Layher®

More Possibilities. The Scaffolding System.

LAYHER CASSETTE ROOF
INSTRUCTIONS FOR ASSEMBLY AND USE

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CONTENTS

NOTE

The products or assembly variants shown in these instructions for assembly and use may be subject to country-specific regulations. The user of the products bears the responsibility for compliance with such regulations. Subject to local regulations, we reserve the right not to supply all the products illustrated here.

Your Layher partner on the spot will be happy to provide advice and answers to all questions relating to the approvals for the products, to their use or to specific assembly regulations.

The contents of this document relate exclusively to original Layher scaffolding components. Layher has prepared these contents, in particular the specifications, presentations, images, directions and recommendations, with the utmost care. Nevertheless, Layher cannot accept any liability for the correctness, completeness and currentness of the contents. No liability shall be accepted for obvious mistakes, typing errors and printing errors. Use of the contents shall be at the user's own risk. Information on structural loading capacity has been prepared by Layher to the best of its knowledge and belief on the basis of the relevant technical regulations or other sets of regulations. This information relates to the exclusive use of original Layher scaffolding components. The scaffolding designs as shown, the detailed solutions and the intended uses must be understood only as non-binding examples. The users of the scaffolding components must, whenever they assemble scaffolding, prepare and document their own structural strength calculations, taking into account the design, the local conditions and the local requirements. The country-specific and relevant requirements, provisions and regulations applying at the respective place of use must be checked on the users' own responsibility.

If components from other manufacturers are used in scaffolding structures, these instructions for assembly and use are not applicable.

1. INTRODUCTION

General

These instructions for assembly and use relate to assembly, modification and dismantling of the main assembly variants of the Cassette Roof from Wilhelm Layher GmbH & Co KG, of Gueglingen-Eibensbach, Germany. These instructions cannot cover all the possible applications. The support scaffolding must be built in accordance with the appropriate instructions for assembly and use for the scaffolding type used. If you have any questions about specific applications, please contact your Layher partner.

Caution: The structural strength of the roof supporting structure must be verified for the appropriate effects at the assembly location. If the cassette roof is part of a supporting structure, i.e. the cassette roof is on support scaffolding with wall covering, the strength of the entire structure must be verified. The stability of the structure must be assured at all times, including in the assembled state. The support scaffolding and the Layher cassette roof plus the covering elements may only be assembled, modified and dismantled under the supervision of a qualified expert and by technically trained employees after they have been instructed.

Only original Layher components may be used for assembly.

Visually check all components prior to installation and before they are used to ensure that they are in flawless condition. Do not use damaged components.

Caution: The assembly, alteration and dismantling of the overall structure involve risk of falls. Perform construction work in such a way that the risk of falls is avoided as far as possible and that the residual risk is minimised. Assembly situations where there is a risk of falls are indicated in these instructions with the following symbol in the assembly sequence pictures.

Fig. 1

The scaffolding erector must stipulate, on the basis of how he assesses the risk, suitable measures to prevent or minimise risks for the specific case and/or for the respective activities involved.

The measures must be selected with due consideration of the actual risk, their usefulness and their practical possibilities, and also depending on

- the qualification of the employees,
- the type and duration of the activity in the high-risk area,
- the possible fall height,
- the state of the surface onto which the employee might fall and
- the state of the workplace and its access

Suitable measures to prevent risks can be:

- the employment of personnel instructed about the specific risk situation
- the use of personal safety apparatus (PSA)
- the use of an advance guardrail system (AGS)
  - in the access bay of the scaffolding
  - Additionally over the entire width of the scaffolding during mounting of the roof beam onto the support scaffolding

If use of personal safety apparatus (PSA) is required for assembly work or is specified by local regulations, the attachment points stated in section 3 must be used. The suitability of PSA for fall prevention must be checked, with particular attention being given here to the assembly height.

Before the start of construction work, the contractor must ascertain whether the planned working area contains equipment that might endanger the employees.

Assembly, modification and dismantling may only be performed with appropriate protective equipment. Components must not be thrown; instead they must be passed along in such a way that they cannot slip or be dropped.

Every use of the support scaffolding and of the cassette roof must be preceded by a check that they are in sound condition, particularly after unusual events that might have damaged the structure.

With regard to the following instructions for assembly and use of the cassette roof system, it must be pointed out that as a general principle scaffolding and roofs may only be assembled, modified or dismantled under the supervision of an expert person by technically trained employees adequately and specifically instructed in this work. To that extent, and with regard to use, we refer to the required conditions set forth in the German Ordinance on Industrial Safety and Health (OH&S). In the following instructions for assembly and use, we provide the erector and the user, on the basis of our risk analysis, with advice on how to comply with the requirements of the above ordinance in the respective assembly situation.

The technical details set forth in the instructions for assembly and use are intended to help the erector and/or user to comply with the requirements of the ordinance, and are not mandatory specifications for them. The erector/user must take the measures needed on the basis of the risk assessment, prepared according to the preconditions of the ordinance, at his own discretion and exercising all due care and diligence. The specific features of the individual case must be taken into account here.

It is essential that the following instructions for assembly and use are complied with in every case. It is pointed out that all information, particularly that regarding stability of the assembly variants, applies only when original Layher components are used. The installation of non-Layher parts can lead to safety defects and insufficient stability.

The present instructions for assembly and use must be available to the supervisor and to the employees involved.

During assembly, modification and dismantling, as well as during use, the legal regulations of the German Ordinance on Industrial Safety and Health (OH&S) concerning the erection and use of scaffolding and roof structures must be complied with.

Inspection and documentation

Fig. 2

The overall structure (support scaffolding and cassette roof) must, whenever it has been assembled and before it is put into service, be inspected by persons qualified to do so. The inspection must be documented. If certain areas are not ready for use, particularly during assembly, modification and dismantling, they must be identified with a prohibition sign indicating "no entry". In addition, it must be made clear by barriers that the structure has not been completed and hence must not be accessed.

After completion of the overall structure, it is useful to verify that inspection has been passed by a clearly discernible identification for the duration of its use.

Use

The user must check that the selected roof structure is suitable and safe to use for the work to be performed. He must ensure that the overall structure is checked for obvious defects before use. If defects are found during this check, the overall structure must not be used in those areas where there are defects until these have been eliminated by the erector. Subsequent alterations are deemed as assembly, modification or dismantling, and may only be performed by technically trained employees. They must be inspected and approved by the erector.

The legal regulations of the German Ordinance on Industrial Safety and Health (OH&S) must be complied with.

A detailed list of articles can be found in our catalogue. General diagrams showing the parts and the data sheets with the information needed for verifying the structural strength can be obtained from Layher's central office.

2. DESCRIPTION

The Layher cassette roof is a sturdy and universally usable interim roof of modular design. It is quick and safe to assemble using only a few components. The system parts can be combined in any way required and adapted to the dimensions of the structure. The roof surface can be walked over (with the exception of light cassettes) and is rated for snow loads of up to 0.75 kN/m^2. The cassette roof can be opened without any problems to pass material through it, and can be designed mobile using additional parts.

Technical data

- Double-pitch roof (roof angle 11°)
- Mono-pitch roof (roof angle 11°)
- Spans of up to 27.1 m [1)]
- Substructure: SpeedyScaf 0.73/1.09 m or Allround 0.73/1.09 m
- Snow load up to 0.75 kN/m^2

[1)] Larger spans are possible if special design measures are taken and also verified.

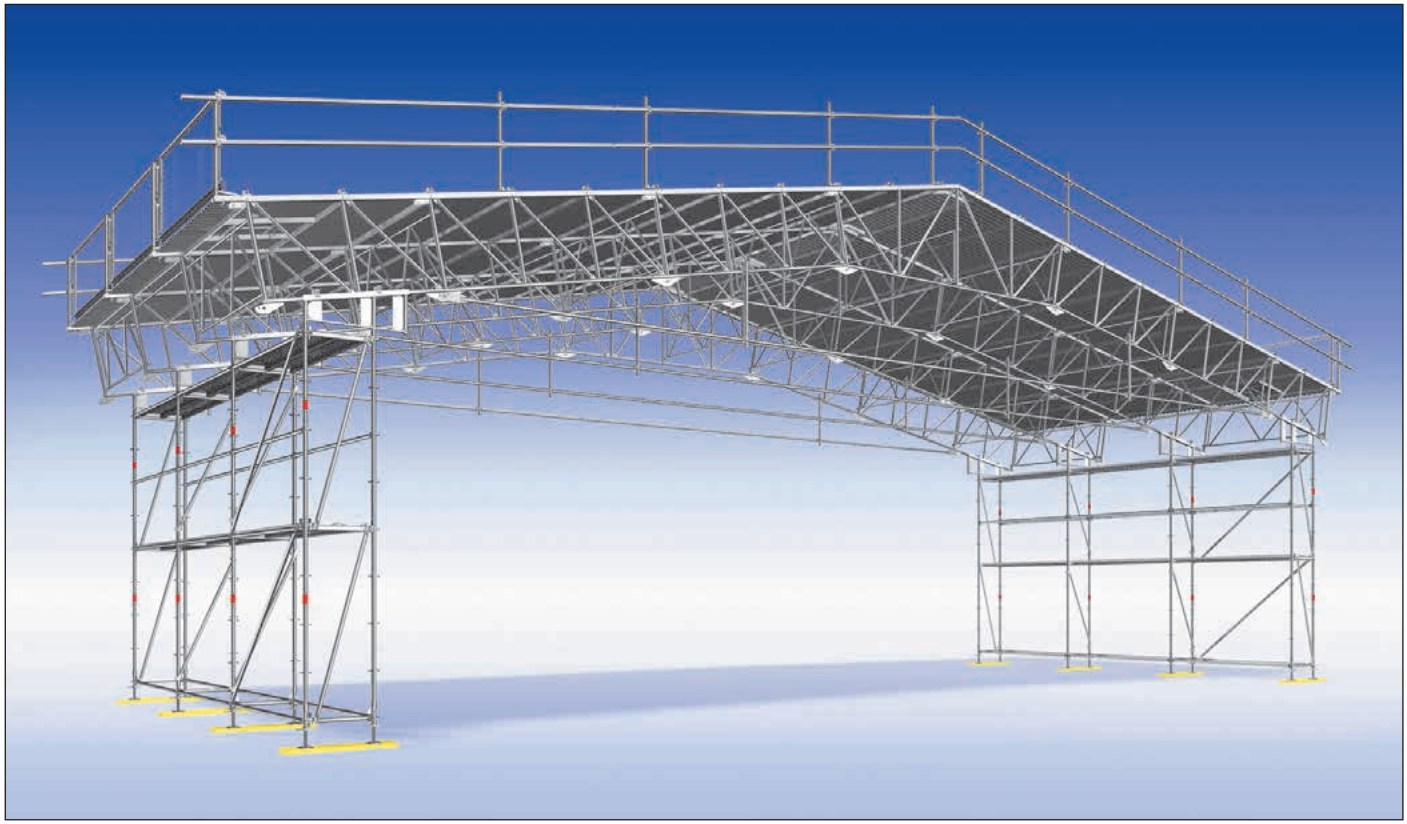


Fig. 3

Standard versions of roof trusses and attachment points

Figs. 4 to 11 show the standard versions of the roof trusses for various spans. Also, the pictures show the attachment points and the positions of additional anti-buckling braces.

- ● For attachment points for crane gear, see also pages 23 and 24
- ---- Anti-buckling brace in bottom chord, see page 19.
- x Tube joint in tie

The structural strength of other roof beam combinations, spans, attachment points or bracing must be verified. An additional check must be made on whether the contents of the present instructions for assembly and use or parts thereof are applicable in diverging cases.

