

SECTION 14 92 00
PNEUMATIC TUBE SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. 152mm (6-inch) round automatic pneumatic tube system, complete ready for operation, including blowers with motors and motor starters, stations, carriers, centralized computer controls, automatic selector equipment, tubing and fittings, wiring, conduit, and necessary accessories and equipment.

1.2 RELATED WORK

- A. Color and Texture of Finish: Section 09 06 00 SCHEDULE FOR FINISHES
- B. Basic Methods and Requirements (Electrical): DIVISION 26.

1.3 GENERAL REQUIREMENTS

- A. Verification of Dimensions: The contract drawings show the extent and general arrangement of the pneumatic tube system. The Contractor shall visit the premises to verify details of the work and working conditions, dimensions in the field and advise the Contracting Officer of any discrepancy before performing any work. He shall be specifically responsible for the conditions and proper relation of this work to the building structure and to the work of other trades.
- B. Welding: Structural and load bearing members shall not be field welded.

1.4 QUALIFICATIONS

- A. Approval by the Contracting Officer is required of products on services of proposed manufacturer, suppliers and installers and will be based upon submission by contractor of certification that:
- B. Manufacturer regularly and presently manufacturers material handling equipment specified as one of his principal products.
- C. Installer has technical qualifications of at least three (3) years experience, trained supervisory and installation personnel and facilities to install specified items. Approval may be granted at the Contracting Officer's option for vendors with less than three (3) years experience upon presentation of satisfactory evidence that all requirements of this specification can be met and that vendor has the physical and financial resources to support all contractual obligations. Approval will not given however where the experience record on either government municipal or commercial projects is one of unsatisfactory performance.

- D. Manufacturer's product submitted has been in satisfactory and efficient operation on at least two (2) installations similar to this project for not less than three (3) years. Submit list of installation; include names and addresses of hospitals and hospital administrators thereof.
- E. There is a permanent service organization maintained or trained by manufacturer which will render satisfactory service to this installation upon receipt of notification that service is needed. Submit name and address of service organization.
- F. Contracting Officer retains the right to approve an experience record and services facilities less than those specified when the best interest of the Government would be served by such action and objectives of this specification are fulfilled.

1.5 PRODUCTS CRITERIA

- A. Multiple units: When two or more units of the same type or class of materials or equipment are required, these units are products of one manufacturer.
- B. Assembled units: Manufacturers of equipment assemblies, which use components made by others, complete responsibility for the final assembled product.
 - 1. All components of an assembled unit need not be products of the same manufacturer but component parts which are alike are the product of a single manufacturer.
 - 2. Components are compatible with each other and with the total assembly for the intended service.
- C. System Requirement
 - 1. The general system configuration shall be made up of independent zones connected together via storage lines. Each zone shall be composed of a group of stations, each connected to the zone via a single tube line through a transfer unit. Contract drawings show locations of each station and schematic piping run. Contractor shall design piping and equipment to suit available space.
 - 2. Install in each sending and receiving line provisions to facilitate future additional stations, without modification of mechanical and electrical components at central control. Arrange wiring so that additional stations may be added by extending wiring from nearest station or transfer unit without running back to central control.
 - 3. Operation: Shall be totally automatic requiring no intermediate manual handling of carriers.

- a. Dispatched carriers shall not pass through the sender of another station.
- b. Destination selection shall be by membrane keypad, dials or push buttons on the station control panel. No destination coding shall be on carriers.
- c. Failure of one station shall not interfere with normal functioning of any other station on system.
- d. A "carrier acceptance" signal on station control panel shall confirm that carrier can be delivered to selected station before system accepts a carrier.
- e. After receipt of "carrier acceptance" signal dispatching sequence shall be controlled by system computer requiring no additional attention from operator.
- f. Carriers shall be rejected at the source station if they cannot be delivered to the destination station. The route to the destination station is checked twice to insure that all sections of the system are operating properly before the carrier is dispatched. A "carrier rejection" signal on station control panel shall indicate carrier cannot be delivered to selected station for one of the following reasons:
 - 1) Non-existing station selection.
 - 2) Selected station filled to capacity.
 - 3) Selected station off-line.
 - 4) System malfunction.
- g. Use no carrier impact valves in system. Carrier transfer from negative pressure or positive pressure sections of system to atmospheric shall be through electro-mechanical devices not dependent on carrier mass or velocity for proper operation.
- h. Carriers may be positioned in all senders simultaneously and designation selection dialed into station control panel.
- i. Carriers already in transit at time of a power failure shall be delivered to selected destinations when power is restored.
- j. Carriers already in transit when system is turned off at central control center shall be delivered to their selected destinations. Additional carriers shall not be accepted into system after off button is depressed.

