

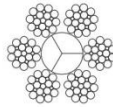
Elevadores y grúas

Las actividades de levantamiento, arrastre y transportación aérea de carga son comunes para todo tipo de industria, es por eso que este segmento es uno de los más importantes en el mercado de cables.



PERCUSIÓN SERIE 6 x 19

Alma de Fibra (AF)



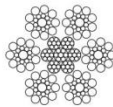
Diámetro		Peso Aprox.	Resist. a la ruptura en ton.	
mm	plg	kg/m	A.M.	
12.70	1/2	0.630	9.710	
14.29	9/16	0.790	12.200	
15.88	5/8	0.980	15.100	
19.05	3/4	1.410	21.600	
22.23	7/8	1.920	29.200	
25.40	1	2.500	37.900	

Construcción:

- 6x21 (10/5/5/1) Filler

TIRFOR SERIE 6 x 19

Alma de Acero (AA)



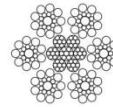
Diámetro		Peso Aprox.	Resist. a la ruptura en ton.	
mm	plg	kg/m	A.M.	
7.94	5/16	0.261	4.16	
9.53	3/8	0.377	5.95	
11.11	7/16	0.502	8.07	
12.70	1/2	0.656	10.40	
15.88	5/8	1.033	15.20	

Construcciones:

- 6x19 (9/9/1) Seale
- 6x26 (10/5+5/5/1) Warrington Seale

CÓNDOR SERIE 6 x 19

Alma de Acero (AA)



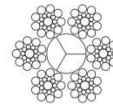
Diámetro		Peso Aprox.	Resist. a la ruptura en ton.		
mm	plg	kg/m	A.M.	A.E.M.	
3.18	1/8	0.041	0.69	0.79	
4.76	3/16	0.109	1.43	1.64	
6.35	1/4	0.170	2.67	3.08	
7.94	5/16	0.270	4.16	4.78	
9.53	3/8	0.390	5.95	6.85	
11.11	7/16	0.520	8.07	9.25	
12.70	1/2	0.680	10.40	12.10	
14.29	9/16	0.880	13.20	15.20	
15.88	5/8	1.070	16.20	18.70	
19.05	3/4	1.550	23.20	26.70	
22.23	7/8	2.110	31.40	36.10	
25.40	1	2.750	40.70	46.90	
28.58	1 1/8	3.480	51.30	59.00	
31.75	1 1/4	4.300	63.00	72.50	
34.93	1 3/8	5.210	75.70	87.10	
38.10	1 1/2	6.190	89.70	103.00	
41.27	1 5/8	7.260	104.00	120.00	
44.45	1 3/4	8.440	121.00	139.00	
47.62	1 7/8	9.670	138.00	158.00	
50.80	2	11.000	156.00	180.00	
53.98	2 1/8	12.400	174.00	200.00	
57.15	2 1/4	13.900	195.00	224.00	
60.33	2 3/8	15.500	217.00	249.00	
63.50	2 1/2	17.300	238.00	274.00	

Construcciones:

- 6x19 (12/6/1) 2 Operaciones
- 6x19 (9/9/1) Seale
- 6x21 (10/5/5/1) Filler
- 6x25 (12/6/6/1) Filler
- 6x26 (10/5+5/5/1) Warrington Seale

HALCÓN SERIE 6 x 19

Alma de Fibra (AF)



Diámetro		Peso Aprox.	Resist. a la ruptura en ton.		
mm	plg	kg/m	A.M.	A.E.M.	
3.18	1/8	0.036	0.63	0.69	
4.76	3/16	0.094	1.36	1.50	
6.35	1/4	0.160	2.49	2.70	
7.94	5/16	0.240	3.86	4.20	
9.53	3/8	0.350	5.53	6.10	
11.11	7/16	0.480	7.50	8.20	
12.70	1/2	0.630	9.71	10.70	
14.29	9/16	0.790	12.20	13.50	
15.88	5/8	0.980	15.10	16.60	
19.05	3/4	1.410	21.60	23.80	
22.23	7/8	1.920	29.20	32.10	
25.40	1	2.500	37.90	41.70	
28.58	1 1/8	3.170	47.70	52.40	
31.75	1 1/4	3.910	58.50	64.50	
34.93	1 3/8	4.730	70.50	77.60	
38.10	1 1/2	5.630	83.50	91.60	
41.27	1 5/8	6.610	97.10	107.00	
44.45	1 3/4	7.660	112.00	124.00	
47.62	1 7/8	8.800	128.00	142.00	
50.80	2	10.000	145.00	160.00	
53.98	2 1/8	11.300	162.00	178.00	
57.15	2 1/4	12.700	181.00	199.00	
60.33	2 3/8	14.100	201.00	221.00	
63.50	2 1/2	15.600	221.00	243.00	

Construcciones:

- 6x19 (12/6/1) 2 Operaciones
- 6x19 (9/9/1) Seale
- 6x21 (10/5/5/1) Filler
- 6x25 (12/6/6/1) Filler
- 6x26 (10/5+5/5/1) Warrington Seale

Su sistema motor maxon

maxon motor

driven by precision

Compuesto de:

Reductor planetario GP 81 A Ø81 mm, 20 - 120 Nm

Número de artículo 110412

EC 60 Ø60 mm, Conmutación electrónica (Brushless), 400 Vatios, con sensores Hall

Número de artículo 167131

Encoder HEDL 9140, 500 ppv, 3 canales, con line driver RS 422

Número de artículo 137959

DEC Module 50/5, Amplificador digital 1-Q-EC 50 V/5 A, control de velocidad

Número de artículo 380200

DEC Module

Número de artículo 370652

Cable con connector

Número de artículo 339380

Freno AB 41, 24 VCC, 2.0 Nm

Número de artículo 228998

Su persona de contacto

maxon motor en todo el mundo

http://www.maxonmotor.es:80/maxon/view/content/contact_pageE-Mail: info@maxonmotor.comInternet: <http://www.maxonmotor.es:80>

Precio de venta recomendado:

1-4 Unidad(es)	€1.771,02
5-19 Unidad(es)	€1.580,57
20-49 Unidad(es)	€1.381,16
de 50 Unidad(es)	Solicitado (en proceso)

condiciones generales de contrato

Reductor planetario GP 81 A Ø81 mm, 20 - 120 Nm

Número de artículo 110412

**Datos generales**

Tipo de reductor	GP
Diámetro exterior	81 mm
Versiones del reductor	A

Datos del reductor

Relación de reducción	93 : 1
Relación de reducción absoluta	107163/1156
Máx. diámetro del eje del motor	14 mm
Número de etapas	3
Máx. par en continuo	120 Nm
Par admisible de forma intermitente a la salida del reductor	180 Nm
Sentido de giro, de motor a eje de salida	=
Máx. rendimiento	70 %
Holgura media del reductor sin carga	0.6 °
Momento de inercia	154 gcm ²
Longitud del reductor (L1)	135.3 mm
Máx. potencia transmisible en continuo	410 W
Máx. potencia transmisible intermitente	610 W

Datos técnicos

Juego radial	máx. 0.1 mm, 8 mm desde la brida
Juego axial	máx. 1 mm
Máx. carga radial	1000 N, 24 mm desde la brida
Máx. carga axial (dinámica)	200 N
Máx. fuerza admisible de montaje a presión	1500 N
Velocidad de entrada recomendada	3000 rpm
Máx. velocidad de entrada (brevemente)	3000 rpm
Rango de temperatura recomendado	-30...+140 °C
Número de ciclos de esterilización	0

Producto

Peso	3700 g
------	--------

EC 60 Ø60 mm, Conmutación electrónica (Brushless), 400 Vatios, con sensores Hall
Número de artículo 167131



Valores a tensión nominal

Tensión nominal	48 V
Velocidad en vacío	3100 rpm
Corriente en vacío	304 mA
Velocidad nominal	2680 rpm
Par nominal (máx. par en continuo)	830 mNm
Corriente nominal (máx. corriente en continuo)	5.85 A
Par de arranque	6820 mNm
Corriente de arranque	46.4 A
Máx. rendimiento	85 %

Datos característicos

Resistencia entre terminales	1.03 Ω
Inductancia en terminales	0.82 mH
Constante de par	147 mNm/A
Constante de velocidad	65 rpm/V
Relación velocidad/par	0.457 rpm/mNm
Constante de tiempo mecánica	3.98 ms
Momento de inercia del rotor	831 gcm ²

Datos térmicos

Resistencia térmica carcasa-ambiente	1.3 K/W
Resistencia térmica bobinado-carcasa	0.5 K/W
Constante de tiempo térmica del bobinado	33.9 s
Constante de tiempo térmica del motor	1200 s
Temperatura ambiente	-20...+100 °C
Máx. temperatura del bobinado	+125 °C

