

**CONSTRUCTION STANDARD SPECIFICATION**

**SECTION 15311**

**PREFABRICATED OFFICE COMPLEX AUTOMATIC SPRINKLER SYSTEM**

	<u>Page</u>
<b><u>PART 1 - GENERAL</u></b>	
1.01 Summary .....	3
1.02 References .....	3
1.03 System Description .....	4
1.04 Submittals .....	6
1.05 Quality Assurance .....	8
 <b><u>PART 2 - PRODUCTS</u></b>	
2.01 Materials .....	9
2.02 Sprinklers .....	9
2.03 Pipe .....	10
2.04 Pipe Fittings .....	11
2.05 Pipe Hangers And Supports .....	11
2.06 Fire Protection Check Valves .....	11
2.07 Fire Protection Interior Control Valves .....	12
2.08 Supervisory Devices .....	12
2.09 Fire Department Connections .....	13
 <b><u>PART 3 - EXECUTION</u></b>	
3.01 Installation .....	13
3.02 Sprinkler Main System Riser .....	16
3.03 Sprinklers .....	16
3.04 Drains .....	17
3.05 Fire Department Connections .....	17
3.06 Identification .....	17
3.07 Flushing .....	18
3.08 Testing .....	18
3.09 Protection Against Freezing .....	19
3.10 Protection For Backflow Prevention .....	19
3.11 Painting And Labeling .....	20
3.12 Disinfection .....	20

PART 4 - CADD SOFTWARE GUIDELINES FOR DRAWING SUBMITTALS

4.01 MicroStation J.....22  
4.02 AutoCAD .....22

PART 5 - ATTACHMENTS

5.01 Attachment 1 – Shotgun Riser Detail .....23

**CONSTRUCTION SPECIAL SPECIFICATION**

**SECTION 15311**

**PREFABRICATED OFFICE COMPLEX AUTOMATIC SPRINKLER SYSTEM**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This specification, in conjunction with the contract documents and drawings, indicates the materials and operations required for the design and installation of a wet-pipe automatic sprinkler system in prefabricated office complexes. Requirements are included for the design and installation of fire protection systems, shop drawings, equipment, pipe, pipe fittings, valves, check valves, backflow prevention devices, alarm initiation and supervisory devices, fire department connections, sprinkler systems, operating instructions, identification, tests, and disinfecting of piping.
- B. This specification applies to all fire protection piping downstream of the flanged stub-up at the base of the sprinkler riser, unless otherwise noted on the contract drawings.
- C. Any variation, clarification or apparent conflict from within this specification shall be submitted to the Sandia Delegated Representative (SDR).

**1.02 REFERENCES**

- A. Sandia National Laboratories (Sandia/NM) Standard Specifications
  - 01065 ES&H for Construction & Maintenance Contracts
  - 01330 Submittal Procedures
  - 02200 Earthwork
  - 02665 Underground Water Lines for Domestic and Fire Protection Systems
  - 09900 Painting
  - 15050 Basic Mechanical Materials and Methods
  - 15994 Mechanical Systems Demonstration
- B. American Public Health Association (APHA)
  - Standard Methods for the Examination of Water and Wastewater
- C. American Water Works Association Standard Specifications (AWWA)

- C500 Metal-Seated Gate Valves for Water Supply Service
- C651 Disinfecting Water Mains
- Manual M14 Recommended Practice for Backflow Prevention and Cross Connection Control
- D. National Fire Protection Association (NFPA)
  - NFPA 13 Standard for the Installation of Sprinkler Systems
- E. Underwriters' Laboratories, Inc. (UL)
  - Fire Protection Equipment Directory
- F. Reflected Ceiling Plan (to be included with the Contract Package)
- G. Floor Plan (to be included with the Contract Package)
- H. Site Plan showing location of riser (to be included with the Contract Package)

### 1.03 SYSTEM DESCRIPTION

- A. Designer Requirements
  - 1. The designer of the fire protection systems shall meet one of the requirements below.
    - a. A registered Professional Fire Protection Engineer in the State of New Mexico.
    - b. Minimum National Institute for Certification in Engineering Technologies (NICET) Level III for wet-pipe, Light Hazard Sprinkler Systems, regardless of size.
    - c. Where NICET design is used, copies of the designer's certificates from NICET shall be submitted along with the drawings for approval. The registered Professional Engineer shall stamp all other plans.
  - 2. The contractor shall produce design drawings (design files) that indicate the extent and arrangement of the automatic sprinkler system.
  - 3. Unless indicated in the contract, drawing(s) refers to the plotted hard copy document or print and the electronic computer aided drafting design (CADD) file.
- B. Design Criteria
  - 1. The Designer is responsible for the design and installation of a wet-pipe automatic sprinkler system in accordance with these specifications and the requirements in NFPA 13. The contractor shall coordinate with architectural, civil, mechanical, and electrical, design and construction documents, to ascertain the required information, to properly design and install an automatic sprinkler system for the prefabricated office complex.
  - 2. The design of the automatic sprinkler system shall be complete with all necessary accessories for proper operation.

