ABL

ALUMINIUM INDUSTRIAL DECKING

Material properties, basic values for design

Alloy:
Anticorodal-053

EN AW-6106 T6

Tensile strength	R_m	$\geq$	250 N/mm²
0.2 proof stress	$R_{p0.2}$	$\geq$	200 N/mm²

acc. to EN 755-2
for sections with wall thicknesses under 10 mm

Acc. to DIN 4113-1/A1:2002 the following permissible stresses apply:

Tension/Compression:

$\sigma_{perm(H)}$ = 115 N/mm²
$\tau_{perm(H)}$ = 68 N/mm²

Bearing stress for bolts:

$\sigma_{permL1(H)}$ = 145 N/mm²
(Bolts with max 1mm clearance)

$\sigma_{permL2(H)}$ = 180 N/mm²
(Bolts with max 0.3 mm clearance)

Alloy:
Anticorodal-114

EN AW-6082 T5

Tensile strength	R_m	$\geq$	270 N/mm²
0.2 proof stress	$R_{p0.2}$	$\geq$	230 N/mm²

acc. to EN 755-2
for sections with wall thicknesses under 5 mm

Acc. to DIN 4113-1/A1:2002 the following permissible stresses apply:

Tension/Compression:

$\sigma_{perm(H)}$ = 115 N/mm²
$\tau_{perm(H)}$ = 70 N/mm²

Bearing stress for bolts:

$\sigma_{permL1(H)}$ = 145 N/mm²
(Bolts with max 1 mm clearance)

$\sigma_{permL2(H)}$ = 180 N/mm²
(Bolts with max 0.3 mm clearance)

Heavy-duty plank on test

As far as diagrams in this leaflet indicate σ_{perm} as a parameter, the permissible stresses of DIN 4113-1/A1 for EN AW-6106 T6 and EN AW-6082 T5 are referred to.

Note concerning material/structures from former productions:
The sections of EN AW-6106 T6 have formerly been produced of DIN AlMgSi0.5 F22, the sections of EN AW-6082 T5 have been produced of DIN AlMgSi1 F28.
Partly higher values apply with regard to the permissible stresses for tension, compression, shear and the bearing stresses for bolts .

For verification in acc. to Eurocode 9:

The bearing capacity in the case of noncombined loads is calculated on the basis of the relation

$$E \cdot 1.5 = \frac{R}{1.1}$$

(E = Effect of actions,
R = Resistance of material)

$$\sigma_{perm} = \frac{R_{p0.2}}{1.65} = \frac{200(230)}{1.65} = 121(139) \text{ N/mm}^2$$

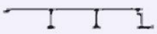
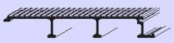
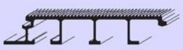
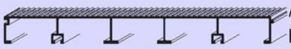
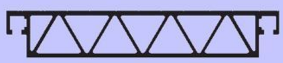
This is somewhat more favourable than DIN, but is of no importance for practical design which is generally made on the basis of deflection value limits.

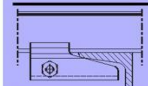
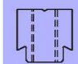
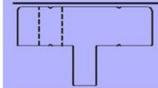
General Data:

Modulus of elasticity: 70,000 N/mm²
Mean thermal expansion coefficient: $23.5 \cdot 10^{-6}$ 1/K
Specific mass: 2.7 g/cm²
Low-temperature performance: good, no low-temperature brittleness

Note: The heat generated by welding influences the strength of the material. In this case refer to DIN 4113/2 or EC 9 for permissible stresses.

Delivery programme

Section/symbol For details see Pages 6-9 und 12-14	Alloy	Die No.	Height gross* (net) [mm]	Net width [mm]	Weight [kg/m]	Weight [kg/m²]	Stock length [m]	Geometric value I_x [cm⁴]	Geometric value W_x [cm³]	Remarks Assembly with Profil No./accessory
Light planks										
	Anticorodal-114 Sorry - no longer available Please contact ABL (former AlMgSi1 F28)	27436	30	200	2.50	12.51	7.35	11.0	5.3	27435 BU1
 See note below	Anticorodal-114 EN AW-6082 T5 (former AlMgSi1 F28)	27435	32.5 (30)	200	2.82	14.10	7.35	12.1	5.5	27436 BU1
	Anticorodal-114 Sorry - no longer available Please contact ABL (former AlMgSi1 F28)	24519	40	220	3.81	17.34	7.35	33.3	13.3	24524, 34774 –
 See note below	Anticorodal-114 EN AW-6082 T5 (former AlMgSi1 F28)	24524	42.6 (40)	220	3.99	18.15	7.35	33.6	12.5	24519, 34774 BU1
	Anticorodal-114 Sorry - no longer available Please contact ABL (former AlMgSi1 F28)	24523	40	200	4.71	23.56	7.35	43.7	18.9	24520, 24521, 24522 BU1
	Anticorodal-114 EN AW-6082 T5 (former AlMgSi1 F28)	24520	42.5 (40)	200	4.97	24.86	7.35	43.9	16.8	24523, 24521, 24522 BU1
	Anticorodal-114 Sorry - no longer available Please contact ABL (former AlMgSi1 F28)	24522	40	100	2.99	–	7.35	28.0	13.3	24520, 24523, 24521 –
	Anticorodal-114 Sorry - no longer available Please contact ABL (former AlMgSi1 F28)	24521	40	100	2.34	–	7.35	19.8	7.8	24520, 24523, 24522 –
	Anticorodal-053 EN AW-6106 T6 (former AlMgSi0.5 F22)	34774	41.5 (40)	400	5.63	14.07	6.00	45.0	16.4	24519, 24524 BU1, KU1
Heavy-duty plank										
	Anticorodal-053 EN AW-6106 T6 (former AlMgSi0.5 F22) See note below	41985	68	400/370 ***	18.1	45.1/48.8 ***	5.20	458.1	125.9	KSG1, SE1
								(I_T=1119,3 cm⁴**)		

Accessories	Alloy	Designation	Height [mm]	Width [mm]	Length [mm]	Weight [g/piece] *with / (without) bolt*	Remarks
	Anticorodal-053 EN AW-6106 T6 (former AlMgSi0.5 F22)	BU1	detail see page 8		90	≈100	fixing from below
	Anticorodal-053 EN AW-6106 T6 (former AlMgSi0.5 F22)	KU1	–	–	40	≈70	coupling from below
	Anticorodal-114 EN AW-6082 T6 (former AlMgSi1 F31)	KSG1	detail see page 14		30	(≈26)	threaded T-nut
	Anticorodal-114 EN AW-6082 T6 (former AlMgSi1 F31)	SE1	detail see page 14		28	(≈95)	supporting element (support bracket/block)

* *Gross height = including ribs*
** *Torsion constant I_T is only indicated in case of static relevance.*
*** *Effective width for wide or narrow planking (see note on page 10)*

Special order quantity requirement - please contact ABL

Light planks - verification

The simple theory of beams is used for the verification of light planks (open sections) subject to **distributed loads** owing to the preferred supporting direction parallel to the ribs.
For the permissible stresses and the modulus of elasticity to be used for the calculation of deflection refer to page 2.

With **point loads** the deflection calcula-tion is not as simple as for distributed loads. In this case, tests are often a help in practice. The diagrams on page 5 show the deflections under one-man load as a function of the span. A linear extrapolation to higher loads is permissible and still on the safe side, but subject to calculation.
Approximate stress values can be calculated from deflection measurements. A more accurate calculation is normally not required, since the planks have high load bearing capacity and are normally only dimensioned according to the deflection allowed.

Permissible deflections

Coverings suitable for walking on should not deflect more than 5 mm under one-man load for psychological reasons (subjective feeling of safety). For areas rarely trodden, this figure can be raised to 8 mm. In special cases, e.g. inspection ways, scaffolding and the like, which are only used by service personnel, larger values are permissible. For distributed loads the permissible deflection is determined according to regulations, e.g. l/400. In general, l/200 should not be exceeded.

