Rail Vehicle Systems

Packaging Handbook for purchased parts

KNORR-BREMSE

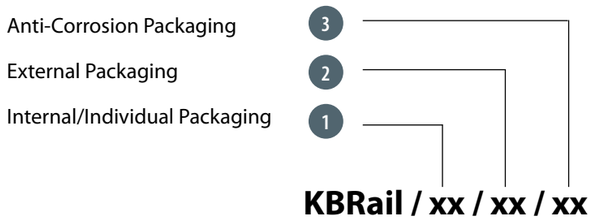
	KNORR-BREMSE PROTECTION REQUIREMENTS							
Knorr-Bremse Packaging Specifications*	Dimensions of parts			Surface Protection		Anti-Corrosion Protection Particularly sea freight, and long transport/storage times	UV Light	ESD-Protection
	Small	Medium	Large	Bulk Goods	Individual goods Surface protection required			
KBRail/A/B	X	X		X				
KBRail/A/B-VCI	X	X		X		X		
KBRail/E/B	X	X			X			
KBRail/E/B/VCI	X	X			X	X		
KBRail/F/B	X	X	X		X			
KBRail/F/B/VCI	X	X	X		X	X		

PART PROTECTION CODE (MM03)	DESCRIPTION
A	Plastic bag
B	Cardboard/Corrugated cardboard box
C	Wrapping paper
D	Sorting board/KB plastic insert tray
E	Tray
F	Netting tube
G	Bubble wrap/bag
H	Foam
I	Stretch wrap
J	Styrofoam protection
K	Cardboard cover
L	ESD protection
S	Paper packaging
Z	Specialised packaging
VCI	VCI film

KNORR-BREMSE RECOMMENDATION				
Internal/Individual Packaging		Anti-Corrosion Packaging	External Packaging	
Bag/plastic pouch	Chapter 4.1.1		Cardboard/Corrugated cardboard box	Chapter 4.2.2
Bag/plastic pouch	Chapter 4.1.1	VCI film/anti-condensation bag	Cardboard/Corrugated cardboard box	Chapter 4.2.2
KB plastic insert tray	Chapter 4.1.2		Cardboard/Corrugated cardboard box	Chapter 4.2.2
KB plastic insert tray	Chapter 4.1.2	VCI film/anti-condensation bag	Cardboard/Corrugated cardboard box	Chapter 4.2.2
Netting	Chapter 4.1.4		Cardboard/Corrugated cardboard box	Chapter 4.2.2
Netting	Chapter 4.1.4	VCI film/anti-condensation bag	Cardboard/Corrugated cardboard box	Chapter 4.2.2

If required to ensure packaging is secure and conveniently transportable, packaging accessories are to be independently selected and applied by the supplier.

***Knorr-Bremse Packaging Specifications:**



x = Part Protection Code pursuant to MM03

Introduction

The following guidelines and specifications of Knorr-Bremse Rail Vehicle Systems and its subsidiary companies lay the basis for the supply of parts (production materials and trading goods) to Knorr-Bremse's European locations. These guidelines and specifications serve as a supplementary contractual agreement to the General Terms and Conditions of Purchasing and Ordering.

This Knorr-Bremse packaging handbook is to be distributed to potential Knorr-Bremse suppliers together with the requisite quote documentation or prior to this.

1.1 OBJECTIVE OF THE PACKAGING HANDBOOK

This packaging handbook provides suppliers with information on the packaging specifications of Knorr-Bremse. Using these specifications as a framework for the development of an optimised packaging system, the objective is to guarantee a smooth flow of materials between the supplier and Knorr-Bremse, which incorporates all qualitative, ecological and financial considerations.

Furthermore, the purpose of the packaging handbook is to serve as a guide in the purchasing process at Knorr-Bremse. This allows Knorr-Bremse to advise their suppliers and provide support in the selection and application of optimum delivery packaging, and, as far as is financially justifiable, to minimise any potentially harmful environmental effects.

The target is the continuous shaping of the logistical chain, together with the cooperative exploitation of the streamlining potential this brings.

1.2 SCOPE OF THE PACKAGING HANDBOOK

This packaging handbook applies to all Knorr-Bremse suppliers delivering parts at Knorr-Bremse locations detailed in Appendix 1.

Queries relating to packaging at Knorr-Bremse are handled by the relevant contact person in the Purchasing and Quality departments.

1.3 GLOSSARY OF TERMS

Packaged goods

+

Packaging components

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Packaging accessories

=

Package

PARTS
All purchased materials used or applied in the production process, as well as trading goods and replacement parts.

ITEM
Parts with the same item number.

PACKAGED GOODS
Parts to be packaged.

PACKAGING COMPONENTS
The container(s) in which the packaged goods are placed. The range of packaging components includes: plastic insert tray, box, bag, SLC, netting tube etc.

PACKAGING ACCESSORIES
Besides aiding the sealing and securing of the packages, packaging components or unit loads, these accessories protect the packaged goods (e.g. stretch wrap, anti-corrosion paper, strapping tape).

PACKAGE
Unit for transport or storage.

PACKAGING
Complete or partial physical envelopment of packaged goods for the purpose of limiting the quantity of goods or for protecting the goods. The packaging should protect the packaged good itself as well as other goods from damage, while also preventing injury to any persons handling the goods.

INTERNAL/INDIVIDUAL PACKAGING
Smallest packaging unit. This may only contain one item (parts with the same part number).
The function of internal packaging is to provide padding or secure parts according to their fragility within the external packaging.

EXTERNAL PACKAGING
Combines several internal/individual pieces of packaging.
The function of external packaging is to withstand the internal and external forces (pressure, inert forces etc.) acting against the package.

ONE-WAY PACKAGING
Packaging intended for one-off use, i.e. it cannot be reused. After use, it is to be recycled.

REUSABLE PACKAGING
Packaging intended for repeated use, i.e. it can be reused.

LOAD CARRIER
Medium for carrying packages to allow their integration into one unit load, e.g. pallets, mesh pallets and wooden boxes.
The function of the load carrier is to protect the package during transportation and to ensure its secure transport and storage.

UNIT LOAD
A unit load comprises the combination of load carrier (e.g. pallets, mesh pallets etc.) and package.

LOAD
The total number of unit loads.

RESY (RECYCLING SYSTEM)
Standardised label indicating the extent to which utilised packaging components and packaging accessories can be recycled.

PRESERVATION
The purpose of preservation is to guarantee protection against harmful influences during a temporary, limited period of time. In doing so, the packaged good is kept in good condition at the time that preservation is implemented.

