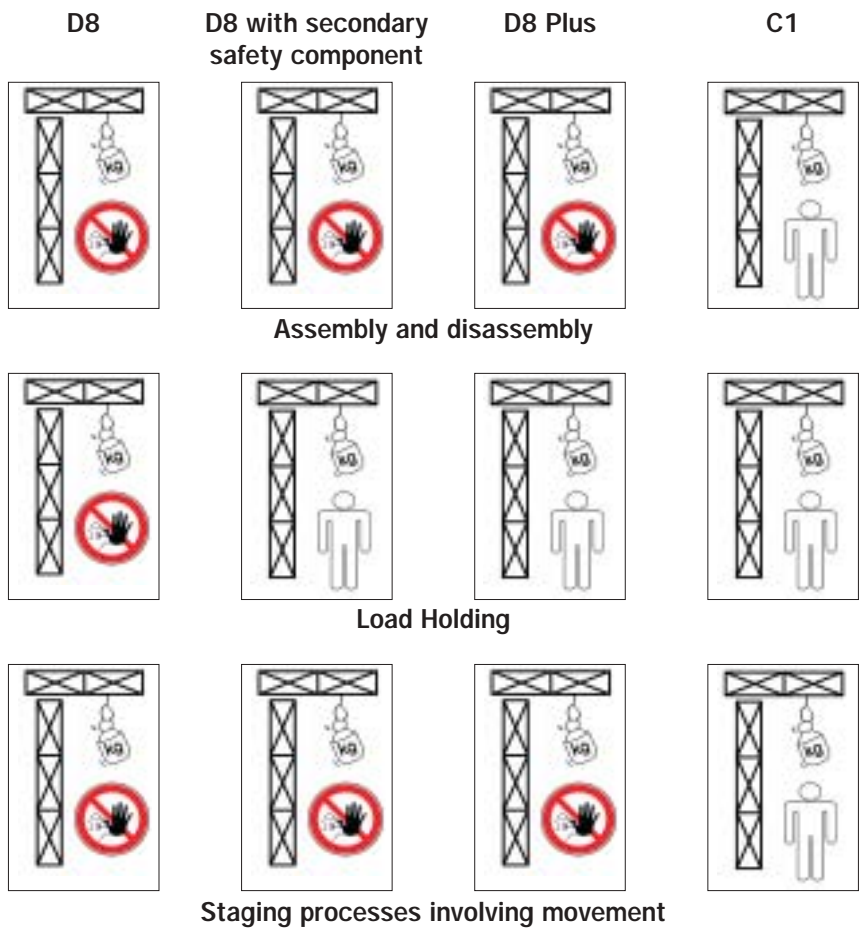


# VPLT. SR2.0

## Codes of Practice for Event Technology



## Provision and Use of Electric Chain Hoists

latest update: December 20, 2004



## Foreword

This Code of Practice has been compiled by the VPLT's „Arbeitskreis Elektrokettenzüge“ (Electric Chain Hoists Working Group) in cooperation with the „Verwaltungs-Berufsgenossenschaft“ (Institution for Statutory Accident Insurance and Prevention in the Administrative Sector), the „Maschinenbau- und Metall-Berufsgenossenschaft“ (Institution for Statutory Accident Insurance and Prevention in the Mechanical-Engineering and Metalworking Industry) and the „Bundesverband der Unfallkassen“ (Central Federation of Public Sector Accident Insurers) in consultation with the working group of safety engineers from the following TV/radio stations and studios: BR, Bavaria, DR, DW, HR, IRT, MDR, NDR, ORB, ORF, RB, RBT, RTL, SFB, SR, SRT, Studio Hamburg, Studio Babelsberg, SWR, WDR and ZDF, as well as the Deutsche Theater-technische Gesellschaft e.V (German theatre-engineering society).

The purpose of this document is to ensure a uniform level of safety for the provision and use of electric chain hoists in the event industry, taking into consideration customary industry practice.

In particular, health and safety requirements to be met by the employer in connection with the provision and use of electric chain hoists are laid down in Sections 3, 4, 7 and 11 of the „Betriebssicherheitsverordnung“ (Ordinance on Industrial Safety and Health) and the Accident-Prevention Regulation for Staging and Production Facilities for the Entertainment Industry (GUV-V C1 / BGV C1).

Electric chain hoists also fall within the scope of the „Maschinenverordnung“ (Machinery Ordinance), the „Niederspannungsverordnung“ (Low-Voltage Ordinance) and the „Gesetz über Elektromagnetische Verträglichkeit“ (Electromagnetic Compatibility Act). Manufacturers and distributors must thus comply with the technical and formal requirements specified therein.

This Code of Practice contains verifiable criteria and characteristics for electric chain hoists, marking thereof, technical documentation and competent use and testing. It also gives an overview of the legal regulations to be applied and specifies requirements concerning quality standards for occupational safety and health (OSH) and serves as a „source of information“ for OSH requirements.

## Important note for English speaking readers

This document is a „Code of Practice“. The German word for „Code of Practice“ is „Standard“. The German word for „Standard“ is „Norm“.



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*The solutions contained in this booklet do not preclude other, at least equally safe solutions which may have been set out in technical rules issued by other member states of the European Union or other states which are party to the Agreement on the European Economic Area.*

## 1 Scope

This Code of Practice applies to the provision and use of electric chain hoists in the event industry.

„Events“ are, for example, concerts, shows, congresses, conferences, exhibitions, presentations, demonstrations, film or television recordings, etc. The staging facilities for such events include theatres, multi-purpose halls, studios, production facilities for film, television or radio, concert halls, congress centres, schools, exhibition centres, trade-fair centres, museums, discotheques, music halls, amusement parks, sports facilities and open-air theatres and venues.

## 2 Terminology

For the purposes of this Code of Practice, „electric chain hoists“ are electrically driven lifting gear with steel chains (referred to as „round steel chains“ in the DIN standards) serving as the load-bearing elements.

This Code of Practice distinguishes between three types of electric chain hoist, as described below.

### **D 8 chain hoist**

Electric chain hoist as described in BGV D 8 / GUV-V D 8 (previously GUV 4.2), „Winden, Hub- und Zuggesteräte“ („Winches, Lifting and Hoisting Devices“), used to lift loads during set-up.

### **D 8 Plus chain hoist**

Electric chain hoist based on BGV D 8 / GUV-V D 8 (previously GUV 4.2), „Winden, Hub- und Zuggesteräte“ („Winches, Lifting and Hoisting Devices“), used to lift loads during set-up and with the special characteristic of being able to hold loads at rest above people without using a secondary safety component.

### **C 1 chain hoist (scenery hoist)**

Electric chain hoist as described in BGV C 1 / GUV-V C 1 (previously GUV 6.15), „Veranstaltungs- und Produktionsstätten für szenische Darstellung“ („Staging and Production Facilities for the Entertainment Industry“), used to hold and move loads above people.

The above-mentioned types of electric chain hoist can be used individually or in groups.

