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E-BOOK 12 PRACTITIONER EDITION

The Site Engineer's Calculation Handbook

Steel, Pipe, Water, Pump and Electrical Quick-Reference with Worked Examples

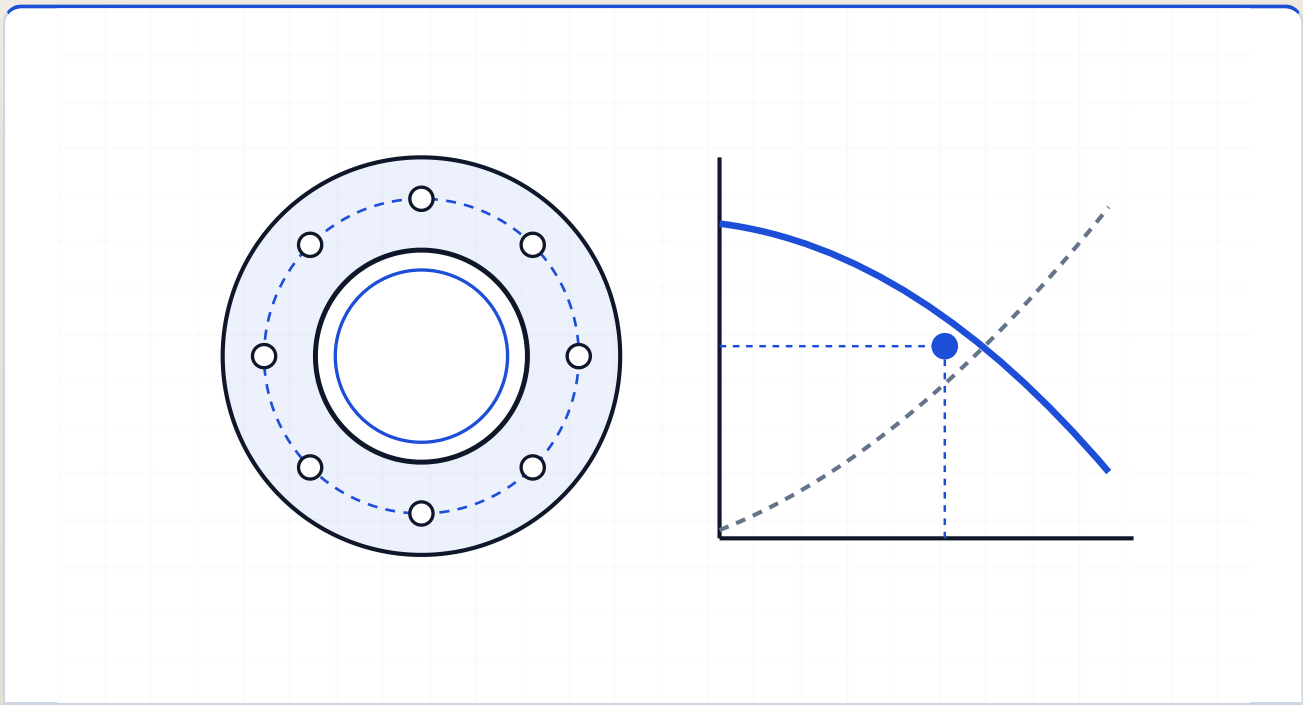


FIG 12.1 — PIPE SCHEDULE, HYDRAULIC VELOCITY & AMPERE DRAFTING SHEET

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/site-engineer-calculation-handbook

The Site Engineer's Calculation Handbook

Steel, Pipe, Water, Pump and Electrical Quick-Reference with Worked Examples

A daily desk-and-site pocket handbook of engineering formulas and worked numerical checks: metric unit conversions, structural steel weights across 11 cross-sections (Angles, ISMB, ISMC, Bars, RHS/SHS, Sheets), circular pipe empty vs water-filled loads, wrapping tape roll estimation, Hazen-Williams fluid velocity & pump kW, motor FLA & APFC kVAr, basement CFM ventilation, BOQ cut-lists, and cross-checking on sge.org.in/tools.

Intended Audience: Civil, structural, and MEP site engineers, QS/billing engineers, fabricators, and contractors verifying BOQs, dead loads, and daily calculations on site.