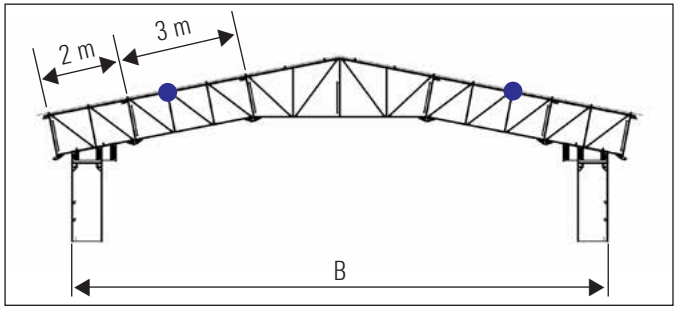


Fig. 4: ***Nominal width B = 13.3 m;*** *12.92…13.62 m*

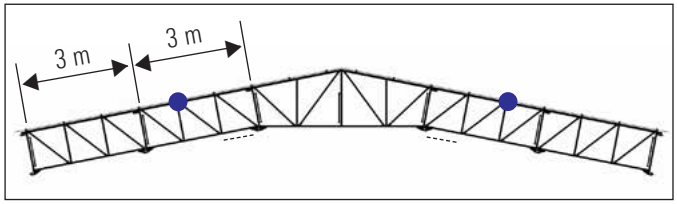


Fig. 5: ***Nominal width B = 15.3 m;*** *14.88…15.58 m*

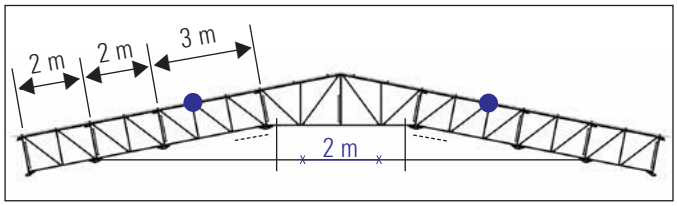


Fig. 6: ***Nominal width B = 17.3 m;*** *16.84…17.54 m*

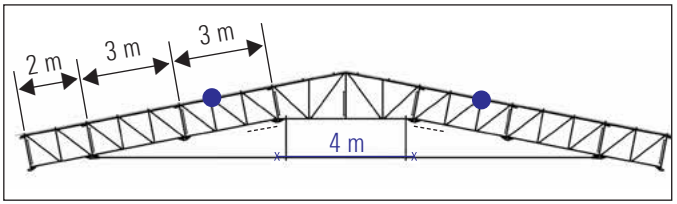


Fig. 7: ***Nominal width B = 19.2 m;*** *18.81…19.51 m*

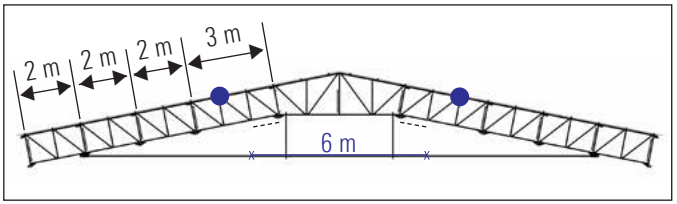


Fig. 8: ***Nominal width B = 21.2 m;*** *20.77…21.47 m*

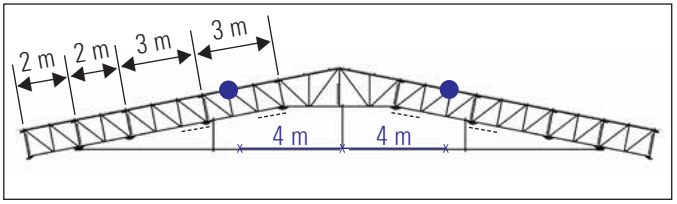


Fig. 9: ***Nominal width B = 23.2 m;*** *22.74…23.44 m*

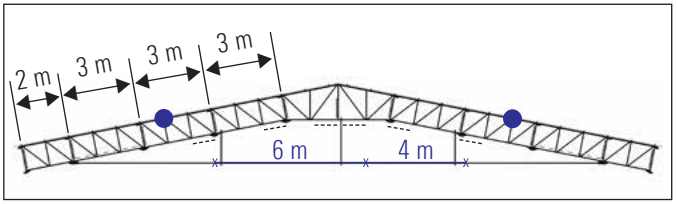


Fig. 10: ***Nominal width B = 25.1 m;*** *24.70…25.40 m*

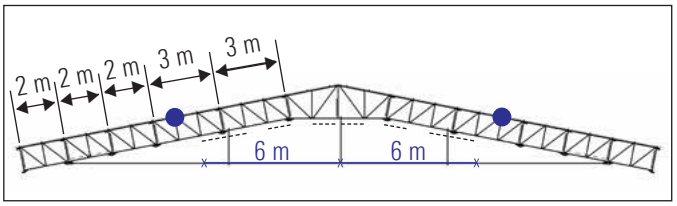


Fig. 11: ***Nominal width B = 27.1 m;*** *26.67…27.37 m*

3. FALL PREVENTION

In line with local regulations, or as the result of a completed risk analysis, fall prevention devices are needed during assembly or dismantling and when walking over the finished cassette roof.
The suitability of PSA for preventing falls must be checked for the specific application. Particular attention must be paid here to the minimum fall heights (clear height underneath the user) as stated in the specifications of the connector manufacturer.

According to German DGUV 38 regulations, devices (to prevent falls by personnel) must be provided for work areas and walkways where the height of the fall is more than 2.0 m. Future safety regulations will require for walkways measures to prevent falls where the height of the fall is 1.0 m.

Openings in roof surfaces must be provided with devices to prevent people from falling or stepping into them.

Components of rope safety gear for PSA

The rope safety gear consists of the following components:
1. Safety harness
2. Connecting line
3. Safety rope with rope guide, fall arrester, rope tensioner and runner element

Safety harness and connecting line
For use of the safety harness and connecting line please refer to the appropriate instructions for assembly and use from the supplier.

Safety rope as attachment device
The safety rope is, as shown in the following picture, fitted to the roof trusses before they are lifted onto the support scaffolding.

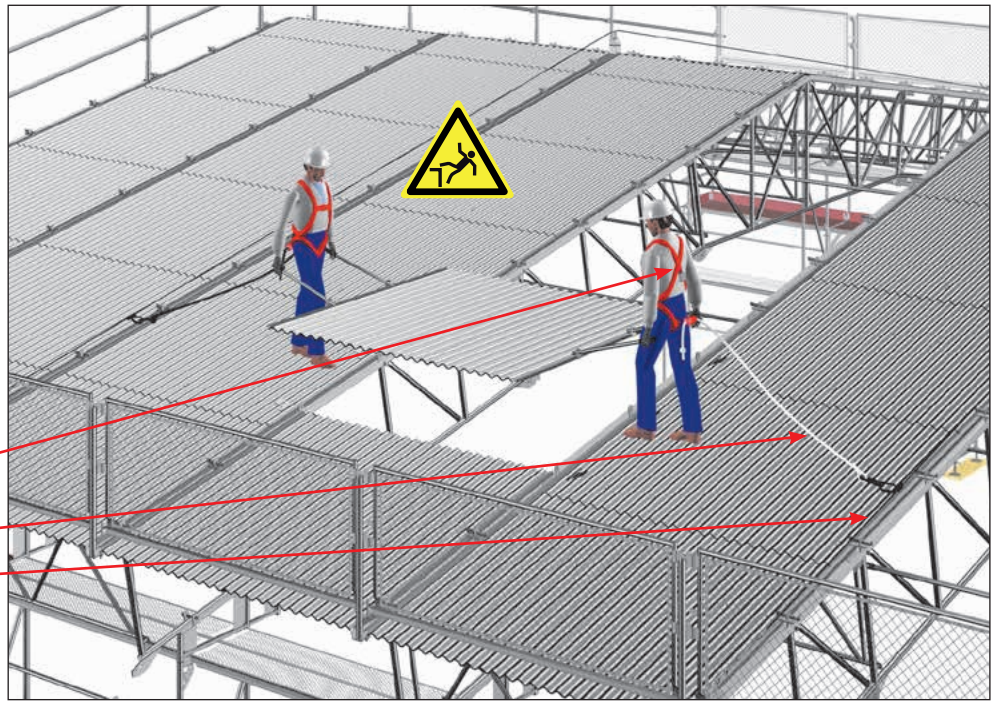


Fig. 12

For covering over an intermediate bay on the cassette roof, the safety ropes must always be fitted on the longitudinal side of the truss that is opposite the risk-of-fall edge. This means that the safety rope of the first erector must be fitted to the intermediate bay [1] at the gable edge [1a], that of the second erector on the second truss bay[1b]. During pre-assembly of the trusses on the ground, a safety rope is always installed on the same truss side [1b, 2b...], except for the first truss bay. In this case the safety rope is fitted directly on the gable side. Once the first intermediate bay is [1] covered, the safety rope must be repositioned on the cassette roof for laying the next intermediate bay [2] [first 1a to 2a]. Attachment is now made to the newly positioned safety rope [2a], and the rope at the risk-of-fall edge [1b] is removed and passed downwards for re-fitting. To cover the second intermediate bay, the first erector is attached to safety rope [2a] and the second to the safety rope [2b].
This cycle is now repeated until the cassette roof has been completely covered with roof cassettes.

Position of the safety rope
- Laying the first intermediate bay
- Laying the second intermediate bay

Fitting/removing the safety ropes
- Fitting to truss bay on the ground
- Moving to the cassette roof
- Dismantling and re-fitting on the ground

For fitting the safety rope see the following page.

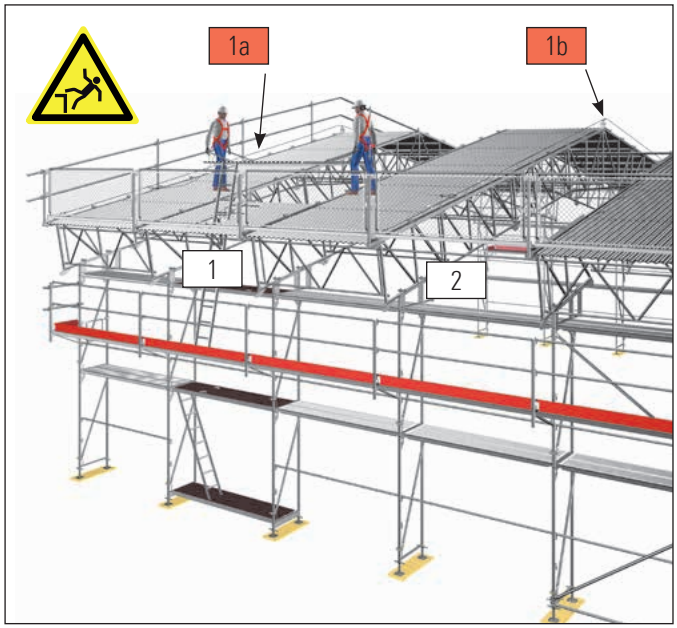


Fig. 13

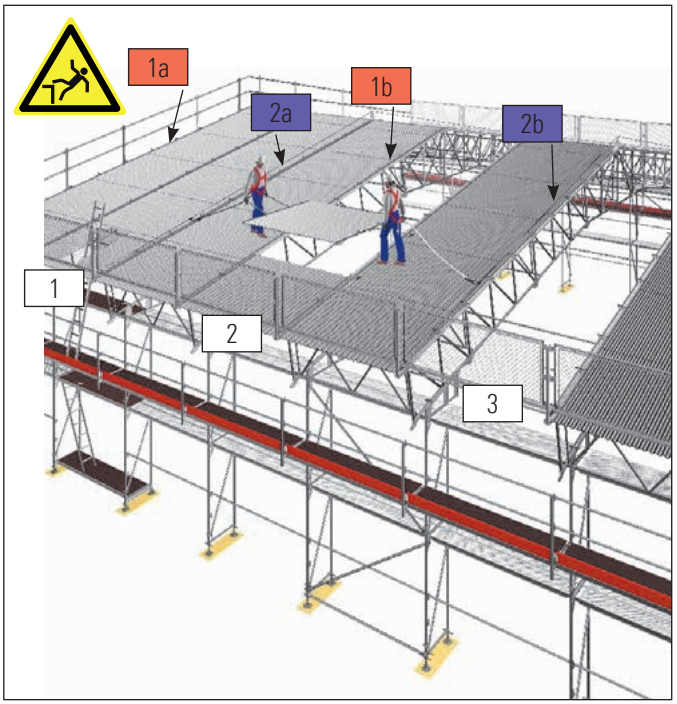


Fig. 14

Fitting the safety rope

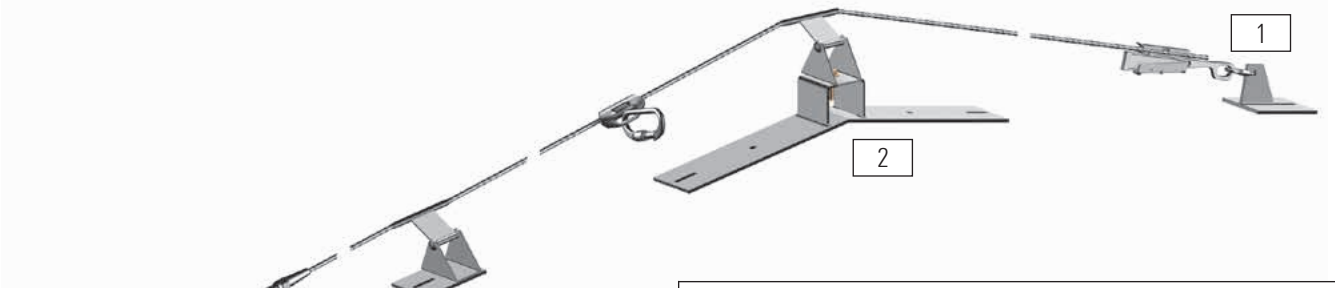


Fig. 15

1. Fitting the first end fastener
The end fastener is placed on one eaves side of the cassette roof instead of the first clamping plate on the top chord of the lattice beam, and wedged in place. The rope pre-tensioner must be fastened to the end fastener using the 8 mm screw shackle (Fig. 16).

