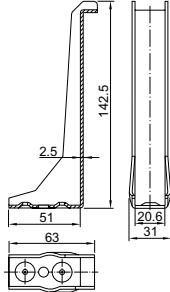


# X-HVB shear connectors

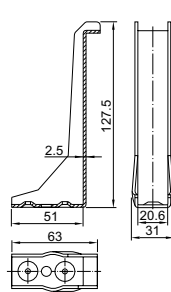
## Product data

### Dimensions

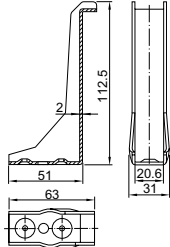
#### X-HVB 140



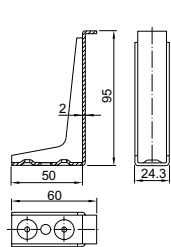
#### X-HVB 125



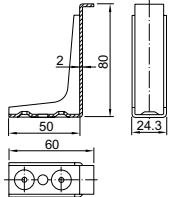
#### X-HVB 110



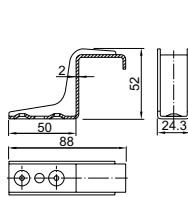
#### X-HVB 95



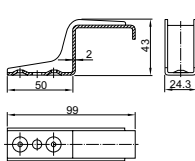
#### X-HVB 80



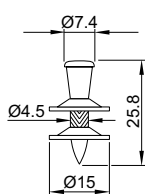
#### X-HVB 50



#### X-HVB 40



#### X-ENP-21 HVB



### General information

#### Material specifications

X-HVB

Carbon steel:  $R_m = 295\text{--}350\text{ N/mm}^2$

Zinc coating:  $\geq 3\ \mu\text{m}$

X-ENP-21 HVB

Carbon steel shank: HRC58

Zinc coating:  $8\text{--}16\ \mu\text{m}$

#### Recommended fastening tools

Tool	DX 76	DX 76 PTR
Fastener guide	X-76-F-HVB	X-76-F-HVB-PTR
Piston	X-76-P-HVB	X-76-P-HVB-PTR
Cartridges	6.8/18M black, red (for details see application limit X-ENP-21 HVB)	

See **Tools and equipment** for more details.

#### Approvals and design guidelines

SOCOTEC (France)

DIBt (Germany)

MLIT / BCJ (Japan),

Rom. Ministry AT 016-01/214-2010 (Roma),

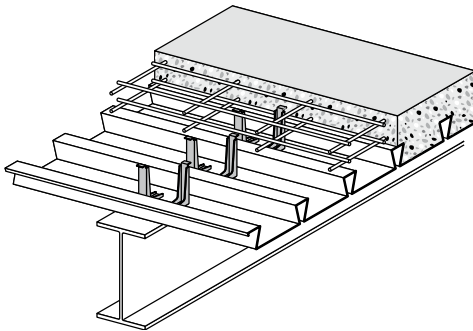
TZÚS (Czech)

Note: technical data presented in these approvals and design guidelines reflect specific local conditions and may differ from those published in this handbook.

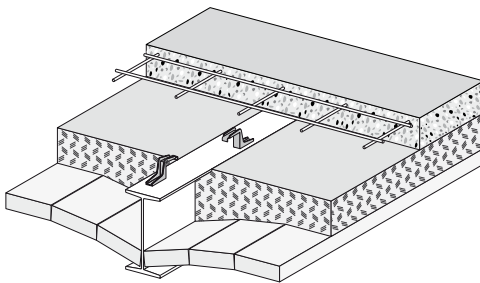
If the fastening is subject to an approval process or where a design guideline must be used, technical data in the approval or design guideline has precedence over data presented here. Approval copies are available from your Hilti technical advisory service.

## Applications

### Examples



Typical application of X-HVB shear connector with steel deck, e.g. new construction.



Typical application of X-HVB shear connector with jack arch system (without steel deck), e.g. rehabilitation project.

## Design data

### Solid slabs

Nominal	Characteristic shear resistance $P_{Rk}$ [kN] <sup>1)</sup>	Design shear resistance $P_{Rd}$ [kN] <sup>2)</sup>	Allowable horizontal shear $q$ [kN] <sup>3)</sup>	Allowable resistance (working load) $R_D$ [kN] <sup>4)</sup>
X-HVB 40	23	18	N.A	13
X-HVB 50	23	18	N.A	13
X-HVB 80	28	23	14	16
X-HVB 95	35	28	17.5	22
X-HVB 110	35	28	17.5	22
X-HVB 125	35	28	17.5	22
X-HVB 140	35	28	17.5	22

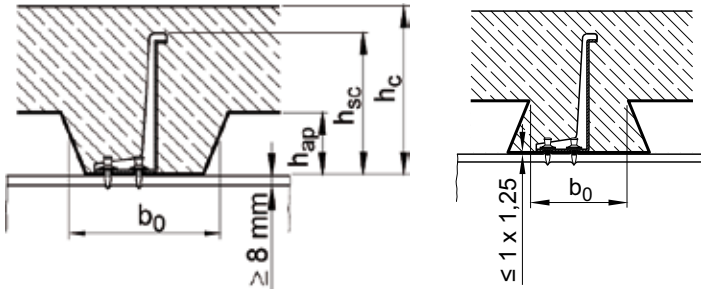
<sup>1)</sup> As defined in EN 1994-1-1 (Nominal strength in AISC-LRFD; unfactored shear resistance in CISC.

