Case Study – Improper Installation of Hydropneumatic System in High Rise Building

By Praful Naik

Preface

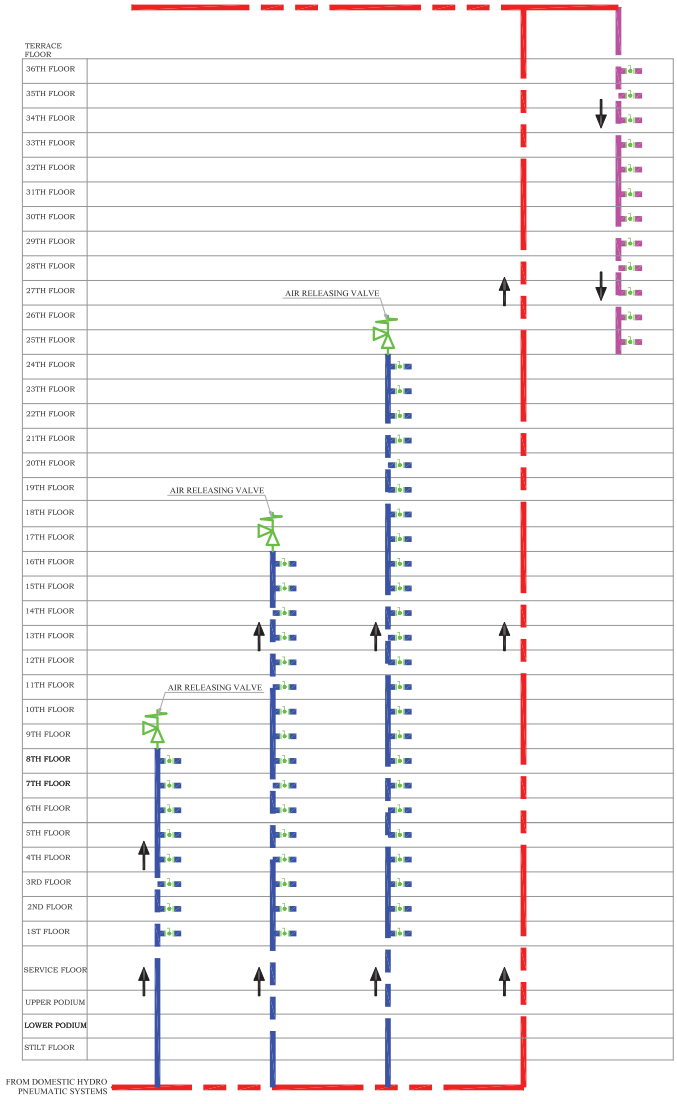
21st century is the century of changes in all spheres of life. Explosion of technology has changed the lifestyle completely. Even construction industry is not left behind. Rising population and skyrocketing land prices in Indian cities have given rise to high rise buildings which accommodate large number of people on a piece of land. It is of utmost importance to not only construct high-rise building with elevation, but also to make optimum use of space and utility by providing the very basic facility of continuous water supply without any wastage at all levels. Engineering is not just use of technique but using this technique in an innovative way can lead to problem solving.

