

# Preventing Wheel/Brake-Area Fires

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While most wheel/brake-area fires pose no serious threat to the airplane or passengers, they can be alarming enough to cause cabin evacuations and costly delays. This article describes proper wheel/axle greasing techniques during wheel and brake maintenance and highlights the importance of not allowing flammable solvents to collect in wheel heat shields during cleaning procedures to minimize the potential for wheel/brake-area fires.

Many airlines, particularly those operating carbon-braked airplanes, have experienced wheel/brake-area fires due to excessive grease buildup, incorrect grease usage, the presence of flammable cleaning solvents in wheel heat shields, or the accumulation of hydraulic fluid on the brake. In the rare instances when wheel/brake-area fires do occur, the grease, solvent, or hydraulic fluid is ignited following landing by heat generated by the application of the brakes.

Wheel/brake-area fires are occasionally reported following normal operating brake temperature condition landings (see fig. 1). The cause of the fires can usually be attributed to the ignition of excessive grease that has accumulated on the axle in the brake assembly cavity (see fig. 2). In addition, some wheel heat shields can retain residual cleaning fluids after being saturated with flammable solvents during maintenance. Wheel/brake-area fires have also been reported due to ignition of hydraulic fluid associated with leaks or hydraulic system maintenance (see fig. 3). While these fires generally do

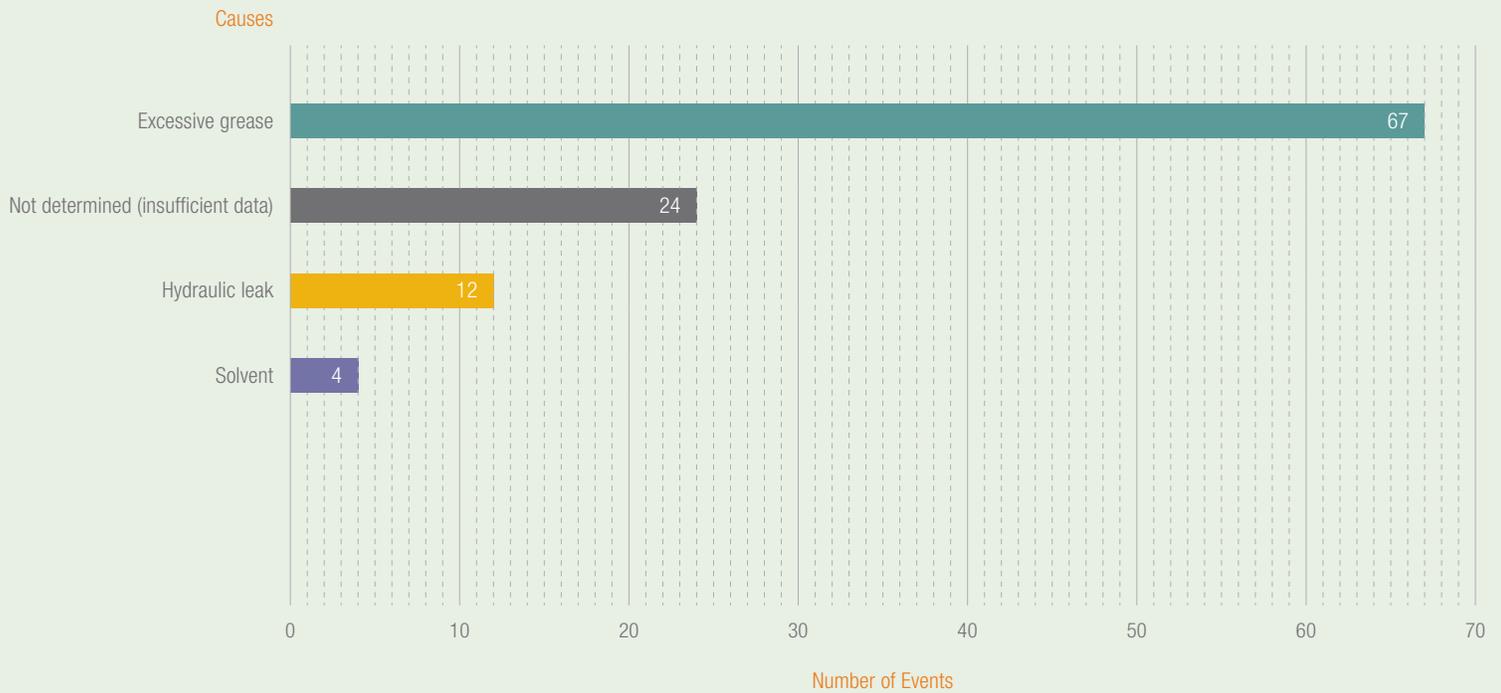
not cause major damage to the airplane or endanger passengers and crew, they can prompt evacuations that can lead to injuries, temporarily take the airplane out of service, and result in costly repairs. Yet most wheel/brake-area fires can be avoided by following some simple procedures:

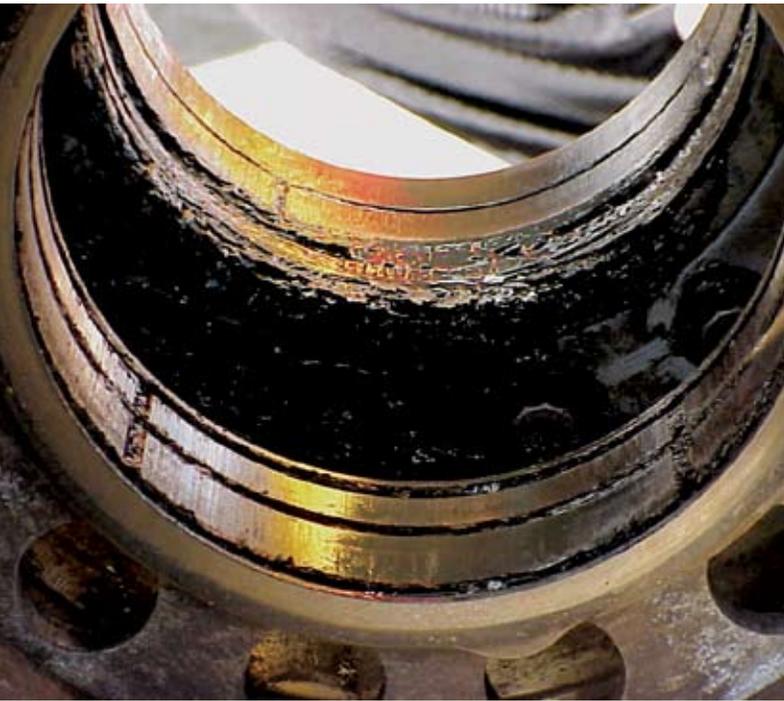
- Clean all grease from the axle before reinstalling the wheel and/or brake assembly.
- Use only approved greases in small quantities at the points where the wheel and brake will contact the axle.
- Follow wheel supplier Component Maintenance Manual (CMM) cautions regarding the use of flammable cleaners on wheel heat shields, including not using dunk tanks on “sealed” heat shields.

ALTHOUGH THESE FIRES  
DON'T CAUSE MAJOR  
DAMAGE, THEY CAN  
LEAD TO DELAYS, ADDED  
MAINTENANCE COSTS,  
AND EVACUATIONS.

