Insulators

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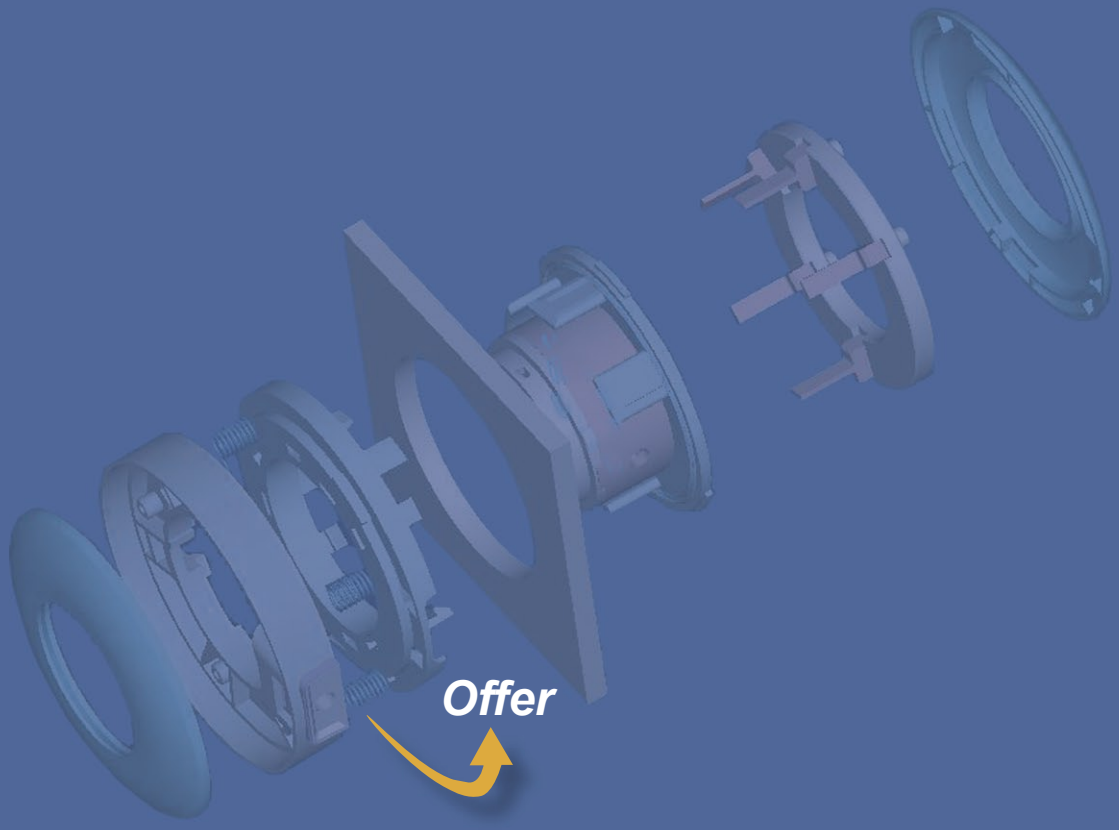


Offer

General characteristics

This range of insulators and partition bushings provides for connecting and supporting low- and medium-voltage electrical equipment.
- Their purpose is to provide electrical and mechanical insulation for equipment or conductors subject to differing potentials.

In designing this range, particular attention was paid to the shapes (registered pattern) to facilitate the connection of the two lugs on the same threaded spindle.
- At the same time, the mechanical and electrical characteristics comply with all the standards in force, in particular for the railway industry.

Of all insulating material, fibre-glass polyester compounds are among the best compromises for the mechanical and electrical characteristics they provide.

The insulators are compression-moulded, for optimum mechanical characteristics.

Applications:
Railway rolling stock, insulation of wiring and supports isolating from sub-assemblies.

Definitions

Rated operating voltage (Ue)

The rated operating voltage of an item of equipment is the voltage which, associated with a rated operating current, determines the use of the equipment in the categories determined by testing.

For single-pole equipment, the rated operating voltage is usually expressed in terms of the voltage across that pole.
For equipment with more than one pole, it is usually expressed in terms of the voltage between the phases (IEC et NF EN 60947).

Flashover voltage

Disruptive discharge outside the insulator and along its surface, between parts normally subject to the operating voltage (NF C 01-471).

