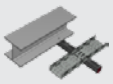
FASTENING ON STEEL

Installation Typicals

APPLICATION SELECTOR

	F-BT-MR SN Threaded stud		F-BT-MR Threaded stud	
				
	Heavy duty		Heavy duty	
	Base material thickness ≥ 10 mm (⅜")		Base material thickness ≥ 10 mm (⅜")	
	Metric	Imperial	Metric	Imperial
 **Cantilever**	Page 17	Page 45	Page 30	Page 58
 **Braced cantilever**	Page 18	Page 46	Page 31	Page 59
 **Strut to steel**	Page 19	Page 47	Page 32	Page 60
 **Strut to steel**	Page 20	Page 48	Page 33	Page 61
 **T-Post (ceiling)**	Page 21	Page 49	Page 34	Page 62
 **U-Frame (ceiling)**	Page 22	Page 50	Page 35	Page 63
 **L-Post**	Page 23	Page 51	Page 36	Page 64
 **Fastening equipment support**	Page 24	Page 52	Page 37	Page 65
 **Junction boxes / switches**	Page 25	Page 53	Page 38	Page 66

USAGE / STRUCTURAL DESIGN DISCLAIMER — 2023/05/31

- This document is updated regularly — please check for an update before using the document and always use the latest version. Please make sure to not use the document later than the indicated expiry date (left lower corner). Technical data for F-BT are currently in approval stage. The published data reflect best current knowledge.
- The mentioned values are ONLY reflecting capacity of the fasteners / studs themselves. Structural analysis of support / structure is NOT in Hilti's scope as Hilti is not aware of the relevant data.
- The user has to make sure that all instructions (for tools, fasteners and auxiliary material used) are followed strictly to achieve the required performance. It is further required that the typicals are set up strictly as shown and described.
- All typicals calculations are based on the capacity that is mentioned in the description of the fasteners — please refer to the respective detailed technical description. Results are rounded for simplification and to harmonize metric and imperial units.
- **Assumption:** calculation is based on rigid system model, without deformation of baseplate or cantilever.
- **Assumption:** in applications that introduce tensile and shear load to the fastener, the shear loads are assumed to be carried only by the top threaded stud(s), which also carry the tensile load. This is, therefore, a worst-case scenario.
- **Assumption:** considered loadings are only the static loads of the cable tray, pipe or other installed elements and the weight of the support itself.
    - Load is always acting in the center of the cable tray, pipe or installed elements, the dimension L1 is from that point to the fasteners plane — please see the description in the respective examples.
    - No other loads (e.g. wind load or loads due to installation / transportation) are known and in scope of the calculation.
- **Assumption:** there is no longitudinal force along length of supported item (e.g. cable tray, pipe) due to thermal expansion or other phenomena.

USAGE / STRUCTURAL DESIGN EXAMPLE LOADS* — CABLE TRAY AND PIPE

Example loads* can be calculated based on a standard cable tray with 50 mm height or pipe (see example tables to the right).

*Loads are typically stated in technical documents as "Force [kN]," however, it is more comprehensible to state the loads as "Weight [kg]" conversion as follows:

1 kg = 9.81 N / (weight to force):
100 kg = 0.98 kN;
1000 kg = 9.8 kN / (force to weight):
1 kN = 102 kg;
10 kN = 1019 kg

Pipe	Diameter [mm]	Load [kg/m]	Load [lb/ft]
25 DN x 33.4 OD	25	3.6	2.4
40 DN x 48.3 OD	40	6.1	4.1
50 DN x 60.3 OD	50	9.8	6.6
80 DN x 88.9 OD	80	15.8	10.6
100 DN x 114.3 OD	100	31.0	20.8
125 DN x 141.3 OD	125	45.9	30.8
150 DN x 168.3 OD	150	63.6	42.7
200 DN x 219.1 OD	200	96.9	65.1

- Load [kg/m] includes the pipe and media (by simplified calculation)
- Pipe weight is in the range of 3.0 – 57 kg/m (for diameter of 25 – 200 mm; with 1 mm pipe insulation)
- Media weight is calculated based on density of water 1.0 kg/l (per pipe cross-section) density dependent on media (e.g. oil 0.6 – 0.9 kg/l)

Cable tray	Width [mm]	Load [kg/m]	Load [lb/ft]
50 W x 50 H	50	7.7	5.2
100 W x 50 H	100	14.5	9.7
150 W x 50 H	150	21.2	14.2
200 W x 50 H	200	27.9	18.7
300 W x 50 H	300	41.4	27.8
450 W x 50 H	450	61.6	41.4
600 W x 50 H	600	81.9	55.0
900 W x 50 H	900	122.3	82.2

- Load [kg/m] includes the cable tray and cable carried by the cable tray (by simplified calculation)
- Cable tray weight (steel, t = 1.25 mm) is in the range of 1.5 – 9.8 kg/m (for width of 50 – 900 mm)
- Cable weight is calculated based on an average filling density of 0.25 kg/m/cm^2 cable tray cross-section typical cable range from 0.15 – 0.35 kg/m/cm^2

FASTENERS USED FOR TYPICALS CALCULATION

Blunt Tip Fasteners

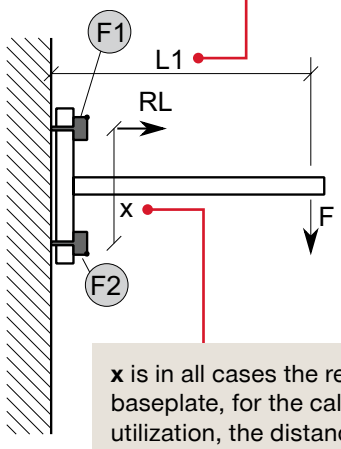
Key Questions	Fastener	F-BT-MR SN Threaded stud	F-BT-MR Threaded stud
		 L	 L
	Material	**Stainless steel A5, 316Ti**	**Stainless steel A5, 316Ti**
1	**Corrosive environment**	**Highly corrosive C4, C5**	**Highly corrosive C4, C5**
2	**No repair of corrosion coating needed**	**M6/M8 (4) :** t_{II} ≥ 4 mm (5⁄32") **M6 (6) :** t_{II} ≥ 6 mm (15⁄64") **M8 (8) :** t_{II} ≥ 8 mm (5⁄16") **M10/M12 (10) :** t_{II} ≥ 10 mm (3⁄8") **3⁄8" (5⁄32") :** t_{II} ≥ 4 mm (5⁄32") **3⁄8" (3⁄8") :** t_{II} ≥ 10 mm (3⁄8")	**M6 (6) :** t_{II} ≥ 6 mm (15⁄64") **M8 (8) :** t_{II} ≥ 8 mm (5⁄16") **M10/M12 (10) :** t_{II} ≥ 10 mm (3⁄8") **3⁄8"/ 1⁄2" (3⁄8") :** t_{II} ≥ 10 mm (3⁄8")
3	**Application Limit***	2 mm (5⁄64") ≤ t_{II} < 30 mm (1 1⁄8")	2 mm (5⁄64") ≤ t_{II} < 30 mm (1 1⁄8")
	Base material L	Steel	Steel
	Tensile load resistance (N_{rec})	**M6/M8 (4) :** 1.8 kN (405 lb) **M6 (6) :** 3.1 kN (695 lb) **M8 (8) :** 4.5 kN (1010 lb) **M10/M12 (10) :** 8.0 kN (1800 lb) **3⁄8" (3⁄8") :** 8.0 kN (1800 lb)	**M6 (6) :** 3.1 kN (695 lb) **M8 (8) :** 4.5 kN (1010 lb) **M10/M12 (10) :** 8.0 kN (1800 lb) **3⁄8" (3⁄8") :** 8.0 kN (1800 lb)
	Shear load resistance (V_{rec})	**M6/M8 (4) :** 1.0 kN (225 lb) **M6 (6) :** 1.4 kN (315 lb) **M8 (8) :** 2.0 kN (450 lb) **M10/M12 (10) :** 3.6 kN (810 lb) **3⁄8" (3⁄8") :** 3.6 kN (810 lb)	**M6 (6) :** 1.8 kN (405 lb) **M8 (8) :** 2.6 kN (585 lb) **M10/M12 (10) :** 4.5 kN (1010 lb) **3⁄8" (3⁄8") :** 4.5 kN (1010 lb)
	Tightening torque w/ flange lock nut	**M6/M8 (4) :** 6 Nm **M6 (6) :** 8 Nm **M8 (8) :** 20 Nm **M10/M12 (10) :** 30 Nm **3⁄8" (3⁄8") :** 30 Nm (22.1 lb-ft)	**M6 (6) :** 8 Nm **M8 (8) :** 20 Nm **M10/M12 (10) :** 30 Nm **3⁄8" (3⁄8") :** 30 Nm (22.1 lb-ft)
	Available thread diameter	M6 | M8 | M10 | 3⁄8" | M12	M6 | M8 | M10 | 3⁄8" | 1⁄2" | M12
	Max. fastened material height	**L = 25 mm (1") :** 3 mm (1⁄8") ≤ t_i < 10 mm (3⁄8") **L > 25 mm (1") :** 3 mm (1⁄8") ≤ t_i < 20 mm (3⁄4")	**L = 25 mm (1") :** 5 mm (3⁄16") ≤ t_i < 10 mm (3⁄8") **L > 25 mm (1") :** 5 mm (3⁄16") ≤ t_i < 20 mm (3⁄4")
	Required equipment	FX 3 and SF 8M-A22	FX 3 and SF 8M-A22
	Approvals	Not ready yet	Not ready yet

Note: t_i: fixture thickness
Note: t_{II}: base material thickness
*Application limit: S355 / Grade 50 / Refer to Hilti Cordless Stud Fusion Technical Manual [May 2023]

HOW TO USE THIS DOCUMENT

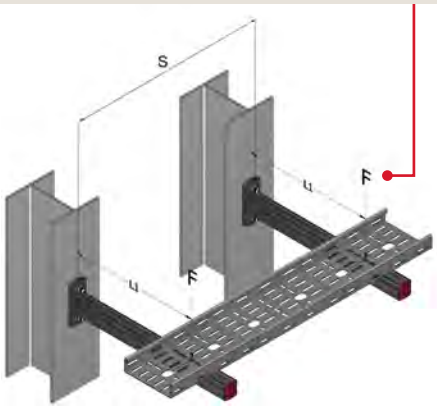
How to interpret the sketches

L1 is in all cases the relevant dimension of the lever arm / cantilever “distance from fastener to load”



x is in all cases the relevant dimension of the baseplate, for the calculation of the fastener utilization, the distance of the involved fasteners

F is in all cases the total load which has to be borne by the structure and it includes the payload and the load of the structure itself



How to read the technical tables

Result parameter **L1** in [mm]

2nd base parameter **x** in [mm]

1st base parameter F in [kg]

Support axis to explain 1st base parameter

Results **e.g. L1**

Result: L1 [mm]	F [kg]							
	50	75	100	125	150	200	250	300
→ Load in [kN]	0.49	0.74	0.98	1.23	1.47	1.96	2.45	2.94
x [mm] 80	585	390	285	210	165	105	70	50
100	730	485	355	265	205	135	90	60
125	915	610	445	335	260	170	115	75
150	1100	730	530	400	310	200	135	90
175	1280	855	620	470	365	235	160	110
200	1465	975	710	535	415	270	180	125

Result parameter **Load** in [kg]

2nd base parameter **x** in [mm]

1st base parameter Lever arm **L1** in [mm]

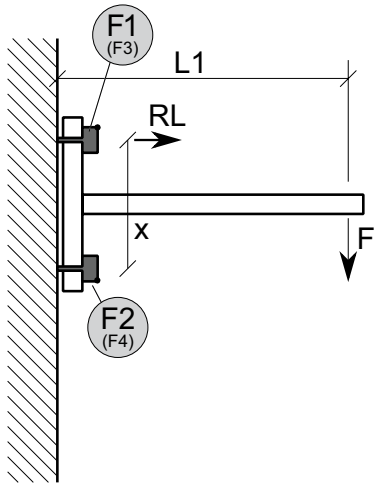
Results **e.g. F**

Result: Load F [kg]	L1 [mm]							
	150	200	250	400	600	800	1000	1200
x [mm] 80	160	130	110	70	45	35	25	20
100	185	155	130	90	60	45	35	30
125	215	180	155	105	75	55	45	35
150	235	200	175	125	90	65	55	45
175	255	220	190	140	100	80	60	50
200	275	235	210	155	110	90	70	60

HOW TO USE THIS DOCUMENT

We can utilize the following tables to solve different typical use cases

Application



F1 – F4 fasteners
F load on the support
RL resulting load (tensile and shear load)
L1 support lever length
x support basis (=distance of fasteners)

It is recommended to position the support lever halfway between the fasteners to ease installation

Customer's typical use cases

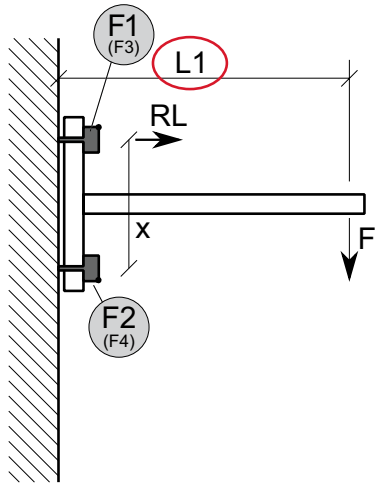
Use Case	L1	x	F	RL	Typical customer task
A	?	✓	✓	✓	"I know the loads and use existing baseplates. I have different lever-arm length, so what is the maximum **L1**?"
B	✓	?	✓	✓	"I know loads and the required lever-arm. I want to minimize the baseplate size, so what is minimum **x**?"
C	✓	✓	?	✓	"I already have supports available and want to know maximum allowable load, so what maximum **F** can I use?"
D	✓	✓	✓	?	"I already have supports available and want to minimize the number of supports, so how do I use **RL** for that?"

✓ Parameter is known; **?** Parameter is the table output

USE CASES IN DETAIL

Use Case A: maximize L1 and achieve a required length

Application



L1	x	F	RL
?	✓	✓	✓
✓	?	✓	✓
✓	✓	?	✓
✓	✓	✓	?