3. The fire protection water supply lines, controlling devices, protective devices, alarm systems, supervisory devices, and related equipment shall be compatible so that all equipment will function together as specified.
4. Light Hazard design criteria:
  - a. Office space shall be designed for Light Hazard, Business occupancy.
  - b. Sprinkler density (gpm/ft<sup>2</sup>) – 0.10
  - c. Area of Application (ft<sup>2</sup>) – 1,500.
  - d. Sprinkler orifice, temperature – ½-in., 155°F QR.
5. Ordinary Hazard design criteria:
  - a. Prefabricated office complexes with lab space shall be designed for Ordinary Hazard, Group II, Business occupancy.
  - b. Sprinkler density (gpm/ft<sup>2</sup>) – 0.17
  - c. Area of Application (ft<sup>2</sup>) – 3,000.
  - d. Sprinkler orifice, temperature – ½-in., 155°F QR.
6. Hydraulic design shall be as follows:
  - a. The design area shall be the hydraulically most demanding "rectangular area" having a dimension parallel to the branch lines equal to 1.4 times the square root of the area of sprinkler operation.
  - b. Where the design area includes a corridor protected by a single row of sprinklers, the maximum number of sprinklers that need be calculated is 7, when openings into the corridor are unprotected by fire rated construction. When openings into the corridor are protected, the maximum number of sprinklers that need to be calculated is 5.
  - c. Maximum waterflow velocity shall not exceed 20-feet per second (6-m/s) in any sprinkler system piping of hydraulically designed systems.
  - d. Hydraulic design shall be based upon the water supply data shown on information supplied by the SDR. The water supply data curve shall be based upon 85% of the available water supply as tested.
  - e. Hydraulic calculations shall be performed using an Sandia/NM approved (Firecad, HAAS, HydraCalc, Hydronics, HyperCalc, THE, Water, etc.) computer program. Hand calculations or calculations on spreadsheets will not be accepted. All

calculation programs shall use the Hazen-Williams calculation method. Utilize the C Factors in NFPA 13 for the hydraulic calculations.

Hydraulic calculations shall include the following adjusted C Factors when using new or existing pipe for sprinkler systems and exterior piping systems.

- f. Extend all (regardless of job size, and including modifications, new installations, retrofits, recalculations, etc.) hydraulic calculations back to the effective point of connection (ring-main) of the sprinkler lead-in to the fire water main supplying the office complex, unless indicated otherwise on the contract drawings.
  7. The distance between sprinklers either on branch lines or between branch lines shall not be less than 6 feet distance apart.
  8. Manifolding of sprinkler risers to one single sprinkler lead-in shall not be permitted.
- C. Fire department connections shall be as follows:
1. Install fire department connections, where show on the drawings. Install underground piping, if required, in accordance with standard specification 02665, "Underground Water Lines for Domestic and Fire Protection Systems."
- D. Exposure protection design shall be as follows.
1. A minimum of 3 gpm (11.4-L/Min) per linear feet (0.3-M) using ½-inch orifice sprinklers spaced a maximum of 10 feet apart horizontally apart shall be calculated. Sprinklers shall be high-temperature rated.
  2. Hydraulic calculations shall include all of the sprinklers facing the exposure, on every row.

#### 1.04 SUBMITTALS

- A. Provide as required by Specification Section 01330, "Submittal Procedures", to the SDR.
- B. After award of contract and prior to fabrication, Fire Protection System Contractor shall submit to the SDR for approval, complete design submittals. Design submittals package shall include:
  1. Paper copies and electronic (if available) of manufacturers' catalog data, system and component operating instructions, and paper and electronic copies of hydraulic calculations for the sprinkler system and underground piping shown on plot plans.
  2. Paper copies and electronic copies of graphic design drawings (CADD files) showing any underground piping, office complex fire protection floor plans, riser diagram, and any other graphic drawings to clearly delineate the design.

3. If welded joints are to be used in the sprinkler system installation, then the Contractor shall provide a paper copy and electronic (if available) of the welding procedure to be used, the quality assurance procedure and the welder's qualifications.
- C. No installation will be permitted prior to Sandia/NM Fire Protection Engineering approval of the complete shop drawings, calculations, and materials submittal.
- D. Electronic Design Submittal
1. All manufacturers' catalog data, system and component operating instructions, design drawings, and calculations for the fire protection system shall be included in the deliverable file package as follows. The fire protection deliverable package, both CADD and non-CADD shall be delivered to Sandia in printed format (hard copy), quantity to be determined by SDR, in addition to one electronic copy. Microsoft Word, Microsoft PowerPoint, Microsoft Project, and Microsoft Access are the required software (latest versions suitable for Windows/NT) to be used. In addition to electronic copies of the bond (paper) documentation, the contractor will provide electronic copies of all engineered calculated project software in the format originally generated (i.e., Firecad, HASS, Hydronics, HyperCalc, etc.). Where these software packaged cannot be used, the contractor shall produce the documents in portable document file (PDF) format, or scanned image in \*.jpg or \*.bmp format. All files will be returned with the file name, description/content, software and software version requirements listed. All deliverable data, designs, records, graphics, and supporting tools are the property of Sandia/NM. Sandia/NM also has the right to provide any of this information to others, as it deems appropriate.
  2. All graphic design drawings will be plotted CADD files. CADD files will follow Sandia/NM File Naming conventions, and utilize a Sandia/NM border title block.
  3. Floor Plans
    - a. All fire protection floor plans will reference architectural floor plans.
    - b. Files will be completed at a one-to-one scale.
    - c. The contractor will identify location of post indicator valve (PIV) and Fire Department Connection that are attached to the office complex.
    - d. Each floor will be a single file (i.e., MicroStation – Master Floor Plan, or AutoCAD – Model File).
    - e. Orientation of North, key play breakout will match architectural construction of floor plans.
    - f. Unless otherwise specified, new floor plans and full height cross sections shall be plotted at  $\frac{1}{4}''=1' 0''$ .
  4. Riser Diagram