### 3 Selection and Provision

Electric chain hoists are available in many different designs and equipped with various fittings and safety features. It is thus very important to select the correct type. The selection must be based on the hazards arising from the type of use, taking into account the specific conditions of use.

This document deals with the use of electric chain hoists in the field of mobile event technology.

Which type of electric chain hoist is selected depends on the conditions of use.

	D 8	D 8 with secondary safety component	D 8 Plus	C 1
<b>Use</b>	<b>When people are present below the load</b>			
Assembly/disassembly, set-up	not permitted	not permitted	not permitted	permitted
Load-holding	not permitted	permitted	permitted	permitted
Staging processes involving movement	not permitted	not permitted	not permitted	permitted

Table1: Selection criteria for electric chain hoists for moving and holding loads above people

Due to the operating methods involved and the hazards that can be expected, electric chain hoists in line with the requirements specified in BGV C1/GUV-V C1 must be provided for equipment permanently installed in staging facilities.

Electric chain hoists to be provided for use at events and in staging facilities must meet the requirements specified in Section 3.1, „Engineering requirements“.

### 3.1 Engineering requirements

Electric chain hoists and their control systems must comply with the European directives and national laws, ordinances, technical rules and rules governing good engineering practice. The applicable rules and regulations are:

<b>9th „GPSGV“</b> (effective from 1 May 2004)	9th „Verordnung zum Geräte- und Produktsicherheitsgesetz – Maschinenverordnung“ (Ordinance Relating to the Equipment and Product Safety Act - Machinery Ordinance)
<b>1st „GPSGV“</b> (effective from 1 May 2004)	1st „Verordnung zum Geräte- und Produktsicherheitsgesetz (Ordinance on the Placing on the Market of Electrical Equipment for Use within Specific Voltage Limits)
<b>EMC Directive</b>	Law on the Electromagnetic Compatibility of Equipment
<b>DIN EN ISO 12 100-1:2003</b>	Safety of machinery – Basic concepts, general principles for design – Part 1: Basic terminology, methodology
<b>DIN EN ISO 12 100-2:2003</b>	Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles
<b>EN 954-1</b>	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
<b>EN 1050</b>	Safety of machinery – Principles for risk assessment
<b>pr EN 14492-2</b>	Cranes – Power driven winches and hoists, Part 2: Power driven hoists
<b>FEM 9.511</b>	Calculation principles for standard lifting equipment – Classification of mechanisms
<b>FEM 9.755</b>	Measures for achieving safe operating periods for motor-driven standard hoisting gear
<b>FEM 9.756</b>	Manual and power-operated hoisting gear for special usage
<b>FEM 9.761</b>	Standard lifting equipment – Lifting-force limiters for controlling loads carried by power-operated electric chain hoists
<b>EN 60204-32</b>	Safety of machinery – Electrical equipment of machines – Part 32: Requirements for hoisting machines
<b>EN 62079</b>	Preparation of instructions – Structuring, content and presentation
<b>EN 12644-1</b>	Cranes – Information for use and testing – Part 1: Instructions
<b>EN 12644-2</b>	Cranes – Information for use and testing – Part 2: Marking
<b>EN 61508</b>	Functional safety of electrical/electronic/programmable electronic safety-related systems
<b>prEN ISO 13849-1:</b> (Draft 2004)	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
<b>DIN 56925</b>	Scenery hoists – Safety requirements and testing
<b>DIN E 56950</b> (To replace DIN 56925)	Entertainment technology – Machinery installations – Safety requirements and inspections

*Table 2: List of European directives, national laws, ordinances, technical rules and rules governing good engineering practice*

The manufacturer/distributor must confirm compliance with the European directives by supplying an EC declaration of conformity with the product.

In multi-hoist processes (i.e. where several electric chain hoists are used for one load or one staging process) where the hoists influence each other, they must all be of the same type.

(See DIN 56 950)

### 3.1.1 Special engineering requirements

The technical rules mentioned above define the engineering requirements for electric chain hoists. In addition, the specific conditions of use in the field of mobile event technology result in special engineering requirements for electric chain hoists, as shown in the table below:

Requirements	D 8	D 8 Plus	C 1
Mechanism group	1 Bm min. <sup>1)</sup>	1 Bm min.	1 Bm min.
Dimensioning of mechanism	1 x rated load <sup>2)</sup>	2 x rated load	2 x rated load
Dimensioning of load-bearing element for rated load	Safety factor 5 min.	Safety factor 10 min.	Safety factor 10 min.
Friction clutch	yes	no <sup>3)</sup>	no <sup>3)</sup>
Safety brake or, alternatively, dynamic transmission brake	1 x	2 x	2 x
Emergency limit switch	no	no	yes
Limit switch	no	no	yes
Overload monitoring <sup>5)</sup>	Friction clutch	Shut-down <sup>3)</sup>	Shut-down at 120% of rated load
Underload monitoring	no	no	yes <sup>4)</sup>
Speed control for vario-drives	n/a	n/a	yes
<b>Generic requirements</b>	<ul style="list-style-type: none"> <li>- Two swivel safety hooks or lifting eyes</li> <li>- Chain-storage capacity in accordance with chain length</li> <li>- Chain-storage unit can be mounted on hoist in any operating position up to a max. chain mass specified by the manufacturer</li> <li>- Load-free (loose) chain end is securely fixed to housing</li> <li>- Housing is impermeable in all mounting positions</li> <li>- Implementation of protection class in accordance with conditions of use</li> <li>- Housing has no sharp edges or corners (due to risk of injury)</li> <li>- Two transport handles for hoists weighing 20 kg or more without chain</li> <li>- Housing construction suitable for tough operating conditions</li> </ul>		

<sup>1)</sup> 1Bm = 400 operating hours under full load in normal use

<sup>2)</sup> Rated load = load during operation. The sum of the load plus the dynamic forces. (See Annex I – Terminology)

<sup>3)</sup> A friction clutch is permitted if it is not within the load path when the electric chain hoist is disconnected from the power supply.

<sup>4)</sup> Underload monitoring with a collective shut-down facility is required for guided loads and system loads (multi-hoist processes).

<sup>5)</sup> See section 3.1.3 „Overload shut-down/overload monitoring“.

Table 3: Special engineering requirements

(See Annex III: Tables for determining the spent portion of the theoretical service life of lifting devices)

(See Annex IV: Positioning of the friction clutch for electric chain hoists)

### 3.1.2 Electrical equipment and control units

Electric chain hoists' electrical equipment is subject to DIN EN 60204-32 (VDE 0113 Part 32).

The power-supply connection, the control unit and the choice of equipment must be such that hazardous operating conditions are avoided in the event of a fault.

The following are examples of faults in the electrical equipment:

- hardware or software errors
- power failure
- wire break
- earth fault or short circuit to an exposed conductive part
- short circuit or interruption
- non-operation or non-release of an armature
- non-opening or non-closing of a contact member.