General Packaging Requirements

The supplier is obligated to accept responsibility for ensuring that all delivered parts are correctly and adequately preserved, protected and packaged in order that they safely reach their destination at a Knorr-Bremse location.

The supplier must observe the packaging handbook specifications, while also taking into account the existence of potential national or international specifications.

Knorr-Bremse demands the application of recyclable materials for both one-way and reusable packaging/load carriers; reusable packaging and load carriers are the preferred option.

For this reason, it is the waste management goal of both Knorr-Bremse and its suppliers to adhere to environmental legislation according to the ecological principle "Vermeidung vor Verminderung vor stofflicher Verwertung" (prevention before reduction before recycling). Employing this policy will result in a consistent contribution to the reduction of waste.

→ Packaging waste prevention
Keep packaging waste quantity to a minimum.

→ Packaging reduction
All reusable and one-way packaging must be defined according to its ecological and economical impact, and only essential packaging should be used.

→ Packaging recycling
Reusable and one-way packaging must be compatible with an environmentally compliant recycling process.

Irrespective of packaging format selection, deliveries must always fulfil the following requirements:

- Defect-free delivery of parts
- Delivery exclusively within clean packaging
- Economically and efficiently constructed unit loads
- Efficient use of space
- Stackability
- Stability in terms of state, form and volume
- Problem-free unloading via ground conveyor
- Secure transport
- Observation of prescribed dimension specifications
- Easy removal of parts/optimum handling in assembly
- Correct identification through use of standardised labelling
- Recyclable materials
- Guaranteed anti-corrosion protection

2.1 PROVISION OF PACKAGING

Based on the requirements of the Knorr-Bremse packaging handbook, the provision of packaging is effected by the supplier. It is therefore the supplier's obligation to accept responsibility for the appropriate implementation of the specifications stipulated by the packaging handbook.

However, Knorr-Bremse is within its rights to independently specify to the supplier the mandatory use of required packaging, e.g. in the case of any fragile parts with particular protection requirements, at any time.

Irrespective of such circumstances, the responsibility for the defect-free delivery of parts to the Knorr-Bremse delivery point remains with the supplier.

In the event that the specified packaging is not adhered to, or the packaging handbook specifications ignored, Knorr-Bremse reserves the right to charge the supplier an administration fee for any additional costs arising from handling, repackaging or waste disposal. The supplier is deemed liable for any damage to quality resulting from the inadequate or stained packaging of parts. Under justifiable circumstances, irregularities (e.g. alternative packaging on production run start-up) must be punctually agreed upon with the respective Knorr-Bremse location, and the appropriate comment ("Alternative Packaging") included on the delivery receipt.

Packaging specified or approved by Knorr-Bremse in the production process may be changed at any point following first receipt of delivery.

The following procedure is therefore possible in the provision of packaging:

→ ***Packaging handbook***
Supplier selects appropriate packaging based on the requirements of the packaging manual.

→ ***Knorr-Bremse specification***
Mandatory packaging to be used is specified by Knorr-Bremse.

The principle of packaging selection is to comply with the properties of the individual parts, the protection requirements, the transport format and the supplier conditions.

2.2 SAFETY AND THE ENVIRONMENT

On delivery of all materials from suppliers to Knorr-Bremse, it is a minimum requirement that the respectively valid legal provisions governing packaging, transport, storage and components be fulfilled. In addition, the application of the environmental, electric and electromagnetic provisions existing in the countries of production and operation is compulsory.

2.2.1 HAZARDOUS MATERIALS

Hazardous materials are substances that pose an actual danger to humans, animals, the environment or public safety and order when being transported through the public domain.

On delivery of hazardous materials, it is essential that all local provisions concerning the marking and transportation of hazardous materials are observed. Knorr-Bremse must be supplied with safety data sheets concerning this prior to delivery.

Labelling is carried out according to the internationally recognised Hazardous Materials Code.

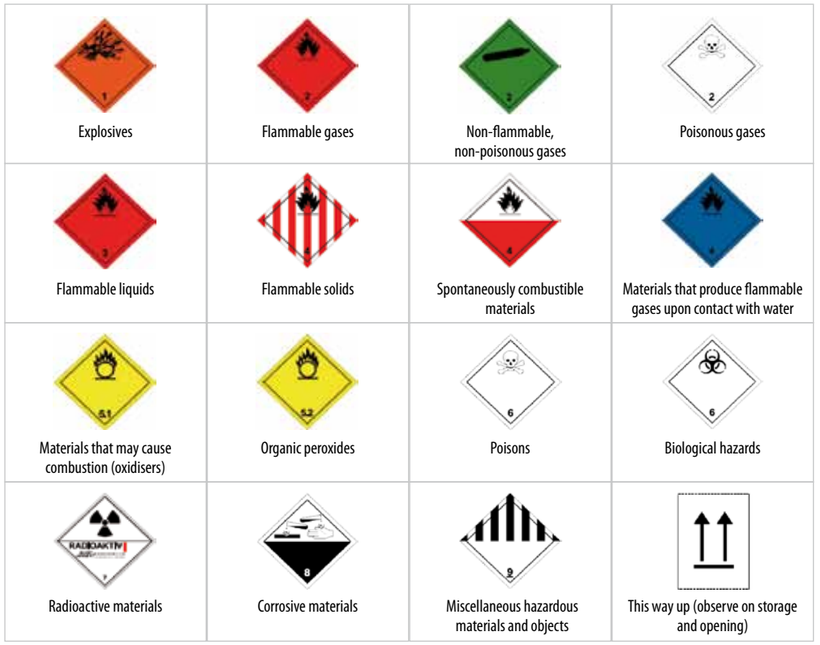


Figure 2.1: Hazardous Materials Symbols

2.2.2 PERMITTED AND PROHIBITED PACKAGING MATERIALS

In order to keep the logistical costs of the separation and collection of material types to a minimum, and to achieve an optimum recycling procedure, only certain pre-defined recyclable materials are permitted for use.

All one-way packaging is produced using environmentally friendly materials that are globally recognised as recyclable substances. The use of compounds and loose filler materials, such as packaging chips, is to be kept to a minimum

The fundamental objective is the use of reusable packaging.

Table 2.1 offers an overview of the permitted packaging materials at Knorr-Bremse.

