Split Rim Explosion Fatality

Intermodal Mechanic Shop Investigation

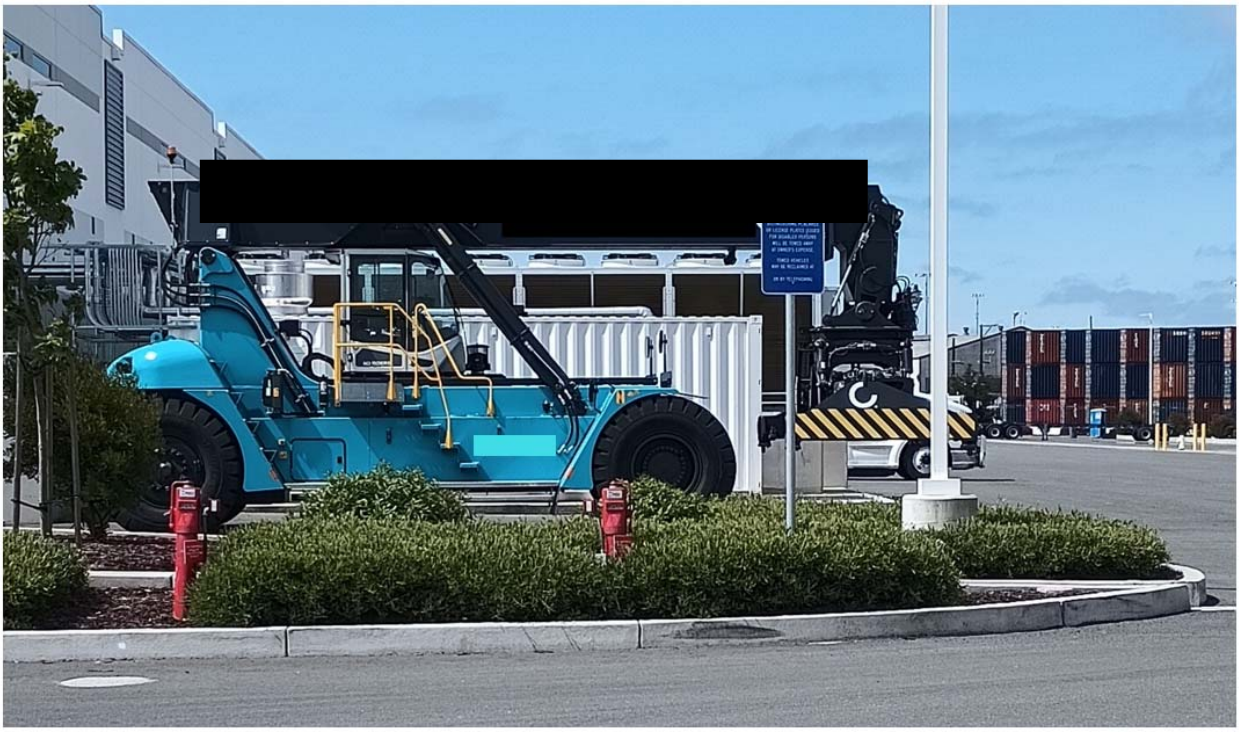
Expert Article

Mechanics and equipment repair technicians servicing multi-piece rims and tires on powered industrial trucks (PITs) or commercial vehicles at intermodal shipping ports are obligated to follow trade and industry standards of care. They must abide by the current OSHA safety regulations and their employer's code of safe practices when handling multi-piece rims. Therefore, prior to servicing tires, wheels, and rims at intermodal container ports, mechanics must remain alert to hazard recognition, and take established preventative measures to avoid serious injury and fatality (SIF).

Photo Courtesy Port Safety Services

Split rim injury incidents at transportation hubs and maritime terminals constitute a major workplace hazard resulting in debilitating injury to mechanics, service technicians, and longshoremen, frequently causing wrongful death.

