PACKAGING AND
MARKING GUIDELINE

IMS

AVL

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Revision protocol:

Rev. No.	Revision date	Reason of changes
01	01.08.2012	Initial Version
02	02.02.2017	Update
03	08.11.2019	- 10.2 Interior protection: closer specification - 12.2.3 Handling mark: closer specification
04	09.12.2019	- Revision protocol added - 13 Indicators: use and status specified
05	20.05.2026	Complete revision

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1 Purpose

This regulation defines all requirements concerning the delivery and packaging of goods supplied to and from AVL Group locations.

2 Scope

This regulation applies to all goods that are delivered to and from locations of the AVL Group. The provisions stated below are considered a supplementary contractual agreement to the purchase orders issued by AVL Procurement.
Deliveries are inspected by AVL Incoming Goods Control for compliance with this regulation, and the results form part of the supplier evaluation.

3 General

This directive defines minimum requirements for packaging. It does not release the supplier or packager from their warranty obligations and/or their responsibility for the proper, quality-compliant execution of the packaging. If, based on the contractor's expertise or experience, it becomes apparent that additional measures are required to protect the goods, the contractor must take the necessary precautions.
The objective of this packaging guideline is to protect all goods against the wide range of stresses that may occur throughout the logistics chain (e.g. pressure, shock, drop, vibration, or temperature influences), ensuring that the goods arrive at their destination undamaged and ready for use.
It is pointed out that the packaging must comply with all relevant international regulations and thus enable onward transport and local import of the goods into the respective destination country (especially India) in compliance with local packaging regulations (especially India).

For the calculation and design of all wooden packaging, the standard DIN 1052

– Design and structural analysis of timber structures applies.

The contractor is obliged to review the packaging regulations provided immediately upon receipt, considering the transport goods, transport route, destination, and storage requirements. Any deficiencies, inadequacies, incompleteness, or errors must be reported without delay. The contractor is also obliged to provide proof of origin or due diligence declarations in accordance with applicable legal requirements (e.g. EUDR, etc.).

4 Packaging Requirement

Due to the transportation loads that occur, packaging must be suitable for the expected stress and must adequately protect the packaged goods throughout the entire transport chain.

4.1 Stress-complaint packaging

The design of stress-appropriate packaging, corrosion protection, and marking depends, among other things, on the following factors:

- Country of destination (condition of transport infrastructure)
- Transport route (handling frequency, etc.)
- Mode of transport (rail/truck/ship/airplane, etc.)
- Duration of transport and storage
- Type of storage (covered)
- Storage duration (minimum 12 months)
- Temperature (−25°C to +60°C)
- Humidity
- Physical properties of the goods (e.g., weight, sensitivity, etc.)

In principle, the size of the packages must be optimally adapted to the goods, particularly regarding space- and freight-efficient packaging, as well as safe transport and smooth assembly. Clearance gauge exceedance must also be considered.

The packaging must be designed so that tilting, shifting, swinging, oscillation, lifting, etc., under normal conditions do not cause damage to the goods or the packaging.

The outer packaging must allow movement of the packaged goods using lifting equipment and/or industrial trucks.

As a rule, the packaging must be constructed so that the packaged goods and their packaging withstand a free fall from a height of 40 cm without damage. Furthermore, the packaging must comply with the latest environmental regulations and all applicable national and international legal requirements.

The wood used for packaging must meet the phytosanitary requirements of ISPM Standard No. 15 and must be marked accordingly.

4.2 Load bearing capacity

4.2.1 Stacking crush pressure

The frame construction of crates, cases, etc., must be designed to withstand a stacking pressure of 10 kN/m² (1 t/m²) without damage.

4.2.2 Load

Packaged goods must be secured within their packaging against horizontally acting forces (tilting, shunting impacts, collisions, etc.) that may occur during transport, so that neither the goods nor the packaging suffer damage under the stresses defined in Figure 25 (examples of acceleration forces during transport operations).

4.3 Maximum net weights

Packets	≤ 30 kg
Cardboard pallets	≤ 500 kg
Cardboard pallets in case of air freight	≤ 150 kg; > 150 kg boxes

Lattice boxes	≤ 1000 kg
Euro-pallet	≤ 1000 kg

4.4 Ecological prinziples

Packaged goods must be secured within their packaging against horizontally acting forces (tilting, shunting impacts, collisions, etc.) that may occur during transport, so that neither the goods nor the packaging suffer damage under the stresses defined in Figure 25 (examples of acceleration forces during transport operations).

Truck: max. crate size L × W × H: xxx × 240 × 250 cm

(loading width & height of tarpaulin truck)

Sea freight / container: max. crate size L × W × H: xxx × 230 × 250 cm

(container loading width & height)

Air freight: max. crate size L × W × H: xxx × xxx × 160 cm

(air cargo loading height)

4.5 Packaging materials

Material	**Approved material**	**Not approved material**
Single-use packaging	PLA (with declaration)	PE, PP
Reusable packaging	PLA	PE
Shrink & stretch film	Biodegradable PE (incl. marking)	PE
Expanded polystyrene (EPS)	-	Not permitted
Packaging chips	-	Not permitted
Paper and cardboard	Free from harmful substances; VCI papers that are demonstrably recyclable together with paper/cardboard	Laminated paper or cardboard
Wood	Plywood, engineered wood, or treated wood according to IPPC (ISPM 15) standard	Untreated wood

AVL – box	OSB3 C/C unpolished
	3-layer
	DIN EN 13986
Emission class	E1
Material	OSB3 material mix
Glue class	EN 314- 2 class 3
Bulk density	620 kg/m^3
Utilisation classes:	1-2
1… Dry area	3
2… Humid area	Covered outdoor
3… Outer area	Climatic exposure leading to higher material moisture than class 2
Bending strength	4930 N/mm^2

4.6 Reach identification

All materials must be labelled in accordance with the REACH Regulation.

5 Material Classification

Since the parts to be packaged vary in their physical and chemical sensitivity, they are classified into the following material categories based on their characteristics:

MK 1

Shock- and corrosion-resistant, heavy, bulky, and robust products:

Steel constructions, profile bars, scaffolding, sheet metal, etc.

MK 2

Parts requiring physical protection:

Structural components that cannot be assigned to Class 1, steel and support structures, thin-walled sheet metal parts, railings, smaller pipes, etc.

MK 3

Corrosion-resistant parts requiring physical protection:

Structural parts and fastening elements (e.g., flanges, brackets, screws, springs, bolts, etc.).

MK 4

Corrosion-sensitive parts requiring both physical and chemical protection:

General mechanical components (e.g., axles, drives, valves, machined surfaces, gear units, shafts), spare parts, non-stainless fastening elements, etc.

MK 5

Parts that are corrosion-sensitive and/or highly sensitive to shock or vibration:

Electronic and precision measuring devices, positioners, control panels, switch cabinets, limit switches, pressure gauges, position indicators, etc.

MK 6

Dangerous goods:
Batteries, adhesives, paints, chemicals, acids, solvents, spray cans, etc.

6 Carriage class

Class 1: TRUCK

This class includes all truck-based transport by road, such as door-to-door transport and consolidated freight with or without multiple handling operations.

Class 2: RAILWAY

Defined by rail-based transport, typically wagon-load shipments.

Class 3: SEA

Class 4: CONTAINER

For sea transport, a distinction is made between conventional loading and container loading.

The difference in packaging requirements is that when loading into a container, crates and cases do not need to be designed for a stacking pressure of 1 t/m², depending on the material classification.

When selecting the packaging category within the applicable material class, it must be noted that a container is not considered packaging, but a transport unit.

Class 5: AIR TRANSPORT

Transport using aircraft as the carrier.
The packaging weight must be kept as low as possible but must still match the material classification and withstand multiple handling operations.

7 Packaging execution

If multiple modes of transport are used for shipment, the packaging must be selected according to the highest required packaging category / transport class involved in the transport chain.

7.1 Packaging execution – selection table

Carriage class	1 TRUCK	2 RAIL-WAY	3 SEA	4 CONTAINER	5 AIR
Material classification	**PACKAGING CATEGORY**				
MK 1	1, 5	1, 5	1, 5	1, 5	1, 6 8, 9
MK 2	1, 4, 5, 6	1, 4, 5, 6	7, 10	1, 4, 5, 6	1, 4 5, 6, 8
MK 3	2, 3 6, 8, 9	6, 8, 9	6, 7, 10	6, 7, 10	2, 3 6, 8, 9
MK 4	3, 6, 8, 9	6, 8, 9	6, 11 12	6, 7, 10 11, 12	2, 3 6, 8, 9
MK 5	2, 3 6, 8, 9	6, 8, 9	6, 11, 12	6, 11, 12	2, 3, 6, 8 9, 11, 12
MK 6	ADR	RID	IMDG- Code	IMDG- Code	IATA

8 Packaging categories

8.1 Category 1 – Skid (Wooden Design) according to ISPM 15

(wrapped, shrunk, or wound in biodegradable PE film including marking)

Base runners are screwed directly to the package, allowing handling with a fork-lift. The wooden runners must have a minimum thickness of 10 cm. The goods are packaged by shrinking or wrapping them in biodegradable PE film.