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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What You Will Learn

- Convert metric pressure, head, flow, length, and area units instantly without calculator slips
- Calculate structural steel kg/m across MS Angles, Channels, I-Beams, Z-Purlins, Bars, Plates, and Hollow Sections
- Compute circular pipe empty metal weight, internal water volume, filled hanger weight, and IS 10221 wrapping tape rolls
- Size sump/water tank capacities, verify pipe fluid velocity limits, and estimate pump motor kW cleanly
- Verify site electrical currents, voltage drop %, APFC capacitor kVAr, and basement smoke exhaust CFM
- Build scrap-saving 6m bar cut-lists and verify every figure digitally using sge.org.in/tools calculators

Chapter 1: Field Units, Pressure Conversions and Engineering Constants

Convert Cleanly Before You Plug Anything Into a Formula

Half of all site calculation errors start with mixing millimetres into metre equations, confusing `bar` with `psi`, or reading `GPM` instead of `lpm`. Keep this conversion sheet pinned inside your site notebook:

Quantity	Conversion Identity (Standard Engineering Values)	Mental Site Quick-Check
Length	`1 m = 1,000 mm = 3.2808 ft = 39.37 in`	`1 ft ~ 0.3048 m` ; `1 inch = 25.4 mm`
Pressure & Water Head	`1 bar = 10.197 m water head = 1.0197 kgf/cm2 = 14.504 psi = 100 kPa`	Think `1 bar ~ 1 kg/cm2 ~ 10.2 m height` !
Water Flow Rate	`1 m3/hr = 16.667 lpm = 4.403 US GPM` | `1 L/s = 60 lpm = 3.6 m3/hr`	`2,280 lpm ~ 136.8 m3/hr ~ 600 US GPM` (standard hydrant!)
Steel & Metal Density	Mild Steel / Iron: **7,850 kg/m3** (`7.85 g/cm3`) | Stainless Steel ~ `7.95 g/cm3` | Aluminum ~ `2.70 g/cm3` | Copper ~ `8.96 g/cm3`	**Steel weighs ~7.85 kg per 1,000 cm3!**
Water Density	Fresh clean water @ 20 C: **1,000 kg/m3** (`1.0 kg per litre`)	`1,000 Litres = 1.0 m3 = 1.0 Metric Tonne`

HINGLISH

Unit conversion = inch, foot, metre, bar aur litre ko ek barabar paimane mein badalna taaki calculation galat na ho. Steel density = loha ka wajan (`7.85 g/cm3`).

Chapter 2: Structural Steel Weight Formulas Across All 11 Shapes

Compute Exact Unit Weight Without Carrying Printed Charts Everywhere

Weight per running metre is simply **Cross-Sectional Metal Area (`mm2`) x Material Density (`g/cm3`) / 1,000**!

Structural Profile Shape	Input Dimensions (mm)	Cross-Section Metal Area Formula (`mm2`)	Multiply by `(rho / 1,000)` -> `kg/m`
1. Circular Pipe (Round Tube)	Outer Dia `OD`, Wall `t`	`pi x (OD - t) x t`	Steel (`7.85`): `(OD - t) x t x 0.0246615`
2. Hollow Profile (RHS / SHS Tube)	Width `W`, Height `H`, Wall `t`	`2 x t x (W + H - 2t) - 0.8584 x t^2`	Accounts cleanly for corner roll radius
3. Solid Round Bar	Diameter `D`	`(pi / 4) x D^2`	Steel (`7.85`): `D^2 / 162.2` (~ `0.006165 x D^2`)
4. Solid Square Bar	Side `a`	`a^2`	Steel (`7.85`): `a^2 x 0.00785`
5. Solid Hexagonal Bar	Across Flats `AF`	`0.866025 x AF^2`	Steel (`7.85`): `AF^2 x 0.006798`
6. Equal / Unequal MS Angle (L)	Leg `A`, Leg `B`, Thick `t`	`t x (A + B - t)`	Area (`mm2`) x `0.00785` (for MS)
7. U Profile / Channel (ISMC)	Web `H`, Flange `B`, `tw`, `tf`	`2(B x tf) + (H - 2 tf) x tw`	Area (`mm2`) x `0.00785`
8. I / H Beam (ISMB / Wide)	Height `H`, Flange `B`, `tw`, `tf`	`2(B x tf) + (H - 2 tf) x tw`	Area (`mm2`) x `0.00785`
9. T-Profile	Flange `B`, Total `H`, `tf`, `tw`	`(B x tf) + (H - tf) x tw`	Area (`mm2`) x `0.00785`
10. Z-Purlin (Lipped)	Web `H`, Flanges `B1, B2`, Lips `C`, `t`	`(H + B1 + B2 + 2C) x t` (girth check)	Strip girth x `t` x `0.00785`
11. Flat Sheet / Metal Plate	Length `L` (m), Width `W` (m), Thick `t`	Surface Area `L x W` (`m2`)	**Per Piece kg** = `L_m x W_m x t_mm x rho`

