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E-BOOK 07 ADVANCED EDITION

Special Hazard Suppression Guide

Data Centres, CO2, Clean Agent and Water Curtain Systems



FIG 07.1 — CLEAN AGENT CYLINDER BANK, MANIFOLD & NOZZLE DISCHARGE

SYLLABUS	CALCULATIONS	SITE READY
10 Structured Chapters	Worked SI Examples & Tables	Forms & Hinglish Glossary

Shree Ganesh Enterprises (SGE) — AMC MEP 24x7
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Special Hazard Suppression Guide

Data Centres, CO2, Clean Agent and Water Curtain Systems

An advanced engineering and safety guide for special fire hazards where standard sprinklers fall short: Data Centres and UPS rooms using Clean Agent total flooding (FK-5-1-12, HFC-227ea, Inert Gas) and aspirating smoke detection, CO2 lethal asphyxiation lock-out protocols, Enclosure Room Integrity testing, Pressure Relief Venting (PRD), and Water Curtain deluge glazing systems.

Intended Audience: Mission-critical data-centre facility heads, hospital/industrial MEP engineers, clean-agent system designers, and advanced fire contractors.

Engineering Notice & Standards Policy

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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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Contents

01 Chapter 1: Why Special Hazards Require Tailored Protection

02 Chapter 2: Data Centres and Server Rooms — Early Detection and Cross-Zoning

03 Chapter 3: Clean Agent Systems (FK-5-1-12, HFC-227ea & Inert Gases)

04 Chapter 4: Agent Quantity Calculation and Pressure-Relief Dampers (PRD)

05 Chapter 5: Enclosure Sealing and Door-Fan Room Integrity Testing

06 Chapter 6: Pre-Discharge Alarms, Abort Switches and Manual Controls

07 Chapter 7: Carbon Dioxide (CO2) Fire Suppression and Mandatory Life-Safety Controls

08 Chapter 8: Water Curtain (Drencher) Systems for Glazing and Openings

09 Chapter 9: Handover Tests, Cylinder Weighing, Refilling and Templates

10 Chapter 10: Cost Matrix, Decision Guide, FAQ and Hinglish Glossary

What You Will Learn

- Select Clean Agent (FK-5-1-12 / HFC-227ea / Inert Gas), CO2, or Water Curtain drencher technologies accurately
- Design Data Centre early-warning detection pairing ASD aspirating sampling with cross-zoned point heads
- Calculate clean agent flooding mass (W = V/S * C/(100-C)) and understand Pressure Relief Damper (PRD) needs
- Supervise Door-Fan Enclosure Integrity testing to achieve 10-minute clean-agent hold times cleanly
- Enforce life-critical CO2 lethality barriers: lock-out valves, pre-discharge alarms, and odorisers
- Size atrium and facade Water Curtain deluge systems with linear drencher demand arithmetic

Chapter 1: Why Special Hazards Require Tailored Protection

Where Standard Water Sprinklers Need Backup or Replacement

Water excels at absorbing heat across ordinary offices, apartments, and factories—yet fails or worsens damage in three mission-critical environments:

1. **Live High-Value Electronics (Data Centres, Core Server Racks, MRI/CT Suites, Switchgear Rooms):** Water extinguishes fire well, *yet soaked busbars and flooded disk racks shut down business continuity for months*. Gaseous **Clean Agents** leave zero conductive water or powder residue!
2. **Deep-Seated Electrical Vaults & Industrial Oil Tanks:** Where dry clean-gas total flooding or local-application **CO2** smothers three-dimensional liquid/cabinet voids.
3. **Open Glazed Atriums & Curtain Facade Separations:** Where no masonry compartment wall exists to stop radiant fire jumping upward from floor to floor—requiring continuous falling **Water Curtain (Drencher)** shields!