Datos mecánicos

Tipo de rodamiento/cojinete	Rodamiento de bolas
Máx. velocidad permitida	7000 rpm
Juego axial	0 - 0.14 mm
Máx. carga axial (dinámica)	24 N
Máx. fuerza axial de montaje a presión (estática)	390 N
(estática, con eje apoyado)	6000 N
Máx. carga radial	240 N, 5 mm desde la brida

Más especificaciones

Número de pares de polos	1
Número de fases	3
Sentido de giro	Sentido horario (CW)
Número de ciclos de esterilización	0
Certificación	
Grado de protección	IP54

Producto

Peso	2400 g
------	--------

Encoder HEDL 9140, 500 ppv, 3 canales, con line driver RS 422
Número de artículo 137959



Tipo	
Número de pulsos por vuelta	500
Número de canales	3
Line Driver	DS26LS31
Max. velocidad mecánica	12000 rpm
Diámetro del eje	-1 mm
Datos técnicos	
Tensión de alimentación Vcc	5.0V \pm 10.0%
Lógica de driver de salida	EIA RS 422
Máx. aceleración angular	250000 rad / s ²
Corriente por canal	-20...20 mA
Tiempo del flanco de subida	180 ns
Condición de medición del tiempo del flanco de subida	CL=25pF, RL=11kOhm,
Tiempo del flanco de bajada	40 ns
Condición de medición del tiempo del flanco de bajada	CL=25pF, RL=11kOhm,
Desfase	90 °e
Imprecisión por desfase	45 °e
Canal index sincronizado con AB	Yes
Máx. momento de inercia del disco del encoder	0.6 gcm ²
Temperatura de funcionamiento	-40...+85 °C
Posición del encoder respecto al motor	-1.0 °

DEC Module 50/5, Amplificador digital 1-Q-EC 50 V/5 A, control de velocidad
Número de artículo 380200



Producto	
Peso	9 g
Motores	
motores EC hasta	250 W
Sensores	
Sensores Hall digitales (motores EC)	Si
Modo de funcionamiento	
Controlador de velocidad (lazo abierto)	Si
Controlador de velocidad (lazo cerrado)	Si
Datos eléctricos	
Tensión de funcionamiento V cc (mín.)	6 V
Tensión de funcionamiento V cc (máx.)	50 V
Máx. tensión de salida (Factor * Vcc)	0.95
Máx. corriente de salida I _{max}	10 A
Corriente de salida en continuo	5 A
Frecuencia del PWM	46.8 kHz
Frecuencia del lazo de velocidad PI	0.25 kHz
Máx. rendimiento	94 %
Máx. velocidad (EC; 1 par de polos) conmutación en bloque	80000 rpm
Bobina de choque integrada por fase	0 µH
Entradas	
Señales de los sensores Hall	H1, H2, H2
Entradas digitales	4
Funciones de las entradas digitales	habilitar, sentido, rango de velocidades
Entradas analógicas	2
Resolución, rango, circuito	10 bits, 0...+5V, referido a tierra
Funciones de las entradas analógicas	valor de consigna, límite de corriente
Salidas	
Salidas digitales	2
Función de las salidas digitales	monitorización de velocidad, listo
Salidas de tensión	
Tensión de alimentación de los sensores Hall	+5 VCC, máx. 35 mA
Funciones de protección	
Funciones de protección	límite de corriente, protección de bloqueo, sobretensión, tensión insuficiente, sobretensión, transitorios de tensión, cortocircuitos en el cable del motor
Condiciones del entorno	

temperatura - funcionamiento (mín.)	-10 °C
temperatura - funcionamiento (máx.)	45 °C
temperatura - almacenamiento (mín.)	-40 °C
temperatura - almacenamiento (máx.)	85 °C
Humedad (condensación no permitida) (mín.)	20 %
Humedad (condensación no permitida) (máx.)	80 %

Datos eléctricos

Peso	9 g
Dimensión (longitud)	43.18 mm
Dimensión (anchura)	27.94 mm
Dimensión (altura)	12.7 mm
Roscas de montaje	montable en regletas de bornes de 2,54 mm

DEC Module

Número de artículo 370652



Producto

Peso

| 94 g

Cable con connector
Número de artículo 339380



Producto

Peso

| 8 g

Freno AB 41, 24 VCC, 2.0 Nm
Número de artículo 228998



Producto

Peso	180 g
------	-------

Datos de accesorios

Longitud del freno	40.3 mm
Momento de inercia	45 gcm ²
Máx. velocidad permitida	10000 rpm
Tensión nominal, filtrada	24 V
par en reposo	2000 mNm

Ledex® Low Profile Size 8EC — Push or Pull

Medium Stroke. Conical Face
Part Number: 191016-0XX

All catalog products manufactured after
April 1, 2006 are RoHS Compliant

Performance

Maximum Duty Cycle	100%	50%	25%	10%
Maximum ON Time (sec) when pulsed continuously ¹	∞	72	43	20
Maximum ON Time (sec) for single pulse ²	∞	132	56	22
Watts (@ 20°C)	41	82	164	410
Ampere Turns (@ 20°C)	2195	3105	4155	6945

Coil Data				VDC	VDC	VDC	VDC
awg (0XX) ³	Resistance (@20°C)	# Turns ⁴		(Nom)	(Nom)	(Nom)	(Nom)
23	19.00	1512		28.0	40.0	56.0	88.0
24	31.20	1952		36.0	51.0	72.0	113.0
25	49.40	2448		45.0	64.0	90.0	142.0
26	78.00	3060		57.0	80.0	113.0	179.0
27	119.00	3740		70.0	99.0	140.0	221.0
28	184.00	4584		87.0	123.0	174.0	275.0
29	301.00	5936		111.0	157.0	222.0	351.0
30	425.00	6750		132.0	187.0	264.0	417.0
31	683.00	8750		167.0	237.0	335.0	529.0
32	1110.00	11000		213.0	302.0	427.0	—
33	1509.00	12050		249.0	352.0	498.0	—

- ¹ Continuously pulsed at stated watts and duty cycle
- ² Single pulse at stated watts (with coil at ambient room temperature 20°C)
- ³ Other coil awg sizes available — please consult factory
- ⁴ Reference number of turns

Specifications

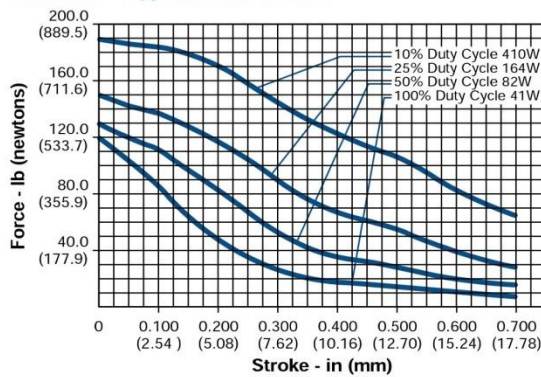
Dielectric Strength	23-27 awg, 1200 VRMS ; 28-33 awg, 1500 VRMS
Recommended Minimum Heat Sink	Maximum watts dissipated by solenoid are based on an unrestricted flow of air at 20°C, with solenoid mounted on the equivalent of an aluminum plate measuring 20 ¹ / ₄ " square by 1 ¹ / ₈ " thick
Coil Resistance	23-30 awg, ±5%; 31-33 awg, ±10%
Weight	4.9 lb (2.2 kg)
Holding Force	120.0 lb (533.7 N) @ 105°C
Dimensions	Ø3.375" x 2.165" L (See page G18)

How to Order

Add the coil awg number (0XX) to the part number (for example: to order a 25% duty cycle unit rated at 90 VDC, specify 191016-025).
Please see www.ledex.com (click on Stock Products tab) for our list of stock products available through our North American distributors.

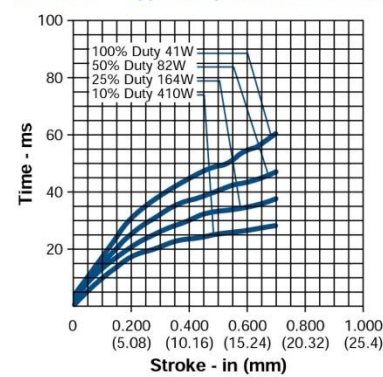
LINEAR Low Profile

Size 8EC— Typical Force at 20°C



Force values for reference only.

Size 8EC— Typical Speed @ No Load, 20°C



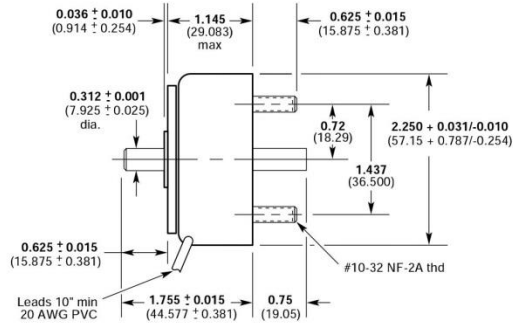
All specifications subject to change without notice.