According to the International Longshoreman and Warehouse Union (ILWU), "West Coast longshore workers have a higher fatality rate than police officers and fire fighters." [1]



Reacher Stacker ("PIT"), Photo Courtesy Port Safety Services

Workplace Setting:

The scene of the incident was an outdoor repair and maintenance shop situated at a West Coast maritime container terminal. The onsite shop was used primarily for service, maintenance, and repair of Top Handlers, a special type of container moving devise commonly called a Powered Industrial Truck or PIT.

[1] ILWU 2014 Dispatcher Newspaper, https://www.ilwu.org/longshore-safety-committee-is-negotiating-for-more-protection-against-deadly-hazards/

Incident:

Prior to operations on the day of the incident, the victim and his co-worker were conducting pre-shift safety inspection of tire conditions on the terminal top handlers. As they identified a defective tire on one of the parked units, they drove the top handler to the mechanic shop to begin replacing the defective tire.

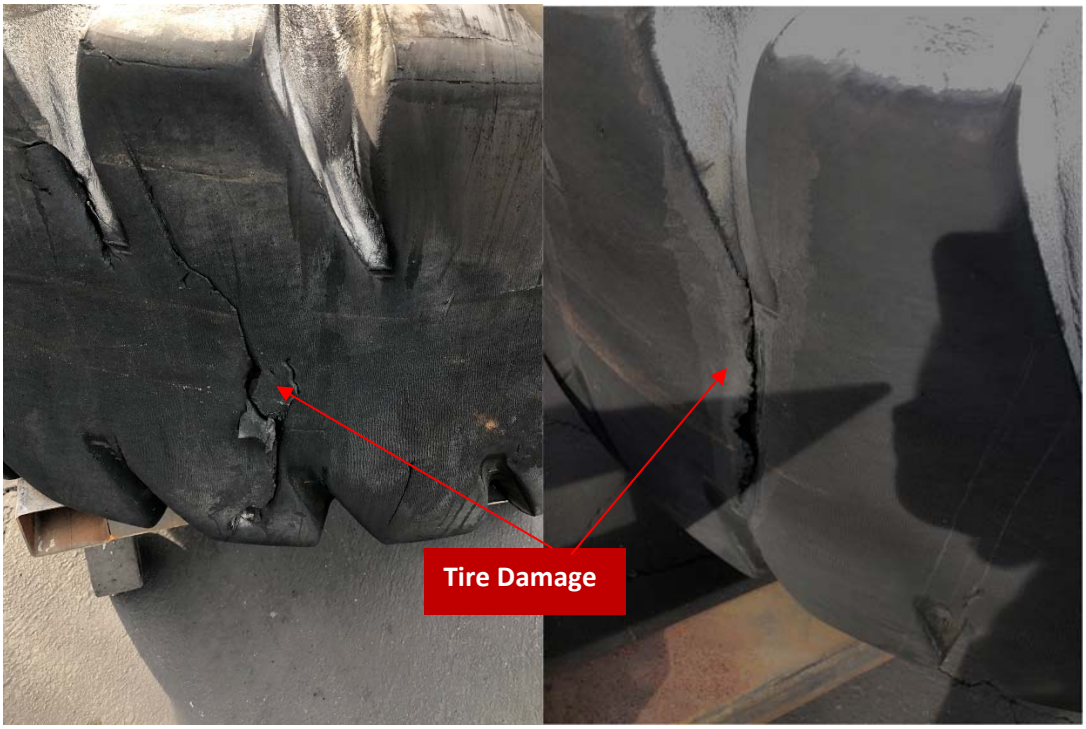


Photo Courtesy Port Safety Services

Directly adjacent to the subject Top Handler, several other mechanics were servicing equipment. According to the written police report, at approximately 7:15 a.m. the victim and his co-worker jacked up the front axle of the PIT in order to raise the unit's dual tires off the ground. The mechanics then started removing the outer lug nuts from the wheel of the top handler.

