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DOC: SGE-EB-2026-05

E-BOOK 05 INTERMEDIATE EDITION

Sprinkler System Design Workbook

Hazard Classes, Coverage, Pipe Sizing and Installation Checks

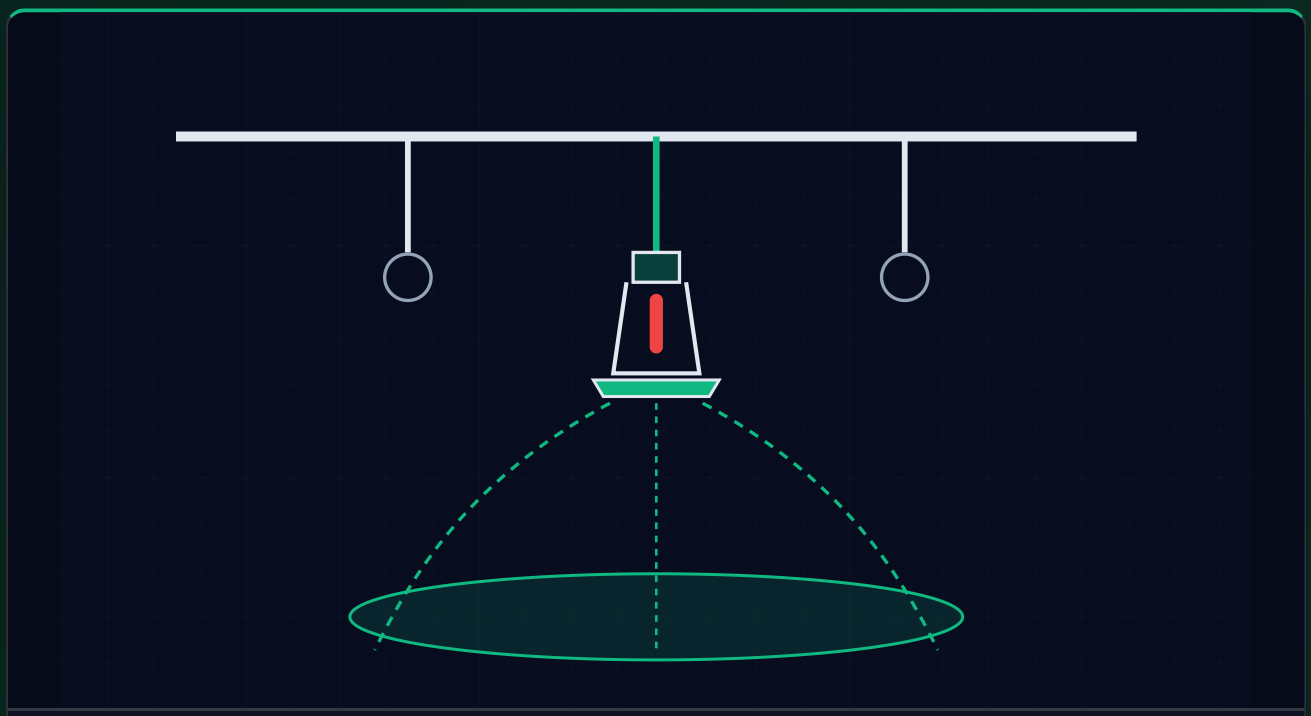


FIG 05.1 — PENDENT SPRINKLER HEAD GEOMETRY & BRANCH HYDRAULIC GRID

SYLLABUS
10 Structured Chapters

CALCULATIONS
Worked SI Examples & Tables

SITE READY
Forms & Hinglish Glossary

Shree Ganesh Enterprises (SGE) — AMC MEP 24x7
Fire Fighting · Fire Alarm · Electrical · Plumbing · HVAC · IBMS · AMC

1st Edition, 2026
sge.org.in/ebooks/sprinkler-system-design-workbook

Sprinkler System Design Workbook

Hazard Classes, Coverage, Pipe Sizing and Installation Checks

A complete engineering workbook for automatic fire sprinkler systems covering wet, dry, pre-action, and deluge architectures, quartzoid bulb ratings, hazard classifications, hydraulic pipe sizing vs pipe schedules, progressive Hazen-Williams branch balancing, ZCV alarm trim, and safe installation checks.

Intended Audience: Fire fighting design engineers, sprinkler execution supervisors, MEP project managers, and facility teams testing alarm valves and flow switches.