- a. Riser will be detailed in nature showing each fire protection component. Each component will be labeled, at a minimum with description, size, and equipment part and manufacturer information.
  - b. Riser details will show at a minimum all components from the PIV and Fire Department Connection up to top of the riser. Riser will be to scale, or dimensions shall be shown indicating height and distances between components.
5. Site Plans: The contractor will verify location on the construction site plans of PIV, fire department connection, and hydrants that are not attached to the office complex.
  6. All requirements listed under submittals apply regardless of use of MicroStation or AutoCAD.
- E. CADD Drawings: Sandia/NM Facilities maintains MicroStation J for Windows/NT, as its standard CADD software. Refer to the requirements in Part 4 for CADD drawing submittals.
- F. As-Built Drawings:
1. Upon completion of the installation, the Contractor shall revise all Fire Protection Design files, calculations, manuals, operating instructions to agree with the construction as actually accomplished. The notation "As-Built" shall be entered in the revision block, dated and initialed. All as-built records will follow the requirements listed under 1.05 Submittals.
  2. Fire Protection Design files must be requested from Sandia/NM prior to as-builts. As-builts will be reflected on the existing design file records.
  3. The as-built files, whether on new or original contract shall show the entire sprinkler system, existing and new construction, as it exists at the completion of the contract work. Delete all references to "new work," "existing," "NIC," etc.
  4. As-built submittals shall be submitted to the Sandia/NM SDR prior to the final acceptance testing. This delivery shall include BOTH electronic and hard copies.
  5. Final hydraulic calculations shall reflect the "As-Built" condition. These calculations must be submitted before final acceptance testing by Sandia/NM.

#### 1.05 QUALITY ASSURANCE

- A. General: Where specific manufacturers or model numbers are mentioned in these specifications, proposed substitutions shall be included in the submittal package furnished to the Sandia Delegated Representative (SDR) for approval after contract award and before installation.
- B. Warranty: All sprinkler system components furnished under this contract shall be guaranteed against defective design, materials, and workmanship for the full warranty time,



which is standard with the manufacturer and/or supplier. Refer to contract requirements. In no case shall the warranty be less than one year from the date of system acceptance.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Materials and equipment used in the installation of the sprinkler system shall be new and listed by the UL Fire Protection Equipment Directory or the FM Approval Guide, latest edition. The standard products and the latest design of the manufacturer shall be used, and installed per their listing, approval, or manufacturer recommendations. All products listed or approved by prior editions of the UL Directory of FM Approval Guide will not be acceptable, if not listed or approved in the most recent edition of the directory or approval guide.
- B. Where two or more units of the same class of equipment are required, these units shall be products of the same manufacturer (e.g., couplings shall be from one manufacturer.) All materials shall be installed per their listing or approval and per the manufacturer's recommendations and specifications.
- C. Tape for screwed joints shall be minimum, 3 mil., 1/2-inch wide.
- D. Corrosion protection tape shall be Scotchwrap 51, manufactured by 3M Company or approved equivalent.

### 2.02 SPRINKLERS

- A. Types:
  - 1. Unless otherwise specified, allowed per other sections of this document, or shown on the drawings, sprinklers shall be nominal, 1/2-inch orifice, automatic, closed-head sprinklers rated at 155° F (68° C) Quick Response, frangible bulb type fusible element.
  - 2. Higher temperature rated sprinklers shall be installed where heads are exposed to high ambient temperature, exposed to the direct rays of the sun, installed in the vicinity of heating equipment, or in attics. The sprinkler temperature chosen shall be a minimum of 50° F above the maximum ambient temperature, and no greater than 100° F above the ambient conditions, unless specifically directed by NFPA 13.
  - 3. Quick Response (QR) sprinklers, where specified on the drawings, shall have a Response Time Index (RTI) of 50 or less in English units and 28 or less in metric units.
  - 4. Sidewall sprinklers shall be Underwriters' Laboratories listed or Factory Mutual approved for Light Hazard Occupancy.

5. Extended coverage sprinklers are not allowed.
6. Only sprinklers with a "Belleville" type seal shall be used. No O-Ring sealed sprinklers shall be allowed either in "crush" seals or "radial" seal styles. Sprinklers shall be of all brass frame construction with a coated metal to metal seating mechanism.
7. Sprinklers in unheated areas (e.g., vestibules) shall be dry sidewall type or dry pendant type.

B. Position and Finish

1. Sprinklers installed on exposed piping shall be manufacturer's standard finish pendant sprinklers. Sprinklers and escutcheons installed below dropped ceilings shall have a finish matching the color of the ceiling tile. Only factory applied finishes shall be acceptable. If the factory has a finish that cannot match the ceiling tile color, standard finish sprinklers are allowed.
2. In rooms where sprinkler heads penetrate a suspended ceiling, only quick response, semi-recessed or recessed sprinklers are acceptable. Standard pendant sprinklers with "cup and skirt" escutcheons, one-piece escutcheons, or flush or concealed sprinklers are not allowed.
  - a. EXCEPTION: On existing installations only, where sprinkler head relocations or small modifications (less than 20 heads) take place, the new sprinklers and escutcheons shall match the existing sprinklers.
3. Escutcheons, head guards, and water shields from the supplied sprinkler manufacturer shall be used solely with the installed sprinkler. No after market escutcheons, head guards, or water shields are allowed.
4. Head guards shall be two-piece, universal attachments, bolted in place on the sprinkler. "Snap-on" one-piece units are not allowed.

2.03 PIPE

- A. Pipe for installation above ground shall conform to the requirements of NFPA 13. Pipe shall be listed by UL and be FM approved, and installed per its listing and approval and meet the following requirements:
  1. Unless otherwise specified, the minimum steel pipe wall thickness shall be Schedule 10 for pipe sizes 1¼ inches or larger. Pipe sizes smaller than 1¼ inches shall be Schedule 40. Threaded or cut groove steel pipe shall be Schedule 40 for sizes less than 8 inches and a minimum of Schedule 30 in sizes 8 inches and larger for pressures up to 300 psi (2.1-MPa.)