The electrical equipment must meet the following minimum requirements:

- rotating-field and phase-sequence monitoring
- emergency off switch/emergency stop switch
- protection against electric shock
- overcurrent protection
- protection against auto start-up after mains failure and voltage recovery
- protection against environmental influences
- selection of direction of travel
- command initiator for the travelling movement

In order to prevent faults from occurring, a hazard analysis, including a risk assessment, must be conducted for all safety-related functions to determine the necessary requirements. The type of electrical equipment used must be chosen on the basis of the requirements determined.

**Note:**

*For information on safety-related control units and safety-related components of control units, see EN 954-1, which is to be replaced by IEC EN 13849-1, and DIN 56 950 in conjunction with EN 61 508)*

### 3.1.3 Overload shut-down/overload monitoring

D 8 electric chain hoists are fitted with friction clutches. The Machinery Directive stipulates that lifting equipment with a rated load-bearing capacity of 1000 kg or more must be fitted with an overload shut-down facility. D 8 Plus and C 1 electric chain hoists must always have an overload shut-down facility; in the case of D 8 Plus electric chain hoists, this requirement can also be fulfilled by means of a friction clutch.

Overload shut-down facilities (lifting-force limiters) must fulfil the requirements of FEM 9.761 „Standard lifting equipment - Lifting-force limiters for controlling loads carried by power-operated electric chain hoists“.

Safe operation of D 8 and D 8 Plus electric chain hoists in assembly and dismantling processes can be achieved by means of technical and/or organisational measures.

For special load types where there is a risk of specific elements (e.g. load-attachment points, load-suspension points, electric chain hoists or load-bearing elements) being overloaded, a load measurement is required.

Examples of special load types include:

- uniform loads on more than two electric chain hoists
- area loads on more than three electric chain hoists
- guided loads

For information on organisational measures, see section 4.1 „Assembly, dismantling and operation of electric chain hoists“.


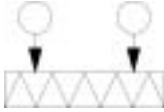
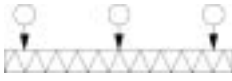


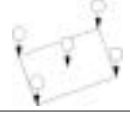

**Note:**

*Section 3 of the „Betriebssicherheitsverordnung“ (Ordinance on Industrial Safety and Health BetrSichV) stipulates that, as part of a hazard assessment, the measures necessary to ensure safe provision and use of electric chain hoists must be determined.*

*In accordance with Appendix 2, Item 4.2.3 of the Betriebssicherheitsverordnung, precautions must be taken when lifting non-guided loads, as follows: „If a load is to be lifted by two or more pieces of equipment at the same time, a procedure which ensures that the equipment works properly in combination must be defined and monitored.“*

### 3.1.4 Control units for C 1 electric chain hoists

The minimum functionality required for control units for C1 electric chain hoists must be selected based on the type of use.

<b>C 1 electric chain hoists</b>			
Load type	Functionality for		
	set-up with intervisibility	staging processes involving movement	
Single load		B	B
Uniform load		B	B + A 1
Uniform load on more than two hoists		B + A 1	B + A 3 or B + A 1 + A 2 + A 4
Loads with no bending		B + A 1	B + A 1 + A 2
Area load on three hoists		B + A 1	B + A 3 or B + A 1 + A 2 + A 4
Area load on more than three hoists		B + A 3 or B + A 1 + A 4	B + A 3 + A 4
Guided loads		B + A 1 + A 4	B + A 3 + A 4

*B* basic functionality

*A* Additional functionality:

*A 1* Asynchronous multi-hoist process with collective shut-down

*A 2* Synchronisation via reference point

*A 3* Synchronous multi-hoist process (synchronous in terms of route and/or time) or synchronous run control

*A 4* Underload shut-down

Table 4: Requirements for control units for C 1 electric chain hoists

### 3.2 Information for use

The manufacturer must produce information for use, in accordance with the principles set out in DIN EN ISO 12 100-2:2003 and EN 62079 (or EN 12644 T 1 where appropriate), and supply it with the product. Manufacturers of electric chain hoists must supply a technical file concerning the intended use for each electric chain hoist they produce. The file must contain the information below:

#### 3.2.1 Technical details

- Maximum load-bearing capacity
- Mechanism group
- Dimensions and minimum breaking strength of the load-bearing element (chain type/chain)
- Rated speeds of the hoisting gear (m/min)
- Lifting height based on chain length used
- Dimensions of chain hoist
- Self-weight of electric chain hoist and load-bearing element
- Power-supply details:
  - Voltage (V)
  - Current (A)
  - Frequency (Hz)
  - Power (kW)
  - Rated motor speed (rpm)
  - Power-up time
- Information on sound emission of chain hoist at a distance of 1m
- Information on impact load of chain hoist in the specific operating situation
- Control-unit requirements
- Interface description
- List of specified accessories

#### 3.2.2 Marking

The following details must be marked on the electric chain hoist in a permanent, easily visible manner:

- a) manufacturer
- b) year and month of construction (YY/MM)
- c) type
- d) identification no.
- e) self-weight in kg
- f) load-bearing capacity in kg
- g) mechanism group
- h) indication, visible in all operating conditions, of whether electric chain hoist is a D 8, D 8 Plus or C 1 hoist.

The latter marking takes one of the following forms:

**D 8**

**D 8 Plus**

**C 1**

The marking must be made on the housing of the electric chain hoist. It should be supplemented by a clear geometrical shape which is easy to see in all operating conditions, as follows:

**D 8 = Triangle ▲**

**D 8 Plus = Square ■**

**C 1 = Circle ●**

### 3.2.3 Instructions for use and assembly

The manufacturer must supply instructions for use and assembly, in German, with the product.

In particular, the instructions should include the following:

- a) details concerning intended use
- b) transport instructions
- c) handling and procedure during assembly and dismantling
- d) instructions on putting product into operation correctly
- e) load-attachment instructions
- f) guidelines for use and operation
- g) care and maintenance instructions
- h) instructions regarding action to be taken if damage occurs
- i) information on procuring spare parts and carrying out repairs
- j) information on performance of periodic testing
- k) details concerning criteria for removal of load-bearing element from service
- l) details concerning criteria for removal of chain hoist from service
- m) information on safety-related components in electrical and electronic control units
- n) information on foreseeable misuse

*(see E DIN 56 950: 2003, section 4 „Hazards“)*

## 4 Use

The tasks of the persons in positions of responsibility must be specified and clearly defined. (See *BGV A1/GUV-V C 1 and BGI 810-0*).

The responsibility of the operator of the staging facility or place of assembly always remains unaffected. In particular, the operator is responsible for the method of construction, load-bearing capacity and condition of the attachment points (load-suspension points) which he/she provides in the building. He/she must supply documentation (e.g. load-capacity plot) concerning these aspects.

Only competent persons (e.g. „Event Rigging Experts“) may assemble, dismantle and operate electric chain hoists. (See *VPLT SR 3.0, section 3 „Training and Qualification“*)

The necessary qualifications for planning, assembly, dismantling and operation depend on the degree of risk involved (See *VPLT SR 1.0, section 4.1 „Qualification and responsibility“*)

The person responsible for management and supervision must draft instructions, based on a risk assessment, on the procedure for the assembly, dismantling and operation of electric chain hoists. He or she must gear the instructions to the specific use concerned and make them available to the employees.