For the suitability of the planks for

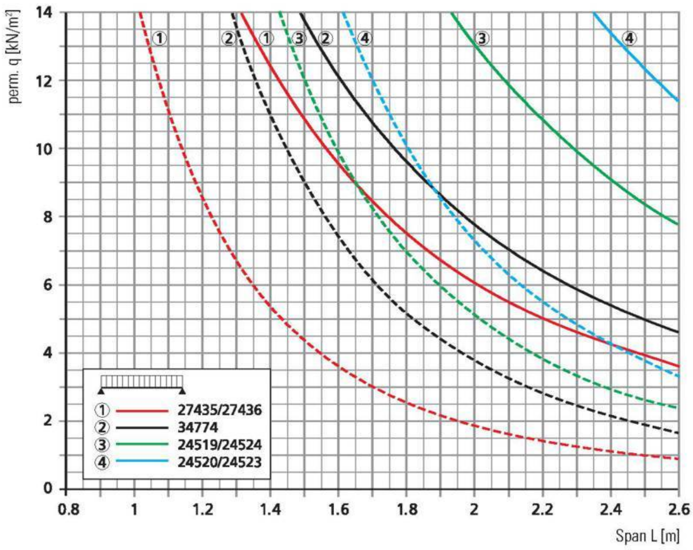
industrial trucks (e.g. four-wheel lifting trucks) see page 14.

Distributed loads

Permissible loads q for planks under uniformly distributed load in function of the span (single-span) under the following criteria:

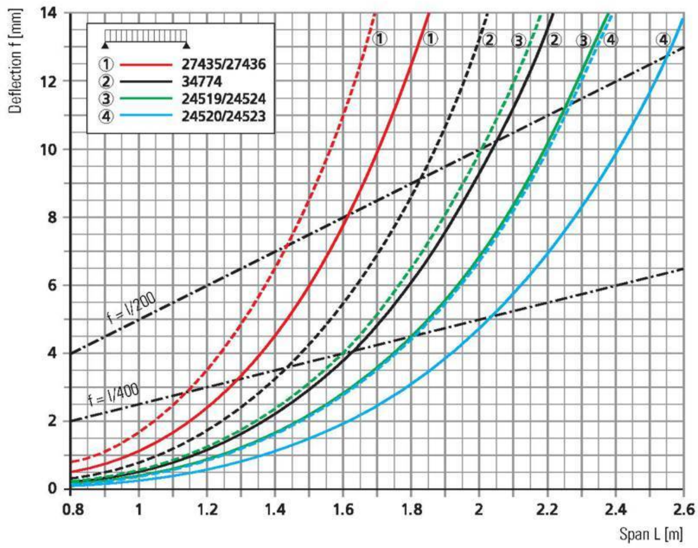
– – – Deflection: f = l/200
——— $\sigma_{perm(H)}$ = 95 N/mm² for No. 34774 and $\sigma_{perm(H)}$ = 115 N/mm² for all other planks

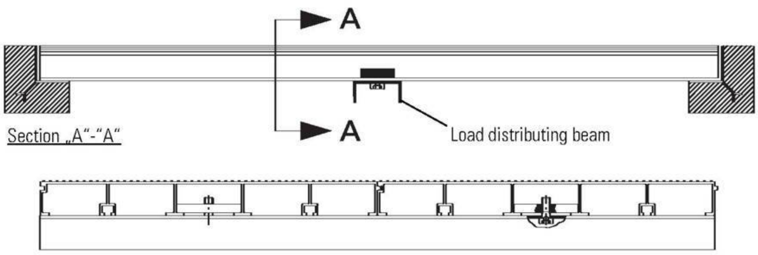
The permissible loads for the criterion deflection l/400 correspond to half the values of l/200.



Deflection of planks f under a distributed load of 3.5 kN/m² (350 kg/m²) and 5 kN/m² (500 kg/m²) in function of the span (single-span)

——— 3.5 kN/m²
– – – 5.0 kN/m²

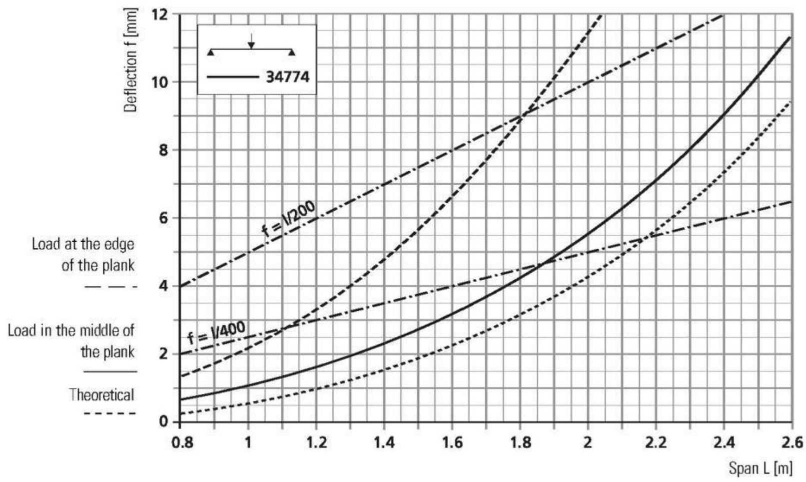




Concentrated loads

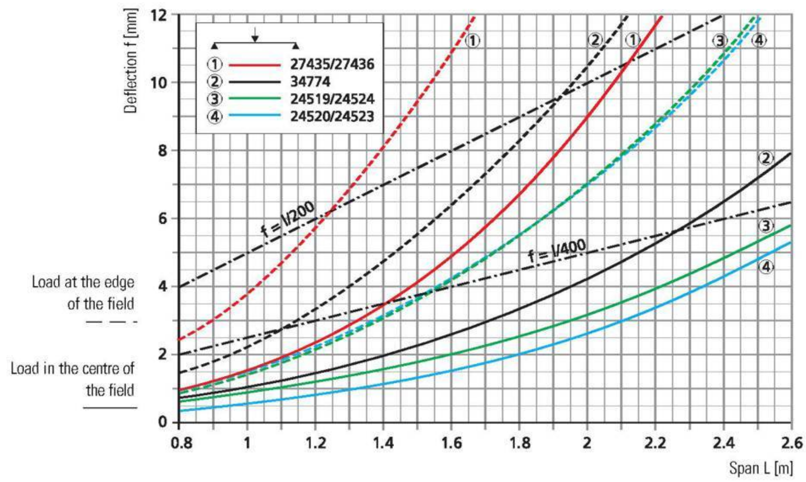
Single plank 400x40 (34774)

Deflection f of a single plank No. 34774 under one-man load (80 kg) as function of the span L (single span). The curves are the results of tests with one person. In the case of "load at the edge" the person stood facing outwards on the edge of the plank with the full weight on the ball of the foot. Indicated are the maximum deflections of the ribs directly under the load. The theoretical deflection curve applies when the single load is uniformly distributed over the width of the plank.
Calculated from deflection measure-ments a span limit l_{lim} of 1.3 m is determined for a point load of 150 kg in the case of "load at the edge" on the basis of permissible stress values (σ = 95 N/mm²).



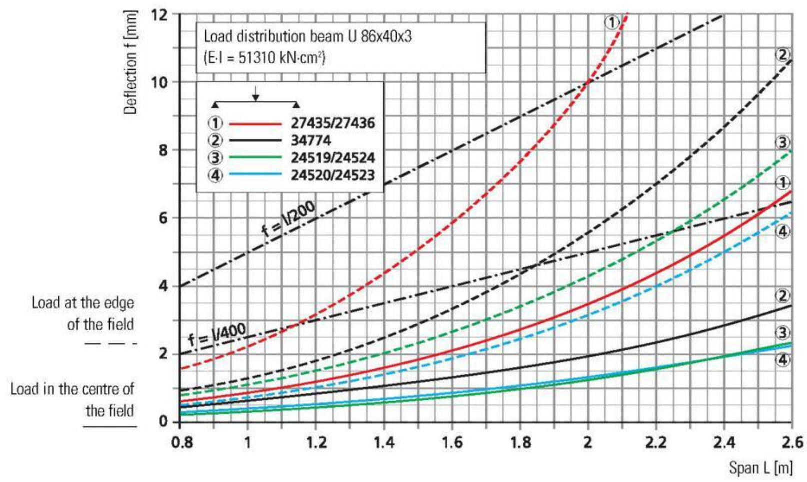
Coupled planks

Deflection f of coupled planks under a one-man load (80 kg) placed in the centre of the field as function of span L (single span).
The curves are the results of tests with one person. The diagram also shows the deflection of a free plank at the end of the field under load at its edge (see definition above).
The planks were all connected by means of tongue and groove. Only planks No. 34774 were connected with an additional coupling KU1 for a span > 1 m.