Engineering Notice & Standards Policy

This publication is an educational and field-reference guide prepared by **Shree Ganesh Enterprises (SGE)**. It is **not** a substitute for a stamped project design, statutory approval, or the governing text of the National Building Code of India (NBC), Bureau of Indian Standards (BIS) codes, Indian Electricity Rules / CEA Regulations, or your State/Municipal Fire Service Bye-Laws. Standards are cited at document level; always verify the **current applicable edition**, manufacturer datasheets, and local amendments before design, procurement, testing, or certification.

Worked numerical examples across this book are illustrative engineering demonstrations. All design inputs, pipe friction factors, battery deratings, and protective clearances must be re-checked for project conditions by a competent licensed professional. High-voltage electrical testing, pump-room servicing, and gaseous fire suppression operations can be fatal if undertaken without qualified personnel, written Permits-to-Work, and Lockout-Tagout (LOTO) controls.

Roman-script Hindi/Hinglish site terms are included cleanly to assist execution teams; formal English engineering terminology governs contractual and code interpretations.

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Publisher: Shree Ganesh Enterprises (SGE) — AMC MEP 24x7 | **Web:** sge.org.in | **Support:** support@amcmep.in

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What You Will Learn

- Select Wet, Dry, Pre-Action, or Deluge sprinkler architectures based on building temperature and water sensitivity
- Decode sprinkler head orientations (pendent, upright, sidewall) and glass-bulb temperature colour codes
- Understand Light, Ordinary, and Extra/High hazard design densities and ceiling clearance rules
- Execute progressive Hazen-Williams node balancing across multi-head sprinkler branches
- Verify K-factor flow rates (Q = K * sqrt(P)) and total combined sprinkler + hose water demand
- Inspect Zone Control Valves (ZCV), alarm check valves, flow switches, hangers, and hydrotests cleanly

Chapter 1: Types of Sprinkler Systems and Selection Criteria

Matching System Architecture to Environment

An automatic fire sprinkler system detects heat directly at the seat of a fire through individual thermal elements and applies controlled water spray locally—usually extinguishing or containing the fire using only 1 to 4 heads rather than flooding the entire building. Choosing the correct pipe-filling method prevents freezing, false flooding, or slow response.

System Type	Pipe Condition	Release Trigger	Best Application
Wet Pipe	Always filled with pressurised water	Heat shatters individual glass bulb	Offices, apartments, malls, hospitals, basements (above 4 C)
Dry Pipe	Filled with compressed air/nitrogen	Bulb breaks -> air vents -> dry valve opens	Unheated cold-storage outside chillers, semi-open frosty canopies
Pre-Action	Dry pipe + electric fire detector interlock	Needs BOTH detector trip AND broken bulb (double interlock)	Archives, museums, server corridors, high-value IT rooms
Deluge	Open heads (no bulbs!) on empty piping	Smoke/heat/linear detector opens Deluge Valve -> ALL heads discharge at once	Transformer bays, aircraft hangars, curtain glazing, chemical tanks

NOTE

System design densities, maximum head spacings, and water durations depend on IS 15105, NFPA 13, and NBC 2016 Part 4. Confirm the governing standard, edition, and insurance underwriter rules (e.g., TAC / FM) before freezing design.

HINGLISH

Wet system = pipe mein hamesha paani bhara rehta hai. Deluge system = khule hue nozzles jinme fire detector se signal aane par ek saath tez baarish hoti hai.

Chapter 2: Sprinkler Heads, Deflectors and Bulb Temperature Colour Codes

Every Bulb Colour Tells a Temperature Story

Inside a standard frangible-bulb sprinkler sits a hermetically sealed glass vial containing expanding alcohol-based liquid and a tiny air bubble. As ceiling gas heats the bulb to its rated nominal temperature, expanding liquid shatters the glass, releasing the cap plug against a shaped metal **deflector** that breaks water into a uniform spray umbrella.

Bulb Colour	Typical Nominal Rating (C)	Typical Area Use Case
Orange	57 C	Low ambient spaces
Red	**68 C**	**Standard offices, apartments, lobbies, shops (max ceiling <= 38 C)**
Yellow	79 C	Hotter utility rooms, kitchens away from fryers
Green	93 C	Boiler rooms, sunlit skylight domes, drying areas
Blue	141 C	Over hot industrial furnaces or curing ovens
Mauve / Purple	182 C	Extreme process heat hoods

(Always confirm exact rating on OEM datasheet against local ambient ceiling temperature—never fit a 68 C Red bulb right above a skylight or boiler hood where solar heat can cross 55 C and burst it falsely!)

