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### **Duct Work and Outlets** **(Factory Fabricated)**

#### **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, and 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 Ductwork shall mean all ducts, casings, dampers, access doors, joints, stiffeners and hangers.

#### **2. Governing Standards**

- 2.1 Unless otherwise specified here, the construction, erection, testing and performance of the ducting system shall conform to the SMACNA-1995 standards ("HVAC Duct Construction Standards-Metal and Flexible-Second Edition-1995" SMACNA

#### **3. Raw Material**

##### **3.1 Ducting**

- 3.1.1 All ducting shall be fabricated of LFO (Lock Forming Quality) grade prime G.I. raw material furnished with accompanying Mill test Certificates.
- 3.1.2 Galvanizing shall be of 120gms/sq.m. (total coating on both sides).
- 3.1.3 In addition, if deemed necessary, samples of raw material, selected at random by owner's site representative shall be subject to approval and tested for thickness and zinc coating at contractor's expense.
- 3.1.4 The G.I. raw material should be used in coil-form (instead of sheets) so as to limit the longitudinal joints at the edges only irrespective of cross-section dimensions.

##### **3.2 Duct Connectors and Accessories**

- 3.2.1 All transverse duct connectors (flanges/cleats) and accessories/related hardware are such as support system shall be zinc-coated (galvanized)/

#### **4. Fabrication Standards**

- 4.1 All ductwork including straight sections, tapers, elbows, branches, show pieces, collars, terminal boxes and other transformation pieces must be Rolastar factory-fabricated or Techno Fabriduct. Equivalency will require fabrication by utilizing the following machines and processes to provide the requisite quality of ducts and speed of supply.
- 4.2 Coil lines to ensure location of longitudinal seams at comes/folded edges only to obtain the required duct rigidity and low leakage characteristics. No longitudinal seams permitted along any face side of the duct.
- 4.3 All ducts, transformation pieces and fittings to be made on CNC profile cutlers for required accuracy of dimensions, location and dimensions of notches at the folding lines.
- 4.4 All edges to be machine treated using lock formers, flanges and roller for fuming up edges.
- 4.5 Sealant dispensing equipment for applying built-in sealant in Pittsburgh lock where sealing of longitudinal joints are specified.

5. **Selection of G.I. Gauge and Transverse Connectors**

- 5.1 Duct Construction shall be in compliance with 1" (250 Pa)w.g. static norms as per SMACNA.
- 5.2 All transverse connectors shall be the Rolamate 4-bolt slip-on flange system or Techno Fabriduct imported makes of similar 4-bolt systems with built-in sealant if any to avoid any leakage additional sealant to be used.
- 5.3 The specific class of transverse connector and duct gauge for a given duct dimensions will be 1"(250 Pa) pressure class.
- 5.4 Non-toxic, AC-applications grade P.E. or PVC Casketing is required between all mating flanged joints. Gasket sizes should conform to flange manufacturer's specification.

6. **Duct Construction**

- 6.1 The fabricated duct dimensions should be as per approved drawings and all connecting sections are dimensionally matched to avoid any gaps.
- 6.2 Dimensional Tolerances : All fabricated dimensions will be within  $\pm 1.0$  mm of specified dimension. To obtain required perpendicularity , permissible diagonal tolerances shall be  $\pm 1.0$  mm per meter.
- 6.3 Each and every duct pieces should be identified by color coded sticker which shows specific part numbers, job name, drawing number, duct sizes and gauge.
- 6.4 Ducts shall be straight and smooth on the inside Longitudinal seams shall be airtight and at comers only, which shall be either Pittsburgh or Snap Button Punch as per SMACNA practice, to ensure air tightness.
- 6.5 Changes in dimensions and shape of ducts shall be gradual (between 1:4 and 1:7). Turning vanes or air splitters shall be installed in all bends and duct collars designed to permit the air to make the tum without appreciable turbulence.
- 6.6 Plenums shall be shop/factory fabricated panel type and assembled at site.
- 6.7 The gauges, joints and bracings for sheet metal duct work shall further conform to the provisions as shown on the drawings.
- 6.8 Ducts larger than 600 MM shall be cross broken, duct sections upto 1200 MM length may be used with bracing angles omitted.
- 6.9 Changes in section of ductwork 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.
- 6.10 All ducts shall be supported from the ceiling/slab by means of M.S. Rods of 10 MM (3/8") DIA with M.S. Angle at the bottom. The rods shall be anchored to R.C. Slab using metallic expansion fasteners.
- 6.11 Factory Fabricated ducts shall have the thickness of the sheet shall be as follows:

Size of Duct	Sheet Thickness	Fastner Size	Type of Joints		Bracing with GI tie rods of following sizes	Support Angle
			<i>For Rolastar duct &amp; Rolamate flanges</i>	<i>For Techno Fabriduct, Ductofab and Zeco flanges</i>		

I	Upto 450 mm	0.50 mm	3/8"	Fabricated out of G.I. sheet of 24 gauge at every 1.2 m interval C&S cleat.	The flanges shall be made out of the same duct sheet and all the four corner shall be fitted for fitting the bolt	—	25x1.00 strap with 6.4 mm Threaded rod
ii	451mm Upto 750 mm	0.50 mm	3/8"	E-24 type flange, shall be fabricated out of 24 G sheet at every 1.2 m interval.		25x25x3 mm with 8mm GI Threaded rod	
iii	751 mm to 1000 mm	0.63 mm	3/8"	E-24 type flange, shall be fabricated out of 24 G sheet at every 1.2 m interval.		Cross tie rods to be fitted with 10mm dia. Threaded GI rod for each piece of duct	25x25x3 mm with 10mm GI Threaded rod
iv	1001 mm to 1500 mm	0.80 mm	5/8"	H-22 type flange, shall be fabricated out of 22 G sheet at every 1.2 m interval.			40x40x5 mm with 10mm GI Threaded rod
V	1501 mm to 2250 mm	1.00 mm	5/8"	J-16 type flange, shall be fabricated out of 16G sheet at every 1.2 m interval.	TDF Flange	Cross tie rods to be fitted with 10mm dia. Threaded GI rod for each piece of duct	40x40x6 mm with 10mm GI Threaded rod
vi	2251 mm and above	1.25 mm	5/8"	J-16 type flange, shall be fabricated out of 16G sheet at every 1.2 m interval .			50x50x6 mm with GI Threaded rods of 12 mm dia.

