Clark County Fire Prevention

Mission Statement: "To provide the highest level of fire protection and related services"

Permit Type: 105.8.f.2

TITLE: **REQUIREMENTS FOR A NEW SPRINKLER SYSTEM IN ACCORDANCE WITH THE 2002 EDITION OF NFPA 13**

PURPOSE: To standardize Clark County Fire Department plan review of fire sprinkler system plans**.**

SCOPE: This guideline covers fire sprinkler system design for typical commercial facilities. This guideline does not cover systems with fire pumps, ESFR sprinkler systems, Large-Drop sprinkler systems, or Specific Application sprinkler systems.

At the time of permit application, three (3) sets of plans, drawn to an indicated scale and legible, must be submitted for review and approval. Permit fees for this type of submittal vary. The standard permit fee is due upon submittal. Please see the **Clark County Fire Department Permit and Service Fee Schedule** for specific information. Please check our website for plan status. Any additional fees will be indicated on the website. Once the plans have been approved and any outstanding fees have been paid, an inspection can be scheduled.

Our website is http://www.accessclarkcounty.com/fire/firedept.htm. To check on plan status, click on the "Plan Status" button and follow the instructions. To schedule an inspection, click on "Services" in the teal strip on the top. On the left side under **Inspection** click on "Fire Inspection" and follow the instructions.

The following items included on plans and in submittals:

Name, physical address, and Assessors Parcel Number (APN) of the project must be included on the plans. Plans shall also designate the authority having jurisdiction. Plans must be drawn to an indicated scale or be suitably dimensioned and legible.

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Revised January 13, 2010, FPB Approved 04 08 2010

For a new sprinkler system plan, the following information is required. A separate submittal is required for each separate building:

- The plan must show a **top view** of the new sprinklered area on a common architectural scale, ie 1/4", 1/8" 3/16", etc. All walls and doors need to be shown, and each room must be labeled according to use. Check the architectural scale against typical building elements (ie door width, ceiling tiles, etc). The top view must consist of a **piping** plan and a **reflected ceiling** plan. The piping plan must show pipe layout, pipe dimensions, attachments, braces, hangers, sprinkler outlets, hydraulic nodes, etc. The reflected ceiling plan must show ceiling layout, walls, soffits, obstructions in protected area, and sprinkler head layout.
- The plan must show **section views** to describe the locations of mains, lines, and heads with respect to the structure. A minimum of one view is required, although additional views may be necessary to determine compliance with NFPA 13. The section view must be drawn to a common architectural scale, ie 1/4", 1/8" 3/16", etc.
- The plans must be **sealed** either by a Fire Protection Engineer or a designer holding a minimum **Level II** certification in automatic sprinkler layout from the National Institute for Certification in Engineering Technologies **(NICET)**
- The plans must show a **site plan** describing the underground supply to the building. The site plan must show and label all fronting roads, show the public water mains, show the location of water meters, show the on-site underground water supply, show the building outline, show the riser location, show the fire riser room/post indicator valve, show the FDC location, show the fire access lane within 100 feet of the FDC, and show the flow and gauge hydrants used for the water supply test.
- **Water supply** results must be provided on the plans adjacent to the site plan. The data that must be provided include the static pressure, the residual pressure, the outlet opening, the pitot reading, the calculated flow, time the test is conducted, and who conducted the test. When determining flow, verify that the coefficient for the outlet (0.9 maximum) and that the coefficient for 4" outlet (if used) is provided (0.83 per NFPA 291).
- Check that **general notes** are provided. The general notes need to indicate the following information:
    - General description of **building use** and associated **occupancy classification** from NFPA 13
    - Description of **sprinklers used**, detailing the response type, temperature rating, coverage style (standard or extended), orifice, k factor, and orientation (pendant, upright, sidewall, etc)
    - Manufacturer, schedule and type of **branch line piping**
    - Manufacturer, schedule and type of **main line piping**
    - Manufacturer and type of **fittings**
    - Manufacturer, schedule and type of **underground piping**
    - Manufacturer, model number and type of **water meter assembly**
    - Type of **freeze protection** (building heated, dry system, anti-freeze system, etc)
    - Maximum sprinkler **deflector distance** below roof deck
    - **Type of construction** (combustible or non-combustible)
    - Whether construction is classified as **obstructed** or **unobstructed**
    - Whether **central station monitoring** of system is required
- Determine the **occupancy classification** of the system. The classifications can be **light** hazard, **ordinary** hazard, **extra** hazard, and various **storage** hazards. For storage occupancies, verify that the proposed storage height and commodity are indicated in the general notes and on the hydraulic calculation placard detail. See Chapter 5 (and Appendix) of NFPA 13 to determine the hazard classification. **Concealed combustible** spaces are considered **Light Hazard** Occupancies per Section 8.14.1.3 of NFPA 13, with spacing requirements of heads in concealed spaces to be in accordance with Table 8.6.2.2.1.
- Check the **seismic braces** on the plans. Seismic braces must be attached to primary structural members, and never are allowed to be attached to the bottom plate of trusses or to any lightweight structural members. There are three general items to look at; **calculations, details**, and **locations** on mains/lines.
    - **Calculations, Lateral and Longitudinal Braces**: **Lateral braces** are those where the brace pipe is perpendicular to the main/line that the brace supports. **Longitudinal braces** are those where the brace is parallel to the main supported. **Lateral braces** need to support load of mains and branch lines, plus a safety factor, within the zone of influence. **Longitudinal braces** need to support the loads of mains (but not branch lines), plus a safety factor, within the zone of influence.
        - **Zone of Influence**: The zone of influence is determined by calculating the proposed separation between braces, and splitting the main at the middle between the braces. Therefore, if lateral

