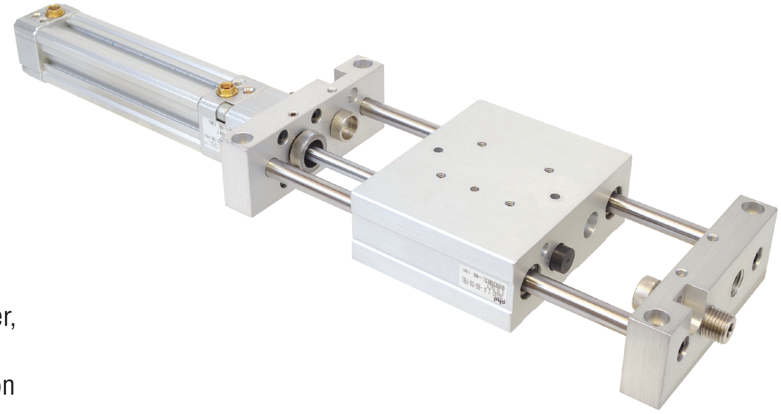
SG



Major Benefits

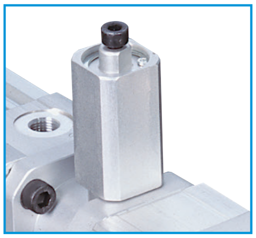
- Long travel, high load
- Standard travel to 36 inches
- Standard travel adjustments
- Units powered by PHD's rugged Series CV Cylinder, now with improved seal & bearing support
- Three position cylinder available as standard option

The cylinder features...

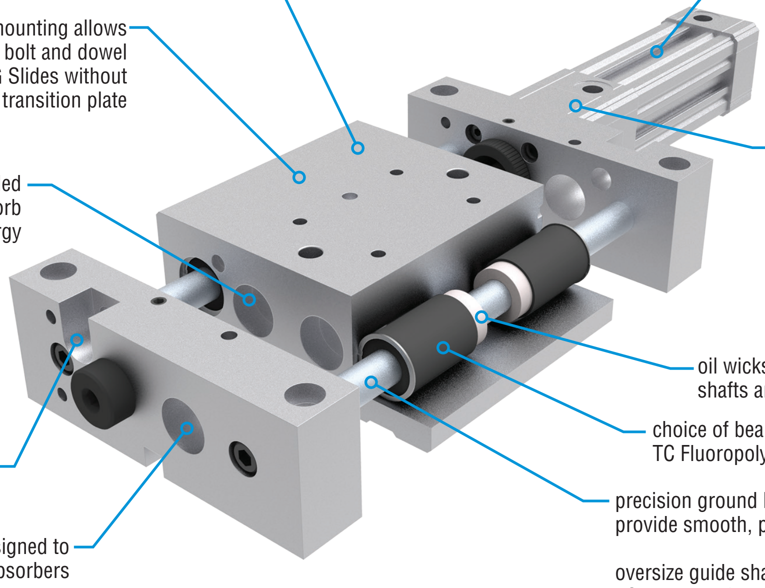
The HUSHCONTROL Advantage

Only PHD Series CV Cylinders are offered with the Hushcontrol Advantage. Hushcontrol is achieved when optional cushions and Port Controls® are ordered with the standard shock pads.

- Superior speed and deceleration control of piston rod and attached loads.
- Significantly lowers noise levels even at high cycle speeds.



Optional Rodlok securely holds a static piston rod in place at any point of stroke desired. Ideal for applications where rod drift is unacceptable due to system leakage, line rupture, or power loss.



TO ORDER SPECIFY:
Product, Series, Type, Design No., Size, Travel, and Options.

S G B E 4 3 x 6 x 3 - DB - M - PB - BB - Q1 - Z1

PRODUCT
S - Slide

SERIES
G - Gantry

TYPE
B - Standard linear ball bushing, standard shaft
C - TC bushing, standard shaft
D - TC bushing, oversize shaft

THREE POSITION UNIT
E - 3 position cylinder (specify only if needed)

DESIGN NO.
4 - Imperial
9 - Metric

SIZE
1 - 19 mm bore cylinder with 8 mm shaft standard, 10 mm shaft oversize
2 - 20 mm bore cylinder with 10 mm shaft standard, 12 mm shaft oversize
3 - 25 mm bore cylinder with 12 mm shaft standard, 16 mm shaft oversize
4 - 32 mm bore cylinder with 16 mm shaft standard, 20 mm shaft oversize
5 - 40 mm bore cylinder with 20 mm shaft standard, 25 mm shaft oversize
6 - 40 mm bore cylinder with 25 mm shaft standard, 30 mm shaft oversize

MID-POSITION TRAVEL
Specify for 3 position units. Travel from retract position 1 to mid-position 2.

SLIDE SIZE	SLIDE TRAVEL IMPERIAL UNITS
41	1" to 12"
42	1" to 12"
43	1" to 16"
44	1" to 20"
45	1" to 24"
46	1" to 36"

Available in 1/4" increments. Total slide travel from retract position 1 to extend position 3.

SLIDE SIZE	SLIDE TRAVEL METRIC UNITS
91	25 mm to 305 mm
92	25 mm to 305 mm
93	25 mm to 405 mm
94	25 mm to 510 mm
95	25 mm to 610 mm
96	25 mm to 915 mm

Available in 5 mm increments. Total slide travel from retract position 1 to extend position 3.

WITH CYLINDER OPTIONS
DB - Cushion controls both direction (Standard in location 1 & 5) (See note 6)
DE - Cushion control extend only (Standard in location 1)
DR - Cushion control retract only (Standard in location 5)
H4 - Cylinder replacement only (See note 5)
H47 - Rodlok cylinder with locking device adaptor (Not available on size 1)
L9 - NPT ports (NPT-standard on imperial units BSPP-standard on metric units)
E - Magnetic piston for radial sensing switches (Available on size 1 only)
M - Magnetic piston for reed and teachable switches on size 1. Magnetic piston for Series 6250 Switches on sizes 2 through 6.
PB - Port controls both directions (Standard locations are 1 & 5, not available on size 1) (See note 6)
PE - Port control extend only (Standard in location 1, not available on size 1)
PR - Port control retract only (Standard in location 5, not available on size 1)
UBxx - Optional port locations (N/A on 3-position units)

Standard ports, cushion controls, and port controls are located in positions 1 & 5. Sizes 2 and 3 use 10-32 [M5] ports when combined with port controls on the same surface.

WITHOUT CYLINDER OPTIONS
H11 - VDMA/ISO cylinder ready 32 and 40 mm bore
H12 - ISO 6432 cylinder ready 19, 20, and 25 mm bore

-H11 and -H12 are available on design number 9 metric units only.

