

DANGEROUS GOODS SHIPPING AND PACKING INFORMATION FOR TEAMS



Shell Eco-marathon • 2022

BRILLIANT MINDS COMING TOGETHER TO BUILD A LOWER-CARBON WORLD

INTRODUCTION

Transportation of dangerous goods is a risk when they are not correctly packed or handled. If the goods are hidden, declared incorrectly, left completely undeclared, packed or labeled incorrectly, health and safety is severely compromised. Commercial freight transportation regulations have increased significantly worldwide within the last couple of years requiring Shell Eco-marathon teams to seek and understand the current restrictions/regulations, and the ramifications for non-compliance.

Teams are required to seek guidance from a commercial freight company for the latest international and national regulations.

Shipments classified as dangerous good materials can include, but not limited to flammable liquids, batteries, and pressurized containers (for example fire extinguishers).

This dangerous goods guideline was developed using the current International Air Transport Association (IATA), International Civil Aviation Organization (ICAO), International Maritime Dangerous Goods, and regional Department of Transportation (DOT) documents covering commercial freight shipments. The intent with this guideline is to provide teams basic knowledge of dangerous goods that are generally utilized by Shell Eco-marathon teams.

It is vital teams understand they are responsible for declaring, packaging and labeling dangerous goods to ensure health and safety are not compromised.

SHELL ECO-MARATHON GLOBAL SHIPPING PARTNER



DSV Solutions (formerly known as Agility Fairs and Events Logistics) is the Global Freight Partner for Shell Eco-marathon. Their global expertise will assist you in identifying any shipping restrictions/regulations for any chemicals and selected battery(ies). They will outline the process of packing and shipping your Shell Eco-marathon vehicle crates through commercial carriers to Shell Eco-marathon and World Championship events worldwide.

Teams are responsible for the packing, labelling, declaring, and shipping their crates including any dangerous goods to ensure health and safety are not compromised.

Note: Teams are not required to use DSV Solutions, but DSV is available to offer any guidance regarding crate shipments.

DSV Solutions is available to support all team shipping for the Americas, Asia and Europe events.

SHIPPING CONTACTS

For more information on shipping your cars and crate to a Shell Eco-marathon event please contact our dedicated Student Ambassadors for your region at the following locations, they will then put you in touch with your local DSV Representative for your event:

EUROPE AND AFRICA

Email: garcia.newell@dsv.com

REQUIRED ACTIONS BY TEAMS

- 1) Acquire the Material Safety Data Sheet (MSDS) or a Safety Data Sheet (SDS) document of any chemicals and batteries, you will be using in your vehicle. (Note this will be either your accessory battery or propulsion battery for the BEV vehicle class)
- 2) As early as possible in your vehicle development, contact your DSV representative and begin discussions about shipping your vehicle to the Shell Eco-marathon event. Specific discussions will be around the packing and shipping of dangerous goods, including lithium-based batteries.

Teams may be excluded from the event that are found to be non-compliant regarding the DG shipping policies.

Not required but a recommendation for teams:

- 1) Plan your shipping such that your vehicle crate has NO dangerous goods. Pack any dangerous goods in a separate container/crate.
- 2) Contacting a dangerous goods packer in your area can provide additional assistance with your crate and completing the necessary paperwork for commercial shipping. The dangerous goods packer will provide a DG's packing certificate, which must be submitted to Shell and DSV prior to shipment.

DEFINITION OF DANGEROUS GOODS

Dangerous goods are substances or articles that pose a risk to people, property or the environment, due to their chemical or physical properties. They are usually classified with reference to their immediate risk.

The transportation of dangerous goods is controlled and governed by a variety of different regulatory regimes, operating at both the national and international levels. Prominent regulatory frameworks for the transportation of dangerous goods include the United Nations Recommendations on the Transport of Dangerous Goods, ICAO's Technical Instructions, IATA's Dangerous Goods Regulations and the IMO's International Maritime Dangerous Goods Code. Collectively, these regulatory regimes mandate the means by which dangerous goods are to be handled, packaged, labelled and transported.

