8 Public Health - Fuel Systems Design (FS)

This PH-FS design guideline written for healthcare facilities, is a consolidated document listing out the design requirements for all new construction and major renovation healthcare projects.

The requirements outlined in these guidelines are not intended to conflict with Federal Regulations, Local Municipality Laws, Executive Orders, or the needs of the end users.

This document is intended for the Architect/Engineer (A/E) and others engaged in the design and renovation of health facilities. Where direction described in applicable codes are in conflict, the A/E shall comply with the more stringent requirement. The A/E is required to make themselves aware of all applicable codes.

The document should be read in conjunction with other parts of the Health Facility Guidelines (Part A to Part F) & the typical room data sheets and typical room layout sheets.

General

The aim of the fuel system guidelines is to promote the correct provision of Fuel Systems for healthcare facilities. The design will be based on the requirements, but there will be parts of the design that will be tailored for healthcare facilities.

Design Criteria

- The design will discuss which systems in healthcare facilities requires Fuel and they are the following:
  - Hot Catering Kitchens
  - Hot Catering Commercial Kiosks
  - Electrical Generators
  - Hot Water Generators
  - Fuel Run Fire-Fighting Pumps
- These design guidelines are to be used in new healthcare facilities as well as facilities that will refurbished.
- The fire and life safety requirements for installing these systems must be as per Civil Defense requirements. The design guidelines will not change this strategy in any form.
- When designing the medical gas requirements for healthcare facilities, a risk assessment needs to be carried out to understand the requirements of the facility.
- Requirements such as distance from supplier of medical (if applicable), the geopolitical understanding, traffic, workdays, peak times, particular times of year where workload is affected (Public Holidays etc.) as well as patient safety.

The objective of the risk assessment is to ensure that the risk to patient safety eliminated or reduced to as low

9 Public Health - Pneumatic Tube System Design (PTS)

This PH-PTS design guideline written for healthcare facilities, is a consolidated document listing out the design requirements for all new construction and major renovation healthcare projects.

The PTS must not jeopardize the continued operation of a healthcare facility and incur any huge capital costs due to equipment replacement.

The requirements outlined in these guidelines are not intended to conflict with Federal Regulations, Local Municipality Laws, Executive Orders, or the needs of the end users.

This document is intended for the Architect/Engineer (A/E) and others engaged in the design and renovation of health facilities. Where direction described in applicable codes are in conflict, the A/E shall comply with the more stringent requirement. The A/E is required to make themselves aware of all applicable codes.

The document should be read in conjunction with other parts of the Health Facility Guidelines (Part A to Part F) & the typical room data sheets and typical room layout sheets.

General

- Pneumatic Tube Systems (PTS) are internal logistics and transport solutions used to transport small items or documents, placed in a container or carrier, from one point to another, through an air pressurized network of tubes.
- In healthcare facilities, Pneumatic Tube Systems (PTS) transport small materials, documents, laboratory samples etc. to and from pharmacies, laboratories, blood banks, surgery centres, emergency departments and nursing stations, as well as other locations throughout healthcare facilities.
- The PTS can be constructed as a single-zone-system or as a multi-zone-system. The major components of such a system include the blower, tubes, stations, diverters, carriers, and the central control unit that forms the command center of such a system. Figure 9.1 shows a single zone operation with 4 stations (two stations on the Ground Floor, two stations on the First Floor and the blower and diverter in the basement area).
- Each healthcare facility PTS is designed for its respective facility. Figure 9.1 below shows an example of PTS.