Rated insulation voltage (Ui)

The rated insulation voltage of an item of equipment is the voltage value used for the dielectric tests.

Under no circumstances should the highest rated operating voltage exceed the rated insulation voltage.

Torque

Tightening torque to be applied in type testing to validate the product's minimal quality.

Tightening torque

Torque to be applied by the user to ensure good electric contact and mechanical attachment.

Puncture

Disruptive discharge in solid dielectric produces permanent loss of electric strength (NF C 01-471).

Creepage distance

The shortest distance over the surface of the insulation between two conductive parts (CEI 60 947-1).

Insulating distance

Distance between two conductive parts along a tight wire following the shortest distance between those two conductive parts (CEI 60 947-1).

Selection

- An insulator has to sastify the following requirements:
Mechanical - Thermal - Electrical

- To order to choose an insulator it is important determine :
The electrodynamics strength;
The distance between each support;
The flex strength.

Choice of material

Among all the insulating material, the glass filled polyester compounds are the best compromise in regard of the mechanical and electrical characteristics.

The insulators are produced by compression by molding in order to obtain the best mechanical characteristics.

Environmental characteristics

Compliance with standards	This generation of insulators was designed to the requirements of standard NF F 61-016
Insulation material	Fibre-glass polyester compound.
Colour	Grey RAL 7035
Operating temperature	- 40°C to + 130°C
Fire classification	UL94-VO & requirement 4 NF F 16-102
Attachment parts	Steel, class 6/8
Protection	Galvanised with olive-green passivation, Zn 8D/Fe, per NF F 61-016. Salt spray resistance according to IEC & NF EN 60 068-2-11.

Caractéristiques électriques

Per NF F 61-016

Type		H15N	H26N	H35N	H50N	H60N
Flashover voltage	(kV)	9	12	17	22	25
Minimum creepage	(mm)	10	25	32	48	58
Actual creepage (measured on our naked insulators)	(mm)	21,5	37,5	49	73,5	87
Insulation resistance	(MΩ)	10^6	10^6	10^6	10^6	$4x10^5$
Rated operating voltage	(Ue)	U ≤ 300	300 < U ≤ 750	750 < U ≤ 1 000	1 000 < U ≤ 1 500	1 500 < U ≤ 1 500
Withstand voltage	(mm)	2.750	3.878	4.500	5.750	5.750

The NF E□

Mechanical characteristics

Distance between bearing surfaces	(mm)	15		26		35		50	60
Insert diameter (filetage M. ISO)	(mm)	Ø4	Ø5	Ø6	Ø8**	Ø8	Ø10	Ø10	Ø12	Ø14
Torque*	(N.m)	2,4	4,8	8	14	20	38	38	68	108
Tensile strength	(N)	1 500	1 500	6 500	6 500	10 000	13 000	18 000	23 000	28 000
Bending strength	(N)	1 000	1 000	2 500	2 500	7 000	9 000	11 000	12 000	13 000
Compressive strength	(N)	10 000	10 000	25 000	25 000	50 000	50 000	70 000	70 000	90 000

* max. tightening torque for mechanical attachment
** Dimension not handled by the NF F 16-101

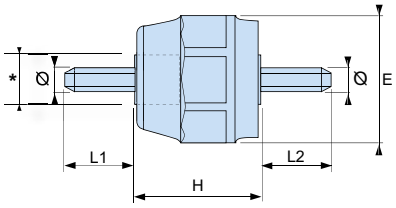
Part numbers and dimensions

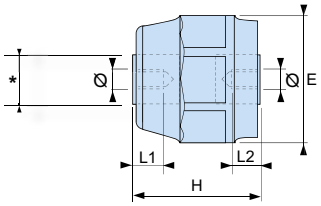
Part number breakdown

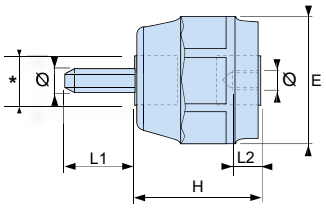
TYPE	Useful insert Ø	M 15 = Male insert	F = Female Insert
FH26N	6	M15 length15 mm	F