EXAMPLES OF DANGEROUS GOODS

Dangerous goods are products in one of three physical states – a solid, liquid or gas. These products can present a range of dangers in a transport environment flammability, toxicity (poisonous), pressurization, and corrosivity being the most common.

The physical state and properties of dangerous goods affect packaging, handling and transportation decisions.

Dangerous goods are essential in the manufacture of common products such as cars, plastics, electronics and pharmaceuticals on which progress and world trade depend. Dangerous goods are safely shipped every day.

ITEMS REQUIRING SPECIAL ATTENTION WITH YOUR SHIPMENTS

Batteries

Lubricants – WD40; greases; etc.

Engine Oils

Fuel

Flammable Liquids

Aerosol Canisters

Pressurized containers – Fire extinguishers; aerosol sprays and lubricants (prohibited in air shipments only).

These items will not ship by any method without a Material Safety Data Sheet (MSDS) or a Safety Data Sheet (SDS) document.

The majority of the above items (lubricants, oils and fuel) can be purchased in the location where the competition will take place.

WHEN DANGEROUS GOODS ARE NOT SHIPPED CORRECTLY

Dangerous goods are... dangerous. When not packed correctly OR even if they are and something happens, the results can be catastrophic.

AN EXAMPLE OF A VEHICLE CRATE

- Vehicle and crate contents destroyed
- Fire contained within crate, no other crates damaged.



CATASTROPHIC EVENT ON THE GROUND

- NOT Shell Eco-marathon related
- Properly pack and ship YOUR dangerous goods to minimize the risk.



ADDITIONAL INFORMATION

TYPES OF COMMERCIAL FREIGHT

AIR

Air freight can be provided by passenger or cargo aircraft. Shipments by air freight are the most stringent and costly as opposed to sea and road freight regarding dangerous goods. However, air freight is a benefit by reducing the numbers of days between point-to-point delivery.

SEA

Shipments by sea freight have fewer restrictions/regulations and can be a cost saving benefit especially combined with other Shell Eco-marathon teams within the same container. However, sea freight requires longer lead time and in some cases can take three to eight weeks for delivery depending on the route and the number of port of calls.

ROAD

Shipments by road freight also have fewer restrictions/regulations and can be a cost saving benefit versus air freight. However, road freight, similar to sea freight, requires a lead time and may require eight to ten days for delivery depending on the route and the number of other delivery points along the way.

SHIPPING DANGEROUS GOODS BY AIR, SEA, OR ROAD

A key point for teams to know regarding dangerous goods is they can ship these items as long as the shipment complies with current governing regulations/restrictions, and can manage the financial requirements.

Your freight forwarding company will explain what is permitted and not permitted regarding dangerous goods in your crate. For example; if your vehicle is an Internal Combustion Engine (ICE) all fuel and lubricant must be drained from the engine.

Your choice of shipping method when depend greatly on the time available for your shipment to reach a regional event. For example; sea or road freight is less expensive but requires 3-8 weeks for arrival; although regulations/restrictions are not as strict versus air freight. Shipping by air requires less lead time, but is more expensive and the regulations/restrictions regarding dangerous goods are the most stringent.

Any dangerous goods identified in your shipment will classify the entire crate as a dangerous good freight and will increase your cost significantly regarding the method chosen. One recommendation for teams is to ship any dangerous goods in a separate smaller package to reduce total costs. Commercial shippers such as UPS, FedEx and DHL are good options to control costs in shipping smaller packages.

SHIPPING DANGEROUS GOODS BY AIR, SEA, OR ROAD (CONTINUED)

We highly recommend you contact an DSV representative or chosen local freight provider early enough to receive the guidance on the best shipping method your team needs to ensure your crate arrives on time and in safe condition.

