04 TENSION TIES

TENSION TIES

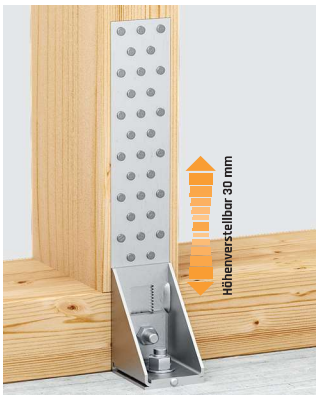
TENSION TIE HT

- Absorption of high tensile loads in timber framework construction
- Reduced overall height
- Short rib (150 mm)
- Optimised hole pattern
- They are also suitable for column connections
- Optional pressure platesl
- Use of pressure plates for tension loads up to 85 kN
- Without pressure plates for tension loads up to 42 kN

Basics of statics **from page 163** / Products & statics **from page 172**

TENSION TIEHT2

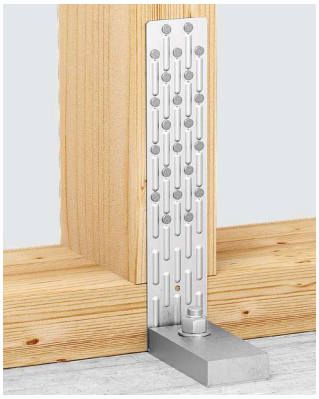
- Assembly of pull tab in wall production
- Interior walls can be fully panelled and completed
- No protruding parts during transport
- Simple and quick height compensation up to 30 mm possible on the building site
- Transfer of high tensile loads
- No improvement work on the building site



Basics of statics **from page 163** / Products & statics **from page 176**

TENSION TIE TOP 240 / TOP 280 VARIO

- Approved connection over intermediate layer
- Efficient wall or column connection on concrete
- Fast and practical processing
- Time savings - no more laborious marking and dowel drilling in advance
- Safe processing due to the coordinated system
- Direct connection to OSB boards between the timber beams is possible with GH screw



Basics of statics **from page 163** / Products & statics **from page 168**

CONNECTOR TOP 80 / TOP 120 VARIO

- No bothersome centre rib during processing
- Full nail fitting always possible
- High stability due to special, discreet corrugation
- Not a nail too many - optimal coordination of the bracket
- No fixing in the edge zone due to optimal hole pattern

Basics of statics **from page 163** / Products & statics **from page 184**

TENSION TIES

ASSORTMENT

4

							Basics Statics & Diagrams from page	Products & Statics from page
TENSION TIE TOP 240 / TOP 280 VARIO		CE	250 GD Z275	NKL 2			163	168
TENSION TIE HT		CE	355 MC galv. verzinkt	NKL 2			163	172
TENSION TIEHT2		CE	355 MC galv. verzinkt	NKL 2			163	176
TENSION TIE INCLUDING PRESSURE PLATE		CE	250 GD Z275	NKL 2			163	182
CONNECTOR TOP 80 / TOP 120 VARIO		CE	250 GD Z275	NKL 2			163	184
TENSION TIE HS		CE	250 GD Z275	NKL 2			163	186
TENSION TIE HB		CE	250 GD Z275	NKL 2			163	186
TENSION TIE HSB / FLAT STEEL ANCHOR		CE	250 GD Z275	NKL 2			163	188