SLIDE OPTIONS
BB - Shock Pad both directions
BE - Shock Pad on extension
BR - Shock Pad on retraction
CB - Proximity Switch ready both ends*
GX - Saddle mounting in position 4
GY - Saddle mounting in position number 1 (Not available on sizes 1, 2, 3 slides)
L4 - Lube fitting in saddle port position 2 and 4
L6 - Lube fitting in saddle port position 3
Q1 - Corrosion resistant guide shafts (ends unplated)
Z1 - Electroless nickel plated ferrous metal parts
*Switches must be ordered separately

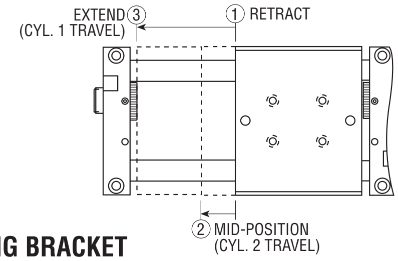
NOTES:
1) All units are shock ready as standard. Shock absorber kits are ordered separately. See option page for complete ordering information.
2) Shock absorber on retraction is not available with UB2x option (port position 2).
3) Shock absorbers are not plated with -Z1 option.
4) Options -BB and -BR are not available with shock absorbers.
5) Rodlok must be ordered separately when are placement cylinder option -H4 is specified with -H47 unit. See option page for Rodlok kits.
6) Cushions and port controls are available on -DB and -PB options only (locations 1 and 5) on 3-position units.

⚠ Options may affect unit length. See dimensional pages and option information details.

SHOCK ABSORBER KITS

SLIDE MODEL	PHD SHOCK ABSORBER NO.
SGxx1, SGxx2	57858-07-x
SGxx3	57858-01-x
SGxx4, SGxx5, SGxx6	57858-02-x

3 POSITION DETAIL



SERIES JC1xDx MAGNETIC SWITCHES (SIZE 1)

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

NOTE: Switches must be ordered separately.

JC1 SWITCH MOUNTING BRACKET

BORE SIZE	BRACKET NO.
1	92100

NOTE: Brackets are ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES (SIZE 1)

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

CORDSET FOR SERIES JC1ST SWITCHES

PART NO.	DESCRIPTION
81284-1-001	M8, 4 pin, Straight Female Connector, 5 meter cable

NOTE: Cordsets are ordered separately.

SPECIFICATIONS	SERIES SG
OPERATING PRESSURE	20 psi min to 150 psi max [1.4 bar min to 10 bar max] air
OPERATING TEMPERATURE	-20° to +180°F [-29° to +82°C]
TRAVEL	Minimum travel +0.090/-0.000 in [+2.3 mm/-0 mm]
3 POSITION	Mid location ±0.039 in [±1 mm]
REPEATABILITY	±0.001 in [±0.025 mm]
VELOCITY	80 in/sec [2 m/sec] max., zero load at 87 psi [6 bar]
LUBRICATION	Factory lubricated for rated life

MODEL	SHAFT DIAMETER		BORE DIAMETER		DIRECTION	EFFECTIVE AREA		BASE WEIGHT		TYPICAL DYNAMIC LOAD	
	in	mm	in	mm		in²	mm²	lb	kg	lb	N
SGBx1	0.315	8	0.750	19.1	EXTEND RETRACT	0.44 0.37	285 236	3.08 + (0.09 x T)	1.40 + (1.61 x T)	40	178
SGCx1	0.315	8						3.07 + (0.09 x T)	1.39 + (1.61 x T)	30	134
SGDx1	0.394	10						3.19 + (0.10 x T)	1.45 + (1.79 x T)	35	156
SGBx2	0.394	10	0.787	20	EXTEND RETRACT	0.49 0.41	314 264	4.96 + (0.14 x T)	2.25 + (2.50 x T)	50	222
SGCx2	0.394	10						4.95 + (0.14 x T)	2.24 + (2.50 x T)	25	111
SGDx2	0.472	12						5.13 + (0.15 x T)	2.33 + (2.68 x T)	50	222
SGBx3	0.472	12	0.984	25	EXTEND RETRACT	0.76 0.64	491 412	6.47 + (0.21 x T)	2.94 + (3.75 x T)	65	289
SGCx3	0.472	12						6.41 + (0.21 x T)	2.91 + (3.75 x T)	60	267
SGDx3	0.630	16						6.76 + (0.29 x T)	3.07 + (5.13 x T)	80	356
SGBx4	0.630	16	1.260	32	EXTEND RETRACT	1.25 1.07	804 691	11.15 + (0.38 x T)	5.06 + (6.80 x T)	160	712
SGCx4	0.630	16						10.96 + (0.38 x T)	4.97 + (6.80 x T)	90	401
SGDx4	0.787	20						11.47 + (0.48 x T)	5.20 + (8.59 x T)	110	490
SGBx5	0.787	20	1.575	40	EXTEND RETRACT	1.95 1.64	1257 1056	15.58 + (0.48 x T)	7.07 + (8.59 x T)	300	1334
SGCx5	0.787	20						15.33 + (0.48 x T)	6.95 + (8.59 x T)	140	623
SGDx5	0.984	25						16.30 + (0.64 x T)	7.39 + (11.36 x T)	175	779
SGBx6	0.984	25	1.575	40	EXTEND RETRACT	1.95 1.64	1257 1056	21.38 + (0.66 x T)	9.70 + (11.70 x T)	500	2224
SGCx6	0.984	25						20.91 + (0.66 x T)	9.48 + (11.70 x T)	225	1001
SGDx6	1.181	30						22.18 + (0.84 x T)	10.06 + (15.07 x T)	275	1224

NOTES:
1) T = Travel Length inches [m]
2) Refer to page 201 or sizing software for stopping capacity of units.
3) Thrust capacity, allowable mass, and dynamic moment capacity must be considered when selecting a slide. Refer to pages 183 to 204 or sizing software for complete sizing and selection information.

SLIDE MODEL	ISO CYLINDER SPECIFICATIONS (OPTION -H11 OR -H12)
SGx91	Ø 16 mm per ISO/6432 Standard
SGx92	Ø 20 mm per ISO/6432 Standard
SGx93	Ø 25 mm per ISO/6432 Standard
SGx94	Ø 32 mm per VDMA 24562/ISO 6431
SGx95	Ø 40 mm per VDMA 24562/ISO 6431
SGx96	Ø 40 mm per VDMA 24562/ISO 6431

NOTES:
1) ISO cylinder per above chart is to be supplied by customer.
2) Cylinder rod extensions are not required. Slide units have an alignment coupler and spacer for each specific unit.

CYLINDER FORCE CALCULATIONS

	Imperial F = P x A	Metric F = 0.1 x P x A
F = Cylinder Force	lbs	N
P = Operating Pressure	psi	bar
A = Effective Area (Extend or Retract)	in²	mm²

MAXIMUM SLIDE VELOCITY

Maximum velocity for Series SG Slides with PHD CV Cylinders is approximately 80 in/sec [2 m/s] on all sizes without port controls. (For specific speeds, consult PHD's Series CV Cylinder pages.) The above figures are based on optimum operating conditions and no load with 87 psi [6 bar] working pressure. For units with -H11 and -H12 options, consult ISO cylinder suppliers.

LUBRICATION

All slides are permanently lubricated at the factory for service under normal conditions. PHD Cylinders can be run using unlubricated air. Use of lubricated air with the cylinders will extend life. Optimum life can be obtained on Series SG Slides by periodic lubrication (every 25 million inches of travel) of the shafts. PHD suggests a lightweight oil. Silicon-based lubricants should **NOT** be used on units with PHD's **TC** bushings.