Depending on your chosen method of shipment and if any dangerous goods have been identified you will be advised as to what goods are permitted or not permitted to pack in your crate. In addition, you will be advised on all required documents.

A reminder teams can contract a dangerous goods packing company to assist in packing and certifying your crates including your batteries. They, in addition to your freight forwarded, will advise on labeling the boxes with the relevant dangerous goods stickers and also produce the relevant dangerous goods shipping notes where required for the shipment.

Teams must ensure they declare all items they are shipping to their freight forwarder as any items not declared could delay the shipment or in some countries customs may confiscate the entire shipment and after a period of time dispose of it.

For example there was an incident in London where a team opened their crate to discover the battery was missing. They assumed all was correct with their shipment, however a battery that was packed separately was not declared to customs. As a result customs confiscated the battery and the team had to source a new one in London.

SHIPPING PURCHASED BATTERIES

ONLY batteries with a MSDS/SDS can be shipped commercially.

Note: modified or hand-made batteries will require a MSDS/SDS to be generated to be shipped commercially.

Batteries are considered hazardous and as such, there are specific restrictions and regulations relating to packaging and shipping. All batteries, but especially lithium-based batteries, are considered dangerous goods because they, if dropped, crushed or short-circuited can cause fires.

To protect against fires, you must ensure compliance with current restrictions and regulations. You need to carefully consider how you are going to pack and ship your batteries.

It is preferable that all batteries are shipped separately from the vehicle crate. Batteries should be packed in to a non conducting box, preferably plywood, with enough packing material to physically protect the battery(s) from damage.

Note: this package will be identified as dangerous goods.

Another permitted method, although not recommended, is to ship vehicle batteries securely mounted within your vehicle with the terminals disconnected and protected. Spare batteries should be packed either in a separate mounting in your vehicle (preferable) or if not, into a separate non conducting box and secured safely within the crate. Note, if this approach is used, the entire crate will be identified as dangerous goods and will increase shipping cost significantly.

Other batteries you are shipping such as those used for power tools, USB phone/tablet back-up chargers must be declared to your freight forwarding company as these are subject to dangerous goods regulations as well as the batteries used to power your vehicle.

For any lithium-based batteries, discharge your batteries to a 30% state of charge before they are packed.

WHAT IS A MODIFIED BATTERY?

A modified battery is any purchased battery that has been altered from its original state.

If you changed the cell mounting or internal wiring of a purchased battery, the result would be a modified battery.

Note: adding a battery management system (BMS) to a purchased battery is NOT considered modified as long as you have not altered the purchased battery physical battery case or internal battery wiring.

WHAT IS A HAND-MADE BATTERY?

A hand-made battery is any battery that was fabricated by the team, or anyone else, and does NOT have a MSDS/SDS.

A hand-made battery would typically be the combining of individual cells in series or parallel configurations to make a single battery. (Example: combining X number of 18650 cells to make a battery unit).

A hand-made battery would NOT have a MSDS/SDS. Although the individual cells would have a MSDS/SDS, the MSDS/SDS would NOT cover the overall battery.

Note: Connecting one or more **purchased batteries, not cells**, into a single battery is NOT a hand-made battery as long as the individual batteries have a MSDS/SDS.

