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Packaging manual

for use when introducing new packaging and making changes existing packaging

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- Central Warehouse -

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hereinafter referred to as "Techem"

Foreword

Techem is an international service provider offering intelligent and sustainable solutions in the areas of energy, water and indoor climate control in real estate. The company aims to make resource consumption in buildings more efficient and thus actively contribute to climate protection. Innovative technologies and digital services enable transparent consumption recording, fair billing and optimisation of energy and water consumption.

With a leading market position in Germany and a strong international presence, Techem serves numerous apartments and buildings. Its range of services extends from the recording and billing of heat, water and cooling to smart sensor technology and digital platforms for the real estate industry.

The company's success is based on many years of experience, innovative strength and close cooperation with partners and suppliers. The focus is on quality, sustainability and reliability – from the selection of products and services to implementation at the customer's site.

The packaging manual sets out binding standards and requirements for packaging. All suppliers and partners are obliged to comply with these specifications in order to ensure a smooth supply chain and product quality.

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1. Introduction and scope

This packaging manual regulates the requirements and procedures for the delivery of goods to Techem and supplements the general terms and conditions of purchase. It is intended for all suppliers and internal departments and is binding for the safe, legally compliant and efficient packaging of all goods, in particular dangerous goods. Additional specific requirements may apply to individual locations, which must also be taken into account. The manual is available at https://www.techem.com/de/de/supply-chain-management.

1.1 Purpose and background of the packaging manual

The safe packaging and clear labelling of goods, especially dangerous goods, is a key prerequisite for smooth and safe transport. Proper packaging minimises risks for all parties involved and ensures compliance with legal requirements. The Packaging Manual sets out the binding requirements for suppliers to ensure a smooth flow of materials and compliance with quality, environmental and safety standards.

In addition, the manual serves as a guide for internal departments to support suppliers in selecting and applying optimal packaging solutions. The focus is also on reducing negative environmental impacts, as far as this is economically feasible.

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2. Definitions (according to ADR)

For clarification, the most important terms relating to packaging and shipping are explained below:

- **Packaging:** Container and all other components necessary to enclose and protect the packaged goods.
- **Outer packaging:** Packaging that combines several individual packages without changing the original packaging.
- **Combination packaging:** Packaging consisting of an outer packaging and one or more inner packagings.
- **Packaging material:** Container in which the goods are transported, e.g. cartons, bags or crates.
- **Packaging aids:** Materials for securing and protecting the packaged goods, e.g. stretch film, adhesive tape.
- **Load carriers:** aids such as pallets or mesh boxes that bundle several packages into a loading unit.
- **Item:** Product identified by a unique item number and description.
- **Battery:** A battery is an electrical energy source consisting of one or more interconnected cells. It supplies energy by converting chemical energy into electrical energy. In dangerous goods legislation, batteries are considered to be combinations of cells that function together as a single unit.
- **Battery cell:** A battery cell is the smallest electrical unit that converts chemical energy directly into electrical energy. A cell consists of a single electrochemical system and forms the basis for batteries. Several cells can be combined to form a battery.

3. General packaging regulations

Packaging performs several key tasks in the movement of goods: it protects the goods from damage, facilitates handling, enables efficient storage and contributes to transport safety. At the same time, packaging is an important factor in sustainability and resource conservation.

3.1 Basic requirements

Packaging that complies with both general and specific legal requirements must be used for dangerous goods. Packaging (with the exception of small quantities) intended for dangerous goods must be tested and approved by a recognised body.

Inner packaging must be selected so that it cannot be damaged or leak in the outer packaging under normal transport conditions. Liquid substances may only be filled into packaging that can withstand the expected internal pressure. Dust-proof packaging or inner bags must be used for powdery or granular substances.

All delivered parts must be packaged appropriately and adequately protected, both internally and externally. In addition to the specifications in this manual, national and international regulations must also be observed.

Packaging waste must be kept to a minimum without compromising the quality of the goods.

Regardless of the type of packaging, the following requirements must always be met:

- The delivery must be undamaged.
- The packaging must meet the quality requirements.
- The labelling on the packaging must be clearly legible from the outside.
- Plastic bags used as containers must be sealed.
- The packaging must be clean.
- The packaging must be stackable.
- The available space must be used optimally.
- Loading units must be formed as efficiently as possible.
- Transport security must be ensured.
- Unloading and handling of the delivery must be possible without any problems.

1 : Example of a pallet with cartons stacked securely and neatly for transport – created in-house using AI

3.2 Determination of packaging

The supplier is responsible for selecting the packaging, taking into account the specifications in this manual. The supplier is responsible for implementing the requirements.

Techem reserves the right to specify the type of packaging in special cases, such as for sensitive parts with special protection requirements. The supplier is responsible for ensuring that the goods are delivered undamaged.

