

Construction of Metro Train Depot at Mihan (North-South Corridor) & Hingana (East-West Corridor) at Ch:19700 & Ch: 18460 Respectively					
Bill of Quantities for HVAC Works					
SN	DESCRIPTION OF ITEM	UNIT	QTY.	RATE (In Rs.)	AMOUNT (In Rupees)
<b>1</b>					
1.1	Supply, Installation, testing and commissioning of <b>Water Cooled Variable Refrigerant Volume System/Split</b> for R410A suitable for $415 \pm 10\%$ , 50 Hz, AC supply. The unit shall consist of indoor units and external condensing units and other accessories as listed below complete in all respects.				
1.1.1	<b>Outdoor Unit</b>				
	Supply Instalaltion, testing & commissioning of <b>Modular type outdoor units ( COP 3.7 at AHRI condition )</b> equipped with highly efficient scroll compressors with all inverter speed type compressor (s), Suitable water cooled type heat exchanger (condenser). Auto check function for connection error, auto address setting and capacity as mentioned below.				
a)	<b>DCC, Administrative Office, Training school / Canteen building</b>				
-	18 HP	Nos	6	518340	3110041
-	22 HP	Nos	2	848582	1697165
-	24 HP	Nos	2	607019	1214037
-	36 HP	Nos	8	1050112	8400893
-	48 HP	Nos	4	1202518	4810073
b)	<b>Inspection. Repair Bay offices</b>				
-	14 HP	Nos	2	474811	949623
-	22 HP	Nos	1	848582	848582
-	36 HP	Nos	3	1050112	3150335
c)	<b>Workshop &amp; Offices: P. way, S&amp;T, E&amp;M, Traction</b>				
	26 HP	Nos	2	844413	1688825
	36 HP	Nos	2	1050112	2100223

1.1.2	<b>Indoor Units</b>				
	Supply, installation, tesing and commissioning of ductable / builtin type/Ceiling mounted type indoor units each complete with coil, pre-filter, etc. Indoor unit shall have fresh air intake connection. The units shall be suitable for 220 volt, 1 phase, 50 Hz, AC supply.				
	The capacities shall be as follows:				
a)	<b>DCC, Administrative Office, Training school / Canteen building</b>				
i	700 CFM built in	Nos	8	83487	667898
ii	1100 CFM, ductable	Nos	8	89090	712716
iii.	1200 CFM, builtin	Nos	30	89090	2672686
iv.	1340 CFM, ductable	Nos	18	90735	1633225
v.	1600 CFM, ductable	Nos	12	114641	1375695
vi	2000 CFM, ductable	Nos	40	190750	7629999
vii	2500 CFM, ductable	Nos	22	201681	4436986
b)	<b>Inspection offices/ Repair Bay offices</b>				
i.	1200 CFM, builtin	Nos	14	89090	1247253
ii.	1340 CFM, ductable	Nos	5	90735	453674
iii.	2000 CFM, ductable	Nos	8	190750	1526000
iv	2500 CFM, ductable	Nos	6	201681	1210087
c)	<b>Workshop &amp; Offices: P. way, S&amp;T, E&amp;M, Traction</b>				
i	1100 CFM, ductable	Nos	4	89090	356358
ii	1340 CFM, ductable	Nos	3	90735	272204
iii.	2000 CFM, ductable	Nos	9	190750	1716750
d)	<b>Cassette Units</b>				
i.	1.0TR, Cassette	Nos	1	65997	65997
ii.	1.3TR, Cassette	Nos	1	71463	71463
iii.	1.5TR, Cassette	Nos	1	73786	73786
iii.	1.7TR, Cassette	Nos	1	73786	73786
i.	2.0TR, Cassette	Nos	1	75972	75972
v.	2.3TR, Cassette	Nos	1	85127	85127
vi	2.8TR, Cassette	Nos	1	85127	85127
vii	3.2TR, Cassette	Nos	1	87313	87313
v.	4.0TR, Cassette	Nos	1	89226	89226

