Title	**Packaging guidelines**		
Document type	General specification		
Document number	KE-S-A-077	Revision	A
Date of release	14.08.2020	Released by	Burkard Frey
Publisher	Knauf Engineering GmbH Am Bahnhof 7 97346 Iphofen		

Rev.	Date	Created	Released	Description
-	26.03.2020	Nicola Weiglein / Alexander Lindenmayr	Dr. Alexander Schütz	First publication
A	14.08.2020	Nicola Weiglein / Alexander Lindenmayr	Burkard Frey	Order of packaging categories as first item and more detailed description of the categories

Structure

a) Introduction - Definition of Knauf Engineering packaging category 1 and 2

Category 1 - Standard truck / transport packaging according to ISPM 15

- Examples of standard packaging for truck transport within EU

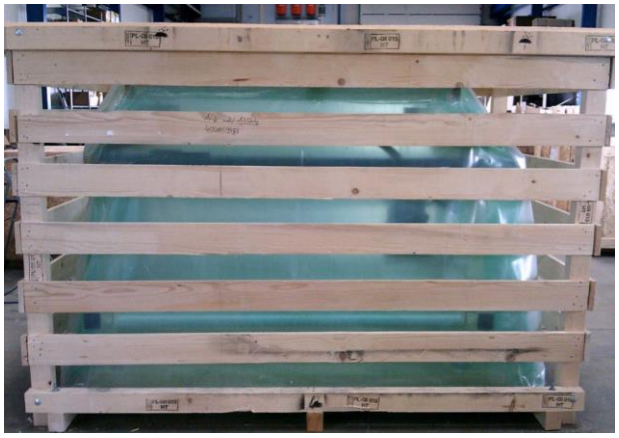



Shipment of the goods e.g. on pallets, in palbox, etc.:

- Observe weathering conditions and sensitivity of the goods for inner and outer packaging
  - see foil application methods from page 13 and from page 42
- If necessary, observe protective layer/preservation and desiccant methods - see from page 12
- Design of packaging types according to load assumptions - see pages 7 - 9

Category 2 - Seaworthy packaging in foil - closed according to ISPM 15

- In foil (PE (polyethylene foil) / aluminium compound foil) depending on scope of delivery, in wooden crate or box



Shipment of the goods e.g. on pallets, in palbox, etc.:

- Observe weathering conditions and sensitivity of the goods for inner and outer packaging - see film application methods from page 13 and from page 42
- If necessary, observe protective layer/preservation and desiccant methods - see from page 10
- Design of packaging types according to load assumptions - see pages 7 - 9

Category 2 - Seaworthy packaging in foil - closed according to ISPM 15

- In foil (PE (polyethylene foil) / aluminium compound foil) depending on scope of delivery, in wooden crate or box

b) General notes and information from, inter alia Wood packaging - Pallets - Export packaging (HPE) - Packaging Guideline

1. Load assumptions

Cargo loading of a ship by crane. The packaging must be designed for the occurring cable tensile forces.

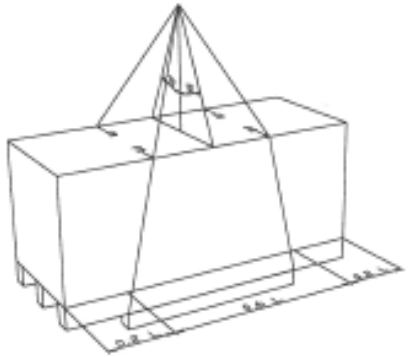


Fig.1: Pressure load due to rope forces

1.1 Vertical loads

The vertical loads on the packages are, on the one hand, the result of the stacking crush pressure through the stowed goods and, on the other hand, of the mass of the packaged goods. In both cases, these are static loads for warehousing processes and static/dynamic loads for transport and handling processes

1.2 Loads caused by falling and vibrations

Vibration loads occurring during each transportation depending on the means of transport used. In the case of sensitive goods, the customer shall communicate the load assumptions to the packaging company. The use of shock indicators or data loggers must be checked in each individual case.

1.3 Lateral pressure forces during crane transportation

Lateral pressure forces occur in the rope at the lid while loading.

Assuming the spread angle of the ropes in the rope arrangement shown in Fig. 1 is 60°, the compressive force acting in the plane of the lid is calculated based on the rope pulling forces:

$F_D = 0{,}145 \times F_G$

In this case, FG is the weight force to be used in (N) consisting of the mass of the package in (kg), multiplied by the gravitational acceleration g ($g \approx 10 m/s^2$).

Rope friction influences are neglected in the calculation, packing case heights and widths are disregarded.

In order to reduce the danger by the frequently varying spread angle, it is recommended to use $F_D = 0.2$ to $0.3 \times FG$.

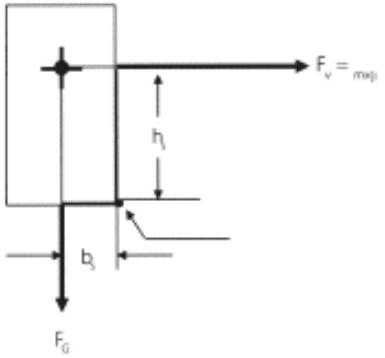


Fig.2: Tilting of packages.

Marker of the centre of gravity

1.4 Tilting conditions

A packing case or packaged item may tilt if the centre of gravity is above the point of intersection of the side diagonals and/or laterally outside the centre.

a) A packing case/packaged item may tip over in the direction of acceleration if

$g_v * b_s \leq g_h * h_2$ is

g_h = horizontal acceleration (see Table 1)

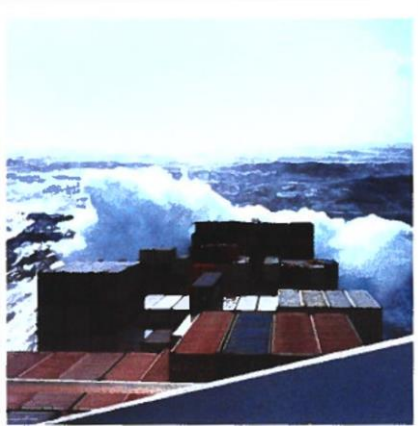
g_v = vertical acceleration (see Table 1)

b) Check that tilt indicators are used

1.5 Centre of gravity information

If goods are packed individually and the markers of the centre of gravity are necessary, this must be determined by the client/manufacturer and communicated to the packer. The centre of gravity is marked according to DIN 55 402, DIN EN ISO 870 or according to the regulations of the recipient country.

Example: Acceleration forces are often underestimated. Here, a not properly secured cylinder will break through the packing case wall. Source: HPE



Example: Acceleration forces on the high seas due to rolling and pitching of the ship. Rolling angles of up to 30° are possible. Source: HPE

Table 1: Load assumptions for different modes of transport

Means of transport	Forward acting acceleration	Backward acting acceleration	Sideways acting acceleration	Vertically acting acceleration	
				static	dynamic
Road vehicle	0.8 g	0.5 g	0.5 g	1.0 g	-
Railway					
Shunting traffic	4.0 g	4.0 g	0.5 g	1.0 g	± 0.3 g
Combined traffic			0.5 g	1.0 g	± 0.3 g
Seagoing vessel					
Baltic Sea	0.3 g	0.3 g	0.5 g	1.0 g	± 0.5 g
North Sea	0.3 g	0.3 g	0.7 g	1.0 g	± 0.7 g
Global	0.4 g	0.4 g	0.8 g	1.0 g	± 0.8 g
Plane	1.5 g	1.5 g	1.5 g	1.0 g	± 2.0 g

Note on the application of the table:

A superimposition of the vertical acceleration is decisive for the design of packing cases and packing case bottoms.

The load securing of the packing case and the stability of the packing case

and the packaged goods in the packing case is based on: in the longitudinal direction : superimposition of longitudinal acceleration

by vertical acceleration.

In transverse direction : superimposition of lateral acceleration by vertical acceleration

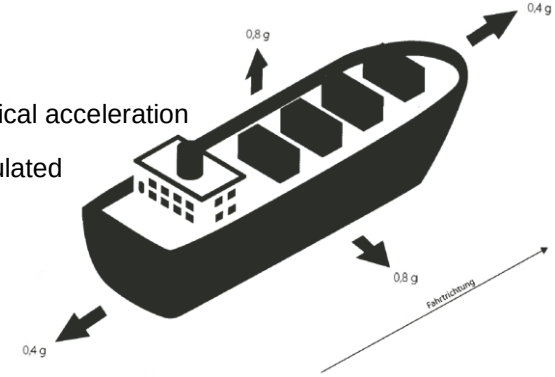
The forces resulting from the accelerations are then respectively calculated

from the product of masses (packaged item / package)

and acceleration

$F = m * g$

Different acceleration forces are possible.



2. Inner packaging

2.1 Corrosion protection

Corrosion protection does not begin with packaging, but is already a main issue in the pre-treatment and production of metallic materials and facilities. Various influences and substances may cause or give rise to corrosion even during the production and process flow.

Such corrosive influences or substances include:

Contact corrosion	already corroded parts in contact with bare metals
Lubricating and cooling liquids	contain water, dirt particles and various substances which remain as residue on the metal.
Wood, paper and cardboard	contain residual moisture and organic acids
Salts	Various chlorides and sulphates are used in washing and cleaning baths and can remain on the metal as residue.
Hand perspiration	Industrial atmospheres contain exhaust gases such as sulphur dioxide which combine with the humidity and can settle as acid precipitation.
Adhesives	Adhesives in corrugated cardboard and wood-based boards may contain solvents. Adhesives can separate acetic acid when exposed to humidity.

