

# Technical specification

## Aluminum profiles

### Tolerances

The profiles are manufactured as extruded profiles. Tolerances for dimensional and shape variations in accordance with EN12020-2.

### Cutting tolerance

Applies for all aluminum profiles offered as "L" length. Where "L" is according to order.

| Variable L (mm) | Length tolerance (mm) |
|-----------------|-----------------------|
| L= 30-1000      | ± 0,30                |
| L= 1001-2000    | ± 0,50                |
| L= 2001-4000    | ± 0,80                |
| L= 4001-6000    | ±1,00                 |

Angular cutting shall be within  $\pm 0,5^\circ$

### Anodised surface

The profile surface is natural in colour and anodised in a matt finish (E6/EV1). Surface quality in conformity with EN 12020-1.

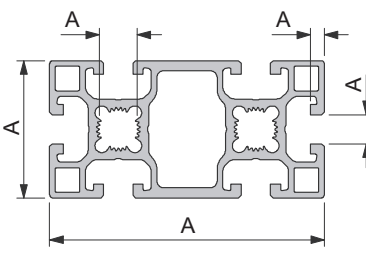
Surface treatment cannot completely eliminate striations and roughness resulting from manufacture. Slight permissible colour differences attributable to material or process-related variations cannot be avoided.

| Material                                            |                                                                                                                                               |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Material designation                                | EN AW-6063 T66                                                                                                                                |
| Material state                                      | heat-hardened                                                                                                                                 |
| Minimum tensile strength (in pressing direction)    | $R_m=245 \text{ N/mm}^2$                                                                                                                      |
| 0.2% tensile yield strength (in pressing direction) | $R_{p0,2}=195 \text{ N/mm}^2$                                                                                                                 |
| Elongation at break                                 | $A_5=10\%$<br>$A_{10}=8\%$                                                                                                                    |
| Modulus of elasticity                               | $E=70.000 \text{ N/mm}^2$                                                                                                                     |
| Brinell hardness                                    | 75 HB                                                                                                                                         |
| Coefficient of linear thermal expansion             | $\alpha_{(-50...+20^\circ\text{C})}=21,8 \times 10^{-6} \text{ 1/K}$<br>$\alpha_{(+20...+100^\circ\text{C})}=23,4 \times 10^{-6} \text{ 1/K}$ |
| Poisson ratio                                       | $\mu=0,34$                                                                                                                                    |

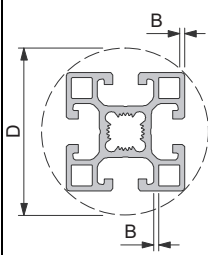
| Anodised surface  |                      |
|-------------------|----------------------|
| Coating thickness | $t = 12 \mu\text{m}$ |
| Coating hardness  | 300 HV               |

### Dimensional and shape tolerances for profiles

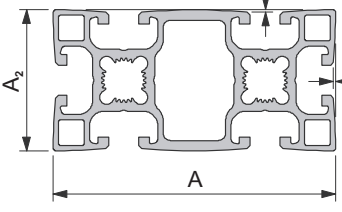
Tolerances for dimensional and shape variations in accordance with EN 12020-2. Narrower tolerances are achieved in some cases as a result of close tolerance ratings for pressing tools.

| Cross-sectional dimensions                                                         | Dimension A (mm) | Dimensional tolerance [mm] |
|------------------------------------------------------------------------------------|------------------|----------------------------|
|  | 0...10           | ± 0,15                     |
|                                                                                    | >10...15         | ± 0,20                     |
|                                                                                    | >15...30         | ± 0,25                     |
|                                                                                    | >30...45         | ± 0,30                     |
|                                                                                    | >45...60         | ± 0,40                     |
|                                                                                    | >60...90         | ± 0,45                     |
|                                                                                    | >90...120        | ± 0,60                     |
|                                                                                    | >120...150       | ± 0,80                     |
|                                                                                    | >150...180       | ± 1,00                     |
|                                                                                    | >180...240       | ± 1,20                     |
|                                                                                    | >240...300       | ± 1,50                     |
| Applicable to all dimensions apart from wall thicknesses                           |                  |                            |

