

► PUBLICATION

CERTIFIED PACKAGING FOR THE TRANSPORT OF HAZARDOUS MATERIALS : PRACTICAL GUIDE

I. CERTIFIED PACKAGING FOR HAZARDOUS MATERIALS

Choosing certified packaging for the transport of hazardous materials is a crucial and complex aspect of modern logistics, involving a multitude of factors such as regulations, safety, environmental considerations, and technology. The importance of this activity is reinforced by the role it plays in maintaining our daily way of life, from the fuel that powers our vehicles to the chemicals required by various industries.

This practical guide has been designed to provide the most comprehensive and detailed overview possible of the various aspects of hazardous materials transport. Its purpose is to educate, inform, and guide professionals who manufacture or handle hazardous or sensitive substances, logistics specialists, transport companies, and any other stakeholders involved in this complex process.



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UNDERSTANDING THE COMPLEXITIES OF HAZARDOUS MATERIALS TRANSPORTATION

The fundamentals of hazardous materials transportation:

This section delves into the definitions of hazardous materials, the international and national regulations governing them, and the responsibilities of various stakeholders involved. Particular attention will be paid to the identification and classification of hazardous materials, crucial for their safe handling and transportation.

Certified packaging:

Detailing the types of packaging used for the transportation of hazardous materials, with a special focus on aluminum solutions, our area of expertise. This part will address the advantages, specifications, and standards related to these packaging's, highlighting why and how they ensure optimal safety.

Testing and certification:

Here, we will discuss the testing and certification processes for packaging, essential to ensure compliance with safety standards. A focus will be placed on understanding and interpreting UN numbers, a critical aspect to ensure adherence to regulatory standards.

Tournaire and its innovative solutions:

Introducing Tournaire, a leader in the field of UN certified aluminum packaging solutions. We will explore how Tournaire integrates innovation, performance, sustainability, support, and a global presence into its products and services.

Through this guide, we hope to not only provide essential information but also promote best practices, thus contributing to a safer and more responsible hazardous materials transportation industry. This article does not replace the internal rules specific to the company or the local, regional, or international regulations, which have the force of law. This guide is provided for informational purposes only and does not imply liability on the part of Tournaire.

II. THE FUNDAMENTALS OF HAZARDOUS MATERIALS PACKAGING AND TRANSPORTATION

DEFINITIONS AND REGULATIONS

The transportation of hazardous materials is a vital aspect of the modern industry, impacting numerous sectors from energy production to the manufacturing of chemicals and pharmaceuticals. These materials, due to their inherently sensitive properties, require strict safety measures set forth by national or international regulations, especially for their storage and transportation. This section outlines hazardous materials, their categorization, their role in the industry, and the importance of securing them during transport.

What is a Hazardous Material?

A hazardous material is defined by any substance that could pose a significant risk to health, safety, or the environment if not handled or transported correctly. These substances can be classified into different categories based on their nature and the type of hazard they present. Categories include explosive, flammable, toxic, corrosive, radioactive substances, among others. These classifications are crucial for determining appropriate safety measures and transportation protocols.

The Role of Hazardous Materials in Industry

Hazardous materials play a crucial role in a multitude of industries. For example, chemicals used in the manufacturing of medications are often classified as hazardous due to their toxicity, especially when concentrated. Similarly, the oil and gas industries rely on the secure transportation of flammable and explosive substances. Lithium batteries, widely used in electronic devices and vehicles, are another example of hazardous materials due to their potential for spontaneous ignition.



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The Importance of Safe Transportation

Transporting these materials presents unique challenges and requires a high degree of responsibility and strict quality management to ensure regulatory compliance. Inadequate transportation can lead to serious accidents, environmental damage, and significant economic losses. Therefore, adhering to stringent standards, such as those established by the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) and those set by other national or global regulatory bodies, is imperative.

Safety in the Transportation of Hazardous Materials

Safety in transporting hazardous materials is not limited to accident prevention. It also includes protecting workers, neighboring communities, and the environment. This encompasses practices such as proper staff training, the use of certified special packaging, adherence to transport quantity limits, and the implementation of emergency procedures in the event of an incident.

In summary, hazardous materials are ubiquitous in modern industry, and their secure transportation is critical for accident prevention and environmental protection. This reality underscores the importance of understanding the fundamentals of hazardous materials transportation.