1.1.3	Supply, installation, tesing and commissioning of Imported Remote controllers (Corded) for operation of indoor units	Nos	190	2733	519233
1.1.4	Supply, installation, tesing and commissioning of fittings Y-joints, distributer and headers for all Indoor units at both the floors layout as per layout drawings	LOT	2	580722	1161443
1.2	<b>Refrigerant Piping</b>				
	Supply,installation,testing and commissioning of Interconnecting refrigerant pipe work with (19mm/13 mm thick) closed cell elastomeric nitrile rubber tubular insulation between each set of indoor & outdoor units as per specifications, all piping inside the room shall be properly supported with MS hanger & clamps.				
a)	41.3 mm O.D. (insulation : 19 mm)	Rm	700	2060	1442308
b)	34.9 mm O.D. (insulation : 19 mm)	Rm	700	1797	1257651
c)	28.6 mm O.D. (insulation : 19 mm)	Rm	300	1586	475883
d)	22.2 mm O.D. (insulation : 13 mm)	Rm	300	1352	405668
e)	19.1 mm O.D. (insulation : 13 mm)	Rm	1400	1136	1590260
f)	15.9 mm O.D. (insulation : 13 mm)	Rm	800	999	799304
g)	12.7 mm O.D. (insulation : 13 mm)	Rm	200	721	144283
h)	9.5 mm O.D. (insulation : 13 mm)	Rm	1100	602	661716
i)	6.4 mm O.D. (insulation : 13 mm)	Rm	150	552	82768
j)	Performing GI Tray with hangers & supports for copper piping (300 mm wide)	RO			
1.3	Supply,installation,testing and commissioning of <b>GI</b> drain piping complete with fittings, supports as per specifications and duly insulated with 6 mm thick closed cell nitrile rubber insulation.				
a)	50 mm dia	Rm	250	792	197995
b)	40 mm dia	Rm	450	634	285431
c)	32 mm dia	Rm	300	511	153436
d)	25 mm dia	Rm	500	445	222379
1.4	Supplying, installing, testing and commissioning of direct driven wall mounted type axial fans complete with motor suitable for 415 ± 10% 3 Phase 50 cycle AC supply with supporting structure and louvers at outlet side of the fan.				

a)	380 mm / 1400 RPM flame proof fan with 0.37 kW motor. Price shall include flame proof motor starter panel and electrical FRLSZH copper wiring considering upto 10 m length for each fan (for DCO store)	Nos	8	41895	335162
b)	Capacity 41000 CFM at 15 mm static pressure, motor rating 9.3 kW (for DG area exhaust)	Nos	4	344955	1379820
c)	Capacity 41000 CFM at 5 mm static pressure, motor rating 7.5 kW (for DG area supply air)	Nos	4	292498	1169993
d)	Capacity 5100 CMH at 15 mm static pressures (for LT panel room exhaust)	Nos	4	49121	196484
1.5	Supply, installation, testing and commissioning of Inline Fan exhaust fan with centrifugal blower and motor encased in sheet metal casing, as per specifications. The motor shall be suitable for $220 \pm 6\%$ V, 50 Hz AC supply. The price shall include fan speed regulator and cowl with bird screen and electrical wiring from socket to fan considering 3 m distance between socket and fan.				
a)	Capacity 3600 CMH at 15 mm static pressures (for pneumatic test screen of workshop offices building)	Nos	4	35575	142299
1.6	Supplying, installing, testing and commissioning of direct driven PROPELLER FANS for 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. Electrical characteristics shall be 220 volt, 1 phase, 50 Hz, AC supply. The prices shall include electrical wiring from socket to fan considering 3 m distance between socket and fan. Sizes are:				
a)	450 mm dia 900 RPM fan suitable for $220 \pm 6\%$ volts 50 cycles, 1 phase AC	Nos	30	19554	586620
b)	380 mm dia 900 RPM fan suitable for $220 \pm 6\%$ volts 50 cycles, 1 phase AC	Nos	40	19845	793814
c)	300 mm dia 900 RPM fan suitable for $220 \pm 6\%$ volts 50 cycles, 1 phase AC supply.	Nos	70	14864	1040491