8.2 Category 2 – Cardboard Box

Cardboard box for goods up to 30 kg and with a maximum Euro-pallet footprint (120 × 80 cm). Construction and design: folding box according to DIN 55429, made of corrugated cardboard according to DIN 55468, triple-wall, wet-strength glued, grade 2.96. Each box may contain only one material number.

8.3 Category 3 – Cardboard Box on Euro Pallet or Single-Use Pallet (ISPM 15)

Cardboard box for goods up to 500 kg, maximum Euro-pallet size 120 × 80 cm. For air freight: max. 150 kg; above 150 kg → crate required. Securing is done using zinc-plated steel strapping or plastic strapping with material marking. Cardboard edge protectors must be used to prevent damage from the strapping.

8.4 Category 4 – Euro Pallet (ISPM 15)

Four-way wooden flat pallet 800 × 1200 mm (European exchange pallet) according to EN 13698-1. Securing is done using zinc-plated steel strapping or plastic strapping with edge protection.

8.5 Category 5 – Single-Use Wooden Pallet (ISPM 15)

Used for various types of goods from approx. 500 kg to 4000 kg and lengths up to 6 m. Securing is done using zinc-plated steel strapping or plastic strapping with material marking. Edge protection must be used to prevent damage.
The pallet is intended for one-time use only.

Design:

- Longitudinal beams: 25–50 mm thick depending on weight
- Outer cladding with 30 mm boards
- Base runner: 10 × 10 cm squared timber

8.6 Category 6 - Box normal/seaworthy up to 2,500 kg

Bottom:

With skids or bottom battens, bottom board made of multi-layer board, minimum 24 mm

Side walls:

OSB3 board minimum 12 mm, cleat frame (12–24 mm) inside up to max. 120 cm height/width, board joints on the inside must have cleats of equal thickness

End wall:

Same design as side wall

Lid:

OSB3 minimum 24 mm with cleated joints, for crate height above 180 cm, lid may be only 12 mm, but crate must not be stacked - marking according to Annex, Handling Marking No. 14.

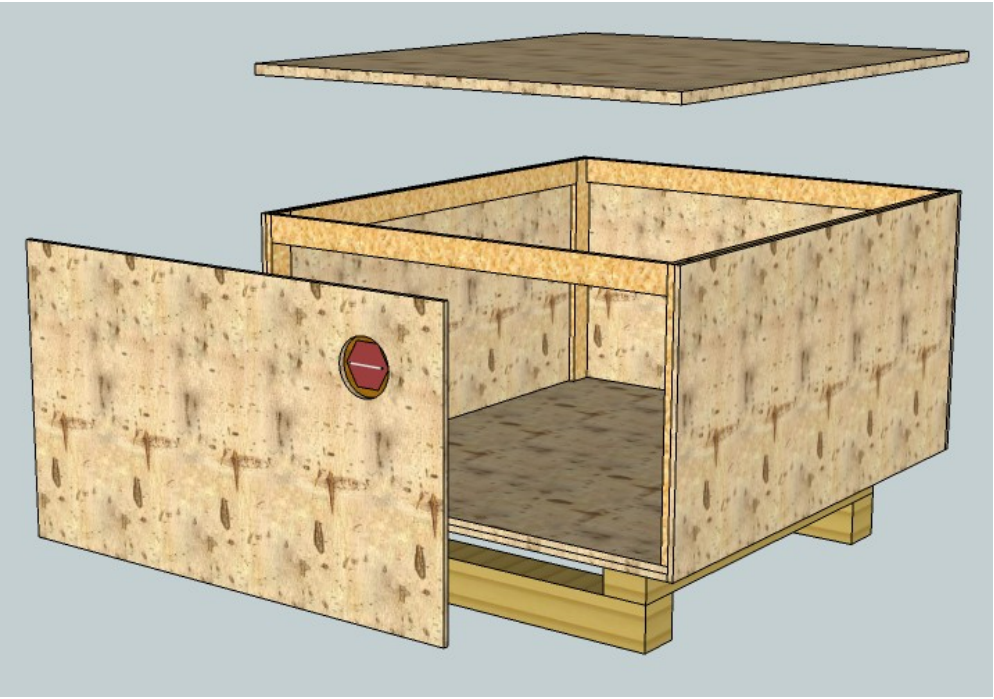

Figure 1: Board box AVL-execution

8.7 Category 7 – Seaworthy box – wooden

Floor: runners (slides) longitudinally, floor formwork made of multi-layer panel, at least 24 mm thick, nailed to a maximum of 5 mm, bulkhead squared timber bolted with longitudinal runner (slide) (continuous screws with washer and nut). Skirting boards (transverse shelters) ⩽ 3000 kg 10 x 8 cm, > 3000 kg 12 x 10 cm thick, distance max. 120 cm, must be bolted to the longitudinal or intermediate runners or nailed several times. (Attachment depending on the position of the centre of gravity, interrupted for forklift access and suitable for rope attachment).

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Mass	**Strength/cross-section**	**Mass**	**Strength/cross-section**
≤ 1000 kg	10 x 10 cm	≤ 10000 kg	12 x 16 cm
≤ 2500 kg	10 x 10 cm	> 10000 kg	16 x 20 cm
≤ 5000 kg	10 x 10 cm		

heavy cargo fittings must be attached after 5 t.

Table 1: Longitudinal-lower skid strength (carriage)

Side wall: Formwork vertical or transverse, OSB3 min. 12 mm strong, strap frames and diagonals inside. Up to 120 cm width and height with one diagonal 30 to 45°. A coating with waterproof specialty paper must be fitted such that it adequately overlaps between the strap frame and formwork.

Dunnage distance max. 70 cm and lined, min. 40 mm strong and 80 mm wide.

End wall: Formwork vertically or transverse, OSB3 min. 12 mm strong, strap frames and diagonals inside, up to 120 cm wide and height with one diagonal (30 to 45°), coating like side wall.

Cover: Formwork longitudinal or transverse, OSB3 min. 12 mm strong, with strap frames, with 6 mm plywood board, covered with biodegradable PE-film in between. The cover strap frames must be rest on the strap frames of the end and side walls.

Strap frames, diagonals and cover compression woods must be designed for

a stacking dynamic pressure of minimum 1.0 t/m^2 2.

Box width inside	**Strength/ cross-section**	**Box width inside**	**Strength/ cross-section**
≤ 100 cm	50 mm	**≤ 300 cm**	12 x 16 cm horizontal
≤ 150 cm	10 x 10 cm	**> 300 cm**	12 x 16 cm vertical
≤ 200 cm	10 x 12 cm		

Table 2: Cover compression woods

The lid compression timbers including the dunnage (lid compression timber supports) must be pulled in at intervals of max. 70 cm and nailed to the lid or side walls.

Strapping: The crate must be strapped with at least 2 steel straps (at least 19 mm wide) at intervals of max. 2 m.