System Solution	Extinguishing Physics	Electrical Safety	Residual Clean-Up	Human Occupancy Safety
FK-5-1-12 / HFC-227ea Clean Agent	Heat absorption + chemical radical interruption	Completely non-conductive	Zero residue (evaporates cleanly)	**Safe at normal Class A design concentrations** (check NOAEL/LOAEL!)
Inert Gas (IG-541 / IG-55 / Nitrogen)	Oxygen reduction (~21% down to ~12–14%)	Non-conductive	Zero residue; zero global warming	Safe when properly designed within oxygen/CO2 thresholds
Carbon Dioxide (CO2)	Severe oxygen starvation (< 15% O2 at 34%+ CO2)	Non-conductive	Zero residue (super-chills)	**LETHAL IN OCCUPIED ROOMS!** Strict evacuation & lock-out mandatory
Water Curtain / Drencher	Cooling water barrier film over glazing/openings	Conductive water	Wet drainage below	Safe for occupants; drains to storm/basement sump

NOTE

Clean agent concentrations, hold times, specific vapour volumes (`S`), and safety margins depend strictly on NFPA 2001, ISO 14520, and NFPA 12 (CO2). Never copy agent mass constants across brands—always verify final calculations through OEM UL/FM listed hydraulic software!

HINGLISH

Clean agent = aisa gas jo bina paani ya powder ke aag bujha de aur server kharab na kare. Total flooding = poore band kamre ko ek saath gas se bhar dena.

Chapter 2: Data Centres and Server Rooms — Early Detection and Cross-Zoning

Stopping Smouldering Cables Before Flame Breaks Out

Modern server racks circulate fierce cooling air at high velocity via CRAC/CRAH downflow plenums. High airflow *dilutes* slow point smoke detectors mounted high on ceiling tiles, hiding hot overheated power connectors until arc flash erupts!

Multi-Layer Data Centre Protection Architecture

1. **Aspirating Smoke Detection (ASD / VESDA style):** Draws room and return-grille air continuously through laser-calibrated capillary pipes—alerting staff at microscopic off-gassing stages (**Alert / Action**) long before fire suppression even thinks of releasing!
2. **Zone Separation Across Sub-Zones:** Monitor **Under Raised Floor Void**, **Room Ambient Space**, and **False Ceiling Void** independently!
3. **Double-Knock (Cross-Zoned) Interlock:** Never trigger expensive clean agent banks on one single dusty sensor! Split room ceiling sensors into odd/even Zones **A** and **B**:
   - **Stage 1 (Single Sensor Trip):** Rings pre-alarm alert at Fire Command Centre and room sounder only; closes nothing destructive yet.
   - **Stage 2 (Both Zone A AND Zone B Trip — Confirmed Fire):** Starts **30-second Pre-Discharge Countdown**, shuts off CRAC/HVAC blowers immediately, closes motorized room isolation dampers cleanly, drops BMS alerts, and prepares solenoid cylinder actuator firing!

FIELD TIP

If your CRAC air conditioners keep spinning while clean agent discharges, fans dilute agent concentration rapidly or blow clean gas right out through leakage gaps—**interlock HVAC & exhaust damper shutdown strictly prior to T=0 discharge!**

HINGLISH

Double knock / Cross-zoning = jab kamre ke do alag-alag sensor aag pakde tabhi gas cylinder khulega, taaki galti se gas barbad na ho.

Chapter 3: Clean Agent Systems (FK-5-1-12, HFC-227ea & Inert Gases)

Comparing Modern Clean Agents

All clean agents must discharge rapidly (typically **within <= 10 seconds** for chemical halocarbon agents; up to **60 seconds** for high-pressure inert gas banks) to achieve uniform extinguishing concentration before fire grows.