1.7	Supplying , installing , testing and commissioning of double skin ventilation unit for Filtration room exhaust complete with fan section and cowl with bird screen each complete with TEFC squirrel cage induction motor, centrifugal DIW forward curved blower, belt drive and vibration isolators. Motor shall be suitable for 415±10% volts, 50 cycles, 3 phase AC supply.				
a)	Capacity 10000 CFM at 40 mm static pressure, motor rating 5.5 kW	Nos	4	195496	781984
1.8	Supplying , installing , testing and commissioning of 2 bank air wash/scrubber with minimum 90% saturation efficiency, complete with 16 gauge GSS casing, 3 mm thick MS plate water tank duly hot dipped galvanised, brass nozzles, GI spray headers, internals, air distribution plate, 4 bens PVC eliminators, strainer with brass jali, centrifugal forward curved fan, fan motor, suitable for 65 mm static pressure, 2 Nos. include cost of GI piping from pump to air washer, valves strainer, gauges and fittings, GSS housing interconnection air washer, and fan section ect. The capacity for air washer shall be as follows. The price shall include FRP housing for the pumps.				
	Fan and pumps shall be suitable for 415 volt+10%, 50 Cycle, 3 phase AC supply				
a)	Kitchen Exhaust-capacity 8000 CFM, fan motor rating 3.7 kW, pump rating 1.1 kw minimum, static pressure of 65 mm WC	Nos	5	475663	2378317
1.9	Supplying , installing , testing and commissioning of double skin draw thru type AIR HANDLING UNITS (FAN SECTION ONLY) complete with 50 mm thick aluminium filteras per specification, each complete with TEFC squirrel cage induction motor, centrifugal DIW forward curved bloward curved blower, belt drive and vibration isolators. Motor shall be suitable for 415+10% volts, 50 cycles, 3 phase AC supply				
a)	Capacity 7200 CFM at 25 mm static pressure, motor rating 3.7 kW (for Canteen fresh air supply)	Nos	5	129049	645246
1.10	<b>DX wall mounted Split Unit</b>				

1.10.1	Providing, fixing, testing and commissioning of Hi wall split unit air conditioning air cooled type with evaporator coil, fan and fan motor ,air cooled condenser with hermetically sealed reciprocating compressor, condenser coil and complete with electrical Wiring as required (Voltage stabilizers are not to be provided)				
	Note:Providing and fixing of M.S. angle iron frame work for outdoor unit including P.O. painting of the same is also included in the above scope. Contractor to submit design/Scheme for Iron frame and obtain approval of engineer-in-charge before proceeding further.				
a)	Nominal capacity 1.5 TR	Nos	25	45676	1141888
1.10.2	Providing, fixing and testing of copper refrigerant piping of appropriate sizes duly insulated with nitrile rubber insulation of 9 mm thickness for all types of split AC units. The pipes plus nitrile rubber insulation are to be covered with PVC flexible conduits for protection.	Rmt	120	1806	216757
<b>2</b>					
2.1	Supply, installation, balancing and commissioning of site made/ factory fabricated GSS sheet metal rectangular/round ducting complete with neoprene rubber gaskets, elbows, splitter dampers, vanes, hangers, supports etc. as per approved drawings and specifications of following sheet thickness complete as required.				
	Note : The duct shall be fabricated ( <b>Site made / Factory made</b> ) out of galvanised sheet, class VIII (Zinc coating 120 gm/m <sup>2</sup> as per the parameters given below which are conforming to IS 655-1963.				
a)	Thickness 0.63 mm sheet	SQM	2600	805	2093210
b)	Thickness 0.80 mm sheet	SQM	300	988	296492
c)	Thickness 1.00 mm sheet	SQM	500	1115	557449
d)	Thickness 1.25 mm sheet	SQM	100	1396	139584
2.2	Supply, fabrication, installation and testing of fire retardent flexible connections as per the approved shop drawings.	SQM	160	2824	451847

2.3	Supply, installation and testing of galvanised steel dampers within ducts to be provided with suitable ducts lever and quadrants for manual control of volume of air flow and for proper balancing of the air distribution system.	SQM	60	9067	544001
2.3.1	Supplying, fixing testing commissioning of supply air diffusers of powder coated aluminium with aluminium volume control dampers with anti smudge ring & removable core.	SQM	50	9618	480883
2.3.2	Supplying, fixing testing commissioning of Return air diffusers of powder coated aluminium without volume control dampers with anti smudge ring & removable core.	SQM	10	6212	62119
2.4	Supply, installation, testing and balancing of powder coated extruded aluminium linear grilles in accordance with the approved shop drawings and specifications:	SQM	350	9810	3433446
2.5	Supply, installation, testing and balancing of extruded aluminium dampers for supply air collers for grills in black matt finish	SQM	100	4013	401312
2.5.1	Supplying & fixing of powder coated extruded aluminium Supply Air Grills with aluminium volume control dampers as per specifications.	SQM	25	7892	197300
2.5.2	Supplying & fixing of powder coated extruded aluminium Return Air Grills with louvers but without volume control dampers complete as required.	SQM	4	4486	17945
2.6	Supply, installation, testing and balancing of fresh air louvers 50 mm deep with bird screen and volume damper of powder coated extruded aluminium consutruction for fresh air as per specifications and approved shop drawings.	SQM	60	11593	695607
2.7	Supply, installation, testing and balancing of motorized GI fire dampers of 120				
a)	Damper area	SQM	4	34186	136743
b)	Control panels and actuators	NOS	4	17093	68372

