

Department of Chemistry,  
University of Mumbai,  
No. :  
Date: September, 2013

To,

-----  
-----  
-----  
-----

Sealed Quotations/Tenders for purchase of following items are invited, for and on behalf of University of Mumbai by the Head, Department of Chemistry, University of Mumbai, so as to reach him in his office latest by 4.00 p.m. on Tuesday, 10<sup>th</sup> September 2013.

**1. Laboratory Furniture, Chemical Storage Racks, Fume Hoods, etc.**

Blank forms containing terms and conditions of supply and technical specifications are available at the office of the Head, Department of Chemistry, University of Mumbai, on all working days between 11.00 a.m. and 4.00 p.m. from Saturday, 31<sup>st</sup> August 2013 to Tuesday, 10<sup>th</sup> September 2013, on payment of ₹ 500.00 (₹ Five Hundred only) in cash OR can be downloaded from our website <http://mu.ac.in/tenders.html> and submitted alongwith a DD of ₹ 500.00 (₹ Five Hundred only) in favour of 'Finance and Accounts Officer, University of Mumbai'. The quotations/tenders duly complete in all respects, along with the necessary documents should be submitted to the Head, Department of Chemistry, University of Mumbai, latest by 4.00 p.m. on Tuesday, 10<sup>th</sup> September 2013.

The quotations/tenders so received, shall be opened on Wednesday, 11<sup>th</sup> September 2013, at 11.30 a.m., in the office of the Head, Department of Chemistry, University of Mumbai, Lokmanya Tilak Bhavan, Vidyanagari, Santacruz (E), Mumbai, 400 098, in presence of representatives of the suppliers. Right to reject any or all tenders, without assigning any reason thereof, is reserved by the University of Mumbai.

**Interested parties are requested to visit the department, inspect and understand the quality and quantity of the requirement. If requested a schematic layout of the available space with its dimensions will be provided.**

Sd/-  
(Dr. V. R. Ajgaonkar)  
Prof. & Head,  
Department of Chemistry,  
University of Mumbai.

# Department of Chemistry

## University of Mumbai

Lokmanya Tilak Bhavan, Vidyanagari  
Santacruz (E), Mumbai - 400 098  
Phone: 26543587/26543354  
Fax: 26528547

**Tender Document**  
**Date 31<sup>st</sup> August, 2013**  
Part A - Terms and conditions  
Part B - Specifications  
Price ₹ 500.00 (non refundable)

### Important Dates

Sale of Tender forms	Saturday, 31 <sup>th</sup> August 2013 to Tuesday 10 <sup>th</sup> September 2013. (All working days, from 11.00 a.m. to 4.00 p.m. except Sunday and Public Holiday)
Last Date for receiving sealed Tenders	Tuesday, 10 <sup>th</sup> September 2013 upto 4.00 p.m.
Date of Opening of Tenders	Wednesday, 11 <sup>th</sup> September 2013; at 11.00 am.

Head, Department of Chemistry  
(Seal & sign)

**Department of Chemistry**  
**University of Mumbai**

Lokmanya Tilak Bhavan, Vidyanagari  
Santacruz (E), Mumbai - 400 098

Phone: 26543587/26543354

Fax: 26528547

**Tender Document**  
**Date 31<sup>st</sup> August, 2013**

Part A -Terms and Conditions of Supply

**Supply of Laboratory Furniture, Chemical Storage Racks,  
Fume Hoods, etc.**

## Part A -Terms and Conditions

1. The last date and time for the acceptance of the quotations / Tenders is Tuesday, 10<sup>th</sup> September 2013 up to 4.00 p.m.
2. The tenderers shall submit the following documents along with their quotations / tenders.
  - a. Income tax clearance certificate, from the Income Tax officer concerned, certifying that the tenderer has cleared all the Income Tax dues.
  - b. Suppliers should state whether they are a Propriety Firm, Partnership Firm or a Private / Public Limited Company and furnish a profile of the firm / company. They should also clearly mention whether they are manufacturers, authorized dealers or retail suppliers.
  - c. The names of the organizations and the offices to which similar supplies have been made.
  - d. Earnest Money Deposit in the form of Demand Draft in favour of Finance and Accounts Officer, University of Mumbai, on any Scheduled / Nationalized Bank payable at Mumbai.
  - e. Sales Tax Registration No.
  - f. Technical specifications offered by the Supplier
3. The rates should be mentioned in the Schedule attached with the tender / quotation paper. Each page of the tender shall be signed in full and stamped with the seal by supplier. The supplier must clearly state in what capacity he or she is signing the tender.
4. The tenderers shall submit the tender in two envelopes. The first envelope (Technical Bid) shall contain all the documents referred to in Para 2 above and shall be sealed. The second envelope (Commercial Bid) shall contain the **Schedule**, in which the supplier shall register the rates of supply. The second envelope shall also, likewise, be sealed. Both the envelopes then should be put together and shall be sealed in an envelope, and shall be submitted to the University by the prescribed time and date. The Technical Bid shall be opened first to ensure that the tenderers have submitted all the requisite documents. If the Technical Bids are not in order or are deficient in some respect, the Commercial Bids in respect of such tenders shall not be opened.
5. The amount of Earnest Money Deposit shall be 5% of the cost of supply subject to a maximum of ₹ 5,00,000.00 (₹ Five Lakh only). The Earnest Money Deposit should be in the form of Bank Draft drawn on a nationalized / scheduled bank (payable at Mumbai) in favour of the 'Finance and Accounts Officer, University of Mumbai', Fort Campus, Mumbai - 400 032 and must be enclosed with the Technical Bid.
6. Tenders / quotations not accompanied by the requisite amount of Earnest Money Deposit shall be rejected.
7. The amount of Security Deposit / Performance Guarantee shall be 5% of the cost. In case of successful tenderers the amount of Earnest Money Deposit shall be converted

