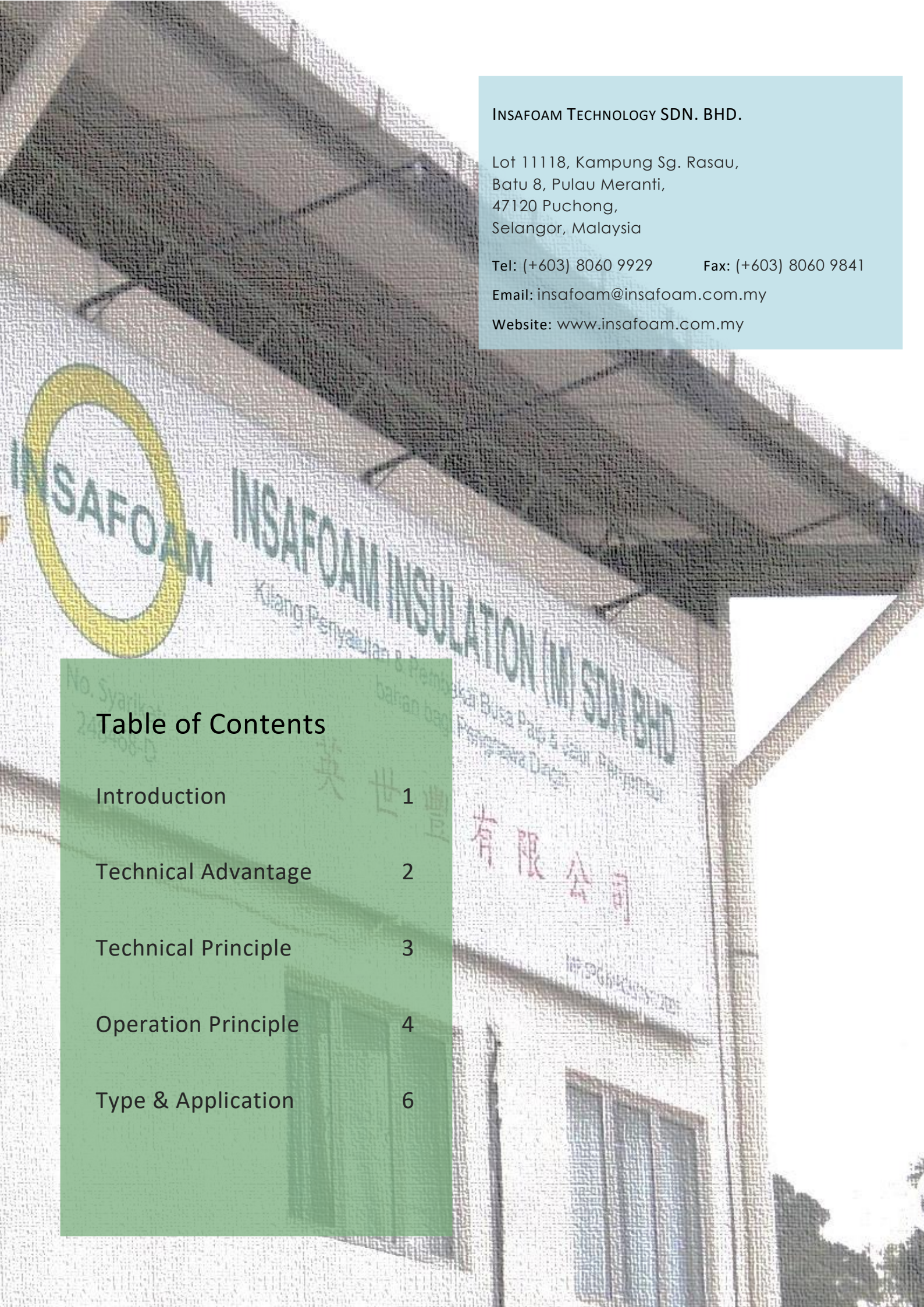
INSAFOAM

THERMAL ENERGY STORAGE

Catalogue



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INSAFOAM THERMAL STORAGE TANK

The **THERMAL ENERGY STORAGE (TES) tank** is a naturally stratified thermal accumulator that allows the storage of chilled water produced during off-peak periods. A **TES tank** reduces the operational cost and the required capacity of cooling plants, increasing the efficiency of the cooling plant and reducing the capital cost.

The **Stratified Thermal Energy Storage (TES) tank** is a widely proven technology that collects excess process thermal energy to be used during load peak hours. By producing chilled water in the evening and using it during daily peak hours there are several advantages. **Insafoam's thermal storage tanks** provide a tailor-made solution in the fields of cooling and heating.