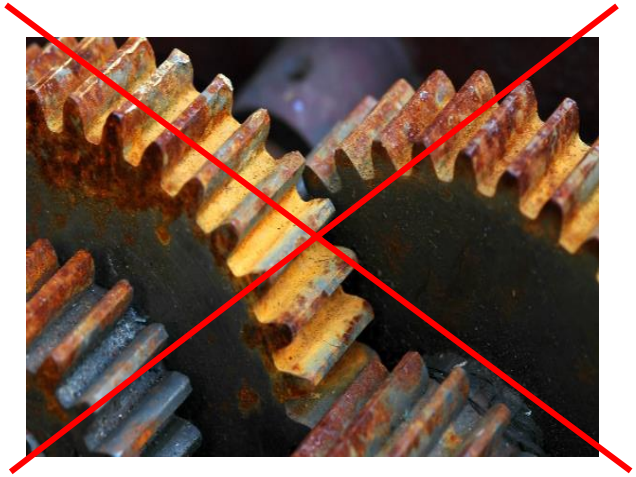
Transportation or storage place stress on the package. Rain, UV exposure, seawater, air humidity, strong temperature fluctuations, different climatic zones, chemical, biotic and mechanical influences may also stress the package. The type and intensity of the stress depends on the route and duration of transport, the type of storage and the sensitivity of the packaged goods. Corrosion protection is therefore indispensable. The customer must inform the packer about the sensitivity of its product to corrosion and about the corrosion protection measures already taken by the customer. ***See enclosed corrosion protection guidelines of Knauf Engineering***

The customer must inform the packer about the type of provisional preservation it has already carried out and whether this provisional preservation has to be removed. It must also be ensured that provisional preservation and final preservation are matched so as not to cause any no detrimental effects on the packaged goods.

Anti-corrosion agents must be selected taking into account the properties of the packaged goods and in accordance with the properties guaranteed by the manufacturer of the anti-corrosion agent.

Three methods are used for temporary corrosion protection during storage and transport

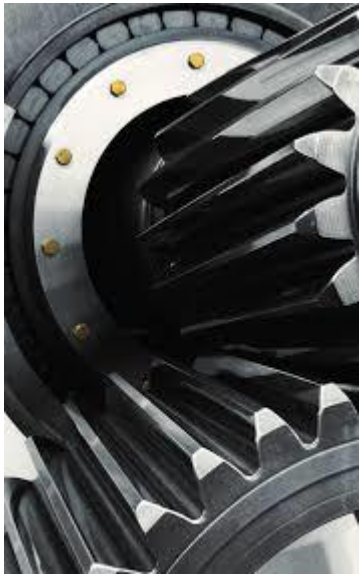
- Protective coating method (coating or oiling method)
- Desiccant method (climate-controlled packaging, barrier layer method)
- VCI Method



In general, this applies to all corrosion protection methods:

- The packaged goods should be clean, without traces of corrosion and without residues from previous work steps
- Do not touch metal parts with bare hands
- Prevent contact between wood, paper and cardboard to metal parts
- Carry out packaging of metals at room temperature
- Allow packages to acclimatize before unpacking

2.2 Protective coating method (coating or oiling method)

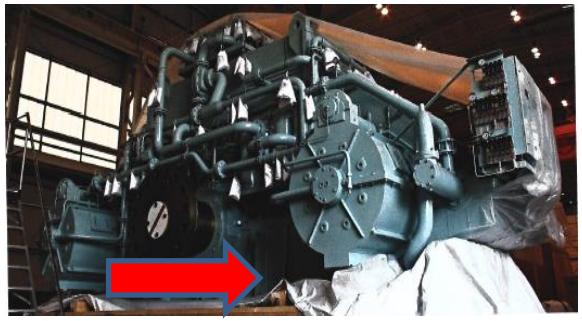


In this method, an even protective layer of a suitable coating agent is applied to the corrosion-prone surface immediately after cleaning and drying the packaged item. These coating agents are oil- or wax-based.

They are applied by dipping, brushing or spraying. The coating repels the corrosion-promoting elements in the ambient air such as water and oxygen from the metal surface.

Notes:

- The agents used for provisional and final preservation must be compatible with each other.
- Additional lubricating properties due to the application of the protective coating.
- Enough time must be provided for the cleaning agents to evaporate.
- In case of solid coatings, cleaning with solvent-based fluids is necessary. Corresponding occupational health and safety requirements must be observed when using solvent-based products.
- Oil residues, cleaning residues and packaging material contaminated with oil must be disposed of separately.



Positioning of desiccants

- Small holes/mating surfaces may stick together or clog.
- Metal surfaces must be completely covered. Surfaces that become exposed due to leaking oil as well as surfaces that are not completely covered in places that are difficult to access are not protected against corrosion.
- The safety data sheet regarding the classification as hazardous substance/goods must be observed.
- Dust and impurities can stick to the oil film.
- When processing oils or greases, the manufacturer's instructions regarding application, protection duration and thermal stability must be observed.
- It must be possible to remove preservation from packaged goods without damage using suitable cleaning agents.

2.3 Desiccant method (climate-controlled packaging)

According to DIN 55 473, desiccants are used for the following purpose: "Desiccants are intended to protect packaged goods from air humidity during transportation and storage to prevent corrosion, mould growth and the like".

To achieve this, the packaged goods are enclosed within a rigid outer packaging with a closed film shell in which the air is dried to the extent that the resulting relative humidity (RH) does not cause atmospheric corrosion during transport and storage processes. A rigid outer packaging is necessary to protect the barrier layer shell. The air inside the film shell is dried by desiccants (adsorbents) in accordance with DIN 55 473. The surface structure of the desiccants stores water molecules and dehumidifies the air. The drying state of the air should always be ≤ 40% of relative humidity.

PE protective film

Below this threshold, all corrosion processes, i.e. those related to this type of corrosion (condensation water corrosion), are generally stopped, as the water quantity required for the corrosion processes is no longer available. **The required amount of desiccant is calculated according to DIN 55 474.** The closed film shell consists of barrier layer shell material and, in the case of larger dimensions, is made of several individual webs by sealing them together. The barrier layer shells used here are:

VCI method

- Polyethylene film (PE)

  LD polyethylene, 0.2 mm thickness, according to DIN 55 530

  The use of PE films for film shells with a thickness of less than 0.2 mm is permissible if the technical requirements of DIN 55 530 for a 0.2 mm thick film are proven to be met.
- Aluminium composite film in accordance with DIN 55 531 and in accordance with the following additional specifications:

  Layer thickness of at least 100 my in the following composition
  - Polyethylene film min. 75 my
  - AL film min. 12 my
  - PET film min. 12 my

  Surface weight approx. 125 g/m²

  Longitudinal and transverse tensile strength at least 55 N

  Sealable at 160 °C to 250 °C with commercially available hot-jaw devices

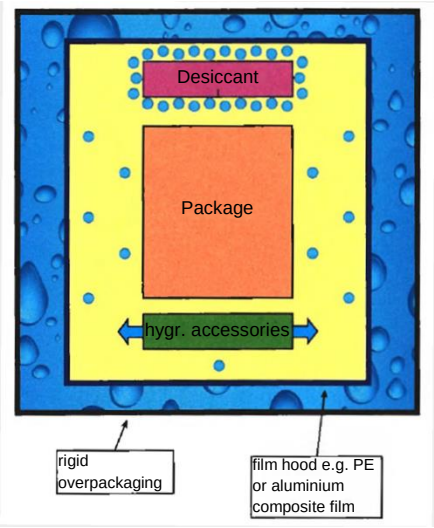


Fig.3: Structure of the desiccant method

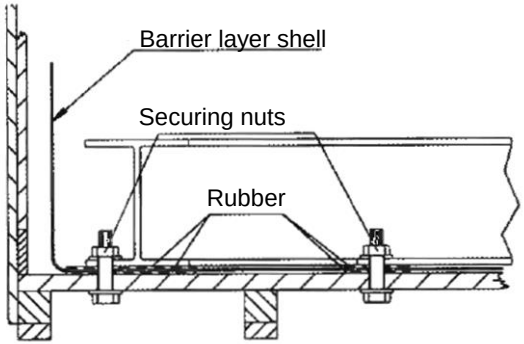


Fig.4: Seals for bolted connections through the film shell

2.4 Packaging

- Cover the load carrier with foam or bubble wrap.
- Place the barrier layer base sheet on top and make accurately fitting openings for bolted connection.
- Seal all feed-throughs through the transparent barrier layer shell, e.g. bolting of the packaged goods to the packing case bottom.
- Position and secure the machine.
- Calculate the amount of desiccant according to DIN 55474. Observe the hygroscopic accessories kit.
- Apply DIN 55473-compliant desiccants in the upper third of the packaging.
- No direct contact of the desiccant bags with metal surfaces.
- Avoid water sacks on the film shell through corresponding structure and appropriate lid design.
- Pad sharp corners or edges on the packaged goods.
- Make correct welding/sealing seams.
- Do not remove the existing protective layers.
- Check the film shell for leaks by vacuuming the air. Then ventilate again.
- Max. 24 months protection duration, for PE film max. 12 months.

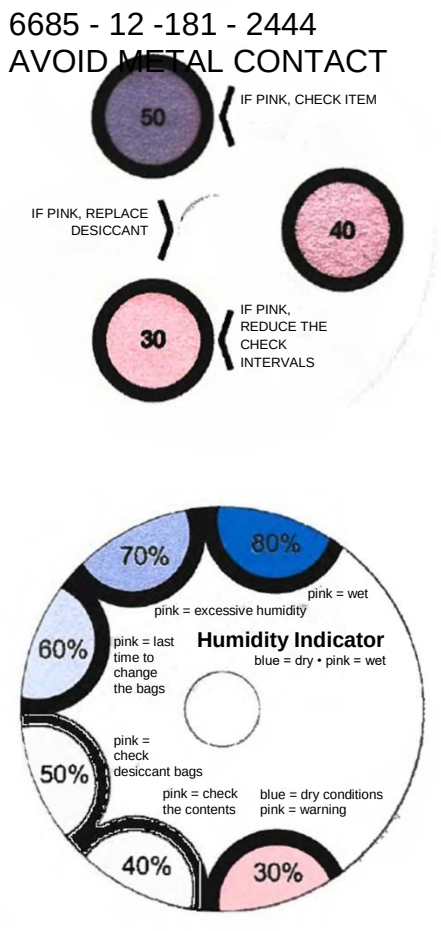


Fig.5: Humidity indicators

The relative humidity inside the barrier layer shell can be checked during the entire transport and storage process using humidity indicators (for examples see Fig. 5).

- Do not place humidity indicators directly near desiccants.
- The accuracy of the humidity indicators depends on the temperature.
- Therefore use correction tables.
- The humidity indicator must be free of cobalt dichloride.