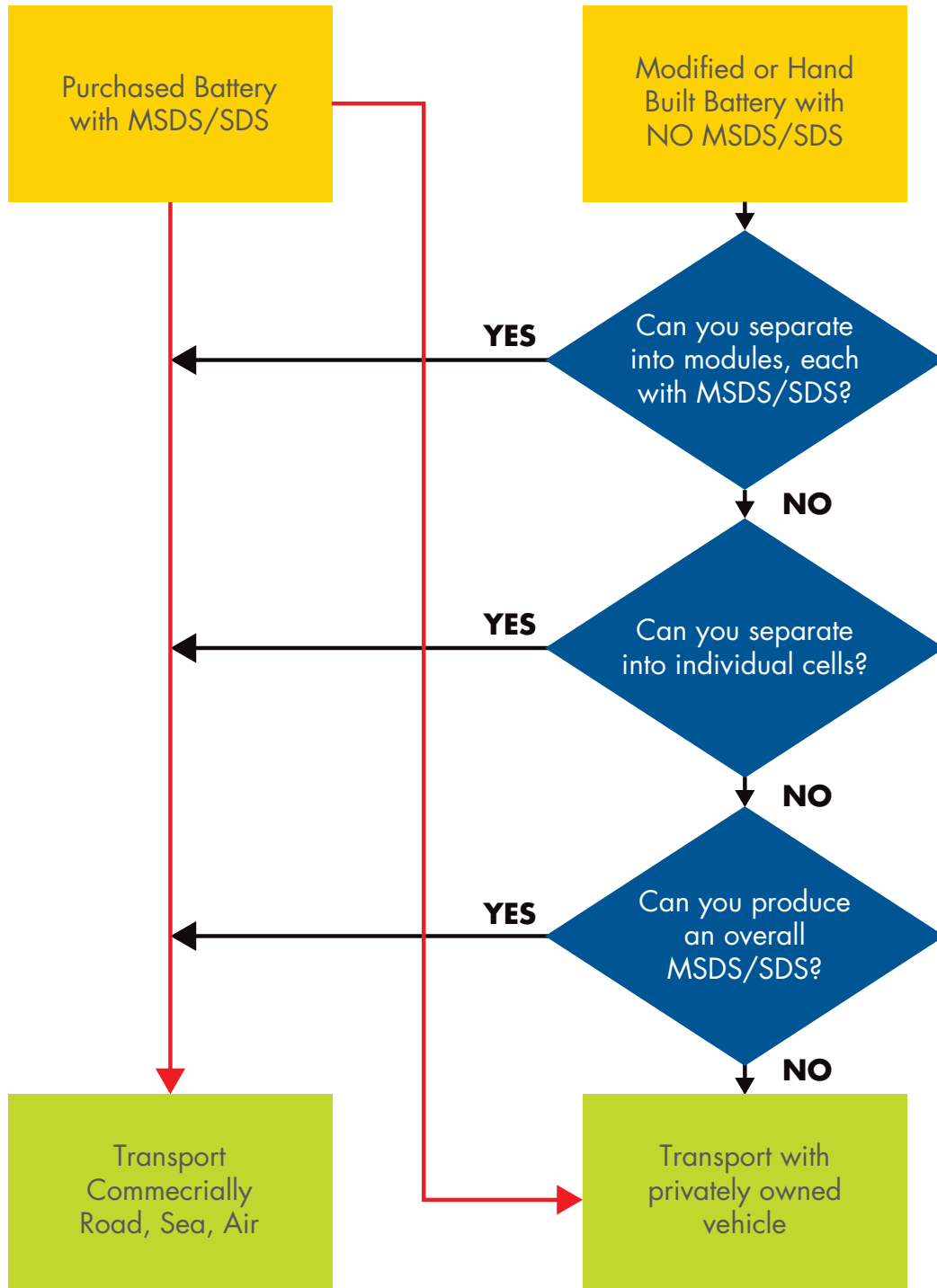
SHIPPING OF MODIFIED OR HAND-MADE BATTERIES

If you have a modified or hand made battery, the battery cannot be shipped by any method of commercial transport **unless** it has been (1) tested by a professional testing company, and (2) a MSDS/SDS generated, or (3) certification has been given for the battery to be shipped

There are official Departments of Transport and regulatory bodies in your home country that can give you advice on having your modified or hand made battery certified. One Global company that may be able to assist you in the certification and MSDS/SDS creation is SGS Inspection Services. www.sgs.com

Note: if you have a modified or hand made battery composed of cells with a MSDS/SDS AND the individual cells can be removed, you can ship the cells as individual batteries. The individual cells can be shipped as long as the cells are packed correctly for the desired shipping method. The remaining battery case used to contain the cells would NOT then be considered dangerous goods and can be shipped in your crate.