Application & Sizing Assistance

Use PHD's free online Product Sizing and Application at **www.phdinc.com/apps/sizing**

SLIDE SELECTION

There are three major factors to consider when selecting a slide:

1 BUSHING LOAD CAPACITY

Use the maximum rolling load values from the graphs for the relevant bushing (pages 195 to 200). Linear ball bushing loads shown below are based on a service life of 1000 million inches [25.4 million meters] of slide travel. See charts for TC bushing service life.

2 SHAFT DEFLECTION

Use the Deflection Graphs (pages 195 to 200) to determine if the slide has acceptable deflection for the application.

3 AIR CYLINDER THRUST

Use the effective piston area (see chart on previous page) of the slide's cylinder to determine if thrust is sufficient for the applied load.

The graphs on pages 195 to 200 provide complete sizing information.

See next page for torsional deflection formulas.

MAXIMUM LOADS

SLIDE MODEL	HORIZONTAL LOAD				TORQUE LOAD			
	MAXIMUM STATIC OR SHOCK LOAD		MAXIMUM DYNAMIC LOAD		MAXIMUM STATIC TORQUE		MAXIMUM DYNAMIC TORQUE	
	lb	N	lb	N	in-lb	Nm	in-lb	Nm
SGBx1	77.0	342.5	49	218.0	93.2	10.5	59.3	6.7
SGCx1	505 / (T / 2 + 0.570)	57.3 / (T / 2 + 0.014)	**	**	611 / (T / 2 + 0.570)	1.8 / (T / 2 + 0.014)	torque* / 1.210	torque* / 0.031
SGDx1	986 / (T / 2 + 0.570)	110.6 / (T / 2 + 0.014)	**	**	1194 / (T / 2 + 0.570)	3.4 / (T / 2 + 0.014)	torque* / 1.210	torque* / 0.031
SGBx2	110.0	489.3	56	249.0	164.6	18.6	83.8	9.5
SGCx2	986 / (T / 2 + 0.610)	110.6 / (T / 2 + 0.015)	**	**	1475 / (T / 2 + 0.610)	4.2 / (T / 2 + 0.015)	torque* / 1.496	torque* / 0.038
SGDx2	1700 / (T / 2 + 0.610)	191.6 / (T / 2 + 0.015)	**	**	2543.2 / (T / 2 + 0.610)	7.3 / (T / 2 + 0.015)	torque* / 1.496	torque* / 0.038
SGBx3	230	1025	72	320.3	366.7	41.4	115	13
SGCx3	2834 / (T / 2 + 0.613)	319.9 / (T / 2 + 0.0156)	**	**	4520 / (T / 2 + 0.613)	13 / (T / 2 + 0.0156)	torque* / 1.595	torque* / 0.0405
SGDx3	6739 / (T / 2 + 0.613)	760.4 / (T / 2 + 0.0156)	**	**	10749 / (T / 2 + 0.613)	30.9 / (T / 2 + 0.0156)	torque* / 1.595	torque* / 0.0405
SGBx4	1250	5560	186	827.3	2387	269.7	355	40.1
SGCx4	6739 / (T / 2 + 0.830)	760.4 / (T / 2 + 0.0211)	**	**	12868 / (T / 2 + 0.830)	36.9 / (T / 2 + 0.0211)	torque* / 1.909	torque* / 0.0485
SGDx4	13138 / (T / 2 + 0.830)	1481 / (T / 2 + 0.0211)	**	**	25087 / (T / 2 + 0.830)	72 / (T / 2 + 0.0211)	torque* / 1.909	torque* / 0.0485
SGBx5	2200	9785.6	340	1512.3	4611	521	713	80.6
SGCx5	13138 / (T / 2 + 0.978)	1481 / (T / 2 + 0.0248)	**	**	27537 / (T / 2 + 0.978)	79 / (T / 2 + 0.0248)	torque* / 2.096	torque* / 0.0532
SGDx5	25679 / (T / 2 + 0.978)	2903 / (T / 2 + 0.0248)	**	**	53823 / (T / 2 + 0.978)	154 / (T / 2 + 0.0248)	torque* / 2.096	torque* / 0.0532
SGBx6	2900	12899.2	565	2513.1	6679	754.7	1301	147
SGCx6	25679 / (T / 2 + 0.967)	2903 / (T / 2 + 0.0246)	**	**	59139 / (T / 2 + 0.967)	170 / (T / 2 + 0.0246)	torque* / 2.303	torque* / 0.0585
SGDx6	44396 / (T / 2 + 0.967)	5006 / (T / 2 + 0.0246)	**	**	102244 / (T / 2 + 0.967)	294 / (T / 2 + 0.0246)	torque* / 2.303	torque* / 0.0585

* This formula yields equivalent horizontal load value. See appropriate Load vs. Life graph on pages 195 to 200. T = Travel inch [m]
** See appropriate TC Load vs. Life Graph for maximum loads on pages 195 to 200.

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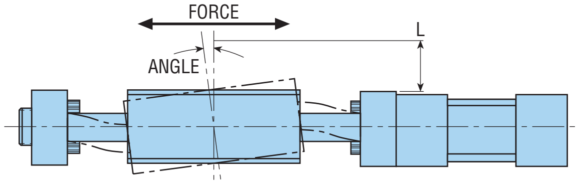
TORSIONAL DEFLECTION CALCULATIONS



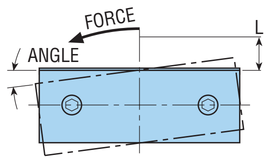
T_Q = Torque in-lb [Nm] (L x Force)
T = Saddle travel inch [mm]
Angle = Degrees

IMPERIAL UNIT

SGBx1, SGCx1	T_Q x (T + 3.543) x 1.65 x 10^{-4} = Angle
SGDx1	T_Q x (T + 3.543) x 6.76 x 10^{-5} = Angle
SGBx2, SGCx2	T_Q x (T + 3.543) x 6.76 x 10^{-5} = Angle
SGDx2	T_Q x (T + 3.543) x 3.261 x 10^{-5} = Angle
SGBx3, SGCx3	T_Q x (T + 3.996) x 3.261 x 10^{-5} = Angle
SGDx3	T_Q x (T + 3.996) x 1.033 x 10^{-5} = Angle
SGBx4, SGCx4	T_Q x (T + 4.744) x 1.033 x 10^{-5} = Angle
SGDx4	T_Q x (T + 4.744) x 4.225 x 10^{-6} = Angle
SGBx5, SGCx5	T_Q x (T + 5.750) x 4.225 x 10^{-6} = Angle
SGDx5	T_Q x (T + 5.750) x 1.731 x 10^{-6} = Angle
SGBx6, SGCx6	T_Q x (T + 6.750) x 1.731 x 10^{-6} = Angle
SGDx6	T_Q x (T + 6.750) x 8.342 x 10^{-7} = Angle