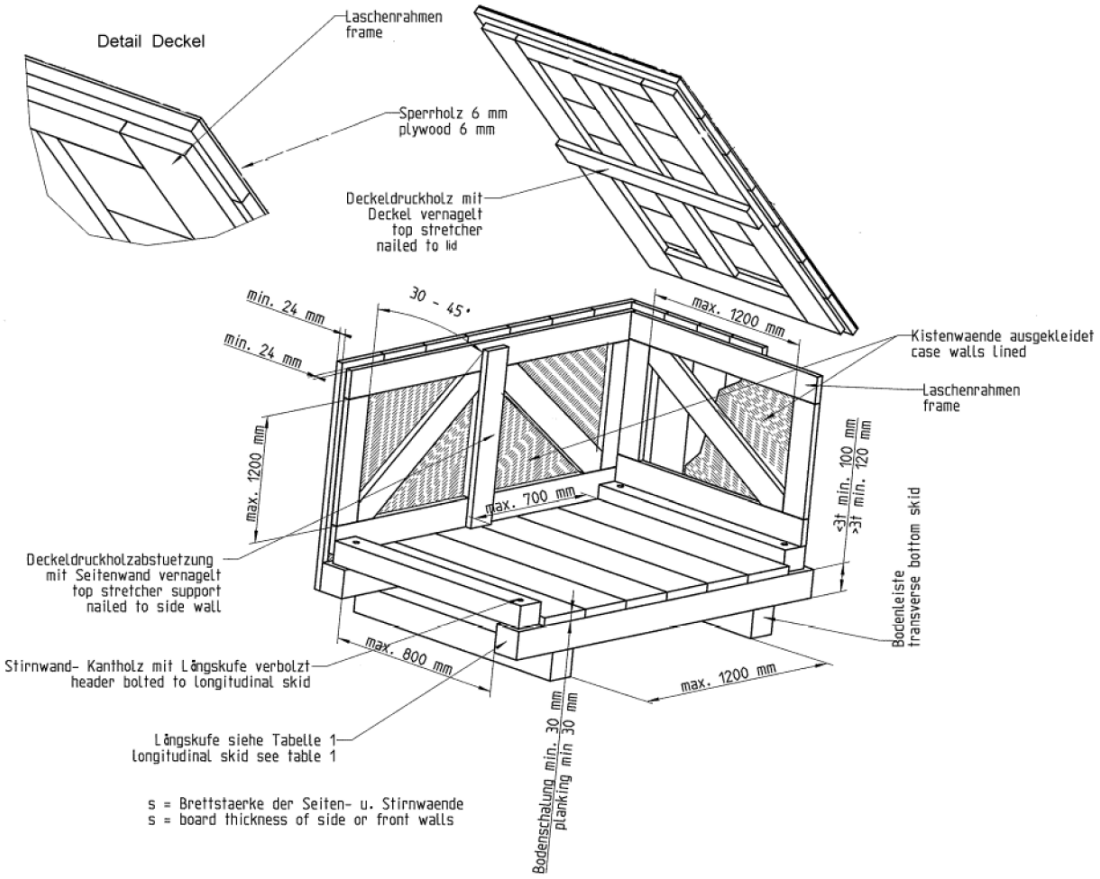


Figure 2: Box – seaworthy – wooden (Dimensions see text)

8.8 Category 8 - Normal box - board design

a) **Use ≤ 500 kg**

Floor: Multi-layer board at least 24 mm nailed with skirting boards (transverse shelters) 10 x 10 cm.

Sides + end walls: OSB3 board nailed together at least 12 mm bluntly.

Lid: OSB3 board at least 24 mm.

b) **Use > 500 kg**

Floor: Multi-layer board at least 24 mm nailed with longitudinal underlays (slides).

Box walls: OSB3 board with at least 12 mm with lug frame.

Lid: OSB3 board 24 mm with flap frame.

Mass	**Strength/cross-section**	**Mass**	**Strength/cross-section**
≤ 1000 kg	10 x 10 cm	≤ 10000 kg	12 x 16 cm
≤ 2500 kg	10 x 10 cm	> 10000 kg	16 x 20 cm
≤ 5000 kg	10 x 10 cm		

heavy cargo fittings must be attached after 5 t.

Table 3: Longitudinal-lower skid strength (carriage)

Figure 3: Box up to 500 kg and box above 500 kg

8.9 Category 9 - Normal box – board design (without solid wood use)

Just like category 8, but strap frames, bracing and lower skids are designed exclusively in the board material.

8.10 Category 10 - Seaworthy box - board design

Floor: Runners longitudinally (slide), floor formwork at least 24 mm thick when using panels and boards. Bulkhead squared timber bolted with longitudinal skids (slides) (continuous screws with washers and nuts). Floor strips (transverse accommodations), distance max. 120 cm, must be bolted to the longitudinal or intermediate runners or nailed several times (attachment depending on the centre of gravity, interrupted for forklift access and suitable for rope stop).

Mass	Strength/cross-section	Mass	Strength/cross-section
≤ 1000 kg	10 x 10 cm	≤ 10000 kg	12 x 16 cm
≤ 2500 kg	10 x 10 cm	> 10000 kg	16 x 20 cm
≤ 5000 kg	10 x 10 cm		

heavy cargo fittings must be attached after 5 t.

Table 4: Longitudinal-lower-skid strength (carriage)

Side wall: Plate thickness at least 12 mm, lug frame at least 24 mm thick, inside up to max. height and width of 120 cm. Panel joints provided with flap inside, same thickness as flap frame. Dunnage spacing max. 70 cm and lined, at least 40 mm thick and 80 mm wide.

Bulkhead: Same as sidewall.

Lid: OSB3 boards at least 24 mm, plate joints inside with flaps, same thickness as flap frame at least 24 mm. The lid compression timbers including dunnage (lid pressure timber supports) are to be pulled in at intervals of max. 70 cm and nailed to the lid or side walls.

Plate frames, diagonals and lid compression timbers must be designed for a stacking pressure of at least 1.0 t/m2.

Box width inside	Strength/ cross-section	Box width inside	Strength/ cross-section
≤ 100 cm	10 x 10 cm	**≤ 300 cm**	12 x 16 cm horizontal
≤ 150 cm	10 x 10 cm	**> 300 cm**	12 x 16 cm vertical
≤ 200 cm	10 x 10 cm		

Table 5: Cover compression woods

Strapping: The box must be strapped with at least 2 non-metallic straps (min. 19 mm wide) at intervals of max. 2 m.

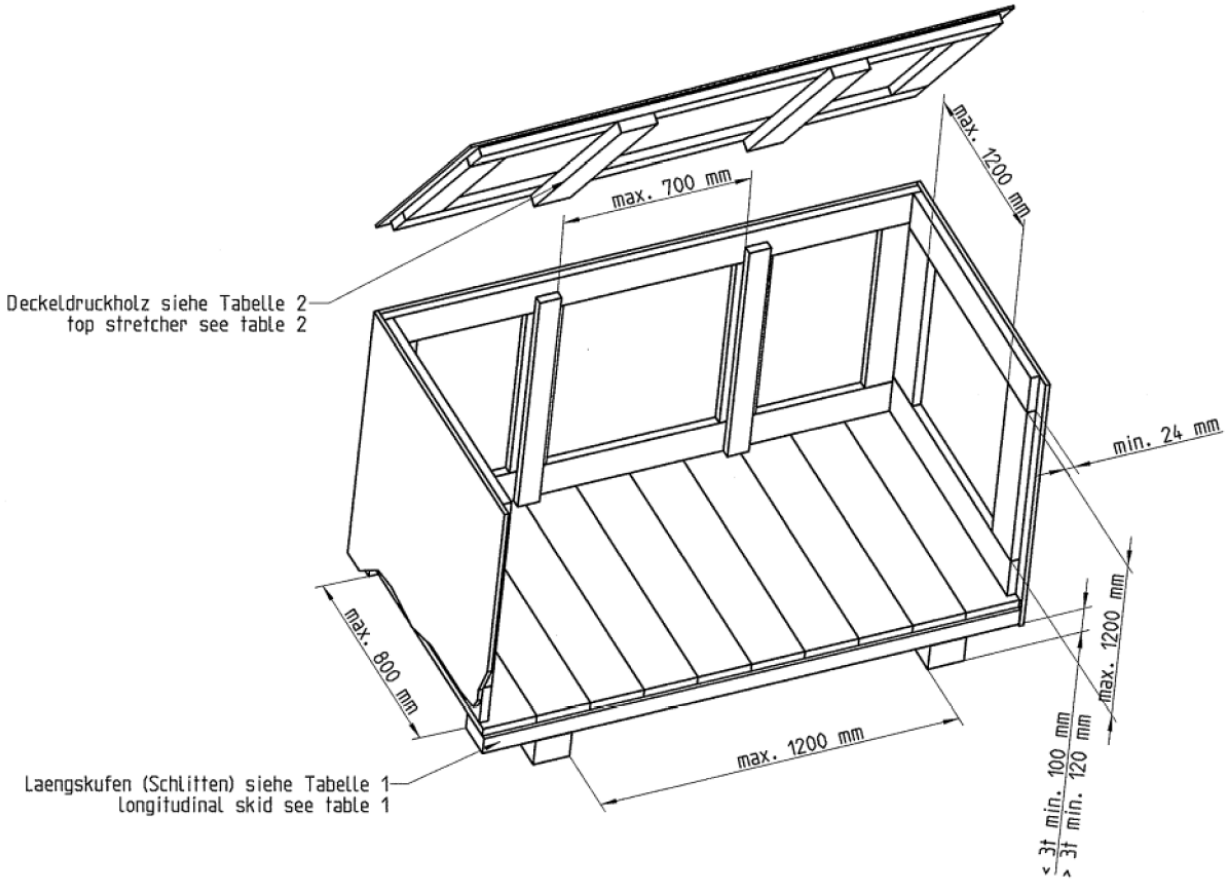


Figure 4: Box – seaworthy – board design (Dimensions see text)

8.11 Category 11 - Seaworthy box - board design with corrosion protection

Same as Category 10. The goods must be wrapped in PE film, biodegradable (incl. labelling). Edges or protruding parts must be sufficiently padded. Distance between foil and crate wall 3 to 5 cm. Direct contact of the film with the bottom of the crate must be avoided (poss. Cardboard underlays). Sealing of the bolt in accordance with Figure 7.

8.12 Category 12 - Seaworthy box with corrosion protection

Boxes and cover design according to category 7 or 10.
The goods are to be wrapped in PE film, biodegradable (incl. marking). Edges or protruding parts must be sufficiently padded. Distance between foil and crate wall 3 to 5 cm.
Direct contact of the film with the bottom of the crate must be avoided (poss. Cardboard underlays).

