

# TECHNICAL APPENDIX

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# MATERIAL CHARACTERISTICS



Material Code	PP	PA	PA6	AU	GM	AL	GM
Basic Material	POLYPROPYLENE Copolymeric	POLYAMIDE	POLYAMIDE	POLYPROPYLENE Self-extinguishing	RUBBER Elastomer	ALUMINIUM	RUBBER Elastomer
Colour	BLUE	BLACK	BLACK	WHITE	BLACK	NATURAL	BLACK

Other colours and materials available on demand.

## MECHANICAL CHARACTERISTICS

Tensile Modulus	1.30 GPa ISO 527-2	8.500 MPa ISO 527-2	3.100 MPa ISO 527-2	3.300 MPa ASTM D638	--	--	--
Notched Izod impact strenght 23°	--	9.0 KJ/m <sup>2</sup> ISO 180/A	5.0 KJ/m <sup>2</sup> ISO 180	--	--	--	--
Elongation at Yield	6% ISO 527-2	3.3% ISO 527	50% ISO 527-2	15% ASTM D638	600% ISO 37	1% ISO 527	600% ISO 37
Tensile Strength, Yield	25.0 MPa ISO 527-2	150 MPa ISO 527	85 MPa ISO 527-2	30 MPa ASTM D638	9 MPa ISO 527	150 MPa ISO 527	9 MPa ISO 527
Charpy impact, Notched	1.30J/cm <sup>2</sup> ISO 179	10 J/m <sup>2</sup> ISO 179	-30°C 3 KJ/m <sup>2</sup> ISO 179/1EA +23°C 4 KJ/m <sup>2</sup> ISO 179/1EA	30 J/m ASTM D256	--	--	--
Shore hardness	85 ISO 2039-2	--	120 ISO2039-2	--	80 A ISO 868	--	80 A ISO 868

## THERMAL CHARACTERISTICS

Flammability Rating	--	V0 UL 94	V2 UL 94	V0 1.6mm UL 94	HB UL94	--	HB UL94
Preventive fire protection	--	EN 45545-2	--	--	--	--	--
HDT Deflection temperature under load 1,82N/mm <sup>2</sup>	--	245°C ISO 75	--	70° ASTM D648	--	--	--
Deflection Temperature at 0,46 MPa (66psi)	92.0°C ISO 75-2	255°C ISO 75	180°C ISO 75-2/B	--	--	--	--
Deflection Temperature at 1.8 Mpa (264 psi)	50°C ISO 75-2	245°C ISO 75	70°C ISO 75-2/A	--	--	--	--
Softening temperature VICAT 49N	--	--	205°C ISO 306	90° ASTM D1525	--	--	--
UV Resistance	NO*	NO	NO	NO	NO	NO	NO
Recommended Min/Max temperature	-30°C +90°C IEC 216	-40°C +140°C IEC 216	-30°C +85°C IEC 216	-30°C +90°C IEC 216	-40°C +90°C IEC 216	up to +300° C IEC 216	-40°C +90°C IEC 216

## ELECTRICAL CHARACTERISTICS

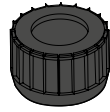
Dielectric strenght 2 mm	--	21 KV/mm IEC 60243	--	24 KV/mm ASTM D149	--	--	--
CTI Comparative Tracking Index 3,2 mm SOL, A	--	600 V IEC 60112	600 V IEC 60112	>600 V IEC 112	--	--	--
Volume Resistivity 23°	--	10*13 Ohm/m IEC 60093	10*15 Ohm/cm IEC 93	--	--	--	--

## CHEMICAL CHARACTERISTICS

Weak acids - Alkaline solution	Limited resistance	Good resistance	Limited resistance	Good resistance	Good resistance	--	Good resistance
Benzine - Mineral oils	Good resistance	Good resistance	Good resistance	Limited resistance	Limited resistance	--	Limited resistance
Alcohol - Other oils - Sea water	Good resistance	Good resistance	Good resistance	Good resistance	Good resistance	--	Good resistance

\* Increased UV protection is available on demand.