Part Number	H	Ø	L1	L2	E	P/N according to NF F 61-061	Weight Kg
FH15N 4 F F	15	4	5	5	Ø18	15.300.1.F4/5.F4/5	0,008
FH15N 4 M7 F	15	4	7	5	Ø18	15.300.1.M4/7.F4/5	0,009
FH15N 5 M10 M10	15	5	10	10	Ø18	15.300.1.M5/10.M5/10	0,012
FH15N 5 M15 M15	15	5	15	15	Ø18	15.300.1.M5/15.M5/15	0,013
FH26N 6 F F	26	6	9	9	Ø26	26.750.1.F6/9.F6/9	0,030
FH26N 6 F M20	26	6	9	20	Ø26	26.750.1.F6/9.M6/20	0,035
FH26N 6 M15 F	26	6	15	9	Ø26	26.750.1.M6/15.F6/9	0,034
FH26N 6 M20 F	26	6	20	9	Ø26	26.750.1.M6/20.F6/9	0,035
FH26N 6 M15 M15	26	6	15	15	Ø26	26.750.1.M6/15.M6/15	0,038
FH26N 6 M20 M15	26	6	20	15	Ø26	26.750.1.M6/20.M6/15	0,039
FH26N 6 M20 M20	26	6	20	20	Ø26	26.750.1.M6/20.M6/20	0,040
FH26N 6 M25 M25	26	6	25	25	Ø26	26.750.1.M6/25.M6/25	0,040
FH26N 6 M25 M15	26	6	25	15	Ø26	26.750.1.M6/25.M6/15	0,039
FH26N 6 M16 M8	26	6	16	8	Ø26	26.750.1.M6/16.M6/8	0,036
FH35N 8 F F	35	8	12	12	Ø41	35.1000.1.F8/12.F8/12	0,092
FH35N 8 F M20	35	8	12	20	Ø41	35.1000.1.F8/12.M8/20	0,092
FH35N 8 F M25	35	8	12	25	Ø41	35.1000.1.F8/12.M8/25	0,105
FH35N 8 M15 F	35	8	15	12	Ø41	35.1000.1.M8/15.F8/12	0,102
FH35N 8 M20 F	35	8	20	12	Ø41	35.1000.1.M8/20.F8/12	0,104
FH35N 8 M20 M20	35	8	20	20	Ø41	35.1000.1.M8/20.F8/20	0,115
FH35N 8 M25 F	35	8	25	12	Ø41	35.1000.1.M8/25.F8/12	0,105
FH35N 8 M25 M25	35	8	25	25	Ø41	35.1000.1.M8/25.M8/25	0,118
FH35N 8 M30 F	35	8	30	12	Ø41	35.1000.1.M8/30.F8/12	0,107
FH35N 10 F F	35	10	12	12	Ø41	35.1000.1.F10/12.F10/12	0,087
FH35N 10 F M15	35	10	12	15	Ø41	35.1000.1.F10/12.M10/15	0,102
FH35N 10 F M20	35	10	12	20	Ø41	35.1000.1.F10/12.M10/20	0,104
FH35N 10 F M25	35	10	12	25	Ø41	35.1000.1.F10/12.M10/25	0,107
FH35N 10 F M35	35	10	12	35	Ø41	35.1000.1.F10/12.M10/35	0,111
FH35N 10 M30 F	35	10	30	12	Ø41	35.1000.1.M10/30.F10/12	0,109
FH35N 10 M35 F	35	10	35	12	Ø41	35.1000.1.M10/35.F10/12	0,111
FH35N 10 M30 M20	35	10	30	20	Ø41	35.1000.1.M10/30.M10/20	0,126
FH35N 10 M30 M15	35	10	30	15	Ø41	35.1000.1.M10/30.M10/15	0,127
FH35N 10 M35 M35	35	10	35	35	Ø41	35.1000.1.M10/35.M10/35	0,136
FH35N 10 M35 M20	35	10	35	20	Ø41	35.1000.1.M10/35.M10/20	0,129
FH35N 10 M20 M30	35	10	20	30	Ø41	35.1000.1.M10/20.M10/35	0,126
FH50N 10 F F	50	10	17	17	Ø50	50.1500.1.F10/17.F10/17	0,206
FH50N 10 F M20	50	10	17	20	Ø50	50.1500.1.F10/17.M10/20	0,228
FH50N 10 F M25	50	10	17	25	Ø50	50.1500.1.F10/17.M10/25	0,228
FH50N 10 M20 F	50	10	20	17	Ø50	50.1500.1.M10/20.F10/17	0,228
FH50N 10 M35 F	50	10	35	17	Ø50	50.1500.1.M10/35.F10/17	0,236
FH50N 10 M40 F	50	10	40	17	Ø50	50.1500.1.M10/40.F10/17	0,239
FH50N 10 M25 M25	50	10	25	25	Ø50	50.1500.1.M10/25.M10/25	0,247
FH50N 10 M35 M25	50	10	35	25	Ø50	50.1500.1.M10/35.M10/25	0,260
FH50N 10 M35 M35	50	10	35	35	Ø50	50.1500.1.M10/35.M10/35	0,272
FH50N 12 F F	50	12	17	17	Ø50	50.1500.1.F12/17.F12/17	0,200
FH50N 12 F M20	50	12	17	20	Ø50	50.1500.1.F12/17.M12/20	0,230
FH50N 12 F M25	50	12	17	25	Ø50	50.1500.1.F12/17.M12/25	0,233
FH50N 12 F M45	50	12	17	45	Ø50	50.1500.1.F12/17.M12/45	0,245
FH50N 12 M25 F	50	12	25	17	Ø50	50.1500.1.M12/25.F12/17	0,233
FH50N 12 M35 F	50	12	35	17	Ø50	50.1500.1.M12/35.F12/17	0,233
FH50N 12 M40 F	50	12	40	17	Ø50	50.1500.1.M12/40.F12/17	0,239
FH50N 12 M45 F	50	12	45	17	Ø50	50.1500.1.M12/45.F12/17	0,245
FH50N 12 M25 M35	50	12	25	35	Ø50	50.1500.1.M12/25.M12/35	0,272
FH50N 12 M35 M25	50	12	35	25	Ø50	50.1500.1.M12/35.M12/25	0,272
FH50N 12 M45 M15	50	12	45	15	Ø50	50.1500.1.M12/45.M12/15	0,273
FH50N 12 M45 M25	50	12	45	25	Ø50	50.1500.1.M12/45.M12/25	0,279
FH50N 12 M45 M35	50	12	45	35	Ø50	50.1500.1.M12/45.M12/35	0,282
FH60N 14 F F	60	14	21	21	Ø60	60.1500.1.F14/21.F14/21	0,346
FH60N 14 F M25	60	14	21	25	Ø60	60.1500.1.F14/21.M14/25	0,398
FH60N 14 M40 F	60	14	40	21	Ø60	60.1500.1.M14/40.F14/21	0,412
FH60N 14 M50 F	60	14	50	21	Ø60	60.1500.1.M14/50.F14/21	0,422
FH60N 14 M40 M25	60	14	40	25	Ø60	60.1500.1.M14/40.M14/25	0,464
FH60N 14 M50 M25	60	14	50	25	Ø60	60.1500.1.M14/50.M14/25	0,474