NOTE (TOLERANCE CAUTION)

Theoretical geometric equations above ignore minor rolling root fillet curves and mill tolerance allowances (`+/-` roll tolerances). Indian Standard BIS handbooks (`IS 808`, `IS 4923`, `IS 1239`) publish standard nominal weights taking rounded fillets into account—differences within 1–3% vs simplified box math are normal! Check `sge.org.in/tools/pipe-schedules` where both presets and custom metal alloy densities (`40+` options) run automatically with 3D views!

WORKED EXAMPLE 1

MS Angle & Hollow Box Tube Weight Check (Illustrative). A site stores **IS Equal Angle 50 x 50 x 6 mm** and **RHS 100 x 50 x 4.0 mm** made of Mild Steel (`rho = 7.85 g/cm3`):

- **MS Angle (`50x50x6 mm`):** `Area = 6 x (50 + 50 - 6) = 6 x 94 = 564 mm2` -> `Weight/m = 564 x 7.85 / 1,000 = 4.43 kg/m` (BIS nominal table prints ~4.50 kg/m including corner fillet radius). For 20 standard 6 m bars (`120 m`): `120 x 4.43 = 531.6 kg`.
- **Hollow Section RHS (`100x50x4 mm`):** `Area = 2(4)(100 + 50 - 8) - 0.8584(16) = 1,136 - 13.73 = 1,122.3 mm2` -> `Weight/m = 1,122.3 x 7.85 / 1,000 = 8.81 kg/m` (`IS 4923` nominal ~8.60 kg/m accounting for larger exterior roll bend radii).

Chapter 3: Pipe Weights (Empty and Filled), Water Volumes and Wrapping Tape

Hangers Must Hold Water Dead Weight, Not Just Empty Steel!

A mistake engineers make constantly: ordering ceiling rod hangers capable only of empty steel weight while ignoring the heavy core of pressurized water inside big risers!

FORMULA

- `Inside Pipe Diameter: ID (mm) = OD - (2 x Wall_t)`
- `Empty Steel Weight ( kg/m ): pi x (OD - t) x t x rho / 1,000`
- `Water Volume Capacity ( Litres/m ): pi x (ID / 2,000)^2 x 1,000 ( = 0.0007854 x ID_mm^2 )`
- `External Coating Surface Area ( m2/m ): pi x OD_mm / 1,000`
- `Anti-Corrosion Wrapping Tape Area ( m2 ): Bare External Area / (1 - Overlap_%)`

WORKED EXAMPLE 2

150 NB Heavy Pipe Water-Filled Weight & Wrapping Rolls (Illustrative). Check **50 metres** of **150 NB Heavy Class MS Yard Pipe** (`OD = 165.1 mm` , `t = 5.4 mm` -> `ID = 154.3 mm` , Steel `rho = 7.85 g/cm3`) protected underground with **150 mm wide x 10 m long rolls of 4 mm Polymeric Tape** applied at **55% spiral overlap**:

- Empty Pipe Weight/m = `3.14159 x (165.1 - 5.4) x 5.4 x 7.85 / 1,000 = 21.27 kg/m` .
- Internal Water Volume/m = `0.0007854 x (154.3)^2 = 18.70 Litres/m` (`= 18.70 kg/m` water!).
- Total **Water-Filled Dead Weight/m** = `21.27 + 18.70 = 39.97 kg/m` ! Over 50 m = **`1,998.5 kg`** **(~2.0 Metric Tonnes total dead load vs just 1.06 T empty!)**.
- Bare Outer Pipe Area (`50 m`) = `3.14159 x 0.1651 m x 50 m = 25.93 m2` .
- Primer (~7 m2/L yield) = `25.93 / 7 = 3.70 Litres` .
- Effective Net Roll Coverage per 10 m roll at 55% overlap (`45% net advance`): `(0.15 m x 10 m) x 0.45 = 0.675 m2/roll` .
- Rolls Needed = `25.93 / 0.675 = 38.4` -> Order **39 to 40 Rolls** (verify directly on `sge.org.in/tools/pipe-schedules` Wrapping Module!).