# MATERIAL CHARACTERISTICS



RUBBER CAP C  
FOR RAIL NUT DF



RUBBER RING AG  
FOR RAIL NUT DF

Material Code	<b>NBR</b>
Basic Material	RUBBER
Colour	<b>BLACK</b>

## MECHANICAL CHARACTERISTICS

Hardness shore	70 A (ASTM D 2240)
Density	g/cm <sup>3</sup> 1.25 (ASTM D 792)
Tensile strenght	MPa 14.3 (ASTM D 412 C)
Elongation at break	% 390 (ASTM D 412 C)
Tear strenght	N/mm 49 (ASTM D 624 B)

## THERMAL CHARACTERISTICS

Operating temperature range	-30°C to +120°C
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# COMPONENTS AND ACCESSORIES MATERIALS

## STEELS

**Plates:** non-alloy steel for structural applications S 235 JR (235JR) and S 275 JR (275JR).  
**Accessories:** S 235 JR (for high hexagon head bolts VA and bushing B), Carbon Steel C20 (nut for fixing clamps to the rail) and steel sheets for deep drawing DX 51D (standard series rail).

## STAINLESS STEEL

**Metal parts:** Stainless Steel 316L (X2CrNiMo17-12-2) 1.4404.  
**U-Bolts:** Stainless Steel 304L with good corosion resistance and Stainless Steel 316L (stainless marine) with excellent resistance to corrosion.

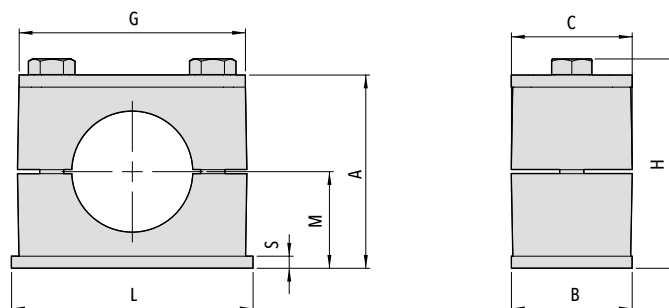
## SURFACE PROTECTION

**Components and accessories:** all our parts and metal accessories are treated with advanced surface treatments.  
**Sendzimir method:** this process consists of immersing products in a bath of molten zinc (used to rail the Standard series) for zinc-plating protection;  
**Crapal:** consists of a steel wire, coated with an alloy of 95% of zinc and 5% of aluminum, dull gray color and excellent corrosion resistance (used for U-bolts);  
**White Zinc plating Fe Zn c8 II:** used for all other metal products.

All protection surfaces are according to the RoHS directive.

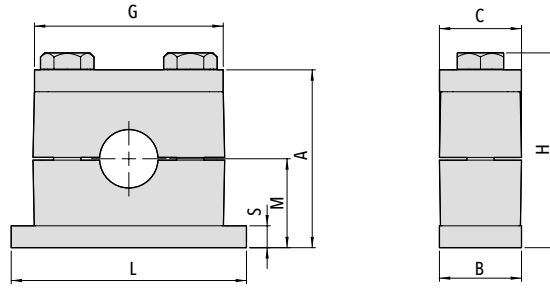
# DIMENSIONS OF CLAMP ASSEMBLIES

VALUES APPLY TO ALL TYPES OF MATERIAL (PP - PA - AU - GM)



