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## **Winters temperature transmitter applications in data center cooling towers.**

### **what is a cooling tower?**

A data centre cooling tower is an installation that is used during power failures in a data center, they are also called TES Tanks– Thermal Energy Storage Tanks. With the rise of AI the demand for new data centers is growing exponentially, and so is the demand for TES tanks.

### **How does it work?**

If cooling systems in a Data Center fail for any power outage or any emergency situations, temperatures rising in the data storage rooms will lead to imminent failure of critical electronic components, such as servers. TES Tanks enables the Data Center to survive the outage without costly damage to servers. The system is based on auxiliary thermal storage tanks that feed chilled water into the chilled water supply lines, if the main chillers stop working due to an outage, it prevents the servers, which are still running on an uninterruptible power supply (UPS), from overheating by maintaining a chilled water supply to the air handler cooling coils. TES Tanks are a mandatory requirement for all Data Centre Projects.

TES tanks are not necessarily large cylindrical structures, they come in all shapes and sizes and don't always store water, some store termed molten-salt, molten aluminum, hot silicone, salt hydrate as well as many other storage options, most need a temperature transmitter and a thermowell, Winters thermowells are capable of withstanding pressures up to 7000 psi and temperatures up to 1,200°F (649°C), if the need arises custom thermowells can be made that have a different performance characteristics. Winters is capable of making thermowells that are threaded or flanged, made from either 304 or 316SS, (custom materials can be used upon request). Winters has many thermowell process and instrument connection options:

The outside diameter and insertion length can also be heavily customized! The high level of customization that Winters offers means that the temperature transmitter can be used not only in TES towers for data centers but also for:

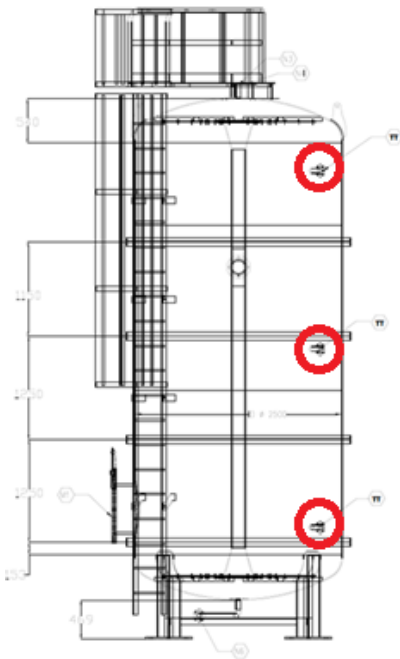
- Commercial buildings
- Energy generating systems
- Industrial facilities
- Many other applications

In commercial buildings TES tanks are used to save energy: during the night the tanks are cooled using chillers, when day comes the HVAC system uses the cool water to cool the air, this lowers energy costs and decreases the carbon foot print.

In energy generating systems TES tanks are used to store energy: in solar power plants the heat gathered by the panels is used to heat molten salt located in TES tanks ,which is then used in steam turbines. TES tanks have a similar use in other energy generation systems: to store energy.

In Industrial facilities the use is similar to the examples mentioned above, TES tanks are used to store heat or for cooling, this helps shift loads , reduces the wear and tear, improves the energy efficiency. In all of the above example temperature transmitters with thermowells are needed, in the next paragraph we will see where the WintersTY52 series WinSMART<sup>TM</sup> temperature transmitter is installed in the TES tower.

## What TY52 does in a cooling tower



As we can see, the temperature transmitter is placed in 3 locations in the cooling tower, at the top, at the center, and at the bottom of the tank. This allows for accurate temperature measurement in the tank, this is also due to the fact that warmer water rises to the top while the colder water is denser and tends to be at the bottom. This measurement is then sent using the TY52 communication protocols, The TY52 has 4 output options:

4/20 mA, 2-wire / V = 10.5-30 Vdc

4/20 mA + HART, 2-wire / V = 16.5-55 Vdc

1/5 Vdc, 3-wire / V = 12-30 Vdc

Modbus, 4-wire / V = 12-32 Vdc

In this project 4/20 mA was used. The 4/20 mA works by sending different milliAmp currents through the wire to show the measured value. For example, if our tank measures temperatures from 0 to 120 degrees then 4mA would be 0 degrees and 20mA would be 120 degrees. The TY52 has a range of -50/400°C. Once the transmitter has the information, it is sent to a PLC or DCS.

TY52 is capable of using the HART communication protocol, HART works using Frequency Shift Keying, Frequency Shift Keying works by using different frequencies to represent binary code, for example 100HZ represents 0 and 200HZ represents a 1. HART is capable of being used at the same time as 4/20mA.

TY52 1/5 Vdc works the same way as 4/20 mA, but 1Vdc represents a 0 while 5Vdc represents 100% of the scale.

The final communication protocol the TY52 is capable of using is Modbus, Modbus works by representing positive voltages as 1's and negative voltages as 0's, when 4 numbers are formed it is converted to hexadecimal, hexadecimal is a numbering system that counts up to 16 (1,2,3,4,5,6,7,8,9,0,A,B,C,D,F), this number is correlated to a data address e.g. (1-1F is write, 2-2F is read), there are many more features than just Read and Write which deserve their own paper.

In this project QTY 12 TY521501 and QTY 18 TY522001 with the appropriate thermowells were used, the thermowells protect the temperature transmitter from damage, as well as allowing the temperature transmitter to be removed without draining the TSE Tanks.