is otherwise considered by the Engineer to be undesirable, and such person shall not be again allowed upon the Works without the consent of the Engineer. Any person so removed from the Works shall be replaced as soon as possible.

A reasonable proportion of the Contractor's superintending staff shall have a working knowledge of English or the contractor shall have available at site at all times a sufficient number of competent interpreters to ensure a proper transmission of instructions and information.

The contractor is encouraged to the extent practicable and reasonable to employ staff and labourers from sources within India.

17.1 Setting-out

The Contractor shall be responsible for :

- (a) the accurate setting-out of the Works in relation to original points, lines and levels of reference given by the Engineer in writing,
- (b) the correctness, subject as above mentioned, of the position, levels dimensions and alignment of all parts of the Works, and

- (c) the provision of all necessary instruments, appliances and labour in connection with the foregoing responsibilities.

If, at any time during the execution of the Works, any error appears in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required to do so by the Engineer, shall, at his own cost, rectify such error to the satisfaction of the Engineer, unless such error is based on incorrect data supplied in writing by the Engineer, in which case the Engineer shall determine an addition to the Contract Price in accordance with Clause 52.1 to 52.4 and shall notify the Contractor accordingly.

The checking of any setting-out or of any line or level by the Engineer shall not in any way relieve the Contractor of his responsibility for the accuracy thereof and the Contractor shall carefully protect and preserve all bench-marks, sight-rails, pegs and other things used in setting-out the Works.

The Contractor shall give to the Engineer not less than 72(seventy two) hours notice of his intention to set out or give levels for any part of the Works so that timely arrangement may be made for checking or issuing instructions. He shall indicate therein by which date the information, if any is required by him.

18.1 Boreholes and Exploratory Excavation

If, at any time during the execution of the works the Engineer requires the contractor to make bore-holes or to carry out exploratory excavations in excess of the requirements specified elsewhere in the contract, such requirement shall be the subject of an instruction in accordance with clause 51.1 & 51.2, unless an item or a provisional sum in respect of such work is included in the Bill of Quantities.

19.1 Safety, Security and Protection of the Environment

The Contractor shall, throughout the execution and completion of the Works and the remedying of any defects therein:

- (a) have full regard for the safety of all persons entitled to be upon the Site and keep the Site (so far as the same is under his control) and the Works (so far as the same are not completed or occupied by the Employer) in an orderly state appropriate to the avoidance of danger to such persons, and
- (b) provide and maintain at his own cost all lights, guards, fencing, warning signs and watching, when and where necessary or required by the Engineer or by any duly constituted authority, for the protection of the Works or for the safety and convenience of the public or others, and

- (c) take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods or operation.
- (d) Screen all lights provided by the Contractor so as not to interfere with any signal light on the railways or with any traffic or signal lights of any local authority.

20.1 Care of Works

The Contractor shall take full responsibility for the care of the Works and materials and Plant for incorporation therein from the Commencement Date until the date of issue of the Taking-Over Certificate for the whole of the Works, when the responsibility for the said care shall subject to clause 20.1(b) pass to the Employer, Provided that:

- (a) if the Engineer issues a Taking-Over Certificate for any Section or part of the Permanent Works the Contractor shall cease to be liable for the care of that Section or part from the date of issue of the Taking-Over Certificate, when the responsibility for the care of that Section or part shall pass to the Employer, and
- (b) the Contractor shall take full responsibility for the care of any outstanding Works and materials and Plant for incorporation therein which he undertakes to or is otherwise required to finish during the Defects Liability Period until such outstanding Works have been completed pursuant to Clause 49.1 to 49.4.

20.2 Responsibility to Rectify Loss of Damage

If any loss or damage happens to the Works, or any part thereof, or materials or Plant for incorporation therein, during the period for which the Contractor is responsible for the care thereof, from any cause whatsoever, other than the risks defined in Sub-Clause 20.4, the Contractor shall, at his own cost, rectify such loss or damage so that the Permanent Works conform in every respect with the provisions of the Contract to the satisfaction of the Engineer. The Contractor shall also be liable for any loss or damage to the Works occasioned by him in the course of any operations carried out by him for the purpose of complying with his obligations under Clause 49.1 to 49.4 and 50.1.

20.3 Loss or Damage Due to Employer's Risk

In the event of any such loss or damage happening from any of the risks defined in Sub-Clause 20.4, or in combination with other risks, the Contractor shall, if and to the extent required by the Engineer, rectify the loss or damage and the

Engineer shall determine an addition to the Contract Price in accordance with Clause 52.1 to 52.4 and shall notify the Contractor accordingly. In the case of combination of risks causing loss or damage any such determination shall take into account the proportional responsibility of the Contractor and the Employer.

20.4 Employer's Risks

The Employer's risks are :

- (a) (i) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,
- (ii) rebellion, revolution, insurrection, or military or usurped power, or civil war,
- (iii) ionising radiations, or contamination by radio-activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive, or other hazardous properties of any explosive nuclear assembly or nuclear component thereof,
- (iv) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speed,
- (b) loss or damage due to the use or occupation by the Employer of any Section or part of the Permanent Works, except as may be provided for in the Contract,
- (c) loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible,
and
- (d) any operation of the forces of nature (insofar as it occurs on the site) which an experienced contractor:
 - (i) could not have reasonably foreseen, or
 - (ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures:
 - (A) prevent loss or damage to physical property from occurring by taking appropriate measures, or
 - (B) insure against.

21.1 Insurance of Works and Contractor's Equipment

The Contractor shall, without limiting his or the Employer's obligations and

responsibilities under Clause 20.1 to 20.4, insure:

- (a) the Works, together with materials and Plant for incorporation therein, to the full replacement cost and it being understood that such insurance shall provide for compensation to be payable to rectify the loss or damage incurred.
- (b) an additional sum of 15 percent of such replacement cost, or as may be specified in Part II of these Conditions, to cover any additional costs of and incidental to the rectification of loss or damage including professional fees and the cost of demolishing and removing any part of the Works and of removing debris of whatsoever nature, and it being understood that such insurance shall provide for compensation to be payable to rectify the loss or damage incurred.
- (c) the Contractor's Equipment and other things brought onto the Site by the Contractor, for a sum sufficient to provide for their replacement at the Site.

The insurance under clause 21.1 shall be issued by an insurance company which has been determined by the contractor to be acceptable to the Consultant.

21.2 Scope of Cover

The insurance in paragraphs (a) and (b) of Sub-Clause 21.1 shall be in the joint names of the Contractor and the Employer and shall cover:

- (a) the Employer and the Contractor against all loss or damage from whatsoever cause arising (including natural calamities, earthquake, subsidence, landslide, rock slide, flood, storm, cyclone, fire, theft, burglary, strike, riot, sabotage, terrorism), other than as provided in Sub-Clause 21.4, from the commencement date until the date of issue of the relevant Taking-Over Certificate in respect of the Works or any Section or part thereof as the case may be, and
- (b) the Contractor for his liability:
 - (i) during the Defects Liability Period for loss or damage arising from a cause occurring prior to the commencement of the Defects Liability Period, and
 - (ii) for loss or damage occasioned by the Contractor in the course of any operations carried out by him for the purpose of complying with his obligations under Clauses 49.1 to 49.4 and 50.1.

It shall be the responsibility of contractor to notify the Insurance Company of any change in the nature and extent of the works and to ensure the adequacy of the Insurance cover at all times during the period of contract.

21.3 Responsibility for Amounts not Recovered

Any amounts not insured or not recovered from the insurers shall be borne by the Employer or the Contractor in accordance with their responsibilities under Clause 20.1 to 20.4.

21.4 Exclusions

There shall be no obligation for the insurance in Sub-Clause 21.1 to include loss or damage caused by the risks listed under sub clause 20.4 para a (i) to (iv).

If the Contractor receives instructions from the Employer to insure against War Risk, such insurance if normally available shall be effected, at the cost of the Employer, with an Insurance Company acceptable to the Consultant and shall be in the joint names of the contractor and the Employer.

22.1 Damage to Persons and Property

The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the Employer against all losses and claims in respect of:

- (a) death of or injury to any person, or
- (b) loss or damage to any property (other than the Works) :

Which may arise out of or in consequence of the execution and completion of the Works and the remedying of any defects therein, and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto, subject to the exceptions defined in Sub-Clause-22.2.

22.2 Exceptions

The "exceptions" referred to in Sub-Clause 22.1 are:

- (a) the permanent use or occupation of land by the Works, or any part thereof,
- (b) the right of the Employer to execute the Works, or any part thereof, on, over, under, in or through any land,
- (c) damage to property which is the unavoidable result of the execution and completion of the Works, or the remedying of any defects therein, in accordance with the Contract.
- (d) death of or injury to persons or loss of or damage to property resulting from any action or neglect of the Employer, his agents, servants or other contractors, not being employed by the Contractor, or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or, where the injury or damage was contributed to by the Contractor, his servants or agents, such part of the

said injury of damage as may be just and equitable having regard to the extent of the responsibility of the Employer, his servants or agents or other contractors for the injury or damage.

22.3 Indemnity by Employer

The Employer shall indemnify the Contractor against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the exceptions defined in Sub-Clause 22.2.

23.1 Third Party Insurance (Including Employer's Property)

The Contractor shall, without limiting his or the Employer's obligations and responsibilities under Clause 22.1 to 22.3, insure, in the joint names of the Contractor and the Employer, against liabilities for death of or injury to any person (other than as provided in Clause 24.1 to 24.2 or loss of or damage to any property (other than the Works) arising out of the performance of the Contract other than the exceptions defined in paragraphs (a), (b) and (c) of Sub-Clause 22.2.

23.2 Minimum Amount of Insurance

Such insurance shall be for at least the amount stated in Appendix to Tender.

23.3 Cross Liabilities

The insurance policy shall include a cross liability clause such that the insurance shall apply to the Contractor and to the Employer as separate insured.

24.1 Accident or Injury to Workmen

The Employer shall not be liable for or in respect of any damages or compensation payable to any workman other than for death or injury resulting from any act or default of the Employer, his agents or servants. The Contractor shall indemnify and keep indemnified the Employer against all such damages and compensation, other than those for which the Employer is liable as aforesaid, and against all claims, proceedings, damages, costs, charges, and expenses whatsoever in respect thereof or in relation thereto.

24.2 Insurance Against Accident to Workmen

The Contractor shall insure against such liability and shall continue such insurance during the whole of the time that any persons are employed by him on the Works. Provided that, in respect of any persons employed by any

Subcontractor, the Contractor's obligations to insure as aforesaid under this Sub-Clause shall be satisfied if the Subcontractor shall have insured against the liability in respect of such persons in such manner that the Employer is indemnified under the policy, but the Contractor shall require such Subcontractor to produce to the Consultant, when required, such policy of insurance and the receipt for the payment for current premium.

25.1 Evidence and Terms of Insurance

The Contractor shall provide evidence to the Consultant as soon as practicable after the respective insurance have been taken out but in any case prior to the start of work at the Site that insurance required under the Contract have been effected and shall, within 84 days of the Commencement Date, provide the insurance policies to the Employer. When providing such evidence and such policies to the Employer, the Contractor shall notify the Engineer of so doing. Such insurance policies shall be consistent with the general terms agreed prior to the issue of the Letter of Acceptance. The Contractor shall effect all insurance for which he is responsible with insurers and in terms approved by the Consultant.

25.2 Adequacy of Insurance

The Contractor shall notify the insurers of changes in the nature, extent or programme for the execution of the Works and ensure the adequacy of the insurance at all times in accordance with the terms of the Contract and shall, when required, produce to the Consultant the insurance policies in force and the receipts for payment of the current premiums.

25.3 Remedy on Contractor's Failure to Insure

If the Contractor fails to effect and keep in force any of the insurance required under the Contract, or fails to provide the policies to Consultant within the period required by Sub-Clause 25.1, then and in any such case the Employer may effect and keep in force any such insurance and pay any premium as may be necessary for that purpose and from time to time deduct the amount so paid from any monies due or to become due to the Contractor, or recover the same as a debt due from the Contractor.

25.4 Compliance with Policy Conditions

In the event that the Contractor or the Employer fails to comply with conditions imposed by the insurance policies effected pursuant to the Contract, each shall indemnify the other against all losses and claims arising from such failure.

The Contractor shall be entitled to place all insurance relating to the Contract (including, but not limited to, the insurance referred to in Clauses 21.1 to 21.4, 23.1 to 23.3 and 24.1 to 24.2) with insurers from India.

26.1 Compliance with Statutes Regulations

The Contractor shall conform in all respects, including by the giving of all notices and the paying of all fees, with the provision of :

- (a) any National or State Statute, Ordinance, or other Law, or any regulation, or bye-law of any local or other duly constituted authority in relation to the execution and completion of the Works and the remedying of any defects therein, and
- (b) the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works, and the Contractor shall keep the Employer indemnified against all penalties and liability of every kind for breach of any such provision.

Provided always that the Employer shall be responsible for obtaining any planning, zoning or other similar permission required for the Works to proceed and shall indemnify the Contractor in accordance with Sub-Clause 22.3.

27.1 Fossils

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site shall, as between the Employer and the Contractor, be deemed to be the absolute property of the Employer. The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing or damaging any such article or thing and shall, immediately upon discovery thereof and before removal, acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same. If, by reason of such instructions, the Contractor suffers delay and/or incurs costs then the Engineer shall, after due consultation with the Contractor, determine:

- (a) any extension of time to which the Contractor is entitled under Clause 44.1 to 44.3, and
- (b) the amount of such costs, which shall be added to the Contract Price, and shall notify the Contractor accordingly.

28.1 Patent Rights

The Contractor shall save harmless and indemnify the Employer from and against all claims and proceeding for or on account of infringement of any patent right, design trademark or name or other protected rights in respect of any Contractor's Equipment, materials or Plant used for or in connection with or for incorporation in the Works and from and against all damages, costs, charges and expenses

whatsoever in respect thereof or in relation thereto, except where such infringement results from compliance with the design or Specification provided by the Engineer.

28.2 Royalties

Except where otherwise stated, the Contractor shall pay all tonnage and other royalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials required for the Works.

29.1 Interference with Traffic and Adjoining Properties

All operation necessary for the execution and completion of the Works and the remedying of any defects therein shall, so far as compliance with the requirements of the Contract permits, be carried on so as not to interfere unnecessarily or improperly with:

- (a) the convenience of the public, or
- (b) the access to, use and occupation of public or private road, railway and any other right of way and footpaths to or of properties whether in the possession of the Employer or of any other person.

The Contractor shall save harmless and indemnify the Employer in respect of all claims, proceedings, arising out of, or in relation to any such matters insofar as the Contractor is responsible therefor.

If any plant (floating or otherwise) belonging to or hired by the Contractor or any sub-contractor or any person employed by the Contractor or by any sub-contractor or any materials or things therein or there from sink from any cause whatsoever, it shall immediately be reported by the Contractor to the competent authorities and the Engineer's Representative, and Contractor shall forthwith, at his cost raise and remove any such plant, materials or things or otherwise deal with the same as the Engineer may direct.

The fact that such sunken plant, materials or things are insured or have been declared a total loss or do not represent any further value shall not absolve the Contractor from his obligations under this Clause to raise and remove the same. Until such sunken plant or materials or things have been raised and removed, the Contractor shall set such buoys and display at night such lights and do all such things for the safety as may be required by the competent authorities or by the Engineer's Representative.

In the event of the Contractor not carrying out the obligations imposed on him by this Clause, the Employer may cause to set buoy and display at night light on such plant and raise and remove the same without prejudice to the right of the Employer to hold the Contractor liable and all expenses and consequences thereon and incidental thereto shall be borne by the Contractor and shall be recoverable from him as a debt by the Employer or may be deducted by the

Employer from any moneys due or which may become due to the Contractor.

30.1 Avoidance of Damage to Roads

The Contractor shall use every reasonable means to prevent any of the roads or bridges communicating with or on the routes to the Site from being damaged or injured by any traffic of the Contractor or any of his Subcontractors and, in particular, shall select routes, choose and use vehicles and restrict and distribute loads so that any such extraordinary traffic as will inevitably arise from the moving of materials, Plant, Contractor's Equipment or Temporary Works from and to the Site shall be limited, as far as reasonably possible, and so that no unnecessary damage or injury may be occasioned to such roads and bridges.

30.2 Transport of Contractor's Equipment or Temporary Works

Save insofar as the Contract otherwise provides, the Contractor shall be responsible for and shall pay the cost of strengthening any bridges or altering or improving any road communicating with or on the routes to the Site to facilitate the movement of Contractor's Equipment or Temporary Works and the Contractor shall indemnify and keep indemnified the Employer against all claims for damage to any such road or bridge caused by such movement, including such claims as may be made directly against the Employer, and shall negotiate and pay all claims arising out of such damage.

If it is found necessary for the Contractor to move one or more loads of heavy constructional plant and equipment, materials or preconstructed units or parts of units of work over roads, highways, bridges on which such oversized and overweight items are not normally allowed to be moved, the Contractor shall obtain prior permission from the concerned authorities. Payments for complying with the requirements, if any, for protection of or strengthening of the roads, highways or bridges shall be made by the Contractor and such expenses shall be deemed to be included in his contract price.

30.3 Transport of Materials or Plant

If, notwithstanding Sub-Clause 30.1, any damage occurs to any bridge or road communicating with or on the routes to the Site arising from the transport of materials or Plant, the Contractor shall notify the Engineer, as soon as he becomes aware of such damage or as soon as he receives any claim from the authority entitled to make such claim. Where under any law or regulation the hauler of such materials or Plant is required to indemnify the road authority against damage the Employer shall not be liable for any costs, charges or expenses in respect thereof or in relation thereto. In other cases the Employer

shall negotiate the settlement of and pay all sums due in respect of such claim and shall indemnify the Contractor in respect thereof and in respect of all claims, proceedings, damages, costs charges and expenses in relation thereto. Provided that if and so far as any such claim or part thereof is, in the opinion of the Engineer, due to any failure on the part of the Contractor to observe and perform his obligations under Sub-Clause 30.1, then the amount, determined by the Engineer, due to any failure on the part of the Contractor to observe and perform his obligations under Sub-Clause 30.1, then the amount, determined by the Engineer, after due consultation with the Employer and the Contractor, to be due to such failure shall be recoverable from the Contractor by the Employer and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly. Provided also that the Employer shall notify the Contractor whenever a settlement is to be negotiated and, where any amount may be due from the Contractor, the Employer shall consult with the Contractor before such settlement is agreed.

30.4 Waterborne Traffic

Where the nature of the Works is such as to require the use by the Contractor of waterborne transport the foregoing provisions of this Clause shall be construed as through "road included a lock, dock, sea wall or other structure related to a waterway and "vehicle" included craft, and shall have effect accordingly.

31.1 Opportunities for other Contractors

The Contractor shall, in accordance with the requirements of the Engineer, afford all reasonable opportunities for carrying out their work to:

- (a) any other contractors employed by the employer and their workmen,
- (b) the workmen of Employer, and
- (c) the workmen of any duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any contract which the employer may enter into in connection with or ancillary to the Works.

31.2 Facilities for other Contractors

If, however, pursuant to Sub-Clause 31.1 the Contractor shall, on the written request of the Engineer:

- (a) make available to any such other contractor, or to the Employer or any such authority, any roads or ways for the maintenance of which the Contractor is responsible, or
- (b) permit the use, by any such, of Temporary Works or Contractor's

Equipment on the Site,

- (c) provide any other service of whatsoever nature for any such, the Engineer shall determine an addition to the Contract Price in accordance with Clause 52.1 to 52.4 and shall notify the Contractor accordingly.

32.1 Contractor to keep Site Clear

During the execution of the Works the Contractor shall keep the Site reasonably free from all unnecessary obstruction and shall store or dispose of any Contractor's Equipment and surplus materials and clear away and remove from the Site any wreckage, rubbish or Temporary Works no longer required.

33.1 Clearance of Site on Completion

Before the issue of any Taking-Over Certificate the Contractor shall clear away and remove from that part of the Site to which such Taking-Over Certificate relates all Contractor's Equipment, surplus material rubbish and Temporary Works of every kind, and leave such part of the Site and Works clean and in a workmanlike condition to the satisfaction of the Engineer. Provided that the Contractor shall be entitled to retain on Site, until the end of the Defects Liability Period, such materials, Contractor's Equipment and Temporary Works as are required by him for the purpose of fulfilling his obligations during the Defects Liability Period.

34.1 Labour

The contractor shall make his own local or other arrangement for the engagement of all labour local or other.

The Contractor and his sub contractors shall abide by the local laws and regulations governing labour applicable from time to time.

Engagement of Labour

The Contractor shall make his own arrangements for the engagement of all labour, local or otherwise, and, save insofar as the Contract otherwise provides, for the transport, housing, feeding and payment thereof.

Supply of Water

The contractor shall, so far as is reasonably practicable, having regard to local

conditions, provide on the Site, to the satisfaction of the Engineer's Representative, an adequate supply of drinking and clear water for the use of the Contractor's and the Engineer's staff and work people, Sub-Contractors and site visitors.

Alcoholic Liquor or Drugs

The Contractor shall not import, sell, give, barter or otherwise dispose of any alcoholic liquor, or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his sub-contractors, agents or employees.

Arms and Ammunition

The Contractor shall not give, barter or otherwise dispose off to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

Festivals and Religious Customs

The Contractor shall in all dealings with labour in his employment have due regard to all recognised festivals, days of rest and religious or other customs.

Epidemics

In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government, or the local medical or sanitary authorities for the purpose of dealing with and overcoming the same.

Disorderly Conduct, etc.

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his employees and for the preservation of peace and protection of persons and property in the neighbourhood of the works against the same.

Observance of Legislation etc.

The Contractor shall at all times during the continuance of the Contract comply fully with all existing Acts, regulations and bylaws including all statutory amendments and re-enactments and acts that may be passed in future either by the state or the Central Government or local authority, including, Indian Workmen's Compensation Act, Contract Labour (Regulation and Abolition) Act 1970 and Equal remuneration Act 1976. Factories Act, Minimum Wages Act provident fund regulations employees provident Fund Act and schemes made

under same Act, Health and Sanitary Arrangements for workmen, Insurance and other benefits and shall keep the Employer indemnified in case any action is commenced for contravention by the contractor. If the Employer is caused to pay or reimburse any amounts for non-observance of the provisions of this clause on the part of the contractor the Engineer shall have the right to deduct from any moneys due to the contractor or recover from the contractor personally any sum required or estimated to be required for making good the loss or damage suffered by the Employer. All registration and station inspection fees if any in respect of his work pursuant to the contract shall be to the account of the contractor.

Fair Wages :

The Contractor shall pay the labours engaged by him on the work not less than a fair wage, which expression shall mean, whether or time or piecework, the respective rates of wages as fixed by the public works department as fair wages for the area payable to the different categories of labourers or those notified under the Minimum wages act for corresponding employees of the Employer whichever may be higher.

The Contractor shall notwithstanding the provisions of any contract to the contrary, cause to be paid a fair wage to the labourers indirectly engaged on the works including any labour engaged by subcontractors in connection with the said works as if the labourer has been immediately employed by him.

Notices :

The Contractor shall before he commences the work display and correctly maintain in a clean and legible condition at a conspicuous place on the Site notices in English and in a local language spoken by the majority of the workers, stating therein the rate of wages which have been fixed as fair wages and the hours of work for which such wages are earned and send a copy of such notices to the Engineer.

Wage Records :

The contractor shall maintain records of wages and other remuneration paid to his employees in such form as may be convenient and to the requirements of the Employer/Engineer and the conciliation officer (Central) Ministry of Labour, Government of India, or such other authorised person appointed by the Central or State Government and the same shall include the following particulars of each worker:

- i) Name, works number and grade
- ii) Rate of daily or monthly wage.
- iii) Nature of work on which employed
- iv) Total number of days worked during each wage period.
- v) Total amount payable for the work during each wage period.
- vi) All deductions made from the wage with details in each case of the

- ground for which the deduction is made.
- vii) Wage actually paid for each wage period.

The contractor shall provide a wage slip for each worker employed on the works.

The wage record and wage slips shall be preserved for at least 12 months after the last entry.

Inspection of Wage Records

The Contractor shall allow inspection of the aforesaid wage records and wage slip to the Engineer and to any of his workers or to his agent at a convenient time and place after due notice is received, or to the Employer or any other person authorised by him on his behalf.

The Employer and the Engineer or any other person authorised by them on their behalf shall have power to make enquiries with a view to ascertaining and enforcing due and proper observance of the Fair Wages Clause. He shall also have the power to investigate into any complaint regarding any default made by the Contractor or sub-contractor in regard to such provision.

The Employer shall have the right to deduct from the moneys due to the Contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non payment of the aforesaid fair wage, except on account of any deductions that may be permissible under any law for the time being in force.

Representation of Parties

- (i) A workman shall be entitled to be represented in any investigation or enquiry under this Clause by :-
- (a) An officer of a registered trade union of which he is a member.
 - (b) An officer of a federation of trade Union to which the Trade Union referred to in pervious Sub-clause is affiliated.
 - (c) Where the Worker is not a member of any registered Trade Union, by an officer of a registered Trade Union connected with or by any other workman employed in the industry in which the workers is employed.
- (ii) The contractor or sub-contractor shall be entitled to be represented in any investigations or enquiry under this clause by an officer of an Association of Employers of which he is a member.
- (iii) No party shall be represented by a legal practitioner in any investigation

or enquiry under this clause, unless all parties agree.

Safety Provisions

The Contractor shall comply with all the precautions as required for the safety of the workman by the I.L.O Convention (NO.62) as far as they are applicable to the Contract. The Contractor shall provide all necessary safety appliances, gears like goggles, helmets, masks, etc. to the workmen and the staff.

The Contractor shall be responsible for observance by his sub-Contractors of the foregoing provisions.

Footwear

The Contractor shall at his own expense provide footwear for all labour engaged on concrete mixing work and all other type of work involving the use of tar, cement, etc. to the satisfaction of the Engineer or his Representative, and on his failure to do so the Employer shall be entitled to provide the same and recover the cost from the Contractor.

The Contractor shall deliver to the Engineer's Representative at his office on the Site a return in detail in such form and at such intervals as the Employer / Engineer may prescribe showing the supervisory staff and the numbers of the several classes of labour from time to time employed on the Site.

35.1 Returns of Labour, etc.

The Contractor shall, if required by the Engineer, deliver to the Engineer's Representative, or at his office, a return in detail in such form and at such intervals as the Engineer may prescribe showing the supervisory staff and the number of the several classes of labour from time to time employed by the Contractor on the site and such information respecting constructional plant as the Engineer's Representative may require.

The Contractor shall file all labour returns in detail to the respective authorities / statutory bodies as prescribed under law applicable at the work site and inform the Employer / Engineer with copies of such returns directly filed.

MATERIALS, PLANTS AND WORKMANSHIP

36.1 Quality of Materials, Plant and Workmanship

All materials Plant and workmanship shall be

- (a) of the Respective kinds described in the Contract and in accordance with the Engineer's instructions, and
- (b) subjected from time to time to such tests as the Engineer may require at

the place of manufacture, fabrication or preparation, or on the Site or at such other place or places as may be specified in the Contract, or at all or any of such places.

The Contractor shall provide such assistance, labour, electricity, fuels, stores, apparatus and instruments as are normally required for examining, measuring and testing any materials or plant and shall supply samples of materials, before incorporation in the Works, for testing as may be selected and required by the Engineer.

The contractor is encouraged to the extent practicable and reasonable, to use plant and material from sources within India.

36.2 Cost of Samples

All samples shall be supplied by the Contractor at his own cost if the supply thereof is clearly intended by or provided for in the Contract.

36.3 Cost of Test

The cost of making any test shall be borne by the Contractor if such test is

- (a) clearly intended by or provided for in the Contract, or
- (b) particularised in the Contract (in cases only of a test under load or of a test to ascertain whether the design of any finished or partially finished work is appropriate for the purposes which it was intended to fulfil) in sufficient detail to enable the Contractor to price or allow for the same in his Tender.

36.4 Costs of Tests not provided for

If any test required by the Engineer which is

- (a) not so intended by or provided for, or
- (b) (in the cases above mentioned) not so particularised, or
- (c) though so intended or provided for, required by the Engineer to be carried out at any place other than the Site local test house or the place of manufacture, fabrication or preparation of the materials or Plant tested.

Shows the materials, Plant or workmanship not to be in accordance with the provision of the Contract to the satisfaction of the Engineer, then the cost of such test shall be borne by the Contractor, but in any other case Sub- Clause 36.5 shall apply.

36.5 Engineer's Determination Where Tests not provided for

Where, pursuant to Sub-Clause 36.4, this Sub-Clause applies the Engineer shall, after due consultation with the Contractor, determine:

- (a) any extension of time to which the Contractor is entitled under Clause 44.1 to 44.3, and shall notify the Contractor accordingly.

37.1 Inspection of Operations

The Engineer, and any person authorised by him, shall at all reasonable times have access to the Site and to all workshops and places where materials or Plant are being manufactured, fabricated or prepared for the Works and the Contractor shall afford every facility for and every assistance in obtaining the right to such access.

37.2 Inspection and Testing

The Engineer shall be entitled, during manufacture, fabrication or preparation to inspect and test the materials and Plant to be supplied under the Contract. If materials or Plant are being manufactured, fabricated or prepared in workshops or places other than those of the Contractor, the Contractor shall obtain permission for the Engineer to carry out such inspection and testing in those workshops or places. Such inspection or testing shall not release the Contractor from any obligation under the Contract.

37.3 Dates for Inspection and Testing

The Contractor shall agree with the Engineer on the time and place for inspection or testing of any materials or Plant as provided in the Contract. The Engineer shall give the Contractor not less than 24 hours notice of his intention to carry out the inspection or to attend the tests. If the Engineer, or his duly authorised representative, does not attend on the date agreed, the Contractor may, unless otherwise instructed by the Engineer, proceed with the tests, which shall be deemed to have been made in the presence of the Engineer. The Contractor shall forthwith forward to the Engineer duly certified copies of the test readings. If the Engineer has not attended the tests, he shall accept the said readings as accurate or instruct the tests to be repeated at the Employer's cost to enable him to decide.

37.4 Rejection

If at the time and place agreed in accordance with Sub-Clause 37.3, the materials or Plant are not ready for inspection or testing or if, as result of the inspection or testing referred to in this Clause, the Engineer determines that the materials or Plant are defective or otherwise not in accordance with the Contract, he may

reject the materials or Plant and shall notify the Contractor thereof immediately. The notice shall state the Engineer's objections with reasons. The Contractor shall then promptly make good the defect or ensure that rejected materials or Plant comply with the Contract. If the engineer so request, the test of rejected materials or Plant shall be made or repeated under the same terms and conditions. All costs incurred by the Employer by the repetition of the tests shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer and may be deducted from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

37.5 Independent Inspection

The Engineer may delegate inspection and testing of materials or Plant to an independent inspector. Any such delegation shall be effected in accordance with Sub- Clause 2.4 and for this purpose such independent inspector shall be considered as an assistant of the Engineer. Notice of such appointment (not being less than 14 days) shall be given by the Engineer to the Contractor.

38.1 Examination of Work before Covering up

No part of the Work shall be covered up or put out of view without the approval of the Engineer and the Contractor shall afford full opportunity for the Engineer to examine and measure any such part of the Works which is about to be covered up or put out of view and to examine foundations before any part of the work is placed thereon. The Contractor shall give notice to the Engineer whenever any such part of the Works or foundations is or are ready or about to be ready for examination and the engineer shall unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such part of the Works or of examining such foundations.

38.2 Uncovering and Making Opening

The Contractor shall uncover any part of the Works or make opening in or through the same as the Engineer may from time to time instruct and shall reinstate and make good such part. If any such part has been covered up or put out of view after compliance with the requirement of Sub-Clause 38.1 and is found to be executed in accordance with the Contract, the Engineer shall, after due consultation with the Contractor, determine the amount of reinstating and making good the same, which shall be added to the Contract Price, and shall notify the Contractor accordingly. In any other case all costs shall be borne by the Contractor.

39.1 Removal of Improper Work, Materials or Plant

The Engineer shall have authority to issue instructions from time to time, for:

- (a) The removal from the Site, within such time or times as may be specified in the instruction, of any materials or Plant which, in the opinion of the Engineer, are not accordance with the Contract,
- (b) The substitution of proper and suitable materials or Plant, and
- (c) The removal and proper re-execution, notwithstanding any previous test thereof or interim payment therefor, of any work which, in respect of
 - (i) materials, Plant or workmanship, or
 - (ii) design by the Contractor or for which he is responsible, is not, in the opinion of the Engineer, in accordance with the Contract.

39.2 Default of Contractor in Compliance

In case of default on the Contractor in carrying out such instruction within the time specified therein or, if none, within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the same and all costs consequent thereon or incidental thereto shall, after due consultation with the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly.

SUSPENSION

40.1 Suspension of Work

The Contractor shall, on the instructions of the Engineer, suspend the progress of the Works or any part thereof for such time and in such manner as the Engineer may consider necessary and shall, during such suspension, properly protect and secure the Works or such part thereof so far as is necessary in the opinion of the Engineer. Unless such suspension is

- (a) otherwise provided for in the Contract, or
- (b) necessary by reason of some default of or breach of contract by the Contractor or for which he is responsible, or
- (c) necessary by reason of extra-ordinary climatic conditions on the Site, or
- (d) necessary for the proper execution of the Works or for the safety of the Works or any part thereof (save to the extent that such necessity arises from any act or default by the Engineer or the Employer or from any of the risks defined in Sub-Clause 20.4), Sub- Clause 40.2 shall apply.

40.2 Engineer's Determination following Suspension

Where, pursuant to Sub-Clause 40.1, this Sub- Clause applies the Engineer shall, after due consultation with the Contractor determine

- (a) any extension of time to which the Contractor is entitled under Clause 44.1 to 44.3, and
- (b) the amount, which shall be added to the Contract Price, in respect of the cost incurred by the Contractor by reason of such suspension.

And shall notify the Contractor accordingly.

40.3 Suspension lasting more than 84 Days

If the progress of the Works or any part thereof is suspended on the written instructions of the Engineer and if permission to resume work is not given by the Engineer within a period of 84 days from the date of suspension then, unless such suspension is within paragraph (a), (b), (c) or (d) of Sub-Clause 40.1, the Contractor may give notice to the Engineer requesting permission, within 28 days from the receipt thereof, to proceed with the Works or that part thereof in regard to which progress is suspended. If, within the said time, such permission is not granted, the Contractor may, but is not bound to, elect to treat the suspension, where it affects part only of the Works, as an omission of such part under Clause 51.1 to 51.2 by giving a further notice to the Engineer to that effect, or, where it affects the whole of the Works, treat the suspension as an event of default by the Employer and terminate his employment under the Contract in accordance with the provisions of Sub- Clause 69.1, whereupon the provisions of Sub-Clause 69.2 and 69.3 shall apply.

COMMENCEMENT AND DELAYS

41.1 Commencement of Works

The Contractor shall commence the Works as soon as is reasonably possible after the receipt by him of a notice to this effect from the Engineer, which notice shall be issued within the time stated in the Appendix to Tender after the date of the Letter of Acceptance. Thereafter, the Contractor shall proceed with the works with due expedition and without delay.

42.1 Possession of Site and Access Thereto

Save insofar as the Contract may prescribe:

- (a) the extent of portions of the Site of which the Contractor is to be given possession from time to time, and

- (b) the order in which such portions shall be made available to the Contractor and subject to any requirement in the Contract as to the order in which the Works shall be executed,

The Employer will, with the Engineer's notice to commence the Works, give to the Contractor possession of

- (c) so much of the Site, and
- (d) such access as, in accordance with the Contract, is to be provided by the Employer,

as may be required to enable the Contractor to commence and proceed with the execution of the Works in accordance with the programme referred to in Clause 14.1 to 14.4, if any, and otherwise in accordance with such reasonable proposals as the Contractor shall, by notice to the Engineer make. The Employer will, from time to time as the Works proceed, give to the Contractor possession of such further portions of the Site as may be required to enable the Contractor to proceed with the execution of the Works with due dispatch in accordance with such programme or proposals, as the case may be.

- (e) All water including rain water which may accumulate on the site during the progress of the works or in trenches or excavations, shall be removed promptly from the site to the satisfaction of engineer and at the cost of contractor.

42.2 Failure to Give Possession

If the Contractor suffers delay and/or incurs costs from failure on the part of the Employer to give possession in accordance with the terms of Sub-Clause 42.1, the Engineer shall, on the request of the contractor and submission of the details and documentary proof, determine:

- (a) any extension of time to which the Contractor is entitled under Clause 44.1 to 44.3, and
- (b) the amount of such costs, which shall be added to the Contract Price, and shall notify the Contractor accordingly.

42.3 Wayleaves and Facilities

The Contractor shall bear all costs and charges for special or temporary wayleaves required by him in connection with access to Site. The Contractor shall also provide at his own cost any additional facilities outside the Site required by him for the purposes of the Works.

43.1 Time for Completion

The whole of the Works and, if applicable, any Section required to be completed within a particular time as stated in the Appendix to Tender, shall be completed, in accordance with the provisions of Clause 48.1 to 48.4, within the time stated in the Appendix to Tender for completion of the whole of the Works or the Section (as the case may be), calculated from the Commencement Date, or such extended time as may be allowed under Clause 44.1 to 44.3.

44.1 Extension of Time for Completion

In the event of

- (a) the amount or nature of extra or additional work, or
- (b) any cause of delay referred to in these Conditions by reference to clause 44.1 to 44.3, or
- (c) exceptionally adverse climatic conditions, or
- (d) any delay, impediment or prevention by the Employer, or
- (e) other special circumstances which may occur, other than through a default of or breach of contract by the Contractor or for which he is responsible,

being such as fairly to entitle the contractor to extension of time for completion of the works or any section or part thereof, the Engineer shall after due consultation with the contractor, and subject to clause 44.2 determine the amount of such extension and shall notify the contractor accordingly.

44.2 Contractor to Provide Notification and Detailed/ Particulars

The Engineer is not bound to make any determination under clause 44.1 unless the Contractor has

- (a) within 28 days after such event has arisen notified the Engineer, and
- (b) within 28 days, or such other reasonable time as may be agreed by the Engineer, after such notification submitted to the Engineer detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.

44.3 Interim Determination of Extension

Provided also that where an event has continuing effect such that it is not practicable for the Contractor to submit detailed particulars within the period of 28 days referred to in Sub-Clause 44.2 (a), he shall nevertheless be entitled to an

extension of time provided that he has submitted to the Engineer interim particulars at intervals of not more than 28 days and final particulars within 28 days of the end of the effects resulting from the event. On receipt of such interim particulars, the Engineer shall, without undue delay, make an interim determination of extension of time and on receipt of the final particulars the Engineer shall review the circumstances and shall determine an overall extension of time in regard to the event in consultation with the Contractor and shall notify the Contractor of the determination. No final review shall result in a decrease of any extension of time already determined by the Engineer.

45.1 Restriction Working Hours

Subject to any provision to the contrary contained in the Contract, none of the Works shall save as hereinafter provided, be carried on during the night or on locally recognised days of rest without the consent of the Engineer, except when work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer. Provided that the provisions of this Clause shall not be applicable in the case of any work which it is customary to carry out by multiple shift.

46.1 Rate of Progress

If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works or any Section is at any time, in the opinion of the Engineer, too slow to enable the contractor to complete the execution of and passing the tests on completion of the Works or such section by the time for completion, the Engineer shall so notify the Contractor who shall thereupon take such steps as are necessary, subject to the consent of the Engineer, to expedite progress so as complete the execution of and passing the tests on completion of the Works or such section by the time for completion. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer under this Clause, the Contractor considers that it is necessary to do any work at night or on locally recognised days of rest, he shall be entitled to seek the consent of the Engineer so to do. Provided that if any steps, taken by the Contractor in meeting his obligations under this Clause, involve the employer in additional supervision costs, such costs shall, after due consultation with the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become to the Contractor and the Engineer shall notify the Contractor accordingly.

47.1 Liquidated Damages for Delay

If the Contractor fails to complete the execution of and passing the test on completion of the works or any section by the time for completion, in accordance with Clause 48.1 to 48.4, within the relevant time prescribed by Clause 43.1, then the Contractor shall pay to the Employer the relevant sum stated in the Appendix

to Tender (Appendix - B) as liquidated damages for such default and not as a penalty (which sum shall be the only monies due from the Contractor for such default) for every day or part of a day which shall elapse between the relevant Time for Completion and the date stated in a Taking-Over Certificate of the whole of the Works or the relevant Section, subject to the applicable limit stated in the Appendix to Tender (Annexure - B). The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any monies due or to become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the contract.

47.2 Reduction of Liquidated Damages

If, before the Time for Completion of the whole of the Works or, if applicable, any Section, a Taking-Over Certificate has been issued for any part of the Works or of a Section, the liquidated damages for delay in completion of the reminder of the Works or of that Section shall, for any period of delay after date stated in such Taking-Over Certificate, and in the absence of alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The Provisions of this Sub-Clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

48.1 Taking-Over Certificate

When the whole of the Works have been substantially completed and have satisfactorily passed any Tests on Completion prescribed by the Contract, the Contractor may give a notice to that effect to the Engineer, accompanied by a written undertaking to finish with due expedition any outstanding work during the Defects Liability Period. Such notice and undertaking shall be deemed to be a request by the Contractor for the Engineer to issue a Taking-Over Certificate in respect of the Works. The Engineer shall, within 21 days of the date of delivery of such notice, either issue to the Contractor, a Taking-Over Certificate, stating the date on which, in his opinion, the Works were substantially completed in accordance with the Contract, or give instructions in writing to the Contractor specifying all the work which in the Engineer's opinion, is required to be done by the Contractor before the issue of such Certificate. The Engineer shall also notify the Contractor of any defects in the Works affecting substantial completion that may appear after such instructions and before completion of the Works specified therein. The Contractor shall be entitled to receive such Taking-Over Certificate within 21 days of completion, to the satisfaction of the Engineer, of the Works so specified and remedying any defects so notified.

48.2 Taking-Over of Sections or Parts

Similarly, in accordance with the procedure set out in Sub-Clause 48.1, the Contractor may request and the Engineer shall issue a Taking-Over Certificate in

respect of :

- (a) any Section in respect of which a separate Time for Completion is provided in the Appendix to Tender, or
- (b) any substantial part of the Permanent Works which has been both completed to the satisfaction of the Engineer and, otherwise than as provided for in the Contract, occupied or used by the Employer, or
- (c) any part of the Permanent Works which the Employer has elected to occupy or use prior to completion (where such prior occupation or use is not provided for in the Contract or has not been agreed by the Contractor as a temporary measure).

48.3 Substantial Completion of Parts

If any part of the Permanent Works has been substantially completed and has satisfactorily passed any Tests on Completion prescribed by the Contract, the engineer may issue a Taking-Over Certificate in respect of that part of the Permanent Works before completion of the whole of the Works and , upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete with due expedition any outstanding work in that part of the permanent Works during the Defects Liability Period.

48.4 Surfaces Requiring Reinstatement

Provided that a Taking-Over Certificate given in respect of any Section or part of the Permanent Works before completion of the whole of the Works shall not be deemed to certify completion of any ground or surfaces requiring reinstatement, unless such Taking- Over certificate shall expressly so state.

If the Contractor is prevented from carrying out the Tests on Completion by a cause for which the employer or the Engineer or other contractors employed by the Employer are responsible, the employer shall subject to clause 7.2 (b) be deemed to have taken over the Works on the date when the Tests on Completion would have been completed but for such prevention. The Engineer shall issue a Taking-Over Certificate accordingly. Provided always that the Works shall not be deemed to have be taken over if they are not substantially in accordance with the Contract.

If the Works are taken over under this Sub-Clause the Contractor shall nevertheless carry out the Tests on Completion during the Defects Liability Period. The Engineer shall require the Tests to be carried out by giving 14 days notice.

Any additional costs to which the Contractor may be put, in making the Tests on Completion during the Defects Liability Period, shall be added to the Contract

Price.

DEFECTS LIABILITY

49.1 Defects Liability Period

In these Conditions the expression "Defects Liability Period" shall mean the defects liability period named in the Appendix to Tender, calculated from:

- (a) the date of completion of the Works certified by the Engineer in accordance with Clause 48.1 to 48.4 or clause 63.1; or
- (b) in the event of more than one certificate having been issued by the Engineer under Clause 48.1 to 48.4, the respective dates so certified.

49.2 Completion of Outstanding Work and Remedying Defects

To the intent that the Works shall, at or as soon as practicable after the expiration of the Defects Liability Period, be delivered to the Employer in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer, the Contractor shall:

- (a) complete the work, if any, outstanding on the date stated in Taking-Over Certificate as soon as practicable after such date and
- (b) execute all such work of amendment, reconstruction, and remedying defects, shrinkages or other faults as the Engineer may, during the Defects Liability Period or within 14 days after its expiration, as a result of an inspection made by or on behalf of the Engineer prior to its expiration, instruct the Contractor to execute.

49.3 Cost of Remedying Defects

All work referred to in Sub-Clause 49.2 (b) shall be executed by the Contractor at his own cost if the necessity thereof is, in the opinion of the engineer, due to:

- (a) the use of materials, Plant or workmanship not in accordance with the Contract, or
- (b) where the Contractor is responsible for the design of part of the Permanent Works, any fault in such design, or
- (c) the neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the Contract.

If, in the opinion of the Engineer, such necessity is due to any other cause, he

shall determine an addition to the Contract Price in accordance with Clause 52.1 to 52.4 and shall notify the Contractor accordingly, with a copy to the Consultant.

49.4 Contractor's Failure to Carry out Instructions

In case of default on the part of the Contractor in carrying out such instruction within a reasonable time, the consultant shall be entitled to employ and pay other persons to carry out the same and if such work, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the Contract, then all costs consequent thereon or incidental thereto shall, after due consultation with the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly.

The Provisions of this Clause shall apply to all replacements or renewals of Plant carried out by the Contractor to remedy defects and damages as if the replacements and renewals had been taken over on the date they were completed.

The Defects Liability Period for the Works shall be extended by a period equal to the period during which the Works cannot be used by reason of a defect or damage. If only part of the Works is affected the Defects Liability Period shall be extended only for that part. In neither case shall the Defects Liability Period extend beyond 2 years from the date of taking over.

When the progress in respect of Plant has been suspended under clause 40.1 to 40.3, the Contractor's obligations under this Clause shall not apply to any defects occurring more than one year after the Time for Completion established on the date of the Letter of Acceptance.

50.1 Contractor to Search

If any defects, shrinkage or other fault in the Works appears at any time prior to the end of the Defects Liability Period, the Engineer may instruct the Contractor, to search under the directions of the Engineer for the cause thereof. Unless such defect, shrinkage or other fault is one for which the Contractor is liable under the Contract, the Engineer shall, after due consultation with the Contractor, determine the amount in respect of the costs of such search incurred by the Contractor, which shall be added to the Contract Price and shall notify the Contractor accordingly. If such defect, shrinkage or other fault is one for which the Contractor is liable, the cost of the work carried out in searching as aforesaid shall be borne by the Contractor and he shall in such case remedy such defect, shrinkage or other fault at his own cost in accordance with the provisions of Clause 49.1 to 49.4.

ALTERATIONS, ADDITIONS AND OMISSIONS (Applicable only for PART-A: Construction of Hostel block 1,2 and 3 for AIIMS within AIIMS campus, Ansari Nagar, New Delhi)

51.1 Variations

The Engineer shall make any variation of the form, or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion, be appropriate, he shall have the authority to instruct the Contractor to do and the Contractor shall do any of the following:

- (a) increase or decrease the quantity of any work included in the Contract,
- (b) change the character or quality or kind of any such work.
- (c) change the levels, lines, position and dimensions of any part of the Works,
- (d) execute additional work of any kind necessary for the completion of the Works
- (e) change any specified sequence or timing of construction of any part of the Works.

No such variation shall in any way vitiate or invalidate the Contract, but the effect, if any, of all such variations shall be valued in accordance with Clause 52.1 to 52.4. Provided that where the issue of an instruction to vary the Works is necessitated by some default of or breach of contract by the contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the contractor.

51.2 Instructions for Variations

The Contractor shall not make any such variation without an instruction of the Engineer. Provided that no instruction shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an instruction given under this Clause, but is the result of the quantities exceeding or being less than those stated in the Bill of Quantities as per approved drawings issued for construction.

52.1 Valuation of Variations

All variations referred to in Clause 51.1 to 51.2 and any additions to the Contract Price which are required to be determined in accordance with Clause 52.1 to 52.4 (for the purposes of this Clause referred to as "varied works"), shall be valued at the rates and prices set out in the Contract if, in the opinion of the Engineer, the same shall be applicable. If the contract does not contain any rates or prices applicable to the varied work, the rates and prices in the Contract shall be used as the basis for valuation so far as may be reasonable, failing which, after due consultation by the Engineer with the Contractor, suitable rates or prices shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such rates or prices as are, in his opinion,

appropriate based on CPWD norms and shall notify the Contractor accordingly. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Clause 60.1 to 60.14.

52.2 Power of Engineer to Fix Rates

Provided that if the nature or amount of any varied work relative to the nature or amount of the whole of the Works or to any part thereof, is such that, in the opinion of the Engineer, the rate or price contained in the Contract for any item of the Works is, by reason of such varied work, rendered inappropriate or inapplicable, then after due consultation by the Engineer with the Contractor, a suitable rate or price shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such other rate or price as is, in his opinion, appropriate and shall notify the Contractor accordingly. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Clause 60.1 to 60.14.

The quoted rates for all the items shall be firm, fixed and binding on the contractor irrespective of any variation of quantities stated in the contract upto $\pm 50\%$ variation of the contract value as a whole. In case the contract value varies beyond $\pm 50\%$, the item rates of only those items whose individual quantities vary beyond $\pm 50\%$ of the quantities mentioned in the contract shall be considered for change in rates. The rates of such items shall be worked out on the basis of market rate analysis and only applicable to the quantities beyond $\pm 50\%$. In the event of disagreement between the Engineer and the Contractor on these rates, the Engineer shall fix such rates and prices as are in his opinion appropriate and shall notify the Contractor accordingly. Provided also that no varied work instructed to be done by the Engineer pursuant to Clause 51.1 to 51.2 shall be valued under Sub-Clause 52.1, or under this Sub-Clause unless, within 14 days of the date of such instruction and, other than in the case of omitted work, before the commencement of the varied work, notice shall have been given either:

- (a) by the Contractor to the Engineer of his intention to claim extra payment or a varied rate or price, or
- (b) by the Engineer to the Contractor of his intention to vary a rate or price.

52.3 Variations Exceeding 50 percent

If, on the issue of the Taking-Over Certificate for the whole of the Works, it is found that as a result of:

- (a) all varied work valued under Sub-Clause 52.1 and 52.2, and
- (b) all adjustments upon measurement of the estimated quantities set out in the Bill of Quantities, excluding Provisional Sums, dayworks and adjustments of price made under Clause 70.1 to 70.3,

but not from any other cause, there have been additions to or deductions from the Contract Price which taken together are in excess of 50 percent of the "Effective Contract Price" (which for the purposes of this Sub-Clause shall mean the Contract Price, excluding Provisional Sums and allowance for day works, if any) then and in such event (subject to any action already taken under any other Sub-Clause of this Clause), after due consultation by the Engineer with the Employer and the Contractor, there shall be added to or deducted from the Contract Price such further sum as may be agreed between the Contractor and the Engineer or, failing agreement, determined by the Engineer as being fair and reasonable having regard to the Contractor's Site and general overhead costs of the Contract. The Engineer shall notify the Contractor of any determination made under this Sub-Clause. Such sum shall be based only on the amount by which such additions or deductions shall be in excess of 50 per cent of the Effective Contract Price.

52.4 Daywork

The Engineer may, if in his opinion it is necessary or desirable, issue an instruction that any varied work shall be executed on a daywork basis. The Contractor shall then be paid for such varied work under the terms set out in the daywork schedule included in the Contract and at the rates and prices affixed thereto by him in the Tender.

The Contractor shall furnish to the Engineer such receipts or other vouchers as may be necessary to prove the amounts paid and, before ordering materials, shall submit to the Engineer quotations for the same for his approval.

In respect of such of the Works executed on a daywork basis, the Contractor shall, during the continuance of such work, deliver each day to the Engineer an exact list in duplicate of the names, occupation and time of all workmen employed on such work and a statement, also in duplicate, showing the description and quantity of all materials and Contractor's Equipment used thereon or therefor other than Contractor's Equipment which is included in the percentage addition in accordance with such daywork schedule. One copy of each list and statement will, if correct, or when agreed, be signed by the Engineer and returned to the Contractor.

At the end of each month the Contractor shall deliver to the Engineer a priced statement of the labour, materials and Contractor's Equipment, except as aforesaid, used and the Contractor shall not be entitled to any payment unless such lists and statements have been fully and punctually rendered. Provided always that if the Engineer considers that for any reason the sending of such lists or statements by the Contractor, in accordance with the foregoing provision, was impracticable he shall nevertheless be entitled to authorise payment for such work, either as daywork, or being satisfied as to the time employed and the labour, materials and Contractor's Equipment used on such work, or at such value

therefor as shall, in his opinion, be fair and reasonable.

PROCEDURE FOR CLAIMS

53.1 Notice of Claims

Notwithstanding any other provision of the Contract, if the Contractor intends to claim any additional payment pursuant to any clause of these Conditions or otherwise, he shall give notice of his intention to the Engineer, within 28 days after the event giving rise to the claim has first arisen.

53.2 Contemporary Records

Upon the happening of the event referred to in Sub-Clause 53.1, the Contractor shall keep such contemporary records as may reasonable be necessary to support any claim he may subsequently wish to make. Without necessarily admitting the Employer's liability, the Engineer shall, on receipt of a notice under Sub-Clause 53.1, inspect such contemporary records and may instruct the Contractor to keep any further contemporary records as are reasonable and may be material to the claim of which notice has been given. The Contractor shall permit the Engineer to inspect all records kept pursuant to this Sub-Clause and shall supply him with copies thereof as and when the Engineer so instructs.

53.3 Substantiation of Claims

Within 28 days, or such other reasonable time as may be agreed by the Engineer, of giving notice under Sub-Clause 53.1, the Contractor shall send to the Engineer an account giving detailed particulars of the amount claimed and the grounds upon which the claim is based. Where the event giving rise to the claim has a continuing effect, such account shall be considered to be an interim account and the Contractor shall, at such intervals as the Engineer may reasonable require, send further interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. In cases where interim accounts are sent to the Engineer, the Contractor shall send a final account within 28 days of the end of the effect resulting from the event. The Contractor shall, if required by the Engineer so to do, copy to the Employer all accounts sent to the Engineer pursuant to this Sub- Clause.

53.4 Failure to Comply

If the Contractor fails to comply with any of the provisions of this Clause in respect of any claim which he seeks to make, his entitlement to payment in respect thereof shall not exceed such amount as the Engineer or any arbitrator or arbitrators appointed pursuant to Sub-Clause 67.3 assessing the claim considers to be verified by contemporary records (whether or not such records were

brought to the Engineer's notice as required under Sub-Clause 53.2 and 53.3).

53.5 Payment of Claims

The Contractor shall be entitled to have included in any interim payment certified by the Engineer pursuant to Clause 60.1 to 60.14 such amount in respect of any claim as the Engineer, after due consultation with the Contractor, may consider due to the Contractor provide that the Contractor has supplied sufficient particulars to enable the Engineer to determine the amount due. If such particulars are insufficient particulars to substantiate the whole of the claim, the Contractor shall be entitled to payment in respect of such part of the claim as such particulars may substantiate to the satisfaction of the Engineer. The Engineer shall notify the Contractor for any determination made under this Sub-Clause.

CONTRACTOR'S EQUIPMENT, TEMPORARY WORKS AND MATERIALS

54.1 Contractor's Equipment, Temporary Works and Materials, Exclusive use for the Works

All Contractor's Equipment Temporary Works and materials by the Contractor shall when brought on to the site, be deemed to be exclusively intended for the execution of the works and the contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the Site to another, without the consent of the Engineer. provided that consent shall not be required for vehicles engaged in transporting any staff labour, contractor's equipment, temporary works, plant or materials to or from the site.

54.2 Employer Not Liable for Damage

The Employer shall not at any time be liable, save as mentioned in Clauses 20.1 to 20.4 and 65.1 to 65.8, for the loss of or damage to any of the said Contractor's Equipment, Temporary Works or materials.

54.3 Customs Clearance

The Employer will use his best endeavours in assisting the Contractor, where required, in obtaining clearance through the Customs of Contractor's Equipment, materials and other things required for the Works.

54.4 Re-export of Contractor's Equipment

In respect of any Contractor's Equipment which the Contractor has imported for the purposes of the Works, the Employer will use his best endeavours to assist the Contractor, where required, in procuring any necessary Government consent to

the re-export of such Contractor's Equipment by the Contractor upon the removal thereof pursuant to the terms of the Contract.

54.5 Conditions of Hire Contractor's Equipment

With a view to securing, in the event of termination under Clause 63.1 to 63.4, the continued availability, for the purpose of executing the Works, of any hired Contractor's Equipment, the Contractor shall not bring on to the Site any hired Contractor's Equipment unless there is an agreement for the hire thereof (which agreement shall be deemed not to include an agreement for hire purchase) which contains a provision that the owner thereof will, on request in writing made by the Employer within 7 days after the date on which any termination has become effective, and on the Employer undertaking to pay all hire charges in respect thereof from such date, hire such Contractor's Equipment to the Employer on the same terms in all respects as the same was hired to the Contractor save that the Employer shall be entitled to permit the use thereof by any other contractor employed by him for the purpose of execution and completion the Works and remedying any defects therein, under the terms of the said Clause 63.1 to 63.4 .

54.6 Costs for the Purpose of Clause - 63.1 to 63.4

In the event of the employer entering into any agreement for the hire of contractor's equipment pursuant to Sub-Clause 54.5, all sums properly paid by the employer under the provisions of any such agreement and all costs incurred by him (Including stamps duties) in entering into such agreement shall be deemed, for the purpose of clause 63.1 to 63.4, to be part of the cost of executing and completing the works and the remedying of any defects therein.

54.7 Corporation of Clause in Sub-contracts

The contractor shall, where entering into any subcontract for execution of any part of the works, incorporate in such subcontract (by reference or other wise) the provisions of this Clause in relation to Contractor's Equipment, Temporary Works or Materials brought on to the Site by the Subcontractor.

54.8 Approval of Material not Implied

The operation of this clause shall not be deemed to imply any approval by the engineer of the materials or other matters referred to therein nor shall it prevent the rejection of any materials at any time by the Engineer.

MEASUREMENT

55.1 Quantities

The quantities set out in the Bill of Quantities are the estimated quantities for the

Works, and they are not to be taken as the actual and correct quantities of the Works to be executed by the Contractor in fulfilment of his obligations under the Contract.

56.1 Works to be Measured

The Engineer shall, except as otherwise stated, ascertain and determine by measurement the value of the works in accordance with the Contract and the Contractor shall be paid that value in accordance with clause 60.1 to 60.14. The Engineer shall, when he requires any part of the Works to be measured, give reasonable notice to the Contractor's agent, who shall:

- (a) forthwith attend or send a qualified representative to assist the Engineer in making such measurement, and
- (b) supply all particulars required by the Engineer

Should the Contractor not attend, or neglect or omit to send such representative, then the measurement made by the Engineer or approved by him shall be taken to be the correct measurement of such part of the Works. For the purpose of measuring such Permanent Works as are to be measured by records and drawings, the Engineer shall prepare records and drawings as the work proceeds and the Contractor, as and when called upon to do so in writing, shall, within 14 days, attend to examine and agree such records and drawings with the Engineer and shall sign the same when so agreed. If the Contractor does not attend to examine such records and drawings and the Contractor does not agree such records and drawings, they shall be taken to be Correct. If, after examination of such records and drawings, the Contractor does not agree the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor, within 14 days of such examination, lodges with the Engineer notice of the respects in which such records and drawings are claimed by him to be incorrect. On receipt of such notice, the Engineer shall review the records and drawings and either confirm or vary them.

57.1 Method of Measurement

The Works shall be measured net, notwithstanding any general or local custom, except where otherwise provided for in the Contract.

57.2 Breakdown of Lumpsum Items

For the purposes of statements submitted in accordance with Sub-Clause 60.1, the Contractor shall submit to the Engineer, within 28 days after the receipt of the Letter of Acceptance, a breakdown for each of the lump sum items contained in the Tender. Such breakdowns shall subject to the approval of the Engineer.

PROVISIONAL SUMS

58.1 Definition of "Provisional Sum"

"Provisional Sums" means a sum included in the Contract and so designated in the Bill of Quantities for the execution of any part of the Works or for the supply of goods, materials, Plant or services, or for contingencies, which sum may be used, in whole or in part, or not at all, on the instruction of the Engineer. The Contractor shall be entitled to only such amounts in respect of the work, supply or contingencies to which such Provisional Sums relate as the Engineer shall determine in accordance with the Clause. The Engineer shall notify the Contractor of any determination made under this Sub-clause.

58.2 Use of Provisional Sums

In respect of every Provisional Sum the Engineer shall have authority to issue instructions for the execution of works or for the supply of goods, materials, Plant or services by :

- (a) the Contractor, in which case the Contractor shall be entitled to an amount equal to the value thereof determined in accordance with Clause 52.1 to 52.4.
- (b) a nominated Subcontractor, as hereinafter defined, in which case the sum to be paid to the Contractor therefor shall be determined and paid in accordance with Sub-Clause 59.4

58.3 Production of Vouchers

The Contractor shall produce to the Engineer all quotations, invoices, vouchers and accounts or receipts in connection with expenditure in respect of Provisional Sums, except where work is valued in accordance with rates or prices set out in the Tender.

NOMINATED SUBCONTRACTORS

59.1 Definition of "Nominated Subcontractors"

All specialists, merchants, tradesmen and others executing any work or supplying any goods, materials, Plant or services for which Provisional Sums are included in the Contract, who may have been or be nominated or selected or approved by the Engineer, and all persons to whom by virtue of the provisions of the Contract the Contractor is required to subcontract shall, in the execution of such work or the supply of such goods, materials, Plant or services, be deemed to be

subcontractors to the Contractor and are referred to in the Contract as "nominated Subcontractors".

59.2 Nominated Subcontractors; Objection to Nomination

The Contractor shall not be required by the Employer or the Engineer, or be deemed to be under any obligation, to employ any nominated Subcontractor against whom the Contractor may raise reasonable objection, or who declines to enter into a subcontract with the Contractor containing provision:

- (a) that in respect of work, goods, materials, Plant or services the subject of the subcontract, the nominated Subcontractor will undertake towards the Contractor such obligations and liabilities as will enable the Contractor to discharge his own obligations and liabilities towards the Employer under the terms of the Contract and will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection therewith, or arising out of or in connection with any failure to perform such obligations or to fulfil such liabilities; and
- (b) that the nominated Subcontractor will save harmless and indemnify the Contractor from and against any negligence by the nominated Subcontractor, his agents, workmen and servants and from and against any misuse by him or them of any Temporary Works provided by the Contractor for the Purpose of the Contract and from all claims as aforesaid; and
- (c) approved by the Engineer.

59.3 Design Requirements to be Expressly Stated

If in connection with any Provisional Sums the services to be provided include any matter of design or specification of any part of the Permanent Works or of any Plant to be incorporated therein, such requirement shall be expressly stated in the Contract and shall be included in any nominated Subcontract. The nominated Subcontract shall specify that the nominated Subcontractor providing such services will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection with any failure to perform such obligations or to fulfil such liabilities.

59.4 Payments to Nominated Subcontractors

For all work executed or goods, material, Plant or services supplied by any nominated Subcontractor, the contractor shall be entitled to :

- (a) the actual price paid or due to be paid by the Contractor, on the instructions of the Engineer, and in accordance with the Subcontract;
- (b) in respect of labour supplied by the Contractor, the sum if any, entered in the Bill of Quantities or, if instructed by the Engineer pursuant to paragraph (a) of Sub-clause 58.2, as may be determined in accordance with Clause 52.1 to 52.4;
- (c) in respect of all other charges and profit, a sum being a percentage rate of the actual price paid or due to be paid calculated, where provisions has been made in the Bill of Qualities for a rate to be set against the relevant Provisional Sum, at the rate inserted by the Contractor against that item or, where no such provision has been made, at the rate inserted by the Contractor in the Appendix to Tender and repeated where provision for such is made in a special item provided in the Bill of Quantities for such purpose.

59.5 Certificates of Payments to Nominated Subcontractors

Before issuing, under Clause 60.1 to 60.14, any certificate, which includes any payment in respect of work done or goods, materials, Plants or services supplied by any nominated Subcontractor, the Engineer shall be entitled to demand from the Contractor reasonable proof that all payments, less retentions, included in previous certificates in respect of the work or goods, materials, Plant or services of such nominated Subcontractor have been paid or discharged by the Contractor. If the Contractor fails to supply such proof then, unless the Contractor :

- (a) satisfies the Engineer in writing that he has reasonable cause for withholding or refusing to make such payments and
- (b) produces to the Engineer reasonable proof that he has so informed such nominated Subcontractor in writing,

the Employer shall be entitled to pay to such nominated Subcontractor direct, upon the certificate of the Engineer, all payments, less retentions, provided for in the nominated Subcontractor and to deduct by way of set-off the amount so paid by the Employer from any sums due or to become due from the Employer to the Contractor.

Provided that, where the Engineer has certified and the Employer has paid direct as aforesaid, the Engineer shall, in issuing any further certificate in favour of the Contractor, deduct from the amount so paid, direct as foresaid, but shall not withhold or delay the issue of the certificate itself when due to be issued under the terms of the Contract.

CERTIFICATES AND PAYMENTS

60.1 Monthly Statements

The Contractor shall submit a statement in 3 copies to the Engineer by 7th day of each month for the work executed upto the end of previous month in a tabulated form approved by the Engineer, showing the amounts to which the Contractor considers himself to be entitled. the statement shall include the following items, as applicable, which shall be taken into account in the sequence listed:

- (a) The estimated contract value of the Temporary and Permanent Works executed up to the end of the month in question, at base unit rates and prices.
- (b) The actual value certified for payment for the Temporary and Permanent Works executed up to the end of the previous month, at base unit rates and prices.
- (c) The estimated contract value at base unit rates and prices of the Temporary and Permanent Works for the month in question, obtained by deducting (b) from (a);
- (d) The value of any variations executed up to the end of the month in question, less the amount certified in the previous Interim Payment Certificate, pursuant to Clause 52.1 to 52.4;
- (e) Amounts approved in respect of Daywork executed up to the end of the month in question, less the amount for Daywork certified in the previous Interim Payment Certificate determined from the Day work Schedule of the Bill of Quantities.
- (f) Amounts reflecting changes in cost and legislation, pursuant to Clause 70.1 to 70.3.
- (g) Any credit or debit for the month in question in respect of materials and Plant for the Permanent Works, under the conditions set forth in Sub-Clause 60.3;
- (h) Any amount to be withheld under the retention provisions of Sub-Clause 60.5, determined by applying the percentage set forth in Sub-Clause 60.5 to the amounts due under paragraphs 60.1(c), (e), (f) and (g);
- (i) Any amounts to be deducted as repayment of the Advance under the provisions of sub-Clause 60.7; and
- (j) Any other sum, to which the Contractor may be entitled under the contract.
- (k) 75% of the value of materials delivered to the site for permanent works on signing of the Indenture for secured advance format of which is enclosed at Annexure - A.

- (l) The amount to be deducted towards the advance income tax shall be at the rate of two percent and the advance works contract tax at the rate of nil percent or as per the statutory requirements in this regard.

60.2 Monthly Payments

The said statement shall be approved / amended by the Engineer in such a way that, in his opinion, it reflects the amounts due to the Contractor in accordance with the Contract, after deduction, other than pursuant to Clause 47.1 to 47.2, of any sums which may have become due and payable by the Contractor to the Employer. In cases where there is a difference of opinion as to the value of any item, the Engineer's view shall prevail. Within the 7th day of the month following the receipt of the monthly statement referred to in Sub-Clause 60.1, the Engineer shall determine the amounts due to the Contractor and shall issue to the Contractor a certificate herein called "Interim Payment Certificate", certifying the amounts due to the contractor.

Notwithstanding the terms of this Clause or any other Clause of the Contract, no amount will be certified by the Engineer for payment until the performance security has been provided by the Contractor and approved by the consultant.

60.3 Materials and Plant for the Permanent Works

With respect to materials and Plant brought by the Contractor to the Site for incorporation in the Permanent Works, the Contractor shall (i) receive a credit in the month in which these materials and Plant are brought to the site and (ii) be charged a debit in the month in which they are incorporated in the Permanent Works, both such credit and debit to be determined by the engineer in accordance with the following provisions:

- (a) no credit shall be given unless the following conditions shall have been met to the Engineer's satisfaction:
 - i) the materials and Plant are in accordance with specifications for the Works;
 - ii) the materials and Plant have been delivered to the Site and are properly stored and protected against loss, damage or deterioration;
 - iii) the Contractor's records of the requirements, order, receipts and use of materials and Plant are kept in a form approved by the engineer, and such records are available for inspection by the Engineer.
 - iv) the Contractor has submitted a statement of his cost of acquiring and delivering the materials and Plant to the site, together with such documents as may be required for the purpose of evidencing

such cost; and

- (b) the amount to be credited to the Contractor shall be equivalent of 75 percent of the Contractor's reasonable cost of the materials and Plant delivered to the Site, as determined by the Engineer after review of the documents listed in paragraph (a) (iv) above, as determined by the Engineer;
- (c) the amount to be debited to the Contractor for any materials and Plant incorporated into the Permanent Works shall be equivalent to the credit previously granted to the contractor for such materials and Plant pursuant to Sub-Clause(b) above, as determined by the Engineer.

60.4 Place of Payments

Payments to the Contractor by the consultant shall be made in Indian Rupees into a bank account or accounts nominated by the Contractor or by account payee cheque.

60.5 Retention Money

A retention amounting to 10 (Ten) percent of the amounts, determined in accordance with the procedure set out in Sub-Clause 60.1 (h) shall be made by the Engineer in the first and following Interim Payment Certificates, until the amount so retained reaches a limit of retention money (5% of Contract Price) as stated in the Appendix to Tender (Annexure - B).

60.6 Payment of Retention Money

- (a) Upon the issue of the Taking-Over Certificate with respect to the whole of the Works or entering/signing of agreement between Employer (AIIMS) and contractor for PART-B of the work, whichever is later, one half of the Retention Money, or upon the issue of a Taking-Over Certificate with respect to a Section or part of the Permanent Works only such proportion thereof as the Engineer determines having regard to the relative value of such Section or part of the Permanent Works, shall be certified by the Engineer for payment to the Contractor.
- (b) upon the expiration of the Defects Liability Period for the Works the other half of the Retention Money shall be certified by the Engineer for payment to the Contractor. Provided that, in the event of different Defects Liability Periods having become applicable to different Sections or parts of the Permanent Works pursuant to Clause 48.1 to 48.4, the expression "expiration of the Defects Liability period" shall, for the purposes of this Sub-Clause, be deemed to mean the expiration of the latest of such periods. Provided also that if at such time, there shall remain to be executed by the Contractor any work ordered, pursuant to Clauses 49.1 to 49.4. and 50.1, in respect of the Works, the Engineer shall be entitled to withhold certification until completion of such work of so much of the

balance of the Retention Money as shall, in the opinion of the Engineer, represent the cost of the work remaining to be executed.

60.7 Advance Payment

- (a) Deleted
- (b) Deleted
- (c) Deleted

60.8 Time of Payment

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other term of the Contract, shall, subject to Clause 47.1 to 47.2, be paid by the Employer to the Contractor within 30 days after the Contractor's monthly statement has been submitted to the Engineer for certification or, in the case of the Final Certificate pursuant to Sub-Clause 60.13, within 120 days after the agreed Final Statement and written discharge have been submitted to the Engineer for certification.

60.9 Correction of Certificates

The Engineer may by any Interim Payment Certificate make any correction or modification in any previous Interim payment Certificate which has been issued by him, and shall have authority, if any work is not being carried out to his satisfaction, to omit or reduce the value of such work in any Interim Payment Certificate.

60.10 Statement of Completion

Not later than 84 days after the issue of the Taking-Over Certificate in respect of the whole of the Works, the Contractor shall submit to the Engineer a Statement of Completion with supporting documents showing in detail, in the form approved by the Engineer.

- (a) the final value of all work done in accordance with the Contract up to the date stated in such Taking-Over Certificate;
- (b) any further sums which the Contractor considers to be due; and
- (c) an estimate of amounts which the Contractor considers will become due to him under the Contract.

Estimated amounts shall be shown separately in such Statement at Completion. The Engineer shall certify payment in accordance with Sub-Clause 60.2 as if the statement of completion were a statement submitted by the contractor under clause 60.1.

60.11 Final Statement

Not later than 56 days after the issue of the Defects Liability Certificate pursuant to Sub-Clause 62.1, the Contractor shall submit to the Engineer for consideration a draft final statement with supporting documents showing in detail, in the form approved by the Engineer.

- (a) the value of all work done in accordance with the Contract; and
- (b) any further sums which the Contractor considers to be due to him under the Contract.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed (for the purposes of these Conditions referred to as the "Final Statement").

If, following discussions between the Engineer and the Contractor and any changes to the draft final statement which may be agreed between them, it becomes evident that a dispute exists, the engineer shall issue an Interim Payment Certificate for those parts of the draft final statement which are not in dispute. The dispute shall then be settled in accordance with Clause 67.1 to 67.4. The Final Statement shall be agreed upon settlement of the dispute.

60.12 Discharge

Upon submission of the Final Statement, the Contractor shall give to the Employer, with a copy to the Engineer, a written discharge confirming that the total of the Final Statement represents full and final settlement of all monies due to the Contractor arising out of or in respect of the contract. Provided that such discharge shall become effective only after payment due under the Final Certificate issued pursuant to Sub-Clause 60.13 has been made and the performance security referred to in Sub- Clause 10.1 has been returned to the Contractor.

60.13 Final Certificate

Within 28 days after receipt of the Final Statement, and the written discharge, the Engineer shall issue to the employer (with a copy to the Contractor) a Final Certificate stating:

- (a) the amount which, in the opinion of the Engineer, is finally due under the Contract, and
- (b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled under the Contract, other than Clause 47.1 to 47.2, the balance, if any, due from the

Employer to the Contractor or from the Contractor to the Employer as the case may be.

60.14 Cessation of Employer's Liability

The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or execution of the Works, unless the Contractor shall have included a claim in respect thereof in his Final Statement and (except in respect of matters of things arising after the issue of the Taking-Over Certificate in respect of the whole of the Works) in the Statement at Completion referred to in Sub- Clause 60.10.

61.1 Defects Liability Certificate

The Contract shall not be considered as completed until a Defects Liability Certificate shall have been signed by the Engineer and delivered to the Employer, with a copy to the Contractor, stating the date on which the Contractor shall have completed his obligations to execute and complete Works and remedy any defects therein to the Engineer's satisfaction. The Defects Liability Certificate shall be given by the Engineer within 28 days after the expiration of the Defects Liability Period, or, if different defects liability periods shall become applicable to different sections or part of the Permanent Works, the expiration of the latest such period, or as soon thereafter as any works instructed, pursuant to Clause 49.1 to 49.4 and 50.1, have been completed to the satisfaction of the Engineer. Provided that the issue of the Defects Liability Certificate shall not be condition precedent to payment to the Contractor of the second portion of the Retention Money in accordance with the conditions set out in Sub-Clause 60.3.

62.1 Unfulfilled Obligations

Notwithstanding the issue of the Defects Liability Certificate the Contractor and the Employer shall remain liable for the fulfilment of any obligation incurred under the provisions of the Contract prior to the issue of the Defects Liability Certificate which remains unperformed at the time such Defects Liability Certificate is issued and, for the purpose of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force between the parties to the Contract.

REMEDIES

63.1 Default of Contractor

If the Contractor is deemed by law unable to pay his debts as they fall due, or enters in to voluntary or involuntary bankrupt, liquidation or dissolution (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), or become insolvent, or makes an arrangement with, or assignment in favour of, his creditors or agrees to carry out the Contract under a committee of inspection

of his creditors, or if a receiver, administrator, trustee or liquidator is appointed over any substantial part of his assets, or if, under any law or regulation relating to reorganisation, arrangement or readjustment of debts proceedings are, commenced against the Contractor or resolution passed in connection with dissolution or liquidation or, if any, step are taken to enforce any security interest over a substantial part of the assets of the Contractor, or if, any act is done or event occurs with respect to the Contractor or his assets which under any applicable law has a substantially similar effect to any of the foregoing acts or events, or if the Contractor has contravened Sub-Clause 3.1, or has an execution levied on his goods, or if the Engineer certifies to the Employer, with a copy to the Contractor, that, in his opinion the contractor

- (a) has repudiated the Contract, or
- (b) without reasonable excuse has failed
 - (i) to commence the work in accordance with Sub-Clause 41.1, or
 - (ii) to proceed with the Works, or any section thereof, within 28 days after receiving notice to pursuant to Sub-Clause 46.1, or
- (c) has failed to comply with a notice issued pursuant to Sub-Clause 37.4, or an instruction issued pursuant to Sub-Clause 39.1 within 28 days after receiving it, or
- (d) despite previous warning from the Engineer, in writing, is otherwise persistently or flagrantly neglecting to comply with any of the obligation under the Contract, or
- (e) has contravened Sub-clause 4.1 :

then for the avoidance of doubt the contractor shall be in default of its obligations under this contract and furthermore the Employer may, after giving fourteen days' notice to the Contractor, enter upon the Site and expel the Contractor there from without thereby voiding the Contract, or releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and powers conferred on the employer or the Engineer by the Contract, and may himself complete the Works or may employ any other contractor to complete the Works. The Engineer shall certify such completion so as to give effect to clauses 49.1(a) and 63.3. The Employer or such other contractor may use for such completion so much of the Contractor's Equipment, Plant, Temporary Works and materials which have been deemed to be reserved exclusively for the execution of the Works, under provisions of the Contract, as he or they may think proper, and the Employer may, at any time, sell any of the said Contractor's Equipment, Temporary Works and unused Plant and materials and apply the proceeds of sale in or towards the satisfaction of any sums due or which may become due to him from the Contractor under the Contract.

63.2 Valuation at Date of Expulsion

The Engineer, as soon as may be practicable after any such entry and expulsion by the Employer, shall fix and determine ex parte, or by or after reference to the parties or after such investigation or enquiries as he may think fit to make or institute, and shall certify :

- (a) what amount (if any) had, at the time of such entry and expulsion, been reasonably earned by or would reasonably accrue to the Contractor in respect of work then actually done by him under the Contract, and
- (b) the value of any of the said unused or partially used materials, any Contractor's Equipment and any Temporary Works.