- k. Carriers already in transit when receiving station is turned off shall be returned to sending station or continue to intended receiving station.
- l. If carrier has not entered transfer unit, make provisions in control circuits to return carrier to its originating station should its destination become inoperative.
- m. If both sending and receiving stations should be turned off after carrier is in transit, carrier shall be sent to receiving station. Power at receiving station shall not shut off until carriers in route to receiving station have been received. Otherwise, there will be no reject station.
- n. Each zone shall contain its own blower and function independently.
- o. The dispatching routing, spacing and storage of carriers shall be directed by the control center to provide automatic, unattended transmission of carriers between all station.
- p. Provide shortest route vacuum-pressure travel. Transactions between stations on the same zone shall process to the closet turnaround point to the destination.
- q. To dispatch a carrier from a station the operator will place a latched carrier in the dispatcher, select the destination address and press the "send" pushbutton at the station.
- r. Allow multiple carriers in transit within the system. Allow the station dispatchers to be simultaneously loaded and destinations selected. Automatically process all carriers until the system is clear.
- s. Provide maximum capacity of three units on one zone without the need to modify or replace existing equipment. Additions shall require add-on equipment only.
- t. The maximum number of stations per zone shall be three.
- u. The modular construction of the system components shall permit changes and the addition of stations and/or zones as Owner requirements change.
- v. Provide automatic empty carrier redistribution. Allow any station with excess carriers to select automatic return which will direct empty carriers anywhere in the system on a most needed basis. The need will be determined by the ratio of assigned carriers to present carriers.

- w. Allow individual station or zone shutdown without affecting remainder of system.
 - x. Carriers in process shall be delivered to either the source or destination station if a failure occurs in the route while they are in transit.
 - y. Carriers in process or pending when any part of the system is signed off shall deliver to their destinations. Any new requests to send shall be rejected.
 - z. Carrier in process shall be returned to the source station if the destination station becomes overloaded while they are in transit.
 - 1) When a power failure occurs at the control center, the system continues to process carriers for approximately one minute without interruption. If the power failure lasts more than one minute, as many in process transactions as possible are completed before the system is shut off. Any remaining in process transactions are stored in memory and delivered to their destinations when power is restored.
 - 2) Station send and receive and system priorities shall insure that carriers are processed to their destinations in the shortest time.
 - 3) Closed loop control shall verify that commands to the system equipment were properly executed before the next segment of each transaction is started.
 - 4) A 115V AC duplex receptacle and on/off switch shall be provided at each station, transfer unit, and blower package.
 - 5) The destination selection capability of any station can be controlled from the Control Center.
 - 6) An option can be selected to allow scheduled off stations to dispatch but no receive carriers.
 - 7) Stations can be automatically assigned up to five on/off periods per day.
 - 8) Stations can be automatically assigned up to ten dispatch and receive priority levels with different time intervals.
 - 9) Component diagnostics can be performed at each station, transfer unit and blower using diagnostic capability in each unit.
- D. Employee Instructions: Provide a qualified representative possessing complete knowledge of system and equipment to train employees in

operation and maintenance of system. Training period shall be as follows:

1. Eight hours instructing maintenance personnel on operation and maintenance of system.
 2. Four hours instructing operating personnel in use of system.
- E. Inspection and Maintenance Service: Furnish inspection and maintenance service on equipment for a period of 1 year after system begins daily operation. This service shall consist of monthly examination by competent and qualified mechanics; cleaning, oiling greasing adjustments and replacement of any parts required to place equipment in proper working order (except parts made necessary by improper use, accident or negligence).

1.6 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data and Shop Drawings of Fabricated Equipment- Submit the following as one package:
 1. Stations
 2. Carriers
 3. Transfer Units
 4. Pneumatic Control Air
 5. Tubing
 6. Hangers
 7. Exhausters
 8. Central Control Center
- C. Complete layout shop drawings showing pneumatic tubes and adjacent ducts and pipes for possible interference. Provide complete dimensioned drawings that indicate tube track routing, right-of-way, methods of suspending and anchoring tube, station details, equipment locations and detailed dimensions of all major components. Include a riser or isometric diagram of track routing and electrical wiring detail.
- D. Submit computer run simulation. Demonstrate that fifteen carriers can be dispatched to and received at designated station in one hour. Base simulation on the following input:
 1. Average carrier velocity shall be 25 feet per second.
 2. Requirements of this specification.
 3. Transaction distribution shall be as follows: Pharmacy. List sending station number of carriers and receiving station.

- E. Operating and Instruction Manual: Provide six manuals. Each manual shall be bound and indexed containing complete operation, maintenance and repair instructions including following:
1. Description of system and components.
 2. Starting and stopping procedures.
 3. Special operating instructions.
 4. Routine maintenance procedures.
 5. Cataloged list of spare parts.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
- WW-H-171E.....Hangers, And Supports, Pipe
- WW-T-799E.....Tube, Copper, Seamless, Water and Refrigeration
(For Use with Solder-Flared or Compression-Type
Fittings)

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

- A. Swisslog Translogic pneumatic tube system.

