PSA X-Foot Ferrules M20 – 121mm long

FP20121ZF, FP20121GF and FP20121SS

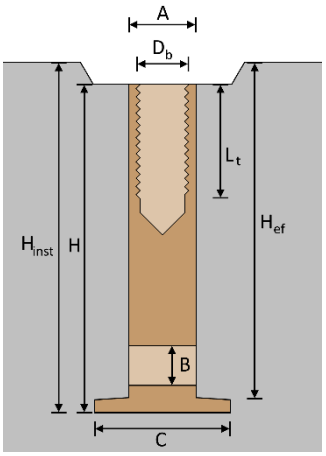
PSA FP20121 X-FOOT FERRULES

To offer a ductile anchorage solution for M20 Grade 4.6 metric bolts, PSA offers a ferrule with body heights of 121mm that can provide a ductile connection.

Product Range PSA FP20121 X-Foot Ferrules		
Part No.	Product description	Material
FP20121ZF	M20 x 121mm Footed Ferrule zinc plated	Carbon Steel
FP20121GF	M20 x 121mm Footed Ferrule galvanised	Carbon Steel
FP20121SS	M20 x 121mm Footed Ferrule - 316 Stainless Steel	A316 Stainless Steel

PSA FP20121 X-FOOT FERRULES - DIMENSIONS

Dimensions and Capacities		
Thread		M20
Ferrule Length	H	121mm
Foot Diameter	C	50mm
Outer Diameter	A	28mm
Thread Length	L_t	40mm
Effective Embedment (flush / Nailing Plate)	H_{ef}	117 / 125
Installation Depth (flush / Nailing Plate)	H_{inst}	121 / 129
Cross hole	B	N12 bar
Steel Capacity Insert	$N_{Rd,S}$	83.3kN



M20 GRADE 4.6 BOLT CAPACITIES

Dimensions and Capacities		
Thread		M20
Tension Capacity Grade 4.6 bolt	$N_{Rd,b}$	78.3kN
Shear Capacity Grade 4.6 bolt	$V_{Rd,b}$	48.6kN
Installation Torque	T_R	143Nm

Notes:

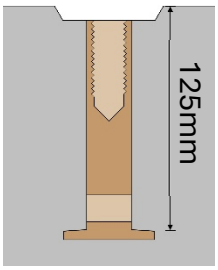
- *Tightening torque based on Grade 4.6 bolt allowable torque*
- *Tightening shall be done using a calibrated torque wrench. Impact wrenches or "rattle guns" should not be used*

CONCRETE CAPACITIES – INCLUDING NAILING PLATE

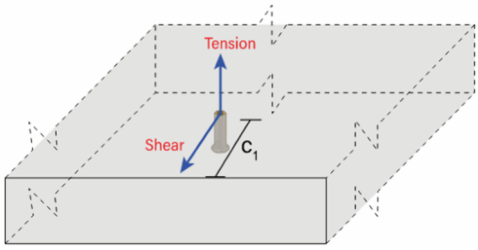
The following design tables provide the concrete design capacities for PSA Footed Ferrules FP20121 when installed using a PSA NP20 Nailing Plate. The design capacities are limited by concrete cone failure for tension and concrete edge failure and concrete pry-out for the shear capacity.

121mm long PSA X-Foot Ferrule | Maximum Concrete Capacities – Nailing plate							
Part No.		20	25	32	40	50	60
Concrete Tensile Capacity $\phi_c \cdot N_{u,c}$	(kN)	48.8	54.5	61.7	68.9	77.1	84.4
Shear Capacity $\phi_c \cdot V_{u,c}$	(kN)	97.6	109.0	123.4	137.8	154.2	168.8

Notes: All design capacities include a reduction factor ϕ_c = 0.6
Effective embedment depth = 125mm, including an additional recess of 8mm for installation with NP20 Nailing Plate
Concrete assumed to be un-cracked
Shear capacity is based on pry-out capacity with a $k_{c,p}$ factor of 2.0



121mm long PSA X-Foot Ferrule | Minimum Edge Distances and Spacings – Nailing plate		
Effective Embedment Depth	(mm)	125
Minimum edge distance for full Tensile capacity	(mm)	188
Minimum insert spacing for full Tensile capacity	(mm)	375



121mm long PSA X-Foot Ferrule | Single Insert near one Edge – Nailing plate												
Edge Distance	Tensile Capacity $\phi_c \cdot N_{u,c}$						Shear Capacity $\phi_c \cdot V_{u,c}$					
C_1	Concrete Compressive Strength (MPa)						Concrete Compressive Strength (MPa)					
(mm)	20	25	32	40	50	60	20	25	32	40	50	60
50	24.1	26.9	30.5	34.1	38.1	41.7	6.2	7.0	7.9	8.8	9.8	10.8
75	28.0	31.3	35.4	39.6	44.2	48.5	10.0	11.2	12.7	14.2	15.9	17.4
100	32.1	35.9	40.7	45.5	50.8	55.7	14.3	16.0	18.1	20.2	22.6	24.7
125	36.6	40.9	46.2	51.7	57.8	63.3	18.9	21.1	23.9	26.7	29.8	32.7
150	41.2	46.1	52.2	58.3	65.2	71.4	23.8	26.6	30.1	33.6	37.6	41.2
175	46.2	51.6	58.4	65.3	73.0	80.0	29.0	32.4	36.7	41.0	45.8	50.2
200	48.8	54.5	61.7	68.9	77.1	84.4	34.5	38.5	43.6	48.8	54.5	59.7
250	48.8	54.5	61.7	68.9	77.1	84.4	46.2	51.7	58.4	65.3	73.0	80.0
300	48.8	54.5	61.7	68.9	77.1	84.4	58.8	65.8	74.4	83.2	93.0	101.9
400	48.8	54.5	61.7	68.9	77.1	84.4	86.5	96.8	109.5	122.4	136.8	149.9
450	48.8	54.5	61.7	68.9	77.1	84.4	97.6	109.0	123.4	137.8	154.2	168.8