2. Mechanical rolled groove pipe or welded pipe shall be a minimum of Schedule 10 for sizes 1¼ inches up to 5 inches, 0.134-inch wall thickness for 6 inches, and 0.188-inch wall thickness for 8- and 10-inch pipe for pressures up to 300-psi (2.1-MPa.)
3. Steel pipe from drain line valves and inspector's test valves, and where pipe is exposed to outdoor weather, etc., shall be internally and externally galvanized. Galvanized fittings are required where galvanized piping is used.

#### 2.04 PIPE FITTINGS

- A. Pipe fittings for installation above ground shall conform to the requirements of NFPA 13 and shall be FM approved or UL listed.
  1. Mechanical groove couplings are required on all 4 inches and larger pipe.
  2. Plain-end pipe couplings shall not be used in any new installation.
  3. Galvanized pipe fittings shall be installed where galvanized piping is specified.
  4. Welded branch outlet fittings (weld-o-lets, groove-o-lets, thread-o-lets, etc) shall be minimum Schedule 10 for pipe sizes 1¼ inches or larger. Pipe sizes smaller than 1¼ inches shall be Schedule 40 standard wall pipe thickness. Welded outlets shall UL listed or FM approved, affixed with the UL or FM identification stamps, and pressure rated for 300-PSI maximum.
  5. Adjustable, two-piece drop nipples shall not be used. All drop nipples shall be one-piece, non-adjustable units with a minimum 1-inch diameter.

#### 2.05 PIPE HANGERS AND SUPPORTS

- A. Pipe hangers, and hangar assemblies shall be UL listed or FM approved.
- B. C-clamps and beam clamps shall have lock nuts and pipe rings shall be of the solid-band adjustable swivel type.
- C. Provide rod ceiling plates at finished ceilings for coach screw rods, expansion shields, and toggle hangers.
- D. When fastening hangars to purlins, bolt-through fastening methods shall be used. Beam clamps with restraining straps shall not be used in any circumstance.

#### 2.06 FIRE PROTECTION CHECK VALVES

- A. Check valves in sprinkler system shall be UL listed or FM approved, have hand hole covers to provide adequate access to facilitate inspection and repair, without the removal of the valve from the system, and shall be listed for installation in the vertical or horizontal position. Wafer check valves are unacceptable. All check valves shall have a working water pressure of 250 PSI.

- B. Backflow prevention devices shall be installed on all sprinkler systems at Sandia/NM as follows, please see section 3.12 for further guidance.
  - 1. A double check valve backflow prevention assembly shall be installed to prevent cross-connection contamination between potable water systems and any fire sprinkler system, at the service connection for the fire sprinkler system.

## 2.07 FIRE PROTECTION INTERIOR CONTROL VALVES

- A. Each system shall have interior control valves as follows:
  - 1. All control valves 2½ inches or larger shall be provided with an electric valve supervision device, connected to the office complex fire alarm system.
  - 2. All control valves shall be OS&Y. Butterfly valves are not permitted, unless directed by Sandia/NM on the drawings. Valves shall be manufactured in accordance with AWWA Standard C500, and have a clear waterway equal to the full nominal diameter of the valve. Valves shall be provided with a hand wheel, with arrow cast in metal to indicate direction of opening.

## 2.08 SUPERVISORY DEVICES

- A. Provide the equipment listed below.
  - 1. Electric valve supervision switches shall be installed for all internal (inside) and external (outside) fire protection valves 2½ inches or larger. The devices shall be electrical; single-pole, double-throw; with normally closed contacts and include design that signals controlled valve is in other than normal position.
  - 2. Install vane-type waterflow alarm initiation devices with 250 psig (1725 kPa) pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125 V ac and 0.25 A, 24 V dc, complete with tamperproof cover.
  - 3. All vane type waterflow alarm initiation devices shall be equipped with an adjustable delay of audible alarm initiation. Adjustment range shall be from 0 to 120 seconds. Vane type waterflow switch shall be Potter Model VSR-F or approved equal.
  - 4. Waterflow vane-type alarm initiation devices shall be labeled as to the correct orientation of flow when mounted on system piping. When drilling of the system riser is necessary to mount flow switch, the drilled out disc (coupon) shall be retrieved and attached to the mounting u-bolt of the flow switch.

## 2.09 FIRE DEPARTMENT CONNECTIONS

- A. Fire department connections shall have a minimum of two 2½-inch inlets with National Standard Hose (NSH) threads, internal double clapper check valve, brass plugs, and attached chains.
- B. Fire department connections shall be installed down stream of the riser check valve.
- C. The completed installations shall include a metal sign or escutcheon plate, with raised lettering, marked "FIRE DEPARTMENT CONNECTION "AUTOMATIC SPKR."

## PART 3 - EXECUTION

### 3.01 INSTALLATION

#### A. Responsibilities

- 1. The Contractor is responsible for the installation of the automatic sprinkler system in accordance with these specifications and the contract drawings. The Contractor shall coordinate with architectural, mechanical, and electrical, design and construction documents, to ascertain the required information, to effect a properly designed and installed sprinkler system for the office complex construction and occupancy classification.
- 2. The installation of the automatic sprinkler system shall be complete with all necessary accessories for proper operation and shall be accomplished by a licensed sprinkler contractor or licensed company regularly engaged in this type of work, and in accordance with requirements of the National Fire Protection Association Standards (NFPA).
- 3. The fire protection system installation shall be coordinated with the other trades (mechanical, electrical and structural, etc.).