F1 – F4	fasteners
F	load on the support
RL	resulting load (tensile and shear load)
L1	support lever length
x	support basis (=distance of fasteners)

Example — Use Case A

Outset situation

- **Cable tray type 450 W x 50 H; span s = 2.2 m** → results in load of **140 kg** per support (example table: 2.25 m x 61.6 kg/m)
- **N is defined by 4 fasteners (e.g. X-BT-MR)**
- **x = 175 mm** (baseplates are already available, and thus, the distance **x** is already given)

Task

The lever-arm length should be as long as possible to gain flexibility. It needs to be at least **0.3 m**

Solution

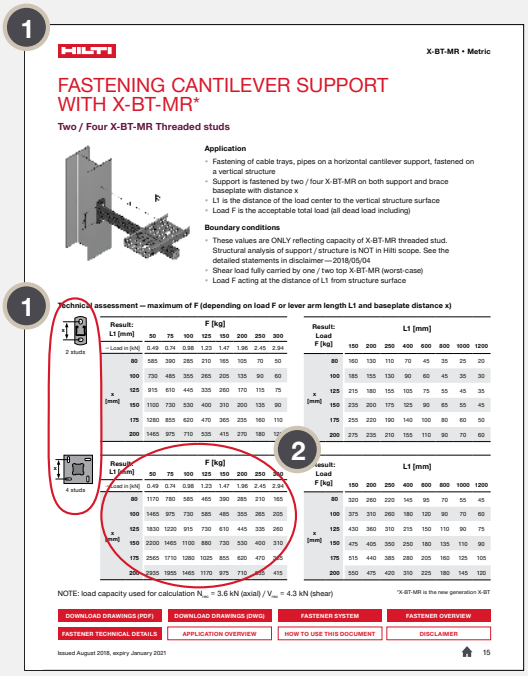
Step 1: select the typicals slide for the right application and number of fasteners (2 or 4 studs)

Step 2: select the table (preferred one for this task is the table which gives **"L1"** as result)

Step 3: select the appropriate column with the load **F** (which is equal or greater than the given load)

Step 4: select the appropriate row with the support distance **x** (which is equal to or smaller than the given support distance)

Result: x = 175 mm the maximum length **L1** is 855 mm


X-BT-MR • Metric

FASTENING CANTILEVER SUPPORT WITH X-BT-MR*

Two / Four X-BT-MR Threaded studs

Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a vertical structure
- Support is fastened by two / four X-BT-MR on both support and brace baseplate with distance x
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load including)

Boundary conditions

- These values are ONLY reflecting capacity of X-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti scope. See the detailed statements in disclaimer — 2018/05/04
- Shear load fully carried by one / two top X-BT-MR (worst-case)
- Load F acting at the distance of L1 from structure surface

Technical assessment — maximum of F (depending on load F or lever arm length L1 and baseplate distance x)

NOTE: load capacity used for calculation N_{rec} = 3.6 kN (axial) / V_{rec} = 4.3 kN (shear)

*X-BT-MR is the new generation X-BT

DOWNLOAD DRAWINGS (PDF) | DOWNLOAD DRAWINGS (DWG) | FASTENER SYSTEM | FASTENER OVERVIEW | FASTENER TECHNICAL DETAILS | APPLICATION OVERVIEW | HOW TO USE THIS DOCUMENT | DISCLAIMER

Issued August 2018, expiry January 2021 15

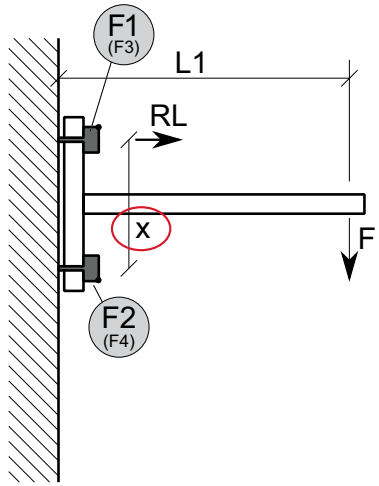
Result: L1 [mm]	F [kg] 50	75	100	125	150	200	250	300
→ Load in [kN]	0.49	0.74	0.98	1.23	1.47	1.96	2.45	2.94
x [mm] 80	1170	780	585	465	390	285	210	165
100	1465	975	730	585	485	355	265	205
125	1830	1220	915	730	610	445	335	260
150	2200	1465	1100	880	730	R	400	310
4 → 175	~~2565~~	~~1710~~	~~1280~~	~~1025~~	855	620	470	365
200	2935	1955	1465	1170	975	710	535	415

R L1 is 855 mm — meets requirement

USE CASES IN DETAIL

Use Case B: minimize x and determine required baseplate

Application



L1	x	F	RL
?	✓	✓	✓
✓	?	✓	✓
✓	✓	?	✓
✓	✓	✓	?

F1 – F4	fasteners
F	load on the support
RL	resulting load (tensile and shear load)
L1	support lever length
x	support basis (=distance of fasteners)

Example — Use Case B

Outset situation

- **Cable tray type 450 W x 50 H; span s = 2.2 m** → results in load of **140 kg** per support (example table: 2.25 m x 61.6 kg/m)
- **N is defined by 4 fasteners (e.g. X-BT-MR)**
- **L1 = 300 mm** (required position of the cable tray, existing cantilever supports)

Task

The size of the baseplate, distance of fasteners (e.g. X-BT-MR) should be as short as possible, existing baseplates provide **x = 80 mm**

Solution

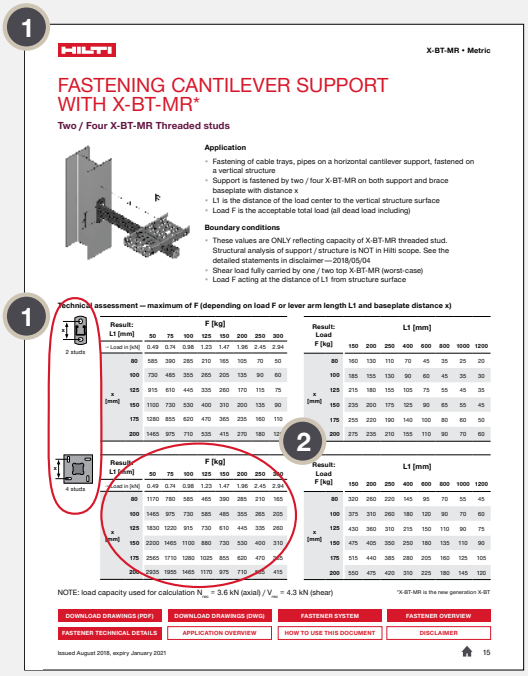
Step 1: select the typicals slide for the right application and number of fasteners (2 or 4 studs)

Step 2: select the table (preferred one for this task is the table which gives **"L1"** as result; the right table would also work)

Step 3: select the appropriate column with the load **F** (which is equal or greater than the given load)

Step 4: select the appropriate row with the lever arm distance **L1** (which is equal to or greater than the given lever arm distance)

Result: the minimum required support distance x is 80 mm → the existing baseplate with **x = 80 mm** works fine



Result: L1 [mm]	F [kg] 50	75	100	125	150	200	250	300
→ Load in [kN]	0.49	0.74	0.98	1.23	1.47	1.96	2.45	2.94
R 80	~~1170~~	~~780~~	~~585~~	~~465~~	390	280	210	165
100	1465	975	730	585	485	355	265	205
125	1830	1220	915	730	610	445	335	260
150	2200	1465	1100	880	730	530	400	310
175	2565	1710	1280	1025	855	620	470	365
200	2935	1955	1465	1170	975	710	535	415

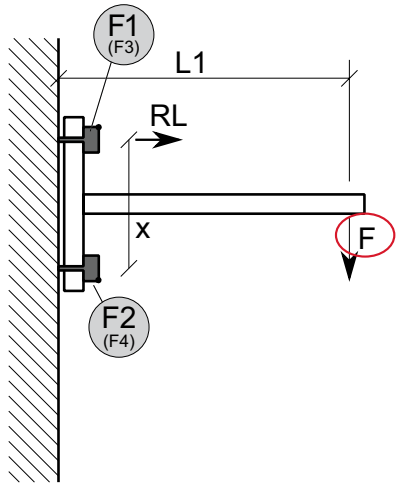
x [mm]

R x is 80 mm — meets requirement

USE CASES IN DETAIL

Use Case C: determine allowed load

Application



L1	x	F	RL
?	✓	✓	✓
✓	?	✓	✓
✓	✓	?	✓
✓	✓	✓	?

F1 – F4 fasteners
F load on the support
RL resulting load (tensile and shear load)
L1 support lever length
x support basis (=distance of fasteners)

Example — Use Case C

Outset situation

- **x = 175 mm** (existing cantilever supports)
- **L1 = 400 mm** (required position of the cable tray, existing cantilever supports)
- **N is defined by 4 fasteners** (e.g. X-BT-MR)

Task

How much load **F** is allowed

Solution

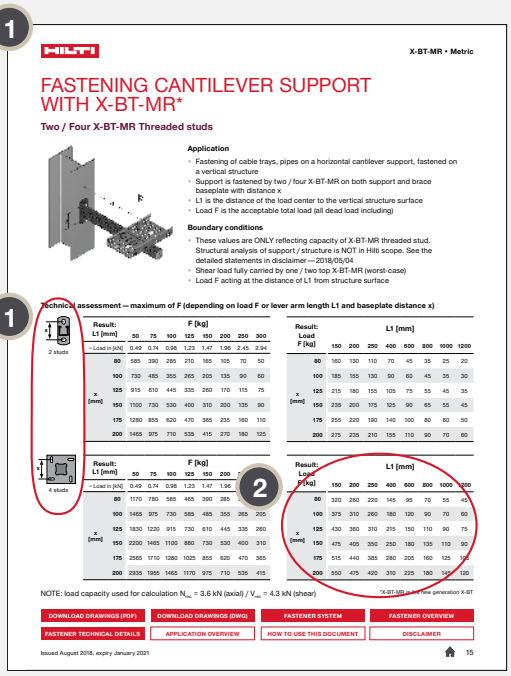
Step 1: select the typicals slide for the right application and number of fasteners (2 or 4 studs)

Step 2: select the table (preferred one for this task is the table which gives **"F"** as result)

Step 3: select the appropriate column with the lever arm length **L1** (which is equal or greater than the given length)

Step 4: select the appropriate row with the support distance **x** (which is equal or smaller than the given support distance)

Result: the maximum load **F** is 280 kg allows e.g. 2.25 m * 2 * 61.6 kg/m = 2 cable trays 450 W x 50 H, see example table



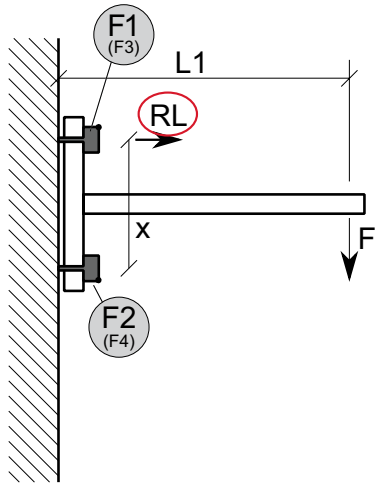
Result: Load F [kg]	L1 [mm] 150	200	3	400	600	800	1000	1200
80	320	260	220	145	95	70	55	45
100	375	310	260	180	120	90	70	60
125	430	360	310	215	150	110	90	75
x [mm] 150	475	405	350	250	R	135	110	90
4 175	515	440	385	280	205	160	125	105
200	550	475	420	310	225	180	145	120

R F is 280 kg

USE CASES IN DETAIL

Use Case D: determine required fastener

Application



L1	x	F	RL
?	✓	✓	✓
✓	?	✓	✓
✓	✓	?	✓
✓	✓	✓	?

F1 – F4	fasteners
F	load on the support
RL	resulting load (tensile and shear load)
L1	support lever length
x	support basis (=distance of fasteners)

Example — Use Case D

Outset situation

- **x = 175 mm** (existing cantilever supports)
- **L1 = 400 mm** (required position of the cable tray, existing cantilever supports)
- **F is 100 kg**

Task

How many fasteners (e.g. X-BT-MR) are required (2 or 4 supported by the existing cantilever supports)

Solution

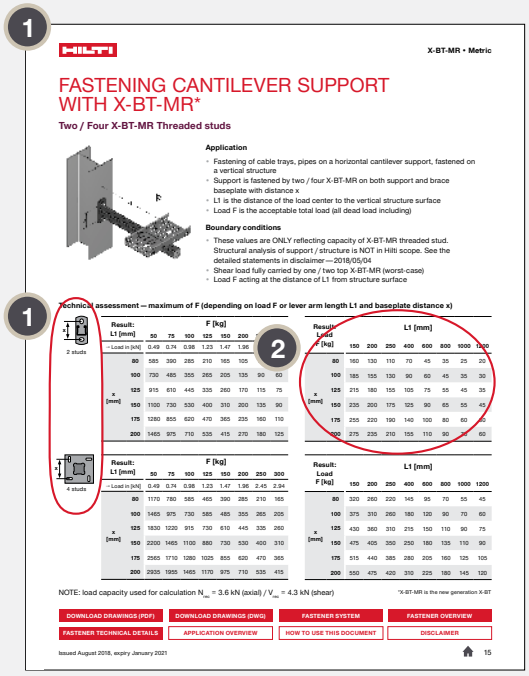
Step 1: select the typicals slide for the right application and number of fasteners (here you need 2 and 4 studs) Follow the steps 1 – 4 through for both cases "2 X-BT-MR" and "4 X-BT-MR"

Step 2: select the table (preferred one for this task is the table which gives **"F"** as result)

Step 3: select the appropriate column with the lever arm length **L1** (which is equal or greater than the given length)

Step 4: select the appropriate row with the support distance **x** (which is equal or smaller than the given support distance)

Result: the maximum load is 140 kg (2 X-BT-MR). You can use 2 X-BT-MR with the given load 100 kg



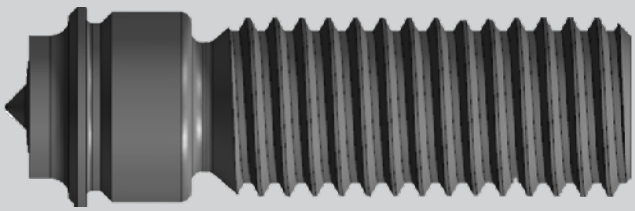
Result: Load F [kg] \ L1 [mm]	150	200	3 400	600	800	1000	1200
80	160	130	110	70	45	35	25	20
100	185	155	130	90	60	45	35	30
125	215	180	155	105	75	55	45	35
150	235	200	175	125	R	65	55	45
4 175	255	220	190	140	100	80	60	50
200	275	235	210	155	110	90	70	60

x [mm]

R 4 X-BT-MR: F is 280 kg
2 X-BT-MR: F is 140 kg → 2 X-BT-MR

F-BT-MR SN THREADED STUD

Metric



F-BT-MR SN TECHNICAL DATA

F-BT-MR SN technical data

- **Surfacing tool / base material:** FX–ST-d20, t_{II} ≥ 10 mm (⅜")
- **Base material:** Steel S235 ... S355 (Europe) / A36 / A, B, D, E, AH 32 / 36, DH 32 / 36 (Shipbuilding)
- **Recommended interaction for combined load: N_{rec} = 8.0 kN** (axial) / **V_{rec} = 3.6 kN** (shear)
- Calculation of maximum allowable load is considering a support plate beside the sealing washer
- The F-BT-MR SN shall only be used with the provided flange safety-nut.

V-N (shear and tension)

$$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} \leq 1.0 \quad \text{with} \quad \frac{V}{V_{rec}} \leq 1.0 \quad \text{and} \quad \frac{N}{N_{rec}} \leq 1.0$$

For further technical data refer to the latest technical information Hilti Cordless Stud Fusion Technical Manual [May 2023].

FX 3-SP TECHNICAL DATA

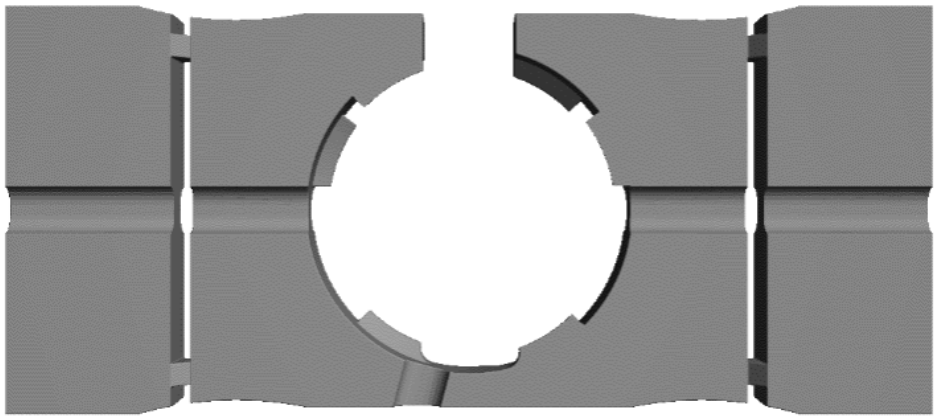
FX 3-SP technical data

- **Material:** PA66GF50
- **Standoff:** 5.5 mm
- **Size:** 100 x 44 mm
- **Fastener type:** F-BT-MR M10 SN
- **Recommended load:** N_{rec} = 8.0 kN (axial, compression)

The F-BT-MR SN shall only be used with the provided flange safety-nut.