## 7. Documentation to Measurements

- 7.1 For each drawing, all supply of ductwork must be accompanied by computer-generated detailed bill of material indicating all relevant duct sizes, dimensions and quantities. In addition, summary sheets are also to be provided showing duct areas by gauge and duct size range as applicable.
- 7.2 Measurement sheet covering each fabricated duct piece showing dimensions and external surface area along with summary of external surface area of duct gauge-wise.
- 7.3 All duct pieces to have a part number, which should correspond to the serial number, assigned to it in the measurement sheet. The above system will ensure speedy and proper site measurement, verification and approvals.

8. **Installation:**

- 8.1 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.
- 8.2 Great care shall be taken to ensure that the duct work does not extend outside and beyond height limits as noted on the drawings.
- 8.3 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 air tight and shall be made in the direction of air flow.
- The ducts shall be re-inforced with structured members where necessary, and must be secured in place so as to avoid vibration of the duct on its support.
- 8.4 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.
- 8.5 The duct work shall be varied in shape and position to fit actual conditions at building site. All changes shall be subjected to the approval of the Engineer-In-Charge. The contractor shall verify all measurements at site and shall notify the Engineer-In-Charge of any difficulty in carrying out his work before fabrication.
- 8.6 Sponge rubber or approved equal gaskets of 6 MM maximum thickness 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 wooden member anchored to the building structure with anchor bolts and with the sheet screwed to them.
- 8.7 Flanges bracings and supports are to be Rolamate or Techno Fabriduct. 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.
- 8.8 Joints, seams, sleeves, splitters, branches, takeoffs and supports are to be as per duct details as specified, or as decided by Engineer-In-Charge.
- 8.9 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 jointing material must have a finish such as cadmium plating or Galvanized as appropriate.
- 8.10 Fire retarding 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 clip band 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.
- 8.11 The flexible joints are to be not less than 75 MM and not more than 250 MM between faces.
- 8.10 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.
- 8.13 Duct passing through brick or masonry, wooden frame work shall be provided within the opening. Crossing duct shall have heavy flanges, collars on each side of wooden frame to make the duct leak proof.

9. **Access panel**

- 9.1 A hinged and gasketed access panel measuring at least 450 mm x 450 mm shall be provided on duct work before each reheat coil and at each control device that may be located inside the duct work.

10. **Miscellaneous**

- 10.1 All duct work joints are to be true right angle and with all sharp edges removed.

- 10.2 Sponge rubber gaskets also to be provided behind the flange of all grilles.
- 10.3 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.
- 10.4 Diverting vanes must be provided at the bends exceeding 600 mm and at branches connected into the main duct without a neck.
- 10.5 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.
- 10.6 The ducts should be routed directly with a minimum of directional change.
- 10.7 The duct work shall be provided with additional supports/hangers, wherever required or as directed by the Engineer-In-Charge, at no extra cost.
- 10.8 All angle iron flanges to be welded electrically and holes to be drilled.
- 10.9 All the angle iron flanges to be connected to the GSS ducts by rivets at 100 mm centres.
- 10.10 All the flanged joints, to have a sponge rubber packing stuck to the flanges with suitable adhesive.
- 10.11 The G.S.S. ducts should be lapped 6 mm across the flanges.
- 10.12 The ducts should be supported by approved type supports at a distance not exceeding 2.0 metres.

## 11. **Painting**

- 11.1 All M.S. ducts supports, hangers, rods etc shall be given two coats of red oxide primer.
- 11.2 All G.I. ducts not concealed in false ceiling shall be given two coats of synthetic enamel paint of appropriate type in approved colors.
- 11.3 The surface to be painted shall be thoroughly cleaned by metal wire brush before applying paint.
- 11.4 The second coat shall be applied only after the first coat has dried completely.

## 12. **Testing**

- 12.1 After duct installation, a part of duct section (approximately 5% of total ductwork) may be selected at random and tested for leakage. The procedure for leak testing should be followed as per SMACNA- "HVAC Air Duct Leakage Test Manual: (First Edition).

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## **Section 2**

## **Duct Accessories & Outlets**

### **1. General**

- 1.1 The various types of air dampers, duct accessories and grilles and outlets shall conform to the following specifications.

### **2. Duct Dampers**

#### **2.1 Volume Control Dampers**



- 2.1.1 The air volume control dampers shall be suitable for either manual and automatic control. The design shall permit accurate modulation in air flow air proportional to the opening or closing of the damper blades.
- 2.1.2 These dampers should provide tight shutoff of air flow. In closed position the air leakage should be between 3% to 5% of design airflow.
- 2.1.3 The damper shall be complete with an outer frame of 1.2 mm (18 Ga) G.I. sheet. The blades shall be fabricated from folded sheets of 1.2 mm (18 Ga) G.I. sheets. The blade shall be mounted on bush or nylon bearing for smooth operation.
- 2.1.4 The operation of the opposing blade shall be controlled either by a gear from or alternate linkage.
- 2.1.5 A suitable linkage shall be available for connecting an actuator for automatic operation.
- 2.1.6 The damper actuator should be selected with sufficient torque to suit the damper size.

### 3. **Standard Grilles**

- 3.1 The supply and return air grilles shall be fabricated from extruded aluminium sections. The supply air grilles shall have single/double louvers. The front horizontal louvers shall be of extruded section, fixed/adjustable type. The rear vertical louvers where required shall of aluminium extruded sections and adjustable type. The return air grille shall have single horizontal extruded section fixed louvers. The grilles shall have an outer frame on all four sides.
- 3.2 The damper blades shall also be of extruded aluminium sections. The grille flange shall be fabricated out of aluminium extruded section. Grilles longer than 450 mm shall have intermediate supports for the horizontal louvers.