Orientation Matters

- **Pendent:** Hangs downward beneath false ceiling tiles; spray umbrella points downward.
- **Upright:** Stands upward *above* exposed distribution piping in basements/warehouses; deflector curves spray outward and down around pipe shadow.
- **Sidewall:** Mounts horizontally along room walls for narrow hotel corridors or small cabins.

WARNING

NEVER paint, tape, whitewash, or apply joint compound onto sprinkler bulbs or deflectors! Paint acts as thermal insulation, delays actuation catastrophically, or glues moving caps shut. Replace any painted head immediately!

HINGLISH

Quartzoid bulb = sprinkler mein laga rangin kaanch ka bulb jo garmi se phoot jata hai. Pendent = neeche latakne wala sprinkler. Upright = pipe ke oopar khada sprinkler.

Chapter 3: Hazard Classification, Design Density and Area of Operation

Fires Differ Vastly by Fuel Quantity

You cannot protect a warehouse storing cardboard cartons to 8 metres using the same pipe spacing as a carpeted corporate office. Standards divide buildings by fire severity into hazard classes. The numbers below illustrate **typical engineering practice** from IS 15105 / NFPA 13 concepts—verify exact table limits in the governing document:

Hazard Category (Illustrative)	Typical Buildings	Typical Design Density	Typical Assumed Area of Operation (AMA)
Light Hazard	Offices, schools, hospitals, hotels, residences	~2.25 to 4.1 mm/min	~84 to 139 m2
Ordinary Hazard (OH Group 1–3)	Basement car parks, retail shops, light factories, commercial kitchens	~5.0 mm/min	~144 to 360 m2
High / Extra Hazard	High-piled storage, foam/plastic/paint manufacturing	~7.5 to 12.5+ mm/min	~260 m2+

Remember: **1 mm/min of water density over 1 m2 equals exactly 1 litre/min per m2!** Thus a 5.0 mm/min density requires 5.0 lpm for every square metre in the assumed operating remote zone.

HINGLISH

Design density = har square metre farsh par ek minute mein kitne litre paani girna chahiye. Area of operation = fire pump ko kitne bade area ke sprinklers ek saath khulne par paani dena hoga.

Chapter 4: Coverage Area, Spacing and Clearance from Obstructions

Letting the Spray Umbrella Form Cleanly

Even with high water pressure, placing sprinklers inside deep structural concrete beam pockets or blocking them behind wide HVAC ducts leaves burning dry spots underneath.

Geometric Layout Rules Checklist (Verify Governing Code)

- **Coverage Limit per Head:** Typically ~12 m2 for Ordinary Hazard (e.g., 3.0 m x 4.0 m spacing) and up to ~20–21 m2 max for Light Hazard (lower for High Hazard ~9 m2).
- **Maximum Spacing Between Heads:** Do not exceed maximum spacing limits (commonly ~4.0 m in OH or ~4.6 m in LH) and never space closer than ~1.8–2.0 m without baffle shields (cold-soldering risk: one operating head sprays and cools the neighbour's bulb!).
- **Distance from Walls:** Keep heads within half maximum spacing (commonly <= 1.5–2.0 m) and minimum ~100 mm off wall surfaces.
- **Deflector-to-Ceiling Slab Gap:** Mount upright deflectors closely under ceiling soffit (typically 25–150 mm unobstructed zone; avoid deep heat pockets > 300 mm below roof slab unless concealed ceilings demand drop assemblies).
- **Wide Duct / Cable Tray Rule:** Wherever rectangular HVAC ducts or stacked cable trays exceed typical width (~1.0 to 1.2 m) in basements/industrial bays, provide extra **pendent sprinklers underneath** the obstruction!

HINGLISH

Cold soldering = jab do sprinkler bahut paas lage hon aur pehla sprinkler chalu hokar bagal wale bulb ko thanda kar de. Obstruction = duct ya beam jo spray ko neeche jaane se rok de.