9 Corrosion protection

9.1 Protective layer method

9.1.1 Corrosion protection using coating material

Products that are protected against corrosion with paints must be pretreated accordingly to ensure that the paints adhere securely. The metal surface must be clean, dry and corrosion-free

For this reason, the pre-treatment, i.e. careful cleaning and drying of the surface, and the subsequent application of the protective layer must always be carried out in one.

9.1.2 Corrosion protection using agents based on mineral oil

Surfaces, which are not protected against corrosion using coating material, must be treated with agents based on mineral oil (PERIGOL® VCI 230, Helamin, Tectyl 506, corrosion protection greases or oils).

9.2 Drying agent method

A flexible barrier layer cover for a conservation duration of minimum 12 months must be specified for the intended transport and storage duration.

The barrier layers used in the process are:

- Polyethylene film (PE) biodegradable
  The use of PE-films for film covers with a thickness less than 0.2 mm is permissible if the techn. requirements of DIN 55530 for a 0.2 mm thick film are fulfilled.
- Aluminium laminated film as per DIN 55531 / TL8135-0003

The humidity must not exceed the value of 40% across the entire period of the transport, trans-shipment and storage.

The materials must be welded in the film, and the air from the film bag must be exhausted before welding the last opening to the extent that a wear through of the cover due to the transport loads will be avoided.

For absorbing the humidity, adequate quantity of drying agents as per DIN 55473 (TL 6850008) must be added. To avoid contact corrosion, the dry-ing agents must be applied such that direct contact with the packed good is not possible.

The quantity of desiccant is defined according to DIN 55474 with:

<table>
<tr><th>Faktor</th><th>Bedeutung</th><th colspan="5">Rechenwert</th></tr>
<tr><td>n</td><td>Anzahl der Trockenmittel</td><td colspan="5"></td></tr>
<tr><td rowspan="2">a</td><td rowspan="2">je Trockenmitteleinheit aufnehmbare Wassermenge entsprechend der zulässigen maximalen Luftfeuchte in der Packung
„zulässige Endfeuchte“ in %</td><td>Zul. Endfeuchte</td><td>20 %</td><td>40 %</td><td>50 %</td><td>60 %</td></tr>
<tr><td>Faktor a</td><td>3</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>e</td><td>Korrekturfaktor bezogen auf die zul. Endfeuchte</td><td>Faktor e</td><td>0,9</td><td>0,7</td><td>0,65</td><td>0,6</td></tr>
<tr><td>V</td><td>Innenvolumen der Packung in m³</td><td colspan="5"></td></tr>
<tr><td>b</td><td>Feuchtegehalt der eingeschlossenen Luft in g/m³</td><td colspan="5">Z. B. bei 20 °C und 85 % rel. Feuchte b = 15 g/m³</td></tr>
<tr><td>m</td><td>Masse der hygroskopischen Packhilfsmittel in kg</td><td colspan="5"></td></tr>
<tr><td rowspan="2">C</td><td rowspan="2">Faktor für den Feuchtegehalt der hygroskopischen Packhilfsmittel in g/kg [0/00]</td><td colspan="5">• 80 für Holz, lufttrocken = 18 % Wassergehalt</td></tr>
<tr><td colspan="5">• 80 für Holz und Pappe
• 80 für Polstermittel auf organischer Basis</td></tr>
<tr><td>A</td><td>Oberfläche der Sperrschichthülle in m²</td><td colspan="5"></td></tr>
<tr><td rowspan="5">WDD</td><td rowspan="5">Wasserdampfdurchlässigkeit der Sperrschichthülle für das zu erwartende Klima in g/m² * d gemessen nach DIN 53 122-1 oder DIN EN ISO 15 106-3</td><td colspan="5">Beispielwerte geeigneter Folien:</td></tr>
<tr><td colspan="2">Art der Folie</td><td colspan="3">Prüfklima 20/85 38/90</td></tr>
<tr><td colspan="2">LD-Pe 0,2 mm dick</td><td>0,4</td><td colspan="2">2,0</td></tr>
<tr><td colspan="2">Al- Verbund</td><td>< 0,1</td><td colspan="2">0,1</td></tr>
<tr><td colspan="5">Es sollte mindestens der Wert 0,1 g/m² * d in die Formel eingesetzt werden.</td></tr>
<tr><td>t</td><td>gesamte Transport- und Lagerzeit in Tagen</td><td colspan="5"></td></tr>
</table>

Table 6: Notation for calculating the number of drying agent units

$$n = \frac{1}{a}\left(V * b + m * c + A * e * WDD * t\right)$$

9.3 VCI-film (Volatile Corrosion Inhibitor)

- For the intended transport and storage period, a VCI paper with targeted active ingredient groups that effectively protect the metal types must be used. These products must meet the following requirements:
    - Amine-free

- Not subject to the classification requirement according to 1272/2008/EC
- Material and energetic recovery
- a grammage >40g/m² designed for a preservation period of at least 12 months.

The materials are to be wrapped in PE film, biodegradable and with labeling, air-tight. Abrasion of the film due to transport stress must be avoided. After the film has been processed, a leak test must be carried out. For the VCI method to work optimally, the metallic surface of the packaged goods must be clean (i.e. dry, not contaminated with oil and/or corrosion, and free of any residues). The distance between the VCI dispenser and the metallic surface must not exceed 30 cm. For large internal volumes, additional VCI dispensers must be added.

The VCI materials used must be free of nitrites, heavy metals, halogens, silicones and other substances subject to labelling.

We recommend VCI products from Zerust Excor®.
Contacts worldwide: http://www.excor.de/kontakt/weltkarte.html

10 Packaging design

10.1 Joining of box parts

The cover and a side part (long side) must be generally screwed in every de-sign so that the removal of goods is facilitated.

Transport boxes used repeatedly must be screwed together 100%. (e.g. unpacking for tests or quality checks, etc.)

In case of raw board materials such as plywood, OSB, raw clamping plates, etc., no screw nails must be used.

10.1.1 Nailing

The nails must not protrude from the wooden surface. The nail heads must not countersunk more than 2 mm and must cut flush with the wooden surface.

10.1.2 Screw connection

Screws must not protrude from the wooden surface. The screw-in depth must be at least 4 x d. Adhere to screws with d $\leqslant$ 8 mm specification for nails. Only countersunk screws may be used.

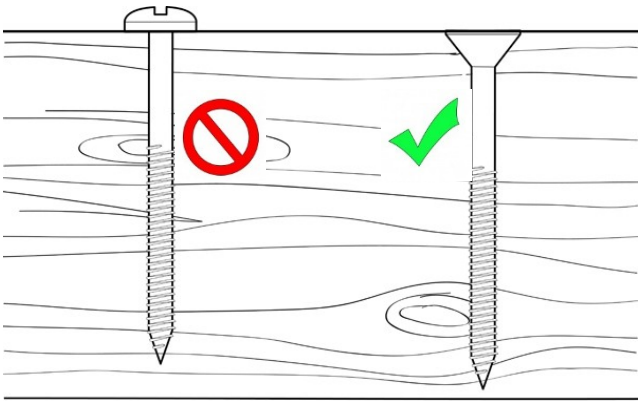


Figure 5: Screw connection of the box parts

10.2 Interior protection

If the base of the packaged good is less than its maximum dimensions in length/width, suitable support must be mounted. Supports made of cardboard or rubber sheets must be used for the supporting surfaces. The parts must be correspondingly protected from damage using the fasteners. To protect the workpiece surface, workpieces must be packaged in tissue paper and above it in kraft paper with a honeycomb structure

The packaged good must be essentially fastened to the box or crate or the box floor such that it is immoveable. This is done with the help of through screw connections – also through the skids or filling material between packaged goods and cardboard or crate wall. If sensitive goods are jarred, an insulation between goods and floor must be installed. If the packaged good cannot be fastened to the floor in this manner, sufficient transit support must be ensured with the help of square timber struts.

Penetrations in the film bags, e.g. for fastening the packaged good to the box floor, must be sealed in an airtight manner externally using intermediate layers of rubber plates.