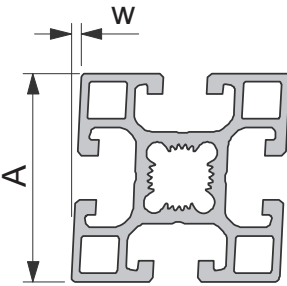
### Wall thicknesses

| Wall thicknesses                                                                     | Wall thickness | Wall thickness tolerance [mm] for circumscribing circle D [mm] |                    |
|--------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------|--------------------|
|                                                                                      | B (mm)         | $D \leq 100$                                                   | $100 < D \leq 300$ |
|  | 0...1,5        | ± 0,20                                                         | ± 0,30             |
|                                                                                      | >1,5...3       | ± 0,25                                                         | ± 0,40             |
|                                                                                      | >3...6         | ± 0,40                                                         | ± 0,60             |
|                                                                                      | >6...10        | ± 0,60                                                         | ± 0,80             |
|                                                                                      | >10...15       | ± 0,80                                                         | ± 1,00             |
|                                                                                      |                |                                                                |                    |

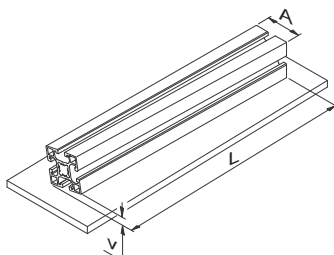
### Convexity-Concavity

| Convexity-Concavity                                                                  | Width A (mm) | Straightness tolerance t1 [mm] |
|--------------------------------------------------------------------------------------|--------------|--------------------------------|
|  | 0...30       | 0,20                           |
|                                                                                      | >30...60     | 0,30                           |
|                                                                                      | >60...100    | 0,40                           |
|                                                                                      | >100...150   | 0,50                           |
|                                                                                      | >150...200   | 0,70                           |
|                                                                                      | >200...250   | 0,85                           |
|                                                                                      | >250...300   | 1,00                           |
| Variation t2 must not exceed 0,5 mm over a width section A2 of 100 mm                |              |                                |

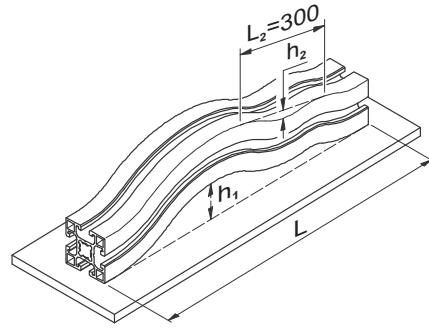
## Rectangularity

| Rectangularity                                                                   | Width<br>A (mm) | Angle tolerance<br>w [mm] |
|----------------------------------------------------------------------------------|-----------------|---------------------------|
|  | 0...30          | 0,3                       |
|                                                                                  | >30...50        | 0,4                       |
|                                                                                  | >50...80        | 0,5                       |
|                                                                                  | >80...100       | 0,6                       |
|                                                                                  | >100...120      | 0,7                       |
|                                                                                  | >120...140      | 0,8                       |
|                                                                                  | >140...160      | 0,9                       |
|                                                                                  | >160...180      | 1,0                       |
|                                                                                  | >180...200      | 1,2                       |
|                                                                                  | >200...240      | 1,5                       |
| The maximum permissible variation for a non-right angle is $\pm 1^\circ$         |                 |                           |

## Torsion

| Torsion                                                                           | Width<br>A [mm] | Torsional tolerance v [mm] for lengths L [mm] |                      |                      |                      |                      |                      |
|-----------------------------------------------------------------------------------|-----------------|-----------------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                                                                                   |                 | $L \leq 1000$                                 | $1000 < L \leq 2000$ | $2000 < L \leq 3000$ | $3000 < L \leq 4000$ | $4000 < L \leq 5000$ | $5000 < L \leq 6000$ |
|  | 0...30          | 1,0                                           | 1,5                  | 1,5                  | 2,0                  | 2,0                  | 2,0                  |
|                                                                                   | >25...50        | 1,0                                           | 1,2                  | 1,5                  | 1,8                  | 2,0                  | 2,0                  |
|                                                                                   | >50...75        | 1,2                                           | 1,2                  | 1,2                  | 1,5                  | 2,0                  | 2,0                  |
|                                                                                   | >75...100       | 1,2                                           | 1,2                  | 1,5                  | 2,0                  | 2,2                  | 2,5                  |
|                                                                                   | >100...125      | 1,4                                           | 1,5                  | 1,8                  | 2,2                  | 2,5                  | 3,0                  |
|                                                                                   | >125...150      | 1,2                                           | 1,5                  | 1,8                  | 2,2                  | 2,5                  | 3,0                  |
|                                                                                   | >150...200      | 1,5                                           | 1,8                  | 2,2                  | 2,6                  | 3,0                  | 3,5                  |
|                                                                                   | >200...300      | 1,8                                           | 2,5                  | 3,0                  | 3,0                  | 4,0                  | 4,5                  |