braces are shown 40 feet apart, then each brace must support 40 feet of main (20 feet to each side with brace at center) and all of the branch lines that attach to the main within that 40 feet dimension. Also, if lateral braces are shown 80 feet apart, then each brace must support 80 feet of main (40 feet to each side with brace at center).

- **Earthquake Load (pounds)**: For **lateral braces**, the load is one-half of the weight of the main plus one-half the weight of branch lines. For **longitudinal braces**, the load is one-half the weight of the main. Use Table A.9.3.5.6 for weights with respect to pipe diameter and schedule when verifying load (note; dyna-flow, dyna-thread, etc have lower weights; check specification sheets for those weights). The **safety factor** required by NFPA 13, Section 9.3.5.6.1 is 1.15 (15%).
- **Brace Selection**: When the load (pounds) is verified, check that the **brace** is sufficient for the load, with **l/r not exceeding 200**, per local amendment to Sections 9.3.5.8.2 and 9.3.5.8.6. See Table 9.3.5.8.9(a) and Table 9.3.5.8.9(b) to verify that the brace is of sufficient diameter and maximum length to meet the l/r 200 max requirement and is sufficient to maintain the calculated load.
- **Fasteners, NFPA 13 Prescriptive**: When the load (pounds) is verified, check that the **fasteners** are sufficient to maintain the attachment between the brace and the structure. There are multiple variables with fasteners, including angles of attachments, type of construction attached to (wood, concrete, steel), and fastener diameter and length. See NFPA 13 **Figure 9.3.5.9.1** for prescriptive requirements. For attachment up into the roof/ceiling assembly, use details A-C, depending on brace angle. For attachment to members (beams, trusses, etc) where the brace is perpendicular to the member (top view), use details D-F, depending on brace angle. For attachment to members where the brace is parallel to the member (top view), use details G-I, depending on brace angle.
- **Fasteners, Manufacturer Specified**: Many manufacturers, TOLCO, AFCON, etc., produce **specific sway brace fasteners**. These fasteners are allowed to be installed by NFPA 13, Section 9.3.5.10. Where the fasteners are attached to braces that are not perfectly horizontal (braces typically at an angle), the manufacturer **rating for the fastener needs to be decreased** by a certain percentage, per **Table 9.3.5.10.3**.

o **Seismic Brace Details**: Section view details are required to shown on plans. The details need to specifically indicate the following:

- **Brace** type, diameter, and length
- **Angle** of brace from **vertical**, 0° to 90°.
- **Fastener** type, diameter, length, and location into member (side attachements)

o **Brace Locations**: Braces shall be provided on mains and branch lines as follows