63.3 Payments after Expulsion

If the Employer shall enter upon the site and expel the Contractor therefrom under Clause 63.1, he shall not be liable to pay to the Contractor any further amount (including damages) in respect of the Contract until the expiration of the Defects Liability Period and thereafter until the costs of execution completion and remedying of any defects, damages for delay in completion (if any) and all other expenses incurred by the Engineer have been ascertained and the amount thereof certified by the Engineer. The Contractor shall then be entitled to receive only such sum (if any) as the Engineer may certify would have been payable to him upon due completion by him after deducting the said amount. If such amount exceeds the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Employer the amount of such excess and it shall be deemed a debt due by the Contractor to the Employer and shall be recoverable accordingly.

63.4 Assignment of Benefit of Agreement

Unless prohibited by law, the Contractor shall, if so instructed by the Engineer within 14 days of such entry and expulsion referred to in Sub-Clause 63.1, assign to the Employer the benefit of any agreement for the supply of any goods or materials or services and/or for the execution of any work for the purpose of the Contract, which the Contractor may have entered into.

64.1 Urgent Remedial Works

If, by reason of any accident, or failure, or other event occurring to or in connection with the Works, or any part thereof, either during the execution of the Works, or during the Defects Liability Period, any remedial or other work is, in the opinion of the Engineer, urgently necessary for the safety or progress of the Works and the Contractor is unable or unwilling at once to do such work, the Employer shall be entitled to employ and pay other person to carry out such work

as the Engineer may consider necessary. If the work or repair so done by the Employer is work which, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the contract, then all costs consequent thereon or incidental thereto shall after due consultation with the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Engineer, and may be deducted by the employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly. Provided that the Engineer shall, as soon after the occurrence of any such emergency as may be reasonably practicable notify the Contractor thereof.

SPECIAL RISKS

65.1 No Liability for Special Risks

The Contractor shall be under no liability whatsoever in consequence of any of the special risks referred to in Sub-Clause 65.2 whether by way of indemnity or otherwise, for or in respect of :

- (a) destruction of or damage to the "Works", save to work condemned under the provisions of Clause 39.1 to 39.2 prior to the occurrence of any of the said special risks, or
- (b) destruction of or damage to property, whether of the employer or third parties, or
- (c) injury or loss of life.

65.2 Special Risks

The special risks are :

- (a) the risks defined under paragraphs (a) sub-para (i), (ii), (iii) and (iv) of Sub-Clause 20.4.

65.3 Damage to Works by Special Risks

If the Works or any materials or Plant on or near or in transit to the Site, or any of the Contractor's Equipment, sustain destruction or damage by reason of any of the said special risks, the Contractor shall be entitled to payment in accordance with the Contract for any Permanent Works duly executed and for any materials or Plant so destroyed or damaged and, so far as may be required by the Engineer or as may be necessary for the completion of the Works, to payment for;

- (a) rectifying any such destruction or damage to the Works, and
- (b) replacing or rectifying such materials or contractor's Equipment and the

Engineer shall determine an addition to the Contract Price in accordance with Clause 52.1 to 52.4 (which shall be the case of the cost of replacement of Contractor's Equipment include the fair market value thereof as determined by the Engineer) and shall notify the Contractor accordingly, with a copy to the Employer.

65.4 Projectile, Missile

Destruction, damage, injury or loss of life caused by the explosion or impact, whenever and wherever occurring, or any mine, bomb, shell, grenade, or other projectile, missile, munition, or explosive of war, shall be deemed to be a consequence of the said special risks.

65.5 Increased Costs arising from Special Risks

Save to the extent that the Contractor is entitled to payment under any other provision of the Contract, the Employer shall repay to the Contractor any costs of the execution of the Works (other than such as may be attributable to the cost of reconstructing work condemned under the provisions of Clause 39.1 to 39.2 prior to the occurrence of any special risk) which are howsoever attributable to or consequent on or the result of or in any way whatsoever connected with the said special risks, subject however to the provisions in this Clause hereinafter contained in regard to outbreak of war, but the Contractor shall, as soon as any such cost comes to his knowledge, forthwith notify the Engineer thereof. The Engineer shall, after due consultation with the Contractor, determine the amount of the contractor's costs in respect thereof which shall be added to the Contract Price and shall notify the Contractor accordingly.

65.6 Outbreak of War

If, during the currency of the Contract, there is an outbreak of war, whether war is declared or not, in any part of the world which, whether financially or otherwise, materially affects the execution of the Works, the Contractor shall, unless and until the Contract is terminated under the provisions of this Clause, continue to use his best endeavours to complete the execution of the Works. Provided that the employer shall be entitled, at any time after such outbreak of war, to terminate the Contract by giving notice to the Contractor and, upon such notice being given, the Contract shall, except as to the rights of the parties under this Clause and to the operation of Clause 67.1 to 67.4, terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof

65.7 Removal of Contractor's Equipment on Termination

If the Contract is terminated under the provision of Sub-Clause 65.6, the Contractor shall with all reasonable dispatch, remove from the Site all Contractor's Equipment and shall give similar facilities to his Subcontractors to do so.

65.8 Payment if Contract Terminated

If the Contract is terminated as aforesaid, the Contractor shall be paid by the Employer insofar as such amounts or items have not already been covered by payments account made to the Contractor, for all work executed prior to the date of termination at the rates and prices provided in the contract and in addition:

- a) The amounts payable in respect of any preliminary items referred to in the Bill of Quantities, so far as the Work or service comprised therein has been partially carried out or performed.
- b) The cost of materials, plant or goods reasonably ordered for the Works which have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery, such materials, Plant or goods becoming the property of the Employer upon such payments being made by him.
- c) A sum being the amount of any expenditure reasonably incurred by the Contractor in the expectation of completing the whole of the Works insofar as such expenditure has not been covered by any other payments referred to in this Sub-Clause.
- d) Any additional sum payable under the provisions of Sub-Clauses 65.3 and 65.5.
- e) Such proportion of the cost as may be reasonable, taking into account payments made or to be made, for work executed, or removal of contractor's equipment under Sub- Clause 65.7 and, if required by the Contractor, return thereof to the Contract's main plant yard in his country of registration or to other destination, at no grater cost.
- f) The reasonable cost of repatriation of all the Contractor's staff and workmen employed on or in connection with the Works at the time of such termination.

Provided that against any payment due from the Employer under this Sub-Clause, the Employer shall be entitled to be credited with any outstanding balances due from the Contractor for advances in respect of Contractor's Equipment, materials and Plant and any other sums which, at the date of termination, were recoverable by the employer from the Contractor under the terms of the Contract. Any sums payable under this Sub- Clause shall, after due consultation with the Employer and the Contractor, be determined by the Engineer who shall notify the Contractor accordingly.

RELEASE FROM PERFORMANCE

66.1 Payment in Event of Release from Performance

If any circumstance outside the control of both parties arises after the issue of the Letter of Acceptance which renders it impossible or unlawful for either party to fulfil his contractual obligations, or under the law governing the Contract the parties are released from further performance, then the sum payable by the employer to the Contractor in respect of the work executed shall be the same as that which would have been payable under Clause 65.8 if the Contract had been terminated under the provisions of Clause 65.6.

SETTLEMENT OF DISPUTES

67.1 Engineer's Decision

If a dispute of any kind whatsoever arise between the Employer and the Contractor in connection with , or arising out of, the Contract or the execution of the Works, whether during the execution of the Works or after their completion and whether before or after repudiation or other termination of the Contract, including any dispute as to any opinion, instruction, determination, certificate or valuation of the engineer, the matter in dispute shall, in the first place, be referred in writing to the Engineer, with a copy to the other party. Such reference shall state that it is made pursuant to this Clause. Not later than the eighty-fourth day after the day on which he received such reference the Engineer shall give notice of his decision to the Employer and the Contractor. Such decision shall state that it is made pursuant to this Clause.

Unless the Contract has already been repudiated or terminated, the Contractor shall, in every case, continue to proceed with the Work with all due diligence and the Contractor and the Employer shall give effect forthwith to every such decision of the Engineer unless and until the same shall be revised, as hereinafter provided in an amicable settlement or an arbitral award.

If either the Employer or the Contractor be dissatisfied with any decision of the Engineer, or if the Engineer fails to give notice of his decision on or before the eighty fourth day after the day on which he received the reference, then either the Employer or the Contractor may, on or before the seventieth day after the day on which he received notice of such decision, or on or before the seventieth day after the day on which the said period of 84 days expired, as the case may be give notice to the other party, with a copy for information to the Engineer of his intention to commence arbitration as hereinafter provided, as to the matter in dispute. Such notice shall establish the entitlement of the party giving the same to commence arbitration, as hereinafter provided, as to such dispute and, subject to Sub-Clause 67.4, no arbitration in respect thereof may be commenced unless such notice is given.

If the Engineer has given notice of his decision as to a matter in dispute to the Employer and the Contractor and no notice of intention to commence arbitration as to such dispute has been given by either the Employer or the Contractor on or before the seventieth day after the day on which the parties received notice as to such decision from the Engineer, the said decision shall become final and binding upon the Employer and the Contractor.

67.2 Conciliation

Where notice of intention to commence arbitration as to dispute has been given in accordance with Sub Clause 67.1, arbitration of such dispute shall not be commenced unless, the parties have explored the possibility of conciliation as per the provisions of Part-III of the Arbitration and Conciliation Act, 1996. When such conciliation has failed, the parties shall adopt the following procedure for arbitration :-

67.3 Arbitration

67.3.1 Any dispute and differences relating to the meaning of the specifications, designs, drawings and instructions herein before mentioned and as to the quality of workmanship or materials used in the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instructions, or these conditions or otherwise concerning the works or the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof in respect of which :-

- a) the decision, if any, of the Engineer has not become final and binding pursuant to Sub Clause 67.1 and
- b) Conciliation has not been reached as per the provisions of Clause 67.2

Shall be referred to the Sole Arbitration of a person appointed by the Chairman and Managing Director (CMD) of HSCC (I) Ltd. from the panel of Arbitrators approved by All India Institute of Medical Sciences, Ansari Nagar, New Delhi. Such Arbitrator shall be appointed within 30 days of the receipt of letter of invocation of Arbitration duly satisfying the requirements of this clause.

67.3.2 If the Arbitrator so appointed resigns his appointment, is unable or unwilling to act due to any reason whatsoever, or dies, the Chairman and Managing Director aforesaid or in his absence the person discharging the duties of CMD of HSCC (I) Ltd. may appoint a new Arbitrator in accordance with these terms and conditions of the contract, to act in his place and the new Arbitrator so appointed may proceed from the stage at which it was left by his predecessor.

67.3.3 It is a term of the contract that the party invoking the Arbitration shall specify the dispute/differences or questions to be referred to the arbitrator under this clause together with the amounts claimed in respect of each dispute.

- 67.3.4** The Arbitrator may proceed with the Arbitration ex-parte, if either party , in spite of a notice from the Arbitrator, fails to take part in the proceedings.
- 67.3.5** The work under the contract shall continue, if required, during the Arbitration proceedings.
- 67.3.6** The Arbitrator shall make speaking Award and give reasons for his decision in respect of each dispute/claim alongwith the sums awarded separately on each individual item of dispute or difference or claims. The Arbitrator shall make separate award on each reference made to him.
- 67.3.7** The award of the Arbitrator shall be final, conclusive and binding on both the parties.
- 67.3.8** Subject to the aforesaid, the provisions of the Arbitration & Conciliation Act, 1996 or any statutory modifications or re-enactment thereof and the Rules made thereunder and for the time being in force shall apply to the Arbitration proceedings and Arbitrator shall publish his Award accordingly.

67.4 Failure to Comply With Engineer's Decision

Where neither the Employer nor the contractor has given notice of intention to commence arbitration of a dispute within the period stated in Sub-Clause 67.1 and the related decision has become final and binding either party may, if the other party fails to comply with such decision, and without prejudice to any other rights it may have, refer the failure to arbitration in accordance with sub-Clause 67.3 as if the conditions specified in clauses 67.3(a) and (b) had been satisfied with respect to such dispute. The provisions of Sub-Clause 67.1 shall not apply to any such reference.

NOTICES

68.1 Notice to Contractor

All certificates, notices or instructions to be given to the Contractor by the Employer or the Engineer under the terms of the Contract shall be sent by post, cable, telex or facsimile transmission to or left at the Contractor's principal place of business or such other address as the Contractor shall nominate for the purpose.

68.2 Notice to Employer and Engineer

Any notice to be given to the Employer or to the Engineer under the terms of the Contract shall be sent by post, cable telex or facsimile transmission to or left at the respective addresses nominated for the purpose in part II of these Conditions.

68.3 Change of Address

Either party may change a nominated address to another address in the Country

where the Works are being executed by prior notice to the other party, with a copy to the Engineer, and the Engineer may do so by prior notice to both parties.

DEFAULT OF EMPLOYER

69.1 Default of Employer

In the event of the Employer:

- a) becoming bankrupt or being a company, going into liquidation, other than for the purpose of a scheme of reconstruction or amalgamation, or
- b) giving notice to the Contractor that for unforeseen reasons, due to economic dislocation, it is impossible for him to continue to meet his contractual obligations, or
- c) if the contractor becomes entitled under Sub-Clause 40.3 to terminate his employment under the contract in accordance with the provisions of this Sub-Clause,

the Contractor shall be entitled to terminate his employment under the contract by giving notice to the Employer, with a copy to the Engineer. Such termination shall take effect 14 days after the giving of the notice.

69.2 Removal of Contractor's Equipment

Upon the expiry of the 14 days notice referred to in Sub-Clause 69.1 the Contractor shall notwithstanding the provisions of Sub- Clause 54.1, with all reasonable despatch, remove from the site all contractor's equipment brought by him thereon.

69.3 Payment on Termination

In the event of such termination the employer shall be under the same obligations to the contractor in regard to payment as if the contract has been terminated under the provisions of clause 65.6, but, in addition to the payments specified in Sub-Clause 65.8 the Employer shall pay to the Contractor the amount of any loss or damage to the Contractor arising out of or in connection with or by consequence of such termination.

69.4 Contractor's Entitlement to suspend Works

Without prejudice to the Contractor's entitlement to interest under Sub-Clause 60.8 and to terminate under Sub-Clause 69.1, the Contractor may, if the Employer fails to pay the Contractor the amount due under any certificate of the

Engineer within 28 days after the expiry of the time stated in Sub- Clause 60.8 within which payment is to be made, subject to any deduction that the Employer is entitled to make under the Contract, after giving 28 days' prior notice to the Employer, with a copy to the Engineer, suspend work or reduce the rate of work.

If the contractor suspends work or reduces the rate of work in accordance with the provisions of this Sub- Clause and thereby suffers delay or incurs cost the Engineer shall after due consultation with the Contractor, determine

- a) any extension of time to which the contractor is entitled under clause 44.1 to 44.3, and
- b) the amount of such costs, which shall be added to the contract price.

And shall notify the Contractor accordingly.

CHANGES IN COST AND LEGISLATION

70.1 Increase or Decrease of Cost

It shall be added to or deducted from the Contract price such sums in respect of rise or fall in the cost of labour and/ or materials or any other matters affecting the cost of the execution of the works as may be determined in accordance with part II of these conditions.

70.2 Subsequent Legislation

If, after the date 28 days prior to the latest date for submission of tenders for the Contract there occur in the country in which the works are being or are to be executed changes to any National or State Statute Ordinance Decree or other Law or any regulation or bye-law of any local or other duly constituted authority, or the introduction of any such State Statute, Ordinance, Decree, Law, regulation or bye-law which causes additional or reduced cost to the contractor other than under sub-clause 70.1 in the execution of the Contract, such additional or reduced cost shall after due consultation with the employer and the Contractor be determined by the Engineer and shall be added to or deducted from the contract price and the engineer shall notify the Contractor accordingly.

70.3 Other Changes in Cost

To the extent that full compensation for any rise or fall in costs to the Contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates and prices included in the Contract shall be deemed to include amounts to cover the contingency of such other rise or fall of costs.

71.1 Engineer's Authority to Correct Errors

The Engineer shall at the request of either or both parties, or at his own initiative, subject to the provisions of this subclause and with retrospective effect from the date of this Contract have authority to make a determination correcting any manifest error (including for the avoidance of doubt and without prejudice to the generality of the Engineer's authority in this regard any error of spelling, grammar or punctuation and any omission, inclusion or misplacement of text) in any provision of this Contract Provided always that:

- (a) The Engineer before making such determination shall by notice to the Employer and the Contractor provide them with a draft thereof and give them a reasonable time in which to comment on the draft.
- (b) The Engineer shall in making such determination take into consideration the presumed intentions of the parties, the wording of any provision of the Conditions of Contract for use in connection with Works of Civil Engineering Construction Fifth Edition (June 1973) (Revised January 1979) ("the ICE Conditions of Contract") or of any other standard form of contract upon which the provision to be corrected has been based, and any comments received by the Employer and/or the Contractor on the draft determination provided to them under subclause (a) of this clause.
- (c) The Engineer shall provide the Employer and the Contractor with a copy of the determination made by him and
- (d) Clause 67.1 to 67.4 shall for the avoidance of doubt apply to any dispute between the Employer and the Contractor in connection with or arising out of the Engineer's determination.

ANNEXURE - A

**PROFORMA
OF
INDENTURE FOR SECURED ADVANCE OR CREDIT**

THIS INDENTURE made this day of _____ between M/s. _____ (hereinafter called the Contractor) which expression shall where the Context as admits or implies be deemed to include his executors/ administrators and assigns of the one part and AIIMS, **New Delhi** (hereinafter called the Employer/Engineer) which expression shall where the context so admits or implies be deemed to include its successors and assigns of the other part.

Whereas by an agreement dated _____ (hereinafter called the said agreement) the Contractor has agreed to construct _____ (the works or the said works).

And whereas the Contractor has applied to the Engineer that he may be or be given credited for materials brought by him to the site of the works subject to the said agreement for use in construction of the works.

NOW THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rs. _____ paid to the Contractor by The Engineer. The receipt where the Contractor hereby acknowledges and of such advance or credited (if any) as may be made to him as aforesaid the Contractor hereby covenants and agrees with The Engineer and declares as follows :-

1. That all sums given as advance or credit by The Engineer to the Contractor as aforesaid shall be employed by the Contractor in or towards the execution of the said works and for no other purpose whatsoever.
2. That the materials for which the advance or credit is given are offered to and accepted by The Engineer as security and are absolutely the Contractor's own property and free from encumbrances of any kind and the Contractor will not make any application for or receive further advance or credit on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor shall indemnify The Engineer against any claims to any materials in respect of which advance or credit has been made to him as aforesaid.
3. That the said materials and all other materials on the security of which any further advance or advances or credit may be given as aforesaid

(hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of The Engineer and in terms of said agreement.

4. That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper safe custody and protection against all risks of the said materials and that until used in the construction as aforesaid the materials shall remain at the site of the said works in Contractor's custody and on his own responsibility and shall at all times be open to inspection by The Engineer. In the event of the materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in greater degree than in due to reasonable use and wear thereof the Contractor will replace the same with other materials of like quality or repair and make good the same as required by The Engineer.
5. That the said materials shall not on any account be removed from the site of the work except with the written permission of The Engineer.
6. That the advance shall be repayable in full when or before Contractor receives payments from The Engineer of the price payable to him for the said works under the terms and provisions of the said agreements. Provided that if any intermediate payments are made to the Contractor on account of work done then on the occasion of each payment The Engineer will be at liberty to make a recovery from the Contractor's bill for such payments by deducting there from the value of the said materials than actually used in the contraction and in respect of which recovery has not been made previously. The value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advance as made under these presents were calculated.
7. That if the Contractor shall at any time make any default in the performance of observance in respect of any of the terms and provisions of the said agreement or of those provisions the total amount of the advance or advances that may still be owing to The Engineer, shall immediately on the happening of such default be repayable by the Contractor to The Engineer together with interest thereon at 12% per annum from the date or respective dates of such advance or advances to the date of payment and with all costs. Damages and expenses incurred by The Engineer in or for the recovery hereof or the enforcement of the security or otherwise by reasons of default of the Contractor and the Contractor hereby covenants and agrees with The Engineer repay and pay the same respective to him accordingly.

8. That the Contractor hereby charges all the said materials with the repayment to The Engineer of all sums advances or credit as aforesaid and all costs. Charges, damages and expenses payable under these presents PROVIDED ALWAYS it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and whenever the covenant for payment and repayment herein before contained shall become enforceable and the money owing shall not be paid in accordance therewith. The Engineer may at any time thereafter adopt all or any of the following courses as he may deem best :
 - a. Seize and utilise the said materials or any part thereof in the completion of the said works in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion and the amount due in respect of advance or credit under these presents and crediting the Contractor with the value of work done as if he has carried it out in accordance with the said agreement and the rates thereby provided if the balance is against the Contractor is to pay the same to The Engineer on demand.
 - b. Remove and sell by public auction the seized materials or any part thereof and out of the money arising from the sale repay The Engineer under these presents and pay over the surplus (if any) to the Contractor.
 - c. Deduct all or any part of the moneys owing from any sums due to the Contractor under said agreement.
9. Except in the event of such default on the part of Contractor as aforesaid, interest or the said advance shall not be payable.
10. That in the event of conflict between the provisions of these presents and the said agreements, the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents, the settlement of which has not been hereinbefore expressly provided for the same shall so far as is lawful be referred to Chairman-cum-Managing Director, HSCC (India) Ltd. or to such person as he may appoint whose decision shall be final and the provisions of the Indian Arbitration Act for the time being in force shall apply to such reference.

IN WITNESS whereof the said The Engineer and the Contractor hereunto set their respective hands and seals the day and year first above written.

Signed sealed and delivered by

Contractor

The Engineer

DETAILED SPECIFICATIONS

SYSTEM DESIGN DATA

1.0 GENERAL

The system design, basis of design, estimated requirements and other relevant data are outlined in this section.

2.0 LOCATION

The proposed Hostel-1, Hostel-2, Hostel-3 , Masjid Mod, AIIMS, New Delhi.

3.0 SCOPE OF WORK

3.1 The work proposed under this tender includes supply, installation, testing & commissioning of independent ventilation systems for the proposed Hostel-1, Hostel-2, Hostel-3 as detailed in the technical specifications and schedule of prices.

4.0 BASIS OF DESIGN

4.1 Codes and Standards

The design shall be done taking into account the following latest revisions applicable to the region in which the project is located.

- ASHRAE
- ISHRAE
- Local by-laws.
- Indian Standard Specifications / codes.
- National Building Code 2005.
- Manufacturers Instructions and guidelines.

4.2 Design Considerations :

- All the equipments etc. shall be suitable for 415 V, three phases or 220 V, Single phase, 50 Hz A.C. supply.
- All HVAC equipments and systems will comply with the mandatory provisions and prescriptive criteria of ECBC, 2007.
- Natural ventilation will comply with the design guidelines provided for natural ventilation in the National Building Code of India 2005.
- All HVAC system will be balanced in accordance with provision of ECBC, 2007.

4.3 Assumptions:

Following assumptions have been made for design calculation:

Ventilation:

Basement : 12 ACPH, during normal condition.
30 ACPH, during fire.

4.4 Electric Power Supply 415V/3ph/50Hz/AC

4.5 Fire Safety:

The ventilation system shall be electrically interlocked with the central fire alarm system of the building such that in case of detection of fire the complete ventilation system will become operational.

- * All the materials used for ducting and insulation shall be fire retardant type.
- * Operation under fire conditions: - Fans will be configured to operate in the following manner under fire conditions:
- * Supply and exhaust fan shall remain on.
- * Smoke extract fan on

5.0 Items to be provided by other Agencies to AC contractor:

- 5.1 Civil works such as trenches for piping, cables and making foundations of equipments.
- 5.2 Construction of blower rooms etc.
- 5.3 Main 3 ph, 415 v, 50 hz, A.C. supply power supply upto main Electrical Distribution Panels in basement-1 blower rooms.
- 5.4 Any kind of false ceiling, boxing etc.
- 5.5 Making frames for fixing grilles & diffusers in false ceiling, boxing or in walls.

6.0 Drawings:

The drawings forming part of these specifications provide a feasible scheme for locating the equipment. The contractor may re-arrange the equipment for improving the layout and meeting the site conditions. All such changes shall however be subject to the architect's approval. These drawings are not meant to be working drawings which shall be prepared by the contractor or as required.

7.0 Test Data:

The complete HVAC system shall be tested as per the specifications given elsewhere and complete test data shall be furnished on prescribed data sheets:

8.0 Technical Data:

The contractor shall furnish complete technical data, on the equipment offered as required under the heading 'Technical data'. In this specification every effort has been taken to put forth only general specifications of various equipments/material. If inadvertently, any of the specification drawn happens to match with the specifications of any one particular firm's product only, in respect of critical parameters, than it will not automatically mean that this particular firm's offer is only technically suitable. In general, the specifications offered by other firms will be assessed in their own entirety to ascertain whether or not the broad functions in general expected of the requirements are available with reasonable tolerance on the desired requirements of the client and accordingly the offers would be considered based on prudent assessment and sole discretion of the Engineer.

9.0 Performance Guarantee:

9.1 The contractor shall guarantee that the capacity of various components as well as the whole system shall not be less than specified.

9.2 The contractor shall ensure that the system shall be free of vibrations and disturbing sounds.

10.0 Foreign Exchange

The contractor shall make his own arrangements to procure the necessary, specified equipments, controls for which no foreign exchange shall be made available.

VENTILATION FANS

1.0 Codes and Standards:-

The design, materials, construction, manufacture, inspection, testing and field performance of the centrifugal fans shall comply with all currently applicable international / national codes / safety regulations. In particular the equipment shall conform to latest editions of all applicable codes and standards listed below.

AMCA-201 - Fans and systems - Application guide

AMCA-203 - Field performance measurement of fan systems

AMCA-210 -Laboratory Methods of testing Fans for Aerodynamic performance rating.

AMCA-2404 - Drive arrangements for centrifugal fans

BS:848, Part-1 - Fans for general purposes - Methods of testing performance

BS:4675, Part-1/ ISO-2372 - Mechanical vibrations in rotating and reciprocating machinery

2.0 Centrifugal Fans:-

2.1 Design Requirements:-

The design parameters for the centrifugal fans shall be as specified in Data Sheet-A (Filled up Data Sheets is enclosed in the Tender package). In the event of conflict between the requirements of this specification and Data Sheet or drawing, the later shall govern

2.2 Design and Constructional Features:-

a. General

a.i Centrifugal fans shall be DIDW / SISW in simply supported arrangement (i.e. Bearings on both the sides) construction complete with access door, squirrel cage induction motor, outlet damper, base frame, canvass connection, V belt drive set, belt guard, foundation bolts, nuts, slide rail and vibration isolators. Direction of discharge / rotation and motor position shall be as per the Good for construction shop drawings. All centrifugal ventilation fans shall be AMCA (Air Movement and Control Associates Incorporation of USA) certified for air & noise performance. Critical speed of the fan shall be minimum 125 % higher than the operating speed. Centrifugal Exhaust fans / motor and other accessories for toilet exhaust system shall be suitable for outdoor applications.

a.ii The Fans shall be AMCA Certified and performance certificate for the particular model of fans being supplied shall be submitted by Contractor.

b. Housing:-

b.i Housing shall be of welded construction, fabricated from carbon steel material with suitable reinforcement for rigidity. It shall be rigidly reinforced and supported by structural angles. Split casings shall be provided for large size fans, however neoprene packing shall be provided through split joints to make it airtight. Cut-off shall be designed

to give smooth and quiet airflow from the outlet. Fan housing shall be of welded construction and provided with flanges at outlet for duct connection. Thickness of casing shall be as per manufacturer's standard & factory practices but casing thickness shall not be less than 2.0 mm for side plate and 1.2 mm for back plates.

b.ii The distance between blade tips and cut-off shall be optimally fixed to reduce pressure pulsation. Inlet and outlet shall be flanged.

b.iii Housing shall be provided with standard clean out door with handles and neoprene gasket.

b.iv Inlet cone shall be spun to have deep smooth contour. Close tolerance shall be maintained between inlet edge and the impeller shroud. Inlet cone profile shall ensure a smooth flow of air to blades. Inlet screens shall be provided for open inlet fans. Inlet guards shall be of 18 gauge galvanized wire mesh with 5 mm sieves. Inlet guards shall allow access for lubrication as required.

c. Impeller (Rotor):-

c.i The impeller shall be backward curve or aerofoil sectioned blades of non – over loading type. The Impeller blades shall be welded to back plate/center and shroud all along the length. Shroud shall be spun to have a smooth contour. Shaft sleeves shall be furnished as required. The impeller, pulley, and shaft sleeves shall be positively secured to the shaft. The locking device shall be designed to take the full torque due to momentum of impeller when the shaft suddenly gets arrested while running at operating speed. Air passages shall be free of interference.

c.ii Maximum operating speed of the fans shall be selected to maintain the fan outlet velocity of 2000 FPM (10.15m/s) and Noise level shall not exceed 75 db(A) at 1 mt. Distance from the equipment. The impeller along with driven pulley shall be balanced statically and dynamically after assembly. Balancing shall conform to minimum G 6.3 grade (as per ISO-1940) or Superior grade.

d. Shaft:-

d.i Shaft shall be properly sized for single piece hollow or solid construction of hot rolled steel and it shall be turned, ground and polished. Fan shaft shall not pass through its first critical speed at rated speed.

d.ii Fan shaft shall be of EN8, SAE-1040, SAE-1035 or equivalent .

e. Bearings:-

Fans shall be equipped with amply sized taper roller or ball or spherical roller anti friction or self aligning pillow block type bearings with integral dust and grease seals. Bearings shall be charged with grease. The grease capacity of the bearings shall be such that the fans are suitable for continuous operation for at least 12 months before re-greasing is required. Bearings shall be selected for a life of 50,000 hours and same shall be as per IS-3824. Grease fittings shall be alemite 6mm button head type.

f. Drive Motor:-

The fan motor, suitable for the centrifugal fan drive shall be supplied by the contractor and the same shall be as per the specification. Motors shall be designed for continuous duty operation and shall have high efficiency. Drive motor shall have minimum 20 % margin over the fan limit load horse power. Motor shall be designed specially for quiet operation and motor speed shall not exceed 1440 rpm. The same shall be capable of accelerating to the rated rpm within safe stall time. The contractor shall submit the motor and fan torque characteristic curves along with other details for fan and motor in support of the selection. The fan and motor combination selected for particular required performance shall be of most efficient and shall be for quiet running characteristics and high efficiency. Fan motor selected shall be in such a way that sound level is lowest (max. 75 db) while running. The power and efficiency factor for all motors shall be submitted along with offer. Motor shall be capable of running continuously with a 5 % drop in rated phase to phase voltage at 15 % increase in design power. Motor of 0.75 KW and over shall be fitted with integral positive temperature coefficient thermistors selected to afford class 1 protection. Motors below 0.75 KW shall be fitted with inherent over heat protection. The Motors shall be TEFC type with IP-55 Protection & Class 'F' Insulation. Motors shall be designed for 415 V + 10% & 50 HZ + 3 %

g. Drives:-

Fans may be direct or belt driven. In case of belt driven fans, there shall be a minimum number of two belts per drive. All belt driven fans shall be equipped with fully enclosed belt guards with speed measurement openings and shall be easily removable. Belts shall be of oil resistant type. Belt guards shall not impede the airflow to the fan inlet. All belts shall be selected based on a service factor of 1.5 as applied to the drive motor kW rating. Should one belt fail the remaining belt(s) should be capable of carrying the full load. All belts shall be sized for 150% rated horsepower. The minimum number of belts to be provided will be as follows:

| BHP | NO. OF BELTS |
|-------------------|---------------------|
| BHP < 5 | 2 Nos. |
| BHP >= 5 But <=10 | 3 Nos. |
| BHP > 10 | 4 Nos. |

In case of direct drive, a hypoid gear coupling or flexible coupling of standard design shall be used. Pulleys shall be selected to provide the required speed. They shall be multi-groove type, with section and grooves selected to transmit 33% more load than the required power and shall be statically balanced. The belt guards shall be of M.S. sheet with angle iron reinforcements and 18 gauge expanded metal screen

2.3 Accessories:-

a. Common Base Frame:-

Mounting skid of structural steel shall be provided for supporting the fan & motor base frames. Mounting skid shall be bolted / welded with the embedded plates provided on the floor. Fans shall be fixed on mounting skid with vibrations isolators mounted in between.

b. Access Door and Drain Connection:-

Access door shall be provided for periodic inspection or cleaning. The door can be either toggle clamp fixed or as per manufacturer's standard design. Drain point with plugs or valves shall be provided if specified.

c. Outlet Damper:-

Fan shall be provided with a damper at outlet. Dampers at outlet of centrifugal fan shall be manually operated multi-louvered type with neoprene edging on blades for tight shut off. Each blade shall be provided with bronze/gun metal bearing at each end of spindle. Operating lever along with the necessary linkage shall be provided at an accessible position for operating the dampers. Suitable fixing device for locking the damper at desired position should be provided.

d. Flexible Connection:-

Flexible connections shall be provided on the suction / discharge ends of the fan as specified. The flexible connection shall be of heavy gauge double canvas / Neoprene impregnated glass fiber of length not less than 150mm.

e. Nuts & Bolts:-

All bolts, nuts & locknuts shall conform to IS: 1367. Self-tapping screws shall not be used.

2.4 NOISE & VIBRATION:-

a. The vibrations measured at bearings in both radial and axial direction shall not exceed the specified range in the "Good to very Good region" of General machinery vibration chart of VDI-2056. The vendor shall furnish along with their offer the overall fan sound power level for each fan and motor operating at the duty conditions.

b. Vibration isolators of proven design for specified isolation efficiency shall be provided. Double deflection rubber in U shear or Cushy foot vibration isolator or Spring type isolators shall be provided for each fan. Rubber bushes, washers, wherever needed for the vibration isolators shall be included in the supply. Sufficient number of such isolators shall be provided to ensure isolation of foundation from vibration of the equipment. At the commissioning stage the vibration amplitudes shall be measured to ensure that the vibrations are within the permissible limit of 30 microns. Generally fans / motors shall be selected to run at very minimum vibration level in accordance with the standards and the fans which are to be mounted on the terrace floor should be selected in such a way that it will not transmit any vibration and sound to the office floors below.

2.5 Painting:-

Fans shall be painted on exterior and interior with two coats of red – oxide zinc chrome primer conforming to IS: 2074 or superior, over which 2 coats of synthetic enamel of approved shade shall be applied on all surfaces. Centrifugal fans / accessories which are to be installed on the terrace floor shall be suitably painted on exterior and interior surface

to avoid corrosion. If these fans are to be installed on the terrace floor in the open ambient temperature / climate. Hence these fans / accessories are to be specially treated to take care of the adverse weather condition.

2.6 Accessories

All necessary accessories shall be provided for proper operation and shall also include **(As part of Unit Price)**.

- a. Dunlop cushy foot vibration isolators for the blowers.
- b. Double canvass connections at the outlet of each fan.
- c. Nuts, bolts, shims etc. as required for the grouting of the equipment.
- d. Slide rails for mounting the motor and belt adjustments.
- e. 18 gauge galvanized wire mesh bird screens in the Inlet.
- f. Outlet damper.

3.0 Axial Flow Fan:-

a. Impeller:

The impeller shall be of die cast aluminium alloy with integrally cast aerofoil sectioned blades and hub. Impeller shall be fixed to motor shaft by a thrust plate and bolt reverse to direction of rotation, in addition to key lock. The critical speed of impeller shall be minimum 1.5 times of the operating speed. The impeller shall be statically and dynamically balanced to G 6.3 grade as per ISO: 1940.

b. Casing:-

Casing shall be of 2mm thick MS for impeller dia up to 600mm and 2.5mm thick MS for impeller dia above 600mm. Casing shall have flanged connection on both ends for ducted application. It shall be provided with suitable supports. Access door shall be provided in the casing for easy access to motor and impeller. Suitable arrangement for mounting of motor shall be provided.

c. Guide Vanes:-

In case of vane axial fans guide vane shall be provided on the discharge side.

d. Guards:-

Suitably designed guards shall be supplied.

e. Drive Motor:-

Motor shall be of totally enclosed fan cooled type squirrel cage induction of IP-55 protection and class-F insulation suitable to run on 415+10% Volts, 50+3% Cycles, 3-phase AC power supply. Motor conduit box shall be mounted on exterior of fan casing, and lead wires from the motor to the conduit box shall be protected from the air stream by enclosing in a flexible metal conduit. Fan motor shall be selected in such a way that sound level is lowest (max. 75 db at 1 m distance) while running. The motor shall be rated for continuous duty. The power and efficiency factor for all motors shall be submitted along with the offer. Motors shall be capable of running continuously with 5 %

drop in rated phase to phase voltage at 15 % increase in design power. Motor of 0.75 KW and over shall be fitted with integral positive temperature coefficient thermistors selected to afford class 1 protection. Motors below 0.75 KW shall be fitted with inherent over heat protection.

f. Speed:-

The speed of the fan shall not exceed 960 RPM for fan with impeller diameter above 450mm and 1440 RPM for fan with impeller diameter 450mm and less.

g. Painting:-

Fans and accessories shall be painted with two coats of red-oxide primer zinc chrome primer conforming to IS: 2074 or superior, over which two coats of synthetic enamel of approved shade shall be applied.

4.0 Propeller Fan:-

Propeller fans shall be direct driven, three or four blade type, mounted on a steel mounting plate with orifice ring. The blades shall be of steel and designed such as to give maximum volume at minimum noise level for minimum power consumption. The impellor shall be directly coupled to a purpose designated motor for efficient operation. Fan / motor shall be suitable for continuous duty and shall perform satisfactorily in ambient temperature of above 50 deg. C. The contractor shall furnish along with their offer the overall fan sound power level for each fan and motor operating at the duty conditions.

a. Mounting Plate:

Mounting plate shall be of steel construction, square with stream lined venturi inlet (reversed for supply applications) coated with backed enamel paint. Mounted plate shall be of standard size, constructed of 12 to 16 gauge sheet depending up on the fan size. Orifice ring shall be correctly formed by spinning or stamping to provide easy passage of air with out turbulence and to direct the air stream.

b. Fan Blades:-

Fan blades shall be constructed of mild steel. Fan hub shall be of heavy welded steel construction with blades to the hub. Fan blades and hub assembly shall be statically and dynamically balanced at the manufacturer's works. Impellor hubs and blades, fan supports, wire guards and internal surfaces of fan chambers shall have smooth finish.

c. Shaft:-

Shaft shall be of steel, accurately ground and shall be of ample size for the load transmitted and shall not pass through first critical speed through the full range of specified fan speeds.

d. Motor:-

Motor shall be standard (easily replaceable) permanent split capacitor or shaded pole for small sizes, totally enclosed with pre – lubricated sleeve or ball bearings, designed for quiet operation with a maximum speed of 1000 rpm for fans 38 cm dia or larger and 1440 rpm for fans 30 cm dia and smaller. Motor for larger fans shall be suitable for 415 + 10% volts, 50 cycles + 3%, 3 phase power supply and smaller fans shall be suitable for 220V +10%, 50 cycles + 3 % single phase power supply. Motors shall be suitable for either horizontal or vertical services as indicated on drawings / Schedule of quantities. Motor selected shall fully comply with the specifications mentioned elsewhere. Fan / Motor selection shall be for continuous and quiet operation and the measured noise level shall not exceed 50 db (A) at 1 meter distance from the equipments. Motors shall be TEFC type with IP-55 protection & class 'F' Insulation.

e. Accessories:-

The following accessories may be required and provided with propeller fans, as indicated in Schedule of quantities.

Wire guard on inlet side and bird screen at the outlet.

Fixed louvers built in to a steel frame.

Regulators for controlling fan speed for single phase fan motors.

5.0 Inline Fans:-

a. Inline fans shall be complete with centrifugal impeller, casing, direct driven motor, vibration isolators, direction of discharge and rotation position shall be as per the job requirement and shall be marked on the fan assembly.

b. Housing shall be constructed of hot rolled 16g GSS sheet metal construction. Housing metal parts shall be either spot-welded or screwed or mounted together with rivets. Indication showing rotation arrow and make, model number and duty conditions of the fan shall be available on the housing.

c. Casing shall be with wide hinged doors which open easily inspection doors with handle and neoprene gasket shall also provided. Casing shall have flanged connection on both ends for ducted applications. Casing shall be primed and finish coated with synthetic enamel paint. Extended grease leads for external lubrication shall be provided.

d. Fan wheel shall be forward curved type, statically and dynamically balanced.

e. The fan shall be provided with ball bearings can be used in any mounting position at maximum indicated temperature. The bearing lubricant shall be suitable for a minimum ambient temperature of minus 150C (admissible for a short time without reaching dew point at minus 300C). For applications at maximum indicated ambient temperature life expectancy shall be 40000 hours minimum.

f. Fan motor, fans shall be supplied with built-in-thermal contact (TK) at the critical high temperature point ("B" = 1300C. The thermal contact shall open and break the power supply to the fan, Fan motors have insulation class "F" and protection class IP55.

g. Motor shall be squirrel cage, totally enclosed, fan cooled standard round frame,

constant speed, continuous duty, single winding, suitable for single phase supply. (220V \pm 10%,50 Hz \pm 3%). Motor shall be specially designed for quiet operation and lead wires from the motor to be conduit box shall be protected from the air stream by enclosing in a flexible metal conduit.

h. Fans shall be direct driven type.

i. All fans are hot dipped galvanized.

j. The assembly of fan and motor shall be suspended from the ceiling by spring type vibration isolators.

6.0 Fire Rated Smoke Exhaust Axial Fan:

a. The fire rated smoke exhaust fans shall be axial type suitable for 250oC for minimum 2 hours.

b. The blades shall be of aluminum alloy fixed on an aluminium hub-flange assembly suitable for multiple blades which shall be adjustable when the fan is stationary.

c. The collar shall be constructed of rolled steel and joints welded. The flanges shall have suitable holes for fixing the fans, ducts etc. The collar and flanges shall be galvanized for protection.

d. The collar shall be long to cover fan and motor.

e. The fan shall be supplied with factory mounted TEFC motor suitable for 250oC for minimum 2 hours. The motor shall be foot mounted.

f. The fan shall be approved for 250oC for 2 hours by International / national authorized agency.

g. The speed of the fan shall not exceed 960 RPM for fan with impeller diameter above 450mm and 1440 RPM for fan with impeller diameter 450mm and less.

7.0 Fire Rated Centrifugal Fan:-

a. Fire rated centrifugal fan generally shall be as described above and may have varied construction features as required.

b. The fan shall be supplied with factory mounted TEFC motor suitable for 250oC for minimum 2 hours. The motor shall be foot mounted.

c. The fan shall be approved for 250oC for minimum 2 hours by International / National authorized agency.

8.0 Limitation:-

a. The air velocity limits shall be as per Schedule of Equipment and/or BOQ but in no case exceed.

b. Velocity at blower outlet shall not exceed 10.16 M/s (2000 FPM).

c. Inlet Velocity shall be limited to 5.08 M/S (1000 FPM).

8.1 Life of Ventilation & Smoke Exhaust Fans:-

Ventilation & Smoke Exhaust Fans shall be capable of providing Average Service Life of 25 years.

PACKAGE TYPE AIR WASHERS

1. The Packaged type Air Washer shall be complete in all respect and shall generally comply with the following specifications given below:

- 1. Air Washers:**

The packaged air washers shall be of G.I sheet metal sectionalized construction and shall include fan section, cooling pad section, motor drive, eliminators etc.

- 2.1 Fan Section:**

The impellers of the fan or fans shall be of G.I sheets, double inlet forward curved centrifugal design, both statically and dynamically balanced. The fan housing shall be of sturdy construction made from 16 G (1.6 mm) G.I sheet with smooth air inlets. The fan shall be mounted on properly aligned shaft and mounted on self aligning bearing blocks. The casing of the fan section shall be made of 16 G (1.6 mm) G.I sheets suitably reinforced to provide rigidity. The frame work shall be either be folded G.I sheets or of hot dipped galvanized iron.

The fan section shall be complete with multi V belt drive, belt guard and adjustable motor mounting base.

- 2.1.1 Cooling Pad**

The Cooling pads shall be of honey comb design to provide extended and sufficient wetted surface to give a water absorbing efficiency of at least 90% at an air efficiency velocity of 500 FPM (2.5 m/sec)

The cooling pads shall be made of either acetate paper or high impact PVC. The cross section and depth shall be sufficient for specified efficiency. The cooling pad section shall be of 16 G (1.6 mm) G.I sheets similar to fan section. It shall be complete with galvanized supports for mounting the pads and a water distribution through the uniform supply of water over the entire surface.

- 2.1.2 Water Sump**

The water sump below the pad section shall be of 3 mm M.S plate with welded joints and stiffness. The tank shall be complete with makeup, overflow and drain connections. A float valve shall be provided for makeup water line. The tank shall be given 2 coats of corrosion resistance paint and final coat of black enamel paint.

The pump set shall be of monoblock construction, with end suction and top discharge with flanged connections, cast iron impeller and casing all mounted directly on a squirrel cage, drip proof induction motor of suitable capacity.

2.2 Motors and Starter

2.2.1 The motor for each blower shall be totally enclosed, fan cooled, squirrel cage induction type and conform to specifications as given under section 9.

2.2.2 The starters shall be “Direct on Line” type upto 7.5 H.P and all larger starters shall be fully automatic Star Delta Type. The starters shall conform to the IS specifications.

2.3 Miscellaneous:

Necessary accessories shall be provided wherever necessarily required for proper operation and shall also include:

Necessary Vibration isolators for the Blowers

Canvass connections at the outlet of each fan

Nuts, bolts, shims etc as required for the grouting of the equipments

Float valves in the air washer tank, along with quick fill connection

Gate valves in drain; make up, quick fill lines etc. as required.

2.4 Limitations

The air velocity limits are a follows:

Velocity across air washer shall not exceed 2.5 m/sec (500 FPM)

Velocity at blower outlet shall not exceed 8m/sec (1500 FPM)

MOTOR STARTERS CONTROL PANELS

1. General:

The motors and switchgears required for various items shall generally be as per specifications given below. All electric motors shall be suitable for 3 phase, 50 cycles 415 volts a.c. supply.

2. Control Panel:

2.1 These panels should be floor/wall mounted, sheet steel clad, modular construction, cubicle design, compartmentalised. These panels shall comprise of incoming & outgoing feeders (circuit breakers, fuse switch units/switch fuse units, contactor starters with overload relays, single phasing preventor etc. as indicated in the drawings.

2.2 The panels shall be provided wherever necessary with necessary interlocks designed to prevent incorrect operation and to ensure safety of operating personnel and equipment.

2.3 All feeders are to be operated from the front and they shall be interlocked suitably. Padlocking arrangement and interlock defeating device shall also be provided. Each module shall have separate door and partition plate. The feeder incomer switches shall be interlocking with the door so that the door can only be opened when switch is in 'off' position. The doors and covers shall be provided with thick gaskets to make it dust tight. All the door covers shall be provided with synthetic rubber gaskets to make it dust tight. Feeder name tags shall be provided.

2.4 Air Circuit Breaker and Fuse Switch Units

The circuit breaker shall be air break fully draw out type equipped with arc chutes and their face barriers of proper design. The continuous current rating of the circuit breakers shall be as given in the detailed technical specifications. The circuit breakers shall have a breaking capacity of 31 mva at 415 volts, 50 hz ac & they shall be able to withstand full fault current for one second.

2.5 The circuit breaker shall be provided with manually operated spring closing mechanism. The operating mechanism shall be trip-free throughout the breaker travel. The breaker shall be equipped with inside 'on' & 'off' position indicator mechanism and so located that the position of the circuit breaker i.e. whether closed or open, is indicated on the front door of the compartment. The 'on' & 'off' trip indicating lights shall also be provided for each breaker feeder.

- 2.6 The moving portion of the circuit breaker shall be so interlocked that it is not possible to isolate it and draw out from the service position or to plug it in from the isolated position when the circuit breaker is closed. The interlock being provided shall be such as to prevent operation of a circuit breaker unless it is fully plugged in or fully isolated and is locked correctly in either of the two positions.
- 2.7 The circuit breaker compartment doors shall be so interlocked as to prevent access to the breaker while in the plugged in position. However special means shall be provided for undoing this interlocked in an emergency.
- 2.8 The draw out feature shall clearly provided three distinct positions of the circuit breaker viz., `service', `test' & isolated. Inadvertent withdrawal of a circuit breaker removable unit too far beyond its supports shall be prevented by a suitably interlock, the design shall provide for the testing of breaker in the test positions i.e. when the breaker's moving unit is in fully disconnected position and the secondary circuit remains connected or energised. The secondary connections between the fixed and removable units shall be provided with means of spring loaded sliding type contacts to make the breaker fully draw out type.
- 2.9 The circuit breaker unit shall be provided with complete range of releases including the overload releases and release for short circuit protection.
- 2.10 The circuit breaker shall be provided with necessary auxiliary contacts with 2 No. spare contacts. All contacts shall be wires upto the terminal board.
- 2.11 The fuse switch unit shall be of load break heavy duty, industrial design and of double break pattern with quick make and quick break mechanism, however, the design shall be such that it shall ensure positive opening even if quick break action is lost due to spring stretching or breaking.
- 2.12 The `on' and `off' position of the switch handle shall be distinctly indicated and inter locks shall be provided to ensure that switch cover can not be opened unless the switch is in the `off' position.
- 2.13 The fuse switch units shall be provided with non-deteriorating type of hrc cartridge fuse link and having rupturing capacity not less than 31 mva at 415 volts.
- 2.14 All alive parts inside switch shall be properly shrouded and interphase barriers shall be provided. Design of the switch handles shall be such that they do not protrude out of the panel in the manner so as to prevent free passage of operating personnel. Design with normal conventional position of switch handle up in `on'

position & down in 'off' position shall be preferred.

2.15 **415 Volts Bus Bars**

2.15.1 The 415 volts main bus-bar shall have continuous current rating as indicated in the specification or equivalent standard rating of at least 50 percent of these of the phase bus bars. The bar and its connections shall be so arranged and supported as to withstand without any damage or deformation, the specific short circuit current. The bus bars shall be braced and supported on reinforced fibre glass support and shall be of electrolytic grade type E 91e of is:5082. these bus bars shall withstand 43.12 ka for one second during short circuit conditions. The bus bars shall be colour coded with pvc tapes or insulating painting for identification purposes. The bus bars shall be sleeved with special type heat shrinkable pvc sleeving.

2.15.2 Bus supports shall be resistant low absorption type moulded insulation of high impact strength and high creepage surface.

2.15.3 All bus work shall be braced to withstand without damage a short circuit current of 43.12 ka symmetrical for one second.

2.16 **Instruments and Meters**

2.16.1 Current transformer shall comply with the requirements of is:2705. They shall have ratio outputs and accuracies as specified or required as shown in single line diagram.

2.16.2 All indicating instruments shall be of industrial pattern and should be provided as shown in the single line diagram.

2.16.3 All instruments shall be switch board type flush mounted with proper scale dimensions so as to be clearly visible to the operators standing on the floor. The instruments shall be provided with front of board zero adjuster shall be not preferably be mounted at heights lower than one meter and higher than two meters above the floor level.

2.16.4 The operating handles, meters, instruments etc. shall be mounted at the front of the switch board. Approved means shall be provided for locking the control switch/operating handles in the open position. For fuse switch gear section of the switch board, meters where specifications shall be mounted in such a manner that it is possible to readily identify the meters for individual units and the arrangements does not create hinderance to maintenance of individual units without having to shut down the bus.

2.16.5 All wires carried within the switch gear enclosure shall be pvc insulated and shall be neatly arranged to be readily accessible and to facilitate easy replacement. Only pvc copper cables shall be used for all power and control inter connections. The cables of 660 volts shall be used. Trained copper cables lugs shall be used. All small wires shall be colour coded and provided with numbered ferrules for easy identification of circuits. As far as possible, each essential circuit shall be connected within the respective switch gear unit. Control wiring terminal shall preferably be near the panel.

3. **Cable Termination:**

3.1 The cables entries and terminals shall be provided in the switch board to suit the number, type and size of aluminium conductor cables as given in the line diagram. Cable entries shall be so designed as to avoid damage to cables and there shall be sufficient space to avoid short bending of cables. The positions of the cable lugs and terminals shall be such that the cable could be neatly drawn and connected through one meter deep trench below the switch gear and the jointing carried out in a convenient and satisfactory manner. The cable entry, design panel, cable boxes and terminals and their locations will have to be approved by the engineer/owner. However the access for cabling shall preferably be from the back of the switch board. The panels shall be provided with control transformers of suitable va rating along with control bus and hr fuses from control supply to contractors.

3.2 The cables socket shall be of copper and of crimping type. Cables risers shall be adequately supported to withstand the effects of rated short circuit current without damage.

3.3 Cable glands of sizes as required shall be provided at all cable entry points in the bottom plate. The glands shall form part of switch board.

4. **Indication:**

Each incoming and outgoing feeder units shall be provided with 'on' 'off' indicating lamps of standard conventional colour coding.

5. **Subsidiary Panels:**

Subsidiary panels shall be provided wherever required such as ah room, air washer room. The construction of these panels should be similar to the main panel and shall have all related accessories.

6. **Contactors Starters:**

6.1 **Star Delta Starter**

The star delta starter shall be air break automatic contactor starter provided with main contactor, star contactor, delta contactor, timer and automatic change over from start to delta, bimetallic over load relay, operating coil, start/stop push button, single phasing preventor, auxiliary make and break contacts, indicating lamps etc. The contactor shall quick make, quick break, double break consisting of robust silver contacts. The coil voltage shall be 415 volts ac at 50 hz. The starter shall be provided with trip indication light and overload reset push button for overload relay.

6.2 **DOL Contactor Starter**

The contactor shall be air break type coil operate, dol contractor starter, provides with cables entries, ambient temperature compensated bimetallic over load relay, single phasing preventor, solenoid coil, start and stop push buttons, 8 auxiliary make and break contacts, indicating lamps etc. The contactors shall be quick make quick make and quick break, double break type consisting of robust silver contacts. The coil voltage shall be 440 volts at 50 c/s. The starter shall be provide with trip indication light and over load reset bush button for overload relay.

7. **Squirrel Cage Induction Motors:**

7.1 The motor shall be of well tried out and design and of reputed make. The motors provided on the equipment shall conform to is:325 in general. The motors shall be squirrel cage induction motors rates for operation at 415 volts, 3 phase, 50 hz a.c. supply. The motor for various equipments shall have the following enclosure level.

- (a) Cooling tower & exhaust blower - ip:55(tefc)
- (b) Compressor and A.H.U. motor-ip:44(tefc).
- (c) Pumps ip:34(spdp).

7.2 The horse power and speed of the motor shall match that of driven equipment and the motor shall be suitable for star delta starting or direct on line starting with class `F' insulation. The motors of 7.5 HP and above 7.5 HP shall be suitable for star delta starting and below 7.5 HP suitable for DOL starting.

DUCT WORK AND OUTLETS

1. General:

- 1.1 The work under this part shall consist of furnishing labour materials, equipment and appliances as specified necessary and required to install all sheet metal and other allied work to make the air conditioning supply, ventilating, exhaust system ready for operation as per drawings.
- 1.2 Except as otherwise specified all duct work and related items shall be in accordance with these specifications.
- 1.3 Duct work shall mean all ducts, casings, dampers, access doors, joints, stiffeners and hangers.

2 Duct materials

- 2.1 The ducts shall be fabricated from galvanized steel sheets. Galvanizing shall be of 275gms/sq.m. (Total coating on both sides), conforming to IS:277-1962 (revised) or aluminium sheets conforming to IS:737-1955(with latest amendments) (wherever aluminium ducts are specified).
- 2.2 All duct work, sheet metal thickness and fabrication unless otherwise directed, shall strictly meet requirements, as described in IS: 655-1963 with amendment-i (1971 edition)

The thickness of the sheet shall be as follows: -

| | size of duct | sheet thickness | | type of joints | bracing if any |
|-------|--------------------|-----------------|-----------|---|-----------------------------|
| | | GI | Aluminium | | |
| 2.2.1 | Upto 750mm | 0.63 mm | 0.80 mm | GI flange | |
| 2.2.2 | 751 mm to 1000 mm | 0.80 mm | 1.00 mm | 25x25x3 mm Angle iron Frame With 8 mm dia.nuts & bolts. | 25x25x3 mm at the rate of 1 |
| 2.2.3 | 1001 mm to 1500 mm | 0.80 mm | 1.00 mm | 40x40x5 40x40x3mm angle iron frame with 8 mm dia. Nuts & bolts. | mm at the rate of 1 |

| | | | | | |
|-------|-----------------------|---------|---------|--|-------------------------------------|
| 2.2.4 | 1501 mm to 2250 mm | 1.00 mm | 1.50 mm | 50x50x5 mm angle iron to be cross braced diagonally with 10 mm dia nuts & bolts at 125 mm centre. | 40x40x3mm at the rate of 1.2 |
| 2.2.5 | 2251 mm and above | 1.25 mm | 1.80 mm | 50x50x6 mm angle iron frame with 10 mm nuts & bolts at 125 mm centre. | 40x40x3 mm at the rate of 1.6 |

2.3 The gauges, joints and bracings for sheet metal duct work shall further conform with the provisions as shown on the drawings.

2.4 Ducts larger than 450 mm shall be cross broken, duct sections upto 12 00 mm length may be used with bracing angles omitted.

2.5 Changes in section of duct work shall be affected by tapering the ducts with as long a taper as possible. All branches shall be taken off at not more than 45 deg. Angle from the axis of the main duct unless otherwise approved by the engineer-in-charge.

2.6 All ducts shall be supported from the ceiling/slab by means of m.s.rods of 9 mm (3/8") dia with m.s. angle at the bottom.

3. **Installations**

3.1 During the construction, the contractor shall temporarily close duct openings with sheet metal covers to prevent debris entering ducts and to maintain opening straight and square, as per direction of engineer-in-charge.

3.2 Great care should be taken ensure that the duct work does not extend outside and beyond height limits as noted on the drawings.

3.3 All duct work shall be of high quality approved galvanized sheet steel guaranteed not to crack or peel on bending or fabrication of ducts. All joints shall be tight and shall be made in the direction of air flow.

The ducts shall be re-inforced where necessary, and must be secured in place so as to avoid vibration of the duct on its support.

- 3.4 All air turns of 45 degrees or more shall include curved metal blades or vanes arranged so as to permit the air to make the abrupt turns without an appreciable turbulence. Turning vanes shall be securely fastened to prevent noise or vibration. All ducts shall be fabricated and installed in accordance with modern design practice. The sheet metal gauges and fabrication procedures as given in i.s.s specifications shall be adhered to and shall be considered as an integral part of these specifications.
- 3.5 The duct work shall be varied in shape and position to fit actual conditions at building. All changes shall be in accordance with accepted air conditioning duct design and subject to the approval of the engineer-in-charge. The contractor shall verify all measurements at building and shall notify the engineer-in-charge of any difficulty in carrying out his work before fabrication.
- 3.6 Sponge rubber of approved equal gaskets shall be installed between duct flanges as well as between all connections of sheet metal ducts to walls, floor columns, heater casings and filter casings. sheet metal connections shall be made to walls and floors by means of galvanized steel angles anchored to the building structure with anchor bolts and with the sheet bolted to the angles. sheet metal connections shall be as shown in the drawings or as directed by engineer-in-charge.
- 3.7 The ducts shall be supported from the structure by means of suitable supports grouted in the r.c.c. work. The type of support should meet the approval of the engineer-in-charge and should involve minimum damage or breakage. In no case the duct will be rested upon the false ceiling/boxing or on supports grouted in the wall.
- 3.8 Flanges and supports are to be black, mild steel and are to be primer coated on all surfaces before erection and painted with aluminium thereafter. accessories such as damper blades and access panels are to be of materials of appropriate thickness and the finish similar to the adjacent ducting as specified.
- 3.9 Joints, seams, sleeves, splitters, branches, takeoffs and supports are to be as per duct details as specified, or as decided by engineer-in-charge.
- 3.10 Joints requiring bolting or riveting may be fixed by hexagon nuts and bolts, stove bolts or buck bolts, rivets or closed centre top rivets or spot welding. Self tapping screws must not be used. all fixing must have a permanently non-corrosive finish such as cadmium plating or galvanizing as appropriate. Spot welds and bronze welds are to be coated on all surfaces with zinc rich paint, as approved by engineer-in-charge.
- 3.11 The flexible joints are to be fitted to the suction and delivery of all fans. The material is to be normally double heavy canvass or as directed by engineer-in-charge. On all circular spigots the flexible materials are to be screwed or clipband

with adjustable screws or toggle fitting. For rectangular ducts the material is to be flanged and bolted with a backing flat or bolted to mating flange with backing flat.

- 3.12 The flexible joints are to be not less than 75 mm and not more than 250 mm between faces.
- 3.13 The duct work should be carried out in a manner and at such time as not to hinder or delay the work of the other agencies especially the boxing or false ceiling contractors.

4. **Dampers**

- 4.1 At the junction of each branch duct with main duct and split of main duct, volume dampers must be provided. Dampers shall be two gauges heavier than gauge of the large duct, and shall be rigid in construction to the passage of air.
- 4.2 The volume dampers shall be of an approved type, lever operated and complete with locking devices which will permit the dampers to be adjusted and locked in any positions.
- 4.3 The dampers shall be of splitter, butterfly or louver type. the damper blade shall not be less than 1.25 mm (18) gauge, reinforced with 25 mm angles 3 mm thick along any unsupported side longer than 250 mm angles shall not interface with the operation of dampers, nor cause any turbulence.
- 4.4 Automatic and manual volume opposed blade dampers shall be complete with frames and bronze bearings as per drawings. Dampers and frames shall be constructed of 1.5 mm steel and blades shall not be over 225 mm wide. The dampers for fresh air inlet shall additionally be provided with fly mesh screen, on the outside, of 0.8 mm thickness with fine mesh spacking.
- 4.5 Wherever required for system balancing, provide a volume balancing opposed blade damper with quadrant and thumb screw lock. Provide damper rod and damper block with upset screws.
- 4.6 After completion of the duct work, dampers are to be adjusted and set to deliver the required amounts of air as specified on the drawings.

4.7 **Motorised Combined Smoke & Fire dampers:**

The fire dampers shall be provided at all supply and return air ducts at AHU room crossings and at all floor crossings or wherever shown on the drawings. The fire & smoke dampers shall be of at least 120 minutes fire rating certified by CBRI, Roorkee as per UL 555 : 1973. Fire damper blade & outer frame shall be formed of 1.6 mm galvanized sheet steel. The damper blade shall be pivoted on both ends using chrome plated spindles in self lubricated bronze bushes. Stop seals will

be provided on top & bottom of the damper housing made of 16 G galvanized sheet steel. For preventing smoke leakage side seals will be provided. In normal position damper blade shall be held in open position with the help of a 24 V operated electric actuators thereby providing maximum air passage without creating any noise or chatter. The damper shall be actuated through electric actuator. The actuator shall be energised with the help of a signal from smoke detector installed in AHU room. Smoke detector shall be provided by the A/C contractor. The fire damper shall also close due to temperature rise in SA ducts through the electric temperature sensor factory set at 165 deg F micro switches with bakelite base will be provided to stop fan motor and give open & close signal at remote panel in case of motorised actuator.

Each fire dampers shall have its own panel which will incorporate necessary circuit required to step down voltage available from power supply to shown status of the damper (open or close), to allow remote testing of damper & indication in event of damper closure due to signal from smoke sensor/ temperature sensor & reset button. Additional terminal will be provided to have signal (sound beep or visual) in Central Control Room

Damper actuator shall be spring return Belimo make so as to close the damper in the event of power failure automatically and open the same in case of power being restored. Spring return action of the actuator shall be an in built mechanism and not mount externally.

The fire damper shall be mounted in fire rated wall with a duct sleeve 600 mm long. The sleeve shall be factory fitted on fire damper. The joints at sleeve end shall be slip on type. Minimum thickness of GI sheet shall be 18 G.

5. **Access panel**

- 5.1 A hinged and gasketed access panel shall be provided on duct work before each reheat coil and at each control device that may be located inside the duct work.

6. **Miscellaneous**

- 6.1 All ducts above 450 mm are to be cross broken to provide rigidity to the ducts.
- 6.2 All duct work joints are to be true right angle or approaching with all sharp edges removed.
- 6.3 Sponge rubber gaskets also to be provided behind the flange of all grilles.
- 6.4 Each shoot from the duct, leading to a grille, shall be provided with an air deflector to divert the air into the grille through the shoot.

- 6.5 Inspection doors measuring at least 450 mm x 450 mm are to be provided in each system at an appropriate location, as directed by engineer-in-charge.
- 6.6 Diverting vanes must be provided at the bends exceeding 600 mm and at branches connected into the main duct without a neck.
- 6.7 Proper hangers and supports should be provided to hold the duct rigidly, to keep them straight and to avoid vibrations additional supports are to be provided where required for rigidity or as directed by engineer-in-charge.
- 6.8 The ducts should be routed directly with a minimum of directional change.
- 6.9 The duct work shall be provided with additional supports/hangers, wherever required or as directed by the engineer-in-charge, at no extra cost.
- 6.10 All duct supports, flanges, hangers and damper boxes etc. Shall be given 2 coats of red oxide paint before installation and one coat of aluminium paint after the erection, at no extra cost.
- 6.11 All angle iron flanges to be welded electrically and holes to be drilled.
- 6.12 All the angle iron flanges to be connected to the gss ducts by rivets at 100 mm centres.
- 6.13 All the flanged joints, to have a 4 mm thick felt packing stack to the flanges with shellac varnish. the holes in the felt packing are to be burnt through.
- 6.14 The g.s.s. ducts should be lapped 6 mm across the flanges.
- 6.15 The ducts should be supported by approved type supports at a distance not exceeding 2.4 metres.
- 6.16 Sheet metal connection pieces, partitions and plenums required, shall be constructed of 1.25 (18 gauge) sheet thoroughly stiffened with 25 mm x 25 mm angle iron braces and fitted with access doors.

7. **Grilles**

- 7.1 The supply and return air grilles shall be fabricated from aluminium extruded sections and the supply air grilles shall have single louvers and the return air grille shall have single horizontal extruded section fixed louvers the grilles may or may not be with an outer frame.
- 7.2 The grilles shall have opposed blade dampers of m.s. black sheets, which shall be key operated from the grille face wherever required.

7.3 The damper blades shall be of 1.25 mm (18 gauge) m.s. black sheets and shaped to form air tight joints the frame work for dampers shall be fabricated from 1.25 mm (18 gauge) m.s. black sheet the grill flange shall be fabricated out of 25 x 25 x1.5 mm aluminium angle grilles longer than 450 mm shall have intermediate supports for the horizontal louvers.

7.4 **Linear Grille**

The linear grille shall be of 1.25 mm (18 G) aluminium extruded section with flush mounted with single louvers for air flow direction adjustment.

8. **Diffusers**

8.1 The ceiling type round or square diffusers shall be of 1.25 mm (18 gauge) aluminium extruded sections with flush or step down face, as specified with fixed pattern and round neck.

8.2 The diffusers shall be die formed for proper air diffusion.

8.3 All supply diffusers shall be provided with m.s. sheet dampers, with knurled knobs for adjustment from the bottom.

9. **Painting**

9.1 All grilles, and diffusers shall be anodised or powder coated, as required, before installation.

9.2 All ducts immediately behind the grilles/diffusers etc. are to be given two coats of black paint in matt finish.

9.3 All grilles, diffusers & registers shall be provided with rubber gasket between flanges and the wall or ceiling.

10. **Testing**

10.1 After completion, all duct system shall be tested for air leakage.

10.2 The entire air distribution system shall be balanced to supply the air quantity as required in various areas and the final balance of air quantity through each outlet shall be submitted to the engineer-in-charge for approval.

11.0 **Fire Rated Duct:-**

All fire rated duct shall be fabricated from 1.25mm thick GI sheet irrespective of duct size. All accessories shall be suitably fire rated for 2 hours

ELECTRIC WIRING

1. General:

The electric wiring of motors for compressors, pumps, air handling units etc. As well as controls, heaters etc. and earthing of all equipment shall be carried out as per specifications given hereunder.

2. Power Cabling for Motors, Heaters etc:

- 2.1 Unless otherwise specified, the power cables shall be PVC insulated, and PVC sheathed aluminium conductor, armoured cables to 1100 V grade conforming to IS 1554. The power cables shall be of 2 core for single phase, 4 core for sizes upto and including 25 sq.mm, 3-1/2 core for sizes higher than 25 sq.mm for 3 phase. Where high voltage equipments are to be fed, the cables shall be rated for continuous operation at the voltages to suit the same.
- 2.2 Power cables shall be of sizes as indicated in the tender specifications. In all other cases, the sizes shall be as approved by the Engineer-in-Charge, after taking into consideration the load, the length of cabling and the type of load.
- 2.3 Cables shall be laid in suitable metallic trays suspended from ceiling, or mounted on walls, or laid directly in ground or clamped on structures, as may be required. Cable ducts shall not be provided in plant rooms. Cable trays shall be fabricated from slotted angle/solid angles to make ladder type cable tray, designed with adequate dimensions for proper heat dissipation and also access to the cables. Alternatively, cable trays may be of steel sheet with adequate structural strength and rigidity, with necessary ventilation holes therein. In both the cases, necessary supports and suspenders shall be provided by the Air-conditioning Contractor as required.
- 2.4 Cable laying work shall be carried out in accordance with IS 1255/1967, Indian standard code of practice. The scope of work for the Air-conditioning Contractor shall include making trenches in ground and refilling as required, but excludes any masonry trenches for the cable work.

3.0 CONTROL WIRING

- 3.1 Control wiring in the plant rooms and AHU rooms shall be done using control wire as per IS 1554 PVC insulated and PVC sheathed, 2.5 sq.mm copper conductor, 1100 V grade, cables drawn in ISI marked steel or PVC conduits. The control cables interconnecting the plant room and the AHU rooms shall be of multi-core armoured type only, and suitable for laying direct in ground.

- 3.2 The number and size of the control cables shall be such as to suit the control system design adopted by the Air-conditioning Contractor.
- 3.3 ISI marked steel conduit pipes, wherever used, shall be of gauge not less than 1.6 mm thick for conduits upto 32 mm dia and not less than 2.0 mm thick for higher sizes. All conduit accessories shall be threaded type with substantial wall thickness.
- 3.4 Control cables shall be of adequate cross section to restrict the voltage drop.
- 3.5 Runs of control wires within the switchboard shall be neatly bunched and suitably supported/clamped. Means shall be provided for easy identification of the control wires.
- 3.6 Control wiring shall correspond to the circuitry/sequence of operations and interlocks approved by Engineer-in-Charge.
- 3.7 In cold storage involving temperatures below zero deg. C, polythene cables shall be used instead of PVC cables.

4.0 **Laying**

- 4.1 The cables shall be laid, as per drawings or along a short and convenient route between switch board and the equipment, either in trenches, on wall or on trays. Hangers, supported from the slab. Cable routing shall be checked on the site to avoid interference with structure, equipment etc. Where more than one cables are running close to each other, proper spacing should be provided between them
- 4.2 The radius of bends of the cable should not be less than 12 times the radius of cable to prevent undue stress and damage at the bends, the cables should be supported and fixed on M.S. supports, when running in trenches, wall or ceiling suspended hangers when laid under ground the cables should be covered with sand and protected with cement concrete covering. Suitable G.I. pipe shall be used wherever cable is laid across road, crossing of other services and when passing through R.C.C.
- 4.3 Wooden bushes shall be provided at the ends of pipes through which cables are taken.

5. **Earthing :**

5.1 Pipe Earth Electrode

G.I. pipe shall be of medium class 40 mm dia 4.5 mt. long in length. Galvanising of the pipe shall conform to relevant is. G.I. pipe electrode shall be cut tapered at the bottom and provided with holes of 12 mm dia drilled not less than 7.5 cm from each other upto 2m of length from bottom. The electrode shall be buried in the ground vertically with its top not less than 20 cms below ground level.

5.2 Plate Earth Electrode

For plate electrode minimum dimensions of the electrode shall be as under:

- i. G.I. plate electrode : 60cm x 60cm x 6mm thick.
- ii. Copper plate electrode: 60cm x 60cm x 3mm thick.

The electrode shall be buried in ground with its faces vertical and top not less than 3 m below ground level.

In case of plate earth electrode a watering pipe of 20 mm dia of medium class gi pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided on top of this pipe for watering the earth. In case of pipe electrode a 40mm x 20mm reducer shall be used for fixing the funnel. The watering funnel attachment shall be housed in masonry enclosure of not less than 30cm x 30cm x 30cm. A cast iron/ms frame with cover having locking arrangement shall be suitable embedded in the masonry enclosure.

5.3 Loop Earthing:

Loop earthing shall be providing for all mountings of main board and other metal clad switches and db's with G.I. strip of size specified but not less than 14 swg copper or 12 swg gi or 4 sq mm aluminium wire. The earthing lead from electrode owner's shall be suitably protected from mechanical injury by a 15 mm dia gipipe in case of wire and 40 mm dia medium class G.I. pipe in case of strip. Metallic covers or supports of all medium pressure or ht apparatus or conductor shall in all cases be connected to not less than two separate and distinct earths.

- 5.3.1 All equipment connected with electric supply shall also be provided with double earthing continuity conductors. The size of G.I. earthing conductors shall be: -

Earthing should be carried out as per is-3043

Size of phase wire sq.mm Size of G.I. conductor
aluminium tape/wire (swg)

| | |
|--------------------------|---|
| 185 | 25 mm x 4 mm (strip) |
| 150 | 25 mm x 4 mm (strip) |
| 120 | 20 mm x 3 mm (strip) |
| ----- | |
| Size of phase wire sq.mm | Size of G.I. conductor aluminium tape/wire (swg) |
| ----- | |
| 95 | 20 mm x 3 mm (strip) |
| 70 | 4 swg |
| 50 | 4 swg |
| 35 | 6 swg |
| 25-6 | 6 swg |
| 4 | 8 swg |

6. Miscellaneous:

- 6.1 The final connections to the equipment shall be through flexible connections where the equipment is likely to be moved back and forth, such as on slide rails.
- 6.2 An isolator switch shall be provided at any motor which is separated from the main switch panel by a wall or partition or other barrier or is more than 15 metres away from the main panel.
- 6.3 Two separate and distinct earthing conduits shall be connected from the equipment upto the main switch board panel.
- 6.4 The entire installation shall be tested as per electricity rules and I.S. 732-1973/is-3043 with amendments 1,2&3 prior to the commissioning of the plant and a suitable test report furnished by competent local authorities. The test report will be obtained by contractor himself at his own expenses.
- 6.5 All exposed hangers etc. shall be given 2 coats of suitable paint of approved colour, when all work has been completed.

TESTS AT SITE

1. General:

The contractor must perform all inspection and tests of the system as a whole and of components individually as required, under the supervision of the architect, in accordance with the provisions of the applicable ashrae standards or approved equal and furnish necessary test certificates from manufacturers.

2. Compressors/Condensers/Chillers/Evaporators/Pumps etc.

- 2.1 Identification of materials in accordance with test certificates.
- 2.2 Inspection of various laboratory test certificates for physical properties and technical composition conducted on test samples of materials to be used for fabrication, forgings etc. for all important components of various equipment.
- 2.3 Hydraulic test for various components and assembled equipments at 1.5 times design pressure or double the operating pressure whichever is higher.
- 2.4 Pneumatic leak test after assemblies at design pressure
- 2.5 Static and dynamic balancing on electronic precision machine for rotating parts, links, impellor/crank shaft assemblies etc.
- 2.6 Inspection of assemblies and dis-assemblies of various parts of equipments and complete equipments themselves as desired by inspection engineer.
- 2.7 Noise level test for various rotating/reciprocating equipments.
- 2.8 Pressure drop test for condenser, chiller and evaporator.
- 2.9 Inspection of manufacturer's test certificates shall be supplied for all electrical motors.
- 2.10 Inspection of welding including welders qualifications as desired by inspection engineers.
- 2.11 For compressor assembly, electronic leak, air running test, pneumatic test with dry nitrogen and leak test in water.

3. Air Handling Units :

3.1 Blowers

- 3.1.1 Identification of material in accordance with test certificates.

3.1.2 Dynamic/static balancing of impeller.

3.1.3 Performance test as per applicable codes.

3.2 **Coils**

3.2.1 Identification of material in accordance with test certificates.

3.2.2 Pneumatic test.

3.3 **Filters**

3.3.1 Manufacturer's test certificates also to be produced for the assembled A.H.U. final dimensional check will be done. Inspection will be done during assembly of components for quality of workmanship, painting etc.

Piping : materials check for specifications and size.

3.4 **Valves**

Hyd./Pneumatic test certificates.

3.5 **Motors**

Manufacturer's test certificate as per motor data sheet.

3.6 **Instruments and Controls**

Visual examination.

4. **For Associates Works at Site:**

4.1 All electrical items will be subjected to inspection at any stage during manufacturing activity. Routine electrical test as per relevant codes. Inspection of manufacturer's test certificates.

4.2 Inspection of raw materials to be used for fabrication and assembly and inspection of manufacturer's certificates.

4.3 Inspection of welding including welders qualification as desired by inspection engineers. Inspection of fabricated items.

4.4 Pressure testing of pipe fit used for the refrigerant and water services.

4.5 Pressure testing, leak testing of complete piping network for chilled water.

- Condenser water and refrigerant/services.
- 4.6 Vacuuming and gas/oil charging for refrigeration system.
 - 4.7 Checking of electrical circuits (power & controls) and checking functioning of controls of refrigerant systems and other circuits of air conditioning plant.
 - 4.8 Checking of calibration of controls and instrumentation
 - 4.9 Checking of assemblies for electrical control panel, instruments panels, local panels (dimensional and functional) annunciator panels etc.
 - 4.10 Inspection of complete electrical installation at site.
 - 4.11 Installation of main equipments like compressor, condenser, chiller, evaporator.
 - 4.12 Performance testing of complete A/C plant as per specifications.
5. The above inspection procedure is given for general guidance and information of vendors and inspection of purchaser/consultant is strictly not limited to these and inspection engineer of purchaser/consultant will have full right to have detailed inspection at any stage right from placement of order to completion of project as desired by inspection engineer, co-ordination of inspection agency of purchaser/consultant with his factory/sub-vendor's factory/erection site will be the sole responsibility of successful vendor after placement of order for complete air conditioning plant covered under these technical specifications.
6. **Piping System:**
- 6.1 In general pressure tests shall be applied to piping only before connection of equipment and appliances. In no case shall piping, equipment or appliances be subjected to pressure exceeding their test ratings.
 - 6.2 Tests shall be completed and approved before any insulation is applied.
 - 6.3 After tests have been completed, the system shall be drained and cleaned of all dust and foreign matter. All strainers, valves and fittings shall be cleaned of all dirt, fittings, and debris.
 - 6.4 **Water Piping**

All water piping shall be tested and proven tight under hydrostatic pressure of 1 1/2 times the design pressure unless stated otherwise in the specifications. Prescribed pressure shall be maintained for four hours.
7. **Duct Work:**

7.1 All branches and outlets shall be tested for air quantity, and the total of the air quantities shall be within plus five percent (5%) of fan capacity.