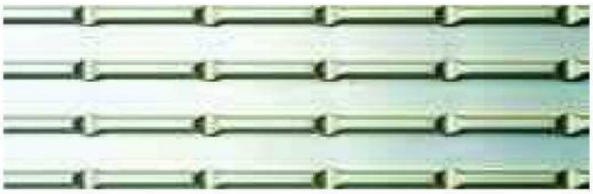


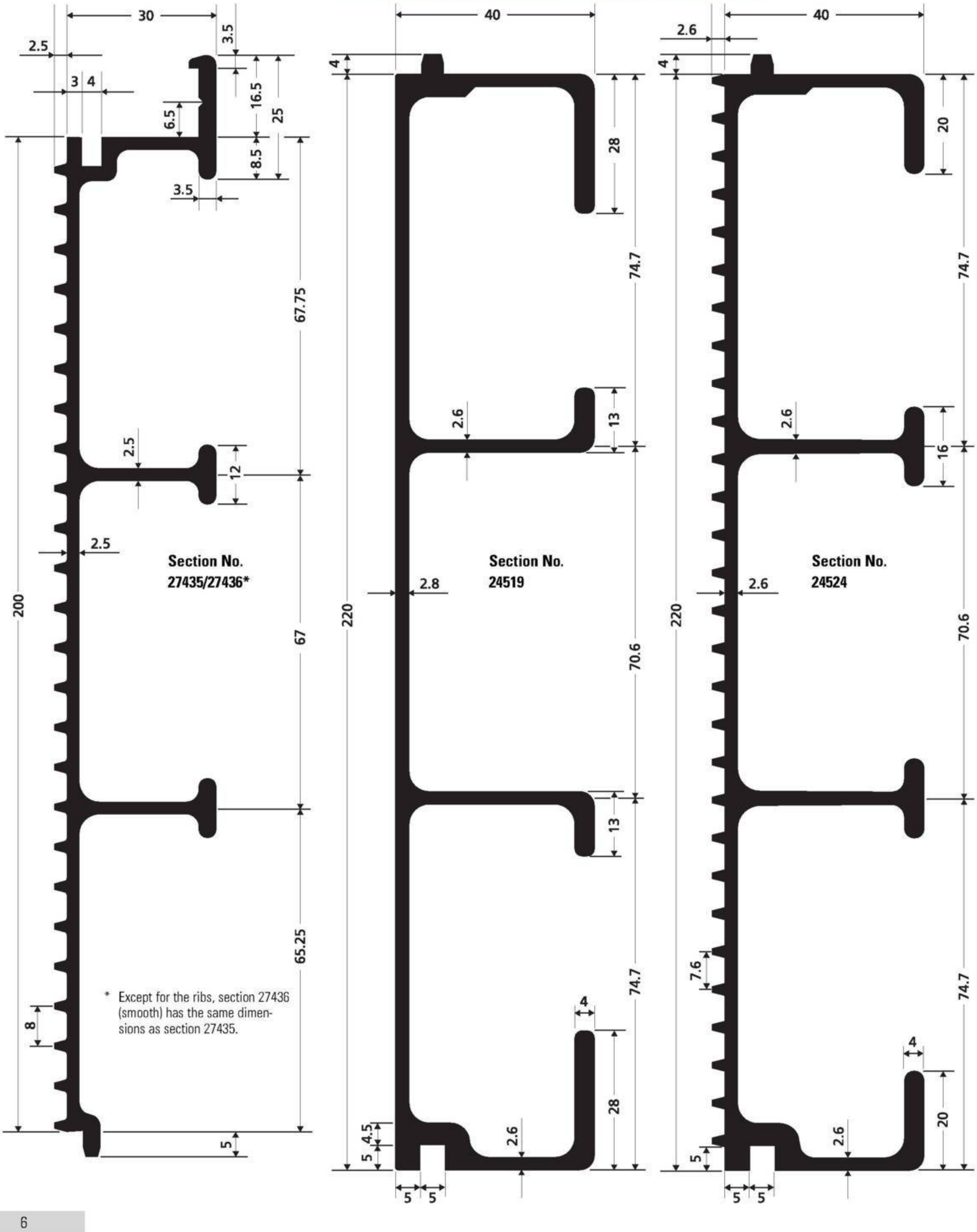
Coupled planks with load distributing beam

(see drawing above)
By the simple and inexpensive method of fitting load distributing beams, the point load is spread over several sections, and the surface feels more rigid to the user. The load distributing beam must not be supported at the ends. The load bearing capacity with distributed load does not change when fitting a distributing beam.
The illustration opposite shows the deflection of planks under one-man load (80 kg) placed in the centre of the field in function of the span L. The curves are the results of tests with one person. The diagram also depicts the deflection of a free plank at the end of the field under load at the edge (see definition above).