MATERIAL	PERMITTED MATERIALS	PROHIBITED MATERIALS
Compounds	–	Compounds are not permitted
General plastics • One-way • Reusable	 PE, PP, PS, PET Labelling subject to DIN6120 PE, PP, PET, ABS Labelling subject to DIN6120	 PVC, PC, Styrofoam PVC, PC, Styrofoam
Plastic packaging components • Film • Bags and sacks • Protective/insulating caps • Thermoformed insert • Foam	 PE PE PE PE, PP, PS, PET, ABS PE, (PP also if reusable)	–
Paper board and paper	Identification and management must comply with RESY.	Paper with water-insoluble layer (e.g. wax, paraffin, bitumen, oil, masking tape)
Strapping	PP, PET	Steel strapping, Polyamide tape, Polyester tape
Anti-corrosion paper	Only VCI paper verified as recyclable with paper/cardboard	Incompatible waterproof or soaked paper (e.g. bitumen, oil and wax paper)
Wood	In accordance with IPPC standard, high-density fibreboard sheets/pallets	Waterproof, varnished, coated wood; wood shavings
Filler materials	Corrugated cardboard, paper, foam compound	Chips (plant-based); Styrofoam chips or part-adjusted block

Table 2.1: Permitted and prohibited materials

In extenuating, exceptional circumstances, a supplier may be permitted to use bitumen, wax, paraffin and oil paper, as well as styrofoam. Written approval from Knorr-Bremse is required in advance.

The packaging material must not affect the clean condition of parts.

PROHIBITED MATERIALS

Packaging materials must not exceed the cumulative concentration limit of 100 ppm for lead, cadmium, mercury and chromate, as described in the EU Packaging and Packaging Waste Directive (94/62/EG).

Furthermore, the supplier must observe the trade-specific list of "prohibited ingredients" (black list) and the "notifiable substances" list (grey list) in all future orders, parts production and packaging selection.

2.2.3 REQUIREMENTS FOR WOOD AND WOOD-BASED MATERIALS

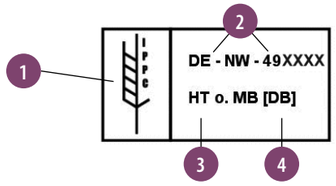
It is essential that packaging materials made from solid wood are handled and labelled according to the IPPC (International Plant Protection Convention).

IPPC labelling requires the following information:

1. IPPC symbol,
2. Company licence number with the country ISO code and regional identifier,
3. Treatment method (HT for heat treatment or MB for gassing with methyl bromide),
4. DB for debarked wood, where applicable (not required by the IPPC Standard).

EXAMPLES

IPPC identification symbol:



Example stamp:

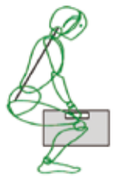
2.3 WEIGHT RESTRICTIONS

The permitted weight limit for packages and load carriers may only be exceeded if technical conditions render adherence to the permitted weight limit impossible.

The total weight must be clearly and visibly marked on the package or load carrier.

2.3.1 LIFTING PACKAGES BY HAND

In order to ensure a minimum risk of injury to the employees of Knorr-Bremse and its suppliers, the (gross) permitted weight limit for a package of up to **20 kg** must not be exceeded.



Any packages weighing over 20 kg must always be delivered on load carriers designed specifically for this purpose.

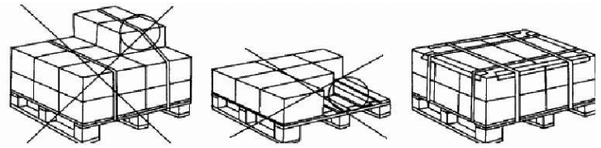
2.3.2 LOAD CARRIERS

The permitted weight limit for load carriers is 1000 kg. This may only be exceeded if written approval from Knorr-Bremse has been received.

2.4 POSITIONING OF PACKAGED GOODS AND PACKAGES

The packaged good should be arranged within the packaging/packaging components to allow an even weight distribution. The size of the packaging should reflect the size of the packaged good. To ensure that the packaged good does not slip out of position during transport and handling, all empty spaces in the packaging components should be filled.

The package should be positioned on the load carrier to allow an even weight distribution. The basic size of the load carrier must not be exceeded by the package.

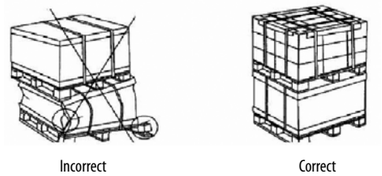


Incorrect Incorrect Correct

If the packages do not completely cover the load carrier, they should be arranged to allow an even weight distribution and to prevent them from slipping out of position.

2.5 UNIT LOAD STACKABILITY

One of the most important properties of a unit load is its stackability. This must guarantee that pallets etc. can be securely piled on top of each other (stacked) with or without any stacking support.



Incorrect Correct

Should unit loads not be stackable due to the condition of the packaged good, they must be labelled accordingly.

2.6 GENERAL ANTI-CORROSION PROTECTION

Corrosion is the process of damage or deterioration of materials through chemical or electrochemical reactions taking place with other surrounding materials. The corrosive agents involved – substances within the immediate proximity of the parts, e.g. dirt, gases, salts or dust – impact on the material and cause corrosion.

All parts susceptible to corrosion, as well as all worked and smoothed surfaces (particularly worked castings and forgings), require specific protection and protective steps must therefore be taken to prevent corrosion.

Preventative protective measures consist of material anti-corrosion protection and protection against corrosion through adequate packaging.

The format, nature and timing of anti-corrosion protection depends on the:

- required protection according to Knorr-Bremse specifications and charts,
- susceptibility of technical surfaces to corrosion and other harmful factors (dust, stains etc.),
- transport conditions, duration of transport,
- storage conditions and duration of storage,
- subsequent treatment,
- subsequent usage.

MATERIAL ANTI-CORROSION PROTECTION

Provided that no other agreement has been reached, the supplier must implement the anti-corrosion measures required by Knorr-Bremse, according to the valid specification/chart. Parts delivered without the agreed anti-corrosion protection are considered as unsatisfactory and will be reported to the supplier.

Only preservation agents permitted by Knorr-Bremse (Knorr-Bremse In-House Standard N12005) may be used.

ANTI-CORROSION PROTECTION FOR PACKAGING

Irrespective of any material anti-corrosion protection applied, delivery must ensure that parts are protected against corrosive agents and surface damage during transport and storage.

Appropriate materials for the protection of parts are caps, film, stoppers and covers. If considered necessary, anti-corrosion film (e.g. VCI film or VCI paper) compatible with normal film/paper recycling procedures must be used.