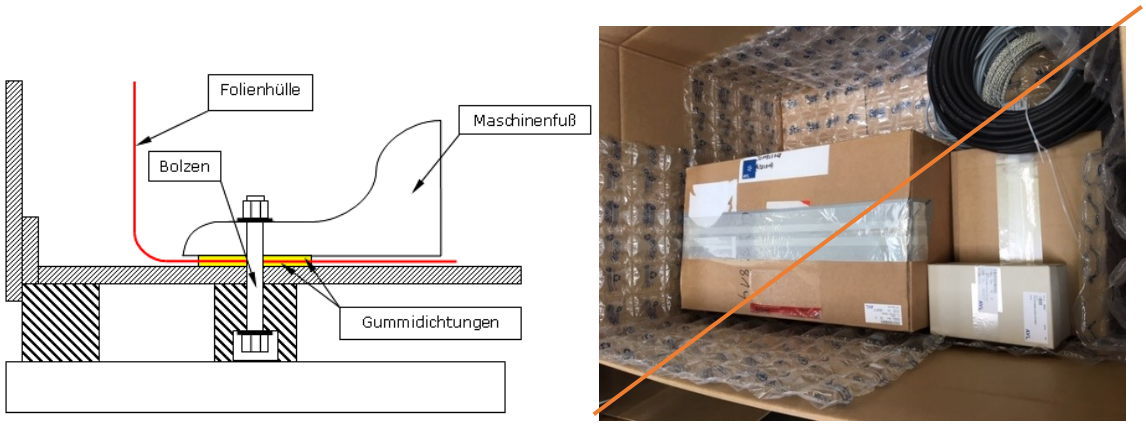


Figure 6: Bolting between packaged goods and box floor with inserted seal, an insulation between goods and floor / wall

Sharp edges, corners, protruding screws, pipe sockets, electrical junction boxes, shop windows, LCD displays, control boxes, keyboards, glass surfaces, pressure gauges and the like must be covered with tissue paper, VCI wrap paper and VCI paper pads. Only filling and cushioning material made of VCI paper or VCI cardboard is used. Under no circumstances should unwaxed paper or cardboard be used without additional moisture barriers. Wood wool, chips or air foils, etc. are not permitted as packaging material. Other packaging is permissible, provided that it complies with the latest environmental protection regulations and national and international legal requirements. However, it must be documented accordingly on the delivery documents. This also includes proof of packaging materials used and their disposal keys.

10.3 Protection from climatic and moisture influences

A plastic plate (Akylux) or hardboard with separating foil must be attached against the lower side of the cover. Stacks must be covered with strips that are 12 cm wide.

Box walls made of timber formwork must line with a barrier layer made of “un-ion paper” to cover the gaps between the individual planks.

Figure 7: Side wall lined with a barrier layer

10.4 Heavy cargo fittings

Boxes with a gross weight of more than 5 t are fitted with steel fittings at the top and bottom edges in the rope layer (sheet thickness depending on the weight, but minimum 3 mm).

Gross weight of package [t]	Steel sheet thickness [mm]
> 5 bis 10	3,0
> 10 bis 25	6,0
> 25 bis 50	8,0
> 50	10,0

Table 7: Steel sheet thickness of the heavy cargo fittings

The upper fittings must be min. 70 cm long after a box length of 250 cm.

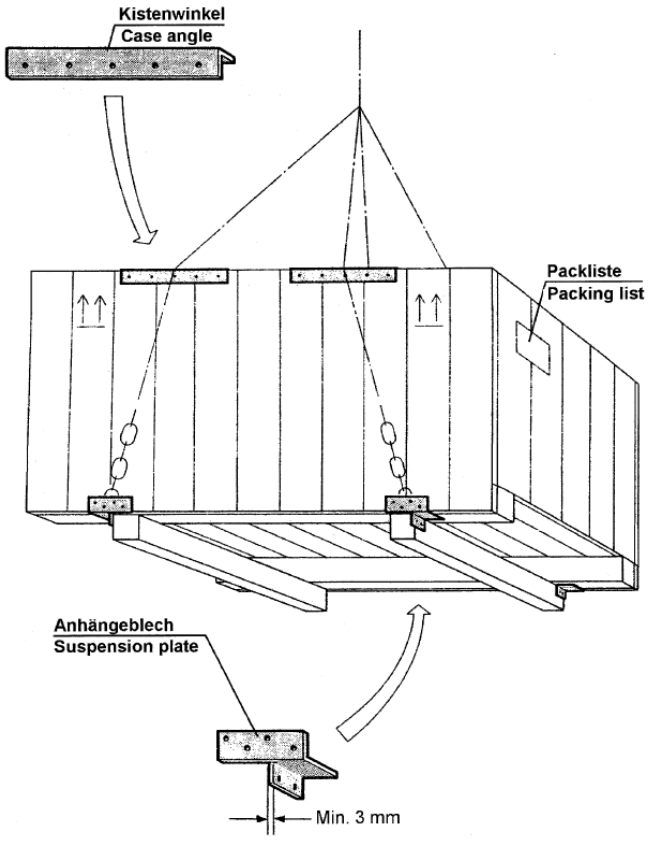


Figure 8: Representation using the arrangement of the heavy cargo fittings

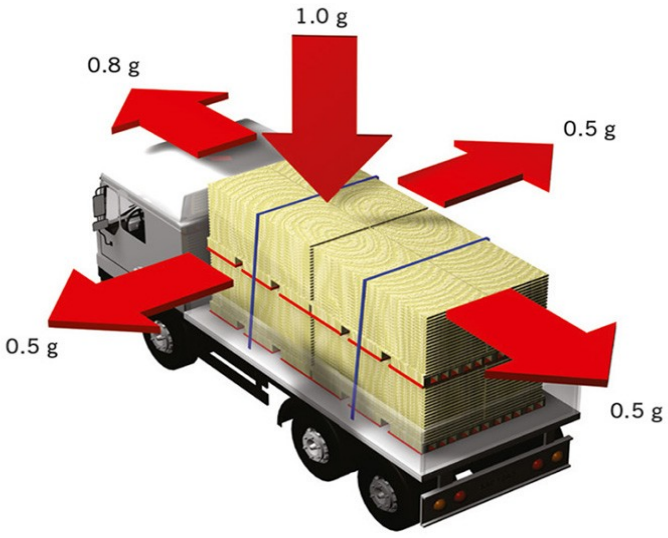
11 CTU-Code (CTU = Cargo Transport Unit)

As a result of the TUL process (Transport, Trans-shipment, Storage), the varied acceleration forces influence the packaged good. In accordance with the CTU guidelines, they must be considered during the box construction and naturally also when mounting the packaged goods within the box. To prevent the load from moving, the load must be secured starting from the most unfavourable combination of horizontal and correspondingly vertical accelera-tion forces in the longitudinal and transverse direction.

The acceleration to be adhered to during the conveyance is the gravitational acceleration g = 9.81 m/s2

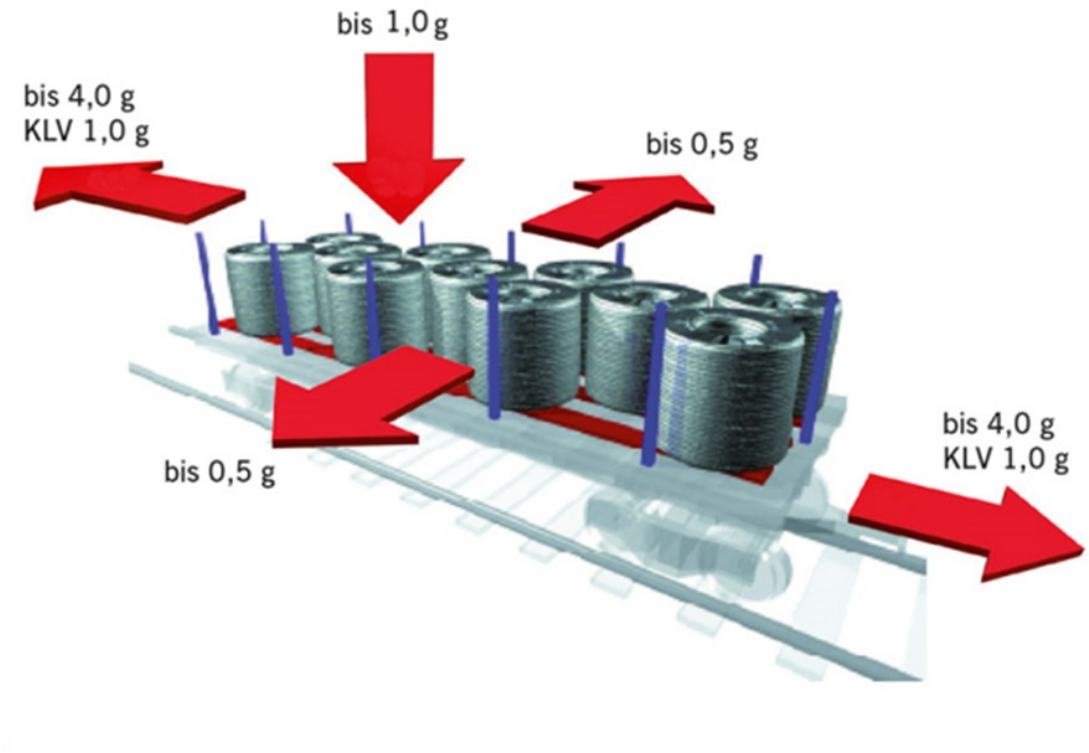
On-road conveyance				
Safeguarding in	**acceleration coefficients**			
	Longitudinal (cx)		Trans-verse (c_y)	Minimum as per below (c_z)
	in advance	back		
Longitudinal direction	0,8	0,5	-	1,0
Transverse direction	-	-	0,5	1,0