Chapter 5: Pipe Schedule vs Hydraulic Calculation

Why Hydraulic Calculations Replaced Rule-of-Thumb Tables

Older codes allowed **Pipe Schedule sizing** (e.g., 25 NB feeds max 2 heads, 32 NB feeds max 3 heads, 40 NB feeds max 5 heads, etc.). While easy for basic tiny rooms, schedule piping ignores real elevation pressure, long runs, and loop cross-feeding—resulting either in starved end heads or needlessly bloated expensive mains. Modern commercial & high-rise designs use **Full Hydraulic Calculation** balanced via Hazen-Williams friction formulas across tree, loop, or gridded networks.

Comparison Axis	Pipe Schedule Method	Full Hydraulic Calculation Method
Permitted Scope	Usually restricted to tiny/low-hazard add-ons	Mandatory for modern mid/high-rise & warehouses
Pipe Sizing Economy	Over-sizes branches near pump, under-sizes far branches	Optimized bore sizes verified to exact residual bar
Pump Selection Link	Approximate rough estimate	Exact flow and pressure duty point proven numerically

Chapter 6: Worked Remote-Area Hydraulic Calculation and K-Factor Flow

K-Factor Discharge Law

Every sprinkler orifice size carries a published discharge constant `K`. Under metric SI units (`Q` in lpm, `P` in bar; standard metric sprinkler `K = 80` matches `K = 5.6` US GPM/psi^0.5):

FORMULA

```
Q (lpm) = K x sqrt(P_bar)  And solving inversely for minimum required pressure at a head to meet density:  P_bar = (Q / K)^2
```

WORKED EXAMPLE 1

Single Head K-Factor Discharge (Illustrative). A standard Ordinary Hazard head has metric **K = 80**. At P = 0.70 bar: `sqrt(0.70) = 0.8367 -> Q = 80 x 0.8367 = 66.93 lpm`. At P = 1.20 bar: `sqrt(1.20) = 1.0954 -> Q = 80 x 1.0954 = 87.64 lpm`.

Progressive Branch Hydraulic Balancing (Worked Step-by-Step)

In a real branch feeding 4 heads spaced 3.0 m apart (`K = 80` each), water flowing toward Head #1 drops pressure from segment to segment. Therefore **Head #2 receives higher pressure than Head #1 and discharges MORE flow!**

WORKED EXAMPLE 2

4-Head Remote Branch Line Calculation (Illustrative). Target minimum residual pressure at remotest Head #1 = **0.50 bar**. Pipes: Heavy Class IS 1239 MS steel (`C = 120`). Using Hazen-Williams SI equation: `DeltaP (bar/m) = 6.05e5 * Q^1.85 / (C^1.85 * d_mm^4.87)` .

Node / Pipe Segment	Pipe Bore & ID (mm)	Length (m)	Head / Segment Flow (lpm)	Segment Loss (bar)	Node Pressure P (bar)	Cumulative Branch Flow (lpm)
Head #1 (Remote End)	—	—	`80 * sqrt(0.50) = 56.57`	—	**0.500 bar**	56.57 lpm
Pipe #1 -> #2	25 NB (ID 25.6 mm)	3.0 m	56.57 lpm	0.063 bar	—	—
Head #2	—	—	`80 * sqrt(0.563) = 60.00`	—	**0.563 bar**	116.57 lpm
Pipe #2 -> #3	32 NB (ID 34.3 mm)	3.0 m	116.57 lpm	0.057 bar	—	—
Head #3	—	—	`80 * sqrt(0.620) = 62.99`	—	**0.620 bar**	179.56 lpm
Pipe #3 -> #4	40 NB (ID 40.2 mm)	3.0 m	179.56 lpm	0.059 bar	—	—
Head #4 (At Cross-Main)	—	—	`80 * sqrt(0.679) = 65.92`	—	**0.679 bar**	**245.48 lpm**

Notice how 4 heads needed not `4 x 56.57 = 226.3 lpm` , but **245.48 lpm** because upstream heads discharge extra water under higher branch pressure! That extra ~8.5% overage is why true node-by-node balancing matters.

WORKED EXAMPLE 3

Total Sprinkler Water Demand & Tank Volume (Illustrative). Ordinary Hazard floor requires **5.0 mm/min** density across **216 m2** design area, plus typical **1,000 lpm** hose-stream allowance for 60 minutes.

