

APPENDIX D INFRASTRUCTURE

FORMAT

1. Technical Specifications content and numbering system shall be based on CSI Master Format 2004 version.

BASIS OF DESIGN

1. BGSU Design standards shall not replace fully developed, project and market specific technical specification. Associate shall utilize the Standards as a minimum standard to guide the design and execution in the field. Exceptions to these standards are allowed provided they are approved by Design & Construction.
2. In instances where fewer than 3 manufacturers are indicated, the Associate shall insert "or approved equal" in the Products section of the technical specifications.
3. All submitted substitute products shall be brought to the attention of Design & Construction, prior to approval.

RELATED SECTION

22—PLUMBING
23—MECHANICAL
26—ELECTRICAL

TUNNELS

1. Minimum inside clear dimensions for new tunnels shall be 7'-0" wide by 7'-0" high.
2. Excavate an additional 3-5 feet on either side of the tunnel as well as 12 inches below tunnel to allow for installation of future direct buried utilities adjacent to the tunnel and/or to pass underneath tunnel.
3. All tunnel tops shall be constructed for AASHTO H-20 wheel loading.
4. Sidewalks shall be separate from the tunnel top by minimum of 6-inches of compacted fill for all new tunnels.
5. Provide non-slip texture on tunnel floor.
6. Water-proof exterior walls and tunnel top.
7. Natural gas, sewer and water lines shall not be routed through the tunnels.
8. During major tunnel renovations:
 - a. Existing natural gas lines shall be removed from tunnels and direct buried.
 - b. Tunnels containing natural gas lines include the Library, Overman and Psychology Tunnels.
 - c. Remove all water lines from the tunnels and install direct buried. All new water mains shall be a minimum 8-inch diameter and shall be designed in a looped configured so that they can be backfed. A branch water line may cross the tunnel if installed near the floor level of the tunnel.
 - d. Remove all abandoned or obsolete communication cables per National Electrical Code (NFPA70 - 800)
9. Junctions:

- a. A junction is defined as the intersection of two or more tunnels.
 - b. Piping, cable and cable trays shall be installed with offsets to maximize clearance to allow maintenance personnel to readily cross junctions.
10. Hatches
- a. Utilize Bilco Aluminum hatches (Model J-AL & JD-AL) reinforced for AASHTO H-20 wheel loading with integral drain channel.
 - b. Provide tunnel access hatch every 250 feet or on either side of where an obstruction makes a section of tunnel impassable.
 - c. Install ships ladders at each hatch for access
11. Receptacles
- a. Receptacles shall be GFI protected and have a weatherproof cover.
 - b. Provide a receptacle every 100 feet maximum.
12. Lighting
- a. Light fixtures shall be weather tight, enclosed and gasket type suitable for high heat, wet / corrosive environments with guard.
 - b. Provide manual switch with weathertight cover.
 - c. Lamps shall be T8 Fluorescent.
 - d. Maintain minimum 1 footcandle average at floor
13. Ventilation
- a. Louvered penthouse shall be utilized for intake air. Location, style and color shall be coordinated with the University for aesthetics, allow for maintenance and sidewalk snow removal.
 - b. Ventilation systems shall be designed to provide a minimum of 6 air changes per hour.
14. Sump Pumps - Electric
- a. Electric powered vertical type.
 - b. Case: Iron.
 - c. Impeller: Bronze.
 - d. Shaft: 416 stainless steel.
 - e. Lower Bearing: Graphite.
 - f. Legs: Galvanized.
 - g. Floor Plate: Galvanized.
 - h. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
 - i. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
 - j. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
 - k. Control-Interface Features:
 - i. Remote Alarm Contacts: For remote alarm interface.
 - ii. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing on-off status of pump and alarm status.