Notes: All design capacities include a reduction factor ϕ_c = 0.6
Effective embedment depth = 125mm, including an additional recess of 8mm for installation with NP20 Nailing Plate
Concrete assumed to be un-cracked
Shear capacity is based on a minimum element thickness of 1.5 · c_1

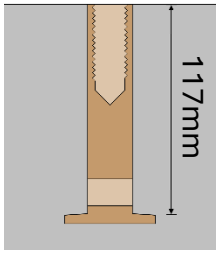
Please refer to the PSA Metric Threaded Insert Design Guide for more information on the design of PSA Metric Threaded Insert and contact the PSA Technical Team for detailed design information for custom conditions.

CONCRETE CAPACITIES – FLUSH INSTALLATION

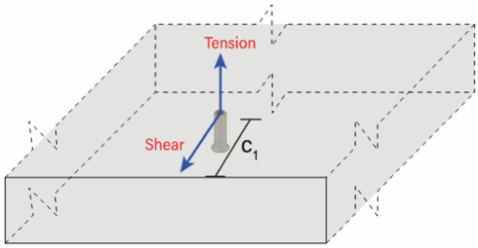
The following design tables provide the concrete design capacities for PSA Footed Ferrules FP20121 when installed flush with the concrete surface. The design capacities are limited by concrete cone failure for tension and concrete edge failure and concrete pry-out for the shear capacity.

121mm long PSA X-Foot Ferrule | Maximum Concrete Capacities – Flush Installation							
Part No.		20	25	32	40	50	60
Concrete Tensile Capacity $\phi_c \cdot N_{u,c}$	(kN)	44.1	49.4	55.8	62.4	69.8	76.5
Shear Capacity $\phi_c \cdot V_{u,c}$	(kN)	88.2	98.8	111.6	124.8	139.6	153.0

Notes:
- All design capacities include a reduction factor ϕ_c = 0.6
- Effective embedment depth = 117mm, considering an installation flush with the concrete surface
- Concrete assumed to be un-cracked
- Shear capacity is based on pry-out capacity with a $k_{c,p}$ factor of 2.0



121mm long PSA X-Foot Ferrule | Minimum Edge Distances and Spacings – Flush Installation		
Effective Embedment Depth	(mm)	121
Minimum edge distance for full Tensile capacity	(mm)	176
Minimum insert spacing for full Tensile capacity	(mm)	351



121mm long PSA X-Foot Ferrule | Single Insert near one Edge – Flush Installation												
Edge Distance	Tensile Capacity $\phi_c \cdot N_{u,c}$						Shear Capacity $\phi_c \cdot V_{u,c}$					
c_1	Concrete Compressive Strength (MPa)						Concrete Compressive Strength (MPa)					
(mm)	20	25	32	40	50	60	20	25	32	40	50	60
50	22.3	24.9	28.2	31.5	35.2	38.6	6.1	6.8	7.7	8.6	9.6	10.5
75	26.1	29.2	33.0	36.9	41.3	45.2	9.8	11.0	12.5	13.9	15.6	17.1
100	30.2	33.7	38.2	42.7	47.7	52.3	14.0	15.7	17.7	19.8	22.2	24.3
125	34.5	38.6	43.7	48.8	54.6	59.8	18.6	20.8	23.5	26.3	29.4	32.2
150	39.2	43.8	49.5	55.4	61.9	67.8	23.4	26.2	29.6	33.1	37.1	40.6
175	44.0	49.2	55.7	62.3	69.6	76.3	28.6	32.0	36.2	40.4	45.2	49.5
200	44.1	49.4	55.8	62.4	69.8	76.5	34.0	38.0	43.0	48.1	53.8	58.9
250	44.1	49.4	55.8	62.4	69.8	76.5	45.7	51.0	57.7	64.6	72.2	79.1
300	44.1	49.4	55.8	62.4	69.8	76.5	58.2	65.1	73.6	82.3	92.0	100.8
400	44.1	49.4	55.8	62.4	69.8	76.5	85.7	95.8	108.4	121.2	135.5	148.4
450	44.1	49.4	55.8	62.4	69.8	76.5	88.2	98.8	111.6	124.8	139.6	153.0

Notes:
- All design capacities include a reduction factor ϕ_c = 0.6
- Effective embedment depth = 117mm, considering an installation flush with the concrete surface
- Concrete assumed to be un-cracked
- Shear capacity is based on a minimum element thickness of 1.5 · c_1

Please refer to the PSA Metric Threaded Insert Design Guide for more information on the design of PSA Metric Threaded Insert and contact the PSA Technical Team for detailed design information for custom conditions.

USE OF PSA FP20121 X-FOOT FERRULES WITH PSA X-FOOT CHAIRS

For applications where the ferrule is used in the near face of precast concrete panels, PSA X-Foot FP20121 Ferrules work in conjunction with the PSA X-Foot Chair. As the nomenclature of the PSA X-Foot Chairs is based on the use of 96mm long ferrules, a shorter chair will have to be used for the FP20121.

The following table explains which chair should be used for the respective panel thickness.

Panel thickness (mm)	PSA X-Foot Chair when used with PSA X-Foot FP20121 Ferrules
150	XC125 - X-Foot Chair for 125mm thick panels
175	XC150 - X-Foot Chair for 150mm thick panels
200	XC175 - X-Foot Chair for 175mm thick panels
225	XC200 - X-Foot Chair for 200mm thick panels
275	XC250 - X-Foot Chair for 250mm thick panels

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