

Packing and Transport

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1 General

The supplier is under an obligation to deliver his products to his customers in satisfactory condition in accordance with the customer's expectations and in compliance with the requirements of the contracts.

Hydraulic parts and equipment must be packed in such a way that they can arrive at their destination undamaged when despatched by normal means of transport. This means that they must be protected against moisture, rain, corrosion, shock, dust, dirt and any other damaging effects while they are in transport.

In order to ensure that the products reach the customer in the same condition as they leave the factory it is important for them to receive adequate protection against corrosion.

Equipment must be broken down into sections which can be packed so that their size and weight are appropriate for handling by the means available, such as fork-lift truck or crane.

The means of transportation and lifting must be appropriate to the weight of the packed goods, as must also the type of boxes, crates or pallets and any other devices associated with the lifting, transport and storage and the related stresses.

- Choose a method of packing which ensures that the goods reach their destination in good condition. The packing must be both economical and effective.
- Ensure that the customer's packing and shipping specifications are complied with.
- Finished equipment and components must be stored safely before shipment so that they cannot come to any harm or be confused with other equipment.
- Bright parts must be protected so that they do not suffer any corrosion before the system in which they are incorporated is put into service.

2 Corrosion protection for packed hydraulic equipment

During its journey from factory to site, especially overseas, hydraulic equipment is often exposed to adverse conditions for which the normal factory corrosion protection might not be adequate.

Some such conditions are:

- rain and/or seawater
- high humidity
- salt-laden air
- extreme high or low temperatures and temperature fluctuations
- chemical attack.

The nature and intensity of these conditions depend on the method of transport, its duration, any intermediate storage and the type and susceptibility of the equipment. The methods of corrosion protection described below provide the extra protection needed to nullify the adverse effects on the equipment which may be encountered.

2.1 Desiccant method

For complete effectiveness of corrosion protection and the desiccant it is necessary for the atmosphere inside the packing to be entirely isolated from the ambient atmosphere.

The equipment is sealed inside polyethylene film at least 0.2 mm thick or, if conditions are extremely bad, in a composite aluminium film (the composite film is 100% gas and water vapour-proof). Desiccant inside the sealed envelope keeps the air at a maximum relative humidity of 50%.

The quantity of desiccant to be used is laid down in DIN 55 474. The climatic conditions in the place of storage at the destination must also be taken into account.

Moisture indicators can be placed inside the envelope to monitor the amount of moisture absorbed by the desiccant.

In the case of envelopes made of the composite aluminium film there should be windows made of polyethylene or similar material welded in with the indicators placed behind them. If boxes are used for long-term storage a suitably large hole and cover should be provided in the side of the box through which the indicator inside the envelope can be examined.

2.2 VCI method

VCI stands for “volatile corrosion inhibitors” and is the name given to the method whereby bright metal parts are protected against corrosion by packaging them in an atmosphere saturated with anti-corrosion substances. The VCI method is preferred for protection during storage and shipment when the protective atmosphere can be effectively contained by this packaging.

Bright metal parts such as pistons, sleeves and the sealing surfaces of valves receive their VCI protection in the form of an anti-corrosion oil or by wrapping or packing in anti-corrosion paper.

The VCI anti-corrosion products continuously give off minute quantities of the inhibitor they contain or with which they have been treated. This means that anti-corrosion oil or paper does not actually have to be touching the metal in order to protect it; a small gap is perfectly satisfactory. Such protection is therefore ideal for irregular shapes such as tapped holes, pipes and machines.

The inhibitors prevent corrosion of metal surfaces by oxygen, water vapour and salt in the air and by wood acids, human sweat and industrial atmospheres. Also, any corrosion that has already started is stopped. The VCI method needs a sealed envelope to exclude the ambient atmosphere if it is to be totally effective.

VCI substances can be used for steel, iron, chromium, cast iron and aluminium, and there are also special substances for copper and its alloys.

However, the VCI method cannot be used for zinc, tin, cadmium, magnesium, lead or alloys of these metals.

3 Load dimensions, limits and regulations

The maximum size of loads for the means of transport to be used eventually for delivering the finished equipment should be taken into account at the initial design stage so that no insurmountable problems are encountered subsequently. Goods which do not exceed the dimensions and limits listed in *Tables 71 and 72* can be transported without special approval.