Ledex® Low Profile Dimensions

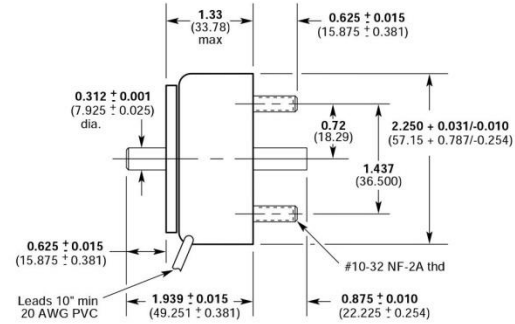
Inches (mm)

All solenoids are illustrated in energized state

Size 6SF

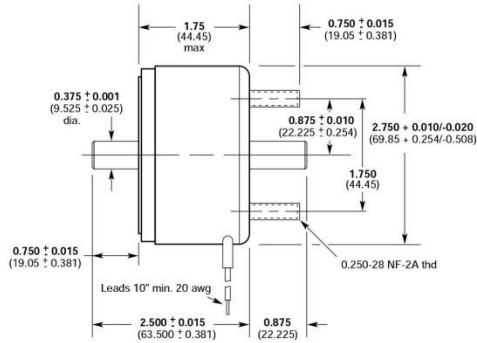


Size 6EC

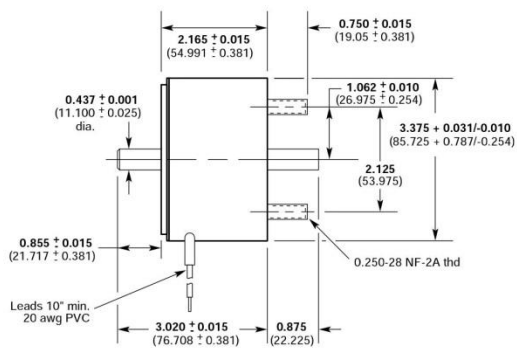


LINEAR Low Profile

Size 7EC



Size 8EC



All specifications subject to change without notice.



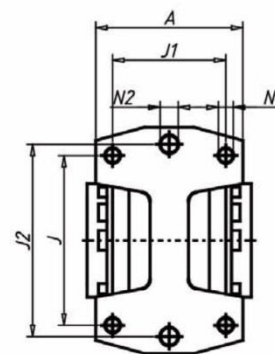
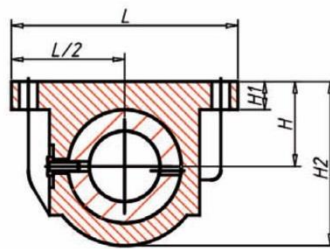
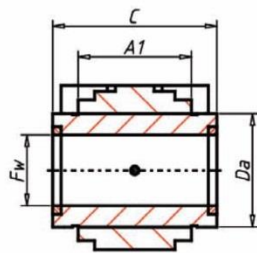
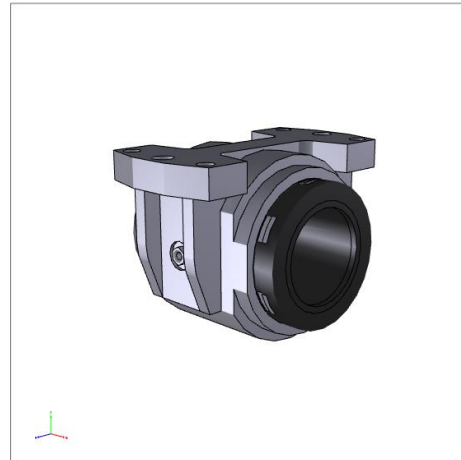
Linear Bearing Units - with Closed Housing and LBCD,
LBCR, LPAR Linear Bearings
LUCR/LUCD

PDF DATASHEET

© 1992-2014 CADENAS GmbH

Last Modification (geometry): 07/06/2012 00:00

Datasheet creation date: 25/05/2014 20:17





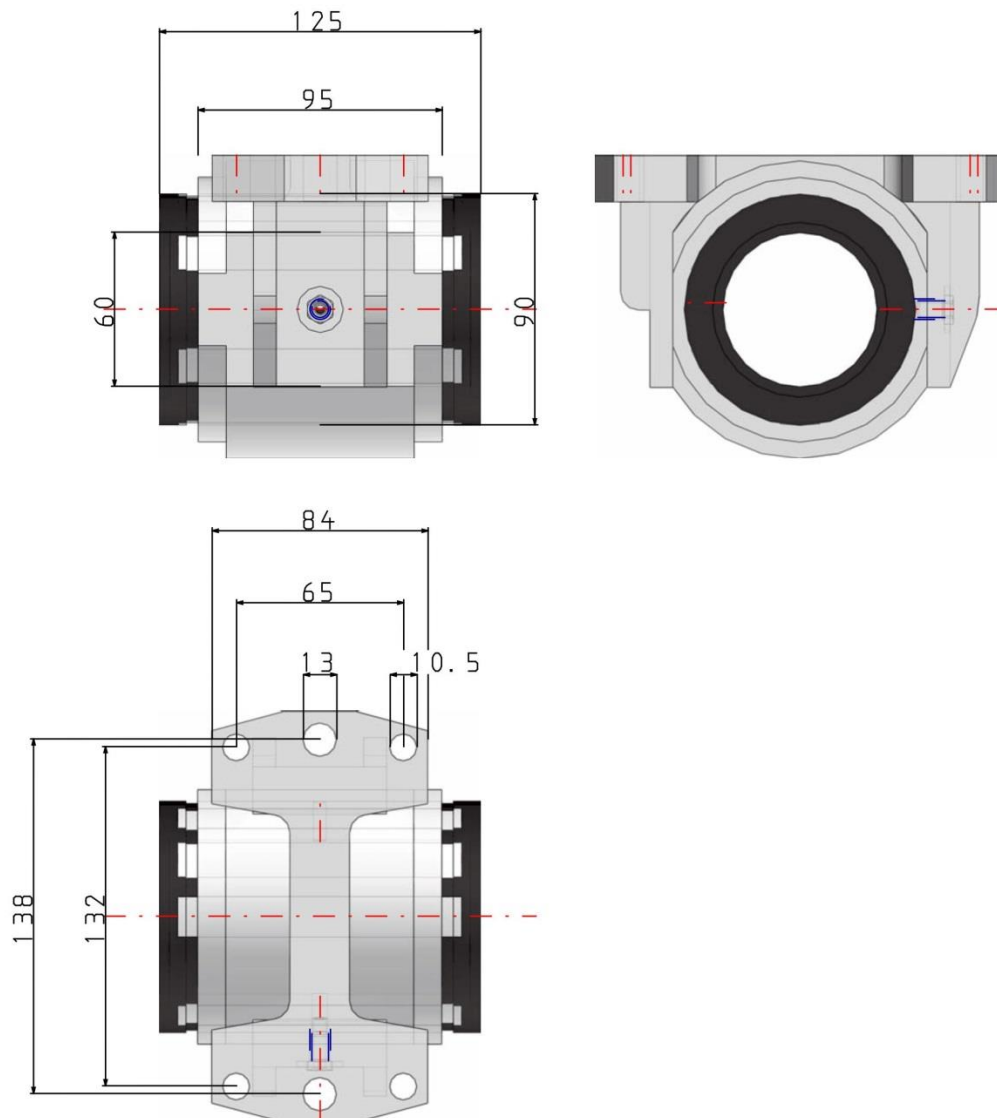
Linear Bearing Units - with Closed Housing and LBCD,
LBCR, LPAR Linear Bearings
LUCR/LUCD

PDF DATASHEET

© 1992-2014 CADENAS GmbH

Last Modification (geometry): 07/06/2012 00:00

Datasheet creation date: 25/05/2014 20:17





Linear Bearing Units - with Closed Housing and LBCD,
LBCR, LPAR Linear Bearings
LUCR/LUCD

PDF DATASHEET

© 1992-2014 CADENAS GmbH

Last Modification (geometry): 07/06/2012 00:00

Datasheet creation date: 25/05/2014 20:17

TYPE (Type)	LUCR 60/LUCD 60
PN (Part No.)	LUCR 60
LB (Linear Bearing)	LUCR - Linear Ball Bearing LBCR
MAT (Material of Balls and Raceway Plates)	Steel
LBU (Linear Bearing Unit)	Without Seal
FWW (Fw / mm)	60
A (A / mm)	84
A1 (A1 / mm)	95
C (C1 / mm)	125
DA (Da / mm)	90
H (H +/-0.01 / mm)	60
H1 (H1 / mm)	18
H2 (H2 / mm)	118
J (J / mm)	132
J1 (J1 / mm)	65
J2 (J2 / mm)	138
L (light / mm)	160
N (N / mm)	10.5
N2 (N2 / mm)	13
CAA (Basic Load Ratings - Dynamic (C) / N)	20400
COO (Basic Load Ratings - Static (Co) / N)	18000
MASS (Mass / kg)	2.17