KEY REGULATIONS FOR THE TRANSPORTATION OF HAZARDOUS MATERIALS

The transportation of hazardous materials is governed by strict regulations at the international (UN), regional (EU), and national levels. These standards are crucial for ensuring the safety of individuals, environmental protection, and the prevention of risks associated with the transportation of these substances. In this section, we will examine the main regulations that govern this field, with a focus on the ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) and other relevant regulatory frameworks.

The ADR: An International Standard

The ADR, established in 1957 and updated in 2023, is primarily a European agreement (with 50 signatory countries) that sets international guidelines for the road transportation of hazardous materials. Its aim is to harmonize safety rules for transporting these substances across member countries, thus ensuring uniform practices and reducing the risk of accidents. More information can be found on the UN/ECE website which compiles various regulations.

- **Classification of Hazardous Materials:** The ADR defines 9 different classes of hazardous materials, ranging from explosives to radioactive substances. This classification is crucial for determining appropriate safety measures.
- **Packaging and Labeling Requirements:** The ADR prescribes specific standards for the packaging and labeling of hazardous materials, ensuring that risks are clearly communicated and that packaging is robust and secure.
- **Staff Training:** The agreement emphasizes the need for proper training of drivers and all personnel involved in the transportation and handling of hazardous materials, including awareness of risks and knowledge of emergency procedures.
- **Documentation and Transport Procedures:** The ADR requires detailed documents to accompany the transport of hazardous materials, describing the nature of the goods, precautionary measures, and contact information in case of emergency.

Other National and International Regulations

In addition to the ADR, several other agreements or regulatory bodies play a significant role in controlling the transport of hazardous materials. Here are a few:

- **RID** (Regulation concerning the International Carriage of Dangerous Goods by Rail): Similar to the ADR but specific to rail transport.
- **IMDG** (International Maritime Dangerous Goods Code): Regulates the transport of hazardous materials by sea.
- **IATA and ICAO for Air Transport:** These organizations establish standards for the transport of hazardous materials by air.
- **National Regulations:** Each country may have its own laws and regulations that complement or reinforce international standards like the ADR, such as the DOT in the USA previously.

Impact on Safety and Risk Prevention

The strict enforcement of these regulations significantly impacts the safety of hazardous materials transportation. By establishing clear and uniform standards, they help prevent accidents and incidents while ensuring the protection of workers, the public, and the environment. Furthermore, they facilitate international trade by providing a common framework for the cross-border transportation of these substances.

In conclusion, regulations like the ADR play a crucial role in securing the transportation of hazardous materials. They are the cornerstone of a safer and more responsible global and local transportation system, essential for the effective management, handling, and safe transport of these high-risk materials.

CLASSIFICATION OF HAZARDOUS MATERIALS

The classification of hazardous materials is a key element in managing the risks associated with their transport. It enables rapid identification of the nature of hazards and the implementation of appropriate preventive and emergency response measures. The different classes define specific risk categories, guiding decisions related to packaging, storage, transportation, and handling of these substances.

Class 1: Explosive substances and articles

Definition: Substances, derivatives of substances, or combinations of substances that, through a chemical reaction, can release gases at high speed, pressure, and temperature, creating an explosion hazard. These materials require specific packaging to minimize risks.

Subclasses:

- Mass explosion hazard
- Projection hazard without mass explosion risk
- Fire hazard with minor blast or projection effects



Class 2: Gases

Definition: Compressed, liquefied, or dissolved gases under pressure, presenting various hazards depending on their flammability, toxicity, or asphyxiation risk.

Subclasses:

- Flammable gases that can ignite rapidly
- Non-flammable, non-toxic gases that may cause asphyxiation
- Toxic gases that can cause serious health effects



Class 3: Flammable Liquids

Definition: Liquids or mixtures that release flammable vapors at temperatures below 60°C, posing a fire risk.



Class 4: Flammable solids and substances dangerous when in contact with water

Subclasses:

- Flammable solids: Solid substances that can easily ignite under normal conditions after brief contact with an ignition source and continue to burn after the source is removed.
- Substances liable to spontaneous combustion: Substances that can ignite spontaneously.
- Substances which, in contact with water, emit flammable gases: Substances that, by reacting with water, are capable of releasing flammable gases.