3.1 Load dimensions not requiring special approval

	Type	Length	Load		Door		Floor Height	Max. Load
			Width	Height	Width	Height		
Rail	E: Open wagon, normal	12 500	2 760	2 000	1 800	2 000	1 235	21 t
Rail	G: Covered wagon, normal	9 000	2 700	2 100	2 000		1 245	21 t
Rail	KLM: Flat wagon, normal	12 500	2 700	2 000			1 250	23 t
Rail	RS: Flat bogie wagon	18 500	2 700	1 200			1 375	45 t
Road	Truck	6 500	2 400	2 650			1 350	8 t
Road	Trailer	8 000	2 400	2 650			1 350	14 t
Road	Articulated truck	12 500	2 400	2 350			1 650	25 t
Road	Semi-trailer	12 000	2 500	3 000			1 000	23 t
Road	Low loader	8 000	2 500	3 500			500	20 t

Table 71: Load dimensions not requiring special approval - West Germany

Note:

Low-loaders and articulated covered trucks are special-purpose vehicles.

The basic rule of the “undivided load” is applicable to the maximum load dimensions and payload limits. This means that

the special-purpose vehicle may only carry one load. In the case of machines with accessories the weight of the accessories must not exceed 10% of the weight of the machine.

	Type		Load			Floor Height	Max. load
			Length	Width	Height		
Road	Truck	6 500	2 400	2 650	1 350	*	
Road	Trailer		8 000	2 400	2 650	1 350	*
Road	Articulated truck		12 500	2 400	2 350	1 650	*
Road	Semi-trailer		12 000	2 500	3 000	1 000	*
Road	Low-loader		5 000	2 500	3 500	500	*

* = Max. loads vary according to country; they depend on permitted axle loads and wheelbases.

Table 72: Load dimensions exempt from special approval - Western Europe

3.2 Load dimensions requiring special approval

Any road transport loads exceeding the widths listed in Tables 71 and 72 require the special approval of the authorities of the states and countries through which the load will pass. The route to be taken will be specified.

Major haulage companies operating at the heavy end of the market have usually been granted permanent special approval for carrying goods up to 3000 mm wide.

The height of road transport loads must not exceed the figures given in Tables 71 and 72. If necessary the equipment must be partially dismantled before loading so that, even including the packing, the height limit is not exceeded. Here too it is sensible to consult specialist haulage companies beforehand in order to investigate what is possible with the transportation of high loads.

In the case of rail transport the loading gauges of the different railway systems are the governing factor and the relevant authorities must be consulted if special sizes are involved.

3.3 Shipment of pressurized hydraulic accumulators

In the case of West Germany there are regulations governing the transport of dangerous substances and they specify that hydraulic accumulators charged with nitrogen can be transported either loose or installed in other equipment.

Shipment can be by road, rail, sea or air, although delivery by post is not currently allowed.

For all forms of transport a green danger sticker with the inscription "NON-FLAMMABLE COMPRESSED GAS" must be applied to the accumulators and the accompanying paperwork must also contain appropriate notes.

It is important for the transport arrangements to be such that the equipment is firmly anchored so that it cannot tip over or fall from the loading surface. Any hydraulic accumulators being delivered loose must be packed in cartons or crates.

3.4 Transport by sea

In order to remain within the maximum external dimensions of packing cases for transportation by sea (Fig. 230), the dimensions of the equipment packed must not exceed 2490 mm wide, 2225 mm high and 4000 mm long.