Linear Bearing Units - with Closed Housing and LBCD,
LBCR, LPAR Linear Bearings
LUCR/LUCD

PDF DATASHEET

© 1992-2014 CADENAS GmbH

Last Modification (geometry): 07/06/2012 00:00

Datasheet creation date: 25/05/2014 20:17

Bill of material

N°	Description	Amount
1	LUCR 60	1

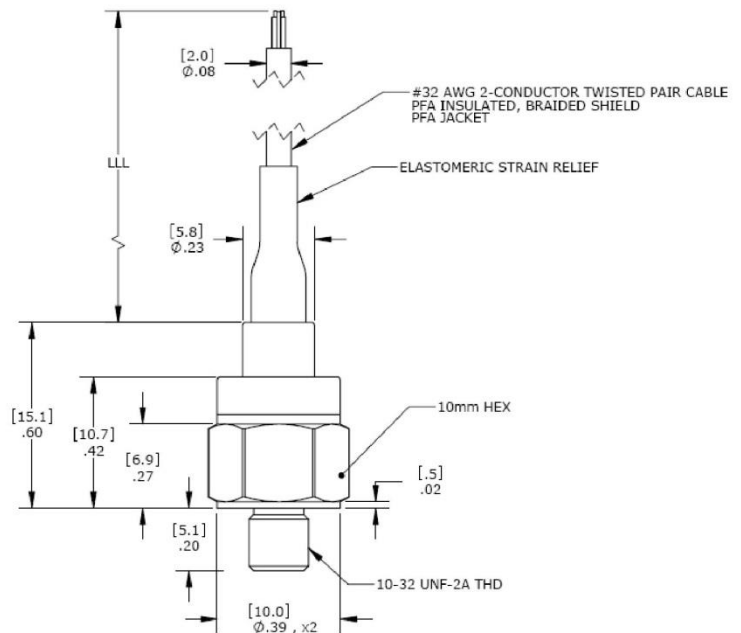
Model 7109A Accelerometer

IEPE Shock Accelerometer
±5,000g to ±20,000g Ranges
Filtered Output
Miniature, Stud Mount



The **Model 7109A** is a miniature stud mount IEPE shock accelerometer available in ±5,000g to ±20,000g ranges. The accelerometer features a welded hermetic stainless steel construction with an integral cable for electrical connection. The model 7109A incorporates a stable piezo-ceramic crystal in annular shear mode with outstanding linearity for shock measurements. The accelerometer has an operating range of 0°C to +85°C and a flat frequency response to >10kHz.

dimensions

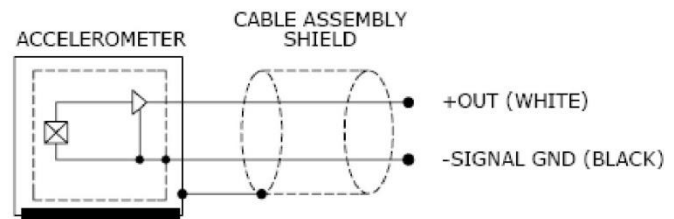


FEATURES

- ±5,000g to ±20,000g Dynamic Range
- Welded Stainless Steel
- Hermetically Sealed
- 0°C to +85°C Operating Range
- Annular Shear Mode
- Case Isolated, Internally Shielded

APPLICATIONS

- Far-field Shock Testing
- Drop Testing
- Structural Testing
- Impact Testing



Model 7109A Accelerometer

performance specifications

All values are typical at +24°C, 100Hz and 4mA excitation unless otherwise stated. Measurement Specialties reserves the right to update and change these specifications without notice. Standard product parameters are described in PSC-1003 for Plug & Play AC Accelerometers.

Parameters

DYNAMIC

Range (g)	±5,000	±10,000	±20,000
Sensitivity (mV/g)	1.00	0.50	0.25
Frequency Response (Hz)	2-8000	2-10000	2-10000
Filter Corner Frequency (-3dB)	25000	25000	25000
Natural Frequency (kHz)	>80	>90	>90
Non-Linearity (%FSO)	±1	±1	±1
Transverse Sensitivity (%)	<5	<5	<5
Shock Limit (g)	±50,000	±50,000	±50,000

Notes

±25%
±1dB
-40dB/decade rolloff

ELECTRICAL

Compliance Voltage (Vdc)	18 to 30	18 to 30	18 to 30
Excitation Current (mA)	2 to 10	2 to 10	2 to 10
Bias Voltage (Vdc)	8 to 12	8 to 12	8 to 12
Bias Voltage (Vdc)	6 to 13	6 to 13	6 to 13
Output Impedance (Ω)	<100	<100	<100
Insulation Resistance (MΩ)	>50	>50	>50
Full Scale Output Voltage (V)	±5	±5	±5
Residual Noise (g RMS)	0.06	0.04	0.03
Discharge Time Constant (sec)	1 to 3		
Warm-Up Time (sec)	<5		
Ground Isolation	Case Isolated, Internally Shielded		

Room Temperature
-55 to +125°C

@100Vdc

Broadband 1Hz to 10kHz

ENVIRONMENTAL

Temperature Response (%)	See Typical Temperature Response Curve
Operating Temperature (°C)	0 to +85
Storage Temperature (°C)	-55 to +125
Humidity	Hermetically Sealed

PHYSICAL

Sensing Element	Ceramic (shear mode)
Case Material	Stainless Steel
Cable	#32 AWG PFA Insulated Leads, Braided Shield, PFA Jacket
Weight (grams)	5
Mounting	#10-32 or M5x0.8 Mounting Stud
Mounting Torque	18 lb-in (2.0 N-m)

See Note 1
Cable not included

¹ A 10-32 Connector Option is Available, Installed at End of Cable Leads

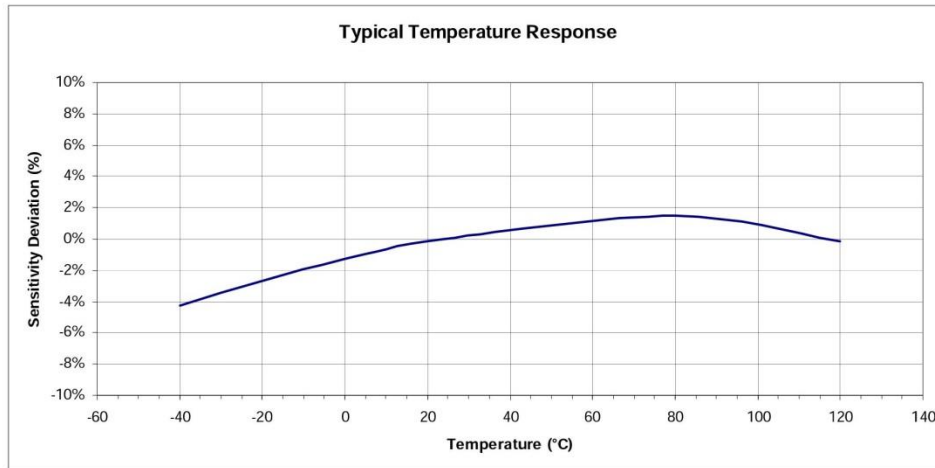
Calibration supplied: CS-SKLIN NIST Traceable Shock Calibration at 5000g

Optional accessories: 161A 4-Channel PE & IEPE Signal Conditioner

The information in this sheet has been carefully reviewed and is believed to be accurate; however, no responsibility is assumed for inaccuracies. Furthermore, this information does not convey to the purchaser of such devices any license under the patent rights to the manufacturer. Measurement Specialties, Inc. reserves the right to make changes without further notice to any product herein. Measurement Specialties, Inc. makes no warranty, representation or guarantee regarding the suitability of its product for any particular purpose, nor does Measurement Specialties, Inc. assume any liability arising out of the application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Typical parameters can and do vary in different applications. All operating parameters must be validated for each customer application by customer's technical experts. Measurement Specialties, Inc. does not convey any license under its patent rights nor the rights of others.