Project background

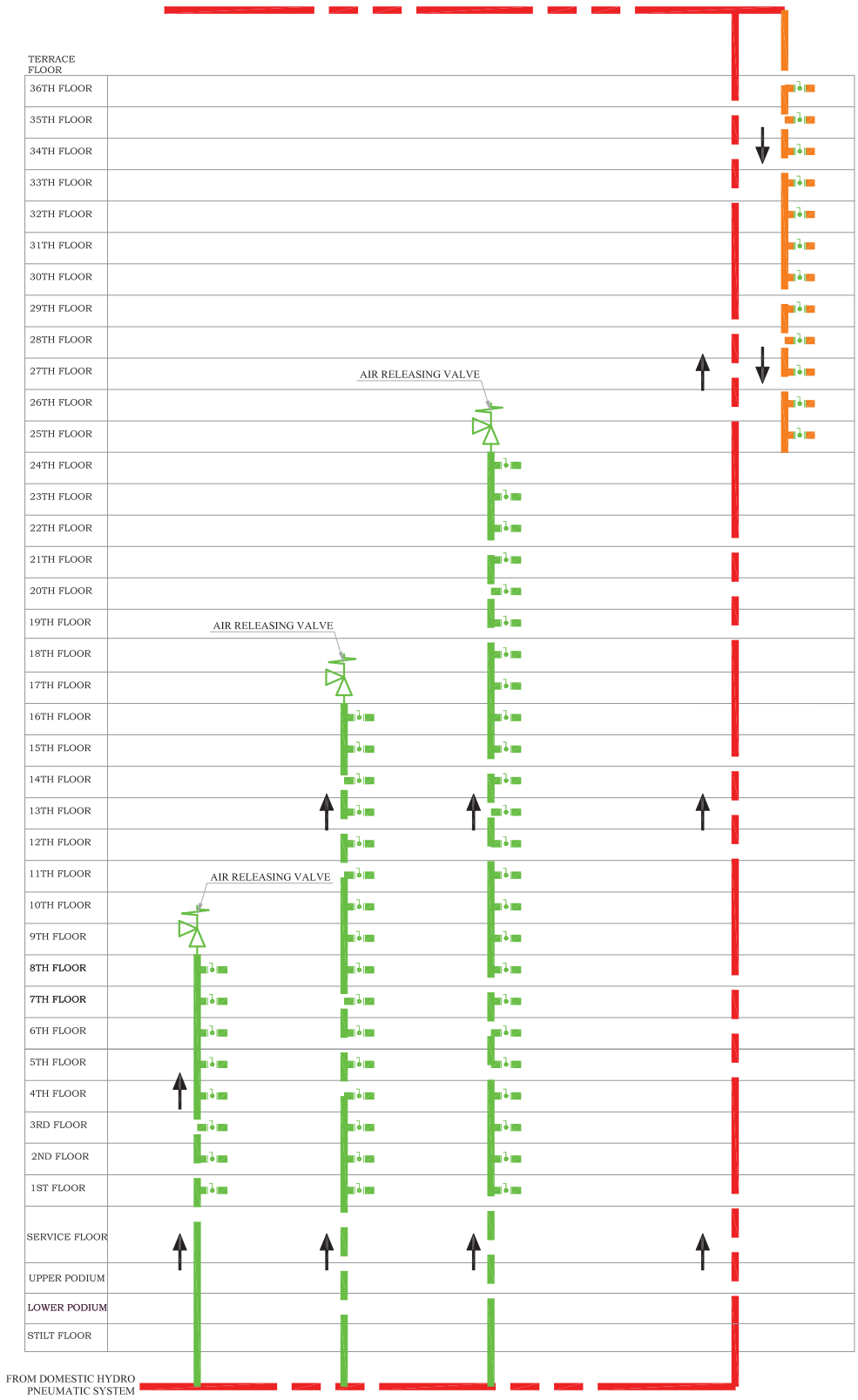
An occupied building with 100% occupancy having lower podium, upper podium, service floor & 36 upper floors.

There is separate water supply for Domestic and Flushing purpose. All water supply is through Hydro Pneumatic System (HPS).

There is a single HPS supplying Domestic water from lower podium to 36th floor and similarly a separate HPS for Flushing water supply which also caters from lower podium to 36th floor. Schematic sketches of Domestic and Flushing water supply is as shown below.



SCHEMATIC DOMESTIC WATER SUPPLY OF A TYPICAL TOILET SHAFT (OLD)



SCHEMATIC FLUSHING WATER SUPPLY OF A TYPICAL TOILET SHAFT (OLD)

Problems and Challenges:

The main problems faced by the residents of the occupied building are:

1) Inadequate pressure
2) Fluctuation in pressure
3) Bursting of pipes
4) Continuous running of HPS

Solution:

A site visit was made to understand the existing conditions and to review the existing drawings.

