

## VOLUME II

### Technical Specifications of Pneumatic Tube System with 10 Years Comprehensive Maintenance Contract After completion of 1 year DLP.

Tata Memorial Centre is setting up HWCC facility at ACTRAC in Mumbai.

The monthly Mumbai climate is as follows.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C	37	38.3	41.7	40.6	39.7	37.2	35.6	33.8	35.6	39.5	38.4	36.7	41.7
Mean maximum °C	34.4	34.9	35.8	35.1	35.4	35	32.1	31.7	32.7	36.4	36.3	35.3	37.6
Average high °C	30.2	30.2	31.5	32.7	33.8	32.2	30	29.7	30.6	33	33.5	32.2	31.6
Daily mean °C	24.9	25.3	27.1	28.9	30.5	29.3	27.8	27.4	27.8	28.9	28.4	26.5	27.7
Average low °C	19.3	20.2	22.7	25	27.1	26.5	25.4	25.1	25	24.8	23.2	20.9	23.8
Mean minimum °C	16	17.1	20	22.9	25	23.3	23.3	23.3	23.1	22.8	20.7	17.7	15.6
Record low °C	11.7	11.7	16.3	20	22.8	21.1	21.7	21.7	20	20.6	17.8	12.8	11.7
Average rainfall mm	0.9	0.2	0.4	0.5	20.2	530.2	711.6	493.8	330.4	78.4	14.9	2.6	2,184.10
Average relative humidity (%)	62	62	63	66	68	77	85	84	80	72	65	63	71

The said facility has Ground + 6 floors which have been demarcated for following purpose.

Floors	Wing A	Wing B
<b>Ground floor</b>	Physiotherapy, Occupation Therapy. Pre Anesthesia check up & Consulting, PHARMACY	Dental clinic, Dental Surgery, BILLING
<b>First floor</b>	General Daycare Ward & Casualty	Casualty & Private Daycare Ward
<b>Second floor</b>	General Ward	General Ward
<b>Third floor</b>	General Ward	General Ward
<b>Fourth floor</b>	Private rooms & Isolation rooms	Private rooms & Isolation rooms
<b>Fifth floor</b>	CSSD	Private rooms & Isolation rooms
<b>Sixth floor</b>	ICU Recovery Beds	ICU Rooms & Isolation Rooms
<b>Seventh floor</b>	7 Operation Theatres + Induction Area	7 Operation Theatres + Induction Area + Patient Holding beds

The positioning of Receiving / Dispatch Stations proposes now at 19 locations & the system shall be extendable for 6 more stations. The minimum necessary arrangement for future extension shall be made now.

**In the following document wherever only one set of Standards are mentioned the other set will automatically be deemed to apply, depending upon the origin of the equipment.**

**The Europe based vendors shall supply a system that will conform to**

1. HTM 2009
2. HTM 08-04
3. ISO 15189
4. ISO 22196
5. EMC directive 89/336/EEC- 92/31/EEC
6. ISO21702
7. CE certification

**The US based vendors shall supply a system that will conform to**

8. NFPA 101 provisions
9. NFPA 99 provisions
10. ASTM
11. NEC 70
12. NEMA

**13. The PTS shall be used for transport of following**

**Diagnostic / Pathology:**

1. Blood samples
2. Urine samples;
3. Culture swabs;
4. Stools;
5. Blood cultures;
6. Spinal fluids;
7. Frozen section;
8. Radioactive blood samples;
9. Laboratory test results (may also be sent via computer network).

**Pharmacy:**

1. Intravenous 500ml to 1,000ml with admixtures;
2. Protein based drugs;
3. General pharmaceutical;
4. Patient TTD drugs;
5. Controlled drugs;
6. Aerosol medications;
7. Cytotoxic drugs (in prepared syringes).

**General:**

1. Samples;
2. Surgical instruments;
3. X-ray films;
4. Medical records;
5. Menu cards.

The colour coded rings of carriers shall be as follows.

1. Pathology – Yellow
2. Pharmacy – Green
3. Blood – Red
4. Documents - Blue

**Facilities by User**

1. Entire building is air-conditioned.
2. A room admeasuring minimum 3M x3 M & clear headroom of minimum 3.5 M shall be made available for 2 blowers & Central Control Cabin shall be provided. This shall suit requirement of selected Vendor. Client reserves option to change the location, from that shown in tender drawing & shall account for the resulting changes in quantities of work as shown in the drawing.
3. A control room for PTS control workstation shall be made available with UPS 5A power.
4. 4 nos. of 15 A UPS power connections shall be made available in Blower room.