Source: CTU-Code



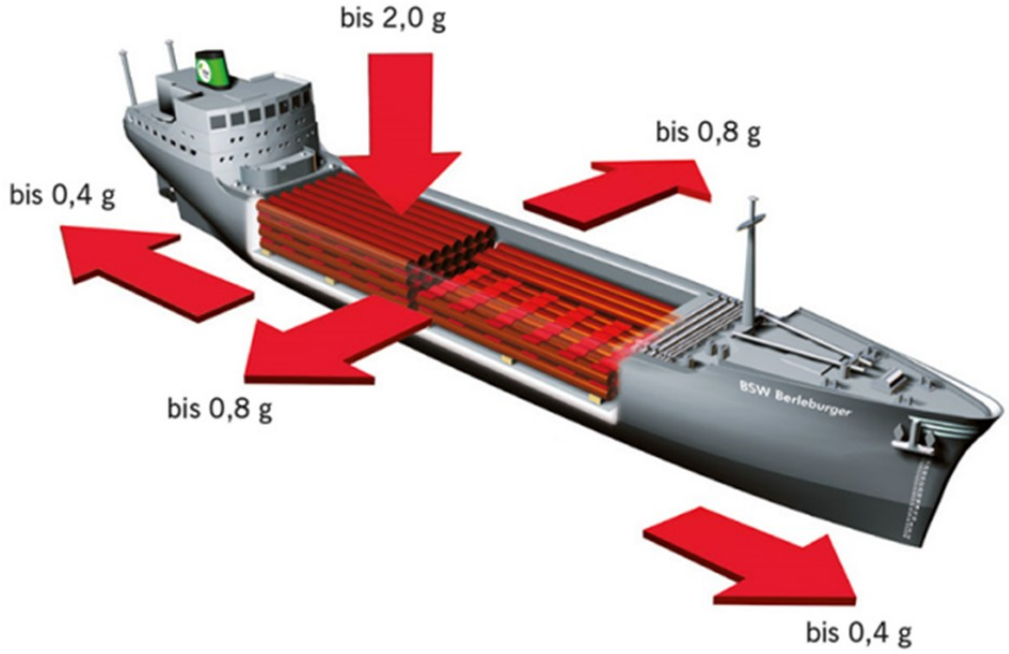
Rail conveyance (Combined traffic – KLV)				
Safeguarding in	**acceleration coefficients**			
	Longitudinal (c_x)		Trans-verse (c_y)	Minimum as per below (c_z)
	in advance	back		
Longitudinal direction	0,5 (1,0)*KLV 0,5 (4,0)*	0,5 (1,0)*KLV 0,5 (4,0)*	-	1,0 (0,7)*
Transverse direction	-	-	0,5	1,0 (0,7)*
* The values in brackets are applicable to impact loads with only short impacts of 150 milliseconds or shorter and can e.g. be used for designing the packages.				

Quelle: CTU-Code



Sea conveyance					
Significant wave height in the sea area		**Safeguarding in**	**acceleration coefficients**		
			Longitudinal (c_x)	Transverse (c_y)	Minimum as per below (c_z)
A	$H_s \leq 8$ m	Longitudinal direction	0,3	-	0,5
		Transverse direction	-	0,5	1,0
B	8 m < $H_s \leq 12$ m	Longitudinal direction	0,3	-	0,3
		Transverse direction	-	0,7	1,0
C	$H_s > 12$ m	Longitudinal direction	0,4	-	0,2
		Transverse direction	-	0,8	1,0

Quelle: CTU-Code



The significant wave height (Hs) is the average formed from the highest one-third of waves (measured from the wave trough to the wave crest). The alloca-tion of geographical sea areas to the corresponding significant wave heights must be taken from the following table:

A	B	C
Hs ≤ 8 m	**8 m < Hs ≤ 12 m**	**Hs > 12 m**
Baltic Sea (with Kattegat)	North Sea	unlimited
Mediterranean Sea	Skagerrak Strait	
Black Sea	The English Channel	
Red Sea	Sea of Japan	
Persian Gulf	Sea of Okhotsk	
Coastal journeys or jour-neys between islands in the following sea areas:	Coastal journeys or jour-neys between islands in the following sea areas:	
Central Atlantic (30°N to 35°S)	South-central Atlantic (35°S to 40°S)	
Central Indian Ocean	South-central Indian	
(up to 35°S)	Ocean (35°S to 40°S)	
Central Pacific (30°N to 35°S)	South-central Pacific (35°S to 45°S)	

Source: CTU-Code

Figure 9: Examples of acceleration forces during transport operations

12 Dispatch guidelines

The following identification marks must be adhered to when dispatching goods.

12.1 Product packaging (inner packaging) and labelling

Every product must be labelled and packed as follows:

1. one packaging unit depending on the order item
2. Material number of the supplier
3. AVL material number in text and barcode (EAN type 128)
4. Quantity and unit of quantity
5. AVL order number and order item
6. Serial number in text and barcode (EAN type 128) (if available)

   The serial number may be a maximum of 17 digits long. If the serial number consists purely of numbers, leading zeros (0) are not permitted.
7. Batch number in text and barcode (EAN type 128) (if available)

Depending on the product size and the supplier's capabilities, a QR/matrix code may be applied instead of a barcode. In this case, the content of this code may only contain the relevant information (e.g. material number). A combination of material/serial/batch numbers is not permitted. The exact definition can be found in the respective order.

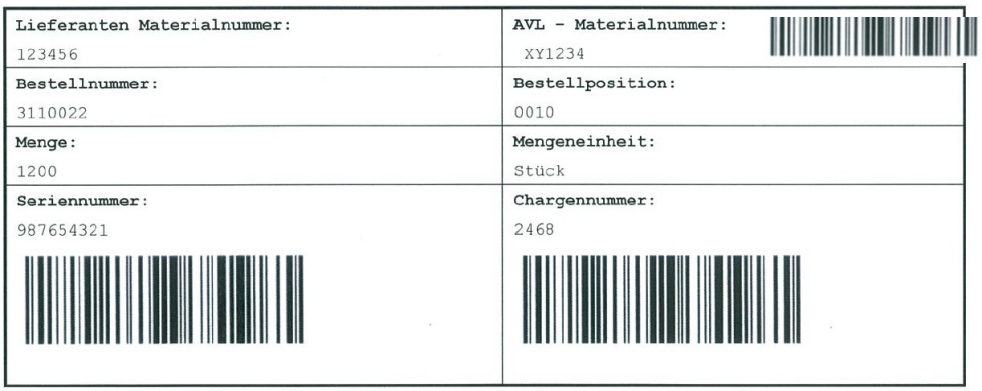


Figure 10: Example of barcode and text arrangement for product packaging

12.2 Transport packaging (outer packaging)

12.2.1 Leading mark

- Identification mark: AVL logo and name (only for indigenous production)
- Identification number: AVL production and serial number
- Customer and order number or AVL purchase order number
- Customer / item number or purchase order item number

12.2.2 Information marking

- Weight details (net and gross)
- Dimensions: L x W x H; the dimensions are specified in cm

12.2.3 Handling mark

Be sure to pay attention to handling markings and use them accordingly.

- whether the package is e.g. sensitive to moisture, cold or temperature
- Storage under roof
- where the position of centre of gravity is
- where belts and the like may be affected

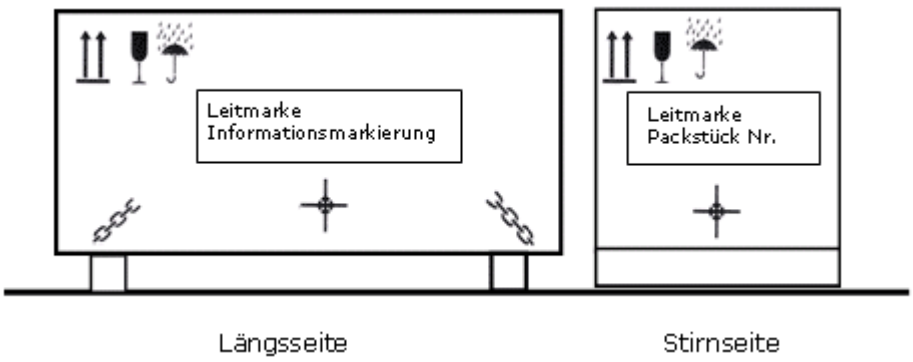


Figure 11: Schematic representation of a package marking

Figure 12: Examples of a box, which is provided with a leading mark, information and handling mark.

Information regarding other handling symbols can be viewed in Annexe 1.

12.2.4 Delivery note specifications

- Delivery note number, also as barcode (EAN type 128)
- Delivery date
- Supplier address (name, zip code, city, country)
- Order number and order item, also as barcode (EAN type 128)
- Material number AVL in text and barcode (EAN type 128)
- Material designation as per order
- Quantity and unit of measure,
- Dimensions and weights per package
- Serial number in text and barcode (EAN type 128) (if available)

Depending on the supplier's capabilities, a QR/matrix code may be applied instead of a barcode. In this case, the content of this code may only contain the respective information (e.g. material number). A combination of material/serial/batch numbers is not permitted. The exact definition can be found in the respective order.

