Vibration Technical Bulletin

Table of Contents

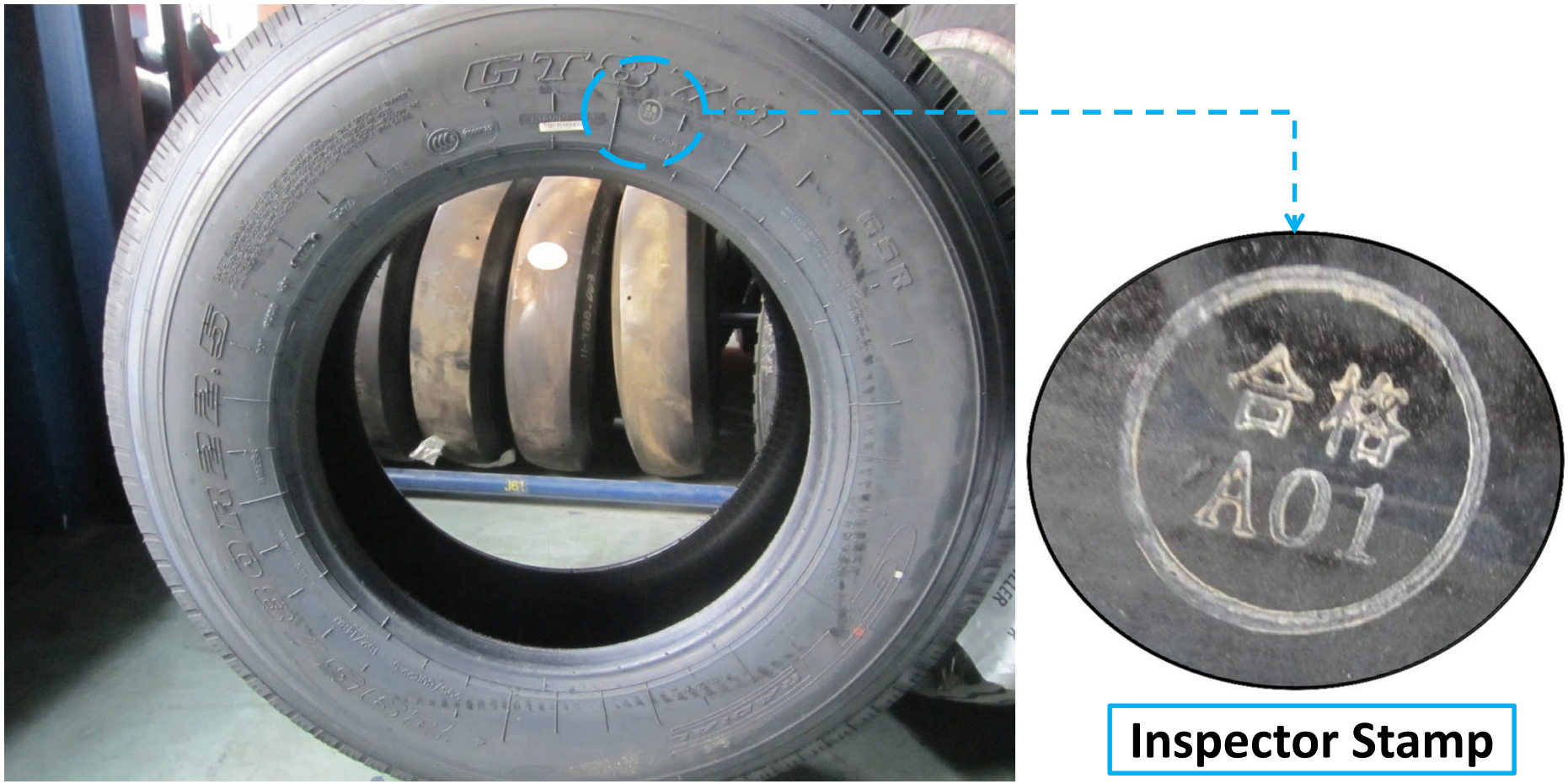
1. Appearance Inspector Stamp

2. Definition of Marking Dots

3. Tire & Rim Assembly

Appearance Inspector Stamp

1. Appearance Inspector Stamp

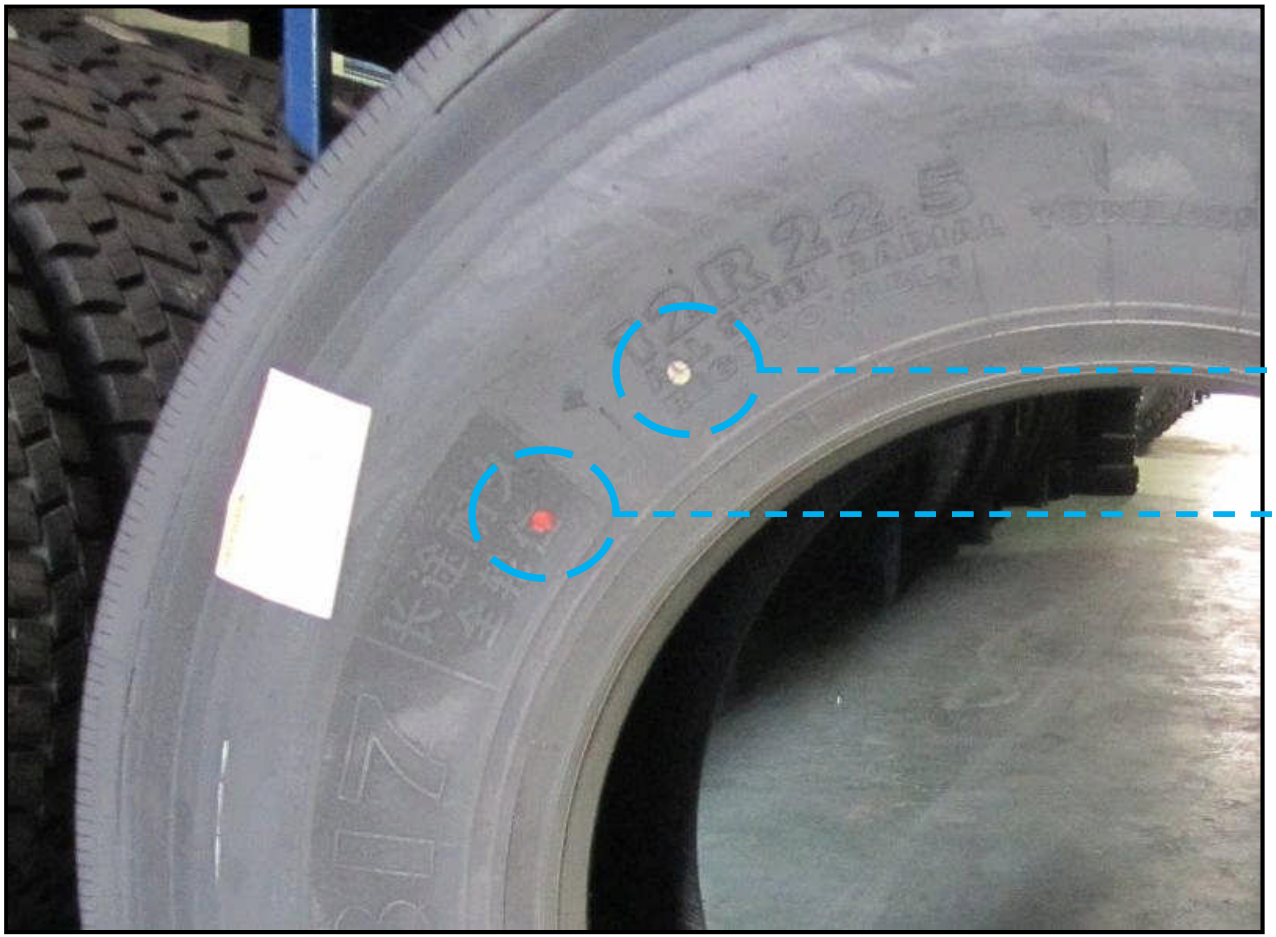


Remarks: the stamp represents the qualified tire appearance and is done by our professional appearance inspectors.

Experience the Performance

Definition of Marking Dots

2. Definition of Marking Dots



Dynamic Balance Dot
(light spot)

Run Out Dot
(Radial force variation
first harmonic maximum)

GT RADIAL

Experience the Performance

Tire & Rim Assembly

3. Tire & Rim Assembly

1. Start

First, if the wheel is aluminum, or if it's steel, look for the low point dimple on the wheel.

If the wheel has no low dimple point, mount the tire with the red dot (run out dot) next to the valve stem.

2. The difference between aluminum & steel wheel

On an aluminum wheel, the valve stem marks the heavy point of the wheel, this is because steel wheels are forged, aluminum wheels are machined. For that reason, aluminum wheels are very uniform in their overall balance.

A steel wheel is not that uniform in overall balance compared to the aluminum wheel, so a low point dimple should be indicated.

3. The White Dot (Dynamic Balancing Dot)

Regardless of the type of wheel, if there is no red dot, mount the tire with the white dot next to the valve stem.

The white dot indicates the overall **light dynamic balance** point of the tire. In other words, it's as though the white dot represents a bit lighter in the area of tire.

3. Tire & Rim Assembly

4. What make the valve stem position difference than others?

At the spot where valve stem is located, the manufacturer has to drill a hole through the wheel for the valve stem, and so on a piece of metal was removed.

The hole is usually about 10 mm in diameter & 8 mm in thickness; if we do the math, knowing that aluminum weighs about 2.70 $g \cdot cm^{-3}$, we will find about 1.70 g of metal was removed for the valve stem.