5. UPS power supply shall be made available at total 4 locations in this building of 7 floors for power supply for station controls.
6. Following facilities shall also be supplied by User
  - a. Standard illumination
  - b. One IP/SLT telephone
  - c. Minimum required office furniture in PTS control room.
  - d. Internet connection
  - e. Data connection
  - f. UPS power connection
  - g. Furniture

#### **Contractor scope of work**

1. Supply, installation, testing & commissioning of entire system to meet User's requirement out of PTS system to meet User's requirements, inclusive of all accessories, auxiliaries. Supports etc. are included in the scope of work.
  - Any item not mentioned explicitly in Tech. Specs & BoQ but is required for completion of works shall be deemed to be included in the Contractor's scope of work.
  - If any aspect/item is found to be missing in the bid, the same shall be brought to the notice of User in Pre Bid Queries.
  - No demand for extra work shall be entertained under any circumstances except those items which are billed on running meter, on the basis of actual measurement over or under the bid quantity, based on route used for deployment of system.
  - Only the manufacturer or his authorised channel partner can bid.
  - Only one offer for each manufacturer shall be considered.
  - The bidder shall confirm to provide facility for servicing the system in Mumbai for a period of last 5 years.
  - The bidder shall submit a list of spares with price recommended by bidder & to be maintained by User, though it is not binding on User to maintain any spares inventory.
  - Preparation of approved location & routing drawing & providing core cutting at required co-ordinates including all fire seals of the approved make & type.
2. Training of Engineers & Operators, till such time that the operators are confident to operate the system satisfactorily.
3. **DLP services** shall be rendered by Bidder during DLP period of 1 year, counted from the date of handing over project to user, which shall be after bidder has attended to all punch lists & trained the User Staff. The call log shall be 8 hrs./day x6days/week & call shall be attended maximum by Next Business Day,
4. **Comprehensive Maintenance Services** which will be as briefly described as below
  - The CMC period of 10 years shall commence after completion of DLP.
  - This shall include both Preventive as also Breakdown maintenance.
  - A Maintenance Check Schedule shall be prepared on mutually agreed basis.
  - The periodicity shall not be less than once in a month.
  - The Period of Preventive Maintenance Schedule shall be prepared on mutually agreed basis.
  - The Breakdown attendance shall be on 8 hrs./day x6days/week & call shall be attended maximum by Next Business Day,
  - The maintenance regime shall include all hardware, software & accessories.

- The cost of spares, engineering, qualified/trained manpower including unskilled manpower shall be included.
  - The payment frequency for annual CMC fees shall be mutually agreed.
5. Further cabling till point of use shall be supplied/laid/installed by contractor in a manner approved by User.
  6. All data communication cables shall be supplied/laid/installed by contractor in a manner approved by User.
  7. 100% back up power is available at the facility from DG sets within about 5-7 seconds from grid failure. The memory of the operations in progress shall not be volatile & the operations shall continue to run as planned, first on UPS & then on DG set power.
  8. The contractor can connect to ground his systems to Users grounding system as a part of his scope of work.
  9. During execution all data sheets, drawings, designs shall be submitted for approval of Consultant.

**The main Operating Parameters are as follows**

1. The system shall be in 2 Zones/Wings.
2. The system is based on entire system operating off one blower with the second blower in full kit as spare.
3. The immediately proposed stations shall be 18 with a provision for addition of 6 more stations in future.
4. There will be provision of extension in hardware & software to connect the system to 2 adjoining buildings.
5. The speed shall be 3M/Sec to 5 M/Sec. It should be possible to adjust the speed for critical consignments.
6. The maximum payload in carrier shall be 5 kGs.

**The station deployment shall be as follows.**

Sr. No	Floor	Area	IPDs Wing A	IPDs Wing B	Proposed Now			Future		
					Wing A	Wing B	Total Now	Wing A	Wing B	Future Total
1	Ground	Pharmacy Counter			1	0	1	3	0	3
		Billing Counter			0	1	1	0	1	1
		Blood bank & Diagnostic			0	1	1	0	0	0
2	First	General day care Ward @ Nurse Station	33	39	0	0	0	0	0	0
		Casualty			0	1	1	0	0	0
		General day care			1	0	1	1	0	1
		Private day care			0	3	3	0	0	0
3	Second	General day care Ward @ Nurse Station	31	31	1	1	2	0	0	0
4	Third	General day care Ward @ Nurse Station	31	31	1	1	2	0	0	0
5	Fourth	Private room @ Nurse Station	15	14	1	1	2	0	0	0
6	Fifth	Private room @ Nurse Station	0	15	0	1	1	0	0	0
7	Sixth	ICU Nurse Station	50	45			0	0	0	0
		ICU ward			1		1	0	0	0
		Recovery Ward				1	1	0	0	0
8	Seventh	OT & Patient holding ward @ Nurse Station	18	24			0			0
		Operation Theatre			1	0	1	0	0	0
		Patient Holding ward			0	1	1	1	0	1
			178	199			19			6
			377							