Note: sealing washer and support plate only added for F-BT MR SN version

For further technical data refer to the latest technical information Hilti Cordless Stud Fusion Technical Manual [May 2023].



FX 3-SP

F-BT SEALING WASHER TECHNICAL DATA

F-BT sealing washer technical data

- **Material:** 1.4404 (A5) and chloroprene rubber
- **Diameter:** 31.5mm
- **Washer setting tool:** X-WST F3-BT (M10-⅜″)
- **Fastener type:** F-BT-MR M10 SN
- **Recommended load:** Nrec = 8.0 kN (axial, compression)

The F-BT-MR SN shall only be used with the provided flange safety-nut.

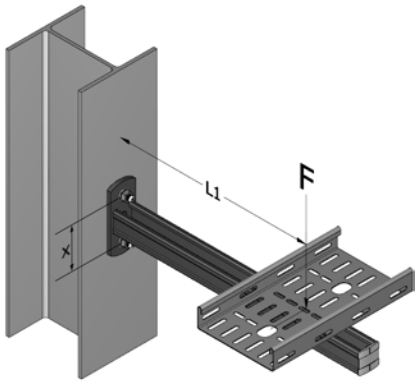
Note: sealing washer and support plate only added for F-BT MR SN version

For further technical data refer to the latest technical information Hilti Cordless Stud Fusion Technical Manual [May 2023]

F-BT sealing washer

FASTENING CANTILEVER SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



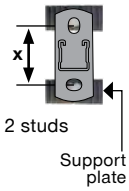
Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a vertical structure
- Support is fastened by two / four F-BT-MR SN on support baseplate with distance x
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

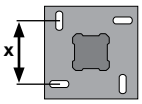
- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR SN (worst-case)
- Load F acting at the distance of L1 from structure surface
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of F (depending on load F or lever arm length L1 and baseplate distance x)



Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	1125	470	255	145	80	35		
	100	1405	590	320	185	100	45		
	125	1760	740	400	230	125	60		
	150	2110	885	480	275	155	70		
	175	2465	1035	560	320	180	85		
	200	2815	1185	640	370	205	95		

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	195	170	150	110	80	65	55	45
	100	215	190	170	130	95	75	65	55
	125	235	210	190	150	115	90	75	65
	150	250	225	205	165	130	105	90	75
	175	260	240	220	180	140	120	100	85
	200	270	250	230	190	155	130	110	95



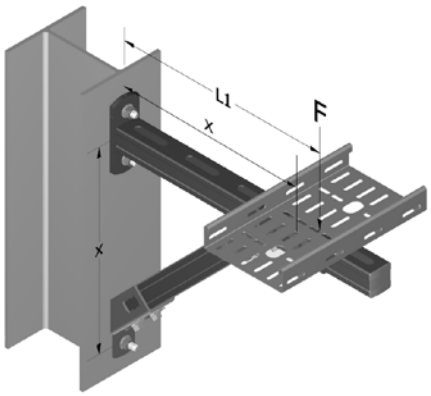
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	2430	1125	690	470	340	255	195	145
	100	3035	1405	865	590	430	320	240	185
	125	3795	1760	1080	740	535	400	300	230
	150	4555	2110	1295	885	645	480	365	275
	175	5315	2465	1510	1035	750	560	425	320
	200	6075	2815	1730	1185	860	640	485	370

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	395	345	305	225	165	130	110	90
	100	435	385	345	260	195	155	130	110
	125	475	425	385	300	230	185	155	135
	150	505	455	415	330	260	215	180	155
	175	525	480	445	360	285	240	205	175
	200	545	505	465	385	310	260	225	195

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 3.6 kN (shear)

FASTENING BRACED CANTILEVER SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



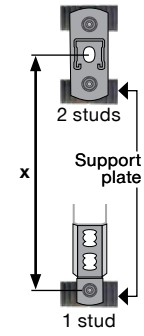
Application

- Fastening of cable trays, pipes on a horizontal, braced cantilever support, fastened on a vertical structure
- Support is fastened by three / six F-BT-MR SN on both support and brace baseplate with distance x
- L1 is the distance of the load center to the vertical structure surface, the angle of the brace is 45°
- Load F is the acceptable total load (all dead load included)

Boundary conditions

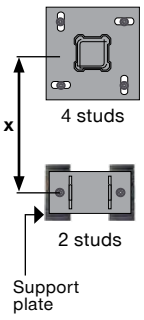
- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR SN (worst-case)
- Load F acting at the distance of L1 from structure surface
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of F (depending on load F or lever arm length L1 and baseplate distance x)



Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	100								
	150		550	365	275	220	180	155	
	200		730	485	365	290	240	205	
	350		1280	855	640	510	425	365	
	500		1830	1220	915	730	610	520	
	800		2935	1955	1465	1170	975	835	

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	100								
	150	365	275	220	135	90			
	200		365	290	180	120			
	350				320	210			
	500					305			
	800								



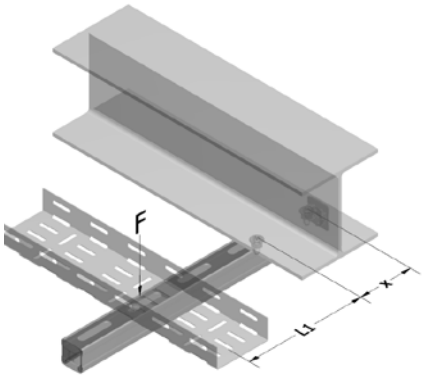
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	100								
	150			720	550	440	365	310	275
	200			960	730	585	485	415	365
	350			1680	1280	1025	855	730	640
	500			2405	1830	1465	1220	1045	915
	800			3845	2935	2345	1955	1675	1465

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	100								
	150	730	550	440	275	180	135	110	
	200		730	585	365	240	180	145	120
	350				640	425	320	255	210
	500					610	455	365	305
	800						730	585	485

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 3.6 kN (shear)

FASTENING STRUT TO STEEL WITH F-BT-MR SN

Two F-BT-MR SN Threaded studs



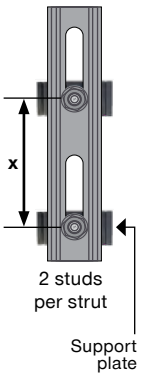
Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a horizontal structure
- Support is fastened by two F-BT-MR SN (horizontal distance x)
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- L1 is acting from center of stud
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR SN distance x)



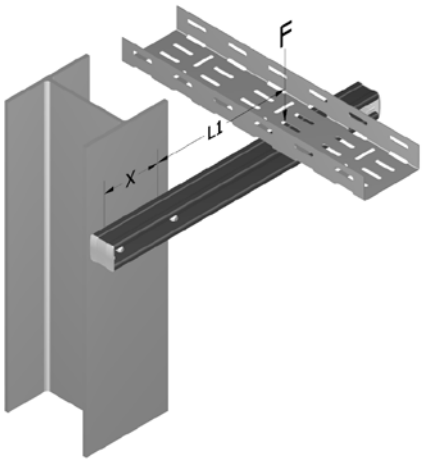
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	1220	570	350	245	180	135	105	80
	100	1530	715	440	305	225	170	130	100
	125	1910	890	550	380	280	210	165	125
	150	2295	1070	665	460	335	255	195	155
	175	2675	1250	775	535	395	300	230	180
	200	3060	1430	885	615	450	340	265	205

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	280	230	195	135	95	70	60	50
	100	325	270	230	160	115	90	70	60
	125	370	310	270	190	140	110	90	75
	150	405	345	305	220	160	125	105	90
	175	435	380	335	245	180	145	120	100
	200	465	405	360	270	200	160	135	115

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 3.6 kN (shear)

FASTENING STRUT TO STEEL WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



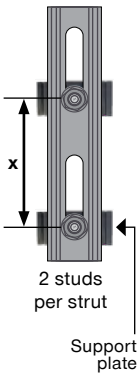
Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a vertical structure
- Support is fastened by two F-BT-MR SN (horizontal distance x)
- L1 is the distance of the load center to the center of the fasteners
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one F-BT-MR SN (worst-case)
- Load F acting at the distance of L1 from structure surface
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR SN distance x)



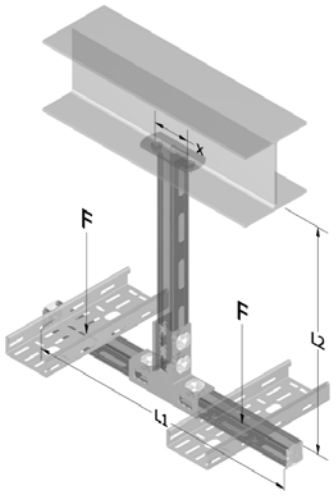
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	505	210	115	65	35			
	100	630	265	140	80	45			
	125	790	330	180	100	55			
	150	950	400	215	125	70	30		
	175	1105	465	250	145	80	35		
	200	1265	530	285	165	90	40		

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	125	100	85	60	40	30	25	
	100	145	120	100	70	50	40	30	
	125	165	140	120	85	60	45	40	
	150	180	155	135	100	70	55	45	
	175	195	170	150	110	80	65	50	
	200	205	180	160	120	90	70	60	

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 3.6 kN (shear)

FASTENING T-POST (CEILING) SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



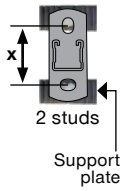
Application

- Fastening of cable trays, pipes on a T-Post support, which is fastened on a horizontal structure
- Support is fastened by two / four F-BT-MR SN (horizontal distance x)
- L1 is the total width of the T-Post, L2 is fix set to 1000 mm
- Load F is the acceptable total load (all dead load included)

Boundary conditions

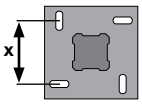
- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- 2 Load cases: load asymmetric acting in the center of one arm only, 30% acting as horizontal load
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR SN distance x)



Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	5055	2445	1575					
	100	6320	3060	1970					
	125	7900	3825	2465	1785				
	150	9485	4590	2960	2145				
	175	11065	5355	3455	2500	1930			
	200	12645	6120	3945	2860	2205			

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	165	165	165	165	165	165	165	165
	100	195	195	195	195	195	195	195	195
	125	225	225	225	225	225	225	225	225
	150	255	255	255	255	255	255	255	255
	175	280	280	280	280	280	280	280	280
	200	305	305	305	305	305	305	305	305



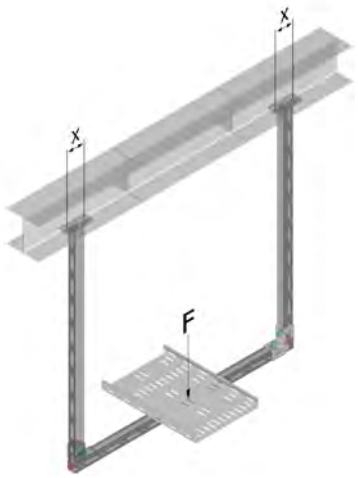
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	10275	5055	3315	2445	1925	1575		
	100	12845	6320	4145	3060	2405	1970	1660	
	125	16055	7900	5185	3825	3010	2465	2075	1785
	150	19270	9485	6220	4590	3610	2960	2495	2145
	175	22480	11065	7260	5355	4215	3455	2910	2500
	200	25695	12645	8295	6120	4815	3945	3325	2860

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	300	300	300	300	300	300	300	300
	100	345	345	345	345	345	345	345	345
	125	400	400	400	400	400	400	400	400
	150	440	440	440	440	440	440	440	440
	175	480	480	480	480	480	480	480	480
	200	515	515	515	515	515	515	515	515

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 3.6 kN (shear)

FASTENING U-FRAME (CEILING) / TRAPEZE SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



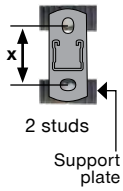
Application

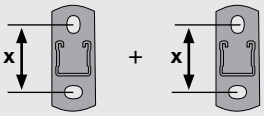
- Fastening of cable trays, pipes on a U-Frame support, which is fastened on a horizontal structure
- Support is fastened by four F-BT-MR SN (2 fasteners per baseplate)
- Load F is the acceptable total load (all dead load included, acting in the center of the U-Frame)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Load acting in the center (U-Frame)
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment—maximum of F



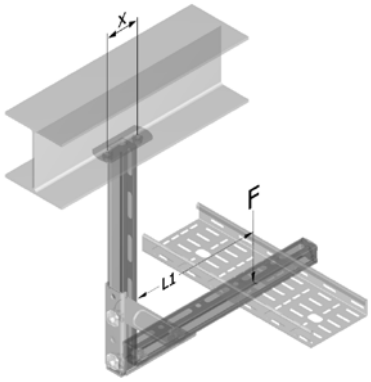


$F = N_{rec}$ • #fasteners per post
F = 8 kN • 4
F = 32 kN / F = 3260 kg

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 3.6 kN (shear)

FASTENING L-POST SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



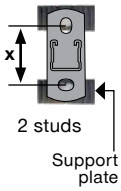
Application

- Fastening of cable trays, pipes on an L-Post support, which is fastened on a horizontal structure
- Support is fastened by two / four F-BT-MR SN (horizontal distance x)
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

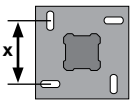
- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Load F acting at the distance of L1 from middle of vertical channel
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR SN distance x)



Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	1260	610	390	285	220	175	145	120
	100	1580	765	490	355	275	220	180	150
	125	1975	955	615	445	345	275	225	190
	150	2370	1145	740	535	410	330	270	230
	175	2765	1335	860	625	480	385	320	265
	200	3160	1530	985	715	550	440	365	305

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	340	270	220	145	100	75	60	50
	100	405	325	270	180	125	95	75	65
	125	475	385	325	220	150	115	95	80
	150	540	440	375	255	180	135	110	95
	175	600	495	420	290	205	160	130	110
	200	650	540	465	325	230	180	145	125



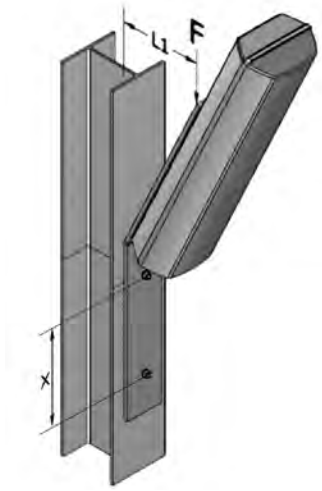
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	2565	1260	825	610	480	390	330	285
	100	3210	1580	1035	765	600	490	415	355
	125	4010	1975	1295	955	750	615	515	445
	150	4815	2370	1555	1145	900	740	620	535
	175	5620	2765	1815	1335	1050	860	725	625
	200	6420	3160	2070	1530	1200	985	830	715

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	685	540	445	295	200	155	125	105
	100	815	650	540	360	250	190	155	130
	125	955	775	650	440	305	235	190	160
	150	1,085	885	750	515	360	275	225	190
	175	1,200	990	845	585	415	320	260	220
	200	1,300	1,085	930	650	465	360	295	250

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 3.6 kN (shear)

