LR 1600/2

0048036

S **I--I ==> Wind 12.8m/s**

Load chart manual

Edition: 27.08.2019

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418100-05

Preface

Manufacturer

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California Proposition 65

Proposition 65 of the US State of California warns against chemicals that are known to cause cancer, birth defects and other reproductive harm.

For additional information, see the website: **www.P65Warnings.ca.gov**.

Proposition 65
⚠ **WARNING:** This product can expose you to chemicals, which are known to the State of California to cause cancer, birth defects or other reproductive harm. For more information see: www.P65Warnings.ca.gov.

Fig.147844: Example of a Proposition 65 sign for USA: Chemicals

Proposition 65
⚠ **WARNING:** This product can expose you to chemicals, including exhaust emissions, which are known to the State of California to cause cancer. For more information see: www.P65Warnings.ca.gov.

Fig.147842: Example of a Proposition 65 sign for USA: Exhaust emissions

Proposition 65
⚠ **WARNING:** This product can expose you to chemicals, including lead and lead compounds, which are known to the State of California to cause birth defects or other reproductive harm. For more information see: www.P65Warnings.ca.gov.

Fig.147843: Example of a Proposition 65 sign for USA: Lead and lead compounds

General

This crane was built according to the state of technology and recognized safety technical regulations. Despite that, danger to body and life for the user and / or third persons or damage to the crane and / or other material assets is still possible.

This crane may only be used:
– when in a perfect technical condition.
– for destined use.
– by trained personnel, which acts in a safety and danger conscious way.
– when no safety relevant problems are present.
– when no modifications were made on the crane.

Any problems, which could affect safety must be fixed immediately.

Modifications on the crane may only be made with written approval by Liebherr-Werk Ehingen GmbH.

Data logger

This crane is equipped with a data recording device. Among others, the following data is recorded:
– Date and time of day
– Entered set up configuration of the crane
– Actual load
– Percentage of crane utilization
– Boom radius (working radius)
– Main boom angle, luffing jib angle
– Total telescopic boom length, length of each telescopic section
– Every actuation of bypass devices

The recorded data can be read with a respective software.

Safety and warning display

The safety and warning display is directed to all persons who work with the crane.

The terms **DANGER**, **WARNING**, **CAUTION** and **NOTICE** used in the crane documentation are intended to point out certain rules of conduct to all persons working with the crane.

Warning signs	Signal word	Explanation
	DANGER	Designates a dangerous situation which will lead to death or serious injury if it is not prevented. [1)]
	WARNING	Designates a dangerous situation, which can lead to death or serious injury if it is not prevented. [1)]
	CAUTION	Designates a dangerous situation, which can lead to slight or medium-grade injuries if it is not prevented. [1)]
	NOTICE	Designates a dangerous situation, which can lead to property damage if it is not prevented.

[1)] This could also result in property damage.

Additional notes

The term **Note** is used in the crane documentation to make all persons working with the crane aware of useful information and tips.

Sign	Signal word	Explanation
ⓘ	**Note**	Designates useful information and tips.

Crane documentation

The crane documentation is comprised of:
– all supplied documents on paper and in digital form.
– all supplied programs and applications.
– all subsequently supplied information, updates and addenda for the crane documentation.

The crane documentation:
– makes it possible for you to operate the crane safely.
– supports you in using the permissible application possibilities of the crane.
– provides you with information about the functionality of important components and systems.

Note
Terminology in the crane documentation.
Certain expressions are used in the crane documentation.
▶ In order to avoid misunderstandings, the same expressions should always be used.

Translations from the German version of the crane documentation: The crane documentation has been translated to be best of one's knowledge. Liebherr-Werk Ehingen GmbH assumes no liability for translation errors. The German version of the crane documentation is solely applicable for factual accuracy. If you find any errors or if any misunderstandings arise when reading the crane documentation, please contact Liebherr-Werk Ehingen GmbH immediately.

WARNING
Danger of accident due to incorrect operation of the crane!
Incorrect operation of the crane can lead to accidents.
Death, severe bodily injuries, property damage.
▶ Only authorized and trained expert personnel are permitted to work on the crane.
▶ The crane documentation is part of the crane and must be accessible on the crane.
▶ The crane documentation and on-site regulations and specifications (such as accident prevention regulations) must be observed.

Using the crane documentation:
– **makes it easier** to become familiar with the crane.
– **avoids** problems due to improper operation.

Observing the crane documentation:
– **increases** reliability in use.
– **extends** the service life of the crane.
– **minimizes** repair costs and downtime.

Place the crane documentation accessible in the driver's cab or in the crane cab.

WARNING
Outdated version of crane documentation!
If subsequently supplied information, updates and addenda to the crane documentation are not observed and added, there is a danger of accident.
Death, severe bodily injuries, property damage.
▶ Observe and add all subsequently supplied information, updates and addenda for the crane documentation.
▶ Make sure that all affected persons always know and understand the latest version of the crane documentation.

WARNING
Crane documentation is not understood!
If parts of the crane documentation are not understood and the tasks are carried out on or with the crane, then there is a danger of accident.
Death, severe bodily injuries, property damage.
- ▶ Clear up open questions regarding the crane documentation with Liebherr Service before carrying out the respective task.

All accident prevention guidelines, operating instructions, load charts etc. are based on the destined use of the crane.

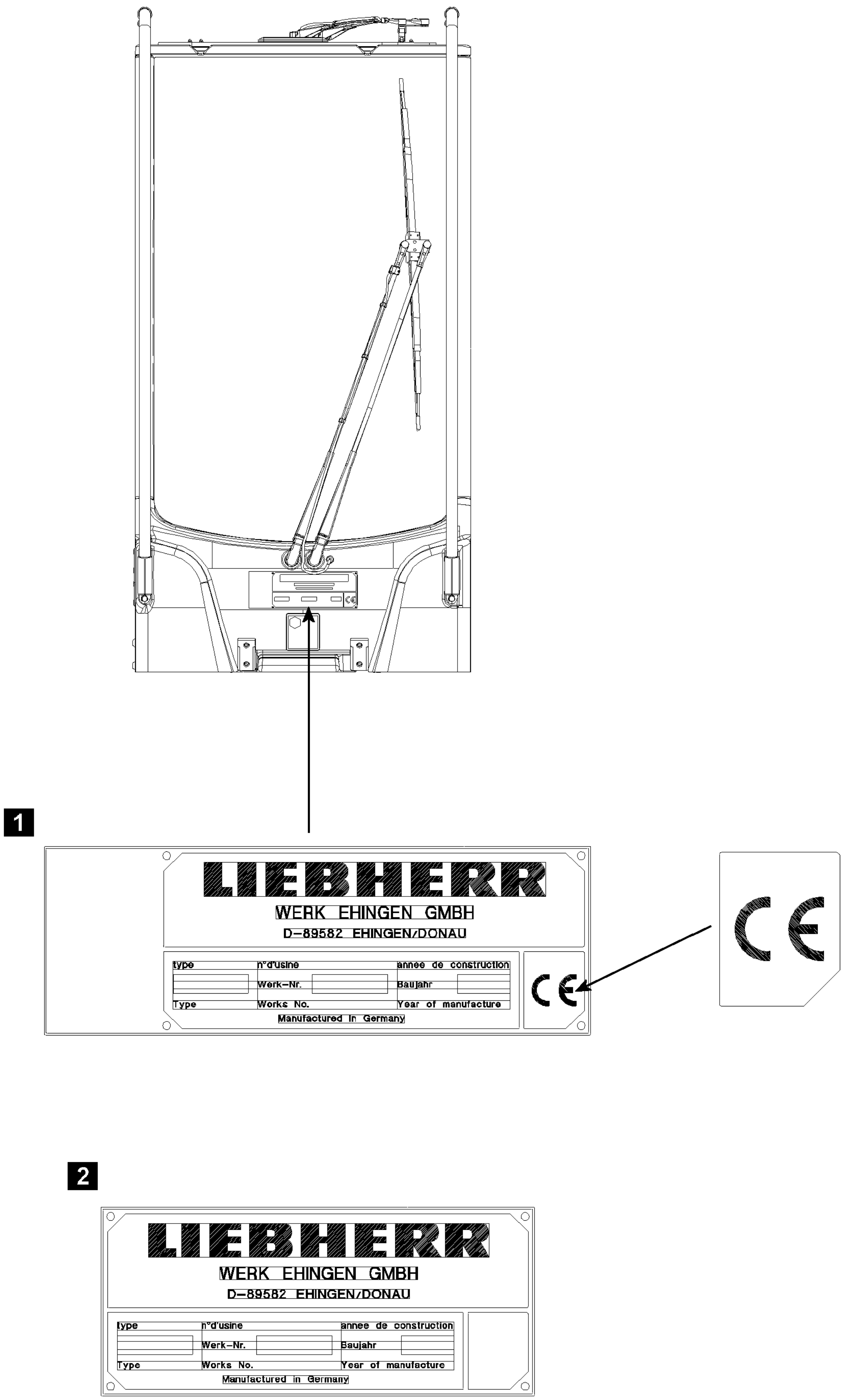

Fig.110001

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CE marking

The CE marking is a mark according to EU laws:
- Cranes with CE-marking are compliant with the European Directives applicable at the moment of placing the cranes on the market, and in particular European machinery directive 2006/42/EC and product standard EN 13000! Data tag Crane with CE-marking, see illustration **1**.
- Cranes that are operated outside the respective area of application of the European machinery directive do not require a CE marking. Data tag Crane without CE marking, see illustration **2**.
- It is prohibited to market and operate cranes without a CE marking, which do not meet the product-specific regulations valid in Europe, when a CE marking is specified for the country, especially in the single European market.
- It is prohibited to operate cranes with a tipping load utilization of 85 % or a bypass device that does not comply with EN 13000 within the European Union or in countries that only permit a lower tipping load utilization! The national regulations apply. These cranes may not have a CE marking.

EU Declaration of Conformity

Upon delivery of the equipment with a CE marking, the EU Declaration of Conformity according to Directive 2006/42/EC is provided directly after the cover sheet. The EU Declaration of Conformity is valid in the following form and language in all countries of the European Union, as well as in countries that recognise the Directives of the European Union. Keep the EU Declaration of Conformity in a safe place.

Note
- ▶ This declaration of conformity is only valid when this mobile crane meets the directives and standards stated in this EU Declaration of Conformity. This applies especially for the programming and function of the safety-relevant overload protection. The CE sign must be removed if changes were made on the crane, which do not conform to the stated directives and standards. These include in particular a tipping load utilization (85 % load charts) that are not permissible in Europe and a changed version of the bypass device for the overload protection.
- ▶ If this modified mobile crane is re-imported later into a country which is within the validity range of the EC machine directive, then the importer is responsible for the verification and the written confirmation, that the condition of the mobile crane at importation into the EC meets the directives and standards, which are stated in this declaration of conformity.
- ▶ The complete crane documentation must be complete and present in the official language of the community of the member state, in which the machine is placed into service and / or where it is operated.
- ▶ For the verification and confirmation we recommend that the importer contacts the crane manufacturer or a person authorized by him.
- ▶ After writing confirmation of the importer on the mobile crane manufacturer, the mobile crane may be labelled again with a CE label and the EU Declaration of Conformity become valid again. For this crane the directives and standard valid at initial delivery consequently continue to apply.

EU Declaration of conformity

If changes are made to the equipment that were not approved in writing by Liebherr-Werk Ehingen GmbH, then this EU declaration of conformity becomes invalid.
Also observe the note regarding validity on the back of the page.

Type of machine:	**Mobile crane**
Type:	**XXX**
Serial No.:	**XXX**
Year of construction:	**XXX**
Power output of the diesel engine:	**XXX kW / XXX rpm**
L_{WA} measured[1)]:	**XXX dB**
L_{WA} guaranteed[1)]:	**XXX dB**

We herewith declare that the above declared machine in its delivery condition complies with all relevant provisions of the following EU Directives:

- **Directive 2006/42/EC of the European Parliament on machinery**
- **Directive 2005/88/EC of the European Parliament amending the Directive 2000/14/EC relating to noise emission[1)]**
- **Directive 2014/53/EU of the European Parliament relating to the making available on the market of radio equipment**

Applied harmonized standards:

EN 13000:2010 + A1:2014   Cranes – Mobile cranes

Applied evaluation procedure according to Annex VIII of Directive 2000/14/EC
Name of the notified body:

TÜV Rheinland LGA Products GmbH, D-90014 Nürnberg, Identification No.: 0197

Authorized agent for the compilation of the technical documentation:

Head of Design Department
Dr.-Hans-Liebherr-Straße 1
89584 Ehingen/Donau

1) during crane operation

Ehingen

(Head of Design Department)

Liebherr-Werk Ehingen GmbH
Dr.-Hans-Liebherr-Straße 1
89584 Ehingen
Germany
04.07.2017_en

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Fig.147811-en: Reprint of the crane's EU Declaration of Conformity

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Intended use

The intended use of the crane consists solely in the vertical lifting and lowering of free and unfixed loads, whose weight and center of gravity are known.

To do so, a hook or hook block approved by Liebherr must be reeved on the hoist rope and it may only be operated within the permissible set up configurations.

Driving with the crane, with or without an attached load is only permissible if a corresponding driving or load chart is available. The set up configurations intended for it and the safety conditions must be observed according to the corresponding crane documentation.

Any other use or any other exceeding utilization is **not** destined use.

Destined use also includes the adherence of the required safety guidelines, conditions, prerequisites, set up conditions and working steps in the crane documentation (for example: Operating instructions, load charts, erection and take down charts, job planner).

The manufacturer is **not** liable for damage caused by non-destined use or improper use of the crane. Any associated risk it is carried solely by the owner, the operator and the user of the crane.

Non-destined use

Non-destined use is:
- Working outside the permissible set up configurations according to the load chart.
- Working outside the permissible boom radii and slewing ranges according to the load chart.
- Selecting load charts, which do not correspond to the actual set up configuration.
- Selection of a set up configuration via code or via manual entry, which does not correspond to the actual set up configuration.
- Working with bypassed / deactivated safety equipment, for example bypassed load torque limiter or with bypassed hoist limit switch.
- Increasing the boom radius of the lifted load after a LMB shut-off, for example by diagonally pulling the load.
- Using the support pressure display as information in order to utilize the crane up to the tipping limit!
- Use of equipment parts which are not approved for the crane.
- Operation of the crane in an area exposed to explosion hazards.
- Using the crane at sports and recreational events, especially for "Bungee" jumps and / or "Dinner in the sky".
- On-road driving in an impermissible travel condition (axle load, dimension).
- Driving with the equipment in place in an impermissible travel condition.
- Pushing, pulling or lifting loads with the level control, the sliding beams or the support cylinders.
- Pushing, pulling or lifting loads by actuating the slewing gear, the luffing gear or the telescoping gear.
- Ripping stuck objects loose with the crane.
- Utilizing the crane for a longer period of time for material handling tasks.
- Releasing the crane suddenly (grapple or dumping operation).
- Utilizing the crane when the weight of the load is suspended on the crane is changed, for example by filling a container suspended on the load hook, except:
  - The load torque limiter was checked before for function with a known load.
  - The crane cab is occupied.
  - The crane is operational.
  - The container size is selected in such a way that an overload of the crane with full load is eliminated within the valid utilized load chart.

The crane may **not** be used for:
- Fastening a stuck load for which the weight and center of gravity are not known and which is released only by flame cutting, for example.
- Letting persons drive along outside the driver’s cab.
- Letting persons drive along outside the crane cab.
- Transporting personnel in the crane cab while driving.
- Transporting personnel with the load handling equipment and on the load.
- Transporting of persons with work baskets (cherry pickers), if the national regulations of the responsible work safety organization are not observed.
- Transporting loads and objects on the crane chassis.
- Transporting loads and objects on the crane superstructure.
- Transporting loads and objects on the ballast trailer.
- Transporting loads and objects on the suspended ballast.
- Transporting loads and objects on the boom lattice sections and / or the crane boom.
- Two hook operation without auxiliary equipment.

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– Extended material handling operation.
– Crane operation on a floating device if the conditions in chapter “Crane on a floating device” are not fulfilled and the written release by **Liebherr Werk Ehingen GmbH** is not present.

The crane documentation must be read and used by all persons who are involved in use, operation, assembly and maintenance of the crane.

Ambient temperature

The crane is designed for an ambient temperature of -20 °C to +50 °C.

If the ambient temperature is lower than -20 °C the crane must be modified with “auxiliary equipment for working at low temperatures”.

WARNING
Working at low temperatures without the corresponding auxiliary equipment!
The crane components can be damaged and fail. The load can rip off.
Death, severe bodily injuries, property damage.

If the crane is operated at an ambient temperature lower than -20 °C:
- ▶ Make sure that the crane is equipped with the corresponding “auxiliary equipment for working at low temperatures”. Observe and comply with chapter 2.08.
- ▶ Use the operating fluids for the corresponding ambient temperature in time. Observe and comply with chapter 7.07.

Safety equipment

Special attention must be paid to the safety equipment built into the crane. The safety equipment must constantly be checked for functionality. The crane may not be operated if the safety equipment are not working or not working correctly.

Note
Your motto must always be:
- ▶ **Safety first!**

The crane has been built in accordance with the applicable regulations for crane operation and travel operation and has been approved by the relevant authorities.

Equipment and spare parts

WARNING
Danger of fatal injury if original equipment parts are **not** used!
If the crane is operated with **not** original equipment parts, the crane can fail.
Death, severe bodily injuries, property damage.
- ▶ Operate the crane only with original equipment parts!
- ▶ Crane operation with equipment parts, which do **not** belong to the crane is prohibited!
- ▶ If there is any doubt about the origin of equipment parts, contact Liebherr Service!

WARNING
The crane permit and the manufacturer’s warranty will become void!
If any original installed parts are modified, manipulated or replaced (e.g. removal of parts, installation of non-original Liebherr parts), both the crane permit and the manufacturer’s warranty will become void.
- ▶ Leave installed original parts unchanged.
- ▶ Do not remove installed original parts.
- ▶ Use only Original Liebherr spare parts.
- ▶ If there is any doubt about the origin of spare parts, contact Liebherr Service.

For ordering equipment and spare parts, always keep the crane number handy and provide it.

Definition of directional data for mobile cranes

Driving forward: Driving with the driver's cab on the front.

Driving in reverse: Driving with the taillights of the crane chassis on the front.

Front, **rear**, **right**, **left** in the **driver's cab** refer to the crane chassis. The driver's cab is always in the front.

Front, **rear**, **right**, **left** in the **crane cab** refer to the crane superstructure. Front is always in direction of the placed down boom.

0° crane superstructure slewing angle: The boom points in the longitudinal direction to the rear past the rear of the vehicle.

180° crane superstructure slewing angle: The boom points in the longitudinal direction to the front past the driver's cab.

Definition of directional data for crawler cranes

Driving forward driving forward from the view of the crane operator seated in the crane cab. Turntable in 0° or 180° position.

Driving reverse driving backward from the view of the crane operator seated in the crane cab. Turntable in 0° or 180° position.

Front, **rear**, **right**, **left** always orient themselves on the **crawler travel gear** from the position of the chain tension devices. The chain tension devices on the crawler travel gear are always on the front.

Front, **rear**, **right**, **left** refer to the direction of view of the crane operator seated in the **crane cab**. Front is always in direction of the placed down boom.

Optional equipment and functions

The equipment marked with * and the functions are optionally available and are **not** part of the standard crane (optional equipment).

Conversion chart

	Initial unit	Multiplication factor	Target unit
Length	mm	0.03937	in
	in	25.4000	mm
	mm	0.00328	ft
	ft	304.8	mm
	cm	0.39370	in
	in	2.5400	cm
	cm	0.0328	ft
	ft	30.48	cm
	m	39.37	in
	in	0.0254	m
	m	**3.281**	**ft**
	ft	**0.3048**	**m**
	km	0.62137	mile
	mile	1.6093	km

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	Initial unit	Multiplication factor	Target unit
Area	cm²	0.155	in²
	in²	6.4516	cm²
	m²	**10.764**	**ft²**
	ft²	**0.0929**	**m²**
Volume	cm³	0.06102	in³
	in³	16.387	cm³
	m³	35.3147	ft³
	ft³	0.0283	m³
	l	0.001	m³
	m³	1000	l
	l	61.024	in³
	in³	0.016387	l
	l	0.0353	ft³
	ft³	28.32	l
	l	0.264178	US. liq. gal
	US. liq. gal	3.7853265	l
Mass (weight)	kg	2.20462	lb
	lb	0.45359	kg
	t	**2204.62**	**lb**
	lb	**0.0004536**	**t**
	t	1.1023	short ton US (tn. sh.)
	short ton US (tn. sh.)	0.90718	t
	t	**0.45359**	**kip**
	kip	**2.20462**	**t**
Mass / length	kg/m	0.055998	lb/in
	lb/in	17.857781	kg/m
	kg/m	0.67197	lb/ft
	lb/ft	1.48816	kg/m
Force	N	0.2248	lbf
	lbf	4.4483986	N
	kN	**224.809**	**lbf**
	lbf	**0.0044483986**	**kN**
Turning moment	Nm	8.85075	lbf·in
	lbf·in	0.112984	Nm
	Nm	0.73756	lbf·ft
	lbf·ft	1.3559	Nm
Performance	HP (DIN HP)	0.7355	kW
	kW	1.3596	HP (DIN HP)

	Initial unit	Multiplication factor	Target unit
Speed	m/s	39.37	in/s
	in/s	0.0254	m/s
	m/s	**3.28084**	**ft/s**
	ft/s	**0.3048**	**m/s**
	km/h	0.62137	mph (mi/h)
	mph (mi/h)	1.60935	km/h
	m/s	2.2369	mph (mi/h)
	mph (mi/h)	0.44704	m/s
Pressure	kPa (kN/m^2)	0.01	bar
	bar	100	kPa (kN/m^2)
	bar	14.5038	psi
	psi	0.06895	bar
	kPa (kN/m^2)	**0.145038**	**psi**
	psi	**6.894759**	**kPa (kN/m^2)**
	N/cm^2	1.450377	psi
	psi	0.6894759	N/cm^2
	N/m^2	0.000145038	psi
	psi	6894.759	N/m^2
	t/m^2	204.81	lbs/ft^2
	lbs/ft^2	0.0048828	t/m^2
Load-related area	m^2/t	0.004882	ft^2/lbs
	ft^2/lb	204.81	m^2/t
Temperature	**°C**	**([°C] · 1.8) + 32**	**°F**
	°F	**([°F] - 32) / 1.8**	**°C**

Conversion chart

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40 Load chart manual

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40.02 Basic information

Fig.195219

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1 Basic information

Note

- The load values in the load charts are indicated in tons (t) or pounds (lb)
- The boom radius is the horizontal distance of the hook block from the rotation axis of the crane superstructure, measured on the ground. The boom flexation is taken into account.
- In the provided loads, the weight o the hoist rope at reeving according to the load chart has been taken into account. If higher reeved, then the load is reduced by the weight of the additional strands of the hoist rope. The weights of the load lifting equipment and the fastening equipment must be deducted from the given load value.
- In two-hook operation, the hoist rope on the second load position has not been taken into account. The weight of all strands of the hoist rope on the second load position must be deduced from the load value.
- For number values, the decimal digits are separated with a period "**.**" . Decimal digits are on the right of the period "**.**".

WARNING

Erroneous operation of crane!
Toppling crane, failure of crane structures.
Death, severe bodily injuries, property damage.

- Working outside the permissible set up configurations, boom radii and slewing ranges according to the load chart is prohibited.
- Move the boom system even without a load only within the permissible ranges according to the load charts or erection and take-down charts.
- Move the boom systems when "assembly operation" is engaged only within the permissible ranges according to the load charts or erection and take-down charts.
- In part limits and notes with character signs (signs, numbers or letters) are given in operating mode icons. They must be adhered to.

Note

In operating modes with ballast trailer or suspended ballast:

- Determine the optimum derrick ballast weight with the LICCON job planner.

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40.05 Crane operation

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Fig.195219

1 General

WARNING
Erroneous operation of crane!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
- ▶ Do not overload the crane.
- ▶ Adhere to the set up configuration according to the load chart.
- ▶ Adhere to the boom lengths, radii and slewing ranges in the respective load chart.
- ▶ Check warning and safety equipment for function.
- ▶ Check the weight data for the load to be lifted.
- ▶ Secure the load to avoid oscillation.
- ▶ Angular pull of the load is prohibited.
- ▶ Do not use the crane to rip loads free.
- ▶ Adhere to the distance to pits, basements and embankments, see Crane operating instructions, chapter 2.04.
- ▶ Make sure that the ground can take on the maximum operating weight of the crane in addition to the weight of the load.
- ▶ Adhere to the safety distance of live overhead electrical lines, see Crane operating instructions, chapter 2.04.

2 Crane operation “Crane supported”

Note
- ▶ Only crawler crane LR 1750 and LR 1750/2 and crawler crane with a narrow gauge crawler track (LR 1400/2-W and LR 1600/2-W).

WARNING
Erroneous operation of crane!
Toppling crane.
Death or severe injuries, high property damage.
- ▶ Support the crane before turning the superstructure.
- ▶ Swing the support beams out and / or extend them to the support base given in the respective load chart.
- ▶ Install the support plates and / or base plates on the support cylinders, wee Crane operating instructions, chapter 3.10.
- ▶ Comply with the maximum permissible incline of the crane, see Load chart manual Chapter 40.65.40.
- ▶ Make sure that the crawler carriers have no contact with the ground.
- ▶ Make sure that the crane is horizontally aligned during crane operation.

3 Crane operation “Crane on crawler carriers”

WARNING
Erroneous operation of crane!
Toppling crane.
Death or severe injuries, high property damage.
- ▶ Make sure that the ground is level and without a slope.
- ▶ Comply with the maximum permissible incline of the crane, see Load chart manual Chapter 40.65.40.

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4 Driving the crane with load

See Crane operating instructions, chapter 4.10.

40.10 Utilization of the crane

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Fig.195219

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1 Utilization of the crane (load collective)

Liebherr mobile and crawler cranes are designed for assembly operation and, according to grouping in class A1 according to ISO 4301-1, they can only take on a limited number of work cycles (N = 63000) with a collective class Q1 = light (kp = 0.125). If cranes are utilized in magnet operation, grapple operation or load handling operation (load collective = “medium” or “higher”), then various points must be observed. See Crane operating instructions, chapter 8.01 “Periodic crane inspections”.

Note

If the crane is utilized through above average high load collectives, for example working in magnet operation, grapple operation or load handling operation:

▶ Carry out inspection intervals in shorter intervals.

NOTICE

Premature wear and cracks in load bearing components!

If the crane is utilized in magnet operation, grapple operation or load handling operation, then premature wear in drive gear sections and / or cracks in load bearing steel structures must be expected!

▶ Reduce loads overall by 50 % compared to the data in the respective load chart.

NOTICE

Increased rope wear and rope damage!

To keep wear of hoist ropes in magnet operation, grapple operation or load handling operation to a minimum, the use of a special rope length is recommended!

If no special rope length is used, then the unused rope layers can loosen up. In high rope pulls, the rope in the unused rope layers can be pulled in and cause rope damage!

▶ In magnet operation, grapple operation or load handling operation use a special rope length so that in the lowest position of the hook block the entire rope length is spooled out to approx. 3–5 remaining coils.

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40.15 Liccon overload protection and limit switch

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Fig.195219

1 LICCON overload protection

WARNING

Improper operation and / or defective warning and safety equipment!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.

- ▶ Make sure that all warning and safety equipment are functioning.
- ▶ Check the LICCON overload protection for function before every application.
- ▶ Set the LICCON overload protection to the current set up configuration before every application.
- ▶ Do not use the LICCON overload protection as operational shut off device.

Note

- ▶ The LICCON overload protection turns the hoist movement and boom luffing movement off when the permissible load torque is exceeded. Relief is possible by moving into the opposite direction.

Safety systems to be checked before every crane application:

- The LICCON overload protection must be set to the current set up configuration.
- The LICCON overload protection must be functioning.
- All limit switches must have been checked for function.
- The cam limit switch / winch speed sensor must be correctly adjusted.
- All test devices (for example length sensor, angle sensor, pressure sensor, wind speed sensor) must have been checked for function.

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40.25 Rope winches

Fig.195219

1 Rope pull

Note

- Every rope winch is designed for maximum rope pull. The maximum rope pulls are listed in the following chart. These rope pulls may not be exceeded. Select the minimum number of hoist rope strands (reeving) according to the “hoist rope reeving” chart depending on the load to be lifted, see Load chart manual, chapter 40.90.

Upon assembly of auxiliary equipment:

- Monitor the rope routing on the winches to avoid slack rope formation.

Chart	Hoist rope		Use
Hoist rope reeving	Rope diameter	Maximum rope pull	
Type 1	28 mm	180 kN (18.1 t)	Winch 1 Winch 2 Winch 6 Winch 6C
Type 2	25 mm	125 kN (12.6 t)	Winch 6
Type 3	28 mm	160 kN (16.1 t)	Winch 6

The following applies for telescopic cranes:

– When telescoping in, the crane movement *lift hoist gear* can be used to prevent the hook blocks from touching the ground and thereby the formation of slack rope. Match the speed of the hoist rope movement to the telescoping speed.

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40.30 Hoist rope reevings

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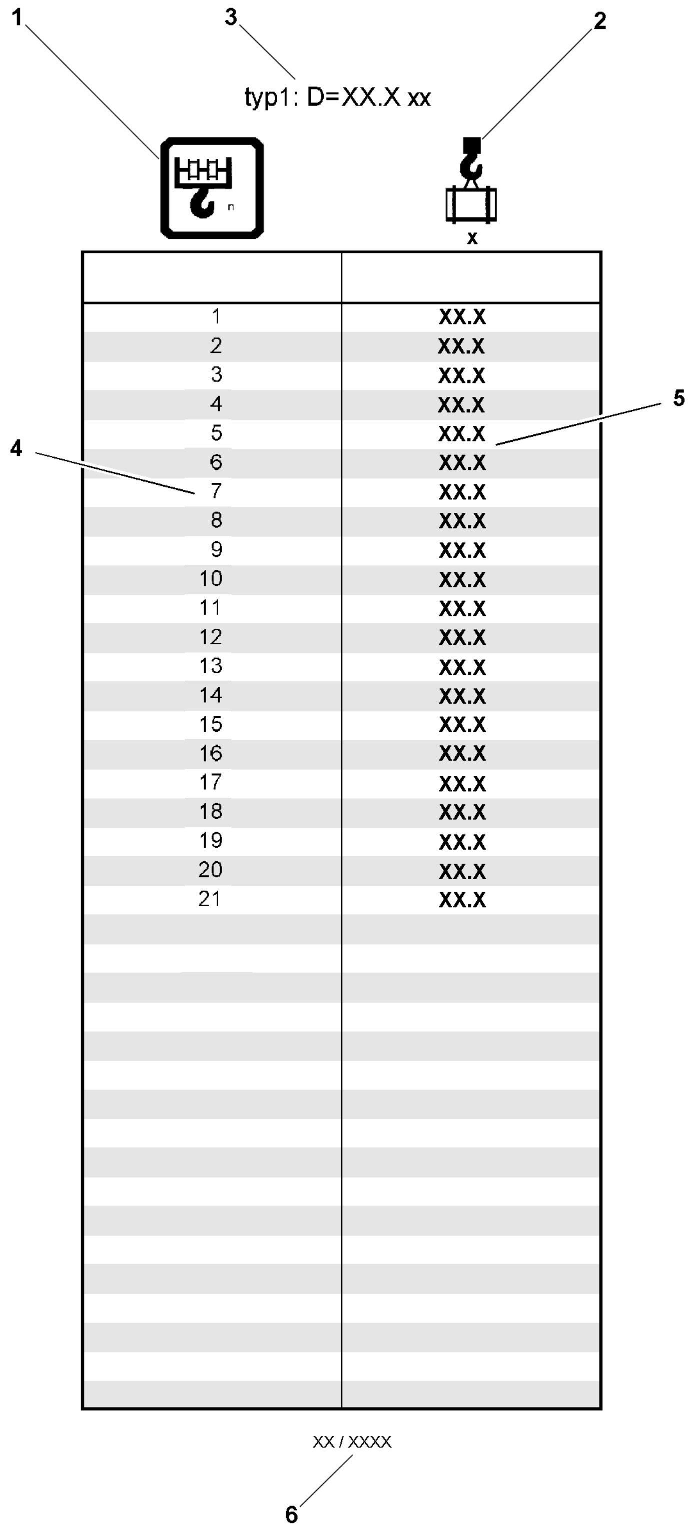

Fig.152630: Hoist rope reeving chart Single operation

1 Hoist rope reeving chart (EST)

The *Hoist rope reeving chart (EST)* indicates the maximum permissible load depending on the number of hoist rope strands, see the Load chart manual, chapter 40.90.

The loads result from the maximum rope pull and is determined according to two standards:
– according to EN 13000 with 4.5-fold rope safety
– according to ASME B30.5 with 5-fold rope safety

The *Hoist rope reeving chart (EST)* lists the maximum permissible loads determined according to EN 13000. The maximum permissible loads determined according to ASME B30.5 can be listed, see section “5-fold rope safety according to ASME B30.5”.

The values provided in the displayed *Hoist rope reeving chart* (EST) are examples and may not match the present crane.

1 Hoist rope reeving icon

2 Load icon

3 Hoist rope type and rope diameter
• This data appears only on for several different hoist ropes

4 Number of hoist rope strands

5 Maximum permissible load in tons (t) or pounds (lb)
• Depending on the number of hoist rope strands

6 Page specification

1.1 Crane operation in individual operation

For crane operation in individual operation, only 1 hoist rope winch is used. Take the required reeving from the *chart hoist rope reeving (EST)*.

Example for the determination of reeving:

Load = 280 t

The required reeving with 1 hoist rope winch is according to the *chart Hoist rope reeving (EST)*:

- 18 rope strands (287.0 t)

1.2 Crane operation in parallel operation

In crane operation in parallel operation 2 hoist rope winches are used. The required reeving is determined in 3 steps.

Step 1: Divide the load by 2 since the load is taken up evenly by hoist rope winch 1 and hoist rope winch 2.

Step 2: Determine the required reeving for 1 hoist rope winch.

Step 3: Use the determined reeving for both hoist rope winches.