ANTI-CORROSION FILM/VCI FILM

Anti-corrosion film contains chemical substances (VCI) which gradually evaporate. They form a protective layer over the surface of the packaged parts which displaces oxygen. It is usually sufficient for the parts to be enveloped by the protective film; however, the gap between anti-corrosion film and part must not exceed 30 cm.

Although airtight packaging is not necessary, the VCI film must be within an enclosed package in order to ensure that the anti-corrosion protection takes effect. The anti-corrosion film must be adjusted to match the respective parts and/or their composition. In the case of components of varied composition, it is possible that only some of the parts will be protected against corrosion. Under such circumstances, it is advisable that a drying agent be used to achieve the best protection.

DRYING AGENT

Drying agents can be used to avoid incidences of corrosion and moisture damage, as well as mould infestations, during sea and air-freighting. Drying agents are managed in drying agent units; the absorption degree of a drying agent is governed by the quantity of these units.

A sufficient quantity of drying agent bags must be arranged for the packaged goods. For this purpose, attention must be paid both to the correct positioning of the bags and to ensuring that the packaging is tightly sealed. The drying agent must not come into direct contact with the parts, as the moisture in the drying agent can cause corrosion.

Prior to delivery to Knorr-Bremse, it must be ensured that all parts susceptible to corrosion are correctly preserved, wrapped or sealed, and packaged.

In this context, correct is defined as:

- Implementation of material anti-corrosion protection according to the determined specifications
- External protection against corrosive agents
- External protection against surface damage/abrasion of the anti-corrosion protection
- External protection against damage to appearance or function

The selected anti-corrosion packaging must not damage the appearance or function of the parts.

Labelling/ Accompanying Information

The clear and systematic labelling of packages and unit loads, coupled with the transfer of the required accompanying information, is essential for the quick and clear identification of the delivered parts.

3.1 LABELLING

Each individual package containing an item must be clearly and visibly labelled on its top face.

All external packages containing several individual packages must be labelled on each horizontal and vertical side, as well as on the top face. This guarantees the quick, clear identification of each package.

To avoid any confusion of parts during the procedure, only the current label may be on the package. This must be clearly and visibly attached to the package. All old labels, including adhesive tags, must be removed.

The label should contain at least the following information:

- Knorr-Bremse item number
- Knorr-Bremse item description
- Quantity

The supplier must ensure that any lettering on any external or internal packaging, as well as packaging accessories (including cardboard containers, adhesive tapes, plastic bags, sealing films, stickers), together with the corresponding data sheets, handbooks, software and other parts documents, is only data pertaining to the supplier or the original manufacturer and is positioned where legally required for the transport of parts.

The external and internal packaging may otherwise only contain the name, trademark or other identification of Knorr-Bremse. If this is not possible, it must – insofar as is legally permitted – carry no indication of origin. Exceptions are only possible with the express approval of Knorr-Bremse.

3.2 DELIVERY DOCUMENTATION

As a minimum requirement, the following delivery/freight documentation must be enclosed with each delivery:

- ➔ Delivery receipt
- ➔ Hazardous materials data sheet (if necessary)

Goods batches will only be accepted when accompanied by complete delivery/freight documentation. Any additional delivery documentation required by Knorr-Bremse (e.g. quality documents) must be enclosed in an envelope separate to the delivery and must not be attached to the delivery receipt.

A list detailing the package contents and stating the order number must be enclosed with every package.

3.2.1 DELIVERY RECEIPT

A delivery receipt (goods issue receipt) is a document providing information on the delivered parts, including quantity, description, weight etc. The delivery receipt is preferably to be deposited within the package (above the parts). However, attachment of this document to the outside of the package using a self-adhesive delivery receipt wallet is also acceptable.

The following list details the most important contents of a delivery receipt:

- ➔ Delivery receipt number
- ➔ Name & address of sender
- ➔ Name & address of recipient
- ➔ Delivery receipt date
- ➔ Name or signature (optional) of packer
- ➔ Gross weight, net weight
- ➔ Delivery receipt position
- ➔ Name of buyer (contact person)
- ➔ Order number
- ➔ Order date
- ➔ Order position
- ➔ Knorr-Bremse item number
- ➔ Knorr-Bremse item description
- ➔ Supplier item number
- ➔ Delivery quantity (per order item) in quantity units
- ➔ Knorr-Bremse quantity unit
- ➔ Type of load carrier (if required)
- ➔ No. of empty containers
- ➔ Production date, expiration date (if required)
- ➔ Batch number (if required)

In order to ensure the quick identification of delivered parts and to avoid errors in incoming goods collection, delivery receipts should (where possible) be supplied with a barcode. If requested, the delivery receipt must be supplied with a barcode corresponding to Knorr-Bremse requisite specifications.

3.2.2 BARCODE

The barcode to be applied conforms to Code Type 128 pursuant to DIN EN799.

Barcode Contents

The Knorr-Bremse-specific barcode must contain the following information and be structured as follows:

1. Supplier delivery receipt number
2. Knorr-Bremse order number (without purchase group code)
3. Knorr-Bremse order position (not delivery receipt position)
4. Delivery quantity in Knorr-Bremse quantity units
   (without details of unit quantity)

This data must be printed on the barcode in this order, separated by a #. The data must additionally appear as legible text underneath the bar code.

Figure 3.1: Format and appearance of a Knorr-Bremse-specific barcode

Figure 3.1 displays an example Knorr-Bremse-specific barcode. This contains, in sequence, the supplier delivery receipt 41089, the Knorr-Bremse order number 4630074632, the Knorr-Bremse order position 10 and the delivery quantity 4.

Barcode Format and Position

The font type Univers Condensed must be used for the text. The font size is determined by the bar width/gap parameters, which are defined below.

The barcode is to be printed in black and white. Its height must be 9-10 mm. The bar-gap width ratio sequence is 6, 12, 18, 24 (B-Parameter/S-Parameter in ESC sequence).

If the delivery receipt number is alphanumeric, capital letters must be used. Within this information, spaces and symbols (except #) are permitted. The delivery receipt number may reach a maximum of 16 characters (including spaces and symbols). Spaces and symbols are not permitted in any fully numerical barcodes. No character may be printed before the first or after the last piece of data (delivery receipt number/delivery quantity). The gap separating the outer ends of the barcode field from borders, other bars and characters should be at least 6.4 mm.

The following additional requirements apply to Knorr-Bremse-specific barcodes

Order position information must not exceed 5 digits. It is not necessary to print leading zeros.