### 4. **Diffusers**

- 4.1 The ceiling type square diffusers shall be of aluminium extruded sections with flush face with fixed pattern and neck. The diffusers shall be provided with blank plate suitable of grid ceiling (T-Bar) of size 600 mm x 600 mm.
- 4.2 All supply diffusers shall be provided with extruded aluminium dampers, with arrangement for adjustment from the bottom, Acoustically lined G.I. plenum, perforated diffusion plate and circular spigot.
- 4.3 The slot diffusers shall be of aluminium extruded sections with diffusion plate and sliding damper. It shall be provided with acoustically lined G.I. plenum box with circular spigot.

### 5. **Linear Diffusers/Grilles**

- 5.1 The linear diffusers/grilles shall be fabricated from Aluminium extruded sections.
- 5.2 The diffusion blades shall be extruded, flush mounted type with single or double direction air flow.
- 5.3 The frame shall be of aluminium extruded section and shall hold the louvers tightly in fixed position. The frame shall be provided on all four sides.
- 5.4 The dampers as described under grilles shall be provided wherever specified.

### 6. **Perforated Diffusers**

- 6.1 The perforated diffusers shall be fabricated from aluminium sheet.
- 6.2 The sheet shall have uniform perforations to allow minimum 50% free area.
- 6.3 The supply air diffusers shall be provided with fully adjustable air pattern deflectors.

6.4 The frame shall be of extruded aluminium sections with blanking plate bonded to frame for grid ceiling (T-bar) application.

7. **Nozzle Diffusers**

7.1 The nozzle type diffusers shall be fabricated from heavy gauges aluminium sheet.

7.2 The base shall be fixed type.

7.3 The nozzle shall be of volute design with the spout diameter being half the base dia. and designed for low noise and long through.

7.4 The nozzle shall be able to rotate to any angle within the base.

7.5 The whole assembly shall be powder coated in suitable colour.

8. **DP Grilles**

8.1 The DP grilles used for Displacement Ventilation shall be fabricated for 18 ga (2.20 mm) M.S. sheets and frame.

8.2 There will be an inner and outer sheet with 3 to 4 m perforation providing a minimum of 60% free area.

8.3 A suitable connection shall be provided for air inlet into the diffuser.

8.4 The damper for the return grille will be integral part of the grille.

8.5 In case of rectangular grilles, a separation butterfly damper of 18 ga (2.20 mm) aluminium shall be provided.

9. **Exhaust Grilles**

9.1 The exhaust grilles shall be fabricated from aluminium extruded sections.

9.2 The exhaust grilles shall be horizontal fixed bar grilles with 15<sup>0</sup> blade inclination.

10. **Exhaust / Fresh Air Louvers**

10.1 The louvers shall be fabricated from aluminium extruded sections.

10.2 The blades shall be extruded flush mounted type with single horizontal throw.

10.3 The frame shall be of aluminium extruded section and shall hold the louvers tightly in fixed position.

11. **Painting and Vision Barrier**

11.1 All grilles, and diffusers shall be powder coated, before installation, in approved colour.

11.2 All ducts immediately behind the grilles/diffusers etc. are to be given two coats of black paint in matt finish.

11.3 The return air and dummy portion of all linear grilles shall be provided with a vision barrier made of 24 gauge galvanised sheets. The vision barrier shall be fixed to the false ceiling frame with self tapping screws and shall be given two coats of black paint in matt finish. Care shall be taken to ensure that the return air path is not obstructed.

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**Section 3**

**Insulation**

1. **General**

The Insulation of water piping, air handling units, ducting, chillers etc., shall be carried out as per specifications given below :

2. **Materials**

The materials to be used for insulation shall be as follows, unless some other material is specifically mentioned elsewhere. The detailed specifications of the materials are listed under respective sub heads.

- 2.1 Duct / Under deck : Closed cell elastomeric insulation with  
Insulation microbial treatment

3. **Duct Insulation**

3.1 The materials for duct insulation shall be sheets of closed cell elastomeric insulation with microbial treatment. The density of insulation shall not be less than 50 kg/cubm and material shall be in the form of sheets of uniform thickness. The 'K' value at 20<sup>0</sup> C. shall not be less than 0.037 W/mK.

- 3.2 The thickness of duct insulation shall be as follows:  
a. Duct in conditioned space - 13 mm thick  
b. Duct in unconditioned space - 19 mm thick

4. **Installation**

4.1 **Closed Cell Elastomeric Insulation**

- 4.1.1 The pipe shall be thoroughly cleaned with a wire brush and rendered free from all rust and grease.  
4.1.2 The pipes shall be given a coat of red oxide primer.  
4.1.3 Two Coats of synthetic glue shall be applied on the cleaned pipe surface.  
4.1.4 The preformed sections of insulation shall be fixed tightly to the surface to take care to seal all joints.  
4.1.5 All longitudinal joints shall be sealed with synthetic glue.  
4.1.6 The insulation shall be covered with canvas cloth dipped and finally two coats of thermal insulation canvas coating (seal bond 30/36).

4.2 **Ducting**

- 4.2.1 Clean the surface with a wire brush and make it free from rust and oil.  
4.2.2 Apply two coats of synthetic glue to the surface.  
4.2.3 Wrap the duct with insulation sheets of the thickness mentioned above.  
4.2.4 The joints shall be sealed with synthetic glue to form a seamless bond. The duct joints shall be additionally covered with a 150mm strip of insulation material.