2. Fitting the ridge fastener
The ridge fastener is attached to the two upper fastening plates of the ridge support using wedges. An intermediate element must be put in place and bolted (Fig. 17).

3. Fitting the second end fastener
The second end fastener is fitted on the opposite eaves side as described under 1. The fall arrester must be bolted to the end fastener, and the rope end tensioner must be attached to the latter using a bolt and a cotter pin (Fig. 18).

4. Fitting an intermediate fastener
Intermediate fasteners are also used instead of the clamping plates of the cassette roof and wedged in place. The maximum free rope length is 15 m! An intermediate element must be put in place and bolted (Fig. 19).

5. Installing the safety rope
The safety rope is now attached to the pre-installed fasteners and guides in accordance with the fitting instructions of the safety rope manufacturer.

Fig. 16

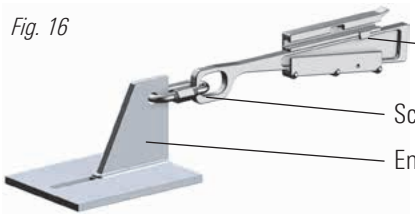


Fig. 17

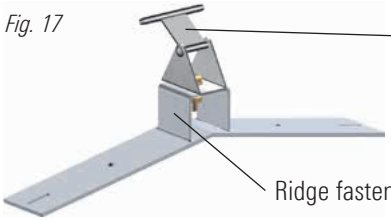


Fig. 18

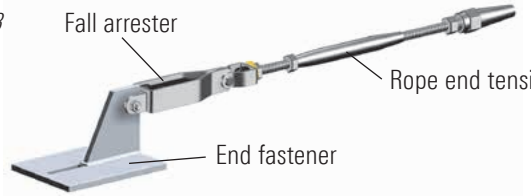
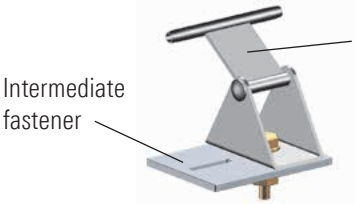


Fig. 19



GENERAL INSTRUCTIONS FOR USING THE SAFETY ROPE

Safety rules

Failure to observe the safety rules can result in risk to life!

- The safety rope may no longer be used even if it is only slightly damaged
- Devices that are damaged, or about which there is any doubt, must immediately be withdrawn from use
- Have regular inspections performed by qualified persons, and record them in the inspection book
- Unauthorised modifications or repairs are not permitted
- The safety system may only be used by personnel who have been instructed and made aware of the hazards
- Accessories from other manufacturers must not impair functional capability or safety
- Clothing and shoes must be appropriate for the use and the weather
- Only to be used by persons in good health (occupational health check G41 relating to working where there is a risk of falling)

Inspections

The fall preventer must be inspected before every assembly job and prior to every use!

The fall preventer may not be assembled or used if even the slightest fault is found! Repairs may only be carried out at a workshop authorised by the manufacturer to do so.

Visual inspection

- Check all parts for completeness and the absence of damage
- In addition, check the function of movable parts
- Check load-bearing parts for deformation or the development of cracks
- Check textile and metallic parts for wear and damage

Function check

- It must be easy to fit the runner element onto the system
- Safety cotter pins on the rope tensioners must be present and must be undamaged

Annual inspection

The fall preventer must be inspected by a qualified expert once a year. The results must be entered in the inspection book.

Storage

- Store and transport system parts and personal safety apparatus in such a way that they are protected from moisture and mechanical effects
- Transport should wherever possible take place in a separate storage box or in the equipment case

Servicing/care

- Dry any system parts and personal safety apparatus that become damp
- Remove dirt by rinsing/brushing it off with water

Repair

- Repairs may only be carried out by the manufacturer or by the manufacturer's authorised partners
- Only the manufacturer's original parts may be used

4. ASSEMBLY DESCRIPTION

General information

Caution: All the relevant regulations such as product and calculation standards, the German Ordinance on Industrial Safety and Health (OH&S), TRBS 2121-1 rules, DGUV Information 201-011 and the manufacturer's instructions on assembly and use must be observed during assembly and use of the cassette roof.

Assembly, modification and dismantling may only be carried out under the supervision of a qualified person by suitably skilled personnel after specific instruction.
At wind strengths above 6 on the Beaufort scale (resistance felt when walking against the wind), assembly work must be halted.
After completing assembly, check that all connectors (bolts, screws, wedges etc.) have been installed according to the plan. In the case of bolt connections, check whether the bolts have been secured with safety clips.
The cassette roof may not be mounted on the support scaffolding until all the anchorages and reinforcements for the support scaffolding have been fitted in accordance with specifications! Any tarpaulin covers must be put in place completely after the cassette roof has been assembled! Its stability must be inspected at regular intervals. Support scaffolding, connections and anchorages must be checked by qualified personnel, particularly after long interruptions to the work and following storms, heavy rain, severe frost or other natural events!

Assembly of support scaffolding

Support scaffolding must always be structurally verified, like the roof itself. As a rule, the overall supporting structure is verified. Whether separate verification is possible for the roof and the support scaffolding is at the discretion of the engineer responsible for verification. The loads resulting from the cassette roof and the support scaffolding must be traced all the way to the ground on which they are assembled. Lifting forces due to wind must be verified separately.
For system scaffolding and for other scaffolding (for example made of tubes and couplers), DIN EN 12811 applies in addition.
The inner and outer standards of the scaffolding frame, or the standards of the support scaffolding, must in all cases be secured with locking pins.

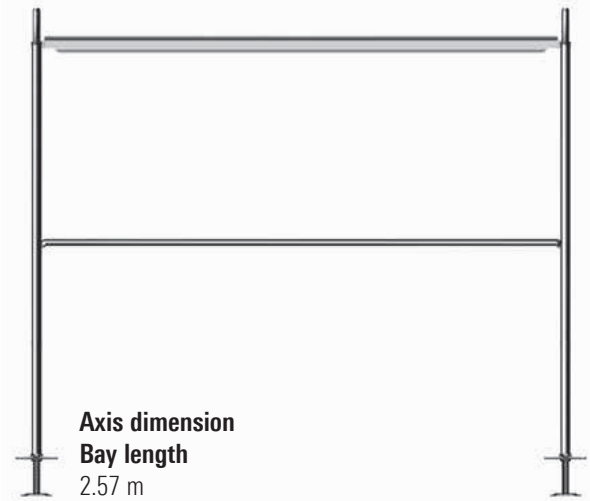
For subsequent mounting of the cassette roof, the top scaffolding level must be provided with side protection. This can be done preferably by attaching brackets about 1.1 m below the top deck level (Fig. 20) or by attaching 1.0 m high frames or standards and fitting upper guardrails and knee rails on both sides (Fig. 21).

Fig. 20

Fig. 21

System dimensions

The Layher cassette roof does not require any specific substructure. It can be fitted onto almost any scaffolding or other suitable substructures. Appropriate roof supports are available on request.



Axis dimension
Bay length
2.57 m

Axis dimensions
Assembly frame
0.73 / 1.09 m

Axis dimensions
Roof support
0.73 / 1.09 m

Fig. 22

Supporting structures – examples

The following shows some examples for the use and assembly of the Layher cassette roof. Please note that these can only serve as general illustrations of the possibilities for design and for preliminary calculation!

In individual cases, technical preparation is required to match the specific conditions, such as structural parameters, assembly location, scaffolding system, scaffolding width, height of structure, wind and snow conditions, type of covering and the span.

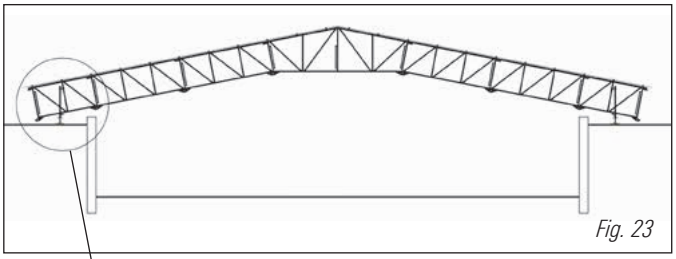


Fig. 23

Protective roof without support scaffolding

Use of the cassette roof to cover excavations or shafts. The system is also applicable when the roof structure is mounted on existing building components. The support point must be designed appropriately for the loads that occur. Depending on the nature of the ground, sufficient load distribution (underpinning) must be assured. Local conditions, such as the actual height of the cassette roof above ground level, will affect whether any anchorage against lifting forces (wind suction) will be required.

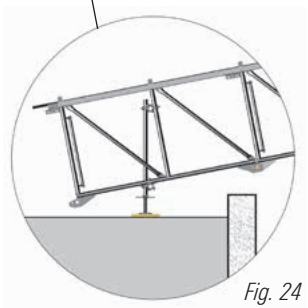


Fig. 24

Mobile cassette roof

In this case, specially designed heavy-duty fixed wheels are used instead of stationary supports. The cassette roof must be secured when in its working position to prevent it from rolling away; large cassette roofs can easily be moved with grip hoists.

Absorption of the high wheel loads must be assured using guide rails and substructures provided by others.

If a mobile protective roof is used for the renovation of building roofs, sufficient anchorage against lifting wind loads must be provided, particularly if the gable ends of the cassette roof remain open.

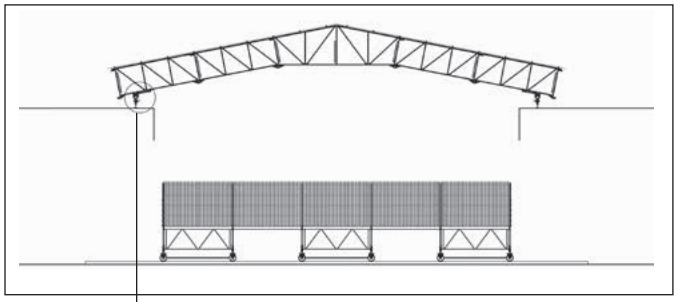


Fig. 25

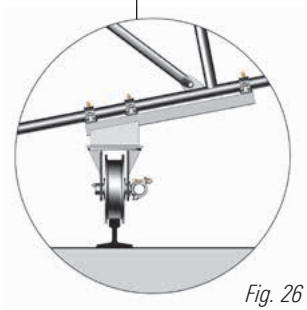


Fig. 26

Temporary warehouse

With the aid of support scaffolding of low height, usually of 1 – 2 levels, the Layher cassette roof can create a building used, for instance, to protect excavation or foundation work, or to serve as a temporary warehouse. Anchoring and/or bracing of the support scaffolding is required. Anchoring is achieved mainly using ground anchors, the loading capacity of which depends on the nature of the ground. Plug connections to concreted foundations, ballasting or cable braces are alternative solutions. Bracing requires anchoring or suitable ballast weights to absorb the cable force at the lower end.