Model 7109A Accelerometer

performance specifications



ordering info

PART NUMBERING Model Number+Range+Cable Length

7109A-GGG-LLL-XX

| | | Thread Option Dash Number
 | | | Cable Length (120 is 120 inches)
 | | Range (10K is 10,000g)

Dash Number Thread Options
 -01 #10-32 UNF-2B
 -02 M5 x 0.8 6g

Example: 7109A-10K-120-01
 Model 7109A, 10,000g, 120inch cable length, #10-32 UNF-2B stud

PACEline CFW

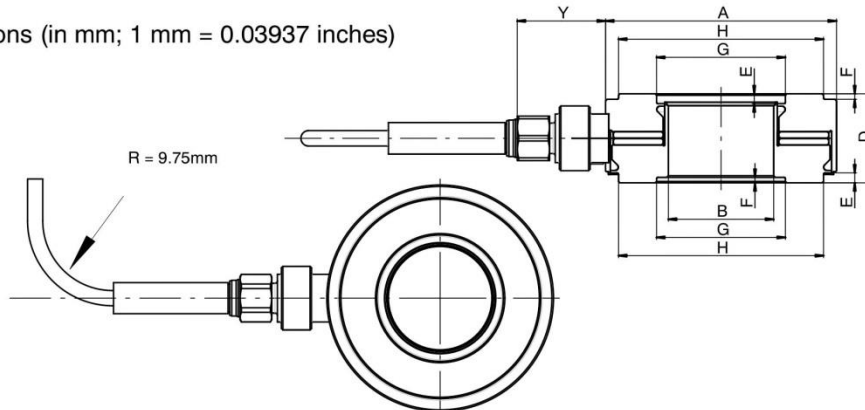
Piezoelectric force washer

Special features

- Symmetrical structure for increased stability
- Nominal (rated) forces: 20 kN, 50 kN, 100 kN, 140 kN, 190 kN, 330 kN and 700 kN
- High cut-off frequency
- Robust charge cable connection



Dimensions (in mm; 1 mm = 0.03937 inches)



Type	A	B	D	E	F	G	H	Y
CFW/20kN	14.5 ^{+0.05}	6.5 ^{H7}	8 ^{-0.05}	0.88	0.38	8.4	11.9	~7.25
CFW/50kN	22.5 ^{+0.05}	10.5 ^{H7}	10 ^{-0.05}	0.83	0.48	13.5	18.7	~10.8
CFW/100kN	28.5 ^{+0.05}	13 ^{H7}	11 ^{-0.05}	1.23	0.68	15.9	25.3	~10.9
CFW/140kN	34.5 ^{+0.05}	17 ^{H7}	12 ^{-0.05}	1.28	0.68	20.6	30.6	~10.95
CFW/190kN	40.5 ^{+0.05}	21 ^{H7}	13 ^{-0.05}	1.68	0.78	24.9	36.3	~11
CFW/330kN	52.5 ^{+0.05}	26.5 ^{H7}	15 ^{-0.05}	1.88	0.88	30.5	48	~11.1
CFW/700kN	75.5 ^{+0.05}	40.5 ^{H7}	17 ^{-0.05}	2.28	1.08	45	70.5	~11.2

B2586-5.1 en



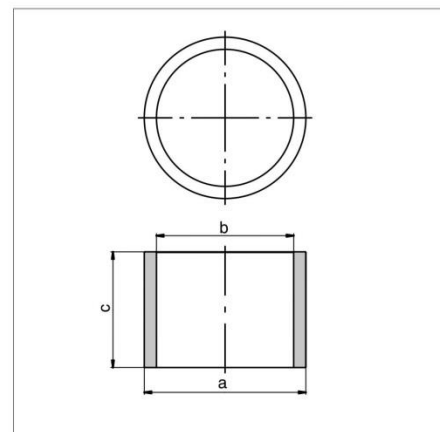
Specifications (data per VDI/VDE 2638 standards)

Piezoelectric force washer		CFW / ...						
Nominal (rated) force	kN	20	50	100	140	190	330	700
Sensitivity (typical) ¹⁾	pC/N	-4	-4.3					
Relative reversibility error	% of E.	<1						
Relative linearity error ²⁾	% of E.	<1						
Crosstalk ³⁾ from F _{x,y} to F _z from M _{x,y} to F _z	N/N	0.03	0.03	0.04	0.03	0.03	0.03	0.03
	N/Nm	0.002	0.002	0.002	0.002	0.003	0.003	0.003
Max. operating force	% of F _{nom}	120						
Maximum bending moment with ³⁾ with F _z = 0% with F _z = 50% with F _z = 100%	Nm	0	0	0	0	0	0	0
		21	80	220	395	650	1200	4000
		0	0	0	0	0	0	0
		0	0	0	0	0	0	0
Max. permissible lateral force ⁴⁾	% F _z	10						
Breaking force	% of F _{nom}	200						
Insulation resistance	Ω	> 10 ¹³						
Nominal (rated) temperature range	°C	-40 ... +120						
Operating temperature range	°C	-40 ... +120						
Storage temperature range	°C	-40 ... +120						
Nominal (rated) displacement	μm	2	3.5	5.8	7.5	9.4	13.5	28
Fundamental resonance frequency	kHz	60	55	45	35	35	30	30
Permissible vibrational stress (vibration bandwidth)	% F _{nom}	100 for compressive force						
Weight	g	7	22	37	57	78	155	365
Degree of protection per DIN EN 60529 (with connected charge cable)		IP65						
Connection		10-32 UNF						

- 1) Must be calibrated under mounting conditions
- 2) Pre-stressed, typically 0.5% of full scale
- 3) F_z is the force in the measurement direction
- 4) related to a point of contact on the force application surface

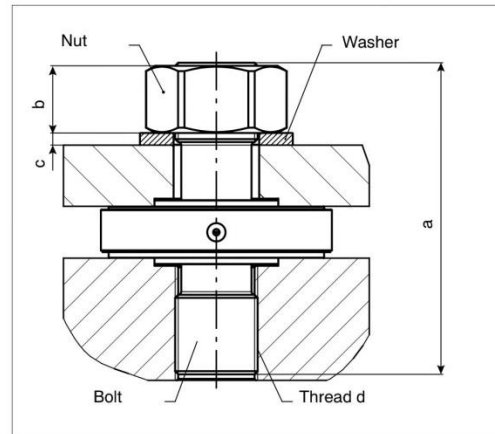
Dimensions centering sleeve

Type	a	b	c
CFW/20kN	6.5 ^{G7}	5	12
CFW/50kN	10.5 ^{G7}	8.5	14
CFW/100kN	13 ^{G7}	11	15
CFW/140kN	17 ^{G7}	13	16
CFW/190kN	21 ^{G7}	17	17
CFW/330kN	26.5 ^{G7}	22.5	19
CFW/700kN	40.5 ^{G7}	36.5	21



Dimensions pre-stressing set

Type	a	b	c	d
CPS/20kN	28	5	1.1	M5 x 0.5
CPS/50kN	40	8	1.6	M8 x 1
CPS/100kN	46	10	1.6	M10 x 1
CPS/140kN	60	12	2.5	M12 x 1
CPS/190kN	62	13	2.5	M14 x 1.5
CPS/330kN	80	19	3.0	M20 x 1.5
CPS/700kN	102	26	4.0	M27 x 2



Scope of delivery

Order number	
1-CFW/20kN ^{*)}	Piezoelectric force washer CFW/20kN with test certificate and centering sleeve
1-CFW/50kN	Piezoelectric force washer CFW/50kN with test certificate, plug protection and centering sleeve
1-CFW/100kN	Piezoelectric force washer CFW/100kN with test certificate, plug protection and centering sleeve
1-CFW/140kN	Piezoelectric force washer CFW/140kN with test certificate, plug protection and centering sleeve
1-CFW/190kN	Piezoelectric force washer CFW/190kN with test certificate, plug protection and centering sleeve
1-CFW/330kN	Piezoelectric force washer CFW/330kN with test certificate, plug protection and centering sleeve
1-CFW/700kN	Piezoelectric force washer CFW/700kN with test certificate, plug protection and centering sleeve

^{*)} The CFW/20kN type is delivered without plug protection and does not have the corresponding thread.

Accessories:

1-KAB143-3	Transducer connection cable (material: PFA), 3m long, connector plug 10-32 UNF at both ends
1-KAB145-3	Transducer connection cable, very robust design, length 3 m; connector plug 10-32 UNF at both ends, 30 cm steel-clad on transducer side, with O-ring seal; this design is not suitable for CFW/20kN, CFT/5kN and CFT/20kN
1-KAB176-2	Transducer connection cable (material: PFA), 2 m long; connector plug on transducer side 10-32 UNF, BNC on amplifier side (e.g. suitable for digital charge amplifier CMD600)
1-CPS/20kN	Pre-stressing set, comprising bolt, nut and washer for 1-CFW/20kN
1-CPS/50kN	Pre-stressing set, comprising bolt, nut and washer for 1-CFW/50kN
1-CPS/100kN	Pre-stressing set, comprising bolt, nut and washer for 1-CFW/100kN
1-CPS/140kN	Pre-stressing set, comprising bolt, nut and washer for 1-CFW/140kN
1-CPS/190kN	Pre-stressing set, comprising bolt, nut and washer for 1-CFW/190kN
1-CPS/330kN	Pre-stressing set, comprising bolt, nut and washer for 1-CFW/330kN
1-CPS/700kN	Pre-stressing set, comprising bolt, nut and washer for 1-CFW/700kN

Modifications reserved.
All product descriptions are for general information only. They
are not to be understood as a guarantee of quality or durability
and do not constitute any liability whatsoever.

