



Hidden Hazards: Dangerous Goods (Hazmats) on Aircraft

Hazardous materials are found throughout the aircraft. They can represent a physical danger to mechanics, but they can also represent a regulatory concern for the repair station that works on an aircraft (or on the components from an aircraft). Whether your repair station manages complete aircraft, or handles component-level work, it is important to be aware of (and to be properly trained on) hazardous materials regulations.

The international term for hazardous materials is "dangerous goods." While the law recognizes subtle differences between the definitions of "hazardous materials" and "dangerous goods," the practical differences are slight, so these two terms can often be used interchangeably.

When we think of dangerous goods in aviation, the media usually picture forbidden items in passenger luggage — like lithium batteries, aerosol cans, or fireworks; however, there is actually a substantial volume of hazardous materials installed in every aircraft. Awareness of these components can be important.

Many components are classified as dangerous goods. Because these items are essential to the airworthiness of the aircraft, and are typically called out in the type certificate or other government design approval, they are legally permitted on the aircraft. But when removing such components, it is important to protect persons from the practical dangers associated with these parts.

When shipping hazmats (such as when they are shipped to a repair station for component-level work, or when they are returned following such work) the law imposes strict requirements related to classification, identification, packaging, marking, labelling, documentation, etc. Even if your facility does not typically handle hazmats, it frequently happens that hazmats are mis-shipped to a facility. If your facility receives unwanted or unplanned hazmats, you cannot simply return them without complying with the legal requirements surrounding such goods (which include proper training for each person who affects the safe transportation of such goods).

What Systems Include Hazmats?

Here is a breakdown of some major systems that feature dangerous goods installed on modern aircraft.

1. Oxygen Generation and Storage Systems

Passenger cabins and flight decks require dedicated emergency oxygen systems. If the cabin depressurizes at high altitudes, these systems activate immediately, relying on two main types of hazardous materials:

- **Chemical Oxygen Generators:** Often found in the passenger service units above seats, these canisters contain sodium chlorate and iron powder. When activated, a chemical reaction produces oxygen. This reaction releases intense heat, making the generators a significant fire hazard if mishandled or improperly stored. They are typically classed as "oxidizers" under class five. Shipping these units requires special care. The United States system for shipping such oxygen generators varies from the international system, and U.S. law requires compliance with the different U.S. system (thus you cannot rely on the international norms). The United States system typically requires a government

permit to be issued to the manufacturer for the chemical oxygen generator. As a shipper, you should obtain a copy of this permit and follow its instructions.

- **Gaseous Oxygen Cylinders:** The flight deck and portable therapeutic units typically use high-pressure cylinders filled with compressed aviator's breathing oxygen. These cylinders can pose a risk of rupture if exposed to extreme heat or mechanical impact. When shipped, they are typically required to be packaged in specialized outer packaging that has been tested and shown to be resistant to both flame and heat (this specialized packaging is required under U.S. law for oxygen generators, as well).

2. Fire Suppression and Safety Systems

To combat fires in inaccessible areas like the cargo holds, engines, and auxiliary power units (APUs), aircraft are equipped with built-in fire extinguishing systems.

- **Halon Extinguishers:** Built-in fire suppression bottles utilize liquefied compressed gases (typically Halon 1301 or 1211). These cylinders are highly pressurized and must be handled with extreme care during maintenance.
- **Cartridges and Actuators (Squibs):** You would not want to rely on a valve that had to be operated in order to release the fire-suppressing chemicals. Such a valve would be used rarely and thus would be susceptible to sticking or other malfunction. To release the fire extinguishing agent instantly, these systems rely on a diaphragm that contains the chemical agent, and then a small, electrically triggered explosive device known as squib whose job is to remove the diaphragm when the fire suppressant is needed. These sorts of squibs are class one hazmats, and are typically shipped under a permit that is first issued to the manufacturer. Make sure you get a copy of that permit and follow its instructions. They are also typically subject to regulation by the Justice Department's Bureau of Alcohol, Tobacco, Firearms and Explosives, which has licensing mechanisms for those who handle and store explosives.

3. Evacuation and Survival Equipment

In an emergency evacuation, life-saving equipment relies on rapid inflation mechanisms driven by hazardous materials.

- **Evacuation Slides and Rafts:** The emergency slides at aircraft doors must inflate within seconds. They are packed alongside high-pressure cylinders containing a mix of carbon dioxide and nitrogen gas. Similarly, inflatable rafts and life preservers typically rely on high-pressure cylinders. The cylinders themselves are regulated as class two hazmats, while the slides, rafts and life preservers are typically regulated under class nine.

4. Advanced Battery Technology

Modern aircraft feature complex electrical systems that require reliable backup and auxiliary power, increasingly fulfilled by powerful battery systems.

- **Lithium-Ion Batteries:** Utilized for main aircraft batteries and auxiliary

power unit starts on newer aircraft, these batteries offer high energy density but carry the risk of thermal runaway if damaged or overcharged. Lithium battery shipping instructions have been changing rapidly for the last decade and it is particularly important to be correctly trained on the most current shipping instructions for lithium batteries. As part of our hazmat course, we publish an annually updated video on how to correctly ship lithium-ion batteries; the 2026 version of this video is available online at <https://www.youtube.com/watch?v=g3EcIIFz8ZA>.

- Nickel-Cadmium (NiCad) Batteries: Frequently used on older or mid-sized commercial aircraft for emergency backup power, these contain corrosive electrolytes and heavy metals. Most non-lithium batteries are regulated as class eight hazmats.

5. Instruments and Lighting Components

Even navigation and illumination systems can rely on materials categorized as hazardous.

- Radioactive Materials: Certain older flight instruments, navigational aids, and emergency exit signs utilize tiny amounts of radioactive isotopes (like Tritium or Krypton-85) to provide self-luminous glow-in-the-dark capability without electrical power. The modern trend has been to design radioactive luminescent articles (like emergency exit signs) so that their radioactivity level falls below the regulated level, so investigate your radioactives carefully to see if they are actually regulated under the radioactive shipping rules. Make sure you also comply with the regulations of the nuclear regulatory commission, which has a licensing mechanism for those who handle and store such materials.

- Mercury: Mercury can be found in older attitude gyros, tilt switches, and anti-ice system controls. Beyond its toxicity, mercury causes severe liquid metal embrittlement when it contacts aluminum, rapidly destroying the structural integrity of airframe components (I was once present for a D-check where the mechanics discovered evidence of damage from a mercury spill). It is typically treated as both a class eight corrosive and also a class six toxic material.

6. Fuel System Components

- Residual fuel is a class three hazard, and anything with residual fuel remaining in it is a class nine "dangerous goods in articles." Mechanics often want to know if there is a de minimis level of fuel that is no longer regulated. The answer is "no." As long as there is fuel residue in a component, it is still regulated as dangerous goods. If you can smell the fuel, then you are smelling the volatile portion that is most likely to be combustible, so you should treat such a smell as prima facie evidence that the component is a dangerous good.

As soon as a component is removed from the airframe, it can become a regulated hazardous material. It should be handled by someone who is trained on hazardous materials. In fact, U.S. and international law require that any person who classifies, packages, marks, labels, and/or documents such a dangerous good component must have been trained, tested and certified in hazardous materials regulations. We offer a public class twice a year to train and certify people in the aviation industry in how to properly handle and ship hazardous materials. **AVI**

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