

### Safety requirements for vacuum lifting devices from the draft prEN 13155 (printed July 1998)

This draft for safety requirements of non-fixed load lifting attachments makes some essential requirements on a vacuum lifting device, which have to be fulfilled by each load suspension device and some only by vacuum lifting devices. Also, safety requirements for grabs and tongs are defined in this draft.

	Requirements	Solutions at Pannkoke
5.2.3.1	Vacuum lifting systems shall be dimensioned so that the adhesion force is still at least two times the effective component of the nominal load at the lower limit for the working range of vacuum level..	<p>The loading capacity of our built-in suction cups have a 2fold safety factory at the minimum permissible depression.</p> <p>The suction cups 388 were tested in the Fachhochschule Kiel with both a slide-off and a pull-off test. The suction cup 388 carries 100 kg with a 2fold safety factor.</p>
5.2.3.2	Non-self-priming vacuum lifters shall be equipped with a pressure measuring device clearly showing the working range and the danger range of the vacuum.	Our control vacuummeter has already been in use for 20 years and each of our vacuum lifting devices has such a control vacuummeter. The working range is marked green, the danger area red.
5.2.3.4	The measuring device or the indicator shall be fully visible for the operator, if the load is suspended with the co-operation of a slinger, for the driver of the hoist in their normal working position.	<p>Each vacuum lifting device with built-in electric vacuum generation has a control vacuummeter, an acoustical and an optical warning signal which indicates a too low partial vacuum and this for more than ten years.</p> <p>Rechargeable battery-operated vacuum lifting devices have been equipped for two years with two optical warning signals.</p> <p>Compressed-air operated vacuum lifting devices for near to ground transports have only one control vacuummeter.</p> <p>The new compressed-air operated devices with a 2-circuit-vacuum-system (2KS) have also an acoustical warning signal.</p>
5.2.3.5	Systems shall be provided to control and monitor vacuum losses comprising:	
	<p>a) a compensation device to balance out vacuum losses, this shall be:</p> <p>1) in the case of vacuum lifters with a vacuum pump and in the case of self priming vacuum lifters: a reserve vacuum</p>	<p>The carrying frame or parts of the carrying frame of our vacuum lifting devices are constructed in general as a vacuum tank. The tightness of the system is tested before delivery. Only devices which lose less than 5 % vacuum within 15 minutes will be delivered.</p> <p>With the rechargeable battery operated vacuum lifting devices there is also the fact that if the vacuum falls below a certain limit during use, the vacuum will be increased via the accumulator vacuum pump.</p>

	<p>b) a device to indicate the danger level when the compensation device cannot balance the loss in vacuum. This indication shall be automatic and clearly perceptible to the operator, to allow persons to leave the danger area below the load. The indication shall be optical and/or acoustic, depending upon the circumstances of use for the vacuum lifter, and in accordance with EN 981, EN 842 und EN 457;</p>	<p>Each vacuum lifting device with built-in electric vacuum generation has a control vacuummeter, an acoustical and an optical warning signal which indicates a too low partial vacuum and this over ten years. Rechargeable battery-operated vacuum lifting devices have been equipped for two years with two optical warning signals. Compressed-air operated vacuum lifting devices for near to ground transports have only one control vacuummeter. The new compressed-air operated devices with a 2-circuit-vacuum-system (2KS) have also an acoustical warning signal.</p>
	<p>c) for vacuum lifters with a vacuum pump, a nonreturn valve between the reserve vacuum and the pump, located as close as possible to the reserve vacuum.</p>	<p>In general it is screwed onto the vacuum tank. But due to tight spaces, there may be a small distance between pump and nonreturn valve. To increase the functional safety, the nonreturn valve is mounted in general in a vertical position.</p>
5.2.3.6	<p>For vacuum lifters which are intended for use in areas where people can be present and subject to risks associated with inadvertent release of the load, the following additional requirements shall be fulfilled:</p>	
	<p>b) A fault in the control system shall not lead to the load dropping.</p>	<p>In case of an energy failure the function SUCTION will be activated on all our vacuum lifting devices which have a control system. On devices with only one hand valve, this is not possible.</p>
	<p>c) The operating elements with which the load can be released shall be secured against erroneous operation.</p>	<p>On electric vacuum lifting devices this is achieved via a mushroom-shaped key (like an emergency stop switch). It has to be turned for changing. The mushroom-shaped key is in a housing with edge protection and with that the actuating element is protected by the surrounding mechanical protection. A protective shield is built around the hand valve(s) to prevent an unintentional actuation.</p>
	<p>d) An automatic warning device shall be provided (visual or acoustic) which clearly and reliably indicates the failure of the energy source to the operator.</p>	<p>For our new production line with 2-circuit-vacuum-system (2KS) this is the case for electric as well as for compressed-air operated vacuum lifting devices.</p>
	<p>f) In cases where it is difficult to clear the area of persons (e. g. for ship loading and unloading) a total redundancy of the vacuum system or an additional safety system ensuring mechanical locking of the load is necessary..</p>	<p>For our new devices with 2-circuit-vacuum-system (2KS) this is the case for electric as well as for compressed-air operated vacuum lifting devices.</p>

Under point 7 there are special requirements concerning the user information. Under point 7.1.2.3 vacuum lifting devices there are special requirements concerning the user information.

- A) Checking of the vacuum level;
- B) Measures to be taken as soon as the warnings are actuated;
- C) Checking of the condition of the vacuum connections and hoses;
- D) Checking of the condition of the suction pads.

Also the minimum marking is clearly described under point 7.2.1. This minimum marking has to be on a durable label:

- a) Identification of manufacturer (or authorized representative or importer);
- b) Model;
- c) Serial number;
- d) Weight of unloaded equipment, when it exceeds 5 % of the lifting capacity of the equipment or 50 kg, whichever is less;
- e) Year of manufacture;
- f) Working load limit in kg. When the equipment is used in several configurations, the resulting working load limits shall also be indicated;
- g) CE-mark.

Requirements which go beyond the safety draft of the **CEN/TC 151/WG 13/SG A1**.

This working team has the following title:

Machines and plants for the manufacture,  
treatment and processing of flat glass  
- Safety requirements -  
Part 1: Storage, handling and transportation  
equipment inside the factory

	Requirements	Solutions at Pannkoke
5.7.1.1	The vacuum shall have redundancy so that if part of the systems fails then the remaining part of it shall be capable of supporting the actual load.	For our new devices with 2-circuit-vacuum-system (2KS) this is the case for electric as well as for compressed-air operated vacuum lifting devices.
5.7.4	Systems shall be provided to control and monitor vacuum losses comprising:	
	a) In the case of vacuum lifters with a vacuum pump a reserve vacuum tank of minimum volume of at least twice the total evacuated volume of the system.	
	b) In the case of vacuum lifters with injector venturi, every injector shall be equipped with a non return valve.	
5.7.5.1	For raw glass either guarding on the rear of the frame with handles or guide handles alone shall be fitted and arranged in a way which protects the operator from falling glass. No guarding is required for small plates (maximum dimension less than 2M), provided the distance from the sucker cup edge of the glass is less than the distance the guide handles are from the glass.	
5.7.5.2	It shall be possible to guide vacuum lifters using both hands, even if the operator has to simultaneously operate a hoist.	