<sup>2)</sup> As defined in EN 1994-1-1

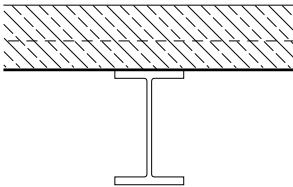
<sup>3)</sup> Allowable shear in AISC-ASD

<sup>4)</sup> Allowable shear for working load design

Reduction factors for profile metal decks



Ribs transverse to beams



Note:  $k_t \leq 1.0$

$$k_t = \frac{K}{\sqrt{N_r}} \cdot \frac{b_0}{h_{ap}} \cdot \frac{h_{sc} - h_{ap}}{h_{ap}}$$

EN 1994-1-1 designs:

$K = 0.70$

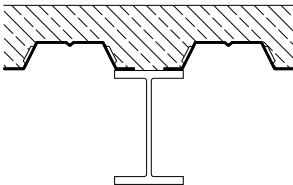
$N_r = \text{HVBs / rib} (\leq 2 \text{ in the calculation even if 3 are placed in a rib})$

AISC, CISC, BS 5950, other design codes:

$K = 0.85$

$N_r = \text{HVBs / rib} (1, 2 \text{ or } 3)$

Ribs parallel to beams



Note:  $k_p \leq 1.0$

for  $\frac{b_0}{h_{ap}} \geq 1.8 \Rightarrow k_p = 1.0$

for  $\frac{b_0}{h_{ap}} < 1.8 \Rightarrow k_p = 0.6 \times \frac{b_0}{h_{ap}} \cdot \frac{h_{sc} - h_{ap}}{h_{ap}}$

## Engineering advice

### Connector placement along the beam

The HVB is a flexible connector and may be uniformly distributed between critical sections. These critical sections, where large changes in shear flow occur, may be at supporting points, points of application of point loads or areas with extreme bending moments.

### Partial shear connection

#### Strength:

The minimum connection depends on the design code used:

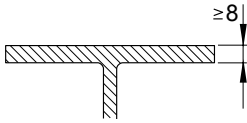
- a) In **EN 1994-1-1** design,  $N/N_f$  must be at least 0.4. This increases depending on span length and decking geometry.
- b) In **AISC**,  $N/N_f$  must be at least 0.25.
- c) In **CISC**,  $N/N_f$  must be at least 0.50.

#### Deflection control only:

If the shear connection is needed for deflection control only, there is no minimum degree of connection. However, minimum allowable connector spacing applies and the steel beam must have enough strength to carry the self-weight and all imposed loads.

**Application requirements**

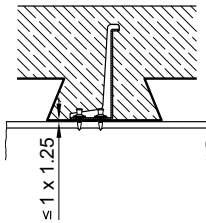
**Thickness of base material**



Minimum thickness of steel base material  **$t_{II} = 8$  mm**

In rehabilitation projects, application to thin beam flanges of minimum 6 mm is possible in order to take the use of small I-sections (e.g. IAO 100 or IPN 80) into account. Please refer to Socotec approval or contact Hilti for detailed information.

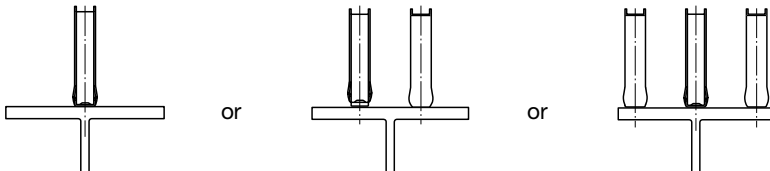
**Thickness of fastened material**



Maximum thickness of decking  **$t_I = 1.25$  mm**

Connector positioning, spacing and edge distances

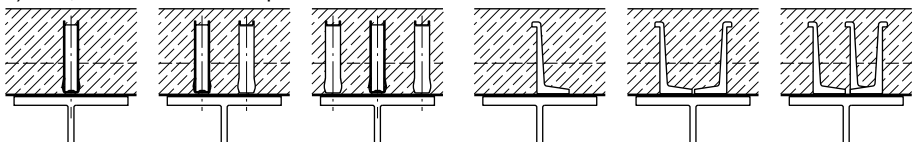
General positioning



Position the HVBs so that the shear force is transferred symmetrically to the beam. HVB orientation parallel to the axis of the beam is preferred.