Notes:

- Common and proven corrosion protection method
- Calculation and application of desiccants according to DIN
- No interaction when materials are mixed (several metals or plastics on one component)
- Application of desiccant units must be correct
- For barrier films, observe the manufacturer’s instructions for use

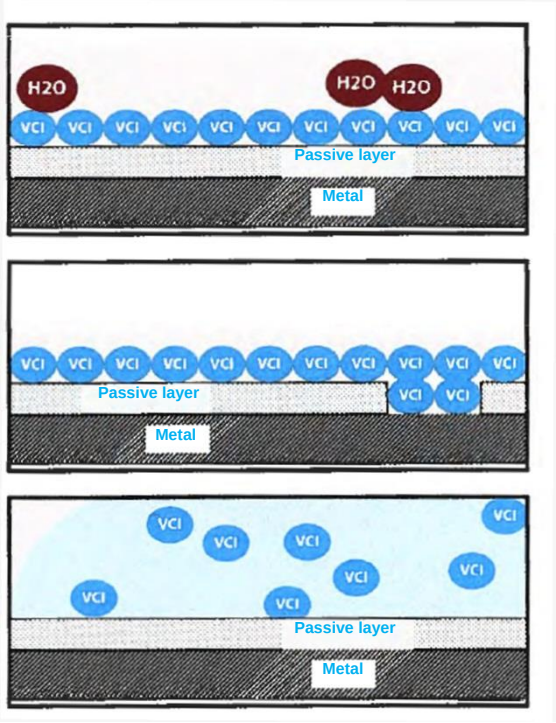


Fig.6: Effects of VCI

2.5 VCI method (Volatile Corrosion Inhibitor)

The VCI method prevents corrosion by creating a protective atmosphere within the packaging.

Paper, PE films, cellulose or other emitters (also fluids) are used as VCI carrier material. The VCI active substances are released from the carrier material until an atmosphere is built up within the packaging. The remaining VCI active substances remain in the carrier material.

Short opening and closure of the VCI packaging (e.g. when removing workpieces individually or during customs control) does not pose a problem, since the VCI protective atmosphere is completely rebuilt, provided that sufficient active substance is still present in the carrier material.

Effects of VCI:

1) VCI active substances form a compound with the passive layer and displace humidity.
2) Gaps in the passive layer are closed by VCI active substances.
3) Inside the packaging, the PH value is neutralized.

Notes

- VCI papers and films are marked with a recycling symbol for disposal or reuse.
- Applicable for many system and component sizes.
- There is no need of removing preservative agents.
- After unpacking, metal parts can be used and processed immediately (e.g. welding, soldering, painting).
- Different grammages, µm thicknesses, formats, blanks, hoods and much more are available.

- VCI materials must be stored in accordance with the manufacturer's instructions.
- There are different VCI grades for ferrous and non-ferrous metals as well as for multi-metal protection (some can be combined).
- The VCI quantity must be used according to the manufacturer’s instructions. The manufacturer’s instructions regarding the compatibility of the VCI agent with the material to be protected must also be observed.
- Direct access to the surface to be protected is necessary.
- The hood and base sheet must be sealed together.
- The corrosion protection remains even in the case of minor damage in the VCI outer packaging. Unless the VCI atmosphere is no longer guaranteed due to permanent draughts.
- Mixing VCI materials from different manufacturers is not recommended.
- The build-up time of the VCI atmosphere depends on the carrier material.
- VCI materials can be active on one or both sides; the manufacturer’s instructions must be observed.
- A maximum distance of 30 cm is assumed between VCI and the material to be protected (rule of thumb).

3. Outer packaging

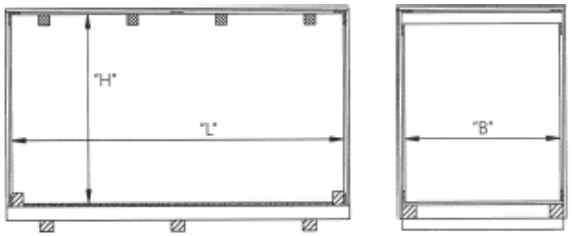


Fig.7: Inner dimensions between the battens

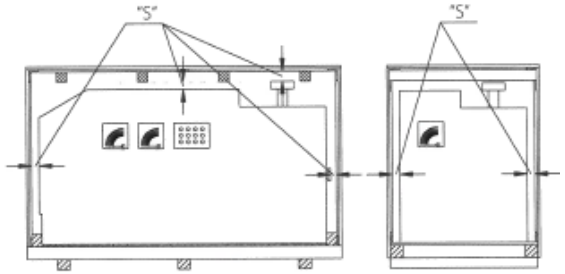


Fig.8: Safety distance

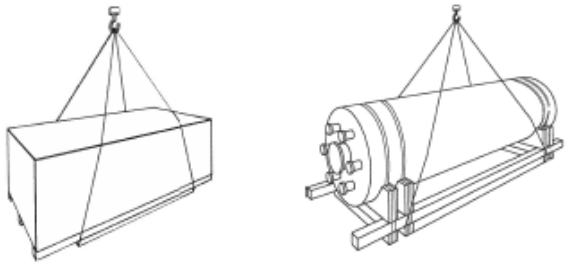


Fig.9: Load-bearing packaging

3.1 Guidelines for measurements

The inner dimensions (in centimetres, cm) are indicated in the order: length (L) – width (B) – height (H).

The following principles apply for determining the inner dimensions of packaging:

a) The inner dimensions are measured between the components which are opposite each other as sides or heads, bottom and lid. In case internal bracing, the distance is measured between the battens (see Fig.9.)

b) The safety distance (“S”) between the packaged goods and the packaging material should not be less than 5 cm (except on supports, bracing, wooden pushing and pressure members) (see Fig.10.).

3.2 Types of packaging

Irrespective of the packaging material, a distinction is made between two basic types of shipping packaging:

Load-bearing packaging (external attachment)

Carried packaging (internal attachment)

During lifting operations, the load-bearing packaging must be able to withstand other, higher loads (bending at the bottom, lateral pressure on the lid) than the carried packaging.

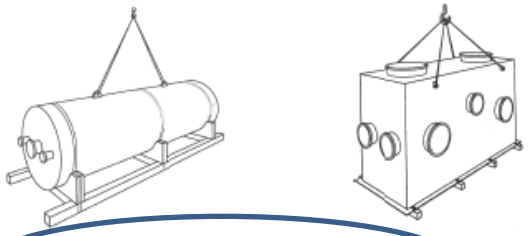


Fig.10: Carried packaging

Example: Carried packaging with plywood crate

Example: Load distribution due to additional enlarged bottom structure

The other forces acting from inside and outside (horizontal, vertical and lateral acceleration, stack pressure) are the same for all packages, provided they can be stacked.

- In addition, the load-bearing packaging must
- Hold together packaged goods consisting of individual parts, to stiffen unstable goods and to allow than being stacked;
- Make the packaged goods stable (tilt and roll-proof), a necessity which is particularly essential for top-heavy objects, eccentric centre of gravity and goods with a small footprint;
- Provide even bottom load distribution, if necessary using suitable support or enlarging the footprint to avoid excessive surface pressure (load-bearing capacity of ship decks, containers, aircraft);
- Where necessary, support individual pieces within the packaging against each other;
- Make the packages equally manipulable for industrial trucks and hoists and make them stackable;
- Keep package goods away from mechanical damage.

The following packaging materials are distinguished by their design, resulting from different requirements with regard to the packaged goods and their sensitivity:

- Packing case
- Crate
- Partial packaging

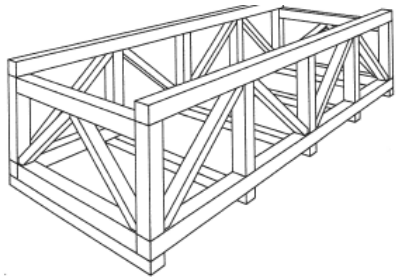


Fig.11: Square timber

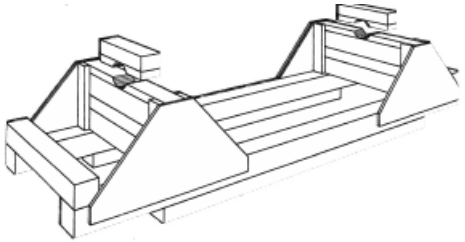


Fig.12: Slide

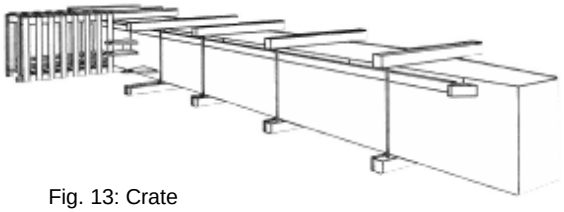


Fig. 13: Crate

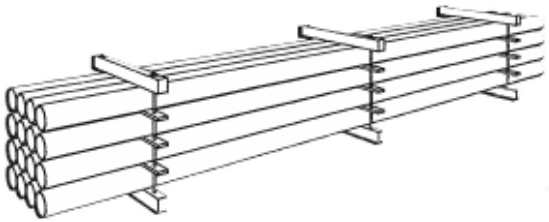


Fig.14: Bundle

Packing case

The packing case is a rigid wooden body which can be handled and loaded in accordance with the load assumptions of these guidelines. It consists of six components arranged at right angles to each other with full-surface casing.

If the largest possible loading dimensions (profile) are exceeded, bevelled lid surfaces may be required (profile packing case).

Crate

The crate within the meaning of these guidelines is a rigid hollow body developed from the packing case, the individual sides of which are not completely clad. But partial full-surface cladding is not excluded.

The proportion of the cladding is usually 40 – 60% of the total wall surface with a minimum cladding width of 10 cm.

Partial packaging

Partial packaging can be of various types. Partial packaging includes

- Square timber
- Slide
- Cladding
- Bundle

For examples of partial packaging, see the pictures on the left.

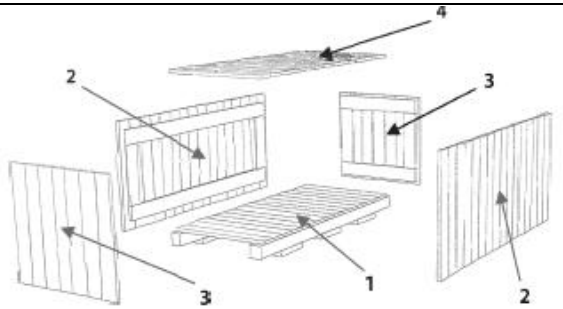


Fig.15: Packing case components. The detailed structure of the components is shown on the following pages

3.3 Design features

Packing case/crate

A load-bearing packing case/crate packaging consists of three structural components:

a) The bottom 1

b) The side walls and heads 2;3

c) The lid 4

Example: Completely assembled packing case with identification for ship cargo, ready for pickup.