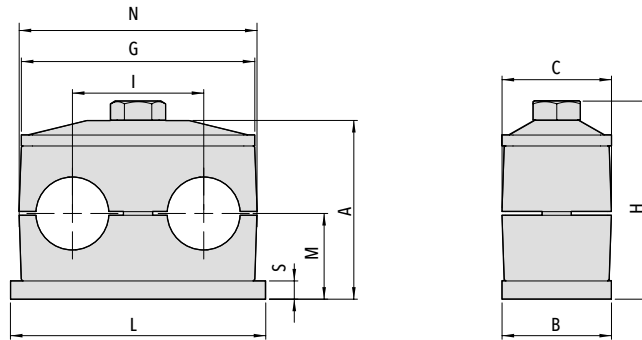
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Code	STANDARD SERIES (DIN 3015, Part 1) - mm (in)										
	A		B	C	G	H		L	M		S
	Knurled	Smooth				Knurled	Smooth		Knurled	Smooth	
<b>C1</b>	33 (1.30")	32 (1.26")	30 (1.18")	30 (1.18")	27,5 (1.08")	37 (1.46")	36 (1.42")	31,5 (1.24")	16,5 (.65")	16 (.63")	3 (.12")
<b>C2</b>	33 (1.30")	32 (1.26")	30 (1.18")	30 (1.18")	34,5 (1.36")	37 (1.46")	36 (1.42")	36 (1.41")	16,5 (.65")	16 (.63")	3 (.12")
<b>C3</b>	39 (1.54")	38 (1.50")	30 (1.18")	30 (1.18")	40,5 (1.59")	43 (1.69")	42 (1.65")	42 (1.65")	19,5 (.77")	19 (.75")	3 (.12")
<b>C4</b>	42 (1.65")	41,2 (1.62")	30 (1.18")	30 (1.18")	48 (1.88")	46 (1.81")	45,2 (1.78")	50 (1.96")	21 (.83")	20,6 (.81")	3 (.12")
<b>C5</b>	48 (1.89")	47 (1.85")	30 (1.18")	30 (1.18")	56,5 (2.22")	52 (2.05")	51 (2.01")	60 (2.36")	24 (.94")	23,5 (.93")	3 (.12")
<b>C6</b>	64 (2.52")	62,6 (2.46")	30 (1.18")	30 (1.18")	69,5 (2.74")	68 (2.68")	66,6 (2.62")	71 (2.79")	32 (1.26")	31,3 (1.23")	3 (.12")
<b>C7</b>	72 (2.83")	70,6 (2.78")	30 (1.18")	30 (1.18")	85,5 (3.37")	76 (2.99")	74,6 (2.94")	88 (3.46")	36 (1.42")	35,3 (1.39")	3 (.12")
<b>C8</b>	103 (4.06")	101 (3.98")	30 (1.18")	30 (1.18")	118 (4.65")	107 (4.21")	105 (4.13")	122 (4.81")	51,5 (2.03")	50,5 (1.99")	5 (.20")
<b>C9</b>	128 (5.04")	125 (4.92")	30 (1.18")	30 (1.18")	144 (5.67")	132 (5.20")	129 (5.08")	148 (5.83")	64 (2.52")	62,5 (2.46")	5 (.20")



HEAVY SERIES (DIN 3015, Part 2) - mm (in)