in Security Deposit / Performance Guarantee and refunded after the warranty period is over.

8. Supplier should read carefully all the instructions and terms and conditions, etc., before registering rates in prescribed schedule of the tender. Taxes and duties etc. should be shown separately.
9. The offers made by the suppliers shall be open for acceptance for 120 days after the last date of submission of tender.
10. The quotation shall be opened by the Head, Department of Chemistry in his office on **Wednesday, 11<sup>th</sup> September 2013**. The tenderers or their authorized representatives shall be allowed to be present at the time of opening of the tenders.
11. In case of imported items / equipments the rates should be quoted in the light of exemptions enjoyed by educational institutions. The University is exempted from payment of Customs/Excise duty, Octroi; and the necessary certificates / forms can be issued by the University.
12. Technical specifications of the instrument / equipment are given in the Annexure of these papers (Part B).
13. The delivery time of instrument / equipment should be clearly mentioned in the tender. No extension shall be granted to the contractors / suppliers for the period of delivery mentioned in the tender, under any circumstances.
14. If the supplier fails to deliver the article as per the delivery schedule, the University of Mumbai shall be free to procure the balance / undelivered supply, at the risk and cost of such supplier.
15. The goods, article, material supplied by the contractor shall be accepted after inspection by an officer authorized by the competent authority. No article / material which do not conform to the specifications laid down in the terms and conditions or damaged in transit or otherwise, shall be accepted.
16. The bills of the suppliers shall be paid by the University after all the article/ material/ instrument / equipment have been received, inspected as above.
17. The warranty period shall be at least for one year from the date of installation.
18. Supplier should give free service at least for three years after the warranty is over.
19. Undertaking from the manufacturer that parts will be made available at least for next ten years even after discontinuation of the supplied model is necessary.

20. A list of all the necessary accessories and spares required to make the unit functional should be provided. Names and phone numbers of the persons responsible for Sales and Service for this territory should be mentioned.
21. The suppliers (either authorized dealers or manufacturers) should have executed at least three orders worth rupees one crore and above of the tendered value within India, from government/PSU Laboratories in the past three years (copies of the PO and Completion Certificates to be attached).
22. The bidders (either authorized dealers or manufacturers) should have a Turnover of at least rupees fifty crores in a year.
23. As the supplier shall be responsible for the supply and installation of the material at the Department of Chemistry, University of Mumbai; the cost towards loading/unloading, insurance, etc. shall be borne by the suppliers.
24. Without any purchase commitment, inspection/demonstration should be arranged at the cost of the supplier for the quoted material at two places in Mumbai.
25. In the event of any breach of the terms and conditions of the supply, the University of Mumbai may terminate the contract placed with the supplier and forfeit the EMD/Security Deposit of the supplier.

## SCHEDULE TO TENDER

**Note:**

1. Tenderers are advised to read carefully the Terms and Conditions of supply and "the Instructions to the tenderers" before recording the rates in this schedule.
2. No erasures or overwriting shall be allowed, unless they are authenticated under the full signature and seal of the tenderers.
3. The Rates shall be FOR, at destinations / godowns/ places indicated in the delivery.

Item No.	Description of goods with details of specifications	Number/Quantity	Price / Rate per Unit	Taxes, Duties etc.

Full Signature of Tenderer

(Seal of the Firm/Company)

**Department of Chemistry**  
**University of Mumbai**

Lokmanya Tilak Bhavan, Vidyanagari  
Santacruz (E), Mumbai - 400 098

Phone: 26543587/26543354

Fax: 26528547

**Tender Document**

**Date 31<sup>st</sup> August, 2013**

Part B -Technical Specifications

**Supply of Laboratory Furniture, Chemical Storage Racks,  
Fume Hoods, etc.**



The department is interested in installation of the furniture in the following laboratories/sections