HINGLISH

Water-filled weight = pipe ke lohe aur uske andar bhare paani ka kul wajan (hanger aur clamp iske hisaab se lena chahiye). Overlap factor = wrapping patti ko 55% chadha kar lapetne par lagne wali extra patti ka hisaab.

Chapter 4: Concrete, Plaster, Sump Tank Volume and Site Civil Basics

Clean Capacity & Fill-Time Math for Tanks and Sumped Pits

- **Rectangular Sump / Tank Net Volume:** `L (m) x B (m) x Effective Liquid Depth (m) x 1,000 = Litres`.
- **Cylindrical Tank / Column Volume:** `0.7854 x D (m)^2 x H (m) x 1,000 = Litres`.
- **Drain-Down or Fill Time:** `Time (minutes) = Tank Volume (Litres) / Flow Rate (lpm)`.

Check `sge.org.in/tools/water-sump-pumping` for quick domestic/sewage sump volume + booster pump cycle verification!

Chapter 5: Fluid Velocity, Friction Loss and Pump kW Sizing

Quick Pipe Diameter & Pump Power Checks

Always confirm suction and delivery velocity limits cleanly inside steel pipes:

- `Velocity v (m/s) = Q (m3/s) / Area (m2)` where `Area = 0.7854 x (ID_m)^2` and `Q (m3/s) = lpm / 60,000`.
- **Keep Pump Suction Headers <= 1.5 to 1.8 m/s** and Delivery Mains **<= 2.5 to 3.5 m/s**!

WORKED EXAMPLE 3

Suction Line Velocity & Pump Power Sanity Check (Illustrative). A 2,280 lpm (`0.038 m3/s`) hydrant pump draws through a **200 NB** Heavy MS suction header (`ID = 206.4 mm = 0.2064 m`).

Suction Cross-Area = `0.7854 x (0.2064)^2 = 0.03346 m2`. Suction Velocity `v = 0.038 / 0.03346 = 1.14 m/s` ! Since `1.14 <= 1.5 m/s` -> **SAFE (zero cavitation squeeze!)**. What if a tight contractor substituted 125 NB (`ID ~ 128.9 mm` , Area `0.01305 m2`) on suction? `v = 0.038 / 0.01305 = 2.91 m/s` -> Severe cavitation noise and starved suction!

Chapter 6: Site Electrical Quick-Checks — Motor FLA, Voltage Drop and APFC kVAr

Cutting Utility Penalties While Sizing Feeders Fast

1. **Three-Phase Motor Quick Thumb Rule (415 V AC):** Approximately `~1.7 to 1.8 Amps per kW` (or `~1.3 A per HP`) for quick visual sanity check on medium/large industrial motors—always verify exact equation `I = P / (1.732 x V x pf x eff)` !
2. **APFC Capacitor Sizing Formula:** Power factor penalties drain industrial factory bills silently whenever lagging motors drag PF down near 0.78–0.82!

WORKED EXAMPLE 4

APFC Capacitor Bank `kVAr` Sizing (Illustrative). A manufacturing facility runs average load **400 kW** at poor existing Power Factor **`pf1 = 0.78`** (`cos phi1 = 0.78 -> phi1 = 38.74 deg -> tan(phi1) = 0.802`). Goal: correct cleanly to **`pf2 = 0.98`** (`phi2 = 11.48 deg -> tan(phi2) = 0.203`).

Required Capacitor `kVAr = P_kW x (tan(phi1) - tan(phi2))` `= 400 x (0.802 - 0.203) = 400 x 0.599 = 239.6 kVAr` . Selection: Install **250 kVAr** automated multi-step Detuned Capacitor APFC Bank!