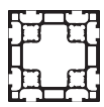
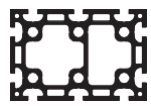
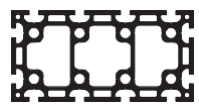
## Straightness

| Straightness                                                                        | Length, L (mm) | Straightness tolerance, h1 [mm] |
|-------------------------------------------------------------------------------------|----------------|---------------------------------|
|  | 0...1000       | 0,7                             |
|                                                                                     | >1000...2000   | 1,3                             |
|                                                                                     | >2000...3000   | 1,8                             |
|                                                                                     | >3000...4000   | 2,2                             |
|                                                                                     | >4000...5000   | 2,6                             |
|                                                                                     | >5000...6000   | 3,0                             |
| Straightness h2 must vary by no more than 0,3 mm over a length L2 of 300 mm         |                |                                 |

## Profile data

The table shows profile data per metre for the different profile series.

| Series |    | Item number    | <br>kg/m | <br>cm <sup>3</sup> | <br>cm <sup>3</sup> | <br>cm <sup>4</sup> | <br>cm <sup>4</sup> | <br>KN |
|--------|-------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Light  |    | TCBL Lx40      | 1,4                                                                                       | 3,9                                                                                                  | 3,9                                                                                                    | 7,8                                                                                                    | 7,8                                                                                                    | 8,0                                                                                       |
|        |    | TCBL Lx40x80   | 2,4                                                                                       | 14,0                                                                                                 | 7,1                                                                                                    | 56,0                                                                                                   | 14,2                                                                                                   | 8,0                                                                                       |
| Basic  |    | TCBB Lx40x16   | 0,8                                                                                       | 0,4                                                                                                  | 2,3                                                                                                    | 0,8                                                                                                    | 4,6                                                                                                    | 10                                                                                        |
|        |    | TCBB Lx40      | 1,5                                                                                       | 4,3                                                                                                  | 4,3                                                                                                    | 8,7                                                                                                    | 8,7                                                                                                    | 10                                                                                        |
|        |    | TCBB Lx40 C    | 1,5                                                                                       | 4,6                                                                                                  | 4,6                                                                                                    | 9,2                                                                                                    | 9,2                                                                                                    | 10                                                                                        |
|        |    | TCB Lx40x80    | 2,5                                                                                       | 15,2                                                                                                 | 7,9                                                                                                    | 60,7                                                                                                   | 15,8                                                                                                   | 10                                                                                        |
|        |    | TCBB Lx40x80 L | 2,6                                                                                       | 15,0                                                                                                 | 8,4                                                                                                    | 60,0                                                                                                   | 16,8                                                                                                   | 10                                                                                        |
|        |  | TCBB Lx40x80 C | 2,6                                                                                       | 16,0                                                                                                 | 8,5                                                                                                    | 16,9                                                                                                   | 10,0                                                                                                   | 10                                                                                        |
|        |  | TCBB Lx40x120  | 3,7                                                                                       | 31,5                                                                                                 | 11,9                                                                                                   | 189,1                                                                                                  | 23,8                                                                                                   | 10                                                                                        |
|        |  | TCBB Lx80x80   | 4,7                                                                                       | 29,3                                                                                                 | 29,3                                                                                                   | 117,2                                                                                                  | 117,2                                                                                                  | 10                                                                                        |
|        |  | TCBB Lx80x80 C | 4,8                                                                                       | 30,6                                                                                                 | 30,6                                                                                                   | 122,4                                                                                                  | 122,4                                                                                                  | 10                                                                                        |
|        |  | TCBA Lx40      | 1,2                                                                                       | 2,6                                                                                                  | 2,6                                                                                                    | 6,0                                                                                                    | 6,0                                                                                                    | 10                                                                                        |
|        |  | TCBR Lx56      | 1,7                                                                                       | 4,3                                                                                                  | 3,8                                                                                                    | 14,2                                                                                                   | 10,2                                                                                                   | 10                                                                                        |
|        |  | TCBA Lx80      | 2,8                                                                                       | 14,5                                                                                                 | 14,5                                                                                                   | 58,4                                                                                                   | 58,4                                                                                                   | 10                                                                                        |
|        |  | TCBA Lx40 MC   | 1,1                                                                                       | 3,7                                                                                                  | 2,1                                                                                                    | 7,5                                                                                                    | 5,0                                                                                                    | 10                                                                                        |