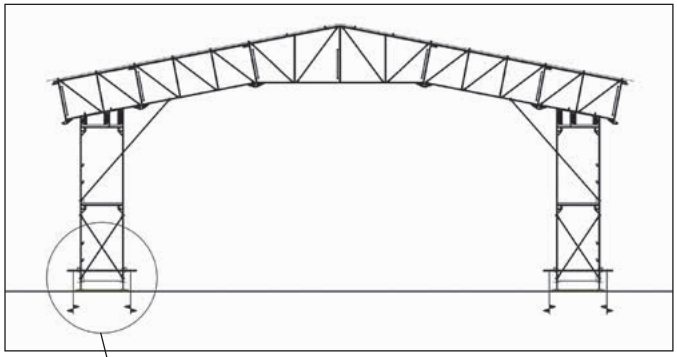


Fig. 27

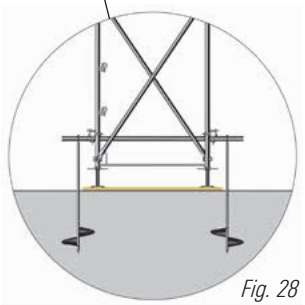


Fig. 28

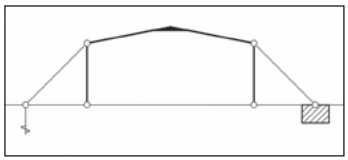


Fig. 29

Weather protection buildings

To enclose entire buildings, higher scaffolding that has to be anchored to the building is usually required.
The critical point, besides the additional loads from the cassette roof in the case of large spans and/or high snow loads, is the stress caused by wind on the free-standing parts of the scaffolding.

To absorb these wind loads, the scaffolding must be given more reinforcement than the structure as required for approval. In many cases it is sufficient to install section braces. If the building is particularly tall and/or there is a large unsupported assembly height, then it might be necessary to strengthen it by widening the scaffolding, unless a favourable ground plan (Fig. 30) allows the wind loads to be absorbed by the gable walls. Alternatively, cable braces are also possible, and these may in some cases be designed with inward pull.

In all the examples shown, high forces occur at the last anchoring level and must be absorbed mostly by double or special anchoring.

Lifting forces caused by the wind depend on the assembly height and on the wall covering.

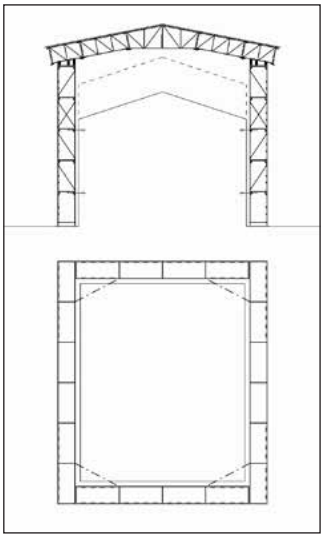


Fig. 30: SpeedyScaf with section braces

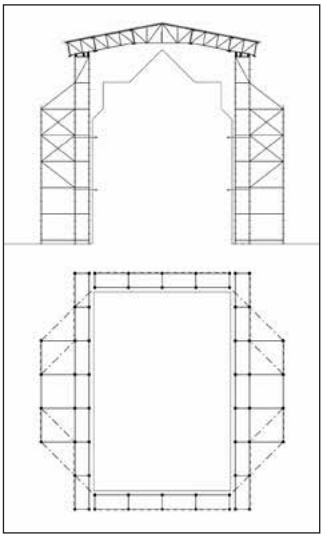


Fig. 31: Allround Scaffolding with widening

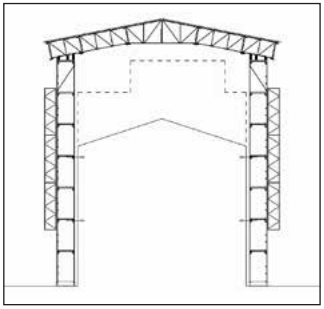


Fig. 32: SpeedyScaf reinforced by lattice beams

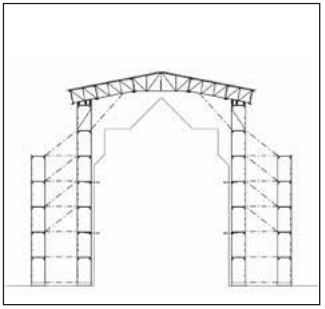


Fig. 33: SpeedyScaf with widening

5. ASSEMBLY

General information

The main load-bearing elements of the cassette roof are roof beams 1.0 m in height and 2.0 or 3.0 m in length. Ridge supports fix the roof pitch at 11°. The U-shaped top chord of the roof beams receives the roof cassettes and at the same time provides drainage.
The roof cassettes consist of a sturdy steel frame and they also brace the cassette roof horizontally. The roof surface is formed by corrugated steel sheets that can be walked on. Alternatively, it is possible to insert light cassettes.
Caution: Light cassettes cannot be walked on, and may only be used alternating with roof cassettes and only in intermediate bays! Light cassettes must not be walked on. The utmost care must be taken here when clearing away snow!
The structural bracing of the individual truss bays or the trusses + fitted bays is achieved using beam stiffeners each fitted to the beam joint. Tube stiffeners must be installed in the intermediate bays instead of beam stiffeners.

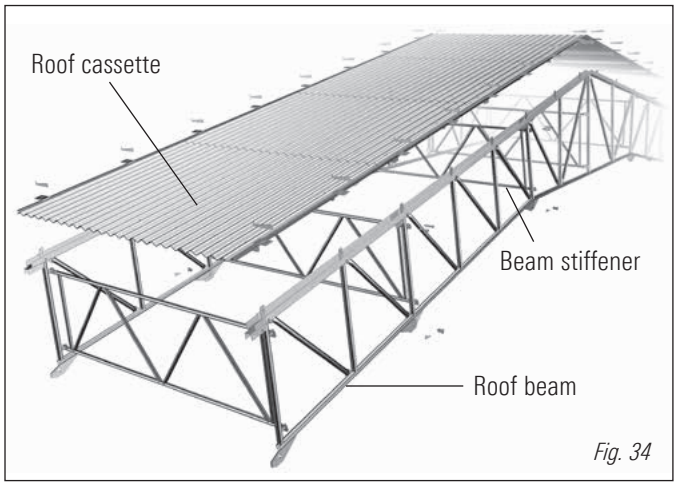


Fig. 34

Roof assembly

Beam stiffener
in truss bays and fitted bays

Tube stiffener
in intermediate bays

The roof is assembled in the case of an **odd number of bays** alternatingly with truss bays (beams, beam stiffeners, roof cassettes) and intermediate bays (roof cassettes and tube stiffeners).
In the case of an **even number of bays** a fitted bay must be installed. This is pre-assembled together with the adjacent truss bay and raised by crane using a crane lifting beam.
To keep the required crane capacity as low as possible, the position of the fitted bay is selected close to the crane location. The fitted bay does not have to be fitted to the end of the roof: it can also be located inside the area of the roof.

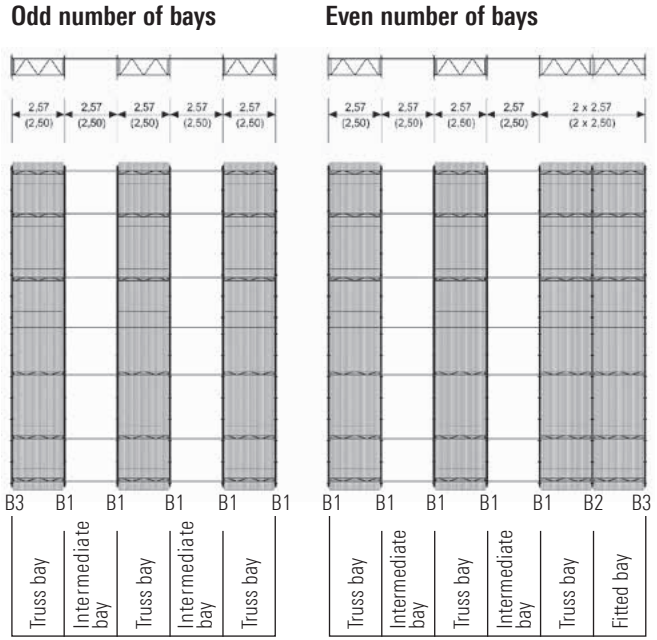


Fig. 35

Design variants of standard version

For the standard version of the roof trusses shown on page 7, calculations were made for the effect combinations of 'dead weight and snow' and 'dead weight and wind suction' according to the load diagrams and load quantities shown below. For dead weights see page 29. Depending on the effects, the variants found in the following table are obtained.

Nominal width B	characteristic snow load 0.25 kN/m² (as per Fig. 37)			characteristic snow load 0.75 kN/m² (as per Fig. 37)		
	characteristic wind suction load (as per Fig. 36)			characteristic wind suction load (as per Fig. 36)		
	0.33 kN/m²	0.37 kN/m²	0.58 kN/m²	0.33 kN/m²	0.37 kN/m²	0.58 kN/m²
13.3 m	✓	✓	✓	✓	✓	✓
15.3 m	✓	✓	① (UG)	✓	✓	① (UG)
17.3 m	① (UG)	① (UG)	OG / ① (UG)	ZB / ① (UG)	ZB / ① (UG)	ZB / OG / ① (UG)
19.2 m	✓	① (UG)	OG / UG	ZB	ZB / ① (UG)	ZB / OG / UG
21.2 m	UG	UG	✕	ZB / UG	ZB / UG	✕
23.2 m	ZB / UG	ZB / OG / UG	✕	ZB / UG	ZB / OG / UG	✕
25.1 m	ZB / OG / UG	ZB / OG / UG	✕	✕	✕	✕
27.1 m	ZB / OG / UG	ZB / OG / UG	✕	✕	✕	✕

① (UG) A 2.0 m roof beam must be connected to the ridge support, if not an anti-buckling brace is required in the bottom chord (see page 19)
ZB Tie
OG Top chord connection with 3 bolts
UG Anti-buckling brace in bottom chord
✕ not permissible!
✓ no further measures

Wind suction loads taken into account during verification of standard version

Characteristic value of wind suction load:
w = 0.33 kN/m²
w = 0.37 kN/m²
w = 0.58 kN/m²

