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E-BOOK 02 INTERMEDIATE EDITION

Fire Protection Design Handbook

A Step-by-Step Method Following NBC 2016 Part 4

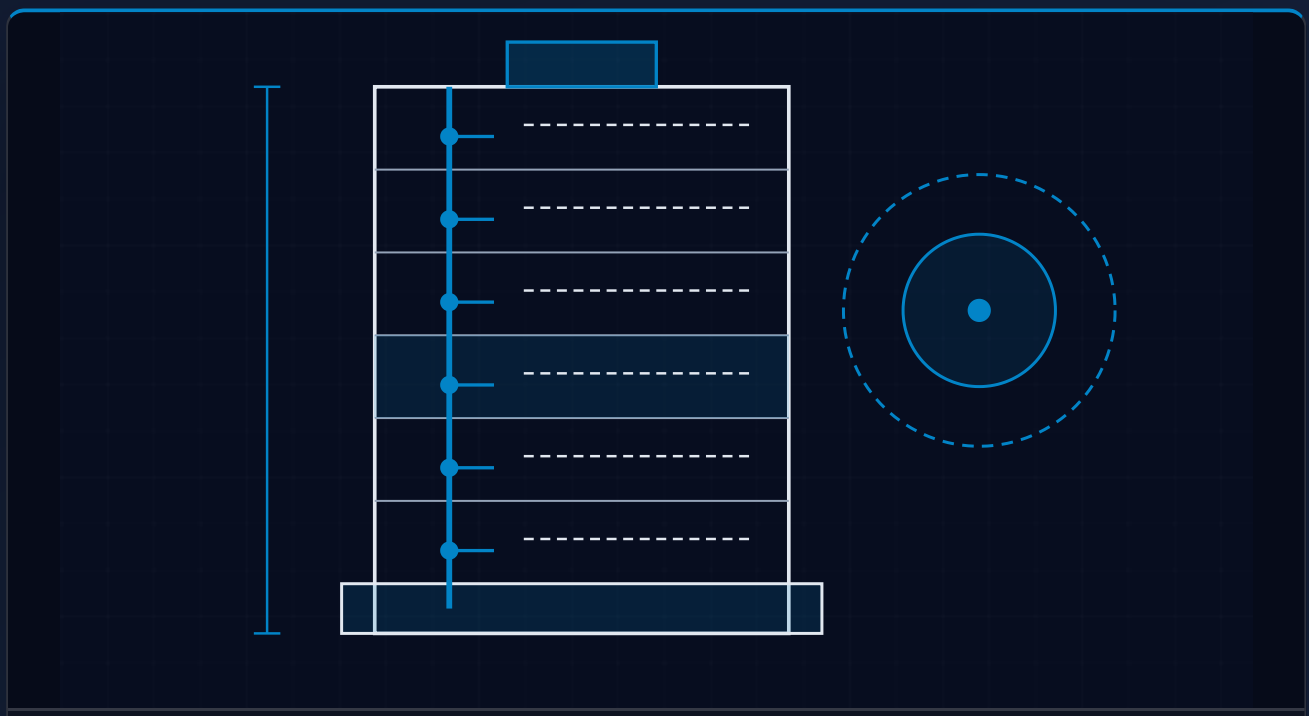


FIG 02.1 — NBC 2016 PART 4 HIGH-RISE ZONING & WET RISER ELEVATION

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

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Fire Protection Design Handbook

A Step-by-Step Method Following NBC 2016 Part 4

A repeatable, step-by-step fire protection engineering design method aligned with the National Building Code of India 2016 Part 4. Covers architectural data gathering, occupancy classification, water tank sizing, Total Dynamic Head pump duty calculations, Hazen-Williams pipe friction arithmetic, inter-discipline coordination, and submission deliverables.

Intended Audience: MEP design engineers, civil and structural engineers, architects, BIM coordinators, and project engineers reviewing statutory fire schemes.

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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Contents

01 Chapter 1: Gathering Architectural Inputs and Building Classification

02 Chapter 2: Life Safety and Passive Design Parameters

03 Chapter 3: Determining the Active System Requirements Matrix

04 Chapter 4: Water Storage Estimation (Underground and Terrace Tanks)

05 Chapter 5: Pump Duty Selection (Flow, Head and Jockey Logic)

06 Chapter 6: Pipe Sizing, Velocity Checks and Hazen-Williams Hydraulics

07 Chapter 7: Wet Riser, Yard Hydrant and Sprinkler Interface Layout

08 Chapter 8: Inter-Discipline Coordination (Architect, Structural, Electrical & HVAC)

09 Chapter 9: Design Review Deliverables, DBR & Submission Package

10 Chapter 10: Cheat Sheet, Design Worksheet, FAQ & Bilingual Glossary

What You Will Learn

- Extract all mandatory architectural and occupancy inputs before placing the first fire symbol on a drawing
- Build an active-and-passive requirements matrix calibrated to building height and occupancy group
- Calculate dedicated underground and terrace fire water storage reserves with clean tank partitioning
- Compute pump Total Dynamic Head (TDH) and main/jockey duty points using step-by-step SI arithmetic
- Perform manual Hazen-Williams friction loss calculations to verify pipe diameters and residual landing-valve pressures
- Assemble a clean Design Basis Report (DBR), riser schematic, and statutory approval submission package

Chapter 1: Gathering Architectural Inputs and Building Classification

Design Begins with Inputs, Not CAD Blocks

A reliable fire protection scheme cannot be copied from a previous building. A hospital ward, an IT park with three basements, a warehouse racking bay, and a residential tower of identical height have sharply different fire loads, occupant vulnerabilities, and smoke travel paths. Before drawing a single red line in CAD, gather verified architectural data in writing.