12.2.5 Material sets

When ordering material sets (AVL – material number consists of several individual parts), you must pack in sets without exception. Separate packaging of the individual parts is not permitted. The exact definition can be found in the respective order. Sets of card packaging are excluded from this.

12.2.6 Packing lists

If an order or delivery contains several packages, a packing list with the contents of the respective package must be affixed to **each package**.

The contents of the packing list have at least the following information:

- Order number and order item also as barcode (EAN type 128)
- AVL – material number according to the order also as a barcode (EAN type 128)
- Serial number in text and barcode (EAN type 128) (if available)
- Quantity and unit of measure
- Dimensions and weights per package
- Delivery date

Depending on the supplier's capabilities, a QR/matrix code may be applied instead of a barcode. In this case, the content of this code may only contain the respective information (e.g. material number). A combination of

material/serial/batch numbers is not permitted. The exact definition can be found in the respective order.

12.2.7 Hazardous goods

The packaging of hazardous goods must comply with the legal regulations of the respective country and the means of conveyance. Hazardous goods must always be packed separately from the rest of the shipment.

The most important international regulations are:

- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) for the road traffic for many European and neighbouring countries,
- Regulations on the International Carriage by Rail of Dangerous Goods (RID) in rail traffic,
- European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN) for the inland water transport,
- International Maritime Dangerous Goods Code (IMDG-Code) in the international maritime traffic,
- Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO-TI) in air traffic, published by the International Civil Aviation Organization: ICAO). They are accepted by the International Association of the air transport companies of the International Air-Transport Association (IATA) with the IATA Dangerous Goods Regulations (IATA-DGR).

They are applicable according to the provisions of the law for the transportation of dangerous goods, also for purely domestic transport.

13 Indicators

Indicators are used for monitoring the logistical processes of transport, transshipment and storage. The traceability must be ensured using the serial number. For example, indicator serial numbers on the delivery note.

The sender of the respective goods is obliged to document the status of the indicators in the event of a warranty transfer according to delivery agreements and to present AVL on request.

This documentation obligation also applies to every recipient, who is also responsible for reporting damage to the outer packaging as well as triggering indicators to AVL. The indicators must be mounted on the crate wall to protect against mechanical damage such as shearing or crushing. To do this, the area on the crate wall must either be milled out or doubled up in a sufficiently large area in order to be able to attach the indicators in a protected manner.

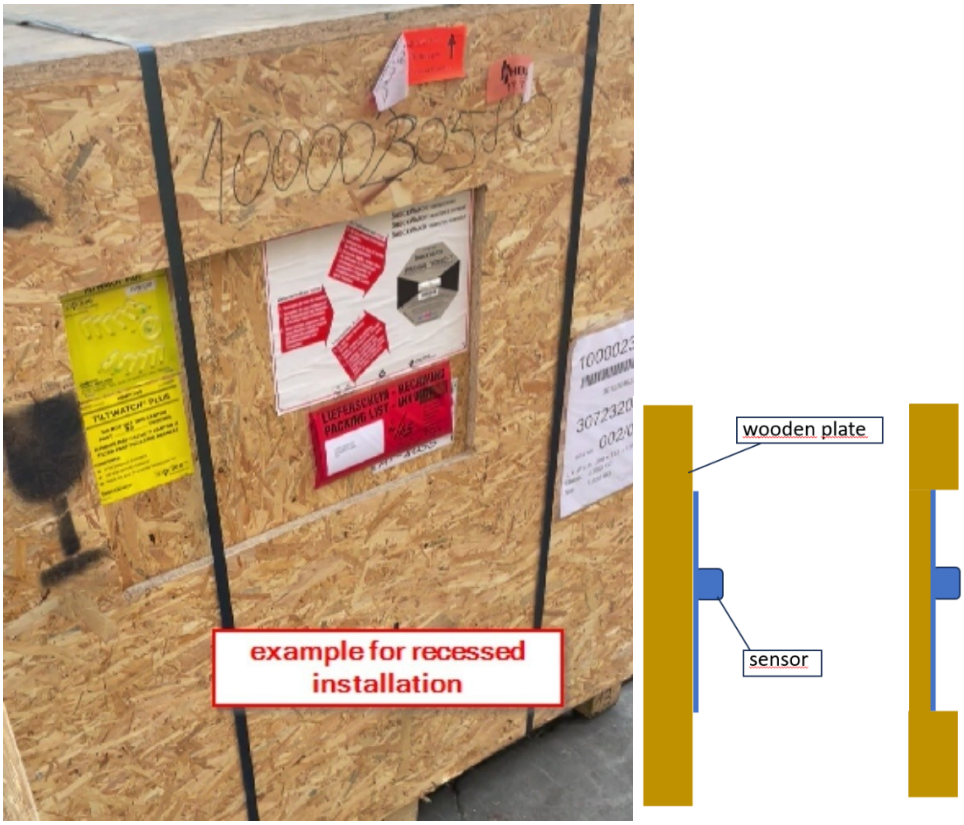


Figure 13: Specification for the installation of the indicators

- **Tilt indicators**

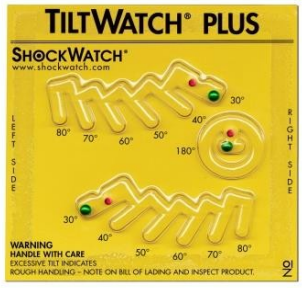
		
Tiltwatch® XTR	Tiltwatch® Plus	Tip-n-Tell

Figure 14: Examples of tilt indicators

- **Impact and shock indicators**

		
Shockwatch®	Shockwatch® 2	Shockwatch® Clip

Figure 15: Examples of shock indicators

13.1 Tilt indicators

A tilt indicator is necessary if one of the following conditions exists:

1. $c_{x,y} \cdot d \geq c_z \cdot b$
2. 2. from a package height of 160 cm

c x,y … horizontal acceleration coefficient of the respective mode of transport (chapter 10),
d … vertical distance from the core area of the loading unit up to its tilting axis [m],
cz … vertical acceleration coefficient of the respective mode of transport (chapter 10),
b … horizontal distance from the core area of the loading unit up to its tilting axis [m].

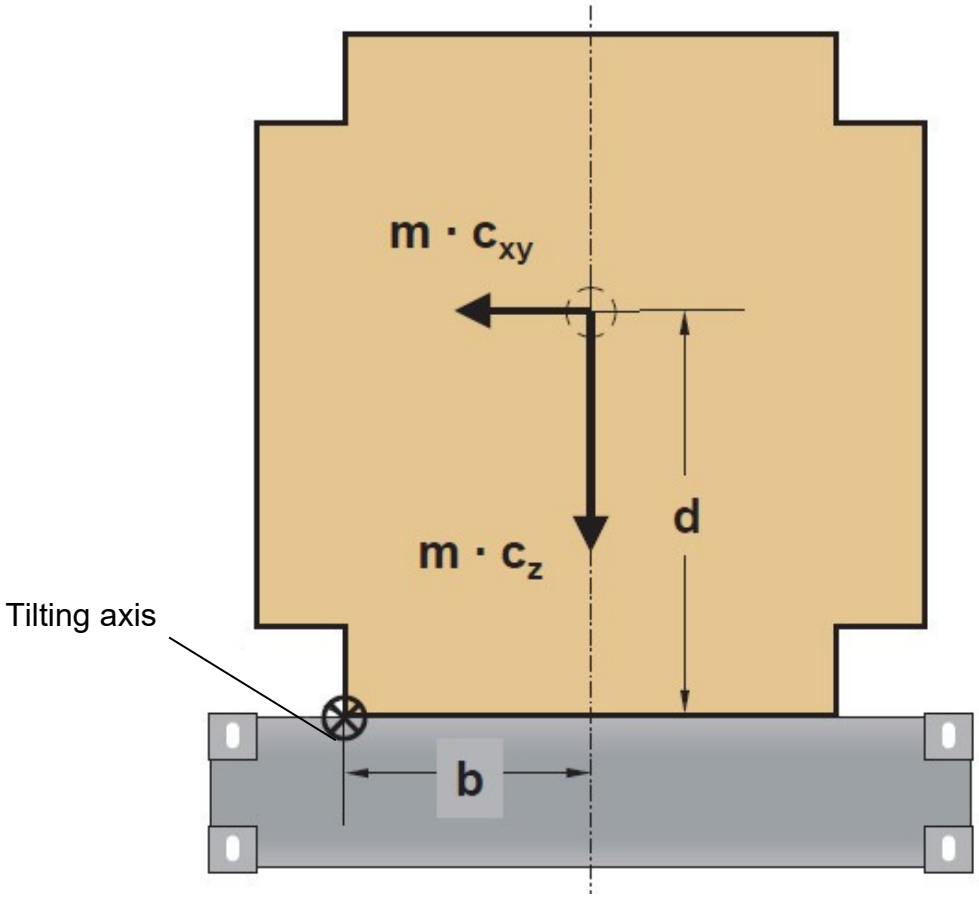


Figure 16: Criterion for attaching a tilt indicator

"The freight is tilt-safe if the height of the core area is less than half the width of its base."