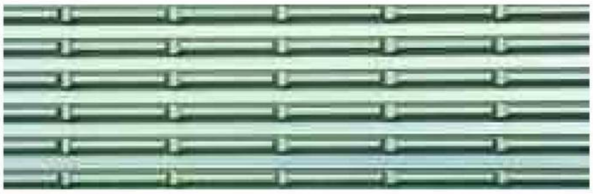


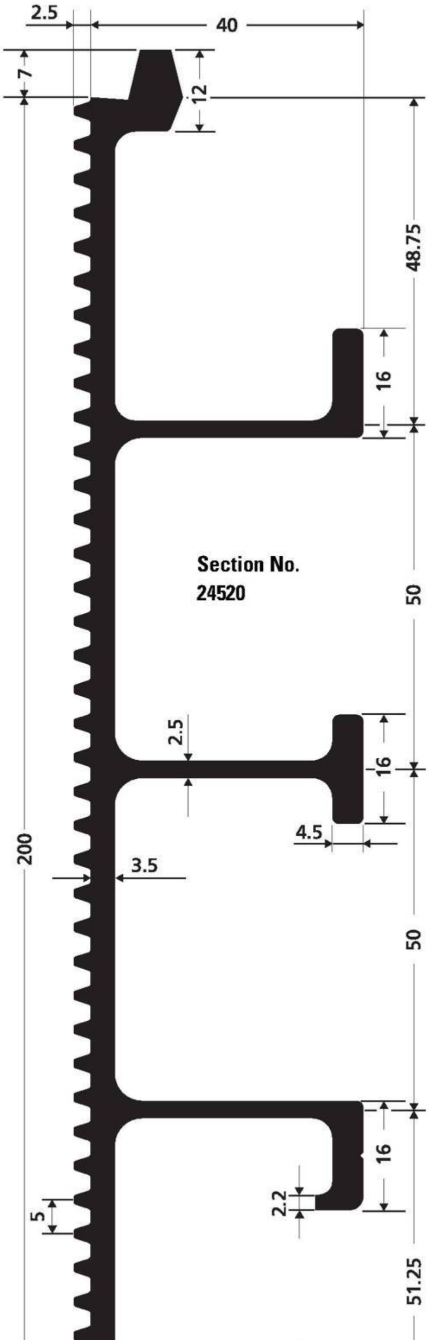
Light Planks
Scale 1:1

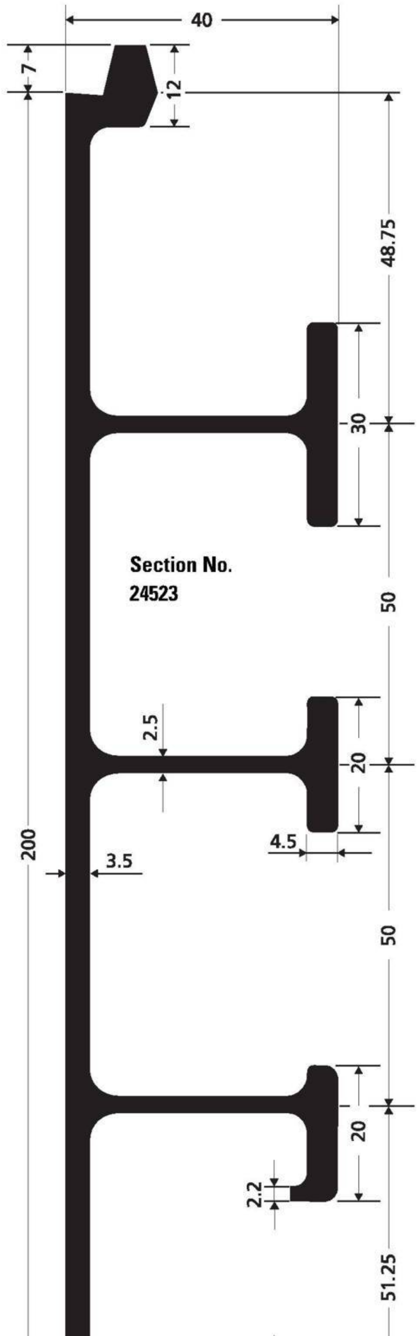


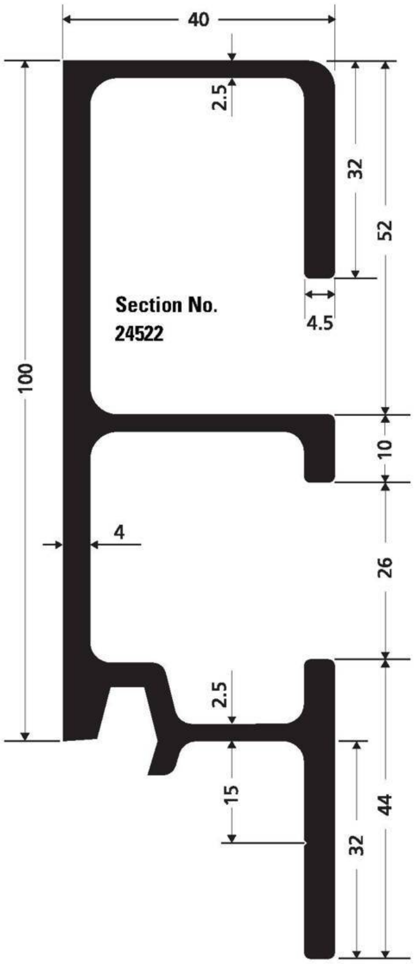


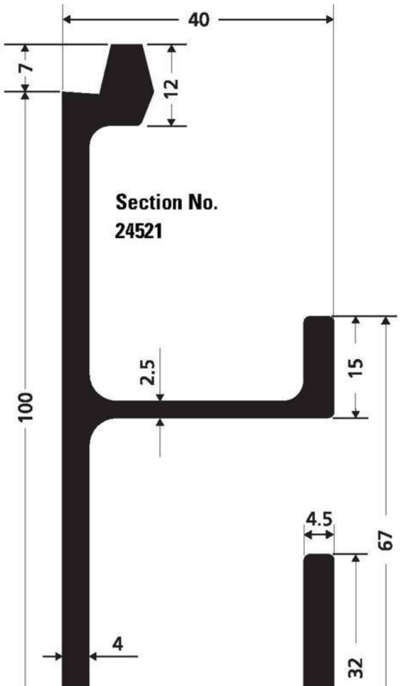
* Except for the ribs, section 27436 (smooth) has the same dimensions as section 27435.



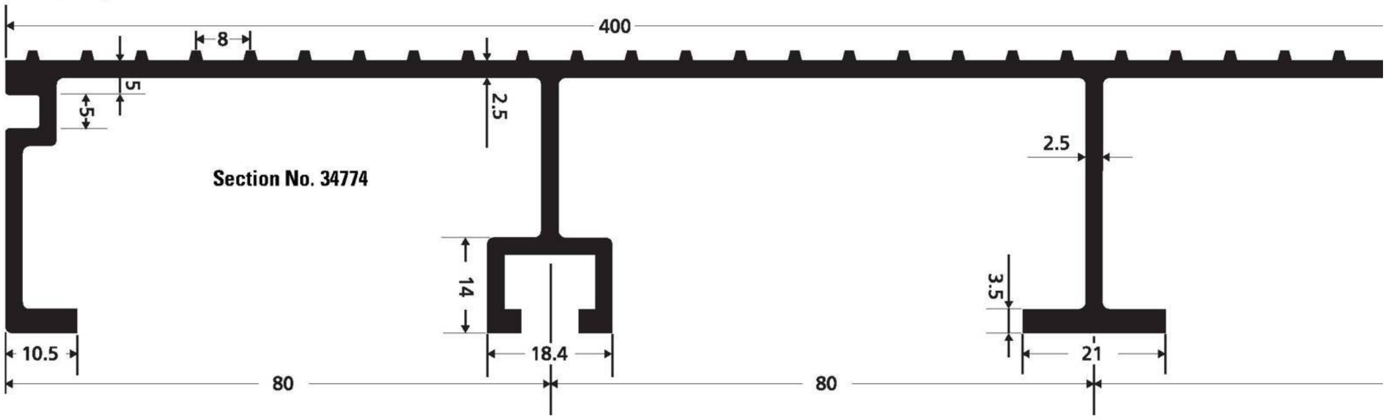

Section No.
24520
2.5
40
7
12
48.75
16
50
2.5
16
4.5
200
3.5
50
16
5
2.2
51.25
2.2
3
15.5
45
32.5


Section No.
24523
40
7
12
48.75
30
50
2.5
20
4.5
200
3.5
50
20
2.2
51.25
2.2
15
45
32


Section No.
24522
40
2.5
32
52
4.5
100
10
4
26
2.5
15
44
32


Section No.
24521
40
7
12
100
15
2.5
4.5
67
4
32
2.5

Light planks   Scale 1:1



Fixing of the planks

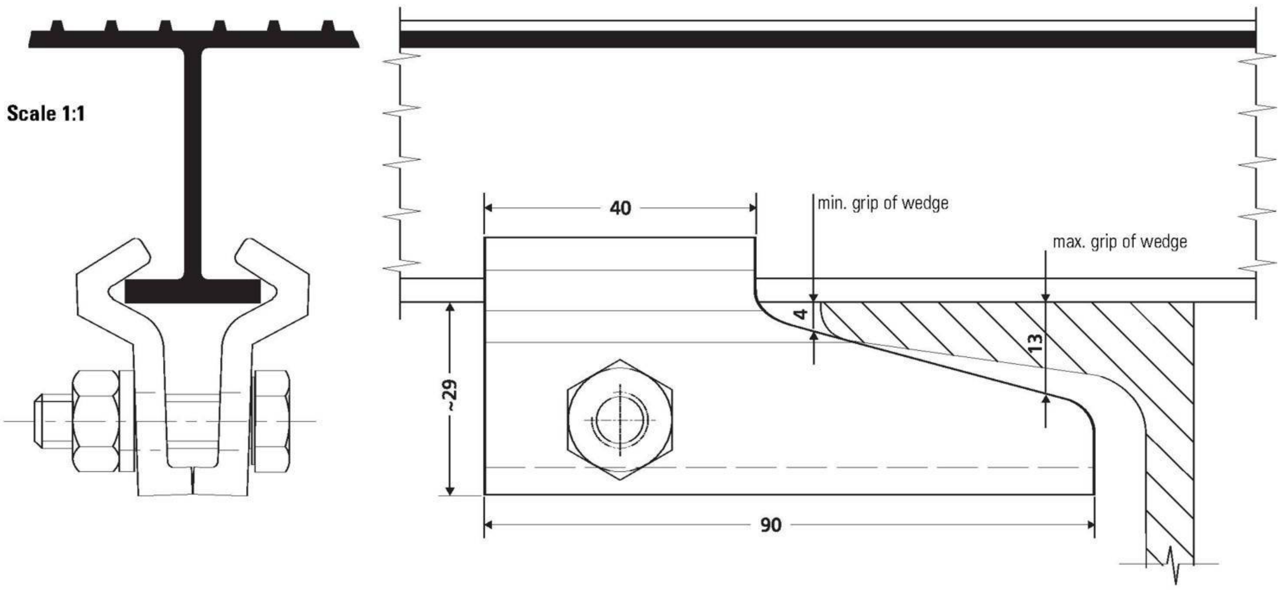
Fixing with fixing wedges BU1 (for planks 27435/27436, 24524, 24520/24523, 34774)

Place clamping jaws of fixing wedge over two adjoining edge feet.
Only slightly tighten bolt.