If the specifications are not adhered to or if different packaging is used, additional costs for handling, packaging or disposal may be charged to the supplier. The supplier is liable for damage or loss of quality resulting from defective, damaged or contaminated packaging. Any deviations must be agreed in good time with the responsible contact person.

The choice of packaging type depends on the properties of the product, the protection requirements, the type of transport and the circumstances at the supplier's premises.

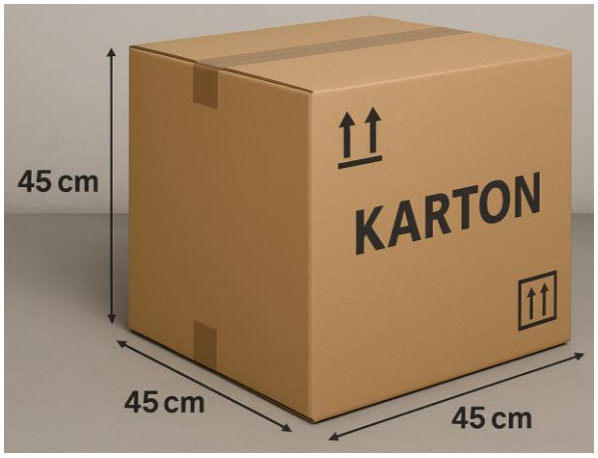
3.3 Packaging standard

The following standards must be observed to ensure efficient material handling and smooth processing in supply chain management:

Packaging proposals from the supplier must be approved by Techem, specifically by Supply Chain Management and Device Engineering & Quality Assurance. Changes to existing packaging solutions require approval by the Head of Supply Chain Management. Temporary deviations must be approved in writing.

The packaging must be adapted to the technical and qualitative requirements of the goods. The weight and size of the goods determine the packaging quality. For overseas shipments, tested, wet-strength corrugated cardboard in accordance with DIN 55 468 Part 2 must be used.

Outer packaging must not exceed the dimensions of 45 cm x 45 cm x 45 cm and a weight of 25 kg. Coordination with the responsible contact persons is necessary to ensure efficient use of the outer packaging.



2 : Example of a box with dimensions – self-representation created using AI

4. Information accompanying the packaging

4.1 Packaging, labelling and marking

Each package must be labelled (white) in a clearly visible location.

Label requirements:

- Minimum size: 10.0 cm x 5.0 cm (adjusted for smaller packaging)
- The following information is required in this order:
    - Techem item number
    - Techem item number as a barcode
    - Techem item description
    - Number of items per package

Barcodes must be printed in "Code 128 subset b" format in black and white only. The minimum height of the barcode is 10 mm; the width must be agreed with the central warehouse. The font size for the item number and number of items must be chosen so that it stands out from the rest of the labelling.

The same labelling rules apply to packaging without labels but with direct printing. The label must be affixed in such a way that it serves as a seal and the packaging can only be opened by damaging it.

3 : Example of a label as a seal over the opening of a cardboard box – self-representation partly using AI

A separate seal is required for directly printed packaging. Otherwise, the packaging may only bear the packaging name (e.g. Standard VDW 2.4), the trade mark or other Techem identifications. Exceptions are only possible after prior agreement with the responsible contact person.

For goods requiring certification, the current certification year (e.g. "2025") and the date of manufacture must be indicated on the label. For goods not requiring certification, the date of manufacture must be noted.

For national MID device recalibration, a coloured label must be used instead of a white one:

- Green for recalibration in 2024
- Red for recalibration in 2025
- Signal yellow for recalibration in 2026

The colours alternate annually in this order. For re-certified goods, the old certification year must be covered over.

4 : Example of a coloured label for MID recalibration – self-representation partially created using AI

4.2 Symbols for packaging/handling instructions

If the packaged goods require special handling, internationally recognised symbols (according to ISO R/780 and DIN 55 402) must be clearly visible on the packaging. These symbols are mandatory in order to avoid misunderstandings in international trade.

Designation	Symbol	Designation	Symbol
Fragile packaged goods *Fragile, handle with care*		Protect from moisture *Keep dry*	
Do not use hand hooks *Do not stack!*		Please do not stack! *Do not stack!*	
This way up *This way up*		Permissible stacking load *Stacking limitation*	
Protect from heat (sunlight) *Keep away from heat*		Clamps in the direction of the arrow *Stacking limitation*	
Centre of gravity *Centre of gravity*		Do not use forklift truck here *Do not use forklift truck here*	
Electronic hazard component		Do not damage barrier layer *Do not destroy barrier*	

1 : Overview of important handling symbols

5. Packaging instructions / Transport of lithium batteries as dangerous goods

5.1. Packaging instructions and labelling

Each hazardous substance or object is subject to specific packaging instructions, which are listed in the ADR as alphanumeric codes (Section 3.2 ADR, Table A, Column 8).