Agent Comparison Feature	FK-5-1-12 (Novec 1230 style)	HFC-227ea (FM-200 style)	Inert Gases (IG-541 / IG-55)
Storage State & Pressure	Liquid at ~25–42 bar (N2 padded)	Liquefied compressed gas at ~25–42 bar	Compressed gas (~200–300 bar!)
Cylinder Footprint	**Very compact** (often inside/adjacent to room)	**Very compact**	**Large multi-cylinder bank** needed
Environmental Profile (GWP)	Ultra-low atmospheric lifetime (~days; GWP < 1)	High GWP (subject to global HFC phasedowns)	Zero ODP / Zero GWP natural gases
Over-Pressure Risk During Dump	Both positive & slight brief negative pulse	Pressure wave on dump	High sustained gas inflow -> **Large PRD vent needed**

Note on Safety Margin: Always verify **Design Concentration (C)** stays below agent **NOAEL** (No Observed Adverse Effect Level) in normally occupied control rooms. Confirm environmental HFC restrictions applicable in your jurisdiction before specifying HFC-227ea on new builds.

> **HINGLISH**
> Hold time = gas chhootne ke baad kam से kam 10 minute tak kamre mein ruka rehna taaki aag dobara na bhadke. Cylinder bank = deewar ke paas line mein lage hue bhaari gas cylinders ka group.

Chapter 4: Agent Quantity Calculation and Pressure-Relief Dampers (PRD)

Total Flooding Gas Mass Formula (Illustrative Engineering Relationship)

Under clean agent total-flooding standards (NFPA 2001 / ISO 14520), minimum mass `W` of chemical agent needed to reach volume concentration `C` (%) inside sealed enclosure net volume `V` (m3) at design minimum room temperature is given by:

> **FORMULA**
> `W (kg) = (V / S) x (C / (100 – C)) Where: V = Net protected enclosure volume (L x W x H , including raised floor + ceiling void!) S = Specific vapour volume of agent in m3/kg at minimum expected room temperature (TAKE EXACT CONSTANT FROM AGENT STANDARD / VENDOR SHEET!) C = Required design volumetric concentration in % (typically derived per fuel class from listed agent table, plus altitude correction if above sea level).`

WORKED EXAMPLE 1

Server Room Clean Agent Mass Estimation (Illustrative). Assume a well-sealed server room has net dimensions **8.0 m x 5.0 m x 3.0 m** (including subfloor void) -> **Net Volume** `V = 120 m3` . For illustration ONLY, assume **FK-5-1-12** Class-A style design concentration `C = 5.3%` and assumed specific volume at 20 C of `S = 0.0719 m3/kg` *(verify exact vendor tables and elevation factors!)*.

Step 1: Volume-to-specific-volume ratio = `120 / 0.0719 = 1,668.98` Step 2: Concentration factor = `5.3 / (100 – 5.3) = 5.3 / 94.7 = 0.055966` Step 3: Theoretical minimum agent mass `W = 1,668.98 x 0.055966 = 93.41 kg` . Result: Specify e.g. **100 kg nominal fill** inside an appropriately sized listed manifold cylinder (plus check piping residual trap losses through vendor flow software before ordering!).

Why Rooms Blow Out Walls Without Pressure-Relief Dampers (PRD)

Dumping 94 kg of liquid evaporating violently into heavy gas inside an airtight 120 m3 server room inside **10 seconds** causes a massive transient pressure spike! Drywall partitions, glass view windows, and false ceiling grids will burst outward unless an automatic **Gravity/Barometric Pressure-Relief Damper (PRD)** opens cleanly into a safe corridor or shaft above allowable wall structural tolerance (typically **250 to 500 Pa** depending on partition framing)!

WORKED EXAMPLE 2

PRD Free-Vent Sizing Concept (Illustrative). Check manufacturer flow software output: peak volumetric discharge rate of a **94 kg** FK-5-1-12 or **300-bar Inert Gas** release creates peak pressure surge inversely proportional to `sqrt(Wall Allowable Overpressure)` . If gypsum partition fails above ~250 Pa vs concrete block tolerating ~500 Pa, cutting allowable pressure by half roughly doubles the required free PRD blade area (`m2`)! Remember: fit **two-way or dual PRD vents** for halocarbon liquids that exhibit a momentary cooling vacuum pull right before gas expansion pressure pushes outward.