CE symbol

Steel with indication of the steel quality and galvanisation

Timber/timber connection

Timber/concrete-connection

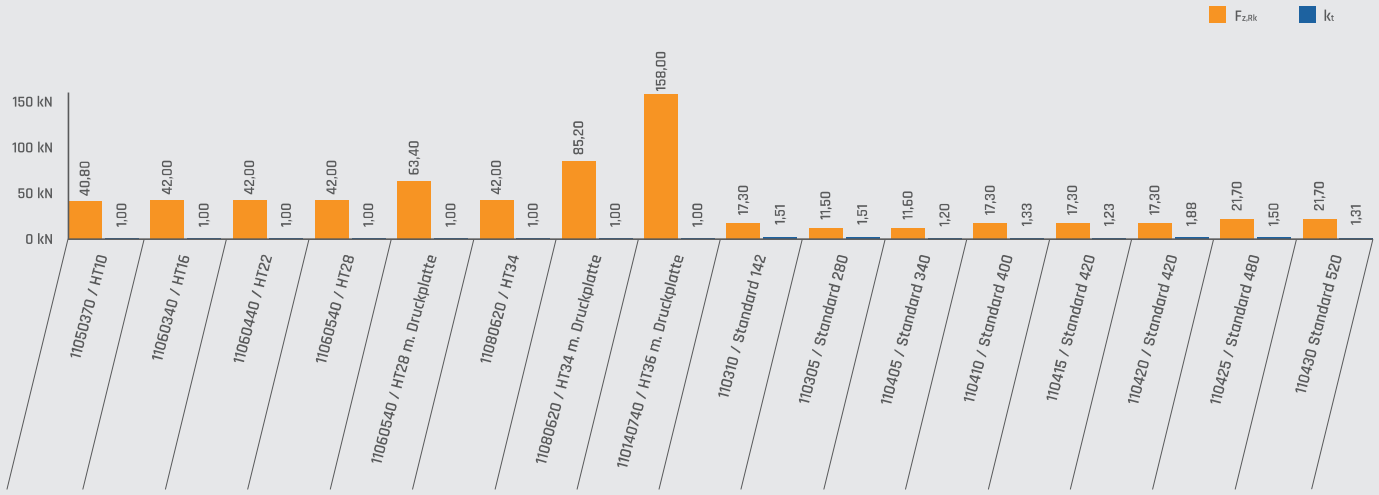
Usage class 1
Moisture content in the building materials that corresponds to a temperature of 20° C and a relative humidity of the ambient air that only exceeds a value of 65% for a few weeks per year, e.g. in the case of buildings that are closed on all sides and heated.
Comment: In UC 1, the average moisture content of most softwoods does not exceed 12 %.

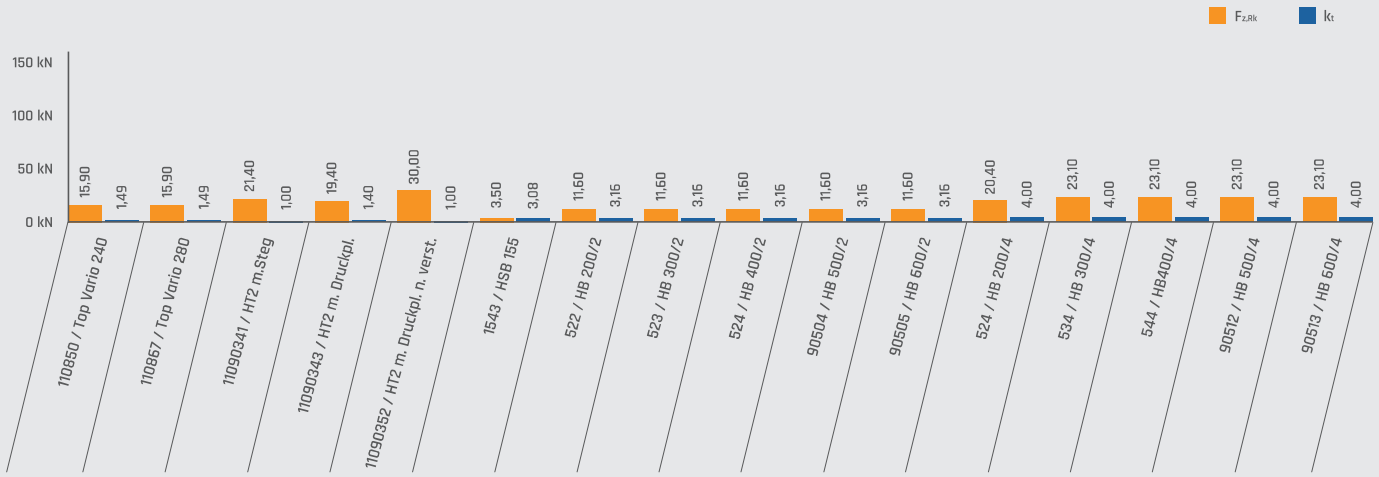
Usage class 2
Moisture content in the building materials that corresponds to a temperature of 20° C and a relative humidity of the ambient air that only exceeds a value of 85% for a few weeks per year, e.g. in the case of open buildings covered by a roof.
Comment: In UC 2, the average moisture content of most softwoods does not exceed 20 %.