1. Organic Research Laboratory with adjacent two rooms (Tilak Bhavan, Ground Floor)
2. Micro Analytical Laboratory (Tilak Bhavan, Ground Floor)
3. Physical Research Laboratory No. 1, 2 & 3 (Tilak Bhavan, First Floor)
4. Organic Research Laboratory No. 1 & 2 (Tilak Bhavan, First Floor)
5. Electro-analytical Laboratory (Tilak Bhavan, Second Floor)
6. Inorganic Research Laboratory (Adjacent to Stores)
7. Organic Paper Laboratory with Ice Room (Dnyaneshwar Bhavan, Ground Floor)
8. Inorganic Paper Laboratory with adjacent two rooms (Dnyaneshwar Bhavan, Ground Floor)

## SPECIFICATIONS FOR SUPPLY OF LABORATORY FURNITURE, CHEMICAL STORAGE RACKS, FUME HOODS, ETC.

### 1.1. Technical Specifications of Floor Units

1.1.1. **General Description** - The steel frames, panels & shutters should be made from Prime Quality CRCA (Cold Rolled Cold Annealed) Steel. All cabinet bodies shall be of over closing design with fully KD (knock down) construction and having a Main and Add On construction to avoid any gaps in between two units. All units have interlocking type construction to form a rigid integral structure. The units are supported on wide base plastic legs of diameter 40 mm. These legs are height adjustable with a range of +/- 50 mm. Each unit should have a locking facility with 180° and 10 lever cam lock mechanism.

- i. *Floor cabinets made of hollow tubular square cross sections would not be acceptable*
- ii. *Welded joints in the floor cabinets would not be acceptable*

#### 1.1.2. Features

- **Surface Treatment:** The complete M.S. material of cabinet to be pre-treated (degreased, Zinc Phosphated) and epoxy powder coated for better corrosion resistance. The thickness of powder coat to be 45 to 50 microns, which passes the Salt Spray test for 1000 hours and having the Scratch Hardness of 3Kgs.
- **Cabinet frame:** Frame is a combination of 1.2 mm horizontal stiffeners and 0.8 mm vertical panel of CRCA MS sheet.
- **Cover panels:** End side panel, false panel and back panel of 0.8 mm thick CRCA MS sheet.
- **Shelves and Drawers:** CRCA shelves having a load carrying capacity of 40 kg. The overall load carrying capacity of cabinet should be 80 Kg of UDL (40 kgs. on each shelf and 40 kgs. on bottom). The overall load carrying capacity of drawer should be 40 kgs. of UDL for a pair of ball slide.
- **Door Pulls:** Flush pulls of PVC, providing a recessed finger grip to be used. Finger holes or slots machined into doors will not be acceptable.
- **Drawer:** Drawer and door, when closed, shall be over closing on the cabinets.
- **Slides:** High precision Double Extension Ball slides which have passed more than 55000 cycles of Drawer Cycle test (forward & backward movements) with a 15kg load in the drawer. should be used which enables the drawer to open fully. *Roller Slides would not be acceptable.*
- **Shutters:** Metal Shutters should be double walled and made up of 0.8mm thick CRCA MS sheet with profil inserts and 40-50 microns pure epoxy powder coated.
- **Hinges:** Hinges shall be made of MS with Cathode electrode deposition for better corrosion resistance. The hinges should be spring loaded with 105 degree opening. Welding of hinges to door or case will not be accepted. Doors under 36" in height shall be hung on one pair of hinges, and doors over 36" high shall be hung on 3 hinges in case of under storage cabinets.

- **Positive Catch:** All units to be with self closing type spring loaded hinges. The hinge should close the doors once left at a certain angle. *No additional catch will be allowed in the units.*
- **Shelf supports:** Shelf support clips shall be nickel-plated steel.
- **Legs:** All Legs to be made of polystyrene with a load carrying capacity of 450 kg/each. *All units to be on polystyrene legs for better clean ability of the lab area.* Fully enclosed flush design will not be acceptable. Leg should be able take evenness of the floor. It should have at least 50mm adjustability.
- **Support Brackets:** Granite /Reagent Support Brackets which serve the purpose of supporting the granite and for carrying the service lines should be made of 2 mm CRCA MS sheet with epoxy powder coating.
- **Configuration of Storage Units:** The storage units should be available in three configurations:
  - ✓ Storage unit with one/two shutters and one adjustable shelf
  - ✓ Storage unit with one drawer, one/ two shutters and one adjustable shelf
  - ✓ Storage unit with 4 drawers

*All storages are fitted with 10 lever, 180 degree cam locks when not specified.*