HINGLISH

Pressure Relief Damper (PRD) = gas chhootne par kamre ke andar badhe hue jhatke wale dabav ko bahar nikalne wali automatic khidki, jisse deewarein na tootein.

Chapter 5: Enclosure Sealing and Door-Fan Room Integrity Testing

You Cannot Hold Gas Inside a Leaky Room

Even perfect calculations mean nothing if clean gas drains rapidly underneath door gaps, through unsealed cable cutouts, and around loose raised-floor pedestals! Standards normally require maintaining extinguishing concentration inside the enclosure for at least **10 minutes hold time** to cool hot embers completely so re-ignition cannot happen.

Room Sealing Inspection Checklist

- ☐ Seal ALL cable trays, busducts, and copper chilled-water pipe entries passing through walls, slab tops, and floor slabs using tested intumescent fire-stop pillows/sealant.

☐ Extend masonry/gypsum walls **slab-to-slab** (never stop clean agent room walls at the false ceiling tile level—gas pours straight over!).

☐ Fit acoustic rubber perimeter bulb seals and automatic drop-bottom door sweeps under ALL access doors.

☐ Lock HVAC supply/return isolation dampers firmly closed prior to discharge countdown zero.

☐ Schedule a calibrated **Door-Fan Room Integrity Test (ASTM/NFPA 2001/ISO 14520)** using certified pressure fans to measure Equivalent Leakage Area (ELA) and **mathematically predict hold time >= 10 minutes** BEFORE filling and arming live agent cylinders!

> **HINGLISH**
> Door-fan test = darwaze par bada pankha lagakar bina asli gas barbad kiye kamre ke leak aur 10-minute gas rokne ki kshamta check karne ka test. Slab-to-slab wall = false ceiling ke upar chhat tak pakki band deewar.

Chapter 6: Pre-Discharge Alarms, Abort Switches and Manual Controls

Human Evacuation Window Control Sequence

```
 [Zone A + Zone B Sensors Trip]
        |
        +---> [HVAC Trips OFF + Damper Closes + Door Strobe/Horn PULSES]
        |
        +---> [30-Second Countdown Starts]
        |         |-- Human holds DEAD-MAN [ABORT] Button -> PAUSES Countdown while held!
        |         |-- Or authorized person pulls Manual Release -> Bypasses delay (check site
config)
        v
 [Countdown Reaches T = 0] ---> [Cylinder Solenoid Fires] ---> [10s Discharge + Discharge Beacons
Lit!]
```

1. **Abort Switch Safety:** Must use momentary "dead-man" push-button inside the room by the door (holding it delays electric countdown ONLY; it never overrides a mechanical manual pull!).
2. **Gas Released / Do Not Enter Strobe:** Mount illuminated sign right outside every room entrance door warning late personnel **NOT to open doors during the 10-minute hold window**!

Chapter 7: Carbon Dioxide (CO2) Fire Suppression and Mandatory Life-Safety Controls

Severe Lethality Hazard: Treat CO2 with Extreme Respect

CO2 extinguishes fire not merely by cooling, but by dropping room ambient oxygen from 21% below 15% using **>= 34% to 65%+ CO2 concentration**. **At 34% CO2, humans lose consciousness within seconds and suffocate rapidly!** Because CO2 is colourless and odourless, unprotected personnel entering a discharged pit or battery

room can collapse silently!

> **WARNING**
> **NEVER** design total-flooding CO2 inside normally occupied spaces without complete regulatory safety hardware. All personnel must evacuate strictly before discharge!