- **Lateral Braces** shall be spaced at a maximum separation of **40 feet**. Where the lateral brace calculations require a smaller separation distance, then the smaller separation distance shall apply. The distance from the last lateral brace to the end of the pipe braced shall not exceed 20 feet, or ½ the maximum separation distance, and the last length of pipe shall be provided with a lateral brace. Lateral braces are required on **mains** regardless of size, and on **branch lines that are 2.5 inch or greater** diameter. Lateral braces are allowed to be **deleted** where the pipe is supported by **hangers with rods less than 6 inches long**.
- **Longitudinal Braces** shall be spaced at maximum separation of **80 feet**. Where longitudinal brace calculations require a smaller separation distance, the smaller separation distance shall apply. The distance from the last longitudinal brace and the end of the pipe shall not exceed 40 feet, or ½ the maximum separation distance. Longitudinal braces are required on **mains** regardless of size, but are not required on branch lines. Longitudinal braces may not be deleted where the pipe is supported by hangers with rods less than 6 inches long.
- **Combination Braces**: When a brace is located within **24 inches** of an elbow/tee, it may serve as a longitudinal brace for one main and for a lateral brace for the perpendicular main. Where a brace serves **dual purpose**, it shall be capable of supporting the **lateral load and longitudinal load added together.**
- **Four-Way Braces**: Four-Way braces shall be provided at the tops of all risers exceeding **3 feet** in height. These may act as lateral and longitudinal braces for the main if calculated to support the imposed loads.

- **Hangers**: Verify that the **hanger** detail indicates a code compliant hanger assembly. Verify that the **attachment to the structure** is as specified in Section 9.1 of NFPA 13 or complies with a manufacturer information sheet.

Where the method of attachment is specific to a manufacturer product, verify that the manufacturer name and product model number is indicated on the plan. Verify that the **rod size** is correct in accordance with Table 9.1.2.1 of NFPA 13. Verify that the hanger assembly is capable to support the correct diameter of pipe for which the assembly is intended.

- **Hangers**: If there are **multiple hanger details**, verify that each **detail is labeled** and that each **hanger on the plan is also labeled** to identify which hanger assembly is proposed for each hanger location.
- **Hangers:** Verify correct **spacing of hangers**. Hanger spacing is dependent on pipe material and diameter in accordance with **Table 9.2.2.1** of NFPA 13. All **arm-overs** exceeding **two feet** in horizontal length require a hanger. Where the system pressure exceeds **100 psi**, **arm-overs** to pendant heads below ceilings **exceeding 12 inches** in length require a hanger.
- Verify a **riser diagram** for the system. The riser diagram must indicate all components on the riser, including:
    - Check valve
    - Flow Switch (pressure switch for dry system)
    - Control Valve
    - Main Drain, sized per Table 8.15.2.4.2
    - Sprinkler head box, with quantity per Section 6.2.9
    - Flexible Couplings, per Section 9.3.2
    - Gauges
    - Dry pipe valve (verify a note adjacent to the dry pipe valve that water will reach the inspector test valve within 60 seconds regardless of system size per amendments to Section 7.2.3.6)
    - Dry Pipe Trim (hi/lo air pressure, air maintenance device, accelerator, etc)
    - Air compressor (dry pipe system)
    - Exterior Horn/Strobe
- **Systems Attachments**: Various system attachments must be shown, such as the **inspector test valve** and the **FDC**. Verify a detail of both the inspector's test valve and the FDC, and that these items are shown on the sprinkler system plan view. The inspector test valve must be located at the most remote point of the sprinkler system. The FDC must be located on a wall facing a fire access lane, and must be within 100 feet of the fire access lane. The FDC must be sized per Section 8.16.2.3. Where the required pressure at the base of riser exceeds 150 psi, a **sign** shall be provided that indicates the required inlet pressure. A **pressure relief valve** is required as a system attachment if the sprinkler system has gridded pipe. The pressure relief valve may be located on any point of the system, but is typically found either at the riser or at the inspector test valve.
- Verify that the **sprinkler legend** is accurate, and indicates the model, id number, response type (QR required for Light Hazard areas), sprinkler orientation, temperature rating, orifice size (minimum 1/2" required), k factor, and quantity of each sprinkler head installed.
- Verify correct **spacing** of fire sprinkler heads.
    - The spacing of heads is dependent on **head types**; see the specific NFPA 13 tables for **standard spray upright/pendant** (8.6.2), **standard spray sidewalls** (8.7.2), **extended coverage upright/pendant** (8.8.2), and **extended coverage sidewalls** (8.9.2).
    - In **Light** Hazard, spacing of **standard spray upright/pendant heads** is 15 feet maximum between heads. The distance to walls must be equal to or less than ½ of the allowable distance between sprinklers (except for small room rule, where a distance of 9 feet is allowed to one wall). The maximum total coverage area for a sprinkler in a Light Hazard Occupancy is 225 square feet.
    - In **Ordinary** Hazard, the spacing of **standard spray upright/pendant heads** and the distances to the walls are the same as for Light Hazard, except that the total coverage area per sprinkler is reduced to a maximum of 130 square feet.
    - In **Extra Hazard**, the spacing of **standard spray upright/pendant heads** depends on the **discharge density**. If the discharge density is **less than 0.25 gpm/sqft**, then the spacing of heads and distances to the walls are the same as for Light Hazard, except that the total coverage area per sprinkler is reduced to a maximum of 130 square feet. If the discharge density is 0.**25 gpm/sqft or greater**, then the maximum spacing between heads is 12 feet. The maximum distance to walls is ½ the maximum separation, and each sprinkler may cover a maximum coverage area of 100 square feet.
    - In **Storage Occupancies**, the **spacing of the standard spray upright/pendant heads** depends on **discharge density**, and is exactly **equal** to the spacing requirements for **Extra Hazard**. The k-factor for heads in storage facilities must be upgraded whenever the design density exceeds 0.20 gpm/sqft per

