PART 1 - GENERAL

1.1 SUMMARY:

A. This section includes materials, installation and testing of compressed air systems.

B. Related Sections:
   1. Section 02200 - Earthwork
   2. Section 02221 - Trenching, Backfilling, Compacting
   3. Section 02300 - Utility Tunnels
   4. Division 15 - Mechanical: Compressed air systems inside building lines or utility tunnels

C. Order of Preferred Installation:
   1. Utility tunnel
   2. Shallow trench
   3. Direct burial

D. It is the University’s policy evaluate the appropriateness of providing additional air for laboratory or shop purposes from the central compressed air system. Laboratory or shop users may be required to provide dedicated air compressors for these purposes if system capacity issues prevail.

1.2 QUALITY ASSURANCE:

A. General: Comply with the requirements of Sections 15010 and 15050.

B. Permit: Obtain permit from the University of Colorado at Boulder Utility Engineer.

C. Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following references as applicable. Materials shall be new and free from defects.

D. Conform to ASME B31-9 – Building Services Piping.

E. Conform to ASME B31-1 – Power Piping.

F. Conform to ASME A13.1 – Scheme for identification of Piping Systems.

1.3 SUBMITTALS

A. Shop Drawings: Indicate piping system schematic with electrical characteristics and connection requirements, including trapeze handers.
B. Product Data: Provide manufacturers catalog literature with capacity, weight and electrical characteristics and connection requirements.

C. Manufacturer’s Installation Instructions: Indicate hoisting and setting requirements, starting procedures, special procedures, assembly and installation of components.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS:

A. Steel Pipe: ASTM A53 or A106, Schedule 40 black.
   2. Joints: Threaded or welded to ANSI B31.1.
   3. Location: As shown on the drawings.

B. Copper Tubing: ASTM B88, Type K hard drawn.
   2. Joints: ASTM B32, colder, Grade 95TA.
   3. Location: As shown on the drawings.

C. Storage
   1. Store products in accordance with manufacturer’s instructions, with seals and labels intact and legible.
   2. Protect piping from weather and construction traffic.
   3. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

2.2 ACCEPTABLE MANUFACTURERS – VALVES:

A. Gate, Globe Check, Plug, Drains, - Crane, Nibco, Jenkins, Milwaukee, Powell, Stockham.

B. Ball Valves – Apollo-Conbraco, Crane, Milwaukee, Nibco, Jenkins, Stockham, Jamesbury.

C. Substitutions: Under provisions of Section 15010.

2.3 VALVES
A. Gate valves: Bronze body, bronze, trim, non-rising stem, handwheel, inside screw, single wedge or disc, solder ends.

B. Ball valves: Bronze one piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle solder.

2.4 UNIONS AND COUPLINGS:

A. Unions:

1. Copper Tube and Pipe: 150 psig bronze unions with soldered joints.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, and water impervious isolation barrier.

2.5 PIPE HANGARS AND SUPPORTS

A. Industry Standards:

1. Compressed Air Piping: Conform to ASME B31.9.

B. Supporting Methods:

1. Hangars for Pipe Sizes ½ to 1-½ Inch: Malleable iron, adjustable swivel, split ring.
2. Hangars for Cold Pipe Sizes to 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangars: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
5. Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
7. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.6 HANGER RODS:

A. Steel Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.7 INSERTS:
A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slat for reinforcing rods, lugs for attaching to forms, size inserts to suit threaded hanger rods.

2.8 WALL PENETRATION SEALS:

A. Pipe to wall penetration closures shall be modular mechanical type, made up of interlocking rubber links shaped to fill the annular area between pipe and wall opening or outer casing, and joined together with machine bolts and nuts. Seal shall be designed to fit loosely around pipe after being positioned, expanded against the outer wall by tightening the bolts. Seal assembly, including bearing plates or washers between seal elements and bolt heads and nuts, shall be electrically non-conductive.

B. Seals shall be “Link-Seal” as manufactured by Thunderline Corp., Belleville, Michigan, or approved equal.

C. Pipe penetrating fire rated wall shall be sealed with UL Listed fire stop.

2.9 FABRICATION:

A. Design hangers without disengagement of supported pipe.

2.10 FINISH:

A. Prime coat exposed steel hangers and supports.

2.11 IDENTIFICATION:

A. Underground Type Plastic Line Marker:

1. Manufacturer’s standard permanent, continuous-printed tape with metallic core, intended for direct-burial service; not less than 6” wide x 4 mils thick. Provide green tape with black printing reading “CAUTION COMPRESSED AIR LINE BURIED BELOW”.