Non-Negotiable CO2 Life-Safety Barriers (Verify NFPA 12 / Governing Code)

- **Mechanical Lock-Out Valve:** Padlocked isolation ball valve installed on the main manifold pipe *before* room nozzles, fitted with monitored limit switch wiring directly to panel trouble lamp! Technicians entering a CO2 room for *any* IT, electrical, or cleaning maintenance **MUST** physically lock the Mechanical Lock-Out Valve **CLOSED** and keep the padlock key in their pocket!
- **Pneumatic / Electrical Time Delay:** Distinct pneumatic pre-discharge siren powered strictly by agent gas pressure itself (needs zero electric wires!) warning everyone out for 30–60 seconds prior to nozzle flow.
- **Wintergreen Odoriser Capsule:** Releases crisp mint smell alongside odourless CO2 so people immediately notice leaking pockets.
- **Post-Discharge Mechanical Exhaust:** Never re-enter until high-capacity floor exhaust fans clear residual dense CO2 safely from floor sumps and technicians verify O2 levels cleanly with portable gas meters!

> **HINGLISH**
> CO2 gas aag toh tezi se bujhati hai par insaan ke liye jaanleva hoti hai. Isliye andar kaam karte samay hamesha main lock-out valve par tala lagana zaroori hota hai!

Chapter 8: Water Curtain (Drencher) Systems for Glazing and Openings

Stopping Radiant Fire Jump Across Glass Facades and Atriums

Where architectural designs place glass atriums, open mall escalators, or car-parking/warehouse openings between adjacent fire compartments, heavy **Water Curtain (Drencher) Lines** mount closely above the glazing header. Triggered automatically via ceiling smoke/linear heat detectors opening a **Deluge Valve**, open fan-spray drencher nozzles pour a continuous cooling waterfall sheet down the glass pane so radiant flame temperatures cannot shatter glazing or jump across floors!

WORKED EXAMPLE 3

Atrium Water Curtain Deluge Demand (Illustrative). A mall atrium opening spans **24 linear metres** of toughened glass storefront separating Block A and Block B. Adopting a typical illustrative design application rate of **10 litres/min per linear metre** of curtain width (confirm exact code density/vendor drencher nozzle spacing table—typically nozzles mounted @ ~1.5–2.0 m centers!):

Base Linear Demand = `24 m x 10 lpm/m = 240 lpm`. Adjust for practical nozzle spacing (e.g., 13 open K-40 nozzles @ 2.0 m centers discharging ~25 lpm each at 0.4 bar residual, or add ~15% hydraulic piping balancing factor): `Actual Balanced Deluge Flow = 240 x 1.15 = 276 lpm` (verify individual nozzle K-factor hydraulics along the drencher manifold!). Reserve for 60 minutes = `276 x 60 = 16,560 litres (~17 m3)` added cleanly to UG fire water demand. Also provide trench floor drains below the glass line so spilled water does not flood lift shafts!

HINGLISH

Water curtain / Drencher system = bade kaanch ke sheeshon ya atrium ke upar paani ka parda girane wala system jo aag ko ek hisse se doosre hisse mein failne se rokta hai.

Chapter 9: Handover Tests, Cylinder Weighing, Refilling and Templates

Never Test Clean Agent Banks by Dumping Real Gas Unnecessarily

During handover commissioning, engineers verify actuation cleanly using:

1. **Live Sensor -> Panel Countdown -> Solenoid Disconnect Check** (unbolt electrical solenoid actuator from cylinder valve completely and watch plunger click cleanly!).
2. **Nitrogen Puff / Flow Continuity Check:** Puff pressurized dry nitrogen briefly through distribution manifolds proving open, unblocked nozzles and blown-off dust caps!
3. **Door-Fan Room Integrity Certification** proving >= 10-minute theoretical hold!