Products normally held in stock







*** The connecting land diameter is, according to NF F 61-016, 1.7 times the screwing diameter.**

Packaging

Part number	Quantity	Part number	Quantity	Part number	Quantity
FH15N, FH26N	100	FH35N	25	FH50N, H60N	10

Cylindrical insulators

The cylindrical shape and small diameters resolve space problems.

Application:
- Installing and insulating power circuit housings.

Electrical characteristics

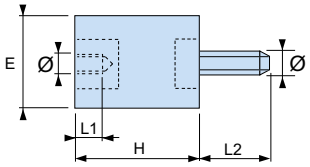
Type		C22	C35	C50
Sparkover voltage	(kV50 Hz)	10	20	25
Surface resistance	(M Ω/cm with 500V applied)	$2x10^6$	$2x10^6$	$2x10^6$
Insulation resistance	(M Ω with 500V applied)	$>10^6$	$>10^6$	$>10^6$
Capacitance	(p F at 1 Kc/s)	10	10	10

Mechanical characteristics

Tensile strength	(N)	2400	3200	4000
Tightening torque	(Nm)	5	13	13

Part numbers and dimensions

Part number *	H	Ø	L1	L2	E	Masse Kg
C22 6 F M9	22	6	8	9	Ø18	0,020
C35 8 F M15	35	8	12	15	Ø20	0,030
C50 8 F M15	50	8	12	15	Ø25	0,055



* **Contact us for other insulator types, dimensions, characteristics.**

Packaging

Part number	Quantity
C22	100
C35	100
C50	50

Umbrella insulators

The spacial shape of these so-called "umbrella" insulators increases the creepage and prevents conductive deposits from covering the entire surface of the insulator.