Example for the determination of reeving:

Load = 280 t

Step 1: 280 t / 2 hoist rope winches = 140 t

Step 2: The required reeving with 1 hoist rope winch is according to the *chart Hoist rope reeving (EST)*:

- 9 rope strands (153.2 t)

Step 3: The required reeving with 2 hoist rope winches in parallel operation is therefore:

- 2 x 9 rope strands = 18 rope strands (2 x 153.2 t = 306.4 t)

2 Hoist rope reeving

Observe and adhere to the following points for hoist rope reeving:
- Reeve in the hoist rope depending on the maximum rope pull and the weight of the hoist load between the boom head and the hook block.
- Before reeving in, check if a minimum hoist rope reeving and a minimum hook block weight are required, see the Load chart manual, chapter 40.40.
- For multiple reeving, the maximum possible load is reduced due to the pulley friction and the rope bend.
- Observe the national standard when selecting the maximum permissible load.
- Take the maximum permissible load depending on the number of hoist rope strands from the *Chart Hoist rope reeving* (EST), see Load chart manual, chapter 40.90.
- The LICCON overload protection must be set to the number of hoist rope strands.

Note

To increase the service life of the rope, observe the following points:
- ▶ Higher reeving to reduce the rope pull is recommended.
- ▶ For care of rope, see Crane operating instructions, chapter 8.04.

Note
- ▶ The number of hoist rope strands indicated in the load chart in the load column refers to their maximum load according to EN 13000.

3 5-fold rope safety according to ASME B30.5

In countries where the national standard ASME B30.5 is used, a 5-fold rope safety for rotation-resistant hoist ropes is specified. For example, in Canada, USA and Taiwan.

In countries where the national standard ASME B30.5 is used, up to 13-fold reeving, the maximum loads resulting from the following charts must be used. From a 14-fold reeving, the maximum loads determined according to EN 13000 apply.

Note
- ▶ Contrary to ASME B30.5, EN 13000 also takes the degree of efficiency of the rope drive into account. Therefore, in countries where the national standard ASME B30.5 is used, loads up to a certain reeving are lower than in EN 13000. From this specific reeving, the maximum loads determined according to EN 13000 apply. In reference to ASME B30.5, from this specific reeving, restrictions are no longer required.
- ▶ When adhering to the standard specifications in chapter 5.3.2.1.1 (e) of ASME B30.5 (2014), rope pulls according to EN 13000 can also be used.

3.1 ASME B30.5 Chart for hoist rope reeving type 1

Reeving	Maximum load (DIN EN 13000)	Maximum load (ASME B30.5)
1	18.1 t	16.5 t
2	35.9 t	33.0 t
3	53.4 t	49.5 t
4	70.7 t	66.1 t
5	87.7 t	82.6 t
6	104.5 t	99.1 t

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Reeving	Maximum load (DIN EN 13000)	Maximum load (ASME B30.5)
7	121.0 t	115.6 t
8	137.2 t	132.1 t
9	153.2 t	148.6 t
10	169.0 t	165.1 t
11	184.5 t	181.7 t
12	199.9 t	198.2 t
13	214.9 t	214.7 t

3.2 ASME B30.5 Chart for hoist rope reeving type 2

Reeving	Maximum load (DIN EN 13000)	Maximum load (ASME B30.5)
1	12.6 t	11.5 t
2	24.9 t	22.9 t
3	37.1 t	34.4 t
4	49.1 t	45.9 t
5	60.9 t	57.3 t
6	72.5 t	68.8 t
7	84.0 t	80.3 t
8	95.3 t	91.7 t
9	106.4 t	103.2 t
10	117.4 t	114.7 t
11	128.2 t	126.1 t
12	138.8 t	137.6 t
13	149.3 t	149.1 t

3.3 ASME B30.5 Chart for hoist rope reeving type 3

Reeving	Maximum load (DIN EN 13000)	Maximum load (ASME B30.5)
1	16.1 t	14.7 t
2	31.9 t	29.4 t
3	47.5 t	44.0 t
4	62.8 t	58.7 t
5	78.0 t	73.4 t
6	92.8 t	88.1 t
7	107.5 t	102.8 t
8	122.0 t	117.4 t
9	136.2 t	132.1 t
10	150.2 t	146.8 t

Reeving	Maximum load (DIN EN 13000)	Maximum load (ASME B30.5)
11	164.0 t	161.5 t
12	177.6 t	176.1 t
13	191.0 t	190.8 t

40.35 Hook blocks and load hooks

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Fig.195219

1 Minimum required hook block weight

WARNING
Falling components and hook block!
If the hook block weight is too low, the hoist rope can pull the hook block upward between the winch and the boom head from a certain hoisting height. Boom head and hook block can be damaged. Damaged components and the hoist rope can fall down.
If slack rope forms between the winch and the boom head when spooling the winch out, then the hook block can suddenly fall down!
Personnel can be severely injured or killed!
This could result in high property damage!
- ▶ Calculate the minimum required hook block weight before lifting the load.
- ▶ Select the weight of the hook block depending on the calculation.
- ▶ Slack rope formation is prohibited.

When the hook block weight is too low:
- ▶ Select a heavier hook block or increase the hook block weight with auxiliary weights or modification kits.

NOTICE
Rope damage due to insufficient weight of the hook block!

If no minimum system-related hoist reeving is required for the operating mode:
- ▶ Reeve a hook block at least depending on the weight of the load to be lifted.

If loads are taken up at great heights:
- ▶ If possible, increase the reeving.

If the reeving was increased:
- ▶ Increase the hook block weight.

When the hook block weight is too low:
- ▶ Select a heavier hook block or increase the hook block weight with auxiliary weights or modification kits.

Note
Observe the following notes:

For wear reduction of the hoist rope:
- ▶ When the available rope lengths and the maximum permissible hook block weight allow to make a higher reeving. Especially then when loads are taken up in great height.

Since the hoist rope weight is taken into account in the load charts at minimum reeving and at minimum radius only to the placement surface of the crane:
- ▶ At higher reeving or when lowering the hook block under the crane placement surface, the additional hoist rope weight must be deduced from the maximum load.

Note
Observe the permissible hook block weights for erection and take down of the boom system.
If the permissible hook block weight for erection and take down of the boom system is exceeded due to the own weight increase of the hook block, then the boom system cannot be erected or taken down with this hook block weight.
- ▶ Observe the permissible hook block weights for erection and take down in the erection and take down charts.

If the permissible hook block weight for erection and take down is exceeded:
- ▶ Remove auxiliary weights for the erection and take down of the boom system.

2 Calculating the minimum required hook block weight

Formula
G = L x M x n x F

Formula to determine the minimum required hook block weight

Abbreviation	Description	Unit
G	Minimum required hook block weight	kg
L	Overall boom length	m
M	Rope weight	kg/m
n	Reeving	-
F	Factor	-

Explanation of variables to calculate the minimum required hook block weight

2.1 Determining the rope weight for the rope diameter

Rope diameter	Rope weight M
13 mm	0.85 kg/m
15 mm	1.12 kg/m
17 mm	1.45 kg/m
19 mm	1.81 kg/m
21 mm	2.24 kg/m
23 mm	2.67 kg/m
25 mm	3.09 kg/m
28 mm	3.94 kg/m
30 mm	4.46 kg/m
32 mm	5.09 kg/m
38 mm	7.21 kg/m
40 mm	7.99 kg/m
52 mm	13.50 kg/m

Rope diameter and rope weight

2.2 Determining the factor for reeving

Reeving n	Factor F
1	1.31
2	1.34
3	1.36
4	1.39
5	1.41
6	1.44

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Reeving n	Factor F
7	1.46
8	1.49
9	1.52
10	1.54
11	1.57
12	1.60
13	1.63
14	1.65
15	1.68
16	1.71
17	1.74
18	1.77
19	1.80
20	1.83
21	1.87
22	1.90
23	1.93
24	1.96
25	2.00
26	2.03
27	2.06
28	2.10
29	2.13
30	2.17

Reeving and factor

2.3 Calculation example for crane operation with 1 hoist rope winch in single operation

Crane configuration:
- Length of main boom: 70 m
- Length of auxiliary boom: 28 m
- Rope diameter: 28 mm
- Reeving: 12 rope strands

Variables for calculation:

L = overall boom length = 98 m
M = rope weight for rope diameter 28 mm = 3.94 kg/m
n = reeving = 12
F = factor for 12 rope strands = 1.60

Calculation:

G = **L** x **M** x **n** x **F**

G = 98 m x 3.94 kg/m x 12 x 1.60

G = 7414 kg

The minimum required hook block weight must be 7414 kg.

It is recommended to increase the minimum required hook block weight at least an additional 10 percent (741 kg) to 8155 kg. This improves the spooling performance of the rope. When doing so, the maximum load for the respective boom combination may **not** be exceeded.

2.4 Calculation example for crane operation with 2 hoist rope winches in parallel operation

Crane configuration:
- Length of main boom: 70 m
- Length of auxiliary boom: 28 m
- Rope diameter: 28 mm
- Reeving: 2 x 8 rope strands

Variables for calculation:
L = overall boom length = 98 m
M = rope weight for rope diameter 28 mm = 3.94 kg/m
n = reeving = (2 x 8)
F = factor for 8 rope strands = 1.49

Calculation:

G = **L** x **M** x (**2** x **n**) x **F**

G = 98 m x 3.94 kg/m x (2 x 8) x 1.49

G = 9205 kg

The minimum required hook block weight must be 9205 kg.

It is recommended to increase the minimum required hook block weight at least an additional 10 percent (921 kg) to 10126 kg. This improves the spooling performance of the rope. When doing so, the maximum load for the respective boom combination may **not** be exceeded.

3 Procedure in case of slack rope

Note
▶ If the hook block can no longer be lowered due to slack rope formation, then the following steps must be carried out!

3.1 Spooling up loose hoist rope

▶ Spool up loose hoist rope between the boom head and the wind carefully onto the winch.

Note
▶ A slight rope slack must remain between the boom head and the winch!

3.2 Luffing the boom down

NOTICE
Danger of collision!
When luffing the boom down, the hoist rope length can shorten and pull the hook block against the boom head.
▶ Monitor the distance of the hook block to the boom head.

▶ Luff the boom down carefully.

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Result:

– The hoist rope between the boom head and the winch is tensioned.

3.3 Lowering the hook block

▶ Lower the hook block carefully with the hoist gear.

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40.35.10 Hook blocks for single operation

Fig.195219

1 Crane operation with 1 hoist rope F= 180 kN and d= 28 mm (type1; hoist rope length: 1050 m)

Note
- The total boom length can be limited depending on the reeving and the hook block weight. The basis of the noted values is crane-specific data.

Crane-specific data	
Rope diameter	28.0 mm
Rope weight	0.00394 t/m
Boom piecing	6 m
Minimum boom length	24 m
Maximum boom length	192 m
Number of hoist winches	1
Hoist rope length	1050 m
Derrick to hoist rope change over	31.0 m

1.1 Load hook 16 E (0 rope pulleys / 16.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	1.1 t without auxiliary weights					
1	192 m					

1.2 Hook block 50 EM (1 rope pulley / 50.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	1.0 t without auxiliary weights	2.0 t for 2 auxiliary weights	3.0 t for 4 auxiliary weights			
3	60 m	120 m	186 m			
2	90 m	186 m	192 m			
1	192 m	192 m	192 m			

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1.3 Hook block 125 DM (3 rope pulleys / 121.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	1.5 t without auxiliary weights	2.5 t for 2 auxiliary weights	3.5 t for 4 auxiliary weights	4.5 t for 6 auxiliary weights	5.5 t for 8 auxiliary weights	
7	36 m	60 m	84 m	108 m	120 m	
6	42 m	72 m	102 m	132 m	138 m	
5	48 m	84 m	120 m	156 m	162 m	
4	66 m	114 m	156 m	192 m	192 m	
3	90 m	150 m	192 m	192 m	192 m	
2	138 m	192 m	192 m	192 m	192 m	
1	192 m	192 m	192 m	192 m	192 m	

1.4 Hook block 200 DM (5 rope pulleys / 184.5 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	2.0 t without auxiliary weights	3.0 t for 2 auxiliary weights	4.0 t for 4 auxiliary weights	5.0 t for 6 auxiliary weights	6.0 t for 8 auxiliary weights	7.0 t for 10 auxiliary weights
11	24 m	42 m	54 m	72 m	78 m	78 m
10	30 m	48 m	60 m	78 m	84 m	84 m
9	36 m	54 m	72 m	90 m	96 m	96 m
8	42 m	60 m	84 m	102 m	108 m	108 m
7	48 m	72 m	96 m	120 m	120 m	120 m
6	54 m	84 m	114 m	138 m	138 m	138 m
5	66 m	102 m	138 m	162 m	162 m	162 m
4	90 m	132 m	180 m	192 m	192 m	192 m
3	120 m	186 m	192 m	192 m	192 m	192 m
2	186 m	192 m	192 m	192 m	192 m	192 m
1	192 m	192 m	192 m	192 m	192 m	192 m

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1.5 Double hook block 400 - 200 DMZ (5 rope pulleys / 184.5 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	5.0 t without auxiliary weights	6.0 t for 2 auxiliary weights	7.0 t for 4 auxiliary weights			
11	72 m	78 m	78 m			
10	78 m	84 m	84 m			
9	90 m	96 m	96 m			
8	102 m	108 m	108 m			
7	120 m	120 m	120 m			
6	138 m	138 m	138 m			
5	162 m	162 m	162 m			
4	192 m	192 m	192 m			
3	192 m	192 m	192 m			
2	192 m	192 m	192 m			
1	192 m	192 m	192 m			

1.6 Double hook block 600 - 300 DMZ (9 rope pulleys / 300.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	8.5 t without auxiliary weights					
19	48 m					
18	48 m					
17	54 m					
16	54 m					
15	60 m					
14	60 m					
13	66 m					
12	72 m					
11	78 m					
10	84 m					
9	96 m					
8	108 m					
7	120 m					
6	138 m					
5	162 m					
4	192 m					

Reeving	Maximum possible total boom length with the following hook block weight:					
	8.5 t without auxiliary weights					
3	192 m					
2	192 m					
1	192 m					

2 Crane operation with 1 hoist rope F= 180 kN and d=28 mm (type1; hoist rope length: 1100 m)

Note

▶ The total boom length can be limited depending on the reeving and the hook block weight. The basis of the noted values is crane-specific data.

Crane-specific data	
Rope diameter	28.0 mm
Rope weight	0.00394 t/m
Boom piecing	6 m
Minimum boom length	24 m
Maximum boom length	192 m
Number of hoist winches	1
Hoist rope length	1100 m
Derrick to hoist rope change over	31.0 m

2.1 Load hook 16 E (0 rope pulleys / 16.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	1.1 t without auxiliary weights					
1	192 m					

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2.2 Hook block 50 EM (1 rope pulley / 50.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	1.0 t without auxiliary weights	2.0 t for 2 auxiliary weights	3.0 t for 4 auxiliary weights			
3	60 m	120 m	186 m			
2	90 m	186 m	192 m			
1	192 m	192 m	192 m			

2.3 Hook block 125 DM (3 rope pulleys / 121.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	1.5 t without auxiliary weights	2.5 t for 2 auxiliary weights	3.5 t for 4 auxiliary weights	4.5 t for 6 auxiliary weights	5.5 t for 8 auxiliary weights	
7	36 m	60 m	84 m	108 m	126 m	
6	42 m	72 m	102 m	132 m	144 m	
5	48 m	84 m	120 m	156 m	168 m	
4	66 m	114 m	156 m	192 m	192 m	
3	90 m	150 m	192 m	192 m	192 m	
2	138 m	192 m	192 m	192 m	192 m	
1	192 m	192 m	192 m	192 m	192 m	

2.4 Hook block 200 DM (5 rope pulleys / 184.5 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	2.0 t without auxiliary weights	3.0 t for 2 auxiliary weights	4.0 t for 4 auxiliary weights	5.0 t for 6 auxiliary weights	6.0 t for 8 auxiliary weights	7.0 t for 10 auxiliary weights
11	24 m	42 m	54 m	72 m	84 m	84 m
10	30 m	48 m	60 m	78 m	90 m	90 m
9	36 m	54 m	72 m	90 m	102 m	102 m
8	42 m	60 m	84 m	102 m	108 m	108 m
7	48 m	72 m	96 m	120 m	126 m	126 m
6	54 m	84 m	114 m	144 m	144 m	144 m
5	66 m	102 m	138 m	168 m	168 m	168 m
4	90 m	132 m	180 m	192 m	192 m	192 m

Reeving	Maximum possible total boom length with the following hook block weight:					
	2.0 t without auxiliary weights	3.0 t for 2 auxiliary weights	4.0 t for 4 auxiliary weights	5.0 t for 6 auxiliary weights	6.0 t for 8 auxiliary weights	7.0 t for 10 auxiliary weights
3	120 m	186 m	192 m	192 m	192 m	192 m
2	186 m	192 m	192 m	192 m	192 m	192 m
1	192 m	192 m	192 m	192 m	192 m	192 m

2.5 Double hook block 400 - 200 DMZ (5 rope pulleys / 184.5 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	5.0 t without auxiliary weights	6.0 t for 2 auxiliary weights	7.0 t for 4 auxiliary weights			
11	72 m	84 m	84 m			
10	78 m	90 m	90 m			
9	90 m	102 m	102 m			
8	102 m	108 m	108 m			
7	120 m	126 m	126 m			
6	144 m	144 m	144 m			
5	168 m	168 m	168 m			
4	192 m	192 m	192 m			
3	192 m	192 m	192 m			
2	192 m	192 m	192 m			
1	192 m	192 m	192 m			

2.6 Double hook block 600 - 300 DMZ (9 rope pulleys / 300.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	8.5 t without auxiliary weights					
19	48 m					
18	48 m					
17	54 m					
16	60 m					
15	60 m					
14	66 m					
13	72 m					
12	78 m					

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Reeving	Maximum possible total boom length with the following hook block weight:					
	8.5 t without auxiliary weights					
11	84 m					
10	90 m					
9	102 m					
8	108 m					
7	126 m					
6	144 m					
5	168 m					
4	192 m					
3	192 m					
2	192 m					
1	192 m					

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40.35.30 Hook blocks for parallel operation

Fig.195219

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1 Crane operation with 2 hoist ropes F= 180 kN and d=28 mm (type1; length hoist rope: 1050 m)

Note
- The total boom length can be limited depending on the reeving and the hook block weight. The basis of the noted values is crane-specific data.

Crane-specific data	
Rope diameter	28.0 mm
Rope weight	0.00394 t/m
Boom piecing	6 m
Minimum boom length	24 m
Maximum boom length	192 m
Number of hoist winches	2
Hoist rope length	1050 m
Derrick to hoist rope change over	31.0 m

1.1 Double hook block 400 - 200 DMZ (2 x 5 rope pulleys / 369.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	6.0 t without auxiliary weights	7.0 t for 2 auxiliary weights	8.0 t for 4 auxiliary weights	9.0 t for 6 auxiliary weights	10.0 t for 8 auxiliary weights	11.0 t for 10 auxiliary weights
2 x 11	42 m	48 m	54 m	66 m	72 m	78 m
2 x 10	48 m	54 m	60 m	72 m	78 m	84 m
2 x 9	54 m	60 m	72 m	78 m	90 m	96 m
2 x 8	60 m	72 m	84 m	90 m	102 m	108 m
2 x 7	72 m	84 m	96 m	108 m	120 m	120 m
2 x 6	84 m	102 m	114 m	132 m	138 m	138 m

1.2 Double hook block 600 - 300 DMZ (2 x 9 rope pulleys / 600.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	11.0 t without auxiliary weights	12.0 t for 2 auxiliary weights	13.0 t for 4 auxiliary weights	14.0 t for 6 auxiliary weights	15.0 t for 8 auxiliary weights	16.0 t for 10 auxiliary weights
2 x 19	36 m	42 m	48 m	48 m	48 m	54 m [1)]
2 x 18	42 m	42 m	48 m	48 m	48 m	54 m [1)]
2 x 17	42 m	48 m	54 m	54 m	54 m	60 m [1)]
2 x 16	48 m	54 m	54 m	54 m	54 m	60 m [1)]

Reeving	Maximum possible total boom length with the following hook block weight:					
	11.0 t without auxiliary weights	12.0 t for 2 auxiliary weights	13.0 t for 4 auxiliary weights	14.0 t for 6 auxiliary weights	15.0 t for 8 auxiliary weights	16.0 t for 10 auxiliary weights
2 x 15	54 m	60 m	60 m	60 m	60 m	66 m [1)]
2 x 14	60 m	60 m	60 m	60 m	60 m	66 m [1)]
2 x 13	66 m	66 m	66 m	66 m	66 m	72 m [1)]
2 x 12	72 m	72 m	72 m	72 m	72 m	72 m
2 x 11	78 m	78 m	78 m	78 m	78 m	78 m
2 x 10	84 m	84 m	84 m	84 m	84 m	84 m
2 x 9	96 m	96 m	96 m	96 m	96 m	96 m
2 x 8	108 m	108 m	108 m	108 m	108 m	108 m
2 x 7	120 m	120 m	120 m	120 m	120 m	120 m
2 x 6	138 m	138 m	138 m	138 m	138 m	138 m

[1)] Hook block does not reach the ground due to the hoist rope length.

2 Crane operation with 2 hoist ropes F= 180 kN and d=28 mm (type1; length hoist rope: 1100 m)

Note

▶ The total boom length can be limited depending on the reeving and the hook block weight. The basis of the noted values is crane-specific data.

Crane-specific data	
Rope diameter	28.0 mm
Rope weight	0.00394 t/m
Boom piecing	6 m
Minimum boom length	24 m
Maximum boom length	192 m
Number of hoist winches	2
Hoist rope length	1100 m
Derrick to hoist rope change over	31.0 m

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2.1 Double hook block 400 - 200 DMZ (2 x 5 rope pulleys / 369.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	6.0 t without auxiliary weights	7.0 t for 2 auxiliary weights	8.0 t for 4 auxiliary weights	9.0 t for 6 auxiliary weights	10.0 t for 8 auxiliary weights	11.0 t for 10 auxiliary weights
2 x 11	42 m	48 m	54 m	66 m	72 m	78 m
2 x 10	48 m	54 m	60 m	72 m	78 m	90 m
2 x 9	54 m	60 m	72 m	78 m	90 m	102 m
2 x 8	60 m	72 m	84 m	90 m	102 m	114 m
2 x 7	72 m	84 m	96 m	108 m	120 m	126 m
2 x 6	84 m	102 m	114 m	132 m	144 m	144 m

2.2 Double hook block 600 - 300 DMZ (2 x 9 rope pulleys / 600.0 t load)

Reeving	Maximum possible total boom length with the following hook block weight:					
	11.0 t without auxiliary weights	12.0 t for 2 auxiliary weights	13.0 t for 4 auxiliary weights	14.0 t for 6 auxiliary weights	15.0 t for 8 auxiliary weights	16.0 t for 10 auxiliary weights
2 x 19	36 m	42 m	48 m	48 m	48 m	54 m [1)]
2 x 18	42 m	42 m	48 m	48 m	48 m	54 m
2 x 17	42 m	48 m	54 m	54 m	54 m	60 m [1)]
2 x 16	48 m	54 m	60 m	60 m	60 m	60 m
2 x 15	54 m	60 m	60 m	60 m	60 m	66 m [1)]
2 x 14	60 m	60 m	66 m	66 m	66 m	66 m
2 x 13	66 m	72 m	72 m	72 m	72 m	72 m
2 x 12	72 m	78 m	78 m	78 m	78 m	78 m
2 x 11	78 m	84 m	84 m	84 m	84 m	84 m
2 x 10	90 m	90 m	90 m	90 m	90 m	90 m
2 x 9	102 m	102 m	102 m	102 m	102 m	102 m
2 x 8	108 m	108 m	108 m	108 m	108 m	114 m
2 x 7	126 m	126 m	126 m	126 m	126 m	126 m
2 x 6	144 m	144 m	144 m	144 m	144 m	144 m

[1)] Hook block does not reach the ground due to the hoist rope length.

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40.35.40 Distance between hook and roller set in the boom head

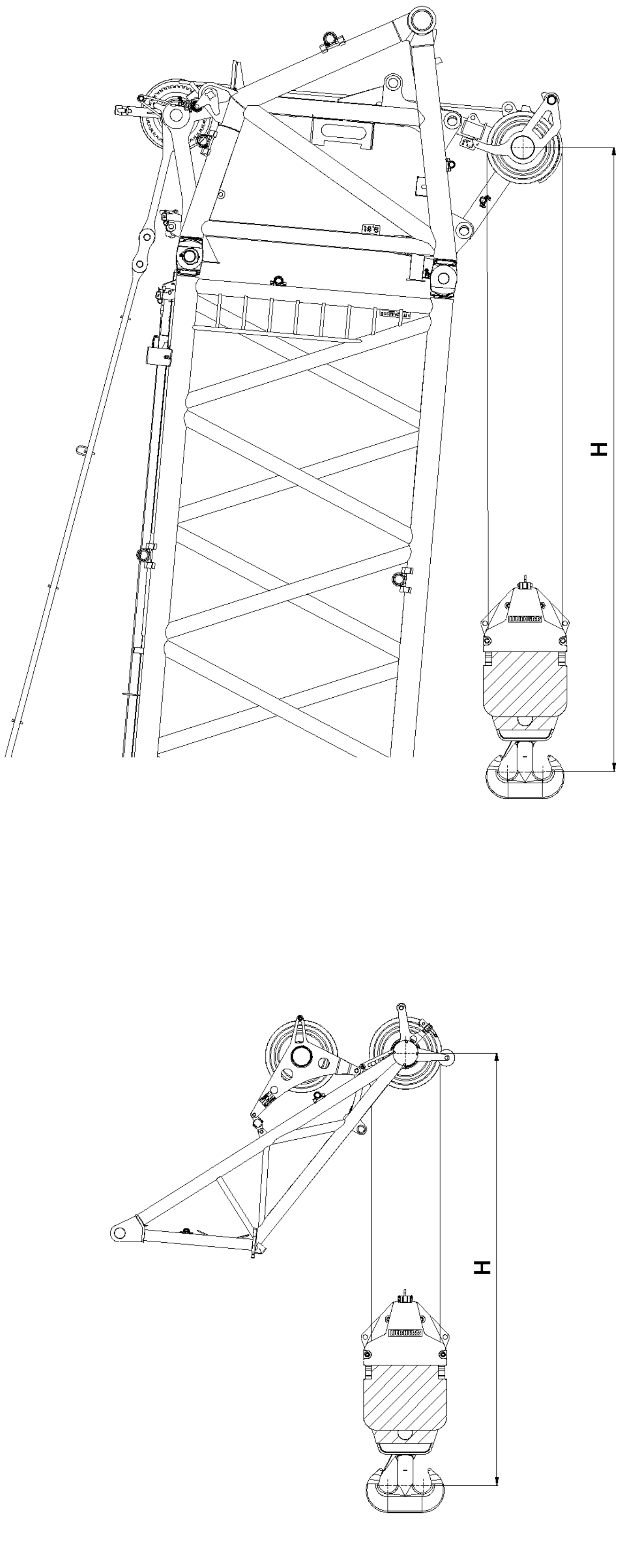

Fig.115552: Distance Hook and pulley set in boom head

1 Distance between hook and pulley set in boom head

To determine the hook height, the hoisting height between the distance and the hook and the center of the pulley set in the boom head must be reduced.

The distances for the hook block used can be taken from the following charts.

Hook block	Distance H		
	SW-end section	W-connector head	F-end section
Load hook 16 E	4.4 m	4.4 m	5.0 m
Hook block 50 EM	4.9 m	4.9 m	5.6 m
Hook block 125 DM	5.1 m	5.1 m	5.7 m
Hook block 200 DM	5.2 m	5.2 m	5.8 m
Double hook block 400 / 200 DMZ	6.2 m	6.2 m	-
Double hook block 600 / 300 DMZ	6.7 m	6.7 m	-

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40.40 Minimum reeving of hoist rope and minimum weight of hook block

Fig.195219

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1 Minimum reevings of the hoist rope and minimum weights of hook block

Note
- ▶ For safe crane operation, the minimum reevings of the hoist rope and the minimum weights of the hook block are required.
- ▶ For the determination of the minimum reevings of the hoist rope, four limiting criteria must be noted.
- ▶ The limiting criteria are described in the following sections.

The following limiting criteria must be observed:
- Maximum permissible rope pull ($n_{min\ [reeving\ chart]}$)
- Static reasons ($n_{min\ [Static]}$), ($G_{min\ [Static]}$)
- Safe load weighing of the LICCON overload protection ($n_{min\ [Load\ weighing]}$)
- Parallel operation ($n_{min\ [Parallel\ operation]}$)

1.1 Limiting criterion: Maximum permissible rope pull

The maximum rope pulls may not be exceeded. Select the minimum reeving of the hoist rope according to the “Chart Hoist rope reeving”, depending on the load to be lifted, see Load chart manual, chapter 40.90.

1.2 Limiting criterion: Static reasons

Note
- ▶ Minimum values that prevent uncontrolled movements of the boom to the rear in steep boom positions.

1.2.1 Minimum reeving hoist rope SW-; SDW-; SDWV-operation

TAB 181 00 027-00

WARNING
Minimum reeving of the hoist rope and minimum weight of hook block not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
- ▶ Adhere to the minimum reevings of the hoist rope and the minimum weights of the hook block depending on the angle range of the main boom, see the following chart.

WARNING
Minimum reeving of the hoist rope not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.

When the boom nose is installed on the luffing lattice jib W- 12 m:
- ▶ Reeve in the boom nose at least 2x.

Note
- ▶ The angle of the main boom describes the incline of the main boom to the horizontal.
- ▶ The data listed in the chart applies generally also for the operation with boom nose.
- ▶ Minimum reevings of the hoist rope are valid for operation with 1 hoist rope winch and for operation with 2 hoist rope winches.

Example for 6 minimum reevings of the hoist rope:

1 Hoist rope winch: 1 x 6 Reevings

2 Hoist rope winches: 2 x 3 Reevings

Boom		Minimum reeving of the hoist rope	Minimum weight hook block	
S	W		Angle main boom > 70°	Angle main boom < 70°
S- 36 m	W- 12 m 1)	8	3.0 t	-
	W- 18 m 1)	4	2.0 t	-
S- 42 m	W- 12 m 1)	8	3.0 t	-
	W- 18 m 1)	4	2.0 t	-
S- 48 m	W- 12 m 1)	10	4.0 t	-
	W- 18 m 1)	4	4.0 t	-
S- 54 m	W- 12 m 1)	10	7.0 t	4.0 t
	W- 18 m 1)	4	4.0 t	-
S- 60 m	W- 12 m 1)	12	8.0 t	6.0 t
	W- 18 m 1)	4	5.0 t	-
	W- 24 m	4	2.0 t	-
S- 66 m	W- 12 m 1)	14	9.0 t	7.0 t
	W- 18 m 1)	6	6.0 t	-
	W- 24 m	4	3.5 t	-
	W- 30 m	4	3.5 t	-
S- 72 m	W- 12 m 1)	16	11.0 t	9.0 t
	W- 18 m 1)	6	7.0 t	4.0 t
	W- 24 m	4	5.0 t	-
	W- 30 m	4	5.0 t	-
S- 78 m	W- 12 m 1)	14	13.0 t	10.0 t
	W- 18 m 1)	8	8.0 t	5.0 t
	W- 24 m	6	5.0 t	-
	W- 30 m	6	5.0 t	-
	W- 36 m	4	3.0 t	-
S- 84 m	W- 12 m 1)	12	16.0 t	12.0 t
	W- 18 m 1)	10	10.0 t	6.0 t
	W- 24 m	6	7.0 t	4.0 t
	W- 30 m	6	7.0 t	-
	W- 36 m	4	3.0 t	-

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Boom		Minimum reeving of the hoist rope	Minimum weight hook block	
S	W		Angle main boom > 70°	Angle main boom < 70°
S- 90 m	W- 18 m [1)]	12	11.0 t	8.0 t
	W- 24 m	6	10.0 t	4.0 t
	W- 30 m	6	9.0 t	-
	W- 36 m	4	5.0 t	-
	W- 42 m	4	4.0 t	-
	W- 48 m	4	4.0 t	-
S- 96 m	W- 24 m	8	11.0 t	6.0 t
	W- 30 m	6	11.0 t	-
	W- 36 m	4	7.0 t	-
	W- 42 m	4	4.0 t	-
	W- 48 m	4	4.0 t	-
S- 102 m	W- 24 m	6	15.0 t	6.0 t
	W- 30 m	6	13.0 t	5.0 t
	W- 36 m	6	8.0 t	-
	W- 42 m	4	5.0 t	-
	W- 48 m	4	4.0 t	-
	W- 54 m	4	4.0 t	-

[1)] Luffing lattice jib valid only for SDWV-operation.

1.2.2 Minimum reeving hoist rope SLF-; SL3F-operation

TAB 181 00 047-00

WARNING
Minimum reeving of the hoist rope and minimum weight of hook block not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
- Adhere to the minimum reevings of the hoist rope and the minimum weights of the hook block in the specified angle range of the main boom, see the following chart.
- Take the hook block down only below the specified angle range of the main boom.

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Boom		Minimum reeving of the hoist rope	Minimum weight hook block	Angle range of the main boom	
SL	F			from	up to
SL- 54 m up to SL3- 108 m	F- 12 m / 11°	7	2.5 t	75°	87°
	F- 12 m / 11°	6	3.0 t	75°	87°
	F- 12 m / 11°	5	3.5 t	75°	87°
	F- 12 m / 11°	4	4.0 t	75°	87°
	F- 12 m / 16°	3	1.5 t	75°	87°

1.2.3 Minimum reeving of the hoist rope SL10DFB-; SL10DFB2-operation

TAB 181 00 191-00

WARNING
Minimum reeving of the hoist rope and minimum weight of hook block not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
▶ Adhere to the minimum reevings of the hoist rope and minimum weights of the hook block, see the following chart.

Boom		Minimum reeving of the hoist rope	Minimum weight hook block
SL	F		
SL10- 102 m To SL10- 153 m	F- 12 m / 11°	5	6.0 t
	F- 12 m / 16°	4	3.0 t

1.2.4 Minimum reeving hoist rope SL2DFB-; SL4DFB-; SL2DFBW-; SL4DFBW-; SL2DFB2-; SL4DFB2-operation

TAB 181 00 192-01

WARNING
Minimum reeving of the hoist rope and minimum weight of hook block not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
▶ Adhere to the minimum reevings of the hoist rope and minimum weights of the hook block, see the following chart.