7.2 Fire dampers, volume dampers and splitter dampers shall be tested for proper operation.

8. **Balancing and Adjustment:**

All air handling ventilation equipment, duct work and outlets shall be adjusted and balanced to deliver the specified air quantities indicated, at each inlet and outlet, on the drawings. If these air quantities cannot be delivered without exceeding the speed range of the sheaves or the available horse power, the architect shall be notified before proceeding with the balancing of air distribution system.

9. **Electrical Equipment:**

9.1 All electrical equipment shall be cleaned and adjusted on site before application of power.

9.2 The following tests shall be carried out:

9.2.1 Wire and cable continuity tests.

9.3 Insulation resistance tests, phase to phase and phase to earth, on all circuits and equipment, using a 500 volt meggar. The meggar reading shall be not less than one mega ohm.

9.4 Earth resistance between conduit system and earth must not exceed half (1/2) ohm.

9.5 Phasing out and phase rotation tests.

9.6 Operating tests on all protective relays to prove their correct operation before energising the main equipment.

9.7 Operating tests on all starters, circuit breakers, etc.

10. **Performance Tests:**

10.1 The installation as a whole shall be balanced and tested upon completion, and all relevant information, including the following shall be submitted to the architects.

10.1.1 Air volume passing through each unit, duct, grilles and apertures.

10.1.2 Differential pressure readings across each filter, fan and coil, and through each

- pump.
- 10.1.3 Static pressure in each air duct.
 - 10.1.4 Electrical current readings, in amperes of full and average load running, and starting, together with name plate current of each electrical motor.
 - 10.1.5 Continuous recording over a specified period, of ambient wet and dry bulb temperatures under varying degrees of internal heat loads and use and occupation, in each zone of each part of the building.
 - 10.2 Daily records should be maintained of hourly readings, taken under varying degrees of internal heat load and use and occupation, of wet and dry bulb temperatures, upstream "on-coil" of each cooling coil. Also suction temperatures and pressures for each refrigerating unit. The current and voltage drawn by each machine.
 - 10.3 Any other readings shall be taken which may subsequently be specified by the architect.
11. **Miscellaneous:**
- 11.1 The above tests are mentioned herein for general guidance and information only but not by way of limitation to the provisions of conditions of contract and specification.
 - 11.2 The date of commencement of all tests listed above shall be subject to the approval of the architect, and in accordance with the requirements of this specification.
 - 11.3 The contractor shall supply the skilled staff and all necessary instruments and carry out any test of any kind on a piece of equipment, apparatus, part of system or on a complete system if the architect requests such a test for determining specified or guaranteed data as given in the specification or on the drawings.
 - 11.4 Any damage resulting from the tests shall be repaired and/or damaged material replaced, all to the satisfaction of the Engineer.
 - 11.5 In the event of any repair or any adjustment having to be made, other than normal running adjustment, the tests shall be void and shall be recommended after the adjustment or repairs have been completed.
 - 11.6 The contractor must inform the architect when such tests are to be made, giving sufficient notice, in order that the architect or his nominated representative may be present.

- 11.7 Complete records of all tests must be kept and 3 copies of these and location drawings must be furnished to the architect.
- 11.8 The contractor may be required to repeat the test as required, should the ambient conditions at the time not given, in the opinion of the architect, sufficient and suitable indication of the effect and performance of the installation as a whole or of any part, as required.

MODE OF MEASUREMENTS

1. Unit Prices in the Schedule of Quantities:

- 1.1 The item description in the schedule of quantities is in the form of a condensed resume. The unit price shall be held to include every thing necessary to complete the work covered by this item in accordance with the specifications and drawings. The sum total of all the individual item prices shall represent the total price of the installation ready to be handed over.
- 1.2 The unit price of the various items shall include the following:
 - 1.2.1 All equipment, machinery, apparatus and materials required as well as the cost of any tests which the consultant may request in addition to the tests generally required to prove quality and performance of equipment.
 - 1.2.2 All the labour required to supply and install the complete installation in accordance with the specifications.
 - 1.2.3 Use of any tools, equipment, machinery, lifting tackle, scaffolding, ladders etc. Required by the contractor to carry out his work.
 - 1.2.4 All the necessary measures to prevent the transmission of vibration.
 - 1.2.5 The necessary material to isolate equipment foundations from the building structure, wherever necessary.
 - 1.2.6 Storage and insurance of all equipment apparatus and materials.
- 1.3 The contractor's unit price shall include all equipment, apparatus, material and labour indicated in the drawings and/or specifications in conjunction with the item in question, as well as all additional equipment, apparatus, material and labour usual and necessary to make in question on its own (and within the system as a whole) complete even though not specifically shown, described or otherwise referred to.

2. Measurements of Sheet Metal Ducts, Grilles/Diffusers etc.

2.1 Sheet Metal Ducts

- 2.1.1 All duct measurements shall be taken as per actual outer duct surface area including bends, tees, reducers, collars, vanes & other fittings. Gaskets, nuts, bolts, vibration rotation pads are included in the basic duct items of the boq.
- 2.1.2 The unit of measurements shall be the finished sheet metal surface area in metres

squares. No extra shall be allowed for lapse and wastages.

- 2.1.3 All the guide vanes, deflectors in duct elbows, branches, grille collars quadrant dampers etc. shall be measured for actual sheet metal surface and paid for at the same rate as duct of same thickness.
- 2.1.4 The unit duct price shall include all the duct hangers and supports, exposing of concrete reinforcement for supports and making good of the same as well as any materials and labour required to complete the duct frame.

2.2 **Grilles/Diffusers**

All grilles/diffusers as per tender requirements shall be treated as a lump sum item. Where extra grilles diffusers are ordered upto award of work, they should be measured as follows:

- 2.2.1 All measurements of grilles/diffusers shall be the actual neck size excluding the outer flanges.
- 2.2.2 The square or rectangular grilles/diffusers shall be measured in plain sq.m.
- 2.2.3 All round diffusers shall be measured by their diameters in cm.
- 2.2.4 All linear diffusers shall be measured as per actual length in metres.

3. **Measurements of Piping, Fittings, Valves, Fabricated Items :**

3.1 **Pipe**

Including water piping, steam piping and all other piping required to be executed at site for completion of the works.

- 3.1.1 All pipes shall be measured in linear metre (to the nearest cm) along the axis of the pipes and rates shall be inclusive of all fittings e.g. tees, bends, reducers, elbows etc. deduction shall be made for valves in the line.
- 3.1.2 Exposing reinforcement in wall and ceiling and floors of possible and making good the same or installing anchor fasteners and inclusive of all items as specified in specifications and schedule of quantities.
- 3.1.3 Rates quoted shall be inclusive of providing and fixing vibration pads and wooden pieces, wherever specified or required by the project co-ordinator.
- 3.1.4 Flexible connections, wherever required or specified shall be measured as part of straight length of same diameter, with no additional allowance being made for providing the same.

3.1.5 The length of the pipe for the purpose of payment will be taken through the centreline of the pipe and all fittings (e.g. tees, bends, reducers, elbows, etc.) as through the fittings are also presumed to be pipe lengths. Nothing extra whatsoever will be paid for over and above for the fittings for valves and flanges, section 3.2 below applies.

3.2 Valves and Flanges

3.2.1 All the extra ci & cm flanged valves shall be measured according to the nominal size in mm and shall be measured by number. Such valves shall not be counted as part of pipe length hence deduction in pipe length will be made wherever valves occur.

3.2.2 All gun metal (gate & globe) valves shall include two Nos. of flanges and two numbers 150 mm long ms nipples, with one side threaded matching one of the valves, and other welded to the M.S. slip-on-flange. Rate shall also include the necessary number of bolts, nuts and washers, 3 mm thick insertion gasket of required temp. grade and all items specified in the specifications.

3.2.3 The rates quoted shall be inclusive of making connections to the equipment, tanks, pumps etc. and the connection made with an installed pipe line shall be included in the rates as per the b.o.q.

3.3 Structural Supports

Structural supports including supports fabricated from pipe lengths for pipes shall be measured as part of pipe line and hence no separate payment will be made. Rates shall be inclusive of hoisting, cutting, jointing, welding, cutting of holes and chases in walls, slabs or floors, painting supports and other items as described in specifications, drawings and schedule of quantities or as required at site by project co-ordinator.

3.4 Copper Connections for Fan Coil Units

3.4.1 Copper connection assembly for making connections to the fan coil units shall be measured, as part of the fan coil unit price and shall include brass flare nuts, brass straight connector, brass tees, brass reducing fittings, fixing of automatic 3 way valve, making connections and leak testing, complete assembly as per specifications and drawings. Nothing extra shall be payable on account of any variation in the length of copper pipe.

4. Insulation:

4.1 The measurement for vessels, piping, and ducts shall be made over the bare uninsulated surface area of the metal.

4.2 **Pipes, Ducts & Vessels**

4.2.1 **Pipes**

The measurements for installation of piping shall be made in linear metres through all valves, flanges, and fittings. Pipes/bends shall be measured along the centreline radius between tangent points. If the outer radius is r_1 and the inner radius is r_2 the centre line radius shall be measured as $(r_1+r_2)/2$. Measurement of all valves, flanges and fittings shall be measured with the running metre of pipe line as if they are also pipe lengths. Nothing extra over the above shall be payable for insulation over valves, flanges and fittings in pipe line/routings. Fittings that connect two or more different sizes of pipe shall be measured.

4.2.2 **Ducts**

The measurements for insulation of ducts shall be made in actual square metres of bare uninsulated duct surface through all dampers, flanges and fittings. In case of bends the area shall be worked out by taking an average of inner and outer lengths of the bends. Measurements for the dampers, flanges, fittings shall be for the surface dimension for the connecting duct, nothing extra over the above shall be payable for insulation over dampers, flanges and fittings in duct routing.

4.2.3 **Vessels**

The area of standard dished and flat ends of vessels shall be the square of the diameter of the uninsulated body of the shell. Areas for other shapes shall be the actual calculated area. There shall be no deduction or additions for nozzles, handles ribs, dampers, expansion joints etc. All projections on vessels or tanks shall be measured separately as pipe/duct.

4.3 **Accessories Insulation**

4.3.1 The unit of measurement for accessories such as expansion tank, pumps, chiller heads etc. shall be uninsulated are in square metres.

4.3.2 In case of curved or irregular surfaces, measurements shall be taken along the curves.

4.3.3 The unit insulation price shall include all necessary adhesives, vapour proofing and finishing materials as well as additional labour and material required for fixing the insulation.

4.4 **Acoustic Duct Lining**

4.4.1 In case of acoustic lining of air ducts, measurements of the bare inside duct

surface in square metres shall be final for billing purposes.

- 4.4.2 The insulation/acoustic panels shall include cost of battens, supports, adhesives, vapour proofing, finished tiles/boards/sheets as well as additional labour and materials required for completing the work.

SCHEDULE OF EQUIPMENT

CENTRIFUGAL FANS

(for Hostel -1)

For Basement (Fresh Air Fans)

Air Quantity : 10000 CFM (for normal ventilation) 1 Nos.
Static Pressure :40 mm wg

Air Quantity : 15000 CFM (for emergency) 1 Nos.
Static Pressure :40 mm wg

(for Hostel -2)

For Basement (Fresh Air Fans)

Air Quantity : 11800 CFM (for normal ventilation) 1 Nos.
Static Pressure :40 mm wg

Air Quantity : 17700 CFM (for emergency) 1 Nos.
Static Pressure :40 mm wg

(for Hostel -3)

For Basement (Fresh Air Fans)

Air Quantity : 51500 CFM (for normal ventilation) 2 Nos.
Static Pressure :40 mm wg

Air Quantity : 77200CFM (for emergency) 2 Nos.
Static Pressure :40 mm wg

AXIAL FLOW FANS FIRE RATED

(for Hostel -1)

Duty: Smoke Spill / Ventilation Fan
Air Quantity : 10000 CFM (fresh air) 1 Nos.
Static Pressure : 40 mm wg
Fan shall be 250 deg C, 2 hours fire rated.

Duty: Smoke Spill / Ventilation Fan
Air Quantity : 15000 CFM (in case of fire) 1 Nos.
Static Pressure : 40 mm wg
Fan shall be 250 deg C, 2 hours fire rated.

(for Hostel -2)

Duty: Smoke Spill / Ventilation Fan
Air Quantity : 11800 CFM (Normal ventilation) 1 Nos.
Static Pressure : 40 mm wg
Fan shall be 250 deg C, 2 hours fire rated.

Duty: Smoke Spill / Ventilation Fan
Air Quantity : 17700 CFM (in case of fire) 1 Nos.

Static Pressure : 40 mm wg
Fan shall be 250 deg C, 2 hours fire rated.

(for Hostel -3)

Duty: Smoke Spill / Ventilation Fan
Air Quantity : 25750 CFM (in normal condition)) 4 Nos.
Static Pressure : 40 mm wg
Fan shall be 250 deg C, 2 hours fire rated.

Duty: Smoke Spill / Ventilation Fan
Air Quantity : 38600 CFM (in case of fire) 4 Nos.
Static Pressure : 40 mm wg
Fan shall be 250 deg C, 2 hours fire rated.

TUBE AXIAL FLOW FANS

(for Hostel -1)

Duty: Lift well pressurisation
Air Quantity : 9000 CFM 2 Nos.
Static Pressure : 30 mm wg

Duty: Lift well pressurisation
Air Quantity : 8250 CFM 2 Nos.
Static Pressure : 30 mm wg

Duty: Lift lobby pressurisation
Air Quantity : 9000 CFM 1 Nos.
Static Pressure : 30 mm wg

Duty: Lift lobby pressurisation
Air Quantity : 10000 CFM 1 Nos.
Static Pressure : 30 mm wg

(for Hostel -2)

Duty: Lift well pressurisation
Air Quantity : 9000 CFM 2 Nos.
Static Pressure : 30 mm wg

Duty: Lift well pressurisation
Air Quantity : 8250 CFM 2 Nos.
Static Pressure : 30 mm wg

Duty: Lift lobby pressurisation
Air Quantity : 9000 CFM 1 Nos.
Static Pressure : 30 mm wg

Duty: Lift lobby pressurisation
Air Quantity : 10000 CFM 1 Nos.
Static Pressure : 30 mm wg

Duty: Toilet Exhaust at terrace
 Air Quantity : 2200 CFM 15 Nos.
 Static Pressure : 25 mm wg

Duty: Toilet Exhaust at terrace
 Air Quantity : 1100 CFM 3 Nos.
 Static Pressure : 25 mm wg

(for Hostel -3)

Duty: Lift well pressurisation
 Air Quantity : 6000 CFM 2 Nos.
 Static Pressure : 30 mm wg

Duty: Lift lobby pressurisation
 Air Quantity : 4000 CFM 1 Nos.
 Static Pressure : 30 mm wg

IN LINE FANS

(for Hostel -1)

Air Quantity :100 CFM 20 Nos.
 Static Pressure :15 mm wg

(for Hostel -2)

Air Quantity :100 CFM 330 Nos.
 Static Pressure :15 mm wg

PROPELLER FANS

(for Hostel -1)

150 mm dia 900 RPM fan suitable for 220 +/- 10% volts,
 50 Cycles, 1 Phase AC Supply 170 Nos

225 mm dia 900 RPM fan suitable for 220 +/- 10% volts,
 50 Cycles, 1 Phase AC Supply 18 Nos

(for Hostel -2)

225 mm dia 900 RPM fan suitable for 220 +/- 10% volts,
 50 Cycles, 1 Phase AC Supply 3 Nos

(for Hostel -3)

150 mm dia 900 RPM fan suitable for 220 +/- 10% volts,
 50 Cycles, 1 Phase AC Supply 60 Nos

225 mm dia 900 RPM fan suitable for 220 +/- 10% volts,
 50 Cycles, 1 Phase AC Supply 10 Nos

LIST OF DRAWINGS

A) HOSTEL-1

1. VENTILATION LAYOUT BASEMENT HSCC/D&E/AIIMS-HS-1/AC-01

B) HOSTEL-2

1. VENTILATION LAYOUT BASEMENT HSCC/HVAC/AIIMS-HS-2/AC-01

C) HOSTEL-3

1. VENTILATION LAYOUT BASEMENT-1 HSCC/HVAC/AIIMS-HS-3/AC-01

2. VENTILATION LAYOUT BASEMENT-2 HSCC/HVAC/AIIMS-HS-3/AC-02

LIST OF APPROVED MAKES AND MANUFACTURERS

The subcontractors/makes/brands of equipment listed below are approved for installation.

All items to be used in the works samples, catalogues and specifications are to be submitted by the contractor for approval of the Engineer. Only approved makes shall be used in the works. The approved samples shall be kept in the custody of the Engineer for comparison.

| ITEM | APPROVED MAKES/SUBCONTRACTORS |
|--|---|
| Subcontractors | Voltas/ETA/BlueStar/Suvidha/UniqueEngineers /Approved equivalent by Engineer |
| Airhandling Unit | |
| Unitary type | Carrier Aircon/Caryaire/Blue Star/ZECO/Saiver |
| Ductable type | Carrier Aircon/Caryaire/Blue Star/ZECO/Saiver |
| Double skin type | Carrier Aircon/Caryaire/Blue Star/ZECO/Saiver |
| AHU cooling coils | Bluestar/Voltas/Zeco/Hitech/Caryaire/Carrier-Aircon |
| Centrifugal fan of double skin type AHU. | Nicotra/Comefri/Flakt/Kruger/GEC |
| Air Washer | Roots Cooling / Ambassador / Humidin |
| Scrubber system | Thermax / Peema / Batliboi |
| End suction back pull out pump | Kirloskar/Beacon-weir/Mather & Platt/KSB/Greaves |
| Pumps coupled with VFD | ITT / Bell & Goset / Grundfos |
| VFD with controls | ITT / Danfoss/ABB/Siemens |
| Humidifier | Rapid cool/Emerald/Khokar |
| Exhaust Fan Sections | Hitech/ Edgetech/Flowel |
| FCUs | Hitech/Blue Star/Carrier/Zeco/Voltas |
| Window AC/Split AC/VRF system | Voltas / Blue star/ Carrier /Hitachi/Daikin |

Ventillation Fans

| | |
|--------------------|--|
| Centrifugal Blower | GEC/ Swent / Flakt/Nadi / Divine/Krugger |
| Inline Fan | Krugger/Flakt/Comefri/Nicotra |
| Propeller Fan | GEC(Alsthom)/Crompton Greaves/ Khaitan/Usha/Polar |
| Axial Fan | Krugger/ Flakt/comefri |

Pipes

| | |
|------------------------------|---|
| GI | ITC/ Jindal/Tata/SAIL/HSL |
| MS upto 150 mm dia | ITC/ Jindal/Tata/SAIL/HSL |
| MS 200 to 300 dia | ITC/ Jindal/Tata/SAIL/HSL |
| GI Sheets | TATA/SAIL/Jindal/Bhushan Steel |
| Aluminium Sheet | Balco/Nalco/Hindalco |
| Grilles/Diffusers | Ravistar/Caryaire/ Mapro/Dynacraft |
| Fire dampers (Motorized) | Caryaire/Dynacraft / Ravistar |
| Cooling Tower | Paharpur/Bell/Mihir/Aadi/Advance |
| Electric Hot Water Generator | Rapid cool/Emerald/Khokar |
| Window /Split Airconditioner | Carrier Aircon/LG/Hitachi/Voltas/Bluestar |

Valves

| | |
|-------------------------|---|
| Gate Valve | Leader/Divine/Sant/Bankim Sarkar |
| Butterfly Valves | Advance/Castle/Audco/Intervalve /Arrow/C&R |
| Balancing Valves | Advance/Castle/Audco/Arrow/C&R |
| Non-return Valves | Advance/Castle/Kirloskar/C&R/Arrow |
| Pot & Y- Strainer | Emerald/Sant/Rapid cool |
| Three way mixing valves | Stafea/Johnson/Honeywell/Danfoss/Anergy/Rapid controls |

Two way motorized valve Staefa/Johnson/Honeywell/Danfoss/Anergy/Rapid controls

Actuating motor for 3 way & 2 way valve Staefa/Johnson/Honeywell/Danfoss/Anergy

Ball Valve with & without strainer Rapid Control/Sant/Leader

Insulation

Fibre glass FGP Ltd./UP Twiga/Kimmco / Owens Corning

Expanded Polystyrene Beardsell Ltd./ BASF/Styrene Packing/ Indian Packaging Industries/ Lloyd

Air Filters Thermadyne/Klenzaid/Kirloskar /Anfilco/Johnflower/Dynafilter

Thermometers/Pressure Gauge Fiebig/Emerald/H Guru/Japsin

Thermostats/Humidistats Honeywell/Penn /Staefa/Johnson/ Anergy/Rapid Controls

Electric Strip Heaters Escorts/Daspass

Controls Honeywell/ Johnson / Staefa

Electric Panels CPRI approved make (To be approved by HSCC)

Electric Motors Siemens/Kirloskar/ABB/ Bharat Bijlee. /Crompton Greaves

Starters/Contactors L&T/ GE Power/ Siemens/ ABB


ACB/MCCB L&T/ GE Power/ Siemens/ ABB

Switch Fuse/ Fuse Switch Units L&T/ GE Power/ Siemens/ ABB

Cables

Power Cables & Control cable CCI/Universal/ICC/NICCO/INCAB/ National/Rallison Cables

Lamps & Push Buttons L&T/GE/ Siemens/ Schneider
Relays Current Transformer/
Ammeter/Voltmeter

| | Design & Engineering Department |  | | | | |
|---|---|---|------------|----------------------|--------------------|-------------------------|
| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| | Note: Based on the tender drawing the agency has to prepare the internal & external plumbing shop drawing and obtain the approval of the same before execution | | | | | |
| 1.00 | SANITARY FIXTURES | | | | | |
| 1.01 | Providing&fixing water closet squatting pan(Indian W.C.Pan)with 100 mm sand cast iron P or S strap,10 Litre low level white P.V.C flushing cistern with manually controled device(handle lever) conforming to IS:7231 with all fittings&fixture complete including cutting and making good the walls & floors wherever required. | | | | | |
| a) | White vitreous china orissa pattern W.C. pan of size 580 x 440 mm with integral type foot rests. | Each | 3.0 | | | |
| 1.02 | Providing and fixing white vitreous china pedestal type water closet (European type) with seat and lid, 10 litre low level white vitreous flushing cistern and C.P. flush bend with fittings & C.I. brackets, 40mm flush bend, overflow arrangement with specials of standard make and mosquito proof coupling of approved municipal design complete including painting of fittings and brackets, cutting and making good the walls and floors wherever required: | | | | | |
| a) | W.C. pan with ISI black solid plastic seat & lid. | Each | 555.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 1.03 | Providing and fixing white vitreous China flat back or wall corner type lipped front urinal basin of 430x260x350 mm and 340x410x265 mm sizes respectively with automatic flushing cistern with standard flush pipe and C.P. brass spreaders with brass unions and G.I. clamps complete, including painting or fittings and brackets, cutting and making good the walls and floors wherever required. | | | | | |
| a) | One urinal basin with 5 litre white PVC automatic flushing cistern | Each | 3.0 | | | |
| 1.04 | Providing and fixing wash basin with C.I. brackets, 15mm C.P. brass pillar taps, 32mm C.P. brass waste of standard pattern, including painting of fittings and brackets, cutting and making good the walls wherever required: | | | | | |
| a) | White vitreous china wash basin size 550x 400 mm with a pair of 15mm C.P. brass pillar tap. | Each | 555.0 | | | |
| 1.05 | Providing and fixing Stainless Steel A ISI 304 (18/8) kitchen sink as per IS 13983 with C.I. brackets and stainless steel plug 40 mm including painting of fittings and brackets, cutting and making good the walls wherever required: | | | | | |
| | Kitchen sink without drain board | | | | | |
| a) | 610x510 mm bowl depth 200 mm. | Each | 227.0 | | | |
| 1.07 | Extra for using coloured W.C. pan instead of white W.C pan | | | | | |
| a) | Orissa pattern W.C. pan 580x440 mm | Each | 3.0 | | | |
| 1.08 | Extra for using coloured pedestal type W.C. pan (European type) with low level cistern of same colour instead of white vitreous china W.C. pan and cistern | Each | 555.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 1.09 | Providing and fixing superior glass (of approved quality) and of required shape and size with plastic moulded frame of approved make and shape with 6 mm thick hard board backing. | | | | | |
| a) | Rectangular shape 453x357 mm | Each | 555.0 | | | |
| 1.10 | Providing and fixing 600x120x5 mm glass shelf with edges round of supported and anodised aluminium angle frame with C.P. brass brackets and guard rail complete fixed with 40 mm long screws, rawl plugs etc., complete. | Each | 555.0 | | | |
| 1.11 | Providing and fixing toilet paper holder . | | | | | |
| a) | Vitreous china | Each | 555.0 | | | |
| 1.12 | Providing and fixing PTMT liquid soap container 109 mm wide, 125 mm high and 112 mm distance from wall of standard shape with bracket of the same materials with snap fittings of approved quality and colour weighing not less than 105 gms. | Each | 3.0 | | | |
| 1.13 | Providing and fixing water Jet Nozzle with hose pipe and haif turn CP brass angle valve to be fitted with seat cover of european water closet complete in all respect of approved quality | Each | 555.0 | | | |
| 1.14 | Providing and fixing soap tray with CP brass lid and brackets fixed to wooden cleats with CP brass screws.(Jaquar model no.1131 or equivalent model of other approved make). | Each | 1102.0 | | | |
| 1.15 | Providing and fixing CP brass towel rail size of 600x20 mm of approved make complete with CP brackets fixed to wooden cleats with CP brass screws(Jaquar model no.1111 or equivalent model of other approved make) | Each | 555.0 | | | |

| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
|--|---|------|------------|----------------------|--------------------|-------------------------|
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 1.16 | Providing and fixing brass coat hook of approved quality and make complete with material of fixing | Each | 1110.0 | | | |
| 1.17 | Extra for providing and fixing white vitreous china oval shape wash basin in place of normal wash basin with CI/MS brackets painted white, 15 mm CP brass pillar taps, 32 mm CP brass waste of standard pattern, including painting of fittings and brackets cutting and making good the walls wherever required | | | | | |
| a) | Counter top oval shape wash basin size 550x470 mm with centre tap hole, single 15 mm CP brass swan neck type pillar tap | Each | 2228.0 | | | |
| 1.18 | Extra for providing and fixing white vitreous china wall hung type water closet (European type) in place of normal pedestal type water closet with white solid plastic seat and lid concealed flushing cystem 9 ltrs capacity(min) approximate size(400x300x100)comprising of SS actuating panel with dual flush with fittings ,specials of standard make(Viega,ACO,Kohler,Jaquar) and complete including painting , cutting and making good the walls and floors wherever required: | Each | 555.0 | | | |
| | | | | | | |
| | | | | | | |
| | SUB TOTAL(SANITARY FIXTURES) | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|-------------|---|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 2.00 | SOIL, WASTE AND VENT PIPES | | | | | |
| 2.01 | Providing and fixing soil, waste and vent pipes. | | | | | |
| a) | 100 mm dia. | | | | | |
| a i) | Centrifugally cast (spun) iron socketed pipe as per IS:3989 | Metre | 8195.0 | | | |
| b) | 150 mm dia | | | | | |
| | Centrifugally cast (spun) iron socketed pipe as per IS:3989 | Metre | 390.0 | | | |
| 2.02 | Providing and fixing M.S holder-bat clamps of approved design to Sand Cast iron/ cast iron (spun) pipe embedded in and including cement concrete blocks 10x10x10 cm of 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size) including cost of cutting holes and making good the walls etc. | | | | | |
| a) | for 100 mm dia. pipe | Each | 1544.0 | | | |
| c) | for 150 mm dia pipe | Each | 85.0 | | | |
| 2.03 | Providing and fixing bend of required degree with access door, insertion rubber washer 3 mm thick, bolts and nuts complete. | | | | | |
| a) | 100 mm | | | | | |
| a ii) | Sand cast iron S&S as per IS-3989 | Each | 200.0 | | | |
| c) | 150 mm dia | | | | | |
| | Sand cast iron S&S as per IS-3989 | Each | 15.0 | | | |
| 2.04 | Providing and fixing plain bend of required degree. | | | | | |
| a) | 100 mm | | | | | |
| a ii) | Sand cast iron S&S as per IS:3989 | Each | 752.0 | | | |
| b) | 150 mm | Each | 38.0 | | | |
| 2.05 | Providing and fixing heel rest sanitary bend. | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| a) | 100 mm dia | | | | | |
| a.ii) | sand cast iron S&S as per IS-3989 | Each | 140.0 | | | |
| 2.06 | Providing and fixing single equal plain junction of required degree with access door, insertion rubber washer 3mm thick, bolts and nuts complete. | | | | | |
| a) | 100x100x100mm | | | | | |
| a.ii) | sand cast iron S&S as per IS-3989 | Each | 1156.0 | | | |
| 2.07 | Providing and fixing single equal plain junction of required degree | | | | | |
| a) | 100x100x100mm | | | | | |
| a.ii) | sand cast iron S&S as per IS-3989 | Each | 92.0 | | | |
| 2.08 | Providing and fixing single unequal plain junction of required degree | | | | | |
| a) | 150x150x100 mm | | | | | |
| a.ii) | sand cast iron S&S as per IS-3989 | Each | 36.0 | | | |
| 2.09 | Providing and fixing door piece, insertion rubber washer 3mm thick, bolts and nuts complete | | | | | |
| a) | 100 mm | | | | | |
| a.ii) | sand cast iron S&S as per IS-3989 | Each | 130.0 | | | |
| 2.10 | Providing and fixing terminal guard. | | | | | |
| a) | 100 mm | Each | 140.0 | | | |
| a.ii) | sand cast iron S&S as per IS-3989 | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 2.11 | Providing and fixing collar | | | | | |
| a) | 100 mm | | | | | |
| a.ii) | Sand cast iron S&S as per IS-3989 | Each | 1190.0 | | | |
| b) | 150 mm | Each | 59.0 | | | |
| 2.12 | Providing lead caulked joints to sand cast iron /centrifugally cast (spun) iron pipes and fittings of diameter: | | | | | |
| a) | 100 mm | Each | 5495.0 | | | |
| c) | 150 mm | Each | 270.0 | | | |
| 2.13 | Providing Drip seal joint of approved make for the sand cast iron/centrifugally cast iron pipes where the workability of lead joint can be effected due to space constraints. | | | | | |
| a) | 100 mm | Each | 2400.0 | | | |
| c) | 150 mm | Each | 60.0 | | | |
| 2.14 | Providing and fixing M.S. stays and clamps for sand cast iron / centrifugally cast (spun) iron pipes of diameter : | | | | | |
| a) | 100 mm | Each | 140.0 | | | |
| 2.15 | Providing and fixing trap of self cleansing with screwed down or hinged grating with or without vent arm complete, including cost of cutting and making good the walls and floors: | | | | | |
| a) | 100 mm inlet and 100 mm outlet | | | | | |
| a i) | Sand cast iron S&S as per IS-3989 | Each | 1080.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 2.16 | Cutting chases in brick masonry walls for following diameter sand cast iron/centrifugally cast (spun) iron pipes and making good the same with cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 12.5 mm nominal size) including necessary plaster and pointing in cement mortar 1:4 (1 cement: 4 coarse sand): | | | | | |
| a) | 100 mm diameter pipe | Metre | 230.0 | | | |
| 2.17 | Painting sand cast iron / centrifugally cast (spun) iron soil, waste vent pipes and fittings with paint of any colour such as chocolate, grey, or buff etc. over a coat of primer (of approved quality) for new work: | | | | | |
| a) | 100 mm diameter pipe | Metre | 6270.0 | | | |
| c) | 150 mm diameter pipe | Metre | 10.0 | | | |
| 2.18 | Providing and fixing floor drain points formed out of 65 mm dia GI elbow, including with 75mm dia Stainless Steel grating with frame, embedded in floor, all complete as directed. | Each | 551.0 | | | |
| 2.19 | Providing and fixing C.P. brass bottle trap for wash basin including CP waste fittings complete 32 mm dia complete in all respect of approved quality. | Each | 615.0 | | | |
| 2.21 | Providing and laying cement concrete 1:2:4 (1 cement:2 coarse sand:4 graded stone aggregate 20 mm nominal size) 80 mm thick all-round the SCI/centrifugally S&S pipe diameter. | | | | | |
| a) | 100 mm dia | Metre | 1580.0 | | | |
| 2.22 | Providing and fixing dash fastner made of rust proof plated steel for holding the soil/waste supply pipes complete in all respect | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| a) | Dash fastner for pipe more than 25 mm dia to 150 mm dia pipe of size 25 mm dia and 75 mm long minimum & shall be capable of taking 6 tonnes load and also include the supporting angles 35x35x5 mm/ of required size or MS bars steel structures as per drawing. | Each | 250.0 | | | |
| 2.23 | Providing and fixing floor clean out plug consist of CI bend & GI socket heavy class with Brass cap & key for opening male threaded cap etc. including lead caulked to CI pipescomplete in all respects as per drawing/ sample approved by Engineer -in - ChargeFCO (floor clean out plug shall be flushed with floor finish | | | | | |
| | 100 mm dia | Each | 35.0 | | | |
| 2.24 | Providing and fixing clean out plug consist of GI socket/nipple heavy class with threaded pludge for opening male threaded cap etc. including lead caulked to CI pipescomplete in all respects as per drawing/ sample approved by Engineer -in -Charge | | | | | |
| | 100 mm dia/150 mm dia | Each | 920.0 | | | |
| 2.25 | Providing and fixing G.I EXTENSION PIECE for 100 mm dia floor trap formed out of main pipe(Type A) with multiple side inlets, suitable for various dia pipes, side connections, including all fixtures and fittings as per site conditions and as per standard details and water tight sealing of joints and area surrounding the grating and as directed. | Each | 1070.0 | | | |
| 2.26 | Providing and fixing cPVC. pipes complete with cPVC fittings including painting,jointing,testing the cost of cutting the chases and making good the same for waste water disposal complete as per direction of engineer incharge. | | | | | |
| a) | 32 mm dia nominal bore (Wash basin to floor trap/floor drain) | Metre | 1104.0 | | | |
| b) | 40 mm dia nominal bore (Sink,Urinal to floor trap) | Metre | 3.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|--|--|-------------|-------------------|-----------------------------|---------------------------|--------------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| b) | 50 mm dia nominal bore (Floor Drain to Floor Trap) | Metre | 583.0 | | | |
| 2.3 | Providing & fixing SS floor trap grating 143x143x5mm thick screwable with SS fixed frame of 150x150 mm size as per approved make & model | Each | 1070.0 | | | |
| SUB TOTAL(SOIL, WASTE AND VENT PIPES) | | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|-------------|--|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 3.00 | WATER SUPPLY | | | | | |
| 3.01 | Providing and fixing Chlorinated Polyvenyl Chloride(CPVC)pipes having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings i/c fixing the pipe with clamps at 1.0 m spacing.This includes jointing of pipes & fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in charge. | | | | | |
| | Internal work – Exposed on wall | | | | | |
| a) | 15 mm nominal outer dia pipes (SDR-11) | Metre | 440.0 | | | |
| b) | 20 mm nominal outer dia pipes (SDR-11) | Metre | 1175.0 | | | |
| c) | 25 mm nominal outer dia pipes (SDR-11) | Metre | 1450.0 | | | |
| d) | 32 mm nominal outer dia pipes (SDR-11) | Metre | 1585.0 | | | |
| e) | 40 mm nominal outer dia pipes (SDR-11) | Metre | 1120.0 | | | |
| f) | 50 mm nominal outer dia pipes (SDR-11) | Metre | 565.0 | | | |
| g) | 62.5 mm nominal outer dia pipes (SDR-11) | Metre | 700.0 | | | |
| 3.02 | Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in Charge. | | | | | |
| | Concealed work including cutting chases and making good the walls etc. | | | | | |
| a) | 15 mm nominal outer dia pipes (SDR-11) | Metre | 6900.0 | | | |
| b) | 20 mm nominal outer dia pipes (SDR-11) | Metre | 1280.0 | | | |

| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
|--|--|-------|------------|----------------------|--------------------|-------------------------|
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| c) | 25 mm nominal outer dia pipes (SDR-11) | Metre | 70.0 | | | |
| d) | 32 mm nominal outer dia pipes (SDR-11) | Metre | 3.0 | | | |
| 3.03 | Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in Charge. | | | | | |
| | External Work | | | | | |
| a) | 25 mm nominal outer dia pipes (SDR-11) | Metre | 60.0 | | | |
| b) | 40 mm nominal outer dia pipes (SDR-11) | Metre | 60.0 | | | |
| c) | 50 mm nominal outer dia pipes (SDR-11) | Metre | 60.0 | | | |
| 3.04 | Providing and fixing G.I. pipes complete with G.I. fittings and clamps, including cutting and making good the walls etc. | | | | | |
| | Internal Work- Exposed on walls | | | | | |
| b) | 80 mm dia nominal bore | Metre | 835.0 | | | |
| c) | 100 mm dia nominal bore | Metre | 30.0 | | | |
| 3.05 | Making connection of G.I. distribution branch with G.I. main of following sizes by providing and fixing tee, including, cutting and threading the pipe etc. complete including obtaining approval for connection from DJB/Municipal corporation : | | | | | |
| a) | 50 to 80 mm nominal bore (SDR-11) | Each | 6.0 | | | |
| 3.06 | providing and fixing gun metal gate valve with C.I. wheel of approved quality (screwed end) | | | | | |
| a) | 25 mm nominal bore | Each | 274.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| b) | 32 mm nominal bore | Each | 244.0 | | | |
| c) | 40 mm nominal bore | Each | 110.0 | | | |
| d) | 50 mm nominal bore | Each | 35.0 | | | |
| e) | 65 mm nominal bore | Each | 29.0 | | | |
| g) | 80 mm nominal bore | Each | 27.0 | | | |
| 3.07 | Providing and fixing ball valve (brass) of approved quality, High or low pressure with plastic floats complete | | | | | |
| a) | 20mm | Each | 8.0 | | | |
| 3.08 | Providing and fixing gun metal non-return valve of approved quality (screwed end) | | | | | |
| a) | 80 mm nominal bore | | | | | |
| a.i) | Horizontal | each | 4.0 | | | |
| b) | 100 mm nominal bore | | | | | |
| bi) | Horizontal | each | 4.0 | | | |
| 3.09 | Providing and fixing brass ferrule with C.I. mouth cover including boring and tapping the main | | | | | |
| a) | 25 mm nominal bore | Each | 6.0 | | | |
| b) | 40 mm nominal bore | Each | 8.0 | | | |
| 3.10 | Providing and fixing unplasticised PVC connection pipe with brass unions: | | | | | |
| a) | 45 cm length | | | | | |
| a i) | 15 mm nominal bore | Each | 2830.0 | | | |
| 3.11 | Providing and fixing C.I. sluice valves (with cap) complete with bolts, nuts, rubber insertions etc. (the tail pieces if required will be paid separately): | | | | | |
| a) | 80 mm diameter | each | 6.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| b) | 100 mm diameter | | | | | |
| bi) | Class I | each | 4.0 | | | |
| 3.12 | Constructing masonry chamber 30x30x50 cm, inside with 75 class designation brick work in cement mortar 1:4 (1 cement: 4 coarse sand) for stop cock, with C.I. surface box 100x100x75 mm (inside) with hinged cover fixed in cement concrete slab 1:2:4 mix (1 cement: 2 coarse sand:4 graded stone aggregate 20 mm nominal size) necessary excavation foundation concrete 1:5:10 (1 cement:5 fine sand: 10 graded stone aggregate 40 mm nominal size) and inside plastering with cement mortar 1:3 (1 cement :3 coarse sand) 12 mm thick finished with a floating coat of neat cement complete as per standard design | | | | | |
| a) | With F.P.s bricks | Each | 10.0 | | | |
| 3.13 | Constructing masonry chamber 60x60x75 cm, inside with 75 class designation brick work in cement mortar 1:4 (1 cement: 4 coarse sand) for sluice valve, with C.I. surface box 100mm top diameter, 160 mm bottom diameter and 180 mm deep (inside) with chained lid and RCC top slab 1:2:4 mix (1 cement: 2 coarse sand:4 graded stone aggregate 20 mm nominal size) necessary excavation foundation concrete 1:5:10 (1 cement:5 fine sand: 10 graded stone aggregate 40 mm nominal size) and inside plastering with cement mortar 1:3 (1 cement :3 coarse sand) 12 mm thick finished with a floating coat of neat cement complete as per standard design | | | | | |
| a) | With F.P.s bricks | each | 6.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|-----------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 3.14 | Painting CPVC/G.I. pipes and fittings with synthetic enamel white paint over a ready mixed priming coat, both of approved quality for new work | | | | | |
| a) | 15 mm nominal outer dia pipes | Metre | 440.0 | | | |
| b) | 20 mm nominal outer dia pipes | Metre | 1175.0 | | | |
| c) | 25 mm nominal outer dia pipes | Metre | 1450.0 | | | |
| d) | 32 mm nominal outer dia pipes | Metre | 1585.0 | | | |
| e) | 40 mm nominal outer dia pipes | Metre | 1120.0 | | | |
| f) | 50 mm nominal outer dia pipes | Metre | 565.0 | | | |
| g) | 65 mm nominal outer dia pipes | Metre | 700.0 | | | |
| 3.15 | Painting G.I. /CPVC pipes and fittings with two coats of anti-corrosive bitumastic paint of approved quality. | | | | | |
| a) | 25 mm diameter pipe | Metre | 60.0 | | | |
| b) | 40 mm diameter pipe | Metre | 60.0 | | | |
| c) | 50 mm diameter pipe | Metre | 60.0 | | | |
| 3.16 | Providing and filling sand of grading zone V or coarser grade all-round the G.I./CPVC pipes in external work | | | | | |
| a) | 25 mm diameter pipe | Metre | 60.0 | | | |
| b) | 40 mm diameter pipe | Metre | 60.0 | | | |
| c) | 50 mm diameter pipe | Metre | 60.0 | | | |
| 3.17 | Providing and placing on terrace (at all floor levels) polyethylene water storage tank ISI:12701 marked with cover and suitable locking arrangement and making necessary holes for inlet, outlet and overflow pipes but without fittings and the base support for tank | | | | | |
| | Treated water Tank and Untreated water tank | per litre | 60000.0 | | | |
| 3.18 | Providing and fixing C.P brass bib cock of approved quality. | | | | | |
| a) | 15 mm nominal bore | Each | 555.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 3.19 | Providing and fixing C.P. brass long nose bib cock of approved quality conforming to IS standards and weighing not less than 810 gms. (Marck, Jaquar, othello) | | | | | |
| a) | 15 mm nominal bore | Each | 1540.0 | | | |
| 3.20 | Providing and fixing C.P. brass angle valve for basin mixer and geyser/cisterns points of approved quality conforming to IS:8931. | | | | | |
| a) | 15 mm nominal bore | Each | 2830.0 | | | |
| 3.21 | Providing and fixing C.P. brass stop cock (concealed) of standard design and of approved make conforming to 18:8931. | | | | | |
| a) | 15mm nominal bore. | Each | 1104.0 | | | |
| 3.22 | Providing and fixing PTMT ball cock of approved quality, colour and make complete with Epoxy coated aluminium rod with L.P./H.P.H.D. plastic ball. | | | | | |
| a) | 40 mm nominal bore, 206 mm long weighin not less than 690 gms | Each | 6.0 | | | |
| b) | 50 mm nominal bore, 242 mm long weighin not less than 1240 gms | Each | 6.0 | | | |
| 3.23 | Cutting holes upto 30x30 cm in walls including making good the same | | | | | |
| a) | with F.P.S bricks | Each | 110.0 | | | |

| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
|--|---|------|------------|----------------------|--------------------|-------------------------|
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 3.24 | Cutting holes up to 15x15 cm in R.C.C. floors and roofs for passing drain pipe etc. and repairing the hole after insertion of drain pipe etc. with cement concrete 1:2:4 (1 cement:2 coarse sand: 4 graded stone aggregate 20 mm nominal size) including finishing complete so as to make it leak proof | Each | 180.0 | | | |
| 3.25 | Extra for providing wash basin mixer pillar tap in place of normal pillar tap | Each | 615.0 | | | |
| 3.26 | Extra for providing divertor type shower mixer with provision for shower & single tap in place of 2Nos. concealed stop cock & 2 Nos. CP long nose bib cock complete in all respect of approved make & model | Each | 555.0 | | | |
| 3.27 | Providing & fixing full way lever operated forged brass ball valve of brass body with forged brass hard chrome plated steel ball tested to a pressure not less than 10 Kg / sqcm with threaded / flanged joints complete with nuts, bolts, gaskets, washers etc. | | | | | |
| a) | 15 mm diameter | Each | 260.0 | | | |
| b) | 20 mm diameter | Each | 350.0 | | | |
| 3.28 | Providing and fixing mosquito proof coupling of approved Municipal design for scour and vent pipes for RCC overhead tanks complete in all respects | | | | | |
| a) | 20 mm diameter | Each | 10.0 | | | |
| c) | 40 mm diameter | Each | 4.0 | | | |
| d) | 50 mm diameter | Each | 4.0 | | | |
| 3.29 | Providing and fixing Pressure release valve of approved quality (screwed end) | | | | | |
| a) | 32 mm nominal bore | Each | 60.0 | | | |
| b) | 40 mm nominal bore | Each | 60.0 | | | |

| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
|--|---|-------|------------|----------------------|--------------------|-------------------------|
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 3.30 | Providing and fixing C.P. brass Overhead (Rain Fall) shower (100mm) with arm and wall flange complete including cutting and making good the walls wherever required. | Each | 555.0 | | | |
| 3.31 | Providing & fixing 9 mm thick thermal insulation tubing of elastomeric flexible material on hot water supply/return pipes having hermetic blistered closed cell structure of expanded synthetic rubber over pipes/ fitting as per manufacturer's specifications etc.complete. | | | | | |
| a | 15 mm to 25 mm diameter | Meter | 1125.0 | | | |
| 3.32 | Supplying, fixing, testing and commissioning of storage type water heater (Geyser) etc. with Stainless steel body , copper container , automatic thermostatic control electric element, pressure release valve, M.S. nuts and bolts etc. conforming to IS: 2082 | | | | | |
| a) | 25 Litre Capacity | Each | 565.0 | | | |
| b) | 35 litre capacity | Each | | | | |
| 3.35 | Providing & fixing water storage cooler of approved make and brand with SS body Complete in respects.(VOLTAS/ BLUE-STAR/ USHA SHRIRAM) | | | | | |
| | minimum flow rate of 20 ltrs. Per hour and storage capacity 40 ltrs. | Each | 50.0 | | | |

| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
|--|---|------|------------|----------------------|--------------------|-------------------------|
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 3.36 | Providing and fixing approved make & suitable model of R.O. plant 25 ltrs. Per hour flow rate having capacity to treat the raw water having TDS 1200 ppm and not less than 40%. The treated water should have TDS less than 100 ppm and hardness less than 50 ppm. The operating voltage to 230 volt AC +/- 10% alongwith required capacity pump and solenoid valves, dry run protection of pump, automatic tank level control, inbuilt auto flush timer for periodic flushing of membranes, hydro pneumatic tank, over voltage and over current protection with switch mode power supply system antiscaling dosing system complete in all respects including installation and fittings with the following provisions: (IONIEXCHANGE/ KENT/AQUAPROCESS/Pantair) | | | | | |
| a) | 10 micron polypropylene sediment pre filter | | | | | |
| b) | 10 micron bacteriostatic activated carbon block on line micron filter with 5 micron rating | | | | | |
| c) | 3 Nos. of reverse osmosis memberane with 0.0001 micron pore size energy saving poly amide type | | | | | |
| d) | UV lamp of minimum capacity 25 LPM and minimum lamp wattage 9W | Each | 50.0 | | | |
| 3.38 | Supplying, assembly, erection, testing and commissioning of level controllers based on level switches and necessary auxillary circuits included in the electric panel ,,including all accessories required for the performance of the system to the satisfaction of the engineer in charge complete including providing and fixing wiring from control panel to the level switches of required size,all interconnections as required . Note : The required transformers / associated equipment shall be designed keeping in view the acrual distance of various tanks from the control panel, particularly the distance of OH soft water tank from panel. The most suitable route of sensor cable travel between the panel and the tank shall have to be worked out by the contractor according to site conditions and in consultation with engineer in charge. All cabling / switch installation should be done in an easy to maintain manner. | | | | | |

| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
|--|---|------|------------|----------------------|--------------------|-------------------------|
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| i) | One way one tank level controller as under. To switch on the tube well pump when the level of water in the UG raw water tank is low and to cut off the pump when the level in the underground raw water tank is high. (Approx. control cable requirement - 200 meters.) | Set | 2.0 | | | |
| | Two way - Two tank level controller as under. | | | | | |
| iii) | For Treated water supply Pumps(Operating between the under ground treated water tank near the plant room and the Terrace treated water tank . (Approx. control cable requirement - 125 meters.) | Set | 2.0 | | | |
| iv) | For Raw water supply Pumps(Operating between the under ground Raw water tank near the plant room and the Terrace Raw water tank . (Approx. control cable requirement - 125 meters.) | Set | 2.0 | | | |
| 3.39 | Providing and fixing gun metal foot valve with stainer of approved quality/model complete in all respect. | | | | | |
| | 80 mm dia | each | 4.0 | | | |
| | 100 mm dia | each | 4.0 | | | |
| 3.40 | Providing and fixing double seal type D.I. Manhole cover of 560 mm clear internal diameter of over all heavy duty with locking arrangement complete in all respects. | Each | 24.0 | | | |
| 3.41 | Testing Underground tank/Terrace Water Tank for water seepage before fixing of tiles or any other finishing including pressure grouting (if required). The tank should be disinfected and cleaned before use as per instruction of Engineer-in-charge(up to 3 lac ltr capacity of each compartment of tank) | set | 5.0 | | | |

| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
|--|---|------|------------|----------------------|--------------------|-------------------------|
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 3.42 | Supplying, installing, testing and commissioning vertical online/horizontal centrifugal pumping set with mechanical seal, C.I. volute and SS impeller & SS shaft connected to a TEFC induction motor of suitable HP for 415 volts, 3 phase, 50 cycles A.C. supply with 150 mm dia pressure gauge with gunmetal isolation cock, vibration eliminating pads, base plate wiring upto panel and equipment for water level controller to start and stop the pump automatically at predecided levels of the water in the tank with provision of protection for dry run etc. complete in all respect including Y-strainer (The shop drawing or the pumps along with its characteristics curves, model and technical data etc. are to be submitted for approval before purchase of pump). | | | | | |
| | Domestic water pumps (Treated water transfer&Raw water Transfer pump to terrace tank) | | | | | |
| | Treated water transfer pump to terrace tank | | | | | |
| | Capacity 100 lpm | | | | | |
| | Head 70M | Each | 4.0 | | | |
| | Raw water transfer pump | | | | | |
| | capacity 100 lpm & Head 70m | Each | 4.0 | | | |
| | | | | | | |
| | SUB TOTAL(Water Supply) | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|-------------|---|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 4.00 | SEWARAGE & DRAINAGE | | | | | |
| 4.01 | Providing laying and jointing glazed stoneware pipes grade 'A' with stiff mixture of cement mortar in the pro-portion of 1:1 (1 cement : 1 fine sand) including testing of joints etc. complete. | | | | | |
| a) | 100 mm diameter | Metre | 70.0 | | | |
| 4.02 | Providing and laying cement concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size) all-round S.W. pipes including bed concrete as per standard design: | | | | | |
| a) | 100 mm diameter S.W. pipe/RCC NP2 | Metre | 70.0 | | | |
| b) | 150 mm diameter S.W. pipe/RCC NP2 | Metre | 250.0 | | | |
| c) | 250 mm diameter S.W. pipe/RCC NP2 | Metre | 400.0 | | | |
| 4.03 | Providing and laying cement concrete 1:5:10 (1 cement:5 coarse sand:10 graded stone aggregate 40 mm nominal size) up to haunches of S.W. pipes including bed concrete as per standard design: | | | | | |
| a) | 150 mm diameter S.W. pipe | Metre | 150.0 | | | |
| b) | 250 mm diameter s.W. pipe | Metre | 150.0 | | | |
| 4.04 | Providing and fixing square-mouth S.W. gully trap grade 'A' complete with C.I. grating, brick masonry chamber with water tight C.I. cover with frame of 300x300 mm size (inside) the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design:. | | | | | |
| a) | 150x100mm size P type | | | | | |
| a.i) | F.P.S. Bricks class designation 75 | Each | 55.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 4.05 | Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes with collars jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement:2 fine sand) including testing of joints etc. complete | | | | | |
| a) | 150 mm dia R.C.c. pipe | Metre | 400.0 | | | |
| b) | 250 mm dia R.C.C. pipe | Metre | 550.0 | | | |
| 4.06 | Constructing brick masonry manhole in cement mortar 1:4 (1 cement : 4 coarse sand), R.C.C. top slab with 1:2:4 mix (1cement : 2 coarse sand : 4graded stone aggregate 20 mm nominal size), foundation concrete 1:4:8 (1cement : 4 coarse sand : 8graded stone aggregate 40 mm nominal size), inside plastering 12mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement, and making necessary channels in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size) finished with a floating coat of neat cement all complete as per standard design. | | | | | |
| a) | Inside size 90x80 cm and 45 cm deep including C.I. cover with frame (light duty) 455x610 mm internal dimensions total weight of cover and frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg): | | | | | |
| a i) | With F.P.S. bricks with class designation 75 | Each | 30.0 | | | |
| 4.07 | Extra depth for manholes | | | | | |
| a) | Size 90 x 80 cm | | | | | |
| a i) | With F.P.S. bricks class designation 75 | Metre | 3.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 4.08 | Constructing brick masonry circular type manhole 0.91m internal dia at bottom and 0.56m dia at top in cement mortar 1:4 (1 cement :4 coarse sand), in side cement plaster 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement, foundation concrete 1:3:6 mix (1 cement: 3 coarse sand: 6 graded stone aggregate 40mm nominal size), and making necessary channel in cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20mm nominal size) finished with a floating coat of neat cement all complete as per standard design: | | | | | |
| a) | 0.91 m deep with S.F.R.C. cover and frame (heavy duty, HD-20 grade designation) 560mm internal diameter conforming to I.S. 12592, total weight of cover and frame to be not less than 182kg., fixed in cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) including centering shuttering all complete. (Excavation, foot rests and 12mm thick cement plaster at the external surface shall be paid for separately) : | | | | | |
| a i) | With F.P.S. bricks class designation 75 | Each | 35.0 | | | |
| 4.09 | Extra depth for circular type manhole 0.91m dia (at bottom) with beyond 0.91m to 1.67 m | | | | | |
| a) | With F.P.S. bricks class designation 75 | Metre | 3.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 4.10 | Constructing brick masonry circular manhole 1.22 m internal dia at bottom and 0.56 m dia at top in cement mortar 1:4 (1 cement: 4 coarse sand) inside cement plaster 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement foundation concrete 1:3:6 mix (1 cement :3 coarse sand : 6 graded stone aggregate 40mm nominal size) and making necessary channel in cement concrete 1:2:4 (1 cement :2 coarse sand : 4 graded stone aggregate 20mm nominalsize) finished with a floating coat of neat cement complete as per standard design. | | | | | |
| a) | 1.68 m deep with SFRC cover and frame(heavy duty HD-20 grade designation) 560 mm internal diameter conforming to IS: 12592, total weight of cover and frame to be not less than 182 kg. fixed in cement concrete 1:2:4 (1 cement :2 coarse sand : 4 graded stone aggregate 20mm nominalsize) including centering shuttering all complete. (Excavation, foot rests and 12 mm tick cement plaster at the external surface shall be paid for separately) | | | | | |
| a.i) | With F.P.S. bricks with class designation 75 | Each | 8.0 | | | |
| 4.11 | Extra depth for circular type manhole 1.22 m internal dia (at bottom) with beyond 1.68 m to 2.29 m | | | | | |
| a) | With F.P.S. bricks with class designation 75 | Metre | 2.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 4.12 | Providing and fixing orange colour safety foot rest of minimum 6 mm thick plastic encapsulated as per IS: 10910 on 12 mm dia steel bar conforming to IS: 1786 having minimum cross section as 23 mm x 25 mm and over all minimum length 263 mm and width as 165 mm with minimum 112 mm space between protruded legs having 2 mm tread on top surface by ribbing or chequering besides necessary and adequate anchoring projections on tail length on 138 mm as per standard drawing and suitable to with stand the bend test and chemical resistance test as per specification mark to be visible even after fixing, including fixing in manholes with 30x20x15 cm cement concrete block 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) complete as per design. | Each | 120.0 | | | |
| 4.13 | Making connection of drain or sewer line with existing manhole including breking into and making good the walls, floors with cement concrete 1:2:4 mix (1 cement:2 coarse sand:4 graded stone aggregate 20 mm nominal size) cement plastered on both sides with cemnet mortar 1:3 (1 cement:3 coarse sand) finished with a floating coat of neat cement and making necessary channels for the drain etc. complete (including obtaining approval from DJB/Municipal corporation | | | | | |
| a) | For pipes 100 to 230 mm dia | Each | 3.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 4.14 | Providing sand cast iron drop connection externally for 60 cm drop from branch sewer line to main sewer manhole including inspection and cleaning eye with chain and lid sand cast Iron drop pipe and bend encased all-round with cement concrete 1 :5:1 0 (1 cement:5 fine sand: 10 graded stone aggregate 40 mm nominal size) with all centering and shuttering required, cutting holes in walls and making good with brick work in cement mortar 1:4 (1 cement: 4 coarse sand) plastered with cement mortar 1:3 (1 cement: 3 coarse sand) on, inside of the manhole wall lead caulked joints between sand cast iron pipes and fittings, stiff cement mortar 1:1 (1 cement: 1 fine sand) joints between sand cast iron tee and S.W. pipe, making required channels complete as per standard design and specifications: | | | | | |
| a) | 150 mm dia. sand cast iron drop connection | Each | 3.0 | | | |
| | Constructing brick masonry road gully chamber 50x45x60 cm with bricks of class designation 75 in cement mortar 1:4 (1 cement:4 coarse sand) including 500x450 mm pre-cast R.C.C. horizontal grating with frame complete as per standard design: | | | | | |
| | With F.P.S. bricks | Each | 130.0 | | | |
| 4.16 | Constructing brick masonry open surface drain including factory made perforated RCC cover with edge protected with MS plate of 3 mm thick with bricks of class designation 75 in cement mortar 1:4 (1 cement : 4 fine sand) including earth excavation, 10cm thick bed concrete 1:5:10 (1 cement: 5 fine sand :10 graded stone aggregate 40mm nominal size) and 25mm thick cement concrete 1:2:4 (1 cement:2 coarse sand:4 graded stone aggregate 12.5 mm nominal size) for filling hunches including 12mm cement plaster 1:4 (1 cement:4 coarse sand) with a floating coat of neat cement inside the drain, its top and exposed side including disposal of surplus earth complete as per standard design. | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| | 25cm drain 30cm average depth | | | | | |
| a) | With F.P.S bricks | Metre | 250.0 | | | |
| | 45cm drain 75cm average depth | | | | | |
| b) | With F.P.S bricks | Metre | 350.0 | | | |
| 4.17 | Supply, installing, testing and commissioning vertical fully floodable type submersible drainage pump in close coupled design single stage, suitable for handling minimum 12 mm dia solids for trans ferring waste water from sump to outside the building with float switch for automatic start and stop arrangement with panel and wiring, chain and pulley, mechanical seal complete in all respect as per instruction of the Engineer in charge . (The shop drawing or the pumps along with its characteristics curves, model and technical data etc. are to be submitted for approval before purchase of pump). | | | | | |
| | Material of Construction (M.O.C): Corrosion Resistant in general | | | | | |
| | : Casing — Cast Iron | | | | | |
| | : Impeller — Stainless Steel | | | | | |
| | : Shaft — Stainless Steel | | | | | |
| | : Bearings — Anti friction, prelubricated ball bearings, packed with grease for life. | | | | | |
| | Motor: — Dry Motor with built in over load protection | | | | | |
| | Protection - IP68. | | | | | |
| | Insulation Class - F | | | | | |
| | Duty of each pump | | | | | |
| | 150 LPM against 12 M head | each | 16.0 | | | |
| | SUB TOTAL(SEWERAGE AND DRAINAGE) | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|-------------|---|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 5.00 | EARTH WORK | | | | | |
| 5.01 | Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m , disposed earth to be levelled and neatly dressed. | | | | | |
| a) | All kinds of soil | cum | 120.0 | | | |
| 5.02 | Excavating trenches of required width for pipes, cables, etc including excavation for sockets, and dressing of sides, ramming of bottoms, depth up to 1.5 m including getting out the excavated soil, and then returning the soil as required, in layers not exceeding 20 cm in depth including consolidating each deposited layer by ramming, watering, etc. and disposing of surplus excavated soil as directed, within a lead of 50 m: | | | | | |
| a) | All kinds of soil | | | | | |
| a.ii) | Pipes, cables etc. exceeding 80 mm dia but not exceeding 300 mm dia | metre | 1200.0 | | | |
| 5.03 | Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20 cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift up to 1.5 m | | | | | |
| | | cum | 45.0 | | | |
| | SUB TOTAL(EARTH WORK) | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|----------|---|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 6 | RAIN WATER PIPING | | | | | |
| 6.01 | Providing and fixing to the inlet mouth of rain water pipe cast iron grating 15 cm diameter and weighing not less than 440 grams | Each | 52.0 | | | |
| 6.02 | Providing and fixing rain water ,soil, waste and vent pipes. | | | | | |
| a) | 100 mm dia. | | | | | |
| a i) | Centrifugally cast (spun) iron socketed pipe as per IS:3989 | Metre | 1285.0 | | | |
| c) | 150 mm dia pipe as per IS:3989 | Metre | 570.0 | | | |
| 6.03 | Providing and fixing M.S holder-bat clamps of approved design to Sand Cast iron/ cast iron (spun) pipe embedded in and including cement concrete blocks 10x10x10 cm of 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size) including cost of cutting holes and making good the walls etc. | | | | | |
| a) | for 100 mm dia. pipe | Each | 402.0 | | | |
| c) | for 150 mm dia pipe | Each | 172.0 | | | |
| 6.04 | Providing and fixing plain bend of required degree. | | | | | |
| a) | 100 mm | | | | | |
| a ii) | Sand cast iron S&S as per IS:3989 | Each | 36.0 | | | |
| c) | 150 mm | Each | 16.0 | | | |
| 6.05 | Providing and fixing heel rest sanitary bend. | | | | | |
| a) | 100 mm dia | | | | | |
| a.ii) | sand cast iron S&S as per IS-3989 | Each | 36.0 | | | |
| c) | 150 mm dia | Each | 16.0 | | | |
| 6.06 | Providing and fixing collar | | | | | |
| a) | 100 mm | | | | | |
| a.ii) | Sand cast iron S&S as per IS-3989 | Each | 72.0 | | | |
| c) | 150 mm | Each | 28.0 | | | |

| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
|--|---|-------|------------|----------------------|--------------------|-------------------------|
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 6.07 | Providing lead caulked joints to sand cast iron /centrifugally cast (spun) iron pipes and fittings of diameter: | | | | | |
| a) | 100 mm | Each | 399.0 | | | |
| c) | 150 mm | Each | 168.0 | | | |
| 6.08 | Painting sand cast iron / centrifugally cast (spun) iron soil, waste vent pipes and fittings with paint of any colour such as chocolate, grey, or buff etc. over a coat of primer (of approved quality) for new work: | | | | | |
| a) | 100 mm diameter pipe | Metre | 1280.0 | | | |
| c) | 150 mm diameter pipe | Metre | 570.0 | | | |
| | SUB TOTAL(Rain Water pipe & fitting) | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|-------------|--|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 7.00 | BOREWELL(1 No) | | | | | |
| 7.01 | Drilling by suitable rig as per IS : 2800-1979 (percussion or combination rig) or Reverse Rotary to suit site condition from ground level in all kind of soils and weathered rock including boulders (excluding rock) diameter of bore 450mm including carry out hydrological survey report before boring & getting the approval based on Hydrogeological survey before start of the work.Also getting approval from local authority if any required | | | | | |
| a) | 0-30m | metre | 60.0 | | | |
| b) | 30-60m | metre | 60.0 | | | |
| c) | 60-90m | metre | 60.0 | | | |
| d) | 90-120 m | metre | 60.0 | | | |
| 7.02 | Extra additional for drilling in Ordinary Rock if any found | metre | 50.0 | | | |
| 7.03 | Extra additional for drilling in Hard Rock if any found | metre | 50.0 | | | |
| 7.04 | Providing and lowering uPVC casing/housing pipe 200mm dia. with wall thickness 10 mm conforming to IS :12818 including sockets of standard design. | metre | 140.0 | | | |
| 7.05 | Providing & fixing uPVC screen/slotted pipe with 1.5 mm to 3mm (slots as per strata condition) including sockets of standard design as per IS: 12818/1992. | | | | | |
| a) | 200 mm dia uPVC socketed pipe with wall thickness 10.0 mm | metre | 160.0 | | | |
| 7.06 | Providing and fixing in position threaded iron cap with locking arrangement of approved design to prevent foreign matters getting into the bore-hole as required. | Each | 2.0 | | | |
| 7.07 | Providing and laying rounded pea gravel washed & served 3 to 6 mm nominal boreas per relevant ISI code. | Cum | 32.0 | | | |
| 7.08 | Providing and laying cement concrete 1:2:4 mix for sanitary sealing of well at top. | Cum | 2.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|----------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 7.09 | Supplying, lowering and fixing in position reducer ,PVC bail plug with "U" hooks as per IS:2800-1964. | Each | 2.0 | | | |
| 7.10 | Development of Tubewell including testing of yield depression & quality of water (for all parameters of potable water), contractor to obtain certificate for quality for water from Competent Authority approved by client or Engineer- In -Charge. | | | | | |
| a) | Development of Tube well by high capacity air compressor till the clear water discharge but not more than 100 hours. | per hour | 160.0 | | | |
| b) | Additional development of Tube well by high an over pumping unit till complete development of tube well does not clear by maximum 100 hours air compressor | per hour | 100.0 | | | |
| 7.11 | Tranportation, mobilisation and demobilisation or drilling equipment and ancillary equipment to site including clearing and cleaning the site after completion of work. | set | 2.0 | | | |
| 7.12 | Providing and fixing brass full way valve with C.I. wheel of approved make, tested to a pressure of 21 kg/sqcm. | | | | | |
| a) | 100 mm dia | Each | 2.0 | | | |
| 7.13 | Providing and fixing gunmetal non return valve of approved make tested to a pressure of 21kg/sqcm. | | | | | |
| a) | 100 mm dia | Each | 2.0 | | | |
| 7.14 | Providing & fixing G.I. pipes (heavy class)confirming to IS with special fittings in external works including earthwork ,excavationin all kinds of soil including ordinary rock,refilling, painting pipes & fitting complete in all respects. | | | | | |
| | 100 mm dia | Metre | 200.0 | | | |
| 7.15 | Providing & filling sand of grading zone V or coarser grade all around GI pipe in external work | | | | | |
| | 100 mm dia | Metre | 200.0 | | | |

| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
|--|--|------|------------|----------------------|--------------------|-------------------------|
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 7.16 | Submersible pumps | | | | | |
| | Providing and installing submersible pump and electrical panel suitable for 8" dia casing of bore with SS impeller, high tensile SS shaft, copper wound squirrel cage wet type induction motor 2880 rpm, 415 V, 50 Hz, 3 phase A.C. supply, conforming to ISS: 8034-1976, capacity 500 litre per minute at 70-120 m head/ or suitable as per the hydrological survey report along with a directly coupled submersible type squirrel cage electric induction 5 H.P.(minimum) . motor suitable for operation on 400 V, 3 phase, 50 c.p.s. A.C. supply, water lubricated bearings and provided with pivoted segment type thrust bearings to withstand non-vertical lead with minimum wear and tear and duly fitted with device to take up the expansion of water with heating of motor, including supply, testing and commissioning of electrical panel from the same manufacturer, complete with all accessories in all respects. The contractor to obtain approval for model and make of pumpset & suitable Electrical panel after having yield report of fully developed tube well and submit actual bore strata chart. | | | | | |
| | including supplying laying and fixing water proof PVC insulated flat submersible cable 3x10 sqmm with end termination with its accessories. complete in all respect as required. | set | 2.0 | | | |
| 8.17 | Carrying out Electrical logging of Borewell before lowering of pipe for analysiing of water quality including Electrical logging report, calculation etc. | Job | 2.0 | | | |
| SUBTOTAL (BOREWELL) | | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|-------------|---|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 8.00 | RAIN WATER HARVESTING(4 NOS.) | | | | | |
| 8.01 | Designing and Constructing of percolation pit cum perforated well 3000mm. dia upto 4000mm deep, 230 mm thick brick masonry work around upto 1.5 m deep with 75 class brick in cement mortar 1:4, 200 mm foundation concrete in 1:4:8 mix below brick work only, 150 mm thick precast removable RCC top slab with required steel reinforcement in cement concrete 1:2:4 mix, filled with coarse aggregate, SFRC covers, river pebbles of requisite size stone as shown in the drawing including centering and shuttering, as shown complete as per detailed drawings complete. | Each | 12.0 | | | |
| 8.02 | Drilling as per IS : 2800-1964 (with percussion or combination rig) from ground level in all kind of soils including boulders (excluding rock) diameter of bore 450mm. | | | | | |
| a) | 0-50m | Metre | 360.0 | | | |
| 8.03 | Extra for drilling in Ordinary Rock | Metre | 60.0 | | | |
| 8.04 | Extra for drilling in Hard Rock | Metre | 60.0 | | | |
| 8.05 | Providing and lowering of 200 mm dia uPVC blank/ slotted pipe with ribs, special fittings, jointing conforming to IS 12818 - 1992. | Metre | 360.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---|---|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 8.06 | Constructing bar screen / settling tank, of sizes 4500x2500 with suitable depth up to 2.0 m in 1: 4 Cement Mortar (one cement : 4 coarse sand) height as per site requirement, in brick masonry 350mm thick walls upto water level and 230mm thick walls above water level & upto ground level, including all excavation, 20 cm thick bed concrete in 1:4:8 (one cement 4 fine sand 8 stone aggregate 40 mm), cement plaster 1:3 (one cement :3 coarse sand) with a floating coat of neat cement as inside finish , top slab in RCC 1:2:4, including centring, shuttering and steel work, also providing and fixing D.I. manhole cover & frame of size 605mm x 450mm of weight not less than 38 kg (frame + cover) and cost of 100mm dia C.I. vent pipe with C.I. Ventilating Cowl and suitable wire mesh provision for inlet, 115mm baffle walls extending 2/3 the width spaced@500mm c/c including finishing with 1:3 cement plaster 15mm thick with floating coat of neat cement slurry , all complete in every respect as per drawing and as directed to suit site condition. | Each | 12.0 | | | |
| SUBTOTAL (RAIN WATER HARVESTING) | | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|----------|--|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 9 | SOLAR WATER HEATING SYSTEM & RECIRCULATION OF HOT WATER SYSTEM (1 Nos) | | | | | |
| 9.01 | Supply, installation, testing and commissioning of solar water heating system, Thermosyphon type, all complete based on Flat plat collector system (Cu-Cu Type only) comprising of but not limited to the following: | | | | | |
| a) | Requisite number of Flat plate collectors of 2 sq. mtr. collector area. Collector absorber plate to be made of copper tubes & copper fins only | | | | | |
| b) | Hot water storage tank made of stainless steel 304- food grade quality with 100 mm Glass wool insulation and cladding with 24 SWG Aluminum sheet. One temperature measuring device and suitable inlet, outlet and drain connections on the storage tank to be provided. Suitable Electrical Heater backup to be provided inside the tank along with thermostat | | | | | |
| c) | Heat Exchanger - Cage type Internal Heat Exchanger made of SS pipes shall be provided inside the Solar Tank. Heat exchangers shall have min. heat transfer area of 0.24 sq. mtrs. for every 100 LPD calacity. Suitable make up tank for the Heat Exchanger circuit shall also be provided | | | | | |
| d) | Interconnecting system piping shall consist of B Class insulated GI pipes covered with 50mm thick glasswool & clad with 26 SWG Aluminium Sheet. All Gate/Ball valves shall be of ISI make. | | | | | |
| e) | Electrical control panel, cabling from panel to pumps and electrical heaters shall also be provided | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| f) | The solar collector shall be arranged on roof of building in such a way that shadow can be avoided and requisite number of MS support for collector/tanks of minimum 35x35x5 MS angle adequate for 150 Km/Hr wind speed. | | | | | |
| g) | Solar water heating system based on Flat plat collector system technology with output capacity of as mentioned below with hot water at 60 degree centigrade having required Nos. solar collectors as per complete item as per technical specification of make BHEL/TATA/EMMVEE. The system has to be installed by Manufacturers authorised distributors/approved specialised firms of Solar water heating of approved make. The shop drawing of the systems shall be provided by the agency as per site condition obtain the proper efficiency. The system shall be procured after obtaining the approval of shop drawings from HSCC / Engineer-in-charge. (Electric heating element shall not be provided in the system as the solar hot water system will supply the hot water to the individual geyser). | | | | | |
| | Solar System of Capacity 1500 Litre/day (With minimum 12 nos of Collector of 2.0 Sqm area each) | each | 2.0 | | | |
| | | | | | | |
| i) | Solar System of Capacity 2000 Litre/day (With minimum 16 nos of Collector of 2.0 Sqm area each) | each | 9.0 | | | |
| | | | | | | |
| 9.02 | Recirculation system (on return line) -Designing, Supply, Installation, Commissioning & Integration with Solar System of Recirculation System consisting of - Insulated Auxiliary Tank SS with epoxy paints (2 times the solar piping system volume) and with Electrical Backup, Pump, of requisite capacity DTC, Sensor PT100, Control Panel wiring, RS 485 mod bus communication port for BMS as per technical specification, MS standard etc. (but does not include the return piping & fitting) | each | 7.0 | | | |
| | | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|-------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 9.03 | Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in Charge. | | | | | |
| | Internal work- Exposed on wall | | | | | |
| a) | 15 mm nominal outer dia pipes (SDR-11) | metre | 365.0 | | | |
| b) | 20 mm nominal outer dia pipes (SDR-11) | metre | 565.0 | | | |
| c) | 25 mm nominal outer dia pipes (SDR-11) | metre | 705.0 | | | |
| d) | 32 mm nominal outer dia pipes (SDR-11) | metre | 595.0 | | | |
| e) | 40 mm nominal outer dia pipes (SDR-11) | metre | 350.0 | | | |
| f) | 50 mm nominal outer dia pipes (SDR-11) | metre | 50.0 | | | |
| 9.04 | Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in Charge. | | | | | |
| | Concealed work including cutting chases and making good the walls etc. | | | | | |
| a) | 15 mm nominal outer dia pipes (SDR-11) | metre | 1006.0 | | | |
| b) | 20 mm nominal outer dia pipes (SDR-11) | metre | | | | |
| 9.05 | Providing and fixing gun metal gate valve with C.I. wheel of approved quality (screwed end): | | | | | |
| a) | 25 mm nominal bore | each | 142.0 | | | |
| b) | 32 mm nominal bore | each | 102.0 | | | |
| c) | 40 mm nominal bore | each | 16.0 | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|----------------|--|-------------|-------------------|-----------------------------|---------------------------|--------------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 9.06 | Providing & fixing 9 mm thick thermal insulation tubing of elastomeric flexible material having hermetic blistered closed cell structure of expanded synthetic rubber over pipes/ fitting as per manufacturer's specifications etc.complete. | | | | | |
| a) | 15 mm dia to 25 mm dia | each | 2135.0 | | | |
| b) | 32 mm dia to 50 mm dia | each | 925.0 | | | |
| 9.07 | Providing and fixing gun metal ball valve of approved quality | | | | | |
| a) | 15 mm nominal bore | each | 256.0 | | | |
| b) | 20 mm nominal bore | each | 110.0 | | | |
| | SUBTOTAL(SOLAR WATER HEATING SYSTEM & RECIRCULATING SYSTEM) | | | | | |

| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
|--|---|------|------------|----------------------|--------------------|-------------------------|
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| 10.00 | WATER SUPPLY PUMP PANEL | | | | | |
| | Supply, installation, testing and commissioning of following M.V. cubicle type totally enclosed, wall mounted type, dust, damp and vermin proof, indoor type Distribution Board/Panel complete with busbars, M.V. danger notice plate, interconnections with suitable capacity aluminium leads/solid aluminium strips/rods, connection of incoming and outgoing cables with thimbles, powder coat painted and having following incoming and outgoing switchgears complete as required. Panel shall have IP-42 protection. | | | | | |
| 10.01 | INCOMER : | | | | | |
| | 125 Amp 415 volts, 35 KA (Isc), FP MCCB with e/f protection thermal magnetic release having variable current settings of 0.8 to 1.0 In. | | | | | |
| | R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | | |
| | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | 1 no. 0 to 500 V Digital voltmeter with selectot switch | | | | | |
| | 1 to 0 to 125 Amps Digital ammeter with selector switch with one set of 125/5A C.T. s | | | | | |
| | BUSBARS : | | | | | |
| | 160 Amp TPN busbars of aluminium | | | | | |
| | OUTGOINGS : | | | | | |
| | | | | | | |
| i | 1 Sets of following (For Tube well) | | | | | |
| | 1 No. 40 Amp. 415/500 volts, 25 KA, TPN, Moulded Case Circuit Breaker with variable current setting of 0.8 to 1.0 | | | | | |
| | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |

Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3)

| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|------------|---|------|------------|----------------------|--------------------|-------------------------|
| 1 | 2 | 3 | | 5 | 6 | 7 |
| | 1 to 0 to 40 Amps Digital ammeter with selector switch with one set of 40/5A CT,s. | | | | | |
| | Neon indicating Lamps for "ON" , "OFF" & "TRIP" indication with 2A SP control MCBs. | | | | | |
| ii | 4 Sets of following (2 For Treated Water Pump, Untreated Water Pump) | | | | | |
| | 1 No. 25 Amp. 415/500 volts,25 KA, TPN, Moulded Case Circuit Breaker with variable current setting of 0.8 to 1.0 | | | | | |
| | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | 1 to 0 to 25 Amps Digital ammeter with selector switch with one set of 25/5A CT,s. | | | | | |
| | Neon indicating Lamps for "ON" , "OFF" & "TRIP" indication with 2A SP control MCBs. | | | | | |
| iii | 4 Set of following (for Drainage Pump) | | | | | |
| | 1 No. 16 Amp. 415/500 volts,25 KA, TPN, Moulded Case Circuit Breaker with variable current setting of 0.8 to 1.0 | | | | | |
| | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | Neon indicating Lamps for "ON" and "OFF" indication with 2A SP control MCBs. | | | | | |
| | WATER SUPPLY PUMP Panel as mentioned above | Set | 1.0 | | | |
| | STARTERS FOR THE WATER PUMPS | | | | | |
| | For Tube well | | | | | |
| | 1 No. 3 Phase, DOL starter of 10 HP with thermal overload relay, Push Buttons, Single Phase Preventer and Switches etc complete as required. | Each | 1.0 | | | |

| Name of Work: BOQ of Plumbing work of Masjid Mod, AIIMS, New Delhi (Proposed construction of Hostel 1,2&3) | | | | | | |
|--|---|------|------------|----------------------|--------------------|-------------------------|
| Sl. No. | Description of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
| 1 | 2 | 3 | | 5 | 6 | 7 |
| | 4 Sets of following (2 For Treated Water Pump, Untreated Water Pump) | | | | | |
| | 1 No. 3 Phase, DOL starter of 3.5 HP with thermal overload relay, Push Buttons, Single Phase Preventer and Switches etc complete as required. | Each | 4.0 | | | |
| | 4 Set of following (Drainage Pump) | | | | | |
| | 1 No, DOL starter of 2 HP with thermal overload relay, Push Buttons, Single Phase Preventer and Switches etc complete as required. | Each | 4.0 | | | |
| | Sub Total (Water Supply Electrical Panel) | | | | | |
| | Total | | | | | |

PROJECT NAME: Proposed Hostel-1, 2 & 3 , AIIMS,Masjid Moth, New Delhi

Name of Works: BOQ of Fire Fighting Works

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|----------------|---|-------------|-------------------|-----------------------------|---------------------------|--------------------------------|
| 1.00 | FIRE FIGHTING SYSTEM | | | | | |
| 1.01 | Providing and laying S&S Centrifugally Cast (Spun) / Ductile Iron Pipes conforming to IS : 8329 : | | | | | |
| 1.01.1 | 150 mm dia Ductile Iron Double Flanged | Metre | 610.0 | | | |
| 1.02 | Providing and laying D.I. specials of class K-12 suitable for push-on jointing as per IS : 9523 | | | | | |
| 1.02.1 | Upto 600 mm dia | quintal | 28.2 | | | |
| 1.03 | Providing push-on-joints to Centrifugally (Spun) Cast Iron Pipes or Ductile Iron Pipes including testing of joints and including the cost of rubber gasket : | | | | | |
| 1.03.1 | 150 mm dia pipes | joints | 270.0 | | | |
| 1.04 | Excavating trenches of required width for pipes, cables etc including excavation for sockets, and dressing of sides, ramming of bottoms, depth upto 1.5m including getting out the excavated soil, and then returning the soil as required, inlayers not exceeding 20 cm in depth including consolidating each deposited layer by ramming, watering, etc. and disposing of surplus excavated soil as directed within a lead of 50 m | | | | | |
| 1.04.1 | Pipes, cables etc exceeding 80 mm dia but not exceeding 300 mm dia | Metre | 610.0 | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|-------|------------|----------------------|--------------------|-------------------------|
| 1.05 | Providing, fixing jointing and testing of Heavy (class - C) G.I. pipes as per relevant IS :1239/4736 with special accessories like tees, elbow, gasket, flanges, flanged joints, rubber insertion nuts and bolts including earth work excavating and trenching, wrapping pipe with 4mm thick 500mm width tar based polymeric corrosion protection tape or equivalent suitable to GI/ MS pipe line including applying uniform coat of cold pipe primer complete 1 m below the ground level, refilling in layers not exceeding 20 cm in depth consolidated each deposited layer by ramming & watering complete in all respect as per IS : 1022 (Under ground) | | | | | |
| a) | 150 mm dia G.I. Pipe with flange joints (5.4 mm wall thickness) | Metre | 60.0 | | | |
| b) | 80 mm dia G.I. Pipe with flange joints | Metre | 30.0 | | | |
| | | | | | | |
| 1.06 | Heavy class G.I. pipes conforming to IS with accessories like tees, elbows, flanged joints, rubber insertion, nuts, bolts or welded joints including fixing the pipe with suitable flat iron strip clamps/brackets, structural members, dash fastener , cutting hole and chases in walls, floor, R.C.C. slab etc. and making good the same, including painting pipes and fittings with a primer coat of steel primer and two coats of postal red enamel paint etc. complete as required. (All the fitting i.e. tee /elbow, Valve shall be joint the pumps will flanged joints) | | | | | |
| a) | 200 mm dia (with Flanged joints) | Metre | 20.0 | | | |
| b) | 150 mm dia (with Flanged joints) | Metre | 415.0 | | | |
| c) | 100 mm dia (with Flanged joints) | Metre | 80.0 | | | |
| d) | 80 mm dia | Metre | 70.0 | | | |
| e) | 65 mm dia | Metre | 30.0 | | | |
| f) | 50 mm dia | Metre | 610.0 | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|-------|------------|----------------------|--------------------|-------------------------|
| g) | 40 mm dia | Metre | 445.0 | | | |
| h | 32 mm dia | Metre | 315.0 | | | |
| i) | 25 mm dia | Metre | 510.0 | | | |
| 1.07 | Providing and fixing Single headed hydrants flanged inlet with 63 mm female instantaneous outlet of gunmetal complete with male blank caps, chains conforming to IS:5290 type A with stainless steel orifice plate (if required) to keep the pressure not more than 3.5 kg/sq.cm at any point. | Each | 87.0 | | | |
| 1.08 | Providing 63mm dia 15 m long reinforced rubber lined hose pipe conforming to IS: 636-1992 Part-II with gunmetal male & female coupling wire wound with pipe as required. | Each | 122.0 | | | |
| 1.09 | Providing and fixing 63mm dia 15 m long canvas hose pipe complete with gunmetal male & female coupling wire wound with the pipe The pipe shall confirm to IS: 4927. | Each | 52.0 | | | |
| 1.10 | Providing and fixing Gunmetal branch pipe with 20mm dia nozzle conforming to IS:903. suitable for installation connections to hose coupling etc. as required. | Each | 87.0 | | | |
| 1.11 | Providing and fixing Four way fire brigade connection housed in steel cabinet of size 900mm x 750mm x 400mm fabricated from 1.5mm thick M.S. sheet having lockable arrangement, openable glazed door with 4mm thick glass, including painting a coat of steel primer and two coats of postal red enamel paint, with necessary supports for the cabinet etc. with 150 mm dia. non return and butterfly valves complete in all respects. | | | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| a) | 4 Way - 150mm dia | Each | 3.0 | | | |
| 1.12 | Providing and fixing Set of "Siamese" quadraplet instantaneous fire brigade connections comprising of two gunmetal instantaneous male inlet coupling 63mm dia with plug and cap, chain bends, tees etc for inlet to the static tank. | Each | 3.0 | | | |
| 1.13 | Providing & Fixing 150 mm dia, 4 way suction coupling for firebrigade withdrawal of water from the fire tank | Each | 3.0 | | | |
| 1.14 | Providing and fixing glazed door shutter and frame for Fire hose cabinet with hold fasts (frame fabricated from 40 x 40 x 5mm and shutter from angle) 2100 mm high x 1200 mm wide x 600mm deep with locking arrangement, 4mm thick glass with M.S. flats including all accessories, painting with one coat of steel primer and two coats of postal red enamel paint complete as per drawing and as directed. The words " hose cabinet" to be painted on the box complete in all respects. | Each | 61.0 | | | |
| 1.15 | Providing and fixing Weather proof standard stand post type hose cabinet (900mm x 750 mm x 400 mm) out door type made of 1.5mm thick M.S. sheet having central opening glazed door with 4mm thick glass suitable for accommodating hydrants, 2 Nos. canvas hose pipe and branch pipe including necessary locking arrangements, painting one coat of primer and two coats of postal red enamel paint.. The shutters are to be lockable type. The words " hose cabinet" to be painted on the box. | Each | 26.0 | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|------|------------|----------------------|--------------------|-------------------------|
| 1.16 | Providing and fixing cast iron body IS: 210 FG 220 and double flange gear simple operation type butterfly valve conforming to IS: 13095 with SS304 disc and shaft NITNLE rubber replaceable seat of the following size complete with bolts, nuts, washers and rubber insertions as per specification. | | | | | |
| a) | 150 mm dia | Each | 20.0 | | | |
| b) | 80 mm dia | Each | 6.0 | | | |
| 1.17 | Supplying, testing, installation & commissioning of pressure switches for pumps including necessary wiring upto the control panel. | Each | 12.0 | | | |
| 1.18 | Constructing masonry chamber 90x90x100 cm, inside with 75 class designation brick work in cement mortar 1:4 (1 cement: 4 fine sand) for sluice valve, with C.I. surface box 100mm top diameter, 160mm bottom diameter and 180mm deep (inside) with chained lid and RCC top slab 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) necessary excavation foundation concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3 coarse sand) 12 mm thick finished with a floating coat of neat cement complete as per standard design. | | | | | |
| | with F.P.S. bricks | Each | 3.0 | | | |
| 1.19 | Supplying and Fixing First Aid Hose Reel , wall mounting swinging type complete with drum & bracket of MS construction, spray painted in Post office Red, conforming to IS 884/1995 with upto date amendments, complete with the following as required. | | | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|------|------------|----------------------|--------------------|-------------------------|
| | 36 Meter long 20 mm dia water hose Thermoplastic (Textile reinforced) Type - 2 as per IS : 12585 | | | | | |
| | 20 mm dia gun metal ball valve & nozzle. | | | | | |
| | Drum and brackets for fixing the equipments on wall. | | | | | |
| | Connection from riser with stop valve (gun metal) & M.S. Pipe | Each | 61.0 | | | |
| | | | | | | |
| 1. 20 | Providing and fixing C.I. sluice valves (With cap) of approved quality complete with bolts, nuts, rubber insertions etc. (the tail pieces if required will be paid separately) Class II | | | | | |
| a) | 200 mm dia | Each | 2.0 | | | |
| b) | 150 mm dia | Each | 13.0 | | | |
| | | | | | | |
| 1.21 | Supply, Installation, Testing and Commissioning of 100 mm dia Bourden type, Stainless Steel dial type Pressure Gauge including brass isolation valve and siphon pipe having caliberation of 0 - 16 Kg / cm ² . | Each | 71.0 | | | |
| 1.22 | Supplying and Fixing of Fire Man's axe with heavy insulated rubber as per standard conforming to IS 926 | Each | 61.0 | | | |
| 1.23 | Supplying and Fixing vane type waterflow switch with contacts suitable for installation on 50 mm to 150 mm dia pipeline for a service pressure upto 20 Kg/sq.cm. | Each | 6.0 | | | |
| | | | | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| 1.24 | Providing, Fixing, Testing and Commissioning of Sprinkler Installation Control Valve of Cast iron body and brass / bronze working parts comprising of water motor, alarm, bronze seat clapper and clapper arm, hydraulically driven mechanical gong bell to sound continuous alarm when the Sprinkler system activates, pressure gauges, emergency releases, strainer, pressure switch, cock valve complete with drain valve and bypass, test control box, ball valves, MS pipe of required size, flanges, orifice plate, gasket etc. of size 200/150 mm dia, as required. | Each | 3.0 | | | |
| 1.25 | Supplying, Installation, Testing & Commissioning modular construction master control annunciation panel for sprinkler with provision for requirer No. of Zone (30% additional spares),eachsprinkler hydrant will have atleast 2 zone on each floor as approved by engineer.The panel shall have but not limited to the following arrangement. | | | | | |
| a) | Indication of Zone sprinkler | | | | | |
| b) | Indication of zone fault | | | | | |
| c) | Fire/fault hooter | | | | | |
| d) | Alarm cancel for fire/fault | | | | | |
| e) | Battery for emergency back up of 4 Hrs. | Set | 3.0 | | | |
| 1.26 | Providing and Fixing 15 mm dia gunmetal / brass quartzoid type Sprinkler Head with quartz bulb and set to operate at specified temperature. | | | | | |
| a) | Pendent / Upright type, 68 C, Chrome plated | Each | 520.0 | | | |
| b) | Side wall extended throw 20 mm dia 68 C, Chrome plated | Each | 50.0 | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|------|------------|----------------------|--------------------|-------------------------|
| 1.27 | Fabricating, Supplying, Installation, Testing and Commissioning Air Vessel of continuous welded construction with flanged discharge header on the top of each riser fabricated out of 10 mm thick dished ends and 8 mm thick MS sheet, Air Release Valve complete with suitable drain arrangement with 25 mm dia gun metal wheel valve complete with all accessories etc. as required of the following sizes | | | | | |
| a) | 1.2 Metre high and 250 mm dia | Each | 6.0 | | | |
| 1.28 | Supply, Installation, Testing and Commissioning External Yard Hydrant Stand Post comprising of GI pipe 80 mm dia (heavy duty C class) from existing ringmain to about 1 meter above ground level and Single Headed Yard Hydrant Valve with 80 mm dia flanged inlet, instantaneous gunmetal coupling of 63 mm dia with cast iron wheel ISI marked, conforming to IS : 5290 (Type A), with ABS cap and chain etc.complete with all accessories as required. | Each | 26.0 | | | |
| 1.29 | Providing and placing on terrace polyethylene water storage tank ISI : 12701 MARKED indicating the BIS license No with cover and suitable locking arrangement and making necessary holes for inlet, outlet and overflow pipes but without fittings and the base support for tank. | Ltrs | 70000.0 | | | |
| 1.30 | Supply, erection, testing & commissioning of exit glow sign board of size 200mm x 350 mm wall mounting signage consisting of photo luminescent coating on acrylic cover | Each | 110.0 | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| 1.31 | Providing and fixing fire extinguisher of carbon dioxide type consisting of brand new high pressure steel cylinder bearing IS: 7285 mark and having the approval of controller of explosives Nagpur, wheel type valve bearing IS:3224 mark internal discharge tube, 1 meter long high pressure discharge hose, non conducting horn, suspension bracket, fully charged bearing IS: making fixed to wall as directed. | | | | | |
| a) | 4.5kg capacity cylinder | Each | 61.0 | | | |
| 1.32 | Providing and fixing 9 liters capacity fire extinguisher water type gas pressure conforming to IS marking, fixed to wall. | Each | 61.0 | | | |
| 1.33 | Providing and fixing ABC type fire extinguishers complete in all respects. | | | | | |
| a) | Capacity 5.0 Kg. | Each | 61.0 | | | |
| 1.34 | Fabricating, Supplying, Installation, Testing and Commissioning Air Vessel of continuous welded construction with flanged discharge header in pump house fabricated out of 10 mm thick dished ends and 8 mm thick MS sheet, Air Release Valve, complete with drain arrangement with 25 mm dia gun metal wheel valve complete with all accessories etc. as required of the following sizes | | | | | |
| a) | 2 Metre high and 450 mm dia suitable to operate Jockey Pump, Main Fire Pump & Diesel Engine Driven Fire Pump | Each | 2.0 | | | |
| 1.35 | Providing and fixing C.I. non-return valve complete with gunmetal seat, bolts, nuts washer & rubber insertions as required conforming to IS:5312. | | | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| a) | 150 mm dia | Each | 14.0 | | | |
| b) | 80 mm dia | Each | 4.0 | | | |
| 1.36 | Supplying, installing, testing and commissioning of electric driven fire pump suitable for automatic operation consisting of the following (as per CPWD specification Part V-1985 for Fire Fighting and its amendments) (For Hydrant system & Sprinkler system). | | | | | |
| a) | Fire pump with stainless steel impeller, CI casing, SS shaft & mechanical seal shall be horizontal split casing centrifugal suction type multistage having following capacity and head so as to ensure a minimum pressure of 3.0 kg per square cm. at the highest and farthest out let at the specified flow complete with necessary strainer / foot valve suction side and pressure gauge on the delivery side including by pass arrangement for periodical testing of the working of the pumping set as required. The pump shall be provided with mechanical seals. | | | | | |
| b) | Squirrel cage type TEFC motor suitable for operation on 415V, 10%, 3 phases 50 Hz. system of suitable HP for the above pump with synchronous speed of 1500 RPM and flexible coupling. The pump motor should conform to IS: 325-1978. | | | | | |
| c) | Common bed plate fabricated from mild steel channel or cast iron type. | | | | | |
| d) | Suitable cement concrete pump foundation & vibration damping arrangement with cushy foot mounting as required. | | | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| l) | Capacity 2280 LPM and Head 75 Metres | Each | 2.0 | | | |
| 1.37 | Supplying, installing, testing and commissioning of diesel engine driven fire pump suitable for automatic operation consisting of the following (as per CPWD specifications PartV 1985.) (For Hydrant system & Sprinkler system). | | | | | |
| a) | Horizontal centrifugal type multi-stage, fire pump with stainless steel impeller CI casing, SS shaft & mechanical seal complete of following capacity and Head so as to ensure a minimum pressure of 3.0 kg per sq.cm. at the highest & farthest outlet at the specified flow, complete with necessary strainer pressure gauge on the delivery side etc. including by pass arrangement for periodical testing of the working of the pump set as required. The pump shall be provided with mechanical seals. | | | | | |
| b) | Water cooled cold starting type multi cylinder 4 stroke diesel engine, developing suitable BHP at 1500 RPM for the above pump set with automatic starting mechanism, cooling system shall be with radial cool engine, maintenance free batteries, battery charge unit, flexible coupling with the pump, common bed plate for mounting diesel engine fuel day tank fuel piping and pump and vibration damping arrangement by cushy foot mounting as required complete in all respects. | | | | | |
| c) | The engine shall be capable to drive the pump at 150% rated discharge at 65% head and shall be suitable for 10% overload capacity for one hour in any period of 12 hrs. continuous run. | | | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| d) | Common bed plate fabricated from mild steel channel or cast iron type. | | | | | |
| e) | Isolation Valve | | | | | |
| f) | Suitable cement concrete pump foundation & vibration damping arrangement with cushy foot mounting as required. | | | | | |
| l) | Capacity 2280 LPM and Head 75 Metres | Each | 2.0 | | | |
| 1.38 | Supplying, installation, testing and periodic commissioning of electric motor driven automatic pressurization pump set consisting of the following (as per specification) (For Hydrant system & Sprinkler system). | | | | | |
| a) | Centrifugal pump of 180 LPM capacity capable of building up pressure lost in any leakage in the system against atotal head (mentioned as under) complete with C.I. casing stainless steel impellor ; mechanical seal & S.S. shaft necessary strainer, pressure gauge on delivery side etc. including by-pass arrangement for testing of the working of the pumping set as required . | | | | | |
| b) | Squirrel cage A.C. induction motor suitable for operation on 415 V, 10% 3 phase 50 Hz. A.C. supply and of minimum 7.5 HP,1500 RPM, for the above pump with flexible coupling as per specification and conforming to IS: 325/ 1978 and shall be TEFC type only. | | | | | |
| c) | Common bed plate fabricated from mild steel channel or cast iron type. | | | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| d) | Suitable cement concrete pump foundation with vibration damping arrangement with cushy foot or similar mounting as per required. | | | | | |
| l) | Head - 75 Metres | Each | 2.0 | | | |
| 1.39 | Providing & fixing puddle flanged including 40 cm long GI pipe piece welded / threaded with MS plates 450x450x6mm thick with both end screwed / flanged | | | | | |
| a) | For 80 mm dia pipe | Each | 4.0 | | | |
| b) | for 150 mm dia pipe | Each | 6.0 | | | |
| c) | for 200 mm dia pipe | Each | 4.0 | | | |
| 1.4 | Supplying, installing, testing and commissioning of electric motor driven type automatic pressurisation, pump set suitable for automatic operation of terrace down comer and consisting of the following (as per CPWD specifications Part V-1985) for fire fighting and its amendmends). | | | | | |
| a | Fire pump with stainless steel impeller CI casing, SS shaft shall be horizontal end suction centrifugally type having a capacity of 900 LPM against a total head of 25m so as to ensure a minimum pressure of 3.0 kg/sqm at the highest and farthest out at the specified flow complete with necessary strainer with foot valve in suction side and pressure gauge on the delivery side including bypass arrangement for periodic testing of the working of the pumping set as required. The pump shall be provided with mechanical seals.(Including taking necessary approval of complete fire fighting scheme from local fire authority before and after start of work) {Agency also has to submit characteristic curve of the pumps, model & other technical data for approval before placing the order} | | | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|-------------|--|------|------------|----------------------|--------------------|-------------------------|
| b | Squirrel cage AC induction motor suitable for operation of 415 V ,+/-10%, 3 phase 50 HZ, AC supply and of minimum 7.5 HP,1500 RPM for the above pump with flexible coupling as per specification and conforming to IS 325-1978 and shall be TEFC type only | | | | | |
| c | Common base plate fabricated from mild steel channel or cast iron type | | | | | |
| d | Star delta suitable starter complete in all respect for automatic/manual operation of pump, start and stop push button contactor with required overload protection and single phase preventor | | | | | |
| e | Suitable cement concrete pump foundation with vibration damping arrangement with cushion foot mounting as required and having provision of suitable weather protection cover. | set | 6.0 | | | |
| B | Fire Fighting PANEL(Electrical) | | | | | |
| 1.41 | FIRE PANEL Emergency | | | | | |
| | Supply, installation, testing and commissioning of following M.V. cubicle type totally enclosed, wall mounted type, dust, damp and vermin proof, indoor type Distribution Board/Panel complete with busbars, M.V. danger notice plate, interconnections with suitable capacity aluminium leads/solid aluminium strips/rods, connection of incoming and outgoing cables with thimbles, powder coat painted and having following incoming and outgoing switchgears complete as required. Panel shall have IP 42 protection | | | | | |
| | INCOMER : | | | | | |
| | 320 Amp 415 volts, 35 KA (Isc), FP MCCB with thermal magnetic release having variable current settings of 0.8 to 1.0 In. | | | | | |
| | R,Y&B phase indicating lamp (LED type) with 2A control SP MCB | | | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|---|------|------------|----------------------|--------------------|-------------------------|
| | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | 1 no. 0 to 500 V Digital voltmeter with selectot switch | | | | | |
| | 1 to 0 to 400 Amps Digital ammeter with selector switch with one set of 400/5A C.T. s | | | | | |
| | BUSBARS : | | | | | |
| | 500 Amp TPN busbars of aluminium | | | | | |
| | OUTGOINGS : | | | | | |
| | 1 Sets of following | | | | | |
| | 1 No. 200 Amp. 415/500 volts,35 KA, TPN, Moulded Case Circuit Breaker with variable current setting of 0.8 to 1.0 | | | | | |
| | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | 1 No. 3 Phase, fully automatic star-delta starter of 75 HP with thermal overload relay, Timer, Push Buttons and Auto-manual selector switch etc complete as required. | | | | | |
| | Single Phase preventer | | | | | |
| | 1 to 0 to 200 Amps Digital ammeter with selector switch with one set of 200/5A CT,s. | | | | | |
| | 1 Set of phase indicating lamp with 2A SP control MCBs | | | | | |
| | Neon indicating Lamps for "ON" , "OFF" & "TRIP" indication with 2A SP control MCBs. | | | | | |
| | | | | | | |
| | 2 Sets of following | | | | | |
| | 1 No. 40 Amp. 415/500 volts,25 KA, TPN, Moulded Case Circuit Breaker with variable current setting of 0.8 to 1.0 | | | | | |

| Item No | Description Of Item | Unit | Total Qty. | Rate (Rs) in figures | Rate (Rs) in words | Amount in figures (Rs.) |
|---------|--|------|------------|----------------------|--------------------|-------------------------|
| | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | 1 No. 3 Phase, DOL starter of 10 HP with thermal overload relay, Push Buttons and Switches etc complete as required. | | | | | |
| | Single Phase preventer | | | | | |
| | 1 Set of phase indicating lamp with 2A SP control MCBs | | | | | |
| | Neon indicating Lamps for "ON" , "OFF" & "TRIP" indication with 2A SP control MCBs. | | | | | |
| | 1 Sets of following | | | | | |
| | 1 No. 32 Amp. 415/500 volts,25 KA, TPN, Moulded Case Circuit Breaker with variable current setting of 0.8 to 1.0 | | | | | |
| | Extended rotary operating mechanism with door interlock with defeat feature and padlock facility. MCCB should have spreader links & phase barriers. | | | | | |
| | 1 No. 3 Phase, DOL starter of 7.5 HP with thermal overload relay, Push Buttons and Switches etc complete as required. | | | | | |
| | Single Phase preventer | | | | | |
| | 1 Set of phase indicating lamp with 2A SP control | | | | | |
| | Neon indicating Lamps for "ON" , "OFF" & "TRIP" indication with 2A SP control MCBs. | | | | | |
| | | | | | | |
| | 1 Set of following (in a separate cubicle) | | | | | |
| | One no. Diesel engine auto starting kit with all necessary relay, controls, wiring etc to start 75 HP diesel engine when electrical driven fire pump fail to | | | | | |
| | One no rectifier circuit, battery charger, batteries, DC Voltmeter, DC Ammeter etc. | | | | | |
| | FIRE PUMP Panel as mentioned above | Set | 2.0 | | | |
| | Sub Total | | | | | |

**Project Name: Construction of Hostel Block 1 , 2 and 3 including Maintenance for AIIMS within
AIIMS campus, Ansari Nagar NewDelhi.**

ABSTRACT OF COST

| S.No | DESCRIPTION OF WORK | Amount |
|-------------|---------------------------------------|---------------|
| 1 | EARTHWORK | |
| 2 | CONCRTE WORK | |
| 3 | RCC WORK | |
| 4 | BRICK WORK | |
| 5 | DOORS & WINDOWS | |
| 6 | STEEL WORK | |
| 7 | FLOORING | |
| 8 | CEILING & ROOFING | |
| 9 | FINISHING | |
| 10 | MISCELLANEOUS | |
| 11 | DEVELOPMENT | |
| 12 | SIGNAGE | |
| 13 | DISMENTLING AND DEMOLITION | |
| 14 | COMPREHENSIVE MAINTENANCE & OPERATION | |
| | TOTAL | |

**ALL INDIA INSTITUTE OF MEDICAL SCIENCES
(AIIMS), ANSARI NAGAR, NEW DELHI**

Tender

For

**Construction of Hostel Block 1, 2 and 3 including Maintenance for
AIIMS within AIIMS campus, Ansari Nagar, New Delhi**

**Volume-I
Prequalification Document**

JUNE 2011



**HSCC (INDIA) LTD.
(CONSULTANTS & ENGINEERS FOR MEGA HOSPITALS & LABORATORIES)
E-6(A), sector-1, NOIDA(U.P) 201301 (India)**

Phone : 0120-2542436-40

Fax : 0120-2542447

PQ tender No. HSCC/BU-HP-II/ 2010

**All India Institute of Medical Sciences
Ansari Nagar, New Delhi**

HSCC/BU-II/Hostel & Surgical/2011

15.06.2011

NOTICE INVITING TENDER

Bids are invited on behalf of Director-All India Institute of Medical Sciences (AIIMS), NEW DELHI from eligible contractors/firms for the following works:

| PKG No. : | Name & description of work | Completion period of work | Estimated cost (Rs.) | Bid Security (in Rs.) | Sale of Tender | Date of Submission & opening |
|-----------|---|---------------------------|----------------------|------------------------|-------------------------------------|---|
| Pkg -I | Construction of Surgical Block including maintenance for AIIMS within AIIMS campus, Ansari Nagar, New Delhi | 20 Months | 55.52 Crore | 65.52 Lakhs. | 20.06.11 to 12.07.11 upto 14:00 hrs | 12.07.11 at 15:00 hrs and opening on 12.07.11 at 15:30 hrs. |
| Pkg-II | Construction of Hostel Block 1, 2 & 3 including maintenance for AIIMS within AIIMS campus, Ansari Nagar, New Delhi | 20 Months | 75.45 Crore | 85.45 Lakhs. | 21.06.11 to 13.07.11 upto 14:00 hrs | 13.07.11 at 15:00 hrs and opening on 13.07.11 at 15:30 hrs. |

For details in regards of eligibility, bid security, purchase and submission of tender document, please refer detail advertisement and tender documents made available at HSCC website www.hsccltd.co.in and AIIMS website www.aiims.edu. Pre bid meeting for surgical block & Hostel block will be held on 04.07.11 at 15.00 hrs. and 05.07.11 at 15.00 hrs. respectively.

Prospective bidders are advised to regularly scan through AIIMS/HSCC web site as corrigendum/amendments etc., if any, will be notified on the AIIMS/HSCC web site and separate advertisement will not be made for this.

DGM (Civil), HSCC (I) Ltd

All India Institute of Medical Sciences**Ansari Nagar, New Delhi****HSCC/BU-II/Hostel & Surgical/2011****15.06.2011****NOTICE INVITING TENDER**

Bids are invited on behalf of Director-All India Institute of Medical Sciences (AIIMS), NEW DELHI from eligible contractors/firms for the following works:

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|-----------|---|---------------------------|----------------------|------------------------|-------------------------------------|---|--------------------------|
| Pkg -I | Construction of Surgical Block including maintenance for AIIMS within AIIMS campus, Ansari Nagar, New Delhi | 20 Months | 55.52 Crore | 65.52 Lakhs. | 20.06.11 to 12.07.11 upto 14:00 hrs | 12.07.11 at 15:00 hrs and opening on 12.07.11 at 15:30 hrs. | 04.07.11 from 15:00 hrs. |
| Pkg-II | Construction of Hostel Block 1, 2 & 3 including maintenance for AIIMS within AIIMS campus, Ansari Nagar, New Delhi | 20 Months | 75.45 Crore | 85.45 Lakhs. | 21.06.11 to 13.07.11 upto 14:00 hrs | 13.07.11 at 15:00 hrs and opening on 13.07.11 at 15:30 hrs. | 05.07.11 from 15:00 hrs. |

Complete set of tender documents for both the above packages comprising prequalification document (Volume I), General Conditions of contract (Volume-II), Instructions to Bidders & Specific conditions of contract (Volume III), Technical specifications (Volume IV) and Bill Of Quantities (Volume V) has been made available at HSCC website www.hsccltd.co.in and AIIMS website www.aiims.edu excluding Volume-VI i.e. Tender Drawings. Tender drawings may be obtained from HSCC office on written request (if other volumes 1 to V downloaded from website) and must be submitted along with the complete bid without which the bid may be rejected. The interested applicants/firms may also check their eligibility for the tender. Interested applicants/firms may see the complete set of tender documents which have been kept at dispatch counter of HSCC Corporate office, at E-6(A), sector-1, Noida. Contractors/firms may also purchase the complete set of tender documents comprising of Vol. I, II, III, IV, V and VI (tender drawings) in person from the office of HSCC (I) Ltd, Noida on any working day as mentioned above on written request mentioning the name & description of work package wise against a non refundable fee of **Rs. 10,000/-** (each package) through Cash/demand draft in favour of HSCC (I) Ltd. NOIDA payable at NOIDA or download the tender documents from said websites and submit complete set of tender documents (Vol-1 to VI) along with the tender document fee of Rs. 10000/- (each package) through demand draft including bid security. However in case of downloading of tender documents from websites it will be the responsibility of applicants/firms to ensure that complete tender documents has been downloaded Interested applicants/firms may like to attend the **pre bid meeting (package wise) shall be held at HSCC corporate office, Noida on above mentioned dates.** The tender document containing volume-I to VI shall be submitted package wise separately complete in all respect along with requisite amount of bid security in favour of HSCC (I) Ltd Noida (package wise) on or before due date and time as mentioned above. HSCC/AIIMS reserves the right to accept or reject any application without assigning any reason or incurring any liability whatsoever. Prospective bidders are advised to regularly scan through AIIMS/HSCC web site as corrigendum/amendments etc., if any, will be notified on the AIIMS/HSCC web site and separate advertisement will not be made for this.

DGM (Civil), HSCC (I) Ltd

PACKAGE-II

INSTRUCTION TO APPLICANTS

PROJECT NAME: **PART-A : Construction of Hostel Block 1 (01 basement + Ground + 10), 2 (01 basement + Ground + 10) and 3 (02 basement + Ground + 5) for AIIMS within AIIMS campus, Ansari Nagar, New Delhi .**

PART-B : Comprehensive Operation & Maintenance for five years

Completion period: within 20 (Twenty) Calendar months

EMPLOYER/CLIENT: All India Institute of Medical Sciences, (AIIMS), Ansari Nagar, New Delhi

1. Scope of Bid :

1.1 For & on behalf of All India Institute of Medical Science (AIIMS), New Delhi (**The Employer/Client**), HSCC (I) Ltd (**The Consultant**) intends to invite bids from eligible contractors/firms for above works details as under

1.2 Brief Details :

Construction of Hostel Block 1 (01 basement + Ground + 10), 2 (01 basement + Ground + 10) and 3 (02 basement + Ground + 5) for AIIMS within AIIMS campus, Ansari Nagar, New Delhi including civil, electrical, HVAC/ventilation, PHE, fire fighting etc and **Comprehensive Maintenance for five years.**

Above works to be executed for All India Institute of Medical Sciences (AIIMS) at Ansari Nagar , New Delhi

Tender is open to all agencies / firms having sound background and Specialisation in carrying out similar works.

2.0 SUBMISSION OF APPLICATION:

2.1 Application for tender must be submitted complete in all respect in sealed envelopes which must be either delivered by hand or by registered mail, at DGM (Civil) HSCC (India) Ltd, Plot No. 6(A), Block-E, Sector-1, NOIDA, U.P.-201301, so as to reach not later than designated date & time and be clearly marked “Application for tender for **“Construction of Hostel Block 1,2 and 3 including Maintenance for AIIMS within AIIMS campus, Ansari Nagar, New Delhi ”**”

2.2 The name and mailing address of the Applicant should be clearly marked on the envelope.

- 2.3 All the information asked for pre-qualification and bids shall be answered in the ENGLISH language by all the agencies/firms.
- 2.4 Failure to provide information in the stipulated format enclosed or to provide timely clarification or substantiation of the information supplied (considered essential to evaluate the Applicant's qualification) shall result in disqualification of the Applicant.

3.0 MINIMUM PRE-QUALIFICATION CRITERIA:

3.1 Pre-Qualification will be based on meeting all the minimum criteria for pre-qualification and other qualification criteria regarding the Applicant's work experience, personnel and equipment capabilities and financial position as demonstrated by the Applicant's responses in the forms attached to the Letter of Application.

3.2 The Applicant should meet the following minimum criteria for Pre-Qualification :

- (i) Average Annual Financial Turnover during the last three financial years i.e. 2007-08, 2008-09 & 2009-10 should be at least 30% of the estimated cost.
- (ii) Experience of having successfully completed similar works during last 7 years ending last day of month previous to the one in which applications are invited should be either of the following :

Three *similar completed works costing not less than the amount equal to 40% of the estimated cost.

or

Two *similar completed works costing not less than the amount equal to 50% of the estimated cost.

or

One *similar completed work costing not less than the amount equal to 80% of the estimated cost.

* Similar works means:

*Similar works means construction of RCC Framed building works including internal & external services like plumbing, fire fighting, electrical & ventilation etc. In case the bidder do not have the experience of major specialized works like Plumbing, ventilation and electrical, fire fighting etc., such specialized works shall be carried out by specialized agencies having sound financial background and experience of executing works of similar nature & magnitude. The bidder is required to give an undertaking as per enclosed format at Annexure-VII.

- A Certificate from client for completion of work(s) must be submitted along with application. Own works / Certification of the agencies shall not be considered for prequalification.
- 3.3 The firm should submit an affidavit duly notarized that they have not abandoned any work of Union Government/ State Governments/ PSU's etc. during the last 5 years. They should also submit an affidavit that they have not been blacklisted, debarred,

declared non performer or expelled by Union Government/ State Governments/ PSU's etc. during the last 5 years

3.4 The applicant should provide information regarding litigation/ Arbitration cases for the last five years as per ANNEXURE-V

3.5 **Financial Capabilities:** The Applicant should submit Audited Balance Sheets for the last three financial years i.e. 2007-08 , 2008-09 & 2009-10. The applicant should not have incurred any loss in more than two years during the last five years ending 31st March 2010 (Fill enclosed ANNEXURE-III).

3.6 Minimum Solvency Requirement:

A solvency certificate from applicant's Bank (Nationalized/Scheduled) that applicant is solvent for 30% of the Project Estimated Cost. The certificate should be not more than one year old.

3.7 **Bidding Capacity:** The bidding capacity of the contractor/firms should be equal to or more than the estimated cost of the work. The bidding capacity shall be worked out by the formula as below:

$$\text{Bidding Capacity} = (A * N * 2) - B$$

Where

A= Maximum Value of construction works executed in any one year during the last 7 years taking in to account the completed as well as work in progress.

N= Number of years prescribed for completion of work for which bids has been invited.

B= Value of existing commitments and on going works to be completed during the period of completion of work for which bids have been invited.

NOTE: Bidders are requested to submit details of calculation along with all supporting documents in respect of arriving value of bid capacity (Fill enclosed Annexure-IX also)

4.0 PERSONNEL, EQUIPMENT AND FINANCIAL CAPABILITIES

4.1 **Personnel Capabilities:** The firm should have suitable qualified and experienced personnel for the successful completion of the works. List of employees and bio-data of key officials shall be submitted stating clearly how these would be involved in this work. (Fill enclosed ANNEXURE-I).

4.2 **Equipment Capabilities:** The Applicant should submit the list of equipments for successful completion of project. (Fill enclosed ANNEXURE-II)

5.0 EXPERIENCE OF EXECUTING OF PROJECTS OF SIMILAR NATURE & COMPLEXITY

The applicant shall submit information about their past experience of **projects** of similar nature and complexity with information about magnitude of the Projects, Type of Projects, Completion Certificate from Client, Time Overrun if any, Cost over run if any , (Fill enclosed ANNEXURE-IV).

6.0 OTHER INFORMATION TO BE SUBMITTED ALONGWITH APPLICATION

6.1 Registration/ Licence : The firm should have Works Contract Tax/VAT Registration with the appropriate Authorities In case the firm is not registered at the time of submission of bid, they will get themselves registered with the concerned authorities in case they are awarded the work

6.2 The applicant should provide information regarding litigation/ Arbitration cases for the last five years as per ANNEXURE-V

6.3 The applicant shall submit the supporting documents regarding the information given in the ANNEXURE-I to ANNEXURE-V

6.4 The contractor will indemnify HSCC/Ministry of Health & Family Welfare/Principle employer/client, as the case may be, against all penal action that may be levied/effectuated by any concerned authority for default in any labour regulation/PF/ESI and other statutory requirements of the relevant Acts/Laws related to the work of the contractor and will bear the legal charges, if any, and will pay the legal charges/dues directly to the concerned authority

7.0 Even though the Applicants meet the above criteria, they are subject to be disqualified, if they have:

- made misleading or false representation in the form, statement and attachments submitted; /or
- Record of poor performance such as abandoning the work, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures, etc. /or
- The performance of any agency already worked/ working with HSCC is not found satisfactory./or
- found to have been black listed in any of the works.

8.0 The applicants are advised to visit the site to get first hand information as regards its approach, accessibility, working conditions, site conditions, availability of labour and material etc. and other matters affecting cost and work. All costs incurred in connection with submission of the pre-qualification application shall be borne by the applicant irrespective of the outcome.

9.0 If any information furnished by the applicant is found incorrect at a later stage, applicant shall be liable to be debarred from tendering in HSCC. The department reserves the right to verify the particulars furnished by the applicant independently.

10.0 The competent authority to pre-qualify shall have the power to relax any condition/criterion for pre-qualification if it considers expedient to do so.

11.0 Even though the agency meets all the criteria, the Employer / Consultant reserves the right to accept or reject any applicant/disqualify any agency without assigning any reason whatsoever.

12.0 UPDATING QUALIFICATION INFORMATION

12.1 Applicants shall be required to update the financial information used for Pre-Qualification as and when asked for and at the time of submitting their bids, to confirm their continued compliance with the pre-qualification criteria and verification of information provided. Free issued cement & steel shall be considered to arrive final completed project cost.

13.0 GENERAL

13.1 Only agencies / firms who have been pre-qualified under this procedure will be considered for further opening of bid. Firm may submit only one bid for any work. If a firm submitting more than one bid all bids of the party will be rejected.

13.2 The Employer / Consultant reserves the right to :

- (a) Reject or accept any application without assigning any reason or incurring any liability thereof
- (b) Cancel the tendering process and reject all applications
- (c) Split the works into different packages if required
- (d) Amend the scope and value of any contract under this project.

13.3 Joint venture companies or experience of any work done in joint venture shall not be considered.

13.4 No correspondence either from successful / pre-qualified applicant or unsuccessful applicant will be entertained in this regard.

13.5 Check list format attached at Annexure VI must be filled and enclosed along with the application.

DGM (C)
For & on behalf of HSCC (I) Ltd.

LETTER OF APPLICATION

[NOTE : On the letterhead paper of the applicant including full postal address, telephone no., fax no., telex no. and cable address]

Date: _____

HSCC(I) Ltd.
Plot No. 6(A), Block(E), Sector-I
NOIDA, U.P.-201301

Sirs,

1. Being duly authorised to represent and act on behalf of
(hereinafter referred to as “the Applicant”) and having reviewed and fully understood all the pre-qualification information provided, the undersigned hereby apply to be pre-qualified by yourselves as a bidder for the

----- **its**
maintenance during the Defect Liability period

| Pre-Qualification Number | Client Name |
|--------------------------|---|
| HSCC/BU-HP-II/2010 | All India Institute of Medical Science (AIIMS), New Delhi |

2. Attached to this letter are copies or original documents defining :

- (a) the applicants legal status
 - (b) the principal place of business
 - (c) the place of incorporation (for applicants who are corporations) or the place of registration and the nationality of the owners (for applicants who are partnerships or individually owned firms)
 - (d) application form no. 1 to 6
3. Your agency and its authorized representatives are hereby authorized to conduct any inquiries or investigations to verify the statements, documents and information submitted in connection with this application, and to seek clarification from our bankers and clients regarding any financial and technical aspects. This letter of application will also serve as authorization or any individual or authorized representative or any institution referred to in the supporting information, to provide such information deemed necessary and requested by yourselves to verify statements and information provided in this application, or with regard to the resources, experience, and competence of the Applicant.
 4. Your agency and its authorized representatives may contact the following persons for further information:

| | |
|---|---------------|
| General, Personnel, Technical and Financial Enquiries | |
| Contact 1 : | Telephone 1 : |
| Contact 2 : | Telephone 2 : |

5. This application is made in the full understanding that :
 - (a) Bids submitted by applicants will be subject to verification of all information submitted at the time of bidding
 - (b) Your agency reserves the right to :
 - amend the scope and value of the contract / bid under this project ; in such event, bids will only be called from pre-qualified bidders who meet the revised requirements ; and
 - reject or accept any application, cancel the pre-qualification process, and reject all applications without assigning reasons or incurring any liability thereof ; and
 - (c) Your agency shall not be liable for any such actions and shall be under no obligation to inform the Applicant

6. The undersigned declare that statements made and the information provided in the duly completed application are , true and correct in every detail.

| |
|----------------------|
| Sealed & Signed |
| Name |
| For and on behalf of |

APPLICATION FORM NO. 1

GENERAL INFORMATION

All individual firms applying for pre- qualification are requested to complete the information in this form. Information to be provided for all owners or APPLICANTS who are partnerships or individually-owned firms.

| | |
|----|--|
| 1. | Name of firm |
| 2 | Head office address |
| 3 | Telephone Contact |
| 4 | Fax E-mail No. |
| 5 | Place of incorporation/ Registration Year of incorporation/ registration |

Authorized Signatory of bidder

APPLICATION FORM NO. 2

STRUCTURE AND ORGANIZATION

1. Name & address of the applicant
2. Telephone No. / Telex No. / Fax No.
3. Legal status of the applicant (attach copies of original document defining the legal status)
 - (a) An individual
 - (b) A proprietor firm
 - (c) A firm in partnership
 - (d) A Limited Company or Corporation.
4. Particulars of registration with various Government bodies (attach attested photocopy)

| | |
|-------------------------------------|------------------|
| Organisation /Place of registration | Registration No. |
|-------------------------------------|------------------|
5. Name and Titles of Directors & Officers with designation to be concerned with this work.
6. Designation of individuals authorised to act for the organisation
7. Was the applicant ever required to suspend construction for a period of more than six months continuously after you commenced the construction? If so, give the name of the project and reasons of suspension of work.
8. Has the applicant ever abandoned the awarded work before its completion ? If so, give name of the project and reasons for abandonment.
9. Has the applicant ever been debarred / black listed for tendering in any organisation at any time If so, give details.
10. Has the applicant ever been convicted by a court of law? If so, give details.
11. Any other information considered necessary but not included above.

Authorized Signatory of bidder

PERSONNEL CAPABILITIES

| Sl. No. | Designation | Total Number | Number available for this work | Name | Qualification | Professional experience | Remarks |
|---------|-------------|--------------|--------------------------------|------|---------------|-------------------------|---------|
| | | | | | | | |

Authorized Signatory of bidder

EQUIPMENT CAPABILITIES

| Sl. No. | Name of Equipment | Nos | Capacity or Type | Age | Condition | Remarks |
|---------|-------------------|-----|------------------|-----|-----------|---------|
| | | | | | | |

Authorized Signatory of bidder

FINANCIAL CAPABILITIES

(Rs. In lacs)

| Financial Year | Annual Turn Over in Indian Rupees (or equivalent to Indian Rupees) as per Audited Balance Sheet |
|---|---|
| 2007-2008 | Rs. |
| 2008-2009 | Rs. |
| 2009-2010 | Rs. |
| Average Annual Turnover over the past three years | Rs. |

| Financial Information in Rs. Equivalent | For year 2005-2006 | For year 2006-2007 | For year 2007-2008 | For year 2008-2009 | For year 2009-2010 |
|---|--------------------|--------------------|--------------------|--------------------|--------------------|
| 1. Total Assets | | | | | |
| 2. Current Assets | | | | | |
| 3. Total Liabilities | | | | | |
| 4. Current Liabilities | | | | | |
| 5. Profit before Tax | | | | | |
| 6. Profit after Tax | | | | | |
| 7. Net Worth | | | | | |

NOTE : The above data is to be supported by audited balance sheets

1. Attach copies of audited balance sheets duly certified by the chartered accountant for all three years (2007-2008,2008-2009 & 2009-2010). Audited Balance sheet should mention the membership number of chartered accountant issued by ICAI along with full address.
2. Attach recent solvency certificate from bankers

Authorized Signatory of bidder

EXPERIENCE OF COMPLETION OF PROJECTS OF SIMILAR NATURE &
COMPLEXITY

(During last seven years ending last day of month previous to the one in which applications are invited)

| Sl. No. | Name of work / project and location | Owner or sponsoring organization | Cost of work in Lakhs | Date of commencement as per contract | Stipulated date of completion | Actual date of completion | Name and address/ telephone number of officer to whom reference may be made | Remarks |
|---------|-------------------------------------|----------------------------------|-----------------------|--------------------------------------|-------------------------------|---------------------------|---|---------|
| | | | | | | | | |

NOTE : Please attach supporting documents (completion certificates along with order copies) for the above information

Authorized Signatory of bidder

APPLICATION FORM NO. 7

ANNEXURE - V

Litigation Details
Court Cases/arbitration

| |
|----------------|
| Name of Bidder |
|----------------|

| Year | Name of the work | Name of the Client, with Address | Title of the court Case/Arbitration | Detail of the Court/ Arbitrator | Status Pending/ Decided | Disputed Amount (Current Value, the equivalent) in case of Court Cases/arbitration | Actual Awarded Amount (Rs) in decided Court Cases/arbitration |
|------|------------------|----------------------------------|-------------------------------------|---------------------------------|-------------------------|--|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Authorized Signatory of bidder

Check-List

| S.No | Criteria | Requirements | Cross Referencing / Page no. at which required information is available (To be mentioned) | Indicate Eligibility Y / N |
|------|--|---|---|----------------------------|
| 1 | Average Turnover for last three years | 30% of the estimated project cost | | |
| 2 | Experience | During last seven years <ul style="list-style-type: none"> ▪ Similar work completed, 3 nos. of value not less than 40% of the estimated cost ▪ Similar work completed, 2 Nos. of value not less than 50% of the estimated cost ▪ One Similar work completed of value not less than 80% of the estimated cost | | |
| 3 | Personnel Capabilities | List of suitable qualified and experienced personnel in relevant field | | |
| 4 | Equipment Capabilities | List of equipment required and proposed to be deployed & source of such equipments | | |
| 5 | Financial Capability | <ul style="list-style-type: none"> ▪ Net worth positive for all the three years ▪ Profit earning for all the three years | | |
| 6 | Solvency Certificate | Solvency certificate from applicant's bank for 30% of the estimated project cost. | | |
| 7. | Abandoning / Blacklisting | Information regarding not abandoned /Black listing for any work of Union Govt./State Govt./PSU's etc. during last 5 years | | |
| 8. | PQ document fee, in case down loaded from web site | | | |

Authorized Signature of Bidder with stamp

UNDERTAKING

We _____ do hereby undertake to engage a specialised _____ agency after approval of HSCC for undertaking the execution of _____ works of (_____ Name of the project _____) whose minimum qualification shall be as under:

- (i) Average Annual Financial Turnover during the last three financial years i.e. 2007-2008, 2008-2009 & 2009-2010 should be at least 30% of estimated price of _____ works.
- (ii) Experience of having successfully completed similar works during last 7 years ending last day of month previous to the one in which applications are invited should be either of the following :
- Three similar completed works each costing not less than the amount equal to 40% of estimated price of _____ works.
- or
- Two similar completed works each costing not less than the amount equal to 50% of estimated price of _____ works.
- or
- One similar completed work costing not less than the amount equal to 80% of estimated price of _____ works.
- (iii) We shall be solely responsible for successful execution of _____ work.

INSTRUCTIONS FOR DOWNLOADING OF TENDER DOCUMENTS FROM INTERNET AND ITS SUBMISSION

1. The tender documents for the **Construction of Hostel Block 1 (01 basement + Ground + 10), 2 (01 basement + Ground + 10) and 3 (02 basement + Ground + 5) including maintenance for AIIMS within AIIMS campus, Ansari Nagar, New Delhi** can be obtained from the HSCC website <http://www.hscc Ltd.co.in> and AIIMS website www.aiims.edu. And the offers can be given on the same subject to the conditions given below which shall be carefully studied by the intending bidders and offers submitted accordingly.
2. The tender documents shall be carefully downloaded from the website and the same shall be printed carefully, The tender documents so downloaded shall be complete in all respects, which shall be the sole responsibility of the bidder(s), and the HSCC/MoHFW shall not be liable for any mistakes/loss or corruption of data in the downloading and/ or printing. The end of each volume of the tender documents should be marked in bold letter as “END OF VOLUME – X” (where “X” is the Volume Number) on a separate page in the uploaded document, which may be checked while downloading the tender documents to ensure that the complete tender documents has been downloaded. The tenderer(s) must also compare the document as printed with the document as uploaded on the website. The tenderer(s) shall sign the undertaking given in ANNEXURE –VIII of Volume – I (PQ) of Bid Document failing which the offer given by them shall be summarily rejected.
3. A master copy of the document downloaded from the website mention above shall be kept at HSCC Head Office, E-6A, Sector -1, Noida -201301, (U.P.). In case of any discrepancy between the tender document printed and submitted by the bidder after downloading from the website and the Master Copy, the later shall prevail and shall be binding on the tenderer(s). The offer received shall be deemed to have been submitted on the document as uploaded and appearing in the website mentioned above whose Master Copy is kept in the office of tender inviting authority.
4. The tenderer(s) shall print the documents on good quality, white A4 size paper on any quality Laser Printer.
5. The cost of tender document of Rs. 10,000/- (including service tax) as mentioned in the notice inviting tender shall be enclosed with the technical package Part –I of the offer as a Demand Draft payable in favor of “HSCC (I) Ltd. NOIDA payable at NOIDA as cost of tender. The cost of tender document shall not be clubbed with the earnest money deposit. The tenders submitted without the requisite cost of tender documents in appropriate form shall not be considered.
6. The tender shall be filled up after careful study of the document and the site and any clarification required may be obtained from the tender inviting authority whose address is given in the tender document.
7. The tenderer(s) downloading the documents from internet must keep themselves updated through the website from which the tender document is downloaded regarding corrigenda, if any, to the same website. The offers received without such corrigenda published are liable to be rejected.
8. Any willful changes/deletion/addition in printing carried out in the tender documents shall be viewed very seriously, whether detected at the time of opening/award of work, and the same may result in penal action including banning of further business with the defaulting tenderer(s). In addition, the tenderer(s) are liable to be prosecuted for the same as per law.
9. The Tenderer(s) or his authorized representative shall be original on each page of the downloaded tender document.

Signature of Tenderer(s)

ANNEXURE - VIII

Bidders submitting their bids using tender documents downloaded from the websites mentioned above should enclose the tender document fee in the form prescribe above in Envelope no.1 of their bids along with Certificate as per format given at ANNEXURE-VIII of this Volume I of the tender documents failing which the bid shall be rejected.

CERTIFICATE

(Only for bidders using tender documents downloaded from website)

We certify that the tender documents (Volume I, II, III, IV, V & VI) submitted by us along with our bid for _____(tender no.)_____ _____(name of work)_____ are downloaded from HSCC website (www.hsccltd.com)and AIIMS website (www.aiims.edu) and is same in content and form (verbatim).

We also undertake that any deviation, if detected at any stage, would entitle AIIMS/ HSCC to reject our bid/tender/offer and take suitable penal action against us. In any such an eventuality, the decision of AIIMS/HSCC shall final and the same would be legally binding on us.

Signature & seal of the Tenderer

PROJECT UNDER EXECUTION OR AWARDED

| Sl.No | Name of Work/ Project & location | Owner of sponsoring Organization | Cost of Work | Date of Commencement As per contract | Stipulated Date of completion | Uptodate Percentage Progress of work | Slow Progress, If any, & reasons thereof | Name & address/ Telephone No. of officer to whom reference may be made | Remarks |
|-------|----------------------------------|----------------------------------|--------------|--------------------------------------|-------------------------------|--------------------------------------|--|--|---------|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| | | | | | | | | | |

Certified that above lists of works is complete and no work has been left out and that the information given is correct to my knowledge and belief.

Signature of Applicant

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INSTRUCTIONS TO BIDDERS

A. General

1.0 Description of Works:

PART-A: Construction of Hostel Block 1 (01 basement + Ground + 10), 2 (01 basement + Ground + 10) and 3 (02 basement + Ground + 5) for AIIMS within AIIMS campus, Ansari Nagar, New Delhi .

PART-B: Comprehensive Operation & Maintenance for five years.

The site of work is with in existing campus of All India Institute of Medical Sciences (AIIMS), Ansari Nagar, New Delhi.

The Scope of work comprising of Construction of multistoried building having Service building, Substation, plumbing, sanitary, etc. The scope of work shall also includes Electrical works, HVAC/Ventilation works, external development works such as roads, land scaping, sewerage, storm water drainage & fire fighting works etc. and their maintenance during defect liability period including & preparation of all detailed shop drawings, obtaining approval from all local authorities, electrical inspector, water, sewer, drainage, electricity connection from local bodies, permission/approval for tree cuttings etc.

1.1 All the terms and conditions, undertakings of PQ documents under which the agency has been pre qualified for this work will have to be strictly followed and will be treated as part of this tender documents in addition to other terms and conditions of the tender documents.

1.2 The Employer

All India Institute of Medical Sciences (AIIMS), NEW DELHI. shall be the principal Employer / employer / owner for **Construction of Hostel Block 1 (01 basement + Ground + 10), 2 (01 basement + Ground + 10) and 3 (02 basement + Ground + 5) for AIIMS within AIIMS campus, Ansari Nagar, New Delhi .** All India Institute of Medical Science (AIIMS), NEW DELHI including PHE, electrical, HVAC/Ventilation, fire fighting & detection systems, etc.

All documents relating to Labour License, submission of drawings to statutory authority for obtaining necessary clearance etc is to be signed/endorsed by representative of the Employer.

1.3 In these documents wherever the word Tender/ Tenderer/ Tendering has been used. The same may be considered synonymous with Bid/ Bidder/ Bidding.

1.4 Time for Completion

The successful Bidder shall complete the whole Works within **20 (Twenty) Calendar months** from Engineer's order to commence the Work.

2.0 Information to be submitted

2.1 Bids submitted shall include the following information:

- (a) Copies of original documents defining the constitution, legal status, place of registration and principal place of business of the company or firm
- (b) A work plan clearly bringing out how the Bidder proposes to carry out the work to achieve the quality and the time schedule

The work plan shall clearly spell out with specific details the following:

- i. Detailed programme in the form of a **PERT/CPM network** clearly bringing out details of start & completion of all important activities and also programme showing material & labour resources related to the above PERT/CPM network.
- ii. List of equipment along with details proposed to be used on the Works.
- iii. List and bio data of Engineers and other important staff members proposed to be employed on the Works.
- iv. Details of new and used shuttering proposed to be employed on the Works.

3.0 Cost of Bidding

3.1 The Bidder shall bear all costs associated with the preparation and submission of his Bids and "The Employer" will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.

4.0 Site Visit

4.1 The Bidder is advised to acquaint himself with the job involved, visit the Site & examine soil conditions (No report will be provided by Engineer), climatic conditions, labour, power, water, material availability, transport and communication facilities, environmental regulations, laws and bye-laws of Statutory bodies of Govt. of Delhi and the Govt. of India and collect all information that will be necessary for preparing the Bid and entering into a Contract.

The cost of visiting the Site and collecting information for the purpose of submission of the Bid shall be to the Bidder's account.

4.2 The Bidder and any of his personnel or agents will be granted permission by the Employer to enter upon the Site for the purpose of such inspection, but only upon the express condition that the Bidder, his personnel or agents will release and indemnify the Employer and Employer's Personnel and agents from and against all liability in respect thereof and will be responsible for personnel injury (Whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expense however caused, which, but for the exercise of such permission would not have arisen.

B. Bid Documents

5.0 Content of Bid Documents

5.1 The Bid Documents comprise the following:

- Volume-I = Prequalification Document
- Volume II = General Conditions of Contract
- Volume III = Specific Conditions of Contract
Comprising of:
 - Instructions to Bidders
 -

- Additional Specific Conditions of Contract relating to
 - (a) General
 - (b) Civil, Public Health works
 - (C) Electrical works.
 - (D) HVAC/VENTILATION works
 - Sample Forms of Securities
 - Sample Form of Agreement
- Volume IV = Technical Specifications
- Volume V = Bill of Quantities
- Volume VI = Tender Drawings

5.2 The Bidder is expected to examine carefully all instructions, conditions, forms, terms, specifications and drawings in the Bid documents. Failure to comply with the requirements of the Bid Documents will be at the Bidder's own risk.

Bids, which are not substantially responsive to the requirements of the Bid documents, will be rejected. **Bidders are requested to clear their queries before submission of bids and submit bids without conditions.**

6.0 Clarification on Bid Documents

6.1 A interested Bidder requiring any clarifications on the Bid documents may notify the Engineer in writing or by telex or cable at the Engineer's mailing address indicated in the Bid documents. A meeting of the prospective Bidders shall be held at which the Engineer will respond to any request for clarification which he receives within two weeks of the first date of the issue of the Tenders. Written copies of the Engineer's response (including an explanation of the query but without identifying the source of the inquiry) will be sent to all prospective Bidders who have received the Bid documents.

7.0 Amendment of Bid Documents

7.1 At any time prior to the dead line for submission of Bids, the Engineer may for any reason, whether at his own initiative or in response to a clarification requested by the prospective Bidder, modify the Bid documents by amendment.

7.2 The amendment will be sent to all prospective Bidders who have received the Bid documents, to arrive not later than 3 days prior to the original or extended deadline for submission of Bids, in writing

or by telex or cable and will be binding upon them. Prospective Bidders should promptly acknowledge receipt thereof by telex or cable to the Engineer.

- 7.3 In order to afford prospective Bidders reasonable time in which to take an amendment into account in preparing their Bids, the Engineer may, at his discretion, extend the deadline for the submission of Bids.

C. Preparation of Bids

8.0 Language of Bid

- 8.1 The Bid prepared by the Bidders and all correspondence and documents relating to the Bid exchanged by the Bidder and the Engineer shall be written in the English Language.

9.0 Documents comprising the Bid

- 9.1 The Bid to be prepared by the Bidder shall comprise of the following: the prequalification document duly filled with required information including all supporting documents, the Bid and Appendix thereto, the Bid Security, the Bill of Quantities; the Schedules of Supplementary information, and any other materials required to be completed and submitted in accordance with the instructions to Bidders embodied in these Bid documents. The Forms, Bill of Quantities and Schedules provided in these Bid documents shall be used without exception.

- 9.2 All documents issued for the purpose of Bidding as described in Clause 5.1 and amendments issued in accordance with Clause 7, shall be deemed incorporated in the Bid. Bid Documents prepared and submitted in accordance with Clause 14 and 15 shall be returned by Bidders to the Employer along with the submission of the Bid.

10.0 Bid Prices

- 10.1 The Bidder shall fill the rates against each item of Bill Of Quantities both in words and figures in the blank spaces provided in the respective columns. Item for which no rate or price is entered by the bidder will not be paid for by the employer/Engineer and its price shall be deemed to be included and covered in the others rates and prices in the bill of quantities. The quantity of execution of such item shall be as per requirement and as such there will be no

limit. Correction, if any, shall be made by crossing out, initialling, dating, stamping and rewriting. Wherever in any head if the same items are appearing and contractor has quoted different rates, contractor shall be paid the lowest quoted rate for such items.

- 10.2 All duties, taxes including works contract tax, building & construction/ labour cess etc and other levies payable by the Contractor under the Contract including Contractors profit and over heads etc. or for any other cost shall be included in the rates and prices and the total amount of Bid submitted by the Bidder. The evaluation and comparison of Bids by the Engineer shall be made accordingly.
- 10.3 The rates and prices quoted by the Bidder shall be fixed for items complete in all respect for the duration of the Contract and not subject to adjustment on any account except as otherwise provided in the conditions of Contract.
- 10.4 The Bidder shall fill his most competitive rates in the first instance as no negotiations shall be made after opening of the Tenders except if required with the lowest Bidder.

11.0 Bid Validity

- 11.1 The Bid shall remain valid and open for acceptance for a period of **180 days** from the last date fixed for receiving the same.
- 11.2 In exceptional circumstances prior to expiry of the original Bid validity period, the Engineer may request the Bidder for a specified extension in the period of validity. The request and the responses thereto shall be made in writing or by cable or telex. A Bidder may refuse the request without forfeiting his Bid Security. A Bidder agreeing to the request will neither be required nor permitted to modify his Bid, but will be required to extend the validity of his Bid Security correspondingly.

12.0 Bid Security

- 12.1 The Bidder shall furnish, as part of his Bid, a Bid Security of the amount of **Rs. 85,45,000/- (Rupees Eighty five Lakhs forty five thousand only) having validity period of 180 days from the last date fixed for receiving of bid.** No deviation shall be permitted from this.
- 12.2 The Bid Security shall be in the form of a Demand Draft/Pay Order/Bank Guarantee in favour of M/s HSCC(India) Ltd., Plot-6(A),

Block-E, Sector-I, NOIDA, UP-201 301 from any Nationalised bank/Scheduled bank.

- 12.3 Any Bid not accompanied by an acceptable Bid Security will be straightaway Rejected.
- 12.4 The Bid Securities of unsuccessful Bidders will be returned as promptly as possible as but not later than 30 days after the expiration of the period of Bid validity prescribed by the Employer.
- 12.5 The Bid Security of the successful Bidder will be returned upon the Bidder executing the Contract and furnishing the required Performance Security.
- 12.6 The Bid Security may be forfeited
- a) If a Bidder withdraws his Bid during the period of Bid validity.
 - b) In the case of successful Bidder, if he does not :
 - i) enter into the Contract, or
 - ii) furnish the necessary Performance Security
 - iii) agree to arithmetic corrections made as per terms of Bid documents.
 - iv) Submitted any misleading information during prequalification and or tendering process.
- 13.0 No interest will be payable by the Engineer on the Bid Security amount cited above.

14.0 Format and Signing of Bid

- 14.1 The Tender shall be filled & signed only by the firm/ corporation in whose name the Tenders have been issued. The Bid shall be typed or written in indelible ink and duly signed by a person or persons duly authorised to being the Bidder to the Contract. Proof of authorization shall be furnished in the form of written Power of Attorney, which shall accompany the Bid.
- 14.2 All pages of Bid shall be initialled and stamped by the person signing the Bid where entries or amendments have been made.
- 14.3 The complete Bid shall be without alterations interlining and erasures except those to accord with instruction issued by the Engineer or as necessary to correct errors made by the Bidder in

which case such correction shall be initialled by person signing the Bid.

D. Submission of Bid

15.0 Sealing, Marking & Submission

15.1 The Bid shall be submitted in accordance with the procedure detailed herein. Specified documents shall be enclosed in envelope of appropriate size each of which shall be sealed.

- (i) Envelope No. 1 : Shall contain the Bid Securities as indicated in Clause 12 of these Instructions to Bidders & tender document fee if downloaded.
- (ii) Envelope No. 2 : Shall contain covering letter and the other Bid documents duly signed including the following :
 - (a) Power of attorney of person authorised to sign the Bid.
 - (b) Original Bid documents (all pages) & drawing (Volume I, II, III, IV & VI) duly signed and stamped.
 - (c) Documents regarding constitution of Bidder as indicated in Clause 2.1 of these Instructions to Bidders.
 - (d) Certificate of Registration.
 - (e) All the information as stipulated in clause 2.0 under information to be submitted
 - (f) Schedule for submission of structural design, drawing and all other shop drawings of civil, sanitary & plumbing, electrical, HVAC/VENTILATION etc.
 - (g) Construction Schedule, **PERT Chart** and Schedule for manpower to be deployed at Site.
- (iii) Envelope No. 3 : Shall contain only the Bill of Quantities and rates/prices (Volume V) duly filled in and signed and stamped without any conditions whatsoever. Bids containing any conditions in Envelope No. 3 are liable to be summarily rejected.

The Contractor must fill up price against each item of BOQ (Volume V) both in words and figures in the blank spaces provided in the respective columns. The rates written in words shall prevail in case of any variation between the rates mentioned in figure and words.

Please note that the price should not be indicated in any of the documents enclosed in Envelope no. 1&2. Non-compliance shall entail rejection of the Bid.

No rates to be quoted for the items where nil quantity is mentioned against that item. Indicating NIL quantity does not mean that this item will not be operated in the work. Rate of item quoted under any section of Bill of Quantity is interchangeable and minimum rate quoted for the same item under any section will be taken for payment.

15.2 The Bidder shall seal the Bid.

15.3 All the above three envelopes shall be sealed in a fourth envelope and addressed to The DGM (Civil), HSCC (I) Ltd, E-6A, Sector-1, Noida-201301 (UP).

15.4 All the above envelope shall bear the following identification:

Name of work: Construction of Hostel Block 1,2 & 3 for AIIMS within AIIMS campus, Ansari Nagar, New Delhi .

Tender number, Due date and Time.

15.5 All the envelopes shall indicate the name and address of the Bidder to enable the Bid to be returned unopened, if required.

15.6 All recipients for the purpose of submitting a Bid shall treat the contents of the documents as private and confidential.

16.0 Deadline for Submission of Bids

16.1 Bids must be received by the Engineer, HSCC (India) Ltd., on or before **of the designated date & time.**

16.2 The Engineer may, at his discretion, extend the deadline for submission of Bids through the issuance of an amendment in accordance with Clause 7 in which case all rights and obligations of

the Employer and the Bidders previously subject to the deadlines shall thereafter be subject to the new deadline as extended.

17.0 Late Bids

17.1 Any Bid received by the Employer/Engineer after the prescribed deadline for submission will liable to be rejected and will be returned unopened to the Bidder.

18.0 Modification and Withdrawal of Bid

18.1 The Bidder may modify or withdraw his Bid after Bid submission, provided that modification or notice of withdrawal is received in writing by the Engineer prior to the prescribed deadline for submission of Bids.

18.2 The Bidder's modification or notice of withdrawal shall be prepared, sealed, marked and despatched in accordance with the provisions for the submission of Bids. Notice of withdrawal may also be sent by telex or cable but shall be followed by a signed confirmation copy, postmarked not later than the deadline for submission of Bids.

18.3 No Bid may be modified subsequent to the dead line for submission of Bids.

18.4 No Bid may be withdrawn in the interval between the deadline for submission of Bids and the expiration of the period of validity of the Bid specified. Withdrawal of a Bid during this interval may result in the forfeiture of the Bid Security.

18.5 Subsequent to the expiration of the period of validity of Bids prescribed in the Bid documents, a successful Bidder who has not been notified by the Engineer of the Award of the Contract may withdraw his Bid without penalty.

E. Bid Opening and Evaluation

19.0 Bid Opening

19.1 Bids shall then be opened in the office of HSCC (I) Ltd., at Plot - 6 (A), Block - E, Sector - I, Noida, Uttar Pradesh - 201 301, half an hour after the prescribed time for Bid submission in presence of the Bidders' representatives who may wish to be present.

Envelope No. 1: Shall be opened first. If the Bid Security & tender document fee (if document downloaded from websites) is not found as prescribed, the Bid shall be summarily rejected.

Envelope No. 2: Shall be opened next. Bids of parties who do not accept the conditions laid above in the Bid documents are also liable to be rejected.

19.2. The Engineer will examine the Bids to determine whether they are complete, whether the requisite bid securities have been furnished, whether the Bids have been properly signed and stamped and whether the Bids are generally in order.

19.3 Telegraphic/ Fax offer will be treated as defective, invalid and rejected. Only detailed complete Bids received prior to the closing time and date of the Bids will be taken as valid.

19.4 The Bidder's names, general technical details, the presence of the requisite Bid Security and such other details as the Engineer, at his discretion may consider appropriate will be announced at the Bid opening.

Envelope No. 3: Shall contain the sealed price Bid (volume-V). Whose bid is found to be generally in order and substantially responsive shall be opened either at the Bid opening or at a subsequent date to be intimated in advance to such eligible Bidders.

19.5 Only summary of prices quoted by the Bidders will be read out.

19.6 The Bid of any Bidder who has not complied with any of the instructions contained herein may not be considered.

20.0 **Process to be Confidential**

20.1 After the public opening of Bids, information relating to the examination, clarification, evaluation and comparisons of Bids and recommendations concerning the Award of Contract shall not be disclosed to Bidders or other persons not officially concerned with such process.

20.2 Any effort by the Bidder to influence the Employer/ Engineer in the process of examination, clarification, evaluation and comparison of Bids and decision concerning Award of Contract may result in the rejection of the Bidder's Bid.

21.0 Clarification of Bids

21.1 To assist in the examination, evaluation and comparison of Bids, the Engineer may ask Bidders individually for clarification of their Bids, including breakdowns of unit prices. The request for clarification and the response shall be in writing or cable or telex, but no change in the price or substance of the Bid shall be sought, offered or permitted except as required to confirm the correction or arithmetical errors discovered by the Engineer during the evaluation of the Bids in accordance with Clause 24 hereof.

22.0 Determination of Eligibility & Responsiveness

22.1 The Engineer will determine whether the Bid is substantially responsive to the requirements of the Bid documents.

For the purpose of this Clause, a substantially responsive Bid is one which conforms to all the terms, conditions and specifications of the Bid documents without any deviation or reservation.

22.2 A Bid, which in relation to the cost estimates of the Engineer is unrealistically priced and which cannot be substantiated satisfactorily by the Bidder may be rejected as non responsive.

23.0 Correction of Errors

23.1 Bids, determined to be substantially responsive will be checked by the Engineer for any arithmetical errors in computation and summation. Errors will be dealt by the Engineer as follows :

- a) Where there is discrepancy between rates indicated in figures and in words, rates in words will govern.
- b) Incorrectly added totals will be corrected.
- c) In case of any clerical error between rates indicated in figures and words, the rate in words shall prevail. In case there is any inconsistency between the rate and the value

extended (after multiplication with the tender quantity), the rate quoted shall prevail.

23.2 If a Bidder does not accept the correction of errors as outlined above, his Bid will be rejected.

24.0 Evaluation and Comparison of Bids

24.1 Only such of the Bids as have been determined to be substantially responsive to the requirements of the Bid documents, in accordance with Clause 22 will be evaluated. Other non-responsive Bids will be rejected.

24.2 Bidders shall note that no preference of any nature will be given to any Bidder notwithstanding any custom, usage or instructions to the contrary.

24.3 Evaluation of the Bids will take into account, in addition to the Bid amounts, the following factors:

- a) Arithmetical errors corrected in accordance with Clause 23.
- b) Such other factors as the Engineer considers may have a potentially significant impact on Contract execution price and payments.

24.4 Offers, deviations and other factors, which are in excess of the requirements of the Bid documents or otherwise result in the accrual of unsolicited benefits to the Employer, shall not be taken into account in Bid evaluation.

24.5 Price adjustment provisions applying to the period of execution of the Contract shall not be taken into account in Bid evaluation except to the extent specifically stated in the Contract.

F. Award of Contract

25.0 Award Criteria

25.1 Subject to Clause 26, Engineer will Award the Contract after prior approval by the Employer to the Bidder whose Bid has been determined to be eligible and to be substantially responsive to the Bid documents and who has offered the lowest evaluated Bid of the Bill of Quantities calculated considering the sum total of the rates quoted for PART-A and PART-B of Bill of quantities (Volume-V) ,

provided further that the Bidder has the capability and resources effectively to carry out the Contract Works.

26.0 Engineer's Right to Accept any Bid, to Reject any or all Bids

26.1 Notwithstanding Clause 25, the Employer/Engineer reserves the right to accept or reject any Bid including the lowest and to annul the Bidding process and reject all Bids, at any time prior to Award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligations to inform the affected Bidder or Bidders of the grounds for the Employer's/Engineer's action.

27.0 Notification of Award

27.1 Prior to the expiration of the prescribed period of Bid validity, the Engineer will notify the successful Bidder by cable or telex or letter confirmed in writing by registered letter that his Bid has been accepted. Notification of award for both the parts i.e PART-A & PART-B may be made together or separately. However for award of PART-B of the work employer (AIIMS) reserves the write not to award the work and/or to reduce the duration of work of PART-B Notification of award for both the parts may be made together or separately.

27.2 The notification of Award will constitute the formation of the Contract.

27.3 Upon the furnishing by the successful Bidder of a Performance Security in accordance with the provisions of Clause 29, the Engineer will promptly notify the unsuccessful Bidders that their Bids have been unsuccessful.

28.0 Signing of Agreement

Upon the receipt of the notification of Award by the successful Bidder, the successful Bidder shall fill the Agreement in accordance with form of Agreement included in the Bid documents and submit the same to the Engineer within two weeks of the date of receipt of notification of Award. The Engineer shall return the draft duly approved within one day from the date of receipt of the draft and the successful Bidder shall get the same engrossed, have the correct amount to stamp duly adjudicated by Superintendent of Stamps and thereafter return the same duly signed and executed on behalf of the successful Bidder, all at his own cost within 3 days

from the receipt of the approved draft. The signing of agreement may be made separately for both the part A & B.

Employer (AIIMS) will directly enter into the agreement with the successful bidder for PART-B of the works (Comprehensive operation & Maintenance works) before taking over.

However, the operation of PART-B of the works shall be at the sole discretion of AIIMS who reserves the right to award PART-B of the works and enter into an agreement for (Comprehensive operation & Maintenance works) PART-B of the works.

No Claim would be entertained from the successful bidder in case AIIMS does not award the work to the successful bidder for PART-B of the work.

29.0 Performance Security

29.1 Within 15 days of receipt of the notification of Award from the Engineer, the successful Bidder shall furnish to the Engineer a Security in the form of a Bank Guarantee from Nationalised/Scheduled bank for an amount of 5 percent of the Contract sum. The Performance security for PART-A & PART-B shall be submitted separately.

The validity of the Performance Security as per the Notification of Award for PART-A work shall be upto the end of the Defect Liability Period with 3 months claim period after expiry of defect liability period.

The Performance security for PART-B shall be valid upto the end of comprehensive Maintenance period as per the Notification of Award for PART-B with a further 03 months claim period. The Performance Security for Part-B shall be submitted in the form of five separate Bank Guarantees for an amount equal to 5% of the Annual Maintenance Rate for each of the five years.

Performance security for the works to be submitted in the name of respective client / HSCC (I) LTD depending upon the case.

29.2 In cases, where the aggregate of expected Contract payment would at any time exceed the Engineer's estimate of actual work performed by more than the amount of Performance Security specified in Clause 29.1 such Security shall be increased accordingly at the expense of the successful Bidder.

- 29.3 Failure of the successful Bidder to lodge the required Bank Guarantee shall constitute sufficient grounds for the annulment of the Award and forfeiture of the Bid Security, in which event the Engineer may make the Award to the next lowest evaluated Bidder or, if there are no other Bidders, call for new Bids.
- 29.4 Performance Security for Part A shall be released only :
- (i) after the satisfactory completion of the Defects Liability Period and certification to this effect by the Employer/Engineer
 - and
 - (ii) entering into an agreement between the employer (AIIMS) and the successful bidder for Part B of the works.
- 29.5 However, in case the employer (AIIMS) exercises his right not to enter into an agreement for Part B of the Works, the Performance Security for Part A of the works shall be released on satisfactory completion of Clause 29.4(i).
- 29.6 Performance Security for Part B shall be released by the Employer (AIIMS) after the satisfactory completion of Part B of the works and its certification by the employer (AIIMS). The Performance Security be released in five instalments on completion of each successful year of performance of maintenance.

SPECIFIC CONDITIONS OF CONTRACT

The Conditions of Contract shall be GENERAL CONDITIONS OF CONTRACT in Volume I (hereinafter called the General Conditions) as modified or added to by the following Specific Conditions of Contract, which shall be read and construed with the General Conditions as if they were incorporated therewith.