FASTENING EQUIPMENT SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



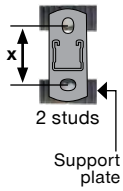
Application

- Fastening of lamps, signals and sensors on inclined cantilever support, fastened on a vertical structure
- Support is fastened by two / four F-BT-MR SN (vertical distance x)
- L1 is the distance of the load center (~middle of the load) to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

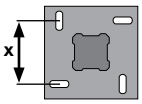
- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR SN (worst-case)
- Load F acting at the distance of L1 from structure surface
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR SN distance x)



Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	1125	470	255	145	80	35		
	100	1405	590	320	185	100	45		
	125	1760	740	400	230	125	60		
	150	2110	885	480	275	155	70		
	175	2465	1035	560	320	180	85		
	200	2815	1185	640	370	205	95		

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	195	170	150	110	80	65	55	45
	100	215	190	170	130	95	75	65	55
	125	235	210	190	150	115	90	75	65
	150	250	225	205	165	130	105	90	75
	175	260	240	220	180	140	120	100	85
	200	270	250	230	190	155	130	110	95



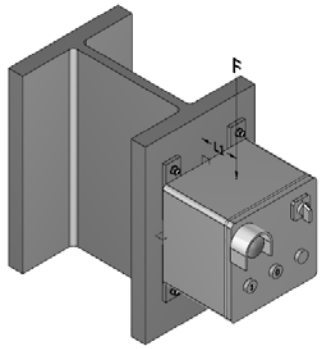
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	2430	1125	690	470	340	255	195	145
	100	3035	1405	865	590	430	320	240	185
	125	3795	1760	1080	740	535	400	300	230
	150	4555	2110	1295	885	645	480	365	275
	175	5315	2465	1510	1035	750	560	425	320
	200	6075	2815	1730	1185	860	640	485	370

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	395	345	305	225	165	130	110	90
	100	435	385	345	260	195	155	130	110
	125	475	425	385	300	230	185	155	135
	150	505	455	415	330	260	215	180	155
	175	525	480	445	360	285	240	205	175
	200	545	505	465	385	310	260	225	195

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 3.6 kN (shear)

FASTENING JUNCTION BOXES / SWITCHES WITH F-BT-MR SN

F-BT-MR SN Threaded stud



Application

- Fastening of junction boxes, switches on a vertical structure
- Element is fastened by F-BT-MR SN

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Technical data binder and design procedures in keeping with design standards are in preparation (EN 1993; AISC 360)
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical data — extract from Hilti Cordless Stud Fusion Technical Manual [May 2023]

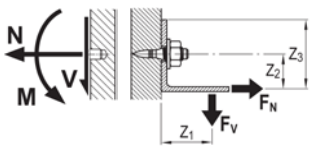
Recommended load	F-BT-MR M10 SN (10)
Base material	Steel S235 to S355 (EU) / A36, Grade 50 (NA)
Tension, N_{rec} [kN / lb]	8.0 kN / 1800 lbs
Compression, N_{rec} [kN / lb]	8.0 kN / 1800 lbs
Shear, V_{rec} [kN / lb]	3.6 kN / 810 lbs
Moment, M_{rec} [Nm / ft-lb]	20 Nm / 14.7 ft-lb

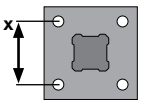
Design resistance	F-BT-MR M10 SN (10)
Base material	Steel S235 to S355 (EU) / A36, Grade 50 (NA)
Tension, N_{Rd} [kN / lb]	11.2 kN / 2520 lbs
Compression, N_{Rd} [kN / lb]	11.2 kN / 2520 lbs
Shear, V_{Rd} [kN / lb]	5.0 kN / 1125 lbs
Moment, M_{Rd} [Nm / ft-lb]	28 Nm / 20.6 ft-lb

Conditions for recommended loads

- Global factor of safety for static weld failure > 2.8 (based on 5% fractile value)
- Minimum spacing between fasteners = 35 mm [1 ⅜"]
- Minimum edge distance = 40 mm [1 ½"]
- Effect of base metal vibration and stress considered
- Redundancy (multiple fastening) must be provided
- Recommended loads in the table refer to the resistance of the individual fastening and may not be the same as the loads F_N and F_V acting on the fastened part

Note: if relevant, prying forces need to be considered in design, see example. Moment acting on fastener shank only in case of a gap between base and fastened material.





4 studs

Recommended interaction formula for combined loading — steel and cast iron base material

Combined loading situation	Interaction formula
V–N (shear and tension)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} \le 1.0$ with $\frac{V}{V_{rec}} \le 1.0$ and $\frac{N}{N_{rec}} \le 1.0$
V–M (shear and bending)	$\frac{V}{V_{rec}} + \frac{M}{M_{rec}} \le 1.0$ with $\frac{V}{V_{rec}} \le 1.0$ and $\frac{M}{M_{rec}} \le 1.0$
N–M (tension and bending)	$\frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$
V–N–M (shear, tension and bending)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$

Note: always refer to latest Hilti Cordless Stud Fusion Technical Manual.

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 3.6 kN (shear)

F-BT-MR SN CATALOG PAGES

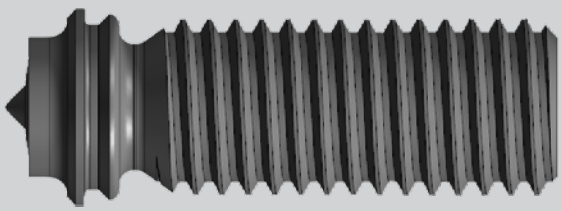
Fasteners	Item Number
F-BT-MR M6 x 25 SN (6)	2293829
F-BT-MR M8 x 25 SN (8)	2293860
F-BT-MR M10 x 25 SN (10)	2293861
F-BT-MR M10 x 50 SN (10)	2293862
F-BT-MR M12 x 25 SN (10)	2293863
F-BT-MR M12 x 50 SN (10)	2293864
F-BT-MR M6 x 25 SN (4)	2346394
F-BT-MR M8 x 25 SN (4)	2293865

Tool	Item Number
Cordless Stud Fusion unit FX 3-A	Local item
Starter kit FX 3-KIT	Local item
SF 8M-A22	Local item

Consumables	Item Number
Gas can FX 3-GC	2241926
Surfacing tool post paint FX 3-ST d20	2270512
Plate support FX M6/M8/M10	2357719
Plate support FX M12	2358345

F-BT-MR
THREADED STUD

Metric



F-BT-MR TECHNICAL DATA USED FOR THE FOLLOWING CALCULATIONS

F-BT-MR technical data

- **Surfacing tool / base material:** FX–ST-d14 / FX–ST-d20, $t_{II} \geq 10$ mm (⅜")
- **Base material:** Steel S235 ... S355 (Europe) / A36 / A, B, D, E, AH 32 / 36, DH 32 / 36 (Shipbuilding)
- **Recommended interaction for combined load: N_{rec} = 8.0 kN** (axial) / **V_{rec} = 4.5 kN** (shear)

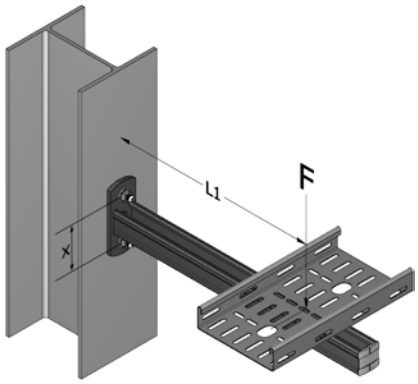
V-N (shear and tension)

$$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} \leq 1.0 \quad \text{with} \quad \frac{V}{V_{rec}} \leq 1.0 \quad \text{and} \quad \frac{N}{N_{rec}} \leq 1.0$$

For further technical data refer to the latest technical information Hilti Cordless Stud Fusion Technical Manual [May 2023].

FASTENING CANTILEVER SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



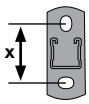
Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a vertical structure
- Support is fastened by two / four F-BT-MR on support baseplate with distance x
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR (worst-case)
- Load F acting at the distance of L1 from structure surface

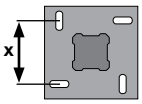
Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and baseplate distance x)



2 studs

Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	1160	510	290	180	115	75	40	
	100	1450	635	365	225	145	90	55	
	125	1815	795	455	285	185	115	65	
	150	2175	955	545	340	220	140	80	
	175	2540	1115	640	400	255	160	95	45
	200	2905	1275	730	455	295	185	110	50

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	220	190	165	120	85	65	55	45
	100	245	215	190	140	100	80	65	55
	125	270	240	215	160	120	95	80	70
	150	290	260	235	180	140	110	95	80
	175	305	275	250	200	155	125	105	90
	200	320	290	265	215	170	140	120	100



4 studs

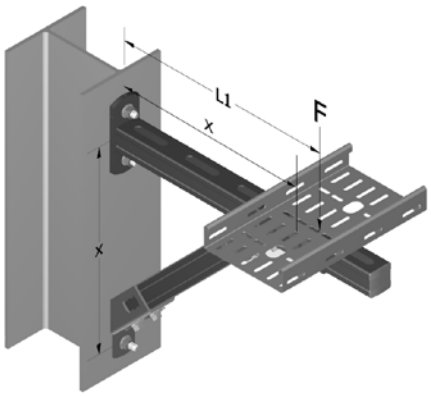
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	2465	1160	725	510	375	290	230	180
	100	3080	1450	905	635	470	365	285	225
	125	3855	1815	1135	795	590	455	360	285
	150	4625	2175	1360	955	710	545	430	340
	175	5395	2540	1590	1115	830	640	500	400
	200	6165	2905	1815	1275	945	730	575	455

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	445	380	330	240	175	135	110	95
	100	495	430	380	280	205	165	135	115
	125	545	480	430	325	245	195	165	140
	150	585	520	470	365	280	225	190	165
	175	615	555	505	400	310	255	215	185
	200	645	585	535	430	340	280	240	205

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 4.5 kN (shear)

FASTENING BRACED CANTILEVER SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



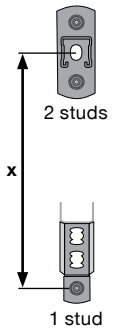
Application

- Fastening of cable trays, pipes on a horizontal, braced cantilever support, fastened on a vertical structure
- Support is fastened by three / six F-BT-MR on both support and brace baseplate with distance x
- L1 is the distance of the load center to the vertical structure surface, the angle of the brace is 45°
- Load F is the acceptable total load (all dead load included)

Boundary conditions

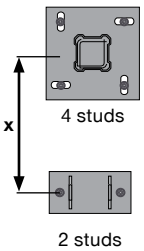
- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR (worst-case)
- Load F acting at the distance of L1 from structure surface

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and baseplate distance x)



Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	100								
	150		650	455	340	275	225	195	170
	200		870	610	455	365	305	260	225
	350		1525	1070	800	640	535	455	400
	500		2180	1525	1145	915	760	655	570
	800		3485	2445	1830	1465	1220	1045	915

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	100								
	150	455	340	275	170	110			
	200		455	365	225	150			
	350				400	265			
	500					380			
	800								



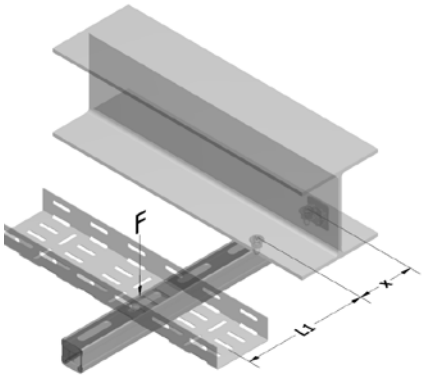
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	100								
	150			830	650	545	455	390	340
	200			1110	870	725	610	520	455
	350			1940	1525	1275	1070	915	800
	500			2775	2180	1820	1525	1310	1145
	800			4440	3485	2915	2445	2095	1830

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	100								
	150	915	685	550	340	225	170	135	
	200		915	730	455	305	225	180	150
	350				800	535	400	320	265
	500					760	570	455	380
	800						915	730	610

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 4.5 kN (shear)

FASTENING STRUT TO STEEL WITH F-BT-MR

Two F-BT-MR Threaded studs



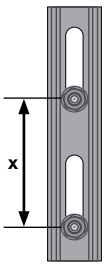
Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a horizontal structure
- Support is fastened by two F-BT-MR (horizontal distance x)
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- L1 is acting from center of stud

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR distance x)



2 studs per strut

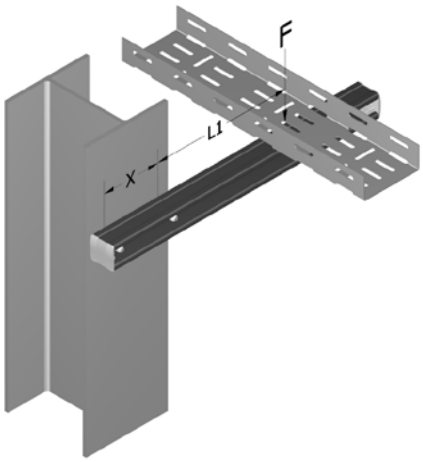
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	1220	570	350	245	180	135	105	80
	100	1530	715	440	305	225	170	130	100
	125	1910	890	550	380	280	210	165	125
	150	2295	1070	665	460	335	255	195	155
	175	2675	1250	775	535	395	300	230	180
	200	3060	1430	885	615	450	340	265	205

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	280	230	195	135	95	70	60	50
	100	325	270	230	160	115	90	70	60
	125	370	310	270	190	140	110	90	75
	150	405	345	305	220	160	125	105	90
	175	435	380	335	245	180	145	120	100
	200	465	405	360	270	200	160	135	115

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 4.5 kN (shear)

FASTENING STRUT TO STEEL WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



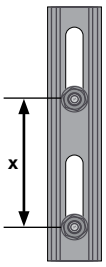
Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a vertical structure
- Support is fastened by two F-BT-MR (horizontal distance x)
- L1 is the distance of the load center to the center of the fasteners
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one F-BT-MR (worst-case)
- Load F acting at the distance of L1 from structure surface

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR distance x)



2 studs per strut

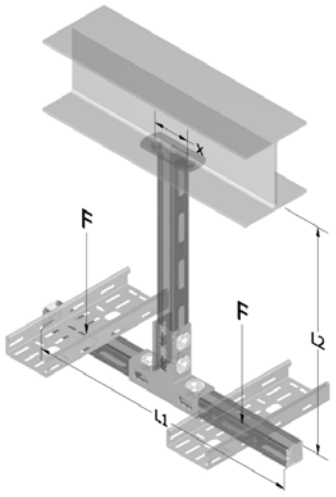
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	650	285	160	100	65	40		
	100	815	355	205	125	80	50		
	125	1020	445	255	160	100	65		
	150	1225	535	305	190	125	75	45	
	175	1430	625	360	225	145	90	50	
	200	1630	715	410	255	165	105	60	

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	155	130	110	75	50	40	30	25
	100	180	150	130	90	65	50	40	35
	125	205	175	150	105	75	60	50	40
	150	225	195	170	125	90	70	55	50
	175	245	210	185	135	100	80	65	55
	200	260	225	200	150	110	90	75	65

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 4.5 kN (shear)

FASTENING T-POST (CEILING) SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



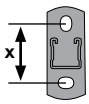
Application

- Fastening of cable trays, pipes on a T-Post support, which is fastened on a horizontal structure
- Support is fastened by two / four F-BT-MR (horizontal distance x)
- L1 is the total width of the T-Post, L2 is fix set to 1000 mm
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- 2 Load cases: load asymmetric acting in the center of one arm only, 30% acting as horizontal load