## **Technical specs of the major components of the PTS system**

In the following document nomenclature & description of some system components may be different for some manufacturers. In case any difference, the purpose shall be understood from the names of system components or if required, clarification may be sought in Pre Bid queries.

### **1. CARRIERS**

- Each carrier body must be made of transparent impact resistant and distortion free moulded polycarbonate. The compliance to various referred standards, as claimed by bidder, shall be by way of a test certificate from an approved third party laboratory.
- The carrier should have humidity proofed soft carbon brush carrier rings (which shall be moist resistant & humidity proof) & guaranteed by a test certificate from a third party laboratory. This is to protect staff of User against Covid 19 & to move smoothly, rapidly with a minimum noise within the system.
- The middle body of the carrier should be transparent so as to enable the user to check the content for spillage before safely opening the carrier.
- Carriers should be durable, sterilize able & should be suitable to transport liquid samples like blood, urine and tissue samples.
- They should be provided with a swivel lid that guarantees the best closure.
- The carriers should also be provided with several locking/sealing mechanisms and a RFID chip for automatic homing and/or track & tracing.
- All carriers should be equipped with a RFID/RCI chip to enable carrier recognition.
- The carrier of 350 mm long with a payload capacity 5 kG & shall be suitable for movement at turns in 160 mm PTS PVC tube.

### **SWIVEL LID**

- All carriers must be swivel-top opening with a hinge to allow full access to material inside, to allow full access in a diameter of 113 mm for easy loading of material inside.
- Flip- top or screw opening is not acceptable.

### **CERTIFIED LEAK-PROOF**

- The leak proof carrier must be certified by a third party laboratory as desired by user.
- It can only be sent in the system when properly closed.
- This is to ensure a carrier cannot open during transfer.

### **CHARACTERISTICS:**

- Large colour and size variation should be available easy to open and close.
- Lockable by using an optional insert lock with key option shall be provided for choice by User..
- Leak-proof (certified) cannot be sent in the system when not closed, easy to cleanable and sterilisable.
- The Swivel lid shall guarantee the best closure. It will be durable made from impact resistant and fixed shape plastic. Transparent middle body shall enable checking of content before opening. It should have carbon brush carrier rings that are moist resistant & anti-virus tested.

**RCI/RFID chip**

- All carriers shall be fitted with the RFID Chips ready for configuration to suit the system.

**COLOR CODE**

- Carrier must be colour coded for each department as per applicable standard.
- Specific users/departments shall identify their payloads by RFID chips & payload content by colour code.

**STERILIZING – AUTOCLAVE**

- All carriers must be automatically announced to be sterilized (autoclave 10 min at 120°C) with RFID chip in the carrier to identify & keep in the database.

**CARRIER ACCEPTANCE IN THE SYSTEM**

- The system should not accept Leak-Proof carriers that are not closed & not identified & registered in the control system by unique carrier ID No.

**2. TUBING**

- The installation shall be carried out using Imported PVC-U tubing to meet DIN 6660/6661 regulations –DN8061/62 group B specification & ISO 22196-99.99% antimicrobial activity against E Coli & Staph. aureus , certified by 3<sup>rd</sup> Party.
- The tube shall be transparent in RAL 7000 with Fire Test Report from to DIN 4102-81.
- All joints, clamps sleeves must be imported only (Local items not to be mixed and used, undertaking should be provided by vendor).
- Where tubing passes through a wall or floor the integrity of the fire rating should not be reduced.
- Intumescent (crushing) type fire sleeves shall be installed at all such points.
- The tubing shall generally be installed at high level.
- The exact routes and positioning of tube work and associated equipment shall be planned with the User prior to commencing work.
- The PVC-U tubing should be adequately supported with suitable (imported) clamps and zinc plated rods (imported) attached to suitable fixing anchors
- Tubing should include cost of data & LVDC power cable and other mounting accessories as required for networking between pneumatic stations.
- It should have good physical strength of 50-55N/mm, general medium density, water absorption during 24 hrs should be 0.03% and combustibility self-extinguishing
- Heat conductivity should be 0.16W/mK
- Straight tube should have minimum one fixing clamp for every 1.5 meters
- The bend should have minimum one fixing clamp at every end
- The offset should have minimum one fixing clamp at each end