METRIC UNIT

SGBx1, SGCx1	T_Q x (T + 90.0) x 5.75 x 10^{-5} = Angle
SGDx1	T_Q x (T + 90.0) x 2.35 x 10^{-5} = Angle
SGBx2, SGCx2	T_Q x (T + 90.0) x 2.35 x 10^{-5} = Angle
SGDx2	T_Q x (T + 90.0) x 1.136 x 10^{-5} = Angle
SGBx3, SGCx3	T_Q x (T + 101.5) x 1.136 x 10^{-5} = Angle
SGDx3	T_Q x (T + 101.5) x 3.600 x 10^{-6} = Angle
SGBx4, SGCx4	T_Q x (T + 120.5) x 3.600 x 10^{-6} = Angle
SGDx4	T_Q x (T + 120.5) x 1.472 x 10^{-6} = Angle
SGBx5, SGCx5	T_Q x (T + 146.0) x 1.472 x 10^{-6} = Angle
SGDx5	T_Q x (T + 146.0) x 6.031 x 10^{-7} = Angle
SGBx6, SGCx6	T_Q x (T + 171.5) x 6.031 x 10^{-7} = Angle
SGDx6	T_Q x (T + 171.5) x 2.906 x 10^{-7} = Angle



IMPERIAL UNIT

SGBx1, SGCx1	T_Q x (T + 3.543) 3 x 2.22 x 10^{-6} = Tangent of Angle
SGDx1	T_Q x (T + 3.543) 3 x 9.09 x 10^{-7} = Tangent of Angle
SGBx2, SGCx2	T_Q x (T + 3.543) 3 x 7.36 x 10^{-7} = Tangent of Angle
SGDx2	T_Q x (T + 3.543) 3 x 3.56 x 10^{-7} = Tangent of Angle
SGBx3, SGCx3	T_Q x (T + 3.996) 3 x 1.71 x 10^{-8} = Tangent of Angle
SGDx3	T_Q x (T + 3.996) 3 x 6.11 x 10^{-9} = Tangent of Angle
SGBx4, SGCx4	T_Q x (T + 4.744) 3 x 3.62 x 10^{-9} = Tangent of Angle
SGDx4	T_Q x (T + 4.744) 3 x 2.35 x 10^{-9} = Tangent of Angle
SGBx5, SGCx5	T_Q x (T + 5.750) 3 x 1.73 x 10^{-9} = Tangent of Angle
SGDx5	T_Q x (T + 5.750) 3 x 7.48 x 10^{-10} = Tangent of Angle
SGBx6, SGCx6	T_Q x (T + 6.750) 3 x 6.69 x 10^{-10} = Tangent of Angle
SGDx6	T_Q x (T + 6.750) 3 x 3.22 x 10^{-10} = Tangent of Angle

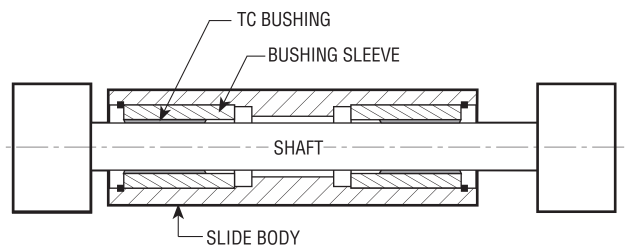
METRIC UNIT

SGBx1, SGCx1	T_Q x (T + 90.0) 3 x 1.20 x 10^{-9} = Tangent of Angle
SGDx1	T_Q x (T + 90.0) 3 x 4.91 x 10^{-10} = Tangent of Angle
SGBx2, SGCx2	T_Q x (T + 90.0) 3 x 3.97 x 10^{-10} = Tangent of Angle
SGDx2	T_Q x (T + 90.0) 3 x 1.92 x 10^{-10} = Tangent of Angle
SGBx3, SGCx3	T_Q x (T + 101.5) 3 x 9.23 x 10^{-12} = Tangent of Angle
SGDx3	T_Q x (T + 101.5) 3 x 3.30 x 10^{-12} = Tangent of Angle
SGBx4, SGCx4	T_Q x (T + 120.5) 3 x 1.96 x 10^{-12} = Tangent of Angle
SGDx4	T_Q x (T + 120.5) 3 x 1.27 x 10^{-12} = Tangent of Angle
SGBx5, SGCx5	T_Q x (T + 146.0) 3 x 9.34 x 10^{-13} = Tangent of Angle
SGDx5	T_Q x (T + 146.0) 3 x 4.04 x 10^{-13} = Tangent of Angle
SGBx6, SGCx6	T_Q x (T + 171.5) 3 x 3.61 x 10^{-13} = Tangent of Angle
SGDx6	T_Q x (T + 171.5) 3 x 1.74 x 10^{-13} = Tangent of Angle

PHD'S TC BUSHING

PHD offers the unique **TC** bushings as an alternative to traditional linear ball bushings. The **TC** bushings offer the following advantages.

- **TC** bushings are maintenance free and self lubricating.
- The thin bushing design permits oversize shafts to be used in the slide body, saving space and decreasing shaft deflection.
- The ability to carry static loads up to 2 times greater than traditional linear bushings.
- Can be used in harsh environments where dirt, grit, metal particles, and metal cutting liquids destroy other bushings.



- **TC** bushings are almost impervious to static shock loads because there are no ball bushings to damage or to brinell the shafts.
- Slides with PHD's **TC** bushings cost less than units with traditional ball bushings.

FRICTION

In horizontal applications, a slide with **TC** bushing requires a higher breakaway pressure than a linear ball bushing.

Breakaway pressure for linear ball bushing = 20 psi [1.38 bar] at zero load.

Approximate breakaway pressure for **TC** bushings is calculated as follows:
psi = [(L x 0.15) / A] + 20   **Bar** = [(L x 0.15) / A] + 1.38

L = Load on saddle lb [kg]
A = (SGCx1, SGDx1) = 0.370 [2.36]
A = (SGCx2, SGDx2) = 0.410 [2.64]
A = (SGCx3, SGDx3) = 0.640 [4.12]
A = (SGCx4, SGDx4) = 1.07 [6.91]
A = (SGCx5, SGDx5) = 1.64 [10.56]
A = (SGCx6, SGDx6) = 1.64 [10.56]

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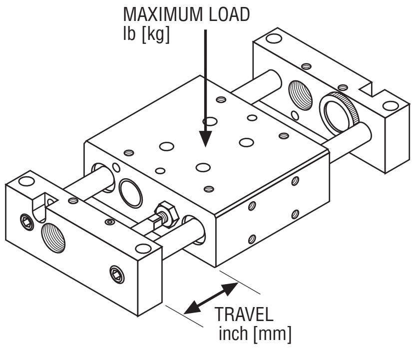
MAXIMUM ROLLING LOAD & DEFLECTION GRAPHS

The following graphs are designed to provide a quick and easy method of sizing and comparing each Series SG Slide. Maximum load versus travel is shown with various deflection curves for determining shaft deflection for the application. The linear ball bushing load ratings shown are derated by a factor of 1.2 from the bearing manufacturer's ratings to provide a design safety factor. Consult PHD for applications which exceed maximum load ranges shown. Maximum loads for linear ball bushings are based on a service life of 1000 million inches [25.4 million meters] of linear travel. See graphs for TC bushing service life.