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**Section-4**

**SAFETY CODES**

1. IS 659 : (Reaffirmed 1991)  
Safety code for air conditioning (revised) (Amendment 1).
2. IS 660 : (Reaffirmed 1991)  
Safety code of mechanical refrigeration. (revised).
3. IS 3233 : 1965 (Reaffirmed 1992)  
Glossary of terms for safety and relief valves and their parts.
4. IS 12992 : 1993, Part I, 1990 Part II  
Safety relief valves.
5. IS 954 : 1989 Functional requirements for carbon dioxide tender for fire brigade use. (2<sup>nd</sup> revision)
6. IS 1641 : 1988 (reaffirmed 1993)  
Code of practice for fire safety of buildings (general) : General principles of fire grading and classification. (1<sup>st</sup> revision)
7. IS 1642 : 1989  
Code of practice for fire safety of buildings. (general) : Details of construction (1<sup>st</sup> revision) (1645 supersedes 1642)
8. IS 1643 : 1988 (Reaffirmed 1993)  
Code of practice for fire safety of buildings (general : Exposure hazard (1<sup>st</sup> revision)
9. IS 1644 : 1998 (Reaffirmed 1993)  
Code of practice for fire safety of buildings (general) : Requirements and personal hazard.
10. IS 1646 : 1982 (Reaffirmed 1990)  
Code of practice for fire safety of buildings (general) : Electrical installation (1<sup>st</sup> revision)
11. IS 3786 : 1983 (Reaffirmed 1991)  
Methods for computation of frequency and severity rates for industrial injuries and classification of industrial accidents. (1<sup>st</sup> revision)
12. IS 3808 : 1979 (Reaffirmed 1990)  
Method of test for non combustibility of building materials (1<sup>st</sup> revision)
13. IS 5311 : 1969 (Reaffirmed 1990)  
Code of safety for carbon tetra chloride.
14. IS 6382 : 1984 (Reaffirmed 1990)  
Code of practice for design and installation of fixed carbon dioxide for fire extinguishing system (1<sup>st</sup> revision)
15. IS 7969 : 1975 (Reaffirmed 1991)  
Safety code for handling and storage of building materials (Amendment 1)

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## **Section-5**

### **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 everything 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 square metres. 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, dash fasteners 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**

Grilles / Diffusers should be measured as follows :

- 2.2.1 All measurements of grilles shall be of the actual outlet size excluding the outer flanges.

The square or rectangular diffusers shall be measured in plain SQ.M. of neck areas, except for diffusers suitable for T-bar installation, which shall be measured in numbers.

2.2.3 All round diffusers and grilles shall be measured by their diameters in CM.

2.2.4 All linear diffusers and grilles shall be measured as per actual length in metres excluding outer flanges.

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 **Ducts & Vessels**

4.2.1 **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.

4.3 **Acoustic Duct Lining**

4.3.1 In case of acoustic lining of air ducts, measurements of the bare inside duct surface in square metres, shall be final for billing purposes.

4.3.2 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.

4.5 **Roof and Wall Insulation & Acoustic Treatment**

4.5.1 The unit of measurement for all underdeck roof insulation, wall insulation, wall/roof acoustic panel shall be the uninsulated area of walls, roofs, to be treated, in square metres.

4.5.2 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 completion of the work.

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**Section-6** **List of Approved Makes of Equipments**

**Note:** The tenderer must indicate the makes he has used to cost his tender. An alternate make may be indicated as a substitute to be used if the offered make become unavailable. More than (2) two makes are Not to be indicated.

S. No.	Items	Approved Makes	<u>Make Proposed</u>	
			In Tender	Alternate
1.	<b>Ducting &amp; Grilles</b>		--	--
1.1	Grilles/ Diffusers	Caryaire/ Ravistar/ Mapro/ Tristar/Brightflow		
1.2	Fire Dampers	Caryaire/ Conaire		
1.3	Fire Dampers motors	Belimo/Seimens		
1.4	G.I. Sheet Metal Duct	Jindal/National/ Tata		
1.5	Factory fabricated duct	Rolastar/ Techno fabriduct /ZECO/Ductofab		
1.6	Duct flange	Rolamate/Techno fabriduct /ZECO/ Ductofab		
1.7	Self Adhesive Sealing Gasket for Ducts	Prima Seal/ Air Flow/ Trocellen		
1.8	Hessian (Fire treated)	Navair/ Pyroguard		

1.9	Stick Pins	Prima Seal/ Air Flow		
1.10	VCD/ Gravity louvers/ Exhaust & fresh air louvers	Air Flow/Caryaire/Waves		
2.	<b>Insulation</b>		--	--
2.1	Expanded Polystyrene	Thermolloyd/ R.P. Packaging		
2.2	Glass Wool	Owens Corning / U.P. Twiga		
2.3	Polyurethane Foam	Malanpur /Lloyd/ Superurethane		
2.4	Crossed Cell Elastomeric	Armacell/ A Flex / Eurobatex		
2.5	Aluminium Tape	Johnson/Birla 3M		
3.	<b>Miscellaneous</b>			
3.1	Anchor fasteners	Hilti/ Fisher		
3.2	Vibration Isolator	Resistoflex/ Dunlop		
3.3	Welding Rods	Advani/Victor		
3.4	<b>Paints</b>			
3.5.1	<i>Enamel</i>	ICI/ Asian/ Nerolac/ Berger		
3.5.2	<i>Bituminous</i>	Shalimar		
3.6	Tar felt ( <i>for underground chilled water pipe insulation</i> )	Shalimar		

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### **IMPORTANT NOTES**

1. The quantities are approximate and can vary both ways.
2. Payment shall be made as per actual work done at the branch/site.
3. Job shall be completed within time period otherwise a penalty of Rs.250.00 per day shall be imposed.
4. The work shall have to be done in the running branch so please ensure that the branch work does not suffer and in case any temporary connections are to be given for lights/fans etc. it shall be a part of this work and no separate payment shall be made as extra.
5. Rates quoted shall be firm and shall include all the taxes and levies.
6. Retention money as 5% of the total bill shall be kept for a period of six months towards defect liability.
7. Contractor shall keep his electrician for two days during the shifting of the branch.
8. All local bye laws shall be followed by the contractor and if required necessary permissions from the authorities be obtained by him and bank shall pay only those charges for which official receipt shall be submitted by the contractor.
9. Contractor must visit the branch to get familiarise with the site and work before quoting.
10. On completion of the work contractor shall submit two copies of proper as laid drawings for record.(Electrical & AC)
11. If the contractors require any further clarifications, they may contact Bank's Engineer or Architect office during office hours.