Usage class 3
Includes climatic conditions that lead to higher moisture contents than in UC 2, e.g. structures that are exposed to the weather without protection. Eurocode 5 / DIN EN 1995-1-1 section 2.3.1.3

TENSION TIES

STATICS DIAGRAM





TENSION TIES

TECHNICAL FEATURES

Geometry

H	Height (mm)
L	Length (mm)
W	Width (mm)
T	Material thickness (mm)

Tables

F_z	Max. load capacity in load direction [kN]
n	Number of holes Ø 5.0 mm
n_{Bo}	Number of holes for dowels/bolts with Ø [mm]
n_{erf}	Necessary number of nails/screws
$F_{Rd, Stahl}$	Design value of steel load capacity [kN]
k_t	Factor for impact on dowels/bolts
	Grain course

Timber connecting element

GH threaded nails ETA-13/0523 Ø 4.0 x L [mm]

GH wood connector screw ETA-13/0523 Ø 5.0 x L [mm]

Dowels/bolts

Load directions

$F_{1,k}$ Load away from baseplate

Design

$F_{z,Ed}$	Design value of impact in load direction F_z
$F_{z;Rk}$	Characteristic value of load capacity
$F_{z,Rd}$	Design value of load capacity
$F_{v,Rk}$	Characteristic value of load capacity of a Connecting element, nail or screw
n	Connecting element, nail or screw
k_{mod}	Chosen number of nails/screws
γ_M	Modification coefficient according to EN 1995-1-1
γ_{M0}	Partial safety factor for connections according to EN 1995-1-1
γ_{M2}	Partial safety factor according to EN 1993-1-1
$F_{Ed,Bo}$	Partial safety factor according to EN 1993-1-1 or EN 1993-1-8
$F_{Ed,Bo}$	Impact on the dowel/bolt in load direction Fz

Steel with indication of the steel quality and galvanisation

Timber/timber connection

Timber/concrete-connection

Usage class 1
Moisture content in the building materials that corresponds to a temperature of 20° C and a relative humidity of the ambient air that only exceeds a value of 65% for a few weeks per year, e.g. in the case of buildings that are closed on all sides and heated.
Comment: In UC 1, the average moisture content of most softwoods does not exceed 12 %.

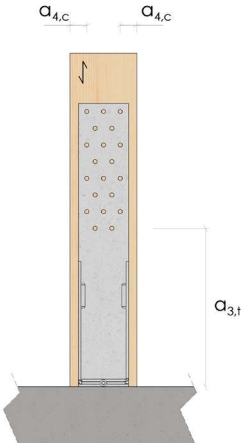
Usage class 2
Moisture content in the building materials that corresponds to a temperature of 20° C and a relative humidity of the ambient air that only exceeds a value of 85% for a few weeks per year, e.g. in the case of open buildings covered by a roof.
Comment: In UC 2, the average moisture content of most softwoods does not exceed 20 %.