The person responsible for management and supervision approves the electric chain hoists for use. Such approval can only be given if proof has been furnished that the tests described in Section 5 of this Code of Practice have been conducted.

Any transfer to other users must be documented in writing. (See *E DIN 15 750*)

### 4.1 Assembly, dismantling and operation of electric chain hoists

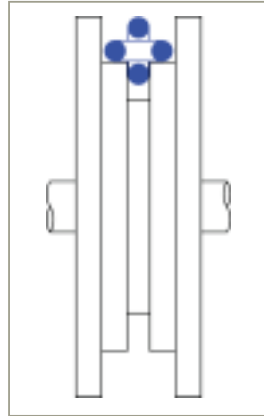
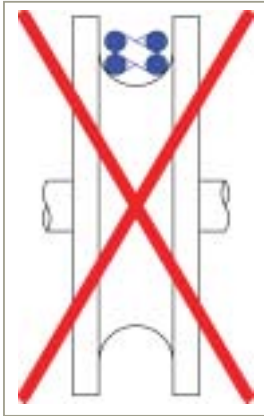
Electric chain hoists must be assembled, dismantled and operated in the manner specified by the manufacturer. Only accessories specified by the manufacturer may be used.

The following requirements must be met:

- when electric chain hoists are selected, their load-bearing capacity must be such that no overloading can occur. It makes sense not to push the hoist's load-bearing capacity to its limit. In the industry, working at 10 to 15 % below the limit has proven successful.
- the dynamic forces, e.g. impact factors, should be taken into account in the analysis when selecting the attachment points in the building. (see *3.2.1 „Technical details“*)
- before each assembly, the attachment points provided in the building must be visually inspected and their load-bearing capacity compared with the data given in the operator's documentation to ensure that they are in proper condition.
- before assembly, the electric chain hoists and all parts and devices necessary for operation (e.g. load-bearing elements, control unit and equipment) must be visually inspected.
- electric chain hoists must hang freely; chains and housings must not come into contact with each other. Electric chain hoists must be suspended in such a way that the chain cannot feed in at a slant, especially when a load (e.g. a truss system) is attached to several electric chain hoists.

- under special operating conditions (e.g. where a ground support or PA towers are used), the chains of the electric chain hoist may be run across rollers. The circumference of the rollers must be at least 10 times the length of a link in the chain size used. The roller profile must be formed in such a way that the load can only exert force on the roller via the horizontal chain links and no bending strain is exerted on the vertical chain links. The roller material chosen must ensure that no damage occurs to the chain.

(See E DIN 56 950: 2003 „Entertainment technology – Machinery installations – Safety requirements and inspections“, 5.2.5.2 „Antriebs- und Umlenkrollen für Stahlketten“)



Correct choice of top pulley

- cables must be laid in such a way that they do not run over sharp edges and are not crushed or subjected to tensile loads.
- when the electric chain hoist and the load are in motion, a person must be present to monitor the process. (See BGV D 8/GUV-V D 8, Section 29 „Initiation of the Lifting Movement“).
- during set-up, the feeding-in and feeding-out of the chain must be monitored. In the case of rigging hoists, assembly should be conducted in a way that ensures that the chain can feed into the chain-storage unit correctly. Care must be taken to ensure that the chain, when not under load, is held taut when feeding in and that, where double-chain electric hoists are used, the chains cannot become twisted.
- movements which can cause hazards may only be conducted if their speed is appropriate to the situation and
  - equipment is in place to provide protection against the hazardous points, e.g. areas are cordoned off by warning tape or persons acting as guards
  - or
  - the hazardous points are monitored by the machine operator
  - and
  - the hazardous points are indicated in a clearly visible and permanent fashion.
 (See BGV C 1/GUV-V C 1, Instruction relating to section 26, Paragraph (1), „Movements by Mechanical Equipment“).
- instructions to initiate movements must be given in an easily discernible and unambiguous manner.

- all load-bearing elements within the load path (e.g. load-suspension points, beam clamps, shackles, steel ropes, electric chain hoists, round slings, trusses, etc.) must be selected and dimensioned taking into account the loads and hazards present in each specific case. (See also BGI 810-2)
- the load on attachment gear such as ropes and webbings must not exceed one tenth of the minimum breaking strength; this is roughly equivalent to one twelfth of the calculated breaking strength. The load on attachment gear must not exceed half of the rated load capacity specified by the manufacturer. (See BGV C 1/GUV-V C 1, Instruction relating to section 9, „Load-Bearing Lines and Attachment Gear“)
- when D 8 electric chain hoists are used to hold loads above persons, secondary safety components are required. Preferably, secondary safety components which allow no drop (= 0 cm) should be used. For this purpose, only metal, positive connections using chain-shortening elements or turnbuckles are permitted. Shortening elements must be designed in such a way that it is not possible for them to loosen of their own accord.
- the sufficiency of the dimensions of secondary safety components (using steel ropes or chains without shortening devices) which allow negligible drop (= max. 10 cm) must be proven by means of calculation, taking into account the dynamic forces which occur. (See also BGI 810-3)