Decimal separation within quantity information must be carried out using a comma, while thousands separators are not permitted. The quantity field is restricted to 17 digits.

For each delivery receipt position, the barcode must be printed on the corresponding delivery receipt position line below the position description.

3.3 HANDLING INSTRUCTION SYMBOLS

If a packaged good requires particular package handling, this must be clearly and visibly indicated on the outside of the packaging. The internationally standardised handling symbols for packages are specified in ISO R780 and DIN 55 402.

These self-explanatory symbols must not be omitted under any circumstance, as they serve to avoid language-barrier issues arising from international transport. The most important symbols are summarised in Table 3.1:

	Fragile, Handle with care		Use no hooks
	This way up		Keep away from heat
	Protect from heat and radioactive sources		Sling here
	Keep dry		Centre of gravity
	No hand truck here		Stacking limitation
	Clamp here		Temperature limitations
	Do not use fork lift truck here		Electrostatic sensitive device
	Do not destroy barrier		Tear off here

Table 3.1: Package markings in accordance with DIN 55402 and ISO R 780 standards

Standardised packaging

Knorr-Bremse demands the application of recyclable materials for both one-way and reusable packaging/load carriers, although reusable is greatly preferred to one-way.

In order to keep packaging component costs as low as possible and to avoid the high expense incurred by disposable packaging, the renewed use of standardised packaging is to be undertaken.

Standardised packaging is divided into specific Knorr-Bremse standardised reusable packaging (e.g. KB plastic insert trays, part-adjusted inlays/inserts etc.), which is normally the property of Knorr-Bremse; as well as generally established standardised packaging (e.g. cardboard, corrugated cardboard, netting tubes etc.).

Knorr-Bremse separates packaging into 3 types: internal packaging, external packaging and load carriers:

- The function of the internal packaging is to provide padding or to secure parts within the external packaging, depending on their level of fragility.
- The function of the external packaging is to withstand the internal and external forces (pressure, inert forces etc.) acting against the package.
- The function of the load carrier is to protect the packaged good during transport and to ensure its secure transport and storage.

The selection of the packaging format is determined by the part properties, protection requirements, transport format and supplier location conditions.

Various aids are required to guarantee a smooth, secure transport. These can include packaging accessories (e.g. stacking frame, edge support etc.) or padding, used to better secure the parts (e.g. bubble wrap or packaging paper etc.). In addition, a number of forms of anti-corrosion packaging (e.g. VCI film and VCI paper) may be used to counteract any possible corrosion, which may take place during transport itself.

Standardised packaging is designed in such a way that, if correctly used, it will meet all the requirements of handling, storage and transport. It therefore offers a full range of qualities including the protection of the packaged good, protection of the space surrounding the packaged good, simple and secure package handling, ease of storage and guaranteed safety and simplicity in handling the packaging either by hand or using a forklift truck.

INTERNAL/EXTERNAL PACKAGING, INSERTS
Bag/plastic pouch
Cardboard/corrugated cardboard packaging
Netting tube
KB plastic insert tray
KB specialised part-adjusted inlay (produced by Knorr-Bremse)
Protective dividing inlay
Divider

EXTERNAL PACKAGING
Cardboard/corrugated cardboard packaging
Reusable container, SLC
Wooden box

LOAD CARRIERS
Euro pallet
One-way pallet
Euro mesh pallet
Wooden box

PACKAGING ACCESSORIES
Fold-away stacking frame
Stacking frame
Stretch wrap/shrink wrap/sheet cover
Strapping using synthetic tape/metal tape
Loading support
Edge support/corner support

PADDING
Bubble wrap
Air bags
Packaging paper
Foam

ANTI-CORROSION PACKAGING
VCI film
VCI paper
Anti-condensation bags

The supplier assumes responsibility for ordering all one-way and reusable packaging provided by Knorr-Bremse.

Suppliers will be charged for any costs incurred by the unauthorised disposal of Knorr-Bremse reusable packaging.

4.1 INTERNAL/INDIVIDUAL PACKAGING

In order to ensure the protection of parts and smooth handling, the packaging of a number of parts requires internal or individual packaging.

Internal/individual packaging is the smallest packaging unit, and may only contain one item (parts with the same item number).

This packaging can be
➔ reusable, or
➔ manufactured from one-way materials.

Reusable internal packaging includes:
- KB plastic insert trays
- KB specialised part-adjusted inlays
- Plastic dividers or protective dividing inlays

Parts may only be packaged within clean reusable packaging. Any stained reusable packaging must be cleaned by the supplier before use. Any costs incurred by this are to be borne by the supplier.

Used reusable packages may only be reused if they are able to fulfil the same standard requirements and protection of parts as brand new reusable packaging.

One-way internal packaging includes:
- Bags/plastic pouches
- Corrugated/cardboard packaging
- Netting tubes
- Inserts, inlays or pre-cut fibreboard

If not detailed in the Knorr-Bremse packaging handbook or otherwise specified by Knorr-Bremse, the responsibility for establishing the need for internal packaging and managing its implementation is assumed by the supplier. However, Knorr-Bremse retains the right to monitor this procedure.

4.1.1 BAGS/PLASTIC POUCHES

For bulk goods or small parts requiring no particular surface protection, the use of bags or plastic pouches is recommended. This allows the packaged goods to remain in direct contact with each other.

PROPERTIES	BAG/PLASTIC POUCH
Dimensions	Dependent on weight and volume of packaged good.
Closure	Includes zip, heat seal, adhesive tape
Usage	Bags are not permitted as stand-alone load. They must be transported in a stable container or be placed on a load carrier. This packaging format is mainly used for bulk goods, particularly small parts such as screws, washers etc.
Conditions of use	Permitted bags must not contain rips, holes, leaks or deficient zips.
Special case	Use of VCI bags for items susceptible to corrosion.

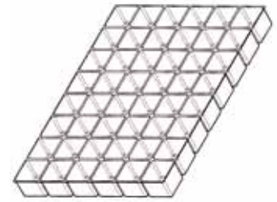
EXAMPLES OF USE:

EXAMPLE OF INCORRECT USE:

Opening requires the use of a cutting tool, causing danger of injury or damage.

4.1.2 KB PLASTIC INSERT TRAYS

For small to medium-sized parts requiring specialised packaging protection against the possibility of transport damage, Knorr-Bremse recommends the use of KB plastic insert trays. This not only ensures defect-free delivery of parts, but also improves the material flow from supplier to Knorr-Bremse by providing optimum handling, easy removal of parts, stackability, stability and optimum space usage.



