Rapid Lesson Sharing

This has happened before!
See page 4 for more lessons from similar incidents.

Event Type: Engine Lug Nut Loosening

Date: June 18 and 20, 2019

Location: Rocky Mountain Region – Grand Mesa, Uncompahgre and Gunnison National Forests; Medicine Bow-Routt National Forests; and Thunder Basin National Grassland

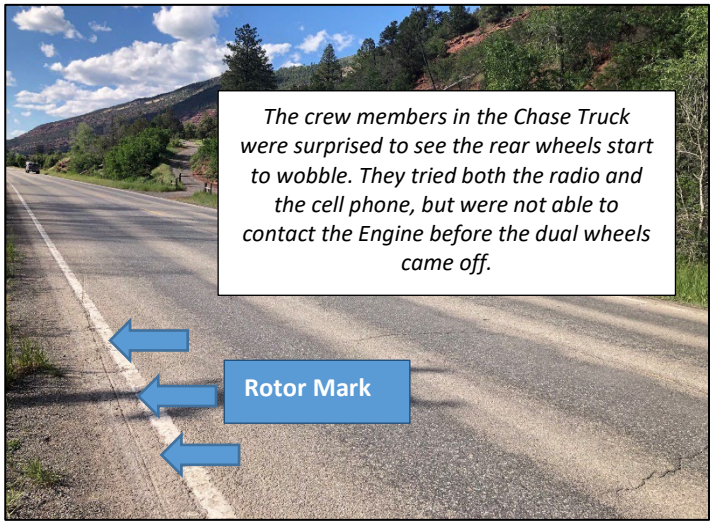
Loose lug nuts result in one near miss and one dual wheel set bouncing through traffic on two Ford 550 Type 6 Engines within two days.

Wheels Bouncing Past the Engine

While on assignment in southern Colorado to assist with prescribed burning, the Type 6 Engine (Engine #1) departed for the burn unit on Tuesday morning, June 18, traveling down the highway about 60 mph.

Following behind, the crew members in the Chase Truck were surprised to see the rear wheels start to wobble. They tried both the radio and the cell phone, but were not able to contact the Engine before the dual wheels came off.

The driver felt the Engine drop, as if the rear end had hit a hole. The driver's side, rear outside dual wheel shot across the oncoming traffic lane and off the road. The inside dual wheel bounced into the other lane, into the ditch, back onto the highway in front of an oncoming car, and back into the ditch—narrowly missing the car. This wheel then travelled back across both lanes, bouncing in front of the Engine and off the side of the road.



Rotor mark (see blue arrows) on left side of highway where the Engine pulled to the side of the road.

Rotor resting on pavement. Notice bent studs on the left.

The driver gradually decelerated, holding the steering wheel firmly with both hands, feathering the brakes and coming to a stop on the side of the road.

Away from Their Home Unit, They Didn't Have Access to Torque Wrench

Engine #1's crew had fixed a flat on those same tires the previous Sunday evening in a parking lot in town. The spare had noticeably more tread than the other tires. They used an impact socket on breaker bar to tighten the nuts.

Because they were away from their home unit, they did not have access to their shop and the torque wrench that they normally would have used.

The next morning they did a visual inspection on the wheel, looking for shiny metal and checking the lug nuts for tightness by hand. They took the Engine to the burn unit that day, getting stuck on difficult roads a couple times. That night, they tightened the nuts with a lug wrench. Tuesday morning, they did another visual inspection before heading to the field.

They had driven about 38 miles since the last tightening before the rear wheels came off.

Repairs to Engine #1 included replacing the rotor, hub and both rims. The service center noted that the studs did not shear off as usual—and could not determine why.

Near Miss

On Thursday, June 20, as Engine #2 pulled into the District office, crew members noticed the rear passenger-side dual wheels wobbling. They got out and could see that the lug nuts were loose on a tire that was just recently changed because of a flat. The crew also checked the rear driver's side and found loose lug nuts there as well.

Wheel showing wear from loose lug nuts. Notice that one stud stayed connected to the wheel.

The crew members who changed the flat tightened the lug nuts to 120 ft-lbs, later to find out that the specification was actually 165 ft-lbs. When the rear wheels were taken off Engine #2, one of the studs stayed connected to the wheel rather than the hub (not sure of the cause).