**Details of tubes & fittings shall be as follows**

The U-PVC forwarding tubes and bends conforming to DIN 6660, fire classification according to EN13501-1 as per following properties:

- Material PVC-U (PVC Hard)
- Colour – Transparent RAL 7000
- Outside diameter – 160mm
- Wall thickness-3.2mm
- Density: 1.52 ±0.2 g/cm<sup>3</sup>
- Resistance to impact: High resistance at 20 degrees Celsius without breaking
- Physical tensile strength: 40- 50N/mm<sup>2</sup>

- Tensile modulus >2000N/mm<sup>2</sup>
- Surface resistivity : >10<sup>12</sup> ohm
- Heat conductivity: 0.16 W/mk
- Thermal Expansion: 0.08mm/m\*k
- Operation Temperature: 0-60°C
- Fire Classification: B-S2-d0 according to EN 13501-1
- Combustibility: Difficult to inflame
- Tolerance of Diameter: +0.35 – 0.50mm
- Bend radius -800 mm
- It shall be sufficient to smoothly move the carriers of 330 mm length.

Tubes and bends should be smoothly connected with PVC-U sleeves welded together with special PVC welding glue after cleaning with PVC cleaner. The Tubes and bends should be mounted at site using thread rods & tube clips at every 1.5 meter distance. The work shall be done with low elastic distortion, high abrasive resistance. Necessary accessories such as Tube clips, Tube clamps, Special Glue, Special Cleaner, PVC sleeves are included along with all types of necessary supports..

### **EXPANSION JOINTS**

- Expansion in the tubes must be corrected by using expansion joints, based on the length and environment temperature range of the system.

### **FUTURE SYSTEM EXPANSION**

- The installation design of tubes, bends and sleeves shall be done with future expansion & necessary fitments & assembly shall be done at this stage to facilitate future alterations and additions to the system without disruptions to system in operation.

### **3. DIVERTERS**

- The location and siting of diverters will be agreed with the User engineer prior to installation
- Diverters shall be mounted using suitable fixings ,conforming to standard & as agreed with the User The installation should be carried out using either 3 way and 6 way diverters for Plant room so as to allow for the future expansion of the system. The diverters should be especially designed for very intensive use and have a very long life cycle. All diverters should be protected with plastic plates and & should be protected with strong metal door for long durability & fire resistance. They will be equipped with a self-controlling and self- adjusting positioning mechanism that prevents the diverter to jam or lock. The drive mechanism must be direct gear driven (2/3-way) or timing belt (6-way). All diverters must include maintenance-free parts, such as the complete gear and chain mechanism, all bearings, self-adjusting seals and failure-free reed contacts. No vulnerable parts are to be used.
- All diverters must meet the European CE standard for mechanical engineering, the EMC standards for electronics and printed circuit boards and meet the IP40 standard.
- Transport should be shockproof and suitable for e.g. blood or other bio-hazard sample transport.

### **SAFETY EXTRA LOW VOLTAGE:**

- The diverters should use the main system cable as power supply (SELV – 24/42 Volt DC).

- This special operating power shall be locally derived as a part of the system.
- This is to ensure that the diverters have low energy consumption, do not need for external power supply and to prevent electrical shock.

#### **CHARACTERISTICS:**

- Silent and shockproof transport, suitable for blood transport and other biohazard materials designed for intensive use should have long lifespan.
- These should have Compact dimensions to permit installation at many places Easy to install.
- These shall include maintenance free parts Low energy consumption.
- It should meet the CE guideline 2006/42/EC for mechanical engineering and the EMC standard 2004/108/EG.

#### **SELF-CONTROLLING AND ADJUSTING**

- Diverters must be fitted with a self -controlling and self-adjusting positioning mechanism that prevents the diverter to jam or lock.

#### **MINIMAL SHOCKS, NOISE AND VIBRATIONS MOUNTING DIRECTION**

- Diverters must move carriers from one tube to another within the system with a minimum of shock, noise and vibration in accordance with the required destination of the carrier. Diverters must be able to be installed horizontally and vertically.