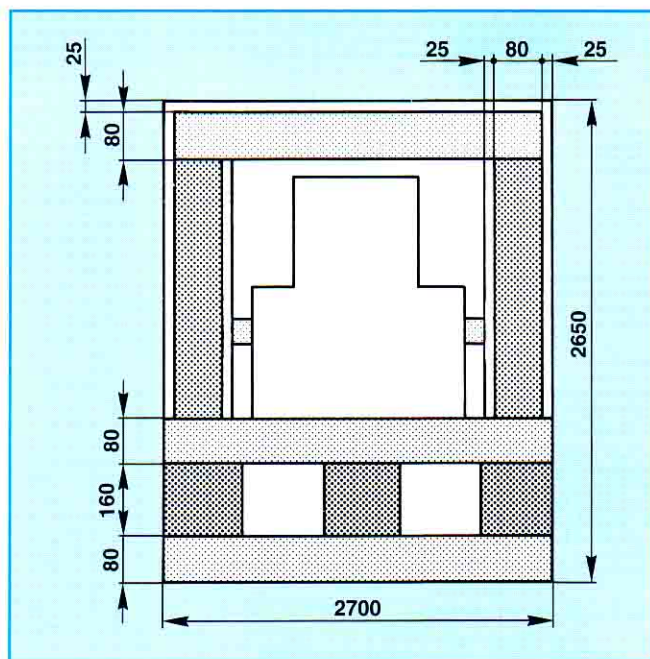


Fig. 230: Heavy packing case for transport by sea

3.5 Loading dimensions for sea containers

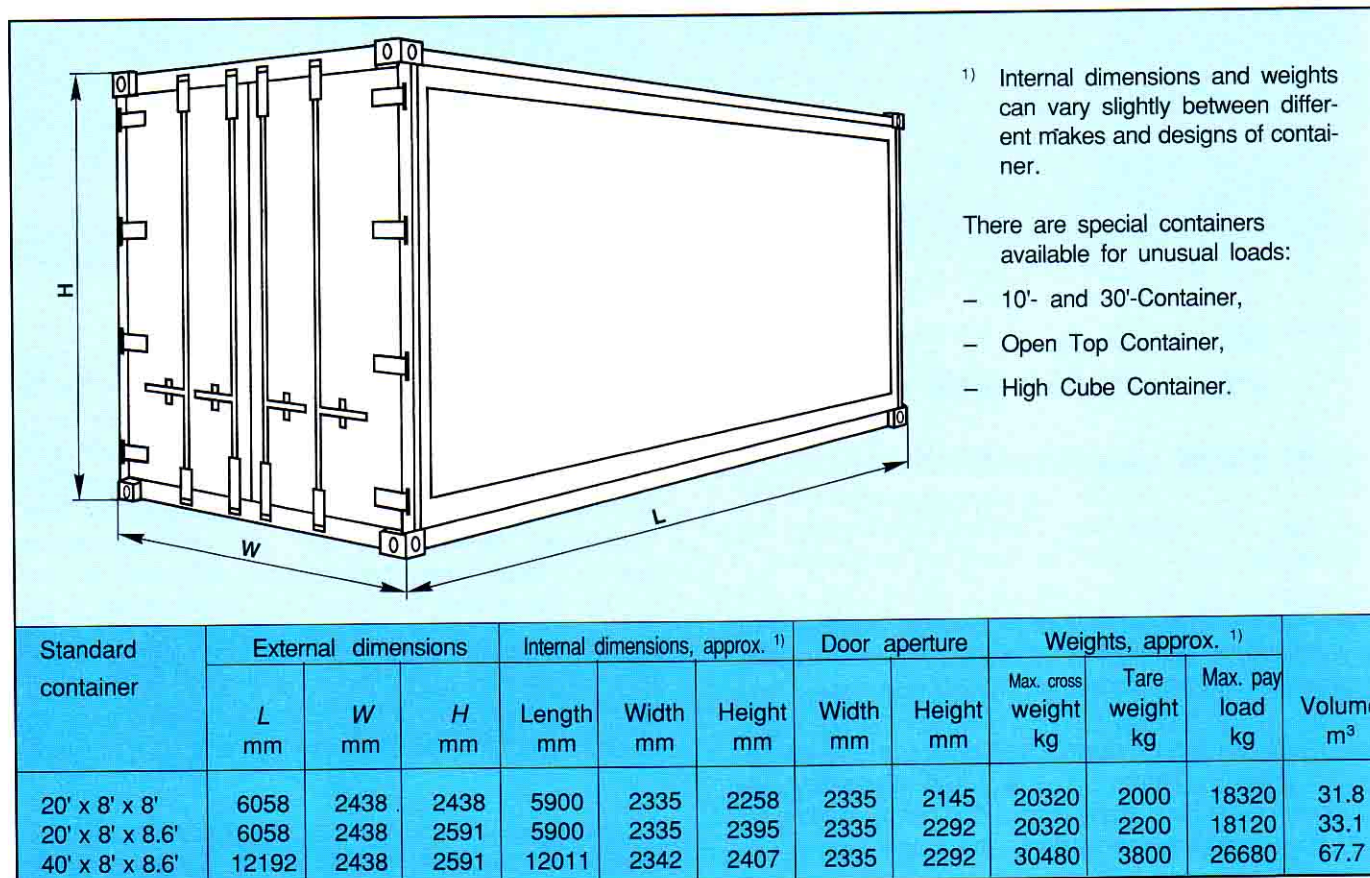


Fig. 231

4 Lifting points for hydraulic equipment

Hydraulic equipment must be designed so that it can be carried and lifted safely by industrial trucks such as fork-lift trucks and lifting gear such as cranes.