Hottinger Baldwin Messtechnik GmbH

Im Tiefen See 45 · 64293 Darmstadt · Germany
Tel. +49 6151 803-0 · Fax: +49 6151 803-9100
Email: info@hbm.com · www.hbm.com

measure and predict with confidence

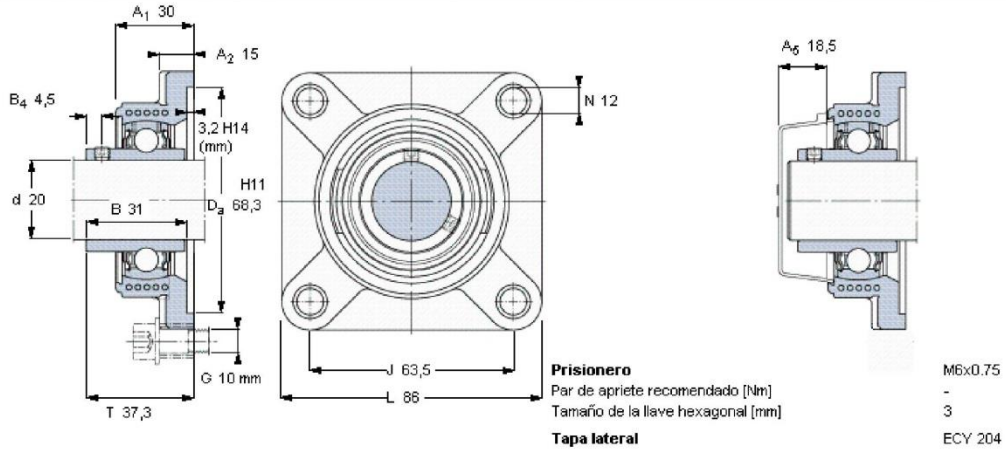


B2586-5.1 en



Soportes de brida con rodamientos Y, soporte Y-TECH, brida cuadrada, con prisionero

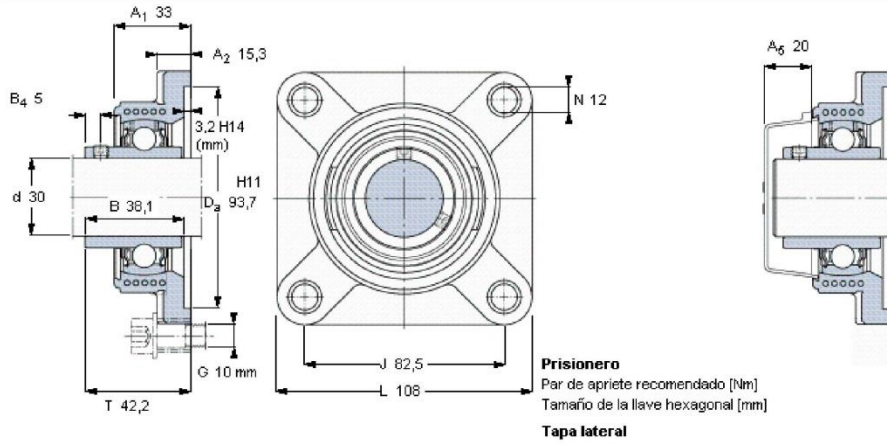
Dimensiones principales					Capacidades de carga básica		Referencias		
d	A1	J	L	T	dinámica C	estática C0	Unidad de rodamientos	Soporte	Rodamiento
mm					kN		-		
20	30	63,5	86	37,3	12,7	6,55	FYK 20 TF	FYK 504	YAR 204-2F





Soportes de brida con rodamientos Y, soporte Y-TECH, brida cuadrada, con prisionero

Dimensiones principales					Capacidades de carga básica		Referencias		
d	A1	J	L	T	dinámica C	estática C0	Unidad de rodamientos	Soporte	Rodamiento
mm					kN		-		
30	33	82,5	108	42,2	19,5	11,2	FYK 30 TF	FYK 506	YAR 206-2F



Prisionero
Par de apriete recomendado [Nm]
Tamaño de la llave hexagonal [mm]

Tapa lateral

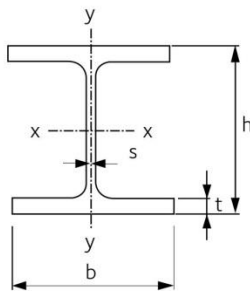
M6x0.75
-
3
ECY 206

Perfil IPB (perfil grey mediano HEB)

Usos y aplicaciones:

Se utilizan como vigas, columnas y canales para diversas aplicaciones estructurales.

I.P.B.	Dimensiones				Sección S	Peso G	Valores estáticos			
	h	b	s	t			J _x	J _y	W _x	W _y
	mm	mm	mm	mm	cm ²	kg/m	cm ⁴	cm ⁴	cm ³	cm ³
100	100	100	6,0	10,0	26,0	20,4	450	167	90	34
120	120	120	6,5	11,0	34,0	26,7	864	318	144	53
140	140	140	7,0	12,0	43,0	33,7	1.510	550	216	79
160	160	160	8,0	13,0	54,5	42,6	2.490	889	311	111
180	180	180	8,5	14,0	65,3	51,2	3.830	1.360	426	151
200	200	200	9,0	15,0	78,0	61,3	3.900	2.000	570	200
220	220	220	9,5	16,0	91,0	71,5	8.090	2.840	736	258
240	240	240	10,0	17,0	106,0	83,2	11.260	3.920	938	327
260	260	260	10,0	17,5	118,0	93,0	14.920	5.130	1.150	395
280	280	280	10,5	18,0	131,0	103,0	19.270	6.590	1.380	471
300	300	300	11,0	19,0	149,0	117,0	25.170	8.560	1.680	571
320	320	300	11,5	20,5	161,0	127,0	30.820	9.240	1.930	616
340	340	300	12,0	21,5	171,0	134,0	36.650	9.690	2.160	646
360	360	300	12,5	22,5	181,0	142,0	43.190	10.140	2.400	676
400	400	300	13,5	24,0	198,0	155,0	57.680	10.820	2.880	721
450	450	300	14,0	26,0	218,0	171,0	79.890	11.720	3.550	781
500	500	300	14,5	28,0	239,0	187,0	107.200	12.620	4.290	842
550	550	300	15,0	29,0	254,0	199,0	136.700	13.080	4.970	827



Normas de cumplimiento IPB

Normas de cumplimiento	
Dimensiones y tolerancias	IRAM-IAS U500-215-2/04
Características mecánicas	IRAM-IAS U500-503/03 Grado F-24 Otro grado consultar
Largos	12 metros Largos especiales consultar
Peso del paquete	2000 kg. aproximadamente

Para todas las medidas, largos y calidad consultar stock y plazo de entregas antes de realizar la compra.

