



# TREBALL FINAL DE GRAU

**Prototipatge d'una microinjectora de termoplàstics**

## **CATÀLEGS**

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## A.1. Filament PET-G

### 3D Printing Filament

#### TECHNICAL DATA SHEET - PRO Series PETG

Commercial name: MatterHackers PRO Series PETG  
Raw material: PETG  
Designation: 3D printing applications  
Manufacturer: MatterHackers

#### Material Specifications

PROPERTY	VALUE	TEST METHOD - ISO
Density	1.27gcm-3	ASTM D792
Glass Transition Temperature	80°C	ASTM D3418
Heat Deflection Temperature	65°C	ASTM D648 at 66 PS
Tensile Strength at Yield	10800PSI	ASTM D638, Type IV
Tensile Elongation	5%	ASTM D638, Type IV
Flexural Modulus	935 KPSI	ASTM D790
Flexural Peak Stress	24.7 KPSI	ASTM D790
Notched Izod Impact	20Jm-1	ASTM D256

#### Filament Specifications

PROPERTY	VALUE
Diameter 1.75mm	1.75 ± 0.05 mm
Diameter 2.85mm	2.85 ± 0.05 mm
Suggested print temperature	230°C - 250°C
Suggested print speed	30 - 150 mm/s
Suggested bed temperature	65°C

## A.2. Controlador PID REX-C100



# Specifications

### Inputs

- Input (Universal input)**
- a) Thermocouple : K, J, R, S, B, E, T, N (JIS/IEC), PLII (NBS)  
 W5Re/W26Re (ASTM), U, L (DIN)  
 • Influence of external resistance : Approx. 0.35µV/Ω  
 • Input break action : Up-scale
- b) RTD : Pt100 (JIS/IEC), JPt100 (JIS)  
 • Influence of input lead resistance : Approx. 0.01[%/Ω] of reading  
 • Maximum 10Ω per wire  
 • Input break action : Up-scale
- c) DC voltage : 0 to 5V, 1 to 5V (0.0 to 100.0% fixed)  
 • Input break action : Down-scale
- d) DC current : 0 to 20mA, 4 to 20mA (0.0 to 100.0% fixed)  
 • Input break action : Down-scale

**Sampling time**  
 0.5 sec

### Performance

- Measuring accuracy**
- a) Thermocouple  
 ±(0.5% of reading + 1 digit) or ±3°C (8°F) whichever is larger  
 R, S inputs: ±8°C (12°F) between 0 and 399°C (0 and 799°F)  
 • Accuracy is not guaranteed between 0 and 399°C (0 and 799°F) for type B.
- b) RTD  
 ±(0.5% of reading + 1 digit) or ±0.8°C (1.6°F) whichever is larger
- c) DC voltage and DC current  
 ±(0.5% of span + 1 digit)
- Insulation resistance**  
 More than 20MΩ (500V DC) between measured and ground terminals  
 More than 20MΩ (500V DC) between power and ground terminals
- Dielectric strength**  
 1000V AC for one minute between measured and ground terminals  
 1500V AC for one minute between power and ground terminals

### Control

- Control method**
- a) PID control with autotuning  
 • Available for reverse and direct action (Specify when ordering)
- b) Heat/cool PID control with autotuning (Not available on REX-C100)  
 • Available for air and water cooling type (Specify when ordering)
- Major setting range**
- Setting range : Same as input range.  
 Heat-side proportional band: 1 to span or 0.1 to span  
 (ON/OFF action when P=0)  
 • Differential gap at ON/OFF action is 2°C (°F) as standard  
 (Factory set value)
- Cool-side proportional band: 0 to 1000% of heat-side proportional band  
 (Heat/cool ON/OFF action when P=0)
- Integral time : 0 to 3600sec.(PD action when I=0)  
 Derivative time : 0 to 3600sec.(PI action when D=0)
- Anti-reset windup (ARW) : 1 to 100% of heat-side proportional band  
 Deadband/overlap : -10 to 10°C (°F) or -10.0 to 10.0°C (°F)  
 Proportional cycle : 1 to 100 sec.
- Control output**
- Relay output : Form C contact, 250V AC 3A (resistive load)  
 (Form A contact : REX-C100)
- Voltage pulse output : 0/12V DC  
 (Load resistance : More than 600Ω)
- Current output : 4 to 20mA DC  
 (Load resistance : Less than 600Ω)
- Triac trigger output : For medium capacity triac drive  
 (less than 100A)

