Dryness fraction

This term refers to quality of wet steam. It is defined as the ratio of the weight of dry steam actually presents to the weight of total wet steam which contains it. It is denoted by x. Thus

$$x = \frac{W_d}{W_d + W}$$

Where W_d = Weight of dry steam in 1 kg of wet steam,

   W = Weight of water in suspension in 1 kg of wet steam

Dryness fraction is zero for saturated water and one for dry saturated steam.

Steps to Calculate Dryness Fraction of Steam

The dryness fraction can be calculated using theoretical and practical methods. The theoretical method follows a simple algorithm involving the use of either the steam table or mollier diagram or both.

The **steam table** is a tabular representation of various properties of steam such as specific enthalpy, specific volume, and specific entropy. In general practice, we use four different tables:

1. Saturated water and steam (temperature) table
2. Saturated water and steam (pressure) table
3. Superheated steam table.
4. Supercritical steam table.

Experimental Measurement of Dryness Fraction of Steam

The most commonly used practical methods to calculate the dryness fraction is explained below.

Study some of the terms below as we learn the equations associated with each method.

t11 = Temperature of the vessel and the before the experiment,

t22 = Temperature of the vessel and the water after the experiment,

h1$h1$ = Corresponding liquid heat of t1�1

h2$h2$ = Corresponding liquid heat of t2�2

mc = Mass of the water inside the calorimeter,

ms = Mass of the steam condensed throughout the experiment

Factors Affecting Dryness Fraction

The dryness fraction of steam is affected by several factors including

1. **Temperature**: As the temperature of steam increases, its dryness fraction increases, and vice versa.
2. **Pressure**: As the pressure of steam increases, the fraction increases, and vice versa.
3. **Quality of feedwater**: The purity of the feedwater used to generate steam can affect the dryness fraction. Impurities in the feedwater can lead to the formation of steam with a lower value.
4. **Design of the steam generation system**: The dryness fraction of the produced steam can be affected by the design of the steam generation system, including the boiler type and size.
5. **Operating conditions**: The operating conditions, such as the load on the steam generation system, can affect the dryness fraction of the steam produced.

Significance and Application of Dryness Fraction of Steam

The dryness fraction of steam is an important parameter because it affects the thermodynamic properties of the steam and its ability to transfer heat. Some of the properties that are dependent are discussed below.

1. **Energy transfer**: Steam with a higher dryness fraction will have higher energy content and will be able to transfer more heat, and vice versa.
2. **Efficiency:** Steam with a higher dryness fraction will be able to transfer more heat, which can improve the efficiency of the system, and vice versa.
3. **Corrosion**: Wet steam can cause corrosion in the pipe and equipment. So, it is important to have dry steam to avoid corrosion.
4. **Safety**: Wet steam can cause the sudden and explosive failure of steam pipework if the pressure is high. Therefore, having dry steam is crucial for safety.