技 術 文 章
Technical Paper

Water & Energy Saving Features in Plumbing Systems

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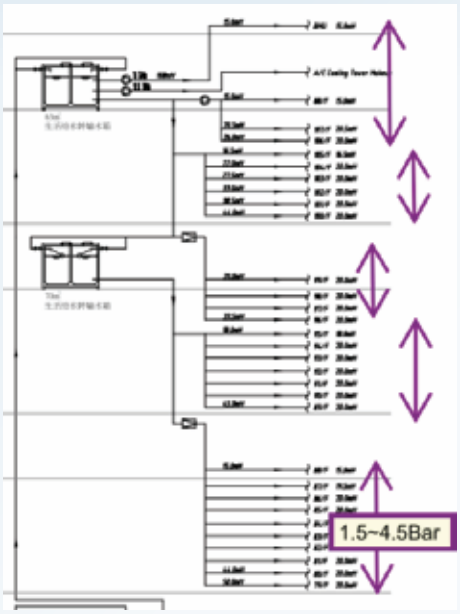
Introduction

Fundamental formula Q = m· c· ΔT, we all had studied since secondary school, but this equipment is useful to entire plumbing and building services installation, it clearly describes the amount of energy (Q) is directly related to the mass (m) and change of temperature (ΔT) in a fluid, it's simply: the more water you use, i.e. more energy input will be required.

In view of high concern on sustainability design in recent building construction industry, would like to share the experience and special design considerations for plumbing and hot water systems.

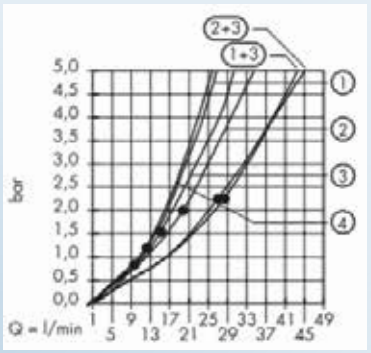
System Supply Pressure



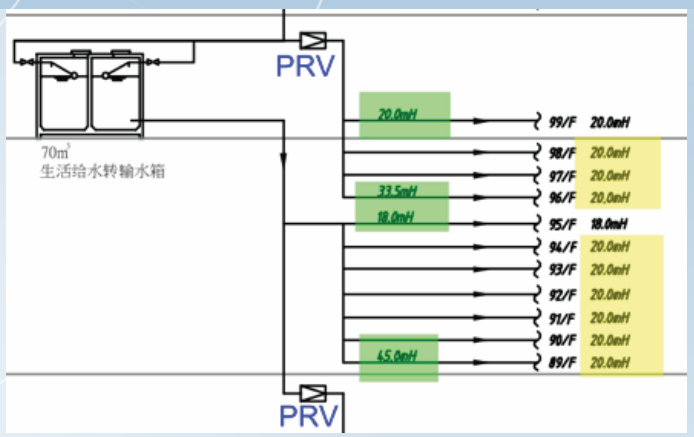
The most common and initial consideration on water saving is to apply water saving sanitary, but the actual amount of water consumed will also subject to manner and pressure of water supply.

Normally, we divided a high rise building into small vertical zones and supply water either by booster pump, gravity only or gravity with pressure reducing valve set (PRV). Water supply to water points on each zone will be designed to have residual pressure at a range of 1.5 ~ 4.5 bar; for project expected to have deluxe sanitary, such as deluxe Hotel guest rooms / residential units, which may require higher operation pressure to overcome the fitment head loss and product comfortable water pattern, and sometime the minimum pressure will be at 2.5 bar instead.

As per the system curve of water tap or sanitary fittments, if higher the residual supply pressure, the more water will be flowed and discharged from the corresponding water point, most of the general sanitary in the market can be operated satisfactory in around 1.5~2 bar head. Hence for high rise building, the floors serving with higher residual head, 4-5 bar, will resulted in larger flow than that of floors with lower pressure, say 1.5 bar; hence more than the actual required amount of water discharged and wastage happened. In view of optimize the control on flow rate against pressure, it is recommended to either system design:



- To have narrower vertical zoning on pressure range, then it will resulted at more zones and more risers / pump or main pressure reducing valve needed;



or another way

- On the branch of water supply to each floor to incorporate a localized pressure reducing valve, which limit to the pressure < 2bar; the flow and capacity of this PRV can be small and easier to be incorporated to pipeduct ceiling void space but, of course, more maintenance works shall be required in future.

Actually, this logic of control supply pressure to each floor had been listed in Mainland China green building design regulations.

Water Saving Sanitary

The actual amount of water consumed will also subject to manner of users' behavior, even though the flow output of a sanitary-ware in low demand type, but longer operation time per usage, or without shut off after use, it's meaningless and even waste more water. Hence sanitary with built-in **Auto-senor water taps** is more and more common, especially for public and hygiene concerns location, public toilets and changing rooms, prevent any miss-used or abnormal usage.

Although auto-senor type will need power, it's small; some modern model with built-in turbine and make use of hydraulic flow to generate power for the sensor operation.

On the other hand, the design of appliances required less flow of water in each operation is considered as water saving type.

BEAM plus - Credit requirements : **1 credit** for installing water efficient appliances that have Water Efficiency Labelling Scheme Grade 2 (>9&<=12 L/ min) or Grade 1 (<= 9L/min)

As per BEAM plus - Credit requirements for baseline building:

- Rest room hand washing : basin tap<= 8.3 L/min
- Kitchen / Pantry : Faucet <= 8.3 L/min
- Shower : Shower <= 9.5 L/min

As per LEED credit, appliance comply with Water Sense: an EPA partnership program:

- Bathroom sink faucet & accessories < 1.5 gallon / min (< 6.75 L/min)
- Shower heads < 2 gallon / min (< 9 L/min)

Hence the requirements of LEED credit is a little higher than that of BEAM plus.

Other System feature to save water & energy

Some operation procedures can control and prevent water wastage through any mis-use, system failure or sanitary fitting leakage :

- Incorporate zone isolation valves with **timer / remote control** to shut-off entire hot / cold water supply for designated areas and STOP the supply at out of operation hours or abnormal long duration operation, such as
  - public / staff changing rooms,
  - production process / factories
  - commercial kitchen,
  - water cooled air-conditioning
  - laundry, etc:

- Incorporate leakage detection, especially for those concealed / underground installations
- Maintenance programme to check against thermal insulation of hot water pipe, water fittments, etc
- Monitoring audit on water usage / consumption
- Control water for irrigation against actual planting need
- Application of Reclaim and re-cycle water
- Utilize direct supply manner to save energy in water transfer

Other the other hand, application of reclaimable energy on hot water system is another way to save and reduce the amount of energy by reduce the ΔT, such as

- Solar panel – absorb solar radiation to heat up water
- Heat pumps – utilize waste from heat air-conditioning plant to heat up water
- Economizer from boiler – capture the waste heat from boiler chimney to water
- Cogeneration & Trigeneration – Utilize the waste heat from turbine (produce electricity) to heat up water and product chilled water as well.