### Alarms

(Optional)

- Temperature alarm**
- a) Number of alarm : 2 points (Maximum)  
 b) Alarm action : Deviation High, Low, High/Low, Band  
 Process High, Low  
 c) Alarm differential gap: 2°C (°F) or 2.0°C (°F) as standard.
- Heater break alarm (For single phase)**
- a) Number of inputs : 1 point  
 b) CT type : CTL-6-P-N(30A), CTL-12-S56-10L-N(100A)  
 c) Display range : 0.0 to 100.0A  
 d) Accuracy : ± 5% of input value or 2A  
 (whichever is larger)
- Output from alarm 2 terminal.
- Control loop break alarm (LBA)**
- a) LBA time setting : 0 to 7200 sec.  
 b) LBA deadband : 0 to 999 °C(°F) or 100% of span  
 (OFF when LBA deadband = 0)
- Not available for triac trigger output type.  
 • Not available for heat/cool type.

**Alarm output**  
 Relay output, Form A contact 250V AC 1A (resistive load)

### General specifications

**External Dimensions (W x H x D)**  
 REX-C100 : 48 x 48 x 100mm  
 REX-C400 : 48 x 96 x 100mm  
 REX-C410 : 96 x 48 x 100mm  
 REX-C700 : 72 x 72 x 100mm  
 REX-C900 : 96 x 96 x 100mm

**Supply voltage**

a) 85 to 264V AC (Including supply voltage variation)  
 [Rating : 100 to 240V AC] (50/60Hz common)

b) 21.6 to 26.4V AC (Including supply voltage variation)  
 [Rating : 24V AC] (50/60Hz common)

c) 21.6 to 26.4V DC (Ripple rate 10% p-p or less)  
 [Rating : 24V DC]

**Power consumption**  
 Less than 17VA for standard AC type  
 Less than 7.5VA for 24V AC type  
 Less than 200mA for 24V DC type

**Effect by power failure**  
 A power failure of 20msec or less will not affected the control action.  
 If power failure of more than 20msec occurs, controller will restart.

**Operating environment** : 0 to 50°C [32 to 122°F] , 45 to 85% RH

**Memory backup** : Backed up by Non-volatile memory.

**Net weight**  
 REX-C100 : Approx. 170g  
 REX-C400 : Approx. 260g  
 REX-C410 : Approx. 260g  
 REX-C700 : Approx. 250g  
 REX-C900 : Approx. 340g

## Model and Suffix Code

Specifications	Model and Suffix Code										
Model	C100 (48 x 48mm size) C400 (48 x 96mm size) C410 (96 x 48mm size) C700 (72 x 72mm size) C900 (96 x 96mm size)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Control method	PID control with AT (reverse action) PID control with AT (direct action) Heat/cool PID with AT (Water cooling type) - Except REX-C100 *1 Heat/cool PID with AT (Air cooling type) - Except REX-C100 *1	F	D								
Input type	See range and input code table	<input type="checkbox"/>									
Scale range	See range and input code table		<input type="checkbox"/>								
Control output (OUT1)	Relay contact output Voltage pulse output DC current output : 4 to 20mA *2 Triac trigger output *3							M	V	8	G
Control output (OUT2)	Control action : F, D Relay contact output Voltage pulse output DC current output : 4 to 20mA							M	V	8	
Alarm 1	No alarm See alarm code									N	
Alarm 2	No alarm See alarm code										N

Note  
 \*1 Triac trigger output and LBA are not available on heat/cool type.      • For CE marked, UL approved and CSA certified products, please add the suffix of "CE" to the end of the model code.  
 \*2 HBA is not available if current output is specified.  
 \*3 Alarm 2 is not available for REX-C100 if triac trigger output is specified.