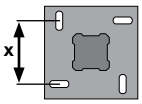
Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR distance x)



2 studs

Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	5055	2445	1575					
	100	6320	3060	1970					
	125	7900	3825	2465	1785				
	150	9485	4590	2960	2145	1655			
	175	11065	5355	3455	2500	1930			
	200	12645	6120	3945	2860	2205	1770		

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	170	170	170	170	170	170	170	170
	100	200	200	200	200	200	200	200	200
	125	235	235	235	235	235	235	235	235
	150	265	265	265	265	265	265	265	265
	175	295	295	295	295	295	295	295	295
	200	320	320	320	320	320	320	320	320



4 studs

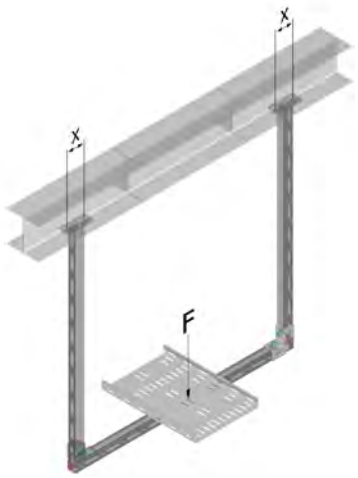
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	10275	5055	3315	2445	1925	1575		
	100	12845	6320	4145	3060	2405	1970	1660	
	125	16055	7900	5185	3825	3010	2465	2075	1785
	150	19270	9485	6220	4590	3610	2960	2495	2145
	175	22480	11065	7260	5355	4215	3455	2910	2500
	200	25695	12645	8295	6120	4815	3945	3325	2860

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	305	305	305	305	305	305	305	305
	100	355	355	355	355	355	355	355	355
	125	410	410	410	410	410	410	410	410
	150	460	460	460	460	460	460	460	460
	175	500	500	500	500	500	500	500	500
	200	535	535	535	535	535	535	535	535

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 4.5 kN (shear)

FASTENING U-FRAME (CEILING) / TRAPEZE SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



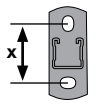
Application

- Fastening of cable trays, pipes on a U-Frame support, which is fastened on a horizontal structure
- Support is fastened by four F-BT-MR (2 fasteners per baseplate)
- Load F is the acceptable total load (all dead load included, acting in the center of the U-Frame)

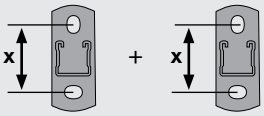
Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Load acting in the center (U-Frame)

Technical assessment—maximum of F



2 studs

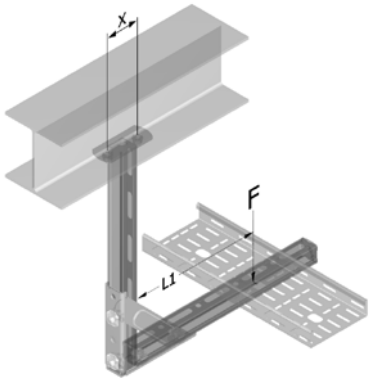


$F = N_{rec}$ • #fasteners per post
F = 8 kN • 4
F = 32 kN / F = 3260 kg

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 4.5 kN (shear)

FASTENING L-POST SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



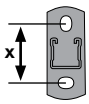
Application

- Fastening of cable trays, pipes on an L-Post support, which is fastened on a horizontal structure
- Support is fastened by two / four F-BT-MR (horizontal distance x)
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Load F acting at the distance of L1 from middle of vertical channel

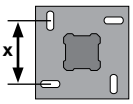
Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR distance x)



2 studs

Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	1260	610	390	285	220	175	145	120
	100	1580	765	490	355	275	220	180	150
	125	1975	955	615	445	345	275	225	190
	150	2370	1145	740	535	410	330	270	230
	175	2765	1335	860	625	480	385	320	265
	200	3160	1530	985	715	550	440	365	305

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	340	270	220	145	100	75	60	50
	100	405	325	270	180	125	95	75	65
	125	475	385	325	220	150	115	95	80
	150	540	440	375	255	180	135	110	95
	175	600	495	420	290	205	160	130	110
	200	650	540	465	325	230	180	145	125



4 studs

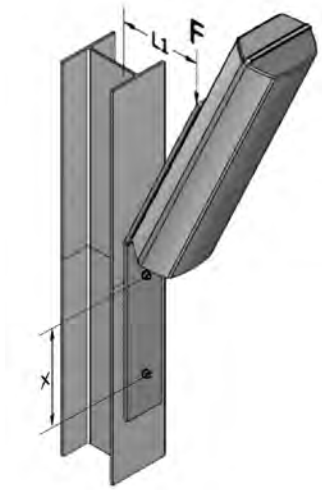
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	2565	1260	825	610	480	390	330	285
	100	3210	1580	1035	765	600	490	415	355
	125	4010	1975	1295	955	750	615	515	445
	150	4815	2370	1555	1145	900	740	620	535
	175	5620	2765	1815	1335	1050	860	725	625
	200	6420	3160	2070	1530	1200	985	830	715

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	685	540	445	295	200	155	125	105
	100	815	650	540	360	250	190	155	130
	125	955	775	650	440	305	235	190	160
	150	1,085	885	750	515	360	275	225	190
	175	1,200	990	845	585	415	320	260	220
	200	1,300	1,085	930	650	465	360	295	250

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 4.5 kN (shear)

FASTENING EQUIPMENT SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



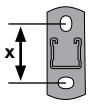
Application

- Fastening of lamps, signals and sensors on inclined cantilever support, fastened on a vertical structure
- Support is fastened by two / four F-BT-MR (vertical distance x)
- L1 is the distance of the load center (~middle of the load) to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

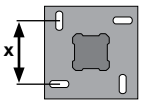
- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR (worst-case)
- Load F acting at the distance of L1 from structure surface

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR distance x)



Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	1160	510	290	180	115	75	40	
	100	1450	635	365	225	145	90	55	
	125	1815	795	455	285	185	115	65	
	150	2175	955	545	340	220	140	80	35
	175	2540	1115	640	400	255	160	95	45
	200	2905	1275	730	455	295	185	110	50

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	220	190	165	120	85	65	55	45
	100	245	215	190	140	100	80	65	55
	125	270	240	215	160	120	95	80	70
	150	290	260	235	180	140	110	95	80
	175	305	275	250	200	155	125	105	90
	200	320	290	265	215	170	140	120	100



4 studs

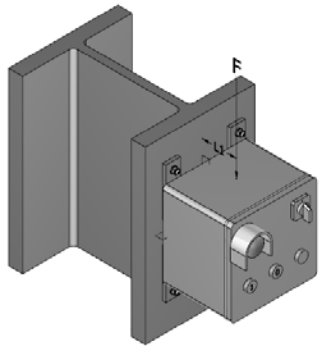
Result: L1 [mm]		F [kg]							
		50	100	150	200	250	300	350	400
→ Load in [kN]		0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92
x [mm]	80	2465	1160	725	510	375	290	230	180
	100	3080	1450	905	635	470	365	285	225
	125	3855	1815	1135	795	590	455	360	285
	150	4625	2175	1360	955	710	545	430	340
	175	5395	2540	1590	1115	830	640	500	400
	200	6165	2905	1815	1275	945	730	575	455

Result: Load F [kg]		L1 [mm]							
		150	200	250	400	600	800	1000	1200
x [mm]	80	445	380	330	240	175	135	110	95
	100	495	430	380	280	205	165	135	115
	125	545	480	430	325	245	195	165	140
	150	585	520	470	365	280	225	190	165
	175	615	555	505	400	310	255	215	185
	200	645	585	535	430	340	280	240	205

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 4.5 kN (shear)

FASTENING JUNCTION BOXES / SWITCHES WITH F-BT-MR

F-BT-MR Threaded stud



Application

- Fastening of junction boxes, switches on a vertical structure
- Element is fastened by F-BT-MR

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Technical data binder and design procedures in keeping with design standards are in preparation (EN 1993; AISC 360)

Technical data — extract from Hilti Cordless Stud Fusion Technical Manual [May 2023].

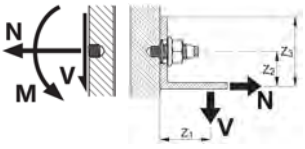
Recommended load	F-BT-MR M10 (10)
Base material	Steel S235 to S355 (EU) / A36, Grade 50 (NA)
Tension, N_{rec} [kN / lb]	8.0 kN / 1800 lbs
Shear, V_{rec} [kN / lb]	4.5 kN / 1010 lbs
Moment, M_{rec} [Nm / ft-lb]	20 Nm / 14.7 ft-lb

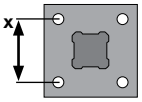
Design resistance	F-BT-MR M10 (10)
Base material	Steel S235 to S355 (EU) / A36, Grade 50 (NA)
Tension, N_{Rd} [kN / lb]	11.2 kN / 2520 lbs
Shear, V_{Rd} [kN / lb]	6.3 kN / 1415 lbs
Moment, M_{Rd} [Nm / ft-lb]	28 Nm / 20.6 ft-lb

Conditions for recommended loads

- Global factor of safety for static weld failure > 2.8 (based on 5% fractile value)
- Minimum spacing between fasteners = 35 mm [1 ⅜"]
- Minimum edge distance = 40 mm [1 ½"]
- Effect of base metal vibration and stress considered
- Redundancy (multiple fastening) must be provided
- The recommended loads in the table refer to the resistance of the individual fastening and may not be the same as the loads $\mathbf{F_N}$ and $\mathbf{F_V}$ acting on the fastened part.

Note: If relevant, prying forces need to be considered in design, see example. Moment acting on fastener shank only in case of a gap between base and fastened material.





4 studs

Recommended interaction formula for combined loading — steel and cast iron base material

Combined loading situation	Interaction formula
V–N (shear and tension)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} \le 1.0$ with $\frac{V}{V_{rec}} \le 1.0$ and $\frac{N}{N_{rec}} \le 1.0$
V–M (shear and bending)	$\frac{V}{V_{rec}} + \frac{M}{M_{rec}} \le 1.0$ with $\frac{V}{V_{rec}} \le 1.0$ and $\frac{M}{M_{rec}} \le 1.0$
N–M (tension and bending)	$\frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$
V–N–M (shear, tension and bending)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$

Note: always refer to latest Hilti Cordless Stud Fusion Technical Manual.

NOTE: load capacity used for calculation N_{rec} = 8.0 kN (axial) / V_{rec} = 4.5 kN (shear)

F-BT-MR CATALOG PAGES

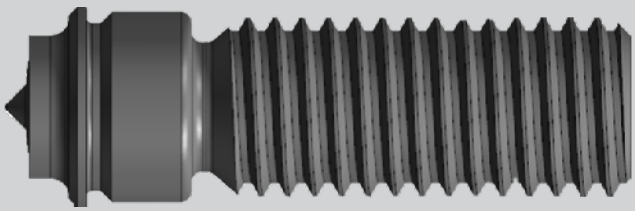
Fasteners	Item Number
F-BT-MR M6 x 25 (6)	2293866
F-BT-MR M8 x 25 (8)	2293867
F-BT-MR M10 x 25 (10)	2293868
F-BT-MR M10 x 50 (10)	2293869
F-BT-MR M12 x 25 (10)	2293870
F-BT-MR M12 x 50 (10)	2293871

Tool	Item Number
Cordless Stud Fusion unit FX 3-A	Local item
Starter kit FX 3-KIT	Local item
SF 8M-A22	Local item

Consumables	Item Number
Gas can FX 3-GC	2241926
Surfacing tool pre paint FX 3-ST d14	2270514
Surfacing tool post paint FX 3-ST d20	2270512

F-BT-MR SN THREADED STUD

Imperial



F-BT-MR SN TECHNICAL DATA

F-BT-MR SN preliminary technical data

- **Surfacing tool / base material:** FX–ST-d20, $t_{II} \geq 10$ mm (⅜")
- **Base material:** Steel S235 ... S355 (Europe) / A36 / A, B, D, E, AH 32 / 36, DH 32 / 36 (Shipbuilding)
- **Recommended interaction for combined load: N_{rec} = 1800 lb** (axial) / **V_{rec} = 810 lb** (shear)
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

V-N (shear and tension)

$$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} \leq 1.0 \quad \text{with} \quad \frac{V}{V_{rec}} \leq 1.0 \quad \text{and} \quad \frac{N}{N_{rec}} \leq 1.0$$

For further technical data refer to the latest technical information Hilti Cordless Stud Fusion Technical Manual [May 2023].

FX 3-SP TECHNICAL DATA

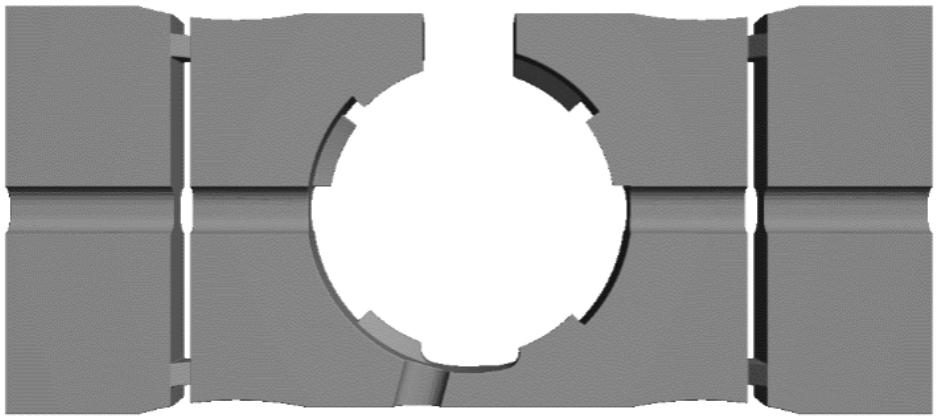
FX 3-SP technical data

- **Material:** PA66GF50
- **Standoff:** 5.5 mm
- **Size:** 100 x 44 mm
- **Fastener type:** F-BT-MR ⅜″ SN
- **Recommended load:** N_{rec} = 1800 lb (axial, compression)

The F-BT-MR SN shall only be used with the provided flange safety-nut.

Note: sealing washer and support plate only added for F-BT MR SN version

For further technical data refer to the latest technical information Hilti Cordless Stud Fusion Technical Manual [May 2023].



FX 3-SP

F-BT SEALING WASHER TECHNICAL DATA

F-BT sealing washer technical data

- **Material:** 316L and chloroprene rubber
- **Diameter:** 1.24"
- **Washer setting tool:** X-WST F3-BT (M10-⅜″)
- **Fastener type:** F-BT-MR ⅜″ SN
- **Recommended load:** N_{rec} = 1800 lb (axial, compression)

The F-BT-MR SN shall only be used with the provided flange safety-nut.