Boom		Minimum reeving of the hoist rope	Minimum weight hook block
SL	F		
SL- 72 m to SL- 138 m	F- 12 m / 11°	5	6.0 t
	F- 12 m / 16°	4	3.0 t
	F- 18 m / 13°	4	2.0 t
	F- 18 m / 18°	4	2.0 t

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1.2.5 Minimum reeving hoist rope HSL2DFB-; HSL4DFB-; HSL2DFBW-; HSL4DFBW-; HSL2DFB2-; HSL4DFB2-operation

TAB 181 00 319-00

WARNING
Minimum reeving of the hoist rope and minimum weight of hook block not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
▶ Adhere to the minimum reevings of the hoist rope and minimum weights of the hook block, see the following chart.

Boom		Minimum reeving of the hoist rope	Minimum weight hook block
HSL	F		
HSL- 72 m to HSL- 138 m	F- 12 m / 11°	5	6.0 t
	F- 12 m / 16°	4	3.0 t
	F- 18 m / 13°	4	2.0 t
	F- 18 m / 18°	4	2.0 t

1.2.6 Minimum reeving of the hoist rope SL13DFB-; SL13DFB2-operation

TAB 181 00 340-00

WARNING
Minimum reeving of the hoist rope and minimum weight of hook block not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
▶ Adhere to the minimum reevings of the hoist rope and minimum weights of the hook block, see the following chart.

Boom		Minimum reeving of the hoist rope	Minimum weight hook block
SL	F		
SL13- 102 m to SL13- 156 m	F- 12 m / 11°	5	6.0 t
	F- 12 m / 16°	4	3.0 t

1.2.7 Minimum reeving hoist rope HSDW-; HSDWB-; HSDWB2-; HSDWBW-; HSDWVB-; HSDWVB2-; HSDWVBW-operation

TAB 181 00 343-00

WARNING
Minimum reeving of the hoist rope and minimum weight of hook block not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
▶ Adhere to the minimum reevings of the hoist rope and the minimum weights of the hook block depending on the angle range of the main boom, see the following chart.

WARNING
Minimum reeving of the hoist rope not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.

When the boom nose is installed on the luffing lattice jib W- 12 m:
▶ Reeve in the boom nose at least 2x.

Note
▶ The angle of the main boom describes the incline of the main boom to the horizontal.
▶ The data listed in the chart applies generally also for the operation with boom nose.
▶ Minimum reevings of the hoist rope are valid for operation with 1 hoist rope winch and for operation with 2 hoist rope winches.

Example for 6 minimum reevings of the hoist rope:

1 Hoist rope winch: 1 x 6 Reevings

2 Hoist rope winches: 2 x 3 Reevings

Boom		Minimum reeving of the hoist rope	Minimum weight hook block	
HS	W		Angle main boom > 70°	Angle main boom < 70°
HS- 36 m	W- 12 m 2)	8	3.0 t	-
	W- 18 m 2)	4	2.0 t	-
HS- 42 m	W- 12 m 2)	8	3.0 t	-
	W- 18 m 2)	4	2.0 t	-
HS- 48 m	W- 12 m 2)	10	4.0 t	-
	W- 18 m 2)	4	4.0 t	-
HS- 54 m	W- 12 m 2)	10	7.0 t	4.0 t
	W- 18 m 2)	4	4.0 t	-
HS- 60 m	W- 12 m 2)	12	8.0 t	6.0 t
	W- 18 m 2)	4	5.0 t	-
	W- 24 m	4	2.0 t	-
HS- 66 m	W- 12 m 2)	14	9.0 t	7.0 t
	W- 18 m 2)	6	6.0 t	-
	W- 24 m	4	3.5 t	-
	W- 30 m	4	3.5 t	-
HS- 72 m	W- 12 m 2)	16	11.0 t	9.0 t
	W- 18 m 2)	6	7.0 t	4.0 t
	W- 24 m	4	5.0 t	-
	W- 30 m	4	5.0 t	-

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Boom		Minimum ree-ving of the hoist rope	Minimum weight hook block	
HS	W		Angle main boom > 70°	Angle main boom < 70°
HS- 78 m	W- 12 m [2)]	14	13.0 t	10.0 t
	W- 18 m [2)]	8	8.0 t	5.0 t
	W- 24 m	6	5.0 t	-
	W- 30 m	6	5.0 t	-
	W- 36 m	4	3.0 t	-
HS- 84 m	W- 12 m [2)]	12	16.0 t	12.0 t
	W- 18 m [2)]	10	10.0 t	6.0 t
	W- 24 m	6	7.0 t	4.0 t
	W- 30 m	6	7.0 t	-
	W- 36 m	4	3.0 t	-
HS- 90 m	W- 18 m [2)]	12	11.0 t	8.0 t
	W- 24 m	6	10.0 t	4.0 t
	W- 30 m	6	9.0 t	-
	W- 36 m	4	5.0 t	-
	W- 42 m	4	4.0 t	-
	W- 48 m	4	4.0 t	-
HS- 96 m	W- 24 m	8	11.0 t	6.0 t
	W- 30 m	6	11.0 t	-
	W- 36 m	4	7.0 t	-
	W- 42 m	4	4.0 t	-
	W- 48 m	4	4.0 t	-
HS- 102 m	W- 24 m	6	15.0 t	6.0 t
	W- 30 m	6	13.0 t	5.0 t
	W- 36 m	6	8.0 t	-
	W- 42 m	4	5.0 t	-
	W- 48 m	4	4.0 t	-
	W- 54 m	4	4.0 t	-

[2)] Luffing lattice jibs valid only for HSDWV-operation.

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1.2.8 Minimum reeving hoist rope SL8F3-operation

TAB 181 00 516-01

WARNING
Minimum reeving of the hoist rope and minimum weight of hook block not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
▶ Adhere to the minimum reevings of the hoist rope and minimum weights of the hook block, see the following chart.

Boom		Minimum reeving of the hoist rope	Minimum weight hook block
SL8	F3		
SL8- 72 m to SL- 105 m	F3- 12 m / 10°	8	2.0 t
	F3- 12 m / 10°	7	2.5 t
	F3- 12 m / 10°	5	3.0 t
	F3- 12 m / 10°	4	3.5 t
	F3- 12 m / 10°	3	4.0 t
	F3- 12 m / 15°	4	1.5 t

1.3 Limiting criterion: Safe load weighing of LICCON overload protection

Note

- The weighing accuracy of the LICCON overload protection is too low for an accurate reading for small hoist rope reevings and steep boom positions.
- The minimum reevings of the hoist rope specified in the charts ensure that the crane will not be overloaded unnoticed especially in boom positions steeper than 60° to the horizontal.

WARNING

Minimum reeving of the hoist rope not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.

- Adhere to the minimum reevings of the hoist rope on the boom on which the load is lifted according to the following charts.

1.3.1 Minimum reeving of the hoist rope on main boom, load on main boom

Operating modes without derrick

Operating mode	Length of main boom	Minimum reeving of the hoist rope	
		Individual operation	Parallel operation
S HS	24 m	10	2 x 10
	30 m	9	2 x 9
	36 m	8	2 x 8
	42 m	7	2 x 7
	48 m	6	2 x 6
	54 m	5	2 x 6
	60 m	4	2 x 6
	66 m	4	-
	72 m	4	-
	78 m	3	-
	84 m	3	-
	90 m	3	-

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Operating mode	Length of main boom	Minimum reeving of the hoist rope	
		Individual operation	Parallel operation
	96 m	3	-
	102 m	3	-
	108 m	3	-

Operating modes with derrick

Operating mode	Length of main boom	Minimum reeving of the hoist rope	
		Individual operation	Parallel operation
SD HSD	36 m	13	2 x 14
	42 m	14	2 x 14
	48 m	12	2 x 12
	54 m	10	2 x 10
	60 m	8	2 x 10
	66 m	7	2 x 8
	72 m	6	2 x 8
	78 m	6	2 x 6
	84 m	5	2 x 6
	90 m	5	2 x 6
	96 m	4	2 x 6
	102 m	4	-
	108 m	4	-
	114 m	4	-
	120 m	3	-
	126 m	3	-
	132 m	3	-
	138 m	3	-
	144 m	3	-

1.3.2 Minimum reeving Hoist rope on luffing lattice jib (WV), load on luffing lattice jib (WV)

Operating mode	Length of the luffing lattice jib	Minimum reeving of the hoist rope	
		Individual operation	Parallel operation
	12 m	5	2 x 6
	18 m	5	2 x 6
	24 m	4	2 x 6
	30 m	4	-
	36 m	3	-

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Operating mode	Length of the luffing lattice jib	Minimum reeving of the hoist rope	
		Individual operation	Parallel operation
WV	42 m	3	-
	48 m	3	-
	54 m	2	-
	60 m	2	-
	66 m	2	-
	72 m	2	-
	78 m	2	-
	84 m	2	-
	90 m	2	-
	96 m	2	-

1.3.3 Minimum reeving Hoist rope on luffing lattice jib (W), load on luffing lattice jib (W)

Operating mode	Length of the luffing lattice jib	Minimum reeving of the hoist rope	
		Individual operation	Parallel operation
W	24 m	5	2 x 6
	30 m	5	2 x 6
	36 m	4	2 x 6
	42 m	4	-
	48 m	3	-
	54 m	3	-
	60 m	3	-
	66 m	3	-
	72 m	3	-
	78 m	2	-
	84 m	2	-
	90 m	2	-
	96 m	2	-

1.4 Limiting criterion: Parallel operation

Note

▶ With the minimum reeving of the hoist rope of 2 x 6 rope strands it is ensured that an impermissible incline position of the hook block is avoided in parallel operation of winch 1 and winch 2. This ensures the parallel run of winch 1 and winch 2.

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WARNING
Minimum reeving of the hoist rope not adhered to!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
▶ Adhere to the minimum reeving of the hoist rope of 2 x 6 rope strands.

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40.45 Determination of hoist rope reeving and hook block

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Fig.195219

1 Procedure to determine the required hoist rope reeving and hook block

Note
- Before every lift, the required hoist rope reeving and hook block must be determined. The following shows step by step how the hoist rope reeving and the hook block must be determined in single operation (crane operation with 1 hoist rope winch) and in parallel operation (crane operation with 2 hoist rope winches).

1.1 Step 1: Determination of load

The loads noted in the load charts include the following weights:
- Weight of the load to be lifted
- Weight of the load lifting equipment (hook block and load hook)
- Weight of the fastening equipment

Note
- Before determination of the hoist rope reeving, the load (weight of load + weight of load lifting equipment + weight of fastening equipment) must be determined.

- Determine the weight of the load.
- To determine the weight of the required hook block for the load to be lifted, see Load chart manual, Chapter 40.35.
- Determine the weight of the fastening equipment.

Result:

- Weight of the load.

1.2 Step 2: Determination of minimum reeving hoist rope depending on maximum permissible rope pull ($n_{min\ [reeving\ chart]}$)

Note
- Determine the hoist rope reevings depending on maximum rope pull from the “Chart Hoist rope reeving” (EST), see Load chart manual Chapter 40.90.

- Determine the hoist rope reeving $n_{min\ [reeving\ chart]}$ for the load in crane operation with 1 hoist rope winch in single operation.
  or
  Determine the hoist rope reeving $n_{min\ [reeving\ chart]}$ for the load in crane operation with 2 hoist rope winches in parallel operation.

Result:

- Required reeving $n_{min\ [reeving\ chart]}$.

1.3 Step 3: Determination of minimum reeving hoist rope and minimum weight hook block for static reasons ($n_{min\ [Static]}$), ($G_{min\ [Static]}$)

Note
- Determine the required hoist rope reevings and hook block weights for static reasons, see Load chart manual, Chapter 40.40.

- Determine the minimum reevings of the hoist rope $n_{min\ [Static]}$.
- Determine the minimum weights of the hook block $G_{min\ [Static]}$.

Result:

- Required reeving $n_{min\ [Static]}$.
- Required hook block $G_{min\ [Static]}$.

1.4 Step 4: Determination of minimum reeving hoist rope for a safe load weighing of the LICCON overload protection ($n_{min\ [load\ weighing]}$)

Note

▶ Determine the required hoist rope reeving for a safe load weighing of the LICCON overload protection, see Load chart manual Chapter 40.40.

▶ Determine the minimum reevings of the hoist rope $n_{min\ [load\ weighing]}$.

Result:

- Required reeving $n_{min\ [load\ weighing]}$.

1.5 Step 5: Determination of minimum reeving hoist rope for parallel operation ($n_{min\ [parallel\ operation]}$)

Note

▶ Determine the required hoist rope reeving for parallel operation, see Load chart manual Chapter 40.40.

▶ Determine the minimum reevings of the hoist rope $n_{min\ [parallel\ operation]}$.

Result:

- Required reeving $n_{min\ [parallel\ operation]}$.

1.6 Step 6: Determination of minimum reeving hoist rope (n_{min}) and minimum weight hook block (G_{min}), which must be used for lifting the load

Note

▶ After determination of the minimum reevings of the hoist rope and minimum weights of the hook block for the limit criteria ($n_{min\ [reeving\ chart]}$, $n_{min\ [static]}$, $G_{min\ [static]}$, $n_{min\ [load\ weighing]}$, $n_{min\ [parallel\ operation]}$) the largest minimum reeving of the hoist rope and the minimum weight of the hook block must be determined.

▶ Determine the largest minimum reeving of the hoist rope n_{min} from the determined minimum reevings of the hoist rope ($n_{min\ [reeving\ chart]}$, $n_{min\ [static]}$, $n_{min\ [load\ weighing]}$, $n_{min\ [parallel\ operation]}$).

▶ Determine the largest minimum weight of the hook block G_{min} from the determined minimum weights of the hook block ($G_{min\ [static]}$).

Result:

- Required minimum reeving of hoist rope n_{min}.
- Required minimum weight of hook block G_{min}.
- These values must be used to lift the load.

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40.50 Load reductions

Fig.195219

1 Load reduction with installed boom nose

Note
- ▶ The specified loads are valid for crane operation on main boom or auxiliary boom without installed boom nose.

If the boom nose is installed in crane operation with operating modes without boom nose, then the loads are reduced by the following points:
- Weight of boom nose.
- Weight of reeved in hoist rope on the boom nose.
- Weight of used load handling equipment on boom nose.
- Weight of used load handling and fastening equipment on boom head.

Note

No separate load charts are available for crane operation on the boom nose with the maximum load of 36 t. The load charts for the main and auxiliary boom operating modes apply with the following reductions:
- ▶ Weight of boom nose.
- ▶ Weight of reeved in hoist rope on the boom nose.
- ▶ Weight of used load handling and fastening equipment on boom nose.
- ▶ Weight of load handling equipment on boom head.

2 Reduction of load carrying capacity with placed guy rods

Note
- ▶ The specified loads apply without placed guy rods.
- ▶ If the guy rods are placed, then the possible load carrying capacity values are reduced.
- ▶ The load reduction depends on the weight and center of gravity of the guy rods and on the boom angle.

The load reduction can be calculated simply from the boom length and the meter weight of the guy rods:

Load reduction = 0.5 x boom length x meter weight of guy rods

Calculation example for crane operation on main boom with placed guy rods from WA-frame 2:
- Boom length: 90 m
- Meter weight of guy rods: 0.120 t/m
- Load reduction (0.5 x 90 m x 0.120 t/m): approx. 5.4 t

3 Load reductions with auxiliary roller set

Note

There are 2 pulley sets, which can be installed individually or together into the SW-end section. The determining factor for the calculation of load charts is the respective boom configuration, see chart “Boom configurations for the calculation of load charts”.
- ▶ If an additional roller set is installed than noted in the boom configuration, then the load must be reduced by its net weight.
- ▶ The W-connector head can be operated with one of the two roller sets.

WARNING
Impermissible hook block weight due to additional roller set!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.

When erecting and taking down the boom system, an additional roller set is installed than intended:
▶ Reduce the hook block weight by the net weight of additional pulley set.

Roller sets	Net weight
320 t	1.5 t
300 t	1.4 t

Net weight of roller sets

Boom	Operating modes	Boom head
S, HS without jib boom	S, SD, HSD	SW-end section with pulley sets 320 t + 300 t
S, SL with auxiliary jib HS- 3.0 m	SHS, SLHS	SW-end section with roller set 320 t
S, HS with jib boom	SW, SDW, SDWV, SWF, HSDW, HSDWV	W-connector head with roller set 300 t
SL, SL2, SL9, SL11, SL14, HSL, HSL2	SL, SLF, SLD, SL2D, SL2DF, SL9, SL11D, SL14D, HSLD, HSL2D, HSL2DF	SW-end section with roller set 320 t
SL3, SL4, SL8, SL10, SL13, HSL4	SL3F, SL4DF, SL8F3, SL10DF, SL13DF, HSL4DF	F-connector head
W	SW, SDW, SDWV, SWF, HSDW, HSDWV	SW-end section with roller set 320 t
F, F3	SLF, SWF, SL2DF, SL3F, SL4DF, SL8F3, SL10DF, SL13DF, HSL2DF, HSL4DF	F-end section

Boom configurations for the calculation of load charts

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40.55 Slewing speed of the crane superstructure

Fig.195219

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1 Maximum permissible slewing speed at suspended nominal load

WARNING
Exceedance of the maximum permissible slewing speed!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
▶ Observe the maximum permissible slewing speed.

Operating mode	Number of slewing gears	Permissible slewing speed	
		LICCON	RPM
All operating modes	1	5 %	0.05 rpm
	2	5 %	0.05 rpm
	3	5 %	0.04 rpm

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40.60 Boom system

Fig.195219

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1 Short description of component groups

1.1 Main boom

Sign	Description
S	Main boom, heavy version
SL	Main boom, mixed version
SL2	Main boom, mixed version, variation 2
SL	Main boom, mixed version, variation 3
SL4	Main boom, mixed version, variation 4
SL8	Main boom, mixed version, variation 8
SL9	Main boom, mixed version, variation 9
SL10	Main boom, mixed version, variation 10
SL11	Main boom, mixed version, variation 11
SL13	Main boom, mixed version, variation 13
SL14	Main boom, mixed version, variation 14
HS	Reinforced main boom, heavy duty version
HSL	Reinforced main boom, mixed version
HSL2	Reinforced main boom, mixed version, variation 2
HSL3	Reinforced main boom, mixed version, variation 3
HSL4	Reinforced main boom, mixed version, variation 4

1.2 Auxiliary boom

1.2.1 Fixed accessory

Sign	Description
F	Fixed lattice jib
F3	Fixed lattice jib, guyed with fiber guy ropes
H	Boom nose

Note
▶ There are no separate load charts for boom noses with their own weighing device.

1.2.2 Moveable accessory

Sign	Description
W	Luffing lattice jib, heavy duty version
WV	Lattice jib, heavy duty version, in fixed angle to main boom

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WARNING
Erroneous operation of crane!
The crane can topple over.
Death or severe injuries, high property damage.
▶ Luff the main boom and the luffing lattice jib solely one after the other.

1.3 Derrick boom

Sign	Description
D	Derrick boom

1.4 Derrick ballast

Sign	Description
B	Suspended ballast without guide
B2	Suspended ballast with guide
B3	Exclusively for erection / take-down of boom system with a LTR 1220 as derrick ballast, see the load chart manual, chapter 40.62.20
B4	Exclusively for erection / take-down of boom system with a LTR 1220 as derrick ballast, see the load chart manual, chapter 40.62.20
BW	Ballast trailer

2 Combination of component groups for operating modes

The component groups of the boom system can be combined to operating modes, see Load chart manual, chapter 40.62.

Note
▶ This load chart manual contains load charts for certain operating modes. Overview of the respective operating modes, see Load chart manual, Chapter 40.90.

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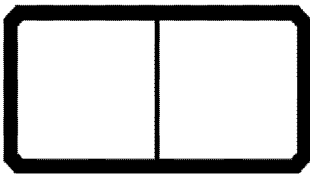
40.62 Operating modes

Fig.195219

1 Description of operating modes in load charts

The operating modes are noted in a two-part icon. The data in the chart are examples and may not apply exactly to your crane!

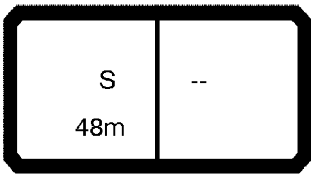
Operating mode icon	
	**Left icon half = Main boom operating mode** Possible data: - Main boom - Main boom angle - Main boom length - Length SA-frame - Hook block weight - Terrain incline - Limitation / note - Derrick boom - Derrick boom length - Derrick boom angle - Derrick radius **Right icon half = auxiliary boom operating mode** Possible data: - Auxiliary boom - Auxiliary boom angle - Auxiliary boom length - Hook block weight - Limitation / note - Derrick ballast radius

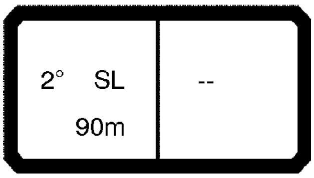
Note

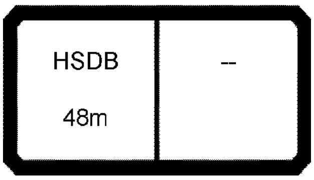
▶ The data in the left and right icon half of the operating mode icon for the respective load chart must match exactly with the selected settings in the LICCON overload protection.

2 Main boom operating modes

Examples:

Operating mode icon	Operating mode	Description
	Left side	
	S	Main boom, heavy version
	48 m	Main boom length

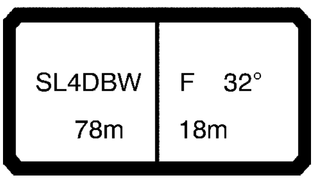
Operating mode icon	Operating mode	Description
	Left side	
	2°	Maximum permissible terrain incline
	SL	Main boom, mixed version
	90 m	Main boom length

Operating mode icon	Operating mode	Description
	Left side	
	HSDB	Reinforced main boom, heavy duty version with derrick boom and suspended ballast without guide
	48 m	Main boom length

3 Auxiliary boom operating modes

3.1 Auxiliary boom operating modes with fixed accessory

Examples:

Operating mode icon	Operating mode	Description
	Left side	
	SL4DBW	Main boom, mixed version, variation 4 with derrick boom and ballast trailer
	78 m	Main boom length
	Right side	
	F	Fixed lattice jib
	32°	Fixed lattice jib installed in an angle of 32° to the main boom
	18 m	Length of the fixed lattice jib

Operating mode icon	Operating mode	Description
HSL2DB 108m | F 28° 30m	Left side	
	HSL2DB	Reinforced main boom, mixed version, variation 2 with derrick boom and suspended ballast without guide
	108 m	Main boom length
	Right side	
	F	Fixed lattice jib
	28°	Fixed lattice jib installed in an angle of 28° to the main boom
	30 m	Length of the fixed lattice jib

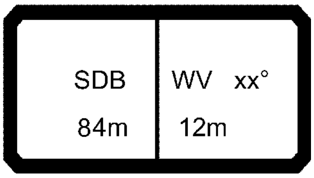
Operating mode icon	Operating mode	Description
SL10DB2 1) 147m | F12m 16° yy=20.0m	Left side	
	SL10DB2	Main boom, mixed version, variation 10 with derrick boom and suspended ballast with guide
	1)	Limitation / note, see Load chart manual, Chapter 40.65.10
	147 m	Main boom length
	Right side	
	F	Fixed lattice jib
	12 m	Length of the fixed lattice jib
	16°	Fixed lattice jib installed in an angle of 16° to the main boom
	yy= 20.0 m	Derrick ballast radius

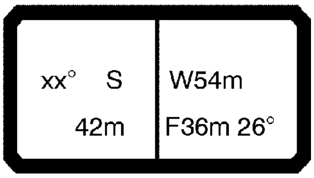
3.2 Auxiliary boom operating modes with moveable accessory

WARNING
Erroneous operation of crane!
The crane can topple over.
Death or severe injuries, high property damage.
▶ Luff the main boom and the luffing lattice jib solely one after the other.

Examples:

Operating mode icon	Operating mode	Description
	Left side	
	xx°	Main boom is in a fixed angle to the horizontal. The angle is noted in line xx in the respective load chart.
	S	Main boom, heavy version
	36 m	Main boom length
	Right side	
	W	Luffing lattice jib, heavy duty version
	24 m	Length of the luffing lattice jib

Operating mode icon	Operating mode	Description
	Left side	
	SDB	Main boom, heavy duty version with derrick boom and suspended ballast without guide
	84 m	Main boom length
	Right side	
	WV	Lattice jib, heavy duty version, in fixed angle to main boom
	xx°	Lattice jib is in fixed angle to main boom. The angle is noted in line xx in the respective load chart.
	12 m	Length Lattice jib

Operating mode icon	Operating mode	Description
	Left side	
	xx°	Main boom is in a fixed angle to the horizontal. The angle is noted in line xx in the respective load chart.
	S	Main boom, heavy version
	42 m	Main boom length
	Right side	
	W	Luffing lattice jib, heavy duty version
	54 m	Length of the luffing lattice jib
	F	Fixed lattice jib
	36 m	Length of the fixed lattice jib
	26°	Fixed lattice jib installed in an angle of 26° to the luffing lattice jib

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4 Operating modes for crane operation on main boom with installed auxiliary boom

Special operating modes are available for crane operation on main boom with installed auxiliary boom. For these operating modes the main boom operating mode is listed in parenthesis.

WARNING
Erroneous operation of crane!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.

When a main boom operating mode is listed in parenthesis:
▶ Lift the load exclusively on the main boom.

Examples:

Operating mode icon	Operating mode	Description
(S)SL2DB 102m | F 31° 12m 5.5t	Left side	
	(S)SL2DB	Main boom, mixed version, variation 2 with derrick boom and suspended ballast without guide Load on main boom
	102 m	Main boom length
	Right side	
	F	Fixed lattice jib
	31°	Fixed lattice jib installed in an angle of 31° to the main boom
	12 m	Length of the fixed lattice jib
	5.5 t	Weight of hook block which must be on the auxiliary boom.

5 Operating modes with several hook blocks

For some operating modes the weight of the hook block is noted, on which no load is suspended.

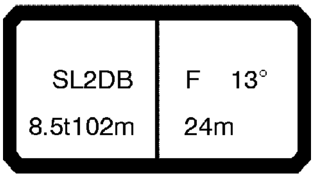
WARNING
Erroneous operation of crane!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.

When a hook block weight is noted in the operating mode icon:
▶ Install the hook block with the specified weight on the respective boom.

2 cases are differentiated:
– Hook block weight on main boom for crane operation on auxiliary boom
– Hook block weight on auxiliary boom for crane operation on main boom

5.1 Hook block weight on main boom for crane operation on auxiliary boom

Examples:

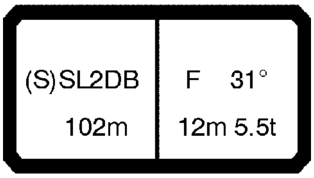
Operating mode icon	Operating mode	Description
	Left side	
	SL2DB	Main boom, mixed version, variation 2 with derrick boom and suspended ballast without guide
	8.5 t	Weight of hook block which must be on the main boom.
	102 m	Main boom length
	Right side	
	F	Fixed lattice jib
	13°	Fixed lattice jib installed in an angle of 13° to the main boom
	24 m	Length of the fixed lattice jib

5.2 Hook block weight on auxiliary boom for crane operation on main boom

WARNING
Erroneous operation of crane!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.

When a main boom operating mode is listed in parenthesis:
▶ Lift the load exclusively on the main boom.

Examples:

Operating mode icon	Operating mode	Description
	Left side	
	(S)SL2DB	Main boom, mixed version, variation 2 with derrick boom and suspended ballast without guide Load on main boom
	102 m	Main boom length
	Right side	
	F	Fixed lattice jib
	31°	Fixed lattice jib installed in an angle of 31° to the main boom
	12 m	Length of the fixed lattice jib
	5.5 t	Weight of hook block which must be on the auxiliary boom.

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40.62.20 Assembly operating modes

Fig.195219

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1 Assembling and disassembling crawler carriers with SA-frame

WARNING
Disregard of assembly instructions!
Toppling crane, falling and oscillating crane components.
Death, severe bodily injuries, property damage.
- ▶ Adhere to and observe the assembly instructions for the assembly and disassembly of crawler carriers with SA-frame, see Crane operating instructions, chapter 3.01.
- ▶ Before assembly and disassembly set the respective assembly operating mode.

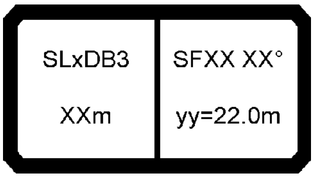
Operating mode icon	Operating mode	Description
	Left side	
	SA	Assembly operating mode with SA-frame
	10.5 m	Length SA-frame

Assembly operating mode for assembling and disassembling the crawler carriers with SA-frame

2 Erection and take-down of boom system with LTR 1220

For the erection and take-down of longer boom systems, a derrick ballast weight of up to 350 t is required. This required weight can be reduced or completely compensated for by using a LTR 1220 as derrick ballast.

WARNING
Disregard of assembly instructions!
Toppling crane, failure of crane structures.
Death, severe bodily injuries, property damage.
- ▶ Observe and adhere to the assembly instructions for erection and take-down of boom systems with an LTR 1220 as derrick ballast, see Crane operating instructions, chapter 5.34.
- ▶ Before erection and take-down, set the respective assembly operating mode.

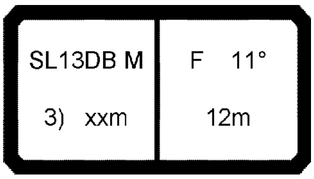
Operating mode icon	Operating mode	Description
	Left side	
	SLxDB3	Main boom, mixed version with derrick boom and a LTR 1220 as derrick ballast The operating mode is valid for each variation of SL-boom
	XXm	The operating mode is valid for all erectable main boom lengths.
	Right side	
	SF	Fixed lattice jib on SL-boom
	XX	The operating mode is valid for all erectable fixed lattice jib lengths
	XX°	Fixed lattice jib installed in an erectable angle to the main boom
	yy= 22.0 m	Derrick ballast radius

Assembly operating mode for erecting / taking down the boom system with a LTR 1220 as derrick ballast

3 Erecting / taking down with reduced counterweight

There are erection and take down charts with reduced counterweight for which no load charts are available. The erection and take-down must be made with the respective assembly operating mode.

WARNING
Erroneous operation of crane!
Toppling crane, failure of crane structures.
Death, severe bodily injuries, property damage.
- ▶ Before erection and take-down, set the respective assembly operating mode.
- ▶ Observe and adhere to the Erection and take-down charts.

Operating mode icon	Operating mode	Description
	Left side	
	SL13DB M	Assembly operating mode; main boom, mixed version, variation 13 with derrick boom and suspended ballast
	3)	Limitation / note, see Load chart manual, Chapter 40.65.10
	xxm	The operating mode is valid for all erectable main boom lengths.
	Right side	
	F	Fixed lattice jib
	11°	Fixed lattice jib installed in an angle of 11° to the main boom
	12 m	Length of the fixed lattice jib

Assembly operating mode for erecting / taking down with reduced counterweight

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40.65 Description of the load chart

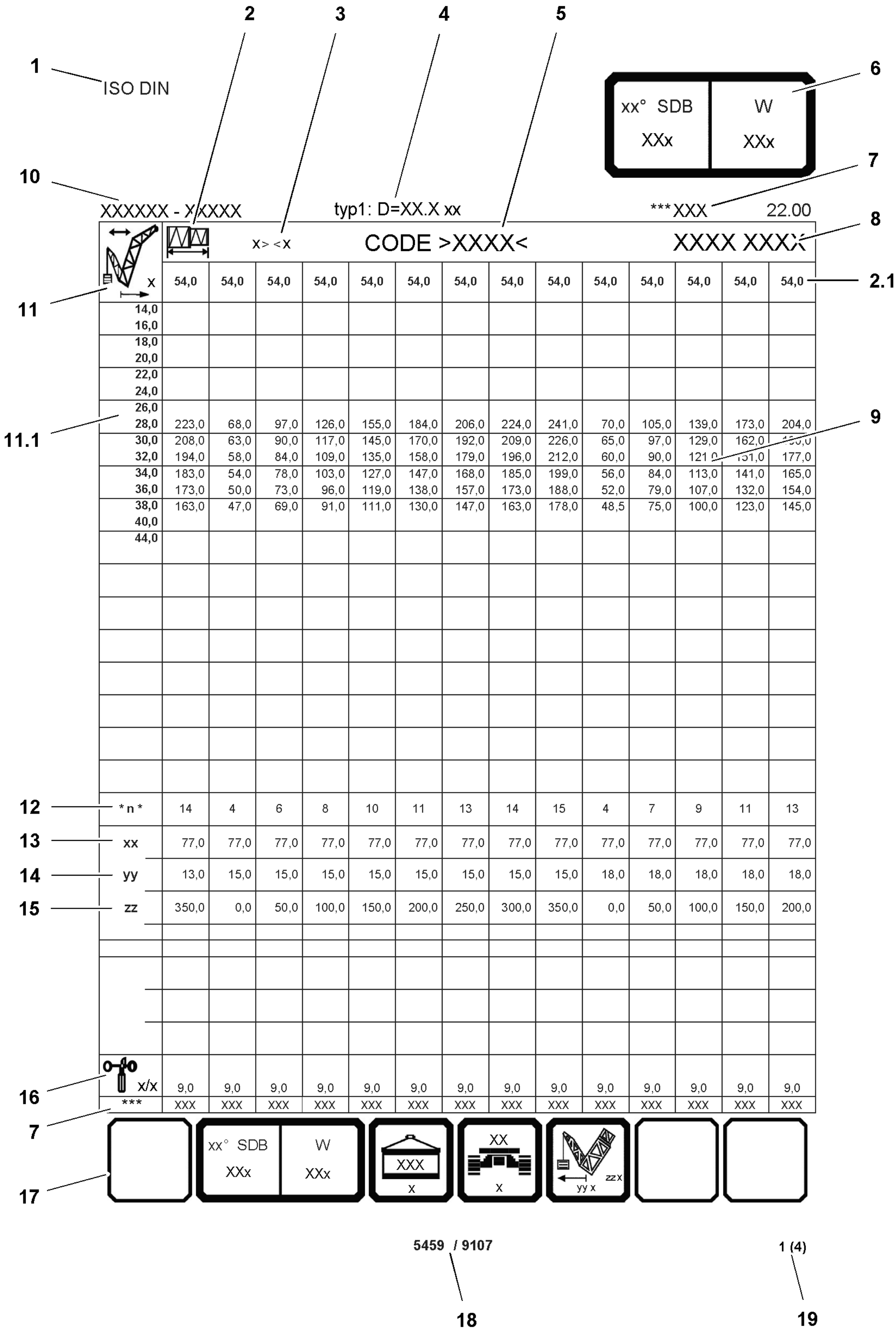

Fig.149249: Example of a load chart

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1 Description of the load chart

WARNING
Erroneous operation of the crane!
Toppling crane, failure of crane structures.
Death, severe bodily injuries, property damage.
▶ Set the LICCON overload protection exactly with the data in the respective load chart.
▶ Working outside the permissible set up configurations, boom radii and slewing ranges according to the load chart is prohibited.
▶ Move the boom system at assembly operation only within the permissible ranges.