Insofar as any of the Conditions of Specific Conditions of Contract conflict or be inconsistent with any of the General Conditions, the conditions of Specific Conditions of Contract shall prevail.

30.0 Definitions

- a) "EMPLOYER" means All India Institute of Medical Science (AIIMS), NEW DELHI.
- b) "Engineer" means DGM (C) of **HSCC (India) Ltd.** or any officer nominated by the Chairman-cum-Managing Director, HSCC (India) Ltd. to act as Engineer from time to time.
- c) Site Incharge means the HSCC incharge of work designated by the Engineer
- d) "Month" and "Year" and all dates shall be calculated according to the Gregorian Calendar.

31.0 Insurance of Works

All Insurances referred to in General Conditions shall be effected with an Indian Insurance Company incorporated and registered in India. All insurances and labour license to be submitted within 15 days from notification of Award of work. Depending upon the case, the insurance cover may be required either together for the whole work or separately for both the parts.

32.0 Guarantees

Performance Guarantees, Advance Payment Guarantee, Retention money Guarantee and any insurance policies entered into by the Contractor under the terms of the Contract, shall stipulate that the proceeds of any claim shall be payable to **Employers**.

33.0 Certificates and Payments:

- a) Deleted
- b) Deleted
- c) Deleted
- d) The Contractor shall submit to the Engineer after the end of each month a detailed statement including measurements showing the estimated contract value of the Permanent Works executed up to the end of the month together with particulars of other amounts to which he is entitled under the Contract.
- e) The statement shall be submitted on a printed proforma (Prepared at the cost of the Contractor) approved by the Engineer along with soft copy of the same in a CD/Pen drive.
- f) The Contractor shall be paid monthly, on the certification of the Engineer, the amount due to him which shall be the sum of the following amounts :
 - i) Subject to and in accordance with Clause 21 of these Specific Conditions, the estimated value of the Permanent Works executed upto the end of the previous month less retention money named in the Bid, and
 - ii) 75% of the value of materials expected to be consumed within 3 months of its delivery at Site for Permanent Works on the Site provided the Engineer is satisfied that the amounts for such materials are reasonable bearing in mind the requirements of Works, less deductions, if any as per Clauses 33(f) and 37 of these Specific Conditions and other Contract conditions.
- g) Deleted
- h) Retention Money
 - i) With in 15 days of award of work, The contractor shall furnish a bank Guarantee from any nationalised/Scheduled bank for an amount of 2.5%(Two & half) of the contract price in the form approved by the Engineer and having validity upto completion period with a claim period of three months as per format attached at Annexure-F.
further retention money @ 5% (Five) shall be Deducted from each interim certificate from First RA bill subject to a maximum of 2.5 %(Two & half) of the contract price and shall be released after defect liability period.

Alternatively/or

Retention money at the rate of 10% (ten percent) shall be deducted from each interim certificate subject to the maximum of 5%(Five percent) of the contract price after approval by engineer.

i) The Retention Money shall, subject to Clause 60.6 (a) & 60.6 (b) of General Conditions of Contract, become due and shall be paid to the Contractor when the Engineer shall issue the Taking Over certificate notwithstanding that at such time there may be outstanding claims by the Contractor against the Employer, provided always that if at such time there shall remain to be executed by the Contractor any Works ordered during the Defect Liability Period pursuant to Clause 49.1, 49.2, 49.3, 49.4 and 50.1 of the General Conditions hereof, the Employer shall be entitled to withhold payment until the completion of such Works as much of the Retention Money as the Engineer may in his absolute discretion think fit.

j) Payment against each monthly R/A bills upon each of the Engineer's certificates shall be made by the HSCC (I) Ltd. acting for and on behalf of Employer or by the Employer directly within 30 working days after such certificate has been issued by the Engineer.

However, 75% of the estimated amount as determined by the Engineer of the payment due against the monthly running bill shall be paid within 10 (Ten) working days after certification by the Engineer in the approved format and complete in all respects.

k) The Engineer may at any time make any corrections or modifications to any certificate, which shall have been issued by him and shall have power to withhold any certificate if the Works or any parts thereof are not being carried out to his satisfaction.

l) The responsibility for making the payments or meeting other obligations to the Contractor in respect of all Works as certified by the Engineer shall be that of the Employer and not of the Engineer.

m) After completion of work and prior to final payment, the contractor shall furnish to the engineer, a release of claim against the Employer arising out of contract, other than

claims specifically identified, evaluated and excepted from the operation of the release by contractor.

- n) Contractor has to submit break up of BOQ rate to facilitate approval of interim payment by the Engineer. However final decision on break up of rates/ part rates to be paid in parts will be taken by Engineer
- o) Monthly bill not submitted in approved formats will not be accepted.
- p) The Payments of PART-B scope of works (Comprehensive operation & Maintenance) shall be made directly by “Employer” (AIIMS) to the Contractor quarterly on pro rata basis of the accepted annual agreement rate of Comprehensive maintenance as applicable for the corresponding year of maintenance.

34.0 Settlement of Disputes - Arbitration

Sub Clause 67.1, 67.2, 67.3 and 67.4 of G.C.C. shall be followed.

35.0 Address

- a. The address of the Employer is as follows :

Superintending Engineer All India Institute of Medical Science, (AIIMS), Ansari Nagar NEW DELHI.
- b. The address of the Engineer/representative is as follows

DGM (Civil) of HSCC (India) Ltd., plot no. E-6A, Sector-1, Noida
- c. The address of the Contractor is

36.0 THE FOLLOWING SHALL BE READ IN ADDITION TO CLAUSE 34.1 TO THE GENERAL CONDITIONS

36.1 Labour

36.1.1 Engagement of Labour

The contractor shall make his own arrangement for engagement of all labour, local or otherwise, and, save insofar as the contract otherwise provides, for the transport, housing, feeding and payment thereof.

36.1.2 Supply of water

The contractor shall provide at his own cost adequate quantity of drinking water on the site to the satisfaction of the Engineer's Representative for the use of contractor's and the Engineer's staff and work people, sub contractor and site visitors.

36.1.3 Alcoholic Liquor or Drugs

The Contractor shall not import, sell, give, barter or otherwise dispose of any alcoholic liquor, or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his sub-contractor, agents or employees.

36.1.4 Arms and Ammunition

The Contractor shall not give, barter or otherwise dispose off to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

36.1.5 Festivals and religious Customs

The Contractor shall in all dealing with labour in his employment have due regard to all recognised festivals, days of rest and religious or other customs.

36.1.6 Epidemics

In the event of any outbreak of illness of an epidemic nature, the contractor shall comply with and carry out such regulation, orders and requirements as may be made by the government, or the local medical or sanitary authorities for the purpose of dealing with and overcoming the same.

36.1.7 Disorderly Conduct, etc

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his employees and for the preservation of peace and protection of persons and property in the neighbourhood of the works against the same.

36.1.8 Observation of legislation etc.

The Contractor shall at all times during the continuance of the contract comply fully with all existing Acts, regulation and bylaws including all statutory amendments and re-enactments and acts that may be passed in future either by state or the central Government or local authority, including, Indian Workmen's compensation act, contract labour (Regulation and Abolition) Act 1970 and equal remuneration Act 1976. Factories Act, Minimum wages Act provident fund regulations employees provident fund Act and Schemes made under same act, Health and sanitary arrangements for workmen, Insurance and other benefits and shall keep the employer indemnified in case any action is commenced for contravention by the contractor. If the Employer is caused to pay or reimburse any amount for non-observance of the provision of this clause on the part of the contractor the engineer shall have the right to deduct from any moneys due to the contractor or recover from the contractor personally any sum required or estimated to be required for making good the loss or damage suffered by the Employer. all registration and station inspection fees if any in respect of his work pursuant to the contract shall be to the account of the contractor.

36.1.9 Fair Wages

The contractor shall pay the labours engaged by him on the work not less than a fair wages, which expression shall mean, whether or time or piecework, the respective rates of wages as fixed by the public works department as fair wages for the area payable to the different categories of Labourers or those notified under the minimum wages act for corresponding employees of the employer whichever may be higher.

36.1.10 The contractor shall notwithstanding the provisions of any contract to the contrary, cause to be paid a fair wage to the labourers indirectly engaged on the works including any labour engaged by subcontractor in connection with the said works as if the labourers has been immediately employed by him.

36.1.11 Notices

The Contractor shall before he commences the work display and correctly maintain in clean and legible condition at a conspicuous place on the site notices in English and in a local language spoken by the majority of the workers, stating therein the rate of wages

which have been fixed as fair wages and the hours of work for which such wages are earned and send a copy of such notices to the Engineer.

36.1.12 Wage Records

The Contractor shall maintain records of wages and other remuneration paid to his employees in such form as may be convenient and to the requirement of the Employer/Engineer and the conciliation officer (Central) Ministry of labour, Government of India, or such other authorised person appointed by the central or state government and the same shall include the following particulars of each worker:

- I) Name works number and grade
- II) Rate of daily or monthly wage.
- III) Nature of work on which employed.
- IV) Total number of days worked during each wage period.
- V) Total amount payable for the work during each wage period.
- VI) All deduction made from the wage with details in each case of the ground for which the deduction is made.
- VII) Wage actually paid for each wage period.

36.1.13 The contractor shall provide a wage slip for each worker employed on the works.

36.1.14 The wage record and wage slips shall be preserved for least 12 months after the last entry.

36.1.15 Inspection of wage Records

The contractor shall allow inspection of the aforesaid wage records and wage slip to the engineer and to any of his workers or to his agent at a convenient time and place after due notice is received, or to the Employer or any other person authorised by him on his behalf.

36.1.16 The Employer and the Engineer or any other person authorised by them on their behalf shall have power to make enquiries with a view to ascertaining and enforcing due and proper observation of the fair wages clause. He shall also have the power to investigate into any complaint regarding any default made by the contractor or sub-contractor in regard to such provision.

36.1.17 The Employer shall have the right to deduct from money due to the

contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non payment of the aforesaid fair wage, except on account of any deduction that may be permissible under any law for the time being in force.

36.1.18 Representation of parties

- (i) A workman shall be entitled to be represented in any investigation or enquiry under this clause by :-
 - (a) An officer of a registered trade union of which he is a member.
 - (b) An officer of a federation of trade union to which the trade union referred to in previous sub-clause is affiliated.
 - (c) Where the worker is not a member of any registered trade union, by an officer of a registered Trade union connected with or by any other workmen employed in the industry in which the workers is employed.
- (ii) The contractor or sub-contractor shall be entitled to be represented in any investigation or enquiry under this clause by an officer of an Association of Employers of which he is a member.
- (iii) No party shall be represented by a legal practitioner in any Investigation or enquiry under this clause, unless all parties agree.

36.1.19 Safety Provision

The contractor shall comply with all the precautions as required for the safety of the workman by I.L.O convention (NO.62) as far as they are applicable to the contract. The contractor shall provide all necessary safety applications, gears like goggles, helmets, masks, etc. to the workmen and the staff.

The contractor shall be responsible for observance by his sub contractor of the forgoing provisions

36.1.20 Footwear

The contractor shall at his own expense provide footwear for all labour engaged on concrete mixing work and all other type of work involving the use of tar, cement, etc. to the satisfaction of the Engineer or his Representative, and on his failure to do so the Employer shall be entitled to provide the same and recover the cost from the Contractor

The contractor shall deliver to the Engineer's representative at his office on the site a return in detail in such form and at such interval as the Employer/Engineer may prescribe showing the supervisory staff and the number of the several classes of labour from time to time employed on the site.

36.2 Variation in price:

No Variation shall be payable in price on account of labour, material (General), POL and / or any other account. Also no variation/escalation shall be payable on account of time over run if any in completion.

36.2.1 Subsequent Legislation

If, after the date seven days prior to the latest date for submission of Bids for the Works, there occurs changes to any National or State Statute, Ordinance, Decree or other law or any regulation or bye-law of any local or other duly constituted authority or the introduction of any such statute ordinance, etc. which causes additional or reduced cost, the same shall be certified by the Engineer and shall be paid by or credited to the Employer and the Contract Price adjusted accordingly. Notwithstanding the foregoing such additional or reduced cost shall not be separately paid or credited if the same shall already have been taken into account in the indexing of any inputs to the price adjustments formula in accordance with the provisions of Sub-Clauses (1), (2), (3), (4) and (5) of this Clause.

The following items are not to be included in the price adjustment calculations:

- a. Liquidated Damages.
- b. Retention money withheld and released.
- c. Advance payments in the form of loan and their repayments.

- d. Value of any additional or varied work valued at current price.
- e. Payment to nominated subcontractors included as "Provisional sums" or "Prime cost" items in the Contract Price.

37.0 Taxation

The Contractor shall pay all taxes, duties, levies, work contract tax etc. of the Government provisions of the Income tax Act or as per the advice of the Income Tax Authority. Deduction of Income tax/ Works Contract tax/ other taxes shall be made from each certificate of payment as per the relevant provisions of the Income tax Act or as per the advice of the Income tax Authority/ other Competent Authority.

38.0 Co-ordination Meeting

The Contractor shall be required to attend co-ordination meetings with the Engineer, the Consultant and other Contractors during the period of Contract at any suitable place as instructed by the Engineer. All costs incidental to such interaction shall be to the Contractor's account and no claim will be entertained by the Employer/Engineer on this account. The contractor shall ensure that the meeting is attended only by their officials/ representatives at appropriate level and as directed by Engineer.

38.1 Engineer's visit to site

The contractor/his representative shall be required to be present during periodical site visit of the engineer along with all the drawings and details required by the engineer and make a good vehicle available to the engineer at their own cost during his period of stay in town. The contractor will make all the places accessible for the smooth visit of engineer at site. The contractor will take all permissions and to make all the arrangements for visit of any place or any local authority concerned related to the works.

39.0 Special Applications

39.1 Site Information

The proposed Site for the **Construction of Pre Clinical Teaching Block** for AIIMS within AIIMS campus, Ansari Nagar, New Delhi .

39.2 Site Development

- a) Proper pumping arrangement should be maintained at site for removing water from the basement at no extra cost.
- b) Proper arrangement of security, safety, transportation, manpower, lighting arrangement to be maintained during execution of works at night.
- c) For rapid execution of work, contractor has to arrange their own tower crane, batching plant and others machinery, tools and tackles needed for the work as given in the submitted PQ document.
- d) As directed by Engineer Proper barricading to be made so that surrounding area free from disturbances. The specifications of barricading to be got approved by Engineer. External face of barricading to be nicely painted and written the name of Employer, consultant & project only. NO sign board of contractor is allowed unless permitted by engineer in writing.
- e) For diversion of under ground services proper arrangement to be made by the contractor with the approval of Engineer.

b) Statutory Requirements

Contractor is responsible for obtaining approval from local electrical inspector & water & Sewer line connection, tree cuttings, permission for borewell and others local Statutory bodies including NDMC, DUAC, DFS etc, if any, and any structure made / to be made of work, which is not in the approved plan, by the local authority. All the statutory expenditure incurred towards payment to the local body for getting local Electric inspector, sewer line and water supply connection, any other statutory fees etc for Employer will be reimbursed on the production of proof of payment. The contractor will be promptly extended all assistance in this connection.

39.2.1 Contractor's Working Area

Suitable working area will be provided by the Engineer to the Contractor. The Contractor may have to carry out some cutting /

filling work for making his working area. The cost of all such Works shall be deemed to have been included in the rates and prices quoted for the Works and no extra payment shall be made on this account.

39.2.2 Contractor's Temporary Structures

The Contractor may, at his own expense and subject to the approval of the Engineer and statutory authorities, construct offices, stores, Workshop in the area allocated to him and remove the same as per the orders of the Engineer on completion of Works. The Contractor shall furnish such details of his Temporary Works as may be called for by the Engineer and the Contractor shall satisfy the Engineer as to their safety and efficiency. Engineer may direct those Temporary work which he considers unsafe or inefficient be removed and replaced in a satisfactory manner. The Contractor shall immediately follow Engineer's directions/instructions.

The Contractor shall make his own arrangement at his own expense for labour camp / accommodation of his labour and staff and their conveyance to Site as no workers/ staff shall unless with the specific approval of the Engineer be allowed to stay within the Site. Gate passes shall be issued by the Engineer to authorise the Contractor's staff and workers to enter the Site.

39.2.3 Procurement of Various Materials

The Employer will not supply any construction materials required for the Works under this Contract. The Contractor must, therefore, make his own arrangements for timely procurement of various materials including steel and cement. Prior approval of each and every material including steel cement, aggregate, bricks etc or any other fittings & fixtures to be taken from engineer before its procurement to site. However in case of excessive delay in procurement of various materials, the engineer may also take decision of procurement of material directly and the cost will be recovered from the contractor.

39.2.4 Water Supply & Power Supply

The Contractor shall make his own arrangement for water supply at Site for drinking as well as construction purposes at his own cost.

The Contractor shall also make his own arrangements for power supply at Site for construction, testing & commissioning of all services and general use at his own cost.

Non-availability of power supply and/or water from whatever source shall not entail any additional claims or extension of Contract period in this account. The contractor will provide water & electricity to the Engineer's office free of cost for the required quantity by the engineer's site office.

39.2.5 Site office

Contractor has to provide with in 15 days of issue of letter of award, at his own cost a reasonably furnished site office accommodation having a sample room, Air conditioned meeting room & staff rooms along with toilets, Electricity, drinking water & pantry, file storage facility along with computers & Laser printers and its consumables, a telephone with STD facility and vehicle/Car of good running condition inclusive of all services like driver, consumables and maintenance etc at any time for exclusive use of engineer/HSCC round the clock during the currency of the contract till defect liability period to HSCC as per requirements given by the Engineer.

39.2.6 Temporary Fencing

The Contractor shall at his own expense, erect and maintain in good condition temporary fences all around the working premises as per specifications & size approved by Engineer/Employer and statutory authorities requirements. After the successful completion of work all the temporary fencing will be dismantled/removed by contractor and all the dismantled/removed material from here shall be the property of the contractor.

39.2.7 Mix Design of Concrete

The contractor shall carry out the mix design for the relevant item of concrete from reputed institution/laboratories as approved by Engineer at his own expenses within 15 days from notification of award. Prior approval of engineer is to be taken before the samples (Cement, Coarse & fine aggregates) sent to the Institution for Mix design. The decision of engineer shall be final and binding for above. The design mix required may with or without admixtures.

39.2.8 Testing of Materials

All materials used in the works shall be subject to inspection and test. The Contractor shall carry out sampling of such materials and making of concrete test cubes as per the appropriate Indian Standards and as directed by the Engineer. The contractor shall deliver the samples of materials and concrete test cubes to the site office of the Engineer at site office/Site Testing Lab in a manner as directed by engineer who will inspect the same and then order for testing of materials and concrete cubes..

The Contractor shall arrange for testing of materials normally in site testing lab but samples may be sent outside testing laboratories if necessary.

The delivery of the samples shall be undertaken by the Contractor. The cost and charges for sampling of materials and concrete cubes and delivering the same to the office of the Engineer and/or other places including all incidentals in connection with the same as directed by the Engineer and the testing charges there of shall be borne by the Contractor and shall be deemed to be included in the rates and prices quoted in the Bill of Quantities. The results of the tests carried out shall be binding on the Contractor who shall comply with any rectification measures that the Engineer may deem fit and order to be executed by the Contractor as a result of testing.

39.2.9 Approval of Samples prior to use

The Contractor shall submit the samples of all materials,(Whether in list of approved make or not in list of approved make) he proposes to use in the Works for prior approval of the Engineer. A sample room shall be maintained at Site in which all approved samples shall be kept for comparison with materials being used at Site.

39.2.10 Bar Bending Schedule

Contractor shall prepare bar bending schedules in the prescribed proforma as approved by the Engineer for prior approval of the Engineer. However, the approval does not relieve the Contractor from his liability for bending, placing and binding reinforcements as per the approved drawings.

39.3 (a) Working drawings/ shop drawings/Design:

The drawings supplied by the engineer have been listed in the tender documents.

These drawings are indicating for the purpose of detailing the intent and requirement of the contracts. The contractor shall take into consideration by space allocated for equipments before ordering them to ensure that the equipment would fit in the space provided with necessary clearances required as per the relevant standard/ manufactures recommendations.

Structural and architectural drawings will be provided by HSCC however to ensure the uninterrupted progress of work and timely completion, the contractor will do further detailing as per site requirement at his own.

Detailing and shop drawings of all services will have to be done by the contractor based on the schematics and other details provided by HSCC or local authorities. The work will be executed by the contractor based on the approved drawings from the concerned authority and accordingly contractor will be responsible for obtaining final NOC/clearance from concerned authority.

The contractor shall submit to the Engineer for approval details of all proposed equipments, accessories, equipment characteristics and capacity details of all equipment, accessories and devices etc. as per the specifications and required by the Engineer.

In case there is delay in any drawings and design viz shop drawings, as made drawings etc. in preparation, design, quality, submission, etc. HSCC may ask the contractor to change the design consultant immediately or get the same done on risk and cost of the contractor.

These drawings and details shall also contain details of construction, size, arrangement, operating clearances, performance

characteristics and capacity of all items of equipments and also details of all related items of work by other discipline.

All drawings to be signed by authorised contractor's representative with name, seal and date before submission to Engineer.

39.4 "AS MADE" Drawings

The Contractor shall supply two complete sets of "As Made" Drawings on polyester tracing film 75 micron thick and also on computer pen drive and three prints showing details of all the Works as executed. The drawings and prints shall be delivered to the Engineer within one month of completion of the various Sections of the work or at such other times as directed by the Engineer. The drawings shall be fully dimensioned with the Engineer's standard title block or as approved by the Engineer. The cost of making the "As Made" drawings shall be deemed to be included in the rates quoted in the Bill of Quantities.

39.5 Monthly Progress Photograph

The Contractor shall supply to the Engineer a pen drive, negative and three prints of colour progress photographs in good quality album with two copy at site and one copy at HSCC Head Office of such portions of the work in progress or completed works every month end or as directed by the Engineer. The pen drive, negative and the photographs shall become the property of the Employer. The photographs shall be of approximate size 169 mm x 115 mm each. The photographs shall be mounted in albums approved by Engineer and shall be suitably inscribed and captioned. The albums in a chronological order shall be handed over to the Engineer. No pen drive prints or the negatives may be supplied to any persons without the authority of the Engineer. All photographs to be taken from digital camera and software to be provided for transformation it to the computer. The photographs may be up to 100 nos per month as required by engineer. An amount of Rs. 10,000/- will be deducted from running bill for non-submission of photographs as required.

39.6 Programme of Work and Progress Reports

The Contractor shall submit to the Engineer within two weeks of the Award of the Contract, six copies of detailed Schedule showing in an approved form the estimated dates of commencement and completion of different parts of the Works including the expected dates for completion of the various Sections of the Works. The detailed Schedule shall be such as it can be updated quarterly or as directed by the Engineer. Six copies of the revised Schedule shall be supplied to the Engineer as and when it is revised. The schedule will be in two parts. The first part will consist of schedule for detailing & preparation & submission of shop drawings and second part of schedule for execution. The schedule will be only detailing of original schedule submitted alongwith tender.

The Contractor shall submit to the Engineer before the second day of every week, a progress report for the preceding week showing the upto date progress and progress during the preceding week on all items of each section of the Works in relation to and in consideration of the detailed Schedule.

39.7 Metric Units

Metric units have been used in the specifications and on all the drawings.

If any materials described in the Contract or ordered by the Engineer are described by dimensions in the metric units and the Contractor can not in accordance with the Contract, procure such materials in the measure specified in sufficient time to avoid delay in the performance of his other obligations under the Contract, but can obtain such materials in other measure to dimensions approximating to those described in the Contract or ordered by the Engineer, then the Contractor shall henceforth give notice to the Engineer of these facts stating the dimensions to which such materials are procurable in the other measure. As soon as practicable after the receipts of any such notice the Engineer shall give an order to the Contractor which shall either

- (a) Direct the Contractor to supply such materials to the dimensions stated in his said notice to be procurable instead of the dimensions described in the Contract or originally ordered by the Engineer, or
- (b) Direct the Contractor to make some other variation whereby the need to supply such materials to the dimensions described in the Contract or originally ordered by the Engineer will be avoided.

39.8 Field Materials Testing Laboratory

39.8.1.1 The Contractor shall provide ,furnish, man and maintain a laboratory at his own cost for the Testing of bricks, concrete cubes, construction materials, soil and any other materials in accordance with (Indian Standards and CPWD norms etc.) & as per the directions of Engineer.

Whenever directed by the engineer the contractor shall permit other contractor working for the employer on the project to use field-testing laboratory on payments as fixed by the Engineer. Such

payments will be made directly by the other contractor using the laboratory.

39.8.1.2 The laboratory shall be equipped and manned by the Contractor at his own cost with all necessary apparatus to carry out the above mentioned tests in accordance with relevant Indian Standards or equivalent approved Standards.

i) Cement testing:

Tests for fineness, Strength, setting time and soundness in accordance with IS:4031.

ii) Concrete Testing:

Test for workability, proportions, density and strength in accordance with IS:516 and 1199. In particular the cube testing machine shall be capable of exerting a slowly applied force up to 200 tonnes and the platens shall be suitable for crushing both 150mm and 200 mm cubes. A Vibrating table of suitable design shall be provided for compaction of cubes.

iii) Aggregate Testing:

In accordance with IS: 2386 (part I to VIII) for the following tests on both fine and coarse aggregates:

- a. Sieve analysis
- b. Determination of bulk density and voids on fine aggregates only:
- c. Determination of moisture content, specific gravity and absorption on coarse aggregates only:
- d. Determination of specific gravity and absorption

39.8.1.3 The contractor shall carry out inspection, testing, checks and also shall maintain records of inspection, testing & checks of material, works and activities related to construction works in the ISO 9001 quality system formats, checklists etc. to be given by consultant during execution period. After getting approval from the Engineer, The contractor shall print at his own cost all forms, tables, formats etc.

39.8.1.4 The laboratory shall be connected to the main water and electricity Services. It shall also be supplied with portable gas equipment.

39.8.1.5 On completion of the Maintenance period, the laboratory is to be

dismantled and removed from Site. The dismantled materials and equipment shall be the property of the Contractor.

40.0 Rates/Prices

The quoted rates/prices for the items shall be complete in all respect including all labour, material, plant and machinery, tools and tackles, batching plant for RCC work including water & electricity, all taxes, duties, levies, octroi, statutory levies applicable from time to time and others as specified in SCC etc. The contractors attention is invited towards different floor finish and their respective finish levels as indicated in architectural drawings, and nothing extra will be payable for additional mortar bed required to achieve uniform finished levels. The Contractor should quote his rates/prices accordingly for the complete items in all respects.

41.0 Compliance of Statutory Obligations for obtaining completion Certificates:

The Contractor shall comply all the statutory obligations and obtain all required clearances to implement the project without any financial repercussions to HSCC/Employer and ensure all follow up actions with the local authorities in this respect for smooth completion of the project. All statutory charges to get any NOC, clearances from local authorities to be obtained by the contractor and the charges towards the NOC shall be reimbursed after submitting the bills/documentary evidences along with RA bills/final bill. The contractor is required to obtain all NOC, completion & Occupancy certificates from respective local bodies as under:

i) Pollution control Board, ii) Environment clearances, iii) NOC form fire department, iv) Lift licence, v) Chief Electrical Inspector CEA, vi) Municipal authority/LDA vii) Airport Authority, viii) Tree cutting, ix) Explosive department, x) Jal Board/Municipal authority for water and sewer connection, xi) And any other statutory requirement to occupy the building and run the services in all respect. Contractor shall organise all inspections of concerned authorities & obtain the NOC's within the time for completion.

The contractor is required to submit the relevant drawings like completion Drawings and any other statutory documentary requirements of local bodies in copies as per requirement to obtain the above etc. at their own cost.

42.0 deleted

43.0

Unpriced Bids

The unpriced copies of the purchase orders of major items/equipments and of subcontracts placed by the Contractor shall be furnished to the Engineer.

44.0

Milestone

The contractor shall submit mile stones for procurement of all the bought out items and completion of all the major activities including details of manpower proposed to be engaged for each activity.

45.

Approval of Make / agencies

a. Engineer may add any equivalent approved make with price adjustment

b. In case of non availability /monopolistic attitude of any approved make engineers decision to introduce any other make shall be final with suitable price adjustment.

c. Approved make of same item under different sub-heads are interchangeable.

d. The same criteria for approval of electrical , HAVC, plumbing, fire fighting works and other specialised agency will be followed, as per undertaking submitted by the contractor during pre qualification.

46.

RCC WORKS

Suitable batching plant with pumping arrangement for a minimum four storey building to be installed at site for the all RCC works. In case break down of the batching plant suitable alternative arrangement like RMC to be made by the contractor to avoid any interruption in RCC work. The alternative arrangement of RMC plant with advance engineer's approval of design mix to be kept ready for such emergency so that RCC can be readily available within 12 hrs of break down of batching plant.

47.

Extra/Substituted items: The items shall be analysed based on following norms :

a) Any extra item/non schedule item will first be analysed based on the similar items existing in the BOQ under any sub heads. Components of any similar item nearest to the non schedule

item will be decomposed to get the various sub components of material and manpower. The item will again be composed on the basis of requirements taking other components from DAR and rates.

- b) Components of material, manpower, wastage, profit, sundries, etc will be taken from CPWD latest DAR
- c) In absence of similar item and In case the components are not available in DAR, the same will be taken from actual observations made and recorded at site. A register to be made for such actual observations to be jointly signed each day of observations and put up to the engineer alongwith analysis for approval.
- d) Actual market rates of the material and bought out items at the time of execution of activity will be verified by the site incharge of HSCC based on the rates submitted by the contractor alongwith his claim for extra items after due consideration for all the project discount on the market rates of any item.
- e) Contractor's profit on extra items will be as per CPWD norms or 10% only in case the item in any forms in not available in DAR.
- f) The analysis of items enclosing actual observation sheets, photocopy of pages of DAR, original paid bills and vouchers to be submitted at site.
- g) Labour rates will be taken from local body /collector rates of that area for minimum wages

The claim and analysis will not be accepted unless proper analysis with supporting documents are submitted.

No extra item will be paid unless prior administrative approval of engineer is taken in writing for its execution with tentative rates and total cost involved.

48. Financial capability: The contractor must have the financial capability to continue the work uninterrupted at site.

No time extension will be considered for delay in payment.

49. Details required along with submission of running/final bills to the Engineer

Clause 33.0 under Certificates & Payment contractor is required to submit following details/documents along with every running/final bill without which bills will not be processed.

1. Bills of every section of work as provided in BOQ to be prepared separately and submitted all together. In case there is no billable amount of any section of work, the same should be clearly indicated zero value during the period of bill.
2. Complete measurement details along with location of each measurement should be clearly indicated.
3. Authorised representative of contractor with name & seal to sign on each page of bill submitted.
4. Carryover and brought forward for each & every quantity to be indicated in the bill.
5. The running bill should contain the measurement of items executed during the period of bill. Full measurement may be given in pre final/ final bill. The measurement of all concealed items should be made before covering them.
6. All the copy of challan of materials, bills and test certificates specially of the items on which secured advance has been claimed , steel, cement, sand, aggregates, bricks, any plumbing material, Aluminium, waterproofing material etc. should be submitted alongwith the every bill to the Engineer. Actual measurement of secured advance to be submitted for verification of Engineer. Rate of secured advance material to be verified by Engineer independently. Secured advance on approved make material will only be payable.
7. Manufacturer Catalogue for aluminium and other items for verification of standard unit weight and checking that material is as per specification should be submitted.
8. Weight slip of reinforcement steel and aluminium and any other material as required by Engineer Representative from authenticated source like Dharam Kanta should be submitted.
9. The computerised soft copy of the entire bill shall be submitted alongwith the bill.
10. Correction as made by Engineer Representative should be incorporated by the contractor and corrected copy in three copy

should be submitted for payment. Date of submission of bill will be reckoned from the date of submission of corrected bill.

11. Material consumption statement should be submitted alongwith every bill.
12. Bill should be indexed properly and each page and correction if any should be signed and stamped by the authorised representative of he contractor and acceptance should be given.
13. Copy of challan of submission of PF & ESI and any other relevant as required from time to time should be submitted.
14. Contractor shall maintain a check list at site duly marked on drawing for the items/works already measured till previous bill should be submitted alongwith the bill.
15. Register for steel, cement, water proofing material, concealed item etc. should be maintained at site in the standard format of CPWD duly modified by Engineer Representative as per requirement. Monthly statement should be submitted along with the bill.
16. Power of attorney of authorized person on behalf of contractor to be submitted. Contractor must ensure that all papers /Measurement book to be signed by authorized person with measurement date, date of start & date of completion etc.
17. Copy of duly certified bank guarantee from bank, performance BG, insurance policies as required in terms of contract to be enclosed with first RA bill.
18. All overwriting, alterations have been countersigned by the authorized person with date.
19. Approval of extra item if any conveyed to be enclosed.
20. Contractor must ensure, in case of time extension, confirmation of extended validity of insurance, performance BG upto Defect liability period as per contract and a copy of approved time extension to be submitted.
21. Contractor must authorise their representatives competent for verification of measurement at site and these person should be available at site.

22. Contractor is required to submit all test certificates of items claimed in bill for payment or for secured advance payment. Any item not meeting the test criteria's will not be considered for payment.
23. All the pages and enclosures of bills to be stamped with name and designation of the person with full signature of contractor's and HSCC's site incharge before submission to the engineer.

In addition to above any other document and details as required for checking, verification and timely processing of bill.

50. Terms & Conditions of Pre-qualification

All the terms & conditions & prequalification criteria's of prequalification document of invitation of prequalification are to be strictly complied during tenancy of contract.

51.0 Comprehensive Maintenance & operation

- 51.1 All the equipment, components and the entire system as a whole shall be guaranteed for its performance and against any manufacturing defect.

The Comprehensive maintenance shall be valid for a period of Five years from the date of satisfactory taking over of Part-A scope of works. This shall be covered under Part-B of the Scope of Works.

The contractor shall guarantee that all equipment, plant machineries and entire system etc shall be free from any defect due to the defective materials and bad workmanship or any other cause and that the equipment, plant machineries shall work satisfactorily and that the performance and efficiencies of the equipment, plant machineries shall be not less than the guaranteed values. Any part found defective during the comprehensive maintenance/defects liability period shall be replaced by the contractor at his own expense. The services of the Contractor's personnel, if requisitioned during this period for such work, shall be made available free of cost to the Employer. However, any consumables like oil, etc are not covered under the comprehensive maintenance /defects liability period.

- 51.2 The Contractor warrants comprehensively that the goods supplied under the contract is new, unused and incorporated all recent improvements in design and materials unless prescribed otherwise by the Employer in the contract. The supplier further warrants that the goods supplied under the contract shall have no defect arising from

design, materials (except when the design adopted and / or the material used are as per the Employer's specifications) or workmanship or from any act or omission of the Contractor, that may develop under normal use of the supplied goods under the conditions prevailing in India.

- 51.3 In case of any claim arising out of this comprehensive maintenance, the Employer shall promptly notify the same in writing to the Contractor. Upon receipt of such notice, the Contractor shall, within 8 hours on a 24(hrs) x 7 (days) x 365(days) basis, repair or replace the defective goods or parts thereof, free of cost, at the ultimate destination. The Contractor shall take over the replaced parts / goods after providing their replacements and no claim, whatsoever shall lie on the Employer for such replaced parts / goods thereafter.
- 51.4 In the event of any rectification of a defect or replacement of any defective goods during the Defects Liability period, the warranty for the rectified / replaced goods shall be extended to a further period of Twenty Four (24) months from the date such rectified / replaced goods starts functioning to the satisfaction of the Employer.
- 51.5 If the Contractor, having been notified, fails to rectify / replace the defect(s) within 8 hours on a 24(hrs)) x 7 (days) x 365 (days) basis, the purchaser may proceed to take such remedial action(s) as deemed fit by the Employer, at the risk and expense of the Contractor and without prejudice to other contractual rights and remedies, which the Employer may have against the Contractor.
- 51.6 During Comprehensive maintenance , the contractor is to perform preventive maintenance of the equipment/system regularly

52.0 Maintenance

- 52.1 The Contractor shall provide comprehensive maintenance services for the works as detailed below:
- (i) for a period of one year after the taking over under Defects Liability Period (under Part-A of scope of works).
 - (ii) for a period of further four years after the completion of all obligations against Part-A of scope of works till the successful completion of the Comprehensive maintenance Period (under Part-B of Scope of Works).

The comprehensive maintenance services during this period shall be inclusive of all spares, accessories, consumables, manpower, tools and tackle, replacement of parts, routine servicing and maintenance of equipment/systems etc. complete in all respects.

The Contractor shall carry out all routine and special maintenance of the equipment/plant/system and attend to any defects that may arise in operation of the equipments/system and plant.

ADDITIONAL SPECIFIC CONDITION OF CONTRACT

AND SPECIFICATIONS

(A) GENERAL

Scope of work broadly consisting of the following modules but not limited to only these:

1. **Construction of Hostel Block 1, 2 and 3 for AIIMS within AIIMS campus, Ansari Nagar, New Delhi** including electrical, HVAC/VENTILATION, Fire fighting, PA FDA and information system etc.
2. Construction of toilet block, relocation of existing services etc. complete in all respect.
3. Horticulture work wherever required.
4. Erection of jali on the walls of manifold and store room.

Any material and inventory which is in usable condition will have to be handed over to AIIMS authorities and its receipt to be submitted to the engineer. In case the usable material and inventories are not handed over or the receipt not submitted then the amount as per advise of AIIMS will be deducted from the bills.

The work on all the modules will be taken up simultaneously by deploying independent team of labor, supervisor etc. to that particular module.

- A. Shut down of electrical HVAC/VENTILATION, Water supply, sanitary or any other services will have to be taken by properly by making a request to AIIMS in writing at least 3 days in advance so that patient care is not affected.
- B. Agency has to make temporary barricading of work site by putting curtains, sheets etc. for making the patient care area of hospital sound and dust proof.
- C. If required, there will be no working during day and it will be allowed only at nights. The execution area to be made for temporary use of patient care during day.
- D. Any statutory approvals required for demolition, carriage of material, addition or deletion of temporary or permanent structure will be taken by the agency. Payments made towards statutory charges will be reimbursed to the agency.

The following facilities are also required to be provided during execution of work :

1. Safety barriers
2. Safety tapes

3. Safety officer
4. Use of safety jacket, caps and shoes and other safety norms
5. Provision for electricity and water during construction
6. Scaffolding provision for support of existing structure during construction
7. Outer lights
8. Traffic warden/guards
9. Approval from local authorities
10. Round the clock working for contractor in shifts
11. Defect liabilities on total work
12. non vendor based specification
13. Waterless urinals, audio visual console for information system
14. Plywood barrier outside working area
15. External lighting
16. Total electrical load
17. Total water requirement
18. Signage's – special module– Alphabets and back lighting
19. Exhaust and HVAC/Ventilation in toilets.
20. Provision of site office and manpower
21. Anti skid strips on ramp
22. Outdoor land scaping
23. Provision for new electrical load and water supply need
24. Round the clock working permission from AIIMS

Further, The following conditions may also include in contract :

- 1 The following Additional Specific Conditions and specification shall be read in conjunction with General Conditions of Contract and Specific Conditions of Contract. If there are any provisions in these Additional Specific Conditions which are at variance with the provisions in the above mentioned documents, the provisions in these Additional Specific conditions shall take precedence.
- 2 The contractor shall be obtain all approvals/ permissions from local/ statutory bodies during progress of works for dismantling/ demolition, additional/ alteration etc of any existing structure/ building or part of it.
- 3 The contractor shall check & ensure design, safety requirements & sustainability of existing structure on account of additions/ alterations/dismantling works.
4. Contractor shall make all arrangement of water, electricity, HVAC/VENTILATION, fire fighting and any or part of services of the existing premises/hospital shall run uninterruptedly during execution of work. However if required to hold/interrupt any or part of services to execute the work, prior approval required to be obtained from concerned department/officials.

ADDITIONAL SPECIFIC CONDITION OF CONTRACT

AND

SPECIFICATIONS

(B) RELATING TO CIVIL, PLUMBING & fire fighting WORKS

1.0 General

1.1 The following Additional Specific Conditions and specification shall be read in conjunction with General Conditions of Contract and Specific Conditions of Contract. If there are any provisions in these Additional Specific Conditions which are at variance with the provisions in the above mentioned documents, the provisions in these Additional Specific Conditions shall take precedence.

1.2 These additional specific conditions and specification shall be considered as an extension and not as a limitation of obligation of the preference.

- * The CPWD General Specification for Electrical works: Part V Down Comer System for fire fighting-latest issue. Termination used in the bid shall also be accordance with CPWD.

- * For items not covered in CPWD Specification, the work shall be done as per the latest relevant IS Code of practice.

- * For item not covered by any of the above the installation shall be done as directed by the Engineer and as per sound engineering practices.

2.0 Scope of Contract

2.1 The scope of work covers the supply, erection, testing and commissioning of the Civil, Plumbing, Fire Fighting & Electrical Systems, Air- conditioning & Landscaping works which also includes design & preparation of structural and all other detailed shop drawings, testing and commissioning of components and accessories.

- * Civil works, plumbing & Fire Fighting works, Fire Alarm System.

- * Electrical works.

- 2.2 The work shall be carried out in conformity with the plumbing drawings and the requirement of architectural, electrical, structural, and other specialised service drawings by the agency approved by Engineer..
- 2.3 The Contractor shall make provision of hangers, sleeves, structural openings and other requirements well in advance to hold up progress of the construction schedule.
- 2.4 The said Contract comprises of furnishing of all materials, equipment, labour & transportation etc. necessary to render the installation fully operational as per the intent of specification and drawings, including any necessary adjustment or corrections. The installation shall be all in conformity with local laws covering such installation.

3.0 Contract Drawings

- 3.1 The drawings issued with the Bid are diagrammatic only and indicate the extent and general arrangement of the installation. Drawings shall not be scaled.
- 3.2 The Contractor shall follow the Bid drawings for preparation of his detailed sanitary, plumbing & fire fighting & Shop drawings and for subsequent installation work. He shall check the drawings of other services to verify spaces in which his work will be installed. The Contractor shall examine all Architectural, Structural, Plumbing and other services drawings before starting the work and report to the Engineer any discrepancies and obtain clarification. Any changes found essential to coordinate installation of this work with other services, shall be made with prior approval of the Engineer.

4.0 Shop Drawings

- 4.1 With in two weeks after Award of the Contract, the Contractor shall furnish for approval of the Engineer, three sets of detailed sanitary, plumbing, fire fighting (external & internal), Pump room & Shop drawings of all equipment and materials required to complete the work as per specifications. These drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics, and capacity of all items of equipment, as also the details of all related items of work of other trades. All shop drawings to be made in accordance with latest fire safety norms & to be got approved by the authorities before it is finally approved by Engineer before start of work.

- 4.2 All drawings necessary for assembly, erection, maintenance, repair and operation of the equipment shall be furnished and different parts shall be suitably numbered for identification and ordering of spare parts.
- 4.3 When the Engineer makes any amendments in the above drawings, the Contractor shall supply fresh sets of drawings with the amendments duly incorporated, along with the drawings on which corrections were indicated.
- 4.4 No material or equipment may be delivered or installed at the job Site until the Contractor has in his possession, the approved Shop drawings for that particular material or equipment.
- 4.5 After approval of the drawings by the Engineer, the Contractor shall further furnish six sets of Shop drawings for the exclusive use of and retention by the Engineer.
- 4.6 Approval of drawings by the Engineer shall not relieve the Contractor of any part of his obligation to meet all the requirements of the Contract or of the correctness of his drawings. The Engineer's approval of specific item shall not mean the approval of the assembly of which it is a component. The Contractor shall be responsible for and is to bear the cost for all alternations of the works due to discrepancies or omission in the drawings or other particulars supplied by him, whether such drawings have been approved by the Engineer or not.
- 4.7 Where the work of the Contractor has to be installed in close proximity to, or will interfere with the work of other trades, the Contractor shall assist in working out the space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections to a suitable scale not less than 1:50, clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordinating with other trades, or so as to cause any interference with the work of other trades, he shall make all the necessary changes without extra cost.
- 4.8 All shop drawings and detail drawings will be made as per requirements of local authorities and tender drawings incorporating all latest regulations and requirements. No separate drawings will be, issued for making shop drawings.

5.0 Samples and Catalogues

5.1 Prior to ordering any equipment/ material/ system, the Contractor shall submit to the Engineer, the catalogues, along with samples from approved list of manufacturers. No material shall be procured prior to the approval by the Engineer.

5.2 Approval of Materials

All materials used on the Works shall be new and of the best quality available, conforming to the relevant specifications and as per good Engineering practice. Prior approval shall be obtained in writing from the Engineer for all materials proposed and when necessary, approved sample duly identified and labelled shall be deposited with the Engineer and shall be kept at Site. List of approved make indicates make / manufacturer generally acceptable but final choice of make / manufacturer of material & models shall be with the Engineer.

6.0 Material and Equipment

6.1 All material and equipment shall conform to the relevant Indian Standards.

6.2 Where interfacing occurs, equipment shall be mutually compatible in all respects.

6.3 Where an item of equipment, other than as specified or detailed on the drawings, is approved by Engineer, requires any re-design of the structure, partitions, foundation, piping, writing or any other part of the mechanical, electrical or architectural layout, all such re-design, and all new drawings and detailing required therefore, shall be prepared by the Contractor at his own expense and approval obtained by the Engineer.

6.4 All similar equipment, materials, removable parts of similar equipment etc. shall be inter-changeable with one another.

7.0 Conformity with Statutory Acts, Rules and Standards

7.1 The installation shall be in conformity with the Bye-laws Regulations and Standards of the local authorities applicable to the installations. But if the specifications and drawings call for a higher standard of materials and/or workmanship than those required by

any of the above regulations and those required by any of the above regulations and standards, then the specifications and drawings shall take precedence over the said Regulations and Standards.

7.2 However, if the drawings or specifications required something, which violates the Byelaws and Regulations, then the Bye-laws and Regulations shall govern the requirement of this installation.

7.3 Indian Standards : The System / Components shall conform to relevant Indian standards wherever they exist and to the national Building Code Amended up to date.

7.4 Nothing in these Specification shall be constructed to relieve the contract of his responsibility for the design. Manufacture and installation of equipment with all its accessories in accordance with applicable statutory regulations and safety codes in force.

8.0 Technical Data

8.1 Deleted

9.0 Manufacturer's Instructions

9.1 Where manufacturers have furnished specific instructions relating to the materials and equipment used, covering points not specifically mentioned in these documents, manufacture's instructions shall be followed.

10.0 Training and Operating Instructions

10.1 If required by the Engineer, the Contractor shall at no extra cost train members of the maintenance staff either at his or the subcontractor's workshop or at such other place or places as may be considered suitable by the Engineer.

10.2 Upon completion of all work and all tests, the Contractor shall furnish the necessary skilled labour and helpers for operating the entire installation for a period of fifteen (15) working days. During this period, the Contractor shall instruct and train the Engineer's representative in the operation, adjustments and maintenance of all equipment installed.

10.3 The Contractor shall submit to the Engineer a draft copy of comprehensive operating instructions and maintenance schedule

for all systems and equipment including in this Contract. This shall be supplemented, not substituted, by manufacturer's operating and maintenance manuals. Upon approval of the draft, the Contractor shall submit to the Engineer four (4) complete bound sets of operating and maintenance schedules along with manufacturers printed literature.

11.0 Inspection and Testing

11.1 The Engineer reserves the right to request inspection and testing at manufacturer's Works at all reasonable times during manufacture of items for this Contract.

11.2 The Engineer or his authorised representative shall have full power to inspect the materials and workmanship at the Contractor's Works or at any place from which the materials or equipment is obtained. Acceptance by the Engineer of any material or equipment shall in no way relieve the Contractor of his responsibility for meeting the requirements of the specifications. All incident expenditure like travelling, boarding and lodging etc shall be born by the contractor.

11.3 Routine and typical tests for the various items of equipment shall be performed at the Contractor's Works and test certificates furnished. If required by the Engineer, the Contractor shall permit the authorised representative of the Engineer to be present during any of the tests.

11.4 After installation has been virtually completed, the Contractor shall carry out under the direction and in the presence of the representative of the Engineer such tests and inspections as have been specified, or as the representative shall consider necessary to determine whether or not the full intent of the requirements of the drawings and specifications have been fulfilled. In case the work does not meet the full intent of the drawings and specifications and further tests are considered necessary, the Contractor shall carry them out and bear the expenses thereof.

11.5 The Contractor shall provide all necessary instruments such as Theodolite, Dumpy level, steel tapes, weighing machine, plumb bobs, spirit levels, hammers, micrometers, thermometers, hydraulic testing machine, smoke test machine and labour for testing. The Contractor shall make adequate records of the test procedures and readings, shall repeat any tests requested by the Engineer and shall provide test certificates signed by an properly authorised person. Such test certificates shall cover all Works. All such

equipments shall be tested for calibration at any approved laboratory.

11.6 If test fail to demonstrate the satisfactory nature of the installation or any part thereof, then no claims for the extra cost of modifications, replacement or retesting will be considered. The decision of the Engineer shall be regarded as final as to what constitutes a satisfactory test.

11.7 The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere.

12.0 Test Certificates

The contractor shall submit test certificates for all the materials / systems. These shall be issued by a government recognized inspection office certifying that all Equipment, Materials, Construction and function are in agreement with the requirements of these specification and accepted standards.

13.0 Performance Guarantee/Retention Money

13.1 It is clearly understood that the specifications, drawings, schedule of quantities for fire fighting system are for bidder's guidance only. The bidder shall carry out necessary calculation and provide alternative equipment required to achieve the specified level of fire fighting required for human safety. Complete sets of Architectural Drawings are available at site in the Engineer's office and reference may be made to these drawings as required for calculations or for other details. The contractor shall also guarantee that performance of various equipments, individually, shall not be less than, the quoted ratings.

14.0 Quiet Operation and Vibration

14.1 All equipment shall operate under all conditions of load without any sound or vibration, which is objectionable in the opinion of the Engineer. In case of rotating machinery, sound or vibration noticeable outside the room in which it is installed or annoyingly noticeable inside its own room, shall be considered objectionable. Such conditions shall be corrected by the Contractor at his own expense.

15.0 Accessibility

15.1 The Contractor shall locate all equipment, which must be serviced, operated or maintained in fully accessible positions. The exact location and size of access panels, required for each valve or other devices requiring attendance, shall be finalised and communicated well in time, to be provided in the normal course of work, failing this, the Contractor shall make all the necessary repairs and changes at his own expense.

16.0 Electrical Installation

16.1 The electrical installation shall be in total conformity with the control wiring drawings prepared by the Contractor and approved by the Engineer & shall be connected and tested in the presence of an authorised representative of the Contractor and of the Engineer.

16.2 It is to be clearly understood that the final responsibility for the sufficiency, adequacy and conformity to the Contract requirements of the electrical installation work lies solely with the Contractor.

17.0 Completion Certificate

17.1 On completion of the installation, a certificate shall be furnished to the Engineer, by the Contractor, countersigned by the licensed supervisor under whose direct supervision the installation was carried out. This Certificate shall be in the prescribed form as required by the local authority. On the basis of this certificate, the Contractor shall arrange for inspection of installation by the concerned local authorities.

17.2 The Contractor shall be responsible at his own cost for getting the installation duly approved by the Authorities concerned.

18.0 Completion Drawings

18.1 At the completion of the work in all respects, the Contractor shall at his own cost submit to the Engineer 4 (four) sets of layout drawings drawn at the approved scale indicating the installation. These drawings shall clearly indicate the complete plant layouts, and piping layouts, location wiring, exact location of all the concealed piping, valves, controls, wiring and other services. The Contractor shall also submit 4(four) sets of consolidated control diagrams, technical literature on all automatic controls and complete technical literature on all equipment and materials. The Contractor shall frame under glass, in the plant room all consolidated control diagrams and all piping diagrams.

19.0 Rates

19.1 Quoted rate includes any materials, equipment, appliances and incidental work not specifically as being furnishing or installed, but which are necessary and customary to make a complete installation.

19.2 The Contractor shall check at all stages and supervise at the point of connection the associated civil, electrical and plumbing works like underground and overhead tanks, power supply and installation of makeup water connection, drain connection in the fire fighting tanks and vicinity of plant room etc. In case of any discrepancy, all rectifications etc, required as a failure to do so, shall be carried out by the Contractor at his own expenses.

20.0 Check List

20.1 The Contractor shall provide to the Engineer 4(four) copies of a comprehensive maintenance checklist and shall post a copy of it in the Plant Room. The checklist shall be a list of each piece of equipment in this Contract, and shall provide a space for each of the next fifty-two weeks to record the maintenance provided to and status of various equipment. Each month at the time of inspection, the Contractor shall certify on this check list that he has examined each piece of equipment and that, in his opinion, it is operating as intended by the manufacturer, and that all necessary intention has been performed.

21.0 Repairs

All equipment that requires repairing shall be immediately serviced and repaired. During the maintenance period, all parts and labours shall be furnished at no extra cost to the Engineer.

22.0 Control System

During the maintenance period, once each month the Contractor shall check all controls in various areas to ensure that these are functioning as designed. This shall apply to all pressure switches and pressure gauges, contactors, relays, controller switches, high and low pressure cut-outs etc.

23.0 Reference Points

23.1 Contractor shall provide permanent bench marks, flag tops and other reference points for the proper execution of work and these shall be preserved till the end of Works.

23.2 All such reference points shall be in relation to the levels and locations, given in the Architectural and plumbing drawings.

24.0 License and Permits

24.1 Contractor shall hold a valid plumbing, electrical, HVAC/VENTILATION license issued by the Municipal Authority or other competent authority under whose jurisdiction the work falls.

24.2 The contractor has to take all the approvals of local bodies for all the addition/deletion over the approved building plans. The documents/drawings to be prepared and submitted in the manner desired by them after the same is approved by HSCC. Contractor has to take approvals of entire/Part works if required before start of works. Contractor will be held responsible if any work at site is carried out without having approval of municipal or local bodies.

24.3 Contractor shall keep constant liaison with the competent Municipal or other authority and obtain approvals and connections for all drainage and water supply works carried out by him.

24.4 Contractor shall obtain from the competent Municipal Authority completion certificates with respect to his work as required for occupation of the building.

24.5 Before start of HVAC/VENTILATION, Electrical, ATT, Water proofing, Fire Fighting, Fire alarm system, PA System, EPABX System, Horticulture Works, aluminium works, stainless steel works, signages works etc. The contractor must take approval of agencies from engineer.

24.6 Any fees deposited in connection with the work on behalf of the Client in Statutory bodies, Corporations, Government departments, etc. shall be paid by the Contractor and the same shall be reimbursed on production of original vouchers. Necessary endorsement / application if required shall be arranged from the Employer by the Engineer.

25.0 Cutting and Making Good

25.1 No structural member shall be chased or cut without the written permission of the Engineer.

26.0. Operation and Running of entire system

The contractor shall pay for and arrange for operation & running of entire sanitary, plumbing and fire fighting system including pumps and RO plant,

solar water heating system etc. for a minimum period of one month after satisfactory completion of work as desired by Engineer. Cost of operation & running of entire system including required material e.g fuel, consumables, tools & tackles, requisite manpower etc. shall be deemed to be included in the contract price and nothing extra shall be paid.

C) RELATING TO ELECTRICAL INSTALLATIONS

1.0 General

1.1 The following Additional Specific Conditions shall be read in conjunction with General Conditions of Contract and Specific Conditions of Contract. If there are any provisions in these Additional Specific Conditions which are at variance with the provisions in the above mentioned documents, the provisions in these Additional Specific Conditions shall take precedence.

2.0 Regulations and Standards

2.1 The installations shall conform in all respects to Indian Standard Code of Practice for Electrical Wiring Installation IS : 732-1989 and as per latest CPWD General Specification for Electrical Works (Part I, II & IV). It shall also be in conformity with the current Indian Electricity Rules and regulations in so far as these are applicable to the installations. Wherever these Additional Specific Conditions calls for a higher standard of material and/or workmanship than those required by any of the above regulations, then this Additional Specific Conditions shall take precedence over the said Regulation and Standards. External works & fire detection & alarm system works to be done as per CPWD specification & relevant IS codes.

3.0 Rates

3.1 The rates bided shall be for complete items of work inclusive of all taxes, statutory charges and all other charges for items contingent to the work, such as, packing, forwarding, insurance, freight and delivery at Site for the materials to be supplied by the Contractor, watch and ward of all materials for the Internal & external, Electrical Installation testing & commissioning work including water & power for successful installation, testing & commissioning work at Site and getting approvals & permanent electricity connection from concerned local body(s) etc.

4.0 Completeness of Bid

All sundry fittings, assemblies, accessories, hardware items, foundation bolts, termination lugs for electrical connections as required, and all other sundry items which are useful and necessary for proper assembly and efficient working of the various

components of the work shall be deemed to have been included in the Bid rates and prices, whether such items are specifically mentioned in the Bid documents or not.

5.0 Works to be done by the Contractor

5.1 Unless and otherwise mentioned in the Bid documents, the following works shall be done by the Contractor, and therefore their cost shall be deemed to be included in their rates and prices:

- i. Foundations for equipments and components where required, including foundation bolts
- ii. Cutting and making good all damages caused during installation and restoring the same to their original finish
- iii. Sealing of all floor openings provided by him for pipes and cables, from fire safety point of view, after laying of the same
- iv. Painting at site of all exposed metal surfaces of the installation other than pre-painted items like fittings, fans, switchgear/ distribution gear items, cubicle switch board etc. and erection, shall however be rectified to the satisfaction of the Engineer
- v. Testing and commissioning of complete installation

6.0 Tools for Handling and Erection

6.1 All tools and tackles required for handling of equipments and materials at Site of work as well as for their assembly and erection and also necessary test instruments shall be the responsibility of the Contractor.

7.0 Terminology & Scope

7.1 Terminology & scope for this project shall be as per CPWD Specification for Electrical Works (Part I - Internal) - latest & External Works - Part II - latest.

7.2 Measurement

Measurement shall be as per CPWD specifications Part – I (Internal) & Part - II (External) unless otherwise specified in the technical specifications / BOQ.

8.0 Drawings

8.1 The drawings indicate the extent and general arrangements of the fixtures, controlling switches, wiring system etc. and are essentially diagrammatic. The drawings indicate the points of termination of conduit runs and broadly suggest the routes to be followed. The Contractor shall submit six sets of working electrical drawings based on tender drawing including reflected ceiling plan coordinating other essential building services for HSCC approval. Contractor has to make necessary changes if any as per comments given by HSCC before execution. The work shall be executed as indicated in the approved drawings, however any minor changes found essential to co-ordinate the installation of this work with the other trades shall be made without any additional cost of owner. The drawings are for guidance of the contractor and exact locations, distance and levels shall be governed by the building. The Contractor shall examine all architectural, structural, plumbing and sanitary & electrical drawings before starting the work and report to the Engineer any discrepancies, which in his opinion appear on them and get it clarified. Contractor shall not be entitled to any extras for omissions or defects in electrical drawings or when they conflict with other services work.

9.0 Conduit/ Trunking Layout

9.1 Prior to the laying of the conduits and trunking, the Contractor shall examine/ study drawings and report to Engineer in case he desires to make any changes from Consultant proposed conduit layout plan and shall get the same approved from HSCC.

10.0 Shop Drawings

10.1 The Contractor shall prepare and submit to the Engineer for his approval detail shop drawings of Main & Sub Distribution Boards, Distribution Boards, special pull boxes, light & fan switch boards, telephone distribution boards, FDA system and lightning protection system and other equipment to be procured/ fabrication by the Contractor within 15 days of signing of the above items required to complete the electrical installation in all respect.

11.0 Manufacturer's Instruction

11.1 Where manufacturers' have furnished specific instructions, relating to the materials used in this job, covering points not specifically mentioned in these documents, these instructions shall be followed in all cases.

12.0 Materials & Equipment

12.1 All materials and equipment shall be ISI marked and shall be of the approved make and design. Unless otherwise called for, only the best quality of materials and equipment shall be used. The Contractor shall be responsible for the safe custody of all materials till these are taken over by client and shall insure as against theft, damage by fire, earth quake etc. A list of items of materials and equipment, together with a sample of each shall be submitted to the Site office.

13.0 Scale

13.1 Drawings shall be prepared to the scale as required for proper explanation and shall indicate the size and location of all equipments and accessories herein. The Contractor shall obtain all dimensions preferably at the building (Site of work) and check those plans for interference with the building structure and other equipment.

14.0 Brochures and Data

14.1 The Contractor shall submit four copies of all brochures / manufacturer's description data and similar literature.

15.0 Approval of Shop Drawings

15.1 The Engineer's approval of shop drawings, schedule, brochures etc. shall be an approval of general details and arrangements only and shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless he has in writing called Engineer to such deviations at the time of submission nor shall it relieve the Contractor from responsibility for errors or omissions of any kind in the shop drawings when approved.

16.0 Samples & Catalogues

For HSCC approval, Contractor shall submit the samples & catalogue of the material, which are used at Site as per the approved makes.

17.0 Approval of Materials

17.1 All materials used on the Works shall be new and of the best quality available, conforming to the relevant specifications and as per good Engineering practice. Prior approval shall be obtained in writing from the Engineer for all materials proposed and when necessary, approved sample duly identified and labelled shall be deposited with the Engineer and shall be kept at Site. List of approved make indicates make/ manufacturer generally acceptable. Contractor shall submit the detail drawings for HSCC approval.

18.0 Inspection, Testing and Inspection Certificate

18.1 HSCC and authorised representative of HSCC shall have at all Reasonable times access to the Contractor's premises or Works and shall have the power at all reasonable time to inspect and examine the materials and workmanship during its manufacture or erection or if the part of works is being manufactured or assembled at other premises or works.

18.2 The Contractor shall arrange all the materials and labour required for inspection of equipment or for any testing to be carried out at his/ manufacturer's works or at Site. Notice for such inspection/ presence for testing shall be given to the Engineer by the Contractor at least fifteen (15) days in advance together with the routine test certificates of the equipments/ materials given by the manufacturer.

18.3 Notwithstanding approval of tests or equipment by the Engineer, the Contractor shall be required to perform site tests and prove the correctness of ratings and performance of equipment/ machinery and materials supplied and installed by the Contractor as per the Contract specifications and conditions. Engineer shall have full power to order the material or work to be tested by an independent agency at the electrical Contractor's expense in order to prove soundness & adequacy.

19.0 Schedule & Manner of Operation

19.1 Time being the essence of this Contract, Contractor shall be expected to furnish all labour & material in sufficient quantities at

appropriate time, expedite and schedule the work to meet the Engineer's requirement and so manage the operations that the work shall be completed in time as stated else where. In case of shut down of power supply, Contractor shall coordinate with Engineer and shall carry out essential works during the shut down period allowed by the Engineer. In case Engineer allows for such period during night or early morning hours, Contractor shall make all provisions to avail such account. Contractor shall not be entitled for any extra claims on such account. Contractor shall programme his work in such a way that items of work requiring presence of Engineer are carried out between 9 A.M. & 5 P.M. on working days.

20.0 Performance Guarantee

20.1 All equipment shall be guaranteed for a minimum period of 12 (Twelve) months from the date of handing over of installation to the Engineer against unsatisfactory performance and/or break down. The equipment or component or any other part of installation so found defective within the guarantee period shall be replaced / repaired by the Contractor free of cost to the satisfaction of the Engineer. The normal guarantee and or warrantee provided by the manufacturer will have to be submitted along with all the test certificates from manufacturer.

21.0 Conformity with Statutory Acts, Rules and Standards

21.1 The installation shall be in conformity with the Bye-laws, Regulations and Standards of the local authorities applicable to the installations. But if the specifications and drawings call for a higher standard of material and/or workmanship than those required by any of the above Regulations and Standards, then the specifications and drawings shall take precedence over the said regulations and standards.

21.2 However, if the drawings or specifications required something which violates the Bye-laws and Regulations, then the Bye-laws and Regulations shall govern the requirement of this installation.

21.3 Indian Electricity Act and Rules : All electrical works in connection with installations of the system shall be carried out in accordance with the provision of the Indian Electricity Act, 1910 and the Indian Electricity Rules 1956, both amended upto date.

21.4 CPWD Specification :The Electrical installation work shall conform to CPWD General specifications for Electrical Works Part I

(Internal) I and Part II (External) latest issues , both amended upto date.

21.5 Indian Standard : The system / components shall conform to relevant Indian Standards wherever they exist and to the latest National Building Code-1983.

21.6 Nothing in these specifications shall be construed to relieve the Contractor of his responsibility for the design, manufacture and installation of the equipment with all its accessories in accordance with applicable Statutory Regulations and safety codes in force.

22.0 Completion Drawings (As Built Drawings)

22.1 On completion of the work and before issue of certificate of virtual completion, the Contractor shall submit to the Engineer completion plan drawn to a scale in tracing cloth with ink indicating the following, along with three blue print copies of the same:

- a. Run and size of conduits, inspection boxes, junction boxes and pulls boxes
- b. Number of size of conductors in each conduit
- c. Location and rating of sockets and switches controlling the light and power outlets
- d. Location and details of main & sub distribution boards, distribution boards indicating the circuit number controlled by them
- e. Type of fitting viz. fluorescent, pendants, brackets, bulkhead etc., including their rating & type of lamp, fans and exhaust fans
- f. A complete wiring diagram as installed and schematic drawings showing all connections for the complete electrical system
- g. Location of telephone outlets, junction boxes and sizes of various conduits and number & sizes of wire drawn
- h. Layout of telephone cables
- i. Location of all earthing stations, route and size of all earthing conductors, manholes etc.

- j. Layout and particulars of cables & sub mains
- k. Schematic drawing for telephone system
- l. Layout of conduits for computer outlet points
- m. Layout and details of fire detection & alarm system consisting of manual call points, fire alarm hooters, smoke & heat detector, FDA control panel including details of conduits and number of wires drawn
- n. Layout and details of lightning protection system
- o. Insulation tests and earth test results
- p. PA System drawings
- q. Fire System drawings
- r. Disc Antenna drawings
- s. Equipment drawings
- t. Cable route layout of HT, LT & other cables
- u. External lighting drawing with road layout

23.0 Confirmation of Quantities

- 23.1 All quantities indicated in BOQ are tentative which may vary as per site conditions. Contractor has to verify quantities before procuring the material. No payment shall be payable for quantity brought to site but not used.

24.0 Terms of Payment (Only for items of major electrical equipments)

For purposes of estimating the contract value of work executed for certificate of payment under clause 32(d) of section II the following norms shall be followed.

- a. 80% of BOQ rate on receipt of equipment against receipt of complete material at site & test certificates in accordance with clause 33(l) of SCC.
- b. 10% of BOQ rate on erection and installation of equipment.

- c. 10% after successful completion of all works including all testing, commissioning & taking over.

25.0 Training of Personnel

The Contractor shall arrange to train the Employer's personnel prior to provisional take over of the project for the following:

- a) Lift
- b) Telephone Exchange
- c) All other Equipments like DG sets, pumps, panels etc.
- d) Adjustment of setting for controls and protective devices
- e) Preventive maintenance
- f) Operation of all electrical panels including their interconnectivity and interlocking scheme
- g) Fire detection system

26.0 Completion Certificate

26.1 On completion of the installation, a certificate shall be furnished to the Engineer, by the Contractor, countersigned by the licensed supervisor under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local authority. On the basis of this certificate, the Contractor shall arrange for inspection of installation by the concerned local authorities.

26.2 The Contractor shall be responsible at his own cost for getting the installation duly approved by the authorities concerned.

27.0 Check List

27.1 The Contractor shall provide to the Engineer 4(four) copies of a comprehensive maintenance checklist and shall paste a copy of it in the Substations & Plant Room. The checklist shall be a list of each piece of equipment in this Contract, and shall provide a space for each of the next fifty-two weeks to record the maintenance provided to and status of various equipment. Each month, at the

time of inspection, the Contractor shall certify on this check list that he has examined each piece of equipment and that, in his opinion, it is operating as intended by the manufacturer, and that all necessary tests have been performed.

28.0 Repairs

All equipment that requires repairing shall be immediately serviced and repaired during the maintenance period. All parts and labours shall be furnished at no extra cost to the Engineer.

29.0 Safe Custody and Storage

Safe custody of all machinery and equipment dismantled, shifted & supplied by the Contractor shall be his own responsibility till the final taking over by the Employer. The Contractor should, therefore, employ sufficient staff for watch and ward at his own expenses. The Employer may, however, allow the Contractor to use the building space for temporary storage of his equipment, if such space is ready and available.

30. Testing and Commissioning

The Contractor shall pay for and arrange without any extra cost, all necessary balancing and testing equipment, instruments, materials, accessories, power, water, fuel and the requisite labour for testing. Any defects in materials and/or in workmanship detected in the course of testing shall be rectified by the Contractor entirely at his own cost, to the satisfaction of the Engineer. The installation shall be tested again after removal of defects and shall be commissioned only after approval by the Engineer. All tests shall be carried out in the presence of the Engineer or the Engineer's representative.

31. Operation and Running of entire system

The contractor shall pay for and arrange for operation & running of entire electrical system including DG sets, lifts and other equipment for a minimum period of one month after satisfactory completion of work as desired by Engineer. Cost of operation & running of entire system including required material e.g fuel, consumables, tools & tackles, requisite manpower etc. shall be deemed to be included in the contract price and nothing extra shall be paid.

32. Layout of all services , operating and maintenance instructions. DO's and Don't's etc

for all the plant rooms, AHU's machine rooms, sub stations, pump room, toilets, control panels etc must be equipped with coloured layout of services for the each floor . Operation and maintenance manual of the respective services, Do's and Don't's for all the plants, machinery & services to be installed with every individual units.

(D) SPECIFIC CONDITIONS OF CONTRACT RELATING TO HVAC/VENTILATION SYSTEM

1.0 General

1.1 The following Additional Specific Conditions shall be read in conjunction with General Conditions of Contract and Specific Conditions of Contract. If there are any provisions in these Additional Specific Conditions which are at variance with the provisions in the above mentioned documents, the provisions in these Additional Specific Conditions shall take precedence.

2.0 Scope of Contract

2.1 The scope and general character of works to be carried out under this section comprises of Supply, Installation, Testing and Commissioning of Heating, HVAC/Ventilation and Air-conditioning installations as illustrated in drawings, specifications, technical data and Bill of Quantities.

3.0 Stores and Materials

3.1 The contractor shall provide every thing necessary for the proper execution of the work according to the intent and meaning of the drawings, Bill of quantities and specifications taken together whether the same may or may not be particularly shown or described therein provided that the same can be reasonably inferred there from. In case of any discrepancy in the drawings or between the drawings, Bill of quantities and specification, the more stringent shall be followed. The decision of the Engineer in this regard will be final and complied with.

4.0 Supply of Equipment

Equipment shall be strictly as per the list of approved makes/ manufacturers given in the Bid documents. However, final choice of make shall lie with the Engineer.

4.1 The Contractor shall submit manufacturer's test certificates of equipment supplied.

4.2 The Contractor shall submit the original "Excise Paid Certificates", and exit Gate passes form manufacturer's factory/works clearly bearing the batch numbers and date of despatch.

5.0 Working Drawings etc.

- 5.1 The Contractor shall within 60 days of signing of the Contract, prepare and submit to the Engineer for approval, 2 sets of detailed shop drawings of equipment, equipment characteristics and capacity details of all equipment, accessories and devices etc. as per specifications and as required by the Engineer.
- 5.2 These drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics, and capacity of all items of equipment, as also details of all related items of work by other disciplines.
- 5.3 If the Engineer makes any amendment in the above drawings, the Contractor shall supply two fresh sets of drawings with the amendments duly incorporated, along with the drawings on which corrections were made. After final approval has been obtained from the Engineer, the Contractor shall submit a further six sets of shop drawings for the exclusive use of and retention by the Engineer.
- 5.4 The shop drawings shall be submitted for approval sufficiently in advance of planned delivery and installation of any material, to allow Engineer ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to failure to produce shop drawings in time.
- 5.5 Approval rendered on shop drawings shall not be consider as a guarantee of measurement or of building condition. Where drawings are approved, said approval does not mean that drawings have been checked in detail nor does it in any way relieve the contractor from his responsibility of furnishing materials or performing work as required by the contract.

6.0 Completion Drawings

- 6.1 Following "AS BUILT" drawings duly laminated and montable at various locations shall be submitted by the Contractor on completion of the work :
- a. Plant installation drawings giving complete details of the entire equipment including foundations

- b. Ducting drawings showing all sizes, damper locations and sizes of all air outlets and intakes, for all floors
- c. Electrical drawings showing cable sizes, equipment capacities, control components and control wiring
- d. Schematic control drawings giving detailed sequence of operation and notes to explain the operation of the control circuit
- e. Piping drawings showing all pipe sizes, valves and fittings
- f. Any other drawings to be supplied as per instructions of the Engineer.
- g. Water supply and drainage of all toilets duly laminated and mounted on walls of toilets
- h. Entire water supply, and fire fighting system on one drawing duly laminated and mounted on pump room
- i. Entire Drainage system including STP from first floor trap till end manhole duly laminated and mounted at desired place.

The drawings shall be cross checked and approved by the Engineer before acceptance.

7.0 Operation and Service Manuals

7.1 The Contractor shall submit 3 (three) sets of operation and service manuals in respect of the air-conditioning plant including salient details of plant.

Following minimum details shall be furnished:

- i) Detailed equipment data as approved by the Engineer
- ii) Manufacturer's maintenance and operating instruction
- iii) Approved test readings

The Contractor shall also submit 4 (four) sets of technical literature on all automatic controls and complete technical literature on all equipment and materials. The Contractor shall frame under glass, in the Air conditioning plant room all consolidated control diagrams and all piping diagrams.

coloured Layouts of all electrical lines in A 1 size properly laminated to be fixed at various locations at the time of handing over of building.

8.0 Inspection at Contractor's Premises

8.1 The Engineer and his representatives shall at all reasonable time have free access to the Contractor's premises/works. The Contractor shall give every facility to the Engineer and his representative and necessary help for inspection and examinations and test of the materials and workmanship.

8.2 The Engineer's representative shall have full powers to inspect drawings of any portion of the work or examine the materials and workmanship of the plant at the Contractor's works or at any other place from where the material or equipment is obtained. Acceptance of any material or equipment shall in no way, relieve the Contractor of his responsibility for meeting the requirement of the specifications.

8.3 For Imported screw type water chilling machine manufacturer's factory test certificate would be acceptable in lieu of inspection at manufacturer works.

9.0 Subcontracting

The Contractor may subcontract part of the works with the written approval of the Engineer to any of the approved subcontractors given in the list of approved subcontractors, makes and manufacturers. A single subcontractor shall be appointed for carrying out the entire work of supplying, installation, testing and commissioning of all the equipment covered under the package. However, the overall responsibility of the Contractor for compliance with the Contract terms does not alter by subcontracting.

10.0 Material Submittals

The Contractor shall submit material submittals for all equipment and machinery for the written approval of the Engineer before placing orders. The material submittals shall comprise of at least the following:

- a. Manufacturer's technical catalogues and brochures giving technical data about performance and other parameters

- b. Manufacturers drawings/ sketches showing construction, dimensional and installation details
- c. Rating charts and performance curves clarifying rating of equipment selected and proposed

11.0 Samples and Prototypes

The Contractor shall submit samples of items such as grilles/ diffusers, valves, controls and/ or any other parts or equipment as required by the Engineer for prior approval in writing before placing the order. The Contractor shall also construct prototype or samples of work as laid down in the Contract or as instructed by the Engineer. Such samples and prototypes after approval shall be retained by the Engineer and shall serve as the standards to be achieved in final construction.

12.0 Testing and Commissioning

12.1 Tests on equipment as called for in the specifications shall be carried out by the Contractor in accordance with the specifications, the relevant Indian Standard Specifications and the relevant Indian and International Standards.

12.2 The initial tests shall include but not be limited to the following:

- a. To operate and check the proper functioning of all electrically operated components viz., compressor motor, pumps, blowers, air handling units, rotating machine, fans, boilers, etc.
- b. To operate and check the proper functioning of all electrical panels, switch gears, safety and other controls
- c. To adjust and balance air, water, steam and gas quantities to provide the designed flow rates by adjusting valves, dampers, diverters etc.
- d. To check the systems against leaks in different circuits, alignment of motor, 'V' Belt adjustments etc.
- e. To check the vibration and noise levels of the equipment

- f. Setting of all control and all such other tests which are essential for smooth functioning of the plant

12.3 The Contractor shall pay for and arrange without any extra cost, all necessary balancing and testing equipment, instruments, materials, accessories, power, water, fuel and the requisite labour for testing. Any defects in materials and/or in workmanship detected in the course of testing shall be rectified by the Contractor entirely at his own cost, to the satisfaction of the Engineer. The installation shall be tested again after removal of defects and shall be commissioned only after approval by the Engineer. All tests shall be carried out in the presence of the Engineer or the Engineer's representative.

13.0 Provisional Taking Over

13.1 After completion of the installation system, the same shall be put to a continuous running test for a period of 2 (two) days. All adjustments should be made prior to this test so that proper conditions/working are achieved during this testing. The test readings shall include items as noted in the Testing Schedules.

The plant will be provisionally taken over after successful completion of the above test and the defects liability period shall commence after provisional taking over of the system.

13.2 Final Performance and Capacity Test

In addition to the above testing, final performance and capacity tests shall be carried out on the equipment as per the "Testing Schedules" during the defects liability period as follows:

- a. Peak summer/ monsoon test during the period from 15th May to 31st July. The installations should be able to maintain the specified inside conditions within the tolerance limits permitted in the Contract.
- b. Peak winter test during the period from 1st December to 15th February. The installations should be able to maintain the specified inside conditions within the tolerance limits permitted in the Contract.

14.0 Operation of Plant

14.1 After provisional taking over of the plant user/owner shall provide staff for operation. Staff will work under the supervision of the Contractor for proper operation of the plant. This responsibility of the Contractor shall continue till completion of test liabilities with

respect to the plant or the maintenance period, which ever ends later.

- 14.2 The user shall have the right to operate all equipments, if in operating condition, whether or not such equipments, have been accepted as complete and satisfactory. Repairs and alterations shall be made at such time as directed by the Engineer. In special circumstances user may have to use the plant to Air condition some areas even before the completion of whole work. The Contractor shall co-operate fully under such circumstances.

15.0 Guarantee and Defects Liability Period

- 15.1 The guarantee shall be valid for a period of 12 (Twelve) months from the certified date of completion of the project. In case the contractor is not able to carry out the seasonal tests (summer/monsoon & winter) within the certified date of completion, the same can be carried out during defects liability period. If required, the Defects Liability period shall be extended till satisfactory completion of seasonal rates.