Usage class 3
Includes climatic conditions that lead to higher moisture contents than in UC 2, e.g. structures that are exposed to the weather without protection. Eurocode 5 / DIN EN 1995-1-1 section 2.3.1.3

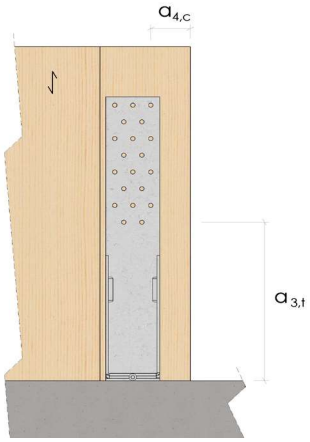
Load directions

Minimum and edge spacing

Column/style



BSH



4

Minimum and edge spacing

		Parallel to the grain	Right-angled to the grain
$a_{3,t}$	End grain with stress	15d	10d
$a_{4,c}$	Unloaded edge	5d	5d

		Parallel to the grain	Right-angled to the grain
$a_{3,t}$	End grain with stress	12d	7d
$a_{4,c}$	Unloaded edge	3d	3d

Minimum spacing according to EN 1996-1-1, without pilot drilling, $\rho_k \leq 420$ kg/m³

Connection to timber

Partial nail fitting or partial screw fitting
$n_{min.}$ 2, make sure that the load does not take effect eccentrically.

Full nail fitting or full screw fitting
$n_{max.}$ according to statics table, with compliance with minimum spacing

Connection over intermediate layers
The specified load-bearing capacities also apply to intermediate layers if the following requirements are met:

Intermediate layer
- OSB boards type OSB/3 and OSB/4 according to EN 13986 (EN 300) or approval
- Synthetic resin-bonded chipboard in accordance with EN 13986 (EN 312) or approval
- Solid wood panels according to EN 13986 (EN 13353) or approval
- Plywood according to EN 13986 (EN 636) or approval
- Plasterboards according to approval
- Fibreboards according to EN 13986 (EN 622-2 and 622-3) minimum raw density 650 kg/m³

The value of the characteristic bearing strength of the intermediate layer must at least fulfil the value for solid softwood of strength class C24. The compressive strength of the intermediate layer when loaded at right angles to the connecting surface (for wood-based panels, compressive strength perpendicular to the board plane) must be at least equal to the value of the compressive strength perpendicular to the grain for solid softwood of strength class C24.

Connection of the intermediate layer
The intermediate layer must be force-fit to the timber component (non-moving intermediate layer).
In other cases and generally in the case of movable intermediate layers, the load-bearing capacity of the connecting element should be determined individually for the respective connection.

Connecting element for intermediate layers
The length must be selected so that the profiled length (insert depth) behind the intermediate layer corresponds at least to the length specified in the statics tables.

Connection to concrete

Proof of the load-bearing capacity for fixing the tension tie in the concrete must be carried out separately taking into account the k_t value in accordance with the requirements of the selected dowel.

Design tables

Maximum load capacities in kN
Characteristic raw density of timber: ρ_k = 350 kg/m³ (C24)
Information in the design tables
Characteristic value $F_{z,Rk}$ max.
Design value $F_{z,Rd}$ for KLED "short" and "very short"

Design of the connecting element
The necessary number of nails or screws can be calculated from the impact $F_{z,Ed}$ and the load capacity of a connecting element $F_{v,Rk}$:
$n_{erf} = F_{z,Ed} / (F_{v,Rk} \times k_{mod} / \gamma_{m})$

Load capacity of the connecting element according to ETA-13/0523

	4.0 x 40 I 5.0 x 40	4.0 x 50 I 5.0 x 50	4.0 x 60 I 5.0 x 60
$F_{v,Rk}$ [kN]	1.83	2.14	2.27

Raw density of timber at least 350 g/m³

Design of the load capacity of the tension tie:

$F_{z,Rd} = \min \{n \times F_{v,Rk} \times k_{mod} / \gamma_M; F_{Rd,steel}\}$

The load-bearing capacity can be verified using the design value of the steel load-bearing capacity specified in the design table:

$F_{z,Ed} / F_{z,Rd} \leq 1$

Design value of steel load capacity $F_{Rd,steel}$ is based on the partial safety factors according to EN 1993-1-1 γ_{M0} = 1.0 and γ_{M2} = 1.25.
For two-piece tension ties HT2, the partial safety factor according to EN 1993-1-8 γ_{M2} = 1,25 is considered additionally.