HINGLISH

APFC capacitor bank = power factor sudhar kar bijli ke bill par lagne wala penalty jurmana bachane wala panel.

Chapter 7: HVAC Air Changes (ACH / CFM) and Fire Sprinkler Discharge Checks

Basement Smoke Clearance & Kitchen/Plant Room Ventilation

Car-park basements and hot generator rooms require mechanical ventilation measured in **Air Changes per Hour (ACH)** converted cleanly into fan flow rate **CFM (Cubic Feet per Minute)**:

FORMULA

`Airflow (m3/hr) = Room Volume (m3) x Required ACH  Airflow (CFM) = Airflow (m3/hr) / 1.699`
(Verify statutory ACH rates for normal CO exhaust vs Fire Smoke Clear modes—typically e.g. 6 ACH normal / 12+ ACH fire clearance depending on local NBC / ASHRAE rules!)

WORKED EXAMPLE 5

Basement Smoke Exhaust Fan CFM (Illustrative). A covered car-park basement measures **3,000 m2** area by **3.2 m** clear slab height -> Volume = `9,600 m3` . Design target smoke clearance rate = **12 ACH** *(verify governing code)*.

Hourly Exhaust Volume = `9,600 m3 x 12 = 115,200 m3/hr` . Convert to CFM: `115,200 / 1.699 = 67,805 CFM` ! (E.g. select two 34,000 CFM axial smoke extract fans rated for 250 C / 2 hr operation!). Cross-verify directly at `sge.org.in/tools/basement-ventilation` !

Chapter 8: BOQ Quantity Take-Off, Wastage Margins and Cut-List Optimization

Never Pay for Piles of Unused 1.5-Metre Steel Offcuts!

Standard Indian steel pipes, angles, channels, and tubes ship from rolling mills in **6.0 metre** (or random `5.5–6.5 m` / `12.0 m` structural beam) commercial bars. Simply dividing total length by `6.0 m` ignores short **offcut waste**—causing mid-project shortages or bloated scrap!

Material Trade	Typical Construction Wastage / Cutting Margin *(Illustrative Planning)*
Structural Steel Plates & Gussets (cut shapes)	~5% to 8%
Linear Pipes, Angles, Channels (6m stock lengths)	~3% to 5% (with optimized cut list)
Underground Armoured Power Cables (including trench bends & drops)	~5% to 10%
Polymeric Anti-Corrosion Tape Wrapping	~10% (plus exact overlap geometric factor!)

WORKED EXAMPLE 6

Optimized 6 m Pipe/Angle Cut-List Check (Illustrative). A rack fabrication job needs **12 struts of 3.4 m** AND **12 braces of 2.4 m**.

- **Sloppy Unplanned Ordering:** Crew cuts `3.4 m` out of twelve `6.0 m` bars (leaving twelve `2.6 m` scraps dumped aside!) and demands 6 more bars to cut the `2.4 m` pieces -> **`18 total bars` ordered!**
- **Smart Cut-List Pairing:** Pair `3.4 m + 2.4 m = 5.80 m` from each **single 6.0 m bar**! Remaining end drop is only `0.20 m` (~3.3% minimal scrap) -> Whole job completes cleanly using just **12 bars total** (saving 33% raw steel purchase!!).

Chapter 9: Digital Verification with `sge.org.in/tools` & Printable Take-Off Forms

Double-Check Manual Math in 10 Seconds Before Ordering Steel

Shree Ganesh Enterprises provides free browser engineering tools at **`sge.org.in/tools`** designed specifically as a digital sanity check beside site paperwork:

Digital Tool Path on `sge.org.in/tools`	What You Verify Instantly
`/tools/pipe-schedules`	**3D Isometric Visualizer + Weight Calculator** across all 11 metal profiles, 40+ densities, IS 1239 Class A/B/C pipes, IS 4923 hollow tubes, IS 10221 wrapping tape rolls & 1-click **BOM CSV export**!
`/tools/fire-hydraulics`	Hazen-Williams head loss, nozzle residual pressure, and pump kW
`/tools/gas-suppression`	Clean agent cylinder mass & Pressure Relief Damper (PRD) free vent area
`/tools/transformer-sizing` & `/cable-voltage-drop`	Connected kVA demand, prospective kA, and `mV/A/m` line drops
`/tools/electrical-earthing` & `/water-sump-pumping`	Soil resistivity pit counts (`IS 3043`) & sump retention sizing
`/tools/basement-ventilation` & `/standards-codes`	ACH-to-CFM fan sizing & core BIS/NBC code directory

