

TIRE INFORMATION SERVICE BULLETIN

INSPECTION PROCEDURES TO IDENTIFY POTENTIAL SIDEWALL “ZIPPER RUPTURES” IN STEEL CORD RADIAL TRUCK/BUS AND LIGHT TRUCK TIRES

PURPOSE

The purpose of this bulletin is to describe the inspection procedures for identifying potential sidewall circumferential ruptures - also known as “zipper ruptures” on truck/bus tires and light truck tires of steel cord radial construction.¹

The photo in Figure 1 is an example of a zipper rupture in a truck tire casing. Note the characteristic “zipper-like” seam running along the sidewall where the rupture occurred.



FIGURE 1: Zipper Rupture Example

⚠️ WARNING

Any tire suspected of operating under inflated and/or over loaded must be approached with caution. Permanent damage due to operating a tire under inflated and/or over loaded cannot always be detected. Any tire known or suspected of being operated at 80 percent or less of normal operating inflation pressure and/or over loaded could possibly have permanent sidewall structural damage (steel cord fatigue).

Ply cords weakened by under inflation and/or over loading may break one after another, until a rupture occurs in the upper sidewall with accompanying instantaneous air loss and explosive force. This can result in serious injury or death.

⚠️ WARNING

Tire and rim servicing can be dangerous and must only be performed by trained personnel using proper procedures and tools.

Failure to follow these procedures^{2,3} may result in serious injury or death.

STEP 1 – INSPECT TIRE

“SUSPECT” TIRES

When a vehicle equipped with steel cord radial truck/bus or light truck tires¹ is suspected of operating with one or more tires under inflated and/or over loaded, approach such tires with caution. A tire service professional must remove the valve core and completely deflate the tire before removing the tire/rim/wheel assembly from the vehicle. After it is removed from the vehicle, the tire service professional should demount the tire from the rim/wheel and conduct a complete visual and hands-on inspection of the tire.

For tires that have already been demounted and are being prepared to be repaired/retreaded, the same inspection procedure applies. If available, the tire service professional could also utilize non-destructive inspection equipment, such as shearography, x-ray, or other non-destructive testing, to look for any anomalies present in the casing. For all tires returning to service, a tire service professional should conduct a complete visual and hands-on inspection of the tire in a well-lighted area and with a hand-held grazing light. See Figures 2 through 4.

Look for:

- Punctures or other injuries
- Distortions, abrasions or undulations (ripples and/or bulges) in the interior and sidewall
- Cuts, snags, or chips that expose any body ply cords or steel wire

Feel for:

- Soft spots in the sidewall flex area
- Distortions or undulations (ripples and/or bulges) in the sidewall
- Protruding wire filaments indicating broken cords

Listen for:

- Any snapping, popping or crackling sounds

If the tire contains punctures, cuts, snags, or chips exposing body ply cords or steel wire, but does not exhibit any other potential zipper characteristics, it should be referred to a full service repair facility for further inspection to determine if it is a repairable condition and not a source of a potential “zipper rupture.” If the tire does exhibit potential zipper characteristics, it must be marked appropriately, made unserviceable and non-repairable and then scrapped! If none of these conditions are present, continue to Step 2.



FIGURE 2: Using a grazing light or other indirect light source will produce shadows which indicate sidewall irregularities and/or signs of a possible “zipper rupture.”



FIGURE 3: Note the abraded area on the tire innerliner. This condition is the result of the tire being operated under inflated and/or overloaded.

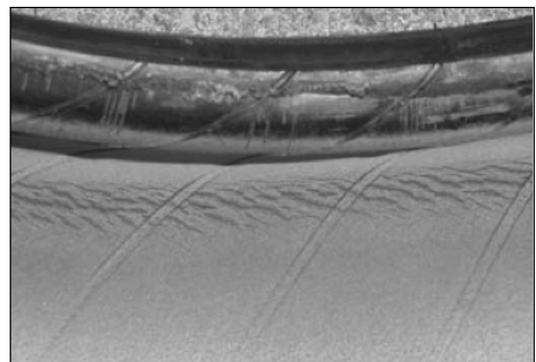


FIGURE 4: Wrinkled and discolored innerliner in the tire’s flex area is another sign of being operated under inflated and/or overloaded.

STEP 2 – INFLATE TIRE TO 20 PSI

PROPER INITIAL INFLATION

If none of the “zipper rupture” conditions are present during the initial inspection of the tire in Step 1, mount the tire on its rim/wheel assembly and inflate to approximately 5 psi to seal the beads.² Place the assembly in an OSHA compliant restraining device, such as a tire safety cage.³ See Figure 5.

Remove the valve core and see next page for further instructions on Step 2.



FIGURE 5: This is just one type of restraining device available for tire service facilities. With the valve core removed, inflate tire using a clip-on air chuck with a pressure regulator and an extension air hose.

⚠ WARNING

DO NOT place hands or head in or near the restraining device while inspecting and inflating the tire. Even in a restraining device, close proximity to the force of air and/or exploded remnants from a tire rupture could cause serious personal injury or death. ALWAYS remain outside of the tire’s trajectory as in the illustrated example below. NOTE: Under some circumstances, the trajectory may deviate from its expected path.