2.8	Supplying and fixing of external thermal insulation on ducts with Closed Cell Cross Linked Polyethylene (XLPE) Foam of density 33 Kg/m <sup>3</sup> with 12/13 mm thick & thermal Conductivity not exceeding 0.035 W/mK at an average Temperature of 40°C. The Material Shall be rated as Class O, As per BS476 Part 7 , The Smoke Density as per AS - 1530.3 Shall not exceed 1. The Material shall have Fire Approval from CBRI - Roorkee & no toxicity under flaming and non- flaming condition as per AITM 3.000 (1993) . Adhesive used for setting the insulation shall be non - flammable, Vapour Proof. All Joints should be sealed with 3 mm thick 50 mm wide PE tape and Flange to be overlapped by 6" width of the same material thickness. Finally Duct insulated should be strapped by 12 mm Plastic Packing strip at every random meter and conforming to standard Specification				
a)	12 / 13 mm thick Closed Cell Cross Linked Polyethylene( XLPE) Foam with Factory Laminated Al PE Foil for Supply Air Duct	SQM	3600	544	1957276
<b>3</b>					
3.1	Supply,installation,testing and commisioning of control cum transmission wiring of 2 core x 1.5 sqmm copper in suitable GI conduits between indoor and outdoor unit and from indoor to controller	Rm	1100	307	337997
3.2	Supply,installation,testing and commissioning of armoured XLPE cables for connection between outdoor condensing units and MCCB isolators complete with clamps & fixing arrangement as per specifications and drawing, based on location of MCCB at a distance not exceeding 5 m from each condensing units.	Lot	4	13348	53392

3.3	Design, manufacture, supplying fixing in position, testing and commissioning of the following front operated cubicle type, front access 2mm thick steel enclosed free standing, dust and vermin proof, switchboard with IP54 protection with hinged and lockable doors complete with interconnections, copper crimping lugs, brass glands, bonding to earth and powder coated painting, suitable for use at 415 volts, 3 phase 4 wire 50 Hertz system.				
	All switchboards shall have provision for entry of cables from the top or bottom as required.				
	All live accessible parts shall be shrouded and all equipment shall be finger touch proof. The busbar insulation shall be with heat shrinkable sleeves. SMC/DMC shrouds and busbar supports shall be used.				
	<b>All wiring shall be XLPE wiring</b>				
3.3.1	Supply, installation, testing and commissioning of electrical panel of Filtration plant ventilation unit with 1 nos Motor Protection Circuit Breakers with short circuit magnetic releases suitable for motor rating of 5.5 kW complete with	Nos	4	25768	103072
a)	Automatic DOL starter contactor with bimetal overload releases and NO/NC for remote operation.				
b)	Single phase preventor				
c)	Ammeter				
	<b>PANEL FOR DG ROOM VENTILATION</b>				
	<b>INCOMING</b>				
	1 nos 100 Amps TPN MCCB.				
	<b>INDICATING PANEL</b>				
	The each incomer shall have the following indicating panel				
a)	96 mm sq. flush voltmeter scaled 0-500 volt with selector switch				
b)	96 mm square flush mounting 0-100/5 amp ammeter with selector switch				
c)	One set of three phase Indicating Lights				
	<b>BUSBAR</b>				
	Electrolytic high conductivity copper as per specifications				
	<b>OUTGOING UNITS</b>				