3.3.1 Load-bearing packing case packaging / types

The type is determined by

- Dimensions of packaged goods
- Net weight
- Load assumptions

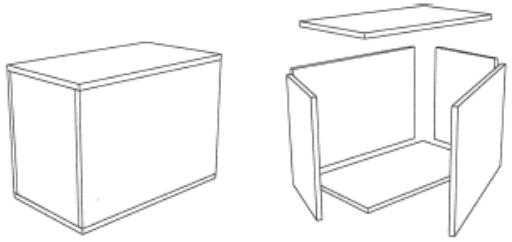


Fig.16: Type A1: Packing case without battens

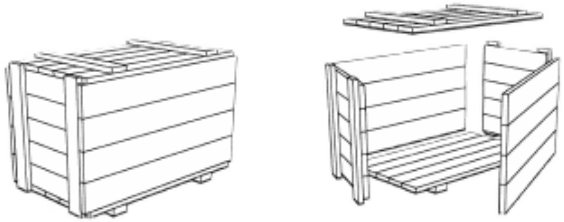


Fig.17: Type A3: Packing case with head, bottom and lid battens

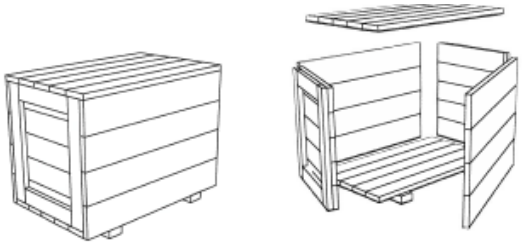


Fig.18: Type A5: Packing case with head battens

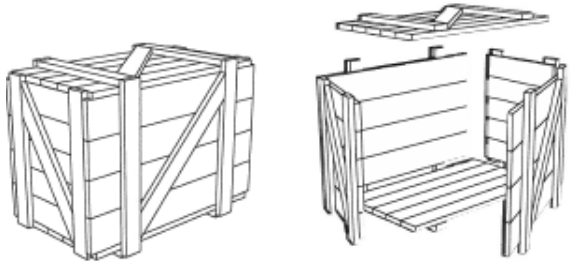


Fig.19: Type A6: Packing case with diagonal, head and ring battens

3.3.1.1. Packing cases, type A1 – A6 for masses up to 500 kg

Type A1 and A2 are rather unusual in practice. They are more difficult to handle because they are without floor skids and are therefore not suitable for transport with a forklift or pallet truck. In the explanations, these types of construction play a subordinate role.

General information on packing case types A1 – A6:

- The bottom of the packing case – regardless of its type – must be dimensioned in such a way that the forces (load assumptions) are absorbed.
- Packing case bottoms, types A3 – A6, should be designed so as to allow industrial trucks to easily reach under the packing cases.
- The edge boards on or in the walls must not be narrower than 8 cm.
- The thickness of the battens for A3 – A6 packing cases corresponds to the thickness of the side and head parts.
- The minimum batten width for types A3 – A6 is 8 cm.
- The distance between the battens should be approx. 80 cm and may not exceed 100 cm.
- The number of battens required is determined by the length of the packing case.

Table 2: Number of battens for A3-A6 packing cases up to 150 cm high.

Packing case length (cm)	200	300	420	530	640	750	860	970	1080	1190
Number of battens required	2	3	4	5	6	7	8	9	10	11

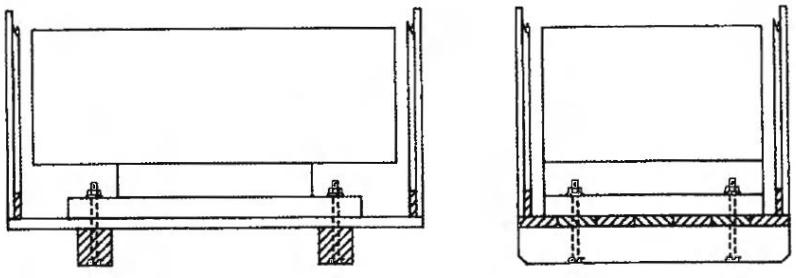


Fig.20: Example: Fastening of packaged goods to the floor, type A3 – A6

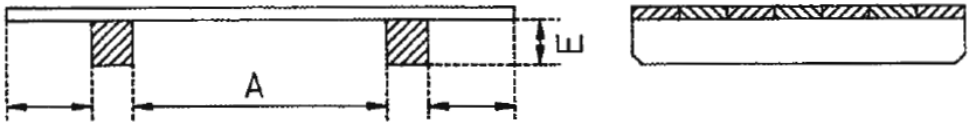


Fig.21: Bottom for packing cases, type A3 – A6 with side stop possibility and forklift entry opening

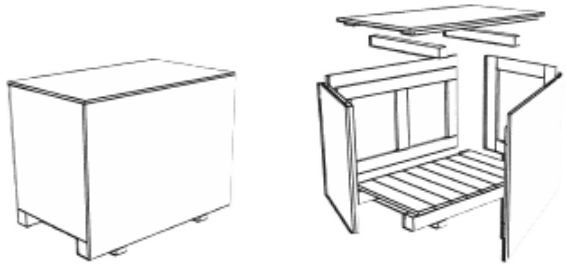


Fig.22: Type B3: Skid packing case with cladding made of wood material

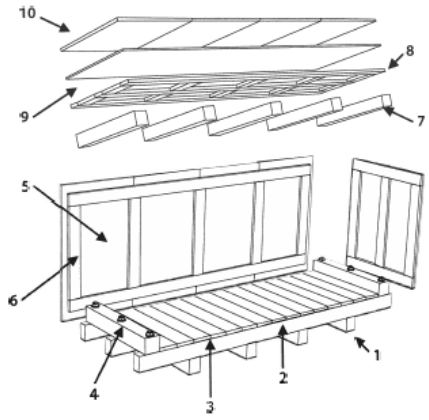


Fig.22: Example: Components of a packing case with cladding made of wood material.
Key to Fig. 22:
1 Transverse skids
2 Longitudinal skids
3 Bottom boards
4 Head battens
5 Plywood /OSB / chipboard cladding
6 Battens
7 Lid battens
8 Battens
9 Barrier layer
10 Plywood / OSB / chipboard

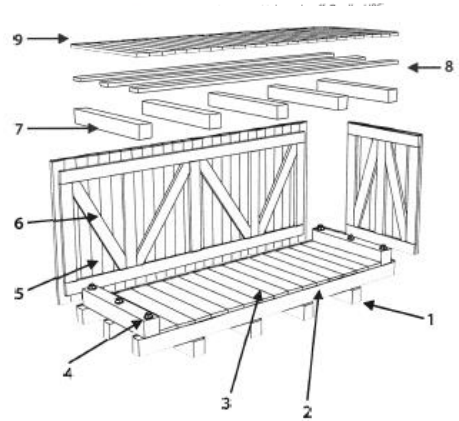


Fig.23: Example: Parts of a packing case with cut-lumber cladding
Key to Fig. 23:
1 Transverse skids
2 Longitudinal skids
3 Bottom boards
4 Head battens
5 Cut-lumber cladding
6 Diagonals
7 Lid battens
8 Battens
9 Lid / cut lumber
Between battens and lid: additional barrier layer of double-web board or film + hardboard

3.3.1.2. Packing cases, types B1 – B3 for masses above 500 kg

For packing cases with gross masses above 500 kg, a distinction is made between 3 basic types B1 – B3.

Table 3: Assignment of construction types B1-B3 to net masses of packaged goods (bearing load)

Net mass (Bearing load)	Types (B1 - B3)		
	Cut lumber	OSB chipboard	Plywood
0 - 3000 kg	B1 -B2	B3	B3
0 - 3000 kg	B1 -B2	B3	B3

Types B2 and B3 are the most common types in practice.

The following two sketches on the left show the detailed structure for types B2 and B3.

On the left side, examples of packing case types with cladding made of wood material or solid wood are shown.

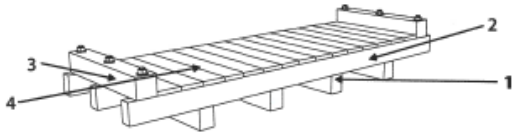


Fig.24: A bottom

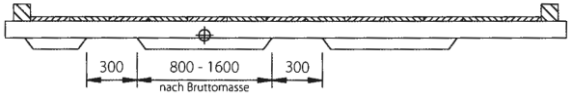


Fig.25: Bottom for skid packing cases, type B1 – B3, more than 200 cm long, with eccentric centre of gravity ("CG")

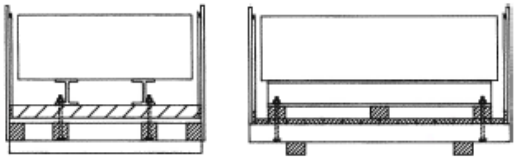


Fig.26: Fastening of packaged goods to the bottom, type B2 and B3

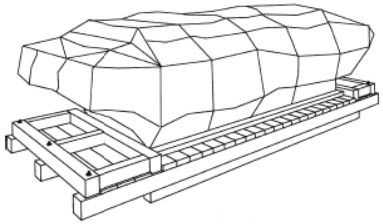


Fig.27: Fastening packaged goods to the bottom without direct screwing

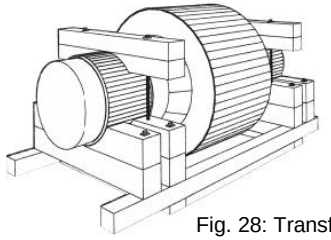


Fig. 28: Transfer of loads to the outer skids

3.3.1.2.1. Bottom structure for types B1 – B3

The packing case bottom, regardless of its design, is the most important load-bearing component. Battens, skids, load-bearing bottom boards and/or squared timber must be dimensioned so as to absorb occurring forces.

The following principles must be observed:

- The bottom must have possibilities of lifting for cranes and forklift trucks in accordance with the later centre of gravity (Fig. 25).
- Packaged goods must always be firmly secured to the bottom of the packing case. They must be fastened with continuous bolting, which in the case of skid packing cases are made through the skids (Fig. 26).
- If direct bolting is not possible, frames, cross or longitudinal pieces, clamping lugs or the like that are bolted to the bottom must absorb the horizontal loads (Fig. 27).
- The packaged goods mass (net mass) must be distributed evenly over the area of the bottom. If the footprint of the packaged goods is smaller than its largest dimensions in length and/or width, suitable supports must be installed. All forces should be transferred to the load application point (Fig. 28).
- In the case of heavy goods packaging, the bottoms must be provided with inside squared timber on the narrow sides (head) and with continuously bolted longitudinal skids (recommendation: from 10 kN or 1000 kg gross mass).
- The bottoms of packing case and crate types B1 – B3 must be provided with at least two load-bearing longitudinal squared lumber (skids).
- The distance between the skids should not be greater than approx. 100 cm.