Electrical characteristics

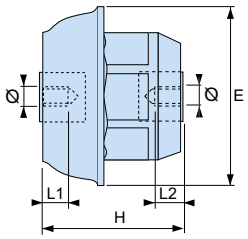
Type		P50S	P100S
Sparkover voltage (kV50 Hz)		25	25
Surface resistance	(M Ω/cm with 500V applied)	$2x10^6$	$2x10^6$
Insulation resistance	(M Ω with 500V applied)	$2x10^6$	$2x10^6$
Capacitance	(p F at 1 Kc/s)	25	10

Mechanical characteristics

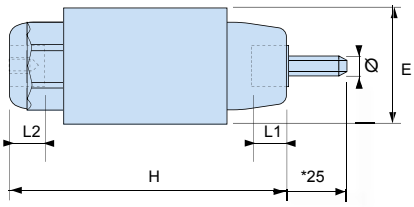
Tensile strength	(N)	23 000	13 000
Bending strength transverse effort	(N)	11 000	2 500
Torsion strength	(Nm)	80	40
Tightening torque (insert)	(Nm)	Ø10=26 Ø12=45	Ø8=13 Ø10=26

Part numbers and dimensions

Part number	H	Ø	L1	L2	E	Weight Kg
P50S 10 F F	50	10	18	18	Ø70	0,220
P50S 12 F F	50	12	18	18	Ø70	0,220
P100S 8 F F	100	8	12	12	Ø49	0,300
P100S 10 F F	100	10	12	12	Ø49	0,300
P100S 8 M25 F8	100	8	25*	12(Ø8)	Ø49	0,300
P100S 8 M25 F10	100	8	25*	12(Ø10)	Ø49	0,300



Hex 46 above flats



Hex 36 above flats

Contact us for other insulator types, dimensions, characteristics.

Packaging

Part number	Quantity
P50S	10
P100S	5

Insulating partition bushings

Introduction

- These partition bushings may be made watertight by the addition of a silicon gasket P/N JMS 025 A1 (withstands a temperature of 100°C). In this event, use M8 screws with smooth shanks for the 4 fixing points.

Application:
- Feeding an electric liaison through a "fire-containment" partition (requirement 4 - NF F16-102)

Electrical characteristics

Type		T90S Captive spindle brass UZ40 MNA		Captive spindle stainless steel Z10 CF 17	
Max. current	(A)	400	(face Ø 16 -M8)	200	(face Ø 16 - M8)
		460	(face Ø 18 -M10)	230	(face Ø 18 - M10)
		540	(face Ø 22 -M12)	270	(face Ø 22 - M12)
		600	(face Ø 24 -M14)	300	(face Ø 24 - M14)
Rated voltage	(V)	1 500			
Flashover voltage for partition 5 mm thick	(kV)	22			
Insulation category	NFC 20 040	D			
Dielectric strength	(kV)	18			

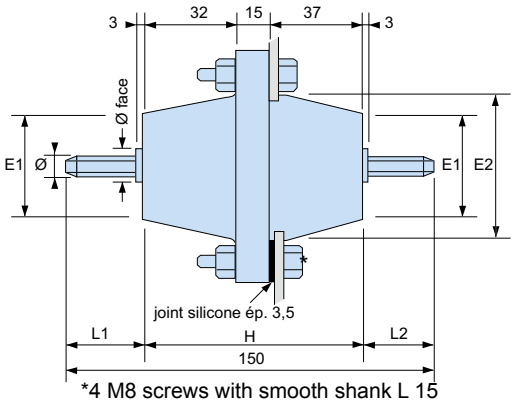
Mechanical characteristics

Tightening torque	(Nm)	7,5	(face Ø 16 -M8)	9,5	(face Ø 16 - M8)
		14,5	(face Ø 18 -M10)	18,5	(face Ø 18 - M10)
		25	(face Ø 22 -M12)	31	(face Ø 22 - M12)
		40	(face Ø 24 -M14)	50	(face Ø 24 - M14)
Weight	(Kg)	From 0.540 to 0.700, according to captive spindle Ø			