The deflection figures given in these graphs are based on the effect of external loads. Shaft straightness, shaft weight, and bearing alignment will affect the accuracy of the saddle location. For torsional deflection calculations, see previous page.

Consult PHD for applications requiring high precision saddle location.

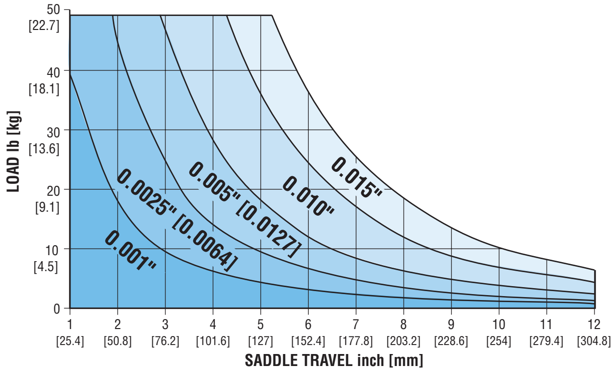
NOTE: Weight scales change from graph to graph for maximum clarity. Deflections shown are theoretical and reflect the performance of the unit at mid-travel. Deflections at ends of travel will be greatly reduced.



Horizontal load values are based on the load centered on the saddle as shown.

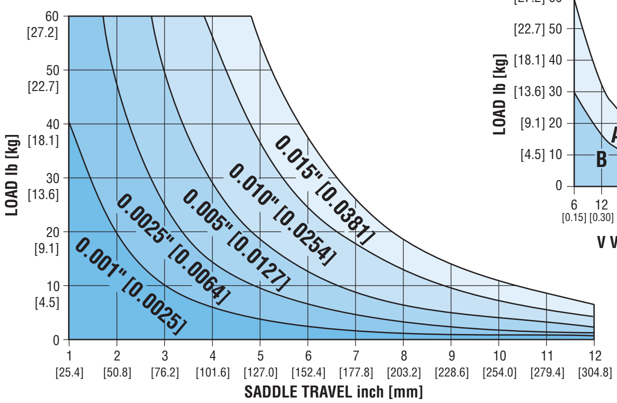
SGBx1 WITH LINEAR BALL BUSHINGS

LOAD CAPACITY AND DEFLECTION

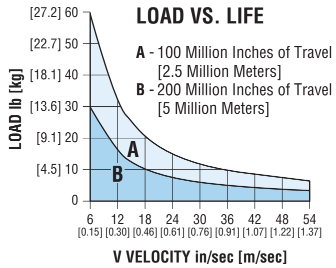


SGCx1 WITH PHD TC BUSHINGS

DEFLECTION

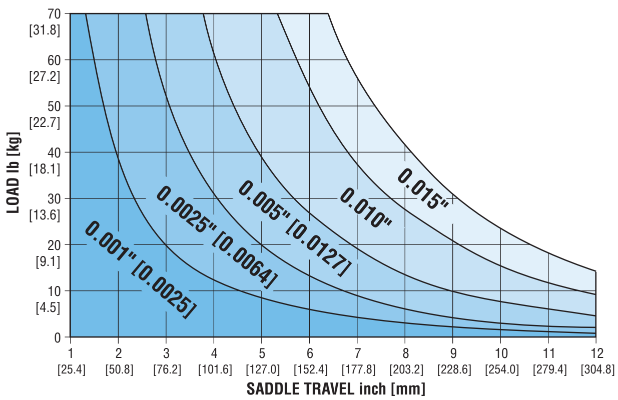


LOAD VS. LIFE

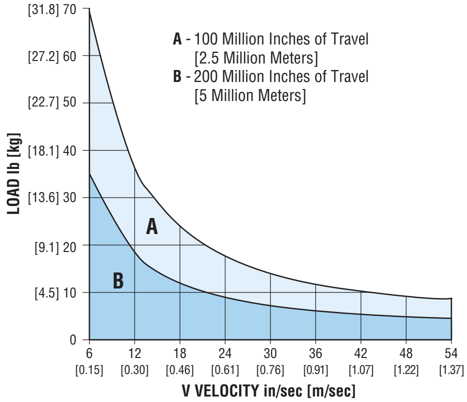


SGDx1 WITH PHD TC BUSHINGS AND OVERSIZE SHAFTS

DEFLECTION



LOAD VS. LIFE

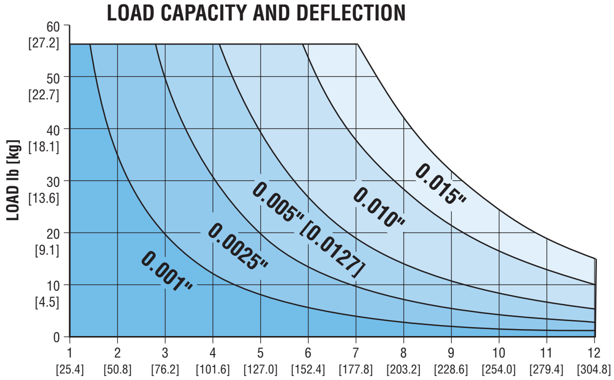


MAXIMUM ROLLING LOAD & DEFLECTION GRAPHS

NOTE: Weight scales change from graph to graph for maximum clarity. Deflections shown are theoretical and reflect the performance of the unit at mid-travel. Deflections at ends of travel will be greatly reduced.