#### B. Contamination and Obstruction Prevention. Pipe interiors shall be kept free of debris.

#### C. Pipe and Fittings Above Ground

- 1. Pipe, fittings, and hangers shall be installed where shown on the drawings and in accordance with the requirements of NFPA 13.
- 2. Overhead sprinkler piping, drain and test piping, fire department connection piping, etc. installed through exterior walls shall be galvanized. All sprinkler piping shall be substantially supported from office complex structure and only UL listed or FM approved type hangers shall be used. Sprinkler lines under ducts shall not be supported from ductwork but shall be supported from office complex structure (with trapeze hangers where necessary), or from steel angles supporting ductwork in accordance with NFPA 13.
- 3. Flanged Fittings or Mechanical Groove Couplings

- a. Flanged fittings or mechanical groove couplings shall be used at the base of risers.
  - b. A flanged tapered reducer shall be installed at the flange and spigot piece when riser is smaller than the underground supply line.
  - c. Pipe shall be installed straight and true with no greater deflection at mechanical groove pipe couplings than is recommended by the manufacturer.
  - d. Plain end couplings are not acceptable.
  - e. Only rigid-type mechanical couplings shall be used. Only in those areas identified by NFPA 13 where flexible type mechanical couplings are specified will the use of flexible couplings be permitted. All other parts of the system shall use rigid-type mechanical groove couplings.
4. Pipe Hangers and Anchors
- a. Offsets in hanger rods will not be permitted.
  - b. Supports, hangers, braces, etc., shall be attached to the office complex primary structural members only.
  - c. When fastening hangars or braces to bar joists, the fastener shall be located within 4 inches of the panel point on the bar joist or truss.
  - d. All piping larger than 4 inches in diameter shall be supported from a minimum of two-bar joists when run parallel to a bar joist.
5. Welded joints: Welded joints are acceptable when shop fabricated in conformance to provisions of NFPA 13.
6. Screwed joints: Teflon paste and tape shall be used as pipe-joint compound at screwed joints.
7. Bushings: Bushings are not permitted.
8. Control valves: Control valves shall be provided with identification signs describing the areas protected. Where the valve location is concealed above the ceiling, a sign below the ceiling shall indicate the valve location, and identify the protected area.
9. Wall, Ceiling, and Floor Penetrations
- a. Unless otherwise specified, sleeves shall be of Schedule 10 steel and a minimum of two pipe sizes larger in diameter than the passing pipe.
  - b. Holes through walls, floors, and ceilings shall be large enough to accommodate pipe expansion. Spaces between pipe and sleeve or pipe and opening for floors and

exterior walls shall be filled with a non-hardening sealant material and made watertight.

- c. Escutcheons shall be provided at wall, ceiling and floor penetrations of piping in occupied areas.
10. The cutting of structural members for the passage of sprinkler piping or for pipe-hanger fastenings is not permitted.
11. Joints
  - a. Joints shall be made in accordance with the requirements of NFPA 13.
  - b. Joints shall be left exposed until final inspection and testing have been witnessed by the SDR.
  - c. Swing joints are preferred for connecting pendent sprinklers to branch lines.
12. Dielectric unions shall be used to connect dissimilar metals (such as steel to copper) to prevent electrolytic action.

D. Flange Joints, General

1. Flanged joints shall be face matched. Raised face flanges shall not be mated to flat-face cast-iron flanges on valves or equipment. The raised face shall be machined flush. All flange bolt holes shall straddle the horizontal and vertical centerlines unless otherwise noted. Bolting shall comply with ANSI B31.1, Power Piping. Torque values and tightening sequence for bolts shall be in accordance with flange manufacturer's instructions.
2. Install insulating kits on flanges connecting dissimilar metals (such as steel to copper) to prevent electrolytic action.
3. The following procedure shall be followed when making final assembly of a bolted flange joint.
  - a. Install the gasket on the gasket-seating surface and bring the cover flange in contact with the gasket.
  - b. Install all bolts, ensuring that they are free of dirt and grit, and are well lubricated.
  - c. Run-up all nuts finger tight.
  - d. Develop the required torque in each bolt in a minimum of four steps. A fairly even compressive force will be exerted on the gasket by:
    - (1) The first sequence shall set the bolts at 30 percent of the required torque. Damage to the gasket can result beyond this amount for the first sequence.

- (2) The second sequence shall set the bolts at 60 percent of the required torque.
- (3) The third sequence shall set the bolts at 90 percent of the required torque.
- (4) The fourth sequence shall set the bolts at 100 percent of the required torque. A final tightening shall be performed in a clockwise bolt-to-bolt sequence to ensure that all bolts have been evenly stressed.

### 3.02 SPRINKLER MAIN SYSTEM RISER

- A. The main system riser shall not be less than 4" in diameter and consist of the following:
  1. A double check valve backflow assembly.
  2. A gauge downstream of the double check valve assembly.
  3. A 2" drain valve (not a quick opening type) located downstream of the double check valve assembly.
  4. A vane-type water flow alarm initiation device installed down stream of the double check valve assembly.
  5. An electric bell located on the exterior of the prefabricated office complex adjacent to the fire department connection.

### 3.03 SPRINKLERS

- A. Pendent sprinklers below ceiling shall be aligned, and parallel to ceiling features, walls, etc. In areas without a suspended ceiling, install sprinkler piping as high as possible, using necessary fittings and auxiliary drains to maintain maximum clear headroom.
- B. Where two sprinkler systems abut, the pendent sprinklers shall be aligned in different directions to distinguish the boundaries of each sprinkler system.
- C. Sprinklers shall not be installed closer than 6 feet apart.
- D. Ceiling Areas: Where suspended ceilings are installed, the sprinkler Contractor shall install pendent sprinklers as shown on the reflected ceiling plans. Where reflected ceiling plans do not specify the location of the pendent sprinklers, the Contractor shall design sprinkler locations at least 6 inches from ceiling tile edges and 2 feet 6 inches from HVAC supply louvers. Install intermediate degree rated sprinklers if 2 feet 6 inches cannot be maintained from HVAC supply louvers. Sprinklers shall be installed following a repetitive pattern and along straight lines to the extent possible. Swing joints shall feed pendent sprinklers from 1-inch outlet tees in branch lines.