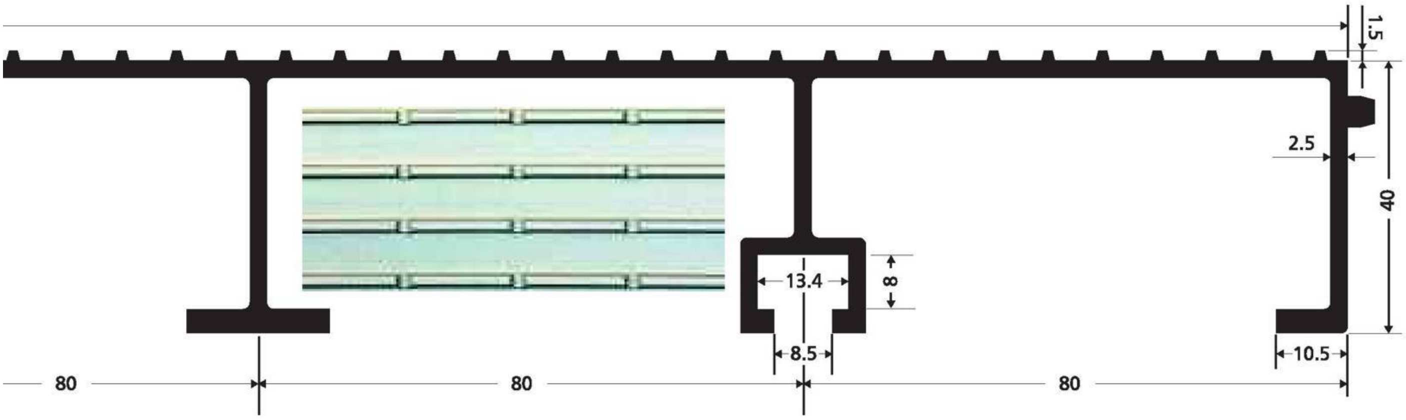
Drive fixing wedge beneath the support projection using a hammer.

Then firmly tighten clamping wedge bolt to prevent loosening during vibration.

As shown in the above pictures, the fixing wedge BU1 can be fitted to the plank joints for plank No. 34774. In combination with the wedge (fixed to the substructure), this helps to prevent the planks from drifting apart. For large spans it may be appropriate to also connect the planks 34774 in the centre of the field with the coupling KU1.



As an alternative to the fixing wedges BU1, the planks can also be fixed by means of bolts or inserted clamping plates (see page 9 for the principle of fixing).



Fixing by bolting from above
(Planks: sections Nos. 27435/27436, 24520/24523, 24522)

The sections indicated above can be connected directly at the protruding flanges. The plank is bolted to the substructure before mounting the next one. A notch in the surface of the flange shows the correct position for drilling.

The drawing below on the left hand side shows the fixing by bolts for planks No. 24523.

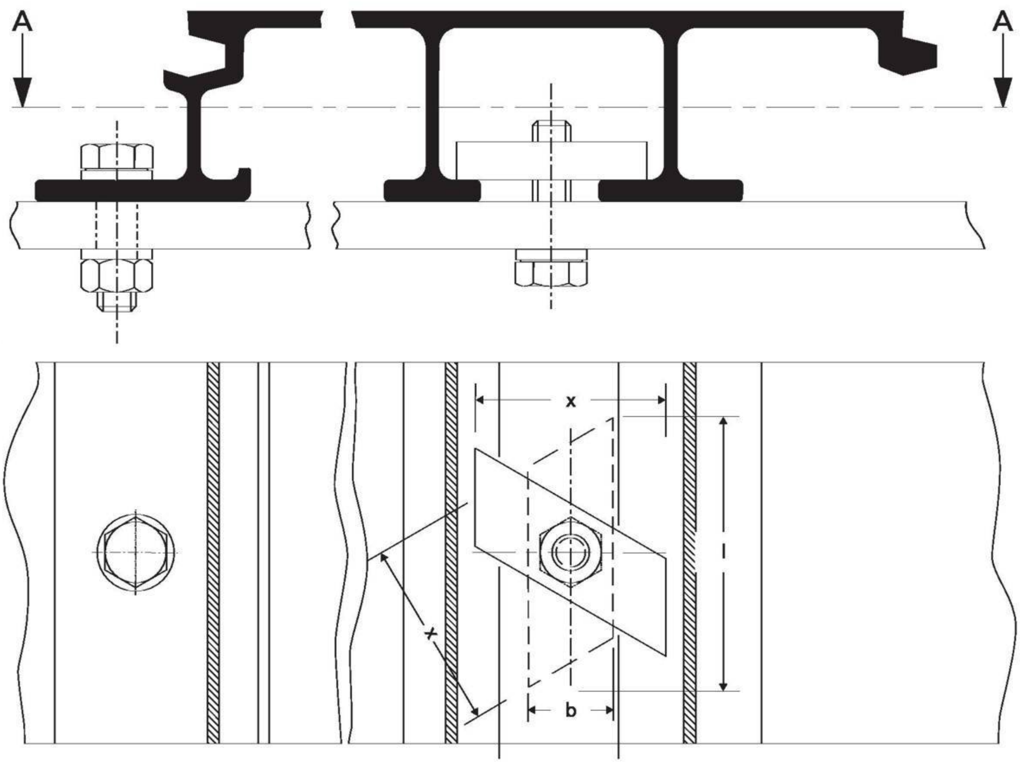
Fixing by clamping plates
(suitable for all planks except section No. 24521)

Access from below is required for this type of fixing.

Suitable clamping plates are manufactured to be inserted between two webs. These plates are fixed by bolts and clamp the flanges of the webs against the substructure.

To facilitate the assembly, the clamping plates may be cut at oblique angles (parallelogram) and provided with a tight thread.
When the dimensions are correct (width b, length l, parallelity x and distance between drilled holes – depending on the type of section), the clamping plates with the partly tightened bolts are swivelled between the webs from below and are then firmly tightened.

The drawing below on the right hand side shows the principle of fixing by slewable clamping plates for plank 24523.



Coverings and floors made from heavy-duty plank No. 41985

Configuration of planks:

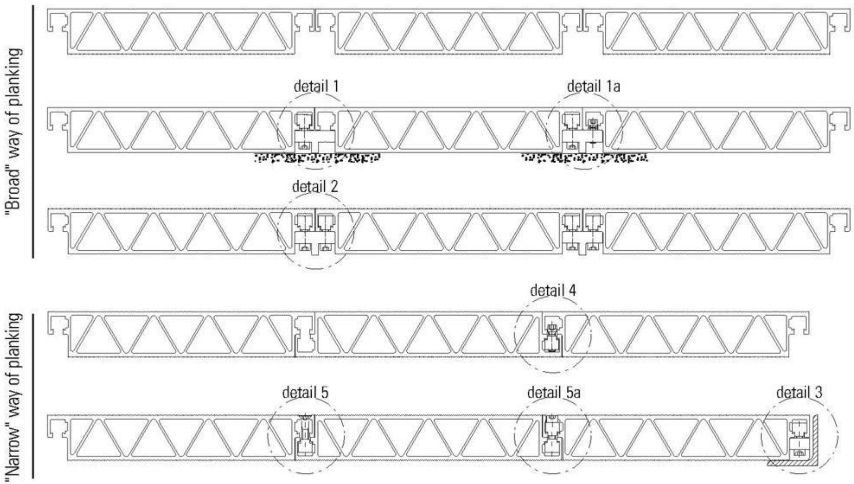
Non-coupled single planks (method 1)

Non-coupled single planks with support block at the supports (method 2) with securing pins, if required.

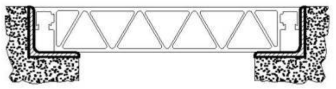
Planks with support brackets within the field and support blocks at the edges (method 3)

Planks laid alternately upside down (not connected to each other) (method 4) with securing pins, if required

Planks laid alternately upside down and firmly bolted (method 5)



Single plank as drain cover (load bearing effect transversally to longitudinal axis of section) (method 6)



See page 14 for information about number and arrangement of coupling media for methods 3 and 5

Planking instructions

For an area of planking that will be driven over by a vehicle, the load bearing capacity of the individual plank is not the only parameter to be considered: When the deflections under load become too strong, this can result in a "rumbling noise", particularly when passing transversally to the planks and planks are not connected to each other. The intensity of the noise strongly depends on the type of wheel (size, tyre, air pressure) and the passing speed. This is more likely when passing over a covering consisting of small pieces of planks. However, it is not always possible to clearly define the conditions under which such noise will be produced. On the other hand, it can almost completely be avoided by connecting the planks to each other by bolts. If, however, single planks or the whole field of planks has to be frequently removed, then the fixing may be of no benefit.