### Range and input code table

Thermocouple input

Input	Code	Range
K	K 01	0 200°C
	K 02	0 400°C
	K 03	0 600°C
	K 04	0 800°C
	K 05	0 1000°C
	K 06	0 1200°C
	K 07	0 1372°C
	K 13	0 100°C
	K 14	0 300°C
	K 20	0 500°C
	K A1	0 800°F
	K A2	0 1800°F
	K A3	0 2502°F
	K A9	20 70°F
J	J 01	0 200°C
	J 02	0 400°C
	J 03	0 600°C
	J 04	0 800°C
	J 05	0 1000°C
	J 06	0 1200°C
	J A1	0 800°F
	J A2	0 1800°F
	J A3	0 2192°F
	J A9	0 400°F
R	R 01	0 1800°C
	R 02	0 1789°C
	R 04	0 1320°C
	R A1	0 3200°F
S	S 01	0 1800°C
	S 02	0 1789°C
	S A1	0 3200°F
	S A2	0 3216°F
B	B 01	400 1800°C
	B 02	0 1789°C
	B A1	800 3200°F
	B A2	0 3308°F

Input	Code	Range	
E	E 01	0 800°C	
	E 02	0 1789°C	
	E A1	0 1800°F	
K	E A2	0 1832°F	
	N 01	0 1200°C	
	N 02	0 1300°C	
	N A1	0 2300°F	
	N A2	0 2372°F	
	T 01	-199.9 400.0°C	
T	T 02	-199.9 100.0°C	
	T 03	-100.0 200.0°C	
	T 04	0 350.0°C	
	T A1	-199.9 752.0°F	
	T A2	-100.0 200.0°F	
	T A3	-100.0 400.0°F	
	T A4	0.0 450.0°F	
	T A5	0.0 752.0°F	
	W5Re	W 01	0 2000°C
	W28Re	W 02	0 2320°C
PL II	A 01	0 1300°C	
	A 02	0 1390°C	
	A 03	0 1200°C	
	A A1	0 2400°F	
U	A A2	0 2534°F	
	U 01	-199.9 600.0°C	
	U 02	-199.9 100.0°C	
	U 03	0 400.0°C	
L	U A1	-199.9 999.9°F	
	U A2	-100.0 200.0°F	
	U A3	0.0 999.9°F	
L	L 01	0 400°C	
	L 02	0 800°C	
L	L A1	0 800°F	
	L A2	0 1600°F	

RTD input

Input	Code	Range
Pt100	D 01	-199.9 649.0°C
	D 02	-199.9 200.0°C
	D 03	-100.0 50.0°C
	D 04	-100.0 100.0°C
	D 05	-100.0 200.0°C
	D 06	0.0 50.0°C
	D 07	0.0 100.0°C
	D 08	0.0 200.0°C
	D 09	0.0 300.0°C
	D 10	0.0 500.0°C
JPt100	D A1	-199.9 999.9°F
	D A2	-199.9 400.0°F
	D A3	-199.9 200.0°F
	D A4	-199.9 100.0°F
	D A5	-100.0 200.0°F
	D A6	0.0 100.0°F
	D A7	0.0 200.0°F
	D A8	0.0 400.0°F
	D A9	0.0 500.0°F
	P	P 01
P 02		-199.9 200.0°C
P 03		-100.0 50.0°C
P 04		-100.0 100.0°C
P 05		-100.0 200.0°C
P 06		0.0 50.0°C
P 07		0.0 100.0°C
P 08		0.0 200.0°C
P 09		0.0 300.0°C
P 10		0.0 500.0°C

Voltage and Current input

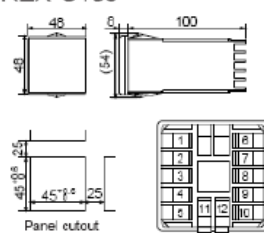
Input	Code	Range
0 5V DC	4 01	0.0 100.0 (Fixed)
1 5V DC	6 01	0.0 100.0 (Fixed)
0 20mA DC	7 01	0.0 100.0 (Fixed)
4 20mA DC	8 01	0.0 100.0 (Fixed)

\* Type B input : Accuracy is not guaranteed between 0 and 399°C (0 and 799°F)

## External Dimensions and Rear Terminals

(Unit : mm)

REX-C100



No.	Description
1	Alarm output
2	Relay contact output
3	Control Output
4	(1) Relay contact output
5	(2) Voltage DC/Current DC
6	(3) Triac trigger output

\* Use 5.2mm or less solderless terminals.