Impact on the dowel

$F_{Ed,Bo} = F_{z,Ed} \cdot k_t$

Design examples

Connection of posts to C24, to concrete panel

Tension tie with pressure plate (110410), nails 4 x 40 mm.
Design value of impact: $F_{z,Ed}$ =14,7 kN; KLED short

Maximum load capacity
KLED short: n_{erf}: 14; $F_{z,Ed}$ =17.3 kN ≥ 14.7 kN = $F_{z,Ed}$

Alternative determination of the necessary nails 4 x 40 mm:
$n_{erf} = F_{z,Ed} / (F_{v,Rk} \times k_{mod} / \gamma_M) = 14,7 / (1,83 \times 0,9 / 1,3) = 11,6 \rightarrow n_{erf} = 12$

Alternative determination of the necessary nails 4 x 40 mm:
$F_{z,Rd} = \min \{n \times F_{v,Rk} \times k_{mod} / \gamma_M; F_{Rd,steel}\} = \min \{12 \times 1.83 \times 0.9 / 1.3; 17.3\} = \min \{15.2; 17.3\} = 15.2$ kN
According to DIN EN 1995-1-1: k_{mod} = 0.9 for KLED short and γ_M = 1.3

Proof of load capacity of the tension tie
$F_{z,Ed} / F_{z,Rd} = 14.7 / 15.2 = 0.97 \leq 1$

Impact on the dowel in concrete
$F_{Ed,Bo} = F_{Ed} \times k_t = 14.7 \times 1.33 = 19.6$ kN

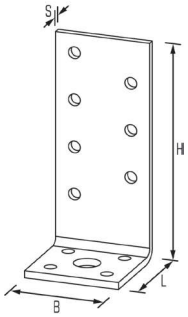
GH-HT22 tension tie (11060441) with nails 4 x 50 mm
Design value of impact: $F_{z,Ed}$ = 31.2 kN class of load impact duration (KLED) medium

Necessary number of nails 4 x 50 mm
$n_{erf} = F_{z,Ed} / (F_{v,Rk} \times k_{mod} / \gamma_M) = 31.2 / (2.14 \times 0.8 / 1.3) = 23.7 \rightarrow n = 24$

Load capacity of the tension tie with 24 nails 4 x 50 mm:
$F_{z,Rd} = \{n \times F_{v,Rk} \times k_{mod} / \gamma_M; F_{Rd,steel}\} = \min \{24 \times 2.14 \times 0.8 / 1.3; 42.0\} = \min \{31.6; 42.0\} = 31.6$ kN
According to DIN EN 1995-1-1: k_{mod} = 0.8 for KLED medium and γ_M = 1.3

Proof of load capacity of the tension tie
$F_{z,Ed} / F_{z,Rd} = 31.2 / 31.6 = 0.99 \leq 1$

Impact on the dowel in concrete
$F_{Ed,Bo} = F_{Ed} \times k_t = 31.2 \times 1.0 = 31.2$ kN



TENSION TIES

TYPE HS

ETA-13 0900

NKL 2

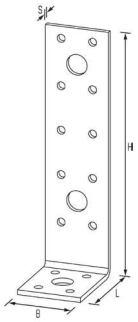
250 GD Z275

Art. No.	Dimensions [mm]							nN	nBo	EAN	Weight	Pallet	PU		
	H	x	L	x	W(B)	x	T(S)	Ø 5	Ø 11	4019346	kg				
943	90	x	35	x	40	x	3,0	11	1	110256	0.103	5400	100	■	■
944	110	x	35	x	40	x	3,0	13	1	110263	0.119	5400	100	■	■
945	130	x	35	x	40	x	3,0	15	1	110270	0.136	5100	100	■	■

4

Angle brackets HS were developed to achieve a secure fastening of timber parts on other building materials such as concrete or steel.
The short leg transfers a suction force, together with a M10 screw (+ Ø 30 washer), into the substructure.