16.0 Measurement of Works

- 16.1 All works shall be measured in accordance with the mode of measurement given in the specific sections of the specifications. In case the method of measurement for any item is not clarified in the specifications, the same shall be measured in accordance with the relevant IS standards.

17.0 Variation in Quantities

- 17.1 The quantities given in the BOQ are for the guidance of the Bidder. The Contractor shall, however, be paid on the basis of actual quantities of works carried out.

18.0 Maintenance

- 18.1 The Contractor shall provide **free** maintenance for a period of twelve months after testing and commissioning of the installation. The Contractor shall carry out all routine and special maintenance of the plant and attend to any defects that may arise in operation of the plant. Consumable items required during the maintenance, loss of which is not attributable to bad material and/or workmanship will be arranged by the Employer without cost to Contractor.

19.0 Performance Guarantee

- 19.1 The Contractor shall submit a performance guarantee certificate from the approved subcontractor that the system shall maintain the desired parameters within +/- 5 % of the specified parameters who shall also guarantee that the capacity of various components as well as the whole system covered under the scope of work,

technical schedules and Bill of Quantities etc. shall not be less than the specified capacities. The guarantee of the specific equipment supplier alone with regard to the performance of the system shall not be acceptable. However, this does not alter the overall responsibility of the Contractor for compliance with the Contract terms and conditions.

20.0 Painting

20.1 All equipment and ancillary items such as pipes, supports etc., will be painted in approved manner, using standard colour scheme as approved by the Engineer.

21.0 Safe Custody and Storage

21.1 Safe custody of all machinery and equipment supplied by the Contractor shall be his own responsibility till the final taking over by the Employer. He should, therefore, employ sufficient staff for watch and ward at his own expenses. The Employer may, however, allow the Contractor to use any part of the building for temporary storage of his equipment, if such spaces are ready and available.

22.0 Terms of Payment

The following norms shall be followed for terms of payment of HVAC/VENTILATION equipments & installation:

- A) 80% of BOQ rate shall be paid on receipt of equipment at Site and after inspection and passing on prorata basis in accordance with clause 33 of SCC
- B) 10% of BOQ rate shall be paid on satisfactory erection and installation of equipment on prorata basis
- C) 10% after successful completion of running tests and provisional taking over.

23.0 Training of Personnel

The Contractor shall arrange to train the Employer's personnel on the following aspects prior to provisional take over of the plant :

- a) Operation of plant
- b) Gas charging and pumping down of the system
- h) Adjustments of settings for controls and protective devices
- i) Preventive maintenance
- j) Disassembling and assembling of compressor including identification and replacement

24. Handing over & Taking over process

For handing over & taking over process in addition to clauses specified the following services/works to be complied by the main contractor:

- a) Submission of Guarantees in stamp paper (format approved by Engineer) for all water proofing treatment executed in the works for a period of ten years. If any defects noticed within 10 years from completion of defect liability period the main contractor shall be sole responsible for the defects and same shall be rectified by the main contractor as per information from client within a period of 10 days from the notice.
- b) Rectification of all defects shall be carried out by the main contractor before Handing over/Taking over process.
- c) As built drawings 4 sets for Architectural, Structural, Plumbing, Electrical, HVAC/VENTILATION system, Specialised services and others, approved by engineer shall be submitted by the main contractor before handing over & taking over process.
- d) All services/equipments to be run and check before handing over & taking over process as per requirements of employer/principal employer.
- e) Contractor has to arrange water & electricity at their own cost for the purpose of testing of services and equipments. No extra amount shall be payable on account of the same.
- f) Main contractor shall submit catalogues, brochures, operation manual, manufacturer test certificate, Guaranty/Warranty papers, licence etc for all equipments/materials before handing over & taking over process.

25. Operation and Running of entire system

The contractor shall pay for and arrange for operation & running of entire HVAC/VENTILATION system for a minimum period of one month after satisfactory completion of work as desired by Engineer. Cost of operation & running of entire system including required material e.g fuel, consumables, tools & tackles, requisite manpower etc. shall be deemed to be included in the contract price and nothing extra shall be paid

Additional specific terms of the Contract for Computerization & Networking works at proposed Construction of Hostel Blockfor AIIMS within AIIMS campus, Ansari Nagar, New Delhi

Scope of work

The scope of work include supply, installation, configuration, commissioning, integration and testing of the Computer desktops, UPSs, Printers and Local Area Network at **Construction of Hostel Block**at AIIMS, New Delhi. The new LAN

integration and connectivity shall be integrated with the existing server at AIIMS campus through network cable.

1. **Licensing** - All the licenses of software i.e. Windows Operating System, Antivirus software, Microsoft office or any other software will be provided in the name of the client (AIIMS, New Delhi).
2. Supplier will be sole responsible for all the maintenance support of all the items supplied and installed at site i.e. Computer desktops, UPSs, Printers and Local Area Network & its connectivity with the main server for the period of three years from the date of commissioning and handing over of all the items.
3. Price shall be inclusive of all statutory taxes, duties, levies and charges up to supply, inspection and installation. Prices shall be firm. No escalation on any account whatsoever shall be payable.

The supplier will be entirely responsible for all taxes, duties, license fees, octroi, road permit fees etc in connection with delivery of the items at site including taxes and levies to be charged in connection with local transportation and incidental services and commissioning.

4. After award of work, in case the quoted model(s) are outdated and new upgraded model introduce in the market then supplier shall supply the latest upgraded model without any extra charges.
5. If any promotional scheme is launched by the manufacturer at the time of supply of the item, all the benefits of the scheme will be given to the client/consignee.
6. If any additional item is required, the cost of the item will be paid to supplier on basis of its market price plus 10% of the market price of the item. The market price will be decided by a committee constituted by engineer. Any discount on price will be applicable.
7. **Local Area Network (LAN)** - The supplier has to provide the plan, design and site preparation as per requirement and as directed to the satisfaction of engineer and as per terms of the technical specifications.

A detailed shop drawings indicating line diagram, route diagram showing details of laying underground, overhead or under wall cables showing details of cable, switches, joint etc. complete in all respect to be submitted to engineer for approval before ordering any items & start of execution work within 15 days of award of work. The design if required will be revised as per direction of engineer before approval.

The supplier is responsible for all unpacking, assembling, wiring, installation, cabling between equipment and components and connection to power supplies. The supplier will test all Systems operations and perform all the necessary setup, configuration and customization for successful operation of the Network and connectivity with existing server at AIIMS campus.

8. The Local Area Network will be accepted only when authorized person from the AIIMS, New Delhi has given satisfactory performance report of the installation.

9. Submission of documents for payment:

The supplier will submit all the relevant documents along with bills to the paying authority. However, before commencement of any payment against computerization and networking works, the supplier will submit Performance Bank Guarantee in the specified format. This Performance Bank Guarantee shall be 10% of value of total quoted cost for all items related to Computerization work and Networking valid for a period of 36 months from the date of commissioning and handing over of all the items.

10. **Maintenance Support** – Supplier will provide three years onsite maintenance support (labor and parts) on all the items i.e. Computer desktops/UPSs/Printers and LAN from the date of commissioning.

A technically qualified & experienced engineer (having good knowledge of Hardware, Software and Network) will have to be posted at site for duration of the project. Your site engineer will co-ordinate with the authorized person of the AIIMS at site for all works including installation, commissioning and maintenance. The cost of this will be deemed to be including in price quoted.

The scope of maintenance support will include cost of spares, labor charges and all other charges as and when required except cost of any consumable items like toner /cartridges etc.

All the hardware & software supplied, installed and network set-up shall be maintained by the supplier/sub agency during the maintenance support.

11. **Warranty** - Supplier provide the standard warranty on all the items and 3 years OEM warranty on all the printers supplied and installed as mentioned in the technical specifications. This warranty against any manufacturing defect/poor workmanship and raw materials. Any defects

on this account shall be attended immediately and in no case beyond 24 hours. The replacement or repair/rectification work shall be carried out at no cost to AIIMS/free delivery of warranty replacement where the breakdown takes place. It must be ensured that no major breakdown occurs due to manufacturing defect during the warranty period. In case such breakdown occurs, AIIMS will reserve the right to extend the warranty period suitably.

12. Availability and Penalty

The site engineer deputed from the supplier for maintenance support should attend the breakdown call and make all efforts to rectify faults related to failure of hardware/software/network at the **Construction of Hostel Block** at AIIMS within 24 hours from the time of reporting of fault.

Hardware/Software/Network up time should be continuous throughout the year covering the normal working hours (8:00 AM to 4:30 PM) on all working days (Monday to Saturday) without fail.

A. For Desktops, UPSs and Printers:

(i) In case the faulty Computer desktop/UPS/Printer is not rectified within 24 hours from the time of reporting of fault, equivalent stand by equipment should be provided till the faulty item is not replaced/rectified.

(ii) If faulty item is not rectified within 48 hours from the time of reporting of fault then penalty equal to Rs.500/- per day shall be imposed and deducted from the performance bank guarantee/security deposit/pending bills.

B. For Networking:

If network breakdown is not rectified within 24 hours from the time of reporting, the penalty equal to Rs.1000/- per day shall be imposed and deducted from the performance bank guarantee/security deposit/pending bills.

FORM OF AGREEMENT

This Agreement made the _____ day of _____ 2010 _____
between All India Institute of Medical Science (AIIMS), NEW DELHI **for the
Construction of Hostel Block 1, 2 and 3 for AIIMS within AIIMS campus,
Ansari Nagar, New Delhi** (hereinafter called "The Employer") represented by
M/s HSCC (India) Limited; E-6(A), Sector-1, NOIDA (U.P)- 201301 who enters
into this Agreement of the one part and M/s
..... (hereinafter called "The Contractor") of
the other part.

Whereas the Employer is desirous that certain works should be executed by the
Contractor, viz _____ ("the Works") and has accepted a
Bid by the Contractor for the execution and completion of the works and the
remedying of any defects therein.

Now this Agreement witnessed as follows :

1. In this Agreement words and expressions shall have the same meanings
as are respectively assigned to them in the Conditions of Contract
hereinafter referred to.
2. The following documents shall be deemed to form and be read and
construed as part of this Agreement, viz :
 - (a) The Letter of Award;
 - (b) The said Bid;
 - (c) The General Conditions of Contract;
 - (d) Prequalification document
 - (e) Instructions to Tenderers and Specific Conditions of Contract;
 - (f) The Specification;
 - (g) The Drawings;
 - (h) The Priced Bill of Quantities;
 - (i) Any other relevant documents referred to in this Agreement or in
the aforementioned documents
3. In consideration of the payments to be made by the Employer to the
Contractor as hereinafter mentioned, the Contractor hereby covenants
with the Employer to execute and complete the Works and remedy any
defects therein in conformity in all respects with the provisions of the
Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of
the execution and completion of the Works and the remedying of defects

therein the Contract Price or only such other sums as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

In Witness whereof the parties hereto have caused this Agreement to be executed the day and year first before written.

Signed, Sealed, and Delivered by the Said

Binding Signature of [HSCC] for and on behalf of All India Institute of Medical Science (AIIMS), NEW DELHI

Binding Signature of Contractor

In the presence of

Witness (1) :

Witness (2) :

ANNEXURE - B

PROFORMA FOR PERFORMANCE BANK GUARANTEE

(On a stamp paper of appropriate value from any Nationalised Bank or Scheduled Bank)

To,

M/s HSCCdia) Ltd.,
Plot No. 6(A), Block E, Sector 1,
NOIDA - 201 301.

Dear Sir,

In consideration of the All India Institute of Medical Science (AIIMS), NEW DELHI for Construction of Hostel Block 1, 2 and 3 for AIIMS within AIIMS campus, Ansari Nagar, New Delhi which expression shall include his successor and assignees represented by his Consultant, M/s. HSCC(India) Ltd., Plot – 6 (A), Block - E, Sector - I, Noida, Uttar Pradesh - 201 301 (hereinafter called HSCC) having awarded to M/S _____ (hereinafter referred to as the said Contractor or 'Contractor' which expression shall wherever the subject or context so permits include its successors and assignees) a Contract No _____ in terms inter alia, of the HSCC Letter No. _____ dated _____ and the General Conditions of Contract and upon the condition of the Contractor's furnishing Security for the performance of the Contractor's obligations and discharge of the Contractor's liability under and in connection with the said Contract upto a sum of Rs.

_____ (Rupees _____ only) amounting to _____ percent of the total Contract value.

1. We, _____ (hereinafter called 'The Bank' which expression shall include its successors and assignees) hereby jointly and severally undertake to guarantee the payment to the Employer in rupees forthwith on demand in writing and without protest or demur or any and all moneys payable by the Contractor to the Employer in respect of or in connection with the said Contract inclusive of all the Employer's losses and damages and costs, (inclusive between attorney and client) charges and expenses and other moneys payable in respect of the above as specified in any notice of demand made by the Employer to the Bank with reference to this guarantee upto an aggregate limit of Rs. _____ (Rupees _____ only).
2. We _____ Bank Ltd. further agree that the Employer shall be sole judge of and as to whether the said Contractor has committed any breach or breaches of any of the terms and conditions of the said

Contract and the extent of loss, damage, cost, charges and expenses caused to or suffered by or that may be caused to or suffered by the Employer on account thereof and the decision of the Employer that the said Contractor has committed such breach or breaches and as to the amount or amounts of loss, damage, costs, charges and expenses caused to or suffered by the Employer from time to time shall be final and binding on us.

3. The Employer shall be at liberty without reference to the Bank and without affecting the full liability of the Bank hereunder to take any other Security in respect of the Contractor's obligations and liabilities hereunder or to vary the Contract or the work to be done there under vis-a-vis the Contractor or to grant time or indulgence to the Contractor or to reduce or to increase or otherwise vary the prices of the total Contract value or to release or to forbear from enforcement of all or any of the Security and/or any other Security(ies) now or hereafter held by The Employer and no such dealing(s) reduction(s) increase(s) or other indulgence(s) or arrangements with the Contractor or release or forbearance whatsoever shall absolve the bank of the full liability to the Employer hereunder or prejudice the rights of the Employer against the bank.
4. This guarantee shall not be determined or affected by the liquidation or winding up, dissolution, or change of constitution or insolvency of the Contractor but shall in all respects and for all purposes be binding and operative until payment of all monies payable to the Employer in terms thereof.
5. The bank hereby waives all rights at any time inconsistent with the terms of this guarantee and the obligations of the Bank in terms hereof shall not be anywise affected or suspended by reason of any dispute or disputes having been raised by the Contractor stopping or preventing or purporting to stop or prevent any payment by the Bank to the Employer in terms hereof.
6. The amount stated in any notice of demand addressed by the Employer to the Bank as liable to be paid to the Employer by the Contractor or as suffered or incurred by the Employer on account of any losses or damages or costs, charges and/or expenses shall be conclusive evidence of the amount so liable to be paid to the Employer or suffered or incurred by the Employer as the case may be and shall be payable by the Bank to The Employer in terms hereof.
7. This guarantee shall be a continuing guarantee and shall remain valid and irrevocable for all claims of the Employer and liabilities of the Contractor arising upto and until midnight of _____.

8. This guarantee shall be in addition to any other guarantee or Security whatsoever that the Employer may now or at any time anywise may have in relation to the Contractor's obligations/or liabilities under and/or in connection with the said Contract, and the Employer shall have full authority to have recourse to or enforce this Security in preference to any other guarantee or Security which the Employer may have or obtain and no forbearance on the part of the Employer in enforcing or requiring enforcement of any other Security shall have the effect of releasing the Bank from its full liability hereunder.
9. It shall not be necessary for the Employer to proceed against the said Contractor before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding that any Security which The Employer may have obtained or obtain from the Contractor shall at the time when proceedings are taken against the said bank hereunder be outstanding or unrealised.
10. We, the said Bank undertake not to revoke this guarantee during its currency except with the consent of the Employer in writing and agree that any change in the constitution of the said Contractor or the said bank shall not discharge our liability hereunder.
11. We_____ the said Bank further that we shall pay forthwith the amount stated in the notice of demand notwithstanding any dispute/difference pending between the parties before the arbitrator and/or that any dispute is being referred to arbitration.
12. Notwithstanding anything contained herein above, our liability under this guarantee shall be restricted to Rs._____ (Rupees_____) and this guarantee shall remain in force till_____ and unless a claim is made on us within 3 months from that date, that is before _____ all the claims under this guarantee shall be forfeited and we shall be relieved of and discharged from our liabilities there under.

Dated_____ day of_____ 20

For and on behalf of Bank.

Issued under seal :

PROFORMA FOR BID SECURITY BANK GUARANTEE

(To cover payment of Bid Security and Conditions of Contract)

(On a stamp paper of appropriate value from any Nationalised Bank or Scheduled Bank)

To

M/s HSCC (India) Ltd.,
Plot No. 6(A), Block E, Sector 1,
NOIDA - 201 301.

Dear Sir,

In consideration of your agreeing to accept Bank Guarantee for Rs.

.....
(Rupees) in
lieu of payment from M/s
having its /their registered office at

.....
(hereinafter called the Bidder) towards Bid Security in respect of your Tender no.

.....
..... calling for Tender for

.....
at and for due fulfilment of the terms and
conditions of the said Tender, we hereby undertake and agree to indemnify and
keep you indemnified to the extent of Rs (Rupees
.....
.....).

In the event of any loss or damages, costs, charges or expenses caused to or
suffered by you by reason of any breach or non observance on the part of the
Bidder of any terms and conditions of the said Tender, we shall on demand and
without cavil or argument, and without reference to the Bidder, irrevocably and
unconditionally pay you in full satisfaction of your demand the amounts claimed
by you, provided that our liability under this guarantee shall not at any time
exceed Rs
(Rupees).

This guarantee herein contained shall remain in full force and till you finalise the
Tender and select the Tender as per your choice and it shall in the event of the
said Bidder being selected and entrusted with the said work, continue to be
enforceable till the said Bidder executes the Agreement with you and
commences the work as stipulated under the terms and conditions of the said
Tender have been fully and properly carried out by the said Bidder and
accordingly discharges the guarantee.

We also agree that your decision as to whether the Bidder has committed any
breach or non observance of the terms and conditions of the said Tender shall be
final and binding on us.

We under take to pay the Consultant any money so demanded by the Consultant notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceedings pending before any Court or Tribunal relating thereto, our liability under this present being absolute and equivocal.

The payment so made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor(s) shall have no claim against us for making such a payment.

This guarantee shall continue to be in full force and effect for a period of 180 days from the date of submission of Bid.

We shall not revoke this guarantee during its currency except with your previous consent in writing. This guarantee shall not be affected by any change in Constitution of our bank or of the Bidder firm. Your neglect or forbearance in the enforcement of the payment of any money, the payment whereof is intended to be hereby secured or the giving of time for the payment hereto shall in no way relieve us our liability under this guarantee.

Dated this day of

Yours faithfully,

For

Signature & seal of the Bank (Authorised Signatory)

APPENDIX TO TENDER

| Important Clause | Clause No. | Volume | Remarks |
|--|-------------------|---------------|--|
| Amount of Performance Security | 10.1 | I | 5% of the Contract Price |
| Minimum amount of third party Insurance | 23.2 | I | Rs. 1,00,0000=00 for Any incident, no. of incidents Unlimited. |
| Amount of Liquidated damages | 47.1 | I | 0.5% of Contract price per week of delay |
| Limit of Liquidated Damages | 47.1 | I | 5% of Contract Price |
| Defect Liability Period | 49.1 | I | 12 Months |
| Percentage of Retention | 33 (g) | II | 5% of Contract Price |
| Programme of work and updated progress reports | 39.6 | III | Programme updated monthly, progress reported weekly |
| Time of Completion | 43.1 / 1.4 | II / III | within Twenty calendar month |

ANNEXURE - E

PROFORMA FOR RETENTION MONEY BANK GUARANTEE
(On a stamp paper of appropriate value from any Nationalised Bank or Scheduled Bank)

To,

M/s HSCC (INDIA) Ltd.,
Plot No. 6(A), Block E, Sector 1,
NOIDA - 201 301.

Dear Sir,

In consideration of All India Institute of Medical Science (AIIMS), NEW DELHI the Construction of Hostel Block for AIIMS within All India Institute of Medical Science (AIIMS), campus, Ansari Nagar, New Delhi which expression shall include his successor and assigns represented by his Consultant M/s. HSCC (INDIA) Ltd., Plot - 6 (A), Block - E, Sector - I, Noida, Uttar Pradesh - 201 301 (hereinafter called HSCC) having awarded

to _____ (hereinafter referred to as the said Contractor or 'Contractor' which expression shall wherever the subject or context so permits include its successors and assigns) and the General Conditions of Contract and upon the condition of the contractor's furnishing guarantee for the retention of the contractor's obligations and discharge of the contractor's liability under and in connection with the said contract upto a sum of Rs.

_____ (Rupees
_____ only) amounting to 2.5% of the total contract value.

1. We, _____ (hereinafter called 'The Bank' which expression shall include its successors and assigns) having its branch office at _____ (a Company under the provisions of the Companies Act 1913 hereby jointly and severally undertake to guarantee the payment to the Employer in rupees forthwith on demand in writing and without protest or demur or any and all moneys anywise payable by the contractor to the Employer under in respect of or in connection with the said contract inclusive of all the Employer's losses and damages and costs, (inclusive between attorney and client) charges and expenses and other moneys anywise payable in respect of the above as specified in any notice of demand made by the Employer to the Bank with reference to this guarantee upto an aggregate limit of _____ Rs. _____ (Rupees _____ only).

2. We _____ Bank Ltd. further agree that The Employer shall be sole judge of and as to whether the said contractor has committed any breach or breaches of any of the terms and conditions of the said contract and the extent of loss, damage, cost, charges and expenses caused to or suffered by or that may be caused to or suffered by The Employer/HSCC on account thereof and the decision of The Employer that the said Contractor has committed such breach or breaches

and as to the amount or amounts of loss, damage, costs, charges and expenses caused to or suffered by The Employer from time to time shall be final and binding on us.

3. The Employer shall be at liberty without reference to the Bank and without affecting the full liability of the Bank hereunder to take any other security in respect of the Contractor's obligations and liabilities hereunder or to vary the contract or the work to be done thereunder vis-a-vis the Contractor or to grant time or indulgence to the Contractor or to reduce or to increase or otherwise vary the prices of the total contract value or to release or to forbear from enforcement of all or any of the security and/or any other security(ies) now or hereafter held by The Employer and no such dealing(s) reduction(s) increase(s) or other indulgence(s) or arrangements with the Contractor or release or forbearance whatsoever shall absolve the bank of the full liability to The Employer hereunder or prejudice the rights of The Employer against the bank.
4. This guarantee shall not be determined or affected by the liquidation or winding up, dissolution, or change of constitution or insolvency of the Contractor but shall in all respects and for all purposes be binding and operative until payment of all monies payable to The Employer in terms thereof.
5. The bank hereby waives all rights at any time inconsistent with the terms of this guarantee and the obligations of the Bank in terms hereof shall not be anywise affected or suspended by reason of any dispute or disputes having been raised by the Contractor stopping or preventing or purporting to stop or prevent any payment by the Bank to The Employer in terms hereof.
6. The amount stated in any notice of demand addressed by The Employer to the Bank as liable to be paid to The Employer by the Contractor or as suffered or incurred by The Employer on account of any losses or damages or costs, charges and/or expenses shall be conclusive evidence of the amount so liable to be paid to The Employer or suffered or incurred by The Employer as the case may be and shall be payable by the Bank to The Employer in terms hereof.
7. This guarantee shall be a continuing guarantee and shall remain valid and irrevocable for all claims of The Employer and liabilities of the contractor arising upto and until midnight of _____.
8. This guarantee shall be in addition to any other guarantee or security whatsoever that The Employer may now or at any time anywise may have in relation to the Contractor's obligations/or liabilities under and/or in connection with the said contract, and The Employer shall have full authority to have recourse to or enforce this security in preference to any other guarantee or security which The Employer may have or obtain and no forbearance on the part of The Employer in enforcing or requiring enforcement of any other security shall have the effect of releasing the Bank from its full liability hereunder.
9. It shall not be necessary for The Employer to proceed against the said Contractor before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding that any security which The Employer may have obtained or obtain from the

contractor shall at the time when proceedings are taken against the said bank hereunder be outstanding or unrealised.

10. We, the said Bank undertake not to revoke this guarantee during its currency except with the consent of The Employer in writing and agree that any change in the constitution of the said contractor or the said bank shall not discharge our liability hereunder.
11. We _____ the said Bank further that we shall pay forthwith the amount stated in the notice of demand notwithstanding any dispute/difference pending between the parties before the arbitrator and/or that any dispute is being referred to arbitration.
1. Notwithstanding anything contained herein above, our liability under this guarantee shall be restricted to Rs. _____ (Rupees _____) and this guarantee shall remain in force till _____ and unless a claim is made on us within 3 months from that date, that is before _____ all the claims under this guarantee shall be forfeited and we shall be relieved of and discharged from our liabilities thereunder.

Notwithstanding anything contained herein,

- a) Our liability under this bank guarantee shall not exceed Rs. _____ (Rupees _____).
- b) This bank guarantee shall be valid up to _____
- c) We are liable to pay the guarantee amount or any part thereof under the Bank Guarantee only & only if you serve upon us as a written claim or demand on or before _____.

Dated _____ day of _____ 20

For and on behalf of Bank.

Issued
under
seal :

TECHNICAL SPECIFICATIONS

CIVIL WORKS

1.0 GENERAL:-

- 1.01 The specifications and mode of measurements for Civil and Plumbing works shall be in accordance with C.P.W.D. specifications 2009 Volumes I and II with up to date correction slips unless otherwise specified in the nomenclature of individual item or in the specifications. The entire work shall be carried out as per the C.P.W.D. specifications in force with up to date correction slips upto the date of opening of tender.
- 1.02 For the item not covered under CPWD Specifications mentioned above, the work shall be executed as per latest relevant standards/codes published by B.I.S. (formerly ISI) inclusive of all amendments issued thereto or revision thereof, if any, upto the date of opening of tenders.
- 1.03 In case of B.I.S. (formerly I.S.I) codes/specifications are not available, the decision of the Engineer based on acceptable sound engineering practice and local usage shall be final and binding on the contractor.
- 1.04 However, in the event of any discrepancy in the description of any item as given in the schedule of quantities or specifications appended with the tender and the specifications relating to the relevant item as per CPWD specifications mentioned above, or in drawings the former shall prevail.
- 1.05 In general the building floor to floor height is 3.25 mtr unless specified otherwise in the drawing. However, the rates for different items of work shall be for up to 4.5 m floor to floor height at all levels, lifts, leads and depths of the building except where otherwise specified explicitly in the item of work or in special conditions appended with the tender. All works above the top most terraces (main) shall be paid under the level existing below (i.e. machine room, mumty etc)
- 1.06 The work shall be carried out in accordance with the architectural, structural, plumbing and electrical drawings etc. The drawings shall have to be properly co-related before executing the work. In case of any difference noticed between the drawings, final decision, in writing of the Engineer shall be obtained by the contractor. For items, where so required, samples shall be prepared before starting the particular items of work for prior approval of the Engineer and nothing extra shall be payable on this account.
- 1.07 All materials to be used on works shall bear I.S. certification mark unless specifically permitted otherwise in writing. In case I.S. marked materials are not available (not produced),

the materials used shall conform to I.S. Code or CPWD specifications, as applicable in this contract.

In such cases the Engineer shall satisfy himself about the quality of such materials and give his approval in writing. Only articles classified as "First Quality" by the manufacturers shall be used unless otherwise specified. All materials shall be tested as per provisions of the Mandatory Tests in CPWD specifications and the relevant IS specifications. The Engineer may relax the condition regarding testing if the quantity of materials required for the work is small. Proper proof of procurement of materials from authentic manufacturers shall be provided by the contractor to the satisfaction of Engineer. Grade of cement used shall be OPC 43 Grade unless otherwise specified explicitly. The contractor shall get the Design Mix for RCC done by the labs approved by OWNER only. Reinforcement Steel used shall be of TMT Fe-500 unless otherwise specified.

- 1.08 In respect of the work of the sub-agencies deployed for doing work of electrification, air-conditioning, external services, other building work, horticulture work, etc. for this project and any other agencies simultaneously executing other works, the contractor shall afford necessary coordination and facilities for the same. The contractor shall leave such necessary holes, openings, etc. for laying / burrying in the work pipes, cables, conduits, clamps, boxes and hooks for fan clamps, etc. as may be required for the electric, sanitary air-conditioning, fire fighting, PA system, telephone system, C.C.T.V. system, etc. and nothing extra over the agreement rates shall be paid for the same.
- 1.09 Unless otherwise specified in the bill of quantities, the rates for all items of work shall be considered as inclusive of pumping out or bailing out water if required for which no extra payment will be made. This will include water encountered from any source such as rains, floods, or due to any other cause whatsoever.
- 1.10 Any cement slurry added over base surface (or) for continuation of concreting for bond is added its cost is deemed to have in built in the item unless otherwise/explicitly stated and nothing extra shall be payable or extra cement considered with consumption on this account.
- 1.11 The rate for all items in which the use of cement is involved is inclusive of charges for curing.
- 1.12 The contractor shall clear the site thoroughly of all scaffolding materials and rubbish etc. left out of his work and dress the site around the building to the satisfaction of the Engineer before the work is considered as complete.
- 1.13 Rates for plastering work (excluding washed grit finish on external wall surfaces) shall include for making grooves, bands etc. wherever required and nothing extra shall be paid for the same.
- 1.14 The rates quoted for all brick/concrete work shall be deemed to include making openings and making good these with the same specifications as shown in drawings and/or as directed. No extra payment shall be made to the contractor on this account.
- 1.15 Rates for all concrete/plaster work shall include for making drip course moulding, grooves etc. wherever required and nothing extra shall be paid for the same.
- 1.16 Rates for flooring work shall include for laying the flooring in strips/as per sample or as shown in drawings wherever required and nothing extra shall be paid for the same.

- 1.17 The drawing(s) attached with the tender documents are for the purpose of tender only, giving the tenderer a general idea of the nature and the extent of works to be executed. The rates quoted by the tenderer shall be deemed to be for the execution of works taking into account the "Design Aspect" of the items and in accordance with the "Construction Drawings" to be supplied to the Contractor during execution of the works.
- 1.18 The quoted rate shall be for finished items and shall be complete in all respects including the cost of all materials, labour, tools & plants, machinery etc., all taxes, duties, levies, octroi, royalty charges, statutory levies etc. applicable from time to time and any other item required but not mentioned here involved in the operations described above. The client/OWNER/Employer shall not be supplying any material, labour, plant etc. unless explicitly mentioned so.
- 1.19 On account of security consideration, there could be some restrictions on the working hours, movement of vehicles for transportation of materials and location of labour camp. The contractor shall be bound to follow all such restrictions and adjust the programme for execution of work accordingly.
- 1.20 The contractor has to ensure co-ordination with Institute authorities to maintain the smooth functioning / operation of existing Institute without disruption during the execution of work. This may require working rescheduling the normal working hours, working in restricted period etc. Nothing extra shall be payable on this account.
- He shall also ensure that all work sites within the Institute complex are properly cordoned off by means of barricades and screens upto a height of 3.0 m above ground level. The contractor shall use painted CGI sheets which are in good condition mounted on steel props.
- 1.21 Stacking of materials and excavated earth including its disposal shall be done as per the directions of the Engineer-in-Charge. Double handling of materials or excavated earth if required shall have to be done by the contractor at his own cost.

2.0 CHEMICAL RESISTANT EPOXY RESIN WALL COATING

MATERIAL

The system shall consist of 2 component solvent free, epoxy based, chemical resistant coating. The thickness of the coating shall be between 300 microns depending on the number of coats. The application of primer and coating is to be done as per the manufacturer's specifications.

a. A coat of primer shall be applied over clean, dry surface:

b. While the primer coat is tack-free, two topcoats of epoxy shall be applied:

APPLICATION/LAYING PROCEDURE

The surface should be properly cleaned and should be free from oil, grease, cement laitance and dust. The surface should be free from potholes, honeycombing, potholes & cavities. If defects are found, the surface should be prepared to a smooth finish.

The surface should be primed using epoxy primer Allow the primer to dry overnight so that it is tack-free.

Top coat of epoxy should be applied in two coats to a thickness of 300 microns. The first coat should be allowed to become tack free before the second coat is applied.

The system should be air cured for a minimum period of 5 to 7 days to achieve the best results against loading & chemical resistance.

3.00 WATE PROOFING TREATMENT BY CHEMICAL INJECTION SYSTEM (PRECONSTRUCTION)

3.01 HORIZONTAL SURFACE (RAFT SLAB)

A. Before the raft reinforcement is placed in position:

- 1.1 Laying PCC as per drawings and specifications.(payable under the corresponding item)
- 1.2 Cement slurry (cement and polymer based water proofing compound) is spread on the PCC for proper bonding with subsequent water proofing treatment.
- 1.3 Water Proofing Course of 20mm thick cement mortar 1:4 (1 cement: 4 coarse sand) mixed with polymer based water proofing compound is laid over the slurry. Stone aggregates 12mm down is embedded at random.
- 1.4 After 24 hours, spreading cement slurry (cement and polymer based water proofing compound) on the 1st layer of mortar.
- 1.5 Providing and laying 2nd layer of 20mm thick cement mortar 1:4 mixed with polymer based water proofing compound. Stone aggregate 12mm down is embedded at random.
- 1.6 After curing for two days, spread cement slurry mixed with water proofing compound over the 2nd layer of cement mortar. Thereafter, the 3rd and final layer of 20mm thick cement mortar in 1:4 mixed with water proofing compound is laid and finished smooth to receive raft foundation.
- 1.7 The total thickness of the treatment from operation 1.2 to 1.6 will be about 60mm.

B. After The reinforcement of raft is placed in position:

- 2.1 Providing and fixing 25mm dia GI threaded grouting nozzles of adequate length at the specified locations @ 1.50 metre c/c or as shown in the drawing all over the slab. The grouting nozzles are tied with reinforcement in such a manner as not to choke its end during concrete operations. The top of these nozzles protrudes above the raft concrete.
- 2.2 After minimum 7 days of concreting, cement grout of cement and polymer based water proofing compound (non shrinkage grouting compound) in proportion as specified is injected, through these nozzles at the pressure of 2.5 to 3.0 Kg/Sq.cm.
- 2.3 After grouting, top of the nozzles is cut and the space is filled with cement mortar 1:2 (1 cement: 2 coarse sand) mixed with polymer based water proofing compound.

3.02 Retaining Wall

- 1.1 The external surface is prepared and polymer based cement slurry is applied.
- 1.2 Providing and laying 25mm thick cement mortar in 1:4 (1 cement : 4 coarse sand) mixed with polymer based water proofing compound in two layers with chicken wire mesh 26 or 24 gauge 25mm size in between the two layers.
- 1.3 The G.I. pipes are placed at 1.5m c/c and at location indicated as per drawing and securely fastened to the reinforcement prior to shuttering and concreting or alternately by drilling holes (25mm to 32mm dia) in the concrete upto a depth as shown in the drawing all over the wall surface @ 1.50mt. c/c and as shown in the drawing. Treatment along all construction joints by providing nozzles, as above, shall also be executed.
- 1.4 Fixing 25mm dia G.I. threaded nozzles in these holes with cement mortar 1:4 mixed with water proofing compound.
- 1.5 Injecting cement grout of cement and polymer based water proofing compound (non shrinkage grouting compound) in proportion as specified in these nozzles at a pressure of 2.5 to 3.0 Kg/Sq.cm.
- 1.6 After the grout the nozzles are cut and filled with cement mortar 1:2 mixed with polymer based water proofing compound in proportion as specified and finished smooth.

Note: The proportion of acrylic based polymer compound to be used in respect of ordinary cement shall be 1% by weight.

Acrylic based integral water proof compound shall satisfy the provision IS: 2645.

Guarantee for water proofing:

Work to be get executed through a approved specialized agency & covered by a 10 years guarantee by the main contractor against leakage, seepage and dampness etc. for which necessary performance guarantee for requisite indicated value of work shall be furnished by the contractor before completion.

Measurements:

The length and breath shall be measured correct to cm. The flooring area shall be measured in sq.m. actually executed in raft slab. Inside wall surfaces of the basement upto ground level from top of raft slab shall be measured in sq.m.

Columns cross sections area not to be deducted from the plan area.

Rate:

Rates shall be inclusive of all operations including labour, material, T&P, scaffolding etc. complete. Nothing extra shall be payable on any account.

4.00 ALUMINIUM COMPOSITE PANEL METAL CLADDING

4.01 Scope of Work

The contractor shall design, supply, fabricate, deliver and install and guarantee all construction necessary to provide a complete aluminium composite panel cladding, complete with all necessary anchors, hardware and fittings to provide a total installation, fully in conformity with the requirements and intent of the drawing and specification as per item description.

The scope of work shall be read in conjunction with those in the specification of curtain walling.

4.02 Design Concept

- a) The proposed cladding shall be based on a water-tight system.
- b) A 20mm wide joint shall be provided between cladding elements to cater for individual panel installation and shall be sealed off with extruded EPDM gasket or silicon sealant.

4.03 Aluminium Composite Panel Cladding

Providing, designing, cutting, bending and fixing 4mm thick aluminium composite cladding of approved make on external façade of size as shown with Water tight system either curved or straight in plan. Skin material 0.5mm thick aluminium sheet (3005 H6) core material natural polyethylene, aluminium cladding panel to be of approved colour/shade fixed with extruded aluminium basic frame, angle cleats, weather sealants, rivets, GI brackets all as approved, using suitable chemical/anchor bolts on structural steel work including necessary accessories complete in all respects. Where level difference is shown dummy structural steel backup frame shall be provided. Protective Film: The finished surface shall be protected with 80 microns self adhesive Peel Off film with two layers of white and black tested to withstand at least 6 months exposure to local weather condition, without loosing the original peel off characteristic or causing stains or other damages.

The quoted rate to include for any provision of openable access panels for services wherever required. Weather silicon sealant, non streaking /staining weather sealant shall also be used wherever required.

Technical Data

| | | |
|----|-------------|---|
| A. | Composition | Skin material 0.5mm thick aluminium sheet (3005 H6) core material natural polyethylene. |
| B. | Dimensions | Panel thickness : 4mm Panel size: Width 1000/1250/1500mm Length between 1500 and 5000mm Tolerance Width \pm 2.0mm Length \pm 4.0mm Thickness + 0.02mm |

| | | |
|----|-----------------------|--|
| C. | Principal Properties | Panel weight: 5.5 kg/sq.m Thermal expansion: 1mm/M/60 deg.C. |
| D. | Acoustic Properties | Average airborne sound transmission loss 26 db. |
| E. | Mechanical Properties | Tensile Strength RM> 160 MPa. 0.2% Proof stress RP> 130 MPa. Modulus of Elasticity E 70,000 MPa. Elongation A-50 – 5-7% |
| | Aluminium Extrusions | Extrusions shall be of aluminium alloy 6063 T5, conforming to BS-1470 – 1475 : 1972 in mill finish. |

4.03.1 Design Wind Loading

850 N/m² positive and negative to Podium.
1150 N/m² positive and negative to Tower.
1500 N/m² positive and negative to Crown to Tower.

No cladding element shall sustain permanent deformation or failure under loading equivalent 1.5 times the design wind pressure specified.

4.03.2 Deflection

Deflection of any aluminium frame shall not exceed 1/175 of the clear span.

4.03.3 Expansion and Contraction

The cladding shall be so fabricated and erected as to provide for all expansion and contraction of the components. Any temperature change due to climatic conditions shall not cause harmful buckling, opening of joints, undue stress on fastening and anchors, noise of any kind or other defects.

4.03.4 Flatness

The cladding surface taken individually shall not have any irregularities such as oil canning, waves, buckles and other imperfections when viewed at any position but not less than at an angle of 15 degrees to the true plane of the panel with natural lighting of incident of not less than the same angle.

4.03.5 Water Tightness

The panel cladding shall be so constructed to be water tight with provision for rear ventilation.

4.03.6 Acoustic Treatment

The cladding panel system shall be designed so as to dampen noise caused by splashing water.

4.04 Fixings

- a) Fasteners including concealed screws, nuts, bolts and other items required for connecting aluminium to aluminium shall be of non-magnetic stainless steel.
- b) Rivets used for fastening panel to aluminium sub-frame shall be of alloy aluminium large flange head type with stainless steel mandrel.
- c) All fixing anchors, brackets and similar attachments used in the erection shall be of aluminium or non-magnetic stainless steel.

4.05 Weather seal

- a) All exposed joints between panel which require to be water tight shall be sealed with extruded EPDM gasket of hardness approx. 75 SHORE.
- b) All secondary weather seal shall be of self-adhesive tape as approved by Architects.

5.00 STRUCTURAL/CURTAIN WALL SYSTEM

5.01 SCOPE OF WORK

- A. The contractor shall design, engineer, test, fabricate, deliver, install, and guarantee all construction necessary to provide a complete curtain wall/structural glazing system to the proposed building, all in conformity with the Drawings as shown. Specification and all relevant construction regulations including providing any measures that may be required to that end, notwithstanding any omissions or inadequacies of the Drawings and/or

Without limiting the generalities of the foregoing, the Curtain Wall/structural glazing Systems shall include, without being limited to, the followings:

Metal frames, glass glazing, spandrels, ventilators, finish hardware, copings metal closure, windows etc.

All anchors, attachments, reinforcement and steel reinforcing for the systems required for the complete installations.

All thermal insulation associated with the system.

All fire protection associated with the system.

All copings, end closure and metal cladding to complete the system.

All sealing and flushing including sealing at junctions with other trades to achieve complete water tightness in the system.

Isolation of dissimilar metals and moving parts.

Anticorrosive treatment on all metals used in the system.

Polyester powder coating aluminium sections.

- B. The contractor shall also be responsible for providing the followings:

1. Engineering Proposals, Shop Drawings, Engineering data and Structural Calculations in connection with the design of the Curtain Wall/structural glazing System.
 2. Scheduling and Monitoring of the Work.
 3. Mock-ups, samples and test units.
 4. Performance Testing of the Curtain Wall/structural glazing framing and glazing assembly.
 5. Co-ordination with work of other trades.
 6. Protection.
 7. All final exterior and interior cleaning and finishing of the Curtain Wall /structural glazing System
 8. As-built record drawings and photographs.
 9. Guarantees and Warranties.
 10. All hoisting, staging and temporary services.
 11. Conceptualising and design of a suitable maintenance system for curtain/structural glazing.
- C. The water tightness and structural stability of the whole Curtain Wall /structural glazing System are the prime responsibility of the Contractor. Any defect or leakage found within the Guarantee Period shall be sealed and made good all at the expense of the Contractor.
- D. The curtain wall/structural glazing system shall be designed to provide for expansion and contraction of components which will be caused by an ambient temperature range without causing buckling, stress on glass, failure of joint sealants, undue stress on structural elements or other detrimental effects. Specific details should be designed to accommodate thermal and building movements.

5.02 BUILDING REGULATIONS

Curtain Wall/structural glazing shall comply with all Government Codes and Regulations including IS codes, if any.

All curtain walling/structural glazing, individual aluminium and glass components and all completed work shall be designed and erected to comply with the following:

- a) Design load and deflection.
- i) Curtain Wall/structural glazing construction in its entirety shall be fabricated and erected to withstand without damage or permanent deformation inward (positive) and outwards (negative) pressure, all acting normal to the construction plane with a maximum deflection of not exceeding 1/175 of the clear span between structural support or 20mm maximum whichever is less.

- ii) Structural performance of all parts of curtain wall/structural glazing system shall conform to relevant IS codes, wind load as per IS-875 and seismic loads as per IS-1893. Deflection shall cause no permanent set in excess of 1/1000 of span nor evidence of structure failure.

5.03 MEASUREMENTS

Measurements of the Curtain Wall /structural glazing shall be in the metric system in sq.m correct to two places of decimal. The area considered for measurement shall be net area as fixed on the exterior face of the curtain wall/structural glazing including open able windows as part of curtain wall/structural glazing. The contractor shall be responsible for verifying all the dimensions and actual conditions on site.

5.04 RATE

The rates shall include the cost of all the operations described above including the cost of all materials, labour, design, fabrication, erection, finishing, scaffolding and testing of water tightness etc.

5.05 TENDER DRAWINGS AND SPECIFICATIONS

The tender drawings indicate profile and configuration required together with relationship to structural frame and interior building elements.

The Specification and tender drawings is of the performance type and includes only the minimum requirements of the /structural glazing Wall System without limiting the Contractor to the method of achieving desired performance.

5.06 POST TENDER REQUIREMENTS

a) Design Proposals

The contractor shall propose the final design in such a way that all basic functional and architectural requirements are fulfilled and get the same approved by Deptt. However, basic design requirements as described in the specification and other Architectural requirements such as the size of window, net glass area, ventilator, configuration of windows and spandrels shall be retained.

The design proposals shall be in the form of drawings, drawn to full scale as far as practical and specification shown in or describing all items of work including:

- i) Request details as indicated on the tender drawings.
- ii) Metal quality, finishes and thickness.
- iii) Glass quality, coating and thickness and proposed manufacturer's brand names.
- iv) Sections of the mullion and transom together with structural calculations.
- v) Arrangement and jointing of components.
- vi) Field connections especially mullion to mullion and transom to mullion.
- vii) Fixing and anchorage system of typical wall unit together with structural calculations.

- viii) Drainage system and provision in respect of water leakage in the curtain wall/structural glazing system.
- ix) Provisions for thermal movements.
- x) Sealant and sealing method.
- xi) Glazing method.
- xii) Wind load and seismic load and any other specific load considered in the design.
- xiii) Lightning protection link-up system of the curtain wall/structural glazing for connection and incorporation into the lightning conductor system of the building . Design concept must be stated in the proposal.

The maximum permissible structural tolerances of the building that the system has been designed to accommodate in case this tolerance exceed those specified in the Specification.

Any parts of the curtain wall/structural glazing, when completed, shall be within the following tolerances:

Deviation from plumb, level or dimensioned angle must not exceed 3mm per 3.5m of length of any member, or 6mm in any total run in any line.

Deviation from theoretical position on plan or elevation, including deviation from plumb, level or dimensioned angle, must not exceed 9mm total at any location.

Change in deviation must not exceed 3mm for any 3.5m run in any direction.

b) Samples

The contractor shall also submit samples of mullion and transom sections in lengths of 300mm with the same finish and workmanship along with the proposals and 300mmx300mm samples of glass (samples to include exposed screws and other exposed securing devices, if any).

c) Preliminary Programme

The tenderer shall also submit a preliminary programme of the contract works showing the various stages of design sampling, testing, fabrication, delivery and installation of the works.

d) Upon approval of the shop drawings, at least 4 copies shall be submitted by the Contractor.

e) The Contractor/Sub-contractor shall submit a maintenance manual for the curtain wall/structural glazing system inclusive of all metal parts, glass and finish etc.

f) During detailed design and execution any details may increase as per actual requirement at site, these variations shall be executed without any extra cost implications to the client.

5.07 EXECUTION

Performance Testing

a) General Requirements

Mock-up units shall be constructed by the contractor and tested to determine the structural stability as well as air and water infiltration or leakage at glazing beads and all other joints designed into the façade.

After approval of structural calculations and shop drawings for the curtain wall/structural glazing, one (1) Test Unit for performance testing of the curtain wall/structural glazing shall be constructed by the contractor at a laboratory approved by the Department.

Erect mock-up under manufacturer's/installer's direct supervision and employ workmen as they would be employed during the actual erection at the job site.

Test procedures test schedules and test locations shall be submitted to Client for approval before testing.

Prior to fabrication of Test Units, the contractor shall submit shop drawings and calculations of the Test Unit for the Architect's approval.

Production for final job site erection shall not start until approval has been obtained as a result of the mock-up test.

b) Test of Wind Pressure

The equivalent load of wind pressure or wind suction shall be given to the Test Unit as increasing or decreasing the inside pressure in the 'Pressure Chamber' at which the Test Unit is fixed.

The static wind pressure shall be applied up to 1.5 Kpa at maximum wind pressure.

The variation of dynamic pressure shall be of any approximate sine-curve-line.

Deflection on each observational points of the Test Unit shall be observed and recorded under the Static pressure as described above.

Any damage and harmful permanent deformation on any parts except sealing materials shall not be found at maximum wind pressure.

The deflection on the main structural parts in these conditions shall not exceed:

1/175 of the span between supports or 20mm, whichever is the lesser for vertical elements.

1/250 of the span between supports for horizontal elements.

The extent of recovery of deformation 15 minutes after the removal of the test load is to be least 95%.

c) Test of Lateral Deflection Per Floor Height

Lateral deflection per floor height shall be occurred on the test unit, when the structural frame which fixes the test unit is deflected horizontally.

The deflection of every + 2.5mm shall be increased upto + 13mm on the Test Unit (Static Deflection Test).

The dynamic deflection shall be applied upto + 13mm.

The variation of dynamic deflection shall be of an approximate sine-curve-line, one period of 3 seconds.

The dimension of the deflection on each observational points of the Test Unit shall be measured under the condition as described above, the damage shall be observed.

Any damage and harmful permanent deformation shall not be found in any parts of the curtain wall/structural glazing except sealant at maximum deflection.

d) Test of Water-tightness

Water shall be sprinkled to the Test Unit under the wind pressure.

Pressure shall not be applied to the Test Unit.

The volume of the sprinkling water in one minute shall be 5 litres/m² min. (0.1 gal/sq/ft.).

All water leakage and drainage system at the joint and openable sash of the curtain wall/structural glazing system shall be observed from the outside of the chamber.

Hold the test 2 times, in sequence as described below, conforming to the above mentioned conditions.

Install the test unit.

Hold 1st water-tightness test.

Hold test of wind pressure as described above.

Hold 2nd water-tightness test.

Lateral deflection test.

Water leakage at all parts of the Test Unit shall not be observed inside during the 1st water-tightness test.

e) Test Report

The Contractor is required to submit five (5) copies of test reports to the Client.

f) Cost of Performance Test

The Contractor shall allow in his tender for the cost of the performance testing and of fabrication, erection, corrections to and demolition of the Test Units including any special provision required in the testing laboratory for the tests mentioned above.

The Contractor shall allow for amendments and adjustments to the mock-up as required by the Employer.

If the Test Unit fails to pass the initial testing, the Contractor shall make the necessary corrections to the Test Unit and shall have to get the Test Unit retested by the Testing Laboratory till it passes the tests.

Cost of corrections to the Test Unit and cost of re-testing shall be borne by the Contractor at no additional cost to the Employer.

g) Shop Drawings and Calculations for the Performance Testing

Prior to fabrication of Test Unit, the Contractor shall submit shop drawings and calculations of the Test Unit for Client/employer's approval.

h) Record Drawings

The testing laboratory shall keep copy of approved Test Unit shop drawings and calculations at testing laboratory during testing of Test Unit.

The testing laboratory shall accurately and neatly record on the above mentioned shop drawings all changes, revisions, modification etc. made to Test Unit, which shall become the record drawings.

At completion of testing and after approval of test reports the testing laboratory shall submit the marked-up record drawings to the Client.

i) Contractor's Representatives

Full time attendance by Approved Representatives of the Contractor & subcontractor associated with the erection of curtain wall/structural glazing shall be provided for the erection of the Test Unit and for all testing of the Test Unit.

5.08 PERFORMANCE GUARANTEE

The tenderer shall provide a performance guarantee of requisite value to be indicated in the General Conditions of Contract for a period of five years, to provide for expenses, to cover the risk and cost of rectification of defect, noticed during the five years guarantee period. Guarantee period to start from the date of completion of the project.

6.0 ACOUSTIC CELING

6.1 The acoustic tiles shall be procured from an approved manufacturer as directed by Engineer-In-Charge.

6.2 The tiles and the suspension system shall be as specified in the item nomenclature .The Contractor shall prepare the shop drawings for the False Ceiling based on actual measurements at site and based on the architectural drawings, clearly indicating the typical panel as well as edge panel on all sides with details to adjust the minor variations in orthogonal. Also, junction details with different types of false ceiling materials shall be prepared and submitted for the approval of the Engineer-in-Charge before execution.

6.3 The installation shall be got done through a reputed interior contractor who shall be engaged by the Contractor. The false ceiling shall be perfectly level after installation.

6.4 The Contractor shall then prepare the mock-up at site for approval of material and quality of workmanship by the Engineer-in-Charge. Only after the approval of Mock-up, the Contractor shall start the mass work.

6.5 The acoustic tiles shall be of size 600x600 mm or as required as per the architectural drawings and as per the site requirements and shall be of the texture and physical &

other characteristics as per approved brand. The tiles shall have NRC, humidity resistance, light reflectance, thermal conductivity and other properties as described in the BOQ item. The contractor shall obtain and submit to the Department the manufacturer's certificate for compliance of the acoustic tiles & the suspension system as per the manufacturer's specifications and also copy of the manufacturer's test report for the record.

- 6.6 The tiles shall be made of non-combustible bio-soluble wool and shall have finely granulated surface texture with virtually invisible micro-perforations as specified & as required for its performance. It shall meet the various performance parameters like aesthetics, acoustics (sound absorption), hygiene, humidity resistance, impact resistance, fire resistance, durability etc.
- 6.7 The tiles shall have precisely machined edges including edge treatment required for the installation depending on the type of suspension system grid of brand and manufacture as approved by the Engineer-in-Charge / Consultant and as per the architectural drawings. The openings of required size for light fittings; fire detection devices, sprinklers, AC diffusers etc. shall be suitably made in the tiles by cutting in an approved and workmanlike manner. For the purpose of measurement, no deduction shall be made in the area of false ceiling on this account. Also, nothing extra shall be payable on this account. The end tiles shall be cut to the required size in a workman like manner as per the site requirement. Nothing extra shall be payable on account of any wastage in the material and /or account of providing grid at closure spacing than 600mm c/c.
- 6.8 These tiles shall be fixed on to coordinated suspension ceiling system with supporting grids system that fully integrates with the ceiling tiles. It shall be ensured that the suspension system shall be suitable to take the entire incidental and dead loads and other authorized loads efficiently and shall not sag. The permissible sag shall be as per the British Standards BS 8290 - 1991. The Contractor shall provide a guarantee for 10 years against sag on account of defective material and / or workmanship.
- 6.9 The suspension system shall consist of hangers, main runners, cross tees, perimeter trims, wall connectors etc. The hangers shall be securely fixed to the structural soffit/slab/beams at spacing not more than 1200mm centre to centre by using electroplated Galvanized M.S anchor fasteners of 6 mm (minimum) diameter of approved make and of adequate capacity to carry the design loads. The main runners shall be fixed at spacing not more than 600mm centre to centre. The last hanger at the end of each main runner shall not be placed more than 450 mm from the adjacent walls. Additional hangers shall be placed at a distance not more than 150 mm from the joint in the main runner on either side. The cross tees 600 mm long shall be centrally inter-locked between main runners to form 600 X 600 mm modules. The main runners shall have central notches to accommodate mitred joint of 600 mm long cross tees.

Additional runners and hangers shall be provided where change of direction is required as per the site conditions. All the hangers, runners, tees, cleats, brackets etc. required for fixing the false ceiling suspension system shall be of anti-corrosive hot dipped galvanized M.S sections with zinc coating not less than 170 gms per sq.m and shall be as per BS 2989. The Galvanized M.S runners, cross tees, perimeter trims/ edge profile etc. shall be powder/coil coated (the coating as per the manufacturer's specifications) matt finished, of required colour and shade. The cross tees shall be connected to the main runner by stab and hook type (clip in) installation. The runners and cross tees shall have mechanical stitching for enhanced torsional resistance and shall have mitred inter-section. Further, the grid system with main

runners and the cross tees shall have 15 mm wide flanges with a 6 mm central recess with reveal profile, with colour all white with black or white reveal of brand as approved by the Engineer-in-Charge / Consultant. The hangers shall be mechanically pre-straightened and shall not be less than 4 mm diameter and of lengths as required for keeping minimum plenum depth as per the architectural drawings. It shall be suitably cut / tied off. The stainless steel level adjuster clips (spring steel, butter fly clips having suitable number and diameter of machine punched holes and bent to required profile) shall be provided on the hangers to achieve the level ceiling. The suspension hangers shall be vertical or near to vertical as far as possible. The hangers shall be suitably designed not to have distributed load more than 12.5 kg. per sq.m and shall have capacity to take incidental loads of fixtures, suspended signages etc. within the tolerance limit of deflection as specified in BS 8290. Providing additional hangers if any, may accommodate increased load.

- 6.10 The contractor shall ensure that the grid system is designed and installed to carry all incidental loads and no other unauthorized load shall be transferred to this system. The luminaries, air grills / diffusers, signage etc. shall be as far as possible independently supported to avoid any over loading of the ceiling system which may result in excessive deflection or twisting of grids. Any strengthening of grid system by providing additional hangers, fasteners, runners, cross tees etc. or providing additional bracing may be carried out as required for any specific locations or for specific purpose for which nothing extra shall be payable. Perimeter trims / edge profiles of required size and shape, powder/coil coated to required colour and shade, shall be installed at the suspension grid perimeter to completely enclose the ceiling and shall be properly secured to the walls at not more than 450 mm centre to centre using stainless steel screws and PVC sleeves. It shall be neatly jointed at all external and internal angles and over lap sections in a workman like manner with mitered joints.
- 6.11 The ceiling should be set out such that the perimeter boards or tiles are in excess of half a module so that the edge panels on both the sides are of equal sizes as far as possible. The tiles shall be cut to required size and shape with rebates as specified using hand tools or mechanically operated tools in a workman like manner but with all precautions as per the manufacturer's specifications regarding generation of dust and ventilation.
- 6.12 The contractor shall ensure that the material is procured and delivered at installation site without any damage. Adequate care shall be taken before installation as well as afterwards till handing over the building for occupation. It shall be protected from rains, excessive humidity, chemical fumes, vibrations, dust etc. The contractor shall ensure careful handling and storage and prevent any rough handling, rolling of cartons or dropping cartons to prevent any edge damage or breakage. Any tile with edge damaged or crack etc. shall not be allowed to be used in the work and shall be replaced by the contractor at his own cost. Similarly, adequate care shall be taken by the contractor while placing or removing and handling the tiles so as not to cause any damage. Also, the contractor shall direct his interior contractors to take adequate precautions to prevent the tiles from any dirt, fingerprints, any other marks / splashes etc. The ceiling shall not be wet cleaned. Abrasive cleaners shall not be used to clean the marks.
- 6.13 The item of false ceiling includes cost of all inputs of labour, materials, wastage if any, T&P, scaffolding, staging or any other temporary enabling structure / services etc. and all other incidental charges including making necessary cut outs for A.C diffusers, Light fittings, grills, Fire detection, alarm, sprinklers devices and fittings etc. No deduction in the area shall be made for openings nor any thing extra shall be

payable for making the openings. Also nothing extra shall be payable on account of any wastage in materials. Also nothing extra shall be payable on account of any strengthening of the supporting suspension system for the false ceiling, around the openings in the false ceiling by using additional hangers, fasteners, runners, cross tees, etc.

7.0 FIRE RATED DOOR SHUTTER, FRAME AND FITTINGS

Door Shutter

Fully insulated wooden fire rated shutter of minimum 120 minutes fire rating shall conform to BS: 476 part 22 and IS:3614 Part II as per the prototype tested and certified by CBRI Roorkee. The fire check door shall not collapse during the rated period of the fire under the specified fire conditions.

Thickness of door shutter 55mm thickness,

Door Leaves shall be constructed of 75mm x 49mm hardwood internal timber frame work, with infill of 96 kg/m³, ceramic fiber blankets of approved quality, coated with intumescent coating on both sides for insulation. The coated insulation shall be sandwiched between 12mm thick, Non combustible calcium Silicate boards of approved quality provided on both sides (edge to edge on internal Hardwood frame) and clad with 3mm thick commercial ply of approved quality & 1mm thick laminate of approved shade, brand and manufacture on both sides. 2nd class teak wood lipping of size 55mm x 14mm shall be provided all round the shutter. The shutter shall be made suitable for mounting on the fire rated wooden door frame.

Door Frame

Door frames of minimum 120 minutes fire rating shall conform to BS: 476 part 22, IS:3614 Part II as per the prototype certified by CBRI Roorkee

Door Frame will be made out of 2nd class Teak Wood (Ivory Coast) frame of section 140x65mm, with heat activated intumescent fire seal strips of size 20 x 4 mm (for smoke sealing) provided in grooves on all three sides of the frame with one coat of fire retardant primer of approved brand including two coats of fire retardant paint un thinned on cleared hard wood surface of door frames (@3.5 sq.m. per litre per coat) including preparation of base surface as per recommendations of manufacturer to make the surface fire retardant.

The frame shall be fixed with 8 nos. 100 mm long, 10 mm dia metal dash fasteners of approved brand and manufacture or as per direction of Engineer in charge

Both frame and shutter shall be fitted with fire & smoke intumescent seal of Viper or equivalent make of size 20 x 4mm on all the three sides except bottom. The pasting of the ply/veneer/laminate must be done using automatic machine and should be free from any nails or perforations. The board shall be Resistant to vermin, mould growth, minor impact, abrasion and short term water attack. The shutter shall be fixed with the frame with the help of SS 304 grade ball bearing hinges of size 100x76x2mm with necessary stainless steel screws and making cut out for vision panel. Provisions/reinforcement for fixing all fixtures shall be built in on the door prior to the supply.

Prototype Test certificate for fire rating of doors from CBRI, Roorkee for earlier tested design shall be attached along with manufacturers test certificate. Provisions/reinforcement for fixing all fixtures shall be built in on the doors prior to the supply.

Testing: The Client holds the right to get the door tested for fire rating at the cost of the contractor/vendor. In case the Engineer-in-charge desires to get the doors tested then one door including shutter, frame and all fittings shall be selected at random out of the entire lot and shall be tested for two hour fire rating. The testing shall be got done from CBRI, Roorkee. The cost of material for testing and transportation / packing & other incidental

testing charges shall be borne by the contractor. In case the door fails to meet the requirement, the entire lot shall be rejected.

Measurement:

Final finished area of door shutter shall be measured after fixing it with the frame in the opening correct to one cm. Final finished length of door frame shall be measured after fixing it in the opening correct to one cm. NOTE:- cost of fire seal strips, dash fasteners are included in the item. Nothing extra shall be paid if size of any component of material exceeds the limit mentioned in the item. The rates shall be inclusive of all materials, T&P, Labour, etc. complete including the cost of fittings, testing etc. as described above.

Fire rated glass

6 mm thick piroshield fire rated clear glass of approved make, of 120 minutes fire rating having a minimum 13 mm square electrically welded chemically treated steel wire mesh of dia 0.51 mm sandwiched in the centre during the continuous rolling process shall be fixed in vision panel

Area of glass shall be measured correct to 5 mm. Rate for the item includes the cost of glass, fire rated gasket channel and moulding/beading etc. all complete.

Fire rated panic exit device

UL listed fire rated single/double leaf panic exit devices tested in accordance with BS EN 1125: 1997 & BS EN 179: 1997, EN 1670 (Corrosion Resistant), & BS 476 Part 22 (for fire rating) shall be provided at fire staircase locations. The device shall be fixed with necessary hardware as recommended by the manufacturer. A minimum one year warrantee is required for the product. The measurement shall be made in numbers of the item provided, which includes all the costs involved in materials and labour as described above.

Fire rated door closer

Fire rated door closer tested in accordance with BS:476 Part 22 (for fire rating) and BS EN 1154 shall be provided wherever required. The door closer shall be fixed with necessary hardware as recommended by the manufacturer. A minimum one year warrantee is required for the product. The measurement shall be made in numbers of the item provided, which includes all the costs involved in materials and labour as described above.

Fire rated mortice lock

2 hrs, fire rated mortice lock with lever handle tested in accordance with BS:476 Part 22. A minimum one year warrantee is required for the product. The measurement shall be made in numbers of the item provided, which includes all the costs involved in materials and labour as described above.

Pull handle

300 mm long stainless steel grade 304 D type pull handle shall be fixed with necessary screws etc. complete. A minimum one year warrantee is required for the product. The measurement shall be made in numbers of the item provided, which includes all the costs involved in materials and labour as described above.

8.0 PVC FLOORING

PVC Sheet Flooring

Materials

The PVC Flooring Material shall conform to IS : 3462. It shall consist a thoroughly blended composition of thermoplastic binder, filler and pigments. The thermoplastic binder shall consist substantially of one or both of the following:

Vinyl chloride polymer

Vinyl chloride copolymer

The polymeric material shall be compounded with suitable plasticizers and stabilizers.

Thickness: The thickness of PVC sheet shall be as per BOQ item.

Thickness of PVC sheets shall be measured with micrometer of Ratchet type or a dial gauge graduated to 0.02 mm. The micrometer shall have flat bearing surfaces of at least 6.5mm diameter at both contact points.

The thickness of the specimen shall be measured at twenty scattered points.

Tolerance

- | | |
|------------------------------|--------------|
| a) Thickness | ±0.15 mm |
| b) Width of Sheets and Rolls | ±0.1 percent |

Adhesive : Rubber based adhesive are suitable for fixing PVC flooring over concrete, wooden and metal sub-floors. PVA based adhesives shall be used for concrete and wooden subfloors. PVA based adhesives are not suitable for metallic surfaces and also for locations where there is constant spillage of water.

Preparation of Sub-Floors

Before Laying PVC Sheets, it is essential to ensure that the base is thoroughly dry and damp proof as evaporation of moisture can't take place once the PVC flooring is laid. Moisture slowly damages the adhesive resulting in PVC sheet being separated from the base and curled up. In case of new work a period of 4 to 8 weeks shall be allowed for drying the sub-floor under normal conditions.

In new concrete floor, the smooth finish required shall be produced by using cement slurry spread on fresh concrete floor and finished smooth. If the concrete floor is old and surface not even, the surface should be made smooth by first cleaning it free of all foreign material and then a layer of cement mortar 1:2 (1 cement : 2 coarse sand) of average thickness of 6mm shall be applied on the surface finishing the surface smooth. The finished surface shall be cured for 7 days and then allowed to dry thoroughly.

Laying and Fixing

Prior to laying, the flooring sheets shall be brought to the temperature of the area in which it is to be laid by stacking in a suitable manner within or near the laying area for a period of about 24 hours.

Before commencing the laying operations, the sub-floor shall be examined for evenness and dryness. The sub-floor shall then be cleaned with a dry cloth. The PVC flooring shall not be laid on a sub-floor unless the sub floor is perfectly dry.

The layout of the PVC flooring on the sub-floor to be covered should be marked with guidelines. The PVC flooring shall be first laid for trial, without using the adhesive, according to the required layout.

The adhesive shall be applied by using a notched trowel to the sub-floor and to the backside of the PVC sheet or tile flooring. When set sufficiently for laying, the adhesive will be sticky to touch, but will not mark the fingers. In general, the adhesive will require about half an hour

for setting. It should not be left after setting for too long a period as the adhesive properties will be lost owing to dust films and other causes.

Care should be taken while laying the flooring under high humidity conditions so that condensation does not take place of the adhesive. It is preferable to avoid laying under high humidity conditions.

The area of adhesive to be spread at one time on the sub-floor depends entirely upon local circumstances. In case of a small room, adhesive may be spread over the entire area but relatively small area of sheets flooring should be treated in a larger room.

When the adhesive is just tack free the PVC flooring sheet shall be carefully taken and placed in position from one end onwards slowly so that the air will be completely squeezed out between the sheet and the background surface. After laying the sheet in position, it shall be pressed with suitable roller weighing about 5 kg to develop proper contact with the sub-floor. The next sheet with its back side applied with the adhesive shall be laid edge to edge with the sheet already laid and fixed in exactly the same manner as the first sheet was fixed. The sheets shall be laid edge to edge so that there is minimum gap between joints. The alignment should be checked after laying of each row of sheet is completed. If the alignment is not perfect, the sheets may be trimmed by using a straight edge.

Any adhesive which may squeeze up between tiles should be wiped off immediately with a wet cloth before the adhesive hardens. If, by chance, adhesive dries up and hardens on the surface of the sheet or tile, it should be removed with a suitable solvent. A solution of one part of commercial butyleacetate and three parts of turpentine oil is a suitable solvent for the purpose.

A minimum period of 24 hours shall be given after laying the flooring for developing proper bond of the adhesive. During this period, the following shall not be put to service. It is preferable to lay the PVC flooring after completion of plastering, painting and other decorative finish works so as to avoid any accidental damage to the flooring.

The joints between the sheets shall be hot welded using a suitable welding rod so that the flooring becomes jointless. The welded shall be so done as not to harm the sheet in any way.

When the flooring has been securely, fixed, it shall be cleaned with a wet cloth soaked in warm soap solution (two spoons of soap in 5 litres of warm water).

Where the edges of the PVC sheets or tiles are exposed, as for example, in doorways and on stair treads, it is important to provide protection against damage of flooring materials. Metallic edge strips may be used and should be securely fastened to the sub-floor to protect edges of the flooring.

The work shall also be carried out in skirting/ coving as per drawing/ instructions of the engineer/ architect.

Measurements

Length and breadth of flooring, skirting and/ or coving shall be measured correct to a cm and its area shall be calculated in sqm correct to two places of decimal. No deduction shall be made nor extra paid for void not exceeding 0.20 square metre. Deductions for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 square metre. Nothing extra shall be paid for providing PVC flooring in borders, margins, skirting/ coving irrespective of their width.

Rate

The Rate shall include the cost of all materials and labour involved in all the operations described above. The rate does not include the cost of sub-floor or damp proof treatment if any. It also does not include the cost of metallic edge strip to protect edge of flooring, wherever provided, it shall be paid separately.

9.0 STAINLESS STEEL RAILINGS

- 9.1 The scope of the work includes preparation of the shop drawings (based on the architectural drawings), fabrication, supply, installation and protection of the stainless steel railing till completion and handing over of the work.
- 9.2 The stainless steel work shall be got executed through specialized fabricator as per the list of the approved agencies having experience of similar works. The Contractor shall submit the credentials of the fabricator for the approval of the Engineer-in-Charge.
- 9.3 The Contractor shall submit shop drawings, for approval of the Engineer-in-Charge, for fabricating stainless steel railing with detailing of M.S. stiffener frame work backing along with the fixing details of the M.S. frame work to the R.C.C columns. The details of the joints in the stainless steel railing including location, etc. shall also be shown in the shop drawings.
- 9.4 The Contractor shall procure and submit to the Engineer-in-Charge, samples of various materials for the railing work, for approval. After approval of samples, the Contractor shall prepare a mock up for approval of Engineer-in-Charge / Consultant. The material shall be procured and the mass work taken up only after the approval of the mock up by the Engineer-in-Charge / Consultant. The mock-up shall be dismantled and removed by the contractor as per the directions of the Engineer-in-Charge. Nothing extra shall be payable on this account.
- 9.5 The stainless steel shall be of grade S 304 with brushed steel satin finish and procured from the approved manufacturer. It shall be without any dents, waviness, scratches, stains etc.
- 9.6 The required joints in the railing provided as per the architectural drawings, shall be welded in a workmanlike manner including grinding, polishing, buffing etc. all complete and compacted. The temporary clamps provided and fixed to hold the stainless steel railing, in position shall be removed after the concrete has set properly. The junction of the flooring and the cladding shall be neatly filled with weather silicone sealant of approved colour and shade. Nothing extra shall be payable on this account.
- 9.7 One test (three specimens) for each lot shall be conducted for the stainless steel pipe in the approved laboratory. Therefore, the material shall preferably be procured in one lot from one manufacturer.
- 9.8 The finished surface shall be free of any defects like dents, waviness, scratches, stains etc. and shall have uniform brushed steel satin finish. Any defective work shall be rejected and redone by the Contractor at his own cost. The finished surface shall therefore be protected using protective tape which shall be removed at the time of completion of the work. The surface shall then be suitably cleaned using non

abrasive approved cleaner for the material. Nothing extra shall be payable on this account.

- 9.9 The item includes the cost of all inputs of labour, materials (including stainless steel pipes, welding, brazing, concrete, protective film, weather silicone sealant etc including cost of providing and fixing M.S. frames), T & P other incidental charges, wastages etc. The items also included providing and fixing stainless steel anchor fasteners for fixing railing.
9. 10 The railing shall be fixed in position using stainless steel pipes, stainless steel posts of grade S 304 of required diameters and thickness as shown on drawing and polished to satin finish including cutting, welding, grinding, bending to required profile and shape, hoisting, butting, polishing etc.

The item includes the cost of all inputs of labour, materials, T&P, other incidental charges, wastage etc. The entire work shall be carried out to the satisfaction of Engineer-In-Charge.

11.00 Mix Design, Batching Plant/ Ready mix Concrete

10.1 Following parameters shall be adopted for mix design in moderate exposure.

| | | |
|----|-----------------------------------|--|
| 1. | Nominal Maximum size of aggregate | 20mm angular as Per CPWD specification |
| 2. | Degree Of quality control | Good |
| 3. | Type of Exposure | Moderate |
| 4. | Maximum water cement/ratio | 0.50 |
| 5. | Type of cement to be used | OPC 43 grade conforming to IS: 8112 |
| 6. | Sand | Coarse Sand as per CPWD specification |
| 7 | Use Of Fly Ash in RMC | Strictly not permitted. |

10.2 BATCHING PLANT: Batching Plant of suitable capacity to be installed within a period of 30 days from award of work. The contractor shall install batching plants (with in 50 meters distance from the site of work) supplying Concrete at site. The batching plant proposed to be engaged by the contractor shall fulfill the following requirements.

- i) It shall be fully computerized.
- ii) Facility to pump concrete upto the highest point of the building.
- iii) It should have facility for providing printed advice showing ingredients of concrete carried by each mixer.
- iv) Should have sufficient capacity to meet the requirement as per schedule.

In case of failure of Batching Plant, RMC may be allowed with a written permission of Engineer in Charge

10.3 Approved admixtures conforming to IS.9103 shall be permitted to be used. The chloride content in the admixture shall satisfy the requirement of BS 5075. The total amount of chloride content in the admixture mixed Concrete shall satisfy the requirement of IS 456-2000.

10.4 The concrete mix design with and without admixture will be carried out by the contractor through one of the following Laboratories / Test house to be approved by Engineer.

i) IIT, Delhi

ii) Shri Ram Institute of Industrial Research, Delhi

iii) Any other Govt Laboratory as approved by Engineer.

10.5. In the event of all the four laboratories being unable to carry out the requisite design /testing the contractor shall have to get the same done from any other reputed laboratory with prior approval of the Engineer.

10.6. The various ingredients for mix design \laboratory tests shall be sent to the lab test house through the Engineer and the sample of such ingredients sent shall be preserved at site by the department till completion of work or change in Design Mix whichever is earlier. The sample be taken from the approved materials which are proposed to be used in the work.

10.7. The rate for the item of Ready Mixed Concrete shall be inclusive of all the ingredients including admixtures if required, labour, machine T&P etc (except shuttering which will be measured & paid for separately) required for design mix concrete of required strength and workability.

The rate quoted by the agency shall be net & nothing extra shall be payable in account of change in quantities of concrete ingredients like cement and aggregates and admixtures etc. in the approved mix design.

10.8. The contractor shall engage Ready Mix Concrete (RMC) producing plants (Distance of plant from site to be approved by Engineer in Charge) to supply RMC for the work. The RMC plant proposed to be engaged by the contractor shall fulfill the following requirements.

i) It shall be fully computerised.

ii) It should have supplied RMC for Govt. projects of similar magnitude.

iii) It should have facility for providing printed advice showing ingredients of concrete carried by each mixer.

10.9. The contractor shall, within 10 days of award of the work submit list of at least three RMC plant companies from the approved makes along with details of such plants Including details of transit mixer, pumps etc. to be deployed indicating name of owner/company, its location, capacity , technical establishment, past experience and text of MOU proposed to be entered between purchaser (the contractor) and supplier (RMC Plant) to the Engineer who shall give approval in writing (Subject to drawl of MOU).

10.10. The Engineer reserves the right to exercise over the:-

i) Ingredients, water and admixtures purchased, stored and to be used in the concrete including conducting of tests for checking quality of materials recordings of test results and declaring the material fit or unfit for use in production of mix.

ii) Calibration check of the RMC.

iii) Weight and quality check on the ingredient, water and admixture added for batch mixing.

iv) Time of mixing of concrete.

v) Testing of fresh concrete, recordings of results and declaring the mix fit or unfit for use. This will include continuous control on the workability during production and taking corrective action.

For exercising such control, the Engineer shall periodically depute his authorized representative at the RMC plant. It shall be the responsibility of the contractor to ensure that the necessary equipment manpower & facilities are made available to Engineer and/or his authorized representative at RMC plant

- 10.11. Ingredients, admixtures & water declared unfit for use in production of mix shall not be used. A batch mix found unfit for use shall not be loaded into the truck for transportation.
- 10.12. All required relevant records of RMC shall be made available to the Engineer or his authorized representative. Engineer shall, as required, specify guidelines & additional procedures for quality control & other parameters in respect of materials, production and transportation of concrete mix which shall be binding on the contractor & the RMC plant.
- 10.13. 43 grade OPC (Conforming to IS-8112) of brand/make/source approved by Engineer shall only be used for production of concrete.
- 10.14. It shall be the responsibility of the Contractor to ensure that the RMC producer provides all necessary testing equipment and takes all necessary measures to ensure Quality control of ready -mixed concrete. In general the required measures shall be:-

i) **CONTROL OF PURCHASED MATERIAL QUALITY**

RMC producer shall ensure that the materials purchased and used in the production of concrete conform to the stipulation of the relevant agreed standards with the material Supplier and the requirement of the product mix design and quality control producer's. This shall be accomplished by visual checks, sampling and testing, certification from materials suppliers and information /data from material supplier. Necessary equipment for the testing of all material shall be provided and maintained in calibration condition at the plant by the RMC producer.

ii) **CONTROL OF MATERIAL STORAGE**

Adequate and effective storage arrangement shall be provided by RMC producer at RMC plant for prevention of contamination, reliable transfer and feed system, drainage of aggregates, prevention of freeing or excessive solar heating of Aggregate etc,

iii) **RECORD OF MIX DESIGN AND MIX DESIGN MODIFICATION**

RMC producer shall ensure that record of mix design and mix design modification is available in his computer at RMC plant for inspection of Engineer or his representative at any time.

iv) **COMPUTER PRINT OUTS OF EACH TRUCK LOAD**

Each truckload / transit mixer dispatched to site shall carry computer printout of the ingredients of the concrete it is carrying. The printout shall be produced to Engineer or his representative at site before RMC issued in work.

v) **TRANSFER AND WEIGHING EQUIPMENT RMC**

Producer shall ensure that a documented calibration is in place. Proper calibration records shall be made available indicating date of next calibration due, corrective action taken etc.