5.2 mm or less

No.	Description
6	Power supply
7	Measured input
8	(1) Thermocouple
9	(2) RTD
10	(3) Voltage/Current
11	Current transformer input
12	

### A.3. Motors pas a pas Nema 23

## HIGH TORQUE HYBRID STEPPING MOTOR SPECIFICATIONS

General specifications		Electrical specifications	
Step Angle (°)	1.8	Rated Voltage (V)	4.5
Temperature Rise (°C)	80 Max (rated current, 2 phase on)	Rated Current (A)	2.0
Ambient Temperature (°C)	-20 ~ +50	Resistance Per Phase ( $\pm 10\%$ $\Omega$ )	2.25 (25°C)
Number of Phase	2	Inductance Per Phase ( $\pm 20\%$ mH)	3.6
Insulation Resistance (M $\Omega$ )	100 Min (500VDC)	Holding Torque (N.cm)	135
Insulation Class	Class B		
Max. radial force (N)	28 (20mm from the flange)		
Max. axial force (N)	10		

● **Wiring Diagram :**

● **Dimensions:**  
(unit=mm)

● **Pull out torque curve :**  
 VOLTAGE: 40VAC, CONSTANT CURRENT: 2.0A, HALF STEP

					SY57STH76-2006A	TECHNICAL CONDITIONS
REV	REVISIONS	DESCRIPTION	BY	DATE	CHANGZHOU SONGYANG MACHINERY & ELECTRONICS NEW TECHNIC INSTITUTE	800076011
DRAW	2013/06/12					
CHECK						
APPROVE						

#### A.4. Anells de banda de Mica calefactables

**Calentador de banda LJXH 2 unids/lote 220V 25x2 5mm/25x30mm  
conector de cerámica elemento inoxidable 60W/70W para máquina de  
inyección de plástico**

Nombre del producto: calentadores de banda de acero inoxidable

Material: acero inoxidable

Tamaño: 25x2 5mm/25x30mm (ID x H)

Voltaje: 220V (se acepta personalización para diferentes voltaje, como 110V, 220V, 450V, etc.)

Potencia: 60W/70W.

Temperatura máxima de funcionamiento: 300-400 grados centígrados

## Stainless Steel Band Heaters

- ✓ Stainless Steel
- ✓ Voltage: 220V



### Specification

Product Name:	Stainless Steel Band Heaters
Material:	Stainless Steel
Size:	25x25mm/25x30mm (ID x H)
Voltage:	220V (Accept custom for differet voltage, such as 110V, 220V, 450V, ect)
Power:	60W/70W
Max working temperature:	300-400 centigrade



## Details

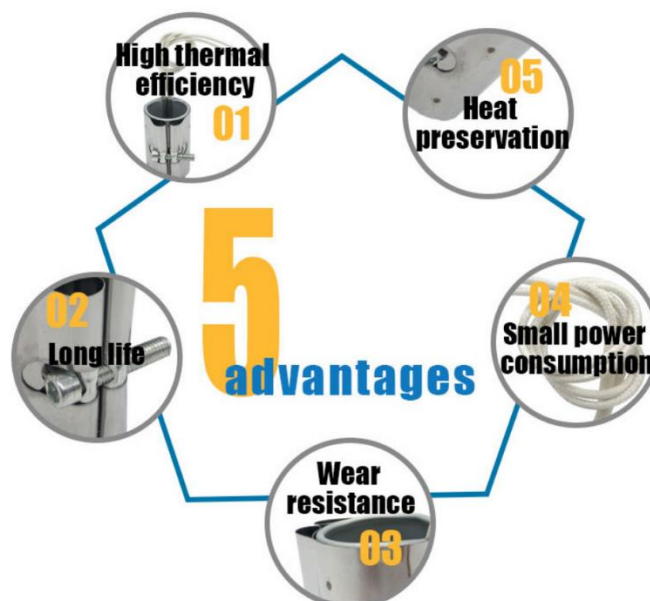


## Product Parameters

On-sale items for **25mm** Inner Diameter Stainless Steel Band Heaters, [Click the hyperlink for more details and BUY.](#)

Internal Diameter	Height	Wattage	Line Length	Material
25mm	25mm	60W	30cm	Stainless Steel
25mm	30mm	70W	30cm	Stainless Steel

## Product Advantage




A.5. GT2 Timing pulley



High Torque Timing Pulleys - 1.5GT, 2GT

For 2GT High Torque Timing Belts, see P.1459 and for 2GT Idlers with Teeth, see P.1453. For 1.5GT High Torque Timing Belts, see the VONA Site.