The installation of an anchor rail (e.g. HTA 28/15 Halfen iron) enables subsequent adjustment and thus makes installation much easier. To prevent the timber parts from twisting, it is recommended that 2 brackets per connection are used.



TENSION TIES

TYPE HB

ETA-10 0010

NKL 2

250 GD Z275

Art. No.	Dimensions [mm]							nN	nBo	EAN	Weight	Pallet	PU		
	H	x	L	x	W(B)	x	T(S)	Ø 5	Ø 13	4019346	kg				
1543	155	x	50	x	40	x	3,0	18	3	110324	0.169	4200	100		■

Angle brackets HB were developed to achieve a secure fastening of timber parts on other building materials such as concrete or steel.
The short leg transfers a suction force, together with a screw into the substructure.

The installation of an anchor rail (e.g. HTA 28/15 Halfen iron) enables subsequent adjustment and thus makes installation much easier. To prevent the timber parts from twisting, it is recommended that 2 brackets per connection are used.

TYPE HS

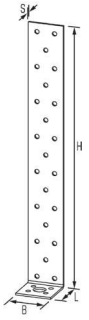
Timber / Concrete

Art. No.	Dimensions [mm]										
	H	L	W(B)	T(S)	n_a	NB	VM	$F_{1,T,Rk}$	$F_{1,Bo,ax,rk}$	$F_{2/3,T,RK}$	$F_{2/3,Bo,sx,rk}$
943	90	35	40	3,0	7	Full	4.0x40	-	-	1,70	1,70
							4.0x60	-	-	2,60	2,60
					3	Partial	4.0x40	0,90	2,20	-	-
							4.0x60	0,90	2,20	-	-
944	110	35	40	3,0	9	Full	4.0x40	-	-	2,20	2,20
							4.0x60	-	-	3,30	3,30
					5	Partial	4.0x40	0,90	2,20	-	-
							4.0x60	0,90	2,20	-	-
945	130	35	40	3,0	11	Full	4.0x40	-	-	2,80	2,80
							4.0x60	-	-	4,10	4,10
					7	Partial	4.0x40	0,90	2,20	-	-
							4.0x60	0,90	2,20	-	-

TYPE HB

Timber / Concrete

Art. No.	Dimensions [mm]				n	nBo	charakt. / KLED	4.0x40 | 5.0x40		4.0x50 | 5.0x50		4.0x60 | 5.0x60			
	H	L	B	S	Ø 5	Ø 13		$F_{z,Rk/Rd}$	n_{erf}	$F_{z,Rk/Rd}$	n_{erf}	$F_{z,Rk/Rd}$	n_{erf}	$F_{Rd,steel}$	k_t
1543	155	50	40	3,0	14	3	charact.	3,50	2	3,50	2	3,50	2	3,50	3,08
							Short	3,50	3	3,50	3	3,50	3		
							Very short	3,50	3	3,50	2	3,50	2		



ETA-10 0010

NKL 2

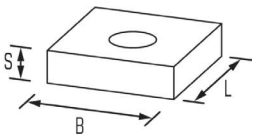
250 GD Z275

TENSION TIES

TYPE HSB

Art. No.	Dimensions [mm]							nN	nBo	EAN	Weight	Pallet	PU		
	H	x	L	x	W(B)	x	T(S)	Ø 5	Ø 14	4019346	kg				
522	200	x	40	x	40	x	2,0	19	1	110706	0.132	4200	100		■
532	300	x	40	x	40	x	2,0	27	1	110713	0.187	2400	50		■
542	400	x	40	x	40	x	2,0	34	1	110720	0.242	1800	50		■
90504	500	x	40	x	40	x	2,0	36	1	135075	0.297	2000	20		■
90505	600	x	40	x	40	x	2,0	48	1	135082	0.351	2000	20		■
524	200	x	40	x	40	x	4,0	19	1	110737	0.264	2100	50		■
534	300	x	40	x	40	x	4,0	27	1	110744	0.373	1600	50		■
544	400	x	40	x	40	x	4,0	34	1	110751	0.483	900	25		■
90512	500	x	40	x	40	x	4,0	36	1	135099	0.593	1000	20		■
90513	600	x	40	x	40	x	4,0	48	1	135006	0.703	1000	20		■