### 3.04 DRAINS

- A. Two-inch drains shall be installed on all main risers and downstream of any interior sectional valves, and shall be piped to drain.
- B. A pressure gage cock and approved gage shall be installed downstream of interior sectional valves of 4 inches size and larger. 3/4-inch valve auxiliary drains with standard hose threads and caps shall be installed at all low points in the system, where more than five sprinklers are trapped. Where the capacity of trapped piping exceeds 20 gallons (75-l), the overflow shall be piped to drain.
- C. Inspector's test connections shall be installed on each sprinkler system as near the most hydraulically remote end of the system as possible. The orifice shall be sized to discharge a flow equivalent to the smallest orifice sprinkler in the system. The inspector's test valve shall be located not more than seven feet above the floor in a visible, easily accessible location.
- D. Drains shall be piped to discharge outside prefabricated office complex in visible location.
- E. Drains and inspector's test connections through outside walls shall be run through the walls as close to the floor or grade line as possible, terminating with a 45 degree galvanized elbow turned down to splash blocks.
- F. Concrete splash blocks, 18" x 18" x 4" (45 cm x 45 cm x 10 cm) minimum in size, shall be installed under each drain or test outlet.

### 3.05 FIRE DEPARTMENT CONNECTIONS

- A. The check valve and normally open automatic ball drip (ABD) shall be located at points where they will not be subject to freezing temperatures, and the discharge from the ball drip shall be piped to drain. The ball drip shall close when the flow of water through the valve is in the range of 4 through 10 gpm (0.25 to 0.6 l/s). All ball drips shall be rated at 175 psi (1.2 MPa). Use valve-drains in place of automatic ball drip drains when the static head of water above the ABD will exceed 11'6" (3.5 m) (5 psi) (34 kPa). Check valves shall be UL listed or FM approved and shall have bodies with the UL or FM stamp.
- B. The fire department connection shall be installed between 18 inches and 48 inches above grade.
- C. Fire Department Connection shall be installed in an area accessible by the Fire Department.

### 3.06 IDENTIFICATION

- A. Control, drain, test, and zone water flow switches shall be provided with identification signs of the standard design adopted by the automatic-sprinkler industry, or their equivalent.
- B. A hydraulic data information nameplate shall be secured to the riser with chain, directly above the controlling check valve and shall include the following design data.
  - 1. Office complex designation

2. Location of remote area
  3. Design density
  4. Area of application
  5. System demand (gpm (l/s) and psi (kPa) at base of riser)
  6. Data shall be permanently engraved on the nameplate as follows:
  7. Material shall be durable plastic or aluminum. Minimum height of lettering is 1/8".
- C. The Contractor shall furnish and place in a clear, plastic envelope attached to each sprinkler main system riser the following:
1. One complete set of typed or printed maintenance and operating instructions.
  2. A set of prints of the as-built working drawings and hydraulic calculations of the sprinkler system.
- D. Contractor shall supply each riser with a cabinet containing maintenance and repair equipment (spare heads, wrench, etc.)
- E. Each Contractor shall affix an identification tag on each system riser indicating:
- Name of the Contractor
  - Business Address of the Installing Contractor
  - Phone Number
  - 24-hour emergency contact phone number.

### 3.07 FLUSHING

- A. Before connecting sprinkler systems to the main supply, each sprinkler supply line shall be flushed out thoroughly by the Sprinkler Contractor in the presence of the SDR, through an unrestricted opening not less than 4 inches in diameter. Minimum flowing quantities are specified in NFPA 13.
- B. Failure to comply with this requirement shall necessitate flushing of the entire sprinkler system by the Contractor at no additional cost to Sandia/NM.
- C. A 4-inch temporary pipe or two 2½-inch fire hoses shall be provided by the Contractor to discharge water to a suitable location, as designated by the SDR.
- D. The Contractor shall flush interior sprinkler piping when required by the SDR.

### 3.08 TESTING

- A. Aboveground Tests: Prior to acceptance of the installation, the Contractor shall, in the presence of the SDR, subject the system to the tests required by NFPA 13 for the completion of the Contractor's Material and Test Certificate.

1. Hydrostatic testing shall be performed before any ceiling is installed below the sprinkler piping. Each water control valve shall be fully opened and closed under water pressure to ensure proper operation.
  2. Where sprinkler locations are roughed-in, using plugged drop nipples projecting below the level of the finished ceiling; the hydrostatic testing shall be performed two times.
    - a. First, after the system is completed using the plugged drops, and before the ceiling panels are installed.
    - b. Second, after the plugged drop nipples are cut to length for the finished ceiling, or replaced with other drop nipples of the correct length, and the sprinklers installed.
  3. The addition of sodium silicate (also known as water-glass) and related substances before hydrostatic testing, to stop water leakage, is not permitted.
  4. Pipe interiors shall be kept free of debris.
- B. Alarm Testing: Contractor shall be responsible for testing new alarms and modified alarms installed under this contract. Defective alarms shall be replaced immediately.

### 3.09 PROTECTION AGAINST FREEZING

- A. Sprinkler piping passing through any unheated spaces in, under, or outside prefabricated office complex exposed to freezing, shall be protected as shown on the plans or in accordance with the methods specified in NFPA 13. Exposed to freezing is defined as any location where the temperature may drop below (40°F) 5°C at any time during the year.
- B. Heating shall be provided for sprinkler protected spaces in lieu of providing anti-freeze systems except where otherwise noted on the drawings or specified herein.