#### **4. STATIONS**

- All stations bidirectional, from station to lab and one station to other also.
- Stations should be of a front-loading design with top send/receive, feed through station with safety door and carrousel and manufactured from hygienic materials.
- The keypad should be of the wipe able membrane type.
- Carriers should be loaded through station & door made up of steel / metal for durability & long life, with a micro switch to identify carrier presence.
- The station should be capable of detecting strange object by RFID of each carrier.
- The design of stations should comply with the latest health and safety regulations.
- Access to the station mechanism should be protected by the interlocked guard door.
- This is to ensure no person can reach hazardous mechanisms.
- The siting, location and mounting heights of all stations are to be agreed with the User prior to installation.
- Provision should be there to ensure that no over loaded carriers are used for transport by system
- It should be possible to get a visual acknowledgement of carrier delivery process – if it is in progress- successful – failed on the sending station to give the sender information on delivery.

#### **Features**

- The stations in built LCD touch screen of minimum 7" display should show
  - Time and Date
  - Carrier destination
  - The station the last carrier arrived from.
  - Station status: -Ready, Selection OK, Out of use, Maintenance, Faulty, Invalid address, Purge.
- The stations indicators should display:
- Carrier being dispatched.



- Carrier incoming.
- Carrier arrived at destination.
- System Busy-System Faulty Stations should be fully automatic, and capable of accepting a carrier when another carrier is incoming to that station.
- Destinations shall be addressed by the use of a digit code or alphabet by accessing the station name through the directory.
- Destinations may be restricted.
- *The destination setting could be optionally set to return to one of three settings after a carrier has been sent:*
- Force new address input.
- Default to a pre-set address.
- Default to "last number redial"
- Wrongly addressed carriers or over-loaded carriers should not be accepted by the system.
- All stations shall be fitted with sophisticated air control to ensure carrier soft arrival.
- The soft arrival system in stations may rely on sensors or valves and should ensure failsafe arrival, even with worn out carriers
- Stations should be designed so that they may be installed in a manner which allows only a very small amount of system air to be discharged into the laboratory with the carrier. Similarly, a carrier being sent from the laboratory should only allow the ingress of a similar amount of laboratory air into the system. This is to ensure that the air quality within the laboratory may not be affected by the installation of the pneumatic tube system.
- The station should attempt to automatically clear and eject a blocked carrier exit by agitating the station mechanism. In case of failure to do so, it should be possible to do so either offline from remote service station or on site.
- The Lab Station could be set to automatically identify and return a carrier to home station with a single keystroke, all carriers to have RFID (Integrated radiofrequency ID) chip.

#### **ARRIVAL BASKET**

- Each station should be provided with a carrier arrival basket and extra tube of sufficient size to accommodate the number of carriers allotted to the appropriate station to ensure soft landing.
- The basket must be fixed under the station and prevent carriers to block the exit of the station and thereby system line.

#### **RETURN TO SENDER**

- The stations must be equipped with a 'return to sender' button/ touch key.
- Stations must have the capability of automatically returning the carrier to the sender once the receiving party removes the items he/she receives and places the carrier back in the station.

#### **SECURITY**

- Carriers could be secured during both the send and receive operations.
- Whenever desired, carriers could be received into a secure receiving cabinet accessible only by digital PIN code.
- In addition, arrival signal units could be programmed to discriminate to different user addresses, thereby allowing urgent full carriers to be immediately notified to

the user, whilst allowing no alarm for empty returns. It should be possible to prioritize all transaction in the entire system by station address.

- Use of the station could be restricted by a user identifiable touch key. This feature is to allow only authorized users access to the system, and record each individual user by name.

#### **Stations for High volume receives and sends**

- High volume sending locations, as mentioned below, must be fitted with a separate or combined -receive and send station each with its own line. One line for receive and send is not accepted. High volume receiving locations, such as the central lab station, must be fitted with a bench arrival station that automatically pushes individual carriers on a rail bench. All these stations should be modular and aesthetically designed and as desired by institute & fulfil all operational requirements.
  1. Pharmacy
  2. Station for outside the centre diagnostic laboratory
  3. Station for outside the centre blood bank