RotIS10

Standard Tooth Profile

These will be some variations of dimensions based on number of teeth selected. Top (Pitch: 1.5mm) Bottom (Pitch: 2.0mm)


Shaft Bore Specs. H (Round Hole) do not have tapped holes.

Type	Belt Width				Material		Surface Treatment	Accessories Set Screws
	4mm GT15040	4mm GT2040	6mm GT2060	9mm GT2090	Pulley	Flange		
GPA	●	●	●	●	A200 Series Aluminum Alloy	Aluminum Alloy	Clear Anodize	304 Stainless Steel

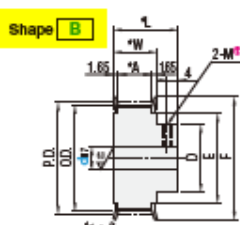
Flange is installed, and set screws are included with Shaft Bore P and N.

• Pulley Shape

Shape A



Shape B



1.5GT Shape B: >24 teeth is not selectable.  
 2GT Shape B: >21 teeth is not selectable

Number of Teeth, Dimension: 1.5GT

mm	18	20	24	30	36
P.D.	8.59	9.55	11.46	14.32	17.19
O.D.	9.13	9.90	11.90	13.86	16.73
D	-	-	-	8	10
F	13	14	16	18	22
E	6	7	8	10	13

Belt Nominal Width / Dimension

mm	Nominal		
	GT15040	GT2060	GT2090
A	5.2	5.2	7.0
M	9.3	9.3	10.2
L	10.2	10.2	21.0

Tapped Hole Dimensions (Shaft Bore Specs.: P, N)

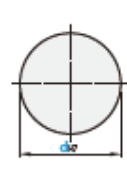
dcr Shaft Bore I.D.	M (Coarse)	Accessories Set Screws
5	M3	M3x3
6-22	M4	M4x3

Number of Teeth, Dimension: 2GT

mm	Number of Teeth																							
	14	15	16	18	20	21	22	24	25	26	28	30	32	34	36	38	40	44	48	50	52	54	60	
P.D.	8.91	9.55	11.10	11.46	12.75	13.27	14.01	15.28	15.92	16.55	17.93	19.18	20.37	21.55	22.90	24.19	25.46	28.01	30.56	31.85	33.20	34.50	37.60	
O.D.	8.48	8.84	9.68	10.05	11.22	12.96	13.50	14.77	15.41	16.04	17.32	18.99	20.85	21.14	22.41	23.68	24.95	27.50	30.05	31.32	32.60	33.80	36.90	
D	-	-	-	-	-	8	10	12	14	16	18	20	22	24	26	28	30	32	36	40	44	48	50	
F	13	14	14	15	17	18	18	20	21	22	23	24	25	27	27	29	30	32	35	36	42	42	42	
E	6	7	7	8	9	10	11	12	12	12	14	15	17	18	18	20	21	23	26	27	33	33	33	

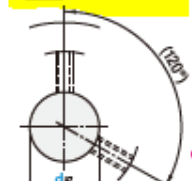
Shaft Bore Specs. The shaft bore will not have a surface treatment.

H Round Hole




No tapped holes or set screws.

P Round Hole + Tap



For A-Shape pulley, the screw holes are set at around 120° to keep away from peaks.

N New .J5 Keyway Bore + Tap



For Keyway Dimension Details, see P.1377. When selecting the shaft bore dia, 10 and the keyway width 4.0mm (height 1.9mm), specify NK10.