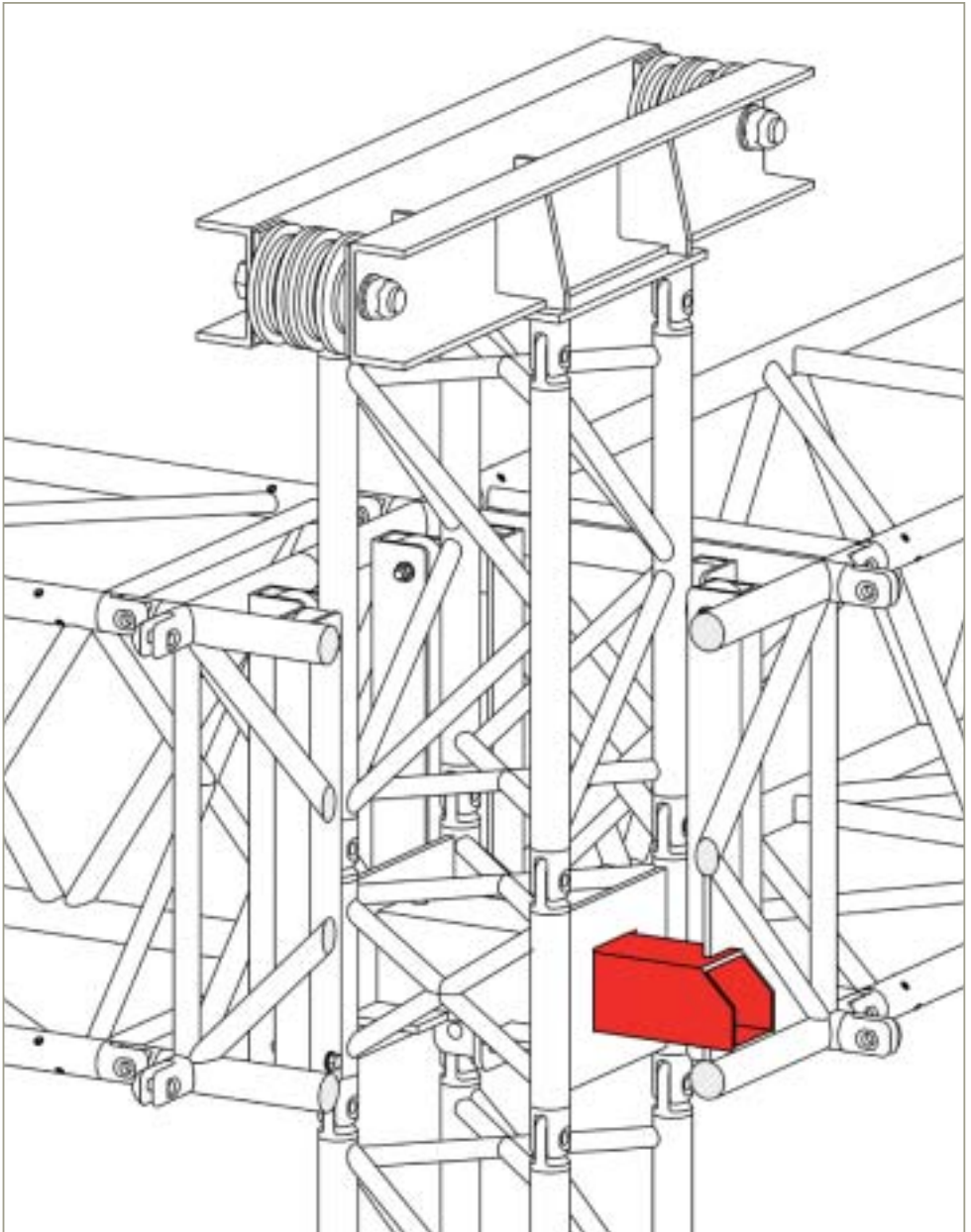
## 4.2 Personal protective equipment

In the case of work activities where technical or organisational measures are not able to prevent the risk of injury or damage to health, the employer must provide suitable personal protective equipment (PPE) and implements. The employees and other persons at risk must use said equipment and implements. (See BGV C 1/GUV-V C 1 section 18 (1)).

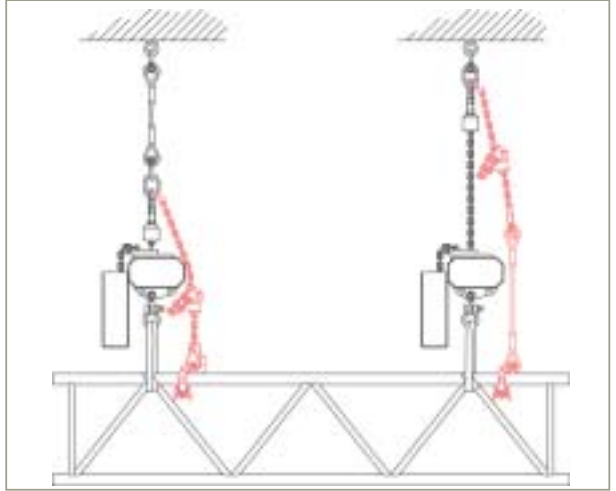
Self-employed sole traders (see BGV A 1/GUV-V A 1) must provide their PPE themselves and, as in the case of all other employees, must use it.

In particular, the following PPE must be provided during the assembly and dismantling of electric chain hoists: safety shoes, gloves, head protection and PPE against falls from a height.

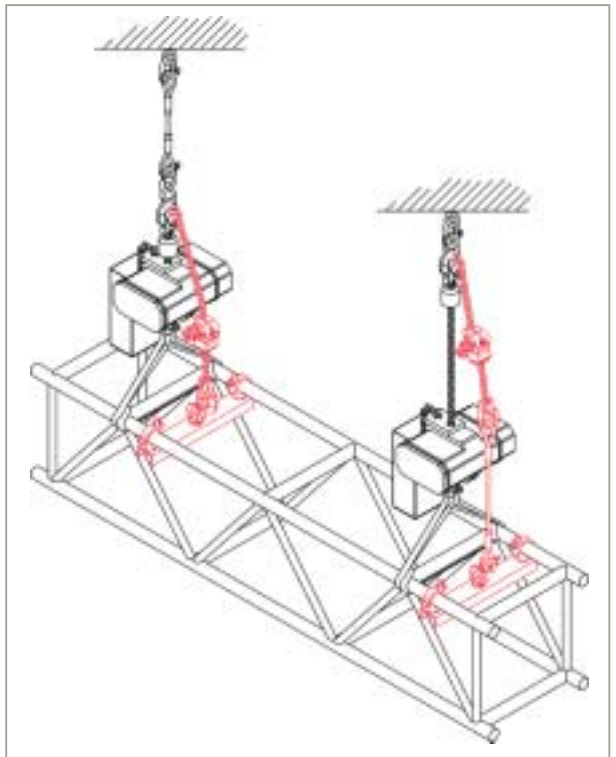
## Examples of secondary safety components



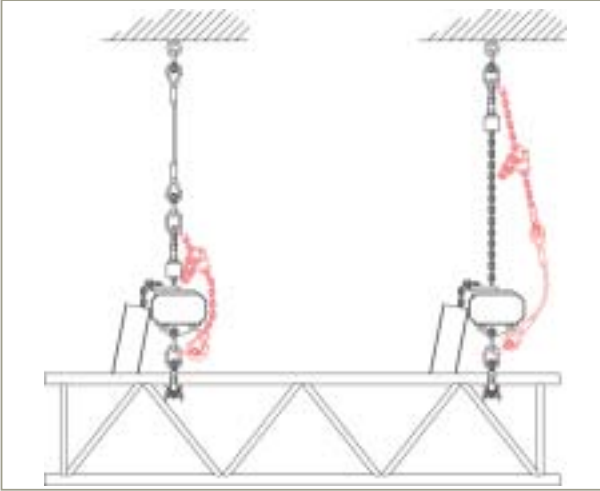
*Lock bars (e.g. where tower systems or stage roofs are used), 3-D image*



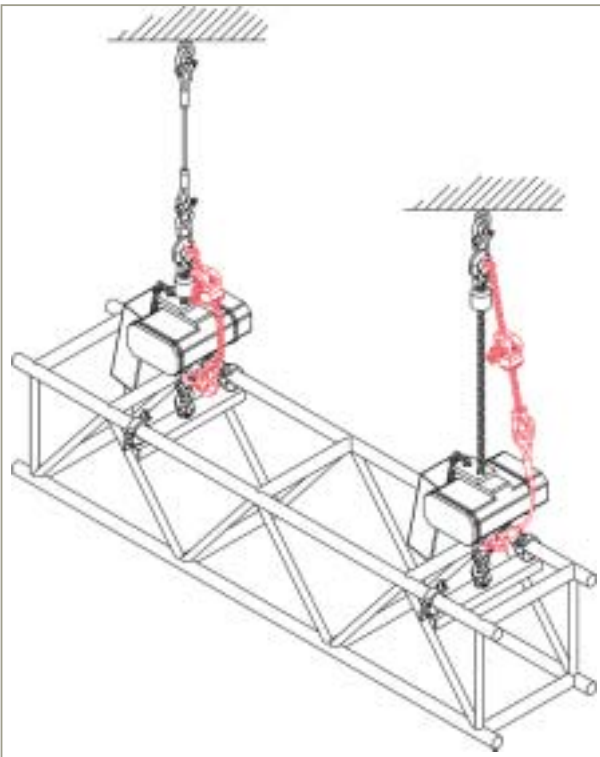
**Example A:**  
Secondary safety component  
without drop with safety rope  
or safety chain A (front view)



