

Pneumatic Tube System Design Manual

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1.0 GENERAL REQUIREMENTS

- A. Provision of a proposed PTS must be consistent with requirements for the project and the VA Facility. See PG18-3 topic 18 for qualification of designer and study requirements (TLA). No specific correlation can be made between the number of beds in a Department of Veterans Affairs (VA) Facility and the need for a PTS. Specific VA facility parameters including staff, timely patient care practices for specimens and on-demand pharmaceuticals are the primary drivers for the use of PTS. PTS systems shall be economically justified by a Life Cycle Cost Analysis (LCCA) study included in the Transportation Logistic Analysis (TLA) or installed to provide medically necessary services.
- B. Medically necessary services are those that require urgent and immediate (STAT) transport of small non-routine items important to the health outcome of a patient. The principal use of a PTS is for the movement of Pharmaceuticals and Lab Specimens. Together these typically represent 75-85% of the use of most Hospital based PTS. Consider providing PTS Stations for Patient Care/Treatment areas that send clinically important time sensitive specimens or historically receive STAT medications orders travel to that area exceeds 15 minutes of travel time.
- C. The qualified MTLC shall create a traffic matrix which shows the estimated traffic between departments to use as a basis for the system design. This matrix shall be used to perform a LCCA study to justify the PTS and its individual stations.

2.0 PHYSICAL PARAMETERS

- A. Tubing:
 1. Transport tubing shall be 15 cm (6") O.D., 16-gauge cold rolled, degreased, electric welded steel.
 2. Air Line shall be 10 cm (4") min. O.D.
 3. Bends shall be formed from transmission tubing to 90-degree at a radius and 120 cm (48") to centerline.
 4. Tube couplings shall be bell-end tubing, bolted sleeves or sleeve couplings forming airtight connections.
 5. Tubing penetrating fire rated walls shall be fire stopped with a U.L. listed firestop system.
 6. Tubing pathways and diverters shall not be located over acoustically sensitive spaces.
 7. Tubing pathways shall be supported on centers no less than 300 cm (10'0") for straight tube, at each tangent of a 90-degree bend, and at each end of an offset of 60 cm (24") or more. Brace tubing pathways longitudinally and transversely on centers not less than 12.12 m (40'0") for straight tube, diagonally at each tangent of a 90-degree bend, and diagonally at each partial bend or offset of 45 degrees or more.



8. The maximum noise limit emanating from the tubing during carrier transmission for all areas including corridors shall be no greater than 55 dBA when measured from 165 cm (5'6") above the finished floor.

3.0 DIVERTERS

- A. Diverters shall be a silent operating, valve-less, electro/mechanical device. Air powered diverters are not acceptable. The unit shall be housed in sheet metal enclosure with easily removable access panels. The Motor shall be fused or otherwise protected from seizing due to obstructions. Diverter designation label shall be provided on access panel and clearly visible when accessed.
- B. The maintenance access to diverters shall have a minimum clear width of 60 cm (24") everywhere in the hospital except the central interchange, where diverters shall have a 30" minimum access width. Access to the unit shall be from the side, not from above or below the unit.
- C. The maximum noise limit emanating from the diverter for all areas including corridors shall be no greater than 55 dBA when measured from 165 cm (5'6") above the finished floor.
- D. Diverters shall be installed in easily accessible areas and may not be installed above or near patient care work areas, exam rooms, etc.

4.0 AIR POWER UNIT (APU) (BLOWER ASSEMBLY)

- A. The APU is a single assembly, complete with blower, air shifter, screen box and vibration isolators. APU shall propel the carrier via vacuum/pressure to provide an average carrier velocity of 5.4 m (18 ft) per second and convey a payload of 2.27 kg (5 pounds). Where required, provide blower with mufflers. Mufflers shall have characteristics to affect a noise reduction down to 70 dBA when measured five feet from outlet and 45 degrees of center.