- 1.2. **Sink Units** - The sink unit consists of a base cabinet, polypropylene sink and a faucet. The raw material used for a base cabinet is 0.8 mm thick CRCA M.S. Sheet. The complete M.S. material of cabinet is pretreated (degreased, Zinc Phosphated) and epoxy powder coated (Ivory colour) for better corrosion resistance. The thickness of powder coat should be 45-50 microns and should pass the test of Salt Spray for 1000 Hours and has a scratch hardness of 3 kg.
- 1.3. **Reagent Shelves** - Reagent Shelves to be made of complete modular design consisting of horizontal 2 stage storage shelves. The end vertical support should be 0.9mm & horizontal shelves of 0.8mm thick CRCA M.S mounted on PP caps. Each shelf should have a load carrying capacity of 30 kgs. of UDL for the length of 1000 mm. Each vertical panel shall be assembled with horizontal shelf with M6 fasteners having Zinc-Cobalt coating for better corrosion resistance. The complete M.S. material of reagent shelf should be pretreated (degreased, Zinc phosphated) and epoxy powder coated for better corrosion resistance. The thickness of powder coat to be 45-50 microns, which passes the test of Salt Spray for 1000 hours and has a Scratch Hardness of 3Kgs.
- 1.4. **Electrical Trunking** - Electrical trunking should be made up of 0.8mm thick CRCA MS Sheet. The complete M.S. material of cabinet should be pretreated (degreased, Zinc phosphated) and epoxy powder coated for better corrosion resistance. The thickness of powder coating should be 45-50 microns and should pass the test of Salt Spray for 1000 hours. It should have a high temperature withstanding capacity with excellent electrical insulation properties.

### 1.5. Top Units

- The top unit to be of the same construction as that of the base storage cabinets and shall have a completely finished interior same as exterior.

### 1.6. Acid Storage Cabinets(Ext. Dim - W x D x H is 1200 x 600 x 1900)

- Smooth, air-damped door closing which is outside the storage compartment offering increased protection of moving and safety relevant components against corrosion
- Wing doors having 90° opening and the interior of the cabinet is completely visible
- Cylinder locking system which is suitable for master- key system
- The shelves are height adjustable (at 32 mm increments) with a load carrying capacity of 75 kg UDL and are secured against tilting
- The adjusting aids are integrated inside the cabinet and helps in easy alignment to compensate for uneven floor
- The Bottom Collecting sump with 3 sided lip seal provides safe collection of leakage
- PE tray protects shelves from corrosive materials

1.7. **Service Panels** - The service panels should be made of 0.6 mm thick CRCA M.S. Sheet. The M.S. material should be pretreated (degreased, Zinc Phosphated) and epoxy powder coated for better corrosion resistance. The thickness of powder coat to be 45-50 microns, which passes the test of salt spray for 1000 hours and having the scratch hardness of 3 kgs. All the electrical fittings, wires coming from mains to switches on service panels should be completely enclosed to avoid any accidental situations. All the accessories should have a very high temperature withstanding capacity and excellent electrical insulation properties.

1.8. **Sinks-Polypropylene Molded Sinks:** Should be made up of 5 mm thick high density and elastic poly propylene with good resistance to organic solvents. Standard bowl size (L x W x D) to be 548 x 398 x 235 mm.

1.9. **Pegboard** -.Single faced stainless steel pegboard having a tray hole for water drainage and detachable pegs. The essence is made up of 1 mm thick stainless steel (SS 304) whereas the pegs are made up of polypropylene and are adjustable with a minimum 10mm distance between each peg (L x W x H is 420 x 550 x 54 mm).

1.10. **Worktop (Granite)** - It shall be 20 mm thick jet black granite with edges having round profiles of 5 mm radius on top side. The overhang on the storage cabinet is 40mm at the front side and 50 mm at the side. It should also have a V-Groove cut at 30 mm from the front edge. The backing material used for granite is a neoprene mat of 6 mm thickness.

## 2. Technical Specifications for Fume Hoods

### 2.1. Standard Fume Hood Performance Requirements

Fume hoods shall be of complete KD (Knock down) construction with airfoil design to insure maximum operating efficiency. Foil sections at the front facials of the hood shall minimize eddying of air currents at the hood face and the rear baffle

system shall minimize turbulence in the upper portion of the hood interior.

- ✓ Test Method - The hood shall be tested by a third party as per the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 110-1995 and BS EN-14175.
- ✓ *Self certified fume hoods will not be acceptable.*

## 2.2. Quality Assurance

- The laboratory fume hood manufacturer shall provide fume hood work tops and casework all **manufactured & shipped with** proper packing & should take the full responsibility of the entire scope of works as specified in the tender.
- *Each fume hood should come Pre Wired along with PDI (Pre Dispatch Inspection Report)*