2. Provide identification markers of one of the following:
   a. Allen Systems, Inc.
   b. Emed Co., Inc.
   c. Seton Name Plate Corp.

3. Materials:
   a. Color: Unless specified otherwise, conform with ASME A13.1,
   b. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
   c. Chart: Typewritten letter size list in anodized aluminum frame.
d. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to get around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed.

2.12 GENERAL:

A. Comply with requirements of Section 15050.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Comply with requirements of Section 15050.

B. Install in accordance with manufacturer’s instructions.

C. Install valved drip connections at every low point of piping system.

D. Install take offs to outlets from top of main, with shut off valve after take off and provide unit price for each valved drip.

E. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

F. Label piping system and components.

G. The compressed air piping system layout in tunnel shall be reviewed and approved by Owner’s Representative before the actual installation.

3.2 INSTALLATION OF IDENTIFICATION:

A. During backfilling and topsoiling of underground compressed air piping, install continuous underground plastic line markers, located at two (2) depths, 1’ below grade and 1’ above pipe, where grade is at least 4’ above pipe.

3.3 INSERTS:

A. Provide inserts for suspending hangers from reinforced concrete slabs.

3.4 PIPE HANGERS AND SUPPORTS:
A. Support horizontal piping as required; the following table lists spans and hanger rod sizes based on MSS SP-69 recommendations. If local codes or special design considerations necessitate shorter spans or larger rod sizes, they shall govern. Valves shown are based on standard weight piping filled with water; Contractor shall adjust requirements as necessary for other conditions (such as increase in loading caused by valves, fittings, or other conditions).

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Max. Support Spacing</th>
<th>Hanger Rod Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ to 1-¼ inch</td>
<td>7’–0”</td>
<td>3/8”</td>
</tr>
<tr>
<td>1-½ inch</td>
<td>9’-0”</td>
<td>3/8”</td>
</tr>
<tr>
<td>2 inch</td>
<td>10’-0”</td>
<td>3/8”</td>
</tr>
<tr>
<td>2-½ inch</td>
<td>11’ 0”</td>
<td>1/2”</td>
</tr>
<tr>
<td>3 inch</td>
<td>12’-0”</td>
<td>1/2”</td>
</tr>
</tbody>
</table>

B. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow.

D. Use hangers with 1-½ inch minimum vertical adjustment.

E. Where several pipes can be installed in parallel at the same elevation, provide multiple or trapeze hangers.

F. Support riser piping independently of connected horizontal piping.

3.5 IDENTIFICATION PREPARATION:

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 9 for stencil painting.

3.6 IDENTIFICATION INSTALLATION:

A. Plastic Pipe Markers: Install in accordance with manufacturer’s instructions.

B. Valves Identification:

1. Identify all valves, in main and branch piping located inside the tunnel. Use tags secured with brass “S” hooks or brass chains.

2. Stamp tags with a unique prefix to identify system to which applied, followed by a number (Example: CA-1, CA-2, etc.). In general, prefix shall match system
abbreviations used on drawings where applicable. Numbering system shall be approved by Owner’s Representative.

3. Provide a typewritten list of valves including: valve identification number, location, function, normal position, service, and area served. Mount list as specified and directed. Include additional copy in operation and maintenance manuals.

C. Piping: Identify piping, concealed or exposed, with plastic pipe markers. Tags may be used on small diameter piping. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and “T”, at each side of penetration of structure or enclosure, and at each obstruction.

3.7 VALVE CHART AND SCHEDULE:

A. Provide valve chart and schedule in aluminum frame with clear plastic shield. Install at location as directed.

3.8 PIPING IDENTIFICATION SCHEDULE:

A. Pipe identification and color coding for general use-piping systems shall be in accordance with the following schedule.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Band Color</th>
<th>Stenciled Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressed Air</td>
<td>Blue</td>
<td>Comp. Air</td>
</tr>
</tbody>
</table>

3.9 Field Quality Control

A. Field inspection and testing will be performed under provisions of Division 1.

B. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ANSI B31.1.

C. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

D. Cap (seal) ends of piping when not connected to mechanical equipment.

END OF SECTION 02795