13.2 Impact indicators

All the packages with sensitive and/or electrical components must be equipped with impact indicators. In order that the ShockWatch® indicators do not trigger too early or too late, it is important to select the correct indicator for monitoring the package. The starting point for selecting the correct Shock-Watch® label is the size of the package in cubic metres (L x W x H) as well as the total weight including packaging.

Shockwatch® table:

Volumen / Gewicht	0,001–0,030 cbm	0,031–0,135 cbm	0,136–0,400 cbm	0,401–1,350 cbm	1,351+ cbm
0 – 5 kg					
6 – 12 kg					
13 – 23 kg					
24 – 45 kg					
46 – 112 kg					
113 – 450 kg					
451 – 650 kg					
651 – 750 kg					
751 – 1000 kg					

Figure 17: Selection table for Shockwatch®

Farbe	BLAU	GRAU	GELB	VIOLETT	ROT	ORANGE	GRÜN
Empfindlichkeit	10 *g* / 50 ms	15 *g* / 50 ms	25 *g* / 50 ms	37 *g* / 50 ms	50 *g* / 50 ms	75 *g* / 50 ms	100 *g* / 50 ms

Figure 18: Allocation of the colours to the g-values Shockwatch®

Shockwatch® 2 table

Volumen / Gewicht	0,14–0,42 cbm	0,42–1,42 cbm	1,42–2,83 cbm	2,83–7,08 cbm	7,08–14,16 cbm	14,16–304,08 cbm	304,08+ cbm
0 – 5 kg					N/A	N/A	N/A
5 – 11 kg						N/A	N/A
11 – 23 kg							N/A
23 – 45 kg							
45 – 113 kg							
113 – 454 kg							
454 – 907 kg							
907 – 2268 kg							
2268 – 4536 kg							
4536 – 6804 kg	N/A						
6804 – 9072 kg	N/A	N/A					
9072 – 13608 kg	N/A	N/A	N/A				
13608+ kg	N/A	N/A	N/A	N/A			

Figure 19: Selection table for Shockwatch® 2

Farbe	PINK	TÜRKIS	BLAU	GELB	VIOLETT	ROT	ORANGE
Empfindlichkeit	5 *g* / 50 ms	10 *g* / 50 ms	15 *g* / 50 ms	25 *g* / 50 ms	37 *g* / 50 ms	50 *g* / 50 ms	75 *g* / 50 ms

Figure 20: Allocation of the colours to the g-values Shockwatch® 2

14 IPPC/ ISPM no. 15

14.1 IPPC-STANDARD (International Plant Protection Convention)

ISPM 15 is applicable only to solid wood. This excludes wood-based materials and solid wood thinner than 6 mm. Handling the packaging as per the accept-ed measures.

14.1.1 IPPC marking

The marking must be attached permanently and such that it is properly legible and visible, on at least two opposite sides of the packaging. The colour must be seawater-proof and light-resistant. “RED” and “ORANGE” are impermissible colours.

- IPPC symbol
- Country code as per ISO 3166
- Code for the region
- Registration number
- Treatment method HT (heat treatment) or MB (methyl bromide)

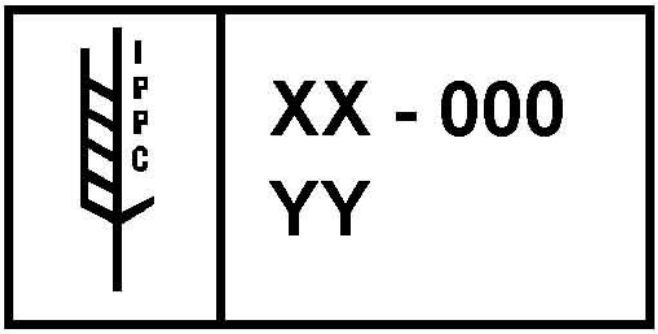


Figure 21: Example of a labelling as per ISPM 15

The import regulations applicable to packaging/ packaging materials must be taken from the “International Standard for Phytosanitary Measures No. 15 available on http://www.ispm15.com/start.htm.

15 Cost assumption

In case of non-adherence of the specifications stipulated in these regulations, AVL List GmbH reserves the right to refuse the acceptance of the shipment and/or to charge the resulting additional costs (e.g. storage, repacking, disposal, increased search expenses owing to lack of order or material data, non-compliant packaging).

16 Transport damages

If we received damaged packaging that indicates possible damages to the goods, we will not accept this delivery and return it at the expense of the supplier.

17 Warenannahmezeiten

Monday to Thursday:	07:00 – 15:30 hours
Friday:	07:00 – 14.00 hours

18 Contact

For all questions arising in connection with this delivery regulation, please contact:

DI(FH) Peter Kienast

ITS / MOL Warehousing and Intralogistics Graz

E-mail: peter.kienast@avl.com
Phone: +43 316 787-14676

AVL List GmbH
Hans-List-Platz 1
A-8020 Graz

Annex

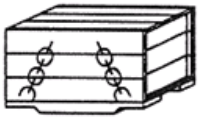
Handling marks:

No.	Meaning	Symbol	Function	Remark
1.	fragile		The content of the package is fragile, and it must therefore be handled with care.	ISO 7000, no. 0621 Application example:
2.	do not use hooks		Hooks are prohibited for handling this package.	ISO 7000, no. 0622
3.	top		Indicates the correct perpendicular position of the package.	ISO 7000, no. 0623 Application example:
4.	protect from heat		The package must be protected from heat.	ISO 7000, no. 0624
5.	protect from moisture		The package must be stored in a dry environment.	ISO 7000, no. 0626
6.	Core area		Indicates the core area of the package, which is handled as an individual unit.	ISO 7000, no. 0627 Application example:

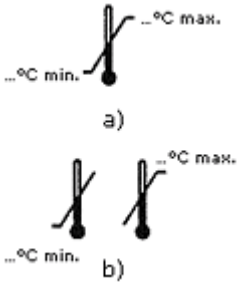
7.	do not roll		The package must not be rolled.	ISO 7000, no. 2405

Handling marks (continued):

No.	Meaning	Symbol	Function	Remark
8	do not position a hand truck here		Hand trucks must not positioned on this side for handling the package.	ISO 7000, no. 0629
9	do not position a forklift truck		The package should not be handled with forklift trucks.	ISO 7000, no. 2406
10	Clamps in direction of arrow		The clamps must be positioned at the indicated sides for handling the package.	ISO 7000, no. 0631
11	do not position clamps in the direction of arrow		The package should not be handled with clamps at the indicated sides.	ISO 7000, no. 2404
12	Limiting the mass of the stack load		Indicates the limitation of the mass of the stack load of packages.	ISO 7000, no. 0630
13	Stack limitation		Maximum number of identical packages, which may be stacked, where n stands for the number of permissible packages.	ISO 7000, no. 2403

14.	do not stack		The packages must not be stacked, and no load should be placed on the package.	ISO 7000, no. 2402
15.	attach here		Lifting accessories must be placed as shown for lifting the package.	ISO 7000, no. 0625 Application example: 

Handling marks (continued):

No.	Meaning	Symbol	Function	Remark
16.	permissible temperature range		Indicates the temperature range in which the package must be stored and handled.	ISO 7000, no. 0632 Application example: 
17.	Do not damage barrier layer		A steam-proof barrier layer is located below the outer packaging, in which the drying agents for corrosion protection are placed. This protective effect will lapse if the barrier layer is damaged. As the symbol has still not been accepted by ISO, a puncturing of the outer cover must be avoided especially in case of packages having the "Packed with desiccants" imprint.	

18.	tear open here		This symbol is intended only for the recipient.	
19.	load only in the topmost position or: top storage or: do not overstow			

Table 8: Standardised handling codes

Material symbols:

In principle, the new applicable material symbols must meet the requirements of the PPWR – EU 2050/40. The symbols, QR codes, markings and information valid at the time of delivery must be fulfilled and affixed accordingly.

Mandatory markings here are at least:

- a.) Material labelling: Each package bears a clear identification of the material composition (material groups and, if applicable, codes) in accordance with the pictograms/codes specified by the European Commission.
- b.) Sorting and disposal pictograms: Use of the EU-wide harmonized pictograms for correct waste separation. Mandatory labels must be physically affixed to the packaging; as well as digital additions (e.g. QR code).
- Recyclability and reusability: If applicable, the corresponding symbols or notices must be affixed in accordance with EU requirements.

For example, previous ones:

Material number	Abbreva-tion	Name of material	Use/recycling to
	FOR	Wood	
	PAP	Other Paperboard	Packaging
	PAP	Corrugated fiberboard	Packaging
	PP	Polypropylene	Strapping
	ALU	Aluminium	Packaging

Table 9: Material symbols