## 2.3. Specifications

- **Superstructure Frame** - A free-standing rigid panel structure of steel (G.I.)
- **Interior Walls** - Double wall ends, not more than 6" wide, shall be provided to maximize interior working area. The area between the double wall ends shall be closed to house the remote control valves. Cutouts to be provide inside the fume hood for service line accessibility. The same to have a cover with a fastener free design. The vertical facias shall contain the required service controls, electrical switches and receptacles.
- **Airfoil** - A streamlined airfoil shall be integral at the bottom of the hood opening on bench and distillation hoods. This foil shall provide a nominal 20mm open space between the foil and the top front edge of the work surface to direct an air stream across the work surface to prevent back flow of air. The sash to be provided with a separate handle which also provides for air flow when in completely closed position. The foil shall be of 1.2mm steel to resist denting and flexing.
- **Baffle** - A stable, non-adjustable baffle with a single slot on the back baffle to aid in distributing the flow of air into and through the hood. The baffle shall be spaced out from the back liner and shall be removable for cleaning.
- **Duct Collar** - A 8"-10" diameter polyethylene funnel shaped rectangular duct collar shall be located in the top of the hood plenum chamber.
- **Lighting**- Two fluorescent light fixture (inclusive of CFL tubes) of 20 volts each to be provided in the fume hood. The lighting fixture to be completely outside the fume hood area.
- **Sash** - A sash provided should move in a vertical rising steel frame without any noise. The bottom of the sash frame shall have a full length metal handle. The sash track has minimum protrusion to avoid any kind of turbulence. The sash shall be counterbalanced with a weights to prevent tilting and binding during operation. The glass panels shall be 5mm toughened glass mounted in an levelled channel with roller for smooth operation.
- **Plumbing Services** - Utility services like Nitrogen, Vacuum and Compressed Air shall consist of remote control valves as selected located within the end panels, controlled by in and out facility with flexible hose passing through the side panels of the hood, with color coded plastic handles. Interior fitting for gases and water shall be with powder coated brass. All gas valves for regular lab gases to have standard needle valve and push and turn type arrangement for all

burning gases to be supplied. All supplied valves to clear the following pressure test conditions: Gas Fittings - 7 bar, Water fittings - 10 bar.

- **Electrical Services** - The hood superstructure shall be fully wired and should have a control box with MCB blower starter all safety devices like trip etc. Inlet to be of 3 phase power supply and the whole electrical to be of plug and play type. It also has 4 nos. electrical sockets and switches of Northwest make (230V, 5/16 A, 50 Hz)
- **Liner** - Interior liner panels shall be 6 mm thick Phenol resin based industrial laminate.
- **Digital Panel**- Fume hoods shall be provided with an alarm system to detect low and high hood face velocities. The alarm system shall indicate the actual face velocity of the hood regardless of sash position. The system shall have an air velocity sensor mounted on the interior side liner of the hood where it is easily accessible for cleaning. The velocity monitor shall have a digital display of the air velocity through the hood face in feet per minute. The alarm signals shall activate any time the face velocity falls below the low velocity alarm set point or rises above the high velocity alarm set point. There shall be both visual and audible alarm signals. The audible alarm shall have a mute. Low and high alarm contacts shall be provided for remote monitoring.
- **Lattice Rod Assemblies** - 12mm diameter solid SS rods shall be clamped with the PP clamps to form a lattice arrangement to hold the test samples and rotors within the fume hood.
- **Centrifugal Blower** - Silenthigh efficiency remote blower consisting of continuous rating motor and chemical resistant impellar. The blower is designed to give a face velocity at safe working height as per the international safe velocity norms. (ANSI/AIHA Z9.5). The blower body is polypropylene UV treated, high density and chemical (corrosion) resistant and is mounted on a metallic stand.
- **Ducting** - Rigid Ducting of PP (Polypropylene) + FRP (Fibre Reinforced Polyester) and flexible ducting with flanges, bends, damper transitions, clamps etc. Flexible joint is provided in the ducting in order to avoid transmitting the blower vibrations to the hood. A weather proof rain cowl is provided at the outlet of blower.
- **Base Cabinets** - Fume hoods are designed to rest on a bench (high base stand, pedestal or a cabinet) which is a complete rigid steel structure. Gauge of steel used in its construction shall be 0.8 mm GI.
- **Transition** - Used to connect fume hood with ducting should be designed to reduce the static pressure and is made up of PP-FRP.
- **Work Surface** - Hood work surface shall be 20 mm thick jet black granite made in the form of a watertight pan, not less than 7 mm deep to contain spillage. Worktop will have oval shaped 100 mm X 200 mm 'PP' Cup-Sink for drainage. The work surface and cup drain shall be available in black colour.

### 3. Performance Requirements

#### 3.1. Steel Casework Construction Performance

- Base cabinets shall be constructed to support at least a uniformly distributed

load of 250 kgs.

- Each leg should have a load carrying capacity of 450 kg
- Each adjustable and fixed shelf shall support an evenly distributed load of 40 Kg.
- All drawers shall operate smoothly, a minimum of 100,000 cycles with an evenly distributed load of 25 kg.
- Swinging doors on floor-mounted casework shall support 45+45 Kg. suspended at a point 1 feet from hinged side, with door swung through an arc of 90 degrees. Weight load test shall allow only a temporary deflection, without permanent distortion or twist. Door shall operate freely after test and assume a flat plane in a closed position.