Energy generated by the utilities more efficiently at night,is used to make Ice.

The following day,the stord cooling is utilized to cool the building.

Technical Advantage

- Maximum efficiency in simultaneous chilled water production and consumption
- Smaller refrigeration equipment sizes and costs, as they are designed for average loads and not for peaks
- Reduce electrical maximum demand which subsequent saving on the power contribution fee and monthly maximum demand charges.
- Saving on operation cost as thermal energy production during low cost off-peak tariff.
- Can convert into fire fighting water tank during emergency.
- Available option of water or ice storage
- Zero Maintenance

Technical Principle

The principle of a Stratified Water Thermal Energy Storage (TES) System are related to both the physical properties of fresh water and the hydraulic characteristics of the stratification inducing pipework. Based on the following two physical properties of water will successfully stratifying the water of different temperature naturally:

1. The Density as it varies with Temperature.
2. The Kinematic Viscosity at it varies with Temperature.

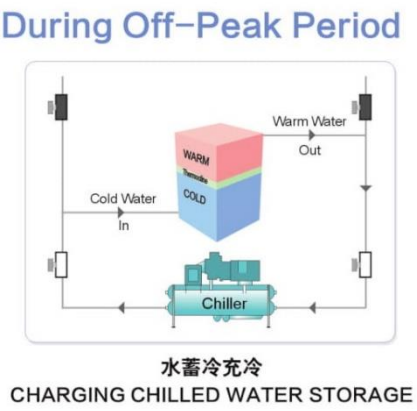
The density difference between two liquids at different temperature creates buoyancy forces, which cause the warm water (lighter density) to be literally floated on top of the cool water (higher density). The relatively large difference in Kinematic Viscosity of liquids separated only by a few degrees in temperature suppresses any mixing of the two fluids, due to flow disturbances and free convection at the vessel walls.

Temperature °C	Density Kg/m^3	Specific Heat kJ/(kg.K)	Viscosity 10^{-6} m^2/s
0	999.840	4.212	1.789
1	999.898	4.210	1.741
2	999.940	4.208	1.692
3	999.964	4.206	1.644
4	999.972	4.204	1.596
5	999.964	4.202	1.548
6	999.940	4.199	1.499
7	999.901	4.197	1.451
8	999.848	4.195	1.403
9	999.781	4.193	1.354
10	999.699	4.191	1.306
11	999.605	4.190	1.276
12	999.497	4.189	1.246
13	999.377	4.189	1.216
14	999.244	4.188	1.186

Operation Principle

Charging during Off Peak

During off peak hour with the advantage of special discounted tariff, chiller will produce chilled water and pump into the bottom diffuser and the warm water will suck out from the top diffuser. A thermocline layer will formed between the chilled water and warm water.



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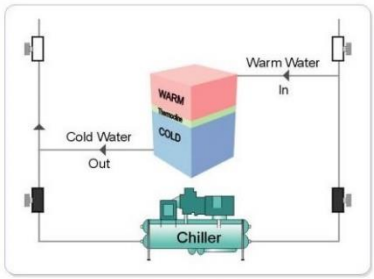
CHARGING CHILLED WATER STORAGE

Discharging during Peak

During peak hour, chilled water will draw out from the bottom diffuser of TES tank and pump into building air conditioning system. During this time the TES will act like a chiller to provide additional (partial storage) or take over fully the chiller function (full storage).