Section 12.1.3.
    - Where **extended coverage** heads are installed, verify that the proposed sprinkler protection area is indicated on the manufacturer specification sheet.
    - For dry systems utilizing pendant heads, verify that the sprinklers comply with NFPA Section 7.2.2.
- In accordance with the amendments to the Fire Code, an **interior horn/strobe device** is required for each building and is also required in each tenant space in a multi-tenant building, for the purpose of occupant sprinkler notification. If the space being protected is either the entire floor area of a building or a separate tenant within a multi-tenant building, then the installation of an interior horn/strobe needs to be indicated.
- **Hydraulic Calculations** shall be provided to prove that the sprinkler system can perform to meet the requirements of NFPA 13. Required hydraulic criteria are specified in Chapter 11 and Chapter 12. Hydraulic calculations prove either an area/density or a room design method, incorporate hose demand, and detail the friction loss for a sprinkler system.
- **General Hydraulic Calculation Requirements**. Hydraulic calculation forms must be provided to completely prove that the system will perform to NFPA 13 requirements. There are several submittal requirements that apply to all types of hydraulic calculations, as follows:
    - **Supply Information**: Water supply information is required to be shown on the plans. Further, the water supply information is required to be indicated on the hydraulic calculations. A curve showing the water supply with respect to the system demand must be provided.
    - **Safety Factor**: A minimum pressure safety factor of 10 psi must be provided at the maximum system flow. The safety factor is the pressure available from the water supply minus the required pressure from the sprinkler system and hose demand.
    - **Remote Area Marking**: The area containing the hydraulic area must be indicated on the plan by shading of the area or otherwise delineating the remote area boundary.
    - **Hydraulic Nodes:** All points of analysis, which include discharging sprinkler heads, points where pipe size changes, tees where internal water flow splits along two directions, top of riser, bottom of riser, supply point, meters (if supply calculation is off-site), and other chosen points of analysis shall be indicated on the plans and on the calculations with hydraulic node labels.
    - **Sprinkler Discharge**: Check that each sprinkler has sufficient discharge to cover the area protected. If the coverage area assigned to a sprinkler is 125 square feet, and the required density is 0.20 gpm/sqft, then the minimum discharge from the sprinkler is 25 gpm.
    - **Hydraulic Summary:** Hydraulic summaries are required on the plan sheets and in the hydraulic calculation forms (NFPA 13, Section A.14.3.2(a)). Generally, the summary shown on the plan sheets should be shown adjacent to the associated remote area. Both summaries must indicate, occupancy classification (per NFPA 13), design density, total remote area (square feet), system flow including hose, pressure required at base of riser, and storage height and commodity (storage occupancies).
    - **Graph Sheet**: A graph sheet must be included with the hydraulic calculation forms. The graph sheet must graphically depict the water supply, as determined by the hydrant flow test. Also, the graph sheet must graphically depict the demand for the sprinkler system, including hose. See NFPA 13, Section A.14.3.2(d) for an example of a graph sheet.
    - **Node Summary**: Each node that is analyzed needs to be listed on the node summary. The node summary will indicate whether the node is flowing, the elevation of the node, the k-factor for sprinklers, the pressure in the node, etc.
    - **Node-to-Node Pipe Summary:** The pipe summary describes the flow between nodes. The summary will indicate flow through each section of pipe, pipe diameter, pipe length, flowing sprinkler nodes, pipe C factor (see Table 14.4.4.5), velocity (32 ft/sec max), node elevations, pressure at nodes, friction pressure loss along pipe, pressure loss due to elevation, loss through fittings, etc.
    - **Hose Demand:** A hose demand must be added to the demand requirements for sprinkler systems. The demands are unique for Light, Ordinary, Extra, and Storage Hazard systems. See Table 11.2.3.1.1 and the multiple tables in Chapter 12 for hose demand requirements.
- **Area Density Method.** The area density method is the predominant method of proving hydraulic calculations. For Light, Ordinary, and Extra Hazards, see Figure 11.2.3.1.5. For Storage Hazards, there are multiple figures in Chapter 12. The calculations need to prove a minimum density of water per square foot (gpm/sqft) over a specified design area. The design density and design area used needs to match those set forth in the figures provided in NFPA 13.