Class 5: Oxidizing substances and organic peroxides

Subclasses:

- Oxidizing substances: Substances that may cause or intensify a fire by releasing oxygen. They may also react violently with other substances, particularly flammable materials.
- Organic peroxides: Organic compounds containing the bivalent -O-O- structure. They are thermally unstable and may undergo self-accelerating exothermic decomposition. Some may be sensitive to shock or friction.



Class 6: Toxic and infectious substances

Subclasses:

- Toxic substances: Substances liable to cause acute or chronic effects, or even death, if ingested, inhaled, or in contact with skin.
- Infectious substances: Substances containing pathogens (bacteria, viruses, parasites, fungi) capable of causing disease in humans or animals.



Class 7: Radioactive material

Definition: Materials containing radionuclides whose concentration or activity exceeds exemption levels.



Class 8: Corrosive substances

Definition: Substances capable of causing severe damage to living tissues and corroding metals.



Class 9: Miscellaneous dangerous substances and articles

Definition: Substances and articles presenting various hazards that do not meet the criteria of the other classes.



IMPORTANCE OF CLASSIFICATION FOR SAFETY

Accurate classification of hazardous materials plays a crucial role in accident and incident prevention. It directly influences preparation methods, packaging and transport requirements, as well as emergency response procedures. Understanding and complying with this classification system is essential for all stakeholders involved in the hazardous materials transport chain.

III. CERTIFIED PACKAGING FOR HAZARDOUS MATERIALS

The safe transportation of hazardous materials requires the use of certified packaging specifically designed to minimize the risks associated with these substances. It is possible to certify substances of different natures: solids or liquids across the 9 classes of hazardous materials.

TYPES OF CERTIFIED PACKAGING

Type A Packaging:

These packages are primarily used for transporting radioactive materials that do not generate significant amounts of heat. According to the specifications of the International Atomic Energy Agency (IAEA), they are designed to withstand normal transportation conditions without releasing radioactive content.



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Type B Packaging:

These are intended to contain more hazardous radioactive materials, such as those used in nuclear reactors. These packages are designed to withstand severe accidents during transport, including fires, submersion underwater, and falls. The IAEA regulations specify strict criteria for their design and testing.

Type C Packaging:

Specifically designed for air transport, these packages are used for highly active radioactive materials. They must meet extremely rigorous requirements, including the ability to withstand high pressures and extreme temperatures.

Drums, Jerricans, and IBC Containers:

These versatile packages are used for various classes of hazardous materials. Their design varies depending on the nature of the content – drums for liquids, jerricans for small volumes, and IBC containers for larger volumes. They are chosen based on their material, capacity, and resistance to transportation conditions.

Aluminum Packaging:

Aluminum offers unique advantages for the transportation of hazardous materials. It is strong, lightweight, corrosion-resistant, and ensures excellent seal and container integrity. These characteristics make aluminum packaging ideal for a wide range of hazardous materials, from flammable liquids to corrosive substances.

STANDARDS AND CERTIFICATION OF PACKAGING FOR HAZARDOUS MATERIALS

Packaging Selection and Customization

The choice of packaging for hazardous materials is guided by the flow of goods, the type of product to be packaged, and its final use. Depending on the requirements, different types of packaging and certifications are used. For example, Bulk Chemicals require Large Bulk Containers (IBCs) of 1000L that travel without overpackaging with "stand alone packaging" type certifications, while finished products are often packaged for transport in "combination packaging," for example, metal flasks, which are then placed in cardboard boxes for transport. In the latter case, the "box and can" set is certified.

The "stand alone" certification requires higher performance criteria. Recently, for sensitive products and medium-sized packaging, it is common to require both stand alone and combination certification, even if these packages are always transported in boxes. This dual certification is considered a safety guarantee, especially at the end of the supply chain, which constitutes a sales argument.

Every industry, especially in the chemical and pharmaceutical sectors, incorporates the Dangerous Goods Transportation (DGT) regulations into the packaging specifications, requiring constant and reliable expertise and certified suppliers.