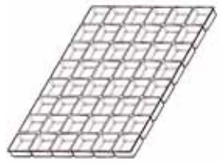
Knorr-Bremse recommends the plastic insert trays in view of the following aims:

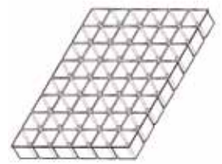
- ➔ Defect-free delivery of parts
- ➔ Stability in terms of state, form and volume
- ➔ Optimum space usage
- ➔ Stackability
- ➔ Easy removal of parts/optimum handling in assembly

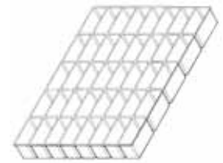
PROPERTIES	KB PLASTIC INSERT TRAY
Dimensions	All plastic insert trays measure 329 x 243 mm and have a material density of 0.7 mm. Compartment size varies according to plastic insert tray type.
Permitted total weight	–
Requirements	Plastic insert tray must be carefully chosen with consideration given to compartment size and dimensions of packaged goods. Parts may not exceed the height of the insert trays. Easy removal and optimum space usage must both be ensured.
Stackability	Plastic insert trays must be completely stackable without modification.
Usage	Plastic insert trays are used as internal/individual packaging. Use when dealing with parts with specific protection or handling requirements. Plastic insert trays should be filled fully (no. of compartments = no. of parts) and for optimum use (compartment dimensions > part dimensions).
Conditions of use	Do not use damaged plastic insert trays (e.g. crushed, cracked or crumpled trays). Trays cut to size may not be reused.

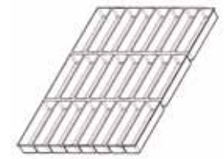
THE FOLLOWING KB PLASTIC INSERT TRAYS ARE USED:

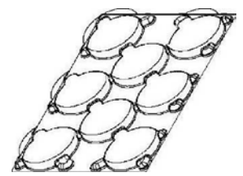
TYP 1A		
	Length:	27 mm
	Width:	26 mm
	Depth:	15 mm
	Compartments:	88

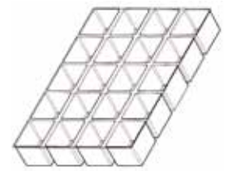
TYP 2A		
	Length:	38 mm
	Width:	38 mm
	Depth:	15 mm
	Compartments:	48

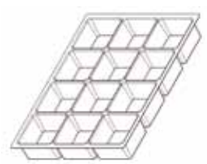
TYP 2		
	Length:	38 mm
	Width:	38 mm
	Depth:	30 mm
	Compartments:	48

TYP 4		
	Length:	62 mm
	Width:	28 mm
	Depth:	35 mm
	Compartments:	40

TYP K01		
	Length:	105 mm
	Width:	28 mm
	Depth:	20 mm
	Compartments:	24

TYP 5		
	Length:	89,45 mm
	Depth:	15,5 mm
	Compartments:	8

TYP 3		
	Length:	61 mm
	Width:	54 mm
	Depth:	47 mm
	Compartments:	20

TYP K02		
	Length:	72 mm
	Width:	68 mm
	Depth:	40 mm
	Compartments:	12

KB plastic insert trays may not be used for the packaging and dispatch of parts **not** intended for Knorr-Bremse.

EXAMPLES OF USE:

EXAMPLE OF INCORRECT USE:

Inappropriate tray type selected
(Over-sized compartments)

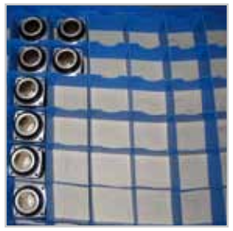
4.1.3 KB SPECIALISED PART-ADJUSTED INLAYS/DIVIDERS

For the transport and storage of parts with a particular finish or geometry (e.g. external thread, specific varnishing etc.), specialised protection is required.

Under such circumstances, part-specific Knorr-Bremse inlays and dividers can be used. To meet the specific requirements of each particular case, Knorr-Bremse and the supplier work together to determine the type of inlay or insert to be implemented, carrying out any necessary adjustments.

PROPERTIES	PART-ADJUSTED INLAYS/DIVIDERS
Dimensions	Varies according to area of use. Individually adjusted to fit the packaged goods.
Permitted total weight	Dependent on insert type and packaged good
Requirements	All inlays and dividers must guarantee sufficient transport and stacking stability, and must be shock-resistant and able to withstand direct contact with other objects. Must guarantee protection of part.
Stackability	Inlays and dividers must be stackable without cause for modification.
Usage	Inlays and dividers are used as individual/internal packaging. For parts with particular protection or handling requirements.
Conditions of use	Do not use damaged (e.g. structural cracks), stained or incomplete inlays/dividers. Lifting capacity and protection must be guaranteed at all times.

EXAMPLES OF USE:



4.1.4 NETTING TUBES

Netting tubes are used for those parts requiring particular protection (e.g. external thread, material etc.), but whose dimensions, shape or weight render them unsuitable for packaging in KB plastic insert trays.

This form of material protection offers a simple and cost-effective alternative to KB plastic insert trays.

PROPERTIES	NETTING TUBES
Dimensions	A variety of sizes and material strengths are available. The netting tube applied varies according to part type and surface protection required.
Cut	Adjustable as required.
Usage	Netting tubes are used as individual packaging. This form of packaging is mainly used as part protection for light to heavy parts with variable contours.
Conditions of use	Netting tubes must not contain rips, holes or stains.
Special case	Can also be used as a protective dividing inlay.

EXAMPLES OF USE:

EXAMPLE OF INCORRECT USE:

Higher handling costs
(each part packed individually)

4.2 EXTERNAL PACKAGING

The function of external packaging is to withstand internal and external forces acting against the package (pressure, inert forces etc.)

External packaging can be used both as internal/individual packaging (e.g. corrugated cardboard for bulk goods), or additionally to integrate several pieces of internal/individual packaging.

Internal/individual packaging must be arranged within the external packaging to allow an even weight distribution. The size of the external packaging must correspond to that of the internal/individual packaging. If the internal/individual packaging is smaller than the external packaging, all empty spaces within the package must be filled to ensure that the internal/individual packaging does not slip out of position during transport and handling.

Examples of external packaging include cardboard and corrugated cardboard packaging, reusable containers and small load carriers.