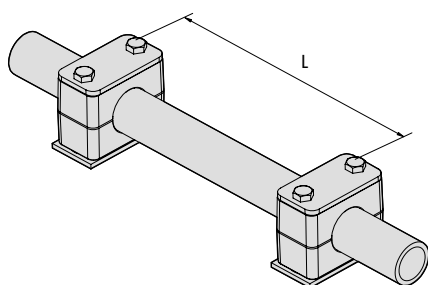
Code	A		B	C	G	H		L	M		S
	Knurled	Smooth				Knurled	Smooth		Knurled	Smooth	
CP1 ALCP1	49 (1.93")	48 (1.89")	30 (1.18")	30 (1.18")	56 (2.20")	55,4 (2.18")	54,4 (2.14")	74 (2.91")	24,5 (.96")	24 (.94")	8 (.31")
CP2 ALCP2	65 (2.56")	64 (2.52")	30 (1.18")	30 (1.18")	70 (2.76")	71,4 (2.81")	70,4 (2.77")	86 (3.39")	32,5 (1.28")	32 (1.26")	8 (.31")
CP3 ALCP3	76 (2.99")	74,8 (2.94")	30 (1.18")	30 (1.18")	85 (3.35")	82,4 (3.24")	81,2 (3.20")	100 (3.94")	38 (1.50")	37,4 (1.47")	8 (.31")
CP4 ALCP4	108 (4.25")	106 (4.17")	45 (1.77")	45 (1.77")	115 (4.53")	115,5 (4.55")	113,5 (4.47")	140 (5.51")	54 (2.13")	53 (2.09")	10 (.39")
CP5 ALCP5	138 (5.43")		60 (2.36")	60 (2.36")	152 (5.98")	148 (5.83")		180 (7.09")	69 (2.72")		10 (.39")
CP6 ALCP6	195 (7.68")		80 (3.15")	80 (3.15")	205 (8.07")	207,5 (8.17")		226 (8.90")	97.5 (3.84")		15 (.59")
CP7 ALCP7	230 (9.06")		90 (3.54")	90 (3.54")	251 (9.88")	245 (9.65")		270 (10.63")	115 (4.53")		15 (.59")
CP8 ALCP8	320 (12.60")		120 (4.72")	120 (4.72")	320 (12.60")	339 (13.35")		340 (13.39")	160 (6.30")		25 (.98")
CP9 ALCP9	470 (18.50")		160 (6.30")	160 (6.30")	470 (18.50")	489 (19.25")		520 (20.47")	235 (9.25")		30 (1.18")
CP10 ALCP10	590 (23.23")		180 (7.09")	180 (7.09")	630 (24.80")	609 (23.98")		680 (26.77")	295 (11.61")		30 (1.18")



TWIN SERIES (DIN 3015, Part 3) - mm (in)

Code	A		B	C	G	H		I	L	M		N	S
	Knurled	Smooth				Knurled	Smooth			Knurled	Smooth		
CF1	37 (1.46")	36,4 (1.43")	30 (1.18")	30 (1.18")	34,5 (1.36")	41 (1.61")	40,4 (1.59")	20 (.79")	37 (1.46")	16,5 (.65")	16,2 (.64")	36 (1.42")	3 (.12")
CF2	39 (1.54")	38,2 (1.50")	30 (1.18")	30 (1.18")	52 (2.05")	44 (1.73")	43,2 (1.70")	29 (1.14")	55 (2.17")	18,5 (.73")	18,1 (.71")	53 (2.09")	5 (.20")
CF3	49 (1.93")	48 (1.89")	30 (1.18")	30 (1.18")	64 (2.52")	54 (2.13")	53 (2.09")	36 (1.42")	70 (2.76")	23,5 (.93")	23 (.91")	67 (2.64")	5 (.20")
CF4	54 (2.13")	53 (2.09")	30 (1.18")	30 (1.18")	79 (3.11")	59 (2.32")	58 (2.28")	45 (1.77")	85 (3.35")	26 (1.02")	25,5 (1.00")	81 (3.19")	5 (.20")
CF5	65 (2.56")	63,8 (2.51")	30 (1.18")	30 (1.18")	102,5 (4.04")	70 (2.76")	68,8 (2.71")	56 (2.20")	110 (4.33")	31,5 (1.24")	30,9 (1.22")	106 (4.17")	5 (.20")

# RECOMMENDED DISTANCE BETWEEN CLAMPS



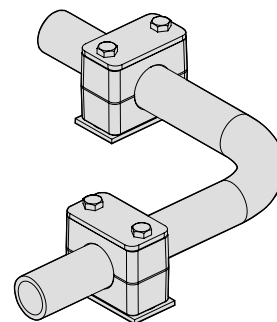
Pipe outside diameter (mm)	Distance L (m)	Pipe outside diameter (mm)	Distance L (m)
6,0 - 13,5	1,0	114,0 - 168,0	5,0
13,5 - 18	1,2	168,0 - 219,0	6,0
18 - 32	1,5	219,0 - 324,0	6,7
32 - 38	2,0	324,0 - 356,0	7,0
38 - 57,2	2,7	356,0 - 406,0	7,5
57,2 - 75	3,0	406,0 - 480,0	8,0
75 - 76,1	3,5	481,0 - 550,0	8,5
76,1 - 88,9	3,7	551,0 - 630,0	9,0
88,9 - 102,0	4,0	631,0 - 716,0	10,0
102,0 - 114,0	4,5	716,0 - 800,0	12,0