#### **5. BLOWER (3-PHASE HEAVY DUTY FOR PRESSURE & SUCTION AIR)**

- Blowers must be located and installed in a clean environment, isolated from areas in which patients stay, free from any dust, vegetation, waste, rubbish, builder's debris and any other possible source of contamination
- The blower must be a heavy duty 3-phase blower with a fully adjustable Multi positioning valve/air reversing valve to provide one system line with variable suction and pressure air.
- The blower operates only during carrier transaction and remains idle when no carrier is being transported.
- It should be supplied with complete silencer, filters, dampers & installation accessories and multi positioning valve device/air reversing valve.
- The blower should be based on unidirectional rotation and equipped with unique electronic multi positioning valve to switch between compressed air and vacuum reducing air and energy losses.
- The blower should be automatically activated through centralized control system.
- Each blower must be fitted with a Multi positioning valve/air reversing valve, contactor and thermal protection. The Valves should be fully adjustable positioning valve. The Valves should be able to determine the amount of pressure and suction air, without changing the rotation direction of the blower.
- The low maintenance unidirectional side channel blower with automatic device to convert air / suction mode (air switch diverter) complete with silencer, carrier damper and accessories.
- Blower shall be installed on vibration dampers so that vibrations are not passed on to Tubing.
- The blower should confirm to  
DIN EN ISO 12100 for Security of Machines General Design Items  
Risk Assessment and Risking DIN EN 60034-1 for rotating electrical machines,  
Part 1: dimensioning and operating behaviour,  
DIN EN60034 5 for rotating electrical machines,  
part 5: types of protection based on the overall design of rotating electrical machines (IP code) – classification ,  
DIN EN 60204 1 for Safety of machinery – Electrical Equipment of machines, General requirements,

DIN EN 60664 -1 for Insulation coordination for electrical equipment in low-voltage systems.

The blower should conform tentatively (based on proprietary designs) to following specifications:

- Volumetric flow rate (m<sup>3</sup>/min): 10-11
  - Total pressure difference (mbar): 150-300
  - Maximum blower speed (rpm): 3000 & more
  - Voltage (V): 415 V
  - Frequency (Hz): 50
  - Current consumption (A): 7-11
  - Motor output (Kw): 3.5 – 4.5 KW
  - Use of VFD preferred for transport speed efficiency.
  - Weight (kg): 70-90
  - Enclosure : IP 54
- Rating plate should have details of data which should also include the model number and make.
  - The side channel blower should have high degree of safety and should produce powerful suction effect.
  - The blower should be provided with safeguard with motor circuit-breaker.
  - The maximum permissible temperature of the conveyed medium should be - 30degrees to +40 degrees Celsius.
  - Solid particles or contaminants must be withheld using the filters before entering the side channel blower.
  - Maximum ambient temperature must not exceed +60 degrees and minimum should not be below -20degrees Celsius.
  - The blower should produce below 85db of noise levels at peak volumetric airflow of 9m<sup>3</sup>/min.
  - The open intake and discharge ports should be protected by wire guards in accordance to DIN EN 294 standards.
  - Should be supplied with Complete with silencer, filters, dampers & installation accessories and air switch device.
  - The blower should be based on unidirectional rotation and equipped with unique electronic air-switch to switch between compressed air and vacuum reducing air and energy losses.
  - The electronic air switch is equipped with state-of-art maintenance free linear gear drive mechanism and electronic modular optical sensor switch for activation and deactivation of the air switch.
  - The blower should be is automatically activated through centralized control system
  - The turbine is with independent power control module with automatic protection system tripper / inverter which is interfaced with centralized control system. The inverter device should be installed for green building / environment enabling low energy consumption / conservation of energy while maintaining optimal speeds and should conform to the following specifications / features:

## **7. MAIN CONTROL UNIT**

The control unit shall be a self-contained integrated microprocessor based controller Unit/ PC Software based.

The system software shall be permanently loaded in ROM /PC to ensure stability in operation.

The controller shall be capable of up scaling to control up to 5 individual systems (zones) and multiple controllers can be linked for systems up to 125 Lines & up to 1000 stations. Any upgrade to the software/ hardware with respect to the firmware and revision during the period of contract, DLP & AMC period should be provided by the Contractor at no extra cost to the User.

### **Features**

- The LINUX based system shall be preferred.
- The system should use Safety Extra Low Voltage (SELV) throughout, except for mains power to controller, exhausters, occasional data and power amplifiers.
- There should be no mains power at stations to ensure operator safety where liquids are transported.
- The cable should be double shielded to comply with the relevant EMC regulations.
- The system should use multi eye optical carrier detectors, rather than mechanical switches. Positioning sensors in diverters, stations, etc. should be electronic rather than mechanical.
- The software should be adaptive and designed to automatically self-adjust and intelligently position the moving components of the system to ensure reliability.
- The control software should continuously monitor all sensors, switches, motors and other components, and give early warning should the performance of any component start to degrade. This is to enable maintenance to be carried out prior to absolute failure and keep system downtime to an absolute minimum.
- The controller shall have a voltage free contact which will be connected to the Building Management System (BMS) to warn of an alarm status as a mandatory to be done by Contractor.
- The controller shall also be connected to the fire alarm system to enable the pneumatic tube system to be automatically shut down in the event of a fire.
- It can be selected that the current dispatch within a system will continue to its destination before shut down occurs.
- No new dispatch should be accepted after alarm has been triggered until alarm status has returned to normal.
- The controller should continuously display an overview in real time of the exhauster and system status, carriers waiting for dispatch and transactions in progress.
- The controller should display the location of the carrier through the system whilst a transaction is in progress.
- The controller should have a real-time clock.
- The controller should have a built in lithium battery which retains the system memory and status in event of a power failure or when the system is switched off.
- The system can be reinstated with minimal intervention in the event of power failure.
- In the event of a fault, the controller should display a suitable alarm report detailing the transaction in progress at the time of the fault, the fault status, the location of the carrier, and the actual component or unit which caused the failure.
- Should the alarm condition have caused a partial or full shut down of the system the limitations of use shall be displayed.