4.2.1 REUSABLE CONTAINERS/SMALL LOAD CARRIERS

Small load carrier (SLC) is the term used for the predominantly standardised container, mainly of plastic manufacture, intended for use in the transport and storage of parts.

The default container utilised is the standardised and combinable VDA Small Load Carrier System (pursuant to DIN 30 820/VDA recommendation 4500). Important: please note that the SLC containers only come in the colour RAL 5012 (blue). (Special model with ESD protection in black)

PROPERTIES	REUSABLE CONTAINERS/SMALL LOAD CARRIERS
Dimensions	Vary according to type of small load carrier. (see Table 4.1 "SLC Types")
Permitted total weight	Manual handling: 20 kg
Requirements	See permitted materials list (Chapter 2.2.2) or consult VDA recommendation (authorised SLC manufacturers)
Stackability	Storage/network system must be available for small load carriers to ensure safe container stacking.
Usage	Reusable containers can be utilised as individual packaging or as external packaging. Parts must be correctly secured within the container to avoid damage or loss during transport and handling.
Conditions of use	Reusable containers must be damage-free, display no evidence of dirt etc. Stability under load must be ensured.

OVERVIEW OF SLC USE AT THE KNORR-BREMSE LOCATIONS IN BERLIN, MUNICH, BUDAPEST AND MÖDLING:

SLC TYPE	PICTURE	BERLIN	MUNICH	BUDAPEST	MÖDLING
C-3214		X	X	X	
C-4314		X		X	
C-4321		X			X
C-6414		X	X		
C-6421		X	X	X	X
C-6428		X			

Table 4.1: SLC Types

Prior agreement must be reached with Knorr-Bremse for the execution of deliveries using SLCs at Knorr-Bremse locations not specified in Table 4.1 or the use of SLC types not specified in Table 4.1.

EXAMPLES OF USE:

Bulk goods

Individual goods in KB plastic insert tray

Individual goods in netting tube

4.2.2 CARDBOARD/CORRUGATED CARDBOARD BOXES

Cardboard and corrugated cardboard boxes are used both as individual/internal packaging and as external packaging.

Unlike a normal cardboard box, corrugated cardboard possesses a greater carrying capacity and is therefore better suited to heavy weights.

PROPERTIES	CARDBOARD AND CORRUGATED CARDBOARD BOXES
Dimensions	Vary according to area of use. Must be individually adjusted to fit the packaged goods.
Permitted total weight	Manual handling: 20 kg
Requirements	Box must be of sufficient quality to ensure stacking stability and must be shock-resistant. Recommended choice of quality standard is specified pursuant to DIN 55468.
Stackability	Boxes must be stackable without any modification required. Any affected packaging must otherwise be clearly labelled.
Usage	Direct contact should be avoided between boxes and any parts susceptible to corrosion (e.g. using VCI film). To avoid damage and any ensuing costs, special care must be taken to ensure the correct handling and secure transport of parts within the box.
Conditions of use	Boxes must be dry, intact and damage-free (e.g. structural cracks).

EXAMPLES OF USE:

Use as external packaging

Use as individual/internal packaging

EXAMPLES OF INCORRECT USE:

4.3 LOAD CARRIERS

The function of the load carrier is to protect the packaged goods during transport and to ensure secure transport and storage.

Examples of load carriers include euro pallets, one-way pallets, euro mesh pallets and reusable containers.

4.3.1 EURO PALLETS

Euro pallets must conform to the internationally recognised sizes of 1200 x 800 x 140 mm (euro pallet according to DIN 15146 Part 2) and 1200 x 1000 mm (euro industrial pallet according to DIN 15146 Part 3). These dimensions must be adhered to in order to ensure optimum pallet utilisation and module formation. (The euro pallet can carry a maximum of 1000 kg from a single weight source, and 2000 kg if even weight distribution is ensured).

PROPERTIES	EURO PALLET
Dimensions	1200 x 800 mm
Permitted total weight	1000 kg
Requirements	Euro pallets according to DIN 15146
Stackability	Euro pallets must be placed in a stable position conducive to safe stacking.
Usage	Euro pallets are used to form unit loads. Safe loading using the euro pallet is achieved using packaging accessories (stretch wrap, tape etc.).
Conditions of use	Euro pallet must be in faultless condition.

In order to be considered fit for use, the euro pallet must display the following key features under all circumstances. If not present, it is no longer exchangeable and cannot continue to be pooled with other pallets.

1. Brand of European Pallet Association **EPAL**
2. Brand of a European rail company
3. Brand of the European Pallet Pool **EUR**
4. Nails conforming to standard
5. Bottom edge boards fully attached
6. No evidence of mould

Euro pallets displaying any of the following characteristics may not be used again:

- Splintered bottom edge board or top edge board
- Necessary identification markings missing (DB, EPAL etc.)
- Missing or broken board/sections
- Carrying capacity no longer guaranteed
- Excessively stained

Bottom edge board missing

Splintered top edge board

Top edge boards missing

4.3.2 EURO MESH PALLET

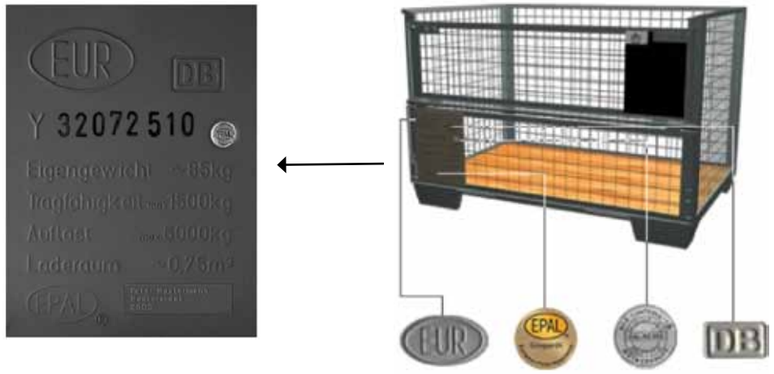
A mesh pallet is a materials handling loading aid. The dimensions of a mesh pallet are standardised at a length of 835 mm and a height of 970 mm, while its weight when empty is approx. 84 kg. Mesh pallets can be stacked and euro pallets can be placed on top of them, making them suitable for block storage. The carrying capacity of a euro mesh pallet within the European Pallet Pool totals up to 1500 kg, and it can withstand a load of 6000 kg.