**READ & AGREE TO ALL THE ABOVE CONDITIONS**

**SIGNATURE WITH SEAL OF THE CONTRACTOR**

## SUMMARY SHEET

Sr.No.	Description	TOTAL AMOUNT
-		
1	INTERIOR WORKS	
2	ELECTRICAL WORKS	
2	HVAC WORKS	
	TOTAL (Rs.)	
	DISCOUNT IF ANY @	
	GRAND TOTAL	



**INTERIOR & FURNISHING WORKS FOR NATIONALHOUSING BANK,  
FIFTH FLOOR AT INDIAN HABITAT CENTRE, NEW DELHI**

Sr.No.	Description	Units	Quantity	Rate	Amount
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**A SUBHEAD – I : (DISMANTLING & CIVIL WORKS)**

**The contractor to quote salvage value for these items which shall be deducted from total value of work.**

1.00	Dismantling, Removal of existing items:(the contractor may verify quantities at site), (i) All partitions including framework approx.1500sq.ft (ii) Furniture - workstation, officer table with storage CMD room furniture - table, back unit, sofa set PS room furniture - 2 nos Conference Table - 1 nos Working counter Reception table - 1 nos (iii) low height storages, approx. 120 sq.ft (iv) False ceiling including framework approx 2600 sq.ft (v) Panelling including framework approx. 500 sq.ft (vi) electrical fitting and fixture (vii) AC ducting and accessories changed The site and premises to be cleared of dismantled serviceable/unserviceable material. i.e. disposal of all dismantled material beyond premises upto dumping yard identified by local authorities including all leads and lifts.  Salvage value of above items - Disposal / rubbish to be disposed well before submission of bill for consideration  CMD room furniture may be retained by Bank.				
2.00	Dismantling / Removing existing glazed tiles and granite counter in toilet, including dismantling existing screeding and raking out joints including disposal of all dismantled material beyond premises upto dumping yard including all leads and lifts.	Sq.ft	30.00		
3.00	Demolishing brick work and disposal of serviceable and unserviceable material outside the premises to nearest dumping yard.	Sq.ft	200.00		
4.00	Construction of new Half Brick masonry with bricks of class designation 75 cement mortar 1:4 (1 cement : 4 coarse sand) including curing etc. complete with providing and placing in position 2 Nos. 6 mm dia M.S. Bars at every their coarse of half brick masonry	Sq.ft	350.00		
5.00	Waterproofing in existing toilet by removing flooring/ sub floor & applying tapecrete as per manufacture specification.	Sqft	80		
5.00	Providing & fixing ceramic tiles 8 mm thick of approved shade & make, of basic rate Rs. 200/- per sft, over 12mm cement mortar on walls.	Sq.ft	340		



Providing and fixing in position Gypsum Board False Ceiling as per manufacturer's specifications and instructions with 12.5 mm thick 'Gypboard' Screw-fixed to the underside Of suspended G.I. grid. G.I. grid should be Constructed and suspended from the main ceiling as per manufacturer's instructions and as per specifications using Original Co. Specified Framework Sections G.I.24 gauge The Gypboard should be fixed to G.I. grid with 25 mm long Drawali Screws. The Gypboard ' to be used should be 12.5mm thick tapered edge boards. The boards should Be taped and filled from underside to give smooth, seamless ceiling. The rate should include necessary additional ceiling sections and intermediate channels openings for light fixtures, A.C. ducts, vertical drops, offsets. etc. Additional Intermediate channels should be fixed to strap hangers for additional support to prevent strap hangers from buckling/swaying at every 1200 mm. Item to be completed in all respect including necessary sleeves for ducts finishing of joints cut outs supports for A.C. grills, light fixtures, speakers etc.

Make: Gypsum board-India Gypsum. Panint-Asian/ ICI

2.00	<b>Wooden false ceiling</b> Providing and fixing false ceiling made of framework as item 1above, but finished with 4mm thick veneer (Greenply or equivalent) with grooves, fixed to 12mm commercial ply (Greenply or equivalent) instead of gypsum board. Veneer to be with melamine polish.	Sq.ft	710
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#### TOTAL OF FALSE CEILING WORKS

#### D SUB-HEAD:-IV: PARTITION WORKS:-

1.00	<b>Glazed Partitions: (Toughened Frameless) PT 1</b> Providing and fixing partitions of frameless glazing made of 12 mm thick toughened float glass fixed to floor and ceiling with Aluminium channels (inserted in floor and ceiling) including backer rod, hardwood, silicon sealants on joints of glass partition complete as per drawing. (Glass area only shall be measured for payment) Item includes door made of 12mm float glass (toughened) with patch fitting etc. including top pivot, bottom and upper patch, floor lock strikeplate and floor spring of DORMA make, all including cutting and making good the floor. Providing and fixing stainless steel door handle 32mm dia 500mm overall length for frameless door shutter.	Sq.ft	150
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#### Providing & Fixing Full Height Partition:-

2.00	<b>Italian marble / Veneer Partition PT 2</b>	Sq.ft	200
(a)	Frame work with 100 x 50 mm thick kail wood members fixed to floor and ceiling @ 600 mm c/c approx. both ways by means of Rawl plugs/ Dash fasteners. The frame shall be treated with a coat of fire retardant paint of approved quality and manufacture.		
(b)	Facing with 12 mm thick commercial ply wood well secured to frame work by means of screws and nails.		
(c)	18-20mm thk Italian marble perlato on one side with adhesive of basic rate 250/- per sft.		
(d)	4mm veneer of approved shade and manufacture, glued and pressed including fixing of bands and grooves etc.on other side, leaving space for texture paint		
(e)	above 3'0" and upto 8'0" texture paint approved shade (OIKOS or equivalent)		