The data in the displayed load chart are examples and may not apply exactly to your crane!

1 Standard

2 Main boom length icon
- Length of main boom **2.1** in meter (m) or feet (ft)

3 Units of measure
- Length units in meters (m) or feet (ft)
- Weight units in tons (t) or pounds (lb)

4 Hoist rope type and rope diameter
- Indicates which “hoist rope reeving chart” must be used
- **Note:** Only for certain crane types

5 Short code
- Describes in code the set operating mode / the set up configuration status

6 Operating mode icon
- Data of operating modes, see the Load chart manual, chapter 40.62

7 Chart number
- It appears either at the top of the chart or in the last line of the chart

8 Organization number
- For internal LIEBHERR load chart administration

9 Load values
- Load values in tons (t) or pounds (lb)

10 Crane type / crane number

11 Boom radius icon
- Boom radius **11.1** in meter (m) or feet (ft)

12 Hoist rope reeving
- On this line, the number of hoist rope strands is stated

13 Main boom angle / auxiliary boom angle
- On this line, the respective boom angle is indicated in degrees (°)

14 Derrick ballast radius
- On this line the derrick ballast radii are indicated in meters (m) or feet (ft)

15 Derrick ballast
- On this line the derrick ballasts are indicated in tons (t) or pounds (lb)

16 Wind speed
- On this line, the maximum permissible wind speed is noted in meters per second (m/s) or feet per second (ft/s)

17 Icon line of function keys

18 Page specification of all load charts
- Current page number and total number of pages of all load charts

19 Page specification of the current load chart
- Current page number and total number of pages of the current load chart

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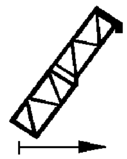
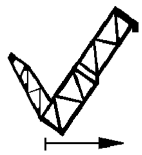
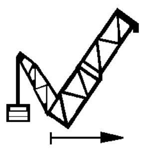
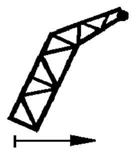
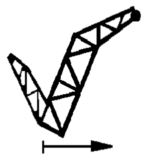
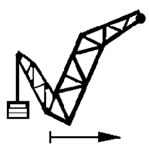
2 Icon explanation

Boom radius	
The boom radius (the working radius) is the horizontal distance of the hook block from the rotation axis of the crane superstructure in meters (m) or feet (ft), measured on the ground.	
	Icon for main boom operating modes
	Icon for main boom operating modes with derrick boom
	Icon for main boom operating modes with derrick boom and derrick ballast
	Icon for auxiliary boom operating modes with fixed accessory
	Icon for auxiliary boom operating modes with fixed accessory and derrick boom
	Icon for auxiliary boom operating modes with fixed accessory, derrick boom and derrick ballast

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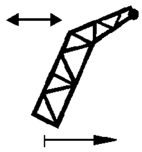
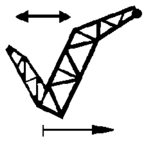
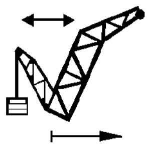
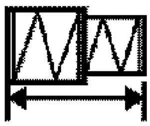
Boom radius	
	Icon for auxiliary boom operating modes with moveable accessory
	Icon for auxiliary boom operating modes with moveable accessory and derrick boom
	Icon for auxiliary boom operating modes with moveable accessory, derrick boom and derrick ballast

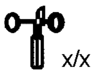
Main boom length	
	In the line below this icon, the various main boom lengths are entered by columns in meters (m) or feet (ft).

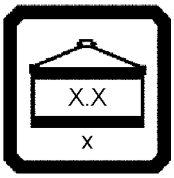
Hoist rope reeving	
*** n ***	The number of hoist rope strands is indicated on the corresponding line. The maximum load capacity of the corresponding table column is reached with the indicated number of hoist rope strands. If a load value in the chart column exceeds that of a load that can be lifted with the maximum possible reeving, then there is an exclamation mark “!” next to the reeving number. If the mark “!” is shown, special equipment is required to lift the respective load.

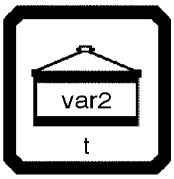
Main boom angle / auxiliary boom angle	
XX	On this line, the main boom angle or the auxiliary boom angle is indicated in degrees (°). The specified angle must be set to be able to reach the load values of the respective chart. The icon appears only for operating modes with an auxiliary boom The respective angles are indicated in line xx in the load charts below the load chart values.

Derrick ballast radius	
yy	On this line, the derrick ballast radius is indicated in meters (m) or feet (ft). The specified derrick ballast radius must be set to be able to reach the load values of the respective chart. The icon appears only in operating modes with derrick ballast. The derrick ballast radius is the horizontal distance of the derrick ballast from the rotation axis of the crane superstructure, measured on the ground. The respective radii are indicated in line yy in the load charts below the load chart values.

Derrick ballast	
zz	On this line, the size of the counterweight is indicated in tons (t) or pounds (lb). The specified derrick ballast must be pulled to be able to reach the load values of the respective chart. The icon appears only in operating modes with derrick ballast. The respective weights are noted in line zz in the load charts below the load chart values.

Permissible wind speed	
	In the corresponding line, the maximum permissible wind speed is noted in meters per second (m/s) or feet per second (ft/s). The maximum permissible wind speed depends on the operating mode and the set up configuration. If the wind speed exceeds the specified value, crane operation must be stopped and the crane must be taken down.
Note:	The maximum permissible wind speed refers to the 3 second wind gust speed at maximum lifting height.

Counterweight	
	This icon indicates the size of the counterweight in tons (t) or pounds (lb). The specified counterweight must be on the turntable, so that the load values for the respective chart can be reached.

Ballast combinations	
	Various ballast combinations are indicated in this icon The following chart shows the composition of the ballast combinations. To reach the values of the respective load chart, the specified counterweights and the central ballast of the respective ballast combination must be installed on the corresponding position.

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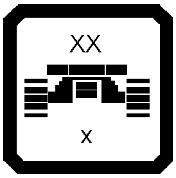
Ballast combination	Counterweight on the turntable	Counterweight on the turntable extension	Central ballast
var1	90 t	67.5 t	65 t
var2	90 t	67.5 t	45 t
var3	90 t	47.5 t	45 t
var4	90 t	27.5 t	45 t
var5	150 t	67.5 t	65 t

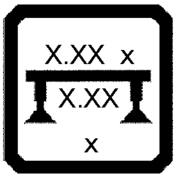
Crane on crawler carrier with central ballast



This icon indicates the size of the central ballast on the crawler travel gear in tons (t) or pounds (lb). The specified central ballast must be on the crawler travel gear to be able to reach the load values of the respective chart.

Crawler travel gear for crane operation “Crane on crawler carriers”.

Crane supported

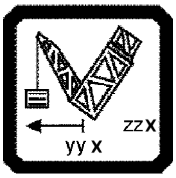


This icon denotes the type and size of the support base. The size of the support base (length x width) is indicated in meters (m) or feet (ft).

The crane must be supported on all four supports. The support beams must be swung out and / or extended to the specified dimension

Support base for “Crane supported” crane operation.

Derrick ballast and derrick ballast radius



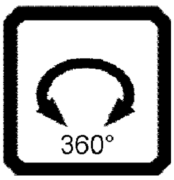
This icon indicates the derrick ballast and the derrick ballast radius The icon appears in operating modes with derrick ballast on the location of the slewing range icon. The permissible slewing range of the crane superstructure in this operating mode is 360°.

zz = Derrick ballast in tons (t) or pounds (lb)

yy = Derrick ballast radius in meters (m) or feet (ft)

The respective values are noted in the load charts below the load values.

Slewing range



In this icon, the slewing range of the crane superstructure is noted for the respective load chart. Various slewing ranges can be possible. When various slewing ranges are possible, then they are listed in the following chart.

Slewing range	Description
360°	Unlimited turning is possible.

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40.65.10 Limitations and notes

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Fig.195219

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1 Limitations and notes in load charts

WARNING
Disregard of limitations and notes in load charts!
Toppling crane, failure of crane structures.
Death or severe injuries, high property damage.
▶ Adhere to the limitations and notes.

Note
▶ In part, limitations and notes are noted for certain operating modes. The limitations and notes are noted with a Code (signs, numbers or letters) on the operating mode icons. The respective Codes are explained as follows.

1.1 Code: 1)

Note
▶ The hook block cannot be lowered to the ground in every situation.

Code 1)	Description
SL10DB2 F12m 16° 1) 147m yy=20.0m	With the existing hoist rope length and the required reeving, the hook block cannot be lowered to the ground in every situation.

1.2 Code: 2)

WARNING
Incorrect erection / take-down of the boom system!
Toppling crane, failure of crane structures.
Death, severe bodily injuries, property damage.
▶ Carry out the erection / take-down of the boom system with the erection and take down charts as described in the operating instructions.

Code 2)	Description
SL13DB F 16° 2) 153m 12m	The erection / take down of the boom system must be carried out with the derrick ballast “B2”.

1.3 Code: 3)

WARNING
Erroneous operation of the crane!
Toppling crane, failure of crane structures.
Death, severe bodily injuries, property damage.
- ▶ Use operating modes with code 3) exclusively for erection / take down of the boom system.
- ▶ Observe and adhere to the Erection and take down charts.

Before ballasting the counterweight up to nominal ballast of the load chart:
- ▶ Set the boom system in the respective steepest operating position.

Before ballasting the counterweight down to the required counterweight of the take down chart:
- ▶ Set the boom system in the respective steepest operating position.

Code 3)	Description
SL13DB M | F 11° 3) xxm | 12m	This assembly operating mode is exclusively for the erection / take down of the boom system with reduced counterweight.

1.4 Code: 4)

– Not active

1.5 Code: 5)

WARNING
Permissible lateral inclination exceeded!
Toppling crane, failure of crane structures.
Death, severe bodily injuries, property damage.
- ▶ Observe and comply with the maximum permissible lateral inclination when driving with the equipment in place. See the separate operating instructions “Driving with the equipment in place”.

Code 5)	Description
SL13DR | -- 5) 82m	With these operating modes, the reduced lateral inclination when driving with the equipment in place must be observed.

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40.65.40 Crane incline

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Fig.195219

1 Maximum permissible incline of the crane

The inclines specified in the load chart manual are valid for crane operation with selected load chart.

WARNING
Exceedance of the maximum permissible incline!
Toppling crane, failure of carrying structure of the crane.
Death or severe injuries, high property damage.
▶ Adhere to the maximum permissible incline of the crane.

Operating mode	Maximum permissible incline of the crane
On crawler	0.3°
On supports	0.0°

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40.70 Wind influences for crane operation

1 Terminology

The following chart lists the most important terms, signs and units for wind influences during crane operation.

Note

- Make yourself familiar with the terms. For the determination and calculations of the permissible wind speed, you have to know the influence factors.
- Contact Liebherr-Werk Ehingen GmbH, if you need additional information for wind influences during crane operation.

Sign	Unit	Name	Definition
A_P	[m²]	Projection surface	Applicable for the calculation of the wind exposure surface, vertically to the surface directed to the flow.
c_W		Wind resistance coefficient	Value for the flow resistance of wind flowing around a body.
A_W	[m²]	Wind-exposed surface	Area exposed to wind = Projection area x Wind resistance coefficient $A_W = A_P \times c_W$
m_T	[t]	Load	Respective chart value from load chart.
m_H	[t]	Hoist load	Weight to be lifted (mass) (including fastening equipment, hook block and possibly the hoist rope part, which was not yet considered in the calculation). The hoist load may not reach more than the maximum chart value of the load chart.
m_N	[t]	Load capacity	Weight (mass) of the component to be lifted (without fastening equipment and hook block).
v(z)	[m/s]	3-second wind gust speed	Mean value of wind speed created over a time frame of 3 seconds at a height of z above the ground.
v_{max}	[m/s]	Maximum permissible wind speed	Maximum permissible 3 second wind gust speed at maximum lifting height.
v_{max_TAB}	[m/s]	Maximum permissible wind speed (load charts)	Maximum permissible 3 second wind gust speed at maximum lifting heights, which are specified for the load chart values in the load chart.
p	[N/m²]	Dynamic pressure	Pressure load on a body due to wind flow. Dynamic pressure = density /2 x (3-second wind gust speed)² $p = \rho/2 \times (v(z))^2$ (ρ = Density of air = 1.25 kg/m³)
F_W	[N]	Wind load	Force effect on a body due to wind flow. $F_W = A_W \times p$

Symbol

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2 Influence of wind on the LICCON overload protection

The wind can put an additional strain or relief on the crane system, especially in operating modes with long boom systems and steep boom position. This can falsify the load display. The LICCON overload protection can possibly shut off too early or too late.

2.1 Wind from the rear

If wind is coming from the rear, the boom system is additionally stressed. The load display is too high. The shut-off of the LICCON overload protection is already triggered by a hoist load that is smaller than the maximum load.

2.2 Wind from the front

If wind is coming from the front, the boom system is relieved. The load display is too low. The shut-off of the LICCON overload protection is triggered only by a hoist load that is larger than the maximum load.

DANGER
Danger of tipping and overload of load carrying components!
The wind from the front does not reduce the load of the hook, hoist rope, hoist rope pulleys and hoist winch. If wind is coming from the front, these components can be overloaded by lifting a load until the shut-off of the LICCON overload protection!
If the wind from the front diminishes, then the entire crane can be overloaded if it had been stressed before until shut-off of the LICCON overload protection.
- ▶ The crane driver must know the weight of the hoist load and may not exceed the maximum load capacity.

2.3 Wind from the side

If wind is coming from the side, the boom system is stressed on the side. The load display is almost the same as for crane operation without wind influences.

DANGER
Danger of tipping and overload of load carrying components!
For crane operation, if the wind speed is higher than the maximum permissible wind speed, then the crane can be overloaded without it being noticed if wind is coming from the side!
- ▶ The crane driver must know the weight of the hoist load and may not exceed the maximum load capacity.
- ▶ Before crane operation, determine the maximum permissible wind speed and carry out the wind surface calculation if necessary.

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3 Permissible wind speed and wind surface calculation

DANGER
Wind speed too high!
Danger of tipping and overload of load carrying components.
Death, severe bodily injuries, property damage.
- ▶ Before starting to work, the crane operator must check with the respective weather bureau to obtain the wind speeds for the duration of operation. If impermissible wind speeds are expected, then it is prohibited to lift a hoist load.
- ▶ The 3 second wind gust speed v(z) at the maximum height of the crane may not exceed the maximum permissible wind speed (v_{max}) and the maximum permissible wind speed according to the load chart (v_{max_TAB}) at any point in time.

Note
- ▶ The maximum permissible wind speed (v_{max}) and the maximum permissible wind speed according to the load chart (v_{max_TAB}) always refer to the 3 second wind gust speed, which is present at the maximum height of the crane.
- ▶ Instead of the 3 second wind gust speed, weather information services often report a wind speed (v_m), which is averaged within a time period of 10 minutes (so-called 10 minute average). It refers to the wind force on the Beaufort scale, normally to the medium value of the wind speed, which is determined within a time from of 10 minutes at a height of 10 m above ground or above sea level.
- ▶ The determining factor for the calculation of the 3 second wind gust speed in maximum height of the crane is significantly higher than the average value of the wind speed, which is determined over a time of 10 minutes at a height of 10 m above ground.

Crane operation is generally permissible up to the maximum wind speed (v_{max_TAB}) specified in the respective load chart for the current boom length.

The prerequisite for that is:
- The wind exposure surface (A_W) of the hoist load does not exceed 1.2 m²/t

DANGER
Wind speed too high!
Danger of tipping and overload of load carrying components.
- ▶ The maximum permissible wind speed according to the load chart (v_{max_TAB}) may not be exceeded, even if the wind exposure surface (A_W) of the hoist load is smaller than 1.2 m²/t.
- ▶ If the wind exposure surface (A_W) of the hoist load is more than 1.2 m²/t , then the maximum permissible wind speed (v_{max}) must be redetermined for the load case.

3.1 Wind resistance coefficient (c_w)

For the determination of the maximum permissible wind speed (v_{max}), the highest wind resistance coefficient (c_W) is required. The wind resistance coefficient (c_W) depends on the shape of the hoist load.

Note
- ▶ Check with person who created the load to be lifted for the wind resistance coefficient (c_W).

The following chart lists the typical shapes with the respective wind resistance coefficients (c_W).

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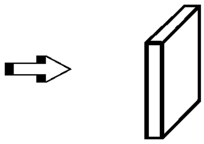
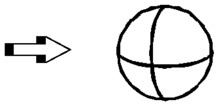
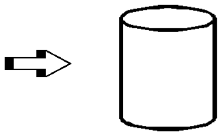
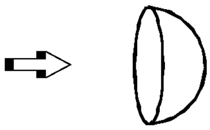
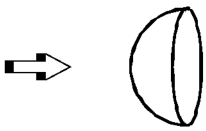
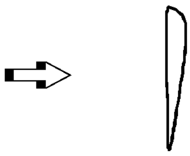
Shape	Wind resistance coefficient c_w	Examples
	1.1 to 2.0	Plate, panel, piling
	0.3 to 0.4	Ball, ball-shaped container
	0.6 to 1.0	Pipe, silo, reactor container
	0.8 to 1.2	Hemisphere
	0.2 to 0.3	Hemisphere
	0.05 to 0.1	Rotor blade, complete rotor
	Approx. 1.6	Rotor blade, complete rotor

Shapes with respective wind resistance coefficients (c_W)

3.2 Determining the maximum permissible wind speed (v_{max})

WARNING
Wind speed too high!
Toppling crane, failure of crane structure.
Death, severe bodily injuries, property damage.
▶ **Never** exceed the maximum permissible wind speed according to the load chart (v_{max_TAB}).

The maximum permissible wind speed (v_{max}) can be determined with the following methods:
- Calculate the maximum permissible wind speed
- Determining the maximum permissible wind speed with wind force diagrams

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If the determined maximum permissible wind speed (v_{max}) is **greater than** the maximum permissible wind speed according to the load chart (v_{max_TAB}):
- Crane operation up to the maximum permissible wind speed according to the load chart (v_{max_TAB}).

If the determined maximum permissible wind speed (v_{max}) is **smaller than** the maximum permissible wind speed according to the load chart (v_{max_TAB}):
- Crane operation permitted up to the determined maximum permissible wind speed (v_{max}).

3.3 Calculating the maximum permissible wind speed

$$V_{max} = V_{max\_TAB} \times \sqrt{\frac{1.2 \frac{m^2}{t} \times m_H}{A_W}}$$

Fig.111606: Formula for calculating the maximum permissible wind speed

The following data is required for the calculation:
- Maximum permissible wind speed according to load chart (v_{max_TAB})
- Hoist load (m_H)
- Projection surface of hoist load (A_P)
- Wind resistance coefficient (c_W)

Description of procedure:
1. Calculation of wind exposure surface ($A_W = A_P \times c_W$)
2. Check if the wind exposure surface (A_W) exceeds the limit value of 1.2 m²/t
3. Calculation of the maximum permissible wind speed (v_{max})

3.3.1 Example for calculating the maximum permissible wind speed

Data for calculation of the load case:

v_{max_TAB} = 9.0 m/s
m_H = 50.0 t
A_P = 70.0 m²
c_W = 1.4

Step 1: Calculating the wind-exposed surface

$A_W = A_P \times c_W$
A_W = 70.0 m² x 1.4
A_W = 98.0 m²
Result: The wind exposure surface (A_W) is: **98.0 m²**

Step 2: Checking if the wind exposure surface (A_W) exceeds the limit value of 1.2 m²/t

The wind exposure surface per ton of hoist load is: 98.0 m² / 50 t = **1.96 m²/t**

Result: The wind exposure surface per ton of hoist load exceeds the limit value of 1.2 m²/t.

The maximum permissible wind speed must be recalculated!

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Step 3: Calculating the maximum permissible wind speed

$$V_{max} = V_{max\_TAB} \times \sqrt{\frac{1.2\frac{m^2}{t} \times m_H}{A_W}}$$

$$V_{max} = 9\,{}^{m}\!/\!_{s} \times \sqrt{\frac{1.2\frac{m^2}{t} \times 50t}{98\,m^2}}$$

$$\underline{\underline{V_{max} = 7.04\,{}^{m}\!/\!_{s}}}$$

Fig.111607: Example for calculating the maximum permissible wind speed

Result: The maximum permissible wind speed is: **7.04 m/s**

3.4 Determining the maximum permissible wind speed with wind force diagrams

Depending on the maximum permissible wind speed according to the load chart (v_{max_TAB}) the maximum permissible wind speed (v_{max}) for the load case can be determined with the following wind force diagrams.

List of wind force diagrams:
- **Diagram 7.0 m/s** : Wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 7.0 m/s
- **Diagram 8.6 m/s** : Wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 8.6 m/s
- **Diagram 9.0 m/s** : Wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 9.0 m/s
- **Diagram 9.9 m/s** : Wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 9.9 m/s
- **Diagram 10.0 m/s** : Wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 10.0 m/s
- **Diagram 11.1 m/s** : Wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 11.1 m/s
- **Diagram 11.2 m/s** : Wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 11.2 m/s
- **Diagram 12.8 m/s** : Wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 12.8 m/s
- **Diagram 13.4 m/s** : Wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 13.4 m/s
- **Diagram 14.3 m/s** : Wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 14.3 m/s
- **Diagram 15.6 m/s** : Wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 15.6 m/s

WARNING
Wind speed too high!
Toppling crane, failure of crane structure.
Death, severe bodily injuries, property damage.
▶ The maximum permissible wind speed according to the load chart (v_{max_TAB}) must match the maximum permissible wind speed of the wind force diagram.

The following data is required for the determination:
- Maximum permissible wind speed according to load chart (v_{max_TAB})
- Hoist load (m_H)

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– Projection surface of hoist load (A_P)
– Wind resistance coefficient (c_W)

Description of procedure:
1. Calculation of wind exposure surface ($A_W = A_P$ x c_W)
2. Check if the wind exposure surface (A_W) exceeds the limit value of 1.2 m²/t.
3. Determination of maximum permissible wind speed (v_{max}) from the respective wind force diagram

3.4.1 Example for determining the maximum permissible wind speed

Data for calculation of the load case:
v_{max_TAB} = 9.0 m/s
m_H = 50.0 t
A_P = 70.0 m²
c_W = 1.4

Step 1: Calculating the wind-exposed surface

$A_W = A_P$ x c_W
A_W = 70.0 m² x 1.4
A_W = 98.0 m²
Result: The wind exposure surface (A_W) is: **98.0 m²**

Step 2: Checking if the wind exposure surface (A_W) exceeds the limit value of 1.2 m²/t

The wind exposure surface per ton of hoist load is: 98.0 m² / 50 t = **1.96 m²/t**

Result: The wind exposure surface per ton of hoist load exceeds the limit value of 1.2 m²/t.

The maximum permissible wind speed must be redetermined!

Step 3: Determining the maximum permissible wind speed (v_{max}) from the respective wind force diagram

Determination of maximum permissible wind speed (v_{max}) from the respective wind force diagram for load charts with a maximum permissible wind speed (v_{max_TAB}) of 9 m/s

Diagram 9.0 m/s

Result: The maximum permissible wind speed is: **7.04 m/s**

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3.4.2 Wind force diagrams

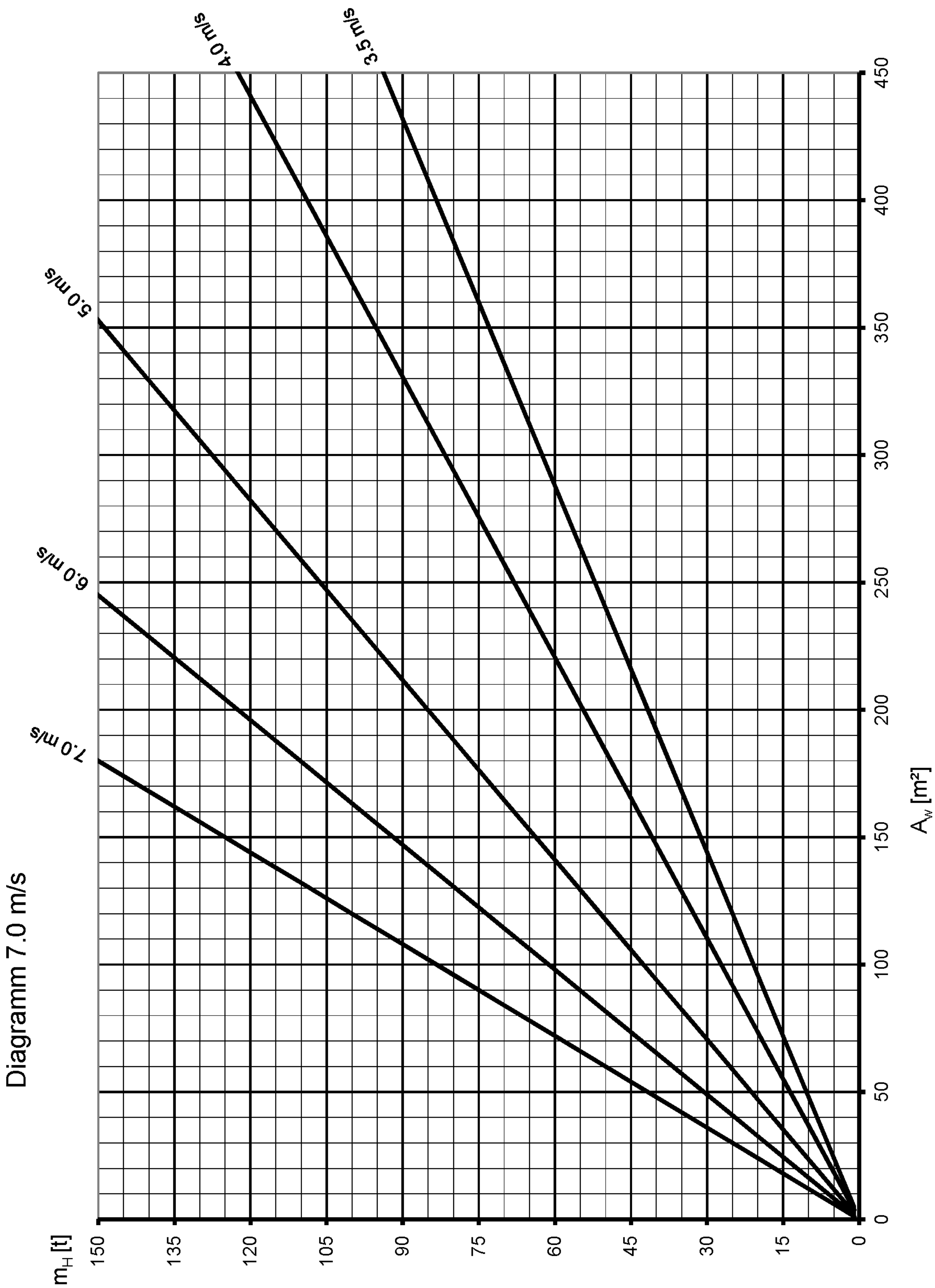

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Fig.149229: Wind force diagram 7.0 m/s for load charts with a maximum permissible wind speed (v_{max_TAB}) of 7.0 m/s

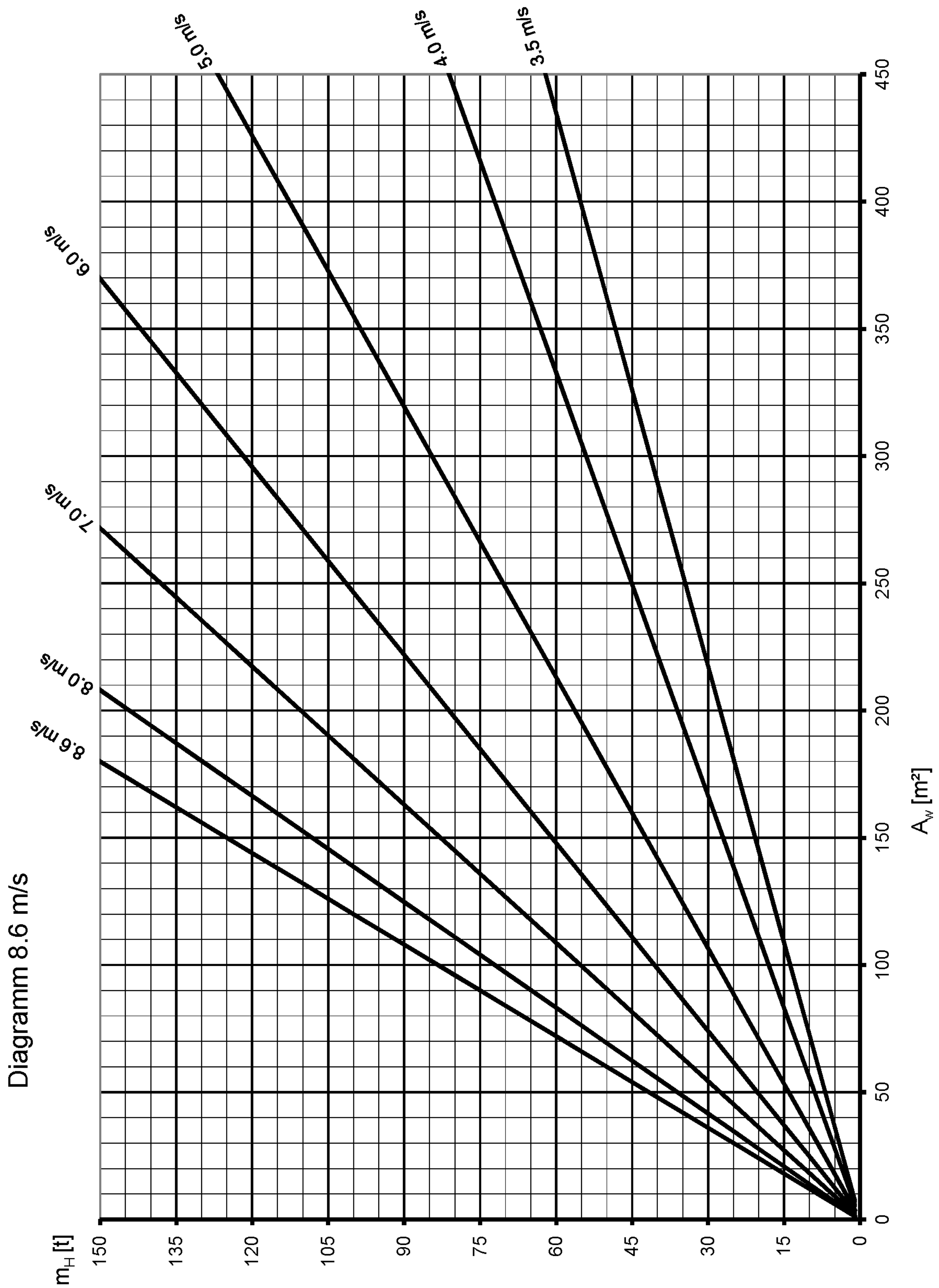

Fig.149230: Wind force diagram 8.6 m/s for load charts with a maximum permissible wind speed (v_{max_TAB}) of 8.6 m/s

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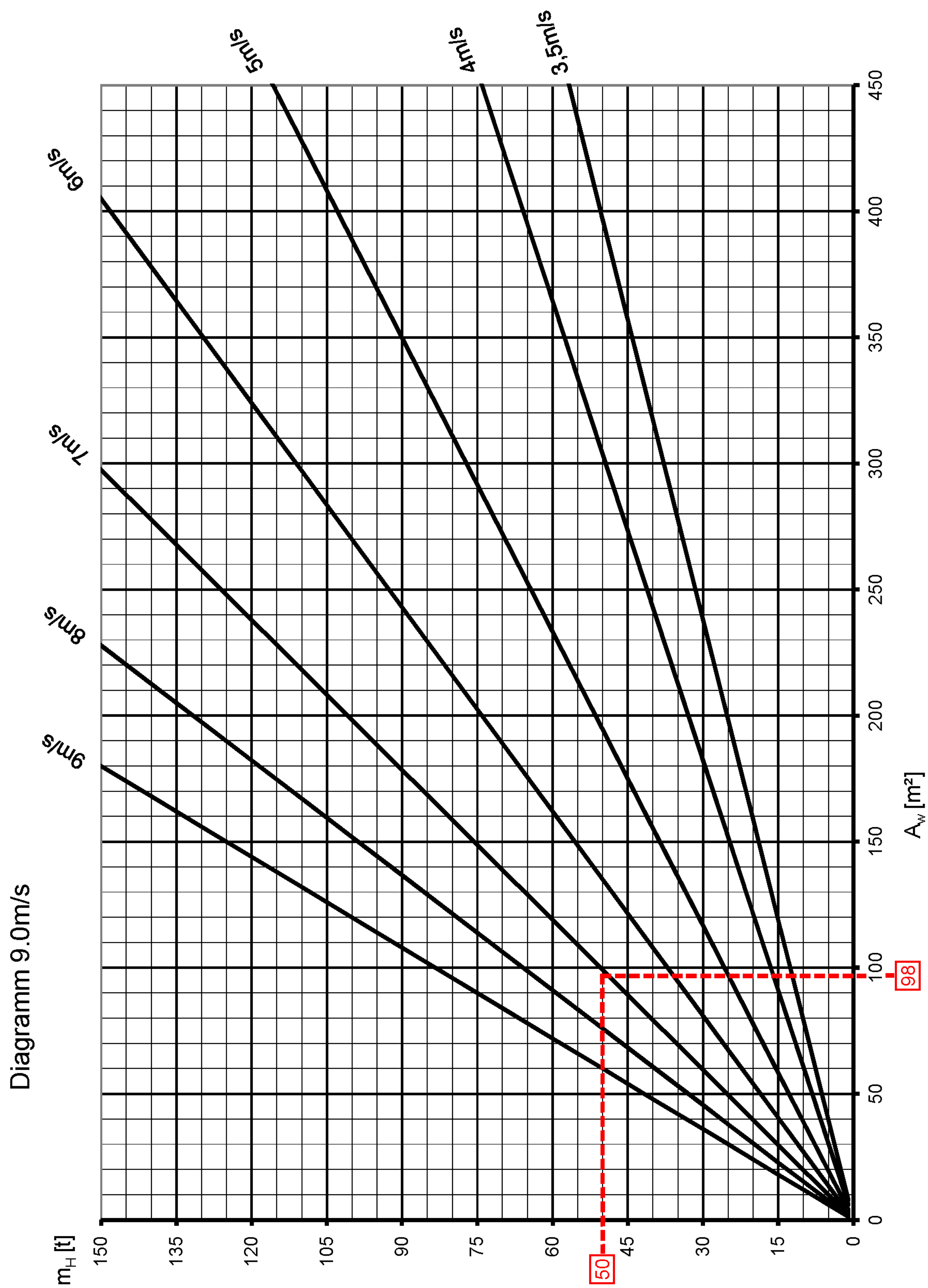