**Example A:**  
Secondary safety component  
without drop with safety rope  
or safety chain A (perspective view)



**Example B:**  
Secondary safety component  
with drop with safety rope  
or safety chain B (front view)



**Example B:**  
Secondary safety component  
with drop with safety rope  
or safety chain B (perspective view)

## 5 Testing

Electric chain hoists are „work equipment“ in the sense defined in the „Betriebssicherheitsverordnung“ (Ordinance on Industrial Safety and Health). The areas governed by the „Betriebssicherheitsverordnung“ include testing of work equipment prior to first use and after each assembly at a new location (see section 10 of the Ordinance). The purpose of this testing is to ensure that the work equipment has been properly assembled and functions safely.

In addition, periodic testing must be conducted. The type and scope of and intervals for these tests are established on the basis of the hazard assessment specified in Section 3, (3) of the „Betriebssicherheitsverordnung“.

Extraordinary testing becomes necessary in the event of extraordinary events which might impair the safety of the work equipment. In particular, examples of extraordinary events include accidents, changes to the electric chain hoists, lengthy idle periods and natural phenomena. The testing may only be carried out by persons qualified and authorised to do so.

Electric chain hoists are also „mechanical equipment“ in the sense defined in accident-prevention regulation BGV C 1/GUV-V C 1, „Staging and Production Facilities for the Entertainment Industry“.

The stipulations in the „Testing“ section of BGV C 1/GUV-V C 1 in conjunction with BGG 912/GUV-G 912, „Prüfung von sicherheitstechnischen und maschinentechnischen Einrichtungen in Veranstaltungs- und Produktionsstätten für szenische Darstellung“ („Testing of Safety and Mechanical Equipment in Staging and Production Facilities for the Entertainment Industry“), stem from the findings of hazard assessments, with customary industry practice taken into consideration. Testing performed in the manner described in BGG 912 can be assumed to meet the requirements of the „Betriebssicherheitsverordnung“ too. This applies to the type and scope of and intervals for testing as well as the qualification of the person qualified and authorised to conduct it.

### 5.1 Test regulations

The following regulations issued by the accident-insurance institutions, in addition to other regulations, must be complied with when testing electric chain hoists:

- BGV C 1/GUV-V C 1 (previously GUV 6.15) „Staging and Production Facilities for the Entertainment Industry“
- BGG 912/GUV-G 912 (previously GUV 66.15) „Grundsätze für die Prüfung sicherheitstechnischer und maschinentechnischer Einrichtungen in Veranstaltungs- und Produktionsstätten für szenische Darstellung“ („Rules for Testing Safety and Mechanical Equipment in Staging and Production Facilities for the Entertainment Industry“)
- BGG 905/GUV-G 905 (previously GUV 60.5) „Grundsätze für die Prüfung von Kranen“ („Rules for Testing Cranes“)

### 5.2 Testing prior to first use

Where the manufacturer has had testing performed before the product was placed on the market and/or where an EC declaration of conformity or a GS test certificate is provided, testing prior to first use (i.e. when the equipment is put into operation for the first time) checks whether the equipment has been properly installed, whether it is complete and whether it is ready for operation (visual and functional testing). Ready-to-use electric chain hoists can be put into operation for the first time by, for example, a „Meister“ for event technology (specialist field: stage/studio) or an „Event Rigging Expert“ („Sachkundiger für Veranstaltungs-Rigging“).

In the case of equipment which does not come under the Machinery Directive (e.g. flying systems for persons) and for which no documentary proof of safety is available, the testing is comprised of:

- a pre-test,
- a structural test and
- an acceptance test

to be carried out by an expert authorised for this purpose.

### 5.3 Testing prior to assembly and each use

Testing prior to each assembly and each use comprises a visual inspection of the electric chain hoists, all parts used and the way in which the equipment is assembled.

In particular, the following criteria must be observed:

for electric chain hoists:

- a) Connection to electrical supply
- b) Strain relief, on the housing, for the control lines
- c) Attachment point, on the housing, for the load-bearing element
- d) Attachment point, on the housing, for the chain-storage unit
- e) Marking as described in 3.2.2

for load-bearing elements:

- a) Apparent deformation of the steel chain or load hooks
- b) Apparent damage to the steel chain or load hooks
- c) Missing parts (connection between steel chains and motor/load hook)
- d) Implements for special purposes (e.g. pulleys)

The person in charge of the hoists must ensure that the electric chain hoists undergo a functional test prior to each use at a new location.

The purpose of the test is to ensure that the hoists have been assembled properly and function safely. The results must be documented with the help of a checklist.

The tests must be carried out by a person authorised and qualified to do so.

Persons considered qualified and authorised to test include:

- event rigging experts
- event technology specialists
- „Meister“ for event technology
- engineers holding a German „Diplom“ degree in engineering for event technology

## 5.4 Periodic and extraordinary testing

Electric chain hoists are to be tested at intervals, based on the nature and frequency of their use, which allow defects and damage to be identified in good time.

D 8 and D 8 Plus electric chain hoists must be tested at least once a year by a competent person. C 1 electric chain hoists must be tested at least once a year by a competent person and once every four years by an expert authorised to do so (in accordance with BGG 912).

Shorter testing intervals may be necessary for electric chain hoists used for tours and/or events which change location frequently or electric chain hoists which are frequently subjected to the negative impacts of transport.

In particular, the tests cover the following points:

for electric chain hoists:

- a) Connection to electrical supply
- b) Strain relief, on the housing, for the control lines
- c) Attachment point, on the housing, for the load-bearing element
- d) Attachment point, on the housing, for the chain-storage unit and secondary safety component for the chain-storage unit
- e) Testing in accordance with BGV A 2/GUV-V A 2
- f) Safety-brake and/or friction-clutch settings
- g) Load test in accordance with manufacturer's specifications
- h) Determination of the spent portion of the theoretical service life of lifting devices (not applicable to C 1 electric chain hoists) (*See Annex III*)

for load-bearing elements:

- a) Deformation of the steel chain or load hooks
- b) Damage to the steel chain or load hooks
- c) Missing parts (connection between steel chains and motor/load hook)
- d) Determination of whether element needs to be removed from service
- e) Inspection of the parts which secure the load hook and hook nut
- f) Implements for special purposes (e.g. pulleys)

The employer/operator must ensure that the results of the periodic tests are recorded in a test log. The electric chain hoist must always be accompanied by a copy of the certificate issued for the most recent test. (*For information on test records, see also BGV C1/GUV-V C 1, section 35*)

## 5.5 Removal-from-service criteria for load-bearing elements

Electric chain hoists' load-bearing elements must be removed from service if an assessment of the following criteria shows that it is no longer possible to guarantee that they can be safely used:

- a) deformation of the steel chain or the load hooks (*see BGI 556*)
- b) damage to or wear of the steel chain or the load hooks
- c) damage to or wear of the chain drive wheel/sprocket.