Prior to the explosion, only the inner tire (dual wheels each side) had been deflated. As the mechanics continued removing lug nuts, they failed to release air from the outside tire, an evasion of a critical safety procedure. The victim, standing directly in front of the tire and wheel assembly, began loosening the final lug nut, when a loud and powerful explosion occurred. The blast propelled the tire and wheel assembly into the victim, who flew 20 feet into the air impacting another unit, killing him instantly. His co-worker was also blasted backwards landing on the concrete shop floor, suffering significant injury.

Top Handlers, Photo Courtesy Port Safety Services

The noise from the explosion alerted co-workers in the shop and at the main gate, as emergency services were summoned, and numerous agencies responded. The victim was pronounced dead on arrival, and the co-worker was transported to a local hospital via ambulance, where he was admitted with serious injuries.

Relevant Factors:

The victim was a 58-year-old longshoreman mechanic who had been working full time at the terminal for almost fourteen years. His job scope included mobile equipment maintenance for all terminal owned and operated top handlers and reacher stackers (PITs).

Prior to the day of injury (DOI), witness testimony indicated that the OSHA Split-Rim Changeout Procedures had been posted as large signs, visible to all workers in the mechanic shop area.

Training Issues:

In a post incident assessment of the mechanics training records by forensic investigators, it was determined that equipment specific documentation of safety training could not be found. Although the terminal employer of the mechanic had an injury and illness prevention program (IIPP), task-specific instruction on safe tire changing and multi-piece rim hazards awareness was

never provided to the mechanics by the employer.

It was also noted by Cal/OSHA, that both the victim and his partner received casual on the job training (OJT) by other mechanics in the employers' shop. It was ultimately determined that no formal instruction (task and hazard specific) was conducted by the employer or applicable training providers.

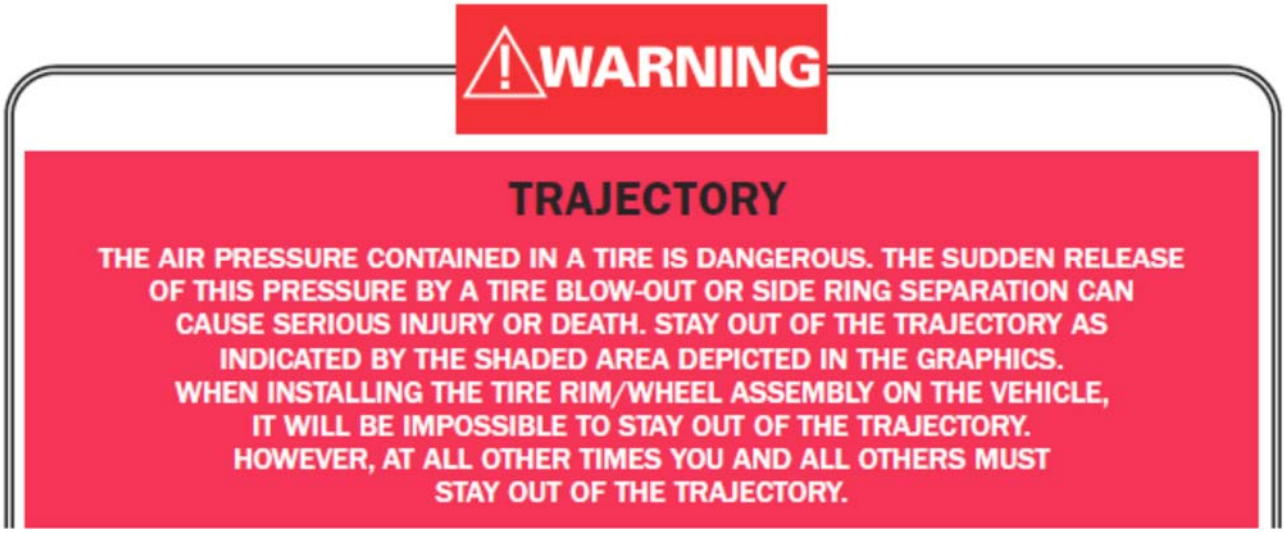
Applicable Standards and Control Measures:

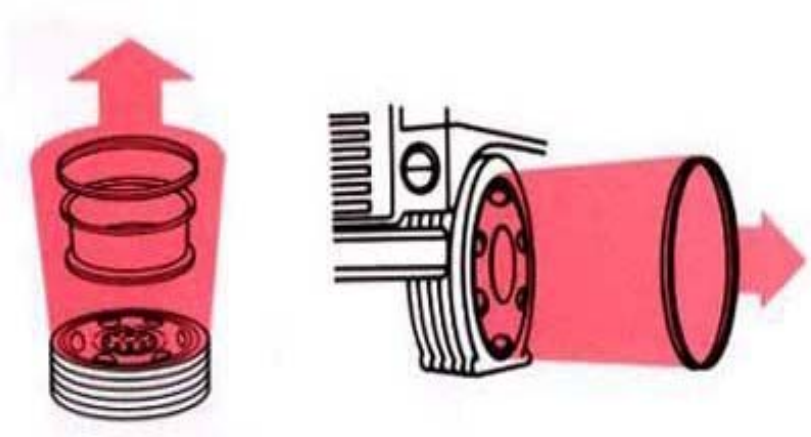
This injury and fatality case could have been prevented by using the correct

tire deflation safety procedure. In this instance full deflation of both tires (duals) should have been performed, including removal of the actual valve stems, and verification that no blockage existed, by inserting a wire into each valve stem for confirmation. Unfortunately on the day of injury, before lug nut removal was started, these well-known safety procedures were evaded by the mechanics.

Multi-Piece/Split Rim, Photos Courtesy HSA

Graphic Courtesy Port Safety Services





Servicing Multi-Piece Rims-Wheels, Spilt Rim Trajectory Hazard, Graphics Courtesy OSHA

DANGER-BEWARE: Un-deflated tires are a major hazard to workers during servicing and repair operations. Before starting, always wear ANSI approved PPE, and use a protective cage prior to inflation of tires.

Before servicing equipment or commercial vehicle tires always ensure full deflation, removal of valve stems, and introduction of a wire into the stem opening to prevent blockage of air, or complete deflation of the tire.

Actual tires and damaged rims (post explosion) Photos via State of California

Investigation:
Split Rim / Multi-Piece Hazards

The principal hazard to workers from split rim wheels is dangerous pressurized air that upon release can suddenly throw or shatter a metal wheel assembly and strike workers. In a split rim wheel explosion incident, the wheel components violently separate with force, and have been known to produce significant injury. [2]

[2] As of this report, two Delta Airlines maintenance workers killed in a tire explosion in Atlanta (AP)
https://www.foxbusiness.com/economy/body-delta-worker-unrecognizable-after-tire-explosion-son-says

The known risk of injury or death is greater with larger multi-piece wheel assemblies as identified in this incident. Unfortunately, full inspection of wheel assemblies is often impossible with mounted tires, as visible cracks and defects that occur over time may be obscured by large tires hiding the problem. Utilization of solid tires may be an option to employers, to preclude the pneumatic tire explosion hazards.

Tool Use Warning, Graphic Courtesy OSHA

OSHA® FactSheet

Servicing Multi-Piece and Single-Piece Rim Wheels in Marine Terminals

Requirements for servicing multi-piece and single-piece rim wheels in marine terminals can be found in 29 CFR 1917.44(o) (tube-type wheels), and 29 CFR 1910.177. This fact sheet is for employers and workers, to demonstrate the hazards associated with handling multi-piece and single-piece rim wheels. It also highlights the OSHA regulations which protect workers.