	2 nos Motor Protection Circuit Breakers with short circuit magnetic releases suitable for 9.3 kW exhaust fan each complete with				
a)	Automatic Star/Delta starter contactor with bimetal overload releases and NO/NC for remote operation.				
b)	Single phase preventor				
c)	Ammeter				
	1 nos 32 amp TPN MCBs as spare				
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	1 nos 32 amp TPN MCBs as spare				
3.1.2	<b>PANEL FOR DG ROOM VENTILATION</b>				
	<b>INCOMING</b>				
	1 nos 100 Amps TPN MCCB.				
	<b>INDICATING PANEL</b>				
	The each incomer shall have the following indicating panel				
a)	96 mm sq. flush voltmeter scaled 0-500 volt with selector switch				
b)	96 mm square flush mounting 0-100/5 amp ammeter with selector switch				
c)	One set of three phase Indicating Lights				
	<b>BUSBAR</b>				
	Electrolytic high conductivity copper as per specifications				
	<b>OUTGOING UNITS</b>				
	2 nos Motor Protection Circuit Breakers with short circuit magnetic releases suitable for 9.3 kW exhaust fan each complete with				
a)	Automatic Star/Delta starter contactor with bimetal overload releases and NO/NC for remote operation.				
b)	Single phase preventor				
c)	Ammeter				
	1 nos Motor Protection Circuit Breakers with short circuit magnetic releases suitable for 7.5 kW Fresh air fan motor each complete with				
a)	Automatic DOL starter contactor with bimetal overload releases and NO/NC for remote operation.				

b)	Single phase preventor				
c)	Ammeter				
	1 nos 32 amp TPN MCBs as spare				
	The Switchboard shall be complete with all interconnections, risers, internal wiring, labels etc. complete as required.	Nos	4	153088	612352
3.4	Supply, laying testing and commissioning of 1100 volt grade armored XLPE. insulated and sheathed aluminium conductor cables of sizes as below, on cable trays with suitable clamps, saddles, hooks, bolts etc. complete as per specifications and as required. The quoted rate shall include the cost of proper dressing of cables and also providing identification tags as required.				
a)	3 core 6 Sq. mm	RM	300	250	74975
b)	3 core 4 Sq. mm	RM	200	212	42486
3.5	Cable termination jointing of the following XLPE cables 1100 Volt grade including cost of crimping tinned copper heavy duty lugs, double compression glands, insulation tape and all requisite material for completion of joints complete as per specifications and as required.				
a)	3 core 6 Sq. mm	Nos	50	625	31252
b)	3 core 4 Sq. mm	Nos	30	453	13580
3.6	Supply and fixing earthing conductor of 6 SWG GI wire for loop earthing complete as required.	RM	600	40	24282
<b>4</b>					
4.1	Civil works comrizing of cement concrete foundation for outdoor units, floor mounted fans, air washers and electrical Panel	Cum	20	5335	106705
4.2	Minor civil works like opening for ducts, cables and pipings	Cum	12	1030	12360

<b>5. Geothermal System</b>					
5	<b>Geo sink</b>				
5.1	GeoSink development - comprehensive geophysical analysis that includes vertical electrical soundings, electrical resistivity analysis, precision vertical drilling, development of CFVS geothermal sink by IGSHPA accredited driller and installer. Working in multiple shifts with multiple geothermal drilling equipment. Manholes with branding as advised by Client. Restoration of the drilling area.	Each	30	281174	8435218
5.2a	Centrifugal Pump (Submersible)	Each	16	86557	1384906
6	<b>GeoExchange Interface system</b>				
6.1	GeoExchange re-circulator pumps with accessories				
6.1a	VFD controlled Centrifugal pump (Re-circulation)	Each	2	96679	1,93,358
6.2	GeoExchange condenser pumps with accessories				
6.2a	Star Delta controlled Centrifugal pump (Re-circulation)	Each	2	96679	1,93,358
6.3	Geo-interface Heat Exchanger System				
6.3a	High efficiency Plate Heat Exchanger	Each	1	1011761	10,11,761
6.4	GeoExchnage Adaptive Control Unit				
6.4a	Control Unit		1	443145	4,43,145
6.4b	VFD for GeoSink pumps		20	25240	5,04,808
6.4c	Switches and Connectors		1	13500	13,500
7	<b>Remote monitoring and data logging system</b>	Lump Sum	1	2475000	24,75,000
8	<b>IGSHPA accredited professional review and certification</b>	Lump Sum	1	900000	9,00,000
9	<b>Piping, Cabling, Instrumentation and Trenching</b>				
9.1.a	HDPE Piping*				
9.2.b	XLPE Cables*				
9.3.c	Trenching*				
9.4.d	Piping accessories				
9.5.e	Isolation valves				
9.6.f	Check valves	Lump Sum	1	2565485	2565485

9.7.g	Y-strainer				
9.8.h	Expansion bellows				
9.9.i	Pressure Gauge				
9.10.j	Temperature sensor				
	Total of Schedule G-				<b>1058,64,339</b>