RMC producer shall ensure additional calibration checks whenever required by the Engineer in writing to contractor. RMC producer shall also maintain a daily production record including details of mixes supplied. Record shall be maintained of what materials were used for that day's production including water and admixtures.

The accuracy of measuring equipment shall be within +2% of quantity of cement +/- 3% of quantity of aggregate, admixture and water being measured.

vi) **MAINTENANCE OF PLANT, TRUCK Mixers AND PUMPS**
Plant, Truck Mixers and Pumps should be well maintained so that it does not hamper any operation of production, transportation and placement.

vii) **PRODUCTION OF CONCRETE**
The following precautions shall be taken during the production of RMC at the plant

i) Weighing (correct reading of batch data and accurate weighing) :- For each load, written, printed or graphical records shall be made of the weights of the materials batched, the estimated slump, the total amount of water added to load the delivery tickets number for that load and the time of loading the concrete into the truck.

ii) Visual observation of concrete during production and delivery or during sampling and testing of fresh concrete assessment of uniformity, cohesion, workability adjustment to water content. The workability of the concrete shall be controlled on a continuous basis during production. The batch mix found unfit shall not be loaded into the truck for transportation. Necessary corrective action shall be taken in the production of mix as required for further batches.

iii) Use of adequate equipment at the plant to measure surface moisture content of aggregates, particularly fine aggregates or the workability of the concrete, cube tests etc. shall also be ensured.

iv) Making corresponding adjustment at the plant automatically or manually to batched quantities to allow for observed, measured or reported changes in materials or concrete qualities.

v) Sampling of concrete, testing monitoring of results.

vi) Diagnosis and correction of faults identified from observations /complaints.

The RMC plant produced concrete shall be accepted by Engineer at site after receipt of the same after fulfilling all the requirements of mix mentioned in the tender documents.

10.15. The rate for the Item of design mix cement concrete shall be inclusive of all the ingredients including admixtures if required, labour, machinery T&P etc. (except shuttering which will be measured & paid for separately) required for a design mix concrete of required strength and workability. The rate quoted by the agency shall be net & nothing extra shall be payable on account of change in quantities of concrete, ingredients like cement and aggregates and admixtures etc. as per the approved mix design.

10.16 Ready mix concrete shall be arranged in quantity as required at site of work. The ready mix concrete shall be supplied as per the pre-agreed schedule approved by Engineer.

10.17. Frequency of sampling and standards of acceptance shall be as per CPWD specifications.

- i) No addition of water or other ingredients shall be permitted in the RMC at site or during transit.
 - ii) The RMC shall be placed by pump of suitable capacity and the contractor shall arrange sufficient length of pipe at site to place the RMC in the minimum required time. The contractor shall co-ordinate with RMC supplier and pumps hirer to have effective concrete placement.
 - iii) Pre-paid delivery tickets shall be produced with each truck load of RMC.
 - iv) The representative of RMC supplier shall attend the site meeting as and when decided by the Engineer
- 10.18 i) The contractor shall assess the quantity of RMC requirement at site well in advance and order accordingly to the RMC supplier. In case excess RMC is received at site, the department shall not be under any obligation to get extra quantities utilized and no payment for such RMC shall be made.
- ii) The contractor shall have to employ labour in shifts to ensure continuous casting of raft and other RCC members. No extra payment on this account shall be made.

11.0 LAMINATED FLOORING

Manufacturing Standards

Laminate flooring panels must be manufactured in conformance with the European Standard of Laminate Flooring EN 13329:1998. The European Standard Specifies characteristics, requirements, and gives test methods for laminate floor coverings. It includes a classification system, based on EN 685, giving practical requirements for areas of use and levels of use. Laminate flooring panels must be abrasion tested according to the above standard and meet or exceed the requirements for the Abrasion.

Preliminary

Remove wrapping and lay flooring panels out flat at room temperature for 48 hours. Check all panels for defects. and ensure the surface to be covered with panels is clean, smooth, and level. Uneven areas must be levelled. Do not install over carpets. Remove carpet along with any residual adhesive material and install on smooth, firm surface.

Concrete Surfaces

A 'Patch Test' must be performed on concrete sub-floors. If there is any evidence of moisture, the concrete must be treated with an appropriate sealer.

NOTE: DO NOT install laminates floor if patch test reveals moisture build up, until concrete is sealed.

It is recommended that a moisture barrier (Poly) be placed all over concrete sub-floors to protect against any possible moisture emissions.

Moisture Barrier

To protect panels against moisture from surfaces where moisture is likely to occur, a moisture barrier must first be placed over the base surface. Use 6-milH (0.2mm) polyethylene film. Overlap the edges of the polyethylene by a minimum of 8 inches and

seal the junction with moisture proof self-adhesive tape. Use on concrete floors and at floors below grade or other areas where condensation or moisture emission may occur.

A moisture barrier should be installed over floors with radiant heat. Before laying the barrier, turn heat down to 16 C (60 F) one week before. Keep the temperature below 27 C (80 F) at all times.

Underlayment

Panels must be installed on top of underlayment .Use a good quality underlayment (Cork or High Density Foam). Underlayment seams should not overlap and should be taped with self-adhesive tape. If installing both a moisture barrier and underlayment, place the underlayment on top of the moisture barrier, or preferably use a reliable combination product.

Underlayment - is a clear thin plastic sheet that is installed over the substrate before the laminate floor is floated. The plastic sheet helps the laminate floor to float freely above the substrate.

Installation

First Row: Measure the row before the first panel. Cut the first panel according to the length required for the last panel. Measure for straightness and cut the panels to make sure the inner edge of the first row panels is square before starting second row. Measure the last row of the panel width first. Then cut first row panels to the same width as the last row. Position the first row panels along one wall, leaving space for expansion between panels and the wall. Lock the ends of the panels together until the first row is finished.

Second Row: The first panel of the second row should be long enough so the ends of the second row panels reach past the end seams of the first row panels. If the remaining section of the last panel of the first row is long enough, use it for the first panel of the second row; Line up the first panel of the second row so the outside end is even with the outside end of the first panel of the first row. After locking in place, lay the remaining panels of the row by first locking the long side in place and then tapping the end of the panel and slide it into firmly into place at its end; and

Lay each of the panels of the remaining middle rows.

Last Row: Because the width of the last row may be less than that of the previous rows, it may be necessary to cut the panels of the last row to the appropriate width .See instructions for first row

Expansion

Because changes in heat and humidity will cause laminate panels to expand and contract in both length and width, expansion spaces must be allowed on all sides of the installed floor. The use of spacers inserted between the panels and perimeter wall is recommended. The spacers should be removed after the panels are installed and before mouldings are attached to the walls. For rooms up to 25 feet (7.6 meters) in width and 40 feet (12.2 meters) long, allow for expansion between 3/8” and 5/8” (10 mm to 16 mm) along each wall.

Expansion Joints

For floors more than 25 feet (7.6 meters) wide or more than 40 feet (12.2meters) long, an additional expansion joint must be inserted. Expansion joints are also required in doorways, and between adjoining rooms or areas where adjacent flooring is installed. Use a T- moulding to cover the expansion joint.

Pipes And Other Obstacles

When installing a laminate panel around a pipe or other obstacle, leave the same expansion gap as you would next to a wall, Measure and, precut the affected panel If there is condensation from pipe, cut the panel so there is sufficient space to keep the panel dry. Fill the space around a pipe with a caulking in order to protect the exposed (cut) edge of the panel.

Directions of Panels

For appearance, panels should be installed so the length direction of the panels is the same as the length direction of the room or as shown in the drawing.

Preparation

- Measure doors for clearance of Installed panels. Cut away doorframe and jambs at the bottom if necessary. Remove existing baseboards.
- Surface should be clean, smooth, and level surfaces with slopes steeper than 12.5mm over 1.62m (1/2* over 5') must be levelled. Measure the perimeter of the room to determine room's squareness, and the required width of the last row of panels. Allow for expansion gaps along each wall.
- Install tongue-and-groove panels, attach the tongue on one panel to the groove side of the other panel and the panels will lock snugly together.
- Start with the panel flat on the floor, decor surface up, and the groove side away from the wall. Insert the tongue of the second panel partially into the groove on the first, while holding the second panel at about a 20 angle from the floor. Press the second panel down and use a hammering block to lock firmly into place. (Reverse the procedure to release.) Continue in a similar fashion for the remaining panels.

Mouldings

Transition moulding should be used for the following purpose:

Reducer: Use in from laminate floor to linoleum or other type of hard surface.

T4Moulding: Use In doorways, between rooms and with adjacent floors, and expansion joints.

Stair Nosing: Use at the edge of each step in a staircase.

End molding: Use for transition form laminate floor to other types of floor covering,

Baseboard: Use at the base wail.

NOTE: Always fasten baseboard to the wall, never to the floor.

Measurement:

Length and breadth shall be measured correct to a centimeter. Height of dado shall be measured correct to a centimeter, and the height of skirting shall be measured correct to 5 mm. The area shall be calculated in sqm. Correct to two places of decimals. Length and height shall be measured along the finished face of skirting or dado.

Rates:

The rate of above item shall include the cost of all material and labour involved in all the operations described above.

12.00 HOLLOW METAL STEEL DOOR WITH HONEY COMB CORE

GENERAL

The Contractor shall furnish all materials, labour, operations, equipment, tools & plant, scaffolding and incidentals necessary and required for the completion of all metal work in

connection with steel doors, as called for in the drawings, specifications and bill of quantities. The supply and installation of additional fastenings, accessory features and other items not specifically mentioned, but which are necessary to make a complete functioning installation shall form a part of this contract.

All metal work shall be free from defects, impairing strength, durability and appearance and shall be of the best quality for purposes specified made with structural proprieties to withstand safety strains, stresses to which they shall normally be subjected to.

All fittings shall be of high quality and as specified and as per approval.

The Contractor shall strictly follow, at all stages of work, the stipulations contained in the Indian Standard Safety Code or its Equivalent British Standard and the provisions of the safety code and the provision of the safety rules as specified in the General Conditions of the Contract for ensuring safety of men and materials.

Any approval, instructions, permission, checking, review, etc., whatsoever by the PMC/AEC, shall not relieve the Contractor of his responsibility and obligation regarding adequacy, correctness, completeness, safety, strength, quality, workmanship, etc.

FRAME

- a) **Material** – Frame to be manufactured from 1.25 mm (18 gauge) galvanized steel sheets complying with latest IS 277 Code of GPL Grade with Z 120 Coatings or its Equivalent British Standard.
- b) **Profile** - Door frame profile to be single rebated of dimensions 100 mm X 57 mm (+ / - 0.3) with bending radius of 1.2 mm.
- c) **Manufacture** - Frame to be manufactured from 1.25 mm thick galvanized steel sheet to the specified profiles and dimensions. Frames manufactured at factory shall be mitered & knock down form with butt joints assembly at site.
- d) **Door frame preparations** – Frames to be provided with a 3 mm thick soffit back plates on all jambs with provision for anchor bolt fixing to wall openings. All frames to have reinforcement pads for fixing of door closer, at appropriate location as per manufacturer's details.
- e) Frames to have factory finish-pre-punched cut outs to receive specific hardware and ironmongery.
- f) Frames to be provided with hinge plates 3 mm thick pre-drilled to receive hinges for screw mounted fixing. All cut outs including hinge plates, strike plates to have mortar guard covers from inside to prevent cement, dust ingress into cut outs at the time of grouting.
- g) Frames to have rubber shutter silencer on strike jambs for single shutter frames and on the head jambs for double shutter frames.
- h) **Finish**

Door frames to be suitably cleaned with solvents for receiving self etching primer and top coats.

Door frames to be primed in zinc phosphate stoving primer (35 microns DFT).

Door frames to be finished in thermo setting Polyurethane paint (35 microns DFT) of approved colour and make as specified.

DOOR SHUTTER

a) **Material**

General purpose door shutter to be manufactured from 0.80 mm (22 gauge) galvanized sheets conforming to latest IS : 277 Code of GPL Grade with Z 120 Coating or its Equivalent British standard.

b) **Manufacture**

Shutters to be press formed to 46 mm thick double skin hollow door with lock seam joints at stile edges. Shutters to have no visible screws or fasteners on either face.

c) **Door shutter core**

Shutters to be provided with honeycomb paper cored to be bonded to the inner faces of the Shutter.

d) **Door shutter preparations**

Shutters to be factory prepared with pre-punched cutouts and reinforcements to receive ironmongery as per final finish hardware schedule. The shutter should have an interlocking arrangement at this stile edges for flat surface on either side.

Shutters to have pre-drilled hinge plates with hinge guard covers. Shutters with locks to have concealed lock box with lock fixing brackets with pre-tapped holes.

All ironmongery preparation to have adequate reinforcement for flush fixing at site.

e) For shutter with door closer reinforcement pads to be provided at appropriate location as per manufacturer's design.

f) **Vision panel**

Vision panel to be provided with clear toughened glass of the thickness 6 mm. Glass to be fixed with clip on frames for square and rectangular vision panels and with spin turned rings for circular vision panels and Glazing Tape with one side adhesive. Vision Panels to be fixed with clip-on frames for square and rectangular Vision Panels with no visible screws. Unless otherwise specified standard sizes are 200 mm x 300 mm, 300 x 750 mm, 450 x 750 mm and 360 mm diameter.

g) **Finish**

Shutters to be suitably cleaned with solvents for receiving etching primer and top coats.

Shutters to be primed in zinc phosphate stoving primer (35 microns DFT).

Shutters to be finished in thermo setting Polyurethane paint (35 microns DFT) of approved colour and make as specified.

PACKING

a) **Frame**

Individual frames members to be protected with Co-extruded PE film, with low tack adhesive. PE film to be minimum 56 micron thick, abrasion resistant with 6 months UV resistance Capability. (Manufacturers Test Report to be submitted) and placed in individual card board boxes. Individual boxes to be sealed. Frames to be assembled at site with aid of roofing bolts.

b) **Shutters**

Shutters to be protected with Co-extruded PE film, with low tack adhesive. PE film to be minimum 56 micron thick, abrasion resistant with 6 months UV resistance Capability. (Manufacturers Test Report to be submitted) and packed in card board and strapped. All frames and shutters duly marked as per door schedule for easy identification at site.

STORAGE

All knocked down frames shall be stacked flat and shutters vertically on wooden runners and suitably covered as per the instructions of manufacturer to prevent rust and damage.

INSTALLATION

i. Door frame fixing

The door frames should be assembled adjacent to the place of installation as the frames are not designed for transporting in an assembled condition. After assembly it is to be ensured that all threaded preparations are covered from the back of the frame using self adhesive strip to prevent penetration of mortar back-fill into screw threads. The head member of assembled frame shall be positioned against jambs ensuring correct alignment and secured using M8 x 20 long plated bolts together with nuts spring and flat washers.

The assembled frame shall be kept in position within the opening by means of bracing. In order to correctly position the frame against finished floor level or equalise on adjustable floor anchors where specified, shim shall be used under jambs. The frame shall be checked for squareness, alignment, twist etc. with carpenters bevel and plumb.

A tie rod shall be fixed to the frame during installation to ensure the correct dimensions between the frame rebated and the same may be removed after installation.

Where a 2nd fix application is required a shim detail is suggested to take up gap between frame and existing opening.

Existing masonry wall openings – Metal expansion shields

- a) Brace, position, level etc.
- b) Mark all positions of fixings on wall.
- c) Remove frame and drill wall to appropriate specified size.
- d) Fit rod anchor shells metal expansion bolts into the wall.
- e) Fit jamb spacer bracket into back of frame profile.
- f) Reposition frame back into opening and realign.
- g) Lightly screw CSK HD machine screws into shells, shim behind frame.
- h) Slowly tighten screws continually checking plumb, square etc. Finally ensure frames are not deformed as tightened.
- i) After fixing the frame shall be grouted with cement mortar 1:3 or Plaster of Paris or Gypsum powder as approved. Gap between frame and wall to be closed by cement pointing using cement mortar 1:3.
- j) Back full the frame through holes provided and insert nylon plugs.

Door shutter fixing

- k) Fix all the hardware to the door shutter like hinges, flush bolts, bolts, mortice locks, door closer, door stoppers, handles etc. with the appropriate screws and bolts supplied. The shutter is to be then fixed to the frame which is already installed. Align the shutter to match the hardware to the cutouts in the frame. Tighten the hinge screws.

Measurements

Area of door shall be measured for payment .Area in Sqm shall be calculated by multiplying width & height as given below.

Width shall be measured correct to 1cm from outer to outer of door frame, measured horizontally

Height shall be measured correct to 1cm from top most of door frame to bottom of door shutter, measured vertically.

Rate of items includes the cost of all materials, labour and T&P involved as given in the BOQ item and specifications.

13.0 HORTICULTURE WORKS:

13.1 GRASSING

13.1.1 PREPARATION

During period prior to planting the ground shall be maintained free from weeds.

Grading and final nevenne of the lawn shall be completed at least three weeks prior to the actual sowing. Clods of excavated earth shall then be broken upto the size not more than 75mm in any direction. The area shall then be flooded with water and after 10 days and within 15 days of flooding, weeds that re-germinate shall be uprooted carefully. The rubbish arising from this operation shall be removed and disposed of in a manner directed by Engineer. Regular watering shall be continued until sowing by dividing the lawn area into portion or approx 5 mts. Square by constructing small bunds to retain water. These 'bunds' shall be nevenn just prior to sowing of grass plants. At the time of actual planting of grass, it shall be ensured that he soil has completely settled.

Slight nevenness, ups and downs and shallow depressions resulting from the settlement of the flooded ground, in drying and from the subsequent weeding operations, shall be removed by fine dressing the surface to the final levels by adding suitable quantities of good earth brought from outside, if necessary as directed by the Engineer. In fine dressing, the soil at the surface and for 40mm depth below shall be broken down to particles of size not exceeding 6mm in any direction.

13.1.2 SOIL :

The soil itself shall be ensured to satisfaction of Engineer to be a good, fibrous loam, rich in humus.

13.1.3 SOWING THE GRASS ROOTS :

Grass roots (Cynodon dactylon or a local approved by the Engineer) shall be obtained from a grass patch, seen and approved before hand.

The grass roots stock received at site shall be manually cleaned of all weeds and water sprayed over the same after keeping the stock in a place protected from sun and dry winds.

Grass stock received at site may be stored for a maximum of three days. In case grassing for some areas is scheduled for a later date fresh stock of grass roots shall be ordered and obtained.

13.1.4 EXECUTION :

Small roots shall be debbled about 15 cms (or at other spacings as per BOQ item)apart into the prepared grounds. Dead grass and weeds shall not be planted.

Grass areas will only be accepted as reaching practical completion when germination has proved satisfactory and all weeds have been removed.

All planting is to be done in moderately dry to moist (not wet) soil and at times when wind does not exceed a velocity of 8 kilometer per hours.

13.1.5 MAINTENANCE OF LAWN

As soon as the grass is approximately an inch high it shall be rolled with a light wooder, roller in fine, dry weather and when it has grown to 2 to 3 inches above the ground, weeds must be removed and regular cutting with the scythe and rolling must be begun. A top dressing of announce of guano to the square yard on well decomposed well broken sludge manure will help on the young grass. The scythe must continue to be used for several months until the grass is sufficiently secure in the ground to bear the mowing machine. It should be possible to use the inch above the normal level of the first two or three cuttings. That is to day the grass should be cut so that it is from 1 to 2 inches in length, instead of the ½ to ¾ of an inch necessary for mature grass.

In absence of rain the lawn shall be watered every ten days heavily, soaking the soil through to a depth of at least 25 cms.

Damage failure or dying back of grass due to neglect of watering especially for seeding out of normal season shall be the responsibility of the contractor.

Any shrinkage below the specified levels during the contract or defects liability period shall be rectified at the contractor's expense.

The contractor is to exercise care in the use of rotary cultivator and mowing machines to reduce to a minimum the hazards of flying stones and brickbats. All rotary mowing machines are to be fitted with safety guards.

13.1.6 ROLING :

A light roller shall be used periodically, taking care that the lawn is not too wet and sodden. Rolling should not be resorted to, to correct the levels in case certain depressions are formed due to watering

13.1.7 EDGING :

The contractor shall establish a neat edge where planting areas meet grass areas with spade or edging tool immediately after all planting, including lawn planting, is completed. Particular care shall be exercised in edging to establish good flowing curves as shown on the plans or as directed by the Engineer. Edging must be cut regularly and shall be maintained by the contractor.

13.1.8 FERTILIZING :

The lawn shall be fed once a month with liquid manure prepared by dissolving 45 grams of ammonia sulphate in 5 litres of water.

13.1.9 WATERING:

Water shall be applied daily during dry weather. Watering whenever done should be thorough and should wet the soil at least upto a depth of 20 cms to eliminate air pockets and settle the soil. To reduce the landscape/horticulture water requirement sprinkler type garden hydrant shall be installed as per drawings/BOQ item. The treated STP/ETP water may be used for horticulture wherever it is feasible.

13.1.10 WEEDING:

Prior to regular mowing the contractor shall carefully remove rank and unsightly weeds.

MAINTENANCE

The landscape contractor shall maintain all planted area within the landscape 1contract boundaries until the period of one year after the complete plantation. Maintenance shall include replacement of dead plants. Watering, weeding, cultivating, control of insects, fungicide and other disease by means of spraying with an approved insecticide or fungicide, pruning and other horticulture operations necessary for the proper growth of the plants and for keeping the landscape sub-contract area neat in appearance.

PRUNING & REPAIRS

Upon completion of planting work on the landscape sub-contract all trees should be pruned and all injuries repaired where necessary. The amount of pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches and to compensate for the loss of roots and the results of transplanting operations. Pruning shall be done in such a manner as not to change the natural habit or special shape of the trees. In general, one third to one fourth branching structure of the plants to be removed to compensate the loss of roots during transplantation by thinning or shortening branches but no leaders shall be cut. All pruning shall be done with sharp tools in accordance with instructions of the consultant. Pruning cuts shall be painted with recommended paints.

TREE GUARDS :

Where tree guards are necessary, care should be taken to ensure that they do not impede movement or restrict growth.

NURSERY STOCK :

Planting should be carried out as soon possible after reaching site. Where planting must, of necessity, be delayed, care should be taken to protect the plants from pilfering or damage from people or animals. Plants with bare roots should be heeled in as soon as received or otherwise protected from drying out, and others set closely together and protected from the wind. If planting should be unpacked, the bundles opened up and each group of plants heeled in separately and clearly labeled. If for any reason the surface of the roots becomes dry the roots should be thoroughly soaked before planting.

PROTECTIVE FENCING :

According to local environment shrubs may have to be protected adequately from vandalism until established.

COMPLETION :

On completion the ground should be formed over and left tidy.

RATE:

The rates quoted for the horticulture items listed in BOQ shall provide for the cost involved in all the operations described above.

14.00 Signages and associated works**General**

1. The sign board shall be in both English and Hindi language
2. Suitable pictogram to be provided as per approved samples
3. The colour of signages to be as per discretion of Engineer.
4. All signages details including sizes of sheet, letters, pictogram and border allround to be submitted and got approved priorly from HSCC.
5. The quoted rate shall be for all heights and floor levels.
6. The scope of work include providing and fixing base frame with removable/ interchangeable signages. Which will be paid in respective items

PVC sheet / sun board

1. Sheet to be best available brand of minimum thickness 3mm.
2. Top vinyl film to be best available brands of LG, Samsung or equivalent.
3. The thickness of film without adhesive to be around 75 microns and with adhesive to be 100 microns.
4. The fixing to be done with screws / hanging chains/pipes/rods of approved make & material as per discretion of Engineer.
5. The rates to be quoted per square inch inclusive of pictogram & fixing up to any floor and height, wall fixing or hanging on ceiling.

MS

1. The make of material to be as approved by engineer.
2. The thickness of GI sheet to be at least 18 G.
3. The shop drawings of supporting structural frame and its foundation for signages to be submitted for approval by HSCC.
4. The welding joints to be rubbed and grinded to give a smooth finish. No undulations shall be visible.
5. The MS frame and sheets to be primered and painted with approved make material.
6. The rates shall be inclusive of above and fixing with cement concrete 1: 1.5 : 3 as per approved design.
7. The rate for structural frame to be quoted separately per kilograms and signage sheet in square meters.

MDF

1. The board to be of best make / approved make as per discretion of Engineer.
2. The thickness of board to be 12mm.
3. Hanging arrangement to be of 12mm or more aluminum rods. The length of rods to be as per available heights at site.
4. Rates to be quoted per square meter.
All-around lipping of aluminium section of desired colour of band in approved shape to be done.

Stainless steel

1. The thickness of sheet to be minimum 16 G for plate sign board and 18/20 G for SS letters.
2. The same to be fixed with SS screws.
3. The engraving of letters to be as per standard norms and colours.
4. The individual alphabets/ letters, wherever required to have an inbuilt arrangement for fixing to support base with stainless steel screws complete for all heights and levels. All corners to be smoothly finished & SS welding.
5. The sheet/letters may be shining or mat finish as approved by engineer.

Aluminum

The thickness of sheet to be minimum 3mm.

1. Fixing to be done with SS or appropriate screws to avoid bimetallic action with aluminum.
2. The rates to be quoted per square meter.
3. The hanging aluminum hollow section to be of 100mm and 150mm width & make to be got approved. The powder coating of approved colour to be done and letters of approved specs and design to be pasted on such hanging aluminium hollow sections.
4. The hanging will be done by adjustable MS/GI rods of approved diameter and painting thereafter

Neon Glow signages

1. The diameter of tube to be got approved.
2. Make to be got approved.
3. Matter to be got approved.
4. To be made from 100% handcraft glass.
5. Rate to include electric wiring to illuminate complete in all respect as directed.

SAMPLES OF ALL MATERIALS, LETTERS MATTERS AND DESIGNS TO BE GOT APPROVED by ARCHITECT/ CLIENT BEFORE EXECUTION OF WORK.

15.00 PLUMBING & SANITARY INSTALLATIONS

- 15.01 Special condition for PHE work: The plumbing work shall be carried out by specialized plumbing agency who has licensed plumber and experience of similar works. For supervising the plumbing work at least one engineer who has rich experience in executing plumbing work shall be engaged full time. Approval of specialized agency shall be obtained from HSCC.
- 15.02 The provision of adequate sanitary and safety facilities as per the norms of NBC and good engineering practice shall be compliance during construction for construction workers and staff.
- 15.03 The water use for construction shall be suitable for the same and should be used efficiently and checks and control valves shall be provided to avoid the wastage and leakage.
- 15.04 To reduce the water consumption of the building, the flushing system of water closet shall be of dual flushing cistern type and plumbing fixture shall be provided which require GRIHA compliance for low flow rate.
- 15.05 Lab service related to plumbing & fire fighting will be executed by specialized agency who has experience of carrying out similar work earlier. All the lab item shall be detailed out &

redesign as per requirement of client , WHO, CDC norms, items given in BOQ are indicative but covered the cost as per the latest requirement of client , WHO, CDC and required approval of client before execution.

15.06 Wall Caps

Wall caps shall be provided on all walls, floors, columns etc. wherever supply and disposal pipes pass through them. These wall caps shall be chromium plated brass snugly fittings and shall be large enough to cover the puncture properly and shall conform to IS: 4291.

15.07 Pipes, Hangers, Brackets, etc.

Sturdy hangers, brackets and caddles of approved design shall be installed to support all pipe lengths, which are not embedded over their entire runs. The hangers and brackets shall be of adjustable heights and painted with red oxide primer, and two coats of enamel paint of approved make and shade. Clamps, coils and saddles shall be provided to hold pipes with suitable gaskets of approved quality. The brackets and hangers shall be designed to carry the weights of pipes safely. Wherever required pipes may run along ceiling level in suitable gradient and supported on structural clamps. Spacing for clamps for such pipes shall be as follows:

| | Vertical | Horizontal |
|--------------|----------|------------|
| G.I. Pipes | 300 cms | 240 cms |
| H.C.I. Pipes | 180 cms | 120 cms |

15.08 Pipe sleeve

Adequate number of sleeves (pipe inserts) of Cast Iron or Mild Steel shall be provided where pipes cross through concrete, masonry and similar work. The pipe inserts shall be provided with removable timber plugs to keep foreign matter out till installation of the services pipe cross the sleeve. The diameter of sleeve should be one size higher than the proposed dia or as instructed by the Engineer.

15.09 Floor trap inlet

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, contractor shall have a special type G.I. / M.S. inlet hopper without or with one, two or three inlet sockets to receive the waste pipe. Joint between waste and hopper inlet socket shall be lead caulked/welded/threaded. Hopper shall connected to a C.I. P or S trap with at least 50mm water seal. Floor trap inlet hoppers and traps shall be set in cement concrete 1:2:4 blocks without any extra cost.

15.10 C.P. gratings

Floor trap and urinal trap shall be provided with 110mm square or round C.P. /stainless steel grating, with rim of approved design and shape. Minimum thickness shall be 3 mm.

15.11 Hot Water Supply

The chase will be closed in cement mortar 1:2 (1 cement : 2 coarse sand). Pipes shall be clamped to the wall inside the chase.

15.12 Making Connections

Contractor shall connect the new sewer line to the existing manhole by cutting the walls, benching and restoring them to the original condition. A new channel shall be cut in the benching of the existing manholes for the new connection. Contractor shall remove all sewage and water if encountered in making the connection without additional cost.

15.13 Water Heater

Water heater shall be automatic pressure type water heater (with pressure release valve) with heavy gauge copper container duly tinned, thermostats, indicator lamp and glass wool insulator. the water heaters shall be fitted with pressure release valve, non-return valve and inlet and outlet stop valves as required. Water heaters to conform to IS:2082.

15.14 FULLWAY BALL VALVE

The valves shall be of full-bore type and of quality approved by the Engineer. The body and ball shall be of copper alloy and stem seat shall be of Teflon.

15.15 COMPOSITE PIPES: Composite pipes shall be used in the internal water supply if specified in the Bill of Quantities. These may required to be connected to the existing/ new GI pipes.

15.16 SAMPLE AND SHOP DRAWINGS;

All plumbing items shall be provided as per approved sample/data sheet approved by the HSCC. Before placing the order, the contractor shall submit the shop drawings prepared based on tender drawings and BOQ alongwith samples for approval of HSCC. The shop drawings shall have all the details. The contractor has to obtain the approval of external plumbing drawings from DJB/MCD before start of work.

16.0 BORE WELLS

16.01 Scope of Work

The general character and the scope of work to be carried out under this contract are illustrated in the following specifications. It gives only general guidance as regards design, drilling and construction of tubewells. Before selecting the method of construction to be adopted ,the contractor shall give due consideration to site condition and Geological data of the site. The construction and testing of tubewells shall be as per IS 2800- 1979 (Part 1 and 2). This contract is an item rate contract. All payments shall be made for the actual work executed. The Contractor shall ensure the required minimum yield. The work shall be carried out as per BOQ item. The details which are not available in BOQ, the details of technical specification are to be adopted.

16.02 Selection of Site

The site where the tubewell is proposed, shall be examined by tenderer, and changes if required shall be discussed with the engineer prior to start of work. Any previous data

available with the Contractor regarding nearby tubewells should be made use of to evolve suitable procedure for drilling , developing, testing etc.

16.03 Geological Data

During the drilling operation, contractor shall collect the samples of different strata from suitable intervals or where change in strata is met with. It shall be carefully examined and analysed and the data shall be preserved carefully and handed over to Engineer. The contractor shall make one drilling time log during the execution of work for the bore well.

16.04 Design and lowering of pipe assembly

The length and diameter of the housing pipe shall be selected on the basis of static water level, the drawdown and the discharge expected from the well and the size of the pump to be installed. The size and length of blind pipes and the slotted/ strainer pipes shall be selected according to the expected discharge and the depth of tubewell. The size and distribution of the slots shall be as per IS 8110. After completion of the bore hole the contractor shall assemble the tube well assembly according to the water bearing strata met during boring, after getting the same approved from the Engineer and shall lower in to the drilled hole the same keeping the slotted strainer opposite to water bearing strata from which the water is to be extracted . The bail plug shall rest on firm ground. Before the bail plug is lowered, about one metre depth of the bore hole shall be packed with the gravel to avoid sinking of the assembly. In case part of a bore hole is not proposed to be utilized, it shall be filled with gravel before lowering the assembly. The slotted pipe and other pipes shall be provided with proper guides to keep them in the centre of the bore to ensure uniform gravel packing all around.

16.05 Gravel Packing

All gravel shall consist of hard rounded particles reasonably uniform in diameter and shall be of size, determined after analyzing the character of the water bearing formation tapped. The gravel shroud around the screen shall be uniform. It should be free from dust, dirt and other vegetable matters. Gravel packing once started shall be carried out continuously until it is completed. Pea gravel/Stone Chips shall be thoroughly washed.

16.06 Development of Borewell

The well shall be developed either by surging and agitating or by over pumping and back washing with an air lift and high velocity jetting. The tube well shall be developed as per IS 2800 -1979 or latest by air compressor to be arranged by the contractor as required and stipulated in BOQ to obtain the maximum discharge available from the completed tubewell. Another acceptable method may also be adopted. This development process shall be continued until the stabilisation of sand and gravel particles has taken place. The development shall continue until the gravel should stop sinking, discharge of depression ceases to improve and the sand content is not more than 20parts per million. A record of the hours of working of Air compressor shall be maintained by Employer Engineer which will be signed by the contractor or his authorised representative. Payment for development of tubewell shall be made at the hourly rate indicated in the schedule of quantities for the actual period during which the Air-Condition has worked. A statement showing the quantity of gravel initially

filled in the bore and the quantity added during development should be prepared by the contractor and got signed by the representative of the Engineer.

16.07 Disinfection

The well shall be disinfected after completion of test for yield. All the exterior parts of the pump coming in contact with the water shall be thoroughly cleaned and dusted with powdered chlorine compound. In fact it shall be disinfected every time a new pump is installed or the one installed is replaced after repairs.

The stock solution of chlorine may be prepared by dissolving fresh chlorinated lime. For obtaining an applied standard concentration of 50 ppm, 1 litre of the stock solution shall be used to treat 300 litres of water.

16.08 Grouting and sealing

Grouting and sealing of tubewell may be done, if required depending upon the site conditions and the quality of the discharge of the strata encountered. To ensure that the grout shall be provided a satisfactory seal, it shall be applied in one continuous operation. Sealing of the tube well may be done by grouting the annular space between bore and the housing pipe, with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 : coarse aggregate 20 mm nominal size) to a depth of 5m below the grouted level.

16.09 Handing over of the borewell.

The tubewell shall be handed over in complete shape. The housing pipe shall be closed by a well cap for the period between the completion of the tube well and the installation of the pump set.

The following information shall be furnished by the drilling agency on completion of the tubewell :

- a) Strata chart of the tube well indicating the different types of soils met with, at different depths.
- b) Samples of strata collected , neatly packed and correctly marked in sample bags.
- c) Chart of actual pipe assembly lowered indicating the size of pipes, depth ranges, where slotted/ strainer pipes have been used, depth and diameter of housing pipe, reduced level of the top of the housing pipe and the diameter and depth of the bore hole.
- d) Position of every joint in the well assembly.
- e) Hours of development done by the compressed air, pump sets or by other means.
- f) Pumping water level at the developed discharge.
- g) Two copies of test certificates of the water samples results from approved testing agency.
- h) Results of development along with levels of static subsoil water and depth of draw for steady discharge.
- i) Results of mechanical (sieve) analysis of samples of aquifer materials wherever applicable.
- j) Yield analysis and recommendation on the safe pumping yield, pump settings and specifications for suitable pumps etc.
- k) Verticality tests results to be recorded in accordance with IS:2800-1979

16.10 TUBEWELL DATA/As per BOQ

1. Yield required 500 lpm (Sand free delivery from borewell)
2. Bore - 450 mm dia.
3. Approximate depth – 100 metre
4. Assembly - Blind/ Slotted Pipes – 200 mm dia. Upto complete depth.
5. Material – MS Class “C” pipes (Heavy Class)/UPVC pipe as per IS: 12818
6. Verticality – True verticality as per IS – 2800- 1979
7. Packing – Pea Gravel/Stone Chips
8. Developing – Minimum 72 Hrs or till sand free discharge is obtained.
9. Water for drilling – Contractor shall make his own arrangement for water required for drilling purposes as well for development purposes.
10. The design for the tube well indicating the depth range of the aquifer zones to be tapped shall be given after a detailed study of the data collected during drilling operations.
11. All the casings shall be of ERW steel/UPVC- IS 12818(As per BOQ) quality confirming to IS specifications and carry manufacturer’s certificate. The pipes shall have a wall thickness of not less than 7 mm or as per IS 1239. The slotted pipes must have an effective open area of atleast 15% and the slotted size should be 1.6 mm. All pipes shall be painted fresh before lowering. The pipes shall be welded thoroughly all round to prevent leakage and breakage. Centering guides may be used to maintain the verticality of the tube wells which shall be tested in accordance with the norms stipulated in IS 2800.
12. The annular space between the bore well and tube well assembly shall be packed with well-graded pea gravel of good quality, durability and high sphericity.

16.11 Guarantee

On award of the work contractor shall submit a guarantee covering the quality and performance of all material supplied and installed under the contract. This guarantee shall cover each and every material whether manufactured by the contractor or not.

16.12 Rate

The rate quoted for Borewell items shall provide for the cost involved in all the above described operations.

17.00 WATER TREATMENT & PUMPS

1.0 SCOPE OF WORK

Work under this section consists of furnishing all labour, materials, equipment's and appliances necessary and required to supply, install and commission pumping and water filtration as described hereinafter and given in the schedule of quantities and/or shown in the drawings. Tentative raw water characteristics are given in Appendix-1

2.0 GENERAL REQUIREMENTS

2.1 All materials shall be new and of the best quality conforming to specifications and subject to the approval of Engineer.

2.2 All equipment shall be of best available make manufactured by reputed firms.

2.3 All equipment shall be installed on suitable foundations, true to level and in a neat work-man-like manner.

2.4 Equipment shall be so installed as to provide sufficient clearance between the end walls and between equipment to equipment.

2.5 Piping within the pump houses shall be so done as to prevent any obstruction in the movement within the pump house.

2.6 Each pumping set shall be provided with a valve and a flap type non-return valve on the delivery side.

2.7 The contractor shall submit the following documents :

a. Process and hydraulic design calculations for all units.

b. Civil, Structural arrangement , design calculations if included in the scope of work.

c. Plant layout drawings

d. Process flow sheet

e. Design Philosophy

f. All technical brochures,

g. Operation and maintenance manuals and other details of the system offered.

h. Equipments listing & list of consumables.

2.8 The contractor shall supply shop drawings with supporting details for approval from Engineer before procurement of material. The contractor shall also obtain approval from local statutory authority / authorities as applicable at no extra cost.

Four sets of shop drawings shall be submitted for approval showing:

- a) Any change in layout from the contract drawings.
 - b) Equipment layout, piping, wiring diagram and instrumentation.
 - c) Manufacturer's or contractor's fabrication drawings for any material or equipment.
- 2.9 COMPLETION DRAWINGS

On completion of the work and before issuance of certificate of virtual completion, the Contractor shall submit to the Engineer. General layout drawings, drawn at approved scale indicating layout of pump house piping and its accessories "As installed ". These drawings shall in particular give the following:

- a. General layout of pump house.
 - b. Panels and other equipment location and sizes etc.
 - c. Complete Schematic as installed.
 - d. Route of all cables and pipes run along with detail sizes and mode of installation.
- 2.10 The contractor shall also include the cost of supply and execution any other item required for the effective functioning of system but not mentioned in schedule of quantities/ specifications.

2.11 The contractor shall also arrange for the appropriate training for the clients staff.

2.12 PERFORMANCE GUARANTEE

At the close of the work and before issue of final certificate of virtual completion by the Engineer, the Contractor shall furnish a written guarantee indemnifying the Owner against defective materials and workmanship for a period of one year after completion and handing over. The Contractor shall hold himself fully responsible for reinstallation or replace free of cost to the Owner.

- a. Any defective material or equipment supplied by the Contractor.
 - b. Any material or equipment supplied by the Owner which is proved to be damaged or destroyed as a result of defective workmanship by the Contractor.
- 2.13 A tentative treatment scheme is shown in the drawings.

3.0 WATER SUPPLY PUMPS

3.1 Water supply pumps shall be centrifugal types as given in the schedule of quantities.

3.2 Water supply pumps shall be suitable for clean filtered water, pump shall be single stage pumps with cast iron body and gunmetal/bronze/SS impeller and directly coupled motor suitable for 400X440 volts, 3 phase, 50 cycles A.C. power supply and mounted on single base frame.

4.0 WATER FILTER (MULTI-GRADE)

Water filters shall be sand/gravel and anthracite pressure filters downward or upward flow type suitable for a rate of filtration given in schedule of quantities.

Filters shall be vertical types of a required diameter, the shell shall be fabricated from M.S. plates suitable to withstand a working pressure given in schedule of quantities. The thickness of shell and of dished ends shall be as per IS: 2825. The filter shall have two-pressure tight manhole cover one at the top and other at side shell portion. Each filter shall be provided with screwed or flanged connections for inlet, outlet, individual drain connections and all other connections necessary and required. Filters shall be rubber lined with 3mm thick non-toxic, non-leaching rubber. Rubber lining to be tested with Spark Tester for pinholes etc. Primary painting of all exposed surfaces to be done.

5.0 UNDER DRAIN SYSTEM

Each filter shall be provided with an efficient under drain system comprising of collection pipes, polypropylene nozzles of manufacturer's design. The entire under draining system shall be provided on M.S. Plate or cement concrete supports provided by the contractor.

6.0 FACE PIPING

Each filter shall be provided with interconnection face piping comprising of inlet, outlet and backwash complete with diaphragm valves/ball valves. Piping shall be fabricated from mild steel pipes as per IS: 1239.

7.0 ACCESSORIES

Each filter shall be provided with the following accessories:

- a) Air release valve with connecting piping.
- b) 100mm dia Borden type gunmetal pressure gauges with gunmetal isolation cock and siphon on inlet and outlet.
- c) Sampling cocks on raw water inlet and filtered water outlet.
- d) Individual drain connection with ball valves for each filter.
- e) Connections with valve for air scouring.
- f) Rate of Flow Indicators in the raw water inlet line.
- g) Quantity meter in the filter water outlet line

8.0 FILTER MEDIA

8.1 Each filter shall be provided with clean and washed filter media, following is recommended.

| | | |
|----------------------|-------------------|--------------|
| Coarse Silex Pebbles | 6.0 - 10.0mm size | (150mm deep) |
| Fine Silex Sand | 1.4 - 2.5mm size | (600mm deep) |
| Anthracite | 0.80 - 1.6mm dia | (600mm) |

8.2 The above filter media arrangement may be altered to suit contractor's own design for the most efficient performance and also keeping the low height available for the installation of these Vessels.

9.0 TEST KITS

9.1 Provide one test kit with initial requirement of reagents for the following:

Residual Chlorine Indicator

Valve

9.2 Details of equipment with literature shall be supplied with the tender.

10.0 VALVES

10.1 Valves 50mm dia and above shall be of cast iron butterfly valves.

10.2 Non-return valves 80mm dia and above shall be cast iron double flanged conforming to IS: 5312, 65mm and below shall be of gunmetal.

10.3 Valves 50mm dia and below shall be cast iron ball valves with stainless steel SS-304, stem and ball (S.S.304 or brass with hard chrome plating) with Teflon seat.

10.4 Suction strainer shall be of cast iron with S.S. Perforated sheet.

11.0 PAINTING AND CLEAN UP

a) On completion of the installation Contract shall be scrub clean all pumps, piping, filters and equipment and apply one coat of primer.

b) Apply two or more coats of synthetic enamel paint of approved make and shade.

c) Provide painted identification legend and direction arrows on all equipment's and piping as directed by Engineer.

d) All M.S. fabricated items M.S. pipe lines structural, vessels for water treatment plant shall be painted with zinc/chromate primer after through cleaning. On completion of the installation Contractor shall scrub clean all pumps, piping, filters and equipment and again apply one coat of zinc chromate primer.

e) On final completion of the work, contractor shall clean up the site and the pump room, pump room of all surplus material, rubbish and leave the place in a broom clean condition.

12.0 MOTOR CONTROL CENTERS

12.1 Switchboard cubicles of approved type shall be fabricated from 2mm thick CRC sheet with dust and vermin proof construction. It shall be painted with powder coating of approved make and shade. It shall be fitted with suitable etched plastic identification plates for each motor. The cubicle shall comprise of the following (Switchgear as given in the schedule of quantities):

a) Incoming MPCB of required capacity

b) Isolation MPCB/MCCB, one for each motor

c) Fully automatic DOL/Star Delta starters suitable for motor DOL upto 7.5 H.P.; Star/Delta for 10 H.P. and above H.P. with push buttons one for each motor and On/Off indicating neon lamps.

d) Single phasing preventor of appropriate rating for each motor

e) Rotary duty selector switch

f) Panel type ampere meters one for each motor shall be with rotary selector switch to read line currents.

- g) Panel type voltmeter on incoming main with rotary selector switch to read voltage between phase to neutral and phase to phase
- h) Neon phase indicating lamps and indicating lamp for each motor and on incoming mains.
- i) Rotary switch for manual or auto operation for each pump
- j) Fully taped separate aluminium bus bar of required capacity for normal and emergency supply where specified.
- k) Space for liquid level controllers and other equipment specified separately in the contract/given in the schedule of quantities
- l) The panel shall be pre-wired with colour coded wiring. All interconnecting wiring from incoming main to switchgear, meters and accessories within the switchboard panel. Wiring shall have suitable copper or aluminium ferrules.

12.2 Switchboard cubicle shall be floor or wall mounted type as directed by the Engineer.

13.0 WATER SOFTENING PLANT

Mild steel pressure vessel complete with dished ends, supporting legs and facing pad for pipe connection, internally rubber lined and externally two coats of red oxide primer and two coats of synthetic enamel paint complete with manhole, cover, frontal pipe work fitted with valves provided with inlet, outlet pressure gauges and sample valves and with frontal pipe work complete with manually. Ball Diaphragm for normal operation and regeneration and hydraulically operated erector, initial charge of resin and internals consisting of distributor, collector and regeneration tank to store and measure chemicals for regeneration.

13.1 Hardness Test Kit

Details of test kit with literature shall be supplied by the contractor at appropriate stage.

14.0 REVERSE OSMOSIS (R.O.) PLANT FOR PROCESS AND DRINKING WATER

14.1 On the basis of sample water analysis, the Contractor shall design, supply, erect, test and commission the pre-assembled RO system. The system shall consist of but not be limited to the following:

- a) PP wound Micron Catridge Filters in food grade material in combination of 5 & 10 micron rating or alternatively spring type cross filter with manual/auto backwashing system and shall be provided with necessary isolation valves, inlet & outlet pressure gauges etc. Micron filters shall be with differential pressure measurement system and cleaning frequency should not be more than once in a month.
- b) Anti-scalent and pH correction system as per feed water quality along with process demanding instrumentation and piping etc.
- c) RO module fitted with thin film composite TFC polyimide spiral wound element type membrane of adequate area/size & no. encased in SS housing and all necessary accessories/controls to perform the desired duty. Cleaning frequency shall not be more than once in a month.
- d) High pressure pump for feeding RO system with necessary instruments like high & low pressure switch, pressure gauges and isolation valves etc.
- e) On line panel mounted pH control and conductivity indicators.
- f) Suitable NRV at the outlet of Permeate.

- g) Electric control panel for the system operation consisting of HP Pump starter with overload protection, manual-auto-off operational selector switch, pre-wired instrumentation panel.
 - h) Decarbonator unit consisting have packed column of food grade FRP, degasser blower, degassed water tank etc. complete with frontal piping.
 - i) MS skid frame mounted cleaning in place system for easy movement with polyethylene tank and accessories.
 - j) In-built flushing system for flushing the deposition of concentrate in the membrane during non-operating period of plant.
 - k) Electronic type Rotameter for permeate and rejection along with companion flanges.
 - l) Dosing system having trip interlocks with HP feed pump to RO membrane to get ripped if the HP pump trips.
 - m) Interconnecting piping & strainers etc.
 - n) Low/High pressure cutouts
 - o) Back pressure regulator.
 - p) Pressure gauges of suitable rang in 4" dial with SS contact parts.
 - q) Flow meters & control valves
 - r) Level Indicator/Controller in the R.O. Water Storage Tank for automatic shut off/starting of the plant.
 - s) Safety relief valves.
 - t) Instrument & Electrical panel with starter and overload protection.
 - u) TRFC type motor suitable for 415v, 3 phase, 50 Hz AC supply.
 - v) Minimum percentage recovery of the system shall be mentioned (and guaranteed by the Bidder).
 - w) The membrane element shall be suitable for handling 6.5 to 8 pH feed quality and the required service to provide permeate quality of less than 100 ppm TDS. The system shall be provided with stand by cartridge filter arrangement and all parts in direct contact with water in the RO system shall be in SS316 material. The Contractor shall also specify necessary procedure for membrane cleaning along with dosages of chemicals.
- 14.2 Power & control wiring for the feed pumps & R.O. output water transfer Pump will be as per Electrical drawings approved for the system.
- 14.3 Solenoid Valve will be provided at the outlet of RO Module.
- 14.4 Piping shall be as per system requirement.
- 14.5 Complete Scheme, Equipment Layout, P&I Diagram & Electric circuit diagrams shall be got approved from the owner or its authorized representative before execution of work.
- 14.6 Water storage tanks for storage of R.O. treated water:
- To be constructed from FDA approved food grade polyethylene, completely drinking water with built in UV stabilizer, screw able or lockable lid. Inner layer should preferably in white colour.

- 14.7 Following items will also be under Contractor's Scope of Work:
- a) RO Water Storage Tank.
 - b) All inter-connecting Pipes within the system battery limits
 - c) Power & signal cabling & control system with in battery limits
- 14.8 Hydro Test shall be offered at pressure 1.5 times the operating pressure or 5 kg/sq.cm, whichever is higher for all equipment during shop inspection.
- 14.9 Warranty: Membranes will be warranted for a period of 36 months.
- 15.0 Automation for Water Treatment & Water Supply System

Raw water from Tube Wells would be received in the underground Fire Tank (T1) from there it overflows to the underground Raw Water Tank (T2).

There is no consumption of water from (T1) except in case of fire or during trial runs of the Fire Pumps and the above overflowing arrangement is provided to prevent stagnation of Water in Tank (T1).

The Tube Well Pump would be automatically switched on off by Level Controller provided in Tank (T2.) The same Level Controller would give audio/visual alarm in case of reaching very high (HH) or very low (LL) level. (Chlorination to kill bacterial/virus is done in the Filtered Water with a Chlorine Dosing Pump in the line going to OH Tanks.)

Raw Water from Tank (T2) is pumped by Pumps P6 A/B to the Filter Water Tank, after passing through Filter. Raw Water from Tank (T2) is also pumped by Pumps P7 A/B to the Over Head Fire Water Tank (T5) from there it overflows to the Over Head Flushing Water Tank (T6 & T5). Filtered water pump P6 A/B would be automatically controlled by the Level controller provided in tank (T5) and Raw Water Lift Pump P7 A/B would be automatically controlled by the Level controller provided in tank (T6 & T5). These Level Controllers as in earlier cases would also give audio visual/alarm in case of very high or very low level.

Filter Water from Tank (T3) is pumped by Pumps P8 A/B to the Soft Water Tank, after passing through Softener. Filter Water from Tank (T3) is also pumped by Pumps P9 A/B to the Over Domestic Water Tanks (T7 & T12). Filtered water pump P8 A/B would be automatically controlled by the Level controller provided in tank (T4) and Filter Water Lift Pump P9 A/B would be automatically controlled by the Level controller provided in tank (T7 & T12). These Level Controllers as in earlier cases would also give audio visual/alarm in case of very high or very low level.

Soft Water from Tank (T4)s pumped by Pumps P10 A/B to the Over Head Soft Water Tank. Soft Water pump P10 A/B would be automatically controlled by the Level controller provided in tank (T8) These Level Controllers as in earlier cases would also give audio visual/alarm in case of very high or very low level.

Domestic Water from Over Head Domestic Water Tank (T7) shall be go into the R.O. Plant placed on the terrace of super specialty block and from there the RO water would be distributed for bother super specialty block and service block

R.O. Water Plant would be automatically controlled by the Level controller provided in tank (T9) Similarly, R.O. Water Plant on Library Block would be automatically controlled by the Level controller provided in tank (T13) This Level Controller as in earlier cases would also give audio visual/alarm in case of very high or very low level.

Electric Control Panel containing DOL starters for all the pumps described above would be supplied by the Owner. The Automation System Vendor has to provide interface with the contractors of these Pump Motor Starters. There would be enough empty space in the bottom tier of this Electric Control Panel. However, Automation System Vendor has to provide full details of such relays controllers indication lights/ alarms etc. to the Owner for incorporating there in the Electric Control Panel.

16.0

TREATED WATER QUALITY

The out put from Softener shall conform to commercial hardness. Similarly the resultant TDS from RO system shall be less than 100 PPM. Other output parameters from the system shall with in the Desirable limits specified in IS :10500 standards.

APPENDIX - I

Tentative Raw Water Characteristics :

| S.NO | PARAMETER | VALUE |
|------|-----------------------------------|-----------------|
| 1. | Hardness | 550 mg/l |
| 2. | Colour | Less than 5 |
| 3. | Odour | Unobjectionable |
| 4. | Turbidity | 4 NTU |
| 5. | PH | 6.5 to 8.5 |
| 6. | Total iron | 0.1 mg/l |
| 7. | Chlorides | 250 mg/l |
| 8. | Total Dissolved solids | 1000 mg/l |
| 9. | Coliform organisms at 37o C (MPN) | 221 per 100 ml |
| 10. | E-Coli | 79/100 ml |

Note : The parameters and characteristics of raw water given are tentative only. The contractor shall on his own collect and assess the nature of water available at the site and has to design the system according to that.

18.0 HYDROPNEUMATIC SYSTEM

1. SCOPE

This section of the contract involves the design, supply, installation, testing and commissioning of the complete Hydropneumatic pumping system and other pumping systems complete with all controls and electrical work for domestic water supply. All submersible, drainage pumps for the project are also included in this contract. It also involves testing and commissioning of the pumping system with the domestic water and flushing water supply & distribution.

This specification described the particulars of the contract, designs and systems chosen, and mode of operation.

All installation work shall comply with the latest rules and regulations.

The work embraced by this specifications covers the design, submission to authorities, supply, delivery on site, installation, testing, commissioning and maintenance of the Hydropneumatic pumping system, other pumping system installation of the building in accordance with this specification and associated drawings.

The scope of work shall include the following (list is indicative and not exhaustive) :

- Variable speed pumping units domestic water supply & distribution.
- Suitably sized food grade quality, non-toxic diaphragm type pressure vessels complete with necessary interconnections and controls.
- Control panel for pump control complete with variable speed drives, circuit breakers, fuses, pressure transmitters etc. complete with all interconnections to pumps and electrical supply panels.
- Pump control units complete with pre-programmed micro-processorchip.
- Pump monitoring units to monitor operation of pumps.
- Each Hydropneumatic Pumping unit shall be supplied as a complete set including variable speed pumps, pressure vessels suction and discharge common manifolds, non-return valves, isolating valves, pressure transmitters on the discharge side and level electrode at the suction tank. Each unit shall be provided with electronic microprocessors for unit control and all necessary electrical work for the unit.
- Submersible drainage pumps for plant room drainage complete with electrical panels and necessary accessories with automation for pump operation.
- The Hydropneumatic system supplier shall provide the pumping units in the designated pump rooms as complete units included all necessary piping within plant such that only discharge connections are required to be connected into the unit's discharge manifolds just inside the plant room, by the Plumbing tenderer. The Hydropneumatic system tenderer shall guarantee specified pump performance at various pump speeds and Hydropneumatic pumps must be able to supply at least 2 bar pressure at the highest/farthest fitting.
- Electrical equipment and installation work including the PLC in Control panel.
- Painting and labelling of pipework and equipment;
- Provision of all hold down bolts, spigots struts and the like required to be built in during construction;
- Provision of all level switches, flow switches and other sensing devices for status indication.
- All interfacing work with other trades.
- Testing and commissioning and balancing of the Hydropneumatic & Pumping system;
- Provisions of operating instructions and maintenance manuals;
- Provision of spare parts;
- Training of the employer's staff for proper operation of the entire systems;
- Liaison with Local Authorities to obtain all necessary certificates and approvals, including the completion of all submission drawings, forms and payment of any fees and charges. All the costs for all the tests required by Local Authorities shall be included. To attend to any

Authorities inspection regardless of whether this inspection is carried out after the defect liability period;

- Provisions of the necessary installation which include pumping works, pipework within the pumping unit up to suction and discharge manifolds, conduit and control wiring, etc. to form a workable system required;
- All other works and systems as specified in the Contract document and or shown on the drawings.
- All cutting, patching, framing up, furring in, chasing and making good associated with the building construction for the passage of pipes, conduits and the like including providing GI pipes sleeves of required size corresponding to pipe dia, wherever pipes crossing fire rated walls and floors and sealing with glass wool in between and fire sealant compound on either end. Details on shop drawings shall also be provided.

2 GENERAL

Equipment offered for supply and installation shall include the following:

All minor items and incidental work, equipment accessories and materials may not be specifically mentioned but are required for the proper completion of the installations in accordance with the true intent and meaning of this Specification.

Readily accessible, dust-proof lubricating facilities on all moving parts and equipment including provision for cleaning all lubricating lines and bearings and charging same with the correct lubricants after installation but prior to testing and commissioning.

Clearly visible and robust manufacturer's name-plates permanently fitted each and every item of equipment and showing the manufacturer's name, type and/or model number, serial number, and all essential operating data such as speed, capacity, voltage, current draw, etc.

The Tenderer also shall allow provision for the inspection of all plant and equipment by the manufacturer or his licensed representative, at least twice during the course of the installation.

3. PIPING

The pipes and fittings in the domestic Water Treatment plant room shall be GI class 'C' (heavy class) conforming to IS: 1239 (Part-I) for pipes and IS:1879 (Part 1 to 10) for malleable cast iron galvanized fittings or specified in the BOQ.

19.0 PUMPS FOR HYDROPNEUMATIC & DRAINAGE SYSTEM

19.1 PUMPS

Pumps shall be vertical, centrifugal, multistage directly coupled to motor. Provision of pump with pump head & base of cast iron and other parts in SS 304 shall be made for pumps required in Hydropneumatic System. Impeller shall be hydraulically balanced and keyed to shaft. Pump shall be mounted on a concrete foundation, projecting at least 15 CM above finished floor level. The pumps base shall be set on a vibration elimination pad. The pump shall be lubricated in strict accordance with the manufacturer's instructions and shall be factory aligned prior to shipment. All motors and bases shall be painted with approved finish shop coat of paint. The pump shall be selected for the lowest operating noise level and shall be complete with flexible connections, valves, and pressure gauges. The pumps shall include cost of foundation channel complete.

The Tenderer shall supply and install pumps of the type and performance as shown on the drawings. All duties of pumps given in the Tender Drawings shall be checked and where necessary corrected before ordering. All the parts of the pumps that are in contact with water e.g. shaft, impeller etc. shall be of stainless steel construction.

Pumps shall be so selected that the design duty point is within 5% of the maximum efficiency point. The pump casing so selected shall have ample space to take an impeller one size larger than that capable of performing the design duty.

Pumps of 2900 rpm with high efficiency and low noise motor can be selected and noise data submitted for approval. All pumps and motors shall be of minimum vibration and noise level during operation. Vibration isolators shall be provided for all pump sets.

Facilities shall be provided to prevent starting of pumps when the water tank is at low water level. An indicator for this low water level alarm shall be provided.

Facilities to select which pump to be duty pump and standby pump shall be provided and be interchangeable.

Pump curves for all pumps offered shall be submitted. All curve indicating excessive shut-off head will not be approved.

Each pump shall be provided with a gate valve at suction and discharge, approved check valve at discharge, approved strainer at suction, flexible connections at pump suction and discharge, eccentric reducer at suction, concentric reducer at discharge, pressure gauges at suction and discharge, circulation relief valve and automatic air relief valve.

Appropriate neoprene vibration isolation mountings shall be provided for each pump sets.

Vertical Pumps

Multi-stage pumps shall be of centrifugal type and arranged with shafts vertically installed. The impellers shall be of stainless steel mechanically balanced and keyed to shaft. Renewable guide rings are to be provided in the casting, keyed to prevent rotation.

Pumps shall be driven by elevated in-line TEFC squirrel cage motors via extended vertical shafted complete with universal couplings.

The shafts shall be stainless steel. Stainless steel sleeves shall be provided to protect the shaft in the water space and through the sealing glands. The sleeves shall be keyed to prevent rotation and secured against axial movement.

The bearings shall be of ball or roller type protected against ingress of water, dirt and other matter.

Vertical multistage pumps shall have universal flanges. Intermediate bearing, support bearing shall be provided in the pump.

The shaft seal shall be easily serviceable and shall allow for correct adjustment and loading of the seal. Pump motors above 7.5 kW shall be equipped with a spacer coupling which allows changing of shaft seals without removing the motor. The pump motors shall be of Class "F" insulation and IP55 rating and shall be provided with built-in thermistors for protection against over heating.

19.2 VARIABLE SPEED HYDROPNEUMATIC PUMPING SYSTEM

Variable speed Hydropneumatic pumping units shall be provided for supply of domestic water, flushing water supply for the project. The units shall be selected so as to provide at

minimum of 2 bar pressure at the highest/farthest fitting in each plumbing system, the unit serves. The hydropneumatic pumping units shall have the following features ;

19.2.1 System Description

The system shall be supplied as complete sets including suction and discharge common manifolds, non-return valves, isolating valves, pressure transmitter on the discharge side and electrode at the suction tank.

The system operation will be such that the initial small water demand shall be met by the charged diaphragm pressure vessel. Should the water demand continue the system pressure will dip to a preset pump cut-in point when the lead pump starts to operate at reduced speed through the variable speed drive. However, should the system pressure be still below the preset value, the controller continuously increases pump speed to meet the system demand. When the lead pump is not able to meet the system pressure at full speed, the second pump also starts to operate.

At peak demand all the pumps operate, Similarly, if there is a drop in water demand the duty pump speed starts to reduce, then standby pumps cuts-off, followed by stopping of the duty pump.

The closed diaphragm pressure vessel shall be of polyethylene material with a pressure gauge and isolating valve. The interior shall be of non-toxic lining suitable for use with potable water. The vessel shall be manufactured to conform to ASME pressure vessel code/standards.

The system shall be under the control of an electronic microprocessor unit (EMU).

A pressure transmitter shall detect the pressure at the delivery manifold and feedback to the microprocessor control panel via control circuit.

The system shall incorporate a frequency converter or frequency converter motors on the pumps and the pressure transmitter shall register the actual pressure on the discharge side.

The variable speed drive pumping system shall maintain a constant pressure regardless of the system demand. If there is a drop in pressure outside the preset point, the Variable Speed Drive (VSD) pump shall start to run until the pressure increases to the preset limit, or it will continue to increase the pump speeds to the upper limit of the frequency. If the water system demand still cannot be met, the second pump shall be called in to run, the VSD will then alter the pump speed to meet the preset pressure point. If the set point is still unable to be met, the third pump is then activated to run (in case of 3 pumps units).

This shall be achieved by continuously varying the motor speed of the duty pump according to the demand up to a maximum designed capacity.

Under decreasing hydraulic demand the reverse sequence to the above description shall apply.

The EMU shall ensure alternation of all the duty and standby pumps for even running hours for all the pumps.

The frequency converter shall be linked to the motor of the duty pump for continuous speed adjustment and ultimately the water delivery shall be maintained at constant pressure at the preset value.

19.2.2 Local Motor Control Panel

The motor control panel shall be equipped with all the necessary electrical components including a microprocessor control unit and a frequency drive. The control panel and the microprocessor shall cover the followings functions :

- Flexibility and simplicity in allowing the necessary re-adjustment of the pumping system pre-set delivery pressure to operate the pumps within the specified maximum and minimum delivery ranges.
- Built-in frictional loss compensation factor which will automatically increase the delivery pressure setting, in collaboration with the increase in flow demand. This shall be able to minimise the system pressure differences and provide a more constant pressure along the supply line and also to save the energy consumption of the motor when running at low speed.
- Automatic changeover of the pumps to be controlled by the microprocessor which dictates the duty and standby pumps to run at variable speed.
- Built-in clock functions with weekly programming and with switch on system to operate at least 10 different pre-set pressure points as required.
- When the system has not been operated for more than 24 hours, it shall automatically start the pumps for a few seconds/day to ensure the pumps readiness at all times. The standby pumps shall be activated upon failure of duty pump(s). In event of control failure, the pumps shall be able to be start/stopped manually at the local panel by means of pressure switches.
- The microprocessor control panel shall be able to cut-off the pumping system when excess pressure is registered in the discharge common manifold.
- The system shall have the capability of receiving input signal concerning reduced water level in suction tanks and shall have control mechanisms to prevent the pumps from running dry.
- Automatically starting the pumps when the water level is back to normal.
- In case of pump failure due to motor overload, the standby pump is switched on automatically. Alarm signal is displayed on the LCD Display unit and alarm lights are activated.
- Functions to limit the no. of start/stop of pumps per hour.
- The system control panel shall incorporate at least the following components :
 - a. LCD Display
 - b. Pumps selections for up to 4 pumps so that system controller can control up to 6 pumps
 - c. Pump status button to display duty pump speed and system capacity
 - d. Zone status button to display operating parameters for different pumping units
 - e. Setting button to input preset pressure, system start/stop time etc.
 - f. ± 1 button to key in numeric data such as pressure set point, etc.
 - g. Enter button for confirmation of input into the system
 - h. Alarm button to show location of fault - self diagnostic function display
 - i. Hour Run measurement for each supplied pumpset

- j. Buttons for scrolling to select the actual display reading for system configuration, i.e. up and down scroll concept.
- k. Necessary devices for programming, supervising and monitoring operation data/system, status shall be incorporating into the control panel.

19.2.3 Operations

Local control panel shall perform as follows :

Auto mode

The desired delivery pressure within the range specified, shall be set at the duty local control panel. The pressure transmitter shall detect the delivery pressure continuously within 1 second and feedback to the microprocessor which will control the variable speed drive frequency converter for speed control of the duty pump. When demand increases, the subsequent pumps in the system will be activated to boost up the pressure. Ultimately the duty pumpset shall be operated fully automatically to maintain the delivery pressure constantly at the desired set value.

Manual Mode

The on/off function of the pumps shall be manually adjusted at the microprocessor located at the local control panel.

Frequency Control By-pass Mode

All the pumpsets shall be started/stopped automatically with the pump output at fixed maximum rotational speed. All the control and protection functions shall remain active. The cut in/cut out pressure shall be internally calculated by the microprocessor for each pump.

19.2.4 System Features

The required performance features of each Hydropneumatic pumping unit shall be as follows :

System Configuration

Variable speed pumps with pressure vessels.

Control panel consisting of the following components :

- Pump Functional Unit (PFU) - control unit c/w pre-programmed microprocessor chip. This unit shall control all pumping unit operations through electronic controller.
- Pumping Monitoring Unit (PMU) - monitor the operation of the pumpsets. This unit shall allow for monitoring and setting of all control parameter.
- Variable Speed Drive
- Circuit Breakers
- Fuses
- Pressure Transmitter

Set Point

Ten separate pressure “set points” shall be able to be programmed into the PMU, and switching between set points is timed by a real time clock when a lower pressure is acceptable during certain periods, for instance after hours or weekends, the set point shall be lowered to minimise power consumption.

An external input shall also be used to switch between set points, or manually adjust a set point at any time.

Friction Loss Compensation

It shall be possible to allow for the friction loss component of the system, calculated at full flow and set as a percentage of the set point which will reduce the working pressure of the pump set depending on the actual no. of pumps in operation. A linear approximation of system resistance curve can therefore be allowed for, and pressure will automatically increase as system flow and subsequent frictional losses increase. As such power consumption shall reduce which is required for the pumping system.

Displays

Through the PMU keypad all variable parameters shall be adjustable, current status of settings and measured values shall be able to display on the 2 line x 24 character liquid crystal display.

Individual menus shall be available for monitoring individual pumps, zones, settings, alarms and ON/OFF functions.

Pump Status

Running hours of each pump
Actual pump status (running, not available, standby, allocated to zone, fault)
Maximum head of pump at zero flow.

Zone Status

This menu shall be the main operating menu where at the setting and operating parameters can be viewed,

Current operating set point
Measured values in the system
Operating capacity in terms of total output
Mode of operation for the zone
Clock programs (relating to set point pressures)
Standby pumps
Pump change over time
Zone configuration
Pressure transducer scaling
Friction loss compensation
Pump priority
Inlet pressure measuring (if required)
System response times
Allowable number of starts per hour for the pumps
Minimum limit (loss of water, burst mains protection)

Setting Menu (Set)

In this menu all parameters for the operation of the pump set shall be able to be adjusted as required.

- a Set points (up to 10)

- b. On/Off function (used to prevent unnecessary cycling at low demands)
- c. Displayed pressure units (Bar, PSI, mBar, kPa)
- d. Real time clock programming for any time of the day, week, or weekend
- e. Zone configuration
- f. Friction loss compensation

Alarm

The alarm menu shall display all faults that occur during operation, logging the time and date of when the fault occurred and when it was corrected, or whether it is still an actual fault, up to 10 faults can be maintained as history in the controller. The following type of faults shall be diagnosed by the controller.

- a. Mains failure
- b. Frequency converter fault
- c. Analogue input (pressure transducer) fault
- d. High discharge pressure fault
- e. Low discharge pressure fault
- f. Motor thermal overload fault

Variable Frequency Drive

Variable frequency drive shall be of a reputable make acceptable to Project Manager and shall be complete with RFI filter and harmonic dampers.

Enclosure

An IP 54 powder coated steel enclosure shall house all the electrical components.

The enclosure can be supplied loose for remote mounting, or mounted on a common base with the pumps, it shall be adequately ventilated for use in conditions up to a maximum ambient temperature of 45 degrees Celsius.

Electrical Componentry

All circuit breakers, thermal overloads and contactors shall be of reputable make acceptable to the architect. Electrical supply to the pump controller shall be protected using an isolating circuit breaker.

Method of Starting

The panel shall be built to start the pumps in suitable starting modes, i.e. D.O.L., Star/Delta, or using Soft Starters.

Quality and Testing

Manufacture of the pumps, plus design and assembly of the complete packaged Hydropneumatic pumping system shall be factory assembled and the pump station shall be fully tested hydraulically and electrically prior to dispatch to site. Test reports etc. shall be submitted for review before dispatch.

19.2.5 Pump Pressure Vessel

Diaphragm type pressure vessels shall be provided as shown on the drawings. They shall be incorporated into the system so that during normal operation the pump shall not need to be start within 30 seconds of it switching off in order to prevent the pump hunting.

The pressure vessel shall be of adequate capacity to accommodate a considerable fluctuation in water demand by the system with minimum start/ stop cycles of the pumps. The vessel

shall be constructed of steel plate built to ASME Standards for Unfired Pressure Vessel. A rubber diaphragm shall be provided in the vessel for separating the water and pre-charge nitrogen. The pre-charge pressure shall be adjustable and charging port with non-return device shall be provided. The adjustable cut-in and cut-off pressure unit for the pumps shall be built-in at the vessel to suit the system.

19.3 FLOATLESS TYPE LEVEL SWITCH IN WATER TANKS

The Tenderer shall supply and install floatless type switch probes in the water tanks as indicated below and shown on the drawings.

Raw Water Tanks at Pump Room

- High level alarm (over-flow);
- Low level alarm;
- Low level cut-out for raw water pumps;
- Earthing probe.

Cooling Tower Make-up

- High level alarm (over-flow);
- Low level alarm;
- Low level cut-out for supply pumps;
- Earthing probe.

Potable Water Tank

- High level alarm (over-flow);
- Low level alarm;
- Low water level cut-out for the domestic hydropneumatic pumps;
- Earthing probe.

Each probe shall be of the correct length for the particular application and tank location. Electrodes shall be of polished stainless steel 20 mm OD. Electrode holders shall be weatherproof in all respect.

The earthing probes shall be connected and wired to the building earth systems of the building.

Each set of electrodes shall be installed inside a 230 mm diameter PVC pipe acting as a wave barrier.

The level switch set shall operate with a stepped down voltage at 24V maximum. Stepped down transformers shall be provided for each set of control probes and shall be installed inside centralised control cubicles inside pump room.

Mechanical steel stuffing boxes shall be used.

Control of Duty / Standby Pumps

Operation of the duty and standby pumps shall be carried out by the following method:

- a Automatically by means of pressure sensor (i.e. pressure switches);
- b Manually by means of a local start/stop push buttons on pump local motor control panel and emergency stop switch.

The pressure switch shall be installed next to the manual release valve. When the pressure drops to the pre-determined level, a signal will be sent to the pump local motor control panel to start the pump.

Automatic controls shall be operated by electronic, floatless type level switches.

Pump Indicator

The following audible and visible indication shall be provided at the pump local control panels as applicable:

- a Red "overflow level" indicator with buzzer for the associated water tanks;
- b Amber "extra high water level" indicator for the associated water tank;
- c Amber "high water level" indicator;
- d Amber "low water level" indicator;
- e Red "pump trip" indicator for each pump;
- f Green "pump on" indicator for each pump;
- g "Pump electrical supply healthy" indicator for each pump;
- h Amber "remote/local" status indicator.

20.00 FIRE FIGHTING SYSTEM

20.01 GENERAL

- 1.1 Work under this contract shall be executed as shown on the drawings and given in the specifications and required at site whether explicitly shown or not.
- 1.2 Not-with standing the sub-division of the documents into separate sections and volumes every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and in to the contract so far as it may be practicable to do so.
- 1.3 Where it is mentioned in the specifications that the contractor shall perform certain work or provide certain facilities, it is understood that the contractor shall do so without any extra cost to the Employer/HSCC.
- 1.4 The material, design and workmanship shall satisfy the local fire regulations. The job specifications contained herein and codes referred to where the job specifications stipulate in addition to these contained in the standard codes and specifications, these additional requirements shall also be satisfied.
- 1.5 Portable fire extinguisher shall be provided in the building as per BOQ which should not contain halogen to minimize the use of ozone depleting substance as per GRIHA.

2.0 SCOPE OF WORK

- 2.1 Work under this contract consist of furnishing labour, materials, equipment and appliances necessary and required to completely do all works relating to the fire protection system as described here-in-after and shown and the drawings, consisting of:

- i) Supply, installation, testing and commissioning of:

Fire hydrant system including fire pumps and ancillary equipment's described later in the Volume.

Fire sprinkler system, as described later in the volume.

Portable Fire Extinguishers

- ii) Preparation of plans and getting pre-installation approval by the Local Fire Authority.

Getting tested by and approval of the installation by the Local Fire Authority during the fabrication/construction stage as well as after completion. . It will be the responsibility of the

Contractor to get all approval and completion certificate from the Local Fire Department without which the work will not be taken over by the owner. Fee payable to the local bodies for such activities shall be borne by the Owner on production of receipts for money paid and the all other expenses barring the fee will be borne by the Contractor.

- iv) Supply of necessary spare parts during the commissioning stage.
- v) Supply of any other item or services not specifically mentioned anywhere but required by the Local Fire Authority or essential for the completion & operation.

3.0 INTERPRETATION

3.1 In interpretation of specifications, the following order of decreasing importance shall be followed:

- a. Statutory Rules & Regulation
- b. Schedule of quantities
- c. Additional specifications
- d. List of approved make of materials
- e. General rules and conditions

3.2 Matters not covered by the specifications given in this contract, as a whole shall be covered by relevant and latest CPWD specifications / Indian Standard Codes. If such codes on a particular subject have not been framed, the decision of the engineer shall be final and binding.

4.0 SPECIFICATIONS

- 4.1 Work shall be carried out strictly in accordance with the specifications attached to the tender.
- 4.2 Works not covered in the specifications shall be carried out as per relevant latest CPWD specifications/ Indian standard Code of practice specifications of materials.

5.0 EXECUTION OF WORK

5.1 The work shall be carried out in conformity with the contract drawings and within the requirements of architectural, HVAC, plumbing, electrical, structural and other specialized services drawings.

6.0 TENDER DRAWINGS

- 6.1 For guidance of the bidder, drawings as listed are enclosed with these tender documents. These drawings are broadly indicative of the work to be carried out. The Contractor on award of work will furnish shop drawings based on the working drawings issued to him, as required in advance for approval of Engineer and get the same approved by Local Fire Authority/other statutory bodies. No claim whatsoever shall be admissible on account of changes that may be introduced by the Engineer /Local Fire Authority.
- 6.2 The Contractor shall examine all specifications, tender conditions and drawings before tendering for the work.
- 6.3 Information, levels and dimensions given in the tender drawings are supposed to be correct but the contractor shall make independent inquiries and verify the same. No claims for extras shall be admissible in case of any deviations for incorrectness of the information, levels or dimensions.
- 6.4 The contractor shall obtain all information relating to the local regulations, bylaws, and application of any and all laws relating to his work or profession. No additional claims shall be admissible on this account.

7.0 SHOP DRAWINGS

- 7.1 The Contractor shall prepare and furnish all shop drawings in quadruplicate at no extra cost for approval by the Engineer before commencing fabrication/manufacture of the equipment. Such shop drawings shall be based on the Architectural & Fire fighting drawings and requirements laid down in the specifications and as per site conditions. The manufacture of equipment shall be commenced only after the shop drawings are approved in writing by the Engineer. Such drawings shall be co-ordinated with all disciplines of work.
- 7.2 Contractor shall verify all dimensions at site and bring the notice of the HSCC any or all discrepancy or deviations notices. The decision of the HSCC in the regard shall be final.
- 7.3 Large size details and manufacturer's dimensions for materials to be incorporated shall take precedence over small-scale drawings.
- 7.4 All drawings issued by the consultants for the work are the property of the Consultants and shall not be lent, reproduced or used on any other works than intended, without the written permission of the Consultants.
- 7.5 Working drawings shall be approved by the consultant. Four sets of shop drawings shall be submitted for approval showing:
- a) Any change in layout from the contract drawings.
 - b) Equipment layout, piping, wiring diagram and instrumentation.
 - c) Manufacturer's or contractor's fabrication drawings for any material or equipment.

8.0 COMPLETION DRAWINGS

On completion of the work and before issuance of certificate of virtual completion, the Contractor shall submit to the Engineer. General layout drawings, drawn at approved scale indicating layout of pump house piping and its accessories "As installed ". These drawings shall in particular give the following:

- a. General layout of pump house.
- b. Panels and other equipment location and sizes etc.
- c. Complete Schematic as installed.
- d. Location of Hydrants, Earth pipes, route of earthing conductors etc.
- e. Route of all cables and pipes run along with detail sizes and mode of installation.