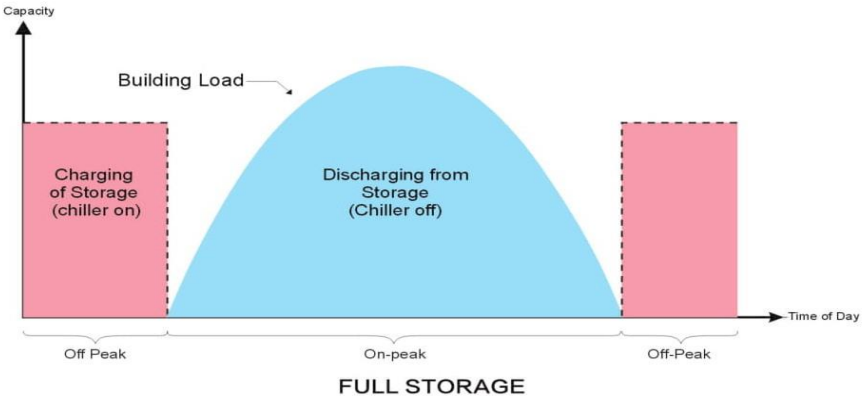


蓄冷槽释冷
DISCHARGING CHILLED WATER STORAGE

Operation Strategies

Full Storage

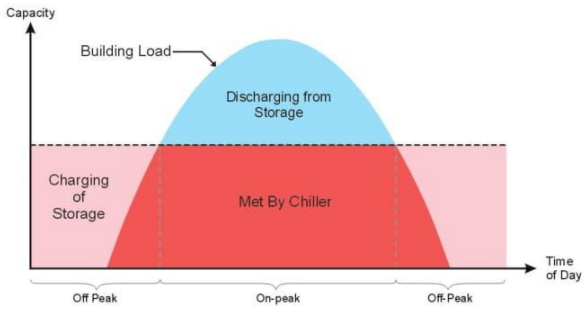
In full storage system, the full cooling load of the day (RTH) will be stored in the TES tank and discharge during the day time without running any chiller. This system can utilise full benefits of the off-peak tariff. However the tank size will be larger to cater the full cooling load of the day.



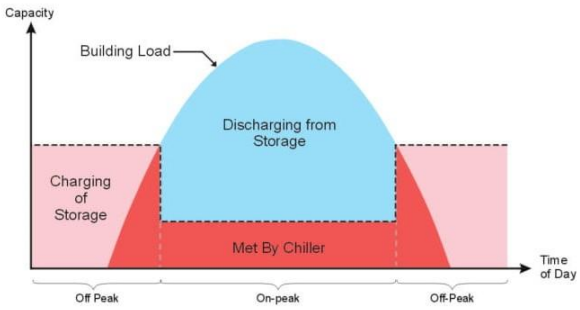
FULL STORAGE

Partial Storage

Partial storage system utilizes both chiller and TES tank discharge to fulfil the cooling load of the building at the same time. The advantages of this system are to reduce the chiller and storage capacity which will lower the capital investment cost, faster payback and reduce plant footprint.



PARTIAL STORAGE–LOAD LEVELING

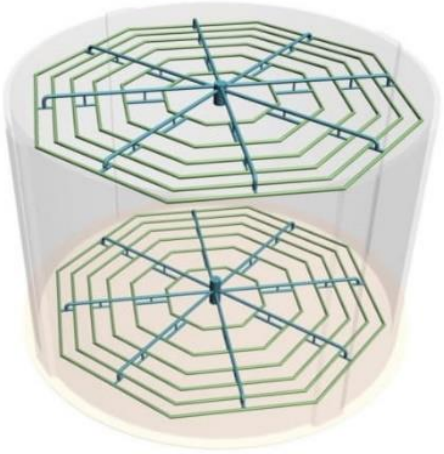


PARTIAL STORAGE–DEMAND LIMITING

Diffuser Type and Application

Octagonal Diffuser

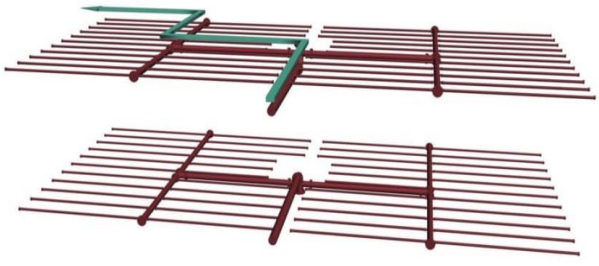
Octagonal diffuser is suitable to apply on round tank either steel or concrete tank. This type of TES tank is mainly applied in the district cooling plant with the larger footprint.



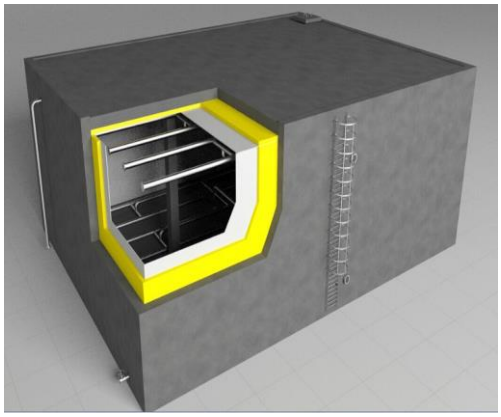
OCTAGON DIFFUSER

H-Type Diffuser

H-Type diffuser is suitable to apply on square concrete tank. This type of TES tank is mainly applied in the large-scale mix development like shopping mall, hospital and hotel.



H-TYPE DIFFUSER



Buffer Tank

Buffer tank is a pre-fabricated pressure vessel with built in diffuser. This type of TES tank is mainly applied on the data centre or special laboratory where the air-conditioning system cannot be interrupted.