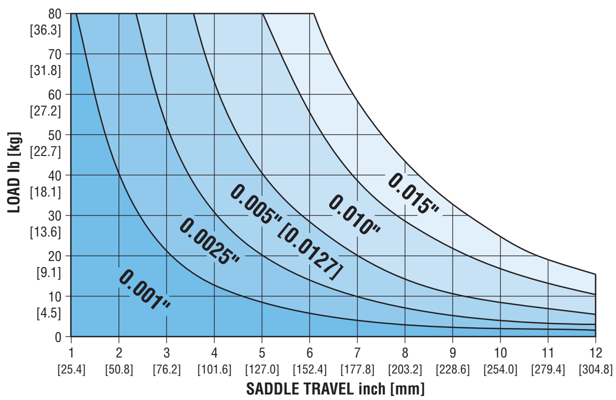
SGBx2 WITH LINEAR BALL BUSHINGS

LOAD CAPACITY AND DEFLECTION

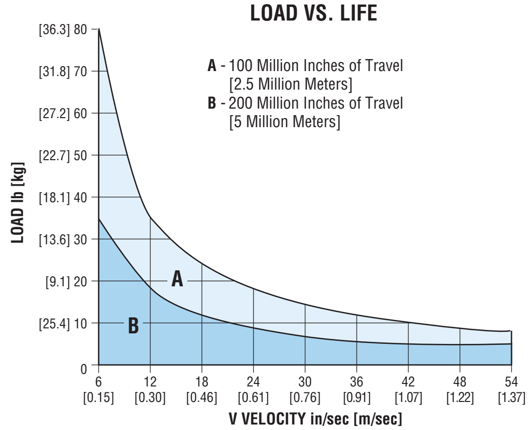


SGCx2 WITH PHD TC BUSHINGS

DEFLECTION

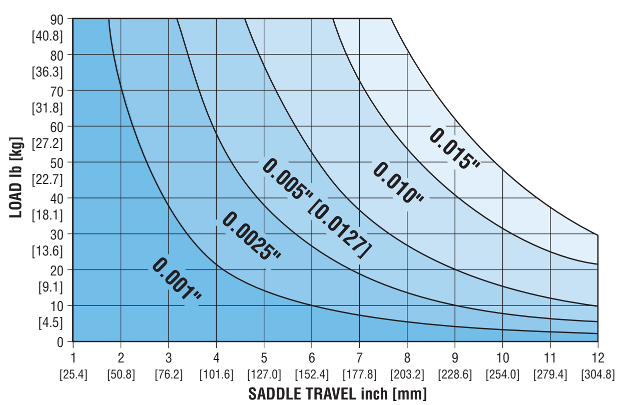


LOAD VS. LIFE

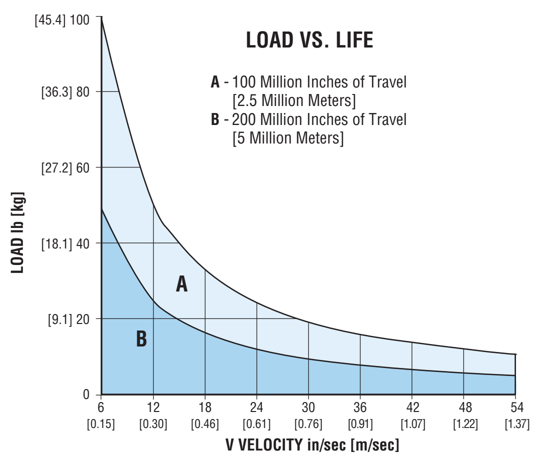


SGDx2 WITH PHD TC BUSHINGS AND OVERSIZE SHAFTS

DEFLECTION



LOAD VS. LIFE



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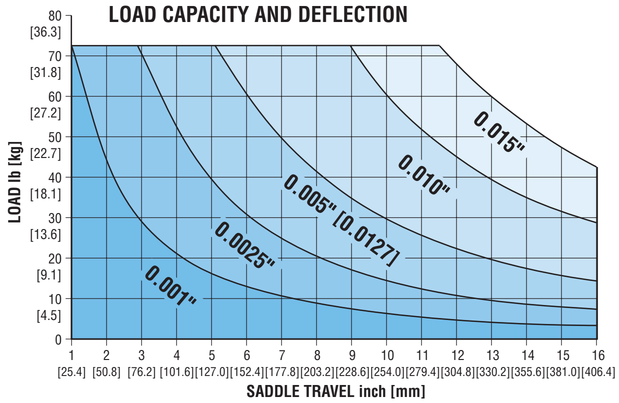
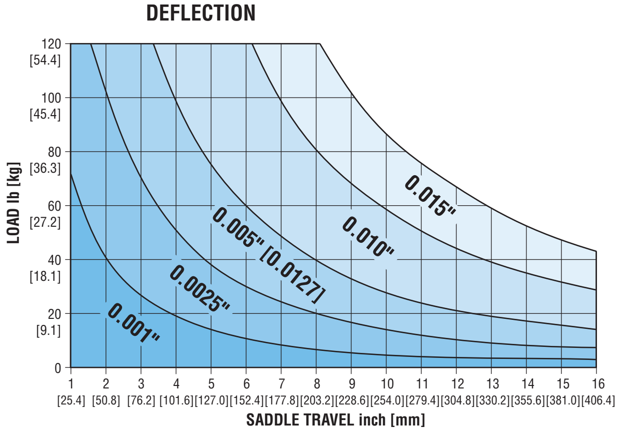
MAXIMUM ROLLING LOAD & DEFLECTION GRAPHS

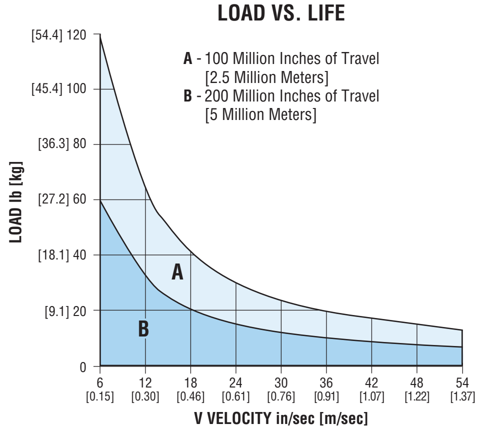
NOTE: Weight scales change from graph to graph for maximum clarity. Deflections shown are theoretical and reflect the performance of the unit at mid-travel. Deflections at ends of travel will be greatly reduced.