Clean Agent & CO2 Semi-Annual / Monthly Maintenance Register

Bank / Tag	Protected Room	Agent Type & Rated Net Weight (kg)	Gauge Zone Pressure (Green?)	Liquid Level / Net Scale Weight Check	Solenoid Mounted & Locked?	Mechanical Lock-Out Valve Pos	Inspector Sign & Date
CA-01	Server Room 1	FK-5-1-12 (100 kg)	[ ] Normal (Green)	____ kg (Date: ____)	[ ] Armed Cleanly	N/A	_____
CO2-01	HT Transformer	CO2 High-Press (45 kg x 4)	Weight Check Only	____ kg each	[ ] Armed Cleanly	[ ] OPEN (Unoccupied)	_____
DV-01	Mall Atrium	Water Curtain (Deluge)	Clapper Sealed	Header: ____ bar	[ ] Pilot Charged	Main Gate Strapped OPEN	_____

Chapter 10: Cost Matrix, Decision Guide, FAQ and Hinglish Glossary

Numbered Special-Hazard Selection Guide

1. **Identify Asset & Human Occupancy:**
   - Are people permanently inside? -> **ELIMINATE CO2 Total Flooding** immediately! Pick FK-5-1-12, HFC-227ea (check local environmental rules), or Inert Gas.
2. **Check Room Sealing & Structural Walls:**
   - Can walls rise airtight slab-to-slab and hold Pressure Relief Dampers? -> **If YES: Total Flooding Clean Agent works well**.
   - If OPEN yard, transformer pad, or glazed mall staircase -> **Pick Deluge Spray or Water Curtain!**
3. **Balance Footprint vs Long Piping:**
   - Tiny tight room close to bank -> Chemical liquid agent (compact single/twin cylinder).
   - Multiple distant zones connected via long header manifolds -> **300-bar Inert Gas** selector-valve manifold bank cuts multi-room cost significantly!

Frequently Asked Questions (Site & Special Hazards)

1. **Why can't I weigh a high-pressure Inert Gas cylinder to check if it leaked?** Chemical halocarbons (HFC/FK) and CO2 hold weight well—so losing gas drops weight on scale or liquid-level ultrasonic stick. Inert gases (IG-541/Nitrogen) weigh tiny grams relative to heavy steel walls, so use calibrated **temperature-compensated pressure gauges** strictly instead!
2. **How can a small HVAC return grille ruin a Rs 15 lakh Clean Agent system?** Unless motorized fire/smoke dampers slam tightly shut on cross-zone Stage 2, costly agent drains straight into neighboring building halls within 45 seconds!
3. **Do clean-agent cylinders require hydrostatic re-testing?** Yes—statutory pressurized cylinder testing cycles apply (typically 5–12 years depending on agent standard and transport cylinder rules; check PESO / DOT regulations locally).
4. **Why is a Server Room ceiling sprinkler sometimes installed *alongside* Clean Agent?** Some municipal authorities require wet/pre-action sprinklers as ultimate structural backup if an occupant props the door open and agent leaks out! Never cancel backup sprinklers unless written statutory exemption is approved.
5. **Can CO2 nozzles ice up during discharge?** Yes—rapid dry-ice throttling chills nozzles violently; keep personnel away and ensure clean dry CO2 grade so moisture does not block tiny orifice jets.
6. **What happens if the manual release handle on a CO2 bank is pulled inside a locked room? DO NOT pull manual release while any worker remains inside**—ensure clear alarm delay and room sweep!
7. **Does FK-5-1-12 damage spinning mechanical hard drives with loud acoustic discharge noise?** Ultra-high sound-pressure discharge levels from high-pressure nozzles have damaged fragile enterprise magnetic platter drives in documented tests; consult vendor acoustic/low-pressure nozzle designs for storage arrays!
8. **How often should a Door-Fan Integrity Test be re-run?** At commissioning **plus after any civil work, cabling drill-through, or HVAC retrofit** piercing the server room boundary!
9. **Can Water Curtain deluge systems run off the main electric hydrant pump?** Yes, provided hydraulic tank storage and combined header pressure/flow include simultaneous deluge demand cleanly without starving yard hydrants!