### **Alarm reports should be generated for the following reasons:**

- Carrier failing to arrive at a specified check point within a reasonable time. (Carrier overdue)

- Failure of any system component to achieve a desired state or condition within an acceptable time period.
- Control system shall be ready for any future upgrades. Shall be capable for detecting and clear fault conditions like power failure, time out, and operational errors automatically without manual intervention.
- Control system shall be capable of customized programming with features including (but not limits to) priority selection, adjusting speed, shutting-down a work station, tracking of carriers.
- Control system shall have individual power backup facility by vendor. Supplier to provide all required hardware and software for the control system
- Soft & hard ware part of pneumatic tube system shall be capable for single/ multiple carrier send/receive functions, event logs, testing functions.
- Software shall have various statistical features including (but not limited to) traffic data, number of transports, itemized cost analysis and billing

#### **MANUAL CONTROL AND USER DEFINED SYSTEM VARIABLES**

- Operations and maintenance personnel should have manual control over the system via the controller's and/or PC's keyboard and display.
- Entry to the system control shall be security protected.
- The system control should provide the following facilities:
- Removal of stations from service
- Removal of diverters from service
- Removal of routes from service
- Removal of systems from service.
- Manual control of all system components; motors; indicators etc. for maintenance testing.
- Status display of all system components, switches, sensors, detectors.
- Part or full system purging.
- Setting of station priorities by both send and/or receive.
- Setting of station default addresses.
- In addition, the controller should allow for easy system programming through the keyboard to allow for additional stations, arrival alarms etc.

#### **SYSTEM OPERATION RECORDING, ANALYSIS AND MANAGEMENT**

- The contents of the built-in memory shall be downloadable to a printer or PC.
- The printer or PC could be left on-line for a continuous record of all transactions and other system information.
- The record should show:
  - Time of dispatch,
  - Duration of transaction,
  - Route of transaction.
  - Any alarm conditions and optionally (with touch-key facility) the name of the station user.
- Management software should be installed for sophisticated data analysis.
- A permanent record of all transactions should be retained with no limit.
- This record could be presented in various tabular, text and graphical formats and could be printed selectively.
- In addition to list and tabular formats showing number of transactions by station and route, the management program should display in graphical form system usage by percentage capacity through each hour of the day, station usage and system usage.

**8. Control PC Control PC with peripherals**

- PC with CPU using INTEL i7 with SMPS Cabinet
- 3.4GHz/16 GB RAM
- Quad Core
- 500 GB HDD SATA 7200 RPM SFF 3.5"
- RS232 Ports
- USB Ports
- 2xPCI Slot for ISDN/Modem Card
- Data Port
- Ethernet 100/1000 LAN Card
- Graphic Card – 2 GB,256 colours, 1920x1280
- Standard Keyboard
- Standard Optical mouse;
- 21" flat LCD/LED Monitor
- Standard Inkjet colour A4 printer
- Original licensed MS-Office and Windows 10, 64-bit OS/Linux OS

**9. Control cables**

Specially designed cable for system connection of devices in IFTO system Not to be used for direct connection to any main power sources.

- All conductors are copper standard, thus cable be highly flexible.
- 2 conductors twisted pair for communication, copper bare fine standard 0.22 sqmm.
- 2 conductors for power distribution, copper bare standard 2.5 sqmm cross section reduces conductor resistance and thus minimizes power losses on the cable.
- All conductors in the cable should be easily identified individually by different color of the sheath.
- Tinned copper wire braid screen covered around conductors for data exchange and additional aluminium foil screen with copper drain wire covered around all conductors securely protect against electromagnetic interference from the environment.
- Sheath material PVC. Outer sheath is coloured violet blue.