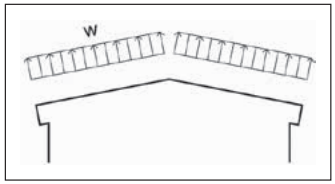


Fig. 36

Snow loads taken into account during verification of standard version

Characteristic value of snow load:
s = 0.25 kN/m²
s = 0.75 kN/m²

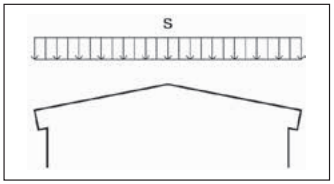


Fig. 37

Truss details

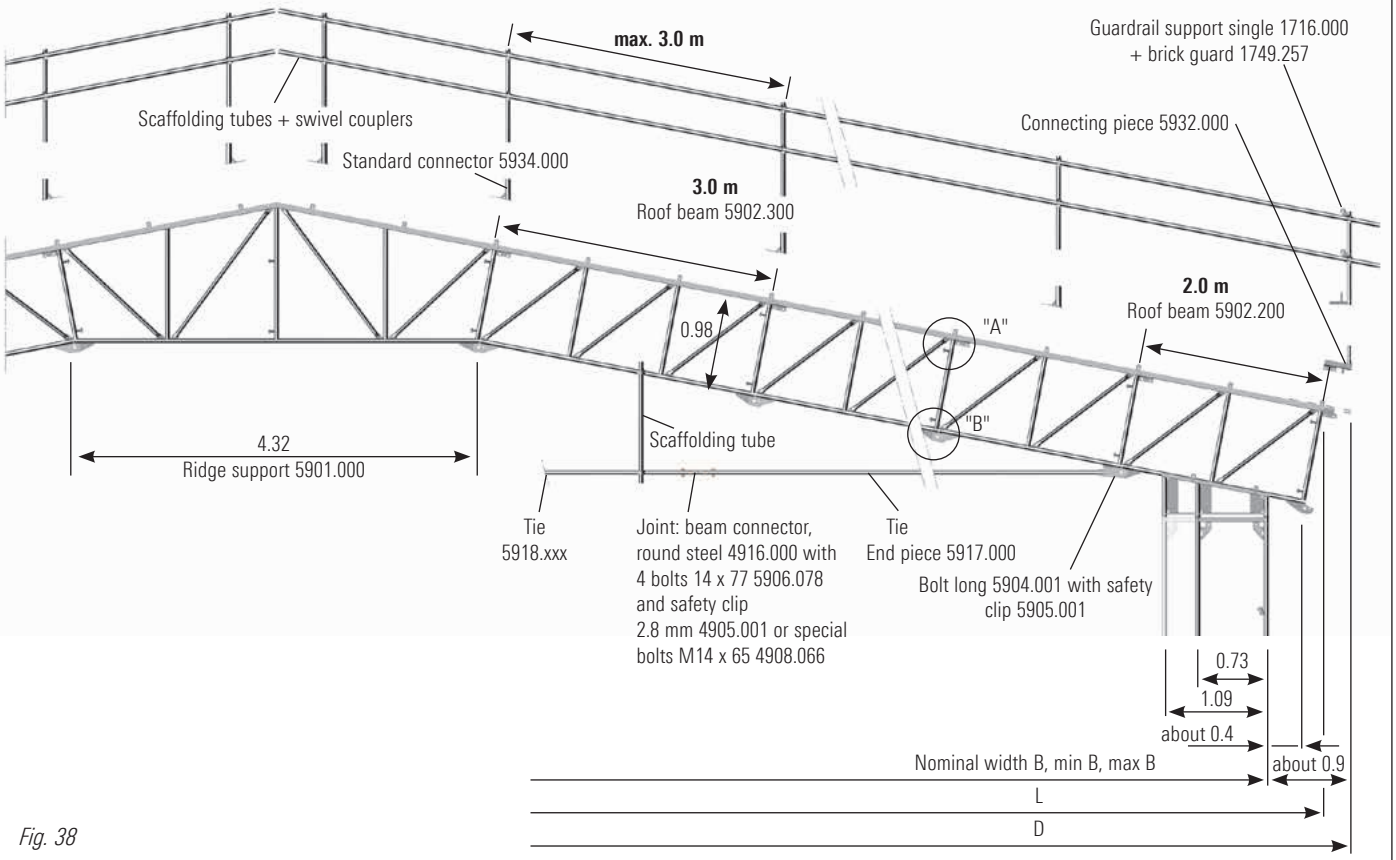


Fig. 38

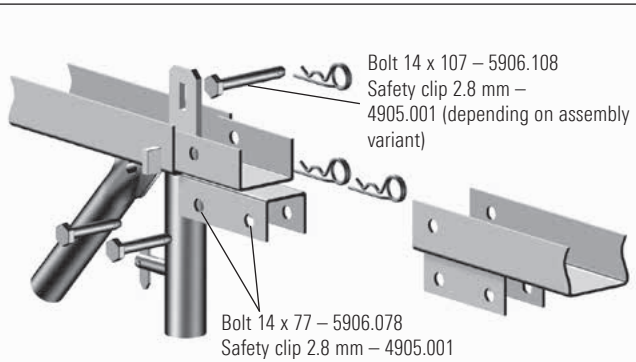
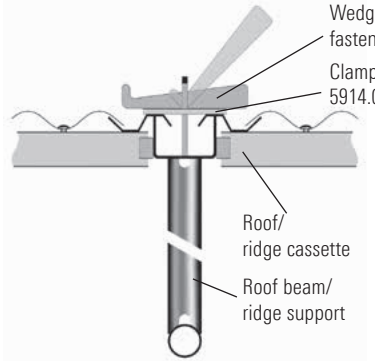


Fig. 39: Detail A – top chord joint



The roof cassettes are inserted in the channel section of the top chord and are secured positively and non-positively using wedges. The clamping plate acts here as a force-distributing base between the wedge and the suspension section of the roof cassette.

Fig. 40: Cassette suspension

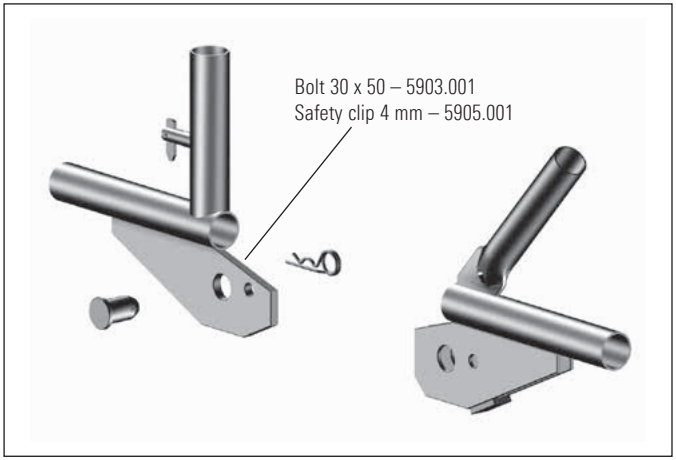
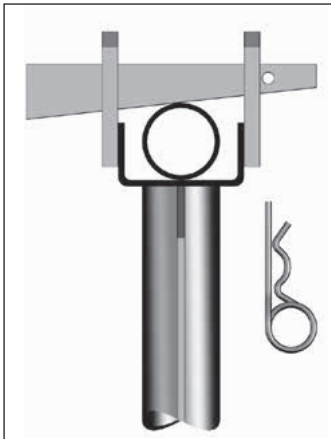


Fig. 41: Detail B – bottom chord joint



Room beam secured against being lifted off by wedges 5913.003 and safety clips 5905.001.

Connect roof support to scaffolding, assembly frame and standards with locking pins 4000.001.

Fig. 42: Roof support

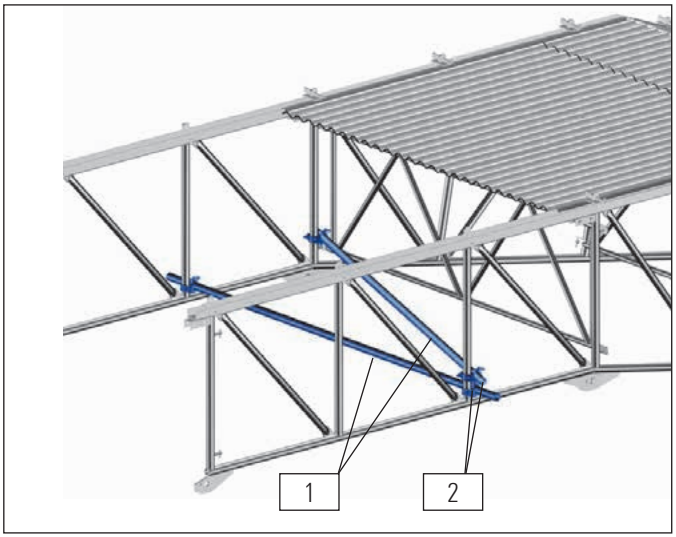


Fig. 43

Anti-buckling brace in bottom chord

The anti-buckling brace must be installed in the bottom chord in a number of assembly variants (see section 5).

1 Scaffolding tubes
2 Layher double couplers

Assembly sequence

The truss bays are assembled on the ground, see the following for assembly sequence 1 – 12. After completing assembly, all connections using screws, bolts, tilting pins and wedges must be re-checked!
When personal safety apparatus (PSA) is being used, the safety rope to which the connecting line must be attached must also be fitted on the ground!

Pre-assembly of roof trusses

1. Setting up of the two ridge supports, connection to three beam stiffeners and subsequent alignment (Fig. 44).
Care must be taken that the tilting pin flap that prevents the installed beam stiffener from slipping out is not damaged!
As assembly progresses, beam stiffeners must be fitted at every beam joint! To allow the roof cassettes to be easily slid on, even with 3.0 m long roof beams, the beam stiffener can be installed after the roof cassette has been put in place (Points 3 and 4).

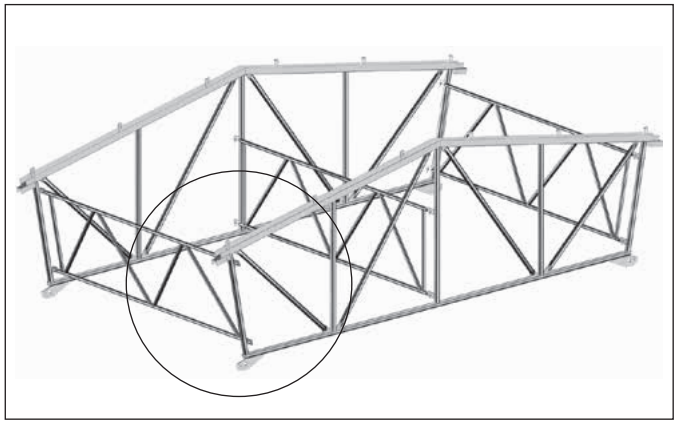


Fig. 44

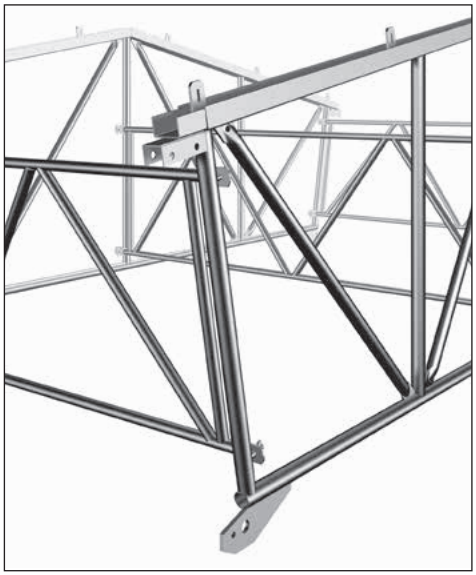


Fig. 45: Detail of Fig. 44

WARNING

Missing stiffeners reduce the load-bearing capacity and can lead to collapse of the roof.

2. Put the roof and ridge cassettes in place.

Place clamping plates onto the two upper fastening straps, and insert the wedges (Fig. 46). The wedges are hammered home as soon as the next roof cassette has been put into place.

Fig. 46

⚠ WARNING

Missing wedges can cause the roof cassettes to lift off and reduce the stiffening of the roof structure.

The ridge fastening for the safety rope is already attached at the gable end instead of the clamping plates (Fig. 48).

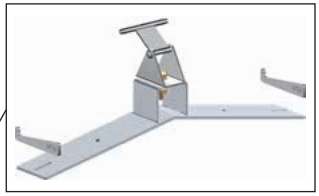


Fig. 47

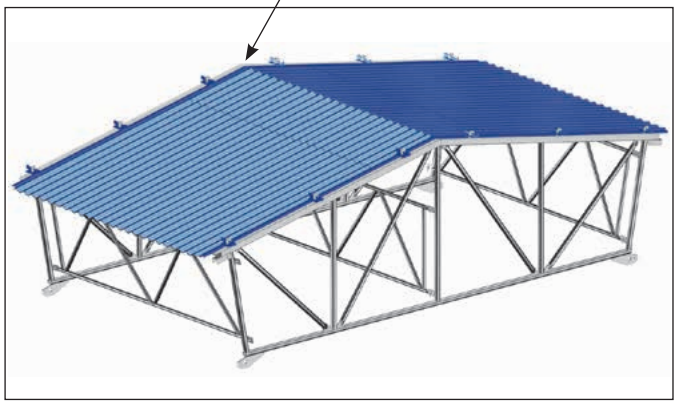


Fig. 48

Tip: To allow the next cassette to be slid under the previous one, a wedge can be placed on both sides between the channel section of the roof beam and the suspension section of the cassette.

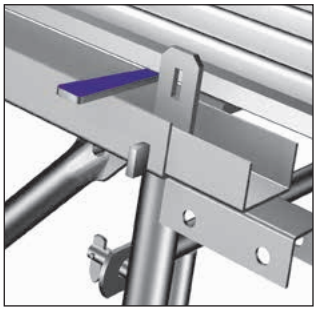


Fig. 49

3. Lift the assembled unit (using crane or fork-lift) on one side and connect the 2.0 or 3.0 m roof beams depending on the planned span (Fig. 50).