Minimum theoretical sprinkler spray = `5.0 x 216 = 1,080 lpm` Applying 15% hydraulic unbalance allowance -> `1,080 x 1.15 = 1,242 lpm` at pump header. Add simultaneous hose-stream allowance = `1,242 + 1,000 = 2,242 lpm` . For 60-minute duration: `2,242 x 60 = 134,520 litres` (~135 m3 reserve).

HINGLISH

Node balancing = har ek sprinkler tak pahunchne wale alag pressure aur extra paani ke bahav ka hisaab lagana. K-factor = sprinkler ke chhed ka size number.

Chapter 7: Installation Control Valves, Flow Switches and Test-and-Drain Assemblies

Anatomy of a Floor Zone Control Valve (ZCV)

Every major building floor or zone taps off the sprinkler riser through a **Zone Control Valve (ZCV)** assembly inside the fire shaft:

1. **Supervised Isolation Butterfly / Gate Valve with Tamper Switch:** Sends trouble signal immediately to the Fire Alarm Panel if shut.
2. **Non-Return Valve (NRV):** Maintains floor pressure if riser pressure fluctuates.
3. **Vane-Type Water Flow Switch:** Detects continuous water flow (> ~30–40 lpm) using a thin plastic paddle inside the branch pipe, delaying ~30–60 seconds mechanically to ignore small water-hammer spikes before triggering floor location alarm!
4. **25 mm Inspector's Test & Drain Assembly:** Simulates flow of exactly **one single sprinkler head** through an equivalent orifice draining cleanly into a tundish/shaft drain pipe, plus pressure gauge verifying branch pressure!

Main Wet Alarm Check Valve (In Pump House)

At the base of the main sprinkler riser sits the heavy cast-iron **Wet Alarm Check Valve** trimmed with a **Retard Chamber** (preventing false gong chimes during transient jockey bumps) and mechanical **Water Motor Gong** on an exterior pump room wall ringing loudly without any electricity!

> **HINGLISH**
> Flow switch = pipe mein paani behne par fire alarm panel ko floor ki khabar dene wala pankh-switch. Inspector's test valve = sirf ek sprinkler khulne ki nakal karke alarm check karne wala valve.

Chapter 8: Safe Site Installation, Hangers, Hydrostatic Testing and Flushing

Execution Discipline & Scaffolding Safety

Sprinkler piping hangs directly overhead across busy basements, corridors, and high-bay warehouses. Faulty anchors bring heavy water-filled steel down on occupants!

Site Execution & Safety Checklist

□ **Working at Height Permits:** Inspect scaffolding guardrails, outrigger brakes, and double-lanyard full-body harnesses whenever fitting mains above 1.8 m.

□ **Anchor Fastener Load Rating:** Verify anchor bolt depth in RCC slabs against **full water-filled weight** (refer to `sge.org.in/tools/pipe-schedules`). Never shoot light drop-in nails into hollow blocks or thin false-slab plaster!

□ **Hanger Placement Rules:** Place hanger within max ~300–450 mm of end sprinkler drop; add lateral **sway bracing** where code requires to stop whip reaction when heads pop open.

□ **Slope & Drain Valves:** Grade trapped low basement pockets slightly toward auxiliary 25 mm drain cocks so seasonal maintenance can empty zones cleanly.

□ **Flushing Prior to Fitting Heads:** Flush main headers vigorously with temporary open ends **before** threading expensive sprinklers so welding slag/mud never blocks small orifices!

□ **Hydrostatic Pressure Test:** Test complete zone headers at high test pressure (typically >= 14 bar or 1.5x working pressure per code for 2 hours) with zero pressure drop and zero weeping joints!

WARNING

Never install chrome/brass sprinkler heads using regular teeth-jaw pipe wrenches! Use ONLY the manufacturer's dedicated **Sprinkler Spanner** gripping the flat brass wrench boss; slipping jaws crack glass bulbs or twist frame arms out of alignment!

HINGLISH

Hydrostatic test = false ceiling band karne se pehle paani ka tezz dabav bhar kar har joint ki leak check karna. Swinging / sway brace = pipe ko hilne se rokne wala tirchha support.