An ordinary valve stem weighing about 20 g will fill the drilled hole on the wheel, and we can see the valve stem position is actually the 'heavy spot' on the wheel. So when matching the **white dot** (the light spot) next to the **valve stem** (the heavy spot) will lead to at **least partially balancing** out the assembly.

5. The Red Dot (Run Out)

The red dot represents '**radial force variation first harmonic maximum**' or run out of a tire. In other words, it indicating where the centrifugal force tending to pull the rotating tire away from the wheel is greatest.

Another way to define it in sense, if the tire is out of round, the red dot indicates the 'high point' or the greatest radial run out forces.

3. Tire & Rim Assembly

6. Why Not Just Measure the Run Out (Red Dot) of Tire?

Even though the radial force variation measurement is much more accurate in predicting tire performance, in reality, the red dot often isn't located exactly at the 'high point.' Instead, it accurately marks where the **greatest run out-like force**.

The red dot is actually marking the 'high point' of the tire or where the tire is a bit 'thicker' from axis to tread. And the low point dimple mark on the steel wheel represents where the wheel is a bit 'thinner' from axle to rim flange edge.

Now, it make sense to match the 'high point of the tire' together with 'low point of the rim', which means matching the tire red dot with rim low point dimple.

3. Tire & Rim Assembly

7. Matching Red Dot on Aluminum Wheel

The red dot location results in higher centrifugal force which pulls the axle a bit from center.

Example: The tire red dot location is ‘thicker’, which has the effect of pushing the wheel a bit upward when red dot rotates to 6 o’clock. At the same time, the ‘heavy spot’ (valve stem) generates a centrifugal force effect to ‘pull’ the axle downward as the valve stem rotates to 6 o’clock.

From this example we can see that those forces could tend to counteract each other if the tire red dot is mounted next time valve stem.

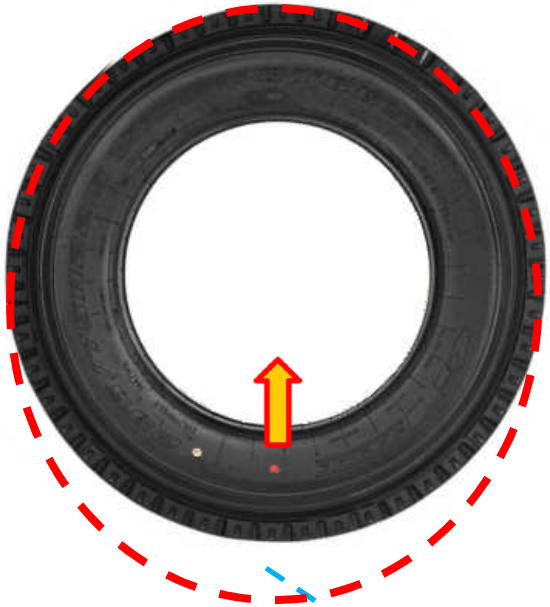
8. Conclusion

Matching the dots with the rim **does not** mean that we can **skip the tire balancing**; it just gives us the best start, so that we can most likely use the **least** total weight to bring about a **balanced tire-wheel assembly**.

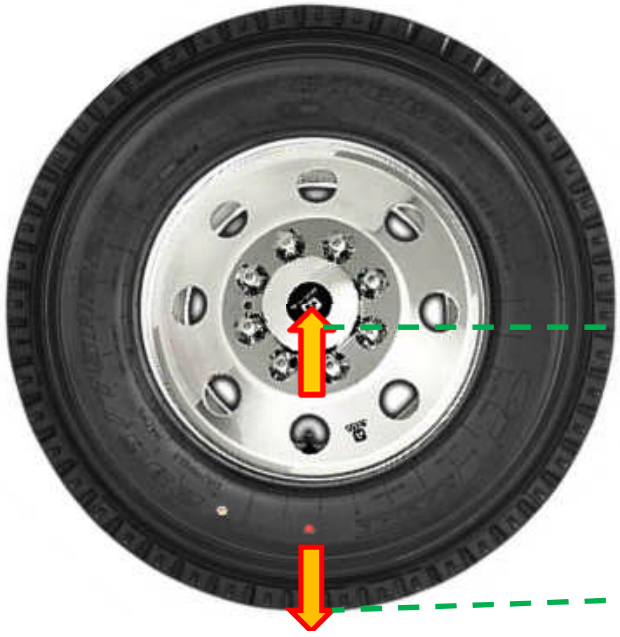
3. Tire & Rim Assembly

F1: when valve stem rotates to 6 o'clock direction, the 'heavy spot' will generate a centrifugal downward force.

F2: This location represents 'thicker' part on tires; when the run out rotates to 6 o'clock direction, an upward normal force will generate a bulge-like on tire run out location.



The run out. (thicker part)



F1 & **F2** tend to counteract each other and give the best start in term of balancing.