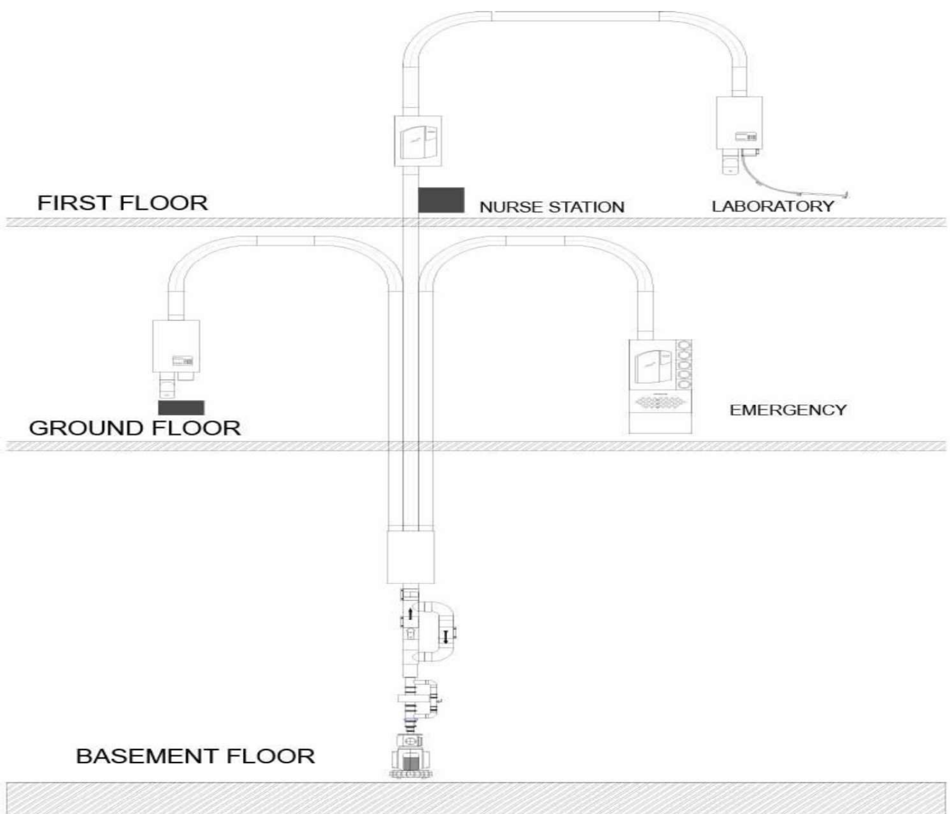

Figure 9.1 – Typical Pneumatic Tube System Layout – Single Zone System

- Multi-zone systems, as seen in Fig. 9.2, are connected together by a transfer system. Each zone has its independent air supply (blower) so transmission can take place at the same time. Dividing a system into multi-zones increases the number of carriers that can be transported as each zone can operate independently. Productivity is improved, efficiency is increased while NPA (non-productive activities) and staffing requirements are decreased.

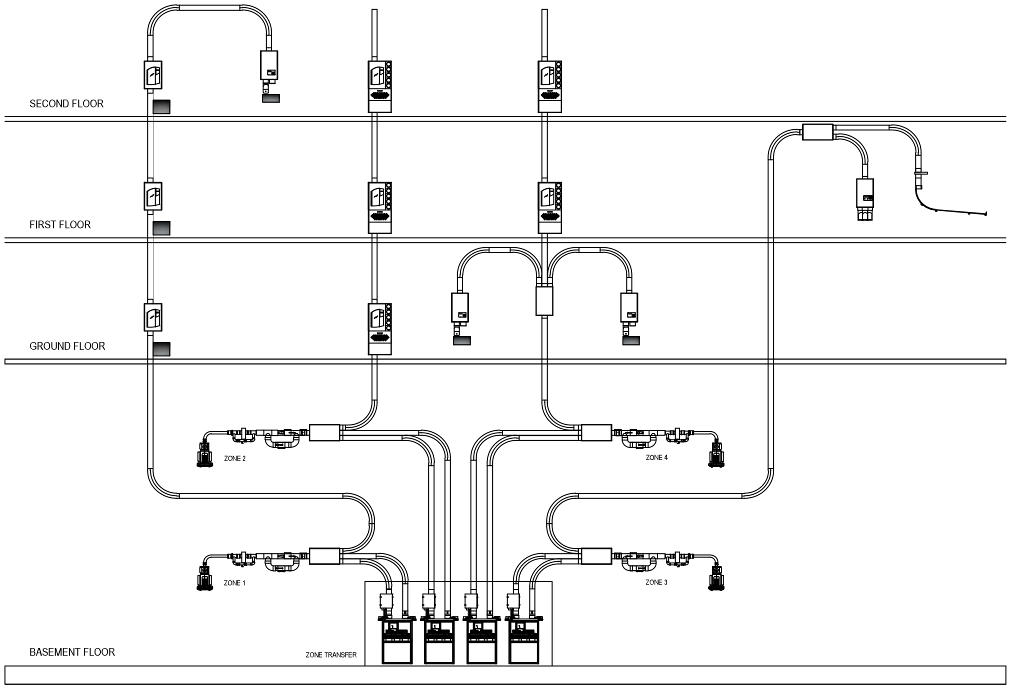

Figure 9.2 – Typical Pneumatic Tube System Layout – Multi-Zone System

Design Criteria

- The PTS shall be provided as per HTM-2009, manufacturers requirements and healthcare facilities planning brief included in part B of these guidelines.
- The contents of the items within the PTS delivery casing transports material between different sending and receiving modules called PTS Stations.
- The locations of these stations are determined by the health planner and briefing requirements as mentioned in Part B of these guidelines.
- The briefing will also state the details of the station operation i.e. the station is sending or receiving or both or a multiple sending and receiving station.
- The PTS carrier, carries the following critical specimens through the system between departments:
  - Blood Specimens for Chemistry and Hematology
  - Arterial Blood for Blood Gas Analysis
  - Urine Specimens for routine analysis and culture
  - Cerebral Spinal Fluid
  - Tissues for Biopsy and other Bodley Fluids
- By simply placing the carrier in the station, the user can send it to a predetermined destination. Some key features are:
  - A carrier can be stored at a station of a single-zone-system, independent of the stage of operation.
  - After a carrier is inserted into the station, it will be transported directly to its destination.
  - After one sending process, the system can automatically start the next.