Meaning of the letters in the packaging instructions:

- P: Packaging and containers
- R: Thin-gauge sheet metal packaging
- IBC: Intermediate bulk containers
- LP: Large packaging

The respective packaging instruction specifies:

- Which individual or combination packaging is permitted for the respective dangerous goods.
- The maximum volume or weight that may be contained.

5.2 Packing dangerous goods together

The combined packaging of dangerous goods with other dangerous or non-dangerous goods in an outer packaging or large packaging is only permitted if no dangerous reactions can occur.

Special provisions for combined packaging are described in ADR, section 4.1.10. If combined packaging is permitted due to material compatibility, the following applies:

- Different dangerous goods may be transported together in combination packaging.
- The inner packaging must be enclosed in a common outer packaging.
- Dangerous goods may also be packed together with non-dangerous goods, provided that the respective classification rules are observed.

5 : Illustration of impermissible combined packaging – self-illustration created using AI

5.3 Definition and requirements for the transport of dangerous goods

The transport of dangerous goods involves the transport of goods and objects which, due to their chemical or physical properties, pose a risk to people, animals, the environment or property during transport. Such substances are classified as dangerous by law and are subject to special regulations.

Techem processes and transports various hazardous substances, mainly lithium metal and lithium-ion batteries.

5.4 Labelling of dangerous goods

Each package containing dangerous goods must be permanently and clearly marked with the corresponding UN number, the prefix "UN" and the appropriate danger label.

- The UN number must be at least 12 mm high.
- Smaller markings are permitted for packages weighing up to 30 kg/30 l.

6 : Example of a package with UN number and danger label – created in-house using AI

5.5 Lithium batteries

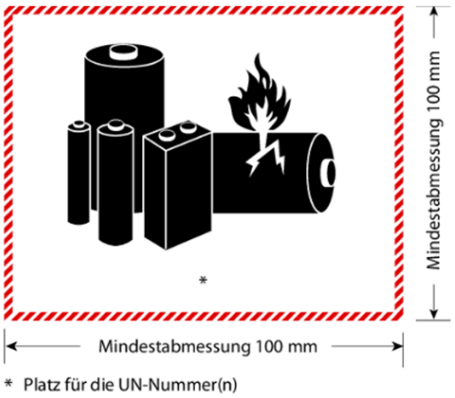
Lithium batteries are powerful energy storage devices which, due to their chemical composition, pose particular risks if handled improperly. Hazards can arise in particular if they are damaged, short-circuited or exposed to intense heat. Compliance with transport and packaging regulations is therefore essential.

Classification:

- UN3090: Lithium metal batteries
- UN3091: Lithium metal batteries in equipment or packed with equipment
- UN3480: Lithium ion batteries
- UN3481: Lithium ion batteries in equipment or packed with equipment

5.5.1 Special Provision 188 (ADR)

Lithium batteries with a nominal energy of less than 100 Wh and a lithium content of less than 2 g are subject to Special Provision 188. Packages must be marked with a special label (minimum 100 mm x 100 mm).



7 : Marking for lithium batteries according to SV188, at least 100 x 100 mm

Outer packaging must also be marked accordingly on the outside. The marking must be made on the shipping carton or pallet wrap with the addition of "Outer packaging/Overpack".

Requirements:

- Lithium-ion cells: max. 20 Wh, batteries: max. 100 Wh
- Lithium metal cells: max. 1 g lithium, batteries: max. 2 g lithium
- Parcels must pass a drop test from a height of 1.20 m without damage
- Inner packaging must completely enclose batteries/cells and protect them from short circuits
- Batteries/cells must be secured against contact with conductive materials
- Maximum weight per package: 30 kg gross
- A special handling notice must be affixed to the outside

8 : Example of outer packaging with lithium battery labelling and "Outer packaging/Overpack" notice – created in-house using AI

9 : Example of outer packaging with lithium battery labelling and "Outer packaging/Overpack" notice on pallet – self-representation created using AI

5.5.2 Shipping as normal dangerous goods

UN-approved packaging is required for batteries with a nominal energy **of 100 Wh** or more or a lithium content **of 2 g or more**. Packaging instruction P903 requires packaging of packaging group II (Y-coded). The packages must be labelled with danger label 9A (minimum 100 mm x 100 mm, reduced for small packages) and the corresponding UN number. For sea transport, the exact technical designation, e.g. "LITHIUM ION BATTERIES", must also be indicated.

Many airlines do **not allow** the shipment of **UN 3480** lithium batteries.