Hazards

The air pressure contained in a tire is very dangerous. When fully inflated, a truck tire can exert more than 40,000 pounds of pressure against the rim flange. The most common hazards found during servicing rim wheels occur during inflation. The seating rings should be properly set or seated during inflation. If the rings are not set properly, the rings or the removable flanges can violently separate from the assembly, causing an explosion and forcefully propelling components of the assembly up to 130 mph. Similarly, another hazard found during the servicing of single-piece rim wheels is that the pressurized air contained in the tire may suddenly be released, either by the bead breaking, the bead slipping over the rim flange, or a zipper rupture.

Servicing

Marine terminal workers may service various types of vehicles equipped with multi-piece or single-piece rim wheels. Workers servicing these types of wheels must have the proper training and be aware of the requirements outlined in §1917.44(o), and §1910.177. The most common vehicles with these types of wheels include: cranes, top-handlers, side-picks, yard hustlers, chassis, trucks, tractors and trailers.

Failure to follow proper procedures when servicing rim wheels can result in serious injury or death. Prior to servicing any rim wheel assembly, workers should always:

- Completely deflate the tire (or both tires of a dual assembly) by taking out the valve core(s) before loosening any nuts or clamps that attach a tube-type tire/rim assembly of a vehicle;
- Use a non-flammable vegetable or soap-based rubber lubricant on the rim surfaces to make tire demounting and mounting easier;
- Use proper tools to demount or mount tires and rims;
- Use a steel duck bill hammer only as a wedge to unseat the beads of tube-type tires;
- Wear adequate protective eyewear (or a face shield), protective footwear and ear protection;
- Use soft-faced hammers to drive the tire irons or assemble components;
- Keep tools clean and inspect them frequently;
- Demount inspect and match all tire and rim components, before reinflating them in a restraining device with the valve core removed; and
- Always stay out of the possible air pressure explosion path (trajectory) area, see §1910.177(f)(10) and §1910.177(g)(8).

Graphic Courtesy Federal OSHA

Findings from our Expert Witness Investigation

In review of the post incident analysis, it was discovered that prior to removing lug nuts from the split rim assembly, the terminal mechanics failed to deflate both tires on the unit. Additionally, valve stems were not removed, or insertion of a wire into the valve stem to prevent obstruction.

A post incident review of the mechanic's training records indicated that task specific safety training was not provided by the employer.

Recommendations for hazard prevention by experts include development of trade and task specific instruction by employers of mechanics. Both didactic (theoretical) and hands-on practical instruction with special emphasis on safe procedures for tire servicing with split rims. Prior to dispatch of mechanics to intermodal shipping terminals, training providers should conduct comprehensive initial training and refresher courses to all longshore mechanics, carefully documenting the member's participation. This recommendation also applies to repair facilities at material handling facilities, warehouses, shipping docks, airports, railyards, and intermodal freight terminals.

Conclusion:

Following a thorough forensic investigation, our experts concluded that the terminal mechanics failed to meet industry and trade standards when they performed an unsafe act in failing to follow established safety rules and OSHA regulations for tire changeouts on split rims. [3]

The hazards of split rim explosions are well known, as short cuts taken by the mechanics constituted a significant violation of regulations, and the principal cause of injury. Although the employer at the maritime terminal had written safety procedures (posted onsite), they failed to conduct OSHA approved safety training for their employees, and to comply with training documentation and recordkeeping protocols at the terminal.

[3] AKA Widow Makers

Forensic Casework Involving Maritime Container Ports

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Featured Expert

Daniel J. O'Connell, BSc. (HONS.) CSP, CHMM, CHCM, CHST, CIT, REA Board Certified Safety Professional, serves as a consulting expert witness to plaintiff and defense counsel since 2007. In addition to his education and board certification, O'Connell is a retired member of the International Longshore and Warehouse Union (ILWU), and International Brotherhood of Teamsters (IBT), Locals 17 and 150 respectively. Mr. O'Connell has extensive experience as a workplace safety consultant and bilingual equipment and PIT trainer/certifier for over four decades.

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