**3.2. Steel Paint System Finish:** All steel coated surfaces to follow the following testing standards

<i>S.No</i>	<i>Characteristic</i>	<i>Specification</i>	<i>Method Used</i>	<i>Standards References</i>
1	DFT ( DRY FILM THICKNESS	35 micron	ELCOMETER OR DFT METER	ASTM-D: 1186 (93), IS - 13871(1993), IS - 101
2	GLOSS AT 60°	70 ±5 units	GLOSS METER	ASTM-D 523-89 Reapproved (1994)
				ISO - 2813
				DIN - 67530, IS - 13871(1993), IS - 101
3	SCRATCH HARDNESS	3 kgs	SCRATCH HARDNESS TESTER	BS - 3900 Part E2 1970
				IS - 101 (Part- /Sec-2) 1988, IS - 13871:1993
4	IMPACT RESISTANCE	275 Kg.cm	IMPACT TESTER	ASTM-D: 2794-93
				BS - 3900 Part E3 1979, IS - 101
				JISK - 5400 (1979), IS - 13871(1993)
5	CROSS CUT ADHESION	1x1 mm or GT=0		DIN - 53151
				ISO - 2409
				ASTM - 3002
				ASTM - 3359
				JISK - 5400 (1979), IS - 13871(1993)

6	FLEXIBILITY	3.25 mm	CYLINDRICAL MANDREL BENDING TESTERS	DIN - 53152, ISO - 1519
				ASTM - D: 522
				BS - 3900 PART E1, IS - 101 (Part-5/ Sec-2) 1988
7	ERICHSEN CUPPING	8 mm	ERICHSEN CUPPING TESTER	JISK - 5400 (1990)
				IS - 101 (Part 5/Sec 2) 1988, IS - 13871(1993)
8	SALT SPRAY	1000 hours	SALT SPRAY CHAMBER	IS - 101 (Part 6/Sec 1)1988
				ASTM - B117(95), IS - 13871 (1993)

**Zinc Phosphate deposition rate:** 1.1 gm/mt. square, IS - 3618 (1966) Reaffirmed in 1991 and IS - 6005 (1998).

**Mild Steel (CRC):** IS - 513 (1994) Reaffirmed in 1998. GRADE is 'D' or 'DD' quality.

**Hoods:** GI

### 3.3. Performance Test Results (Chemical Spot Tests)

- Testing Procedure:** Chemical spot tests for non-volatile chemicals shall be made by applying 5 drops of each reagent to the surface to be tested and covering with a 1-1/4" dia. watch glass, convex side down to confine the reagent. Spot tests of volatile chemicals shall be tested by placing a cotton ball saturated with reagent on the surface to be tested and covering with an inverted 2-ounce wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire test period, and at a temperature of 77° ±3° F. For both methods, leave the reagents on the panel for a period of one hour. At the end of the test period, the reagents shall be flushed from the surface with water, and the surface scrubbed with a soft bristle brush under running water, rinsed and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Immediately prior to evaluation, 16 to 24 hours after the reagents are removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.
- Test Evaluation:** Evaluation shall be based on the following rating system.

  - Level 0 - No detectable change.
  - Level 1 - Slight change in color or gloss.
  - Level 2 - Slight surface etching or severe staining.
  - Level 3 - Pitting, catering, swelling, or erosion of coating (obvious and significant deterioration)



***After testing, panel shall show no more than three (3) Level 3 conditions.***

- *Test Reagents:*

<i>Test No</i>	<i>Chemical Reagent</i>	<i>Test Method</i>
1	Acetate, Amyl	Cotton ball & bottle
2	Acetate, Ethyl	Cotton ball & bottle
3	Acetic Acid, 98%	Watch glass
4	Acetone	Cotton ball & bottle
5	Acid Dichromate, 5%	Watch glass
6	Alcohol, Butyl	Cotton ball & bottle
7	Alcohol, Ethyl	Cotton ball & bottle
8	Alcohol, Methyl	Cotton ball & bottle
9	Ammonium Hydroxide, 28%	Watch glass
10	Benzene	Cotton ball & bottle
11	Carbon Tetrachloride	Cotton ball & bottle
12	Chloroform	Cotton ball & bottle
13	Chromic Acid, 60%	Watch glass
14	Cresol	Cotton ball & bottle
15	Dichlor Acetic Acid	Cotton ball & bottle
16	Dimethylformamide	Cotton ball & bottle
17	Dioxane	Cotton ball & bottle
18	Ethyl Ether	Cotton ball & bottle
19	Formaldehyde, 37%	Cotton ball & bottle
20	Formic Acid, 90%	Watch glass
21	Furfural	Cotton ball & bottle
22	Gasoline	Watch glass
23	Hydrochloric Acid, 37%	Cotton ball & bottle
24	Hydrofluoric Acid, 48%	Watch glass
25	Hydrogen Peroxide, 3%	Watch glass
26	Iodine, Tincture of	Watch glass
27	Methyl Ethyl Ketone	Cotton ball & bottle
28	Methylene Chloride	Cotton ball & bottle
29	Mono Chlorobenzene	Cotton ball & bottle
30	Naphthalene	Cotton ball & bottle