15. Identification: Label tunnels walls at each junction and at every access hatch.

HIGH PRESSURE STEAM (HPS – GREATER THAN 35 PSIG)

1. A steam main is defined as a steam line that serves a total building gross floor area greater than 150,000 gsf and is longer than 100 feet or back feeds another steam line that serves 150,000 gsf and is longer than 100 feet. All other steam lines shall be classified as steam branch lines.
2. All steam mains shall be installed in utility tunnels or inside of a mechanical equipment room, direct buried is not allowed.
3. All steam branch lines longer than 100 feet shall be a minimum of 8-inch and shall be valved and capped at the end of the branch for future extension.
4. All steam mains West of Centrex should be at least 12-inch and all steam mains East of Centrex should be at least 10-inch.
5. Isolation Valves shall be installed in the main loops at a minimum of every 300 feet and at every junction with another steam main to allow for isolation of a section of a failed steam main while back feeding the rest of the system.
6. Criteria:
 - a. Normal Operating Pressure: 100 psig
 - b. Normal Operating Temperature: 338°F
 - c. Maximum Steam Velocity: 100 fps
 - d. Minimum Thermal Expansion Safety Factor: 1.50
7. Refer to Mechanical Section for Pipe, Valve and Fitting Schedule.
8. Insulation: per ASHRAE 90.1
9. Jacketing: Aluminum 0.02-inch thick, smooth no vapor barrier
10. Steam main drip traps shall be sized with a 2 times safety factor at full differential pressure and shall be provided every 200 feet or less.
11. Label: HPS every 20 feet.

PUMPED CONDENSATE (CPCR & PCR)

1. Criteria:
 - a. Normal Operating Pressure: 60 psig
 - b. Normal Operating Temperature: 307°F
 - c. Maximum Velocity: 6 fps
 - d. Minimum Thermal Expansion Safety Factor: 1.50
2. Refer to Mechanical Section for Pipe, Valve and Fitting Schedule.
3. Insulation: per ASHRAE 90.1
4. Jacketing: Aluminum 0.02-inch thick, smooth no vapor barrier
5. Identification: PCR / CPCR / GCR every 20 feet.
6. Refer to Mechanical Section for Steam Powered Condensate Pumps

HIGH PRESSURE STEAM CONDENSATE PIPING

1. Criteria:
 - a. Normal Operating Pressure: 100 psig

- b. Normal Operating Temperature: 338°F
2. Refer to Mechanical Section for Pipe, Valve and Fitting Schedule.
3. Insulation: per ASHRAE 90.1
4. Jacketing: Aluminum 0.02-inch thick, smooth no vapor barrier
5. Identification: HPC every 20 feet.

COMPRESSED AIR PIPING

1. Piping: Carbon Steel ASTM A53, Grade A, Schedule 40, Butt Weld
2. Fittings: Butt Weld, ASTM A234, forged steel Class 300, for 2 ½ inch and larger. ASTM A234, Grade WPB ANSI/ASTM B16.3, malleable iron Class 250 for 2 inch and smaller,
3. Joints: Threaded for 2 inch and smaller, welded ANSI/AWS D1.1, for 2 ½ inch and larger.
4. Flanges: Class 300 for steam forged steel slip-on flanges or weld – neck flanges for carbon steel.
5. Valves: Full Port Ball Valve, Carbon Steel Body, TFE Seat, Carbon Steel Ball with Chrome Plated Hand Lever 300#
6. Identification: CA every 20 feet.