	(f)	Finishing all wood surfaces with Melamine finish as per standard practices and specification complete.		
3.00		<b>Both side Veneer Partition PT 3</b>	Sq.ft	650
	(a)	Frame work with 50 x 50 mm thick kail wood members fixed to floor and ceiling @ 600 mm c/c approx. both ways by means of Rawl plugs/ Dash fasteners. The frame shall be treated with a coat of fire retardant paint of approved quality and manufacture.		
	(b)	Facing both sides with 9 mm thick commercial ply wood well secured to frame work by means of screws and nails.		
	(c)	Fixing both sides 4mm thick commercial ply with grooves as per drawing and design.		
	(d)	Veneer both sides of the partition with 4 mm thick veneer of approved shade and manufacture, glued and pressed including fixing of bands and grooves etc. as per drawing complete.		
	(e)	Finishing all wood surfaces with Melamine finish as per standard practices and specification complete.		
	(f)	Teak wood frame of size 50x75mm including making rebate for shutters, including 35 mm thk. door shutter (thickness excluding finishing) with 4mm thick veneer both sides and with 8mm glass as per design. The edges shall be with 12mm thick teakwood lipping, including locks, hinges, handle, stopper, door closer etc. complete.		
3.01		Extra for providing 8mm glass with teak wood frame of size 75 x 40mm, and teak wood beading size 12 x 35mm including melamine polish to wood work.	Sq.ft	30
4.00		<b>Double frame partition PT 4</b>	Sq.ft	390
	(a)	Frame work with 50 x 50 mm thick kail wood members fixed to floor and ceiling @ 600 mm c/c approx. both ways by means of Rawl plugs/ Dash fasteners. The frame shall be treated with a coat of fire retardant paint of approved quality and manufacture.		
	(b)	Facing outside with 9 mm thick commercial ply wood well secured to frame work by means of screws and nails.		
	(c)	Fixing outside 4mm thick veneer with grooves as per drawing and design.		
	(d)	Additional Frame work as per (a) above		
	(e)	Fixing upto 3'0" height leather finish panel 4mm thick of 'SIBU' of approved shade and manufacture, glued and pressed		
	(f)	fixing above 3'0" height 4mm veneer of approved shade and manufacture, glued and pressed including fixing of bands etc.		
5.00		<b>Veneer / Texture paint partition PT 5</b>	Sq.ft	630
	(a)	Frame work with 50 x 50 mm thick kail wood members fixed to floor and ceiling @ 600 mm c/c approx. both ways by means of Rawl plugs/ Dash fasteners. The frame shall be treated with a coat of fire retardant paint of approved quality and manufacture.		

(b)	Facing both sides with 9 mm thick commercial ply wood well secured to frame work by means of screws and nails.		
(c)	Fixing both sides 4mm thick commercial ply with grooves as per drawing and design.		
(d)	One sides veneer of the partition with 4 mm thick veneer of approved shade and manufacture, glued and pressed including fixing of bands and grooves etc. as per drawing complete.		
(e)	other side texture paint approved shade (OIKOS or equivalent)		
(f)	Finishing all wood surfaces with Melamine finish as per standard practices and specification complete.		
(g)	Teak wood frame of size 50x75mm including making rebate for shutters, including 35 mm thk. door shutter (thickness excluding finishing) with 4mm thick veneer both sides and with 8mm glass as per design. The edges shall be with 12mm thick teakwood lipping, including locks, hinges, handle, stopper, door closer etc. complete.		
6.00	Providing & fixing glass wool 50mm thick for insulation purpose in partitions and above false ceiling. Density of Glasswool=24 kg/m3	Sq.ft	1870

**TOTAL OF PARTITION WORK**

**E SUB-HEAD:-V: PANELLING WORKS:-**

1(a)	Frame work with 50 x 25 mm thick Kailwood frames fixed to Brick or RCC columns @ 600 mm c/c approx. both ways by means of Rawl plugs / Dash fastners.The frame work is to be treated with a coat fire retardent Paint of approved quality and manufacture.		
(b)	Facing with 9 mm thick commercial ply wood well secured to frame work by means of screws and nails.		
(c)	Fixing 4 mm thick veneer with grooves as per drawing and design.	Sq.ft	1390
2.00	Same as above, but with leather finish board 4mm thick of 'SIBU' of approved shade.	Sq.ft	100
3.00	Same as above, but with texture paint of approved shade.	Sq.ft	600
2.00	Frame work as per 1 (a) & (b) Fixing leather finish board 4mm thick of 'SIBU' make of approved shade as per pattern and drawing with groove.	Sq.ft	150
	Fixing of mirror finish laminate in strip as per drawing		

**TOTAL OF PANELLING WORK**

**F SUB-HEAD VI; MODULAR FURNITURE**

1.00	<b>MD Table</b> Polishing of existing table, side & backunits, console with melamine polish & PU finish to Table Top.	Nos	R/o
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2.00	<b>PS Table</b>	Nos	2.00
	<p>Providing and placing Table, of size 1500 x 750, back unit size 2600x 450 and side unit size 900 x 450, made of 19mm thick commercial board and top of 25 mm thick board, all finished with 4mm veneer with PU polish .All inside surface to be with enamel paint. Table and side/back units to be provided with drawer unit, and storages, provision for CPU, keyboard, UPS, cable manager as per design. Make WIPRO or equivalent.</p>		
3.00	<b>MEETING Table</b> (10 people)	Nos	1.00
	<p>Providing and placing <b>Meeting table</b> as per design, made of 25mm commercial board top finished with 4mm veneer, and having 12mm thick sand blasted glass in between as per design. The base shall be TW legs as per design. All wood to be with melamine polish &amp; PU finish to table top.</p>		
4.00	<b>CONFERENCE TABLE</b>	Nos	1
	<p>Providing and placing Conference table (6000x 1800mm) as per design, made of 40mm commercial board top finished with 4mm veneer,The base support shall be made of 40mm commercial boards at suitable cross locations as per drawing.</p>		
5.00	<b>Workstation</b>	Nos	2.00
	<p>Manufacturing as per design and placing in position work stations of sizes and shapes as mentioned below with working level height of 750mm. The workstations shall be mounted on partition panels overall thickness between 68-70mm 1350 high. The partition panels shall be made of knockdown metal frame comprising of vertical sections made from minimum 1.5mm. CRCA MS D Grade formed into channels duly powder coated. These vertical channels must have front slits in them at an interval of 76.2mm. To accept tile claddings. The Top Horizontal member of this framework shall be made from M. S. square pipe, having a minimum wall thickness of 1.2mm and a minimum cross sectional dimension of 25.4mm x 38.1mm duly powder coated. Tile cladding 9mm. th. All partition panels shall be finished by end extrusions of 1.2 mm thickness made of powder coated Aluminium alloy HE-9 (63400) of section 69mm x13.2mm and of matching height of the panel fitted with screws and top runner of extrusion made of powder coated Aluminium alloy HE-9 (63400) of section 69 mm x 13.2 mm x 1.2mm thick. The top runner shall be snap fitted to the top of the panel by means of PVC clip fitted with screws as per drawings.</p>		
	<p>a L-shaped 1500 x 1375 mm including drawer units as per design.</p>		
	<p>THE PARTITION SHALL HAVE 8MM GLASS &amp; PIN UP BOARD AS DESIGN make WIPRO or equivalent</p>		
6.00	<b>Low height storage</b> (750mm Ht)	sqft	80.00