1.5GT

Type	Part Number	Number of Teeth	Type Nominal Width	Pulley Shape	Pulley Shape					
					A			B		
					Shaft Bore Spec./Options	Shaft Bore Spec./Options	Shaft Bore Spec./Options	Shaft Bore Spec./Options	Shaft Bore Spec./Options	Shaft Bore Spec./Options
Aluminum GPA	GT15040	18	A	H Round Hole	P Round Hole + Tap	N Keyway + Tap	H Round Hole	P Round Hole + Tap	N Keyway + Tap	
		20		2	-	-	-	-		
		24		3, 4	-	-	-	-		
		30		4, 5	-	-	-	-		
		36		4, 5, 6	5, 6	-	4	5, 6		

2GT

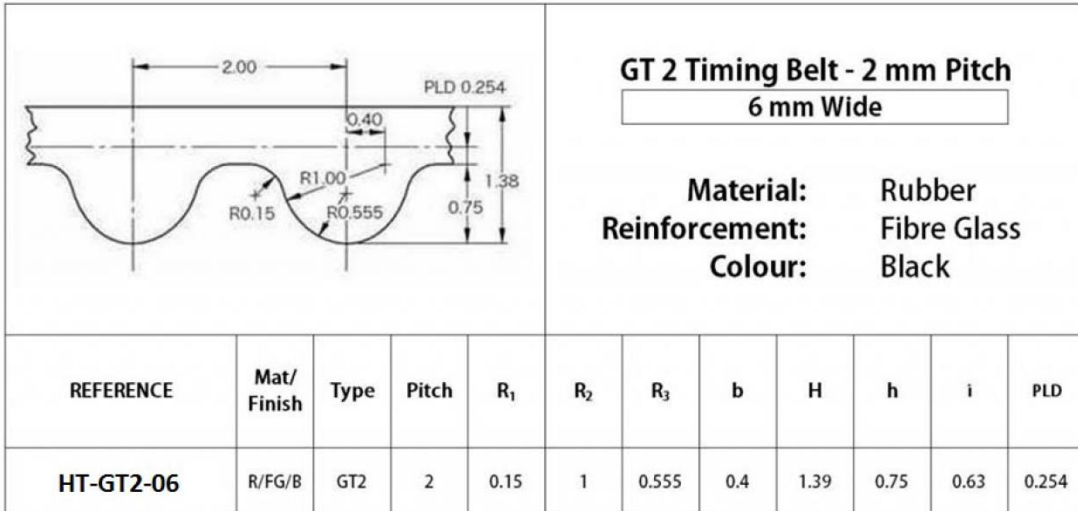
Type	Part Number	Number of Teeth	Type Nominal Width	Pulley Shape	Pulley Shape					
					A			B		
					Shaft Bore Spec./Options	Shaft Bore Spec./Options	Shaft Bore Spec./Options	Shaft Bore Spec./Options	Shaft Bore Spec./Options	Shaft Bore Spec./Options
Aluminum GPA	GT2040	14	A	H Round Hole	P Round Hole + Tap	N Keyway + Tap	H Round Hole	P Round Hole + Tap	N Keyway + Tap	
		15		2	-	-	-	-		
		16		3, 4	-	-	-	-		
		18		3, 4	-	-	-	-		
		20		4, 5	-	-	-	-		
		21		4, 5	-	-	-	-		
		22		4, 5	-	-	-	-		
		24		4, 5	5, 6, 6.25, 7	-	4	5, 6, 6.25, 7		
		25		4, 5	5, 6, 6.25, 7	-	5	5, 6, 6.25, 7		
		26		4, 5	5, 6, 6.25, 7, 9	-	5, 6, 6.25, 7, 9	5, 6, 6.25, 7, 9		
		28		4, 5	5, 6, 6.25, 7, 9	-	5, 6, 6.25, 7, 9	5, 6, 6.25, 7, 9		
		30		4, 5	5, 6, 6.25, 7, 9	-	5, 6, 6.25, 7, 9	5, 6, 6.25, 7, 9		
		32		4, 5	5, 6, 6.25, 7-10	5, 6, 6.25, 7-10	5, 6	5, 6, 6.25, 7, 9		
		34		4, 5	5, 6, 6.25, 7-10	5, 6, 6.25, 7-10	5, 6	5, 6, 6.25, 7, 9		
		36		4, 5	5, 6, 6.25, 7-10	5, 6, 6.25, 7-10	5, 6	5, 6, 6.25, 7, 9		
		40		4, 5	5, 6, 6.25, 7-12	5, 6, 6.25, 7-12	5, 6	5, 6, 6.25, 7, 9		
		44		4, 5	5, 6, 6.25, 7-15	5, 6, 6.25, 7-15	5, 6	5, 6, 6.25, 7, 9		
		46		4, 5	5-15	5-15	5, 10, NK10	5, 6, 6.25, 7, 9		
		50		4, 5	5-19	5-19	5, 10, NK10, 11-13	5, 6, 6.25, 7, 9		
		55		4, 5	5-24	5-24	5, 10, NK10, 11-14	5, 6, 6.25, 7, 9		
60	4, 5	5-28	5-28	5, 10, NK10, 11-18	5, 6, 6.25, 7, 9					