### 3.10 PROTECTION FOR BACKFLOW PREVENTION

- A. A double check valve backflow prevention assembly shall be installed on all new systems and where shown on the drawings for modifications to systems to prevent cross-connection contamination between potable water systems and any fire sprinkler system. Install the (DCVA) at the service connection for the fire sprinkler system or as noted on the contract drawings.
- B. (DCVA) assemblies shall be either FM approved or UL listed and be approved by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California (USC-FCCHR).
- C. Backflow prevention assemblies used or installed under this contract shall be tested by a "Certified Backflow Control Assembly Tester" who possesses a current (within three (3) years from date of issuance) certificate that confirms successful completion of an approved (SDR specified or USC-FCCCHR or Colorado Environmental Training Center, Golden, Colorado) training course.

- D. DCVA assemblies shall be installed in accordance with AWWA Manual M14 requirements, or as directed by the SDR.
- E. If DCVA devices will be installed outside the office complex they must be in heated enclosures and with adequate space for inspection, tests and maintenance.
- F. The Contractor shall perform an operational test on any new or relocated backflow prevention assemblies used or installed under this contract. Passing backflow preventers shall be labeled with a tag indicating: test performed, tester's initials and date. Testing documentation shall be submitted to the Sandia Delegated Representative (SDR).
- G. Repairs to DCVA shall be made with original manufacturer's parts.
- H. A full forward flow test shall be conducted per NFPA 13 requirements at the time of system acceptance and witnessed by the Sandia/NM Fire Protection Engineer.

### 3.11 PAINTING AND LABELING

- A. Contractor shall paint those portions of fire protection as required by Section 09900, "Painting". Labeling shall be as follows:
  - 1. Sprinkler system (e.g., inspectors tests, drain valves) shall be labeled with all information required by NFPA Standard 13.
  - 2. Labeling shall be accomplished with the use of permanently marked weatherproof metal or rigid plastic identification signs. The signs shall be secured with corrosion-resistant wire, chain, or other approved means. These signs shall be provided by the manufacturer, manufacturer's representative, or installer of the sprinkler system.
  - 3. Sprinkler riser shall be labeled with office complex and sprinkler system riser numbers. Labeling shall be accomplished with the use of "Brady" or approved equal self-sticking labels. The color and size shall contrast the surface that it is applied to. The labels shall be provided and applied by Sandia/NM Fire Protection Systems Maintenance Organization.

### 3.12 DISINFECTION

- A. Piping installed under this contract shall be disinfected per AWWA C651 before it is placed in operation, by using one of the following methods.
- B. EXCEPTION: Where non-potable fire protection piping is added downstream of a RPBFP, disinfection is not required.
- C. Continuous Feed Method:
  - 1. Place calcium hypochlorite in pipe sections when installing pipe or inject liquid chlorine into the system via the injection port. Pipe is filled with water and chlorine concentration shall remain at 10 mg/l for a minimum of 24 hours. During this time, all valves in new section will be cycled open and closed to allow for adequate disinfection.

Valves connecting the new or repaired line with mains in active service shall remain closed to prevent chlorine pollution.

2. Samples shall be drawn at 1-, 4-, 8-, 12-, 16-, 20-, and 24-hour marks to determine the chlorine concentration. Acceptable tests are the N-diethyl-p-phenylenediamine (DPD) drop dilution method (AWWA C651, Appendix A) or the High Range Test Kit. The tests shall be done by the contractor and witnessed by the SDR. The results shall be recorded for auditing purposes.

D. Slug Method:

1. Similar to the continuous feed method. Follow AWWA C651. Chlorine concentration to be 100 mg/l for a minimum of 3 hours. During this time, all valves shall be cycled open and closed to allow for adequate disinfection. Valves connecting new or repaired lines with mains in active service shall remain closed to prevent chlorine pollution.
2. Samples shall be drawn every 15 minutes to determine concentration. Acceptable tests are the DPD drop dilution method or the High Range Test Kit. The tests shall be conducted by the contractor and witnessed by the SDR. The results shall be recorded for auditing purposes.

E. Repairing or Cutting into Existing Mains:

1. New interior piping surfaces shall be swabbed with a one- percent hypochlorite solution. The section being modified shall be subjected to a high chlorine disinfection process per AWWA C651. The concentration shall be a minimum of 300 mg/l for 15 minutes.
2. Samples shall be drawn before the chlorine is injected and every 5 minutes thereafter. Chlorine concentration shall be tested by the contractor or SDR designee using the High Range Test Kit. SDR shall witness the test and results shall be recorded.

F. Flushing:

1. After the lines have been chlorinated using one of the above methods, it becomes necessary to flush the lines with water until test sample indicates that the water is suitable for drinking. The residual chlorine concentration in the water is to be between 0.2 and 2.0 mg/l, as measured using a Low Range Test Kit. The test shall be witnessed by SDR or other SDR designee and the results recorded.
2. Heavily contaminated water shall be disposed of or neutralized under the direction of Sandia/NM Pollution Prevention and Environmental Monitoring Department.

G. Bacteriological Testing:

1. All new and modified water lines require testing for coliform organisms per AWWA C651. The testing shall occur after successful chlorination and flushing of the lines. Samples shall be taken from the new line in sodium thiosulfate treated sterile bottles and analyzed as specified by APHA's Standard Methods for the Examination of Water

and Wastewater. Analysis, at the discretion of the SDR representative shall be performed by Sandia/NM Industrial Hygiene or an independent laboratory.

2. Results shall be recorded with the original documentation of results attached. These will be used for auditing purposes.
3. Fire protection lines will not be accepted until a negative bacteriological test is performed. Lines will be chlorinated and flushed repeatedly, at no additional cost to Sandia/NM, until such a negative test is accomplished.