The studs and wheel sustained some damage due to the wheel wobbling. Repairs to Engine #2 included new studs, lug nuts, and wheel.

Conditions

- Both Engines are stationed at the same unit. Both sets of tires involved were regularly used by the Engine Crews to practice changing tires. They estimate that those wheels have been changed about a dozen times each year.
- Engine #1 is a 10-year-old holdover with more than 100,000 miles. The new replacement Engine is currently out-of-service for a known manufacturing issue.
- The Engine Captain was not present when the lugs of Engine #2 were torqued.

What Went Well

- No one was injured and damage to equipment was not extensive.
- The driver of Engine #1 had prior experience operating Type 4 and 6 Engines and had developed skills at the Great Basin Engine Academy which contributed to the favorable handling of Engine #1.

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may give the false impression that they are tight enough.

Lessons Learned by the Operators

- Carry a torque wrench on each Engine and tighten to the specified torque frequently after changing a tire.
- Tightening lug nuts with a lug wrench or breaker bar may give the false impression that they are tight enough.
- Look for wear and stretch in studs.
- Rotate the spare tire into the tire rotation schedule to create even wear on all the tires.

Improvements for Moving Forward

- The same week as these two incidents occurred, a committee on the Engines' home unit met and decided to start using the BLM's Fire Engine Maintenance Procedure and Record (FEMPR) for daily vehicle checks. They also agreed to propose the development of a U.S. Forest Service-specific version to the Region 2 Equipment Committee.
- Loose lug nut indicators will be installed on some Engines to evaluate their usefulness. For more information, watch the video found here: https://youtu.be/sfgfps4ouGU.
- Torque specifications will be posted on vehicle dashboards.

Loose lug nut indicators installed on Engine #2.

This RLS was submitted by: The Forest Safety Manager

Do you have a Rapid Lesson to share?
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Share Your Lessons

This information is from the *Two More Chains* Winter 2018 Issue.

"The driver's-side rear dual wheels separated from Engine 2423 and traveled across the roadway, striking the right front of a passenger vehicle heading north on Hwy 395."

From the Engine 2423 Lessons

More Lessons on Lug Nuts

Three incidents from 2017 in which the wheel lug nuts came loose or fell off and the operators submitted an RLS or a SAFENET on the incident: o Mile 0 Rx Fire; o Long Valley Fire; o Type 6 Engine Wheel Stud Malfunction RLS

Two additional incidents from 2016 and 2011 in which the lug nuts came loose and the wheels fell off the trucks:
o Type 6 Engine Wheel Torque Malfunction RLS; o Engine 2423 Lessons Learned Review.

Review of Key Lessons

Common Key Lessons Concerning Lug Nuts Coming Loose on Fire Trucks:

- ✓ Operators of vehicles who have had any reason to remove a tire from a vehicle should follow re-torqueing specs of the wheels as stated in the Owner's Manual. (Refer to your Owner's Manual for specific information.)
- ✓ Learn and understand the requirements of your vehicles.
- ✓ The painting of a wheel rim mating surface will create an additional layer and will wear down, causing a space to develop and allowing lugs nuts to come loose.
- ✓ The types of impact wrenches differ in their capacity to tighten the lug nuts at a foot/pounds rate. The ability of an air gun system to tighten lug nuts is not only based on the rated power of the gun, but on the ability of a system to supply a constant level of air pressure to the end of the hose.
- ✓ An air gun system is not a torque wrench!
- ✓ A visual inspection of your lug nuts is not adequate. You need to check them with a torque wrench, following your vehicle manufacturer's recommendations.
- ✓ Operators need to become familiar with the history of their truck and what maintenance had been previously performed.
- ✓ Perform daily preventative maintenance checks and document your work.

"While driving their Engine down Interstate 40, the Operator suddenly feels a change in driving characteristics as one of their passenger-side rear duals suddenly passes them!"

From the Type 6 Engine Wheel

"A wheel from the driver-side rear duals passed them and came to rest in an agricultural field. The second wheel came off and crossed the northbound lane into a sage flat."

From the Type 6 Engine Wheel Stud Malfunction RLS

Bottom Line

Take a deep breath before your daily PM check. Focus on the intent. Rotate who performs the check. Write down what you find and do. Read what others have written down.