NOTE

All design thresholds and system requirements in India depend on the National Building Code of India 2016 Part 4, State Fire Service notifications, and local Municipal Development Authority bye-laws. Confirm the current applicable edition and local amendments before freezing design parameters.

Architectural Data Capture Matrix

Input Parameter	What to Ask the Architect	Why It Controls Fire Design
Occupancy group & mixed uses	Retail, office, hospital, hotel, factory, storage	Sets sprinkler density, exit width, refuge rules, tank size
Building height	Top finished terrace / parapet level from ground road	Triggers wet riser vs down-comer, fire lift, pressurisation
Floor plate & total built-up area	Gross area per floor and aggregate BUA	Determines detector/sprinkler count and hydrant zoning
Basement levels & areas	B1, B2, B3 area and ventilation mode	Triggers basement sprinklers, smoke exhaust ACH, access ramps
Road width & open setbacks	Minimum abutting road and side setbacks around block	Required for fire tender movement and yard hydrant layout
Staircase count & travel distances	Clear flight widths and furthest dead-end distance	Verifies passive egress compliance prior to active sizing

NBC Occupancy Group Reference

The National Building Code of India 2016 Part 4 categorises buildings across Groups A through J (Residential, Educational, Institutional, Assembly, Business, Mercantile, Industrial, Storage, Hazardous). Where a single complex houses retail shops on the lower two levels and residential apartments above, apply the stricter rule for shared shafts and escape routes unless full horizontal fire compartmentation is engineered.

HINGLISH

Occupancy group = bhavan ke upyog ki shreni. Built-up area = kul nirmit kshetrafal. Travel distance = aag lagne par surakshit seedhi tak pahunchne ki adhiktam doori.

Chapter 1 Checklist

- ☐ Obtain signed architectural floor plans, sections, and site plan with road widths.
- ☐ Record exact height from finished road level to terrace floor level (and roof parapet).
- ☐ Highlight basements, mezzanines, transformer vaults, DG yards, and LPG banks.
- ☐ Verify mixed-occupancy boundaries and vertical shaft separations.

Chapter 2: Life Safety and Passive Design Parameters

Active Systems Cannot Rescue Blocked Exits

Water pumps and sprinklers control fire growth, but **passive fire protection** buys the minutes required for human evacuation. If staircases are too narrow, travel distances exceed permitted limits, or fire shafts lack compartment seals, even a compliant pump house cannot prevent smoke casualties.

Key Passive Checks During Design Review

1. **Travel Distance & Dead-End Corridors:** Measure walking paths around furniture layouts—not straight air lines—from the remotest room point to the nearest protected exit door.
2. **Exit Capacity & Door Swing:** Ensure exit doors open outward in the direction of escape (except small individual room doors where permitted) and never encroach onto staircase landings.
3. **Refuge Areas:** High-rise structures exceeding typical height thresholds require designated external/open refuge zones at specified floor intervals—kept clear of HVAC chillers or electrical panels.
4. **Fire Compartmentation & Fire Doors:** Electrical shafts, HVAC ducts crossing floor slabs, and lift lobbies require tested fire barriers and rated self-closing fire doors.

> **FIELD TIP**
> Always verify fire shaft wall thickness and fire-rating with the structural architect early. Drywall or unsealed masonry gaps around riser pipes destroy staircase pressurisation during an actual fire.

> **HINGLISH**
> Passive protection = bina paani ya bijli ke aag aur dhuen ko rokne wali deewarein aur darwaze. Staircase pressurisation = seedhiyon mein taaza hawa ka dabav banana taaki dhuan andar na ghuse.

Chapter 2 Checklist

- ☐ Verify number of independent staircases per floor plate.
- ☐ Confirm staircase doors carry automatic door closers and panic hardware where needed.
- ☐ Locate dedicated fire-rated MEP shafts (separate from normal LV/IT risers where required).

Chapter 3: Determining the Active System Requirements Matrix

Translating Building Height & Occupancy into System Scope

Once height and occupancy group are verified, map which active sub-systems are mandatory. The table below presents an **illustrative design framework** reflecting common practice under NBC 2016 Part 4 principles; verify every cell against the actual tables of the code and your State Fire Service schedule.

Building Category (Illustrative)	Portable Extinguishers	First-Aid Hose Reel	Wet Riser / Down-comer	Yard Hydrants	Automatic Sprinklers	Fire Detection & Alarm	Basement / Stair Smoke Control
Low-rise Residential (< 15 m, typical)	Required	Common in larger blocks	Usually not triggered	Usually not triggered	Basement if > threshold	Manual/basic typically	If enclosed basement
Mid-rise Business / Commercial (15–30 m)	Required	Required	Wet Riser	Required	Typical throughout	Addressable FAS + PA	Basements & enclosed stairs
High-rise Commercial / Hospital (> 30 m)	Required	Required	Multiple Wet Risers	Ring Main Required	Full coverage + Refuge	Networked FAS + Voice	Full staircase/lift lobby + exhaust
Industrial / High-Hazard Warehouse	Specialised	Required	Ring main + Hydrants	Perimeter Ring	High-density / ESFR	Beam / ASD + MCP	Heat/smoke vents

WARNING

Never remove sprinklers or detection from a Design Basis Report merely to cut contractor tender pricing. Reduced scope often triggers rejection at Final NOC inspection after civil work is complete.

HINGLISH

Requirement matrix = bhavan ki oonchai aur shreni ke hisaab se kaun-kaun se system lagne hain, uski poori taaleeka.

Chapter 3 Checklist

- ☐ Cross-verify each building block individually (podium vs tower vs ancillary utility block).
- ☐ Mark basements, kitchen exhaust hoods, server rooms, and HT transformer yards for special systems.