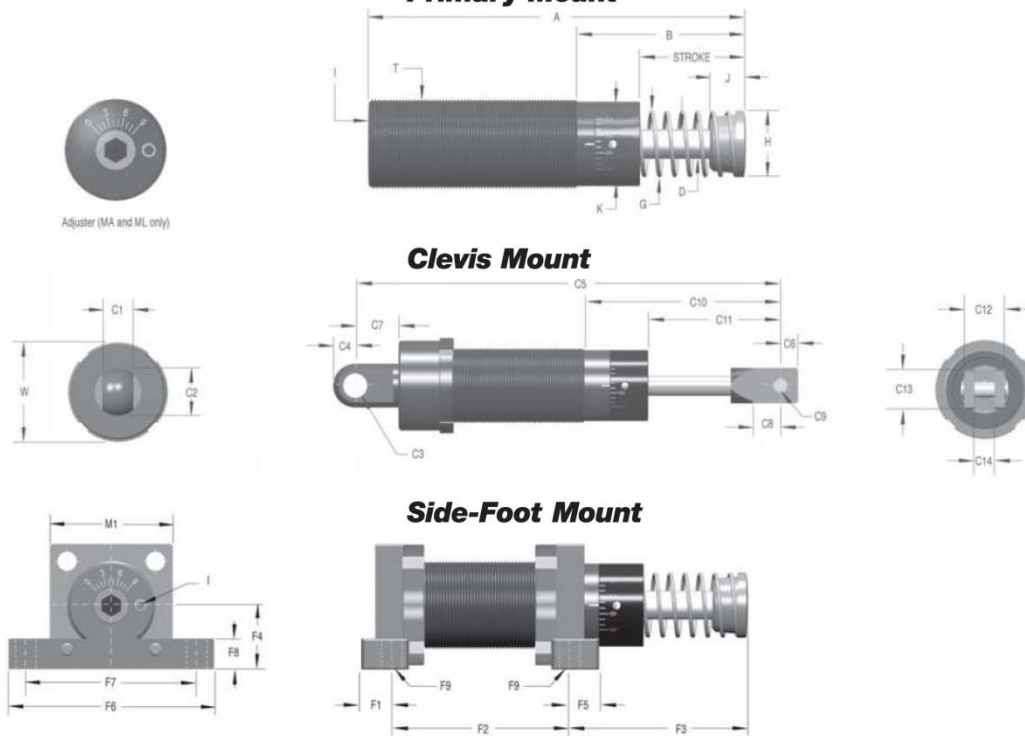


Acindar
Grupo ArcelorMittal

Catalog AU08-1022-1/NA
Magnum Series

Industrial Shock Absorbers
Linear Decelerators

Magnum Series MC/MA/ML 45
Self-Compensating and Adjustable



45 Model Dimensions IN INCHES (MILLIMETERS)															
Model	Stroke	A	B	D	G	H	I*	J	K	T	W	C1	C2	C3	C4
MC, MA, ML 4525	0.91 (23.1)	5.69 (144.5)	1.97 (50)												
MC, MA, ML 4550	1.91 (48.5)	7.69 (195.3)	2.97 (75.4)	0.50 (12.7)	1.36 (34.5)	1.38 (34.9)	1/8 NPT	0.87 (22.1)	1.65 (41.9)	1-3/4-12 M45x1.5	2.25 (57.20)	0.75 (19.1)	1.00 (25.4)	.5005 (12.7)	0.50 (12.7)
MC, MA 4575	2.91 (73.9)	9.69 (246.1)	3.97 (100.8)												
Model	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	F1	F2	F3	F4	F5
MC, MA, ML 4525	7.85 (199.4)					2.57 (65.3)	1.51 (38.4)					3.50 (88.9)	1.94 (49.3)		
MC, MA, ML 4550	9.85 (250.2)	0.50 (12.7)	1.06 (26.9)	0.69 (17.5)	.3755 (9.6)	3.57 (90.7)	2.51 (63.8)	1.00 (25.4)	1.00 (25.4)	.505 (12.8)	0.50 (12.7)	4.38 (111.8)	3.06 (77.7)	1.16 (29.5)	0.37 (9.5)
MC, MA, ML 4575	11.85 (301)					4.57 (116.1)	3.51 (89.2)					5.38 (237.8)	4.06 (103.1)		
Model	F6	F7	F8	F9											
MC, MA, ML 4525															
MC, MA, ML 4550	3.75 (95.3)	3.00 (76.2)	0.56 (14.2)	0.35 (8.9)											
MC, MA 4575															

*For models MAA and MAS 33 the 1/8-27 male fitting is shipped with the shock. MAA and MAS 45 and 64 have pipe plugs.



Catalog AU08-1022-1/NA
Magnum Series

**Industrial Shock Absorbers
Linear Decelerators**

Magnum Series MC/MA/ML 45
Self-Compensating and Adjustable

Specifications...MC Series, Self-Compensating									
Model	We Effective Weight lbs (kg)		E3 Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour)			Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
				E4					
				Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	External Accumulator (Re-circulating)			
MC 4525-1	50-200	(23-91)	3,000 (339)	950,000 (107,000)	1,400,000 (158,000)	1,700,000 (192,000)	15.1-22.8 (67-101)	0.03	2.5 (1.13)
MC 4525-2	170-680	(77-300)							
MC 4525-3	575-2,300	(261-1,043)							
MC 4525-4	1,950-7,800	(885-3,538)							
MC 4550-1	100-400	(45-181)	6,000 (678)	1,000,000 (112,000)	1,700,000 (192,000)	2,200,000 (248,000)	15.1-32.2 (67-143)	0.08	3.0 (1.36)
MC 4550-2	340-1,360	(154-617)							
MC 4550-3	1,150-4,600	(522-2,087)							
MC 4550-4	3,900-15,600	(1,769-7,076)							
MC 4575-1	150-600	(136-544)	9,000 (1,017)	1,300,000 (146,000)	2,000,000 (225,000)	2,500,000 (282,000)	11.7-40.3 (52-179)	0.11	3.5 (1.59)
MC 4575-2	510-2,040	(231-925)							
MC 4575-3	1,730-6,920	(785-3,139)							
MC 4575-4	5,850-23,400	(2,654-10,614)							

Impact velocity range: 0.5 to 16.5 ft/sec (0.15 to 5 m/sec)

Specifications...MA Series, Adjustable									
Model	We Effective Weight lbs (kg)		E3 Energy per Cycle in lbs (Nm)	Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	External Accumulator (Re-circulating)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
MA 4525	95-22,000	(43-9,979)	3,450 (390)	950,000 (107,000)	1,400,000 (158,000)	1,700,000 (192,000)	15.1-22.8 (67-101)	0.03	2.5 (1.13)
MA 4550	150-32,000	(68-14,515)	6,900 (780)	1,000,000 (112,000)	1,700,000 (192,000)	2,200,000 (248,000)	15.1-32.2 (67-143)	0.08	3.0 (1.36)
MA 4575	155-33,000	(70-14,968)	10,350 (1,169)	1,300,000 (146,000)	2,000,000 (225,000)	2,500,000 (282,000)	11.7-40.3 (52-179)	0.11	3.5 (1.59)

Impact velocity range: 0.5 to 16.5 ft/sec (0.15 to 5 m/sec)

Specifications...ML Series, Low Velocity Adjustable									
Model	We Effective Weight lbs (kg)		E3 Energy per Cycle in lbs (Nm)	Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	External Accumulator (Re-circulating)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
ML 4525	N/A	N/A	3,450 (390)	950,000 (107,000)	1,400,000 (158,000)	1,700,000 (192,000)	15.1-22.8 (67-98)	0.03	2.5 (1.13)
ML 4550	N/A	N/A	6,900 (780)	1,000,000 (112,000)	1,700,000 (192,000)	2,200,000 (248,000)	15.1-32.2 (67-143)	0.08	3.0 (1.36)

Impact velocity range: 0.06 to 1.5 ft/sec (0.02 to 0.46 m/sec)

Note: A side port can be adapted to Magnum Series 45 MAA, MLA and MCA models and is a special adder item. A side port adapter ring is molded onto the outer tube and increases the overall diameter by 0.5 inches (12.7 mm) in the area of the ring. The side port centerline is located 1.04 inches (26.4 mm) from the front of the outer tube. Add (-P) to the model ordering code if a side port is desired, see [page 34](#).

Note: Side load not to exceed 5°. Maximum side load depends on application.

Lock nut included with each shock absorber. See [page 51](#) for dimensions.

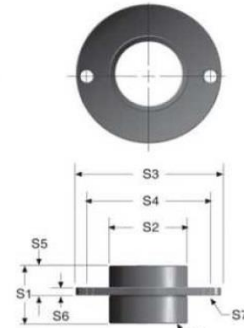


Catalog AU08-1022-1/NA
Magnum Series Group Accessories

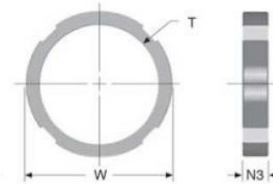
**Industrial Shock Absorbers
Linear Decelerators**

Magnum Series Group Accessories

Flanged Stop Collars IN INCHES (MILLIMETERS)									
Used With	Part #	T	S1	S2	S3	S4	S5	S6	S7
MA 33 ML 33 MC 33	250-0070	1-1/4-12 UNF	2.00 (50.8)	1.50 (38.1)	2.50 (63.5)	2.00 (50.8)	0.88 (22.4)	0.25 (6.4)	0.282 (7.16)
MA 33M ML 33M MC 33M	250-0071	M33x1.5	2.00 (50.8)	1.50 (38.1)	2.50 (63.5)	2.00 (50.8)	0.88 (22.4)	0.25 (6.4)	0.282 (7.16)
MA 36 ML 36 MC 36 MA 36M ML 36M MC 36M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MA 45 ML 45 MC 45	250-0072	1-3/4-12 UN	1.85 (47.0)	2.25 (57.2)	3.25 (82.6)	2.75 (69.6)	0.88 (22.4)	0.25 (6.4)	0.282 (7.16)
MA 45M ML 45M MC 45M	250-0073	M45x1.5	1.85 (47.0)	2.25 (57.2)	3.25 (82.6)	2.75 (69.9)	0.88 (22.4)	0.25 (6.4)	0.282 (7.16)
MA 6450 MA 64100 ML 6425 ML 6450 MC 6450 MC 64100	250-0074	2-1/2-12 UN	2.25 (57.2)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.282 (7.16)
MA 6450M MA 64100M ML 6425M ML 6450M MC 6450M MC 64100M	250-0075	M64x2	2.25 (57.2)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.282 (7.16)
MA 64150 MC 64150	250-0076	2-1/2-12 UN	3.13 (79.4)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.282 (7.16)
MA 64150M MC 64150M	250-0077	M64x2	3.13 (79.4)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.282 (7.16)



Lock Nuts IN INCHES (MILLIMETERS)				
Used With	Part #	T	W	N3
MA 33 ML 33 MC 33	250-0038	1-1/4-12 UN	1.50 (38.1)	0.25 (6.4)
MA 33M ML 33M MC 33M	250-0292	M33x1.5	1.56 (39.6)	0.25 (6.4)
MA 36 ML 36 MC 36	250-0631	1-3/8-12 UNF	1.75 (44.5)	0.25 (6.4)
MA 36M ML 36M MC 36M	250-0537	M36x1.5	1.75 (44.5)	0.25 (6.4)
MA 45 ML 45 MC 45	250-0041	1-3/4-12 UN	2.25 (57.2)	0.37 (9.4)
MA 45M ML 45M MC 45M	250-0297	M45x1.5	2.25 (57.2)	0.37 (9.4)
MA 64 ML 64 MC 64	250-0042	2-1/2-12 UN	3.00 (76.2)	0.37 (9.4)
MA 64M ML 64M MC 64M	250-0301	M64x2	3.00 (76.2)	0.37 (9.4)



One lock nut included with each shock absorber where appropriate.