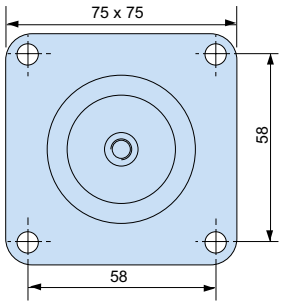
Part numbers and dimensions

Captive brass type	H	Ø	L1	L2	E1	E2
T90S 8 L M30 M30	84	8	33	33	Ø45	Ø55
T90S 10 L M30 M30	84	10	33	33	Ø45	Ø55
T90S 12 L M30 M30	84	12	33	33	Ø45	Ø55
T90S 14 L M30 M30	84	14	33	33	Ø45	Ø55

Captive stainless steel type	H	Ø	L1	L2	E1	E2
T90S 8 I M30 M30	84	8	33	33	Ø45	Ø55
T90S 10 I M30 M30	84	10	33	33	Ø45	Ø55
T90S 12 I M30 M30	84	12	33	33	Ø45	Ø55
T90S 14 I M30 M30	84	14	33	33	Ø45	Ø55



*4 M8 screws with smooth shank L 15



Packaging

Individual	Individual

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Insulating partition bushings

Introduction

- Insulation material: Polyester
- 4 threaded nickel brass inserts "high resistance".
- Nickel brass inner feed-through tin lead finish "high resistance".

Application:
- Railway rolling stock : power connection for the engine gearbox units in locomotives.

Electrical characteristics

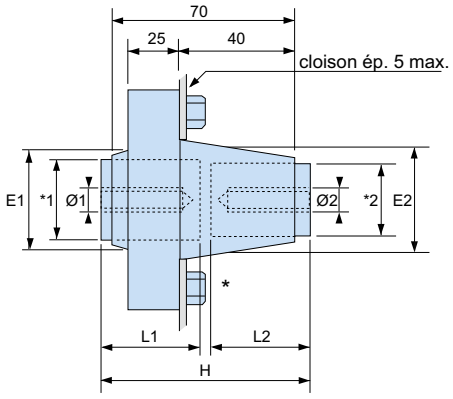
Operating temperature		- 40°C to + 130°C
Max. current	(A)	600
Rated voltage	(kV)	3
Dielectric strength	(kV)	10
Sparkover test	(kV)	> 35 kV after 24 hrs immersed in water
Tensile strength test		Rr > 200 daN at 60 mm from the attachment zone on both ends
Torsion strength test		16 m.daN

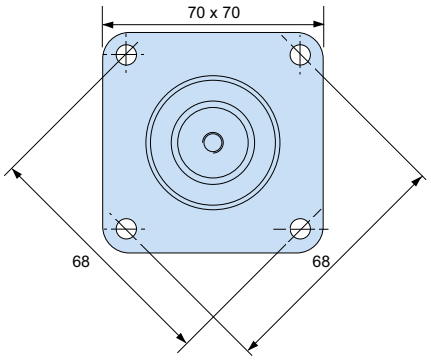
Mechanical characteristics

Weight	(Kg)	0,625

Part numbers and dimensions

Part number	H	Ø1	Ø2	*1	*2	E1	E2	Profil-filet
MDS 075 A1	82	8	8	Ø29	Ø28	Ø33	Ø42	Ø33
MDS 075 B1	82	12	12	Ø29	Ø28	Ø33	Ø42	Ø33
MDS 075 C1	82	10	12	Ø29	Ø28	Ø33	Ø42	Ø33
MDS 075 D1	82	10	12	Ø30	Ø30	Ø33	Ø42	Ø33
MDS 075 E1	82	12	12	Ø30	Ø30	Ø33	Ø42	Ø33
MDS 075 F1	82	10	10	Ø29	Ø28	Ø33	Ø42	Ø33





*4 M6 screws, 10.5 deep

Packaging

Individual

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How to select an insulator based on the terminal crossbar and short-circuit current

The load that an insulator is capable of withstanding corresponds to the electro-dynamic stress arising at the time of the short circuit.

Its value corresponds to a force **F** applied to the conductor's centre of gravity.