## CLAMPS INSTALLATION IN CASE OF BEND PIPE

Bend pipes **should be fixed by clamps immediately before and after the bend.**

Moreover it is recommended to design these clamps as **fixed point clamps.**

**Joints is recommended** for applications with the use of clamps **before and after the junction.**



## PROPERTY AND CLASSES FOR BOLTS AND SCREWS

ACCESSORIES	MATERIAL	FINISHING	CLASS
Socket cap screw	Steel	Zinc plated/Untreated	8.8
	Stainless Steel	---	A4-70
Hexagon head bolt	Steel	Zinc plated/Untreated	8.8
	Stainless Steel	---	A4-70
Safety washer	Steel	Zinc plated/Untreated	8
	Stainless Steel	---	A4-70
U-bolt nut	Steel	Zinc plated	8
	Stainless Steel	---	A4-70 A2-70
Flanged nut for U-bolts	Steel	Zinc plated	8
	Stainless Steel	---	---
Washer for U-bolts	Steel	Zinc plated	100 HV
	Stainless Steel	---	A4-70 A2-70
Nut bolt	Steel	Zinc plated	8

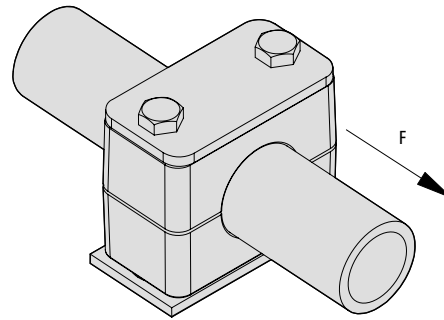
# TIGHTENING TORQUES AND MAXIMUM LOADS IN PIPE DIRECTION

All tightening torques and maximum loads in pipe direction regard clamps with upper plates and hexagon head bolts according to EN ISO 4014/4017.

The value of the load F is an average value of tests performed with steel tube S 235 JR.

If the stress of the clamp in an axial direction of the pipe, the pipe slides into the clamp.

Sliding starts when F value is reached.



## STANDARD SERIES

Code	Hexagon head bolt (EN ISO 4014/4017)	Polypropylene		Polyamide		Aluminium	
		Tightening torque (Nm)	Max load in pipe direction F (KN)	Tightening torque (Nm)	Max load in pipe direction F (KN)	Tightening torque (Nm)	Max load in pipe direction F (KN)
C1	M6	8	0,7	10	0,7	12	3,6
C2		8	1,2	10	0,9	12	4,3
C3		8	1,5	10	1	12	4,4
C4		8	1,7	10	1,8	12	4,8
C5		8	1,8	10	1,9	12	5,2
C6		8	2	10	2,1	12	7,5
C7		8	2,2	10	2,8	12	9
C8		8	2,3	10	2,5	---	---
C9		8	2,4	10	2,5	---	---

## HEAVY SERIES

CP1	M10	13	1,8	21	4,5	32	13
CP2		13	3	21	4,7	32	16
CP3		15	3,5	25	5,2	37	16,5
CP4	M12	30	8,5	40	9,5	55	30,5
CP5	M16	46	11,5	56	27	125	36,5
CP6	M20	80	15	155	25	225	62,5
CP7	M24	110	30	200	34	250	71,7
CP8	M30	190	41	360	50	500	86,5
CP9		210	125	380	130	500	190,5
CP10		270	168	450	180	600	244,5

## TWIN SERIES

CF1	M6	6	1,1	6	1,1		
CF2	M8	13	2,5	13	2,5		
CF3		13	2,1	13	2,1		
CF4		13	2,9	13	3,1		
CF5		9	2,2	9	2,7		