PROPERTIES	EURO MESH PALLETS
Dimensions	1200 x 800 mm
Permitted total weight	1500 kg (excluding own weight)
Requirements	Euro mesh pallet according to DIN 15155. Weight must be evenly distributed and secured against slipping out of position.
Stackability	Mesh pallet must be placed in a stable position and be in the correct condition to enable safe, secure stacking.
Usage	Where possible, this unit load should only contain one item.
Conditions of use	Euro mesh pallet must be in faultless condition, displaying no evidence of external damage, e.g. bent frame or mesh, cannot be opened, rust damage, missing parts etc.

In the same manner as the euro pallet, the euro mesh pallet must also display particular information identifying it as suitable for pooling with other mesh pallets:

- ➔ EUR sign
- ➔ Rail company sign (e.g. DB)
- ➔ Own weight in kg
- ➔ Load limit
- ➔ Load space
- ➔ Carrying capacity
- ➔ Code letter "Y"
- ➔ Manufacturer

Example of a permitted mesh pallet suitable for pooling:



Euro mesh pallets displaying any of the following characteristics may not be further used:

1. Deformed T-square or corner posts
2. Front end hatches do not open
3. Deformed base frame or feet
4. Cracked or badly bent steel mesh
5. Missing or broken board
6. Missing identification label
7. Generally shabby condition (e.g. due to rust)

4.3.3 ONE-WAY PALLET

A one-way pallet or export pallet is a transport pallet specifically intended for one-off use in the transport of parts from the supplier to Knorr-Bremse. Varying according to preference or Knorr-Bremse requirements, this form of load carrier comes in wood, plastic or corrugated cardboard. While there are a variety of pooling systems on the market for the reusable pallet (euro pallet), there is no one-way pallet exchange currently in operation. The end-recipient in the delivery chain assumes responsibility for disposal of the pallet.

PROPERTIES	ONE-WAY PALLET
Dimensions	1200 x 800 mm
Permitted total weight	Permitted total weight varies according to material: Cardboard: up to 800 kg; high-density fibreboard or wood: up to 1000 kg; plastic: up to 1000 kg.
Requirements	One-way pallet made of wood, plastic, cardboard etc. See chapter 2.2.2 for permitted materials list
Stackability	Pallet must be placed in a stable position and allow safe, secure stacking.
Usage	Pallets are used to form unit loads. Safe loading using the pallet is achieved using packaging accessories (stretch wrap, tape etc.).
Conditions of use	Pallet must be in faultless condition.

EXAMPLES:

Plastic one-way pallet:

Pressboard/wooden one-way pallet:

Cardboard one-way pallet:

4.3.4 WOODEN BOX

Wooden boxes are mainly used in the delivery of highly valuable parts being transported via sea freight.
Prior to approving the use of wooden boxes, please check for the availability of more effective alternative forms of packaging meeting the necessary requirements. Wooden boxes should always be a secondary option.

All wooden boxes must comply with the IPPC standard aimed at minimising the introduction of injurious organisms into raw wood. Wood packaging components must be obtained from an officially authorised manufacturer and be heat or gas-treated.

PROPERTIES	WOODEN BOX
Dimensions	Box designs vary according to usage need
Permitted total weight	Varies according to box build, max. 1000 kg
Requirements	Wooden box according to DIN 55499. Parts packaged in wooden boxes must be secured to avoid slipping out of position. Only safely stackable wooden boxes displaying no evidence of staining are permitted.
Stackability	Wooden box must be placed in a stable position and allow safe, secure stacking. Non-stackable wooden boxes must be accordingly marked.
Usage	Wooden boxes are used to form unit loads and should only contain one item.
Conditions of use	Wooden box must be in faultless condition.

EXAMPLES OF USE:

4.4 PACKAGING ACCESSORIES

Packaging accessories are used to ensure that all packaging materials are completely sealed and to increase package strength, therefore offering greater protection to the packaged good.

Auxiliary packaging materials are divided into packaging accessories, padding and anti-corrosion packaging.

PACKAGING ACCESSORIES	PADDING	ANTI-CORROSION PACKAGING
Packaging accessories are used to ensure safe transport and to protect external packaging etc. Examples of packaging accessories include pallet frames, stretch wrap, edge guards, shrink wrap etc.	Padding is used to cushion and secure the packaged good within the packaging, e.g. packaging paper, foam, bubble wrap etc.	Anti-corrosion packaging is used as a safeguard against corrosion. Examples include: VCI film, anti-condensation bags, VCI paper etc.
  	  	  

4.5 CLEANING AND DISPOSAL OF LOAD CARRIERS/ PACKAGING COMPONENTS

The operational inspection and disposal of packaging components and load carriers no longer fit for use is effected either prior to return delivery by Knorr-Bremse to the supplier, or prior to repeat use on the part of the supplier.

The repair or, where necessary, the disposal of packaging components and load carriers no longer serviceable is carried out by the proprietor. If ownership cannot be easily determined (e.g. in the case of the pooling system), the party in possession of the packaging components and load carriers is considered responsible for their disposal and replacement.

The supplier is responsible for ensuring that the parts it delivers are packaged in clean packaging components. Any potentially required cleaning (external/ internal) before repeat use of the packaging components must be carried out by the supplier or a service provider specified by the supplier. The removal of tags and partially removed tags also falls under the remit of packaging component cleaning.

KNORR-BREMSE LOCATIONS

Dr. Techn. Josef Zelisko GmbH	Mödling / Austria
Freinrail Systèmes Ferrioviaires S.A.	Reims / France
Frensistemi S.r.L.	Florence / Italy
IFE CR a.s.	Brünn / Czech Republic
Knorr-Bremse GmbH	Mödling / Austria
Knorr-Bremse Nordic Rail Services AB	Lund / Sweden
Knorr-Bremse Rail Systems (UK) Ltd	Melksham, Wiltshire / GB
Knorr-Bremse Systeme für Schienenfahrzeuge GmbH	Berlin / Germany
Knorr-Bremse Systeme für Schienenfahrzeuge GmbH	München / Germany
Knorr-Bremse Systemy dla Kolejowych Srodków Loko-mocji PL Sp.zo.o	Krakau / Poland
Knorr-Bremse Vasúti Jármü Rendszerek Hungária Kft	Budapest / Hungary
Merak Sistemas Integrados de Climatizatión S.A	Getafe, Madrid / Spain
Microelletrica Scientifica S.p.A.	Rozzano / Italy
Oerlikon-Knorr Eisenbahntechnik AG	Niederhasli / Switzerland
Skach GmbH	Mödling / Austria
Sociedad Española de Frenos Calefacción y Señales S.A.	Getafe, Madrid / Spain