Blank Structural Steel & Pipe Take-Off Sheet Template

Item Tag	Shape Profile & Standard Size	Material & Density (`g/cm3`)	Unit Weight (`kg/m`)	Cut Length (`m`)	Qty (`Nos`)	Total Metal Weight (`kg`)	Filled Water / Notes
`ST-01`	_____	_____ (____)	____ kg/m	____ m	____	_____ kg	_____
`ST-02`	_____	_____ (____)	____ kg/m	____ m	____	_____ kg	_____

Chapter 10: One-Page Master Formula Cheat Sheet, FAQ and Glossary

Master Engineering Formula Cheat Sheet

- **Weight/m General Rule:** `Cross-Section Area (mm2) x Density (g/cm3) / 1,000`
- **Circular MS Pipe:** `(OD - t) x t x 0.0246615` (`kg/m` @ `7.85`)
- **Pipe Water Volume:** `0.0007854 x ID_mm^2` (`Litres/m`)
- **MS Round Bar:** `D_mm^2 / 162.2` (`kg/m` @ `7.85`)
- **Hydraulic Power (kW):** `(9.81 x Q_m3s x H_m) / Pump_Eff`
- **3-Phase Amps (415 V):** `Watts / (1.732 x 415 x pf x eff)`
- **APFC Capacitor (kVAr):** `kW x (tan phi1 - tan phi2)`
- **Ventilation CFM:** `(Volume_m3 x ACH) / 1.699`

Frequently Asked Questions (Site Engineering & QS Billing)

1. **Why do my hand calculations for an I-Beam (`ISMB 200`) show ~24.8 kg/m while IS 808 table prints 25.4 kg/m?** Standard rolled I-beams and channels carry generous tapered flange slopes and rounded root fillet radii (`r1, r2`) containing extra steel mass omitted by sharp rectangular simplification! Always check both theoretical and BIS nominal tables cleanly in tenders.
2. **When contractor delivers random 5.8 m pipes billed as 6.0 m, how do billing engineers reconcile safely?** Agree **Rolling Margin & Weighbridge vs Nominal Section Weight** clauses strictly in PO terms (`e.g., actual weighbridge vs IS theoretical rolling tolerance +/- 2.5%`). Measure random physical bundle lengths and ultrasonic wall thicknesses (`t`) with micrometer on inward gate inspection!
3. **Why does Galvanized Steel (GI) weigh almost identically to Mild Steel?** Only a micron-thin zinc dip coat (~50–80 microns) sits on GI—keep base density `7.85 g/cm3` cleanly (minor +2–3% zinc coat allowance only on thin sheet gauges).
4. **How quickly can I verify an MS Plate (`2500 x 1250 x 8 mm`) piece weight?** `2.5 m x 1.25 m x 8 mm x 7.85 = 196.25 kg` per sheet (`196.25 kg` directly—never quote sheet weight in `kg/m` !).
5. **If pipe flow velocity doubles from 1.5 m/s to 3.0 m/s inside the same bore, does friction loss double? NO—it jumps almost FOUR TIMES (`Q^1.85`)!** Slightly bumping pipe bore by one nominal step (`80 NB -> 100 NB`) slashes friction loss and pumping electricity drastically!