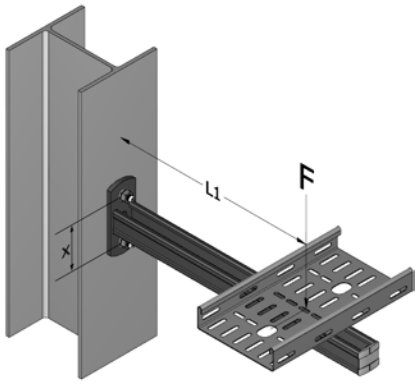
Note: sealing washer and support plate only added for F-BT MR SN version

For further technical data refer to the latest technical information Hilti Cordless Stud Fusion Technical Manual [May 2023]

F-BT sealing washer

FASTENING CANTILEVER SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



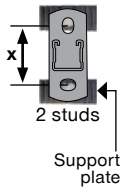
Application

- Fastening of cable trays, pipes, on a horizontal cantilever support, fastened on a vertical structure
- Support is fastened by two / four F-BT-MR SN on support baseplate with distance x
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

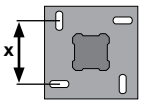
- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR SN (worst-case)
- Load F acting at the distance of L1 from structure surface
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of F (depending on load F or lever arm length L1 and baseplate distance x)



Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	47.25	20.25	11.25	6.75	4.00	2.25		
	4.0	63.00	27.00	15.00	9.00	5.50	3.00	1.50	
	5.0	78.75	33.75	18.75	11.25	6.75	3.75	1.75	
	6.0	94.50	40.50	22.75	13.75	8.25	4.75	2.00	
	7.0	110.25	47.50	26.50	16.00	9.50	5.50	2.50	
	8.0	126.00	54.25	30.25	18.25	11.00	6.25	2.75	

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	426	289	218	176	147	126	111	99
	4.0	483	344	267	218	185	160	141	126
	5.0	525	389	309	256	218	191	169	152
	6.0	558	426	344	289	249	218	195	176
	7.0	584	457	375	318	276	244	218	198
	8.0	605	483	402	344	301	267	241	218



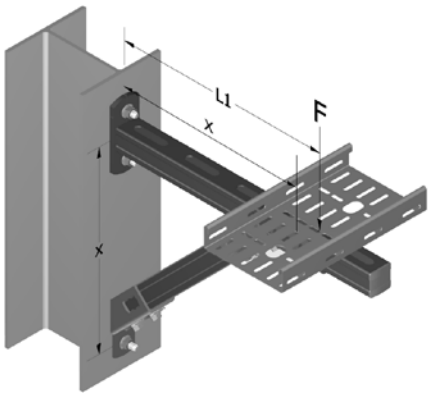
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	101.00	47.25	29.25	20.25	14.75	11.25	8.50	6.75
	4.0	134.75	63.00	39.00	27.00	19.75	15.00	11.50	9.00
	5.0	168.50	78.75	48.75	33.75	24.75	18.75	14.50	11.25
	6.0	202.25	94.50	58.50	40.50	29.75	22.50	17.25	13.50
	7.0	236.00	110.25	68.25	47.25	34.75	26.25	20.25	15.75
	8.0	269.75	126.00	78.00	54.00	39.75	30.00	23.25	18.00

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	851	578	437	352	294	253	222	197
	4.0	966	689	535	437	370	320	282	253
	5.0	1,051	778	618	512	437	382	338	304
	6.0	1,116	851	689	578	498	437	390	352
	7.0	1,168	913	750	636	552	488	437	396
	8.0	1,210	966	804	689	602	535	481	437

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 810 lb (shear)

FASTENING BRACED CANTILEVER SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



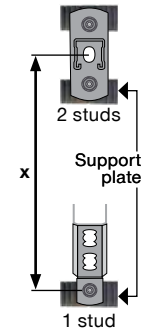
Application

- Fastening of cable trays, pipes on a horizontal, braced cantilever support, fastened on a vertical structure
- Support is fastened by three / six F-BT-MR SN on both support and brace baseplate with distance x
- L1 is the distance of the load center to the vertical structure surface, the angle of the brace is 45°
- Load F is the acceptable total load (all dead load included)

Boundary conditions

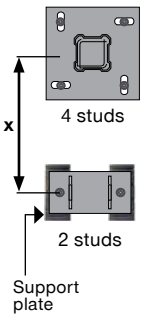
- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR SN (worst-case)
- Load F acting at the distance of L1 from structure surface
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of F (depending on load F or lever arm length L1 and baseplate distance x)



Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	4.0								
	6.0		24.25	16.00	12.00	9.50	8.00	6.75	6.00
	8.0		32.25	21.50	16.00	12.75	10.75	9.00	8.00
	14.0		56.50	37.75	28.25	22.50	18.75	16.00	14.00
	20.0		80.75	53.75	40.25	32.25	26.75	23.00	20.00
	32.0		129.25	86.25	64.50	51.75	43.00	36.75	32.25

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	4.0								
	6.0	809	404	270	202				
	8.0		539	359	270				
	14.0			629	472				
	20.0				674				
	32.0								



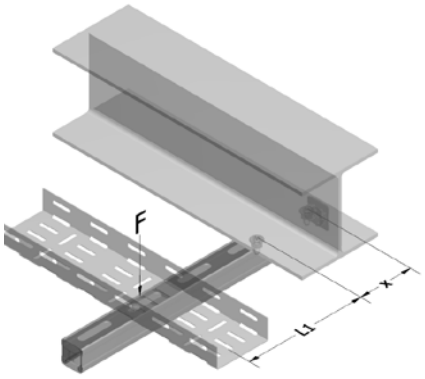
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	4.0								
	6.0			31.25	24.25	19.25	16.00	13.75	12.00
	8.0			41.75	32.25	25.75	21.50	18.25	16.00
	14.0			73.00	56.50	45.25	37.75	32.25	28.25
	20.0			104.25	80.75	64.50	53.75	46.00	40.25
	32.0			167.00	129.25	103.50	86.25	73.75	64.50

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	4.0								
	6.0	1,618	809	539	404	323	270		
	8.0		1,079	719	539	431	359	308	270
	14.0			1,258	944	755	629	539	472
	20.0				1,348	1,079	899	770	674
	32.0						1,438	1,233	1,079

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 810 lb (shear)

FASTENING STRUT TO STEEL WITH F-BT-MR SN

Two F-BT-MR SN Threaded studs



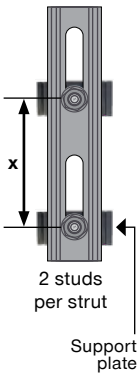
Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a horizontal structure
- Support is fastened by two F-BT-MR SN (horizontal distance x)
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- L1 is acting from center of stud
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR SN distance x)



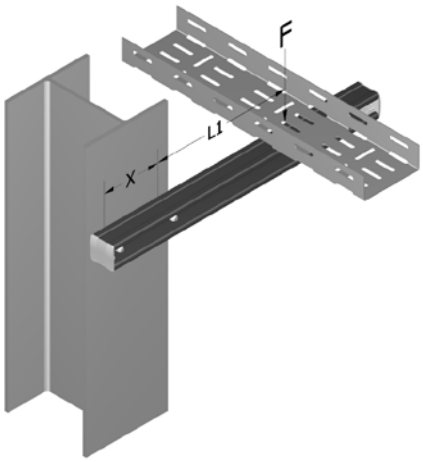
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	50.75	23.75	14.75	10.25	7.75	5.75	4.50	3.50
	4.0	67.75	31.75	19.75	13.75	10.25	7.75	6.25	4.75
	5.0	84.75	39.75	24.75	17.25	12.75	9.75	7.75	6.00
	6.0	101.75	47.75	29.75	20.75	15.50	11.75	9.25	7.25
	7.0	118.75	55.75	34.75	24.25	18.00	13.75	10.75	8.50
	8.0	135.75	63.75	39.75	27.75	20.75	15.75	12.50	9.75

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	599	359	257	200	163	138	120	106
	4.0	719	449	327	257	211	180	156	138
	5.0	817	529	391	310	257	219	191	170
	6.0	899	599	449	359	300	257	225	200
	7.0	968	662	503	406	340	293	257	229
	8.0	1,027	719	553	449	378	327	287	257

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 810 lb (shear)

FASTENING STRUT TO STEEL WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



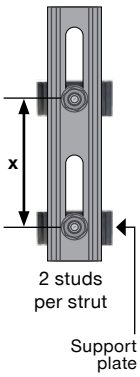
Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a vertical structure
- Support is fastened by two F-BT-MR SN (horizontal distance x)
- L1 is the distance of the load center to the center of the fasteners
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one F-BT-MR SN (worst-case)
- Load F acting at the distance of L1 from structure surface
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR SN distance x)



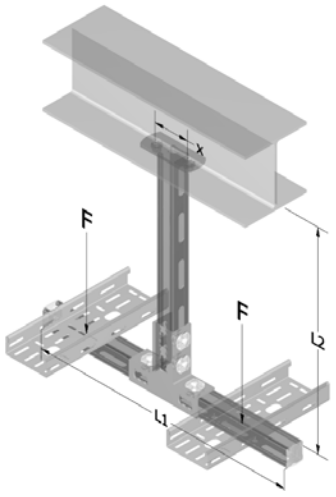
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	21.25	9.00	5.00	3.00	1.75			
	4.0	28.25	12.00	6.75	4.00	2.25	1.25		
	5.0	35.25	15.00	8.25	5.00	3.00	1.50		
	6.0	42.50	18.25	10.00	6.00	3.50	2.00		
	7.0	49.50	21.25	11.75	7.00	4.25	2.25		
	8.0	56.50	24.25	13.50	8.00	4.75	2.75		

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	270	162	116	90	73	62	54	47
	4.0	323	202	147	116	95	81	70	62
	5.0	368	238	176	139	116	99	86	76
	6.0	404	270	202	162	135	116	101	90
	7.0	436	298	226	183	153	132	116	103
	8.0	462	323	249	202	170	147	129	116

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 810 lb (shear)

FASTENING T-POST (CEILING) SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



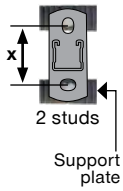
Application

- Fastening of cable trays, pipes on a T-Post support, which is fastened on a horizontal structure
- Support is fastened by two / four F-BT-MR SN (horizontal distance x)
- L1 is the total width of the T-Post, L2 is fix set to 1000 mm
- Load F is the acceptable total load (all dead load included)

Boundary conditions

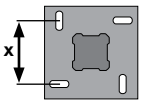
- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- 2 Load cases: load asymmetric acting in the center of one arm only, 30% acting as horizontal load
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR SN distance x)



Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	209.75	101.75	65.75					
	4.0	279.75	135.75	87.75	63.75				
	5.0	349.50	169.75	109.75	79.75				
	6.0	419.50	203.75	131.75	95.75	74.25			
	7.0	489.50	237.75	153.75	111.75	86.50	69.75		
	8.0	559.50	271.75	175.75	127.75	99.00	79.75		

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	352	352	352	352	352	352	352	352
	4.0	436	436	436	436	436	436	436	436
	5.0	509	509	509	509	509	509	509	509
	6.0	573	573	573	573	573	573	573	573
	7.0	630	630	630	630	630	630	630	630
	8.0	680	680	680	680	680	680	680	680



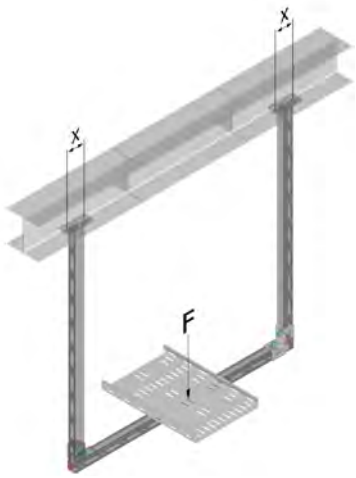
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	425.50	209.75	137.75	101.75	80.25	65.75		
	4.0	567.50	279.75	183.75	135.75	107.00	87.75	74.00	63.75
	5.0	709.25	349.50	229.75	169.75	133.75	109.75	92.75	79.75
	6.0	851.25	419.50	275.75	203.75	160.50	131.75	111.25	95.75
	7.0	993.00	489.50	321.50	237.75	187.25	153.75	129.75	111.75
	8.0	1135.00	559.50	367.50	271.75	214.00	175.75	148.25	127.75

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	642	642	642	642	642	642	642	642
	4.0	778	778	778	778	778	778	778	778
	5.0	892	892	892	892	892	892	892	892
	6.0	989	989	989	989	989	989	989	989
	7.0	1,072	1,072	1,072	1,072	1,072	1,072	1,072	1,072
	8.0	1,144	1,144	1,144	1,144	1,144	1,144	1,144	1,144

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 810 lb (shear)

FASTENING U-FRAME (CEILING) / TRAPEZE SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



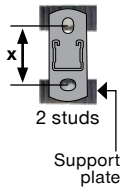
Application

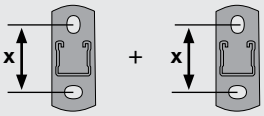
- Fastening of cable trays, pipes on a U-Frame support, which is fastened on a horizontal structure
- Support is fastened by four F-BT-MR SN (2 fasteners per baseplate)
- Load F is the acceptable total load (all dead load included, acting in the center of the U-Frame)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Load acting in the center (U-Frame)
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment—maximum of F



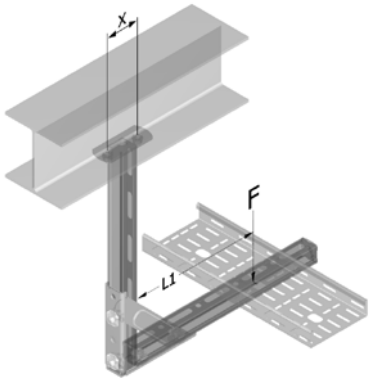


$F = N_{rec}$ • #fasteners per post
F = 1800 lb • 4
F = 7200 lb

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 810 lb (shear)

FASTENING L-POST SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



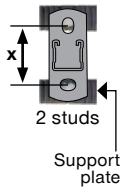
Application

- Fastening of cable trays, pipes on an L-Post support, which is fastened on a horizontal structure
- Support is fastened by two / four F-BT-MR SN (horizontal distance x)
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

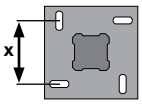
- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Load F acting at the distance of L1 from middle of vertical channel
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR SN distance x)



Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	52.25	25.25	16.25	11.75	9.25	7.25	6.00	5.00
	4.0	69.75	33.75	21.75	15.75	12.25	9.75	8.25	6.75
	5.0	87.25	42.25	27.25	19.75	15.25	12.25	10.25	8.50
	6.0	104.75	50.75	32.75	23.75	18.50	14.75	12.25	10.25
	7.0	122.25	59.25	38.25	27.75	21.50	17.25	14.25	12.00
	8.0	139.75	67.75	43.75	31.75	24.75	19.75	16.50	13.75

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	719	399	276	211	171	144	124	109
	4.0	899	513	359	276	225	189	163	144
	5.0	1,058	620	438	339	276	233	202	178
	6.0	1,198	719	513	399	327	276	240	211
	7.0	1,325	812	585	457	376	319	276	244
	8.0	1,438	899	654	513	423	359	313	276



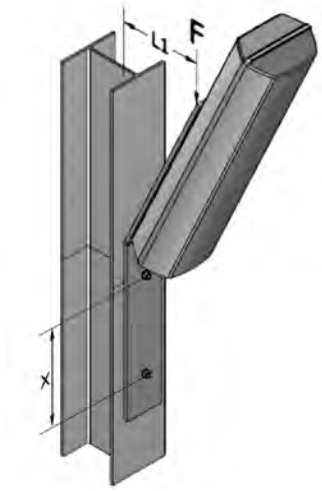
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	80	106.25	52.25	34.25	25.25	20.00	16.25	13.75	11.75
	100	141.75	69.75	45.75	33.75	26.75	21.75	18.50	15.75
	125	177.25	87.25	57.25	42.25	33.25	27.25	23.00	19.75
	150	212.75	104.75	68.75	50.75	40.00	32.75	27.75	23.75
	175	248.25	122.25	80.25	59.25	46.75	38.25	32.25	27.75
	200	283.75	139.75	91.75	67.75	53.50	43.75	37.00	31.75

