Guidelines for Plumbing

1. In buildings other than low-rise (<=30 m), desired water pressure at all fittings is 150 Kpa (1.5 bar) with a minimum of 100 Kpa. Where gravity based system is used, booster pumps may be needed on the floors which falls within 12 mtrs. of the bottom of water tank.
2. Maximum water pressure in the riser should not exceed 18 bar (preferably not more than 12 bar).
3. The standard fixture pressures are between 1 bar to 4 bar. We will have to ensure that the selected sanitary fixtures are suitable for this kind of pressure.
4. The Water hammering of the plumbing line shall be evaluated during design phase and water hammer arrestors shall also be included in the BOQ.
5. Following piping systems are to be used:

Type of Pipe	**Low-Rise (<=30 m)**	**Mid-rise (30 m – 70 m)**	**High-rise (70 m – 150 m)**	**Very High Rise (150 m+)**
Uptake Pipes OR Hydro-pneumatic systems	Indian UPVC* Schedule 40 pipes & fittings with solvent welded joints.	Indian UPVC* Schedule 80 pipes & fittings with solvent welded joints.	a. <u>Upto 100 m</u> – CPVC b. <u>Above 100 m</u> - GI Class B pipes with welded joints or Victaulic fittings (Internal food grade epoxy coated GI Pipes for drinking water line);	GI Class C pipes with Victaulic joints (Internal food grade epoxy coated GI <u>Over 300 m –</u> Polybutylene (PB) fittings may be considered.
Down take Pipes	Indian UPVC*	Indian UPVC*. PRV to be used to moderate pressures so that design pressure ratings of water heaters and CP ware at any point is not exceeded and pipeline pressure is kept below 8 bar.	CPVC / GI with welded joints; PRV's are needed to moderate pressure to the values not exceeding rated design pressures of water heaters and CP ware at any point . For > 300 m height, PB can be used to take care of vertical sway / better acoustic quality / easy installation.	

All fittings should be capable of withstanding pressure which is 1.5 x the design pressure in the pipes in that relevant segment of the building. While selecting pipes / fittings, appropriate de-rating factor w.r.t. temperature to be taken care of.

* It is presumed that Indian UPVC pipes can be used only for design pressure not exceeding 10 bar for sizes 2.5" & above (as in 2012) . This may be updated as Indian manufacturers improve their operations.

Current (2012) cost ladder: Indian UPVC < CPVC < GI with welded joints < GI with victaulic fittings < International-standard UPVC < PB

6. Following piping systems are to be used for Drainage vertical stacks/Fire Pipes:

	Low-Rise (<=30 m)	**Mid-rise (30 m – 70 m)**	**High-rise (70 m – 150 m)**	**Very High Rise (150 m+)**
Soil/Waste/Vent/Storm water Stacks	Indian origin UPVC (6 bar rated)	Indian origin UPVC (10 bar)	high Pressure PVC class E (Indian/ international) (Pressure rating 16 bar with velocity breakers) or CI	High Pressure PVC class E (Indian/ international) (Pressure rating 16 bar with velocity breakers @EVERY 10 FLOORS).
Fire risers	MS pipes ((12 bar rated)	MS pipes (Working pressure up to 12 bars).	ASTM A 53, ERW PIPES (Working pressure up to 18 bars).	ASTM A 53, ERW /seamless pipes with grooved fittings. (Working pressure to be limited to 18 bars with pressure break may be required at intermediate floor).

7. For all buildings over 70 m, last bend shall be Cast Iron with flange connectors suitable for dissimilar materials of drainage system.
8. In case of UPVC piping, fittings need to be one grade higher than the pipes. Thrust support shall be provided on the last bend.
9. For all the buildings over 70 meters the last two floors shall be independent of the main drainage downtake. It will be worthwhile to consider an offset in the last bend and a separate downtake for the last two floors to reduce the pipe rapture or the backflow to the lowest floor toilets.
10. Tanks which are located in the vertical part of the building viz. above ground floor, should be planned in GRP/FRP to reduce dead load on building and ease construction. Required capacity of such tanks can be maximized by having side access as opposed to top access.
11. Under-slung piping is preferable for toilets/kitchen in order to avoid sunken slabs and expedite construction cycle. Where feasible in overall design, the plumbing shafts may be located in such a manner that the outlet of EWC trap can be directly connected to vertical down takes in the shaft, thereby saving acoustic under slung pipes for EWC. In case wherever acoustic pipes cannot be used , UPVC pipes can be wrapped with acoustic insulation . Where the under-slung piping occurs in bathrooms directly above one another, and false ceilings are provided, only soil pipes need acoustic insulation to mute noise created by flushing of water. Other alternatives to UPVC pipes with acoustic insulation can include 'noiseless' UPVC pipes (currently not manufactured in India – 2012) or polypropylene pipes.
12. Two separate water supply lines to be provided for water supply:
    a. Domestic water – Kitchen, utility areas, basins & showers, jet spray in toilets.
    b. Flushing – For flush tanks, irrigation (with treatment) & cooling towers (if applicable)
13. In low rise buildings (< 30 m above ground), common downtake for soil and waste should be used for cost optimization, along with a gully trap in each bathroom for the waste.
14. In case of separate waste pipe, a filter should be provided at the ground/below ground level before the waste enters the horizontal drainage system. This filter should be easily accessible for regular maintenance.