23435 Industrial Park Drive
Farmington Hills, Michigan 48335
tel: 248.476.0213
fax: 248.476.2470

www.acecontrols.com

Installation Instructions

Magnum Group Shock Absorbers ACE MC 33, 36, 45 and 64 Self-Compensating Series ACE MA, ML 33, 36, 45 and 64 Adjustable Series

Maximum efficiency of operation can be obtained by carefully following these instructions:

GENERAL

Install the shock on a surface of sufficient strength. Align the shock absorber rod end button with the load striking surface.

Guard the shock absorber to protect it from foreign materials such as acids, steam, weld flash, solvents, cutting fluids, dust and debris.

Mount in an area consistent with the operating temperature range of the shock absorber, not to exceed 75° F (24° C) ambient at full energy capacity. To allow maximum heat dissipation, **do not paint the shock absorber**.

Applications using two or more **adjustable shock absorbers** should have the load balanced equally between them.

Note: Self-contained models MC, MCN, MA, MAN, ML and MLN are pre-filled with ATF and are ready for use after proper installation.

STANDARD MOUNTING INSTALLATION (Figures 1, 1A)

Fully screw the shock absorber into the threaded mounting hole. **Tighten the lock nut.** Refer to the Torque Specifications chart, Figure 8, for proper lock nut installation.

For **adjustable models**, orient the adjustment graduations to the desired position by unscrewing the shock absorber no more than a 3/4 turn and then tightening the lock nut.

CAUTION: Insufficient tightening of the lock nut may result in the shock absorber working loose due to structural vibration.

FLANGE MOUNTING INSTALLATION (Figures 2, 2A)

Bolt the flange to the mounting structure. **Assure that the bolts are securely tightened.** Thread shock absorber into flange.

For rear flange mounting (Figure 2), install lock nut securely against flange. For front flange mounting (Figure 2A), install lock nut securely against mounting structure.

Refer to Torque Specifications chart, Figure 8, for proper lock nut installation.

ACE Controls Inc.

World leader in deceleration technology
ISO 9001:2000 Certified

Figure 1...Standard Mounting



Figure 1A...Standard Mounting

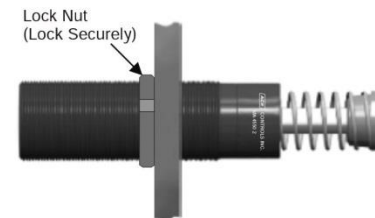
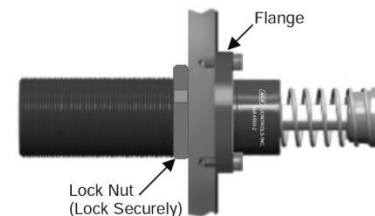


Figure 2...Rear Flange Mounting



Figure 2A...Front Flange Mounting



SIDE-FOOT MOUNT INSTALLATION (Figure 3)

Thread lock nuts onto shock absorber. Thread shock absorber into side-foot mounts. Install lock nuts securely. Bolt side-foot mount assembly to the mounting structure. **Assure that the bolts are securely tightened. In order to prevent movement of the side foot-mount assembly, weld a key into position behind the rear foot bar.**

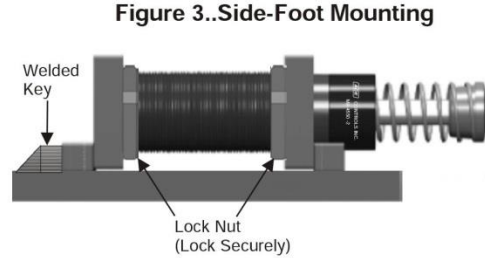


Figure 3...Side-Foot Mounting

CLEVIS MOUNT INSTALLATION (Figure 4)

Fasten the rear clevis and the rod clevis to the mating clevis members of the equipment. Assure that the equipment cannot pull the rod out any farther than the shock absorber stroke will allow.

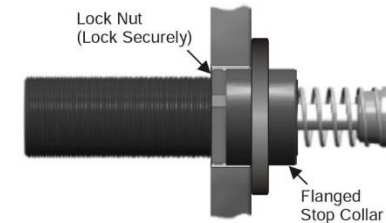


Figure 4...Clevis Mount

FLANGED STOP COLLAR INSTALLATION (Figure 5)

Thread shock absorber into flanged stop collar. Front edge of flanged stop collar is opposite the internal threaded end of flanged stop collar. **Front edge of integral shock absorber stop collar should be directly aligned with front edge of flanged stop collar.** Thread lock nut onto shock absorber. Install lock nut securely against rear surface of flanged stop collar. Bolt flanged stop collar to mounting surface. Horizontal alignment of the bolts is preferred.

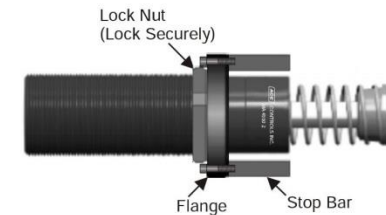
Figure 5...Flanged Stop Collar



ADDING STOP BARS TO FRONT FLANGE MOUNT APPLICATION (Figure 6)

Mount stop bars to flange. Thread shock absorber into flange. **Front edge of stop bars should be directly in line with front edge of stop collar.** Thread lock nut onto shock absorber. Install lock nut securely against rear surface of flange. Refer to the Torque Specifications chart, Figure 8.

Figure 6...Stop Bars



ADJUSTMENT FOR MA, ML 33, 36, 45 AND 64 SERIES (Figure 7)

Proper adjustment is important to the efficient operation of the ACE adjustable shock absorber. All units are preset at the factory at 5. After installation of the shock absorber, cycle the machine a number of times. Turn the front stop collar or the rear adjuster against the scale marked 0 to 9 until optimum deceleration is achieved. (i.e. smooth deceleration throughout the stroke). **If hard impact is experienced at the start of the stroke, turn the adjuster toward 9. If hard set-down is experienced at the end of stroke, turn adjuster toward 0.** If the final setting is less than 2 or greater than 8, a different shock absorber should be utilized. **Be sure to tighten the lock screw, (64 Series models only), on the side of the shock absorber to secure the adjustment setting. Torque the lock screw to 12 ft-lbs. (16 Nm). Failure to do this may result in a shift in the adjustment setting during deceleration. A 5/64 (2 mm) allen/hex bit wrench is required.**

Figure 7...Adjustment



TORQUE SPECIFICATIONS CHART (Figure 8)

Refer to the Torque Specifications chart for the proper torque when installing the shock absorber lock nut.

Figure 8...Torque Specifications

APPLYING APPROPRIATE TORQUE WITHOUT CALIBRATED TOOLING

The following procedure may be utilized if calibrated tooling is not available to torque lock nut. Note: it is assumed that all necessary installation instructions have been followed prior to this procedure.

1. After positioning the shock properly in relation to the accessory (i.e. flange, collar, etc.) or mounting surface, with the proper adhesive (if applicable), finger tighten the lock nut against the accessory or mounting surface until it can no longer be turned.
2. Using appropriate equipment, tighten the lock nut until it rotates 1/8 to 1/4 of a full rotation (45 to 90 degrees) from the finger tight position. ACE has determined that a lock nut secured in this manner meets the torque specifications listed in the chart on the right.

Model	Torque/Lock Nut
MC, MA, ML 33, 36 Series	54-59 ft-lbs (74-81 Nm)
MC, MA, ML 45 Series	167-183 ft-lbs (225-250 Nm)
MC, MA, ML 64 Series	560-610 ft-lbs (755-830 Nm)

Note: flanges, stop bars, flanged stop collars, side-foot mount and clevis mount assemblies are available from ACE Controls directly or through distributors. See the ACE main catalog or visit the ACE web site for stocking distributors.

ACE Form16, MA, ML, MC Magnum