31	Nitric Acid, 20%	Watch glass
32	Nitric Acid, 30%	Watch glass
33	Nitric Acid, 70%	Watch glass
34	Phenol, 90%	Cotton ball & bottle
35	Phosphoric Acid, 85%	Watch glass
36	Silver Nitrate, Saturated	Watch glass
37	Sodium Hydroxide, 10%	Watch glass
38	Sodium Hydroxide, 20%	Watch glass
39	Sodium Hydroxide, 40%	Watch glass
40	Sodium Hydroxide, Flake	Watch glass
41	Sodium Sulfide, Saturated	Watch glass
42	Sulfuric Acid, 33%	Watch glass
43	Sulfuric Acid, 77%	Watch glass
44	Sulfuric Acid, 96%	Watch glass
45	Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	Watch glass
46	Toluene	Cotton ball & bottle
47	Trichloroethylene	Cotton ball & bottle
48	Xylene	Cotton ball & bottle
49	Zinc Chloride, Saturated	Watch glass

\* - Where concentrations are indicated, percentages are by weight.

#### 3.4. Service Fittings and Accessories

- *Laboratory Service Fittings:* Service fittings shall be laboratory grade, and water faucets and valve bodies shall be cast red brass alloy or bronze forgings, All fittings shall be powder plated unless specified otherwise.
- *Service Indexes:* Fittings shall be identified with service indexes in the colour coding as per DIN 12920.
- All water faucets and gas valves should meet the following performance tests and requirements:

3.4.1. *Chemical Resistance:* Finish shall meet the following tests for chemical resistance

3.4.2. *Fume Test:* Suspend coated samples in a container at least 6 cubic foot capacity, approximately 12" above open beakers, each containing 100 cc of 70% nitric acid, 94% sulfuric acid and 35% hydrochloric acid respectively. After exposure to these fumes for 150 hours, the finish on the samples shall show no discoloration, disintegration or other defects.

3.4..3. **Direct Application Test:** Subject coated samples to the direct action of the reagents and solvents listed below at a temperature of 25 degrees C dropping from a burette at the rate of 60 drops per minute for ten minutes. Finish on the samples shall not rupture, though slight discoloration or temporary softening is permissible.

Acetic Acid (98%)	Kerosene
Acetone	Lactic Acid (10%)
Ammonium Hydroxide (28%)	Methanol
Amyl Acetate	Methyl Alcohol
Amyl Alcohol	Methyl Ethyl Ketone
Benzene	Methylene Chloride
Butyl Alcohol	Mineral Oil
Calcium Hypochlorite	Monochloro Benzene
Carbon Disulfide	Naphthalene
Carbon Tetrachloride	N-Hexane
Chloroform	Nitric Acid (70%)
Chromic Trioxide Acid	Perchloric Acid (70%)
Cresol	Phenol
Crude Oil	Phosphoric Acid (75%)
Dioxane	Sea Water
Distilled Water	Silver Nitrate (30%)
Ether	Sodium Bichromate (Saturated)
Ethyl Acetate	Sodium Carbonate (10%)
Ethyl Alcohol	Sodium Chloride (20%)
Ethyl Ether	Sodium Hydroxide (50%)
Formaldehyde (37%)	Sodium Hypochlorite
Formic Acid (90%)	Sodium Sulfide
Gasoline	Sulfuric Acid (87%)
Glacial Acetic Acid (99.5%)	Toluene
Glycerine	Trichlorethylene
Hydrochloric Acid (38%)	Turpentine
Hydrofluoric Acid (48%)	Urea (Saturated)
Hydrogen Peroxide (5%)	Xylene
Isopropyl Alcohol	Zinc Chloride (Saturated)

3.4..4. **Mar and Abrasion Resistance:** Finishes shall have pencil hardness of 2H-4H with adhesion substantial enough to withstand both direct and reverse impacts of 160 inch pounds. Finish shall have excellent mar resistance and be capable of withstanding scuffing, marring and other ordinary wear.

3.4..5. **Reparability:** Finish shall be capable of surface repair in the event that a fitting is scratched or a surface rupture occurs. The service fitting manufacturer shall have available an air-drying aerosol coating, specially formulated to match the existing finish colour, which may be applied in the field to repair coated surfaces.

## 4. Exhaust Blower

**4.1. General-** The exhaust fans supplied and installed shall be of 'Centrifugal Corrosion Resistant' type and shall be capable of delivering the design flow rate against all duct losses. The fans shall be robust in construction and suitable for continuous duty operation. It shall be mounted with ease of maintenance and shall be installed with proper vibration isolators to minimize vibration transmission to ductwork and support structure. Fans selected shall be silent and vibration free when running and suitable for outdoor use. A standard hub seal shall be incorporated onto the impeller hub to prevent corrosive 'medium' from contacting the shaft.