Testing and Certification of Packaging

Packaging intended for the transportation of hazardous materials, as well as packaging manufacturers, are subject to a rigorous certification process to ensure compliance with international safety standards. These two processes are essential to guarantee that these packaging's can withstand the challenges and constraints of transportation environments without compromising the safety of people and the environment. Only organizations officially recognized by the authorities can issue Approval Certificates, which are indispensable for the transportation of dangerous goods and to conduct audits on the holders of these certificates. It is crucial to ensure, when purchasing and selling certified packaging, that the Approval Certificates are valid and up-to-date.



Photo credit: Tournaire

Initially, each packaging is assessed for its drop resistance, seal integrity, and pressure tolerance. These tests are of uppermost importance, especially for aluminum packaging, chosen for its lightness and corrosion resistance, frequently used in the transportation of hazardous materials.

Before testing, a careful selection of packaging types and sizes, and overpacks is made based on the flow and type of hazardous material to be transported (solid, liquid, gas). This choice also depends on the classification of the packaged product and its final use. The range of packaging and overpacks is vast: for bulk transport, Large Bulk Containers (IBCs) such as 1000L pallet boxes are common, as well as metal drums from 30L to 200L, and for smaller flows of sensitive materials, aluminum cans and bottles from 5L to 32L. For finished products, smaller packaging such as metal bottles and flasks are used, which can be grouped in cardboard boxes for protection during transport.

A key step in the process is determining the UN code for each chemical component of the product. These codes are found in tables within the ADR and other regulations. They define the product's associated constraints and hazard group:

- Group I : Very dangerous materials
- Group II : Moderately dangerous materials
- Group III : Less dangerous materials

In France, accredited laboratories such as APAVE, BVT, LNE et LEREM, play a decisive role in the certification of packaging. A list of accredited bodies can be consulted on French Ministry of Ecology's website. These institutions perform a series of mandatory tests, including seal integrity, drop, pressure resistance, and stacking tests, to ensure that the packaging meets the strict safety requirements defined by international agreements. The BAM in Germany is another renowned laboratory in this field. Accredited laboratories are also responsible for regularly auditing the holders of Approval Certificates, issuing a Certificate of Conformity on these occasions, confirming that the company has implemented the manufacturing and quality control measures to comply with regulatory prescriptions related to packaging for the transportation of hazardous materials. Only these accredited laboratories are able to issue Certificates of Conformity and UN Approval Certificates which are recognized worldwide.

Once the tests have been passed, a Certificate of Approval with its unique UN number is assigned to the unitary or combined packaging, specifying materials, types and components of packaging, method of assembly, hazard group, maximum permitted density and pressure, as well as other crucial technical information. This Certificate and the UN number are a guarantee of conformity and reliability for end users, transporters and the authorities of each country crossed.

The certification process and adherence to the instructions in the Approval Certificate ensure that the packaging used for the transportation of hazardous materials is suitable for its content and mode of transport, thereby reducing the risks of accidents or contamination during transport. It is essential that these procedures are rigorously followed to maintain the high safety standards required in the hazardous materials transportation field.

This certification process for packaging and packaging suppliers ensures that the packaging not only meets safety requirements but also the specific needs of industries that rely on these materials for their daily operations.

The renewal of UN certifications is an essential step to ensure the compliance of packaging dedicated to the transportation of hazardous materials. These certifications, generally valid for a period of five years, must be renewed to guarantee adherence to the most recent safety standards. This process involves periodic testing and reevaluation of the packaging to confirm its durability and integrity. Regular monitoring is crucial to maintain quality and safety standards and to adapt to the sector's technological and regulatory developments.

UNDERSTANDING UN NUMBERS

After testing, laboratories assign a UN number on the Approval Certificate, which must appear alongside the hazard pictograms on the primary packaging for individual certification and on the grouping carton for combined packaging. This number encodes essential information, which is important to know and master in detail to ensure its compliance with the transported product.



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For instance, in the aforementioned case next to the UN (United Nations) logo, the identification "1B1/Y1,2/250/21/F/BVT 202121/TOU." should be deciphered as follows:

- The type of packaging (e.g., 1B1 for a partially openable aluminum packaging),
- The hazard group (X for Groups I, II, or III; Y for Groups II and III; Z for Group III only),
- The density here is 1.2 or the maximum approved mass for solid product certifications,
- The test pressure in kPA – here 250, equivalent to 2.5 bar,
- The manufacturing year – here 2021,
- The manufacturing country here F for France,
- The identifying laboratory here BVT that conducted the tests and the report number,
- The manufacturer's identification – here "Tou" for Tournaire.