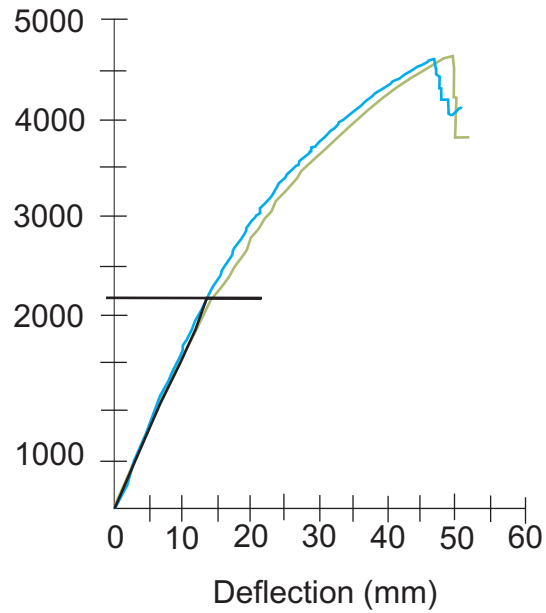
| Series           |     | Item number    | <br>kg/m | <br>cm <sup>3</sup> | <br>cm <sup>3</sup> | <br>cm <sup>4</sup> | <br>cm <sup>4</sup> | <br>KN |
|------------------|-------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Heavy            |    | TCBH Lx40      | 1,8                                                                                      | 5,7                                                                                                 | 5,7                                                                                                 | 11,4                                                                                                  | 11,4                                                                                                  | 16                                                                                       |
|                  |    | TCBH Lx40 C    | 1,8                                                                                      | 6,0                                                                                                 | 6,0                                                                                                 | 11,9                                                                                                  | 11,9                                                                                                  | 16                                                                                       |
|                  |    | TCBH Lx40x80   | 3,0                                                                                      | 18,8                                                                                                | 10,4                                                                                                | 75,1                                                                                                  | 20,7                                                                                                  | 16                                                                                       |
|                  |    | TCBH Lx40x80 C | 3,1                                                                                      | 19,6                                                                                                | 10,9                                                                                                | 78,5                                                                                                  | 21,8                                                                                                  | 16                                                                                       |
|                  |    | TCBH Lx80      | 5,3                                                                                      | 34,8                                                                                                | 34,8                                                                                                | 139,3                                                                                                 | 139,3                                                                                                 | 16                                                                                       |
|                  |    | TCBH Lx80 C    | 5,4                                                                                      | 36,1                                                                                                | 36,1                                                                                                | 144,4                                                                                                 | 144,4                                                                                                 | 16                                                                                       |
| Ultra            |    | TCBU Lx80      | 6,4                                                                                      | 40,8                                                                                                | 40,8                                                                                                | 163,2                                                                                                 | 163,2                                                                                                 | 20                                                                                       |
|                  |  | TCBU Lx80x120  | 8,9                                                                                      | 81,7                                                                                                | 59,5                                                                                                | 490,0                                                                                                 | 238,0                                                                                                 | 20                                                                                       |
|                  |  | TCBU Lx80x160  | 11,4                                                                                     | 135,4                                                                                               | 78,2                                                                                                | 1083,0                                                                                                | 312,9                                                                                                 | 20                                                                                       |
| Special profiles |  | TCBR Lx40      | 1,5                                                                                      | 3,8                                                                                                 | 3,8                                                                                                 | 7,6                                                                                                   | 7,6                                                                                                   | 6                                                                                        |
|                  |  | TCBB Lx40x160  | 6,1                                                                                      | 67,4                                                                                                | 20,2                                                                                                | 539,3                                                                                                 | 40,4                                                                                                  | 6                                                                                        |
| RC               |  | TCRC Lx40x80   | 2,7                                                                                      | 9,1                                                                                                 | 20,4                                                                                                | 18,3                                                                                                  | 81,6                                                                                                  | 6                                                                                        |
|                  |  | TCRC Lx40x120  | 3,3                                                                                      | 10,6                                                                                                | 38,9                                                                                                | 21,2                                                                                                  | 233,1                                                                                                 | 6                                                                                        |

## Bending moments

The table on the next page is showing all available results of various bending moment tests.