10 : Example of dangerous goods labelling for UN3090 including sea transport designation – self-representation created using AI

5.6 Flow chart for determining the correct packaging instructions

No	Check step	Answer	Shipping instructions	Note
1	Battery defective/damaged?	Yes	→ *Continue to [**2**]*	Dangerous goods with increased risk
		No	→ *Continue to [**3**]*	
2	Battery 'critical'?	Yes	**SV 376, P911**	Critical batteries, e.g. with thermal risk
		No	**SV 376, P908**	
3	UN-approved battery?	Yes	**SV 310, P910**	For tested and approved batteries
		No	→ *Continue to [**4**]*	
4	Battery for disposal or recycling?	Yes	**SV 377, P909**	Contact your local collection point or disposal company
		No	→ *Continue to [**5**]*	
5	Transport as air freight?	Yes	**VA 968 Part IA / VA 969 Part I**	Observe air freight regulations
		No	→ *Continue to [**6**]*	
6	Lithium content ≤1g/cell and ≤2g/battery?	Yes	**SV 188**	'Exempt' dangerous goods
		No	**P903**	'Fully regulated' dangerous goods

Table2 : Flow chart for determining the correct packaging instructions for lithium metal batteries

5.7 Devices with lithium batteries (e.g. data collectors/smart readers)

When shipping devices with built-in lithium batteries, please note that these are classified as Class 9A dangerous goods due to their high lithium content. They may only be shipped by a freight forwarder, as parcel service providers do not transport dangerous goods of this type.

Storage and transport instructions:

- Devices must not come into contact with moisture.
- Avoid storing near heat sources.
- The temperature must not fall below -25 °C or exceed +75 °C.
- Storage without suitable dangerous goods packaging is not permitted.
- Shipping is carried out exclusively by a forwarding agent.

5.8 Special features of packaging for Smart Reader batteries

The Smart Reader battery packaging is designed for safe transport on pallets from the battery manufacturer to the Smart Reader manufacturer or Techem central warehouse. Transport is usually by ship and lorry. In exceptional cases (e.g. short-term increases in demand), transport may also be by aeroplane.

In addition, the packaging must meet further requirements due to special processes:

Requirement	Reason
Inner carton with 28 individual batteries	Uniform number of items per inner carton regardless of battery supplier
Three inner cartons per outer carton. The total number of individual batteries per outer carton is 3 x 28 = 84.	Uniform number of items per outer carton, regardless of battery supplier
Desirable: 24 outer cartons per pallet. The total number of individual batteries per pallet is 24 x 84 = 2,016	Uniform number of items per pallet, regardless of the battery supplier
The inner carton complies with PG II according to ADR and bears the corresponding test number and all required dangerous goods markings according to UN3090 / ADR.	The inner carton is shipped individually as a dangerous goods package. In addition, the Techem technician transports the inner carton in his vehicle.
The inner carton is designed so that any number of batteries (between 1 and 28) can be transported safely. The drop test from a height of 1.2 m prescribed for PG II must also be passed with any number of batteries. The carton is easy to open and reseal. No adhesive tape is required for this.	At the start of their tour, Techem technicians have a fully loaded box with 28 batteries. They remove one battery and insert it into the Smart Reader. With the remaining 27 batteries, they drive to the next customer and remove another battery, and so on.
The outer carton (containing 84 individual batteries) is designed and labelled so that it can be shipped individually as a dangerous goods package (UN3090 / ADR).	Fitters who install a particularly large number of Smart Readers usually receive a box containing 84 individual batteries as a dangerous goods package. The Techem fitter also transports the box in his vehicle.
Easy removal and replacement of the batteries, including assembly (65 mm long two-core cable with 4-pin Molex connector). The packaging must not be damaged in the process.	The batteries are removed from the box by a service provider, checked and returned to the box. This must be easy and effortless. They are then transported by vehicle.
The box must be suitable for transporting empty batteries.	Empty batteries are replaced by the Techem technician. The empty batteries are transported to the disposal company in the original battery box.

Table3 : Requirements for packaging Smart Reader batteries

5.9 Special features of packaging for OK3 replacement batteries

Lithium-ion batteries are considered dangerous goods and must be packaged and labelled accordingly. The packaging must **reliably prevent short circuits**, in particular by insulating the poles and protecting them from conductive materials.

Each battery must bear a **type plate** for clear identification. During transport, the batteries must be labelled in accordance with ADR with the corresponding **UN number** (e.g. UN 3480 or UN 3481).

OK3 replacement batteries fall under **Special Provision 188**, as they have a lower power output (less than 100 Wh and 2 g of lithium).

11 : Example of individual packaging for OK3 replacement batteries – self-representation partially created with AI

12 : Example of battery protection – self-representation partially created with AI

13 : Example label to be affixed to the outer packaging of a cardboard box

7. Final provisions

Compliance with the specifications in this packaging manual is mandatory for all suppliers. In the event of non-compliance, any costs incurred may be passed on and the supplier may be held liable. Changes or deviations are only permitted with prior written approval.

Techem Supply Chain Management

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Additions: *Topics relating to hazardous goods were agreed in advance with the responsible hazardous goods officer, checked and approved.*