SGBx3 WITH LINEAR BALL BUSHINGS

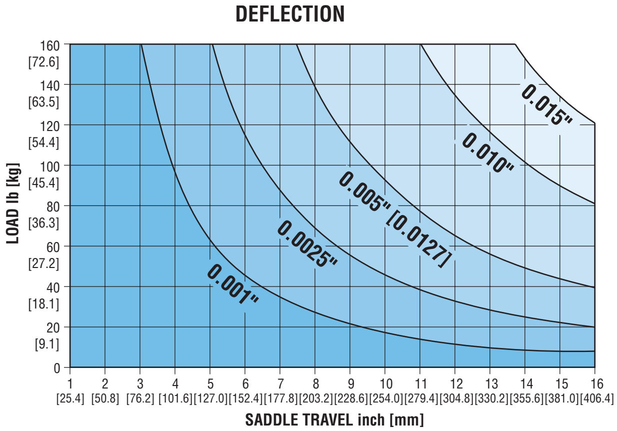


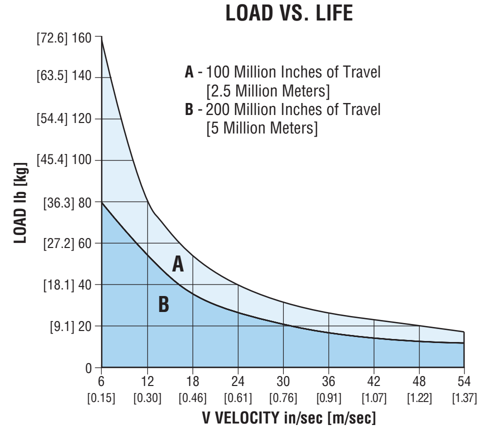
SGCx3 WITH PHD TC BUSHINGS





SGDx3 WITH PHD TC BUSHINGS AND OVERSIZE SHAFTS





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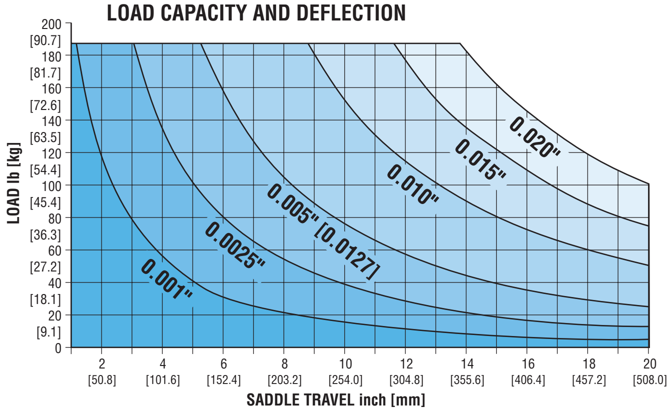
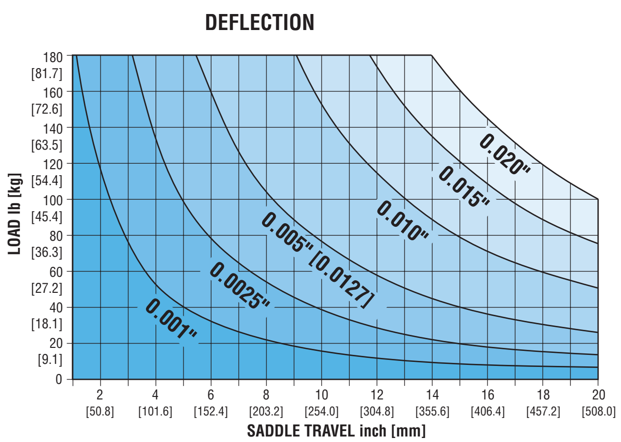
MAXIMUM ROLLING LOAD & DEFLECTION GRAPHS

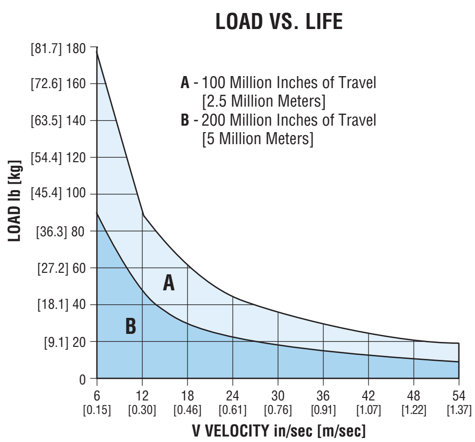
NOTE: Weight scales change from graph to graph for maximum clarity. Deflections shown are theoretical and reflect the performance of the unit at mid-travel. Deflections at ends of travel will be greatly reduced.

SGBx4 WITH LINEAR BALL BUSHINGS

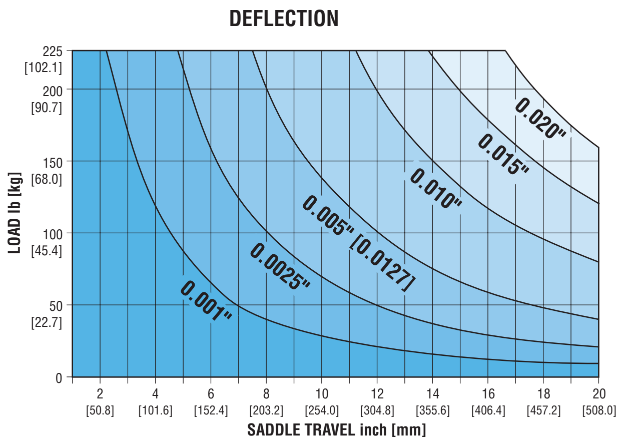


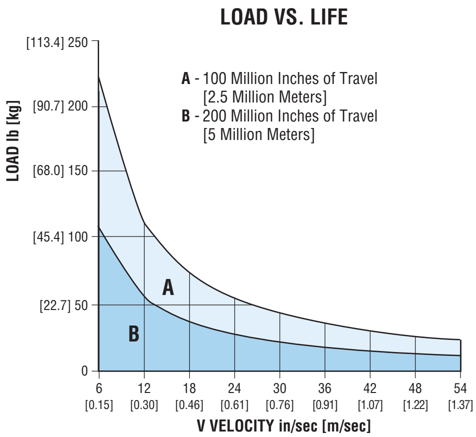
SGCx4 WITH PHD TC BUSHINGS





SGDx4 WITH PHD TC BUSHINGS AND OVERSIZE SHAFTS

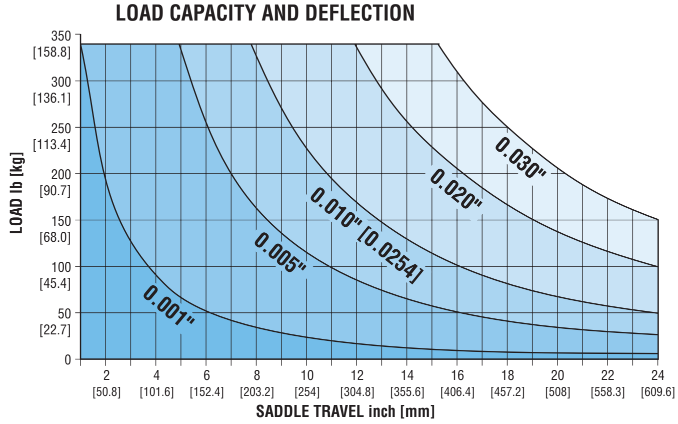




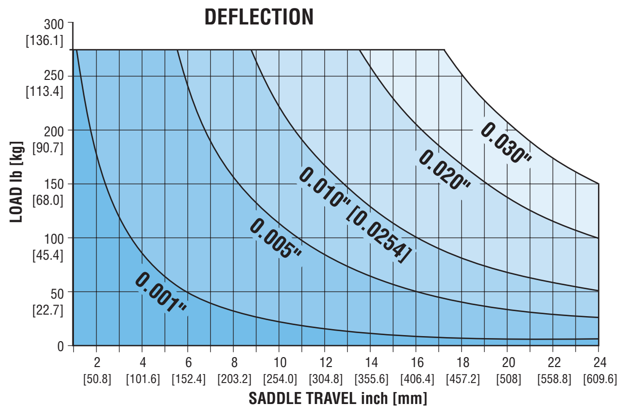
MAXIMUM ROLLING LOAD & DEFLECTION GRAPHS

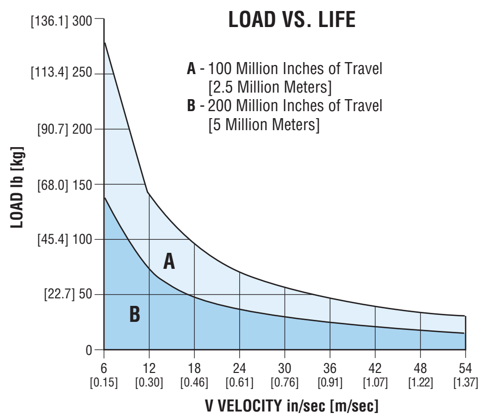
NOTE: Weight scales change from graph to graph for maximum clarity. Deflections shown are theoretical and reflect the performance of the unit at mid-travel. Deflections at ends of travel will be greatly reduced.