6. **Can PVC/CPVC plastic pipe weights calculate using these same steel formulas?** Yes! Plug exact plastic density (`~1.40–1.55 g/cm3` for rigid PVC; **~ `0.96 g/cm3`** for HDPE / Alpolen) cleanly using our Custom Density tool at `sge.org.in/tools/pipe-schedules`!
7. **Why do check-plate (checkered floor plate) sheets weigh ~2.1 kg/m2 more than plain flat sheets of equal base thickness?** Raised diamond/tear-drop anti-slip ribs forged onto the upper rolling face add roughly `~1.8 to 2.4 kg/m2` extra steel mass depending on pattern height!
8. **Should we specify 12-metre crane-delivered steel beams vs 6-metre beams?** 12-metre I-beams save expensive full-strength site splice butt welds across warehouse portal rafters—confirm street trailer turning access before ordering!
9. **How accurate is `1 bar = 10 m head` for quick site field checks?** Actual exact conversion is `10.197 m` (~2% higher). Fine for quick mental checks (`7 bar ~ 71.4 m`), always use exact `10.197` (or `9.81 * H`) in pump contracts!
10. **What is "Kerf Loss" on structural cut lists?** Thickness of metal ground away to dust by each chop-saw / plasma blade pass (`~2–4 mm` per cut)—usually negligible on two cuts per 6 m bar, important when slicing 50 tiny 100 mm cleats cleanly!
11. **Does `D^2 / 162.2` apply cleanly to Aluminum solid round rods too? NO!** `162.2` embeds steel density (`7.85`). For Aluminum (`2.70`), compute `Area x 2.70 / 1,000`, which gives roughly `~0.34x` steel weight (`D^2 / 471.5`)!
12. **How can junior site engineers export calculated schedules directly into supplier RFQs?** On `sge.org.in/tools/pipe-schedules`, add each profile into the **Consolidated Bill of Materials (BOM)** cart and click **"Download CSV"** or **"Send RFQ to WhatsApp"** cleanly!

Hindi–English Bilingual Glossary

English Term	Hinglish / Site Hindi	Technical Meaning
Specific Density (`rho`)	Dhatu ka ghanatva / wajan	Mass per unit volume (`7.85 g/cm3` steel)
Cross-Sectional Area	Kati hui satah ka kshetrafal	Sliced flat metal end surface area (`mm2`)
Unit Weight (`kg/m`)	Ek metre ka wajan	Kilograms per running linear metre
Metric Tonne (MT)	Hazaar kilo (1,000 kg)	Standard structural buying tonnage unit
Nominal Bore (NB)	Pipe ka aam andaruni size	Traditional designation (`e.g. 100 NB = 4 inch`)
Outside Diameter (OD)	Bahari golai vyas	Real outer steel cylinder width (`114.3 mm` for 100 NB)
Wall Thickness (`t`)	Pipe/sheet ki motai	Gauge thickness resisting internal pressure
Hollow Section (RHS/SHS)	Chaukor ya aaytakaar khali tube	Square/Rectangular structural steel tubes (`IS 4923`)
Checkered Plate	Daane-daar fisalna-rok chadar	Diamond-raised floor walkway plate
Rolled Steel Angle (ISA)	L-aakar ka angle	Structural equal or unequal corner iron
Channel (ISMC)	C-aakar ki channel patti	Structural U/C section beam
I-Beam / Girder (ISMB)	I-aakar ka bhaari gardar	Main structural spanning girder
Z-Purlin	Chhat sheet rokne wali Z-patti	Cold-formed roof purlin carrying GI sheds
Rolling Tolerance	Mill se banne mein chhota farq	Normal manufacturing weight variation percentage
Mill Test Certificate (MTC)	Karkhane ka asali quality patra	Lab heat number & thickness batch proof
Bar Bending / Cut List	Tukde kaatne ka chart	Planned length pairing cutting offcut scrap
Offcut Scrap	Kaatne ke baad bacha tukda	Leftover end short pieces from 6 m bars
Weighbridge / Dharamkanta	Truck tolne wala kaanta	Official calibrated bulk delivery scale
Micrometer / Vernier Caliper	Motai naapne wala yantra	Digital gauge verifying genuine wall mm
Dead Weight (Water-Filled)	Paani bhari pipe ka kul bhar	Essential load sizing hanger anchors safely
Wrapping Overlap	Patti par patti chadhana	Spiral width step ensuring continuous seal
Fluid Velocity (`m/s`)	Paani behne ki raftar	Speed deciding pipe bore & noise
Air Changes per Hour (ACH)	Ghante mein hawa badalna	Ventilation freshness / smoke clear rate
Cubic Feet per Minute (CFM)	Hawa pankhe ki kshamta	Standard industrial fan airflow unit
Take-Off Sheet	Naksha dekh kar ginti list	Manual quantity extract directly from drawings
Bill of Quantities (BOQ)	Poori maatra aur rate suchi	Priced itemized tender supply schedule

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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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