**Technical Data should be as follows:**

- Conductor resistance 0.22 Sqmm. max. 79 Ohm/ Km
- Conductor resistance 2.5 Sqmm. Max. 7.5 Ohm/Km
- Insulation resistance more than 200 MOhm x Km
- Capacitance conductor/ conductor – Approx. 55 pf/m
- Capacitance conductor/ screen – Approx. 98 pf/m
- Test voltage 900V
- Working voltage 450V
- Temperature Range flexing -5 C to + 70° C
- Temperature range static -30 C to + 70° C
- Outer diameter approx 10mm

## 10. Miscellaneous

### STATIC ELECTRICITY

The system should be designed to minimize the build-up of static electricity and facilities should be provided to safely discharge to earth (by vendor), neither such that neither system malfunction nor nuisance is caused.

### SWEATING - CONDENSATION

The system should be designed to minimize the potential for condensation caused by the movement of warm wet air through cold tubes. The location of air inlets shall be designed to reduce the potential for large temperature reductions on the air within the system, both during the systems peak operation periods, and during times when the system is only lightly used. If required air dryers shall be used.

If during DLP period, any stretch of line is found to be suffering from sweating, the contractor shall insulated the affected patch at his own cost.

### RISK MANAGEMENT

#### High risk samples: Slow speed sending:

For high risk and sensitive sample sending's, the system must include a control device such as VFD for automatic reducing the carrier transport speed to an acceptable level. This must be available on the control unit and on the station itself by selecting a button, or it must be automatically predefined by selecting a certain address that requires a slow speed transfer.

#### Strange object detection:

The system (with RCI/RFID) must recognize when strange objects (other than a carrier) is put in the system and give an alarm.

### OPERATIONAL UPTIME

**The Up Time of 98.5% shall be guaranteed.**

#### Power failure: System protection and recovery

The system must be protected against power failure and be able to carry out all the uncompleted tasks / processes after power is restored. The system must also be equipped with automatic fault detection, automatic recovery capability.

#### Operational during unavailability

When a single station or line is unavailable, the station or line must be isolated and limited without affecting the operation of the rest of the system. e.g. unavailability because of upgrading / maintenance.

#### Operational during configuration

It is crucial the whole system stays operational during the following proceedings in the control unit:

- a. Remote and on-site (re)configuration of system settings/parameters
- b. Remote and on-site service and maintenance

#### System self-service: Automatic purge

The system is capable of carrying out an initial automatic purge per system line in an attempt to clear a blockage or sticking carrier, with the sticking carrier being purged to the source station. If this initial purge operation fails, the carrier must be diverted

to a pre-designed (fault) station. If the second purge operation fails, a manual reset must be required.

**Direct IP connection with technical support**

The system (control unit) must be directly IP connectable with technical support for servicing and support whenever required.

**Connection with Building Management System**

The control unit must be connectable to the building management system by a potential-free contact (hard) to report system failures.

**TRAINING**

The training shall include training of:

1. Technical staff
2. Users

Included in this tender is the training of users and technical staff responsible for operation and maintenance of the system. The training of technical staff must draw special attention to:

1. The prime function of the system.
2. The intended method of operating the system.
3. Problems and hazards that can arise from failing to follow the agreed operating, monitoring and maintenance procedures.
4. The danger of making unauthorized modifications, alterations or additions to the system as well as the possible legal consequences.
5. The procedure to be followed if it is suspected that the system is no longer operating correctly.
6. Error messages & their meaning
7. Trouble shooting

**COMMISSIONING & TESTING**

1. The manufacturer's engineer shall certify that the system is ready for commissioning.
2. All stations shall be checked in accordance with the "Station test and commissioning" checklist that is part of the testing and commissioning procedure for medical pneumatic tube systems.

**TESTS AFTER COMPLETION OF WORK**

After completion of the project, the employer may carry out the tests after completion, which shall be carried out under normal operating conditions to assure that the system performs well under normal operating conditions.

Tests include but not limited to:

1. Running of equipment and system as a whole to a minimum of 30 days
2. System specific tests and equipment specific test.
3. Any other test which the employer intends to carry out to check the stability and reliability of the system.
4. Any defects if pointed out in tests after completion shall be rectified at Contractor's expense and within time as deemed reasonable by the employer.



### **Incorporation of Antivirus/Antibacterial properties of system**

The specially quoted carriers & tube/pipes should be used to destroy sources of contamination & infection in the system. All returning carriers should be passed through UV light gate.

HEPA filters should be used, wherever possible to filter the atmospheric air being sucked in.