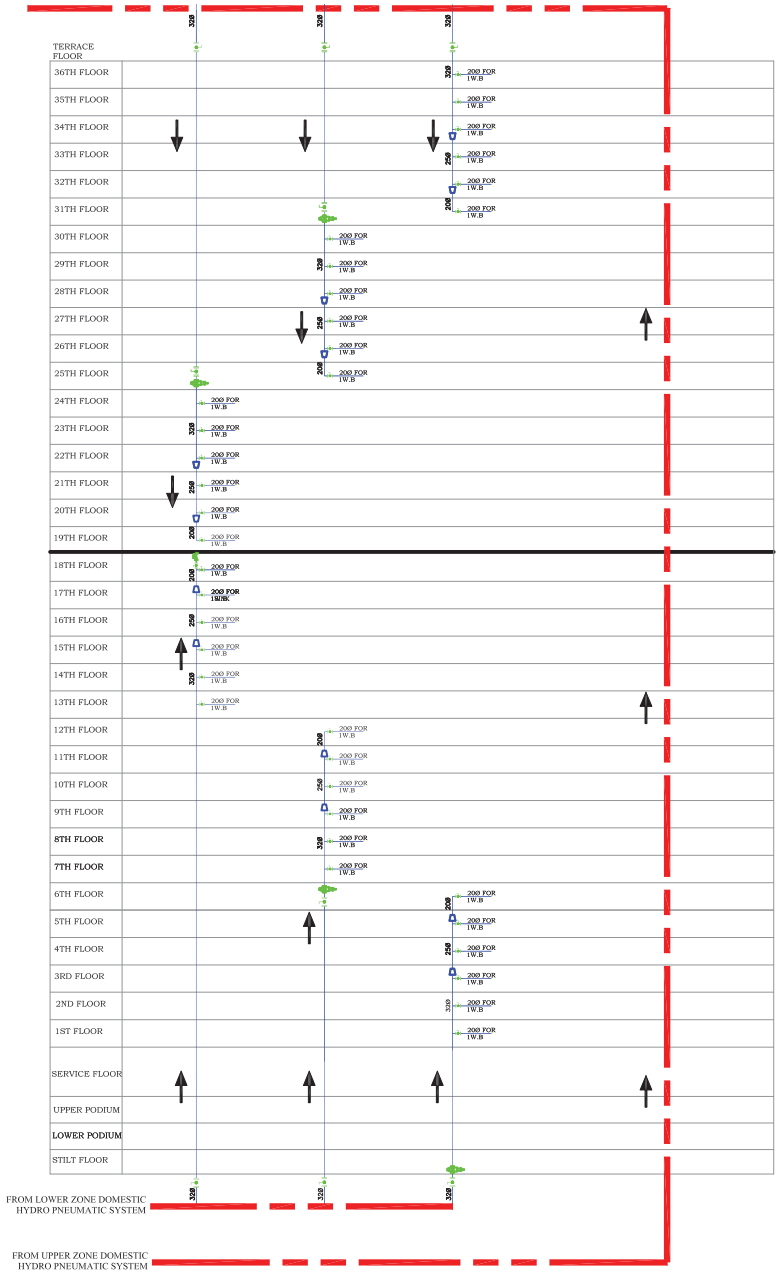
The building has been provided with only one HPS system for the entire 36 floors by which the water flows from ground to top for flushing and domestic uses. Due to this non uniform pressure was generated resulting in uneven flow, excess consumption of electricity and high maintenance cost.

After understanding the problem as a designer, it was decided to split the entire building into two zones, Lower Zone and Higher Zone. Lower zone will supply water up to 18th floor while higher zone will supply water above 18th floor.