Providing and fixing Low height storages. Top board 25mm thick parrricle board substrate with HPL post formed in full round profile (bull nosing), underside covered with balancing laminate. All edges duly banded with 0.4mm PVC edge banding with hot melt glue and machine trimmed. Front shutters over lapping the carcass edges in 18mm thick with high pressure laminate (HPL) post formed in quarter round profile with particle board substrate back side also laminated.Sides edge banded as above in approved shade.All edges duly machined edge banded with hot melt glue. Concealed stainless steel hardware incl. metal dowels, spring loaded hinges, locks, tower bolts, handles and other fixtures accurately fixed with necessary machines/drills etc. complete as per detailed drawings(front area to be measured and paid for)

8.00 Providing and placing as per drawings and design with seat & back made of 50X50mm hard wood frame to required shape with seat of 100mm to rubber (Prima / TOTO )attached to flat springs and fixed to frame. Front, back and sides of sofa to have 6mm thick commercial ply wood facing moulded to required shape over hard wood frame and covered with 25mm thick foam & fully upholstered with approved fabric 25mm thick foam & fully upholstered with approved fabric on mark in as per specification.

(Fabric cost not less than Rs. 350/- per meter as approved).

(a)	<b>three seater shaped sofa</b>	Nos	R/o
(b)	<b>two seater shaped sofa .</b>	Nos	R/o
(c)	<b>one seater shaped sofa</b>	Nos	R/o
9.00	Providing and placing Rectangular Center Tables of size 600 x 600 x 450 mm high of appropriate make & design with 25 mm commercial board with 4mm veneer. All exposed wood work to be of melamine polished, as per specifications as approved by Bank/Architect.	Nos	R/o
10.00	Providing and placing as per design and drawing <b>Corner Table</b> 450 x 450 450 mm high.Table made of appropriate make & design with 25 mm commercial board with 4mm veneer. All exposed wood work to be of melamine polished, as per specifications as approved by Bank/Architect.	Nos	R/o
11.00	Console unit (1200 x 450 x 750) Providing and placing as per design and drawing. Console Unit 1200 x 450 X 750 mm high.Table made of appropriate make & design with 25 mm commercial board with 4mm veneer. All exposed wood work to be of melamine polished, as per specifications as approved by Bank/Architect.	Nos	R/o
12.00	Reception table Providing and placing as per design and drawing. Console Unit 2100 x 600 X 900 mm high.Table made of appropriate make & design with 25 mm commercial board with 4mm veneer. All exposed wood work to be of melamine polished, as per specifications as approved by Bank/Architect.	Nos	1
12.00	Wall cabinet Providing and placing as per design and drawing. Wall cabinet 600 x 450 X 2400 mm high.cabinet made of appropriate make & design with 25 mm commercial board with 4mm veneer & 8mm thk glass. All exposed wood work to be of melamine polished, as per specifications as approved by Bank/Architect.	Nos	1

**TOTAL OF MODULAR FURNITURE**

**G SUB-HEAD:-VII: DOORS WORKS:-**

1.00	<b>Double Shutter Solid Flush Door - Veneer</b> Providing & fixing 50mm thk marine flush door with 50 X 12mm lipping patti on all sides with glass wool filling, finished in 4mm thk veneer on both sides of approved shade as per architects instructions. complete with all hinges, stoppers, rubber bush, lock, handle, concealed door closer / floor srping of approved make.		
(i)	2100 x 2400mm	NOS	2
2.00	<b>Solid Flush Door -Veneer</b> Providing & fixing 40mm thk marine flush door with 40 x 12mm lipping patti on all sides with glass wool filling, finished in 4mm thk veneer on both sides of approved shade as per architects instructions. complete with all hinges, stoppers, rubber bush, lock, handle, concealed door closer / floor spring of approved make.		
(i)	1000 x 2400mm	NOS	1
(ii)	750 x 2400mm	NOS	2
3.00	Providing and fixing 50mm thk Sliding Folding flush doors with 9mm commercial ply both sides, with HETICH hardware as per company specifications, SS handle . Doors to be finished 4mm veneer both side with groove as per design, including melamine polished.	Sqft	192
4.00	Providing and fixing 6mm ply to AHU room door on one side and fixing 1.5mm laminate approved, shade and make. Door to be replaced with SS handle	Sqft	50
5.00	Melamine polish to wooden member of Existing main glass door	Sqft	<b>30</b>

**TOTAL OF DOORS WORK**

**H SUB-HEAD:-VIII: MISCELLANEOUS WORKS:-**

1.00	<b>Special Effect / Designer paint</b> Painting with approved shade and colour on walls / gypsum partition or equivalent make with two coats of putty, two coats of approved primer, one coat with emulsion and one or two coats of metallic paint including preparation of surface, scrapping, sand papering, scaffolding, all materials, labour etc complete	Sq.ft	1000
	Note :- Paint work shall include preparation of base in line and level (over-plastered finish/ gypsum board), sanding and putty work all complete. Work shall be in 3 or more coats to achieve uniform coloured finish.		
2.00	<b>Roler Blinds</b> Providing & fixing Roler blinds as per approved shade	Sq.ft	1150
3.00	<b>Frosted Glass Film</b>	Sq.ft	100



Providing & fixing in position '3M' make frosted glass film in stardust range fixed to glass as per pattern. Area of application to be measured as maximum length x maximum height of application on that particular piece of glass.