In such cases, certain measures may be taken to solve the problem:

a) Support the protruding edge of the plank (use SE1 as a support block).
b) Use support brackets within the field which have been fixed alter-nately (for plank lengths > 1.5 m and loads up to 5 tons).
c) For very short planks it may be necessary to fix single planks firmly to the substructure or to connect them in pairs by bolting, thus creating a certain counterweight to prevent them from leaping up under load.

For drain coverings one has to make sure that there is enough space to place the lower edge of plank on the support (minimum width of support: 20 mm each side).

It is not permissible to support the planks via the protrusion at each side. Steel angles 75x7 (hot galvanized) can be used as support angles for flat surface planking. If the substructure permits, the drain covering plank can be driven across with 10 tons twin tyres maximum.

The table below shows an overview of the maximum spans which are recommended or have to be respected depending on the load and the configuration of the planking.

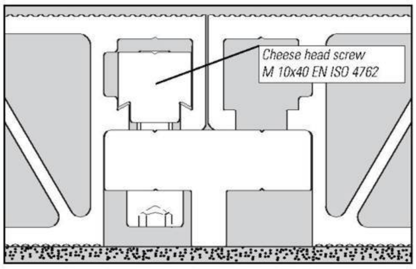
	Span Widths for Single Span [m]:					
	Field consisting of non-coupled single planks		Plank field with support brackets and support blocks		Plank field connected by bolting with support blocks	
	Method 1	**Method 2**	**Method 3**		**Method 5**	
Wheel load	*without support blocks*	*with support blocks*	*without continuous support of end planks**	*with continuous support of end planks**	*without continuous support of end planks**	*without continuous support of end planks**
1.0 t	1.7	2.0	2.3	2.6	3.0	3.5
1.5 t	1.5	1.7	2,2	2.4	2.7	3.0
3.3 t	1.1	1.3	1,9	2.0	2.2	2.5
5.0 t	n. r.	1.00 ²)	n. r.	1.5	1.6	2.0
6.0 t	n. r.	0.85 ²)	n. r.	n. r.	1.4	1.8
10.0 t¹)	n. r.	0.75 ²)	n. r.	n. r.	0.8 ²)	1.2 ²)

¹) Twin tyres
²) Permissible bending stress fully used in longitudinal direction
n.r.: not recommended or inadmissible for lack of suitability to be driven on
*** **Attention:** When removing single planks, the adjacent planks become end planks which have a lower load-bearing capacity. For the load-bearing capacity of single planks see planking method 1 in the table above.*

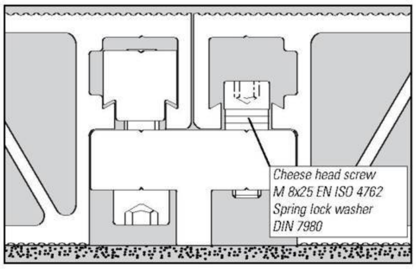
Configuration of planking
Scale 1:2

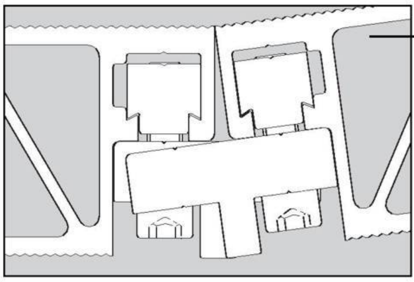
In general the planks are mounted in closed frames to prevent them from drifting apart due to e.g. driving forces (braking). If there is no framework or if the plank field shall be driven across even after removing single planks (Attention: reduction of permissible load), then suitable action can or has to be taken to secure the planks against drifting apart. Such securing options do not form part of our range of supply and will have to be made manually. Details 1a and 4 are suitable examples. This type of securing does not work with support brackets.

Detail 1
Support blocks at the ends of the planks to prevent them from leaping up



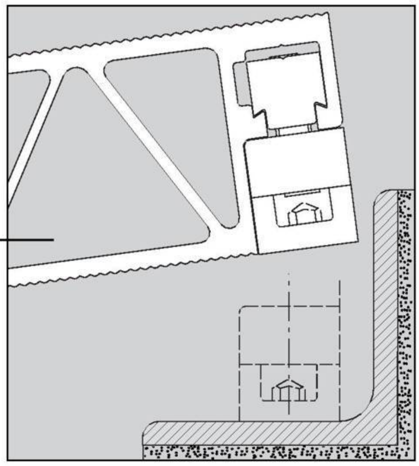
Detail 1a
Support blocks at the ends of the planks to prevent them from leaping up.
Alternative to Detail 1 including securing (pin) against drifting apart.



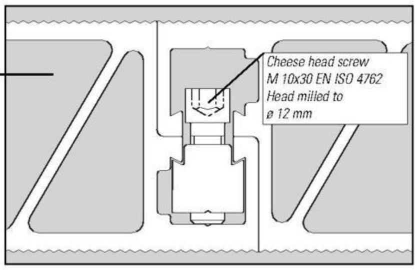


Detail 2
Coupling of planks by means of support brackets
This type of coupling is frequently used for making stages or by fairground entertainers (where the floors have always to be built up and taken down).

Detail 3
Support block to support the end plank and to prevent it from leaping up.



Detail 4
Planks laid alternately upside down and secured with pins to prevent them from drifting apart

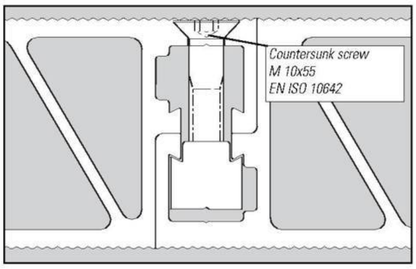


The pictured details are only examples for possible solutions. Alcan Singen only delivers parts as indicated on page 14. Screws do not form part of our range of supplies. Alternatives (such as e.g. Details 1a and 5a) have to be made by the customer himself.

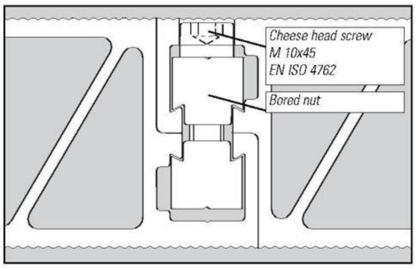
Screw qualities:

galvanized:	**min. grade 8.8**
stainless steels:	**min. A4, grade 70**

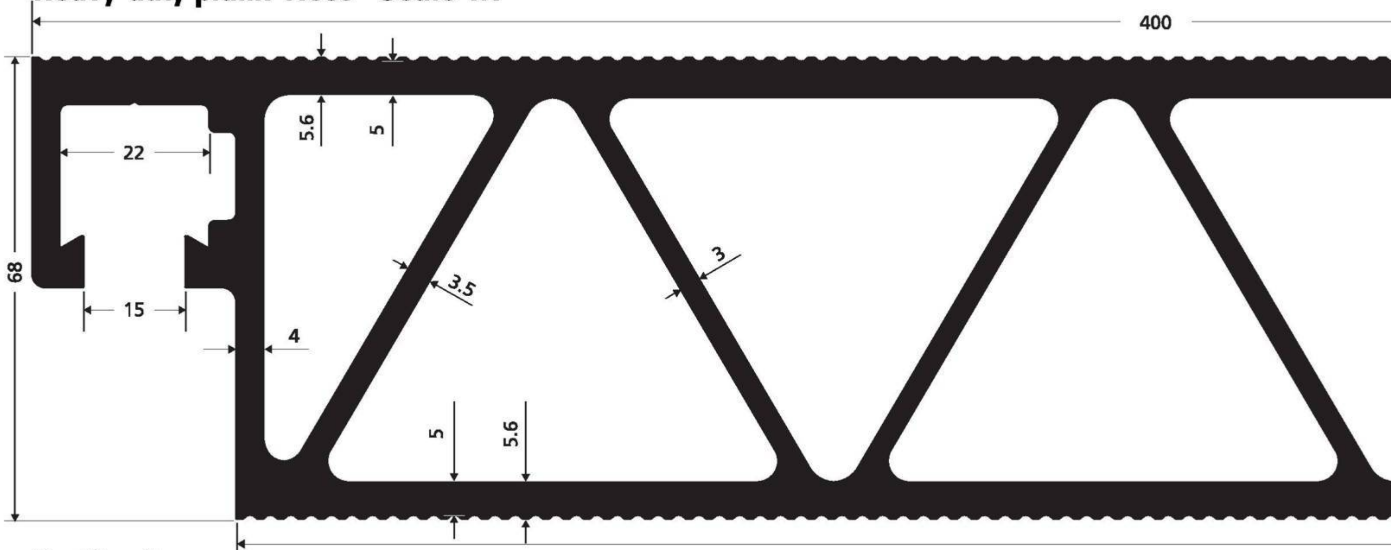
Detail 5
Planks laid alternately upside down and connected by countersunk head screw