# Annex

I Terminology

II Normative und informal references

III Tables

for determining the spent portion of  
the theoretical service life of lifting devices

IV Positioning of the friction clutch  
for electric chain hoists

## Annex I – Terminology

### Attachment gear

Elements used to connect the load-bearing element to the load.

### Authorised expert

A person who, by virtue of his or her professional training and experience, has special knowledge in the field of safety and mechanical equipment and is familiar with the relevant state occupational health and safety regulations, regulations issued by the institutions for statutory accident insurance and prevention („Berufsgenossenschafts“) and good engineering practice (e.g. DIN standards, VDE rules, technical rules issued by other European Union member states or other states which are party to the Agreement on the European Economic Area). The expert must be able to test the safety of the safety and mechanical equipment and produce an assessment thereof.

Experts are authorised in accordance with BGG 912-1/GUV-G 912-1.

### Calculated breaking load ( $F_c$ )

The product of the material cross-section and the rated strength of the material.

### Competent person (testing)

A person who, by virtue of his or her professional training and experience, has adequate knowledge in the field of mechanical equipment and is familiar with the relevant state occupational health and safety regulations, regulations issued by the institutions for statutory accident insurance and prevention („Berufsgenossenschafts“) and good engineering practice (e.g. DIN standards, VDE rules, technical rules issued by other European Union member states or other states which are party to the Agreement on the European Economic Area) to such an extent that he or she can assess whether mechanical equipment is safe.

### Event rigging expert (IHK)

A person who, by virtue of his or her professional training and experience, has adequate knowledge in the field of event rigging and has an „IHK certificate“ qualification (from the Chamber of Industry and Commerce) (see VPLT standard SR3.0).

### Importer

Importers are the persons or entities who/which introduce technical work equipment, or have it introduced, into the European Economic Area. The law assumes, as it does in the case of manufacturers as well, that the importer is able to assess the safety of the imported technical work equipment.

### Load (-bearing) capacity

The maximum load which the mechanical equipment can carry when used as intended, without dynamic forces being taken into account.

### Load-bearing elements

Parts which are permanently fixed to a piece of mechanical equipment and are used to carry loads.

### Manufacturer

The producer of the product, i.e. the person or entity who/which procures the materials or pre-manufactured parts and builds a product with them and/or places a product on the market in their name.

### **MHHW**

„Fachausschuss Maschinenbau, Hebezeuge, Hütten- und Walzwerksanlagen“ (Expert Committee on Mechanical Engineering, Lifting Equipment, Iron-Making and Steel-Making) of the „Berufsgenossenschaftliche Zentrale für Sicherheit und Gesundheit“/BGZ (BG Central Office for Health and Safety at Work) of the „Hauptverband der gewerblichen Berufsgenossenschaften“/HVBG (German Federation of Institutions for Statutory Accident Insurance and Prevention).

### **Multi-hoist processes**

A process in which several electric chain hoists are used for one load or one staging process.

### **Non-positive connection**

Method of securing the connection between two parts (e.g. two gearwheels) in which, in contrast to positive connection, the parts are held in their positions by an external force, usually friction (e.g. non-positive connection between belt and pulley or between wheel and road surface).

### **Placing on the market**

Any making available of technical work equipment to others (users).

### **Positive connections**

Type of connection between two machine elements (e.g. shaft and collar) in which the shapes of the parts to be connected correspond (e.g. catches, bolts, pins, fit-in keys or feather keys and the corresponding counterparts). As a result, the two parts are not able to move against each other and any forces and torque can be transferred from one part to the other.

### **Rated load**

The sum of the load and the dynamic forces during operation.

### **Rigging hoist**

Situation in which the electric chain hoist is installed in such a way that the load is attached to the load-bearing element for the hoist's housing and the hoist „climbs up“ along its own chain.

### **Scenery hoist**

A device which is equipped with a load-bearing element, used to lift, lower and hold loads of > 5 kg, and to which the net load can only be attached at one point.

### **Secondary safety component**

A second, independent piece of equipment which prevents the load from falling.

## Annex II – Normative and informal references

*(No liability can be accepted for the correctness or completeness of the following references)*

### **ArbSchG**

Arbeitsschutzgesetz (German Occupational Health and Safety Act)

### **BetrSichV**

Betriebssicherheitsverordnung (Ordinance on Industrial Safety and Health)

### **BGV A 1/GUV-V A 1**

„Grundsätze der Prävention“ („Principles of Prevention“)

### **BGV A 2/GUV-V A 2**

„Elektrische Anlagen und Betriebsmittel“ („Electrical Plant and Equipment“)

### **BGV C 1/GUV-V C 1**

„Veranstaltungs- und Produktionsstätten für szenische Darstellung“ („Staging and Production Facilities for the Entertainment Industry“)

### **BGI 556/GUV-I 556**

„Anschläger“ („Load-Attachment Personnel“)

### **BGI 810-0 (SP 25.1/2-0)**

Fernsehen, Hörfunk und Film; Arbeitssicherheit in Produktionsstätten – „Einsatz von Bühnen- und Studiofachkräften“ („Television, Radio and Film - Occupational Safety in Production Facilities – Deployment of Qualified Stage and Studio Workers“)

### **BGI 810-2 (SP 25.1/2-3)**

Fernsehen, Hörfunk und Film; Arbeitssicherheit in Produktionsstätten – „Aufhängungen“ („Television, Radio and Film - Occupational Safety in Production Facilities – Suspension Methods“)

### **BGI 810-3 (SP 25.1/2-4)**

Fernsehen, Hörfunk und Film; Arbeitssicherheit in Produktionsstätten – „Bereitstellung und Benutzung von Sicherungsseilen und -ketten“ („Television, Radio and Film - Occupational Safety in Production Facilities – Provision and Use of Safety Ropes and Chains“)

### **BGI 813 (SP 25.1/5)**

„Fernsehen, Hörfunk und Film, Prüfung elektrischer Anlagen und Geräte“ („Television, Radio and Film – Testing of Electrical Plant and Devices“)

### **BGG 912/GUV-G 912**

„Prüfung von sicherheitstechnischen und maschinentechnischen Einrichtungen in Veranstaltungs- und Produktionsstätten für szenische Darstellung“ („Testing of Safety and Mechanical Equipment in Staging and Production Facilities for the Entertainment Industry“)

### **VPLT SR1.0**

„Bereitstellung und Benutzung von Traversensystemen“ („Provision and Use of Truss Systems“)

### **VPLT SR3.0**

„Sachkundiger für Veranstaltungs-Rigging: Qualifikation“ („Event Rigging Expert – Qualification“)

### **MVStättVO**

Muster-Versammlungsstättenverordnung oder darauf basierende landesrechtliche Bestimmungen (Model Ordinance on the Construction and Operation of Places of Assembly – or regulations adopted by Germany's federal states on the basis of the ordinance)

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**Production and design** – As a rule, production and design must be based on the state of the art. Existing standards and guidelines covering engineering or production requirements must be complied with.