4.00	<b>White Board</b> Providing & fixing white B226 magnetic white board with duster & marker stand. size:- 2400 x 1350mm	NOS	1
5.00	<b>Glass panels on ss studs</b> Providing & fixing 8 mm thk glass with edge polish fixed on S.S.Studs.	Sq.ft	80
6.00	<b>Back Painted Glass on ss studs</b> Providing and fixing in position 12 mm th back painted glass with edge polish, fixed with SS studs finish	Sq.ft	100
7.00	Providing & laying <b>Hard wood flooring for deck</b> of approved shade & colour, of size 1198x198x15mm thick as per approved sample, colour,& laid on the existing levelled flooring nd profile etc. complete,surface treated with aluminium oxide on top of a high density fibre board. The planks shall have a click system tounge and groove joint, with their edges duly impregranated with paraffin on a smooth and damp proof base using rubber adhesive of approved quality including pressing the sheets with a suitable tool to get a smooth surface of chemical / fade / fire resistant	Sq.ft	150
8.00	Providing & making Planter as per Design in Drawing Planters made of 19mm commercial board, with 4 mm thick. Veneer of approved shade. All edges duly banded with 0.4mm PVC edge banding with melt glue and machine trimmed i/c 22 Gauge G.I. Sheet to be placed inside of box and having hinged handles, 4 Nos inside of planter to be finished with spirit polish complete as per drawing.	Nos	15

#### TOTAL OF MISCELLANEOUS WORKS

##### I SUB-HEAD:-IX :Sanitary Fixtures:

1.00	Providing & fixing wall mirror 8mm thick of size 2' x 4' fixed to wall with SS studs.	Sqft	24
2.00	Providing & fixing white colour vitreous China floor mounting European water closet with cistern complete with all internal fittings/accessories,C.P. bolts, nuts, or other hanging arrangements, bakelite toilet seat & cover with C.P.wall hinges & rubber buffers complete with all internal fittings/accessories.		
2.10	Floor mounted W.C. pan Hindware Olivia 220 One Piece Toilet 92042( S' Trap distance-22cm) with white plastic seat. Product Size 66x38x72cm	EACH	2
3.00	Providing & fixing white colour vitreous china wash basin (Hindware Monalisa Over the counter Basin ) 46 dia(cm) with brackers, 32 mm dia C.P. brass waste, 32 mm dia C.P. cast brass bottle trap.	EACH	2

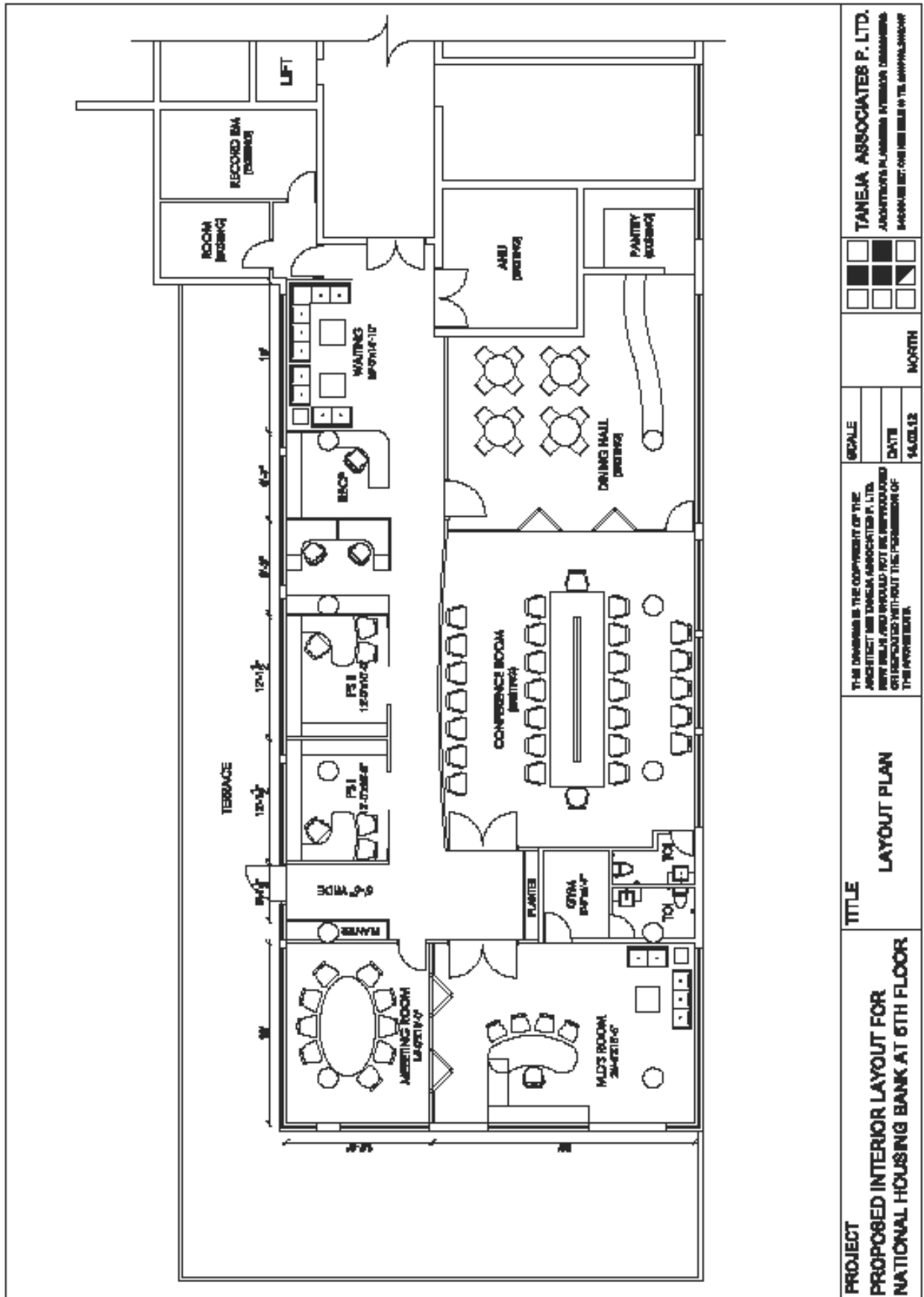












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