5.0 STATIONS

- A. The station is an electro/mechanical device that enables the system user to send or receive carrier transactions.
- B. The station shall consist of a self-supporting "rough-in can", which is wall recessed and designed for flush interface with architectural enclosure. Various electro-mechanical components are contained within the can.
- C. Station locations must always be within the main workspace of the department it is supporting. Stations containing remote arrival lights but not located in the main workspace are unacceptable.

6.0 CARRIERS

- A. Carrier: A carrier is defined as the capsule that contains the various items to be transported throughout the system.



- B. The carrier shall have the following characteristics:
 - 1. Inside dimensions shall be a minimum of 11.25 cm (4.5”) diameter by 38.75 cm (15.5”) length.
 - 2. Molded plastic, full access, side opening with positive latching closure.
 - 3. Specifically designed for bi-directional travel.
 - 4. Replaceable rubbing bands and latches.

7.0 CENTRAL INTERCHANGE

- A. The central interchange is defined as the space that contains the air power units, the head diverters (i.e., the 1st diverter on the zone) and all the associated tubing that enables a carrier transaction to from one zone to another (i.e., interzone transport). Remote location of any of this equipment is not allowed as this would compromise system efficiency and create maintainability issues.
- B. Transports between zones will be direct from zone to zone and shall not pass through another zone.
- C. A central interchange design (either specified or offered by a vendor in bidding) based on an exchanger shall not permit a single point of failure that would shut down multiple zones. Multiple exchange units might be required in certain conditions.
- D. PTS throughput (i.e., the ability to accomplish transactions) is most efficient when the central interchange is near the Clinical Laboratory. Consequently, the Medical Transportation Logistics Consultant (MTLC) and A/E team must quantify and identify the central interchange space at the outset of the project's Schematic Design Phase.

8.0 SYSTEM CONTROL CENTER

- A. The system control center consists of a workstation or better class of computer that contains and administers the system software. Control center computer shall include color printer, keyboard terminal, and uninterruptible power supply with intelligent shutdown. Note that PTS software is unique and proprietary to each PTS manufacturer.
- B. System software automatically controls all equipment alignments required to transport a carrier from a location to a given destination. However, it must contain a feature that enables Maintenance staff to manually control any equipment movement.

9.0 FUNCTIONAL DESIGN PARAMETERS

- A. The total number of stations shall be segregated into several zones. A zone is defined as several stations connected with tubing and diverters and containing one APU. A zone is not to exceed a total of 8 stations except where calculations can justify a higher number of stations based on Zone Utilization studies. In no event shall there be more than 11 stations on a single zone.
- B. Zone utilization shall not exceed 55% during the peak hour with the total average utilization over 3 consecutive hours with the peak hour being the middle not exceeding 50%.



- C. Zone utilization is defined as the percentage of time a zone is being used during a given time frame. Example: If a zone is used 36 minutes during a given hour, its zone utilization is 60% ($36 \div 60$).
- D. For design purposes, we limit the zone utilization of any zone to about 55% during its peak hour. Unless direct evidence shows otherwise assume the peak hour is quantified as 7% of the total daily transactions (i.e., a 24-hour period).
- E. PTS Stations at Nursing Stations shall be placed in direct sight of and not further than 6 m (20 ft) from the attendant responsible for that station.
- F. Where multiple PTS stations in Pharmacy or Lab are required to handle the traffic volumes each station shall connect to a different zone with the total configuration arranged to handle the required system traffic.
- G. Daily transaction totals are unique to each healthcare facility. Estimated transactional volumes must be derived through an interview process with all potential system users in the given facility. Once accomplished, a system matrix can be created, which quantifies the total number of transports that will be realized between any two stations during a 24-hour period and the total transport volume.
- H. Upon finalization of the transport matrix, a preliminary PTS layout is accomplished. This layout shows station locations, the central interchange location, system zoning and tubing pathways. Transport distances are now measurable, and once transport volumes from the matrix are inputted, zone utilizations can be computed. Although this is a very time-consuming process, it is the only process that will ensure accurate zone forecasting.