Chapter 9: Periodic Inspection, Common Site Faults and Troubleshooting

Catching Dead Protections on Routine Walkdowns

Common Site Fault	Why It Fails During a Fire	Quick Inspection Test
ZCV Valve Shut Unnoticed	Entire floor has zero water despite main pumps healthy	Check tamper monitor on FACP + test drain pressure drop
Missing Escutcheon Canopy Ring	Hot smoke escapes upwards into false ceiling delaying bulb shatter	Inspect ceiling tile fit tightly around escutcheon trim
Partition Walls Built Right Under Heads	Rooms blocked off leaving empty dead zones without heads	Walk floor changes quarterly; relocate/add pendent drops
Stock Stacked Within 450 mm of Roof	Boxes block spray pattern before droplets reach burning base	Enforce clear **450–500 mm** yellow painted ceiling clearance line
Painted / Dusty Kitchen Heads	Grease/paint delays opening until room hits flashover	Replace grease/paint-coated heads (never scrub with solvent!)

Chapter 10: Cheat Sheet, Remote-Area Worksheet, FAQ and Bilingual Glossary

Sprinkler Engineering Cheat Sheet

- **Q–P Formula:** `Q (lpm) = K x sqrt(P_bar)` (typical Ordinary Hazard head `K = 80`)
- **Min Ceiling Clearance Under Deflector (Storage):** `>= 450 mm` clear free air above top racks
- **Inspector's Test Orifice:** Matches single smallest head K-factor on that floor zone
- **Pipe Hanger Supports:** Must carry 100% Water-Filled Pipe Dead Weight cleanly

Blank Remote-Area Branch Calculation Worksheet

Segment / Node	Pipe Bore & ID	Eq. Length (m)	Segment Q (lpm)	Loss / m (bar/m)	Total Loss (bar)	End Pressure (bar)	Velocity (m/s)
Head 1 -> Node 2	___ NB (___mm)	____ m	____ lpm	____	____	____	____
Node 2 -> Node 3	___ NB (___mm)	____ m	____ lpm	____	____	____	____
Node 3 -> Node 4	___ NB (___mm)	____ m	____ lpm	____	____	____	____
Feeder Main to Pump	___ NB (___mm)	____ m	____ lpm	____	____	____	____

Frequently Asked Questions

1. **Do ALL sprinklers in a room go off at the same time when smoke hits them?** No! That only happens in movies. Individual bulbs shatter ONLY when direct hot fire gases reach that specific head (~68 C). Typically 1 to 4 heads control 90%+ of real fires.
2. **Can a cigarette or burnt toast trigger a wet sprinkler head?** No; smoke does not open glass bulbs—only sustained physical heat (~68 C) directly against the glass vial breaks it.
3. **Why is there a small waterless cavity above a concealed/recessed escutcheon unacceptable?** Open gaps vent rising heat into the plenum above, causing the sprinkler below the tile to open late (or miss completely).
4. **What is a Flexible Stainless Sprinkler Drop?** A braided flexible hose assembly connecting hard steel branch lines down to false ceiling tiles cleanly—makes tile level alignment fast and seismic-friendly where approved.
5. **Why does the Flow Switch need a retard timer (e.g., 30 seconds)?** Brief pressure surges when Jockey pumps kick in rock the internal plastic paddle slightly; a mechanical/pneumatic 30-second retard ignores transient bumps and confirms true continuous fire flow.
6. **Can we hang electrical cable trays off sprinkler hanger rods?** Never! Sprinkler hangers are engineered solely for fire piping; hanging trays overloaded rods and violates codes.
7. **Is black MS steel pipe permitted without galvanizing in wet sprinkler systems?** Yes—standard Heavy Class MS pipe (painted post-installation red outside) is typical for wet systems because stagnant water uses up dissolved oxygen quickly; dry/pre-action systems need **galvanized** pipe to resist moist air scaling.

8. **How close can a spotlight or AC diffuser sit to a sprinkler head?** Avoid placing hot halogen/heat vents immediately beside bulbs (risk of accidental thermal burst) and keep ceiling obstructions out of spray umbrella lines.
9. **What is a Spare Sprinkler Cabinet?** Every building must maintain a red metal box holding spare heads of each K-factor/temperature installed plus the exact manufacturer sprinkler wrench.
10. **Why did a sprinkler head start dripping slowly without fire?** Either factory defect, wrench damage during erection, or mechanical impact/freeze damage—shut zone ZCV, drain branch safely, and fit a brand-new OEM replacement immediately!
11. **Does every high-rise sprinkler zone require a separate main pump?** Not necessarily—one high-head sprinkler main/diesel pump set feeds the vertical sprinkler riser with floor ZCVs (and PRVs on lower floors if static exceeds nozzle/valve limits).
12. **How often should ZCV Inspector's Test valves be opened?** Typically quarterly/semi-annually alongside fire alarm flow-switch verification tests, logging time-to-alarm seconds!