The lifting points for cranes are needed for handling within the factory, for loading and unloading for transport and for installation on site.

4.1 Positioning of lifting points

Lifting lugs must be attached in the direction of pull so that they cannot be bent or otherwise deformed by a pull at an angle.

Equipment to be transported horizontally, e.g. accumulator racks, must be fitted with lifting lugs which allow the equipment to be turned from the vertical to the horizontal.

4.2 Load limits for lifting lugs

In connection with the load limits for lifting lugs it must be remembered that the permitted limits decrease according to the angle of pull of the chain or strop.

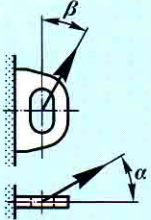
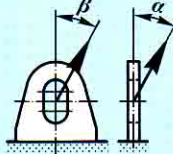
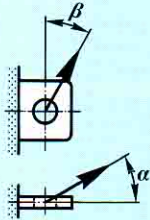
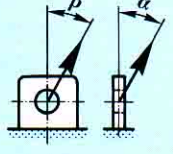
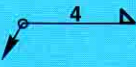


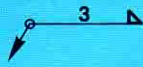
					
α in °	β in °	Max. load in t	Max. load in t	Max. load in t	Max. load in t
0	0	3.4	2.6	1.00	1.20
0	30 to 45	2.3	2.0	0.80	1.40
0	45 to 60	2.1	1.6	0.90	0.90
0	60 to 90	1.7	1.3	0.50	0.50
30 to 45	30 to 45	1.0	0.8	0.20	0.20
30 to 45	45 to 60	0.8	0.6	0.20	0.20
30 to 45	60 to 90	0.6	0.5	0.16	0.16
45 to 60	30 to 45	0.3	0.3	0.08	0.08
45 to 60	45 to 60	0.3	0.2	0.07	0.07
45 to 60	60 to 90	0.2	0.2	0.06	0.06
Type of lifting lug		Type: A	Type: B	Type: C	Type: C
Welded seam					

Table 73: Load limits for lifting lugs

5 Packing hydraulic equipment

The methods of packing hydraulic equipment described below vary according to the destination.

5.1 Delivery inside West Germany

Smaller items of equipment (up to 50 kg) are delivered in cardboard containers or cartons. The goods must be packaged in suitable materials inside the cartons so that they do not suffer any damage during transport. Any empty spaces must be filled with a suitable filling material. For gross weights over 50 kg skids must be attached to the bottom of the packing, or the packing must be mounted on a pallet, so that it can be lifted with a fork-lift truck. Corrosion protection of bright metal parts is by the VCI method (see Section 2.2).

5.2 Delivery within the EEC

The same packing as described in Section 5.1 is appropriate.

Corrosion protection is by the VCI method.

5.3 Delivery to Eastern Block countries and overseas

Seaworthy packing, i.e. packing cases, is employed in the majority of cases. Corrosion protection is by the dessicant and VCI methods. Other details are as described in Section 5.1.

5.4 Delivery to the USSR

Seaworthy packing is employed in the majority of cases with corrosion protection by the dessicant and VCI methods using composite aluminium film.

Other details are as described in Section 5.1.

6 Packing hydraulic power units

The methods of packing hydraulic power units described below vary according to the destination.

Export packing must be designed for a total transport and storage period of from 6 to 24 months.

Exposed bright metal parts must be sprayed with a corrosion inhibitor.

6.1 Delivery within West Germany

Items of hydraulic power units such as tanks, valve tables, valve stands and pump sets are bolted to a wooden base and covered with polyethylene film for protection against water and dust.

Awkward items such as cylinders and accumulators are packed on pallets or skids depending on their size.

6.2 Delivery within the EEC and to Eastern Block countries

Hydraulic power units are shipped in wooden crates with the equipment sealed inside polyethylene film. Corrosion protection by the dessicant method can be provided if the customer wishes.

6.3 Delivery overseas in seaworthy packing

For transport by sea, hydraulic power units are loaded in wooden packing cases lined with waterproof bituminized paper (although the bottom of the case is not lined so that any water which gets in can drain away). Corrosion protection for periods up to 6 months is provided by the dessicant method.

6.4 Delivery to the USSR or transport periods over 6 months and storage times up to 24 months

Hydraulic power units are transported in wooden packing cases lined with waterproof bituminized paper (the bottom of the case is not lined).

Corrosion protection for the equipment is provided by the dessicant method using composite aluminium film.