    - **Shape of Remote Area:** The remote area used in the area density method needs to be laid out in a specified rectangular shape per Section 14.4.4.1.1.1. The side that is parallel to the run of the branch lines must be a minimum length equal to the square root of the design area times 1.2. Therefore, if the design area needs to be 1,500 square feet, the side along the branch line must be (1.2)*(√1500) = 46.5 feet
- **Area Modifications:** There are various modification to remote area prescribed by code. When the area is modified, the required design density is not modified.
    - **Quick Response Reduction**: For light and ordinary hazard occupancies, the total remote area size can be reduced when quick response heads are used in the design, per Section 11.2.3.2.3. Any proposed reduction in the remote area must show a calculation in accordance with the formula in NFPA 13.
    - **Dry Pipe/Preaction System Increase:** When a sprinkler system is filled with pressurized air, the remote area needs to be increased by 30%.
    - **Sloped Ceiling Increase:** For sprinklers under sloped ceilings, the remote area needs to be increased by 30% when the slope exceeds 2 in 12.
    - **Extra Hazard High Temp Head Reduction:** Where high-temperature heads are used in Extra Hazard systems, the remote area may be reduced by 25%, but no less than 2,000 sqft. The reduction must be indicated on the plans.
- **Room Design Method:** For small rooms, it may be more advantageous to the designer to calculate the sprinkler system to meet the room design method. The room design method allows for calculation only of the sprinkler heads that cover the room that is analyzed. The room design method is allowed only for Light, Ordinary, and Extra Hazard.
    - **Light:** One option is to protect openings. Protected openings must be protected by automatic/self-closing opening protectives, and the protection does not have to be rated. The other option is to extend the protection through unprotected openings. If the openings are not protected, then up to two heads through each unprotected opening needs to be added to the sprinklers serving the room being calculated
    - **Ordinary and Extra:** In order to use the room design method, openings must be provided with protection. The protection must be fire-rated in accordance with Building Code requirements, and the protection must be automatic/self-closing. If the openings are not protected, the entire room through openings must be incorporated into the design area, until the minimum remote area is met or walls with proper opening protection is encountered.

Revised and Resubmitted Plans:

Where plans are revised due to a field change from existing approved plans or resubmitted due to a plan review denial, such submittal shall include all items set forth in this guideline. Further, all of the changes that occurred on the plans must be clouded on the plans to allow for distinction between the areas that were and were not changed. In addition, either a copy of the previous approved plan, or the red-line marked plans from the denied submittal, must be provided with the submittal. These are required to allow review of changes that occur on the plans between different submittals.