Fig.149231: Wind force diagram 9.0 m/s for load charts with a maximum permissible wind speed (v_{max_TAB}) of 9.0 m/s

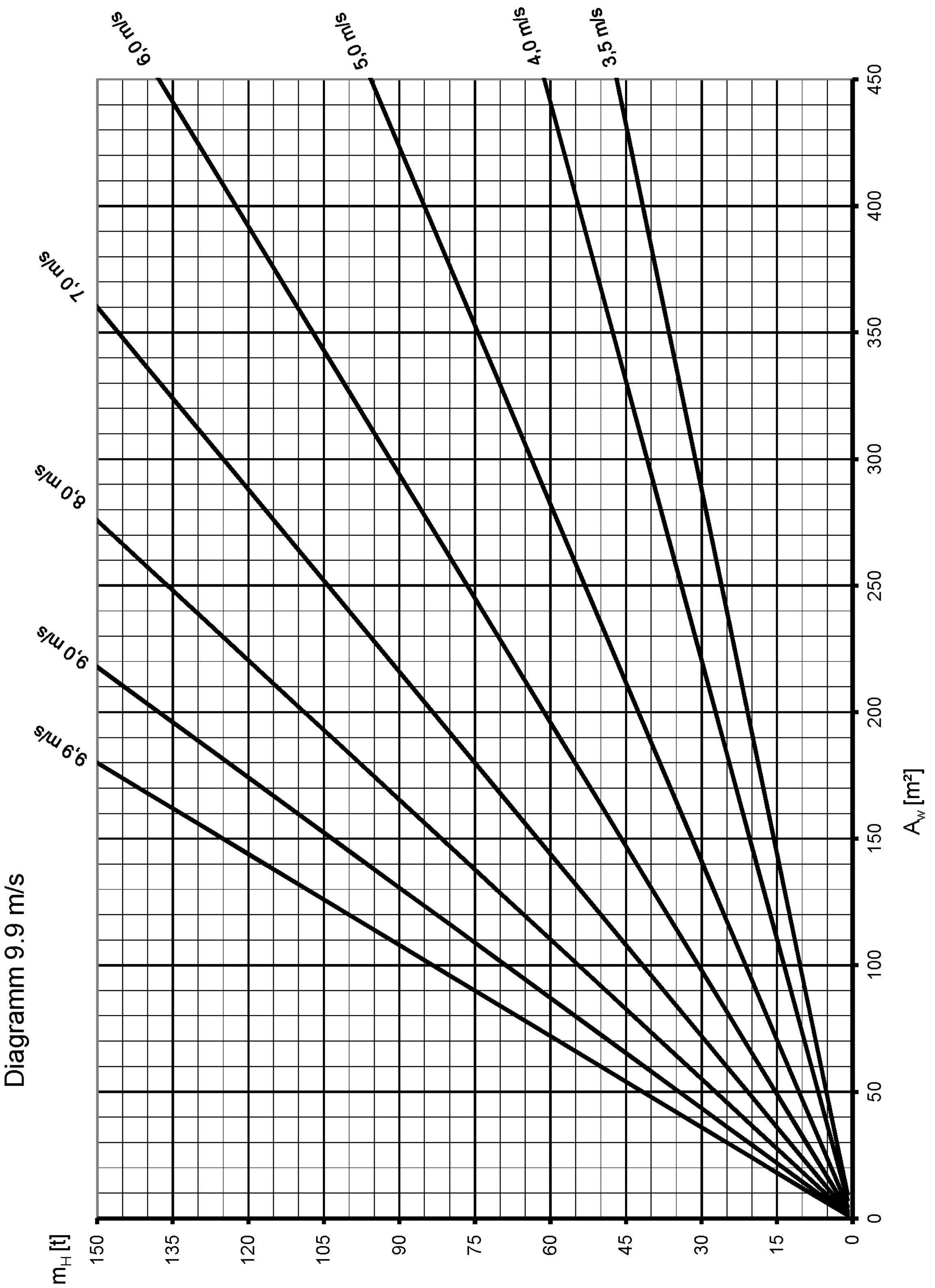

Fig.149232: Wind force diagram 9.9 m/s for load charts with a maximum permissible wind speed (v_{max_TAB}) of 9.9 m/s

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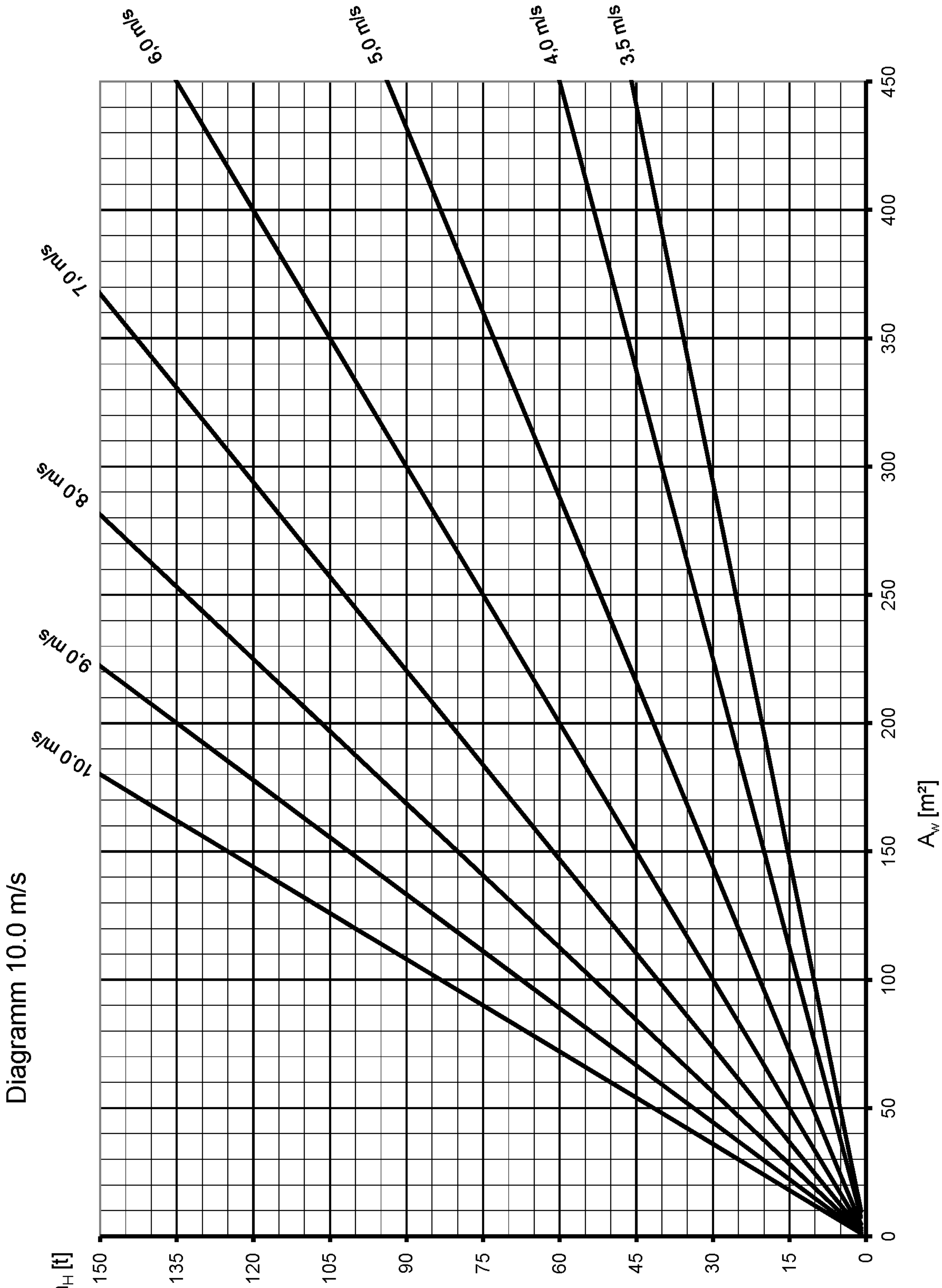

Fig.152631: Wind force diagram 10.0 m/s for load charts with a maximum permissible wind speed (v_{max_TAB}) of 10.0 m/s

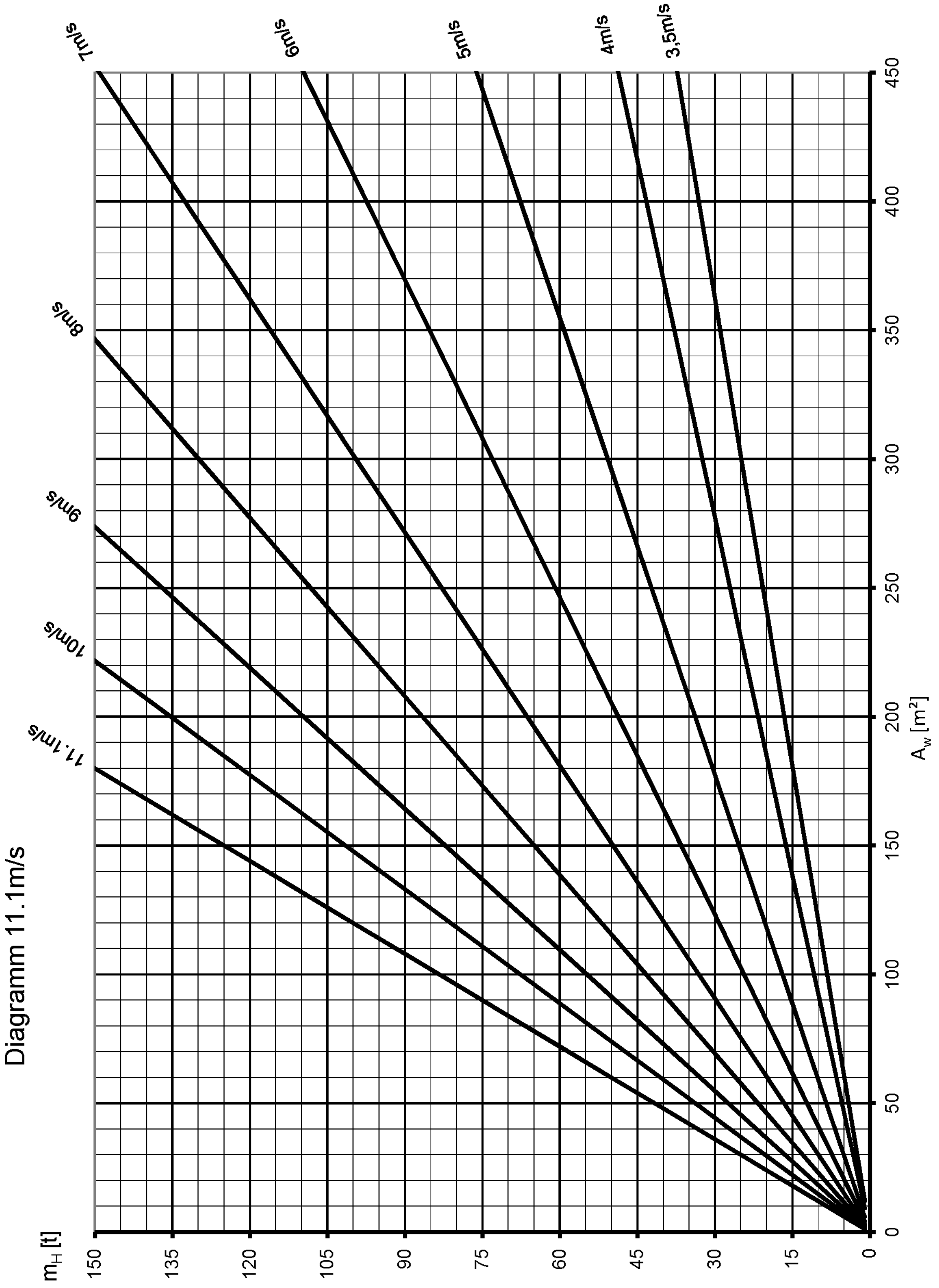

Fig.149233: Wind force diagram 11.1 m/s for load charts with a maximum permissible wind speed (v_{max_TAB}) of 11.1 m/s

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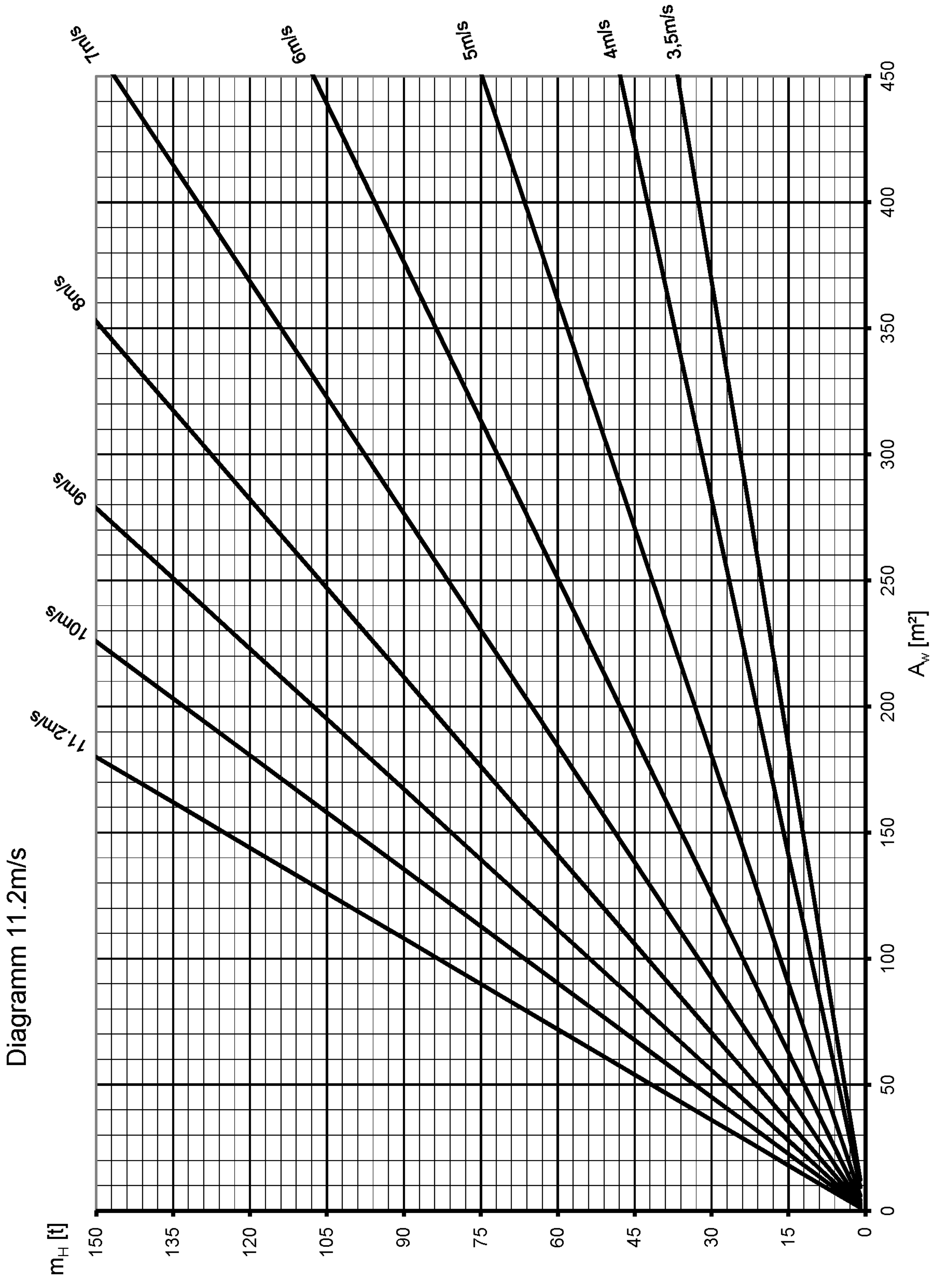

Fig.149234: Wind force diagram 11.2 m/s for load charts with a maximum permissible wind speed (v_{max_TAB}) of 11.2 m/s

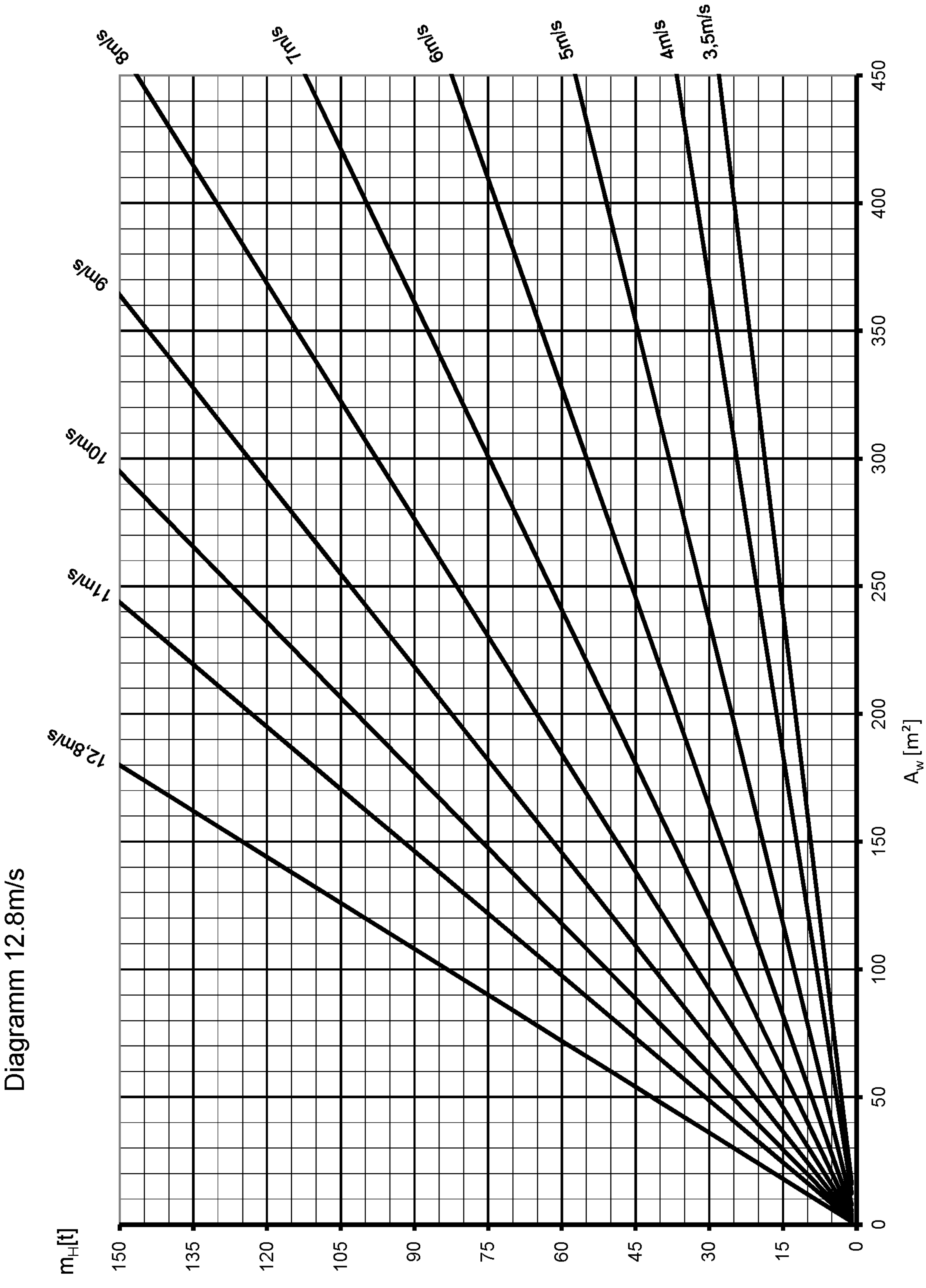

Fig.149235: Wind force diagram 12.8 m/s for load charts with a maximum permissible wind speed (v_{max_TAB}) of 12.8 m/s

LWE//418100-05-02/en

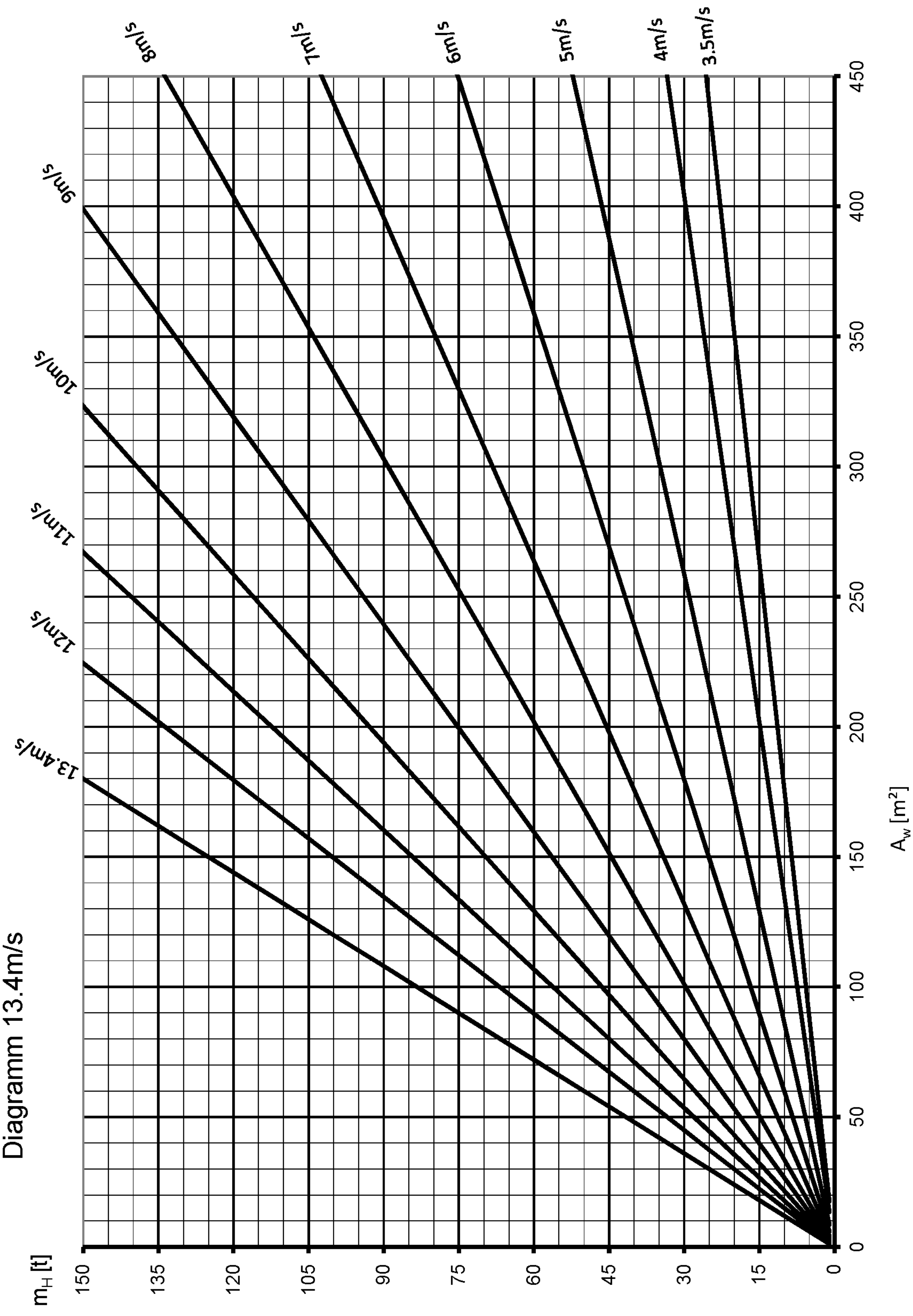

Fig.149236: Wind force diagram 13.4 m/s for load charts with a maximum permissible wind speed (v_{max_TAB}) of 13.4 m/s

LWE//418100-05-02/en

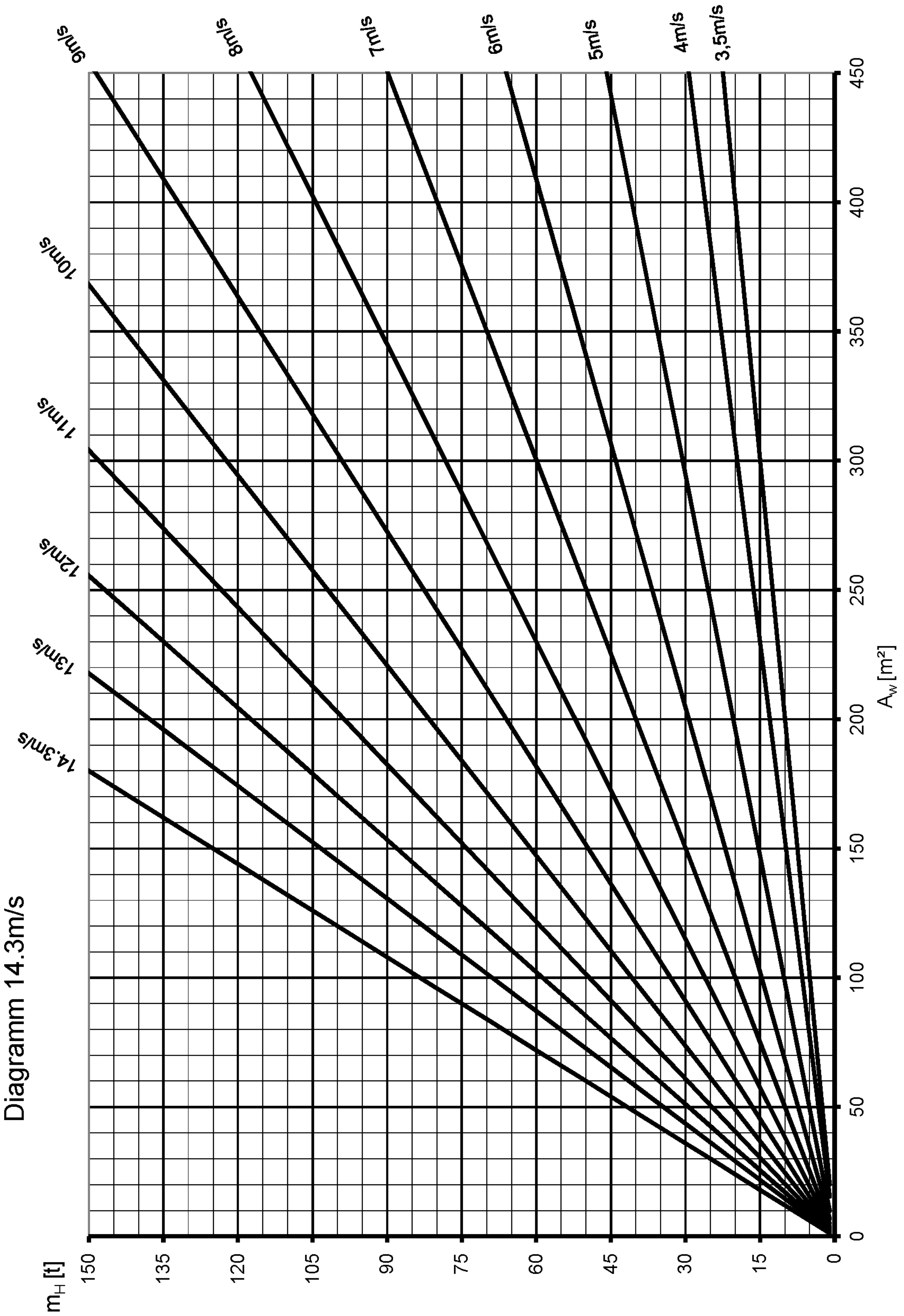

Fig.149237: Wind force diagram 14.3 m/s for load charts with a maximum permissible wind speed (v_{max_TAB}) of 14.3 m/s

LWE//418100-05-02/en

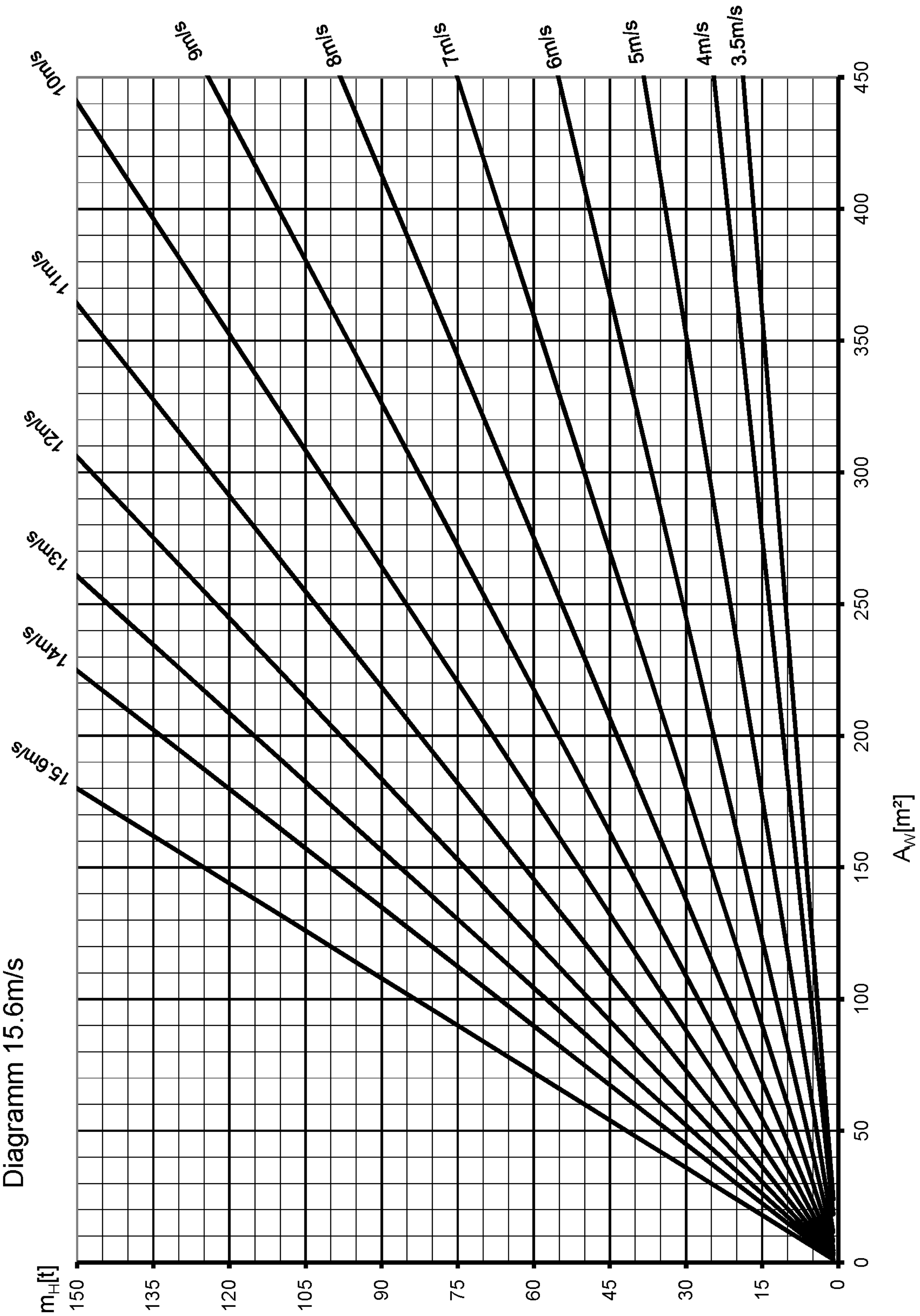

Fig.149238: Wind force diagram 15.6 m/s for load charts with a maximum permissible wind speed (v_{max_TAB}) of 15.6 m/s