When selecting an insulator, start by calculating the resultant bending moment, and then choose an insulator with a breaking load above that.

Data required:

1 - **I** = short circuit current in KA
. for alternating current : if **Ie** is the short circuit RMS value then $\mathbf{I=1,8\sqrt{2}.\ Ie}$
. for direct current : **I** = short circuit current

2 - **a** and **b** = cross-section of the crossbar per phase; in mm

3 - **s** = separation between the phases; in mm

4 - **L** = span between 2 insulators for the same phase; in mm

A) Determining the form factor

From graph 1, determine the coefficient **K** as a function of the cross-section and of the layout of the bars.

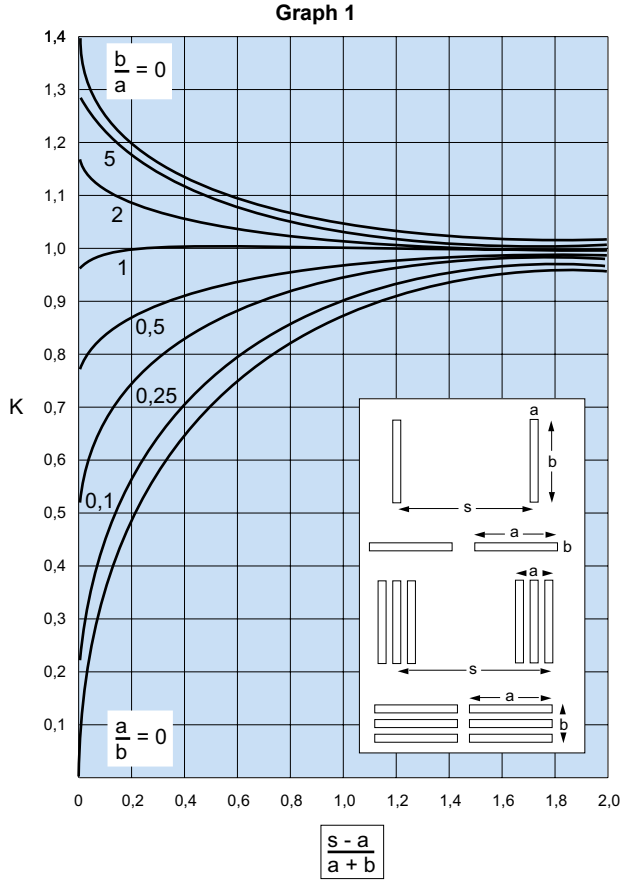
1) calculate the expression : $\frac{\mathbf{s - a}}{\mathbf{a + b}}$

2) calculate the expression : $\frac{\mathbf{a}}{\mathbf{b}}$

3) locate **K** on the corresponding curve.

- "**a**" represents the thickness of the bar or group of bars.
- "**b**" represents the height of the bar or group of bars.
- "**s**" represents the spacing between the bars or group of bars.

Graph 1



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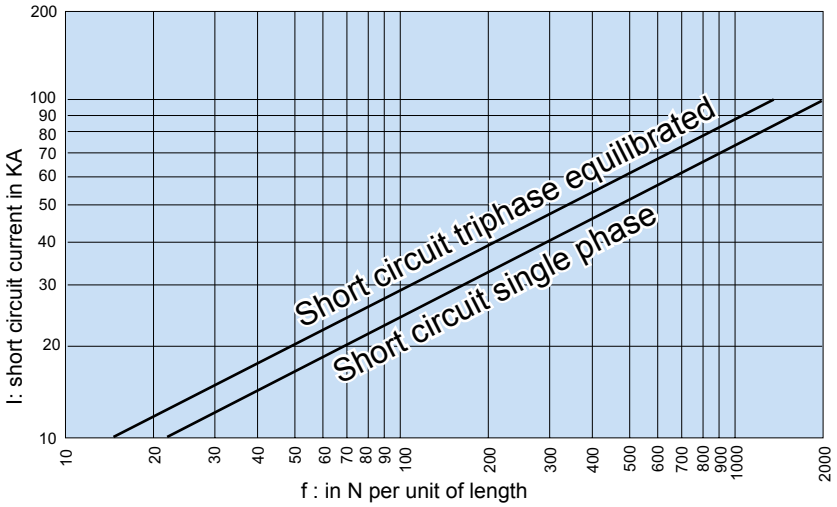
B) Determining the force acting on a unit of length
From graph 2, determine the force "**f**" acting on a bar 10 mm thick as a function of the short circuit current.