**BRAKE-AREA FIRE EVENTS SINCE 1996  
(EXCLUDING DRAGGING BRAKES, BRAKE MISASSEMBLY,  
OR WHEEL BEARING SEIZURES)**

Figure 1

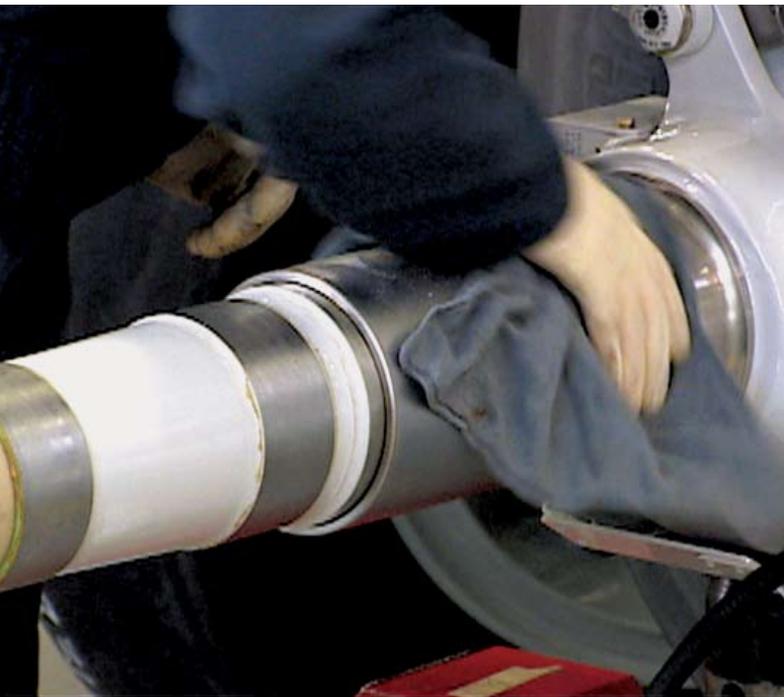




**REMOVED BRAKE FOLLOWING FIRE FROM EXCESSIVE AMOUNT OF GREASE**  
*Figure 2*



**REMOVED BRAKE FOLLOWING FIRE FROM HYDRAULIC FLUID LEAK**  
*Figure 3*



**ESSENTIAL STEP: EXISTING (OLD) GREASE BEING REMOVED**  
*Figure 4*



**THIN LAYER OF GREASE BEING APPLIED TO BRAKE/AXLE SLEEVES**  
*Figure 5*

## WHAT CAUSES WHEEL/BRAKE-AREA FIRES

Wheel/brake-area fires are typically caused by a buildup of grease on the axle during service or the application of excessive amounts of grease during wheel/tire changes and brake installations, and the presence of a heat source, namely the brakes. During brake lubrication, excessive grease can also collect in the cavity between the piston housing and torque tube pedestal bushing due to a damaged or missing grease seal or excessive lubrication through the brake piston housing axle bushing lubrication fitting.

Wheel/brake-area fires have also been linked to cleaning fluids retained in the heat shield. Some heat shield designs can absorb cleaning solvents, causing the shield to become saturated with flammable cleaning fluids if they are sprayed or immersed during cleaning.

During normal braking on landing, the temperatures in the main landing gear wheel/brake area can cause grease and residual cleaning fluids in these areas to ignite. Carbon brakes normally operate at slightly higher temperatures than steel brakes, which explains why nearly all reports are associated with carbon brakes. These types of wheel/brake-area fires usually occur within the first few cycles following a wheel or brake change, or following lubrication of the piston-housing grease fitting when a grease seal is damaged or missing. Fires due to leaking hydraulic system components can occur immediately following fluid spillage onto a hot brake.

## PREVENTING WHEEL/BRAKE-AREA FIRES

Because their cause is well known, wheel/brake-area fires can be prevented by following proper maintenance procedures. These include:

- Cleaning existing grease from the axle. When removing or installing wheels and brakes, it is essential to remove old grease from the axle (see fig. 4). Because cleaning fluids and solvents can damage carbon brakes and titanium components, a dry rag must be used to remove the grease.
- Removing old grease from the axle every time wheels and brakes are installed or removed.
- Using only approved greases in small quantities. While it is important to have adequate lubrication within the wheel bearings, only a thin layer of grease is necessary at the wheel/axle interface for wheel/tire installations. Similarly, only a thin layer of grease needs to be applied to the interface surfaces of the brake and axle sleeves when installing brakes (see fig. 5). When applying grease to the axle bushings on the brake assembly, it is important to completely fill the grooves in the bushings with grease.
- Being certain that the brake axle bushing grease seal (on airplanes that have them) is not damaged before installing brakes and that the grease seal is properly installed per the applicable Airplane Maintenance Manual (AMM) or CMM instructions.

- Following wheel supplier CMM cautions when cleaning wheel heat shields. The main wheel heat shield must be cleaned by following the manufacturer's recommended maintenance procedures in the appropriate supplier CMM. Spraying or immersing certain heat-shield designs in cleaning fluids can trap residual fluids within the shield, which can lead to a subsequent fire. The wheel heat shields should be removed according to the supplier CMM during wheel-cleaning operations.

## ADDITIONAL INFORMATION

The recommendations in this article are provided in addition to the standard AMM statements to use only approved "wheel bearing" greases and not apply excessive amounts of grease during main gear wheel and brake installations. This information can be found in AMM chapters 12 and 32. The specific wheel and brake component cleaning maintenance practices can be found in the applicable supplier CMM.

Boeing also updated a Maintenance Tip in July 2006 titled "Main Landing Gear Wheel/Brake-Area Fires" that addresses this issue (707 MT 32-002 R1, 727 MT 32-002 R1, 737 MT 32-010 R1, 747 MT 32-045 R1, 747-400 MT 32-022 R1, 757 MT 32-016 R1, 767 MT 32-026 R1, 777 MT 32-021 R1).

## TRAINING AID

Boeing has developed a training aid to help maintenance personnel visualize and understand proper wheel and axle greasing and cleaning techniques. This aid is a 12-minute digital video disc (DVD) titled "Main Landing Gear Wheel/Brake Area Fire Prevention: Maintenance Tips." Boeing recommends showing this DVD to engineering and maintenance personnel associated with landing gear duties during crew meetings. This DVD (VPS48559) is available from Boeing Data and Services Management at [csd.boecom@boeing.com](mailto:csd.boecom@boeing.com).

## SUMMARY

Wheel/brake-area fires, while usually not serious themselves, can result in minor airplane damage, possible injuries to crew members and passengers when evacuating an airplane, and flight delays. Most wheel/brake-area fires, however, can be avoided simply by following proper maintenance procedures for cleaning and greasing components. For more information, please contact Brian Webber at [brian.k.webber@boeing.com](mailto:brian.k.webber@boeing.com) [A](#)