Detail 5a
Planks laid alternately upside down.
Alternative to Detail 5; bolting with hexagonsocket head cap screw and bored nut



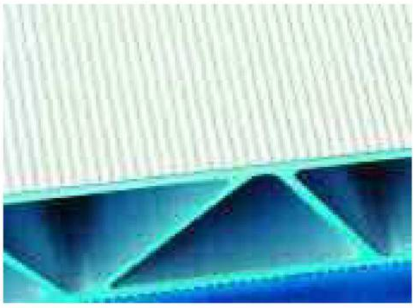
Heavy-duty plank 41985 Scale 1:1



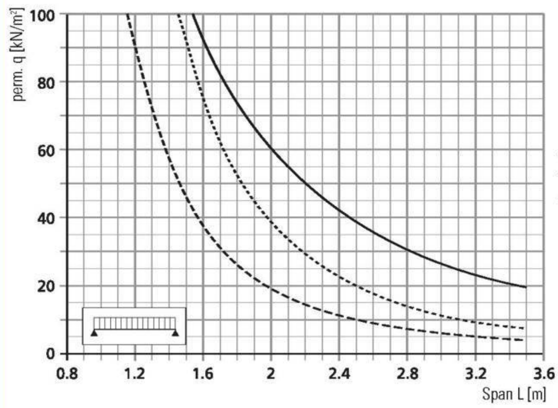
Verifications

Distributed load

The diagrams below were determined on the assumption of an infinitely long field, i.e. there is no load bearing effect transverse to the longitudinal axis of the profile. For this reason one is on the safe side with a four-side support for short fields.

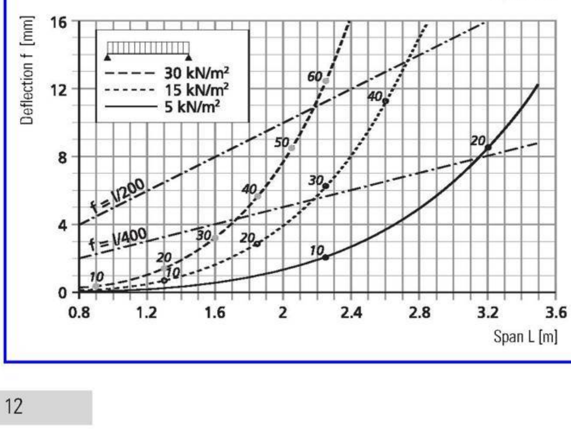


The figures indicated along the curves are the maximum bending stresses (N/mm²) calculated on the above assumption in longitudinal direction of the profile for the respective span..



Permissible distributed load for industrial plank 41985 (wide planking – ways of planking 1-3; single-span) under the following conditions:

— — — deflection f = l/400
- - - - - deflection f = l/200
——— $\sigma_{perm(H)}$ = 95 N/mm²



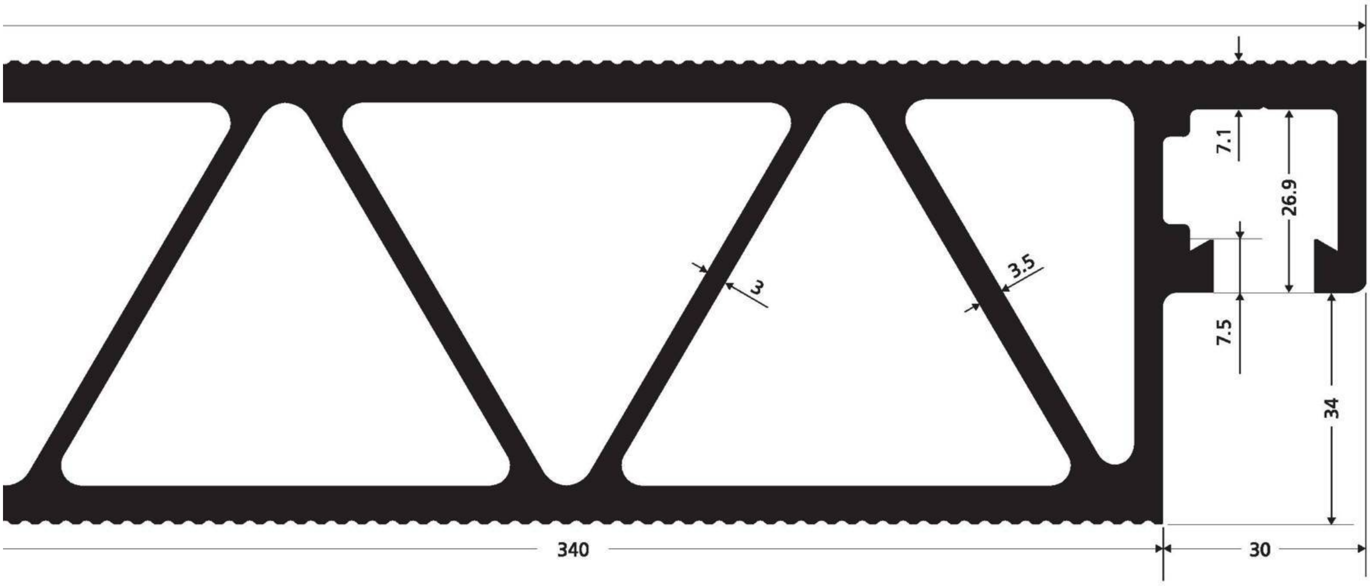
Deflection of the industrial plank 41985 (wide planking – ways of planking 1-3; single-span) under distributed loadsof 5 (500), 15 (1500), and 30 (3000) kN/m² (kg/m²)

Point loads

The upper diagram on page 13 shows the deflection of a single plank under wheel loads in relation to the span. The assumption was that wheel loads up to 6 tons are distributed over an area of 20x20 cm and loads of 10 tons over an area of 20x60 cm (twin tyres). Therefore, the diagram is useful for all driveable surfaces of non-coupled single planks. If due to local circumstances the planks can only be driven on in the longitudinal direction, then a somewhat larger span may be permitted for the 10 ton load (load on two planks).

Due to the high stiffness of the planks against torsion and in transverse direction, their load bearing capacity can be considerably increased by connecting them. The lower diagram on page 13 shows the results of deflection calculations for plank fields placed into a support grid. Load tests were performed with high wheel loads (up to 10 tons) on 7 planks lying one next to the other. The results confirm the calculations.

Since the deflections rise almost linearly with the load at similar geometric conditions, the diagram below on the right hand side only shows curves for the standard wheel load of 1 ton. The values for higher loads can be calculated by simple multiplication. Since the loaded area is generally assumed to be 20x20 cm, there is still a load-bearing reserve for the 10 ton load (twin tyres).