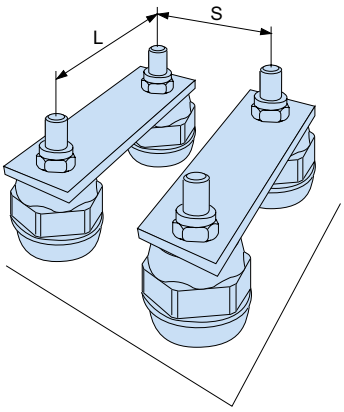
Graphique 2



C) Calculate the force exerted on the insulator support

$$F = f \times \frac{L}{S} \times K$$

F : in N
f : calculate in B) above
K : calculate in A) above
L = span between 2 insulators; in mm
S = spacing between the bars; in mm



D) Choosing the insulator
Choose an insulator whose strength is greater than the resultant value of "**F**".

Recommendations for mounting an insulator

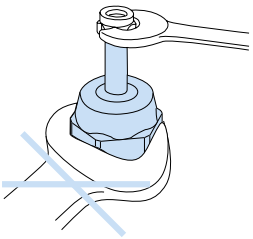
Max. tightening torque values for electrical connections (N.m)
The accuracy class for tightening is C. (NF E 25-030)

nominal Ø (male or female in mm)	Copper connection			Aluminium connection		
	M/L washer 3-part washer	M/L washer CS washer H FR nut	M/L washer 3-part washer	M/L washer 3-part washer	M/L washer CS washer	M/L washer 3-part washer H FR nut
4	+	+	+	+	+	+
5	2.5	3		1.9	2.4	
6	3.8	5	5.8	2.7	3.5	4.7
8	10	13	15	6	8	11
10	20	26	30	13	17	23
12	35	45	50	23	30	38
14	55	70*	80	38	50*	63

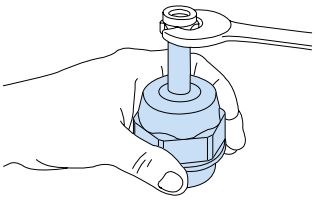
Instructions for correct tightening
Tighten the screws or nuts with a torque wrench or electric screwdriver, per the values in the table above.

(+)Not to be used with the tightening torque for electrical connection.
(*) To be avoid if possible.

Avoid this

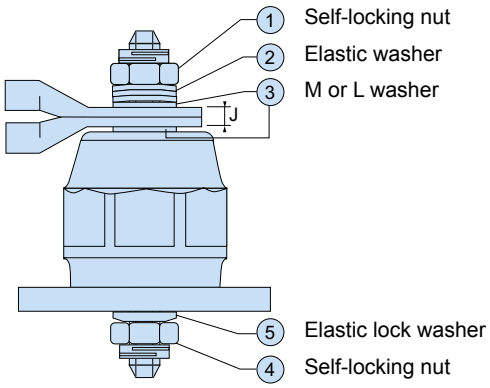


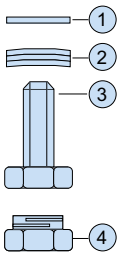
Support with your hand



Mounting principe for a complete unit

Example of correct insulator mounting.
The user must take care to calculate the length of the spindle so as to produce the desired length for "J".
Mounting accessories; washers and nuts are not provided by MAFELEC.





Connection mounting (not exposed to the elements) per NF F 61-010 & NF F 61-016.
Type of fastenings:

1 Flat M or L washer, VH 160, NF E25-514, Zn 12 / D / Fe.

2 Conical smooth elastic 3-part washer, with protection Zn8 / D / Fe (NF A 91-102) or CS washer (conical striated) Zn8 / D / Fe (NF E 25-511)

3 Depending on the type of insulator:

- for female insert : H, M screw, minimum class 5.8; Zn(1) / D / Fe (NF E 25-114)

4 - for male insert: H FR, M nut, minimum class 6; Zn(1) / D / Fe (NF E 25-411)

(1) thickness of finish:
- Zn5 fur Ø < 8mm
- Zn8 fur Ø > 8mm

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