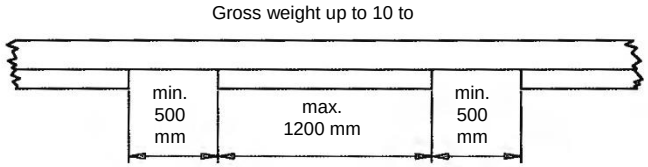


Fig. 29: Distance between the battens

Squared timber as lower skids

- Unless the conditions differ due to the measures required for securing the packaged goods, the number of skids should be selected from the following table:

Table 4: Minimum number of skids depending on the width of the bottom

Skids: Minimum number for a bottom width in cm up to			
100	180	275	325
2	3	4	5

Additional longitudinal (e.g. Fig. 25) or squared timber (e.g. Fig. 21) is to be provided as lower skids (rope lifting battens) as a means of lifting for surface handling and crane transport of skid packing case or packing case type B1 – B3.

Unless special transport conditions make it absolutely necessary to sand the packages (longitudinal bottom skids must be bevelled), squared timber should be used as bottom skids.

Rope lifting battens must be shortened relative to the skid length so as to conform with the centre of gravity and the points of support of the packaged goods on the bottom: if the centre of gravity is in the middle and with an even bottom load, by 1/5 of the skid length from the ends.

The entry height for industrial trucks is 9.5 – 10 cm, irrespective of the gross mass of the packing cases.

The recesses of the rope lifting battens for forklift trucks (entry openings) can correspond to the following dimensional drawings according to Fig. 29.

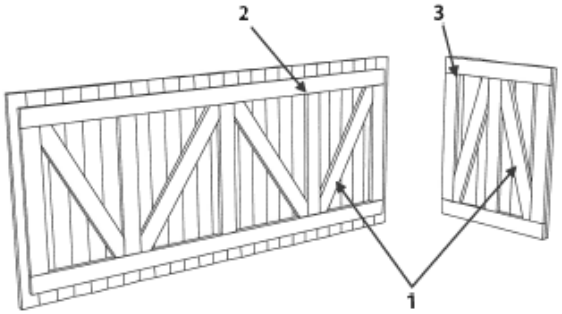


Fig.30: Side and head wall.
Key to Fig. 30:
1 Diagonal
2 Battens (side)
3 Battens (head)

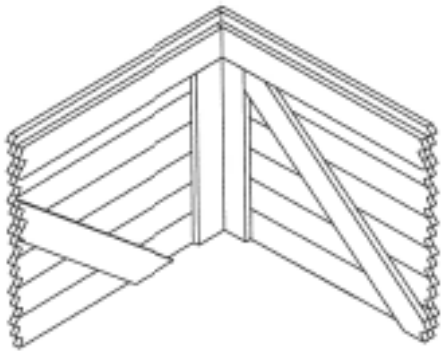


Fig. 31: Arrangement of side battens/end battens for above 150 cm high packing cases.

3.3.1.2.2. Side and head walls

The sides and head parts of packing cases with load-bearing walls of all types are load-bearing components which, when assembled as a body, form a static unit. They are particularly exposed to stresses:

- Dynamic forces during transport
- Static forces during storage (stacking crush pressure).

The overall stability of a package is endangered if important components do not meet the assumed or actual requirements as part of the load assumptions of these guidelines. The battens for surface and corner connections must therefore be carefully selected with regard to their qualitative suitability.

Edge boards must not be narrower than 10 cm, other boards not narrower than 8 cm. The batten width is at least 10 cm for types B1 – B3.

The number of battens for the sides is determined by the length of the packing case (see Tables 2, 5 and 6).

The distance between the battens should be approx. 80 cm and may not exceed 100 cm.

In the case of packing cases with an outer height of more than 150 cm, both side and head walls must be reinforced with diagonal battens (with the exception of B3). For better stabilisation of the side/head corner connection, the sides should be provided with end battens (for the number of battens see Table 5), to which the head walls are directly connected (Fig. 31).

The number of battens of the head walls usually corresponds to the number of skids. Only for B1: If boards of the surface cladding are butted because they are not available in sufficient length, the butt must be offset by at least one batten distance. The butt joint must be backed with a batten.

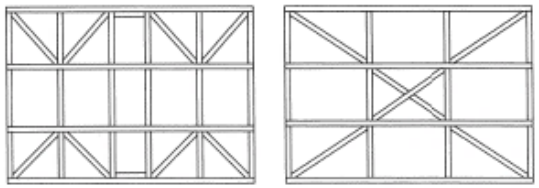


Fig.32: 3 fields long and 3 fields high, c 9 maximum size 700 cm length x 350 cm height

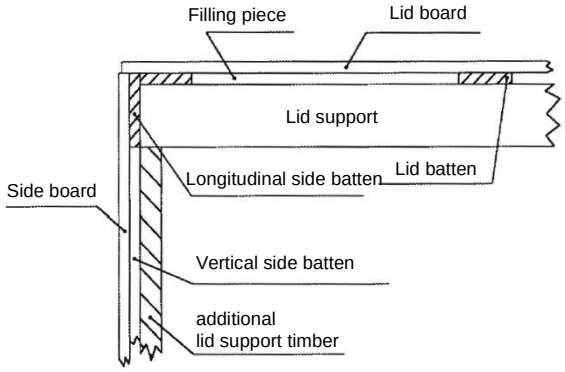


Fig. 33: Batten arrangement

Table 5: Number of battens for packing case type B1 above 150 cm high with a packing case length in cm of up to:

Packing case length (cm)	130	240	350	460	570	680	790	900	1010	1120
Number of battens required	2	3	4	5	6	7	8	9	10	11

The bracing of packing case types B2 and B3 is suitable for stacking crush pressure.

The bracing of this packing case type is divided into fields based on the length, width and height of the packing case in accordance with Table 6.

Table 6: Minimum capacity for types B2 and B3

Packing case length (cm)	Number of fields per side / head					
Number of fields	≥ 250 ≤ 350	a 3	b 6	c 9	d 12	e 15
Outer dimension	≥ 150 ≤ 250	a 2	b 4	c 6	d 8	e 10
Height in cm	≤ 150	a1	b 2	c 3	d 4	e 5
Outer dimension Length in cm		≤ 300	≥ 300 ≤ 500	≥ 500 ≤ *700*	≥ 700 ≤ 900	≥ 900 ≤ 1000

Packing cases with side walls made of plywood, OSB or chipboard must be braced in accordance with the board grid. The general principles for the bracing of packing case walls apply. Board joints must always be backed with battens. Diagonals are not required.

For examples of field division and arrangement of diagonal battens see Fig. 32.

The top longitudinal batten on the type B2 packing case sides is placed towards bottom at such a distance that the lid support timber and lid supports are positioned on the long side (Fig. 33).

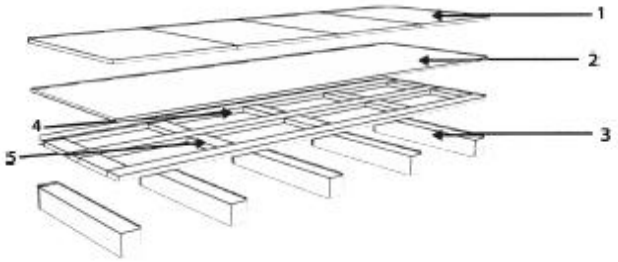


Fig.34: Lid design
Key to Fig. 34:
1 Lid made of plywood, OSB or chipboard (possibly solid wood)
1 Web plate made of plastic or hardboard with film interlayer
3 Lid batten
4 Batten
5 Lining

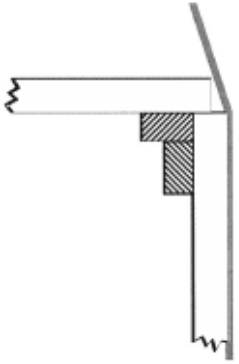


Fig.35: Engaged lid board

3.3.1.2.3. Lid

The packing case lid closes a package at the top and provides an evenly loadable flat surface. The packing case lid, which rests either directly on the head and side walls or on a corresponding frame structure, normally consists of a single layer of boards and a batten frame.

In addition to the stack pressure forces which occur when several packing cases or similar are stacked on top of each other, the lid must also absorb lateral pressure forces. They arise during handling as a result of the use of ropes or chains. To prevent damage to the lid boards by lateral pressure forces, they should be arranged as shown in Fig. 35. The lid surface on all sides should be approx. 5 mm smaller than the external dimensions of the packing case in length and width, in order to prevent the lids from being lifted during handling by crane.

Large, wide lids must be provided with special support to withstand the considerable load from the stacking crush pressure. The calculation shall be made in accordance with the load assumption. As barrier layer material, e.g. an internal, full-surface polyethylene tarpaulin shall be provided, supported against water sack formation (e.g. installation of hard wood fibre boards, veneer boards or double-web polypropylene boards). Profiled packing cases with bevelled lid surfaces require special measures for lid support.

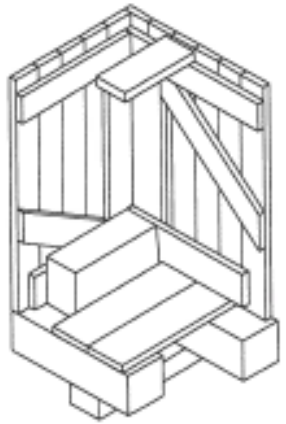


Fig.36: Example: lid girder resting on the bracing. The lid girder is mounted directly on the longitudinal batten and leads to a point load there.

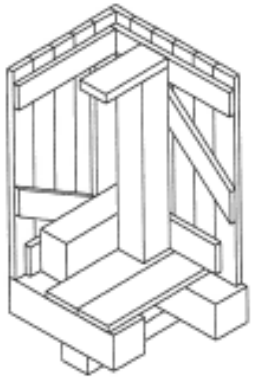


Fig. 37: Example: lid girder supported on vertical support.
The lid girder is attached by means of a vertical support and ends with the longitudinal batten so that the forces are distributed evenly. It can be seen that the interior of the packing case is reduced by the supports.