HOW CAN I TRANSPORT MY BATTERY?



CLASSIFICATION OF DANGEROUS GOODS

For transport purposes, dangerous goods are allocated to one of nine 'classes', according to the main danger they present. These are as follows:

Class 1 – Explosives

Class 2 – Gases

Class 3 – Flammable liquids

Class 4 – Flammable solids and other flammable substances

Class 5 – Oxidizing substances and organic peroxides

Class 6 – Toxic and infectious substances

Class 7 – Radioactive material

Class 8 – Corrosive substances

**Class 9 – Miscellaneous dangerous substances and articles
(Including lithium ion batteries)**

Many of these classes are sub-divided. For example, toxic substances are allocated to Class 6.1; infectious substances are allocated to class 6.2.

Substances or articles are classified as 'dangerous goods' for sea shipment if they meet the criteria prescribed in the IMDG Code for any of these classes.

Substances or articles are classified as 'dangerous goods' for air shipment if they meet the criteria prescribed in the IATA Code for any of these classes.

The danger(s) presented by a particular substance or article determine the safe transport procedures for it e.g. the way it needs to be packed, whether it can be loaded on a passenger or freighter aircraft, where it needs to be loaded in an aircraft or stored within an airport.

IATA DGR BATTERY CLASSIFICATION CONTAINED IN YOUR BATTERY MSDS/SDS

Lithium batteries are classified as Class 9 – Miscellaneous Goods as:

UN3480 LITHIUM ION BATTERIES

UN3090 LITHIUM METAL BATTERIES

Or if inside a piece of equipment or packed in the same box but away from the equipment they are classed as:

UN3481 LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT

UN3481 LITHIUM ION BATTERIES PACKED WITH EQUIPMENT

UN3091 LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT

UN3091 LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT

DANGEROUS GOODS REGULATIONS OVERVIEW



Orange Book

United Nations Recommendations on the Transport of Dangerous Goods.



ADR

European Agreement Concerning the International Carriage of Dangerous Goods by Road



IMDG – Code

International Maritime Dangerous Code



IATA–DGR

International Air Transport Association – Dangerous Goods Regulation

ICAO T.I.

International Civil Aviation Organization Technical Instructions

CRATE LABELLING REQUIREMENTS FOR SHIPMENT BY AIR

Current Handling Label



New 'Mark' Label



CRATE LABELLING REQUIREMENTS FOR SHIPMENT BY AIR

Section IB

Section IB - Packing Instructions 965 & 968

Lithium ion and lithium metal cells and batteries that meet the Watt-hour or lithium content limits set out in Section II of PI 965 and PI 968 respectively, but that exceed the weight or quantity limits set out in Table 956-II or Table 968-II are subject to all of the applicable requirements in the DGR except for the requirements for UN specification packagings.

The requirements applicable are as follows:

- (a) dangerous goods training (DGR 1.5);
- (b) classification (DGR 3.9.2.6);
- (c) limits on the total weight per package (applicable packing instruction);
- (d) strong outer packagings (see Section IB of applicable packing instruction);
- (e) marking and labelling of packages (DGR Section 7)
Note: packages must bear both the lithium battery handling label and the Class 9 hazard label. If packages are assembled into an overpack the requirements for overpacks in DGR 7.1.7 and 7.2.7 apply;

- (f) Shipper's Declaration for Dangerous Goods (Section IB of PI 965 or PI 968);
Note 1: "IB" must be added to the DGD following the packing instruction number. This can be done either with the PI number, e.g. 965 IB, or as shown in Dangerous Goods Regulations Figure 8.1.P, in the authorisations column. Refer to Section 8 of the IATA Dangerous Goods Regulations for full details.