Positioning on metal decks - ribs transverse to beam

1) One, two or three HVBs per rib



Parallel to beam

Perpendicular to beam

2a) Position in the rib : 1 HVB per rib – leg centred in the rib or 40 mm clearance

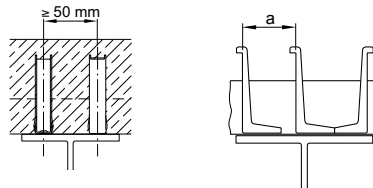


2b) With 2 or 3 HVBs per rib – legs centred in the rib or alternated about the center



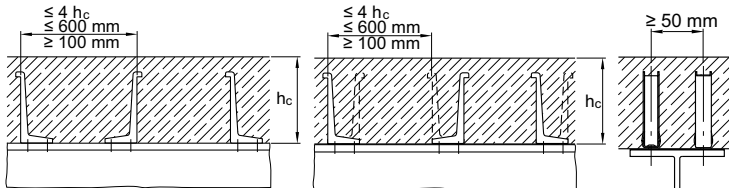
3) Spacing along the ribs

- basic minimum spacing,  $a \geq 50$  mm
- $a \geq 100$  mm for:
  - $b_o/m < 0.7$  and  $b_o/h_{ap} < 1.8$
  - SDI 3" composite decking (USA)



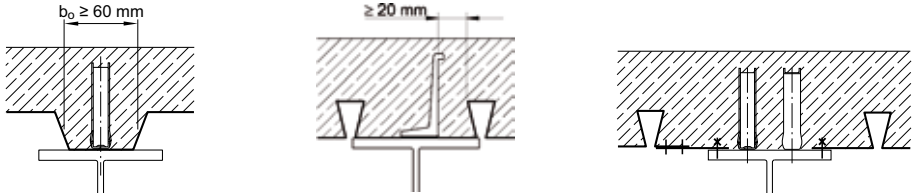
$m$  = rib spacing

Positioning on solid slabs and metal decks – ribs parallel to beam



- With 1 connector per row, alternate direction of connectors from X-HVB to X-HVB.
- With 2 or 3 connectors per row, alternate direction of connectors inside of each row and from row to row.

Clearance to metal decking



Split decking if necessary for spacing / clearance

**Corrosion information**

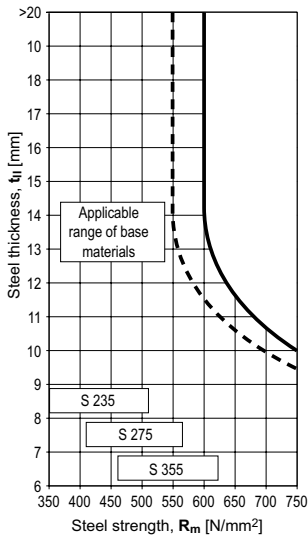
The intended use only comprises fastenings which are not directly exposed to external weather conditions or moist atmospheres.



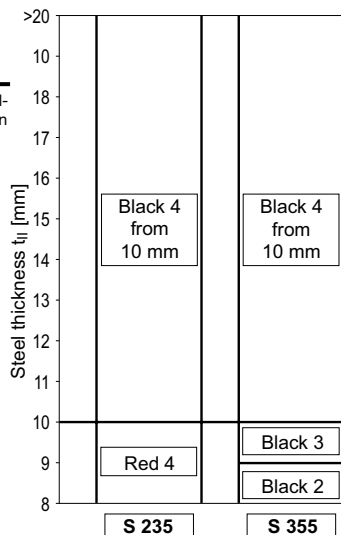
**Application limits**

Application limits are valid only if correct cartridge and power setting are used!

Application limits X-ENP-21 HVB



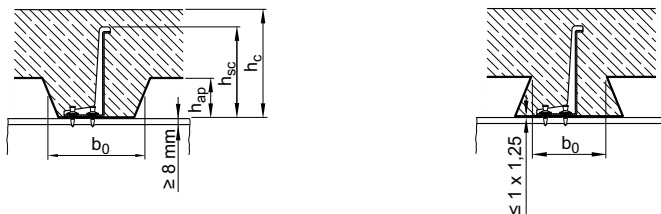
Cartridge preselection and power setting



In thermo-mechanically rolled construction steel, e.g. S 355M per EN 10025-4 the application limit is reduced by 50 N/mm<sup>2</sup>

Fine adjustment by carrying out installation tests on site

## Fastener selection

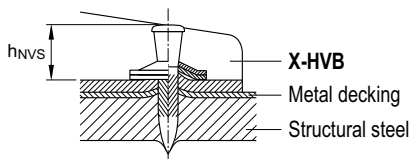


## Connector

Designation	Item no.	Maximum decking height $h_{ap}$ [mm]	
		$b_0 / h_{ap} \geq 1.8$	$b_0 / h_{ap} < 1.8$
X-HVB 40	2112256	Not for use with profiled decking	
X-HVB 50	56467	Not for use with profiled decking	
X-HVB 80	239357	45	45
X-HVB 95	348179	60	57
X-HVB 110	348180	75	66
X-HVB 125	348181	80	75
X-HVB 140	348321	80	80
All connectors with two nails			
X-ENP-21 HVB	283512		

## Fastening quality assurance

## Fastening inspection



**X-ENP-21 HVB**  $h_{NVS} = 8.2\text{--}9.8$  mm