2.2 STATIONS

- A. Recessed wall type, with face plate and doors flush with wall. Provide self-supporting "rough-in" frame to which various operating and decorative components are added. Provide switch with signal lights or written legends to indicate station "ON" or "OFF". In lieu of switch at station, provide control at computer.
- B. Doors, if provided for air cushioning or arriving carrier, shall have heavy spring loaded hinges and positive "self-closing" latches. Door handles shall be stainless steel.
- C. Sheet metal surfaces shall be factory painted with a polyurethane base or scuff resistant low gloss black, or be covered with molded decorative plastic. Finish frame for final mating to wall surface shall be stainless steel or same material as terminal surface.
- D. There shall be no in rush of air when send door is opened.
- E. Station shall be capable of receiving and storing not less than four carriers.
- F. Provide means to assure quiet arrival of carriers.

- G. Carrier storage compartment shall be capable of storing four empty carriers and be integral with station.
- H. Furnish and mount station directories and station operating instructions at each station and central control center.
- I. Station Control Panel shall contain.
 - 1. Membrane keypad - for destination and special function selection.
 - 2. Display with 48 characters - for message display.
 - 3. Send/Enter key - to activate dispatch after destination selection or to enter data for special functions.
 - 4. Cancel/Clear Key - to allow for transaction cancellation or clearing of display during special function activation.
 - 5. Special Function Key- to request special features.
 - 6. Directory - listing station addresses.
 - 7. Instruction Compartment - for operating and special function instructions.
 - 8. Discreet rejection messages shall be provided for:
 - a. Dispatching station full.
 - b. Dispatching station off.
 - c. Dispatching station not in service.
 - d. Receiving station full.
 - e. Receiving station does not exist.
 - f. Receiving station off.
 - g. Receiving station not in service.
 - h. Selection not permitted.
 - i. Transaction aborted.
- J. Message will be displayed for the following conditions:
 - 1. Incoming carriers at the receiving station.
 - 2. To return surplus carriers when the receiving station has a specified surplus over its assigned number of carriers.
 - 3. To empty a station receiver when it is full.
 - 4. Receiving station not receiving - traffic forwarded to another station.
- K. The following special functions shall be selectable from each station.
 - 1. Transaction Tracking
 - 2. Secure Transaction
 - 3. Emergency Shutdown
 - 4. State Transaction
 - 5. Traffic Forwarding

6. Incoming Carrier Query
7. Station On/Off
8. Carriers Present
9. Station Diagnostics
10. Audible Full Station
11. Audible Carrier Arrival

2.3 CARRIERS

Transparent shatterproof plastic with side opening or double end opening. Carriers shall be bi-directional and have replaceable wear bands and latches. Open carriers shall not be accepted in system. Carrier shall have an interior diameter of approximately five inches and a minimum length of 11" or transporting 1000 ML IV bottle. Furnish four for each station. Mark station number on three carriers of each station. If automatic return of carrier to station in need is furnished as standard equipment, carriers need not be marked.

2.4 TUBING

- A. Air and conveying tubing and bends shall be 16 gauge cold rolled, electric welded steel with flash removed and zinc-coated after fabrication. Joints shall be bell-end tubing or sleeve couplings forming air tight connections. Provide 6-inch system to match Medical Center standard.
- B. Form bends to minimum 124.5 cm (48 inch) radius. Use expanded bends only where carrier travel is down.
- C. Provide expansion joints where tubing passes through a construction expansion joint.

2.5 SOUND DAMPENING

Provide 1-1/2 inch thick insulation, one pound density flexible fiberglass with 0.0025 inch foil facing with joints taped.

2.6 HANGERS

- A. Fed. Spec. WW-H-171.
- B. Horizontal Tubing: Types 1, 4, 5, 6 and 11. Provide lock nuts on Type 1 hangers.
- C. Vertical Tubing: Riser Clamp Type 8.
- D. Trapeze Hangers: Structural channel, single irons or preformed channel shapes. May be used for groups of pipes close together and parallel.

2.7 TRANSFER UNITS

- A. Sheet metal enclosure with access panels. Joints between transfer unit tubing segment and incoming/outgoing tubing lines shall be sealed with

slip sleeve at each joint to minimize air leakage. Direction change through unit shall be gradual, using curved tube section. Unused lines shall be covered with port cap.