Lid girders have two basic functions:

- Supporting the lid and transferring the stacking crush pressure to the sides, the heads or the bottom
- Support against lateral pressure forces caused by crane transport for packages with load-bearing packaging (external attachment)

Packing cases with a large lid surface must be provided with so-called lid girders. If the lid girders are placed directly on the upper longitudinal battens, loads are created, such that the battens would break under high stacking crush pressures. To avoid these high loads on the battens, vertical supports can be installed inside the packing case on which the lid girders rest. This construction is very resilient. However, the packing cases must then be made larger, since the vertical supports require additional space.

Fig. 36 and Fig. 37 show the various ways of securing the lid girders.

Example: Fixture for supporting the packaged goods

3.3.2 Fixtures

Fixtures include measures for supporting, bracing, securing and shock or vibration damping of the packaged goods (the cushioning materials are elastic, resilient elements, e.g. rubber-bonded metals, air cushions, PU foam padding).

Fixtures in packing cases are generally made of wood, and in cases of particular stress, of steel.

Fixtures on the bottom are used to protect against horizontal and vertical loads arising from transport movements. The dimensions, number and position in the package and the connection with the components are determined by the particular features of the packaged goods (Fig. 20 and Fig. 21 and Figs. 25, 26, 27 and 29).

Special attention is to be paid to the fixtures in the area above the bottom in the cavity of a package. Here, bracing secures against tilting movements of the packaged goods. Transverse and longitudinal struts in this area can only be nailed or screwed to the sides and heads. Since members are usually nailed into the end grain here for lack of better options, this securing method is given little attention.

Therefore, additional support of the struts up to the battens or to the packing case wall is necessary, where as large as possible surface of load transmission is ensured.

The prerequisites for such support are diagonal struts of the heads and sides.

The necessary fixtures in packages for the stabilisation of the top surfaces have two basic tasks:

- Supporting the lid and transferring the stacking crush pressure to the sides, the heads or the bottom

Example: Edge protection inside

Example: Edge protection outside

- Support against lateral pressure forces caused by crane transport for packages with load-bearing packaging (external attachment)

The force transmission from the lid girders into the side walls should not rely on the nailing. Lid girders must either rest on the frame structure of the sides (types B2 and B3) or be supported in a suitable way down to the bottom (B1 and A3 – A6) if the packaged goods should not absorb the lid load (stacking crush pressure).

The lid girders must not be neglected as this would weaken the cross-section of the wood. If lid girders are installed exclusively as lateral pressure supports, this measure does not raise any concerns, but it must be replaced by simpler designs due to the considerable amount of time required for manufacture.

The lateral pressure forces caused by crane ropes are usually also absorbed by the lid girders. In the area of attack of the crane ropes, the intervals of the lid girders are therefore reduced unless other (load-distributing) measures (longitudinal timber, edge angles) are taken to stabilise the corners.

The number of lid girders depends on the type of the packing case. Lids with load-bearing batten frames (types B2 and B3) require fewer girders than packing cases with load-bearing walls (types A3 – A6 and B1).

With masses of more than 5 t, edge protection should be fitted both to the longitudinal skids and to the top edges of the packing case.

Example: Packing case covered by tarpaulin

3.3.3 Crate

The type is determined by:

- Packaged goods dimensions
- Net masses
- Load assumptions

Although the crate requires less external cladding, it is much more complex in design than a closed packing case, which ultimately provides better protection for the packaged goods.

Fig.38: Type A4

3.3.3.1. Normal crate

Packing case types A3 – A6 (see Fig. 38) correspond to the design principle of basic packing case types A3 – A6 (for masses up to 500 kg).

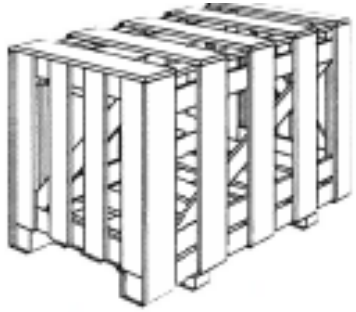


Fig.39: Type B2

3.3.3.2. Skid crate

Crate types B1 and B2 (see Fig. 39) are designed as skid crates for transport reasons.

3.3.3.3. Components

The principles applying to packing cases also apply to the components of crates (chapter 3.3.1.). In contrast to packing cases, the surface cladding is not closed.

The ratio of boarded to open surface is generally 1:1 to 2:1. This means that intervals between the individual boards, which are about ½ - 1 of board width, must be maintained. The board width should not be less than 10 cm.

The intervals should be approximately the same on opposite components to ensure that there is sufficient space for securing fixtures.

It is also important that sufficient surfaces are available for marking. If applicable, partial surfaces must be fully boarded in order to allow for the attachment of large markings. Alternatively, boards of weather-resistant materials can be attached.

The bottom surfaces of crates are always boarded in the same ratio as the other components. In special cases, full-surface boarding or covering of the bottom openings with weather-resistant glued plywood must be provided.

Side and head parts are to be reinforced with diagonal battens, taking into account the widths and heights of packing cases and crates, in order to meet the requirements of chapter 2 load assumptions.

Fixtures in crates should be the same as fixtures in packing cases. In the case of horizontally boarded crates, particular attention is to be paid to adequate lid support with regard to the stacking crush pressure load.

4. Packaging aids

4.1 Packaging aids

Packaging aids are divided into:

- Joining means
- Packaging films
- Cushion
- Desiccant
- Humidity, impact and tilt indicators
- Strapping

4.2 Joining means

The quality of wooden packaging is defined by the boards, square timber and board materials used and by the quality of the joints between these components. The joints are of crucial importance with regard to the suitability for use in the logistical process and also with regard to the durability of the packaging. Boards, squared timber and board materials can be joined in different ways. Common joints are in particular nails, clamps, rivets, bolts, studs, plates and angles. The quality of the fasteners and the way in which they are attached play an important role here.

4.2.1 Nail connections

Several factors determine the quality of nail joints: The properties of the nails, the nail pattern, the type of wood used, the technique of driving in the nails and the wood moisture. A nail is easier to remove from fresh wood than from dried wood. It should also be kept in mind that, as a result of the drying process, dry wooden packaging made of fresh wood has lower extraction qualities than wooden packaging made directly from dry wood.

Table 7: Influence on nail extraction resistance

Cause	Increase in %	Decrease in %
Riveting	400	
Ring groove shaft	200	
Resinated shaft	50	
Subsequent drying of the packaging		40
Oiled, greased nail		30
Nailing parallel to the fibre		50

The following instructions must be observed when nailing:

Smooth or profiled nails according to DIN EN 14952 with the corresponding CE mark must be used for load-bearing nail connections.

Driving in of fasteners with the pneumatic nailer

The permissible nail loads are to be determined according to DIN EN 1995 -1-1, 8.3 in conjunction with the national annex.

Nail connections in end grain wood must not be calculated for statics as load-bearing.

The nail thickness must be determined according to the thinnest of the wooden parts to be joined.

The length of nails passing through wooden parts to be joined shall be such that the tip can be turned over at least 5 mm. Nail tips must not protrude. Nail heads must not be recessed more than 2 mm.

The length of nails which pass through wooden parts to be joined must be such that the minimum penetration depth for smooth nails is 12d (d = nail diameter) and for groove length 8d.

The nailing of battens must be offset (gap effect). According to DIN EN 1995-1-1, the minimum nail distance shall be 10d parallel to the fibre direction and 5d transverse to the fibre direction. The minimum distance of the nails to the edge of the component shall be 20 mm, provided that the dimensions of the components permit this.

4.2.2 Clamp connections

For load-bearing clamp connections, clamps according to DIN EN 14592 must be used.

The permissible clamp loads shall be determined in accordance with DIN EN 1995-1-1, 8.4 in conjunction with the national annex. The minimum penetration depth must be 14d and the angle between the back of the clamp and the wood fibre at least 30 degrees.

In all other respects, the provisions for nails apply.

4.2.3 Drive-in screws (nail screws)

Drive-in screws are driven in with the nailer and are suitable for mounting board material. If necessary, they can be easily removed, e.g. when opening packing case lids for inspection during customs clearance and when replacing desiccants if the corrosion protection time elapsed.

4.2.4 Bolted connections

For bolted connections, hexagon head screws and threaded rods according to DIN EN ISO 4016, cup round-head screws with square neck according to DIN 603 and threaded bolts according to DIN 976 must be used.

The permissible bolt loads are to be determined according to the respective product standard or DIN EN ISO 893.

When using eye bolts according to DIN 580 or lifting eye nuts according to DIN 582, the permissible load capacities of the respective product standard must be taken into account.

Where possible, bolt holes should be drilled by machines to ensure a good fit, so as not to exceed a play of 1 mm.

Bolts must have a diameter of at least 10 mm, for wood thicknesses above 8 cm at least 12 mm.

Where possible, bolts should be spaced at least 10 cm from each other and from the end of the wood in the fibre direction.

In bolted connections, DIN 436 or DIN 440 washers must be arranged on the head and nut side. The dimensions of the washers for load-bearing connections are specified in the following table:

Table 8: Dimensions of U-washers for load-bearing bolted connections

Bolt diameter	M 12	M 16	M 20	M 22	M 24
Washer thickness	6	6	6	8	8
Outer diameter for round washer in mm	58	68	80	92	105
Side length for square washer in mm	40	50	60	70	80

4.3 Packaging films

Only those types of film are explain which are used in the packaging industry for the production of film hoods (corrosion protection using the desiccant method, see chapter 2.3.). In contrast to films which are only used for covering or as hood material in the VCI method (see chapter 2.5.), the demands placed on these films are higher.

A distinction is made between 2 types of film:

- Polyethylene films (PE films)
- Aluminium composite films

Aluminium composite film

4.3.1 Polyethylene films (PE films)

The demands placed on barrier layer films made of PE films are described in TL 8135-0019 and DIN 55 530.

The films normally consist of low-density polyethylene (PE-LD).

The temperature application range can be determined according to DIN 55 530 based on the test conditions (water vapour permeability WVP) as approx. 40 °C above the freezing point.

For temperatures below the freezing point, the application limit is -20 °C.

4.3.2 Aluminium composite films

The aluminium composite films are described in DIN 55 531 with regard to their function as barrier layer material and are divided into different types with regard to their material structure. The conformity of aluminium composite films with the above-mentioned standards is indicated by information (printed) on the film. The film also contains information on processing such as sealing temperature, sealing time and sealing pressure.