SITE HIGH VOLTAGE ELECTRICAL

1. Transformers shall be 15 Kv class, three phase, delta – wye, liquid filled, outdoor, pad-mounted type and shall directly step down power to 480 volt, 208 volt, etc. as required.
 - a. Outdoor, Oil filled transformer with medium voltage primary (12.47 KV).
 - b. Secondary voltage as specified for Project.
 - c. Quality Assurance: comply with the following standards:
 - 1) IEEE C57.12.26
 - 2) NFPA 70
 - 3) ANSI C57.12.28.
 - 4) U.L.
 - 5) NEMA.
 - d. Insulating oil: R-Temp, Enviro – Temp, or similar environmentally friendly insulating fluid.
 - e. Tap changer: one center, two @ +2.5%, two @ -2.5%.
 - f. Surge Arrestors on primary.
 - g. Impedance: manufacturer's standard impedance in accordance with ANSI C57.12.00 and C57.12.34.
 - h. Paint: Munsell green to match high voltage switches.
2. Loop switches shall be 15 Kv class, outdoor pad mounted and shall be dual source so that the switch can be fed from either side of the distribution loop and shall have individual fault interrupting tap switches that can open and be isolated without disturbing the other circuits within the distribution system.

- a. G&W PVI series pad mounted combination unit, with two (2) SF-6 puffer main interrupters and up to four (4) breaker taps. Pad lockable, dead front-quick change bushings, front access. Paint finish: Munsell green.
 - b. Typical PVI 62-376-12-62F switch unit; two (2) main interrupters rated 600A, 15 kV Class with four (4) vacuum breaker taps. Taps are SMU-20 fuse (type "E" breaker curve settings), 12,000A interrupting and 19,200A momentary. The following accessories are required; pressure gage, viewing windows, grounding lugs and approval of Bowling Green Municipal Utility Electrical Engineering Department.
3. The following general guidelines should be utilized:
- a. The building to tap switch ratio should be 1:1.
 - b. The transformer to tap switch ratio should not exceed 2:1.
 - c. 12.47 kV transformers and switches should be located outdoors at grade.
4. Cable: 12.47 kV loop cable shall be rated at 15kV, type MV – 105, and listed for cable tray and underground duct usage with 133% insulation level, 105 deg C continuous operating temperature, and a minimum ampacity of 635 Amps when in a cable tray.
- a. Conductors.
 - i. Three 750 kcmil 15 kV conductors with one ~~#4/0~~ #1/0 ~~600V~~ ground conductor.
 - ii. Uncoated copper compact stranded per ASTM B-496.
 - b. Strand Screen: Extruded semiconducting EPR strand screen meets or exceeds electrical and physical requirements of ICEA S-93-639/NEMA WC74 and UL 1072.
 - c. Insulation.
 - i. 220 mils, 133% Insulation level.
 - ii. Comply with the electrical and physical requirements of ICEA S-93-639/NEMA WC74 and UL 1072.
 - iii. Test the insulated conductors in accordance with AEIC CS8.
 - d. Insulation Screen: Extruded semiconducting EPR insulation screen meets or exceeds requirements of ICEA S-93-639/NEMA WC74, AEIC CS8 and UL 1072.
 - e. Shield: 5 mil uncoated copper tape with 12.5% nominal overlap.
 - f. Phase Identification: Color-coded (black, red, blue) polyester ribbon laid longitudinally under the copper shield.
 - g. Grounding Conductor: Uncoated copper compact stranded per ASTM B-496 and sized in accordance with UL 1072.
 - h. Assembly: Cabled with fillers in the interstices, binder tape overall.
 - i. Jacket: PVC. Comply with the electrical and physical requirements of ICEA S-93-639/NEMA WC74 and UL 1072 for polyvinyl chloride jackets.
 - j. UL Listed as Type MV-105, sunlight resistant for use in cable tray, and for direct burial in accordance with UL 1072.

5. Cable Trays: 4-inch high x 12-inch wide, flange out. Tray shall be NEMA Class 12B aluminum ladder style with 12" rung spacing and 3" loading depth.
 - a. Cables shall be installed in a single layer in accordance with the N.E.C.
 - b. Support spacing shall not exceed 12 feet.
6. Conduit: minimum 4", type EPC, schedule 40 PVC, per NEMA TC2. For ductbank installations, conduits shall be supported on duct separators (4 per 20ft of duct) and secured with nonmetallic straps. Conduits shall be completely encased in concrete for the entire length of the ductbank with a warning tape placed 12" above the concrete envelope.

End of Section