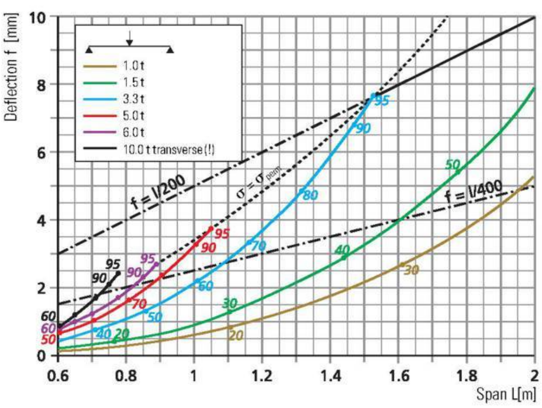


Tests performed on a plank field according to planking method 3 (with support brackets), have shown a similar load-bearing effect of the adjoining planks which are not directly loaded. Therefore, the lower diagram also applies when the values of deflection or stress are increased by the factor 1.2. This factor results from the "broad" way of planking and from the slightly higher clearance of the brackets in practice.

However, in general the spans and loads indicated in the table on page 10 shall not be exceeded because driving criteria do also play a part in planking.

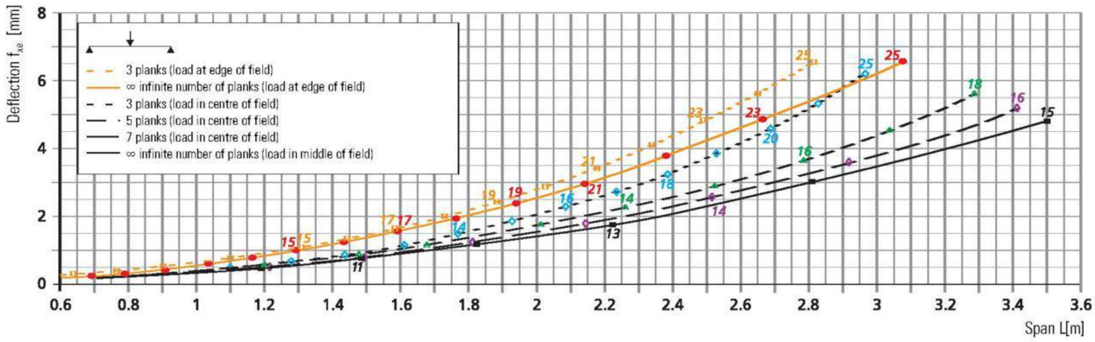
Note: Special knowledge is required to establish the static proof for surfaces which are travelled by heavy loads. The indicated diagrams do not cover all possibilities. They may be a help for frequent cases, but cannot replace a detailed static calculation for a particular case, especially where several migrant loads or strongly concentrated loads are concerned.

Deflection of a single industrial plank 41985 (single-span) under different wheel loads



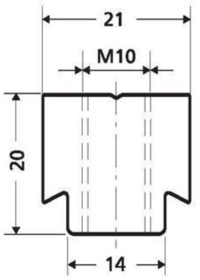
The figures indicated along the curves are the maximum bending stresses (N/mm²) calculated on the above assumption in the longitudinal direction of the profile for the respective span.

Deflection of plank fields of a different number of coupled industrial planks 41985 (single-span) under standard wheel load of 1 ton

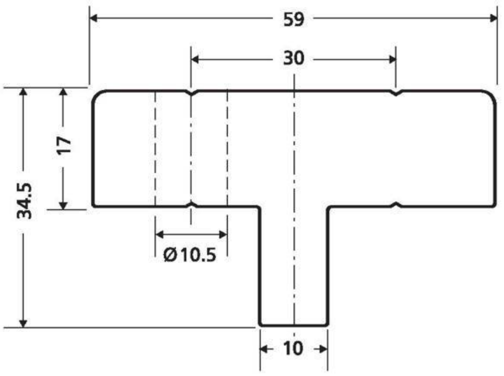


Connecting elements for heavy-duty plank 41985
Scale 1:1

Nut KSG1
Length: 30 mm



Support element
(support bracket/support block) SE1
Length: 28 mm

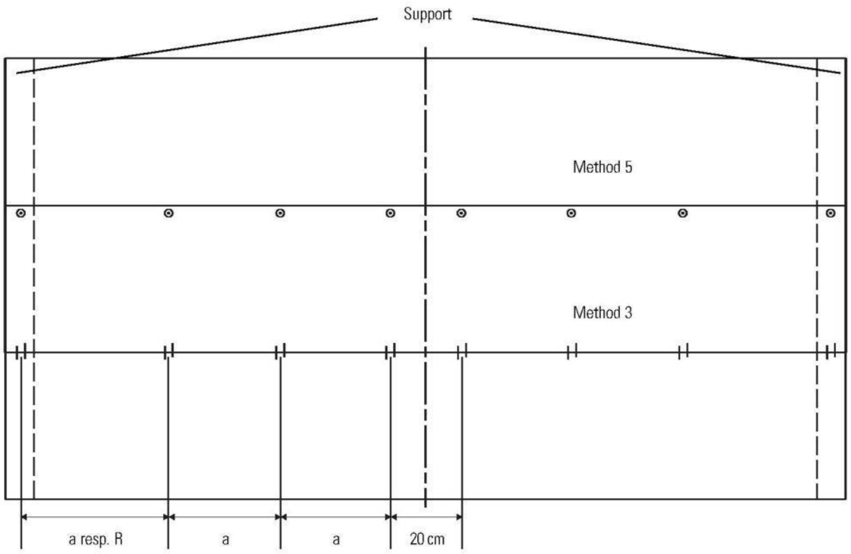


Number and position of the connecting elements for the heavy-duty plank 41985 with planking methods 3 and 5 (see page 10)

If for heavy wheel loads one wants to make full use of the load-bearing effect of the directly adjoining non-loaded planks, then the following rules apply:

In this case always two connecting elements have to be placed in the centre at a distance of 20 cm and one connecting element at each end of the plank. Additional connections have to be placed in between at equal distances **a**.

Note: "Connection" means a screwed connection according to Details 5, 5a, or two support brackets placed in opposite direction at a clear distance of about 10 mm in planked condition.



The suitability of light industrial planks for industrial trucks

The wheels of industrial trucks such as hand platform stackers mostly have a small diametre, but often have to carry heavy loads so that even solid floors may be damaged. The lighter industrial planks (thin cover sheets, large distance between the webs) were not designed for heavy-duty operation and loads of such vehicles. For this reason several rules have to be respected, especially when driving transversally to the profile direction.

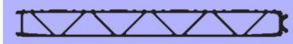
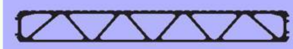
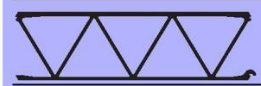
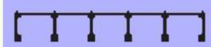
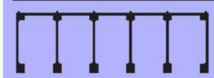
In practice it is sufficient to distinguish between two widths of wheels:
50 mm and 100 mm. In this case the diameter is of secondary importance.

On the basis of the safety factors which are commonly used in the building and construction industry to avoid the risk of local denting, the following loads per single wheel should not be exceeded for 50 and 100 mm wheel width respectively (standard values):

27 436:	75 / 90 kg resp.
27 435:	80 / 110 kg resp.
24 519 and 24 524:	90 / 115 kg resp.
24 523:	160 / 200 kg resp.
24 520:	170 / 220 kg resp.
34 774:	60 / 75 kg resp.

The above figures show that the heavier planks (thicker cover sheets, narrow distance between webs) already allow the regular use of certain industrial trucks.
For lighter planks metal sheets or wooden planks have to be used.
If the planks are driven on parallel to the profile direction or at an angle which makes sure that the wheels are always in contact with the ribs, then considerably higher loads are permissible.

Design profiles – not available ex stock

Section/symbol	Die	Gross height* (net height) [mm]	Useful width [mm]	Weight [kg/m]	Geometric values I_x [cm^4]	W_x [cm^3]	I_T*** [cm^4]
	39244**	31.3 (30)	500	12.19	64.8	41.1	202
	36897**	40 (38.7)	400	10.01	93.7	44.9	264
	30947**	46.3 (45)	400	13.23	159.1	64.0	453
	16128	100	345	16.97	990.1	183.3	1892
	29294	42.5 (40)	300	6.38	53.5	19.6	–
	37942	45 (42)	280	6.27	53.0	20.2	–
	40342	90 (87)	282	9.49	384.1	76.7	–

Alloys 6106, 6082
Detailed drawings, minimum quantities, and delivery times on request.
* Gross height = including ribs
** Profiles 39244, 36897, and 30947 are only available for construction engineering applications.
*** Torsional moment of inertia I_T is only indicated if relevant.

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