The connections were tested with universal testing machines: the legs of the U-structure in the picture were pulled outwards to make a bending moment on the connection.

### Tension



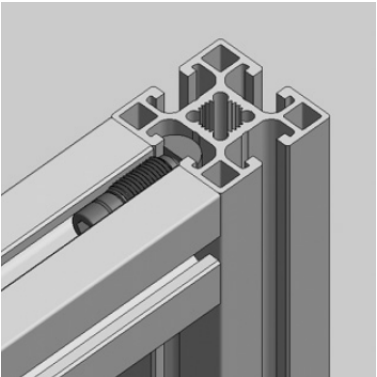
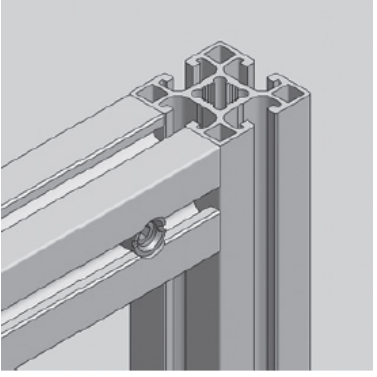
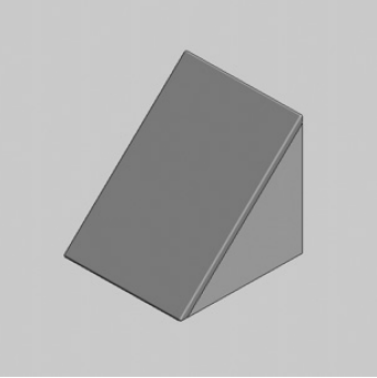
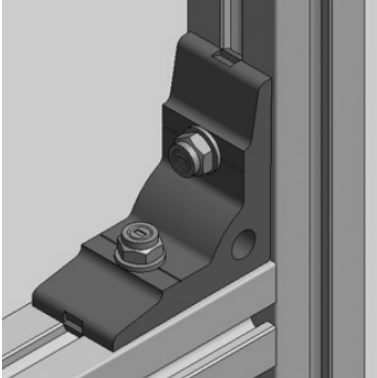
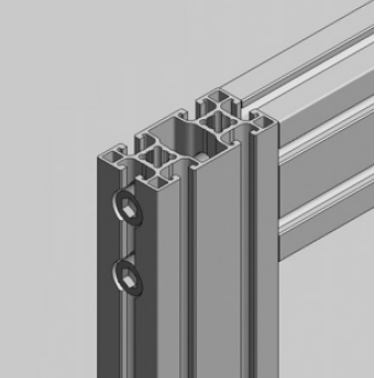
Note! The values are showing the yield points:

a safety factor must be added.