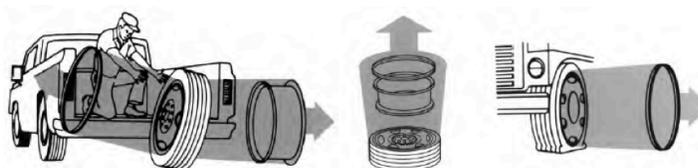



FIGURE 6: Proper inflation in a safety cage

STEP 2 - INFLATE TIRE TO 20 PSI (CONTINUED ON NEXT PAGE)

STEP 2 - INFLATE TIRE TO 20 PSI (CONTINUED)

With the valve core removed, inflate the tire with an OSHA compliant inflation device that includes a clip-on air chuck, an in-line valve with a pressure gauge or pressure regulator and a sufficient length of hose to keep the tire service professional standing in an area facing the tire tread and outside the trajectory area during inflation.³ See Figure 6.

- For light truck and medium truck tires inflate the tire up to 20 psi
- For tires designed for bus and refuse applications, inflate the tire up to 40 psi

Throughout initial inflation in Step 2, always:

Listen for:

- Any snapping, popping or crackling sounds

Look for:

- Distortions or undulations (ripples and/or bulges) in the sidewall. See Figure 7



FIGURE 7: At 20 psi, you can begin to see the presence of distortions in the sidewall of this truck tire (circled in red). Due to a heavier sidewall construction, bus and refuse tires would present this condition at 40 psi.

If any of these conditions are present during inflation – stop! Do not approach the tire. Before removing from the restraining device, completely deflate the tire remotely. Remove the clip-on air chuck. The tire must be marked appropriately, made unserviceable and non-repairable, and then scrapped! If none of these conditions are present, with the valve core still removed, continue to Step 3.

STEP 3 – INFLATE TIRE TO 20 PSI OVER COLD INFLATION PRESSURE ON SIDEWALL

CONTINUE INFLATION

If none of the “zipper rupture” conditions are present during Step 2 (initial inflation 20 psi for light truck and medium truck tires; 40 psi for bus and refuse tires), then continue the inflation process in the OSHA compliant restraining device, with the valve core still removed, using a clip-on air chuck with a pressure regulator and an extension air hose. ALWAYS remain outside the tire’s trajectory during inflation. See Figure 6 on page 3.

Figures 8 and 9 show a tire being inflated in a restraining device. The distorted sidewall indicates a potential “zipper rupture.”

- For light truck and medium truck tires, continue inflating the tire to 20 psi over the cold inflation pressure molded on the tire sidewall – but do not exceed 120 psi
- For tires designed for bus and refuse applications, continue inflating the tire to 20 psi over the cold inflation pressure molded on the tire sidewall – but do not exceed 140 psi.

Throughout inflation process in Step 3, always -

Listen for:

- Any snapping, popping or crackling sounds

Look for:

- Distortions or undulations (ripples and/or bulges) in the sidewall

If any of these conditions are present during inflation – stop! Do not approach the tire. Before removing from the restraining device, completely deflate the tire remotely. Remove the clip-on air chuck. The tire must be marked appropriately, made unserviceable and non-repairable, and then scrapped! If none of these conditions are present, remove the clip-on air chuck, install the valve core, and adjust the inflation pressure to the recommended operating inflation pressure.



FIGURE 8: Visible sidewall condition indicative of a pending “zipper rupture.” Note the bulge in the sidewall.



FIGURE 9: Visible sidewall condition indicative of a pending “zipper rupture.” Note the undulating rippled sidewall.

ENDNOTES

¹ For construction determination please refer to the tire sidewall markings.

² Refer to the following wall charts: OSHA “Demounting and Mounting Procedures for Tubeless Truck and Bus Tires,” OSHA “Demounting and Mounting Procedures for Tube-Type Truck and Bus Tires,” OSHA “Multi-Piece Rim Matching Chart,” and USTMA Demounting and Mounting Procedures for Passenger and Light Truck Tires.”

³ Occupational Safety and Health Administration (OSHA) Standard Title 29 CFR Ch. XVII §1910.177 requires all tubeless and tube-type tires on commercial vehicles to be inflated using an approved restraining device (e.g., safety cage), or barrier, and using a clip-on air chuck with a pressure regulator and an extension air hose. While the OSHA standard pertains to medium/heavy truck tires, USTMA also recommends the use of a safety cage for all steel cord radial light truck tires.

OTHER REFERENCE MATERIAL

- Tire Industry Association (TIA) - For training materials and other information visit www.tireindustry.org
- USTMA wall charts regarding sidewall “zipper ruptures” and tire demounting/mounting procedures. Wall charts and other publications may be ordered online: www.USTires.org
- Technology and Maintenance Council of the American Trucking Associations, Inc., Recommended Maintenance Practices Manual and other publications. Available to order online: www.trucking.org
- U.S. Department of Labor Occupational Safety and Health Administration Title 29 Code of Federal Regulations Ch. XVII Section 1910.177 Servicing multipiece and single piece rim/wheels. Available to view/download online: <https://www.osha.gov/sites/default/files/publications/wheel-chart-booklet.pdf>

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