However, the standard requirements are not sufficient for use as sealable barrier layer material for corrosion protection packaging. The requirements referred to in chapter 5.3 of this guideline must also be met. It can be assumed that the temperature application ranges of aluminium composite films are between -35 °C and +70 °C.

4.4 Cushion

There are various types of cushioning materials for cushioning of packaged goods and for covering of edges, corners and protruding parts of packaged goods.

- Air cushion padding
- Bubble wraps
- Fibre padding
- Foams
- Wood wool / paper wool / honeycomb panel
- Vibration and shock absorbing elements

4.4.1 Air cushion padding

Air cushions consist of closed cells, which are made of an elastic film designed for the application and are filled with air. In passive state, only the static load from the packaged goods acts on the cushion. If there are additional dynamic loads, they are dampened by pressing the cushion in.

The amount of air filled can vary depending on the respective properties and requirements of the packaged goods. Air cushion padding is available in various sizes and designs. In it can be shaped as a sphere, normal cushion as well as a corner and edge cushion and a cushion of tubular shape.

(However, the use of the air cushion padding must be checked with regard to environmental requirements for the respective country).

Example: Bubble wraps

Advantages of the air cushion padding:

- Easy handling
- Not hygroscopic
- Very variable in use
- Less susceptible to extreme climatic conditions
- High restoring force and optimum damping properties

Disadvantages of the air cushion padding:

- Susceptible to pointed and sharp objects such as nails or similar
- Change in cushioning properties during air transport it is possible due to low air pressure

4.4.2 Bubble wraps

The action of the bubble wrap film is basically the same as that of the air cushion padding. They consist of two plastic films welded together, one of which is completely smooth and the other has small, round recesses which enclose the necessary air after welding the two films together. Bubble wrap films are mainly used inside packaging materials. The advantages and disadvantages are the same as those of the air cushion padding.

4.4.3 Fibre padding

Fibre padding is considered a high-quality cushioning material for packaged goods with high sensitivities. It is made of animal hair or coconut fibres. After cleaning and processing to obtain nonwoven material, the fibres are provided with a rubber coating and firmly bonded together by vulcanization to obtain plates.

Example: Vibration and shock absorbing elements.

Fibre padding is relatively insensitive to the influences of moisture and temperature. They have a very good restoring force even under permanent loads.

4.4.4 Foams

Cushioning materials made of foam plastics are mainly made of polystyrene (PS), polyurethane (PU) or polyethylene (PE) materials. The foam plastics are divided into soft, semi-hard and hard plastics. An important feature of their cushioning properties is, apart from their density, their cell structure – open or closed cells.

4.4.5 Vibration and shock absorbing elements

Such “machine elements” are used in coordination with the customer for sensitive packaged goods.

Fig.40: DIN-Certco mark

4.5 Desiccant

The desiccants are supplied in bags of 1/6, 1/3, 1/2, 1, 2, 4, 8, 16 and 32 units. A desiccant unit is specified according to DIN 55 473 and is subject to constant monitoring by manufacturers of desiccant bags certified by DIN-Certco. Therefore, when using the bags, it is important to ensure that the bags are provided with an inscription with DIN designation together with the certification mark.

4.6 Transport monitoring systems

Example: built-in humidity indicator

4.6.1 Humidity indicator

Humidity indicators are mainly used for long-term storage in connection with the desiccant method (see chapter 2.3.). They indicate whether the relative humidity in a closed (conditionally water vapour-tight) package has exceeded a permissible limit value. The humidity indicators are calibrated at a temperature of 20 °C and the display is reversible. It is recommended to use an appropriate data logger to ensure a reliable determination of the relative humidity.

4.6.2 Shock indicator

Shock indicators are available for different sensitivity levels. An irreversible discolouration of the indicator indicates a shock event that has exceeded the limit value. These indicators are mainly used for smaller packages, which are therefore more shock prone. In addition, a clear warning attached as a sticker can indicate the presence of a shock indicator.

4.6.3 Tilt indicator

Tilt indicators are mainly used for tipping-prone and smaller packages. If a tilt angle is exceeded, an indicator becomes irreversibly discoloured. In addition, a corresponding warning can be attached to the package as a sticker.

4.6.4 Data logger

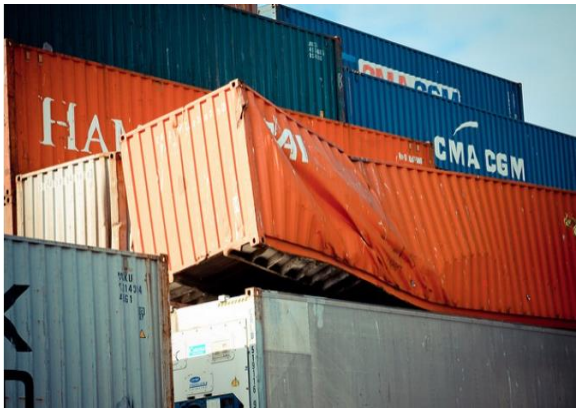
Data loggers are used to monitor, measure and store transport loads. Depending on the design, shocks, temperature, relative humidity, drop height, incidence of light, etc. can be recorded. The data logger enables the determination of the time at which an incident occurred.

4.7 Strapping

Strapping of packing cases is useful for small A3 – A6 packing cases due to the higher transport and handling loads (drop loads). In this case, strapping also holds them together. For larger packing cases, B1 – B3, and larger gross weights, strapping can be used as additional protection against unauthorized opening.

Strapping should be selected and used in accordance with DIN EN 13891.

5. Stowing of containers



5.1 Load capacity of the container

5.1.1 Container components

The side walls of the container can be loaded as follows:

Max. payload * 0.6

The following applies to the end walls and doors in the end walls:

Max. payload * 0.4

The load on side and end walls must be distributed over the entire surface!

The following applies to the surface load of the bottom: By forklift trucks with axle loads of up to 5,460 kg and a wheel contact area of at least 142 cm² per wheel.

Floor: Section load

$$\text{Permissible section load} = \frac{\text{Permissible container payload}}{\text{Inner length of the container}}$$

Real section load of a single package

$$\text{Real section load} = \frac{\text{Package mass}}{\text{Length of the support surface in longitudinal direction}}$$

Overloading of the container bottom can be ruled out if the following condition is met:

Real section load = ≤ permissible section load

Container frame: Forces can be transferred to the vertical and horizontal container frame components (rips) by supporting wood.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5.1.2 Truck loading

6. Markings

Table 9: Standardised markings Part 1

No.	Meaning of the pictograms	Pictograms	Function	Notes
1	fragile		The contents of the package are fragile and must therefore be handled with care	ISO 7000, No. 0 621
2	do not use hooks		Hooks are prohibited for handling the package	ISO 7000, No. 0 222
3	top		Indicates the correct upright position of the package	ISO 7000, No. 0 623
4	protect from heat		The package must be protected from heat	ISO 7000, No. 0 624
5	protect against radioactive radiation		The contents of the package can deteriorate or become unusable due to radioactive irradiation	ISO 7000, No. 2 401
6	keep dry		The package must be kept in a dry environment	ISO 7000, No. 0 626
7	centre of gravity		Indicates the centre of gravity of the package, which is handled as a single unit	ISO 7000, No. 0 627

Table 11: Standardised markings Part 2

8	do not roll		The package must not be rolled	ISO 7000, No. 2 405
9	not to use hand truck here		It is prohibited to use hand trucks for handling the package at this place	ISO 7000, No. 0 629
10	do not use forklift trucks		The package should not be handled with forklift trucks	ISO 7000, No. 2 405
11	clamps in the direction of the arrow		The clamps must be positioned on the indicated sides to handle the package	ISO 7000, No. 0 631
12	do not place brackets in the direction of the arrow		The package should not be handled with clamps on the indicated sides	ISO 7000, No. 2 404
13	limitation of the mass of the stacking load		Indicates the limitation of the mass of the stacking load of packages	ISO 7000, No. 0 630
14	stack limitation		The largest number of identical packages that may be stacked, where n is the number of packages allowed	ISO 7000, No. 2 403
15	do not stack		Stacking of the packages is not permitted and no load should be placed on the package	ISO 7000, No. 2 402

Table 11: Standardised markings Part 3

16	attach here		Lifting accessories must be positioned as indicated to lift the package	ISO 7000, No. 0 625
17	permissible temperature range		Indicates the temperature range in which the package must be stored and handled	ISO 7000, No. 0 632

7. Hazardous substances - Dangerous goods area

Hazardous substances are substances, mixtures or products with dangerous properties. They can cause acute or chronic damage to human health, be inflammable, explosive or dangerous for the environment.

Dangerous goods are substances and products which, during transport, may be dangerous to people, property or the environment.

7.1 Hazardous substances

Hazardous substances must be packed and labelled in accordance with the applicable regulations of the Ordinance on Hazardous Substances (GefStoffV).

The regulations of the Packaging Ordinance (VerpackV) apply to all packaging put into circulation according to the scope of the Recycling and Waste Management Act (KrW-/AbfG). For packaging which has contained harmful substances (Sect. 7) and packaging which must be labelled in accordance with the Ordinance on Hazardous Substances (GefStoffV) (Sect. 16 para. 1), there is a take-back obligation for the industrial and commercial sector. The conditions of acceptance and the procedure of the take-back system must be communicated in writing.

Suppliers of hazardous substances must submit a safety data sheet before the first delivery.

7.2 Dangerous goods

The sender is responsible for packaging and labelling of the dangerous goods (§ 411 HGB). The packaging and labelling of delivered dangerous goods must comply with the regulations of the Dangerous Goods Transportation Act (national) and the ADR/RID (international).

For transport packaging that has contained hazardous filling goods, there is a take-back obligation. The conditions of acceptance and the procedure of the take-back system must be communicated in writing.