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40.90 Load charts

Fig.195219

1 Load charts

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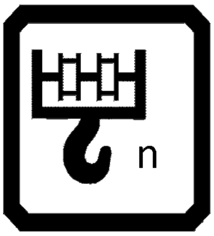
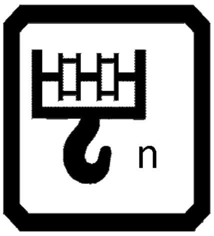
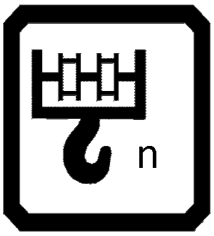
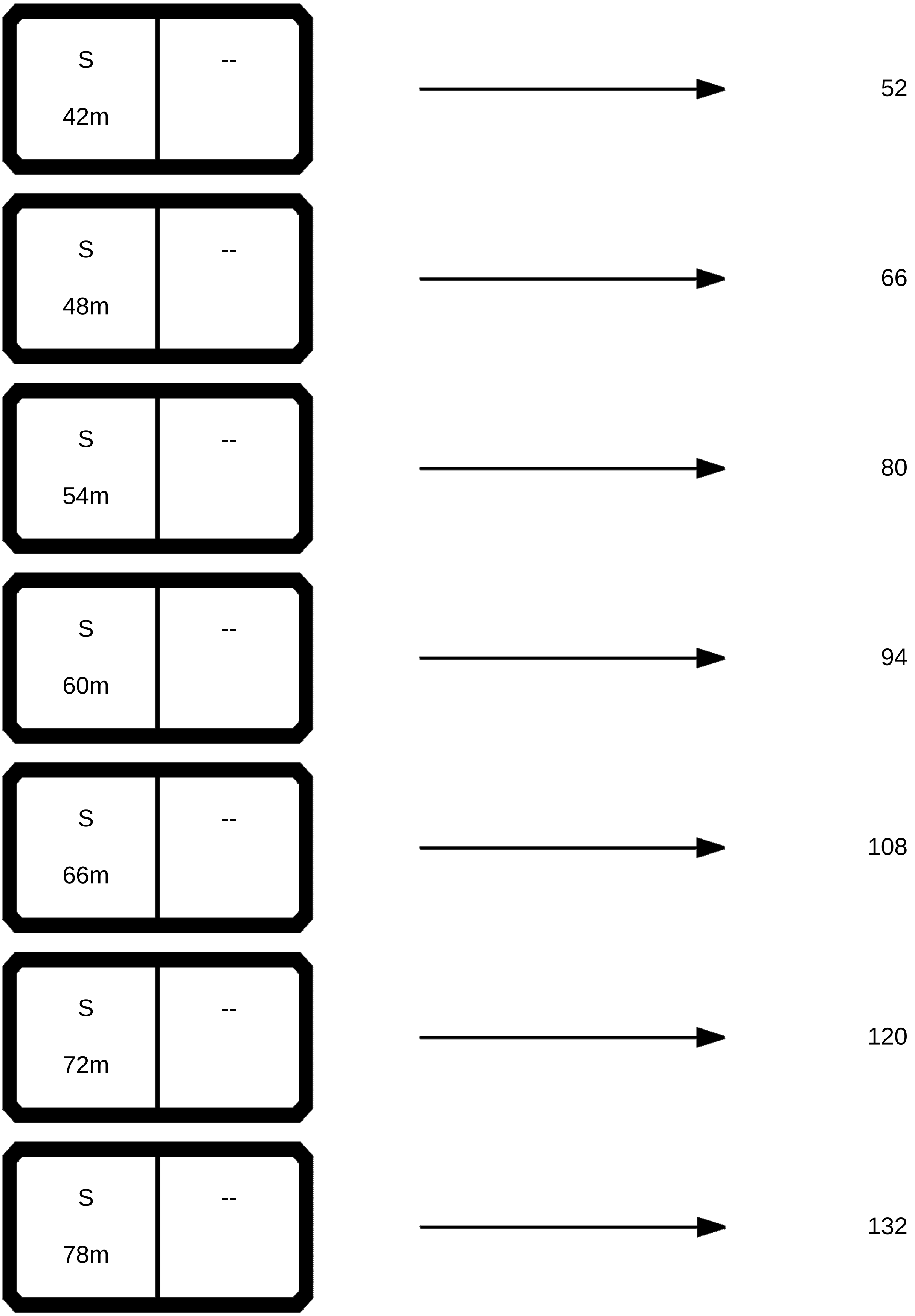
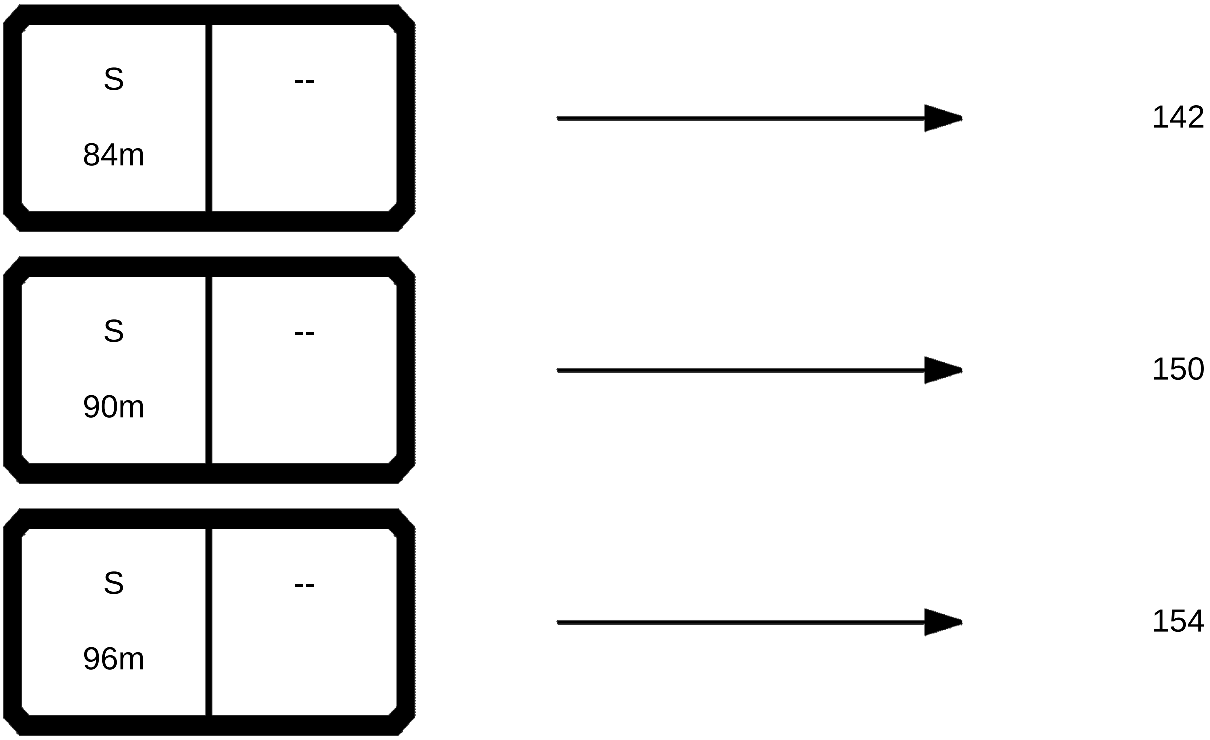
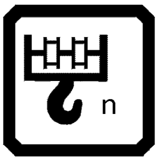
		→	4
		→	6
		→	8
SA 10.5m	-- (SA)	→	9
S 24m	--	→	10
S 30m	--	→	24
S 36m	--	→	38


S
42m
--
52
S
48m
--
66
S
54m
--
80
S
60m
--
94
S
66m
--
108
S
72m
--
120
S
78m
--
132


S
--
84m
142
S
--
90m
150
S
--
96m
154

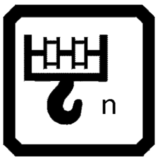
typ1: D=28.0 mm



t

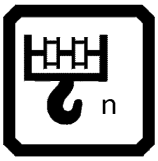
1x	18.1
2x	35.9
3x	53.4
4x	70.7
5x	87.7
6x	104.5
7x	121.0
8x	137.2
9x	153.2
10x	169.0
11x	184.5
12x	199.9
13x	214.9
14x	229.8
15x	244.4
16x	258.8
17x	273.0
18x	287.0
19x	300.8
20x	314.3
21x	327.7
22x	340.8
23x	353.8
24x	366.6
25x	379.1
26x	391.5
27x	403.7
28x	415.7
29x	427.6
30x	439.2
31x	450.7
32x	462.0
33x	473.2
34x	484.2
35x	495.0
36x	505.6
37x	516.1
38x	526.4
39x	536.6
40x	546.6

typ1: D=28.0 mm



41x	556.5
42x	566.2
43x	575.8
44x	585.2
45x	594.5
46x	603.7
47x	612.7
48x	621.6
49x	630.3
50x	639.0

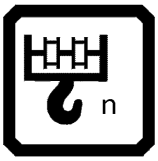
typ2: D=25.0 mm

 n	 t
1x	12.6
2x	24.9
3x	37.1
4x	49.1
5x	60.9
6x	72.5
7x	84.0
8x	95.3
9x	106.4
10x	117.4
11x	128.2
12x	138.8
13x	149.3
14x	159.6
15x	169.7
16x	179.7
17x	189.6
18x	199.3
19x	208.9
20x	218.3
21x	227.5
22x	236.7
23x	245.7
24x	254.6
25x	263.3
26x	271.9
27x	280.4
28x	288.7
29x	296.9
30x	305.0
31x	313.0
32x	320.9
33x	328.6
34x	336.2
35x	343.7
36x	351.1
37x	358.4
38x	365.6
39x	372.6
40x	379.6

typ2: D=25.0 mm

n	t
41x	386.5
42x	393.2
43x	399.9
44x	406.4
45x	412.9
46x	419.2
47x	425.5
48x	431.7
49x	437.7
50x	443.7

typ3: D=28.0 mm



t

1x	16.1
2x	31.9
3x	47.5
4x	62.8
5x	78.0
6x	92.8
7x	107.5
8x	122.0
9x	136.2
10x	150.2
11x	164.0
12x	177.6
13x	191.0
14x	204.2
15x	217.2
16x	230.1
17x	242.7
18x	255.1
19x	267.3
20x	279.4
21x	291.3
22x	303.0
23x	314.5
24x	325.8
25x	337.0
26x	348.0
27x	358.9

SA	--
10.5m	(SA)

typ1: D=28.0 mm *** 300 22.01

m > < t CODE >0001< V181 0001

m	10.5
3.0	47.0
3.5	47.0
4.0	47.0
4.5	47.0
5.0	45.0
5.5	42.0
6.0	37.5
6.5	33.0
7.0	28.0
7.5	25.9
8.0	23.7
8.5	21.5
9.0	19.0
9.5	17.8
10.0	16.3
10.5	15.0
11.0	13.5
* n *	0
m/s	14.3

	SA	--			
	10.5m	(SA)	0 t	17.5 x 10.0 m	360°

S	--
24m	

typ1: D=28.0 mm *** 169 22.00

m > < t CODE >5183< V181 0400

m	24.0
5.5	476.0
6.0	428.0
6.5	387.0
7.0	337.0
8.0	266.0
9.0	218.0
10.0	184.0
11.0	159.0
12.0	139.0
14.0	107.0
16.0	85.0
18.0	69.0
20.0	57.0
22.0	48.0
* n *	34
m/s	12.8

	S	--	30 t	17.5 x 10.0 m	360°		
	24m						

ISO DIN

S	--
24m	

typ1: D=28.0 mm *** 167 22.00

m > < t CODE >5182< V181 0400

m	24.0
5.5	525.0
6.0	475.0
6.5	435.0
7.0	399.0
8.0	342.0
9.0	291.0
10.0	246.0
11.0	213.0
12.0	187.0
14.0	145.0
16.0	115.0
18.0	95.0
20.0	80.0
22.0	68.0
* n *	38
m/s	12.8

S	--			
24m		70 t	17.5 x 10.0 m	360°

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ISO DIN

S	--
24m	

typ1: D=28.0 mm *** 165 22.00

m > < t CODE >5181< V181 0400

m	24.0
5.5	567.0
6.0	517.0
6.5	476.0
7.0	438.0
8.0	376.0
9.0	326.0
10.0	292.0
11.0	261.0
12.0	234.0
14.0	182.0
16.0	146.0
18.0	121.0
20.0	102.0
22.0	88.0
* n *	43
m/s	12.8

S	--
24m	

110 t

17.5 x 10.0 m

360°

LR 1600/2 -- 048036

ISO DIN

S	--
24m	

typ1: D=28.0 mm *** 164 22.00

m > < t CODE >5180< V181 0400

m	24.0
5.5	583.0
6.0	538.0
6.5	497.0
7.0	458.0
8.0	394.0
9.0	341.0
10.0	305.0
11.0	274.0
12.0	245.0
14.0	201.0
16.0	161.0
18.0	134.0
20.0	113.0
22.0	98.0
* n *	44
m/s	12.8

S	--
24m	

130 t

17.5 x 10.0 m

360°

S	--
24m	

typ1: D=28.0 mm *** 163 22.00

m > < t CODE >5179< V181 0400

m	24.0
5.5	596.0
6.0	550.0
6.5	510.0
7.0	473.0
8.0	409.0
9.0	356.0
10.0	319.0
11.0	286.0
12.0	256.0
14.0	215.0
16.0	177.0
18.0	147.0
20.0	125.0
22.0	108.0
* n *	46
m/s	12.8

	S 24m	--	150 t	17.5 x 10.0 m	360°		

ISO DIN

S	--
24m	

typ1: D=28.0 mm *** 162 22.00

m > < t CODE >5178< V181 0400

m	24.0
5.5	600.0
6.0	565.0
6.5	526.0
7.0	490.0
8.0	427.0
9.0	371.0
10.0	333.0
11.0	299.0
12.0	267.0
14.0	224.0
16.0	192.0
18.0	160.0
20.0	136.0
22.0	118.0
* n *	46
m/s	12.8

S	--
24m	

170 t

17.5 x 10.0 m

360°

S	--
24m	

typ1: D=28.0 mm *** 161 22.00

m	m > < t	CODE >5177<											V181 0400
m	**24.0**												
5.5	600.0												
6.0	575.0												
6.5	538.0												
7.0	502.0												
8.0	439.0												
9.0	385.0												
10.0	346.0												
11.0	311.0												
12.0	278.0												
14.0	234.0												
16.0	200.0												
18.0	172.0												
20.0	147.0												
22.0	128.0												
*** n ***	46												
m/s	12.8												

	S / 24m	--	190 t	17.5 x 10.0 m	360°		

S	--
24m	

typ1: D=28.0 mm *** 151 22.00

m > < t CODE >5176< V181 0400

m	24.0
5.5	476.0
6.0	428.0
6.5	392.0
7.0	360.0
8.0	309.0
9.0	267.0
10.0	239.0
11.0	213.0
12.0	190.0
14.0	159.0
16.0	135.0
18.0	116.0
20.0	96.0
22.0	80.0
* n *	34
m/s	12.8

	S / 24m	--	30 t	14.0 x 14.0 m	360°		

ISO DIN

S	--
24m	

typ1: D=28.0 mm *** 149 22.00

m > < t CODE >5175< V181 0400

m	24.0
5.5	525.0
6.0	475.0
6.5	435.0
7.0	399.0
8.0	342.0
9.0	297.0
10.0	266.0
11.0	238.0
12.0	212.0
14.0	178.0
16.0	152.0
18.0	130.0
20.0	114.0
22.0	101.0
* n *	38
m/s	12.8

S	--	70 t	14.0 x 14.0 m	360°
24m				

ISO DIN

S	--
24m	

typ1: D=28.0 mm *** 147 22.00

m > < t	CODE >5174<	V181 0400

m	24.0
5.5	567.0
6.0	517.0
6.5	476.0
7.0	438.0
8.0	376.0
9.0	326.0
10.0	292.0
11.0	261.0
12.0	234.0
14.0	196.0
16.0	168.0
18.0	144.0
20.0	128.0
22.0	113.0
* n *	43
m/s	12.8

	S	--	110 t	14.0 x 14.0 m	360°		
	24m						

ISO DIN

S	--
24m	

typ1: D=28.0 mm *** 146 22.00

m > < t CODE >5173< V181 0400

m	24.0
5.5	583.0
6.0	538.0
6.5	497.0
7.0	458.0
8.0	394.0
9.0	341.0
10.0	305.0
11.0	274.0
12.0	245.0
14.0	206.0
16.0	176.0
18.0	151.0
20.0	134.0
22.0	119.0
* n *	44
m/s	12.8

S	--
24m	

130 t

14.0 x 14.0 m

360°

ISO DIN

S	--
24m	

typ1: D=28.0 mm *** 145 22.00

m > < t CODE >5172< V181 0400

m	24.0
5.5	596.0
6.0	550.0
6.5	510.0
7.0	473.0
8.0	409.0
9.0	356.0
10.0	319.0
11.0	286.0
12.0	256.0
14.0	215.0
16.0	185.0
18.0	159.0
20.0	140.0
22.0	124.0
* n *	46
m/s	12.8

S 24m	--	150 t	14.0 x 14.0 m	360°

S	--
24m	

typ1: D=28.0 mm *** 144 22.00

m	24.0	m > < t	CODE >5171<	V181 0400
5.5	600.0			
6.0	565.0			
6.5	526.0			
7.0	490.0			
8.0	427.0			
9.0	371.0			
10.0	333.0			
11.0	299.0			
12.0	267.0			
14.0	224.0			
16.0	192.0			
18.0	166.0			
20.0	147.0			
22.0	130.0			
* n *	46			
m/s	12.8			

S 24m	--	170 t	14.0 x 14.0 m	360°

ISO DIN

S	--
24m	

typ1: D=28.0 mm *** 143 22.00

m > < t CODE >5170< V181 0400

m	24.0
5.5	600.0
6.0	575.0
6.5	538.0
7.0	502.0
8.0	439.0
9.0	385.0
10.0	346.0
11.0	311.0
12.0	278.0
14.0	234.0
16.0	200.0
18.0	172.0
20.0	153.0
22.0	136.0
* n *	46
m/s	12.8

S	--			
24m		190 t	14.0 x 14.0 m	360°

ISO DIN

S	--
30m	

typ1: D=28.0 mm *** 169 22.00

m > < t CODE >5197< V181 0500

m	30.0
6.0	398.0
6.5	345.0
7.0	303.0
8.0	244.0
9.0	202.0
10.0	172.0
11.0	149.0
12.0	130.0
14.0	104.0
16.0	84.0
18.0	68.0
20.0	57.0
22.0	48.0
24.0	40.5
26.0	35.0
28.0	30.5
n	27
m/s	12.8

	S 30m	--	30 t	17.5 x 10.0 m	360°		

ISO DIN

S	--
30m	

typ1: D=28.0 mm *** 167 22.00

m > < t CODE >5196< V181 0500

m	30.0
6.0	474.0
6.5	433.0
7.0	396.0
8.0	323.0
9.0	270.0
10.0	230.0
11.0	200.0
12.0	177.0
14.0	142.0
16.0	115.0
18.0	94.0
20.0	79.0
22.0	68.0
24.0	59.0
26.0	51.0
28.0	45.0
*** n ***	34
m/s	12.8

S	--	70 t	17.5 x 10.0 m	360°
30m				

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ISO DIN

S	--
30m	

typ1: D=28.0 mm *** 165 22.00

m > < t CODE >5195< V181 0500

m	30.0
6.0	518.0
6.5	473.0
7.0	432.0
8.0	373.0
9.0	325.0
10.0	288.0
11.0	252.0
12.0	223.0
14.0	180.0
16.0	146.0
18.0	120.0
20.0	102.0
22.0	87.0
24.0	76.0
26.0	67.0
28.0	60.0
* n *	38
m/s	12.8

S	--
30m	

110 t

17.5 x 10.0 m

360°

LR 1600/2 -- 048036

ISO DIN

S	--
30m	

typ1: D=28.0 mm *** 164 22.00

m > < t CODE >5194< V181 0500

m	30.0
6.0	534.0
6.5	491.0
7.0	452.0
8.0	390.0
9.0	340.0
10.0	302.0
11.0	269.0
12.0	246.0
14.0	199.0
16.0	161.0
18.0	133.0
20.0	113.0
22.0	97.0
24.0	85.0
26.0	75.0
28.0	67.0
*** n ***	39
m/s	12.8

S	--	130 t	17.5 x 10.0 m	360°
30m				

S	--
30m	

typ1: D=28.0 mm *** 163 22.00

		m > < t	CODE >5193<										V181 0500	
m	**30.0**													
6.0	547.0													
6.5	508.0													
7.0	471.0													
8.0	408.0													
9.0	355.0													
10.0	316.0													
11.0	281.0													
12.0	258.0													
14.0	212.0													
16.0	176.0													
18.0	146.0													
20.0	124.0													
22.0	107.0													
24.0	94.0													
26.0	83.0													
28.0	74.0													
*** n ***	41													
m/s	12.8													

	S 30m	--	150 t	17.5 x 10.0 m	360°		

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ISO DIN

S	--
30m	

typ1: D=28.0 mm *** 162 22.00

m > < t CODE >5192< V181 0500

m	30.0
6.0	560.0
6.5	521.0
7.0	484.0
8.0	422.0
9.0	370.0
10.0	329.0
11.0	293.0
12.0	268.0
14.0	220.0
16.0	190.0
18.0	159.0
20.0	135.0
22.0	117.0
24.0	103.0
26.0	91.0
28.0	82.0
*** n ***	42
m/s	12.8

S	--	170 t	17.5 x 10.0 m	360°
30m				

ISO DIN

S	--
30m	

typ1: D=28.0 mm *** 161 22.00

m	m >< t	CODE >5191<	V181 0500
m	30.0		
6.0	575.0		
6.5	534.0		
7.0	497.0		
8.0	437.0		
9.0	386.0		
10.0	343.0		
11.0	305.0		
12.0	280.0		
14.0	229.0		
16.0	199.0		
18.0	171.0		
20.0	147.0		
22.0	127.0		
24.0	112.0		
26.0	99.0		
28.0	89.0		
* n *	43		
m/s	12.8		

S	--	190 t	17.5 x 10.0 m	360°
30m				

LR 1600/2 -- 048036

ISO DIN

S	--
30m	

typ1: D=28.0 mm   *** 151   22.00

m > < t   CODE >5190<   V181 0500

m	30.0
6.0	427.0
6.5	389.0
7.0	356.0
8.0	306.0
9.0	267.0
10.0	236.0
11.0	210.0
12.0	191.0
14.0	156.0
16.0	134.0
18.0	114.0
20.0	96.0
22.0	81.0
24.0	69.0
26.0	60.0
28.0	52.0
n	29
m/s	12.8

S	--
30m	

30 t

14.0 x 14.0 m

360°

S	--
30m	

typ1: D=28.0 mm *** 149 22.00

m	30.0	m > < t	CODE >5189<	V181 0500
6.0	474.0			
6.5	433.0			
7.0	396.0			
8.0	341.0			
9.0	297.0			
10.0	263.0			
11.0	234.0			
12.0	214.0			
14.0	174.0			
16.0	150.0			
18.0	129.0			
20.0	113.0			
22.0	99.0			
24.0	89.0			
26.0	79.0			
28.0	71.0			
* n *	34			
m/s	12.8			

	S 30m	--	70 t	14.0 x 14.0 m	360°		

S	--
30m	

typ1: D=28.0 mm *** 147 22.00

m > < t CODE >5188< V181 0500

m	30.0
6.0	518.0
6.5	473.0
7.0	432.0
8.0	373.0
9.0	325.0
10.0	288.0
11.0	256.0
12.0	235.0
14.0	193.0
16.0	167.0
18.0	143.0
20.0	126.0
22.0	111.0
24.0	100.0
26.0	90.0
28.0	81.0
*** n ***	38
m/s	12.8

S	--	110 t	14.0 x 14.0 m	360°
30m				

S	--
30m	

typ1: D=28.0 mm *** 146 22.00

m > < t CODE >5187< V181 0500

m	30.0
6.0	534.0
6.5	491.0
7.0	452.0
8.0	390.0
9.0	340.0
10.0	302.0
11.0	269.0
12.0	246.0
14.0	203.0
16.0	175.0
18.0	150.0
20.0	133.0
22.0	117.0
24.0	105.0
26.0	94.0
28.0	86.0
* n *	39
m/s	12.8

	S	--	130 t	14.0 x 14.0 m	360°		
	30m						

LR 1600/2 -- 048036

ISO DIN

S	--
30m	

typ1: D=28.0 mm *** 145 22.00

m > < t CODE >5186< V181 0500

m	30.0
6.0	547.0
6.5	508.0
7.0	471.0
8.0	408.0
9.0	355.0
10.0	316.0
11.0	281.0
12.0	258.0
14.0	212.0
16.0	183.0
18.0	157.0
20.0	139.0
22.0	123.0
24.0	111.0
26.0	99.0
28.0	90.0
* n *	41
m/s	12.8

	S	--	150 t	14.0 x 14.0 m	360°		
	30m						

S	--
30m	

typ1: D=28.0 mm *** 144 22.00

m		m > < t			CODE >5185<							V181 0500		
m	**30.0**													
6.0	560.0													
6.5	521.0													
7.0	484.0													
8.0	422.0													
9.0	370.0													
10.0	329.0													
11.0	293.0													
12.0	268.0													
14.0	220.0													
16.0	190.0													
18.0	164.0													
20.0	146.0													
22.0	129.0													
24.0	116.0													
26.0	104.0													
28.0	95.0													
*** n ***	42													
m/s	12.8													

	S 30m	--	170 t	14.0 x 14.0 m	360°		

S	--
30m	

typ1: D=28.0 mm *** 143 22.00

m > < t	CODE >5184<	V181 0500

m	30.0
6.0	575.0
6.5	534.0
7.0	497.0
8.0	437.0
9.0	386.0
10.0	343.0
11.0	305.0
12.0	280.0
14.0	229.0
16.0	199.0
18.0	171.0
20.0	152.0
22.0	135.0
24.0	121.0
26.0	109.0
28.0	99.0
* n *	43
m/s	12.8

S	--	190 t	14.0 x 14.0 m	360°
30m				

ISO DIN

S	--
36m	

typ1: D=28.0 mm *** 169 22.00

m > < t CODE >5211< V181 0600

m	36.0
6.5	310.0
7.0	276.0
8.0	224.0
9.0	188.0
10.0	161.0
11.0	140.0
12.0	123.0
14.0	98.0
16.0	80.0
18.0	67.0
20.0	56.0
22.0	47.0
24.0	40.0
26.0	34.5
28.0	29.6
30.0	25.7
32.0	22.3
34.0	19.2
* n *	20
m/s	12.8

S	--
36m	

30 t

17.5 x 10.0 m

360°

ISO DIN

S	--
36m	

typ1: D=28.0 mm *** 167 22.00

m > < t CODE >5210< V181 0600

m	36.0
6.5	409.0
7.0	364.0
8.0	298.0
9.0	251.0
10.0	216.0
11.0	189.0
12.0	167.0
14.0	135.0
16.0	112.0
18.0	94.0
20.0	79.0
22.0	67.0
24.0	58.0
26.0	50.0
28.0	44.5
30.0	39.0
32.0	35.0
34.0	31.0
* n *	28
m/s	12.8

	S	--					
	36m		70 t	17.5 x 10.0 m	360°		

S	--
36m	

typ1: D=28.0 mm *** 165 22.00

m > < t CODE >5209< V181 0600

m	36.0
6.5	470.0
7.0	434.0
8.0	372.0
9.0	314.0
10.0	271.0
11.0	238.0
12.0	211.0
14.0	172.0
16.0	143.0
18.0	120.0
20.0	101.0
22.0	87.0
24.0	76.0
26.0	66.0
28.0	59.0
30.0	53.0
32.0	47.5
34.0	43.0
* n *	33
m/s	12.8

S	--
36m	

110 t

17.5 x 10.0 m

360°

S	--
36m	

typ1: D=28.0 mm *** 164 22.00

m > < t CODE >5208< V181 0600

m	36.0
6.5	491.0
7.0	452.0
8.0	386.0
9.0	339.0
10.0	299.0
11.0	262.0
12.0	233.0
14.0	190.0
16.0	159.0
18.0	133.0
20.0	112.0
22.0	97.0
24.0	84.0
26.0	74.0
28.0	66.0
30.0	59.0
32.0	54.0
34.0	48.5
* n *	35
m/s	12.8

	S 36m	--	130 t	17.5 x 10.0 m	360°		

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ISO DIN

S	--
36m	

typ1: D=28.0 mm *** 163 22.00

m > < t CODE >5207< V181 0600

m	36.0
6.5	504.0
7.0	467.0
8.0	403.0
9.0	353.0
10.0	311.0
11.0	281.0
12.0	251.0
14.0	208.0
16.0	175.0
18.0	146.0
20.0	124.0
22.0	107.0
24.0	93.0
26.0	83.0
28.0	74.0
30.0	66.0
32.0	60.0
34.0	54.0
*** n ***	36
m/s	12.8

S	--	150 t	17.5 x 10.0 m	360°
36m				

S	--
36m	

typ1: D=28.0 mm *** 162 22.00

m > < t CODE >5206< V181 0600

m	36.0
6.5	518.0
7.0	483.0
8.0	420.0
9.0	368.0
10.0	325.0
11.0	294.0
12.0	262.0
14.0	223.0
16.0	186.0
18.0	159.0
20.0	135.0
22.0	117.0
24.0	102.0
26.0	91.0
28.0	81.0
30.0	73.0
32.0	66.0
34.0	60.0
* n *	38
m/s	12.8

S	--	170 t	17.5 x 10.0 m	360°
36m				

ISO DIN

S	--
36m	

typ1: D=28.0 mm *** 161 22.00

m > < t CODE >5205< V181 0600

m	36.0
6.5	530.0
7.0	496.0
8.0	435.0
9.0	383.0
10.0	338.0
11.0	306.0
12.0	273.0
14.0	232.0
16.0	194.0
18.0	171.0
20.0	146.0
22.0	127.0
24.0	111.0
26.0	99.0
28.0	88.0
30.0	80.0
32.0	72.0
34.0	66.0
* n *	39
m/s	12.8

S	--
36m	

190 t

17.5 x 10.0 m

360°

S	--
36m	

typ1: D=28.0 mm *** 151 22.00

m	m > < t	CODE >5204<	V181 0600
m	36.0		
6.5	386.0		
7.0	355.0		
8.0	304.0		
9.0	265.0		
10.0	233.0		
11.0	210.0		
12.0	186.0		
14.0	157.0		
16.0	130.0		
18.0	114.0		
20.0	96.0		
22.0	80.0		
24.0	68.0		
26.0	59.0		
28.0	52.0		
30.0	45.5		
32.0	40.0		
34.0	36.0		
* n *	26		
m/s	12.8		

	S	--	30 t	14.0 x 14.0 m	360°		
	36m						

ISO DIN

S	--
36m	

typ1: D=28.0 mm   *** 149   22.00

m > < t   CODE >5203<   V181 0600

m	36.0
6.5	429.0
7.0	395.0
8.0	337.0
9.0	295.0
10.0	259.0
11.0	233.0
12.0	207.0
14.0	176.0
16.0	146.0
18.0	128.0
20.0	111.0
22.0	99.0
24.0	87.0
26.0	78.0
28.0	71.0
30.0	63.0
32.0	56.0
34.0	51.0
* n *	30
m/s	12.8

S	--	70 t	14.0 x 14.0 m	360°
36m				

S	--
36m	

typ1: D=28.0 mm   *** 147   22.00

m > < t   CODE >5202<   V181 0600

m	36.0
6.5	470.0
7.0	434.0
8.0	372.0
9.0	325.0
10.0	286.0
11.0	258.0
12.0	229.0
14.0	195.0
16.0	163.0
18.0	143.0
20.0	123.0
22.0	110.0
24.0	98.0
26.0	88.0
28.0	80.0
30.0	72.0
32.0	66.0
34.0	60.0
* n *	33
m/s	12.8

S	--	110 t	14.0 x 14.0 m	360°
36m				

ISO DIN

S	--
36m	

typ1: D=28.0 mm *** 146 22.00

m > < t CODE >5201< V181 0600

m	36.0
6.5	491.0
7.0	452.0
8.0	386.0
9.0	339.0
10.0	299.0
11.0	270.0
12.0	241.0
14.0	204.0
16.0	171.0
18.0	150.0
20.0	130.0
22.0	116.0
24.0	103.0
26.0	93.0
28.0	84.0
30.0	76.0
32.0	70.0
34.0	64.0
*** n ***	35
m/s	12.8

S	--	130 t	14.0 x 14.0 m	360°
36m				

ISO DIN

S	--
36m	

typ1: D=28.0 mm *** 145 22.00

m	36.0	m >< t	CODE >5200<											V181 0600
6.5	504.0													
7.0	467.0													
8.0	403.0													
9.0	353.0													
10.0	311.0													
11.0	281.0													
12.0	251.0													
14.0	214.0													
16.0	179.0													
18.0	157.0													
20.0	137.0													
22.0	122.0													
24.0	109.0													
26.0	97.0													
28.0	89.0													
30.0	80.0													
32.0	74.0													
34.0	68.0													
*** n ***	36													
m/s	12.8													

	S / 36m	--	150 t	14.0 x 14.0 m	360°		

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ISO DIN

S	--
36m	

typ1: D=28.0 mm *** 144 22.00

m > < t CODE >5199< V181 0600

m	36.0
6.5	518.0
7.0	483.0
8.0	420.0
9.0	368.0
10.0	325.0
11.0	294.0
12.0	262.0
14.0	223.0
16.0	186.0
18.0	164.0
20.0	143.0
22.0	128.0
24.0	115.0
26.0	103.0
28.0	94.0
30.0	85.0
32.0	78.0
34.0	72.0
* n *	38
m/s	12.8

	S 36m	--	170 t	14.0 x 14.0 m	360°		

S	--
36m	

typ1: D=28.0 mm *** 143 22.00

m > < t CODE >5198< V181 0600

m	36.0
6.5	530.0
7.0	496.0
8.0	435.0
9.0	383.0
10.0	338.0
11.0	306.0
12.0	273.0
14.0	232.0
16.0	194.0
18.0	171.0
20.0	150.0
22.0	134.0
24.0	120.0
26.0	108.0
28.0	98.0
30.0	89.0
32.0	82.0
34.0	75.0
* n *	39
m/s	12.8

S	--	190 t	14.0 x 14.0 m	360°
36m				

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ISO DIN

S	--
42m	

typ1: D=28.0 mm *** 169 22.00

m > < t CODE >5225< V181 0700

m	42.0
7.0	252.0
8.0	207.0
9.0	175.0
10.0	151.0
11.0	131.0
12.0	116.0
14.0	92.0
16.0	76.0
18.0	63.0
20.0	53.0
22.0	45.0
24.0	38.5
26.0	33.0
28.0	28.5
30.0	24.5
32.0	20.9
34.0	17.8
36.0	15.2
38.0	12.9
* n *	16
m/s	12.8