### 4.2. Specifications:

- *Housings: PP-* Single block strong high density UV treated and recyclable polypropylene (PPH) with no welded joint. Reversible and rotatable to any 8 standard discharge positions by 45 degree increments. All fan mounting hardware in stainless steel.
- *Wheels: PP* - Forward curved centrifugal type impeller made, of injection moulded PPH. Fan wheel supplied with hub cap constructed of PPH. Wheels electronically and dynamically balanced to ISO 1940.
- *Motors* - Direct drive, asynchronous, single or three phases, IP55. Single speed: three phase 230/400 V-50/60 Hz. Explosion proof motors available on request. Motor is outside the airstream. Three phase motors speed adjustable by variable frequency inverter drive.
- *Motor Support* - Metal stand constructed of epoxy coated sheet metal, polypropylene motor pedestal or roof unit kit.
- *Temperature Resistance* - PPH casing and wheel recommended upto 80 degree celcius.
- *Performance* - Fan performance based on tests conducted in accordance with AMCA 210-85 and ISO 5801.

## 5. Ducting

### 5.1. Technical Specifications for PP/FRP Ducting:

- One side smooth & glassy finish and other end is matt finish.
  - ✓ The smooth surface should be the inner surface of the duct.
  - ✓ On mat side, FRP lining to be done.
  - ✓ 25 mm x 25 mm Stitch welding is done on inner surface and continuous welding on outer surface with 5 mm welding thickness.
- FRP Lining to be done on the outer surface of PPGL I.e. on mat side.
  - ✓ One layer FRP is one mm.
  - ✓ The final layer should be with fine mat to have smooth and good finish.
  - ✓ While making the lining, there should not be any air pockets or any sort of uneven finish.
  - ✓ There should be time gap between the FRP layers, allowing each layer to be got dried.

- Isothelic resin to be used which is fire resistant for 20 seconds.
- The flange thickness should be 1.5 times of the duct thickness up to 750 mm and 2 times above 750 mm ducting. All flanges are to be matched with M8, GI fasteners and flat washers on both the sides. They should have fasteners at the 4 corners and they should be fixed at a pitch distance of between 125 mm to 150mm. The flanges should be properly ground and dressed. Duct support distance should not be more than 2500 mm.
- Any duct length should not be more than 3600 mm.

**5.2. Duct Construction** - The fabricated duct dimensions should be as per approved drawings and all connecting sections are dimensionally matched to avoid any gaps. All PP FRP to be 3+3 mm thick.

### **5.3. Dampers and Flexible Hose**

**5.3.1. General** - Volume control damper sets shall be provided where specified according to the specifications in the offer BOQ. Dampers shall be double thickness heavier than the thickness of the large duct & shall be rigid in construction. The volume control dampers shall be of an approved type, lever operated & complete with locking devices which will permit the dampers to be adjusted & locked in any positions. Construct blades of 3 mm thick PP MOC, provide heavy-duty molded self-lubricating nylon bearings, 13mm (1/2") diameter Plastic axles spaced on 225mm (9") centres. Construct frame of 300 mm diameter outer with Flange for fitting minimum 6 bolts and nuts. The outer shell body shall be a transparent material of Polypropylene. Automatic & manual volume opposed blade shall be not over 225mm wide. The dampers for fresh air inlet shall additionally provide with fly mesh screen, on the outside of 0.8mm thickness with fine mesh.

**5.3.2. Manually Adjustable Damper Sets** - Damper sets shall be arranged in substantial supporting frames and each blade shall be mounted on a shaft, which turns in sintered bronze bearings. All damper blades shall be inter-connected by means of a suitable bar linkage for ganged operation. All dampers shall be arranged with spindle horizontal and shall be sized to handle the air quantities shown on the drawings. Where manually adjustable damper sets are installed in ductwork or other accessible locations the operating shafts shall be extended through the duct and a lockable quadrant fitted.

**5.3.3. Bird Screens** - Galvanized woven mesh or weld mesh bird screens in rigid galvanized iron frames shall be installed behind all Bypass exhaust air openings to the outside of the building.

**5.3.4. Flexible Connections** - Provide flexible duct connections wherever ductwork connects to vibration isolated equipment and on all exhaust final connections to spot extractor and as indicated on the drawings. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make air-tight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse and tensional movement and also capable of absorbing vibrations of connected equipment. Flexible connections shall be air tight and resistant to water and fire. Flexible connections shall be fitted to isolate fans from

equipments and/or ductwork. The connections shall be arranged to permit the renewal of the connection without disturbing the duct work or the plant. The metal parts of connected equipment shall be separated by not less than six inches and installed with sufficient slack to compensate for free movement of fans or spring vibration isolators.

APPROVED MAKES

<b>Sr.No</b>	<b>Description</b>	<b>Approved Make</b>
1	Steel	TATA STEEL
2	Powder Coating	NEROLAC KANSAI/ASIAN PAINTS/BERGER
3	Water Faucets and Gas Valves	WATERSAVER/BROEN
4	Eye Wash and Body Shower	WATERSAVER/BROEN
5	Switches and Sockets	NORTHWEST
6	Data and Voice Sockets	NORTHWEST
7	Hinges	HETTICH/HAFFLE
8	Legs	HETTICH/HAFFLE
9	Locks and Double Extension Ball Slides	GODREJ
10	Air Flow Digital Controls	TEL
11	Exhaust Blower	SEAT/COLASIT
12	Safety Storage Cabinets	ASECOS