Connect the beam joint with bolts:
top chord
- 2 bolts, 14 x 77 mm and
- 1 bolt, 14 x 107 mm
  [depending on assembly variant];

bottom chord
- 1 bolt, 30 x 50 mm

They are secured with 2.8 or 4 mm safety clips.

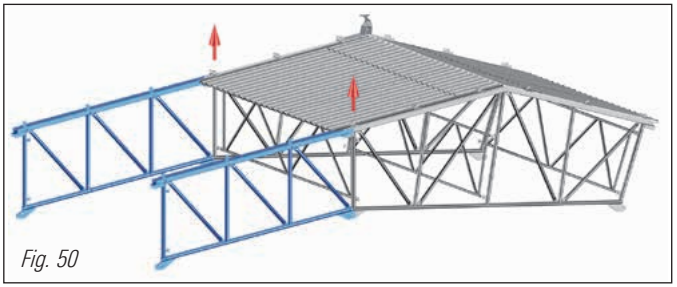


Fig. 50

⚠ WARNING

Missing bolts reduce the load-bearing capacity and can lead to collapse of the roof.

4. Put a further roof cassette in place, and insert clamping plates and wedges. Fit a further beam stiffener. Knock in the wedges at the previously emplaced roof cassettes (Fig. 51)!

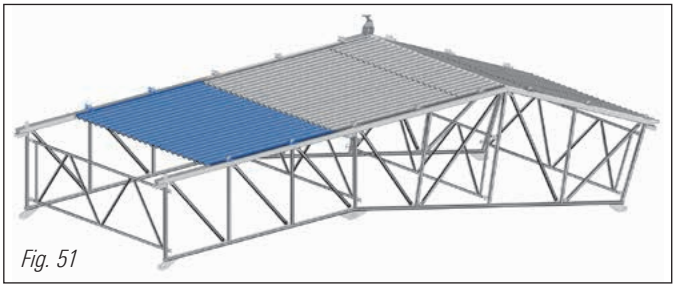


Fig. 51

5. Lift up the assembled unit and connect further 2 m or 3 m roof beams.

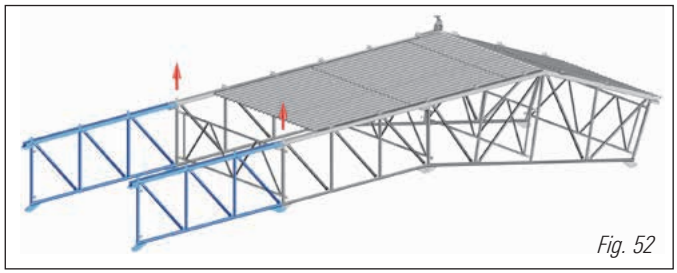


Fig. 52

6. Position further roof cassettes. Insert clamping plates and wedges. Install a further beam stiffener. Knock in the wedges at the previously emplaced roof cassettes!

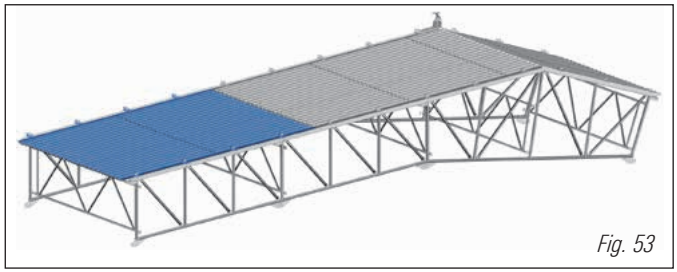


Fig. 53

7. Lift up the assembled unit and connect further 2 m or 3 m roof beams. Fit a further beam stiffener.

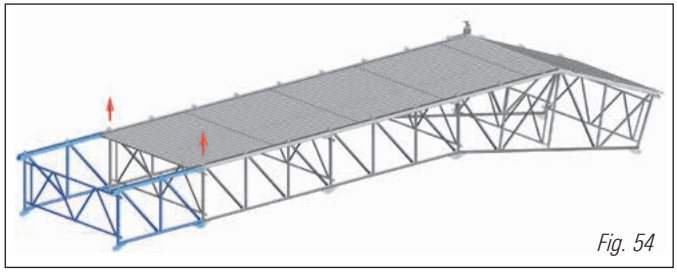


Fig. 54

8. Put a further roof cassette in place, and insert clamping plates and wedges.
Repeat steps 7 + 8 until the half-truss has been fully assembled in accordance with the planned cross-section. Then follow the same sequence to assemble the other half-truss.

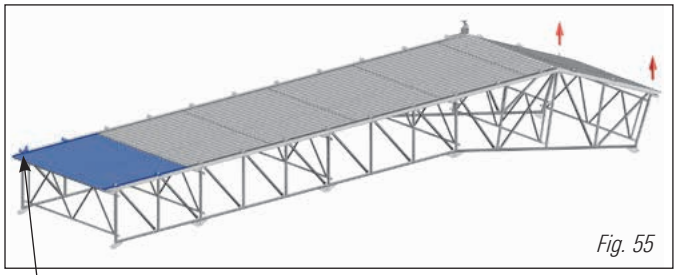


Fig. 55

Fig. 56

An end fastener for tightening the safety rope must be fitted at each gable side instead of the last clamping plate (Fig. 55)!

Caution! When a tie is fitted, a 2.0 m roof beam must be used at the end of the truss. The tie is fitted after all the roof beams have been assembled and the roof cassettes put in place (see also page 18).

Fig. 57

9. A verge safety guardrail must be fitted to the two outer trusses. To do so, standard connectors spaced max. 3.0 m apart are used instead of clamping plates. Scaffolding tubes 1.0 m long are inserted into the tube connectors of the standard connectors, and the guardrail is made up of scaffolding tubes and couplers (for guardrail heights see DIN EN 12811). Tube joints must be connected using centering pins and joint couplers!

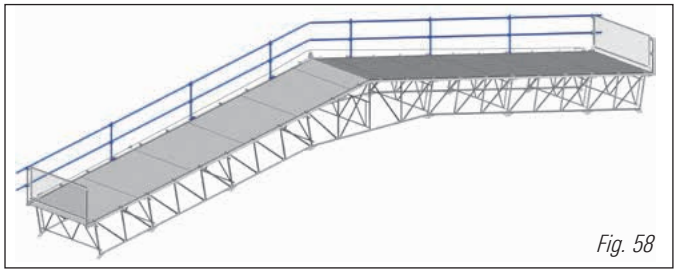


Fig. 58

⚠ WARNING

The guardrail loads cannot be sustained if the posts are too far apart. This can lead to collapse.

10. At the end of each truss, the connecting pieces for the side protection on the eaves side must be fitted, guardrail supports pushed on, and the brick guards hung in place and wedged (see also page 18).
Caution: The safety rope for the rope safety gear must be fastened to each truss in accordance with section 3 (page 8).

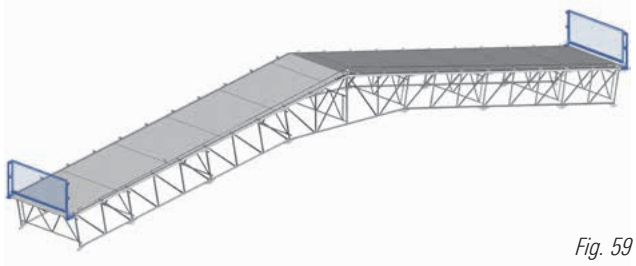


Fig. 59

11. Lift the truss bay using a crane and suitable lifting gear onto the support scaffolding.
For details of the crane loads see page 24, for the attachment points see page 7.

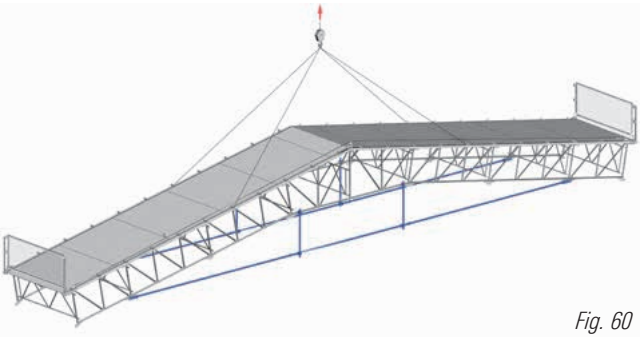


Fig. 60

12. Lift the truss bay and fitted bay together onto the support scaffolding using a crane and suitable lifting gear. The central truss must be held by crosspieces (see page 24).
For details of the crane loads see page 24, for the attachment points see page 7.

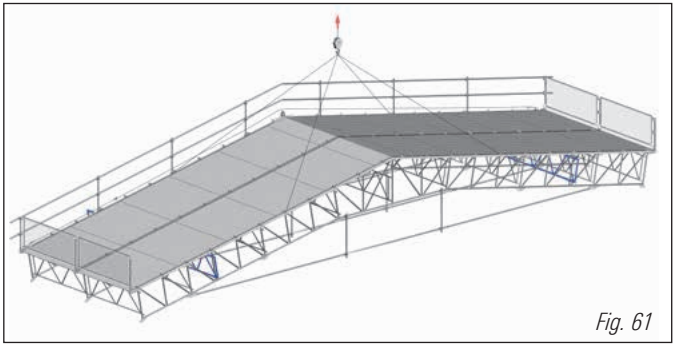


Fig. 61

Crane assembly
The pre-assembled truss bays are placed on the support scaffolding using the crane, the intermediate bays are braced with tube stiffeners and closed with roof cassettes.

- Attachment points for four-part rope or chain gear. For positions of attachment points see page 7. If necessary, also use polyester belt loops or wire rope!

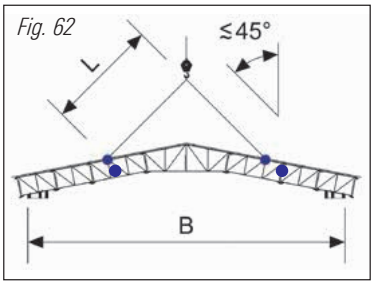


Fig. 62

With normal truss bays the attachment is made directly to the roof beams. When a fitted bay is assembled together with a truss bay, the central truss is held by crosspieces between the two outer trusses. Attachment is then made to the two outer trusses.

Caution: The specifications and the directions for use of the attachment equipment manufacturer, plus the relevant regulations of the professional associations, must be followed without fail!

Section A-A

☐ Double coupler

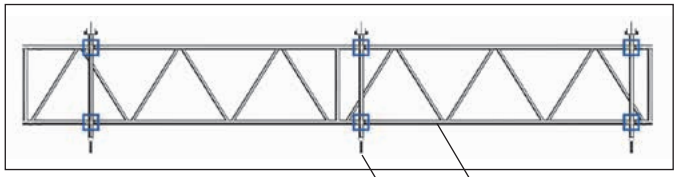
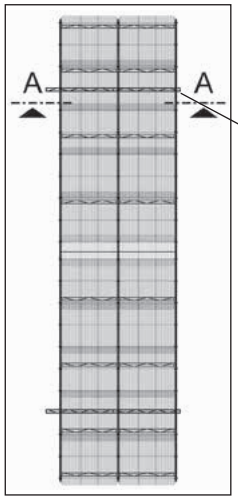


Fig. 63

Plan view

Crosspiece Type A



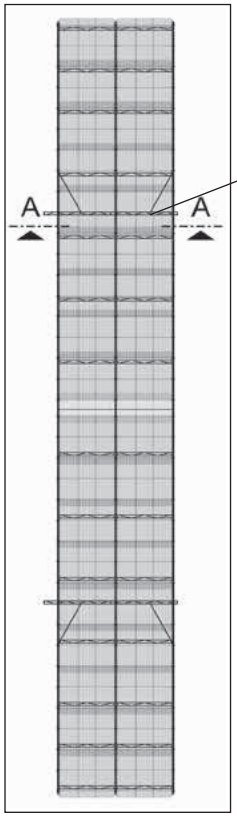
Heavy-duty lattice beam crosspiece 6.0 m

Connection using 3 x 2 double couplers

Fig. 64

Plan view

Crosspiece Type B



Heavy-duty lattice beam crosspiece 6.0 m

Connection using 3 x 2 double couplers and 2 x scaffolding tubes 2.0 m to top chord using swivel couplers

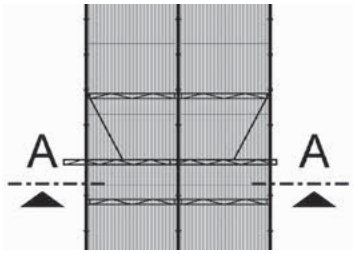


Fig. 65

Fig. 66

Nominal width B	Tie	Truss bay [kg]	Truss bay and fitted bay [kg] *)	Crosspiece Type	Rope length L min [m]
13.3 m	without	1300	2250	A	6
15.3 m		1430	2480	A	6
17.3 m		1670	2880	A	6
19.2 m		1790	3110	A	6
21.2 m		1930	3350	A	6
23.2 m		2160	3730	A	6
19.2 m	with	2000	3410	A	6
21.2 m		2250	3840	A	6
23.2 m		2430	4130	A	6
25.1 m		2710	4560	B	10
27.1 m		2905	4910	B	10

List of crane loads

*) plus the dead weight of the crosspieces:
Types A and B each approx. 200 kg/pair

Fitting the roof trusses on the support scaffolding

The support scaffolding must be built fully in accordance with structural strength requirements and with the valid regulations (see pages 12 – 15). While swivelling the roof truss onto the free-standing support scaffolding, the erectors must be standing on a scaffolding level provided with side protection on both sides, or be wearing rope safety gear!