15. In developments with multiple underground water tanks, it is necessary to ensure that the water supply pressure from the municipal connection is virtually equal at all UG tanks. In order to ensure this, the water distribution system has to be devised in a loop (any other solution which ensures equitable water supply to all UG tanks is also acceptable).
16. All water supply systems (and for that matter, all other utilities like STP, Electric substations) can be combined within a set of buildings which are likely to form a society or have the same usage (viz. either all residential, all office, all retail etc.). This may also be combined for all the buildings within a given location, even if these are of different usage and/or different societies, if there is significant cost saving and subject to approval from Director-Operations.
17. Fire tanks and domestic water tanks should be co-located as far as possible, since water will flow into domestic water tank through overflow from fire water tank.
18. Fire fighting tanks should be sized (total capacity on ground + terrace + any other levels) to meet fire fighting needs for 60 minutes for building/podium/basement (subject to 19. below). This is as per NFPA (National Fire Protection Act – USA) standards.
19. In multi-building projects, it can be assumed that 1/4th of the wings (subject to minimum of 1) shall be on fire simultaneously. (Note: In parking podium/basement, it can be assumed that only 1/4th of the zones shall be on fire simultaneously).
20. If the Fire tank sizing as per 18 and 19 above are less than the CFO's requirements, follow the requirements as per 18 and 19.
21. Domestic water tank capacity (total capacity on ground + terrace + any other levels) should be equal to 1 day storage for buildings <=150 m and 1.5 days storage for buildings > 150 m (super high rise). 1.5 days storage capacity may also be considered for building <=150m in those locations which have extreme water shortage viz. daily water supply (even if for limited no. of hours) is not guaranteed. (Note: raw water tank for receiving tanker / bore well / open well water has to be created separately with capacity of 50 – 100 cu. m.)
22. Gravity based water supply systems are preferable to hydro-pneumatic systems, on account of lower cape and lower opex. However, in case of gravity based systems, it is to be ensured that sufficient pressure is available at the 3-4 habitable floors (within 12 mtrs height) immediately below any above ground water tank location (small booster pumps may be used for this purpose). This is necessary only where high

pressure CP ware like rain shower or Jacuzzi area provided. In normal buildings, since overhead tanks are elevated by 1.5 and 2 meters and certain minimum water level is maintained in the tank by level controller, booster is not required.

23. In case of a multi-wing / multi-building project in which some/all wings share the water supply and/or fire fighting tanks, it is to be examined as to what is more cost effective and the lowest cost option should be preferred:
    a. Separate water supply and fire fighting pumps (with their respective backups) for each wing.
    b. Having software/sensor based system, which facilitates sharing of water supply and fire fighting pumps between wings (with limited backup for the pumps) and reduced capex for pumps.
24. Pumps and their back-ups to be provided as follows:
    a. Fire pump (electrical): 1 working + 1 standby + 1 diesel pump (with single riser for hydrant and sprinkler) (pump room to be oversized for temporary placing of one additional pump if CFO NOC calls for 2 working + 2 standby). Wet riser and sprinkler systems can be combined only when there are limited number of sprinklers in each floor. In buildings where entire floor is sprinkled , two systems will have to be independent of each other except for their interfacing thru fire alarm panel.
    b. Fire pump (Jockey): 1 working + 1 standby (pump rooms to be oversized for temporary placing of 2 additional jockey pumps if CFO NOC calls for 2 jockey + 2 standby).
    c. Fire pump (booster): 1 working + 1 standby
    d. Water supply (at all locations): 1 working +_1 standby
    e. Where rating of valves is PN25, maximum pressure in the risers will be restricted to 25 bars. For higher pressures, valve rating has to be enhanced.