9.0 DOCUMENTS

The Contractor shall submit to the Engineer, the following documents on completion of the work and before issuance of virtual completion.

- i. Warranty for equipment installed.
- ii. Test certificates.
- iii. History sheets of the equipments.

- iv. Catalogues.
- v. Operation and Maintenance manuals.
- vi. List of recommended spares and consumables.
- vii. Reconciliation statement.
- viii. All approvals and sanctions.

10.0 MATERIALS

- 10.1 All materials used on this work shall be new, conforming to the specifications.
- 10.2 Materials shall conform to the technical specification and/or the latest CPWD Specifications /Indian Standards Specifications as amended up to date and carry certification mark, wherever so required.
- 10.3 Only approved make of material shall be used. The contractor shall get the samples of all the items approved from the Engineer before commencing the supply.

11.0 TESTING OF MATERIALS

- 11.1 Contractor shall be required to produce manufacturer's test certificates for the particular batch of materials supplied to him. The test carried out shall be as per the relevant CPWD specifications/Indian Standards.
- 11.2 Any weights of sizes given in the tender having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost. The decision of the HSCC shall be final and binding on the contractor.
- 11.3 The Engineer shall have full power to get any material of work to be tested by an independent agency at Contractor's expense in order to prove the soundness and adequacy.

12.0 INSPECTION AND TESTING

- 12.1 All equipment shall be inspected and tested as per an agreed quality Assurance Plan before the same is packed and dispatched from the Contractor's Works. The Contractor shall carry out tests as specified/directed by Engineer.
- 12.2 Contractor shall perform all such tests as may be necessary to meet requirements of Local Authorities, Municipal or other statutory laws/ bye-laws in force. No extra shall be paid for these.
- 12.3 The Engineer may, at his sole discretion, carry out inspection at different stages during manufacturing and final testing after manufacturing.
- 12.4 Approvals or passing of any inspection by the engineer or his authorized representative shall not, however, prejudice the right of the Engineer to reject the plan if it does not comply with the specification when erected or give complete satisfaction in service.
- 12.5 All materials and equipment found defective shall be replaced and the whole work again tested to meet the requirements of the specifications, at the cost of the contractor. Contractor has to obtain a performance certificate/approval for the complete layout of piping/equipment erected.

13.0 WELDING

- 13.1 The welding procedure, types of electrodes etc. shall be in accordance with the following IS specifications.

Welding Procedures IS: 823

Welding Electrodes IS: 814, but of approved makes only

Testing of Welders IS: 817

13.2 Only Welders fulfilling the requirements of IS: 817 and approved by the HSCC shall be employed by the Contractor.

14.0 JOINING MATERIAL (GASKET)

Gasket, for use in between flanged joints, to be of CAF as per IS-2712, thickness as specified in S.O.Q.

15.0 PAINTING

15.1 All above ground pipes, pipe fittings, hose cabinets structural steel work pipe supports etc. shall be painted as per specifications given below.

15.2 Painting shall be done only after the completion of fabrication work and testing.

15.3 The instructions of paint manufacturer shall be followed as far as possible otherwise the work is to be done as directed by the HSCC.

15.4 All cleaning materials, brushes, tools and tackles, painting, material etc. shall be arranged by the Contractor at site in sufficient quantity.

15.5 All rust, dust shall scales, welding slag or any other foreign materials shall be removed fully so that a clean and dry surface is obtained prior to painting. Any other oily containment shall be removed by use of a solvent prior to surface cleaning.

15.6 First coat of primer paint must be applied by brush on dry clean surface immediately or in any case within 3 hours of such cleaning.

15.7 Primer paints - one coat (minimum thickness 100 microns) self-priming epoxy mastic.

15.8 Finishing coats:

a) For Pump Rooms - 2 coats (thickness minimum 50 microns each) of epoxy paint, fire red shade as per IS: 4.

b) For other than Pump Rooms - 2 coats of synthetic enamel paint, fire red shade as per IS: 4.

16.0 COATING WRAPPING FOR UNDERGROUND PIPES

16.1 All underground piping shall be protected by coating and wrapping as per the following procedure.

16.2 The materials and workmanship shall in general conform to IS: 10221, 1982 or as directed by the HSCC.

16.3 Cleaning - The pipes shall be thoroughly cleaned by dust, rust will scales, oil, grease etc. by stiff wire brush and scrappers. The surface shall be coated with the primer immediately after cleaning.

16.4 Priming – Suitable primer shall be applied as an undercoat. The manufacturers recommended procedure would be followed for applying the primer.

16.5 Paste Application - Paste shall be applied to fill up uneven surfaces in order to ensure smoothness for subsequent wrapping with multi-layer tape.

- 16.6 Tape Wrapping - The tape is to wrap while the second coat of primer is still tacky. Winding is to be done with 50% overlap so that the total thickness of 2.0mm tape would become 4.0mm. It should be ensured while wrapping that air bubbles are not trapped. The ends of tape shall be secured with nylon binding to ensure that the tape doesn't get loosened while handling.
- 16.7 The total thickness including 2 coats of primer, 50% overlap of tape etc. should not be less than 4.5mm or as per manufacturer recommendations.
- 16.8 The 'Holiday Test' is to be conducted as per IS: 10221 for detecting any entrapped air or any other defect. The Contractor is to arrange for the Holiday Test and to rectify the defects if found any.
- 17.0 TRAINING OF DEPARTMENT PERSONNEL
- 17.1 The Contractor shall train the Owner's personnel to become proficient in operating the equipment installed. Training shall be done before the expiry of the defects liability period.
- 17.2 The period of training shall be adequate and mutually agreed upon by the Engineer and Contractor.
- 17.3 The Owner's personnel shall also be trained for routine maintenance work and lubrication, overhauling, adjustments, testing, minor repairs and replacement.
- 17.4 Nothing extra shall be paid to the Contractor for training Owner's personnel.

18.0 PERFORMANCE GUARANTEE

At the close of the work and before issue of final certificate of virtual completion by the Engineer, the Contractor shall furnish a written guarantee indemnifying the Owner against defective materials and workmanship for a period of one year after completion and handing over. The Contractor shall hold himself fully responsible for reinstallation or replace free of cost to the Owner.

- a. Any defective material or equipment supplied by the Contractor.
- b. Any material or equipment supplied by the Owner which is proved to be damaged or destroyed as a result of defective workmanship by the Contractor.

20.02 SPECIFICATIONS FOR PUMPS AND ANCILLARY EQUIPMENT

1.0 SCOPE OF WORK

- 1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install electrically/diesel engine operated pumps for fire hydrant installations as required by the drawings and specified hereinafter or given in the schedule of quantities.
- 1.2 Without restricting to the generality of the foregoing the pumps and the ancillary equipment and shall include the following:

Electrically/diesel operated pumps with motors/diesel engine, base plate and accessories.

Pump suction and delivery headers, valves, air vessel and connections.

- c) Alarm system, Pressure gauges/Pressure switch.
- d) Electrical switchboards, wiring, cabling, cable tray, control panel and properly connecting to earthing system of the Factory.
- e) Foundations, vibration eliminator pads and foundation bolts.

2.0 GENERAL REQUIREMENTS

- 2.1 Pumps shall be installed true to level on suitable concrete foundations. Base plate shall be firmly fixed by foundation bolts properly grouted in the concrete foundations.
- 2.2 Pumps and motors shall be truly aligned with suitable instruments.
- 2.3 All pump connections shall be standard flanged type with appropriate number of bolts.
- 2.4 Manufacturer instructions regarding installation connections and commissioning shall be followed with respect to all pumps, switchgear and accessories.

3.0 QUALITY CONTROL

- 3.1 These shall comply with the IS Codes as specified.

4.0 SUBMISSIONS

- 4.1 Product Manuals
- 4.2 Hydraulic Details

5.0 STORAGE

- 6.0 These shall be stored as delivered in original packings.

6.0 FIRE AND JOCKEY PUMPS

6.1 Pump Sets

- i) Centrifugal, split casing, horizontal pump should be selected as per IS. Pump should have following specification.

Materials of Construction

| | |
|----------------|--------------------------------------|
| PARTS | |
| CASING | CAST IRON |
| IMPELLER | BRONZE IS:318, GR.LTBJ/LTB 2/ SS-410 |
| CASING WEARING | CAST IRON |
| SHAFT | STAINLESS STEEL |
| SHAFT SLEEVE | SS-410 |
| SHAFT SEAL | MECHANICAL |
| THRUST BEARING | ANTI-FRICTION OF TITLING PAD TYPE |

- ii) Pumps shall be connected to the drive by means of spacer type love joy couplings, which shall be individually balanced dynamically and statically.
- iii) The coupling joining the prime movers with the pump shall be provided with a sheet metal guard.
- iv) Pumps shall be provided with approved type of mechanical seals.

- v). Pumps shall be capable of delivering not less than 150% of the rated capacity of water at a head of not less than 65% of the rated head. The shut off head shall not exceed 120% of the rated head.
- vi). The pump shall meet the requirements of the Tariff Advisory Committee and the unit shall be design proven in fire protection services.
- vii) Pumps shall be provided with pressure gauge with isolation cock on the delivery side.
- viii) In case of motor driven pump the motor rating should be adequate to drive the pump at 150% of rated discharge.

Waterproof PVC coated windings.

6.2 Electric Drive

- i) Electrically driven pumps shall be provided with totally enclosed fan cooled induction motors. For fire pumps the motors should be rated not to draw starting current more than 3 times normal running current.
- ii) Motors for fire protection pumps shall be at least equivalent to the horse power required to drive the pump at 150% of its rated discharge and shall be designed for continuous full load duty and shall be design proven in similar service.
- iii) Motors shall be wound for class B insulation and winding shall be vacuum impregnated with heat and moisture resistant varnish glass fibre insulated.
- iv) Motors for fire pumps shall meet all requirements and specifications of the Tariff Advisory Committee.
- v) Motors shall be suitable for 415 volts, 3 phase 50 cycles a/c supply and shall be designed for 38 deg. C ambient temperature. Motors shall conform to I.S. 324.
- vi) Motors shall be designed for two start system.
- vii) Motors shall be capable of handling the required starting torque of the pumps.
- viii) Contractor shall provide inbuilt heating arrangements for the motors for main pumps to ensure that motor windings shall remain dry.
- ix) Speed of the motors shall be compatible with the speed of the pump.
- x) The fire pumps shall operate on drop of pressure in the mains as given below. The pump operating sequence shall be arranged in a manner to start the pump automatically but should be stopped manually by starter push buttons only.

6.3 Operating Conditions for Fire & Sprinkler Pumps

| | CUT IN | CUT OUT | REMARKS |
|-----------------------------|---------------------|---|---|
| Operating Pressure | ----- | (10M+Head of pump as per BOQ in M). ie 1.0+(H)Kg/Sqcm | ----- |
| Jockey Pump | (H-0.5) Kg/Sqcm. | H Kg/Sqcm. | Jockey pump to stop when main fire pumps starts |
| Main Fire Pump (One No) | (H-1.0) Kg/Sqcm. | Push button manual | To start by pressure switch No. 2 on air vessel |
| Common Diesel | (H-2.0) | Push button | To start by pressure switch No. 3 |

| | | | |
|------------------|----------|--------|--|
| Engine (One NO) | Kg/Sqcm. | manual | |
|------------------|----------|--------|--|

6.4 Vibration Eliminators

- i) Provide on all suction and delivery lines double flanged reinforced neoprene flexible pipe connectors. Connectors should be suitable for a working pressure of each pump and tested to the test pressure given in the relevant head. Length of the connector shall be as per manufacturer details.

6.5 Installation

- i) Pumps shall be installed true to level on suitable concrete foundations. Base plate shall be firmly fixed by foundation bolts properly grouted in the concrete foundations.
- ii) Pumps and motors shall be truly aligned by suitable instruments.
- iii) All pump connections shall be standard flanged type with appropriate number of bolts. In case of non-standard flanges companion flanges shall be provided with the pumps.
- iv) Manufacturer's instructions regarding installation, connections and commissioning shall be followed with respect to all pumps and accessories.
- v) Contractor shall provide necessary test certificates and performance charts with NPSH requirement of the pumps from the manufacturer. The contractor shall provide facilities to the Architect or their authorised representative for inspection of equipment during manufacturing and also to witness various tests at the manufacturer's works without any cost to the owners.

6.6 DIESEL ENGINE

Diesel engine shall be of 6 cylinder with individual heat assemblies. The engine shall be water cooled and shall include heat exchanger and connecting piping strainer, isolating and pressure reducing valves, by pass line, exhaust pipe, silencer day tank for fuel all interconnected piping etc. complete in all respects.

The speed of the engine shall match the pump speed for direct drive.

- c) The engine shall be capable of being started without the use of the wicks, Cartridge heater plugs or either at the engine room temperature 4 deg.C and shall take full load with in 15 second from the receipt of the signal to start.
- d) The engine shall effectively (i.e. without any derating) operated at 46 deg.C ambient temperature at 150 meter above mean sea level.
- e) Noise level of the engine shall not exceed 90 db (free sound pressure) at 3-meter distance
- f) The engine shall be self starting type upto 4 deg.C shall be provided with one 24 volts heavy duty D.C. battery, starter, cutout, battery leads complete in all respects. One additional spare battery leads complete in all respects. One additional spare battery shall be provided. The battery shall have an adequate capacity for cold cranking amperage as recommended by the Engine Manufacturer.

- g) An automatic change over system shall be provided so that the spare battery comes into operation in case the engine is not started by its own battery.
- h) Pump Control Panel should have visual and audio alarm and indication for battery failure.
- i) The working battery as well as battery should have output amperage capacity for at least 3 consecutive cranking/starting of the Engine.
- j) Provide a battery charger of sufficient amperage capacity of fully charge the batteries in 20 hours with trickle and booster charging facility and regulators.
- k) Arrangement for starting shall be automatic on receiving the signal. But shut-off shall be manual.
- l) The engine shall be provided with an oil bath or dry type air cleaner as per manufacturer's design.
- m) Engine shall be suitable for running on high-speed diesel oil.
- n) The system shall be provided with a control panel with push button starting arrangement also wired to operate the engine by differential pressure switches.
- o) The entire system shall be mounted on a common structural base plate with anti vibration mounting and flexible connections on the suction and delivery piping.
- p) Contractor shall provide one fully mounted and supported day oil tank fabricated from 6mm thick MS sheet electrically welded with capacity for 8 hours working at full load but not less than 200 ltrs. Provide level indicators - low level and full level in the day oil tank on the control panel through float switches and an air breather. Day oil tank shall also be provided with filling connection (threaded) with cap, gauge glass indication & cocks, drain cock, inspection/cleaning cover with gasket and nuts/bolts. M.S. dyke to hold 150% of the day tank capacity to be built around the Day Tank.
- q) Contractor to provide one exhaust pipe with suitable muffler (residential type) to discharge the engine gases to outside in open air as per site conditions (contractor to check the site).
- r) Contractor to provide all accessories, fittings, and fixtures necessary and required for a complete operating engine set. The exhaust pipe shall be taken outside the building with minimum number of bends (approx. length 30 Mts.) and shall be duly heat insulated with 50mm thick glass wool covered with 24 gauge aluminum cladding.
- s) Contractor shall submit to the Owner special requirements, if any, for the ventilation of the pump room.

6.7 BASE PLATE

Pumps and motors shall be mounted on a common structural base plate and installed as per manufacturer instructions.

6.8 AIR VESSEL

The contractor shall provide one air vessel fabricated from 8mm M.S. plates with 10mm dished ends and suitable supporting legs. Each air vessel shall be provided with a 80mm dia, flanged connection from pump, one 25mm dia, drain with valve, one gun metal water level gauge and 25mm sockets for pressure switches. The vessel shall be 450mm dia x 1800mm high and tested to 20 Kgs./Sq.cm. pressure.

6.9 CUBICLE TYPE SWITCH BOARDS/L.T. PANEL

- 6.9.1 Cubicle type switch boards and components shall conform to the requirements of the latest revision including amendments of the following codes and standards.

| | | |
|----------------------------------|---|--|
| IS:8623 | : | Specification for factory built assemblies of switch- gear and control gear for voltage up to and including 1000-V AC/1200 V-DC. |
| IS:4237 | : | General requirements for switchgear and control-gear for voltage not exceeding 1000-V. |
| IS:2147 | : | Degree of protection provided by enclosures for low voltage switchgear and control-gear. |
| IS:1018 | : | Switchgear and control-gear selection/installation and maintenance. |
| IS:6005 | : | Code of practice for phosphating of iron and steel. |
| IS:13947-1993/ IE:C947-1989 | : | Air circuit breaker/Moulded case circuit breaker. |
| IS:1248 | : | Direct acting indicating analogue electrical measuring instruments and testing accessories. |
| IS:2705 Part I, II & III 1964 | : | Current transformers for metering & protection with classification burden & insulation. |

The board shall be metal enclosed single front, indoors, floor mounted free standing type or wall mounting type as mentioned in BOQ. The panel shall be designed for a degree of protection of IP-52. The panel height shall not exceed 2350 mm including horizontal main bus bar at top. Keeping in view the operating height of the top switch 1750mm from finish floor. 400-mm clear space shall be left through out the panel at bottom. The cold rolled sheet steel will be of 2mm thick.

All cutouts and covers shall be provided with synthetic rubber gaskets. (Preferably neoprene).

The panel shall be divided into distinct vertical sections each comprising of:

- i) Complete enclosed bus bar compartment for running horizontal and vertical bus bars.
- ii) Complete enclosed switchgear compartment one for each circuit for housing air circuit breaker, MCCB etc.
- iii) Compartmentally for power and control cables of at least 300mm width covering entire height provided.

All cable alley must be provided with threaded nipples for CO2 flooding system and shall be connected to all compartment with centralized CO2 system

- v) The panel shall have 20% spare space duly wired for future use.

The front of each compartment shall be provided with hinged single lead door with locking facilities. Panel shall be provided with suitable lifting facilities. Isolators & MCCB/ACBs shall be of fixed/drawout type as described later.

Each feeder shall have compartmentalized construction cable entry shall be from top/bottom (3mm thick gland plate shall be provided) as required.

The panel shall be provided with three phase buses and neutral bus bars of aluminium sections throughout the length of the panel and shall be adequately supported and braced to withstand the stresses due to the short circuit current of 50 KA rms. For 1 sec. Maximum temperature rise of bus bars

and bus bar connection while carrying rated current shall not exceed 40 amp. over an ambient temperature of 50 deg.C.

The minimum clearance in air between phases and between phases and earth for the entire run of the bus bar connections shall be 25mm minimum bus bars support insulators shall be made of non-hydroscopic non-combustible track resistant and high strength type porcelain or polyester fibber glass moulded material.

All bus bars shall be colour coded as per IS: 375 and the current density shall be 1 amp/sq.mm.

G.I. earth bus of 50x6mm size shall be provided at the bottom of the panel through out the length. Similarly 40x6mm G.I. strip in each vertical section for earthing the individual equipment/accessories shall be provided and connected to main horizontal bus.

Contractors shall be electro-magnetic types with interrupted duty as per IS: 2959. The main contacts shall be of Silver or silver alloy, provided with minimum 2 NO and 2 NC auxiliary contacts. The push button should be of shrouded type and each should be provided with 1 NO and 1 NC contact. Colour coding shall be as per IS: 6875 (Part II).

6.9.2 ACB

The circuit breaker shall be of air break type in order to eliminate fire and explosion risk and shall comply with the IS: 13947-1993 with a rupturing capacity of not less than 50 MVA at 415 volts or as specified elsewhere (The service short circuit breaking capacity shall be as specified and equal to the short circuit with stand value). The breaker shall be provided with microprocessor based releases for over load and short circuit protection.

The breaker shall consist of a horizontal drawout pattern triple pole, fully interlocked, independent manual spring operated mechanism. The mechanism should be such that the circuit breaker is at all times free to open immediately. The trip coil is energized. Current carrying parts should be silver plated and suitable arcing contacts shall be provided to protect the main contact arc-chutes for each pole shall be provided and shall be lifted out for the inspection of main and arcing contact.

Self-aligning cluster type isolating contacts shall be provided on breaker for interlocking protection metering and for any other purposes.

Breaker shall be provided with automatic safety shutters to screen the main live contact when the breaker is withdrawn. The frame of the circuit breaker should be positively earthen when the breaker is racked into the cubicle.

The following safety arrangements shall be provided for the safety of the personnel to prevental-operation.

- i) Interlock to prevent the truck from being withdrawn or replaced except in the fully isolated position.
- ii) Interlock to prevent earth connection from being made by the earthing device except breaker is open.
- iii) Interlock to prevent the breaker from being made alive without its rack in position.

6.9.3 Moulded Case Circuit Breaker (MCCB)

MCCB shall conform to the latest IS: 13947-1993/IEC 947-1989. The Service Short Circuit Breaking Capacity (ICS at 415 VAC) should be 50 KA.

MCCB shall be Current Limiting and comprise of Quick Make - Break switching mechanism preferably Double Break Contact system are extinguishing device and the tripping unit contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand

capability against thermal and mechanical stresses. All MCCBs shall be capable of defined variable overload adjustment. All MCCBs rated 200 Amps and above shall have adjustable magnetic short circuit pick up.

The trip command shall over ride all other commands. MCCB shall employ maintenance free double break contact system to minimize the let thru' energies and capable of achieving discrimination upto the full short circuit capacity of downstream MCCB. The manufacturer shall provide both the discrimination tables and let thru' energy curves. The MCCB shall not be restricted to Line/Load connections.

The handle position shall give positive indication of 'ON', 'OFF' or 'Tripped' thus qualifying to disconnection as per the IS/TEC indicating the true position of all the contacts. In case of 4 pole MCCB the neutral shall be defined and capable of offering protection.

The general-purpose control switch shall be provided for ON/OFF Auto/Manual. The switch shall be provided with engraving plates on the front with the complete inscription.

The switch shall be normally a fixed control box type heavy-duty unit.

Indicating lamps shall be of the panel mounting, LED type and shall have execution plates marked with its function wherever necessary. The colour of the lamp cover shall be red for 'ON' and green for 'OFF'.

6.9.4 Motors and Starters for Fire Pumps

The starters shall be of DOL type. The motors should have double sq. cage or other provision to limit the starting current to 4 times the full load current.

6.9.5 Name Plates & Lables

- i) Panel and all modules shall be provided with prominent engraved identification plates. The module identification designation. For single front switchboards, similar panel and board identification lables shall be provided at the rear also.
- ii) All nameplates shall be of non-rusting metal or 3-ply lamicold, with white engraved lettering on black background. Inscription and lettering sizes shall be subject to Owner's approval.
- iii) Suitable stencilled paint marks shall be provided inside the panel/module identification of all equipment in addition to the plastic sticker lables, if provided. These lables shall be partitioned so as to be clearly visible and shall have the device number, as mentioned in the module wiring design.

6.9.6 Painting of all Steel Work

The steel used for fabrication of electrical/panels/equipment should be stove enameled as per the detailed specifications given below:

- a) Degreasing: All the steel components, to be painted, should be effectively cleaned by alkaline degreasing.
- b) Pickling: Oxide scale rust formation are to be removed in a hot bath of sulphuric acid. Pitting of the surface is to be prevented by the use of pickling in habitors.
- c) Cold Rinsing: The parts are then to be washed with cold water to remove all traces of acidic solution.
- d) Phosphating: In order to attain durable paint coating the metal surface is to be given phosphating treatment by development a phosphate layer on the surface. Preferably hot grenadine solution is to be used in the phosphating plant.

Pessivating: This process is to be carried out by using deodilate solution.

Drying: The treated parts should then be dried in a hot chamber in dust free atmosphere to ensure that they are absolutely clear and dry before the paint is applied.

Primer Coating: The treated and dried parts are to be sprayed with high corrosion resistance primer.

Stove Drying: The primer coating is to be backed in an electrically heated, air circulated area type storing oven.

- i) Finishing Coat: The finishing paint coat is to be applied by spraying two coats of 15 micron thickness powder coated paint of approved shade.

6.9.7 Wiring

Control and protective wiring shall be done with copper conductor PVC insulated 1100 volts grade multi-stranded flexible wire of 2.5 sq.mm 2 cross section. The colour coding shall be as per latest edition of IS: 374.

Each wire shall be identified by plastic ferrule. All wire termination shall be made with type connection. Wire shall not be taped or spliced between terminal points.

Terminal blocks shall preferably be grouped according to circuit function and each terminal block group shall have at least 20% spare capacity.

Not more than 1 (one) wire shall be connected to any terminal block.

6.9.8 Current Transformer

Current transformers shall be of ratio, burden (shall be worked out by panel supplier), class/accuracy specified in Single Line Diagram.

Current transformers shall conform to latest edition to relevant standards. Current transformers shall be epoxy resins cast with bar Primary or ring type.

The design and construction shall be sufficiently robust to withstand thermal and dynamic stresses due to the maximum short circuit current of the circuit.

The current transformer shall preferably be capable of being left open circuited on the secondary side with primary carrying rated full load current, without overheating or damage. Short time current rating and rated withstands time shall be same as corresponding C.B.

CT core laminations shall be of high-grade silicon steel.

Secondary terminals of CT shall be brought out to a terminal block, which will be easily accessible for testing and external connections. Facility shall be provided for short-circuiting and earthing of CT secondary leads through a removable and accessible link with provision for attaching test link.

Rating plate details and terminal markings shall be according to the latest edition of relevant Indian Standard specification.

Generally separate current transformers (core) shall be used for metering and protection.

7.0 CABLES

- a) Contractor shall provide all power and control cables from the motor control center to various motors and control devices, of ratings as per IS: 3961.

- b) All power and wiring cables shall be FRLS with (inner and outer sheath) aluminium conductor PVC insulated armoured and PVC sheathed of 1.1 KV grade. Control cables and power cables of 2.5 sq.mm or less shall be of copper, FRLS, armoured. Cables and wires shall comply with requirements of IS: 5831, 694, 8130, 7098 (I) & 1554 as the case may be.
- c) All cables shall have stranded conductors. The cables shall be supplied in drums as far as possible and bear the manufacturer's identification mark.
- d) All cable joints shall be made in an approved manner as per accepted practice.

7.1 CABLE TRAYS

7.1.1 Cable trays shall be 2mm thick GI/CRCA powder coated as per approved shade of client. Sheet steel, ladder type/perforated cable trays including fixing along wall/ceiling complete with M.S. rod/flat hangers directly grouted in walls/ceiling etc as required.

7.1.2 The sizes shall be as follows and as directed by the Owner.

A. PERFORATED CABLE TRAY

- a) 150 mm wide 75 mm deep
- b) 300 mm wide 75 mm deep

B. LADDER TYPE CABLE TRAY

- a) 150 mm wide
- b) 300 mm wide

7.2 EARTHING

7.2.1 Fire Fighting Contractors shall have to provide earthing strips (G.I. 25x3mm) or earthing wires (G.I. 8 SWG) as may be required for proper earthing of the equipments supplied by him. Thickness of galvanization to be 75 microns (minimum). Each electrical equipment is to be earthen at 2 points.

20.03 SPECIFICATIONS FOR FIRE HYDRANT SYSTEM

1.0 SCOPE OF WORK

1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install wet riser fire hydrant system as required by the drawings and specified hereinafter or given in this schedule of quantities.

1.2 Without restricting to the generality of the foregoing, the fire hydrant system shall include the following: -

Mild steel mains including valves, hydrants and all other accessories.

Mild steel pipe fire risers within the building.

Landing valves, synthetic hose pipes, hose reels, hose cabinets, fire brigade connections, connection to pumps, appliances and pressure reducing devices.

Excavation, anchor blocks and valve chambers.

2.0 GENERAL REQUIREMENTS

2.1 All materials shall be of the best quality conforming to the specifications and subject to the approval of the employer. The wet riser system shall remain pressurized at all times during operation, and as such the piping work shall be carried out to withstand the same.

- 2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
- 2.3 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages, etc.
- 2.4 Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for RCC ceilings and walls.
- 2.5 Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

3.0 PIPES AND FITTINGS

FOR INTERNAL WORK:

- a. All pipes within the building in exposed locations and shafts including connections buried under floor shall be ERW mild steel tubes conforming to IS: 1239 (Heavy class) up to 150mm AB and IS 3589 above 150 NB's with screwed or welded joints as specified by the engineer in charge at least 10% of welded joints shall be radiographically tested.
- b. Fittings of 50mm or below shall be forged steel with socket weld ends of approved makes. For 65mm and above shall be W.I./M.S. with butt weld ends.

4.0 JOINTING

Gasket, for use in between flanged joints, to be of CAF as per IS-2712, thickness as specified in S.O.Q.

5.0 EXCAVATION

- 5.1 Excavations for pipeline shall be in open trenches to levels and grades shown on the drawings or as required at site. Pipelines shall be buried to a minimum depth of 1 to 1.5 meter or as shown on the drawings.
- 5.2 Wherever required contractor shall support all trenches or adjoining structures with adequate supports to prevent land slides.
- 5.3 On completion of testing and painting, trenches shall be refilled with excavated earth in 15-cm layers and compacted.
- 5.4 Contractor shall dispose off all surplus earth within the site.

6.0 ANCHOR BLOCKS

- 6.1 Contractor shall provide suitable cement concrete anchor blocks as may be necessary for overcoming pressure thrusts in under ground/external pipes. Anchor blocks shall be of cement concrete 1:2:4 mix.

7.0 VALVES

- 7.1 Butterfly valves above 65mm shall be of cast iron body and bronze/gunmetal seat. They shall conform to type PN 1.0 of IS: 13095.
- 7.2 Non return valves shall be of cast iron body and bronze / gunmetal seat. They shall be swing conform to Class 1 of IS: 5312 and have flanged ends. They shall be swing check type in horizontal runs and lift check type in vertical runs of piping. They shall not be spring loaded type.
- 7.3 Check valves shall be cast iron double flanged conforming to IS 5312-1975 with cast iron steel body and stainless steel internal trims.

Valves on pipes 65mm and below shall be heavy pattern gunmetal valves with cast iron wheel seat tested to 20kg/sqcm pressure. Valves shall conform to IS:778.

8.0 FIRE HYDRANTS

8.1 EXTERNAL HYDRANTS

Contractor shall provide external hydrants. The hydrants shall be controlled by a cast iron sluice valve. Hydrants shall have instantaneous type 63-mm dia outlets. The hydrants shall be of gunmetal and flange inlet and single outlet conforming to I.S.5290-1983 with G.I. duck foot bend and flanged riser of required height to bring the hydrant to correct level above ground.

8.2 Contractor shall provide for each external fire hydrant two nos. of 63 mm dia 15 meter long synthetic fibre non perculating hose pipe with gunmetal male and female instantaneous type couplings machine wound with copper wire hose to I.S. 636 type B and couplings to IS 903 with IS certification), gunmetal branch pipe with 16 mm nozzle to I.S. 903-1984.

9.0 INTERNAL HYDRANTS

9.1 Contractor shall provide on each landing and other locations as shown on the drawings one single headed gunmetal landing valve with 63 mm dia outlets and 80 mm inlet (I.S. 5290-1969) with individual shut off valves and cast iron wheels. Landing valves shall have flanged inlet and instantaneous type outlet as shown on the drawings.

9.2 Instantaneous outlets for fire hydrants shall be of standard pattern approved and suitable for fire brigade hoses. Contractor shall provide for each internal fire hydrant station four numbers of 63 mm dia 7.5 meter long synthetic non perculating hose pipes with gunmetal male and female instantaneous type coupling machine wound with G.I. wire (Hose to I.S. 636 type B and couplings to I.S. 903 with I.S. certification), fire hose reel, gunmetal branch pipe with nozzle I.S. 903 fireman's axe.

9.3 Each hose box shall be, after thorough cleaning of surface, painted as per Section 28 of General Technical Specifications. The words FIRE HOSE to be painted on the inner face of the glass.

10.0 FIRST AID HOSE REELS

10.1 Contractor shall provide standard fire hose reels with 20 mm dia high pressure rubber hose of 36 meters length with gunmetal nozzle with 5mm bore, and control valve, shut of nozzle connected wall mounted on circular hose reel of heavy duty mild steel construction and cast iron brackets. Hose reel shall conform to IS: 884-1969. The hose reel shall be connected directly to the M.S pipe riser through an independent connection.

11.0 PRESSURE GAUGES

11.1 All pressure gauges shall be of dial type with bourdon tube element of SS 316. The gauge shall be of reputed make. The dial size shall be 150-mm dia and scale division shall be in metric units marked clearly in black on a white dial. The range of pressure gauge shall be 0 to 12 kg/sq.cm.

11.2 All pressure gauges shall be complete with isolation cock, nipples, tail pipes etc.

12.0 PRESSURE SWITCHES

12.1 The pressure switch shall be industrial type single pole double throw electric pressure switch designed for starting or stopping of equipment when the pressure in the system drops or exceeds the pre-set limits. It shall comprise of a single pole changeover switch, below element assembly and differential sprindle.

12.2 All the pressure switches shall have 1/4" B.S.P (f) inlet connection and screwed cable entry for fixing cable gland.

12.3 The electric rating of the switch shall be as under:

| Type of supply | Voltage | Non –Inductive | Inductive |
|----------------|---------|----------------|-----------|
| A.C. | 110-380 | 10 Amp | 6 Amp |
| D.C. | 24-250 | 12 Watts | 12 Watts |

13.0 FIRE BRIGADE CONNECTION

13.1 The contractor shall provide as shown on drawing gunmetal four ways collecting head with 63mm dia instantaneous type inlets with built in check valve and 100/150 mm dia. Outlet connection to the fire main grid and for tank filling, collecting head shall conform to IS: 904-1964.

14.0 AIR VALVES

14.1 The contractor shall provide 25 mm dia screwed inlet cast iron single acting air valve on all high points in the system or as shown on drawings.

14.0 DRAIN VALVE

50mm dia black steel pipe conforming to IS:1239 heavy class with 50mm gunmetal full way valve for draining and water in the system in low pockets.

Pressure gauge of suitable range shall be installed on the discharge side of each pump vacuum gauge shall be provided on suction side for pumps with negative suction. The dial size shall be 250mm. The gauges shall have brass cocks.

Orifice plates shall be of 6mm thick stainless steel to reduce pressure on individual hydrants to operating pressure of 3.5kg/sq.cm. Design of the same shall be given by the Contractor as per location and pressure condition of each hydrant.

15.0 VALVE CHAMBERS

15.1 Contractor shall provide suitable brick masonry chambers in cement mortar 1:5 (1 cement: 5 coarse sand) on cement concrete foundations 150 mm thick 1:5:10 mix (1 cement: 5 fine sand 10 graded stone aggregate 40 mm nominal size) 15 mm thick cement plaster inside and outside finished with a floating coat of neat cement inside with cast iron surface box approved by fire brigade including excavation, back filling, complete.

15.2 Valve chamber shall be of the following size:

For depths 130 cm and beyond 120x120 cms
Weight of C.I. frame and cover shall be 38 kg.

16.0 PIPE PROTECTION

See Clause 15.0 & 16.0 on 'Painting' and 'Coating/wrapping' under General Technical Specifications).

17.0 PIPE SUPPORTS

17.1 All pipes shall be adequately supported from ceiling or walls by means of anchor fasteners by drilling holes with electrical drill in an approved manner as recommended by manufacturer of the fasteners.

17.2 All supports/clamps fabricated from M.S. structural e.g. rods, channels, angles and flats shall be painted as described in specifications for "Painting" under General Technical Specifications.

- 17.3 Where inserts are not provided the contractor shall provide anchor fasteners. Anchor fasteners shall be fixed to walls and ceilings by drilling holes with electrical drill in an approved manner as recommended by the manufacturer of the fasteners.

| Pipe Support Spacing | Horizontal | Vertical |
|----------------------|------------|----------|
| Pipe upto 50 mm | 2 Mtr | 3 Mtr |
| Pipe 65 - 100 mm | 1.75 Mtr | 3 Mtr |
| Pipe above 100mm | 1.50 Mtr | 3 Mtr |

18.0 AIR VESSEL AND AIR RELEASE VALVE

Air vessel on top of each wet riser piping shall be installed before execution for approval fabricated out of at least 8mm thick steel to withstand the pressure, with dished ends and supporting legs. This shall be of 300 mm dia and 1m high. This shall be completed with necessary flange connection to the wet riser piping and air release valve with necessary piping to meet the functional requirement of the system. The air vessel shall be of continuous welded construction and galvanized to IS: 4736-1968. This shall be tested for twice the working pressure.

19.0 TESTING

- 1 All piping in the system shall be tested to a hydrostatic pressure of 11.0 kg/sq.cm without drop in pressure for at least 2 hours.

Rectify all leakages, make adjustments and reset as required and directed.

20.0 HOSE CABINETS

- 20.1 Provide doors/hose cabinets for internal/external hydrants respectively fabricated from 16 gauge M.S. sheet with double glass front door and locking arrangement, with breakable glass key access arrangement, duly painted red as per specifications given on page 12 para 28.8 fixed to wall/floor as per site conditions. The cabinet shall have a separate chamber to stove a key with breakable glass as per approved design. Hose cabinets shall be hinged double door partially glazed with locking arrangement, painted as per Section 28 of General Technical Specifications with 'FIRE HOSE' written on it prominently. Samples of hose cabinet for indoor and outdoor works shall be got approved from HSCC before production/delivery at site.

- 20.2 For external hydrants the hose cabinets shall be fabricated from 16 gauge thick M.S. sheet with double shutter glass front door and locking arrangement with breakable glass key access arrangement. The cabinet shall have 'FIRE HOSE' written on it prominently. Sample of hose cabinet shall be got approved from the HSCC before installation at the site.

21.0 MEASUREMENT

- 21.1 Mild steel pipes shall be measured per linear meter of the finished length along the center line and shall include all fittings (including flanges), welding, jointing, clamps for fixing to walls or hangers, anchor fasteners and testing.

- 21.2 Butterfly valves, check valves and full way valves shall be measured by numbers and shall include all items necessary and required for fixing and as given in the specifications/schedule of quantities.

- 21.3 Landing valves hose cabinets, synthetic non-perculating fire hose pipes, First-aid fire hose reels (with gunmetal full way valves) and gunmetal branch pipes shall be measured by numbers and shall include all items necessary and required for fixing as given in the specifications/schedule of quantities.

- 21.4 Suction and delivery headers shall be measured per linear meter or finished length and shall include all items as given in the schedule of quantities.

- 21.5 Painting/wrapping/coating of headers, pipes shall be included in the rate for pipes and no separate payment shall be made.
- 21.6 Brick masonry chambers shall be measured by number and shall include all items as given in the schedule of quantities/specifications.
- 21.7 No additional payment shall be admissible for cutting holes or chases in walls or floors, making connections to pumps, equipment and appliances.

20.04 SPECIFICATIONS FOR SPRINKLER SYSTEM

1.0 SCOPE OF WORK

1.1 Work under this section shall consist or furnishing all labour, materials, equipment and appliances necessary and required to completely install the sprinkler system as required by the drawings and specified herein after or given in the schedule of quantities.

- a) Sprinkler mains, branch and external piping complete with valves, alarm, hangers and appurtenances and painting.
- b) Sprinkler heads with spare sprinklers
- c) Connections to risers, pumps and appliances

2.0 GENERAL REQUIREMENTS

- 2.1 All materials shall be of the best quality conforming to specifications and subject to the approval of the engineer.
- 2.2 Pipes and fittings shall be fixed truly vertical horizontal or in slopes as required in neat workman like manner.
- 2.3 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages, etc.
- 2.4 Pipes shall be supported from walls and ceiling by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for RCC ceilings and walls.
- 2.5 Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.
- 2.6 Sprinkler heads shall be approved by the underwriters Laboratories (U.L.) or Fire officers Committee (FOC). The finish shall be as specified in the schedule of quantities. The contractor shall give required tools for removing and fixing of different types of sprinklers free of cost as directed by the HSCC.

3.0 SPRINKLER HEADS

- a) Sprinkler heads shall be of quartzoid bulb type with bulb, valve assembly yoke and the deflector. The sprinklers shall be of approved make and type.
- b) Types:
 - i) Conventional Pattern:

The sprinklers shall be designed to produce a spherical type of discharge with a portion of water being thrown upwards to the ceiling. The sprinklers shall be suitable for erection in upright position or pendant position.

- ii) Spray Pattern:

The spray type sprinkler shall produce a hemispherical discharge below the plane of the deflector.

iii) Ceiling (flush) Pattern:

These shall be designed for use with concealed pipe work. These shall be installed pendant with plate or base flush to the ceiling with below the ceiling.

c) Constructions:

i) Bulb: - Bulb shall be made of corrosion free material strong enough to with stand any water pressure likely to occur in the system. The bulb shall shatter when the temperature of the surrounding air reaches a predetermined level.

ii) Valve Assembly:-Water passage of the sprinkler shall be closed by a valve assembly of flexible construction. The valve assembly shall be held in position by the quartzoid bulb. The assembly be stable and shall withstand pressure surges or external vibration without displacement.

iii) Yoke: - The yoke shall be made of high quality gun metal. The arms of yoke shall be so designed as to avoid interference with discharge of water from the deflector. The sprinkler body shall be coated with an approved anti-corrosive treatment if the same is to used in corrosive conditions.

iv) Deflector:-The deflector shall be suitable for either upright or pendent erection. The deflector shall be designed to give an even distribution of water over the area protected by each sprinkler.

d) Colour Code :

The following colour code shall be adopted for classification of sprinkler according to nominal temperature ratings:

e) Size of Sprinklers Orifices:

The following sizes of sprinklers shall be selected for various classes or hazards.

| | |
|-----------------------|-----------------------|
| Extra light hazard | 10/15 mm nominal bore |
| Ordinary light hazard | 15 mm nominal bore |
| Extra high hazard | 15/20 mm nominal bore |

f) Stock of replacement sprinkler :

The following spare sprinklers shall be supplied along with the system:

| | |
|---------------------------|---------------|
| Extra high hazard systems | 6 sprinklers |
| Ordinary hazard systems | 24 sprinklers |
| Extra high hazard systems | 36 sprinklers |

g) Temperature Rating:

For normal conditions in temperature climates rating of 68/74 deg. C shall be used. However the temperature rating shall be as closed as possible to, but not less than 30 deg. C above the highest anticipated temperature conditions.

4.0 Installation Control Valve:- Installation control valves shall comprise of the following:

a. One man stop valve of full way pattern with gunmetal pointer to indicate where open/shut.

b. One automatic alarm valve, fitted with handle and cover.

- c. One hydraulic alarm motor and gong for sounding a continuous alarm upon out-break of fire.
 - d. One combined waste and testing valve including 5mtr of tubing and fittings.
 - e. Alarm stop valve
 - f. Strainer
 - g. Drain plug
 - h. Padlock & strap
 - i. Wall box for installation of valve
- 5.0 Pressure Gauges:-Burden type pressure gauges conforming to IS/BS specifications shall provided at the following locations.
- a. Just above alarm valve.
 - b. Just below alarm valve, on the installation stop valve.
 - c. One pressure gauge on delivery side of each pump.
 - d. Required number of pressure gauges on pressure tank.
- 6.0 INSTALLATION OF PIPING
- A. Below ground piping :- Under ground piping shall be installed in masonry trenches with cover or reinforced concrete. The pipe work shall be supported at regular intervals of 2.5m with masonry or RCC supports. Wherever pipes pass through roads/pavements suitable size hue pipes shall be provided for protection of piping. Underground pipes shall be protected against corrosion with two coats of bituminous painting and wrapped with tarfelt or similar covering. If the piping is to be buried in ground with back filling of earth, a coat of epoxy painting shall be given.
- B. Above ground piping:-
- a. All above ground piping shall be installed on suitable to pipe hangers/supports as required. The hangers shall be made of MS angles, channels etc. and painted to the required finish (with suitable synthetic enamel Paint). The spacing of piping supports shall be as follows:

| | | |
|------|-------------------|----------|
| i) | 20mm to 32mm dia | 2 mtr |
| ii) | 40mm to 65mm dia | 2 mtr |
| iii) | 65mm to 100mm dia | 1.75 mtr |
| iv) | above 150mm dia | 1.50 mtr |
 - b) Piping shall be so installed that the system can be thoroughly drained. All the pipes shall be arranged to drain to the installation drain valve. In case of basement and other areas where the pipe work, is below the installation drain valve/auxiliary valves of the following sizes shall be provided.
 - i) 20mm dia valve for pipes upto 50mm dia
 - ii) 25mm dia valve for 65mm dia pipes
 - iii) 32mm dia valves for pipes larger than 65mm dia
 - c) Piping shall be screwed type upto 50mm dia. Welding of joints will be allowed for pipes of 50mm of larger diameters.
 - d) The piping shall be pressure tested by the hydrostatic method upto a pressure of 1.5 times the working pressure the piping shall be slowly charged with water so that all the air is expelled from the piping by providing a 25mm inlet with a stop cock. The piping shall be allowed to stand full of water for a period

of 2 hours and then the piping shall be put under pressure by means of manually operated test pump or by a power driven test pump. The pressure gauges used for testing shall be accurate and shall preferably be calibrated before the testing is carried out. All the leakages and defects in joints revealed during the testing shall be rectified to the entire satisfaction of the Consultant. The system may be tested in sections parts as the work of erection of piping proceeds. The piping shall withstand 1.5 times the working pressure for at least 2 hours.

7.0 FLOW SWITCH

7.1 Provide one electrically operated flow switch of appropriate dia, at the head of each circuit. Flow switches should be capable of the required flow in the circuit. The electrical cabling for the flow switches and control panel shall be provided by the contractor.

8.0 PUMP SETS

Same as wet riser & Hydrant system specification.

9.0 ANNUNCIATION SPRINKLER PANEL

The equipment for control panel should be compact neatly wired and enclosed in a suitable 14 gauge M.S. sheet/16 CRCA sheet Metal Box which is suitably treated against corrosion. The control panel should be painted with over banked enamel paint. The panel shall consist of:

a) Panel should be made in a modules of 10 zones e.g. Each module will have audible and visual indications and will monitor the circuit conditions.

A.C. Power Supply
Fault and Fire indication lamp.
Alarm acknowledgment push buttons.

b) The circuits provided in the control panel for each zone shall indicate the following conditions:

i) Open Circuit in zone wiring

Short Circuit in zone wiring

iii) Normal conditions

iv) Power failure

v) Low battery

c) The Automatic annunciation panel shall suitable for operation on 24V DC and shall be provided with power supply unit suitable to operate on A.C. mains of 230V with a variation of 10%. The system shall be so designed that in case of failure of A.C. main supply it shall automatically change over to battery supply.

d) Suitable protection may be provided against charging of the battery over and above the specified values.

7.0 BATTERY UNIT

i) The system shall be powered by lead acid storage stationery complete with automatic dual rate charger boost and trick operating from 220V, 50 Hz, single phase, mains supply. The battery capacity should be adequate for operation of the system connected to it for at least 24 hours in the non-alarm state followed by 30 minutes operation of all sounders and other connected equipments after a power (mains) failure.

- ii) The automatic charger should operate at the boost charge when the battery terminal voltage is less than about 2.1V 20 per cell, and operate at a trickle charge rate of 100 to 200 HA, when the battery terminal voltage exceeds about 2.25 per cell.
- iii) The power unit should have the following:
 - a) Voltmeter 0-30 V
 - b) Ammeter of suitable range
 - c) Indicator lights for mains
 - d) Indicator lights for DC output
- iv) The preferred nominal DC voltage shall be 24 V and shall preferably be isolated. (IF an isolated supply is provided a line earthing indicator should also be provided).
- v) The DC system and the detection and sounder circuits shall be protected against their attaining a voltage to earth exceeding 50V.
- vi) The connection to the 220V, 50Hz, single phase system shall be through a three pin plug socket especially provided for the connection to the annunciation panel. This connection should in addition utilized for earthing all non-current carrying metal parts of the sprinkler system, except those that are either doubly insulated or mounted at a height exceeding 2.2 meters.
- vii) The battery unit shall be housed in a steel cabinet with suitable mounting at least 2.5mm thick suitably painted with two coats of Post Office Red, Enamel necessary vent holes should be provided for proper ventilation.
- viii) One battery unit complete with battery charger shall be provided for each control panel.

10.0 TESTING

- 10.1 All pipes in the system shall be tested to a hydrostatic pressure of 11.0 kg/sq.cm without drop in pressure for at least 2 hours. Rectify all leak ages, make adjustments and retest as required.

11.0 MEASUREMENT

- 11.1 Black steel pipes shall be measured per linear meter of the finished length and shall include all fittings including flanges, welding, jointing clamps for fixing to walls or hangers and testing.
- 11.2 Butterfly valves, check valves and full way valve and flow indicating switches shall be measured by numbers and shall include all items necessary and required for fixing as given in specifications.
- 11.3 Cabinet and the spare sprinkler heads, with spanner etc. shall be measured as per actual item given in the schedule of quantities.
- 11.4 Sprinkler heads shall be measured by numbers.
- 11.5 No additional payment shall be admissible for cutting holes, or chases in the wall or floors, making connections to pumps, equipment and appliances.
- 11.6 Painting and coating/wrapping of pipes shall be included in the rates for pipes and no extra payment shall be made.

20.05 COMMISSIONING OF FIRE FIGHTING SYSTEM

1.0 SCOPE OF WORK

1.1 Work under this section shall consist of pre commissioning, commissioning testing and providing guarantees for all equipment, appliances and accessories supplied and installed by the contractor under this contract.

2.0 GENERAL REQUIREMENTS

2.1 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.

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

2.3 All inspection and testing for gauging the efficacy of all equipment would be as per the TAC regulations.

A survey of the site of the work shall be made by the Contractor before preparation of the detailed drawings for submission to the department for approval. The installation shall be carried out strictly in accordance with the approved drawing.

2.4 The scope of installation work shall include the following, where or not expressly mentioned in the schedule of work.

- i. Cement concrete (1:2:4mix) foundation for all pump sets.
- ii. Vibration isolation arrangement for all pump sets.
- iii. Filling up the hole in flooring with cement concrete, after laying the wet riser pipes.
- iv. Necessary supports and clamps for wet riser pump room.
- v. Necessary supports and clamps for wet riser plumbing the building.
- vi. Supporting bracket/frame work for the fuel oil tank of the engine.
- vii. Excavation of the earth, consolidation and refilling after laying of wet riser piping in ground.
- viii. Provision of necessary brick base or intermediate support as required in approved manner in case of soils which are not strong enough to support the pipes, thereby likely to cause different settlement.
- ix. Necessary anchor block of ample dimensions in 1:2:4 cement concrete at all bends, tee connections, foot of the wet riser, and other places as required to stand the pressure thrust in pipes.
- x. Necessary masonry work/steel work for supporting hose cabinets near external (yard) hydrants.
- xi. Valve chambers of approved design with external (yard) hydrant.
- xii. Ground level hydrants of approved design, where specified.
- xiii. Cutting and making good the damages for the installation work of the riser system
- xiv. Strainers and foot valves for pumps with negative suction and strainers for pumps with positive suction.
- xv. All the required control piping, exhaust piping (5m long) from engine, oil piping for fuel oil and lubricating oil for the engine, drain piping from the pumps to the drain point in the pump room,

overflow piping from priming tank to the sump. The piping work shall include all necessary fittings, valve and accessories for effective functional requirements.

xvi. Inter-connecting cable work with controls, control panel, batteries etc. including battery leads.

xvii. Orifice plates at individual hydrants, as required.

Where provision of GI/MS pipe shall below ground become inescapable, it shall be protected from soil corrosion by 2 coats of coal tar hot enamel paint and 2 wraps of reinforced fiber glass tissue or bitumenised horizon.

Each CI pipe/GI pipe shall be subjected to hydraulic pressure test before installation, in presence of the Engineer or his authorised representative.

External (yard) hydrants shall be located at least 2m away from the face of the buildings but not more than 15m and be accessible.

Where external hydrants below ground level are specifically indicated in tender specifications, there shall be enclosed in masonry or cast iron structure of size 75cm² and 8cm above ground level. The hydrant shall be with in 8cm from the top of the enclosure.

Necessary facility for draining the rise pipe shall be provided at ground floor level with 40mm size sluice valve.

Internal hydrants at each floor shall be located at about 1m above floor level.

Valve chambers shall be of 1m² in size, with cover.

All hoses shall be numbered and a record submitted with completion plane. The number and length shall be easily recognizable on each hose pipe.

External hose boxes shall be installed such that the hose is not exposed to sun rays.

3.0 PRECOMMISSIONING

On completion of the installation of all pumps, piping, valves, pipe connections, electrical wiring motor control panels and water level controlling devices the contractor shall proceed as follows:

3.1 TESTING OF M.C.C

Tests to be carried out for motor control centers shall be :

3.1.1 Insulation resistance test with 500 volt merger, before and after high voltage test, on all power and control wiring.

3.1.2 High voltage test at 2000 volts A.C. for one minute on all power and control wiring.

3.1.3 Low voltage continuity test (6 volts) on power wiring of each feeder, between bus bars and outgoing terminals with switches and contractors in closed position.

3.1.4 Low voltage continuity test (6 volts) on all control wiring.

3.1.5 Operation test for all feeders with only control supply made "ON" to ensure correctness of control wiring, operation of the various equipment used, such as push buttons, protective devices, indicating lamps and relays, etc. All contractors shall be checked for the presence of humming and chattering.

3.1.6 Earth continuity test with voltage not exceeding 6 volts between various non-current metallic of equipment, steel work, etc. and the earth bus provided in the M.C.C.

3.1.7 Operation of all instruments and meters provided on the M.C.C.

3.2 FIRE PROTECTION SYSTEM

3.2.1 Check all hydrant valves and close if any valve is open. Check that all suction and delivery connections are properly made.

3.2.2 Test run and check rotations of each motor and correct the same if required.

3.3 PIPE WORK

3.1 Check all clamps, supports and hangers provided for the pipes.

3.2 Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specifications if any leakage is found. Rectify the same and reset the pipes.

4.0 COMMISSIONING AND TESTING

4.1 FIRE HYDRANT SYSTEM

4.1.1 Pressurize the fire hydrant system by running the main fire pump and after attaining the required pressure shutoff the pump.

4.1.2 Open by-pass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts-out at the pre-set pressure. If necessary adjust the pressure switch for the jockey pump. Close by-pass valve.

4.1.3 Open by-pass valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump should cut-in at the preset pressure and should not cut-out automatically on reaching the normal line pressure. The main fire pump should stop only by manual push button. However, the jockey pump should cut out as soon as the main pump starts.

4.1.4 Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump.

4.1.5 When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant simultaneously and allow the hose pipe to discharge water into the fire tank to avoid wastage. The electrically driven pump should run continuously for eight hours so that its performance can be checked.

4.1.6 Diesel engine driven pump should also be checked in the same manner as given in para above by running for 8 hours.

4.1.7 After laying and jointing, the entire piping shall be tested to hydrostatic test pressure. The pipes shall be slowly charged with water so that the air is expelled from the pipes. The pipes shall be allowed to stand full of water for a period of not less than 24 hours and then tested under pressure. The test pressure shall be 10kg/cm². The test pressure shall be applied by means of manually operated test pump or by a power driven test pump to be provided by the Contractor. In either case precautions shall be taken to ensure that the required test pressure is not exceeded.

4.1.8 The open end of the piping shall be temporarily closed for testing.

4.1.9 Test shall be conducted on each pump set after completion of the installation with respect of delivery head, flow and B.H.P. The test shall be carried out by the Contractor at his own cost.

4.1.10 All leaks and defects in different joints noticed during the testing and before commissioning shall satisfaction of Engineer.

- 4.1.11 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 does not fit into the other properly, shall be replaced by the contractor. Landing valves shall also be checked by opening and closing under pressure.
- 4.1.12 Testing of fittings/equipments shall be carried out either at site or at works in the presence of a representative of the Engineer. Test certificates shall also be furnished by the Contractor.
- 4.1.13 The automatic operation of the system for the various functional requirements and alarms as laid down in his specification shall be satisfactory carried out on as described above.

4.2 HANDING OVER

- 4.2.1 All commissioning and testing shall be done by the contractor to the complete satisfaction of the engineer /consultants, and the job handed over to the client.

Contractor shall also hand over to the client all maintenance and operation manuals and all items as per the terms of the contract.

20.06 HAND APPLIANCES

1.0 SCOPE OF WORK

- 1.1 Work under the section shall consist of furnishing all labour, material, appliances and equipments necessary and required to install fire extinguishing hand appliances.

- 1.2 Without restricting to the generality of the foregoing the work shall consist of the following:

Installation of fully charged and tested fire extinguishing hand appliances CO2, Foam, Dry chemical powder type as required by these specifications and drawings.

2.0 GENERAL REQUIREMENTS

- 2.1 Fire extinguishers shall conform to the following Indian Standard Specifications and shall be with ISI approved stamp as revised and amended upto date: -

- a) Water gas type I.S. 940
- b) Dry powder type I.S. 2171-1962
- c) Mechanical Foam I.S. 10204
- d) ABC I.S. 13849

- 2.2 Fire extinguishers shall be installed as per Indian Standard "Code of practice for selection, installation and maintenance of portable first aid appliances "I.S. 2190-1962".

- 2.3 Hand appliances shall be installed in readily accessible locations with the appliance brackets fixed to wall by suitable anchor fasteners.

- 2.4 Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.

- 2.5 All appliances shall be fixed in a true workman like manner truly vertical and at correct locations.

- 2.6 The contractor has to obtain approval of Fire Department for all fire fighting installations.

20.07 STANDARDS AND CODES

1. IS 1648 Code of practice for fire safety of building (general) fire fighting equipment and maintenance.
2. IS 3844 Code of practice for installation of internal fire hydrant in multistorey buildings
3. IS 2217 Recommendations for providing first aid and fire fighting arrangement in public buildings.
4. IS 2190 Code of practice for selection, installation and maintenance of portable first aid fire appliances.
5. Part IV, fire fighting National building code
6. IS 5290 External fire hydrants
7. IS 5290 Internal landing valves
8. IS 904 2 & 3 way suction collecting heads
9. IS 884 First aid hose reel
10. IS 5132 High pressure rubber pipe
11. IS 1537 C.I. Double flanged pipes
12. IS 1538 C.I. Double flanged fittings
13. IS 780 C.I. Sluice valves and Gunmetal valves
14. IS 934 Specifications for portable chemical fire extinguisher soda acid type.
15. IS 2873 Specifications for fire extinguisher of Carbon-di-oxide.

21. TECHNICAL SPECIFICATIONS OF SOLAR WATER HEATING SYSTEMS

The detailed technical specifications of solar water heating systems, its equipment, components and installation etc. are indicated hereunder:

| | | |
|----|--|---|
| 1. | SYSTEMS CAPACITY | As specified |
| 2. | NO of SYSTEMS | As specified |
| 2. | SYSTEM TEMP. OUTPUT | 60°C year average basis on clear sunny days |
| 3. | SOLAR COLLECTORS Type Make Applicable IS No. Quantity of Solar collectors Absorption area | Selectively coated (Cu-cu type) ISI marked Make BHEL/TATA BP /EMMVEE SOLAR SYTEMS Pvt. Ltd IS:12933 As per requirements 2.0 Sqm(MIN) |
| 4. | COLLECTOR/TANK SUPPORT FRAME | MS Angle 35x35x5mm/40X40X4mm minimum adequate for 150 km/hr wind pressure |
| 5. | HOT WATER STORAGE TANKS (INSULATED) | |

| | | |
|-----|--|---|
| | Quantity Capacity Material Insulating material Insulating material Density Insulation thickness Waterproof covering Cladding material | 1 No. each As per site requirements 304 Stainless Steel Rockwool/Glass wool 48 kg/cu.m 100mm (Min.) polythene lining Aluminum 22 swg (0.71 mm thick) |
| 7. | Distribution PIPINGS (Extra payable as per actual measurements) CPVC/Composite Pipe Pipe fittings System Internal piping size Insulating material Insulation thickness covering Weatherproof coating /Cladding material | ISI marked ISI marked As per site requirements Imported foam pipe section 9mm/10mm thick Fiber Tissue lining Imported resin /aluminium sheet 28 SWG |
| 8 | PUMPS | As per requirements JHONSAN/ Kirloskar |
| 9. | TEMPERTURE GAUGE Quantity Type Range End connection Make | 1 No. each for each system Dial gauge 0-120C ½" BSP H Guru |
| 10. | STRAINER Material Type Mesh | Cast Iron Y-type Horizontal Brass |
| 11 | ELECTRICAL BACK-UP | As PER REQUIRED Heater ISI Marked |
| 12 | HEAT EXCHANGER Material Type Surface area | Stainless Steel 304 Cage As per site requirements |
| 13 | OPERATION GUARANTEE | One year |
| 14 | ALLIED CIVIL & ELECTRICAL WORKS | Complete for making the system operational/functional in all respects including wiring upto nearby distribution board. |

Manufacturers or their authorized distributors/specialized firms of solar water heating system of BHEL /TATA BP solar system/ EMMVEE SOLAR SYTEMS Pvt. Ltd make. Distributors will be required to produce documents in support of their authorization from the manufacturer. The work shall be carried out by trained authored staff of the company.

Collector specifications: The collectors shall be of Cu-Cu type with Absorber area of 2.0 sq. mtrs. The absorber riser-tubes shall be made of high-grade copper & welded to the copper fins with the State of the Art ULTRASONIC WELDING process to ensure superior conductivity of heat & long life of absorber plate. The absorber plate shall be selectively coated with a very special NALSUN coating for efficient absorption of heat from the Sun-rays. The efficiency of the collectors has been specified as $FR (Ta) = 0.72$, $FROL = 3.62 \text{ W/Sq. mtr/}^{\circ}\text{C}$. The outer dimensions of the collector box shall be 2080 mm x 1070 mm x 100 mm with Frame made out of Extruded aluminum sections of 16 SWG specifications (powder coated yellow). The insulating material in the collectors would be 50mm (bottom) and 25mm (sides) Rock-wool with thermal conductivity of 0.029W/mk and density 48kg/sq. cm. The top glass would be toughened clear glass of thickness 4.0mm, with 88% transitivity and be of a reputed make like ATUL. The **Collector stands** would be made of 40X40X4mm (min) thick MS angles with enamel paint covering. The Grommet & Glass beading shall be made out of High quality EPDM rubber for long life. All hardware used shall be of SS-304 or Zinc Plated steel. The solar collector shall be arrange on roof in such a way so that the shadow of the collectors/ parapet etc can be avoided. The outer sides shall be having a Powder Coated finish in Yellow colour. The collector should have very high Absorbitivity of $> 0.95 \%$ & Emissivity $< 0.2 \%$. Anti-Condensation breather outlet shall be incorporated at rear bottom of collector to drain out condensed moisture if any. This prevents the inner glass surface from Fogging.

Tank specifications: The Insulated Hot Water Tank shall be of the Vertically oriented cylindrical type made out of SS-304. It shall be duly insulated with 100mm thick glass-wool insulation with thermal conductivity of 0.028 to 0.033 W/mk and density 48 kg/cu.m. This will be covered with Aluminium cladding of thickness #22 SWG along with chicken mesh and thin polythene sheet. There shall be a built in Heat Exchanger of multiple tube type made of SS-304 to transfer the heat to the water in the tank. This closed loop system shall be provided with a make up tank. Also provided shall be a sacrificial anode to prevent Galvanic Corrosion. Electrical backup of as required with SS/Cu Thermostat (range 30-80^oC, 15A/250 VAC) shall also be provided.

22.00 LIST OF APPROVED MAKES : CIVIL WORKS

| Sl.No. | MATERIALS | MANUFACTURERS |
|--------|--|---|
| 1. | Doors & Windows fixtures/ Fittings: | Everite, Hardima, Global, Crown |
| 2. | Door Closer / Floor spring : | Doorking, Everite, Hardwyn, Amar DArmy, Hardima |
| 3. | Aluminium Sections. : | Hindalco, Jindal, Indal , Bhoruka, |
| 4. | Clear Glass/ Clear Float Glass / Toughened Glass : | Saint Gobain(SG),Modi,Gujrat Guardian, Tata , AIG |
| 5. | Laminates : | Formica, Decolam, Century, Marino, Green Ply |
| 6. | Synthetic Enamel Paints : | Berger (Luxol gold), Asian(Apcolite), ICI Dulux (Gloss), Nerolac (Full gloss hard drying) |
| 7. | Oil Bound Distemper : | Asian (Tractor), Berger (Bison), Nerolac (Super Acrylic). |
| 8. | Cement Paint : | Snowcem Plus, Berger (Durocem Extra), Nerolac (Nerocem with titanium),. |
| 9. | Plastic Emulsion Paint : | ICI, Asian, Nerolac |
| 10. | Other Paints/Primers : | ICI Dulux, Asian, Berger, Nerolac |

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| 11. | Cement | : | OPC 43 grade conforming to BIS-8112 and approval of source by Engineer |
| 12. | Reinforcement Steel | : | TMT steel conforming to BIS-1786 and approval of source by Engineer |
| 13. | Glass Mosaic Tiles | : | Italica, Bizzaza. Pallidio |
| 14. | Back-up Rod. | : | Supreme Industries or equivalent |
| 15. | M.S. Pipe | : | Jindal Hisar, Prakash-Surya, BST, Kalinga, Tata |
| 16. | Polycarbonate Sheets | : | GE Plastics or approved equivalent |
| 17. | Wooden/Metal Fire Check Doors | : | Navair, Shakti-met, Godrej, Pacific Fire Control, Promat |
| 18. | Gypsum Board System | : | India Gypsum, Laffarge, Boral |

| Sl.No. | MATERIALS | | MANUFACTURERS |
|--------|--|---|---|
| 19. | Sunken Portion Treatment | : | Choksey, Roffe, Krytone,Sika, |
| 20. | Admixtures for concrete. | : | Cico, Vam Organics, Roffe, Pidilite,FOSROC |
| 21. | Ceramic Tiles | : | Johnson, Somany, Kajaria, Nitco |
| 22. | Pre-Laminated Particle Board | : | Novopan, Greenlam, Kitlam, Marino |
| 23. | Flush Door Shutters. | : | Century, Kitply, Novapan, Green Ply, Marino |
| 24. | Glazed Tiles | : | Bell, Somany, Johnson, Kajaria, Cera, |
| 25. | PVC Water Stops | : | Supreme, Fixopan or approved equivalent |
| 26. | White Cement. | : | Birla White, J.K. |
| 27. | Powder Coating Material Pure Polyester. | : | Jotun , Berger, Goodlass Nerolac |
| 28. | Masking Tapes | : | Suncontrol , Wonder Polymer. |
| 29. | Stainless Steel Screws For Fabrication and fixing of Windows.: | | Kundan , Puja , Atul. |
| 30. | Dash Fasteners./Anchor bolts | : | Hilti, Fischer, Bosch. |

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| 31. | Stainless Steel Bolts, Washers and Nuts. | : | Kundan, Puja, Atul. |
| 32. | Stainless Steel Pressure Plate Screws. | : | Kundan, Puja, Atul. |
| 33. | Stainless Steel Friction Stay. | : | Securistyle, Earl Bihari. |
| 34. | E.P.D.M. Gaskets. | : | Anand Reddiplex, Enviro Seals |
| 35. | Weather Silicon. | : | Dow Corning, Wacker, GE |
| 36. | Structural Silicon at butt joints | : | - Do - |
| 37. | PVC continous fillet for periphery packing of Glazings /Structural glazings.: | | Roop, Anand, Forex Plastic. |
| 38. | Floor Springs. | : | Doorking, Opel or equivalent |
| 39. | Water proofing / Injection Grouting | : | Specilized agency as approved by engineer |
| 40. | 6mm thick Reflective Glass | : | Glaverbel, Glavermas, Saint Gobain. |

Sl.No. MATERIALS

MANUFACTURERS

| | | | |
|-----|--|---|---|
| 41. | Door Locks. | : | ACME, Godrej, Harrison, Hardima, Mobel |
| 42. | Door Seal – Woolpile Weather Strip | : | Anand -Reddiplex. |
| 43. | Aluminium Grill | : | Hindalco, Decogrille or approved Equivalent |
| 44. | Vitrified Tiles | : | Restile , Naveen, Bell-Ceramics, Kajaria, Somani, |
| 45. | Carpets | : | Hollitex, Standard, Mohawk |
| 46. | Aluminium Cladding sheets | : | Alstrong , Alpolic, Alucobond, Alucomat Alu Decor |
| 47. | Aluminium Die-cast handles & two point locking kit | : | Giesse, Securistyle, Alu-alpha |
| 48. | Stainless steel D-handles | : | D-line, Giesse, Dorma,Hardima |
| 49. | Fabric for Auditorium | : | ESSMA, Raymonds or equivalent |
| 50. | Stainless Steel Pipes/Flats | : | 304 Grade (as approved by Engineer) |
| 51. | Structural Steel | : | Conforming to BIS 2062 and approval of source by Engineer |
| 52. | Ready Mix Concrete | : | ACC,BIRLA, Ahlcon or approvedequivalent |
| 53. | Epoxy Flooring/ wall coating | : | Fosrock, Beck, Famaflor, |

54. SBS bitumen based Self adhesive membrane
Material : Grace-Bituthene CP1.5, Texsa-Texself 1.5
55. Acoustic Mineral Fibre : USG-Radar, Armstrong, 21st Century, Acostyle
56. Curtain wall/Structure Glazing/Hermatic seal Sliding
Doors : Specialised Agency to be approved by
Engineer
57. Fire Panic bar : Briton, Monarch, Von-Duprin, Dorma, Mobel
58. Ply board : Greenply, Kitply, Century, Archid, Marino

| Sl.No. | MATERIALS | MANUFACTURERS |
|--------|---|--|
| 59 | PVC Doors (Solid Profile) | : Rajshri or approved equivalent |
| 60 | PVC Doors (Hollow Profile) | : Syntex, Plasopan or approved equivalent |
| 61 | PVC Flooring | : LG, Tarkett, Responsive or approved equivalent |
| 62 | SS Railing | : Specialised Agency to be approved by Engineer |
| 63 | Interlocking Paver Tiles | : Ultra, Shree or Approved Equival |
| 64 | Wall Clading Tiles | : Ultra, Shree or Approved Equivalent |
| 65 | Acoustic Seals | : Anand Reddiplex , Enviroseal or equivalent |
| 66 | Smoke Seals | : Pemko or Equivalent |
| 67 | Fire rated door closer/Mortice Lock/ Door Co-ordinator | Dorma, Becker F.S. Australian or approved equivalent |

Note : Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of Engineer

23.00 LIST OF APPROVED MAKES : PLUMBING WORKS

| S.No. | Materials | Relevant IS Code | Manufacturers |
|-------|---|-------------------|--|
| 1. | Vitreous China Sanitary ware | 2556 | Hindustan Sanitary ware, Cera, Kohler, American standard |
| 2. | White Glazed Fire Clay Sink | 771 | Sanfire, Cera, Neycer, Hindware. |
| 3. | Stainless Steel Sink | | Jayna, Jaguar, Commander, Nirali |
| 4. | Plastic seat cover of W.C | 2548 | Commander, Cera, Kohler Jaquar, American standard |
| 5. | Geysers | | Racold, Venus, Voltas, Usha Lexus |
| 6. | C.P. Fittings Mixer/Pillar taps Washers, C.P. brass accessories | 1795 4291/4827 | Aquabaths, Othello, Jaquar, Kohler, Marc |
| 7. | Centrifugally /Sand cast iron pipes & fittings | 3989/1729 | Neco, Hepco |
| 8. | G.I. Pipes | 1239 Part I | Jindal-Hissar, Tata, Prakash-Surya B.S.T., SAIL, |
| 9. | G.I. Fittings | 1239 Part I | Unik, K.S., Zoloto Zenith |
| 10. | Gunmetal Valves | 778 | Zoloto, Leader, |
| 11. | Brass stop & Bib Cock | 781 | Zoloto, Sant, L&K, Jaquar |
| 12. | Ball valve with floats | 1703 | Zoloto, Leader, Sant, Jayco |
| 13. | Stoneware pipes & Gully Traps | 651 | IS Marked pipes |
| 14. | R.C.C. pipes | 458 | IS Marked pipes |
| 15. | D.I. Manhole Covers | 1726 | RIF, NECO, |
| 16. | Water Tank | | Sintex, Polycon, Uniplast |
| 17. | Mirror | | Golden, Atul, Modi guard Gujrat Guardian |
| 18. | Hand drier | | Kopal, Automat, Euronics |
| 19. | PVC flusing cistern | | Commander, Parryware, Duralite |
| 20. | Insulation of Hot water pipes | | Vidoflex insulation, Superlon insulation or equivalent |

| S.No. | Materials | Relevant ISI Code | Manufacturers OR EQUIVALENT |
|-------|--------------------------------------|-------------------|---|
| 21. | PVC Rain Water Pipes. | | Supreme, Prince, Finolex. Oriplast |
| 22. | C.I. pipes Class LA and fittings, DI | | Jindal, Tata, Electrosteel. |
| 23. | Sluice valve / NRV | | Kirloskar, Kilburn, Zoloto Castle, |
| 24. | Water supply pumps | : | KIRLOSKAR, WILO, GRUNDFOS |
| 25. | Submersible pumps | : | KIRLOSKAR, GRUNDFOS, KSB, Mather & Platt |
| 26. | UPVC pipes & fittings | ; | Finolex , Prince, Supreme, Oriplast |
| 27. | Chlorinator | : | ALFA, USA, Ion exchange, Sigma DH Combine Inc. |
| 28. | HDPE Solution tank | : | WATCON, ION EXCHANGE, Water Supply Specialist P (Ltd) |
| 29. | C.P Flush Valves | : | Jaquar, DOCOL(Germany) marketed by GEM, Ideal |
| 30. | C.P Angle Valves, bib cock | : | Othello, Jaquar, Marc, Kholer, Aquabaths |
| 31. | Infrared Sensor operated Faucets | : | Jaquar, AOS-Robo , Euronics,U-tec Kholer |
| 32. | Gratings, Strainers, Cleanouts etc | : | Neer Brand (Sage Metals) or Equivalent |
| 33. | Level controller | : | Femac or equivalent |
| 34. | Drainage Pumps | : | Grundfos, KSB, Kirloskar |
| 35. | Water / Sewage Treatment Plant | : | Thermax, Geo Miler & Co,Fontos Ion-Exchange, Aquaprocess, Akar- Impex, Polycon Technologies, Indwa |
| 36. | Decorative bath room fittings | : | Jaquar (Florentine range), Marc (equivalent) Aquabaths (equivalent) |
| 37. | R.O System | : | Thermax, Aqua Process, Ion-Exchange, Paintir, Polycon Technologies, Fontos |

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| 38. | PE-AL-PE | : | Kitec, Jindal, NEXGEN |
| 39. | HDPE pipes and fittings | : | Oriplast, So-Soon, Finolex |
| 40. | Infrared Sensor operated Urinals | : | Jaquar, Euronics,U-tec |
| 41. | Grab Bars | : | Marino or equivalent |
| 42. | CPVC pipe | : | Ajay, Flowguard, Astral |
| 43. | Solar Panel | : | Tata BP, BHEL, EMMVEE |
| 44. | Copper Pipe | : | Raj Co., Maxflo |
| 45. | Copper Fittings | : | Viega, IBP |
| 46. | Lab drainage | : | Viega or Equivalent as approved. |
| 47. | Lab Fittings | : | Vijay, Viega, or equivalent approved |

Note : **Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of Engineer**

24.00 LIST OF APPROVED MAKES : FIRE FIGHTING WORKS

| S.No. | Material | Relevant ISI Code | Brand/ Manufacturers OR EQUIVALENT |
|-------|--|-------------------|---|
| 1. | G.I./M.S. Heavy class pipe | 1239/3589 | Jindal-Hissar, Tata, Prakash -Surya, B.S.T., SAIL |
| 2. | Gate Air Valve | | Leader, Zoloto, SBI, |
| 3. | Butterfly valves | 13095 | Audco, Keystone, Intervolve, C & R, Zoloto, Castle |
| 4. | Portable Fire Extinguisher | 2171 | Minimax, Safex, Nitin, Firex, Ceasefire, Newage, Eversafe |
| 5. | First aid Fire hose reels | 884 | Minimax, Safex, Firex, Newage, Eversafe |
| 6. | Fire hose pipes | 636 | Newage, Safex, Eversafe, Jyoti |
| 7. | Fire Hydrant valves | 5290 | Minimax, Newage, Eversafe, Ceasefire, Vijay, Agnice |
| 8. | Sprinkler Heads | | |
| a) | Pendent type | | Tyco, Viking-usa, Spray safe, HD, Newage |
| b) | Side wall type | | Newage, Reliable, Tyco, Viking-usa |
| c) | Sprinkler Side wall extended through | | Spray safe, HD, Viking-usa, Tyco. |
| 9. | Sluice and non return/ check valve foot valve strainer | | Kirloskar, I.V.C., Kilburn, Zoloto, Leader |
| 10. | Rubber hose 12/20mm dia | | Dunlop, Good year, Jyoti Eversafe |
| 11. | Reinforced rubber lined/canvas | | Newage, Jayshree, CRC, Eversafe |
| 12. | Standby battery lead acid | | Exide, Standard, Amco |
| 13. | PVC Insulated Copper Conductor. | | Finolex, Plaza, National |
| 14. | Recessed/concealed type | | Spraysafe., Reliable |
| 15. | Horizontal centrifugal/Fire pumps | | Kirloskar, Mather & Platt(WILO), Max-Flow, GRUNDFOS, |
| 16. | Diesel engine | | Kirloskar Cummins, Ashok Leyland |
| 17. | Electric motors | | Kirloskar, GEC, Siemens, NGEF, ABB Crompton |
| 18. | Electrical switch gear & starters | | As per Electrical Works |
| 19. | Cables | | As per Electrical Works |
| 20. | Flow meter | | Scientific Equipment (P) Ltd. Hyderabad , |

| | | |
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| | | System Sensor |
| 21. | Suction strainer | Leader, ZOLOTO, AUDCO |
| 22. | Vibration eliminator connectors | Resistoflex, or equivqlent |
| 23. | Single phase preventor | L & T, GEC, SIEMENS |
| 24. | G.I. Fittings 1239 Part I | Unik, K.S., Zoloto Zenith |
| 25. | Yard Hydrant Stand Post,4 way suction | Eversafe, Minimax, Newage |

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**Construction of Hostel Block 1, 2 and 3 for AIIMS within
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Prequalification Document

May 2011



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Fax : 0120-2542447

PQ tender No. HSCC/BU-HP-II/ 2010

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General Condition of Contract

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JUNE 2011



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Instruction to bidders & Specific Condition of Contract

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Bill of Quantity

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COST ESTIMATES

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