The truss bays are placed onto the support scaffolding with a crane and suitable lifting gear (for attachment points see page 7).

The truss bays must be positioned as they are being set down. To do so, an erector is ready on each side of the support scaffolding. A rope permits rotation of the truss bay from the deck (Fig. 68).

The wedges at the roof supports must be hammered home immediately and secured using safety clips (see Fig. 67)!

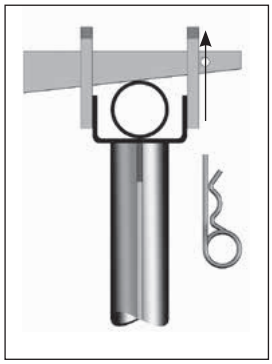


Fig. 67

The truss bays must be connected with tube stiffeners in the area of the eaves, working from the scaffolding.

The roof is assembled in the case of an odd number of bays alternatingly with truss bays (beams, beam stiffeners and roof cassettes) and intermediate bays (tube stiffeners and roof cassettes).
In the case of an even number of bays, a fitted bay must be installed. It is pre-assembled on the ground together with the adjacent truss bay (page 23, No. 12) and placed onto the support scaffolding with the help of a crane lifting beam (lattice beam) (see page 24).

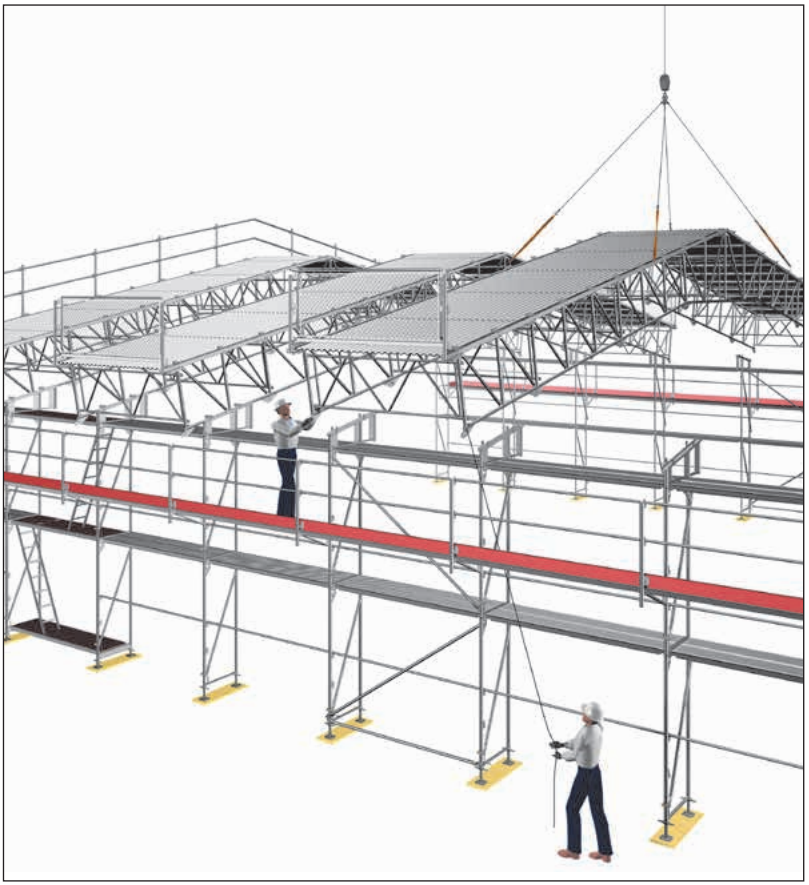


Fig. 68

Fitting the intermediate bay

Personnel on the cassette roof must be protected against falls (see page 8)!

It is recommended to begin with the first intermediate bay, as there is a verge guardrail on the adjacent truss bay (gable area), which means that this truss bay only has one edge where there is a risk of falling.

A cassette with access hatch should be fitted at the level of the support scaffolding on each eaves side, so that it is possible to climb down again onto the support scaffolding once the cassette roof has been entirely laid out.

The cassette roof can be accessed from the top scaffolding level via roof cassettes with access hatch or via a separately provided stair tower.

If a roof cassette with access is used to get onto the roof, a simple ladder should be passed from the bracket level through the roof hatch (Fig. 70). The simple ladder must be secured against slipping (e.g. using a belt tensioner between a ladder rung and the steel frame of the roof cassette).

A secured ladder must also be used to access the roof for fitting the intermediate bay. The erector must immediately attach himself to the safety rope as soon as he is on the roof (Fig. 69).

The eaves-side brick guard of the first intermediate bay must be suspended and wedged in place (Fig. 71)!

Fig. 69

Fig. 70

Fig. 71

A crane is generally used to position the first cassette of the intermediate bay at the eaves, and the cassette is inserted directly.

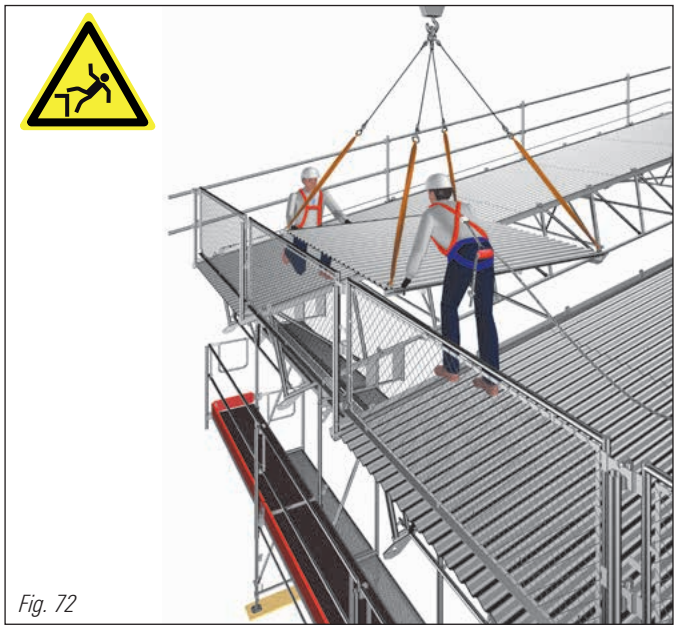


Fig. 72

The tube stiffeners are fitted to the respective beam joints before further roof cassettes are put into place. No tube stiffener is needed in the ridge area.

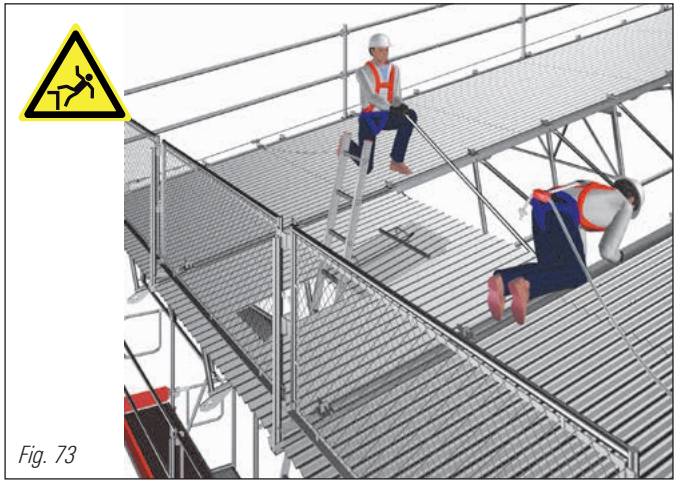


Fig. 73

The intermediate bay is entirely covered with roof cassettes.

Caution: The safety rope for the rope safety gear must be repositioned before the next intermediate bay is put in place (see point 3, page 8)!

Two handles for each fitter simplify laying of the roof cassettes, and avoid the need to get too close to the edge where there is a risk of falls.

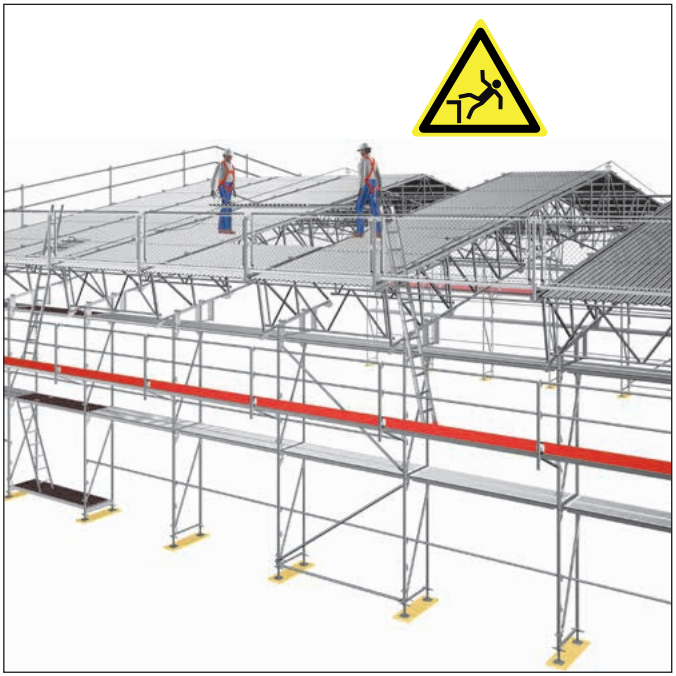


Fig. 74

Side protection at roof openings

Roof openings must be safeguarded all the way round. The necessary guardrails are constructed as for the verge (see point 9 on page 22).
Special standard connectors are fastened to the corners of the opening instead of clamping plates. Scaffolding tubes 1.0 m long are inserted into the tube connectors of the standard connectors, and the guardrail is also made up of scaffolding tubes and couplers (for guardrail heights see DIN EN 12811).
To prevent slipping through above the opening, a third tube must be fitted between the knee-rail and the roof cassette.

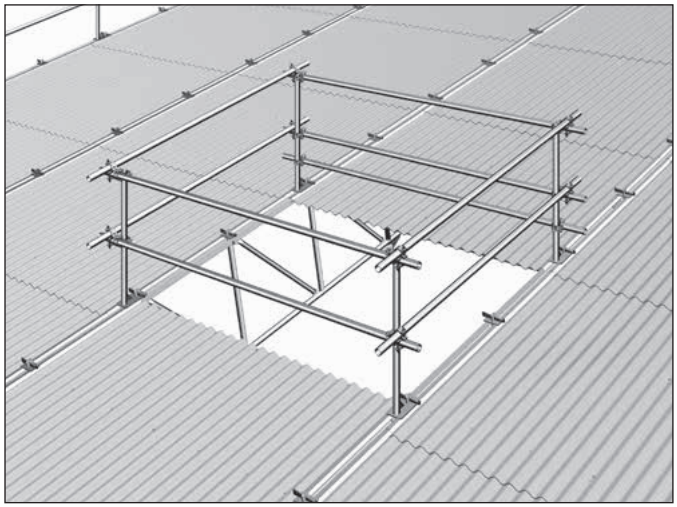


Fig. 75

Dismantling

The cassette roof is dismantled in the reverse order. The following must be noted in addition:

- Remove immediately components of which the connectors have been released.
- To prevent any risk of tripping, removed scaffolding components must not be left on walkways.
- Removed components must not be thrown down.
- Components must be stored properly.