Pneumatic Tube System Components

- The system consists of many components that make the system as well as allow the system to be designed and operated correctly. The system components are the following:

- Blower & Air Reverse Valve –The Blower (PTS compressor system) generates the air that moves the PTS carriers throughout the healthcare facility via pressure or vacuum suction. The location of the blower will be in the healthcare facility plant room as per coordination with the healthcare operator and health planning briefing. As soon as all pending processes are finished, the blower disconnects automatically
- Recommendation: Blowers should come fitted as standard with energy efficient IE2/NEMA motors (acc. to destination country) conformant to the IEC 60034-30 standard. Blowers to be installed in the plant room along with the system control unit and interzone/linear coupler if applicable.

- Blower Group – This a group of PTS blowers that are interconnected that include sending and receiving drivers allowing any single blower to handle the carrier delivery from sending and receiving as well as vice versa. These are usually installed in large healthcare facilities such as a tier 4-6 delineation healthcare level.
- Carrier – A PTS Reusable plastic containers that hold and protect contents (lab specimens, pharmaceuticals, blood products, etc.) sent through a pneumatic tube system. The carriers come in different sizes to cater for the function or requirement of the facility. The carriers used in healthcare facilities include:
- Standard carriers: for medications or solid particles and small instruments
- Leak-proof carriers: for the transport of liquids or sensitive samples used in the PTS
- Special carriers: these designed and developed for very specific uses such as carriers lined with lead or cooling carriers
- All carriers are equipped with an RFID sensor for easy distribution of carriers to departments by programming 'Home' station and 'Destination', which will automatically be guided by the scanner mode or dialed destination. The carrier's movement can be tracked.
- Control Center – The PTS software that controls the communication between the stations, devices, and user requirements. This also locates the current location of the carrier via a user interface.
- Database – A repository of information for each of the PTS carrier movements including a date and time as well as station operability.
- Interzone Connection – A section of tubing that connects one zone to another zone.
- Station – The user interface unit that may include an interactive touch screen system, a mechanical dialing system and or an RFID scanner, for the sending or receiving of the carrier.
- Diverter – A PTS route switching device used at branching points within a tube network to allow a carrier to move from one path to another. In many healthcare facilities, this is usually located within riser shafts or above the ceilings.
- Tubing – Tubing or system piping is generally provided for 110mm or 160mm. The tubes are available in PVC (Grey), PVC (Transparent), GI and Stainless Steel, depending on the environmental conditions of the site. Healthcare operators may request a pipe greater than 160mm to be provided for bulk pharmacy items or multiple samples or documents being carried from one location to another.
- Zone – A collection of stations with direct tubing connections. Zones are interconnected with inter zone connections. A traditional zone includes approximately 10 stations, while a Blower Group Zone can support up to approximately 60 stations.
- Slow Speed Device – This device used especially in hospitals where certain sensitive goods such as laboratory tests and blood samples require transport with a reduced speed.

Pneumatic Tube System Pipe Material

- For PTS systems, they are 3 No. pipe materials used.
  - PVC
  - Galvanized Steel
  - Stainless Steel

- Each of the systems are dependent on the healthcare facility's needs, cost of operation and special requirements for the system to function correctly inside the healthcare facility.

Pipe Material Comparison

- Below is a table providing the comparison of using Stainless Steel & GI Tube.

	Stainless Steel (SS) Tubes	Galvanized Iron (GI) Tubes
1	Manufactured by mixing molten steel with 10% molten chromium	Manufactured by dipping steel in molten zinc
2	Mixed with chromium to protect from rusting	Covered by a thin layer of zinc oxide to protect from rusting
3	Strong	Weaker
4	SS is made up of chromium, meaning that its protective layer is always in place. This makes stainless steel strong	GI has only a layer of zinc coating which eventually wears off
5	Because of its strength, major pipelines made of stainless steel. Its makeup also makes it the best to work with in marine environments, as it is more resistant to salt. By contrast, unlike Galvanized iron, stainless steel does not rust even when scratched since its protection is an integral part of it.	Galvanized steel is covered by a rust protective layer that is less than a millimeter thick. This means that whenever it is scratched, rusting immediately starts to occur around the scratched area.

Table 9.1a – Pros & Cons for Steel Pipes

- Below is a table providing the advantages and disadvantages of using PVC Tube.

Advantages	Disadvantages
High grade of internal finishing	Low Fire Resistance. Fire Collars are required when passing a fire zone.
Easy to install due to the material being light and easy to cut	Low Mechanical against external damages

Easy to inspect and repair.	Flammable solvents used to install fittings
Good for long life as corrosion is not an issue	
Cheaper than Steel	

Table 9.1b – Pros & Cons for PVC Pipes

- In healthcare facilities, PVC and Stainless-Steel systems are preferred above Galvanized Iron.
- Recommendation: It is not recommended to use Galvanized Iron Tubes for the PTS installation due to oxidation and corrosion in hot and humid climates.