### A.6. GT2 Timing belt

**Mechanical Dimension:**

Unit: mm



SKU: [MCH-1123](#)

**Brief Data:**

- Belt Pitch: 2mm.
- Belt Width: 6mm.
- Length: 1 meter.
- Shape: Open-Ended Timing Belt.
- Belt Height: 1.38mm.
- Tooth Height: 0.75mm.
- Breaking Strength: 124 lb / 56kg.
- Working Tension: 6.25 lb / 2.8kg.

## A.7. Cargols DIN 912

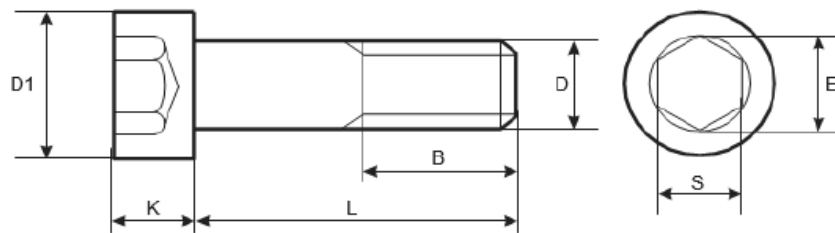


Product Dimensions, Standards and Weights

DIN 912 Technical Specifications

### Metric DIN 912 Hexagon Socket Head Cap Screw

Visit our [online store](#) for product availability



D	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24
D1	5.5	7	8.5	10	13	16	18	21	24	27	30	33	36
K	3	4	5	6	6	10	1	14	16	18	20	2	24
S	2.5	3	4	5	6	8	10	12	14	14	17	17	19
B	18	20	22	24	28	32	36	40	44	48	52	56	60
L (mm)	Weight in kg(s) per 1000 pcs												
5	0.67												
6	0.71	1.5											
8	0.8	1.65											
10	0.88	1.8	2.7	4.7									
12	0.96	1.95	2.95	5.07									
16	1.16	2.25	3.45	5.75	12.1	20.9							
20	1.36	2.85	4.01	6.53	13.4	22.9	32.1						
25	1.61	3.15	4.78	7.59	15	25.9	35.7						
30	1.86	3.65	5.55	8.7	16.9	27.9	39.3	63	77.9				
35		4.15	6.32	9.91	18.9	31	42.9	58	84.4				
40		4.65	7.09	11	20.9	34.1	47.3	63	94	129	150		
45			7.88	12.1	22.9	37.2	51.7	69	97.6	137	161		

4) Mechanical properties of steel for metric DIN 912 hexagon socket head cap screws

MECHANICAL PROPERTY		PROPERTY CLASS									
		4.8	5.6	5.8	6.8	8.8		9.8	10.9	12.9	
						Up to M 16	Over M 16				
Tensile Strength (Rm. N/mm <sup>2</sup> )	nom.	400	500		600	800		900	1000	1200	
	min.	420	500	520	600	800	830	900	1040	1220	
Vickers Hardness	min.	130	155	160	190	250	255	290	320	385	
	max.	250				320	336	360	380	435	
Brinell Hardness	min.	124	147	152	181	319	242	266	295	353	
	max.	238				385	319	342	363	412	
Rockwell Hardness	min. HR	71	79	82	89	-					
	HRC	-	-	-	-	20	23	28	32	39	
	HR	95				99	-				
	max. HRC	-	-	-	-	32	34	37	39	44	
Yield Stress Rel. N/mm <sup>2</sup>	nom.	320	300	400	480	-					
	min.	340	300	420	480	-					
Stress at permanent set limit N/mm <sup>2</sup>	nom.	-				640		720	900	1080	
	min.	-				640	660	720	940	1100	