Each segment of this number thus provides essential information on the physical limits of the product to be packaged and on the packaging's compliance, thereby ensuring safe and regulatory transport of hazardous materials.

WHICH PARTNER FOR THE PACKAGING AND THE TRANSPORTATION OF YOUR HAZARDOUS MATERIALS?

The transportation of hazardous materials is a demanding field that requires highly qualified partners, certified by governmental bodies, thus capable of mastering the technical and regulatory constraints specific to this sector. These partners must have a deep understanding of the various types of packaging and overpacks, as well as the transported products, and constantly stay up-to-date with UN and ADR regulations, even anticipating major evolutions.

When choosing a supplier for hazardous materials packaging, you can opt for a manufacturer or distributor, depending on your specific needs. A distributor offers a wide range of certified packaging in stock and provides the necessary approval certificates, ensuring the validity and compliance of the used packaging.

Manufacturers bring deep technical expertise, thanks to a long history in the industry or through their specialization in certain categories of packaging or materials. These players offer a wide variety of certified packaging, as well as the ability to create customized solutions to meet specific needs. With their experience in designing and manufacturing packaging, these manufacturers ensure strict adherence to quality and safety standards through procedures regularly checked by accredited organizations and their clients.

IV. TOURNAIRE – LEADER IN ALUMINUM PACKAGING SOLUTIONS

Our History & Experience

Tournaire, established in 1833, is recognized for its expertise in aluminum packaging solutions, especially in the transportation of hazardous materials. Innovation, at the heart of their strategy, is reflected in their avant-garde approach to metal forming and surface treatment. This technical expertise allows for the development of packaging that meets stringent safety and performance requirements.

Tournaire's reputation is built on its commitment to excellence and quality. The seamless aluminum packaging, lightweight and durable, offers an optimal solution for the safe transportation of hazardous materials, thus minimizing the risks of leakage or contamination.



Photo credit: Tournaire

Our Commitment

Tournaire's commitment to sustainability and social responsibility is deeply embedded in its operations. Protecting people and products is at the core of this approach, recognizing that securing hazardous materials directly contributes to environmental protection. In doing so, Tournaire works not only for immediate safety but also for the preservation of the environment for future generations.

Tournaire's customer service is remarkable, offering comprehensive support from material selection to compatibility testing, through regulatory support. Their ability to maintain a large inventory and adaptive logistics ensures the continuous availability of packaging solutions, a critical aspect in the field of hazardous materials.

Their global presence, supported by a rich history and ISO 9001 and 14001 certifications, attests to their expertise and reliability. Tournaire stands out for its ability to offer customized solutions for the transportation of sensitive materials, strictly adhering to UN and ADR standards to ensure safe transport in compliance with international regulations.

About us

In summary, Tournaire embodies the balance between innovation, technical expertise, social responsibility, and commitment to quality and sustainability. Their holistic approach to the transportation of hazardous materials, focused on safety, efficiency, and environmental protection, positions them as a partner of choice in this highly demanding sector.

VII. CONCLUSION

Managing the transportation of hazardous materials is a significant concern for safety, environmental preservation, and value protection. We hope this purely informative guide has shed light on the importance of a thorough understanding of all aspects of this complex process. It indeed spans from the classification and regulation of hazardous materials to the strict requirements for packaging and certification. By emphasizing the importance of the appropriate selection of packaging, especially aluminum for its robustness and safety, we have underscored the importance of choosing solutions that are adapted and compliant with regulatory requirements.

Tournaire, with its rich history and recognized expertise in the manufacturing of seamless aluminum, positions itself as a vital partner in resolving issues related to the transportation of hazardous materials. Our commitment to innovation, quality, sustainability, and social responsibility reflects our mission to protect not only the hazardous materials themselves but also the people and environment surrounding them.

Ultimately, understanding and managing the transportation of hazardous materials is crucial for ensuring safety and preserving our planet. At Tournaire, we are dedicated to supporting our clients in these challenges by providing reliable and innovative packaging solutions, tailored to their specific needs. Our expertise, derived from over 190 years of experience, is the guarantee of a solid and lasting partnership, for a safer and more responsible future.

Damien **CANAC**
and the Tournaire team