Hindi–English Bilingual Glossary

English Term	Hinglish / Site Hindi	Technical Meaning
Wet pipe sprinkler	Hamesha paani bhari line	Pressurised automatic sprinkler network
Dry pipe system	Hawa bhari pipe line	Air-pressurised pipes for freezing zones
Pre-action system	Double-lock suraksha system	Requires BOTH alarm sensor + broken bulb
Deluge system	Bina bulb ka tez chhidkaav	All open nozzles spray together on detection
Quartzoid glass bulb	Rangin kaanch ka capsule	Temperature-sensitive alcohol bulb
Deflector	Chhidkaav phailane wali chhatri	Toothed disc shaping water droplet umbrella
Pendent head	Neeche ki taraf latka sprinkler	Ceiling-mounted downward facing head
Upright head	Pipe ke upar khada sprinkler	Head facing skyward above bare piping
Sidewall head	Deewar par side mein laga head	Horizontal throw sprinkler for narrow rooms
K-Factor	Nozzle bahav gunaank	Flow discharge coefficient (`Q = K*sqrt(P)`)
Escutcheon plate	Ceiling par sajawat ki ring	Trim collar sealing hole around sprinkler
Cold soldering	Thanda hokar atkaav	Active spray chilling an adjacent head
Zone Control Valve (ZCV)	Floor ka mukhya control set	Assembly of butterfly valve, NRV, flow switch, drain
Water Flow Switch	Paani behne ka sensor switch	Paddle switch alerting alarm panel of flow
Tamper Switch	Band valve batane wala switch	Microswitch alerting if ZCV is shut
Inspector's Test Valve	Ek head barabar test cock	Small orifice testing alarm trigger accurately
Wet Alarm Check Valve	Pump room ka ghanti valve	Main riser check valve ringing water gong
Retard Chamber	Jhatka rokne ki chhoti tanki	Delay vessel preventing false gong chimes
Water Motor Gong	Bina bijli ki paani ghanti	Mechanical striker bell spun by water stream
Sway Bracing	Tirchha hilaav rok support	Diagonal bar resisting thrust & seismic pull
Flushing	Kachra saaf paani bahana	High-velocity wash clearing welding slag
Sprinker Spanner	Asli sprinkler paana	Purpose wrench gripping flat boss safely
Hydraulic Balancing	Har branch ka dabav milana	Node-by-node loss math proving end head pressure
Grooved Coupling	Clamp wala bina welding jod	Mechanical Victaulic-style gasketed pipe joint
Dropper	Niche aati patli branch pipe	Vertical 25 NB drop feeding ceiling tile head
Concealed Sprinkler	Chhupa hua flat plate head	Cover-plate sprinkler dropping open at heat
Trace / Drain Line	Khali karne ki pipe	Pipe carrying floor test water cleanly to shaft drain
Dead Leg	Band chhor wali sookhi line	Unused pipe stub accumulating rust sludge

Sprinkler System Design Workbook

A complete engineering workbook for automatic fire sprinkler systems covering wet, dry, pre-action, and deluge architectures, quartzoid bulb ratings, hazard classifications, hydraulic pipe sizing vs pipe schedules, progressive Hazen-Williams branch balancing, ZCV alarm trim, and safe installation checks.

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01 Fire Fighting System A to Z
02 Fire Protection Design Handbook
03 The Fire Pump House Manual
04 Pressure Switch & Pump Controller Field Manual
05 **Sprinkler System Design Workbook**
06 Fire Alarm Design & Cable Calculation Guide
07 Special Hazard Suppression Guide
08 Fire NOC & Building Approval Playbook
09 Fire Extinguishers, Home & Office Safety
10 Cable Sizing, LT Panel & Short-Circuit (kA) Guide
11 HT Cable Hi-Pot Testing & Fault Location
12 The Site Engineer's Calculation Handbook

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Shree Ganesh Enterprises (SGE) designs, supplies, installs, tests, commissions, and maintains Fire Fighting, Addressable Fire Alarm, HT/LT Electrical, Plumbing, HVAC, and IBMS systems — backed 24×7 by AMC MEP 24x7.

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