PRESSURE PLATE



TYPE HB / HSB

NKL 2

235 JR verzinkt

Art. No.	Dimensions [mm]					nBo	EAN	Weight	Pallet	PU		
	L	x	W(B)	x	T(S)	Ø 14	4019346	kg				
555	43	x	40	x	10,0	1	109991	0.137	5000	50		■

The HSB concrete flat steel anchors are used to achieve a secure fastening of timber parts on other building materials such as concrete or steel. The short leg transfers a suction force, together with a M10 screw (+ Ø 30 washer), into the substructure.

The installation of an anchor rail (e.g. HTA 28/15 half-iron) enables subsequent adjustment and thus makes installation much easier.

To prevent the timber parts from twisting, it is recommended that 2 brackets per connection are used.

For use as a flat steel anchor, the upturned part is cast in concrete.

TYPE HSB

Timber | Concrete

Art. No.	H	L	W(B)	T(S)	n	nBo	charakt. / KLED	4.0x40 | 5.0x40		4.0x50 | 5.0x50		4.0x60 | 5.0x60			
					Ø 5	Ø 13		$F_{z,Rk/Rd}$	n_{erf}	$F_{z,Rk/Rd}$	n_{erf}	$F_{z,Rk/Rd}$	n_{erf}	$F_{Rd,Stahl}$	k_t
522	200	40	40	2,0	19	1	charact.	11,60	7	11,60	6	11,60	6	11,60	3,16
							Short	11,38	9	11,60	8	11,60	8		
							Very short	11,60	8	11,60	7	11,60	7		
532	300	40	40	2,0	27	1	charact.	11,60	7	11,60	6	11,60	6	11,60	3,16
							Short	11,60	10	11,60	8	11,60	8		
							Very short	11,60	8	11,60	7	11,60	7		
542	400	40	40	2,0	34	1	charact.	11,60	7	11,60	6	11,60	6	11,60	3,16
							Short	11,60	10	11,60	8	11,60	8		
							Very short	11,60	8	11,60	7	11,60	7		
90504	500	40	40	2,0	37	1	charact.	11,60	7	11,60	6	11,60	6	11,60	3,16
							Short	11,60	10	11,60	8	11,60	8		
							Very short	11,60	8	11,60	7	11,60	7		
90505	600	40	40	2,0	48	1	charact.	11,60	7	11,60	6	11,60	6	11,60	3,16
							Short	11,60	10	11,60	8	11,60	8		
							Very short	11,60	8	11,60	7	11,60	7		
524	200	40	40	4,0	19	1	charact.	16,44	9	19,22	9	20,40	9	23,10	4,00
							Short	11,38	9	13,31	9	14,12	9		
							Very short	13,91	9	16,26	9	17,26	9		
534	300	40	40	4,0	27	1	charact.	23,10	13	23,10	11	23,10	11	23,10	4,00
							Short	21,50	17	23,10	16	23,10	15		
							Very short	23,10	15	23,10	13	23,10	13		
544	400	40	40	4,0	34	1	charact.	23,10	13	23,10	11	23,10	11	23,10	4,00
							Short	23,10	19	23,10	16	23,10	15		
							Very short	23,10	15	23,10	13	23,10	13		
90512	500	40	40	4,0	37	1	charact.	23,10	13	23,10	11	23,10	11	23,10	4,00
							Short	23,10	19	23,10	16	23,10	15		
							Very short	23,10	15	23,10	13	23,10	13		
90513	600	40	40	4,0	48	1	charact.	23,10	13	23,10	11	23,10	11	23,10	4,00
							Short	23,10	19	23,10	16	23,10	15		
							Very short	23,10	15	23,10	13	23,10	13		