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	80	1,438	799	553	423	342	287	248	218
	100	1,798	1,027	719	553	449	378	327	287
	125	2,115	1,240	877	678	553	467	404	356
	150	2,397	1,438	1,027	799	654	553	479	423
	175	2,649	1,624	1,171	915	751	637	553	489
	200	2,876	1,798	1,307	1,027	846	719	625	553

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 810 lb (shear)

FASTENING EQUIPMENT SUPPORT WITH F-BT-MR SN

Two / Four F-BT-MR SN Threaded studs



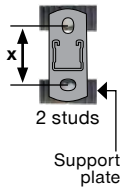
Application

- Fastening of lamps, signals and sensors on inclined cantilever support, fastened on a vertical structure
- Support is fastened by two / four F-BT-MR SN (vertical distance x)
- L1 is the distance of the load center (~middle of the load) to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

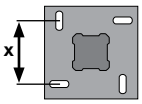
- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR SN (worst-case)
- Load F acting at the distance of L1 from structure surface
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR SN distance x)



Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	47.25	20.25	11.25	6.75	4.00	2.25		
	4.0	63.00	27.00	15.00	9.00	5.25	3.00		
	5.0	78.75	33.75	18.75	11.25	6.75	3.75	1.50	
	6.0	94.50	40.50	22.50	13.50	8.00	4.50	2.00	
	7.0	110.25	47.25	26.25	15.75	9.50	5.25	2.25	
	8.0	126.00	54.00	30.00	18.00	10.75	6.00	2.75	

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	426	289	218	176	147	126	111	99
	4.0	483	344	267	218	185	160	141	126
	5.0	525	389	309	256	218	191	169	152
	6.0	558	426	344	289	249	218	195	176
	7.0	584	457	375	318	276	244	218	198
	8.0	605	483	402	344	301	267	241	218



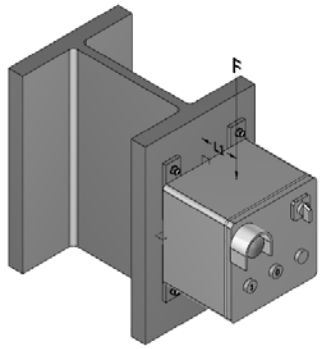
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	101.00	47.25	29.25	20.25	14.75	11.25	8.50	6.75
	4.0	134.75	63.00	39.00	27.00	19.75	15.00	11.50	9.00
	5.0	168.50	78.75	48.75	33.75	24.75	18.75	14.50	11.25
	6.0	202.25	94.50	58.50	40.50	29.75	22.50	17.25	13.50
	7.0	236.00	110.25	68.25	47.25	34.75	26.25	20.25	15.75
	8.0	269.75	126.00	78.00	54.00	39.75	30.00	23.25	18.00

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	851	578	437	352	294	253	222	197
	4.0	966	689	535	437	370	320	282	253
	5.0	1,051	778	618	512	437	382	338	304
	6.0	1,116	851	689	578	498	437	390	352
	7.0	1,168	913	750	636	552	488	437	396
	8.0	1,210	966	804	689	602	535	481	437

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 810 lb (shear)

FASTENING JUNCTION BOXES / SWITCHES WITH F-BT-MR SN

F-BT-MR SN Threaded stud



Application

- Fastening of junction boxes, switches on a vertical structure
- Element is fastened by F-BT-MR SN

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR SN threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Technical data binder and design procedures in keeping with design standards are in preparation (EN 1993; AISC 360)
- Calculation of maximum allowable load is considering a support plate beside the sealing washer

Technical data — extract from Hilti Cordless Stud Fusion Technical Manual [May 2023]

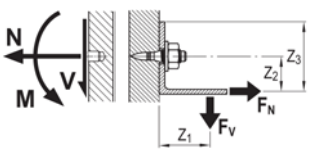
Recommended load	F-BT-MR ⅜ x 1 SN ⅜
Base material	Steel S235 to S355 (EU) / A36, Grade 50 (NA)
Tension, N_{rec} [kN / lb]	8.0 kN / 1800 lbs
Shear, V_{rec} [kN / lb]	3.6 kN / 810 lbs
Moment, M_{rec} [Nm / ft-lb]	20 Nm / 14.7 lb-ft

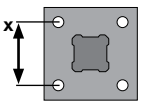
Design resistance	F-BT-MR ⅜ x 1 SN ⅜
Base material	Steel S235 to S355 (EU) / A36, Grade 50 (NA)
Tension, N_{Rd} [kN / lb]	11.2 kN / 2520 lbs
Shear, V_{Rd} [kN / lb]	5.0 kN / 1125 lbs
Moment, M_{Rd} [Nm / ft-lb]	28 Nm / 20.6 lb-ft

Conditions for recommended loads

- Global factor of safety for static weld failure > 2.8 (based on 5% fractile value)
- Minimum spacing between fasteners = 35 mm [1 ⅜"]
- Minimum edge distance = 40 mm [1 ½"]
- Effect of base metal vibration and stress considered
- Redundancy (multiple fastening) must be provided
- Recommended loads in the table refer to the resistance of the individual fastening and may not be the same as the loads F_N and F_V acting on the fastened part.

Note: if relevant, prying forces need to be considered in design, see example. Moment acting on fastener shank only in case of a gap between base and fastened material.





4 studs

Recommended interaction formula for combined loading — steel and cast iron base material

Combined loading situation	Interaction formula
V–N (shear and tension)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} \le 1.0$ with $\frac{V}{V_{rec}} \le 1.0$ and $\frac{N}{N_{rec}} \le 1.0$
V–M (shear and bending)	$\frac{V}{V_{rec}} + \frac{M}{M_{rec}} \le 1.0$ with $\frac{V}{V_{rec}} \le 1.0$ and $\frac{M}{M_{rec}} \le 1.0$
N–M (tension and bending)	$\frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$
V–N–M (shear, tension and bending)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$

Note: always refer to latest Hilti Cordless Stud Fusion Technical Manual.

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 810 lb (shear)

F-BT-MR SN CATALOG PAGES

Fasteners	Item Number
F-BT-MR ⅜ x 1 SN (⅜)	2293880
F-BT-MR ⅜ x 1 1/2 SN (⅜)	2293881
F-BT-MR ⅜ x 2 SN (⅜)	2293882
F-BT-MR ⅜ x 4 SN (⅜)	2293883
F-BT-MR ⅜ x 1 SN (5/32)	2293887

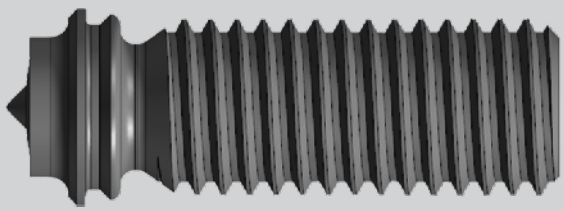
Tool	Item Number
Cordless Stud Fusion unit FX 3-A	Local item
Starter kit FX 3-KIT	Local item
SF 8M-A22	Local item

Consumables	Item Number
Gas can FX 3-GC	2241926
Surfacing tool post paint FX 3-ST d20	2270512
Plate support FX M6 M8 M10	2357719
Plate support FX M12	2358345


MQ-41-R

F-BT-MR THREADED STUD

Imperial



F-BT-MR TECHNICAL DATA USED FOR THE FOLLOWING CALCULATIONS

F-BT-MR technical data

- **Surfacing tool / base material:** FX–ST-d14 / FX–ST-d20, $t_{II} \geq 10$ mm (⅜")
- **Base material:** Steel S235 ... S355 (Europe) / A36 / A, B, D, E, AH 32 / 36, DH 32 / 36 (Shipbuilding)
- **Recommended interaction for combined load: N_{rec} = 1800 lb** (axial) / **V_{rec} = 1010 lb** (shear)

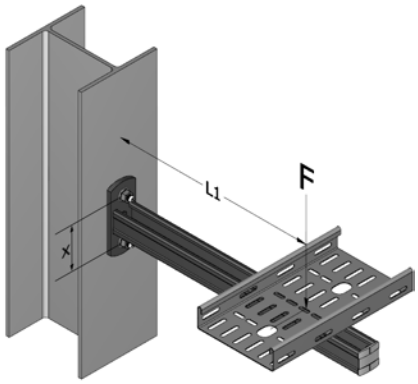
V-N (shear and tension)

$$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} \leq 1.0 \quad \text{with} \quad \frac{V}{V_{rec}} \leq 1.0 \quad \text{and} \quad \frac{N}{N_{rec}} \leq 1.0$$

For further technical data refer to the latest technical information Hilti Cordless Stud Fusion Technical Manual [May 2023].

FASTENING CANTILEVER SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



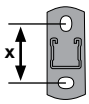
Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a vertical structure
- Support is fastened by two / four F-BT-MR on support baseplate with distance x
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR (worst-case)
- Load F acting at the distance of L1 from structure surface

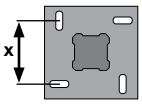
Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and baseplate distance x)



2 studs

Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	48.50	21.75	12.75	8.25	5.50	3.75	2.25	1.50
	4.0	64.75	28.75	16.75	10.75	7.25	5.00	3.25	2.00
	5.0	81.00	36.00	21.00	13.50	9.00	6.00	4.00	2.25
	6.0	97.25	43.25	25.25	16.25	11.00	7.25	4.75	2.75
	7.0	113.50	50.50	29.50	19.00	12.75	8.50	5.50	3.25
	8.0	129.75	57.75	33.75	21.75	14.50	9.75	6.25	3.75

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	476	311	231	184	153	130	114	101
	4.0	548	376	286	231	194	167	146	130
	5.0	604	430	334	273	231	200	177	158
	6.0	647	476	376	311	265	231	205	184
	7.0	682	515	413	345	296	260	231	208
	8.0	711	548	446	376	325	286	256	231



4 studs

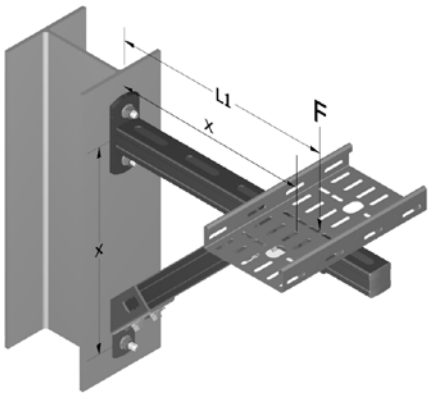
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	102.50	48.50	30.50	21.50	16.00	12.50	10.00	8.00
	4.0	136.75	64.75	40.75	28.75	21.50	16.75	13.25	10.75
	5.0	170.75	81.00	51.00	36.00	27.00	21.00	16.75	13.50
	6.0	205.00	97.00	61.25	43.25	32.25	25.25	20.00	16.25
	7.0	239.25	113.25	71.25	50.50	37.75	29.50	23.50	19.00
	8.0	273.50	129.50	81.50	57.50	43.25	33.50	26.75	21.50

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	952	622	462	368	305	261	228	202
	4.0	1,097	752	573	462	387	334	293	261
	5.0	1,207	860	668	547	462	400	353	316
	6.0	1,294	952	752	622	530	462	410	368
	7.0	1,364	1,030	827	690	593	519	462	416
	8.0	1,422	1,097	893	752	650	573	511	462

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 1010 lb (shear)

FASTENING BRACED CANTILEVER SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



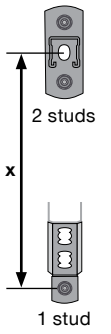
Application

- Fastening of cable trays, pipes on a horizontal, braced cantilever support, fastened on a vertical structure
- Support is fastened by three / six F-BT-MR on both support and brace baseplate with distance x
- L1 is the distance of the load center to the vertical structure surface, the angle of the brace is 45°
- Load F is the acceptable total load (all dead load included)

Boundary conditions

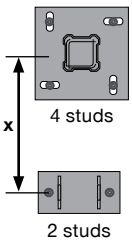
- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR (worst-case)
- Load F acting at the distance of L1 from structure surface

Technical assessment — maximum of F (depending on load F or lever arm length L1 and baseplate distance x)



Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	4.0								
	6.0		28.25	20.00	15.00	12.00	10.00	8.50	7.50
	8.0		37.75	26.75	20.00	16.00	13.25	11.50	10.00
	14.0		66.00	47.00	35.25	28.25	23.50	20.00	17.50
	20.0		94.50	67.25	50.50	40.25	33.50	28.75	25.25
	32.0		151.25	107.75	80.75	64.50	53.75	46.00	40.25

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	4.0								
	6.0	1,011	506	337	253				
	8.0		674	449	337				
	14.0			786	590				
	20.0				843				
	32.0								



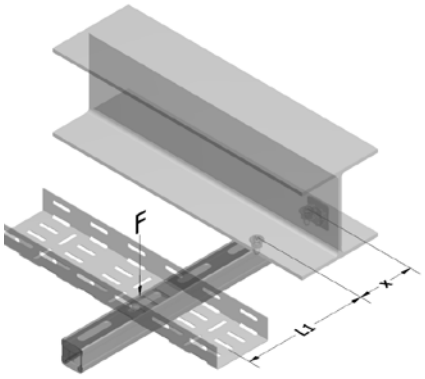
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	4.0								
	6.0			36.25	28.25	23.50	20.00	17.25	15.00
	8.0			48.25	37.75	31.50	26.75	23.00	20.00
	14.0			84.50	66.00	55.00	47.00	40.25	35.25
	20.0			120.75	94.50	78.75	67.25	57.75	50.50
	32.0			193.25	151.25	126.00	107.75	92.25	80.75

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	4.0								
	6.0	2,023	1,011	674	506	404	337		
	8.0		1,348	899	674	539	449	385	337
	14.0			1,573	1,180	944	786	674	590
	20.0				1,685	1,348	1,123	963	843
	32.0						1,798	1,541	1,348

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 1010 lb (shear)

FASTENING STRUT TO STEEL WITH F-BT-MR

Two F-BT-MR Threaded studs



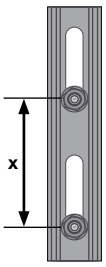
Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a horizontal structure
- Support is fastened by two F-BT-MR (horizontal distance x)
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- L1 is acting from center of stud

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR distance x)



2 studs per strut

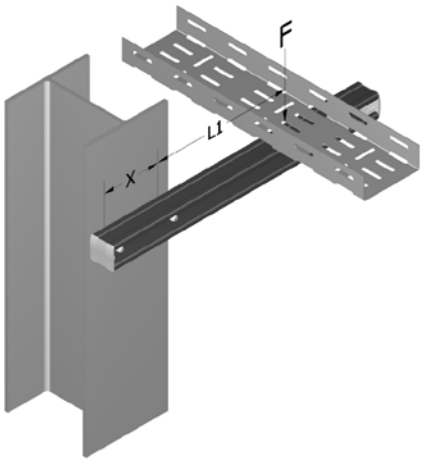
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	50.75	23.75	14.75	10.25	7.75	5.75	4.50	3.50
	4.0	67.75	31.75	19.75	13.75	10.25	7.75	6.25	4.75
	5.0	84.75	39.75	24.75	17.25	12.75	9.75	7.75	6.00
	6.0	101.75	47.75	29.75	20.75	15.50	11.75	9.25	7.25
	7.0	118.75	55.75	34.75	24.25	18.00	13.75	10.75	8.50
	8.0	135.75	63.75	39.75	27.75	20.75	15.75	12.50	9.75

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	599	359	257	200	163	138	120	106
	4.0	719	449	327	257	211	180	156	138
	5.0	817	529	391	310	257	219	191	170
	6.0	899	599	449	359	300	257	225	200
	7.0	968	662	503	406	340	293	257	229
	8.0	1,027	719	553	449	378	327	287	257