#### PART 4 – CADD SOFTWARE GUIDELINES FOR DRAWING SUBMITTALS

##### 4.01 MicroStation J

- A. Sandia/NM Facilities maintains MicroStation J for Windows/NT, release 05.07.01.14 (vector) as its standard CADD software. When future upgrades occur, it is required that the Fire Alarm Designer utilize the new workspace and MicroStation software. To maximize efficiency, Sandia/NM will provide a custom MicroStation J workspace environment, which includes toolboxes, tool frames, macros, MicroStation Development Language (MDL) application, user commands, help routines, and menu bars to help in the production of facilities CADD files. Refer to the Facilities CADD Standards Manual for further instructions.

##### 4.02 AutoCAD

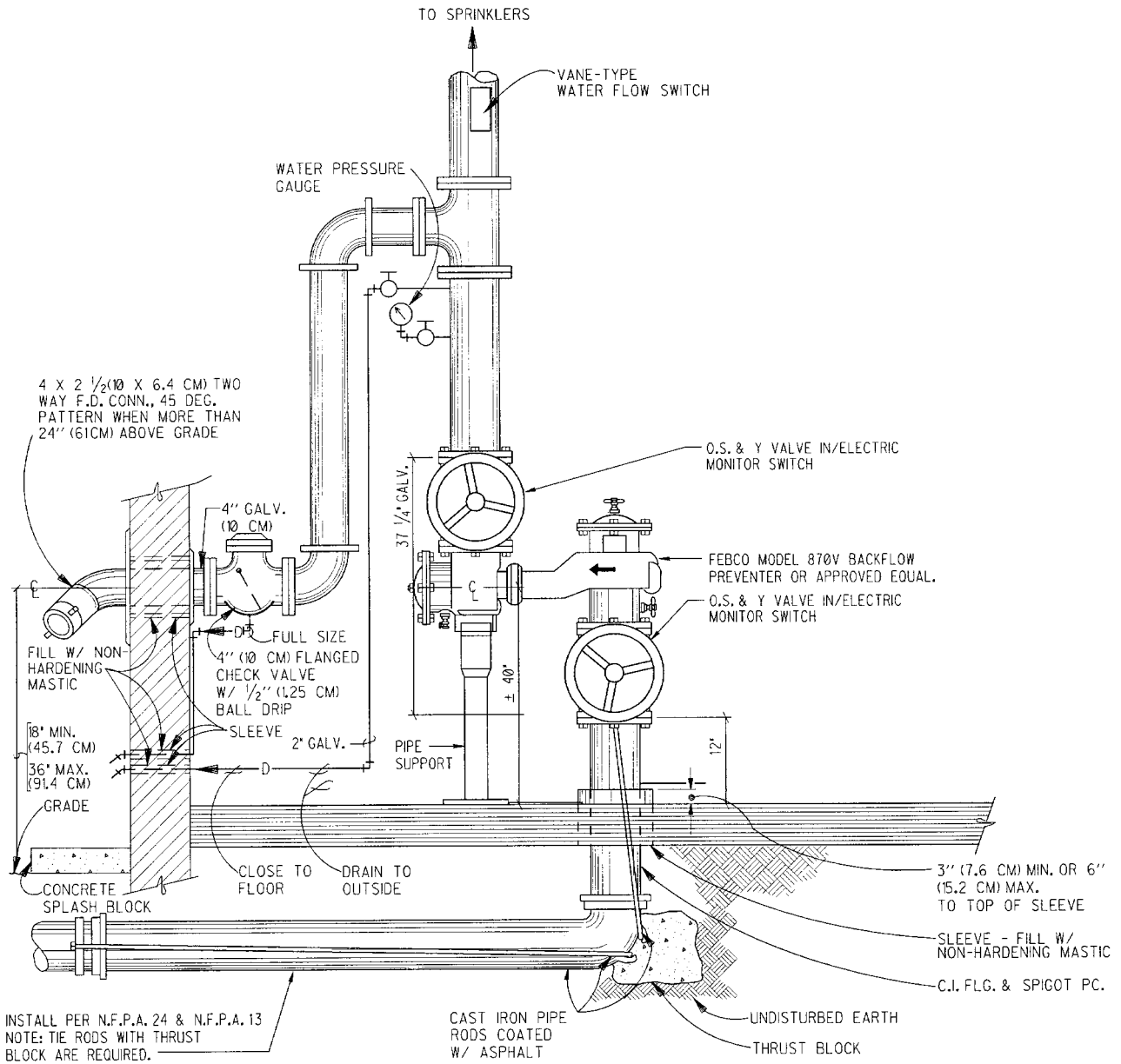
- A. AutoCAD 2000 or later versions may be used in lieu of MicroStation J under the condition that the following requirements will be met:
  1. The translated MicroStation architectural floor plan must be referenced into AutoCAD model. Each AutoCAD model will show the Fire Alarm Design for a given floor.
  2. The Sandia/NM standard border files must be referenced into all project sheets (layout tabs). Each layout tab will contain border, keyed notes, general notes, details, and title block information. Each layout tab will be identified (labeled) with correct Sandia/NM plotted file name.
  3. All data, designs, records, graphics and supporting tools generated during project creation shall be included in the deliverable file package.
  4. Any fonts, line styles, or blocks used to generate these files that are not AutoCAD 2000 standard must be submitted as part of the deliverable package.
  5. All layers will follow CAD Layer Guidelines, 2nd edition or newer, established by the American Institute of Architects.

6. A table, listing all line, text, and block information will be created within each design file just outside of the plotted area. Information to include: layer names, color, pen width association, line style, description, text size, block names and identification of frozen layers.
7. When design is completed, all deliverables must be in MicroStation J format. Any assistance or questions should be directed to and from the Sandia/NM CADD Coordinator.

## PART 5 - ATTACHMENTS

### 5.01 Attachment 1 – Shotgun Riser Detail

END OF SECTION



Attachment 1 – SHOTGUN RISER DETAIL