Note 2: if packages of Section IB are consolidated with other cargo, the



SHIPPER'S DECLARATION FOR DANGEROUS GOODS

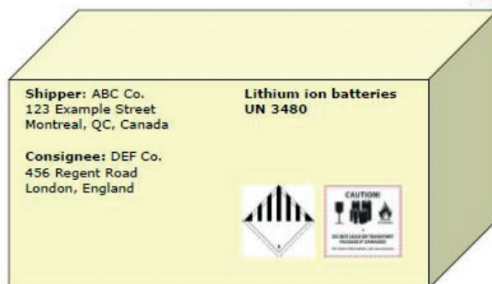
Name: _____ Date: ____/____/____
 Title: _____
 Company: _____

Shipper's Declaration: I hereby declare that the information provided in this declaration is true and correct, and that the goods are properly classified, packaged, marked and labelled, and that they are in conformity with the applicable Dangerous Goods Regulations.

Signature: _____

Section IB

TRANSPORT DETAILS		Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties.			
This shipment is within the limitations prescribed for: (State non-applicable)		Airport of Departure: Montreal			
PASSENGER AND CARGO AIRCRAFT		Airport of Destination: London, Heathrow			
		Shipment type: (State non-applicable) NON-HAZARDOUS / HAZARDOUS			
NATURE AND QUANTITY OF DANGEROUS GOODS					
Dangerous Goods Identification					
UN or ID No.	Proper Shipping Name	Class or Division (Subsidiary Group Risk)	Quantity and type of packing	Packing Inst.	Authorization
UN 3480	Lithium ion batteries	9	1 Fibreboard box X 5.5 kg G	965	IB



Airport of Destination	Requested Flight/Date	Amount of Insurance	INSURANCE - If carrier offers insurance, and such insurance is requested in accordance with the conditions thereof, indicate amount to be insured in figures in box marked "Amount of Insurance".				
Forwarding Information			SGI				
Dangerous Goods as per attached DGD							
no. of Pieces SCP	Gross Weight	no. of Containers	Rate Class	Chargeable Weight	Rate / Charge	Total	Nature and Quantity of Goods (incl. Dimensions or Volume)

CRATE LABELLING REQUIREMENTS FOR SHIPMENT BY AIR

Section II

Section II - Packing Instructions 965 – 970

"Small" Lithium ion and lithium metal cells and batteries that meet the Watt-hour or lithium content limits set out in Section II of PI 965 to PI 970 are only subject to certain parts of the DGR when shipped as cargo. The bulk of the requirements for these small lithium batteries are contained within the General Requirements at the start of each packing instruction which apply to all lithium batteries and then the specific requirements set out in Section II of each packing instruction, which are as follows:

- (a) classification (DGR 3.9.2.6);
- (b) limits on the quantity of lithium cells or batteries per package (Table II of the applicable packing instruction);
- (c) strong outer packagings (see Section II of applicable packing instruction);
- (d) marking and labelling of packages (Additional Requirements of Section II of the applicable packing instruction);
- (e) the details of the consignment must be described (Additional Requirements of Section II of the applicable packing instruction).



Packages containing lithium batteries, or lithium batteries contained in, or packed with, equipment that meet the provisions of Section II of these packing instructions are not required to have a Class 9 hazard label and there is no requirement for a Shipper's Declaration for Dangerous Goods for consignments of these batteries.



Description of Hazardous Material (including proper shipping name, hazard class, hazard category, hazard label code, hazard statement, and hazard pictogram)		Quantity		Net weight		Gross weight		Net volume		Gross volume		Other information (e.g., container, equipment, etc.)		Other information (e.g., destination, etc.)	
UN No.	Proper Shipping Name	Class	Category	kg	lb	kg	lb	liters	gallons	liters	gallons	Other	Other	Other	Other
UN 3480	Lithium ion batteries	9													

Lithium ion batteries
In compliance with
Section II of PI965
Cargo Aircraft Only