2.8 EXHAUSTERS AND CONTROL

- A. Exhausters shall operate all loops at one time on a vacuum/pressure to provide an average carrier velocity of 25 feet per second. Size exhauster to provide vacuum pressure to operate a minimum air circuit of 1000 feet. Speed of exhauster motor shall not exceed 3,500 rpm.
- B. Connect exhauster to a 40 degree C ambient temperature, squirrel cage type ball or roller bearing motor having normal starting torque, and low starting current characteristics. Size motor to operate compressor without being overloaded and mount on the same frame with the compressor. Motor shall be in accordance with NEMA Standard.
- C. Exhauster shall have disconnect switch at the motor. Arrange controls so system can be started only at same point where it was originally stopped. Starter shall be the type specified in ELECTRICAL Sections.
- D. Provide each exhauster with intake and exhaust mufflers. Exhaust mufflers shall have characteristics to effect a noise reduction down to a range from 60 to 65 decibels when measured five feet from outlet and 45 degrees of center.

2.9 PNEUMATIC CONTROL AIR SYSTEM

- A. Control air tubing shall be seamless copper tubing in accordance with Fed. Spec. WW-T-799.
- B. Provide air dryer with self-contained electric motor driven refrigeration type capable of delivering air to the system at minus 12 degrees F dew point.
- C. Provide dual air compressors each having capacity of handling the system. Provide oil removing filter, automatic drain valves by passes and a pressure regulator with a gage.
- D. Air compressors and dryer shall not be installed in interstitial space.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install vertical risers and horizontal trucks within designated spaces.
- B. Slots and openings in shear walls are in place and no new holes are allowed.
- C. Core holes in completed structural floors and interstitial space floors for tubing to stations.

- D. Vertical pipes or tubing passing through occupied floors other than designated risers are not permitted.
- E. Hangers shall be spaced not more than 10 feet on centers. Support each diverter, wye branch and bend by two hangers. Provide floor clamps for each tube at each floor on vertical runs. Install wye branches and diverters with split sleeves to facilitate system maintenance. Do not suspend hangers from piping above.
- F. Apply insulation only to bends and wyes not located in pipe shafts, equipment rooms and pipe basements.
- G. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- H. Station frame shall be installed flush to wall.

3.2 PRE-TESTS AND TEST

- A. Pre-test as per specifications in the presence of the COR, for proper operation before requesting final inspection. Final inspection shall be conducted at other than normal working hours, if required by the COR's Representative. The pneumatic tube system shall be tested as specified in the presence of, and under the direction of the COR's Representative.
- B. General: Test shall be conducted by a competent factory trained engineer possessing complete knowledge of system and equipment.
- C. Test Procedure: Phase I - To determine that system meets functional, operational installation and hardware requirements of specifications:
 - 1. Inspect components to determine compliance with hardware and installation specifications.
 - 2. At a random station demonstrate the following:
 - a. Place carrier into send compartment. Do not close door. Make random destination selection. Depress dispatch button. Acceptable result: System shall ignore dispatch request.
 - b. Remove carrier from send compartment. Close dispatch door. Make random destination selection. Depress dispatch button. Acceptable result: System shall ignore dispatch request.
 - c. Place carrier into send compartment. Close dispatch door. Make random inter-zone (loop) destination selection. Depress dispatch button. Acceptable result: Carrier accepted light shall turn on, carrier shall be delivered to selected destination.

- d. Place carrier into send compartment. Close dispatch door. Make intra-zone destination selection. Depress dispatch button.
Acceptable result: Carrier accepted light shall turn on, carrier shall be delivered to selected destination.
 3. At random station, try to send under following listed conditions.
Acceptable result in each case: Carrier rejected signal shall light and carrier will not be accepted into system. Following each test, depress cancel button which shall cancel the reject light.
 - a. Destined station filled to capacity.
 - b. Destined station turned off.
 - c. Power off at destined station.
 - d. Destined loop control switch off.
 - e. Dispatching loop control switch off.
 - f. Simulate a malfunction of a different zone and try to dispatch a carrier into that zone.
 - g. Simulate a malfunction of the same zone and try to dispatch carrier to a random station in the system.
 - h. Simulate malfunction of inter-loop transfer and attempt to dispatch carrier to random station in the system.
 4. At random station, dispatch carrier to another random station. Immediately after start of sending, remove power from the destined station. Acceptable result: Carrier will return to dispatching station.
 5. One station per zone will be randomly selected to dispatch carrier into a different zone. Ten seconds after start of sending, remove power from main system control center. Restore power and depress system "on" switch. Acceptable result: Carrier shall be delivered to destined station.
 6. Simulate any malfunction of the system. Acceptable result: computer shall generate specified printout, specific alarm light will activate at central control, master audio visual alarm shall activate. Operate reset switch or buttons. Acceptable result: All alarm indicators shall reset.
- D. Carriers: Carriers used for final tests shall be new.
1. Inspect carriers used for tests for scratches on leather washers and skirts, or rubbing bands. Presence of deep scratches indicate rough spots in tubing and/or joints. Rough spots shall be corrected before acceptance of system.

2. Carriers scratched, marred or damaged as a result of test shall be repaired or replaced.

- - - E N D - - -