Indicators for monitoring the condition of the dessicant can be placed inside the envelope if the customer wishes (see Section 2.1).

Protection against internal corrosion with a suitable oil is necessary to maintain the equipment in good condition during long periods of transport and storage (see "Internal Protection of Hydraulic Components and Power Units").

7 Identification and marking

7.1 Identification of individual components and spare parts

All individual components, including loose items in a packed unit, must be identified separately by the manufacturer/supplier. The information must also be given on the packing note/delivery note.

7.2 Marking of packed goods

Each item of packed goods must be marked either with a stencil using seawater-resistant, non-fading paint or with labels provided by the customer. In the case of stencilling the size of the lettering should be appropriate to the size of the unit. With unpacked items of equipment and those mounted on skids the marking should be directly on the equipment itself.

Basically, all units should be marked on both long sides.

7.3 Handling symbols/Danger symbols

The following international symbols should be applied to identify any goods requiring special handling.

Danger symbols should be taken from the IMDG Code (Fig. 236). The symbols should be marked on the sides containing the identification marks. Centre-of-gravity symbols should be marked on both sides and ends.

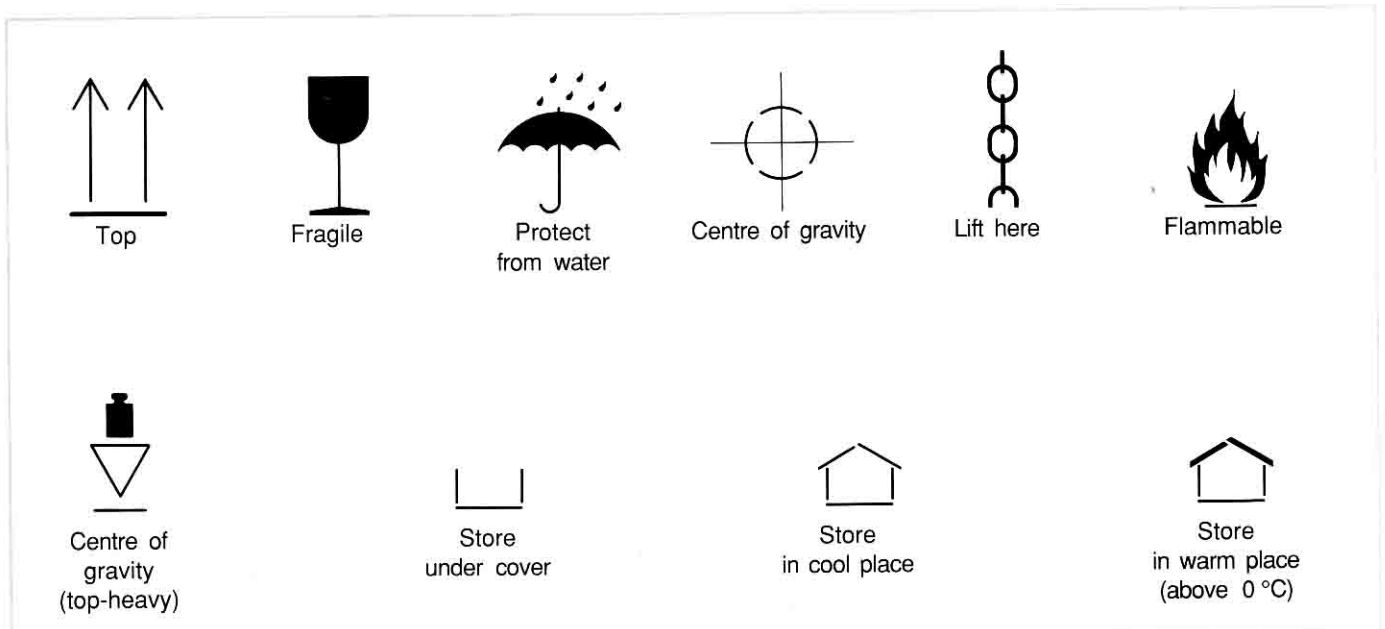


Fig. 236: Handling and danger symbols

8 References

Company Publication: Verpackungs- und Versandvorschriften für Hydac-Blasen- und Membranspeicher, die mit Vorfülldruck (Stickstoff) geliefert werden.
HYDAC GmbH, Sulzbach

Company Publication: Allgemeine Verpackungsbedingungen für Maschinen- und Anlagenbauteile
Mannesmann Anlagenbau AG, Theodorstraße 90, D-4000 Düsseldorf 30