

Air Humidity

In a project in Qatar, there was some doubt as to the maximum possible air humidity that can occur. This is relevant for the design of condensers, which prepare the air for cooling.

The constraints are as follows:

Ambient air temperature: max. 52°C

ambient pressure: 1 bar

max. rel. air humidity: 100%

If one uses just this information to calculate water load, when designing condensers for a 10000 kg/h throughput, one would obtain:

$$0.1363 \cdot 18 / (0.1363 \cdot 18 + 0.8637 \cdot 29) \cdot 10000 \text{ kg/h} = 892 \text{ kg/h}$$

taking into account that the vapour pressure of water at 52 °C is 0.1363 bar.

However, Qatar is an extremely dry desert peninsula surrounded by the Persian Gulf. So, the amount of water will be determined primarily by the water temperature of the Persian Gulf, which is supposed to be, at most, 37 °C. Hence, the calculated water load of the condenser would be:

$$0.0628 \cdot 18 / (0.0628 \cdot 18 + 0.9372 \cdot 29) \cdot 10000 \text{ kg/h} = 399 \text{ kg/h}$$