S	--	30 t	17.5 x 10.0 m	360°
42m				

S	--
42m	

typ1: D=28.0 mm *** 167 22.00

m > < t CODE >5224< V181 0700

m	42.0
7.0	333.0
8.0	276.0
9.0	235.0
10.0	203.0
11.0	178.0
12.0	158.0
14.0	128.0
16.0	106.0
18.0	90.0
20.0	77.0
22.0	66.0
24.0	57.0
26.0	49.5
28.0	43.0
30.0	38.0
32.0	33.5
34.0	29.9
36.0	26.7
38.0	23.8
* n *	22
m/s	12.8

	S	--	70 t	17.5 x 10.0 m	360°		
	42m						

ISO DIN

S	--
42m	

typ1: D=28.0 mm *** 165 22.00

m > < t CODE >5223< V181 0700

m	42.0
7.0	415.0
8.0	345.0
9.0	294.0
10.0	255.0
11.0	225.0
12.0	200.0
14.0	163.0
16.0	137.0
18.0	117.0
20.0	100.0
22.0	86.0
24.0	75.0
26.0	65.0
28.0	58.0
30.0	52.0
32.0	46.0
34.0	41.5
36.0	37.5
38.0	34.0
* n *	28
m/s	12.8

S 42m	--	110 t	17.5 x 10.0 m	360°

S	--
42m	

typ1: D=28.0 mm *** 164 22.00

m > < t CODE >5222< V181 0700

m	42.0
7.0	448.0
8.0	379.0
9.0	324.0
10.0	281.0
11.0	248.0
12.0	222.0
14.0	181.0
16.0	152.0
18.0	130.0
20.0	112.0
22.0	96.0
24.0	83.0
26.0	73.0
28.0	65.0
30.0	58.0
32.0	52.0
34.0	47.5
36.0	43.0
38.0	39.5
* n *	31
m/s	12.8

S	--	130 t	17.5 x 10.0 m	360°
42m				

ISO DIN

S	--
42m	

typ1: D=28.0 mm *** 163 22.00

m > < t CODE >5221< V181 0700

m	42.0
7.0	465.0
8.0	401.0
9.0	352.0
10.0	308.0
11.0	272.0
12.0	243.0
14.0	199.0
16.0	167.0
18.0	143.0
20.0	123.0
22.0	106.0
24.0	92.0
26.0	81.0
28.0	73.0
30.0	65.0
32.0	59.0
34.0	53.0
36.0	48.5
38.0	44.5
* n *	33
m/s	12.8

S	--	150	17.5 x	360°
42m		t	10.0 m	

S	--
42m	

typ1: D=28.0 mm *** 162 22.00

m > < t CODE >5220< V181 0700

m	42.0
7.0	477.0
8.0	416.0
9.0	366.0
10.0	324.0
11.0	287.0
12.0	263.0
14.0	217.0
16.0	182.0
18.0	157.0
20.0	134.0
22.0	116.0
24.0	101.0
26.0	90.0
28.0	80.0
30.0	72.0
32.0	65.0
34.0	59.0
36.0	54.0
38.0	49.5
* n *	34
m/s	12.8

S	--
42m	

170 t

17.5 x 10.0 m

360°

ISO DIN

S	--
42m	

typ1: D=28.0 mm *** 161 22.00

m > < t CODE >5219< V181 0700

m	42.0
7.0	489.0
8.0	429.0
9.0	380.0
10.0	337.0
11.0	299.0
12.0	274.0
14.0	226.0
16.0	197.0
18.0	168.0
20.0	145.0
22.0	126.0
24.0	110.0
26.0	98.0
28.0	87.0
30.0	79.0
32.0	71.0
34.0	65.0
36.0	59.0
38.0	55.0
* n *	35
m/s	12.8

S	--	190 t	17.5 x 10.0 m	360°
42m				

ISO DIN

S	--
42m	

typ1: D=28.0 mm *** 151 22.00

m > < t CODE >5218< V181 0700

m	42.0
7.0	351.0
8.0	300.0
9.0	263.0
10.0	232.0
11.0	205.0
12.0	187.0
14.0	152.0
16.0	131.0
18.0	110.0
20.0	94.0
22.0	80.0
24.0	68.0
26.0	58.0
28.0	51.0
30.0	44.5
32.0	39.0
34.0	35.0
36.0	31.0
38.0	27.8
* n *	23
m/s	12.8

	S	--	30 t	14.0 x 14.0 m	360°		
	42m						

S	--
42m	

typ1: D=28.0 mm *** 149 22.00

m >< t CODE >5217< V181 0700

m	42.0
7.0	390.0
8.0	335.0
9.0	293.0
10.0	259.0
11.0	229.0
12.0	209.0
14.0	171.0
16.0	148.0
18.0	125.0
20.0	110.0
22.0	96.0
24.0	85.0
26.0	77.0
28.0	68.0
30.0	62.0
32.0	55.0
34.0	49.5
36.0	44.5
38.0	40.5
* n *	26
m/s	12.8

S	--	70 t	14.0 x 14.0 m	360°
42m				

S	--
42m	

typ1: D=28.0 mm *** 147 22.00

m > < t CODE >5216< V181 0700

m	42.0
7.0	428.0
8.0	367.0
9.0	321.0
10.0	285.0
11.0	253.0
12.0	231.0
14.0	189.0
16.0	164.0
18.0	139.0
20.0	123.0
22.0	108.0
24.0	96.0
26.0	87.0
28.0	78.0
30.0	70.0
32.0	64.0
34.0	58.0
36.0	53.0
38.0	49.0
* n *	30
m/s	12.8

S	--	110 t	14.0 x 14.0 m	360°
42m				

S	--
42m	

typ1: D=28.0 mm *** 146 22.00

m > < t	CODE >5215<	V181 0700

m	42.0
7.0	448.0
8.0	384.0
9.0	336.0
10.0	298.0
11.0	265.0
12.0	242.0
14.0	198.0
16.0	172.0
18.0	146.0
20.0	130.0
22.0	114.0
24.0	101.0
26.0	92.0
28.0	82.0
30.0	74.0
32.0	68.0
34.0	62.0
36.0	57.0
38.0	53.0
* n *	31
m/s	12.8

S	--
42m	

130 t

14.0 x 14.0 m

360°

S	--
42m	

typ1: D=28.0 mm *** 145 22.00

m	m > < t	CODE >5214< V181 0700
	42.0	
7.0	465.0	
8.0	401.0	
9.0	352.0	
10.0	312.0	
11.0	277.0	
12.0	253.0	
14.0	208.0	
16.0	181.0	
18.0	154.0	
20.0	136.0	
22.0	120.0	
24.0	107.0	
26.0	96.0	
28.0	86.0	
30.0	78.0	
32.0	72.0	
34.0	66.0	
36.0	60.0	
38.0	56.0	
*** n ***	33	
m/s	12.8	

	S / 42m	--	150 t	14.0 x 14.0 m	360°		

ISO DIN

S	--
42m	

typ1: D=28.0 mm *** 144 22.00

m > < t CODE >5213< V181 0700

m	42.0
7.0	477.0
8.0	416.0
9.0	366.0
10.0	324.0
11.0	287.0
12.0	263.0
14.0	217.0
16.0	189.0
18.0	161.0
20.0	142.0
22.0	126.0
24.0	112.0
26.0	101.0
28.0	91.0
30.0	83.0
32.0	76.0
34.0	70.0
36.0	64.0
38.0	59.0
* n *	34
m/s	12.8

S	--
42m	

170 t

14.0 x 14.0 m

360°

LR 1600/2 -- 048036

ISO DIN

S	--
42m	

typ1: D=28.0 mm *** 143 22.00

m > < t CODE >5212< V181 0700

m	42.0
7.0	489.0
8.0	429.0
9.0	380.0
10.0	337.0
11.0	299.0
12.0	274.0
14.0	226.0
16.0	197.0
18.0	168.0
20.0	149.0
22.0	132.0
24.0	117.0
26.0	107.0
28.0	96.0
30.0	87.0
32.0	80.0
34.0	73.0
36.0	67.0
38.0	63.0
* n *	35
m/s	12.8

S	--	190 t	14.0 x 14.0 m	360°
42m				

ISO DIN

S	--
48m	

typ1: D=28.0 mm *** 169 22.00

m > < t CODE >5239< V181 0800

m	48.0
8.0	193.0
9.0	164.0
10.0	142.0
11.0	124.0
12.0	110.0
14.0	88.0
16.0	72.0
18.0	60.0
20.0	50.0
22.0	42.5
24.0	36.0
26.0	31.0
28.0	26.4
30.0	22.6
32.0	19.2
34.0	16.4
36.0	13.9
38.0	11.6
40.0	9.6
44.0	6.2
* n *	12
m/s	12.8

	S	--	30 t	17.5 x 10.0 m	360°		
	48m						

ISO DIN

S	--
48m	

typ1: D=28.0 mm *** 167 22.00

m > < t CODE >5238< V181 0800

m	48.0
8.0	257.0
9.0	220.0
10.0	192.0
11.0	169.0
12.0	150.0
14.0	122.0
16.0	102.0
18.0	86.0
20.0	74.0
22.0	64.0
24.0	55.0
26.0	48.5
28.0	42.5
30.0	37.5
32.0	33.0
34.0	29.1
36.0	25.7
38.0	22.6
40.0	19.9
44.0	15.4
* n *	16
m/s	12.8

S 48m --

70 t

17.5 x 10.0 m

360°

LR 1600/2 -- 048036

ISO DIN

S	--
48m	

typ1: D=28.0 mm *** 165 22.00

m > < t CODE >5237< V181 0800

m	48.0
8.0	322.0
9.0	276.0
10.0	241.0
11.0	214.0
12.0	191.0
14.0	156.0
16.0	131.0
18.0	112.0
20.0	97.0
22.0	85.0
24.0	74.0
26.0	65.0
28.0	57.0
30.0	51.0
32.0	45.5
34.0	40.5
36.0	36.5
38.0	33.0
40.0	30.0
44.0	24.6
*** n ***	21
m/s	12.8

S	--	110 t	17.5 x 10.0 m	360°
48m				

ISO DIN

S	--
48m	

typ1: D=28.0 mm *** 164 22.00

m > < t CODE >5236< V181 0800

m	48.0
8.0	354.0
9.0	305.0
10.0	266.0
11.0	236.0
12.0	211.0
14.0	173.0
16.0	146.0
18.0	125.0
20.0	109.0
22.0	95.0
24.0	83.0
26.0	73.0
28.0	65.0
30.0	58.0
32.0	52.0
34.0	46.5
36.0	42.0
38.0	38.5
40.0	35.0
44.0	29.2
* n *	24
m/s	12.8

S	--
48m	

130 t

17.5 x 10.0 m

360°

LR 1600/2 -- 048036

ISO DIN

S	--
48m	

typ1: D=28.0 mm *** 163 22.00

m > < t CODE >5235< V181 0800

m	48.0
8.0	386.0
9.0	333.0
10.0	291.0
11.0	258.0
12.0	232.0
14.0	191.0
16.0	161.0
18.0	138.0
20.0	120.0
22.0	105.0
24.0	92.0
26.0	81.0
28.0	72.0
30.0	64.0
32.0	58.0
34.0	52.0
36.0	47.5
38.0	43.5
40.0	39.5
44.0	33.5
*** n ***	26
m/s	12.8

	S 48m	--	150 t	17.5 x 10.0 m	360°		

S	--
48m	

typ1: D=28.0 mm *** 162 22.00

m > < t CODE >5234< V181 0800

m	48.0
8.0	416.0
9.0	361.0
10.0	316.0
11.0	281.0
12.0	252.0
14.0	208.0
16.0	176.0
18.0	151.0
20.0	132.0
22.0	115.0
24.0	101.0
26.0	89.0
28.0	79.0
30.0	71.0
32.0	64.0
34.0	58.0
36.0	53.0
38.0	48.5
40.0	44.5
44.0	38.0
* n *	29
m/s	12.8

S 48m	--	170 t	17.5 x 10.0 m	360°

S	--
48m	

typ1: D=28.0 mm *** 161 22.00

m	m > < t	CODE >5233<	V181 0800
m	48.0		
8.0	427.0		
9.0	375.0		
10.0	336.0		
11.0	301.0		
12.0	267.0		
14.0	225.0		
16.0	190.0		
18.0	164.0		
20.0	144.0		
22.0	125.0		
24.0	110.0		
26.0	97.0		
28.0	87.0		
30.0	78.0		
32.0	70.0		
34.0	64.0		
36.0	58.0		
38.0	54.0		
40.0	49.5		
44.0	42.0		
* n *	29		
m/s	12.8		

	S 48m	--	190 t	17.5 x 10.0 m	360°		

LR 1600/2 -- 048036

ISO DIN

S	--
48m	

typ1: D=28.0 mm *** 151 22.00

m > < t CODE >5232< V181 0800

m	48.0
8.0	300.0
9.0	257.0
10.0	231.0
11.0	205.0
12.0	182.0
14.0	153.0
16.0	127.0
18.0	106.0
20.0	90.0
22.0	77.0
24.0	67.0
26.0	58.0
28.0	50.0
30.0	44.0
32.0	38.5
34.0	34.0
36.0	30.0
38.0	26.8
40.0	23.7
44.0	18.5
*** n ***	19
m/s	12.8

S	--
48m	

30 t

14.0 x 14.0 m

360°

ISO DIN

S	--
48m	

typ1: D=28.0 mm *** 149 22.00

m > < t CODE >5231< V181 0800

m	48.0
8.0	332.0
9.0	287.0
10.0	257.0
11.0	229.0
12.0	204.0
14.0	172.0
16.0	144.0
18.0	126.0
20.0	107.0
22.0	95.0
24.0	85.0
26.0	74.0
28.0	67.0
30.0	61.0
32.0	54.0
34.0	49.0
36.0	44.0
38.0	39.5
40.0	36.0
44.0	29.9
* n *	22
m/s	12.8

	S	--	70 t	14.0 x 14.0 m	360°		
	48m						

ISO DIN

S	--
48m	

typ1: D=28.0 mm *** 147 22.00

m > < t CODE >5230< V181 0800

m	48.0
8.0	366.0
9.0	317.0
10.0	284.0
11.0	253.0
12.0	226.0
14.0	191.0
16.0	161.0
18.0	140.0
20.0	120.0
22.0	106.0
24.0	95.0
26.0	84.0
28.0	76.0
30.0	69.0
32.0	62.0
34.0	57.0
36.0	52.0
38.0	47.5
40.0	43.5
44.0	37.0
*** n ***	24
m/s	12.8

S 48m	--	110 t	14.0 x 14.0 m	360°

S	--
48m	

typ1: D=28.0 mm *** 146 22.00

m		m > < t	CODE >5229<	V181 0800
m	48.0			
8.0	383.0			
9.0	332.0			
10.0	297.0			
11.0	265.0			
12.0	236.0			
14.0	200.0			
16.0	169.0			
18.0	148.0			
20.0	126.0			
22.0	112.0			
24.0	101.0			
26.0	89.0			
28.0	81.0			
30.0	74.0			
32.0	66.0			
34.0	60.0			
36.0	56.0			
38.0	51.0			
40.0	46.5			
44.0	39.5			
* n *	26			
m/s	12.8			

	S / 48m	--	130 t	14.0 x 14.0 m	360°		

ISO DIN

S	--
48m	

typ1: D=28.0 mm *** 145 22.00

m > < t CODE >5228< V181 0800

m	48.0
8.0	400.0
9.0	347.0
10.0	310.0
11.0	277.0
12.0	247.0
14.0	209.0
16.0	177.0
18.0	155.0
20.0	133.0
22.0	118.0
24.0	106.0
26.0	94.0
28.0	86.0
30.0	78.0
32.0	70.0
34.0	64.0
36.0	59.0
38.0	54.0
40.0	49.5
44.0	42.5
* n *	27
m/s	12.8

	S 48m	--	150 t	14.0 x 14.0 m	360°		

S	--
48m	

typ1: D=28.0 mm *** 144 22.00

m >< t CODE >5227< V181 0800

m	48.0
8.0	416.0
9.0	361.0
10.0	323.0
11.0	289.0
12.0	257.0
14.0	218.0
16.0	184.0
18.0	162.0
20.0	139.0
22.0	124.0
24.0	111.0
26.0	99.0
28.0	90.0
30.0	82.0
32.0	74.0
34.0	68.0
36.0	63.0
38.0	58.0
40.0	53.0
44.0	45.5
* n *	29
m/s	12.8

	S 48m	--	170 t	14.0 x 14.0 m	360°		

S	--
48m	

typ1: D=28.0 mm *** 143 22.00

m > < t CODE >5226< V181 0800

m	48.0
8.0	427.0
9.0	375.0
10.0	336.0
11.0	301.0
12.0	267.0
14.0	227.0
16.0	192.0
18.0	169.0
20.0	146.0
22.0	130.0
24.0	117.0
26.0	103.0
28.0	95.0
30.0	86.0
32.0	78.0
34.0	72.0
36.0	66.0
38.0	61.0
40.0	56.0
44.0	48.5
* n *	29
m/s	12.8

	S 48m	--	190 t	14.0 x 14.0 m	360°		

ISO DIN

S	--
54m	

typ1: D=28.0 mm *** 169 22.00

m > < t CODE >5253< V181 0900

m	54.0
8.0	179.0
9.0	153.0
10.0	132.0
11.0	116.0
12.0	103.0
14.0	82.0
16.0	67.0
18.0	55.0
20.0	46.0
22.0	38.5
24.0	32.5
26.0	27.3
28.0	23.0
30.0	19.2
32.0	16.0
34.0	13.1
36.0	10.6
38.0	8.4
40.0	6.5
* n *	11
m/s	12.8

	S 54m	--	30 t	17.5 x 10.0 m	360°		

LR 1600/2 -- 048036

ISO DIN

S	--
54m	

typ1: D=28.0 mm *** 167 22.00

m	54.0	m > < t	CODE >5252<	V181 0900
8.0	239.0			
9.0	206.0			
10.0	180.0			
11.0	159.0			
12.0	142.0			
14.0	115.0			
16.0	96.0			
18.0	81.0			
20.0	69.0			
22.0	59.0			
24.0	51.0			
26.0	45.0			
28.0	39.0			
30.0	34.5			
32.0	30.0			
34.0	26.4			
36.0	23.2			
38.0	20.4			
40.0	17.7			
44.0	13.1			
48.0	9.5			
*** n ***	15			
m/s	12.8			

	S 54m	--	70 t	17.5 x 10.0 m	360°		

S	--
54m	

typ1: D=28.0 mm *** 165 22.00

m > < t CODE >5251< V181 0900

m	54.0
8.0	300.0
9.0	259.0
10.0	227.0
11.0	202.0
12.0	181.0
14.0	148.0
16.0	124.0
18.0	106.0
20.0	92.0
22.0	80.0
24.0	70.0
26.0	62.0
28.0	55.0
30.0	49.0
32.0	43.5
34.0	39.0
36.0	35.0
38.0	31.5
40.0	28.0
44.0	22.4
48.0	17.9
*** n ***	19
m/s	12.8

	S 54m	--	110 t	17.5 x 10.0 m	360°		

LR 1600/2 -- 048036

ISO DIN

S	--
54m	

typ1: D=28.0 mm *** 164 22.00

m	54.0	m > < t CODE >5250< V181 0900
8.0	330.0	
9.0	286.0	
10.0	251.0	
11.0	223.0	
12.0	200.0	
14.0	165.0	
16.0	139.0	
18.0	119.0	
20.0	103.0	
22.0	90.0	
24.0	80.0	
26.0	71.0	
28.0	63.0	
30.0	56.0	
32.0	50.0	
34.0	44.5	
36.0	40.5	
38.0	36.5	
40.0	33.0	
44.0	27.0	
48.0	22.1	
* n *	22	
m/s	12.8	

	S 54m	--	130 t	17.5 x 10.0 m	360°		

LR 1600/2 -- 048036

ISO DIN

S	--
54m	

typ1: D=28.0 mm *** 163 22.00

m > < t CODE >5249< V181 0900

m	54.0
8.0	361.0
9.0	312.0
10.0	275.0
11.0	245.0
12.0	220.0
14.0	181.0
16.0	153.0
18.0	132.0
20.0	115.0
22.0	101.0
24.0	89.0
26.0	79.0
28.0	70.0
30.0	63.0
32.0	56.0
34.0	51.0
36.0	45.5
38.0	41.5
40.0	38.0
44.0	31.5
48.0	26.3
* n *	24
m/s	12.8

S 54m --

150 t

17.5 x 10.0 m

360°

S	--
54m	

typ1: D=28.0 mm *** 162 22.00

m > < t CODE >5248< V181 0900

m	54.0
8.0	391.0
9.0	339.0
10.0	298.0
11.0	266.0
12.0	239.0
14.0	198.0
16.0	168.0
18.0	144.0
20.0	126.0
22.0	111.0
24.0	99.0
26.0	87.0
28.0	78.0
30.0	69.0
32.0	62.0
34.0	56.0
36.0	51.0
38.0	46.5
40.0	42.5
44.0	36.0
48.0	30.5
* n *	26
m/s	12.8

S	--	170 t	17.5 x 10.0 m	360°
54m				

S	--
54m	

typ1: D=28.0 mm *** 161 22.00

m > < t CODE >5247< V181 0900

m	54.0
8.0	421.0
9.0	366.0
10.0	322.0
11.0	287.0
12.0	259.0
14.0	215.0
16.0	182.0
18.0	157.0
20.0	137.0
22.0	121.0
24.0	108.0
26.0	95.0
28.0	85.0
30.0	76.0
32.0	69.0
34.0	62.0
36.0	57.0
38.0	52.0
40.0	47.5
44.0	40.0
48.0	34.5
* n *	29
m/s	12.8

S	--	190 t	17.5 x 10.0 m	360°
54m				

ISO DIN

S	--
54m	

typ1: D=28.0 mm *** 151 22.00

m > < t CODE >5246< V181 0900

m	54.0
8.0	293.0
9.0	257.0
10.0	224.0
11.0	202.0
12.0	181.0
14.0	148.0
16.0	121.0
18.0	100.0
20.0	85.0
22.0	73.0
24.0	63.0
26.0	55.0
28.0	47.5
30.0	42.0
32.0	37.0
34.0	32.5
36.0	28.5
38.0	24.8
40.0	21.7
44.0	16.4
48.0	12.3
* n *	19
m/s	12.8

S 54m --

30 t

14.0 x 14.0 m

360°

ISO DIN

S	--
54m	

typ1: D=28.0 mm *** 149 22.00

m > < t CODE >5245< V181 0900

m	54.0
8.0	325.0
9.0	287.0
10.0	250.0
11.0	226.0
12.0	203.0
14.0	168.0
16.0	141.0
18.0	121.0
20.0	107.0
22.0	92.0
24.0	81.0
26.0	73.0
28.0	64.0
30.0	57.0
32.0	52.0
34.0	47.0
36.0	41.5
38.0	38.0
40.0	34.5
44.0	27.9
48.0	22.6
* n *	21
m/s	12.8

	S	--	70 t	14.0 x 14.0 m	360°		
	54m						

LR 1600/2 -- 048036

ISO DIN

S	--
54m	

typ1: D=28.0 mm *** 147 22.00

m > < t CODE >5244< V181 0900

m	54.0
8.0	358.0
9.0	316.0
10.0	275.0
11.0	250.0
12.0	225.0
14.0	186.0
16.0	157.0
18.0	136.0
20.0	120.0
22.0	104.0
24.0	92.0
26.0	83.0
28.0	73.0
30.0	66.0
32.0	60.0
34.0	54.0
36.0	48.5
38.0	44.5
40.0	41.0
44.0	33.5
48.0	28.7
* n *	24
m/s	12.8

	S	--	110 t	14.0 x 14.0 m	360°		
	54m						

LR 1600/2 -- 048036

ISO DIN

S	--
54m	

typ1: D=28.0 mm *** 146 22.00

m > < t CODE >5243< V181 0900

m	54.0
8.0	374.0
9.0	331.0
10.0	288.0
11.0	262.0
12.0	236.0
14.0	195.0
16.0	165.0
18.0	143.0
20.0	126.0
22.0	109.0
24.0	97.0
26.0	87.0
28.0	78.0
30.0	70.0
32.0	64.0
34.0	58.0
36.0	52.0
38.0	48.0
40.0	44.0
44.0	36.5
48.0	31.5
*** n ***	25
m/s	12.8

S	--	130 t	14.0 x 14.0 m	360°
54m				

ISO DIN

S	--
54m	

typ1: D=28.0 mm *** 145 22.00

m > < t CODE >5242< V181 0900

m	54.0
8.0	388.0
9.0	344.0
10.0	301.0
11.0	274.0
12.0	247.0
14.0	204.0
16.0	173.0
18.0	150.0
20.0	132.0
22.0	115.0
24.0	102.0
26.0	92.0
28.0	82.0
30.0	74.0
32.0	68.0
34.0	62.0
36.0	56.0
38.0	51.0
40.0	47.5
44.0	39.5
48.0	34.0
* n *	26
m/s	12.8

S	--	150 t	14.0 x 14.0 m	360°
54m				

S	--
54m	

typ1: D=28.0 mm *** 144 22.00

m > < t CODE >5241< V181 0900

m	54.0
8.0	405.0
9.0	359.0
10.0	314.0
11.0	286.0
12.0	257.0
14.0	214.0
16.0	181.0
18.0	157.0
20.0	139.0
22.0	121.0
24.0	107.0
26.0	97.0
28.0	87.0
30.0	78.0
32.0	72.0
34.0	66.0
36.0	59.0
38.0	55.0
40.0	51.0
44.0	42.5
48.0	36.5
* n *	28
m/s	12.8

	S 54m	--	170 t	14.0 x 14.0 m	360°		

S	--
54m	

typ1: D=28.0 mm *** 143 22.00

m	m > < t	CODE >5240<	V181 0900
m	54.0		
8.0	421.0		
9.0	374.0		
10.0	327.0		
11.0	297.0		
12.0	268.0		
14.0	223.0		
16.0	190.0		
18.0	165.0		
20.0	146.0		
22.0	127.0		
24.0	113.0		
26.0	102.0		
28.0	92.0		
30.0	83.0		
32.0	76.0		
34.0	70.0		
36.0	63.0		
38.0	58.0		
40.0	54.0		
44.0	45.0		
48.0	39.0		
* n *	29		
m/s	12.8		

	S	--					
	54m		190 t	14.0 x 14.0 m	360°		

ISO DIN

S	--
60m	

typ1: D=28.0 mm *** 169 22.00

m	m > < t — CODE >5267< — V181 0A00
m	**60.0**
9.0	143.0
10.0	124.0
11.0	109.0
12.0	97.0
14.0	77.0
16.0	63.0
18.0	52.0
20.0	43.0
22.0	35.5
24.0	29.7
26.0	24.7
28.0	20.4
30.0	16.7
32.0	13.5
34.0	10.7
36.0	8.2
38.0	6.0
*** n ***	9
m/s	12.8

S 60m	--	30 t	17.5 x 10.0 m	360°

S	--
60m	

typ1: D=28.0 mm *** 167 22.00

m	60.0	m > < t	CODE >5266<	V181 0A00
9.0	194.0			
10.0	170.0			
11.0	150.0			
12.0	134.0			
14.0	109.0			
16.0	91.0			
18.0	77.0			
20.0	65.0			
22.0	56.0			
24.0	48.5			
26.0	42.0			
28.0	36.5			
30.0	31.5			
32.0	27.4			
34.0	23.8			
36.0	20.6			
38.0	17.8			
40.0	15.2			
44.0	10.9			
48.0	7.5			
*** n ***	12			
m/s	12.8			

	S	--	70 t	17.5 x 10.0 m	360°		
	60m						

LR 1600/2 -- 048036

ISO DIN

S	--
60m	

typ1: D=28.0 mm *** 165 22.00

m > < t CODE >5265< V181 0A00

m	60.0
9.0	244.0
10.0	215.0
11.0	191.0
12.0	172.0
14.0	141.0
16.0	119.0
18.0	101.0
20.0	87.0
22.0	76.0
24.0	67.0
26.0	59.0
28.0	52.0
30.0	46.5
32.0	41.5
34.0	37.0
36.0	33.0
38.0	29.5
40.0	26.4
44.0	20.7
48.0	16.1
52.0	12.4
* n *	15
m/s	12.8

S	--
60m	

110 t

17.5 x 10.0 m

360°

ISO DIN

S	--
60m	

typ1: D=28.0 mm *** 164 22.00

m >< t CODE >5264< V181 0A00

m	60.0
9.0	269.0
10.0	238.0
11.0	212.0
12.0	191.0
14.0	157.0
16.0	133.0
18.0	114.0
20.0	99.0
22.0	86.0
24.0	76.0
26.0	67.0
28.0	60.0
30.0	54.0
32.0	48.5
34.0	43.5
36.0	39.0
38.0	35.0
40.0	31.5
44.0	25.3
48.0	20.3
52.0	16.3
*** n ***	17
m/s	12.8

S	--	130 t	17.5 x 10.0 m	360°
60m				

LR 1600/2 -- 048036

ISO DIN

S	--
60m	

typ1: D=28.0 mm *** 163 22.00

m > < t CODE >5263< V181 0A00

m	60.0
9.0	295.0
10.0	260.0
11.0	232.0
12.0	209.0
14.0	173.0
16.0	147.0
18.0	126.0
20.0	110.0
22.0	96.0
24.0	85.0
26.0	76.0
28.0	68.0
30.0	61.0
32.0	55.0
34.0	49.5
36.0	44.5
38.0	40.0
40.0	36.5
44.0	30.0
48.0	24.5
52.0	20.1
* n *	19
m/s	12.8

S 60m	--	150 t	17.5 x 10.0 m	360°

S	--
60m	

typ1: D=28.0 mm *** 162 22.00

m >< t CODE >5262< V181 0A00

m	60.0
9.0	320.0
10.0	283.0
11.0	253.0
12.0	228.0
14.0	189.0
16.0	161.0
18.0	139.0
20.0	121.0
22.0	107.0
24.0	95.0
26.0	85.0
28.0	76.0
30.0	68.0
32.0	61.0
34.0	55.0
36.0	50.0
38.0	45.5
40.0	41.5
44.0	34.5
48.0	28.7
52.0	23.9
* n *	21
m/s	12.8

	S	--	170 t	17.5 x 10.0 m	360°		
	60m						

ISO DIN

S	--
60m	

typ1: D=28.0 mm *** 161 22.00

m	60.0	m > < t	CODE >5261<	V181 0A00
9.0	345.0			
10.0	306.0			
11.0	274.0			
12.0	247.0			
14.0	206.0			
16.0	175.0			
18.0	151.0			
20.0	132.0			
22.0	117.0			
24.0	104.0			
26.0	93.0			
28.0	84.0			
30.0	75.0			
32.0	67.0			
34.0	61.0			
36.0	55.0			
38.0	50.0			
40.0	46.0			
44.0	39.0			
48.0	33.0			
52.0	27.7			
* n *	23			
m/s	12.8			

	S	--					
	60m		190 t	17.5 x 10.0 m	360°		

S	--
60m	

typ1: D=28.0 mm *** 151 22.00

m > < t CODE >5260< V181 0A00

m	60.0
9.0	253.0
10.0	223.0
11.0	197.0
12.0	177.0
14.0	141.0
16.0	115.0
18.0	96.0
20.0	81.0
22.0	69.0
24.0	59.0
26.0	51.0
28.0	45.0
30.0	39.0
32.0	34.0
34.0	29.9
36.0	26.1
38.0	22.8
40.0	19.9
44.0	14.9
48.0	10.6
52.0	7.2
* n *	16
m/s	12.8

	S	--					
	60m		30 t	14.0 x 14.0 m	360°		

LR 1600/2 -- 048036

ISO DIN

S	--
60m	

typ1: D=28.0 mm *** 149 22.00

m	60.0	m > < t CODE >5259< V181 0A00
9.0	283.0	
10.0	250.0	
11.0	221.0	
12.0	201.0	
14.0	163.0	
16.0	140.0	
18.0	118.0	
20.0	104.0	
22.0	91.0	
24.0	79.0	
26.0	70.0	
28.0	63.0	
30.0	56.0	
32.0	49.0	
34.0	44.5	
36.0	40.5	
38.0	36.0	
40.0	32.0	
44.0	26.3	
48.0	20.7	
52.0	16.6	
* n *	18	
m/s	12.8	

S	--	70 t	14.0 x 14.0 m	360°
60m				

LR 1600/2 -- 048036

ISO DIN

S	--
60m	

typ1: D=28.0 mm *** 147 22.00

m > < t CODE >5258< V181 0A00

m	60.0
9.0	312.0
10.0	276.0
11.0	244.0
12.0	223.0
14.0	181.0
16.0	156.0
18.0	132.0
20.0	117.0
22.0	103.0
24.0	90.0
26.0	79.0
28.0	72.0
30.0	64.0
32.0	57.0
34.0	52.0
36.0	47.5
38.0	43.0
40.0	38.0
44.0	32.0
48.0	26.2
52.0	21.9
* n *	20
m/s	12.8

S	--	110 t	14.0 x 14.0 m	360°
60m				

ISO DIN

S	--
60m	

typ1: D=28.0 mm *** 146 22.00

m > < t CODE >5257< V181 0A00

m	60.0
9.0	326.0
10.0	289.0
11.0	255.0
12.0	234.0
14.0	190.0
16.0	164.0
18.0	139.0
20.0	123.0
22.0	109.0
24.0	95.0
26.0	84.0
28.0	76.0
30.0	69.0
32.0	61.0
34.0	56.0
36.0	51.0
38.0	46.0
40.0	41.5
44.0	35.0
48.0	28.9
52.0	24.3
*** n ***	21
m/s	12.8

	S / 60m	--	130 t	14.0 x 14.0 m	360°		

S	--
60m	

typ1: D=28.0 mm *** 145 22.00

m > < t CODE >5256< V181 0A00

m	60.0
9.0	340.0
10.0	302.0
11.0	267.0
12.0	244.0
14.0	199.0
16.0	172.0
18.0	147.0
20.0	129.0
22.0	115.0
24.0	100.0
26.0	89.0
28.0	81.0
30.0	73.0
32.0	65.0
34.0	60.0
36.0	55.0
38.0	49.5
40.0	44.5
44.0	38.0
48.0	31.5
52.0	26.7
* n *	22
m/s	12.8

