Tire Manufacturing

Tires in general

Each and every one of us knows what a tire is: a rubber tube, placed around the wheel of most vehicles that are commercially available today.

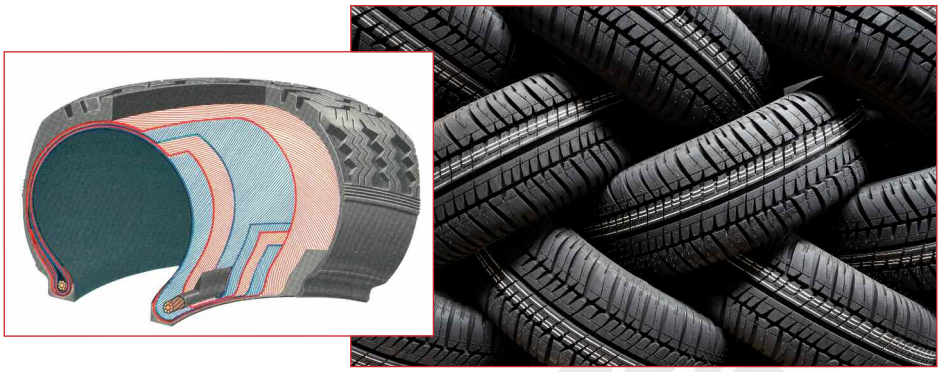
However, the tire is much more complicated than a simple rubber tube. A tire is composed of many varied layers where the only visible one is the rubber that faces the exterior of the tire. The layers consist of; the outside rubber with the tread, the nylon cap, the steel belts, the body ply, and the inner liner.

Each part of the tire has a complex manufacturing procedure that involves the monitoring of temperature and humidity.

Why the need to measure relative humidity?

The manufacturing starts with the preparation of the raw materials for the different layers: rubber bales, chemicals, textiles and steel. The relative humidity and temperature measurements are critical in the first three steps of the production process.

Step 1—Rubber compound mixing operation: the rubber bales are mixed with fillers and chemicals, depending on the required characteristics. After the rubber compound is prepared, the compound goes through a "cure package" where the tire is formed and gives it its elasticity. After the "cure package" is added the maximum temperature in the process is 110°C.



A conventional tire is composed of several carcass plies of textile, set at opposing angles of approximately 100 degrees to each other and 40 degrees to the tire center line. (blue and red).

Step 2—Fabric and steel cord preparation: The fabric cord and the steel cord are used to reinforce the rubber compound and provide strength to the tire. The fabric is hygroscopic and will shrink or stretch depending on the level of relative humidity. Thus the fabric cord has to be kept in a temperature and humidity controlled room. The steel cord is brass coated and the metal will expand and contract with fluctuating temperatures. High levels of relative humidity (above 70%rh) will cause corrosion. Additionally, if dust or grime is left to accumulate on the steel, there will be retention of water vapor which may induce corrosion even in lower levels of relative humidity. Therefore, the steel wire forming area must comply with the following requirements: 23°C ±3°C and 55%rh ±8%rh.

Step 3—Belt and play calendaring: The rubber compound is pressed on and into the cords. This process is critical as the bonding of fabric to rubber or steel to rubber will relate to the performance of the tires. The production area must be controlled at 22°C ±2°C and a relative humidity below 50%.

The steps remaining, inner liner calendaring, bead component preparation, tire tread and sidewall extrusion operations, tire tread extrusion, tire sidewall extrusion, tire building, tire curing and tire inspection are also key steps in the development of a perfect tire. However, there is a lesser requirement for a temperature and humidity controlled environment.

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