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 1010 lb (shear)

FASTENING STRUT TO STEEL WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



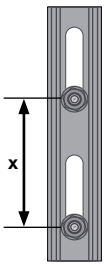
Application

- Fastening of cable trays, pipes on a horizontal cantilever support, fastened on a vertical structure
- Support is fastened by two F-BT-MR (horizontal distance x)
- L1 is the distance of the load center to the center of the fasteners
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one F-BT-MR (worst-case)
- Load F acting at the distance of L1 from structure surface

Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR distance x)



2 studs per strut

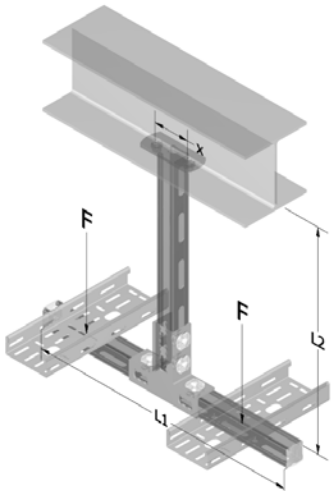
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	27.25	12.00	7.00	4.50	3.00	2.00	1.25	
	4.0	36.25	16.00	9.25	6.00	4.00	2.50	1.75	
	5.0	45.50	20.25	11.75	7.50	5.00	3.25	2.00	
	6.0	54.50	24.25	14.00	9.00	6.00	4.00	2.50	1.50
	7.0	63.75	28.25	16.50	10.50	7.00	4.75	3.00	1.75
	8.0	72.75	32.25	18.75	12.00	8.00	5.25	3.50	2.00

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	337	202	144	112	92	78	67	59
	4.0	404	253	184	144	119	101	88	78
	5.0	460	297	220	174	144	123	107	95
	6.0	506	337	253	202	168	144	126	112
	7.0	545	373	283	228	191	164	144	129
	8.0	578	404	311	253	213	184	162	144

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 1010 lb (shear)

FASTENING T-POST (CEILING) SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



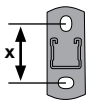
Application

- Fastening of cable trays, pipes on a T-Post support, which is fastened on a horizontal structure
- Support is fastened by two / four F-BT-MR (horizontal distance x)
- L1 is the total width of the T-Post, L2 is fix set to 1000 mm
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- 2 Load cases: load asymmetric acting in the center of one arm only, 30% acting as horizontal load

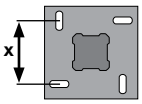
Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR distance x)



2 studs

Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	209.75	101.75	65.75					
	4.0	279.75	135.75	87.75	63.75				
	5.0	349.50	169.75	109.75	79.75	61.75			
	6.0	419.50	203.75	131.75	95.75	74.25			
	7.0	489.50	237.75	153.75	111.75	86.50	69.75		
	8.0	559.50	271.75	175.75	127.75	99.00	79.75		

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	362	362	362	362	362	362	362	362
	4.0	451	451	451	451	451	451	451	451
	5.0	529	529	529	529	529	529	529	529
	6.0	599	599	599	599	599	599	599	599
	7.0	661	661	661	661	661	661	661	661
	8.0	716	716	716	716	716	716	716	716



4 studs

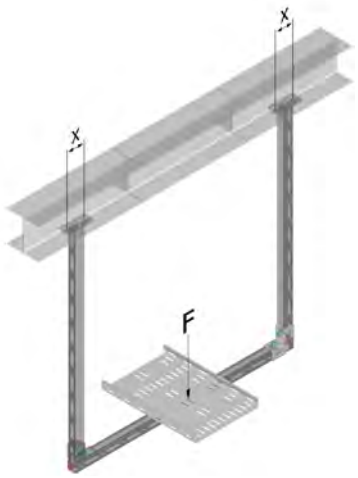
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	425.50	209.75	137.75	101.75	80.25	65.75	55.50	
	4.0	567.50	279.75	183.75	135.75	107.00	87.75	74.00	63.75
	5.0	709.25	349.50	229.75	169.75	133.75	109.75	92.75	79.75
	6.0	851.25	419.50	275.75	203.75	160.50	131.75	111.25	95.75
	7.0	993.00	489.50	321.50	237.75	187.25	153.75	129.75	111.75
	8.0	1135.00	559.50	367.50	271.75	214.00	175.75	148.25	127.75

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	657	657	657	657	657	657	657	657
	4.0	801	801	801	801	801	801	801	801
	5.0	923	923	923	923	923	923	923	923
	6.0	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027
	7.0	1,116	1,116	1,116	1,116	1,116	1,116	1,116	1,116
	8.0	1,195	1,195	1,195	1,195	1,195	1,195	1,195	1,195

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 1010 lb (shear)

FASTENING U-FRAME (CEILING) / TRAPEZE SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



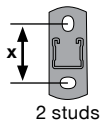
Application

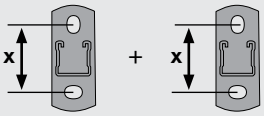
- Fastening of cable trays, pipes on a U-Frame support, which is fastened on a horizontal structure
- Support is fastened by four F-BT-MR (2 fasteners per baseplate)
- Load F is the acceptable total load (all dead load included, acting in the center of the U-Frame)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Load acting in the center (U-Frame)

Technical assessment—maximum of F



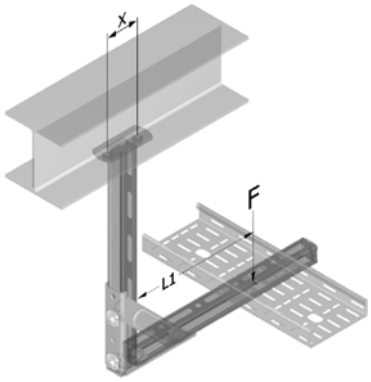


$F = N_{rec}$ • #fasteners per post
F = 1800 lb • 4
F = 7200 lb

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 1010 lb (shear)

FASTENING L-POST SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



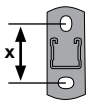
Application

- Fastening of cable trays, pipes on an L-Post support, which is fastened on a horizontal structure
- Support is fastened by two / four F-BT-MR (horizontal distance x)
- L1 is the distance of the load center to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Load F acting at the distance of L1 from middle of vertical channel

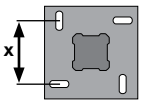
Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR distance x)



2 studs

Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	52.25	25.25	16.25	11.75	9.25	7.25	6.00	5.00
	4.0	69.75	33.75	21.75	15.75	12.25	9.75	8.25	6.75
	5.0	87.25	42.25	27.25	19.75	15.25	12.25	10.25	8.50
	6.0	104.75	50.75	32.75	23.75	18.50	14.75	12.25	10.25
	7.0	122.25	59.25	38.25	27.75	21.50	17.25	14.25	12.00
	8.0	139.75	67.75	43.75	31.75	24.75	19.75	16.50	13.75

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	719	399	276	211	171	144	124	109
	4.0	899	513	359	276	225	189	163	144
	5.0	1,058	620	438	339	276	233	202	178
	6.0	1,198	719	513	399	327	276	240	211
	7.0	1,325	812	585	457	376	319	276	244
	8.0	1,438	899	654	513	423	359	313	276



4 studs

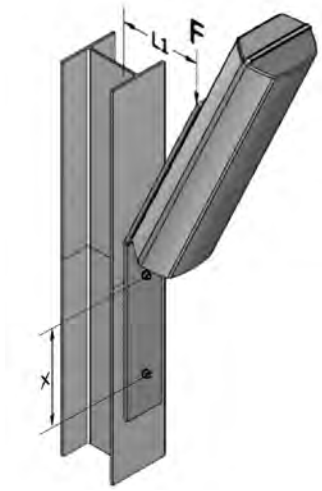
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	80	106.25	52.25	34.25	25.25	20.00	16.25	13.75	11.75
	100	141.75	69.75	45.75	33.75	26.75	21.75	18.50	15.75
	125	177.25	87.25	57.25	42.25	33.25	27.25	23.00	19.75
	150	212.75	104.75	68.75	50.75	40.00	32.75	27.75	23.75
	175	248.25	122.25	80.25	59.25	46.75	38.25	32.25	27.75
	200	283.75	139.75	91.75	67.75	53.50	43.75	37.00	31.75

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	80	1,438	799	553	423	342	287	248	218
	100	1,798	1,027	719	553	449	378	327	287
	125	2,115	1,240	877	678	553	467	404	356
	150	2,397	1,438	1,027	799	654	553	479	423
	175	2,649	1,624	1,171	915	751	637	553	489
	200	2,876	1,798	1,307	1,027	846	719	625	553

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 1010 lb (shear)

FASTENING EQUIPMENT SUPPORT WITH F-BT-MR

Two / Four F-BT-MR Threaded studs



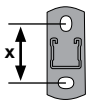
Application

- Fastening of lamps, signals and sensors on inclined cantilever support, fastened on a vertical structure
- Support is fastened by two / four F-BT-MR (vertical distance x)
- L1 is the distance of the load center (~middle of the load) to the vertical structure surface
- Load F is the acceptable total load (all dead load included)

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Shear load fully carried by one / two top F-BT-MR (worst-case)
- Load F acting at the distance of L1 from structure surface

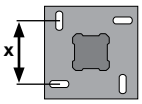
Technical assessment — maximum of L1 and F (depending on load F or lever arm length L1 and F-BT-MR distance x)



2 studs

Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	48.50	21.50	12.50	8.00	5.25	3.50	2.25	
	4.0	64.75	28.75	16.75	10.75	7.25	4.75	3.00	1.75
	5.0	81.00	36.00	21.00	13.50	9.00	6.00	3.75	2.25
	6.0	97.00	43.25	25.25	16.25	10.75	7.25	4.50	2.75
	7.0	113.25	50.50	29.50	19.00	12.50	8.50	5.50	3.25
	8.0	129.50	57.50	33.50	21.50	14.50	9.75	6.25	3.75

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	476	311	231	184	153	130	114	101
	4.0	548	376	286	231	194	167	146	130
	5.0	604	430	334	273	231	200	177	158
	6.0	647	476	376	311	265	231	205	184
	7.0	682	515	413	345	296	260	231	208
	8.0	711	548	446	376	325	286	256	231



4 studs

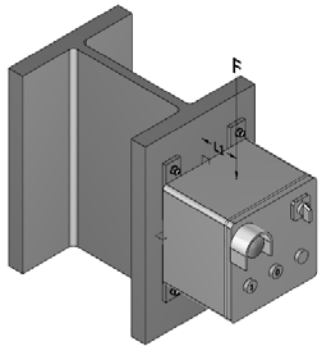
Result: L1 [inch]		F [lbs]							
		100	200	300	400	500	600	700	800
x [inch]	3.0	102.50	48.50	30.50	21.50	16.00	12.50	10.00	8.00
	4.0	136.75	64.75	40.75	28.75	21.50	16.75	13.25	10.75
	5.0	170.75	81.00	51.00	36.00	27.00	21.00	16.75	13.50
	6.0	205.00	97.00	61.25	43.25	32.25	25.25	20.00	16.25
	7.0	239.25	113.25	71.25	50.50	37.75	29.50	23.50	19.00
	8.0	273.50	129.50	81.50	57.50	43.25	33.50	26.75	21.50

Result: Load F [lbs]		L1 [inch]							
		6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0
x [inch]	3.0	952	622	462	368	305	261	228	202
	4.0	1,097	752	573	462	387	334	293	261
	5.0	1,207	860	668	547	462	400	353	316
	6.0	1,294	952	752	622	530	462	410	368
	7.0	1,364	1,030	827	690	593	519	462	416
	8.0	1,422	1,097	893	752	650	573	511	462

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 1010 lb (shear)

FASTENING JUNCTION BOXES / SWITCHES WITH F-BT-MR

F-BT-MR Threaded stud



Application

- Fastening of junction boxes, switches on a vertical structure
- Element is fastened by F-BT-MR

Boundary conditions

- These values are ONLY reflecting capacity of F-BT-MR threaded stud. Structural analysis of support / structure is NOT in Hilti's scope. See the detailed statements in disclaimer—2023/05/31
- Technical data binder and design procedures in keeping with design standards are in preparation (EN 1993; AISC 360)

Technical data — extract from Hilti Cordless Stud Fusion Technical Manual [May 2023]

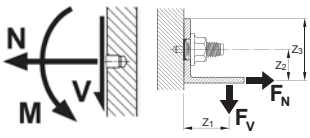
Recommended load	F-BT-MR ⅜ x 1 ⅜
Base material	Steel S235 to S355 (EU) / A36, Grade 50 (NA)
Tension, N_{rec} [kN / lb]	8.0 kN / 1800 lbs
Shear, V_{rec} [kN / lb]	4.5 kN / 1010 lbs
Moment, M_{rec} [Nm / ft-lb]	20 Nm / 14.7 lb-ft

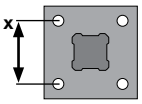
Design resistance	F-BT-MR ⅜ x 1 ⅜
Base material	Steel S235 to S355 (EU) / A36, Grade 50 (NA)
Tension, N_{Rd} [kN / lb]	11.2 kN / 2520 lbs
Shear, V_{Rd} [kN / lb]	6.3 kN / 1415 lbs
Moment, M_{Rd} [Nm / ft-lb]	28 Nm / 20.6 lb-ft

Conditions for recommended loads

- Global factor of safety for static weld failure > 2.8 (based on 5% fractile value)
- Minimum spacing between fasteners = 35 mm [1 ⅜"]
- Minimum edge distance = 40 mm [1 ½"]
- Effect of base metal vibration and stress considered
- Redundancy (multiple fastening) must be provided
- Recommended loads in the table refer to the resistance of the individual fastening and may not be the same as the loads FN and FV acting on the fastened part

Note: if relevant, prying forces need to be considered in design, see example. Moment acting on fastener shank only in case of a gap between base and fastened material.





4 studs

Recommended interaction formula for combined loading — steel and cast iron base material

Combined loading situation	Interaction formula
V–N (shear and tension)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} \le 1.0$ with $\frac{V}{V_{rec}} \le 1.0$ and $\frac{N}{N_{rec}} \le 1.0$
V–M (shear and bending)	$\frac{V}{V_{rec}} + \frac{M}{M_{rec}} \le 1.0$ with $\frac{V}{V_{rec}} \le 1.0$ and $\frac{M}{M_{rec}} \le 1.0$
N–M (tension and bending)	$\frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$
V–N–M (shear, tension and bending)	$\frac{V}{V_{rec}} + \frac{N}{N_{rec}} + \frac{M}{M_{rec}} \le 1.0$

Note: always refer to latest Hilti Cordless Stud Fusion Technical Manual.

NOTE: load capacity used for calculation N_{rec} = 1800 lb (axial) / V_{rec} = 1010 lb (shear)

F-BT-MR CATALOG PAGES

Fasteners	Item Number
F-BT-MR ⅜ x 1 (⅜)	2293890
F-BT-MR ⅜ x 1-½ (⅜)	2293891
F-BT-MR ⅜ x 2 (⅜)	2293892
F-BT-MR ⅜ x 4 (⅜)	2293893
F-BT-MR ½ x 1-½ (⅜)	2293895
F-BT-MR ½ x 2 (⅜)	2293896

Tool	Item Number
Cordless Stud Fusion unit FX 3-A	Local item
Starter kit FX 3-KIT	Local item
SF 8M-A22	Local item

Consumables	Item Number
Gas can FX 3-GC	2241926
Surfacing tool pre paint FX 3-ST d14	2270514
Surfacing tool post paint FX 3-ST d20	2270512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