**Use** – The accident-prevention regulations issued by the public and industry accident-insurance institutions must be observed at all times.

## Anhang III – Tables for determining the spent portion of the theoretical service life of lifting devices

The expected frequency (operating-time category, Table 1) and the strenuousness (load spectrum, Table 2) of the lifting equipment's use serve as the basis for determining what is known as the „mechanism group“ (Table 3), which in turn determines the dimensioning of the mechanism.

Table 1: Mechanism classification

Operating time category		Average daily operating time in hours	Projected total operating time in hours
V 0,06	T 0	≤ 0,12	200
V 0,12	T 1	≤ 0,25	400
V 0,25	T 2	≤ 0,5	800
V 0,5	T 3	≤ 1	1 600
V 1	T 4	≤ 2	3 200
V 2	T 5	≤ 4	6 300
V 3	T 6	≤ 8	12 500
V 4	T 7	≤ 16	25 000
V 5	T 8	> 16	50 000

Source: FEM 9.511

Table 2: Load spectrum

Load spectrum		Definition	Cubic mean
1 (light)	L 1	Mechanisms or parts thereof which are only subjected to the maximum load in exceptional cases, but are constantly subjected to very light loads only	$K \leq 0,50$
2 (medium)	L 2	Mechanisms or parts thereof which are quite often subjected to the maximum load, but are constantly subjected to light loads	$0,50 < k \leq 0,63$
3 (heavy)	L 3	Mechanisms or parts thereof which are frequently subjected to the maximum load and are constantly subjected to medium loads	$0,63 < k \leq 0,80$
4 (very heavy)	L 4	Mechanisms or parts thereof which are regularly subjected to loads close to the maximum load	$0,80 < k \leq 1,00$

Source: FEM 9.511

Table 3: Classification of mechanism groups

Load spectrum	Cubic mean	Operating-time class								
		V 0,06	V 0,12	V 0,25	V 0,5	V 1	V 2	V 3	V 4	V 5
		T 0	T 1	T 2	T 3	T 4	T 5	T 6	T 7	T 8
		Average daily operating time in hours								
		≤ 0,12	≤ 0,25	≤ 0,5	≤ 1	≤ 2	≤ 4	≤ 8	≤ 16	> 16
1 L1	$k \leq 0,50$			1 Dm	1 Cm	1 Bm	1 Am	2m	3m	4m
2 L2	$0,50 < k \leq 0,63$		1 Dm	1 Cm	1 Bm	1 Am	2m	3m	4m	5m
3 L3	$0,63 < k \leq 0,80$	1 Dm	1 Cm	1 Bm	1 Am	2m	3m	4m	5m	
4 L4	$0,80 < k \leq 1,00$	1 Cm	1 Bm	1 Am	2m	3m	4m	5m		

Source: FEM 9.511

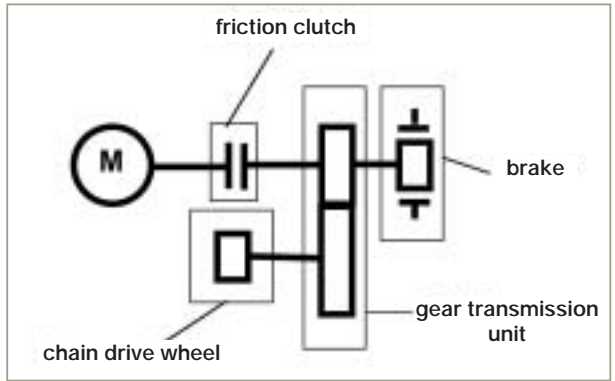
Table 4: Theoretical service life

Line	Mechanism group Load spectrum/ load spectrum factor	1 Dm	1 Cm	1 Bm	1Am	2m	3m	4m	5m
		M1	M2	M3	M4	M5	M6	M7	M8
		Theoretical service life D (h)							
1	Light 1 / L1 $K = 0,5$ ( $km_1 = 0,125$ )	800	1 600	3 200	6 300	12 500	25 000	50 000	100 000
2	Medium 2 / L2 $0,5 < k < 0,63$ ( $km_2 = 0,25$ )	400	800	1 600	3 200	6 300	12 500	25 000	50 000
3	Heavy 3 / L3 $0,63 < k < 0,8$ ( $km_3 = 0,5$ )	200	400	800	1 600	3 200	6 300	12 500	25 000
4	Very heavy 4 / L4 $0,8 < k < 1$ ( $km_4 = 1$ )	100	200	400	800	1 600	3 200	6 300	12 500

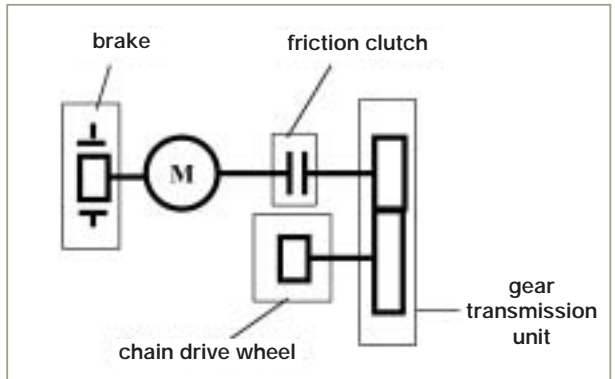
Source: FEM 9.755

## Annex IV – Positioning of the friction clutch for electric chain hoists

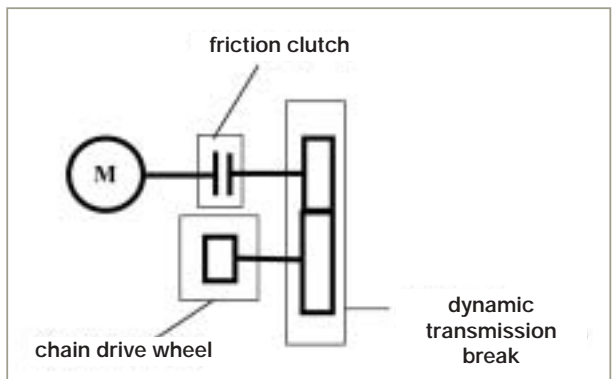
**Position 1:**  
Friction clutch is not in the load path when chain hoist is disconnected from power supply



**Position 2:**  
Friction clutch is in the load path when chain hoist is disconnected from power supply



**Position 3:**  
Friction clutch is not in the load path when chain hoist is disconnected from power supply (gear transmission unit holds load)



# VPLT. SR2.0

## Provision and Use of Electric Chain Hoists

latest update: December 20, 2004

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