10. **What colour should Clean Agent pipes be painted?** Check local standards/project specs—often safety red with clear band identification stickers naming agent type ("CLEAN AGENT - FK-5-1-12" / "HIGH PRESSURE CO2").
11. **What if the Abort switch is pressed *after* the solenoid has fired?** Abort only holds electronic countdown *before* T=0 discharge. Once electric squib/solenoid punctures cylinder disc, physical discharge finishes completely.
12. **How do maintenance technicians protect themselves when checking detectors in a CO2 protected transformer pit?** Follow strict Lockout-Tagout + physically lock the **Mechanical Lock-Out Valve CLOSED** on the CO2 manifold + hang warning tags before stepping inside!

Hindi–English Bilingual Glossary

English Term	Hinglish / Site Hindi	Technical Meaning
Clean Agent	Bina daag/paani ke gas agent	Electrically non-conductive evaporating suppressant
Total Flooding	Poore kamre ko bharna	Uniform concentration filling an entire enclosure
Aspirating Detection (ASD)	Hawa kheench kar pehchan	Ultra-sensitive laser smoke tube sniffing system
Cross-Zoning / Double Knock	Do sensors ek saath pakde	Logic stopping false discharge from single dusty head
Specific Vapour Volume (S)	Gas ki phailne ki maatra	Vendor constant (`m3/kg`) determining cylinder kg
Design Concentration (C)	Kamre mein gas ki percentage	Target `%` volume stopping combustion cleanly
NOAEL / LOAEL	Surakshit saans lene ki hadd	Toxicological safe human threshold concentration
Enclosure Integrity	Kamre ki hawa-bandi	Airtightness keeping gas trapped for hold period
Door-Fan Test	Darwaze par pankha lagakar leak test	Non-destructive blower measurement predicting hold time
Hold Time	Gas ruke rehne ka samay	Required retention duration (commonly ~10 minutes)
Pressure Relief Damper (PRD)	Dabav bahar nikalne ka flap	Wall vent releasing dump shock so partitions don't crack
Pre-Discharge Alarm	Gas chhootne se pehle ki chetavni	Distinct audio/strobe giving 30–60s evacuation gap
Abort Switch	Daba kar rakhne wala rok button	Dead-man button holding countdown during inspection
Mechanical Lock-Out Valve	Hath se band aur tala lagane wala valve	Life-saving isolation stopping CO2 kill while inside
Pneumatic Delay	Bina bijli ka hawa timer	Gas-driven safety pause prior to lethal CO2 dump
Odoriser	Mehak milaane wala capsule	Adds mint scent alerting staff to odourless CO2
Asphyxiation	Oxygen kami se dam ghutna	Fatal risk inside discharged CO2 rooms
Deluge Valve	Ek saath bhari paani kholne wala valve	Quick-opening valve flooding open nozzles together
Water Curtain / Drencher	Sheeshe par girne wala paani parda	Open flat-spray nozzles cooling exposed facades
Selector / Directional Valve	Ek bank se alag kamron mein modna	Routes shared cylinder gas only to burning room
Ultrasonic Liquid Level Check	Machine se cylinder bharav check	Measures liquid height without lifting heavy bottles
Squib / Solenoid Actuator	Cylinder pin todne wala motor/coil	Electrical firing cap triggering discharge
Fire-Stopping Putty / Pillow	Deewar ke chhed band masala	Intumescent seal blocking flame & gas leaks
Negative Vacuum Pulse	Shuruati andar kheenchav	Momentary cooling suction before expansion surge
GWP (Global Warming Potential)	Paryavaran garmi asar	Regulatory climate impact score of HFCs
Nitrogen Puff Test	Dry nitrogen se pipe saaf check	Verifies open nozzles cleanly before arming gas

Special Hazard Suppression Guide

An advanced engineering and safety guide for special fire hazards where standard sprinklers fall short: Data Centres and UPS rooms using Clean Agent total flooding (FK-5-1-12, HFC-227ea, Inert Gas) and aspirating smoke detection, CO2 lethal asphyxiation lock-out protocols, Enclosure Room Integrity testing, Pressure Relief Venting (PRD), and Water Curtain deluge glazing systems.

COMPLETE 12-VOLUME SGE ENGINEERING LIBRARY

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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