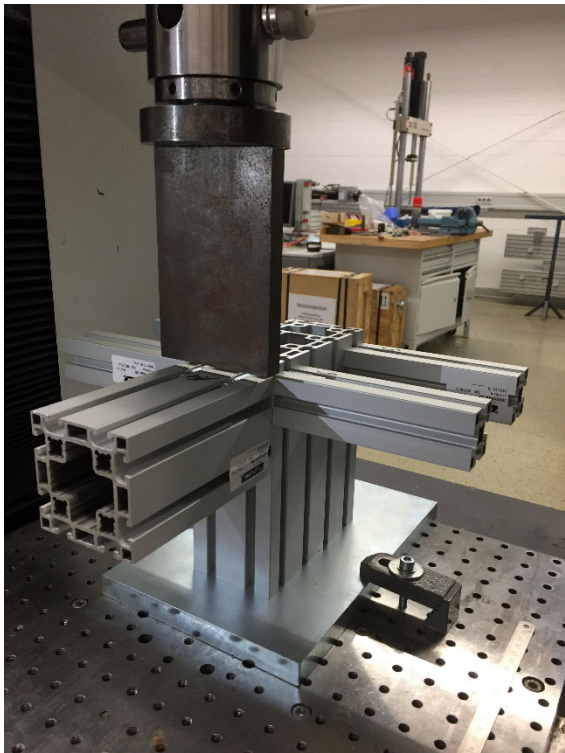
| No. | Connector                                                        | 40x40 Light<br>TCBL ...x40 | 40x40 Basic<br>TCBB ...x40 | 80x80 Basic<br>TCBB ...x80 | 40x40 Heavy<br>TCBH ...x40 | 80x80 Heavy<br>TCBH ...x80 | 80x80 Ultra<br>TCBU ...x80 |
|-----|------------------------------------------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 1   | Universal joint<br>TCUJ ...                                      | 160                        | 170                        | 840                        | 200                        | 980                        | 1100                       |
| 2   | Central joint, rigid<br>TCEC 14 ...                              | 60                         | 90                         | -                          | 120                        | -                          | -                          |
| 3   | Corner joint 40x40 (die-cast)<br>Single<br>TCFA 40x40 A...       | 110                        | 130                        | -                          | 160                        | -                          | -                          |
| 4   | Corner joint 40x40 (die-cast)<br>Peer<br>TCFA 40x40 A...         | -                          | 240                        | -                          | -                          | -                          | -                          |
| 5   | Corner joint 40x80 (die-cast)<br>Single<br>TCFA 40x80 A...       | -                          | 580                        | -                          | -                          | -                          | -                          |
| 6   | Corner joint 40x80 (die-cast)<br>Peer<br>TCFA 40x80 A...         | -                          | -                          | -                          | -                          | -                          | -                          |
| 7   | Angle joint 40x80 (profile<br>version) single<br>TCFA 40x70 B... | 230                        | 280                        | -                          | -                          | -                          | -                          |
| 8   | Angle joint 40x80<br>(profile version) peer<br>TCFA 40x70 B...   | -                          | 460                        | -                          | -                          | -                          | -                          |
| 9   | Angle joint 80x80<br>(profile version) single<br>TCFA 80x70 B... | -                          | -                          | 600                        | -                          | 650                        | 770                        |
| 10  | Angle joint 80x80<br>(profile version) peer<br>TCFA 80x70 B...   | -                          | -                          | 830                        | -                          | -                          | 1300                       |
| 11  | M12 screwed joint<br>TCSJ 12...                                  | -                          | -                          | 780                        | 130                        | 840                        | 1900                       |

All values are in Nm

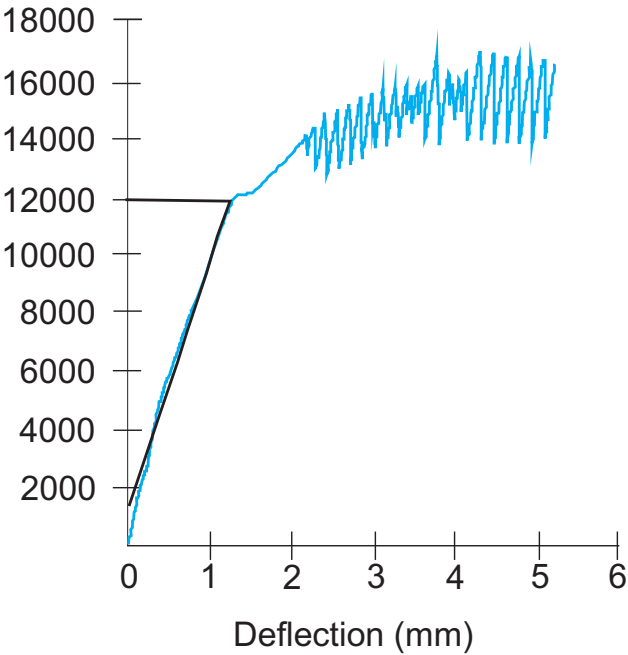
|                 |                                                                                     |               |                                                                                      |
|-----------------|-------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------|
| No. 1           |     | No. 2         |     |
| No. 3-6         |    | No. 7-10      |    |
| No. 11          |   |               |                                                                                      |
| Single brackets |  | Peer brackets |  |

Shear tests

The shear forces of some connections were tested: the steel plate pressed the horizontal beam downward. The vertical beam was always an 80x160 Ultra.



Tension



The values are showing the yield points: a safety factor must be added!

| Connector | TCBB Lx40<br>40x40 Basic | TCBB Lx80<br>80x80 Basic |
|-----------|--------------------------|--------------------------|
| TCUJ...   | 7450                     | 11950                    |
| TCEC 14 E | 3400                     | -                        |

All values in N