6. VERIFICATION OF STABILITY

Roof structure

Layher roof cassettes and beams are modules with which a cassette roof can be assembled to individual dimensions. The cassette roof can be used either purely as a roof structure or as a partial structure within a more complex one.
In any event, the structural strength must be calculated before the cassette roof is assembled. The support scaffolding – where provided – is part of the structural strength calculation. The loads resulting from the cassette roof and the scaffolding must be traced all the way to the ground on which they are assembled. As a rule, ballast is needed to ensure safety against lifting off and sliding. Standard joints subject to tension must be designed pull-resistant.
Dead weights, cross-sections and materials of the components in the system scaffolding (SpeedyScaf or Allround Scaffolding) are stated in the respective approval notifications. For system scaffolding and for other scaffolding (for example made of tubes and couplers), DIN EN 12811 applies in addition.

Pages 13–15 show the principles behind some typical enclosing structures.

The characteristic dead weight of the roof structure is stated in the following table. This data applies for a truss spacing of 2.57 m.

Spacing of outer standards of support scaffolding			Roof width	Truss length projected into the ground plan	Characteristic value of the permanent effect on the truss due to dead weight of the truss and other roof components, relative to the truss length L [1] projected into the ground plan					
Nominal width B [3]	min B [3]	max B [3]	D [3]	L [3]	Regular truss B1 [2]		Fitted bay truss B2 [2]		Gable truss B3 [2]	
					without tie	with tie	without tie	with tie	without tie	with tie
13.3 m	12.92 m	13.62 m	15.1 m	14.5 m	66 kg/m	72 kg/m	81 kg/m	90 kg/m	47 kg/m	54 kg/m
15.3 m	14.88 m	15.58 m	17.1 m	16.5 m						
17.3 m	16.84 m	17.54 m	19.1 m	18.4 m						
19.2 m	18.81 m	19.51 m	21.0 m	20.4 m						
21.2 m	20.77 m	21.47 m	23.0 m	22.4 m						
23.2 m	22.74 m	23.44 m	25.0 m	24.3 m						
25.1 m	24.70 m	25.40 m	26.9 m	26.3 m						
27.1 m	26.67 m	27.37 m	28.9 m	28.3 m						

[1] Verge and eaves guardrails and other additional expansion components are not included in the weight stated.
[2] For truss designations B1, B2 and B3 see Fig. 35, page 16.
[3] See Fig. 38, page 18

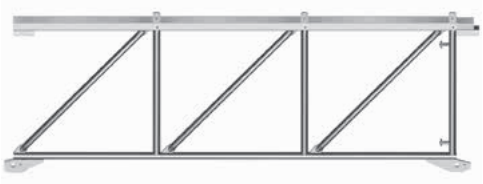
According to our structural strength analysis, the cassette roof with the standard roof truss designs shown on page 7 and with the measures specified on page 17 can be subjected to a characteristic snow load of 0.75 kN/m² up to a nominal width of 23.3 m, and to a characteristic snow load of 0.25 kN/m² up to a nominal width of 27.1 m.

Furthermore, the cassette roof can, according to our structural strength analysis, be subjected to a characteristic wind suction load of 0.58 kN/m² up to a nominal width of 19.2 m, and to a characteristic wind suction load of 0.37 kN/m² up to a nominal width of 27.1 m. A wind load case with a lifting-off wind load symmetrical on both sides was taken as the basis here. A non-symmetrical wind load case and load combinations of snow and wind were not covered by our analysis.

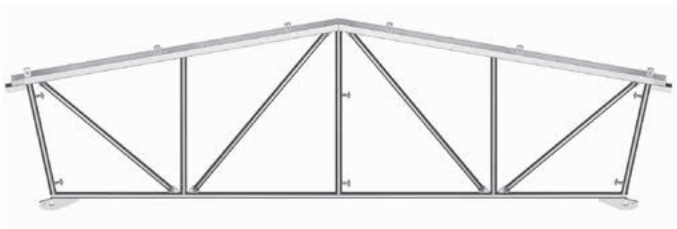
For structural strength analyses of individual projects, we provide general diagrams showing the parts and data sheets with the information needed for verifying the structural strength.

7. COMPONENTS

Roof beam
L = 2.0 m, Ref. No. 5902.200, weight 48.2 kg
L = 3.0 m, Ref. No. 5902.300, weight 64.5 kg



Ridge support
L = 4.3 m, Ref. No. 5901.000, weight 106.0 kg

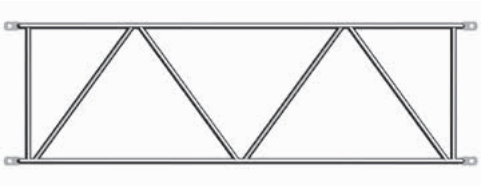


Bolt, 30 x 50
Ref. No. 5903.001, PU 10, weight 3.0 kg
Bolt, 30 x 64
Ref. No. 5904.001, PU 10, weight 4.0 kg
Bolt, 14 x 77
Ref. No. 5906.078, PU 20, weight 2.2 kg
Bolt, 14 x 107
Ref. No. 5906.108, PU 20, weight 3.0 kg

Bolt, M14 x 80, with washer and nut
Ref. No. 5906.081, PU 20, weight 2.8 kg

Safety clip, 4 mm
Ref. No. 5905.001, PU 50, weight 1.5 kg
Safety clip, 2.8 mm
Ref. No. 4905.001, PU 50, weight 0.5 kg

Beam stiffener
L = 2.57 m, Ref. No. 5907.000, weight 15.2 kg



Tube stiffener
L = 2.57 m, Ref. No. 2504.257, weight 5.1 kg

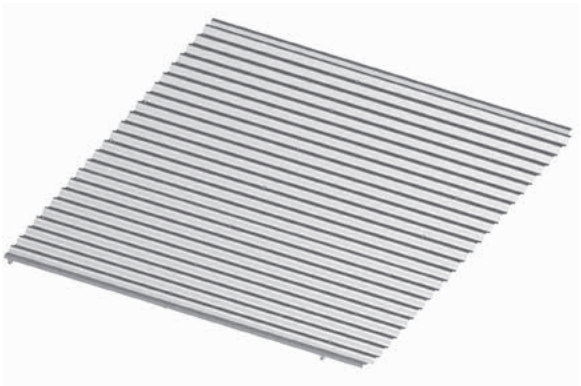
Tie end piece
L = 6.0 m, Ref. No. 5917.000, weight 29.5 kg

Tie
L = 2.0 m, Ref. No. 5918.200, weight 7.1 kg
L = 4.0 m, Ref. No. 5918.400, weight 17.0 kg
L = 6.0 m, Ref. No. 5918.600, weight 25.5 kg

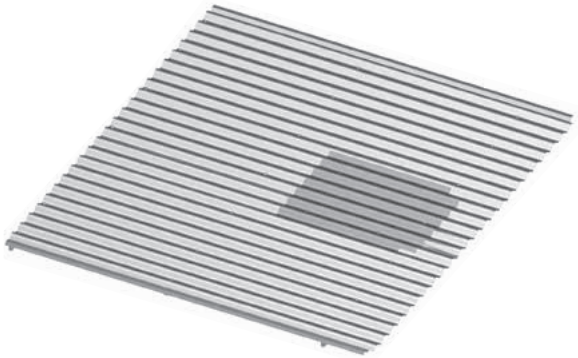
Lattice beam connector
L = 0.44 m, Ref. No. 4916.000, weight 3.4 kg

Special bolt, M14 x 65 with nut
Ref. No. 4908.066, PU 50, weight 6.5 kg

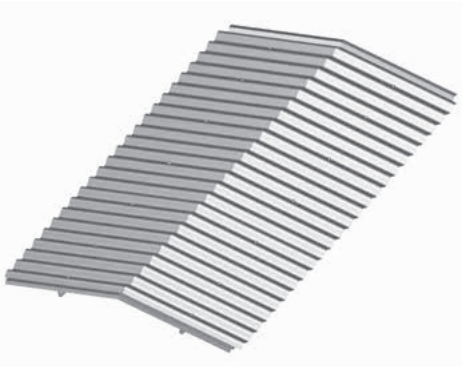
Roof cassette
1.0 x 2.57 m, Ref. No. 5909.100, weight 35.2 kg
2.0 x 2.57 m, Ref. No. 5909.200, weight 66.0 kg



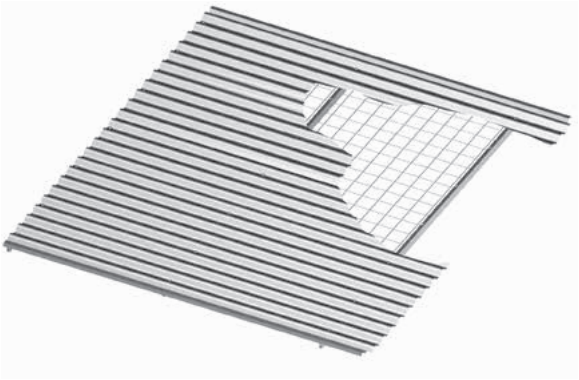
Roof cassette with access hatch
2.0 x 2.57 m, Ref. No. 5910.200, weight 75.7 kg



Ridge cassette
L = 2.57 m, Ref. No. 5911.000, weight 44.4 kg



Light cassette
2.0 x 2.57 m, Ref. No. 5930.200, weight 46.0 kg



Wedge for cassette fastening
Ref. No. 5913.002, PU 25, weight 7.5 kg

Clamping plate for roof cassette, steel
Ref. No. 5914.001, PU 25, weight 15.0 kg

Carrying handle
L = 0.75 m, Ref. No. 5931.100, weight 1.2 kg

Roof support
0.73/1.09 m, Ref. No. 5915.000, weight 15.3 kg

Wedge for roof support
Ref. No. 5913.003, PU 25, weight 7.5 kg

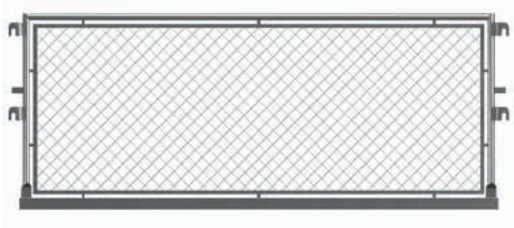
Lower part for walkway, steel
L = 0.73 m, Ref. No. 5916.073, weight 8.7 kg

Connecting piece for cassette support
L = 0.3 m, Ref. No. 5932.000, weight 4.1 kg

Standard connector
L = 0.2 m, Ref. No. 5934.000, weight 3.2 kg

Guardrail support single
L = 1.0 m, Ref. No. 1716.000, weight 5.5 kg

SpeedyScaf brick guard
1.0 x 2.57 m, Ref. No. 1749.257, weight 21.1 kg

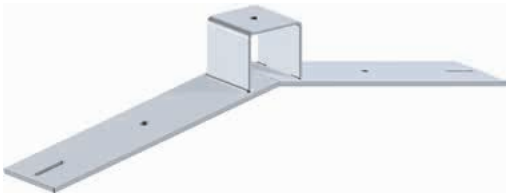


ROPE SAFETY GEAR

End fastener
0.23 x 0.12 m, Ref. No. 5969.010, weight 3.1 kg

Intermediate fastener
0.23 x 0.12 m, Ref. No. 5969.020, weight 2.2 kg

Ridge fastener
0.87 x 0.12 m, Ref. No. 5969.030, weight 9.7 kg



Intermediate element incl. hexagon bolt M12 x 40 and lock nut
L = 0.12 m, Ref. No. 5969.080, weight 0.5 kg

Gripper (runner)
L = 0.09 m, Ref. No. 5969.040, weight 0.4 kg

Rope end tensioner with rope
L = 25.0 m, Ref. No. 5969.025, weight 7.0 kg
L = 35.0 m, Ref. No. 5969.035, weight 9.4 kg

Rope pre-tensioner
L = 0.3 m, Ref. No. 5969.060, weight 1.0 kg

Fall arrester
L = 0.25 m, Ref. No. 5969.070, weight 1.1 kg

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