	S	--					
	60m		150 t	14.0 x 14.0 m	360°		

ISO DIN

S	--
60m	

typ1: D=28.0 mm *** 144 22.00

m > < t CODE >5255< V181 0A00

m	60.0
9.0	355.0
10.0	315.0
11.0	278.0
12.0	255.0
14.0	208.0
16.0	180.0
18.0	154.0
20.0	136.0
22.0	121.0
24.0	106.0
26.0	94.0
28.0	85.0
30.0	77.0
32.0	69.0
34.0	63.0
36.0	58.0
38.0	53.0
40.0	47.5
44.0	41.0
48.0	34.0
52.0	29.2
* n *	24
m/s	12.8

	S	--	170 t	14.0 x 14.0 m	360°		
	60m						

S	--
60m	

typ1: D=28.0 mm *** 143 22.00

m > < t CODE >5254< V181 0A00

m	60.0
9.0	369.0
10.0	328.0
11.0	290.0
12.0	266.0
14.0	218.0
16.0	188.0
18.0	161.0
20.0	142.0
22.0	127.0
24.0	112.0
26.0	99.0
28.0	90.0
30.0	82.0
32.0	73.0
34.0	67.0
36.0	62.0
38.0	56.0
40.0	51.0
44.0	43.5
48.0	37.0
52.0	31.5
* n *	25
m/s	12.8

	S 60m	--	190 t	14.0 x 14.0 m	360°		

S	--
66m	

typ1: D=28.0 mm *** 167 22.00

m > < t	CODE >5279<	V181 0B00

m	66.0
10.0	161.0
11.0	143.0
12.0	128.0
14.0	104.0
16.0	87.0
18.0	73.0
20.0	62.0
22.0	53.0
24.0	45.5
26.0	39.5
28.0	34.0
30.0	29.4
32.0	25.3
34.0	21.8
36.0	18.6
38.0	15.8
40.0	13.3
44.0	8.9
48.0	5.4
*** n ***	10
m/s	12.8

	S / 66m	--	70 t	17.5 x 10.0 m	360°		

S	--
66m	

typ1: D=28.0 mm *** 165 22.00

m > < t CODE >5278< V181 0B00

m	66.0
10.0	204.0
11.0	182.0
12.0	164.0
14.0	135.0
16.0	114.0
18.0	97.0
20.0	84.0
22.0	73.0
24.0	64.0
26.0	56.0
28.0	49.5
30.0	44.0
32.0	39.0
34.0	34.5
36.0	31.0
38.0	27.4
40.0	24.3
44.0	19.0
48.0	14.7
52.0	11.0
56.0	7.8
60.0	5.2
* n *	13
m/s	12.8

S	--	110 t	17.5 x 10.0 m	360°
66m				

ISO DIN

S	--
66m	

typ1: D=28.0 mm   *** 164   22.00

m > < t   CODE >5277<   V181 0B00

m	66.0
10.0	226.0
11.0	202.0
12.0	182.0
14.0	151.0
16.0	128.0
18.0	109.0
20.0	95.0
22.0	83.0
24.0	73.0
26.0	65.0
28.0	58.0
30.0	51.0
32.0	46.0
34.0	41.0
36.0	37.0
38.0	33.0
40.0	29.8
44.0	24.0
48.0	19.0
52.0	14.8
56.0	11.4
60.0	8.5
* n *	14
m/s	12.8

	S 66m	--	130 t	17.5 x 10.0 m	360°		

LR 1600/2 -- 048036

ISO DIN

S	--
66m	

typ1: D=28.0 mm *** 163 22.00

m > < t CODE >5276< V181 0B00

m	66.0
10.0	248.0
11.0	222.0
12.0	200.0
14.0	167.0
16.0	141.0
18.0	121.0
20.0	106.0
22.0	93.0
24.0	82.0
26.0	73.0
28.0	65.0
30.0	59.0
32.0	53.0
34.0	47.5
36.0	43.0
38.0	39.0
40.0	35.5
44.0	28.8
48.0	23.2
52.0	18.7
56.0	14.9
60.0	11.8
*** n ***	16
m/s	12.8

	S 66m	--	150 t	17.5 x 10.0 m	360°		

LR 1600/2 -- 048036

ISO DIN

S 66m	--

typ1: D=28.0 mm *** 162 22.00

m >< t CODE >5275< V181 0B00

m	66.0
10.0	269.0
11.0	242.0
12.0	218.0
14.0	182.0
16.0	155.0
18.0	134.0
20.0	117.0
22.0	103.0
24.0	91.0
26.0	82.0
28.0	73.0
30.0	66.0
32.0	60.0
34.0	54.0
36.0	49.0
38.0	44.5
40.0	40.5
44.0	33.5
48.0	27.4
52.0	22.5
56.0	18.4
60.0	15.0
* n *	17
m/s	12.8

	S 66m	--	170 t	17.5 x 10.0 m	360°		

S	--
66m	

typ1: D=28.0 mm *** 161 22.00

m > < t CODE >5274< V181 0B00

m	66.0
10.0	291.0
11.0	261.0
12.0	236.0
14.0	198.0
16.0	168.0
18.0	146.0
20.0	128.0
22.0	113.0
24.0	100.0
26.0	90.0
28.0	81.0
30.0	73.0
32.0	67.0
34.0	60.0
36.0	55.0
38.0	49.5
40.0	45.0
44.0	38.0
48.0	31.5
52.0	26.3
56.0	22.0
60.0	18.3
*** n ***	19
m/s	12.8

	S	--	190 t	17.5 x 10.0 m	360°		
	66m						

LR 1600/2 -- 048036

ISO DIN

S	--
66m	

typ1: D=28.0 mm *** 149 22.00

m	66.0													
m > < t	CODE >5273<													V181 0B00
10.0	247.0													
11.0	219.0													
12.0	197.0													
14.0	164.0													
16.0	137.0													
18.0	118.0													
20.0	99.0													
22.0	89.0													
24.0	79.0													
26.0	69.0													
28.0	60.0													
30.0	54.0													
32.0	48.5													
34.0	43.0													
36.0	38.0													
38.0	34.5													
40.0	31.0													
44.0	23.9													
48.0	19.8													
52.0	15.3													
56.0	11.7													
60.0	8.6													
*** n ***	16													
m/s	12.8													

	S	--	70 t	14.0 x 14.0 m	360°		
	66m						

ISO DIN

S	--
66m	

typ1: D=28.0 mm *** 147 22.00

m > < t CODE >5272< V181 0B00

m	66.0
10.0	273.0
11.0	243.0
12.0	218.0
14.0	182.0
16.0	152.0
18.0	132.0
20.0	113.0
22.0	101.0
24.0	90.0
26.0	79.0
28.0	69.0
30.0	63.0
32.0	57.0
34.0	50.0
36.0	45.0
38.0	41.5
40.0	37.5
44.0	29.8
48.0	24.8
52.0	19.8
56.0	16.3
60.0	13.7
* n *	17
m/s	12.8

S	--	110 t	14.0 x 14.0 m	360°
66m				

S	--
66m	

typ1: D=28.0 mm *** 146 22.00

m	66.0	m > < t	CODE >5271<	V181 0B00
10.0	286.0			
11.0	254.0			
12.0	228.0			
14.0	192.0			
16.0	161.0			
18.0	140.0			
20.0	119.0			
22.0	107.0			
24.0	95.0			
26.0	83.0			
28.0	74.0			
30.0	67.0			
32.0	61.0			
34.0	54.0			
36.0	48.5			
38.0	44.5			
40.0	40.5			
44.0	32.5			
48.0	27.4			
52.0	22.1			
56.0	18.3			
60.0	15.4			
* n *	18			
m/s	12.8			

	S	--	130 t	14.0 x 14.0 m	360°		
	66m						

S	--
66m	

typ1: D=28.0 mm *** 145 22.00

m > < t CODE >5270< V181 0B00

m	66.0
10.0	298.0
11.0	266.0
12.0	239.0
14.0	201.0
16.0	169.0
18.0	147.0
20.0	125.0
22.0	112.0
24.0	100.0
26.0	88.0
28.0	78.0
30.0	71.0
32.0	65.0
34.0	58.0
36.0	52.0
38.0	48.0
40.0	44.0
44.0	35.5
48.0	30.0
52.0	24.8
56.0	20.7
60.0	17.3
* n *	19
m/s	12.8

S	--	150 t	14.0 x 14.0 m	360°
66m				

S	--
66m	

typ1: D=28.0 mm *** 144 22.00

m > < t CODE >5269< V181 0B00

m	66.0
10.0	311.0
11.0	278.0
12.0	249.0
14.0	210.0
16.0	176.0
18.0	154.0
20.0	131.0
22.0	118.0
24.0	105.0
26.0	93.0
28.0	82.0
30.0	75.0
32.0	68.0
34.0	61.0
36.0	56.0
38.0	51.0
40.0	47.0
44.0	38.5
48.0	33.0
52.0	27.2
56.0	22.8
60.0	19.0
* n *	20
m/s	12.8

S 66m	--	170 t	14.0 x 14.0 m	360°

LR 1600/2 -- 048036

ISO DIN

S	--
66m	

typ1: D=28.0 mm *** 143 22.00

m > < t CODE >5268< V181 0B00

m	66.0
10.0	324.0
11.0	289.0
12.0	260.0
14.0	219.0
16.0	184.0
18.0	161.0
20.0	137.0
22.0	124.0
24.0	111.0
26.0	98.0
28.0	88.0
30.0	80.0
32.0	73.0
34.0	65.0
36.0	59.0
38.0	55.0
40.0	50.0
44.0	41.0
48.0	35.5
52.0	29.7
56.0	25.0
60.0	20.9
* n *	21
m/s	12.8

S 66m	--	190 t	14.0 x 14.0 m	360°

ISO DIN

S	--
72m	

typ1: D=28.0 mm *** 167 22.00

m	72.0
m > < t	CODE >5291< V181 0C00
10.0	151.0
11.0	135.0
12.0	121.0
14.0	99.0
16.0	82.0
18.0	69.0
20.0	58.0
22.0	49.5
24.0	42.5
26.0	36.0
28.0	31.0
30.0	26.3
32.0	22.4
34.0	18.9
36.0	15.7
38.0	13.0
40.0	10.5
44.0	6.2
*** n ***	9
m/s	12.8

	S 72m	--	70 t	17.5 x 10.0 m	360°		

S	--
72m	

typ1: D=28.0 mm *** 165 22.00

m > < t CODE >5290< V181 0C00

m	72.0												
10.0	193.0												
11.0	173.0												
12.0	156.0												
14.0	129.0												
16.0	108.0												
18.0	92.0												
20.0	80.0												
22.0	69.0												
24.0	60.0												
26.0	53.0												
28.0	46.5												
30.0	40.5												
32.0	36.0												
34.0	31.5												
36.0	27.8												
38.0	24.4												
40.0	21.4												
44.0	16.1												
48.0	11.8												
52.0	8.3												
n	12												
m/s	12.8												

S	--	110 t	17.5 x 10.0 m	360°
72m				

LR 1600/2 -- 048036

ISO DIN

S	--
72m	

typ1: D=28.0 mm *** 164 22.00

m > < t CODE >5289< V181 0C00

m	72.0													
10.0	214.0													
11.0	192.0													
12.0	173.0													
14.0	144.0													
16.0	122.0													
18.0	104.0													
20.0	90.0													
22.0	79.0													
24.0	69.0													
26.0	61.0													
28.0	54.0													
30.0	48.0													
32.0	42.5													
34.0	38.0													
36.0	34.0													
38.0	30.0													
40.0	26.8													
44.0	21.1													
48.0	16.4													
52.0	12.5													
56.0	9.2													
60.0	6.5													
*** n ***	13													
m/s	12.8													

	S	--					
	72m		130 t	17.5 x 10.0 m	360°		

ISO DIN

S	--
72m	

typ1: D=28.0 mm *** 163 22.00

m > < t CODE >5288< V181 0C00

m	72.0
10.0	235.0
11.0	211.0
12.0	191.0
14.0	159.0
16.0	135.0
18.0	116.0
20.0	101.0
22.0	88.0
24.0	78.0
26.0	69.0
28.0	62.0
30.0	55.0
32.0	49.5
34.0	44.5
36.0	40.0
38.0	36.0
40.0	32.5
44.0	26.1
48.0	21.0
52.0	16.7
56.0	12.9
60.0	9.7
64.0	7.0
* n *	15
m/s	12.8

S	--	150 t	17.5 x 10.0 m	360°
72m				

LR 1600/2 -- 048036

ISO DIN

S	--
72m	

typ1: D=28.0 mm *** 162 22.00

m > < t CODE >5287< V181 0C00

m	72.0
10.0	256.0
11.0	230.0
12.0	208.0
14.0	174.0
16.0	148.0
18.0	128.0
20.0	112.0
22.0	98.0
24.0	87.0
26.0	78.0
28.0	69.0
30.0	62.0
32.0	56.0
34.0	51.0
36.0	46.0
38.0	41.5
40.0	37.5
44.0	31.0
48.0	25.5
52.0	20.6
56.0	16.5
60.0	13.0
64.0	10.1
* n *	16
m/s	12.8

S	--
72m	

170 t

17.5 x 10.0 m

360°

ISO DIN

S	--
72m	

typ1: D=28.0 mm *** 161 22.00

m > < t CODE >5286< V181 0C00

m	72.0
10.0	276.0
11.0	249.0
12.0	226.0
14.0	189.0
16.0	161.0
18.0	140.0
20.0	122.0
22.0	108.0
24.0	96.0
26.0	86.0
28.0	77.0
30.0	70.0
32.0	63.0
34.0	57.0
36.0	52.0
38.0	47.5
40.0	43.0
44.0	36.0
48.0	29.7
52.0	24.4
56.0	20.0
60.0	16.3
64.0	13.1
* n *	18
m/s	12.8

	S 72m	--	190 t	17.5 x 10.0 m	360°		

ISO DIN

S	--
72m	

typ1: D=28.0 mm *** 149 22.00

m	72.0	m > < t	CODE >5285< V181 0C00
10.0	241.0		
11.0	216.0		
12.0	192.0		
14.0	161.0		
16.0	133.0		
18.0	115.0		
20.0	99.0		
22.0	85.0		
24.0	76.0		
26.0	67.0		
28.0	58.0		
30.0	51.0		
32.0	46.0		
34.0	41.0		
36.0	36.0		
38.0	31.5		
40.0	28.4		
44.0	22.6		
48.0	16.9		
52.0	13.4		
56.0	9.8		
60.0	6.7		
* n *	15		
m/s	12.8		

	S 72m	--	70 t	14.0 x 14.0 m	360°		

S	--
72m	

typ1: D=28.0 mm   *** 147   22.00

	m > < t	CODE >5284<										V181 0C00		
m	**72.0**													
10.0	265.0													
11.0	240.0													
12.0	214.0													
14.0	179.0													
16.0	149.0													
18.0	129.0													
20.0	112.0													
22.0	96.0													
24.0	86.0													
26.0	77.0													
28.0	68.0													
30.0	59.0													
32.0	54.0													
34.0	48.5													
36.0	43.5													
38.0	38.0													
40.0	34.5													
44.0	27.9													
48.0	21.5													
52.0	17.9													
56.0	14.3													
60.0	11.4													
64.0	9.2													
*** n ***	17													
m/s	12.8													

	S	--					
	72m		110 t	14.0 x 14.0 m	360°		

S	--
72m	

typ1: D=28.0 mm   *** 146   22.00

m > < t   CODE >5283<   V181 0C00

m	72.0
10.0	278.0
11.0	251.0
12.0	225.0
14.0	188.0
16.0	157.0
18.0	136.0
20.0	118.0
22.0	102.0
24.0	92.0
26.0	82.0
28.0	72.0
30.0	63.0
32.0	58.0
34.0	52.0
36.0	47.0
38.0	41.5
40.0	38.0
44.0	31.0
48.0	24.2
52.0	20.3
56.0	16.5
60.0	13.3
64.0	10.9
* n *	18
m/s	12.8

	S	--	130 t	14.0 x 14.0 m	360°		
	72m						

S	--
72m	

typ1: D=28.0 mm *** 145 22.00

m > < t CODE >5282< V181 0C00

m	72.0
10.0	290.0
11.0	263.0
12.0	235.0
14.0	197.0
16.0	164.0
18.0	143.0
20.0	124.0
22.0	107.0
24.0	97.0
26.0	87.0
28.0	77.0
30.0	68.0
32.0	62.0
34.0	56.0
36.0	50.0
38.0	44.5
40.0	41.0
44.0	34.0
48.0	27.1
52.0	22.8
56.0	18.5
60.0	15.0
64.0	12.5
* n *	19
m/s	12.8

	S	--	150 t	14.0 x 14.0 m	360°		
	72m						

LR 1600/2 -- 048036

ISO DIN

S	--
72m	

typ1: D=28.0 mm *** 144 22.00

m > < t CODE >5281< V181 0C00

m	72.0
10.0	302.0
11.0	274.0
12.0	246.0
14.0	206.0
16.0	172.0
18.0	150.0
20.0	131.0
22.0	113.0
24.0	102.0
26.0	92.0
28.0	81.0
30.0	72.0
32.0	66.0
34.0	60.0
36.0	54.0
38.0	48.0
40.0	44.0
44.0	37.0
48.0	29.7
52.0	25.1
56.0	20.4
60.0	16.7
64.0	14.2
* n *	20
m/s	12.8

	S 72m	--	170 t	14.0 x 14.0 m	360°		

ISO DIN

S	--
72m	

typ1: D=28.0 mm *** 143 22.00

m > < t CODE >5280< V181 0C00

m	72.0
10.0	314.0
11.0	286.0
12.0	257.0
14.0	216.0
16.0	181.0
18.0	158.0
20.0	138.0
22.0	119.0
24.0	108.0
26.0	97.0
28.0	86.0
30.0	76.0
32.0	70.0
34.0	64.0
36.0	57.0
38.0	51.0
40.0	47.5
44.0	40.0
48.0	32.5
52.0	27.4
56.0	22.4
60.0	18.5
64.0	15.8
*** n ***	20
m/s	12.8

S	--	190 t	14.0 x 14.0 m	360°
72m				

S	--
78m	

typ1: D=28.0 mm *** 165 22.00

m	78.0	m > < t CODE >5301< V181 0D00
11.0	166.0	
12.0	150.0	
14.0	124.0	
16.0	105.0	
18.0	89.0	
20.0	77.0	
22.0	67.0	
24.0	58.0	
26.0	51.0	
28.0	45.0	
30.0	39.5	
32.0	34.5	
34.0	30.5	
36.0	26.7	
38.0	23.4	
40.0	20.4	
44.0	15.2	
48.0	10.9	
52.0	7.3	
* n *	10	
m/s	12.8	

	S / 78m	--	110 t	17.5 x 10.0 m	360°		

S	--
78m	

typ1: D=28.0 mm *** 164 22.00

m > < t CODE >5300< V181 0D00

m	78.0
11.0	184.0
12.0	166.0
14.0	139.0
16.0	118.0
18.0	101.0
20.0	88.0
22.0	76.0
24.0	67.0
26.0	59.0
28.0	52.0
30.0	46.5
32.0	41.5
34.0	37.0
36.0	32.5
38.0	29.1
40.0	25.8
44.0	20.1
48.0	15.5
52.0	11.5
56.0	8.2
60.0	5.4
*** n ***	11
m/s	12.8

S	--	130 t	17.5 x 10.0 m	360°
78m				

ISO DIN

S	--
78m	

typ1: D=28.0 mm *** 163 22.00

m > < t CODE >5299< V181 0D00

m	78.0
11.0	202.0
12.0	183.0
14.0	153.0
16.0	131.0
18.0	112.0
20.0	98.0
22.0	86.0
24.0	76.0
26.0	67.0
28.0	60.0
30.0	54.0
32.0	48.0
34.0	43.0
36.0	38.5
38.0	34.5
40.0	31.0
44.0	25.0
48.0	20.0
52.0	15.7
56.0	12.1
60.0	9.1
64.0	6.5
* n *	13
m/s	12.8

	S	--					
	78m		150 t	17.5 x 10.0 m	360°		

S	--
78m	

typ1: D=28.0 mm *** 162 22.00

m > < t	CODE >5298<	V181 0D00

m	78.0
11.0	221.0
12.0	200.0
14.0	168.0
16.0	143.0
18.0	124.0
20.0	108.0
22.0	96.0
24.0	85.0
26.0	75.0
28.0	68.0
30.0	61.0
32.0	55.0
34.0	49.5
36.0	44.5
38.0	40.5
40.0	36.5
44.0	30.0
48.0	24.5
52.0	19.9
56.0	16.0
60.0	12.6
64.0	9.6
68.0	7.0
* n *	14
m/s	12.8

	S 78m	--	170 t	17.5 x 10.0 m	360°		

ISO DIN

S	--
78m	

typ1: D=28.0 mm *** 161 22.00

m > < t CODE >5297< V181 0D00

m	78.0
11.0	239.0
12.0	217.0
14.0	183.0
16.0	156.0
18.0	136.0
20.0	119.0
22.0	105.0
24.0	93.0
26.0	84.0
28.0	75.0
30.0	68.0
32.0	61.0
34.0	56.0
36.0	51.0
38.0	46.0
40.0	42.0
44.0	35.0
48.0	29.0
52.0	24.1
56.0	19.6
60.0	15.8
64.0	12.6
68.0	9.9
* n *	15
m/s	12.8

S	--	190 t	17.5 x 10.0 m	360°
78m				

ISO DIN

S	--
78m	

typ1: D=28.0 mm *** 147 22.00

m > < t CODE >5296< V181 0D00

m	78.0
11.0	237.0
12.0	215.0
14.0	176.0
16.0	150.0
18.0	126.0
20.0	111.0
22.0	96.0
24.0	84.0
26.0	76.0
28.0	68.0
30.0	60.0
32.0	52.0
34.0	47.5
36.0	43.0
38.0	38.5
40.0	34.0
44.0	27.4
48.0	21.8
52.0	16.6
56.0	13.7
60.0	10.8
64.0	8.3
68.0	6.4
* n *	15
m/s	12.8

S 78m --

110 t

14.0 x 14.0 m

360°

ISO DIN

S	--
78m	

typ1: D=28.0 mm *** 146 22.00

m > < t CODE >5295< V181 0D00

m	78.0
11.0	248.0
12.0	225.0
14.0	185.0
16.0	158.0
18.0	133.0
20.0	118.0
22.0	102.0
24.0	89.0
26.0	81.0
28.0	72.0
30.0	64.0
32.0	56.0
34.0	51.0
36.0	46.5
38.0	42.0
40.0	37.0
44.0	30.0
48.0	24.3
52.0	18.7
56.0	15.7
60.0	12.6
64.0	9.8
68.0	7.9
* n *	16
m/s	12.8

	S / 78m	--	130 t	14.0 x 14.0 m	360°		

ISO DIN

S	--
78m	

typ1: D=28.0 mm *** 145 22.00

m	78.0	m > < t	CODE >5294<	V181 0D00
11.0	259.0			
12.0	235.0			
14.0	194.0			
16.0	166.0			
18.0	140.0			
20.0	124.0			
22.0	108.0			
24.0	94.0			
26.0	85.0			
28.0	77.0			
30.0	68.0			
32.0	60.0			
34.0	55.0			
36.0	50.0			
38.0	45.0			
40.0	40.0			
44.0	33.0			
48.0	26.9			
52.0	20.9			
56.0	17.7			
60.0	14.5			
64.0	11.6			
68.0	9.5			
* n *	17			
m/s	12.8			

	S / 78m	--	150 t	14.0 x 14.0 m	360°		

S	--
78m	

typ1: D=28.0 mm *** 144 22.00

m	78.0
	m >< t CODE >5293< V181 0D00
11.0	270.0
12.0	245.0
14.0	202.0
16.0	173.0
18.0	146.0
20.0	130.0
22.0	114.0
24.0	100.0
26.0	91.0
28.0	82.0
30.0	73.0
32.0	64.0
34.0	59.0
36.0	54.0
38.0	48.5
40.0	43.5
44.0	36.0
48.0	29.7
52.0	23.7
56.0	20.1
60.0	16.5
64.0	13.3
68.0	11.1
* n *	17
m/s	12.8

	S 78m	--	170 t	14.0 x 14.0 m	360°		

S	--
78m	

typ1: D=28.0 mm *** 143 22.00

m	m > < t CODE >5292< V181 0D00
m	**78.0**
11.0	282.0
12.0	256.0
14.0	211.0
16.0	182.0
18.0	154.0
20.0	137.0
22.0	120.0
24.0	105.0
26.0	95.0
28.0	86.0
30.0	77.0
32.0	68.0
34.0	62.0
36.0	57.0
38.0	52.0
40.0	46.5
44.0	39.0
48.0	32.5
52.0	26.1
56.0	22.2
60.0	18.3
64.0	14.9
68.0	12.6
*** n ***	18
m/s	12.8

	S 78m	--	190 t	14.0 x 14.0 m	360°		

S	--
84m	

typ1: D=28.0 mm *** 164 22.00

m > < t CODE >5309< V181 0E00

m	84.0
12.0	159.0
14.0	133.0
16.0	113.0
18.0	97.0
20.0	84.0
22.0	73.0
24.0	64.0
26.0	56.0
28.0	49.5
30.0	44.0
32.0	39.0
34.0	34.5
36.0	30.5
38.0	26.7
40.0	23.5
44.0	17.9
48.0	13.3
52.0	9.3
56.0	6.0
* n *	10
m/s	12.8

	S	--	130 t	17.5 x 10.0 m	360°		
	84m						

ISO DIN

S	--
84m	

typ1: D=28.0 mm *** 163 22.00

m >< t CODE >5308< V181 0E00

m	84.0
12.0	175.0
14.0	147.0
16.0	125.0
18.0	108.0
20.0	94.0
22.0	82.0
24.0	73.0
26.0	64.0
28.0	57.0
30.0	51.0
32.0	45.5
34.0	40.5
36.0	36.0
38.0	32.5
40.0	28.8
44.0	22.8
48.0	17.7
52.0	13.5
56.0	9.9
60.0	6.8
* n *	11
m/s	12.8

	S 84m	--	150 t	17.5 x 10.0 m	360°	

S	--
84m	

typ1: D=28.0 mm *** 162 22.00

m > < t CODE >5307< V181 0E00

m	84.0
12.0	192.0
14.0	161.0
16.0	138.0
18.0	119.0
20.0	104.0
22.0	92.0
24.0	81.0
26.0	72.0
28.0	65.0
30.0	58.0
32.0	52.0
34.0	46.5
36.0	42.0
38.0	38.0
40.0	34.0
44.0	27.6
48.0	22.2
52.0	17.6
56.0	13.8
60.0	10.4
64.0	7.6
68.0	5.1
*** n ***	12
m/s	12.8

	S	--					
	84m		170 t	17.5 x 10.0 m	360°		

ISO DIN

S	--
84m	

typ1: D=28.0 mm *** 161 22.00

m > < t CODE >5306< V181 0E00

m	84.0
12.0	208.0
14.0	176.0
16.0	150.0
18.0	131.0
20.0	114.0
22.0	101.0
24.0	90.0
26.0	80.0
28.0	72.0
30.0	65.0
32.0	59.0
34.0	53.0
36.0	48.0
38.0	43.5
40.0	39.5
44.0	32.5
48.0	26.7
52.0	21.8
56.0	17.6
60.0	14.0
64.0	11.0
68.0	8.2
72.0	5.8
* n *	13
m/s	12.8

S	--	190 t	17.5 x 10.0 m	360°
84m				

ISO DIN

S	--
84m	

typ1: D=28.0 mm *** 146 22.00

m >< t CODE >5305< V181 0E00

m	84.0
12.0	220.0
14.0	181.0
16.0	155.0
18.0	131.0
20.0	114.0
22.0	101.0
24.0	87.0
26.0	77.0
28.0	70.0
30.0	63.0
32.0	56.0
34.0	48.5
36.0	44.0
38.0	40.0
40.0	35.5
44.0	27.3
48.0	22.6
52.0	18.0
56.0	13.6
60.0	11.0
64.0	8.4
68.0	5.9
* n *	14
m/s	12.8

S	--	130 t	14.0 x 14.0 m	360°
84m				

ISO DIN

S	--
84m	

typ1: D=28.0 mm *** 145 22.00

m > < t CODE >5304< V181 0E00

m	84.0
12.0	231.0
14.0	189.0
16.0	163.0
18.0	139.0
20.0	121.0
22.0	107.0
24.0	93.0
26.0	82.0
28.0	74.0
30.0	67.0
32.0	59.0
34.0	52.0
36.0	47.5
38.0	43.0
40.0	39.0
44.0	30.5
48.0	25.3
52.0	20.3
56.0	15.5
60.0	12.8
64.0	10.0
68.0	7.4
72.0	5.6
* n *	15
m/s	12.8

	S 84m	--	150 t	14.0 x 14.0 m	360°	

S	--
84m	

typ1: D=28.0 mm *** 144 22.00

m > < t CODE >5303< V181 0E00

m	84.0
12.0	240.0
14.0	198.0
16.0	171.0
18.0	146.0
20.0	127.0
22.0	112.0
24.0	98.0
26.0	86.0
28.0	79.0
30.0	71.0
32.0	63.0
34.0	56.0
36.0	51.0
38.0	46.5
40.0	42.0
44.0	33.5
48.0	27.8
52.0	22.4
56.0	17.2
60.0	14.5
64.0	11.7
68.0	9.0
72.0	7.1
76.0	5.2
* n *	15
m/s	12.8

S	--	170 t	14.0 x 14.0 m	360°
84m				

LR 1600/2 -- 048036

ISO DIN

S	--
84m	

typ1: D=28.0 mm *** 143 22.00

m > < t CODE >5302< V181 0E00

m	84.0
12.0	250.0
14.0	207.0
16.0	178.0
18.0	153.0
20.0	133.0
22.0	118.0
24.0	103.0
26.0	92.0
28.0	83.0
30.0	75.0
32.0	67.0
34.0	59.0
36.0	54.0
38.0	50.0
40.0	45.5
44.0	36.0
48.0	30.5
52.0	24.6
56.0	19.1
60.0	16.2
64.0	13.3
68.0	10.5
72.0	8.6
76.0	6.6
* n *	16
m/s	12.8

S 84m	--	190 t	14.0 x 14.0 m	360°

ISO DIN

S	--
90m	

typ1: D=28.0 mm *** 162 22.00

m > < t CODE >5313< V181 0F00

m	90.0
12.0	184.0
14.0	155.0
16.0	133.0
18.0	115.0
20.0	100.0
22.0	88.0
24.0	78.0
26.0	69.0
28.0	62.0
30.0	55.0
32.0	49.5
34.0	44.5
36.0	39.5
38.0	35.5
40.0	32.0
44.0	25.5
48.0	20.1
52.0	15.5
56.0	11.7
60.0	8.3
64.0	5.4
* n *	11
m/s	12.8

S	--
90m	

170 t

17.5 x 10.0 m

360°

S	--
90m	

typ1: D=28.0 mm *** 161 22.00

m > < t CODE >5312< V181 0F00

m	90.0
12.0	200.0
14.0	169.0
16.0	145.0
18.0	126.0
20.0	110.0
22.0	97.0
24.0	86.0
26.0	77.0
28.0	69.0
30.0	62.0
32.0	56.0
34.0	50.0
36.0	45.5
38.0	41.0
40.0	37.0
44.0	30.5
48.0	24.5
52.0	19.7
56.0	15.5
60.0	11.9
64.0	8.8
68.0	6.1
* n *	13
m/s	12.8

	S	--	190 t	17.5 x 10.0 m	360°		
	90m						

ISO DIN

S	--
90m	

typ1: D=28.0 mm *** 144 22.00

m > < t CODE >5311< V181 0F00

m	90.0
12.0	234.0
14.0	197.0
16.0	166.0
18.0	144.0
20.0	122.0
22.0	109.0
24.0	97.0
26.0	85.0
28.0	76.0
30.0	69.0
32.0	62.0
34.0	56.0
36.0	48.5
38.0	44.0
40.0	40.0
44.0	32.5
48.0	25.3
52.0	20.9
56.0	16.6
60.0	12.6
64.0	10.1
68.0	7.7
72.0	5.2
* n *	15
m/s	12.8

	S 90m	--	170 t	14.0 x 14.0 m	360°		

LR 1600/2 -- 048036

ISO DIN

S	--
90m	

typ1: D=28.0 mm *** 143 22.00

m > < t CODE >5310< V181 0F00

m	90.0
12.0	238.0
14.0	204.0
16.0	174.0
18.0	151.0
20.0	129.0
22.0	115.0
24.0	102.0
26.0	89.0
28.0	80.0
30.0	73.0
32.0	66.0
34.0	59.0
36.0	52.0
38.0	47.5
40.0	43.5
44.0	35.5
48.0	27.9
52.0	23.2
56.0	18.6
60.0	14.2
64.0	11.7
68.0	9.2
72.0	6.6
* n *	15
m/s	12.8

S	--
90m	

190 t

14.0 x 14.0 m

360°

LR 1600/2 -- 048036

ISO DIN

S	--
96m	

typ1: D=28.0 mm *** 161 22.00

m > < t CODE >5315< V181 1000

m	96.0
14.0	163.0
16.0	140.0
18.0	122.0
20.0	107.0
22.0	94.0
24.0	84.0
26.0	75.0
28.0	67.0
30.0	60.0
32.0	54.0
34.0	48.5
36.0	43.5
38.0	39.5
40.0	35.5
44.0	28.6
48.0	22.9
52.0	18.1
56.0	14.0
60.0	10.4
64.0	7.3
* n *	10
m/s	12.8

S	--
96m	

190 t

17.5 x 10.0 m

360°

S	--
96m	

typ1: D=28.0 mm   *** 143   22.00

m > < t   CODE >5314<   V181 1000

m	96.0
14.0	189.0
16.0	169.0
18.0	149.0
20.0	129.0
22.0	112.0
24.0	100.0
26.0	89.0
28.0	78.0
30.0	71.0
32.0	64.0
34.0	58.0
36.0	52.0
38.0	46.0
40.0	41.0
44.0	34.0
48.0	26.8
52.0	21.0
56.0	17.3
60.0	13.6
64.0	10.1
68.0	7.9
72.0	5.7
* n *	12
m/s	12.8

S	--	190 t	14.0 x 14.0 m	360°
96m				