Regulations for the transport of dangerous goods on the company premises

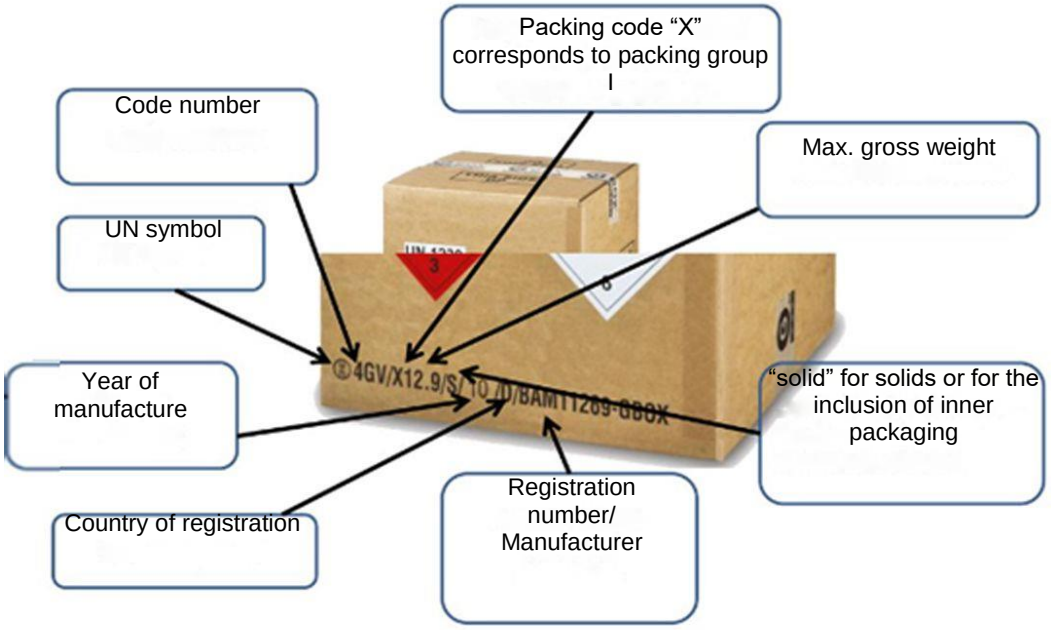
The supplier bears the sole responsibility for the transport of hazardous goods. The general rules of the Road Traffic Regulations (StVO) apply on the company premises. The vehicle driver must have a valid ADR certificate corresponding to the dangerous goods. The vehicle driver must carry a transport document and accident leaflet in accordance with ADR for the loaded dangerous goods. The marking, equipment, registration and technical condition of the vehicles must comply with the ADR regulations. The load must be secured on the vehicle in accordance with the regulations.

Marking of dangerous goods

7.2.1 Packer obligations in the transport of dangerous goods

The central tasks of the packager when shipping dangerous goods include:

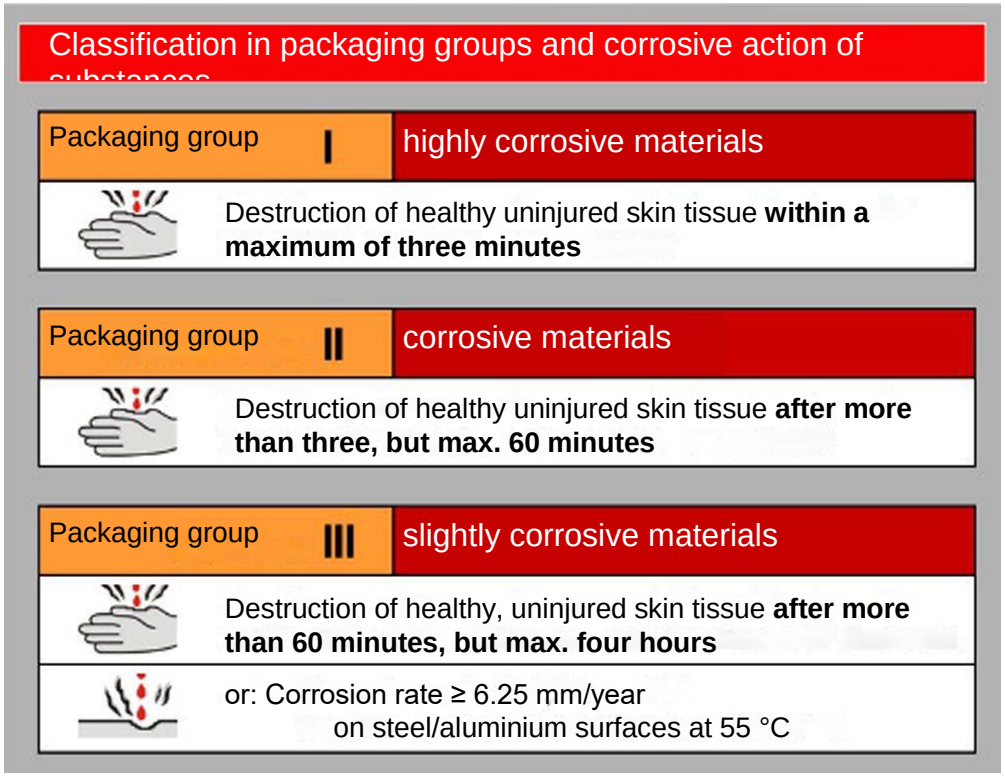
- Selection of a prescribed approved packaging
- Inspection of the packaging
- Observance of the prohibition to packing together
- Identification of the packaging



Identification of packaging

7.3 Packaging groups

- **Packaging group I:** high danger, very dangerous substance (performance letter on packaging X)
- **Packaging group II:** medium danger, dangerous substance (performance letter on packaging Y)
- **Packaging group III:** low hazard, less dangerous substance (performance letter on packaging Z)



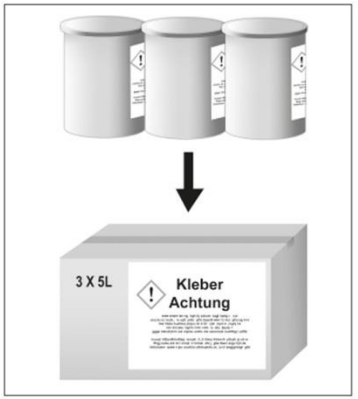


Fig. 1: Hazardous materials correctly packed according to GHS

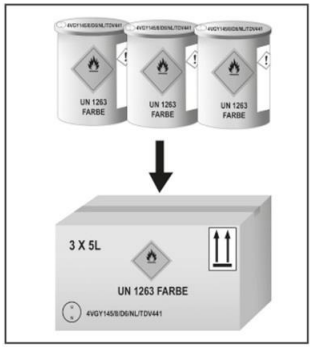


Fig. 2: Correct packing and identification of dangerous goods

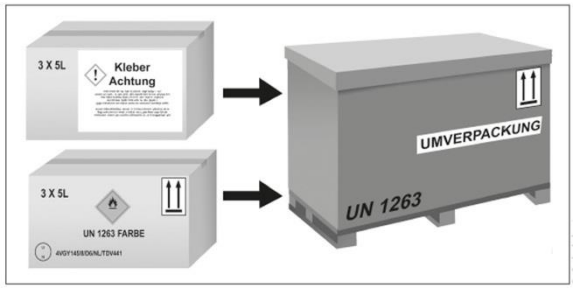


Fig. 3: The chemicals from Fig. 1 and 2 in an outer packaging

7.4 Type of packaging

1. The chemical is a hazardous substance, but not a dangerous good:

If your chemical is not subject to the regulations for the transport of dangerous goods and is to be labelled exclusively in accordance with the regulations for hazardous substances, the hazardous substance label must be affixed to the inner and outer packaging (Fig. 1). Important for you: The outer packaging of a dangerous goods consignment does not need to be labelled according to the labelling requirements for hazardous substances. This means for you: A GHS identification label is not required.

2. The chemical is both a hazardous substance and a dangerous good:

Top priority for the transport of dangerous goods: The outer packaging must be labelled according to the dangerous goods regulations. This means for you: Danger label and UN number must be attached to the outer packaging! In cases where the meaning of the hazard label is identical to the meaning of a hazard pictogram, the hazard label may be used instead of the hazard pictogram for labelling inner and outer packaging. Pictograms for which there is no equivalent hazard label must always be present in addition in the labelling of the inner packaging (Fig. 2).

3. Hazardous substance and dangerous goods in an overpackaging:

It goes without saying that you can send a box with of hazardous substances in an overpackaging together with a box filled with hazardous goods. In this case, all dangerous goods labels must also be attached to the outer packaging. In addition, the labelling must contain the text “OVERPAKING” (Fig. 3).

8. Packing list samples and other important information for suppliers

Supplier designation no. Address

Knauf Engineering GmbH
Logistics
Alte Reichsstr. 31
97346 Iphofen

PACKING LIST No./Ne

Order number:

Complete delivery ☐ Partial delivery ☐ Residual delivery ☐

Package number	Packaging		Weight		Volume	Dimension (cm)			Individual weight	Quantity	Order item	Order short text	Customs tariff number	Country of origin
	Quantity	Type*	Net kg	Gross kg	Volume m^3	Length	Width	Height	Net kg					
* Packaging type: 1 Packing case, 2 *Crate. 3 = Overpacked/loose. 4 = Slide. 5 = Bundle. 8 = Box. 7 = Drum, 8 = Bucket. 9 Bag. 10 = Sack. 11 = Pallet. 12 -Basket. 13 = Roll. W = Coil. 15 = Container														
Package	0		0	0										

Important information

for suppliers

The following information is to be indicated on **all** delivery documents (delivery note. packing list, invoice, etc.):

1. Order number
2. Order items per delivery item
3. Order short text according to purchase order per delivery item
4. Information on completeness of the delivery (partial, complete or residual delivery)
5. Notes / information on dangerous goods or hazardous substances incl. safety data sheet

In addition, a supplier's declaration and a *certificate of origin* (6427/6427) must be submitted with the notification of readiness for dispatch.

Without this information, the goods receipt posting is not possible. Furthermore, invoices addressed to us cannot be released and paid.

Please use the attached sample when preparing the packing list.

9. For further questions...

- ***Regarding transport organisation, notification of readiness for dispatch, necessary documents, import regulations, contact:***

Alexander Lindenmayr

Project Office & Shipment Monitoring

Lindenmayr.alexander@knauf.de

Tel. +49 9323 31 496

Nicola Weiglein

Project Office & Shipment Monitoring

Weiglein.nicola@knauf.de

Tel. +49 9323 31 2214

- ***For pickup / loading of the delivering content:***

Karlheinz Eichelmann

Logistics - Iphofen

Eichelmann.karlheinz@knauf.de

Tel. +49 9323 31 1680

- ***For packaging / hazardous goods and delivery to Warehouse Iphofen:***

Andreas Noack

Warehouse - Iphofen

Noack.andreas@knauf.de

Tel. +49 9323 31 4048