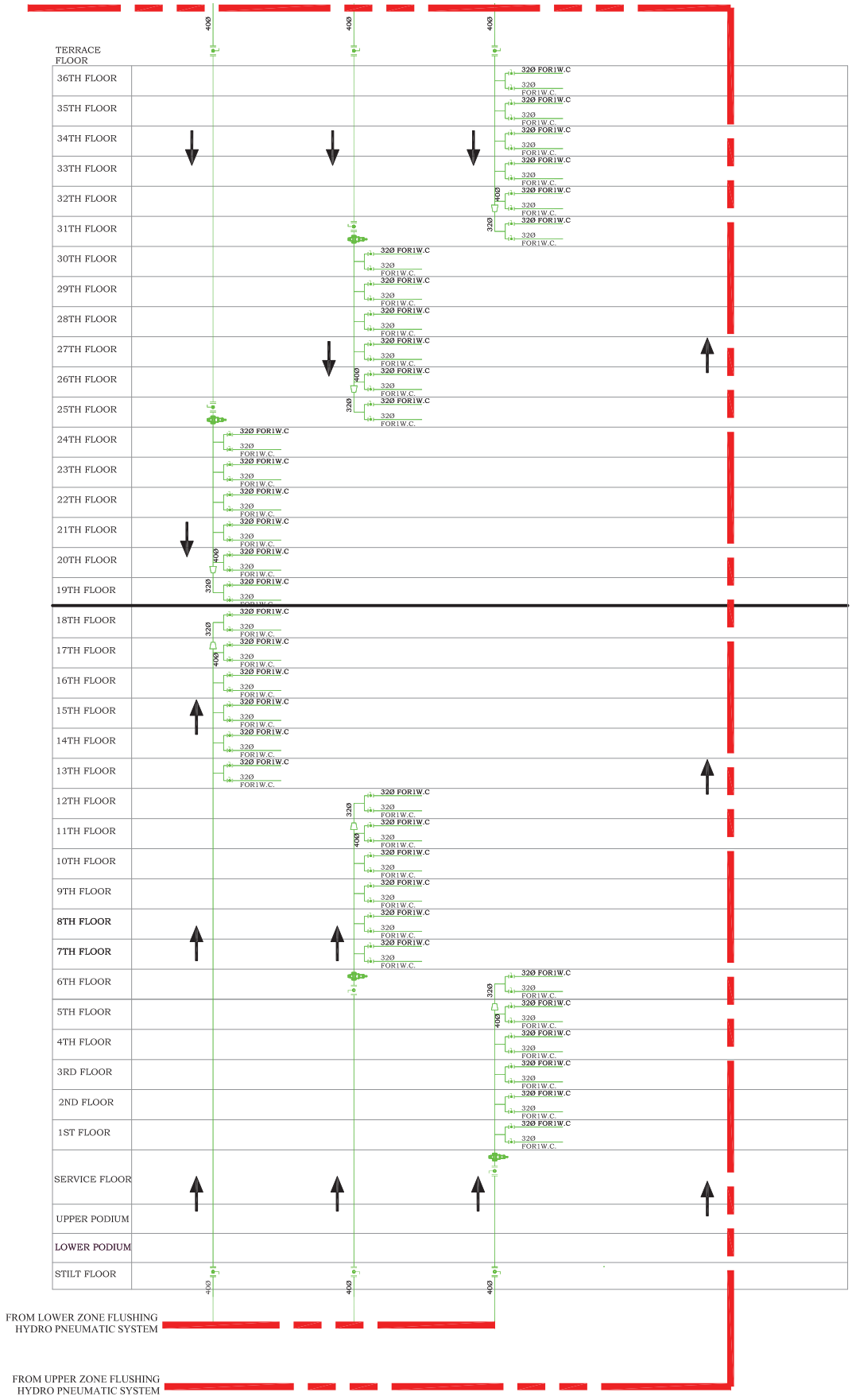
Since the pumps were already installed, to reduce the Capex it was proposed to use both the systems either without making any changes in pump or after modifying existing pumps by removing some impellers to match revised flows and heads. Schematic sketch of proposed system is given in sketch no. 3 & 4

Existing systems were having Variable Frequency Drive (VFD) to match the fluctuations in demand load during entire day. New systems were also proposed with VFD for the same purpose.

Also, existing water supply pipes are of G.I. material and rusted. Recommendation of combination of GI pipe & PVC pipes as per the design pressure was made.



SCHEMATIC DOMESTIC WATER SUPPLY OF A TYPICAL TOILET SHAFT (PROPOSED)



SCHEMATIC FLUSHING WATER SUPPLY OF A TYPICAL TOILET SHAFT (PROPOSED)

Outcome: The new suggestion and implementation turned out to be a win win situation for both occupants and client. It is observed that after dividing water supply system in two zones all problems mentioned above were resolved. Above all, major advantage was reduction in power consumption. After installing new HPS with lower zone and higher zone it was observed that power consumption for water supply is reduced in the range of 25% to 40%.

Suggestion:

1) It is advisable to have HPS for water supply in high rise buildings, which is economical in operation cost.
2) For water supply, divide total floors of the building in more numbers of zones (It shall be divided moderately to achieve maximum saving in power and capex shall be economical) and install separate HPS for each zone. This will reduce power consumption drastically.
3) While dividing total floors in zones the cost of the HPS, area required in pump room shall also be considered. Hence number of zones shall be such that it will be economical for capital cost as well operating cost.

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Praful P. Naik is a Civil Engineer. His firm Hydrotech Consultant (MEP Consultant & Engineers) has executed various Residential, Commercial, Industrial, Hotels, Hospitals, and Villa projects. He has done Non-Plant buildings of Reliance Industries at Jamnagar, hospitals of New Mumbai Municipal Corporation at Nerul as well Airoli. He has also completed Mumbai Cricket Association at Kandivali Etc. He can reached on projects@hydrotechconsultant.com.