SGBx5 WITH LINEAR BALL BUSHINGS

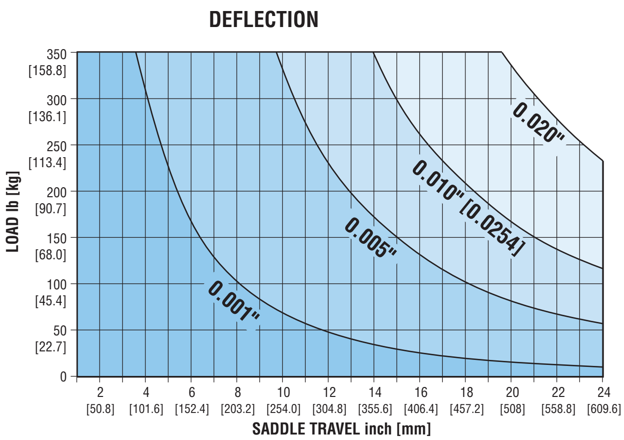


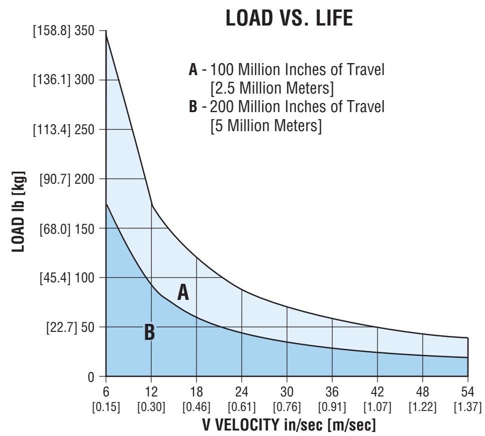
SGCx5 WITH PHD TC BUSHINGS





SGDx5 WITH PHD TC BUSHINGS AND OVERSIZE SHAFTS



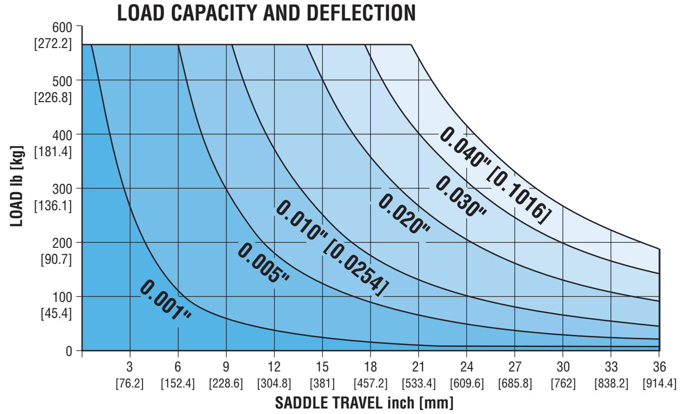


MAXIMUM ROLLING LOAD & DEFLECTION GRAPHS

NOTE: Weight scales change from graph to graph for maximum clarity. Deflections shown are theoretical and reflect the performance of the unit at mid-travel. Deflections at ends of travel will be greatly reduced.

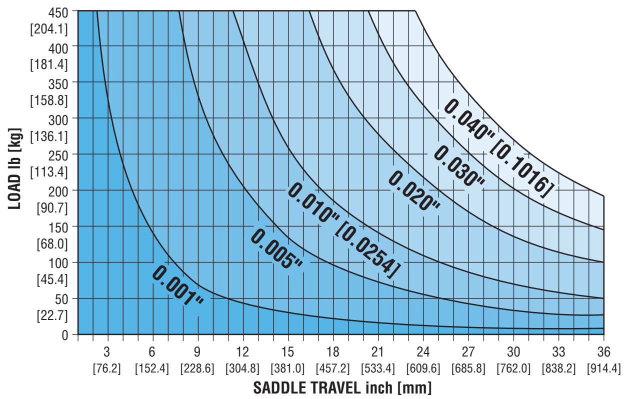
SGBx6 LOAD DEFLECTION

LOAD CAPACITY AND DEFLECTION

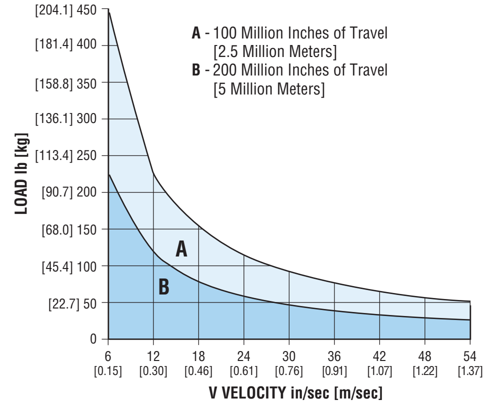


SGCx6 WITH TC BUSHINGS

DEFLECTION

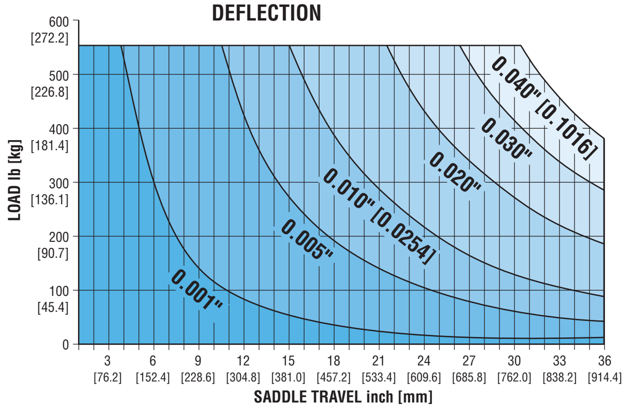


LOAD VS. LIFE

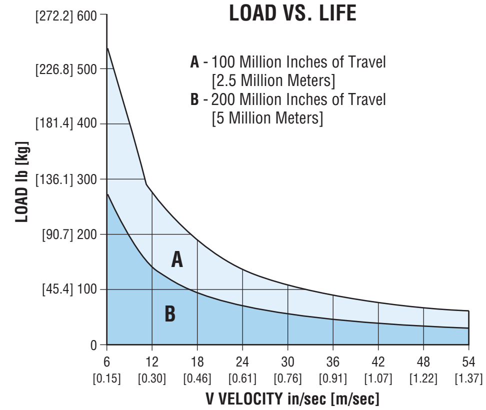


SGDx6 WITH PHD TC BUSHINGS AND OVERSIZE SHAFTS

DEFLECTION



LOAD VS. LIFE



STOPPING CAPACITY

To determine stopping capacity:
Calculate total moving weight.
From Table 1, determine saddle weight (W_M).
Multiply the travel by the travel adder + saddle weight

Example for SGB23 x 10 [SGB63 x 100]:
W_M = [10 x 0.034] + 3.50 = 3.84 lb
[W_M = (100 x 6.1 x 10-4) + 1.59 = 1.65 kg]

Add W_M to attached load (payload) = Total Moving Weight [W_TM]
3.84 + 5.0 = 8.84 lb [1.65 + 2.27 = 3.92 kg]

Using the Kinetic Energy Graphs below, plot the total moving weight and impact velocity. If the value is less than slide with cylinder, shock pad, or travel adjustment curves, that type of deceleration is adequate. If it is greater than these curves, hydraulic shock absorbers are required.

To determine the correct hydraulic shock, complete the calculation on the next page.

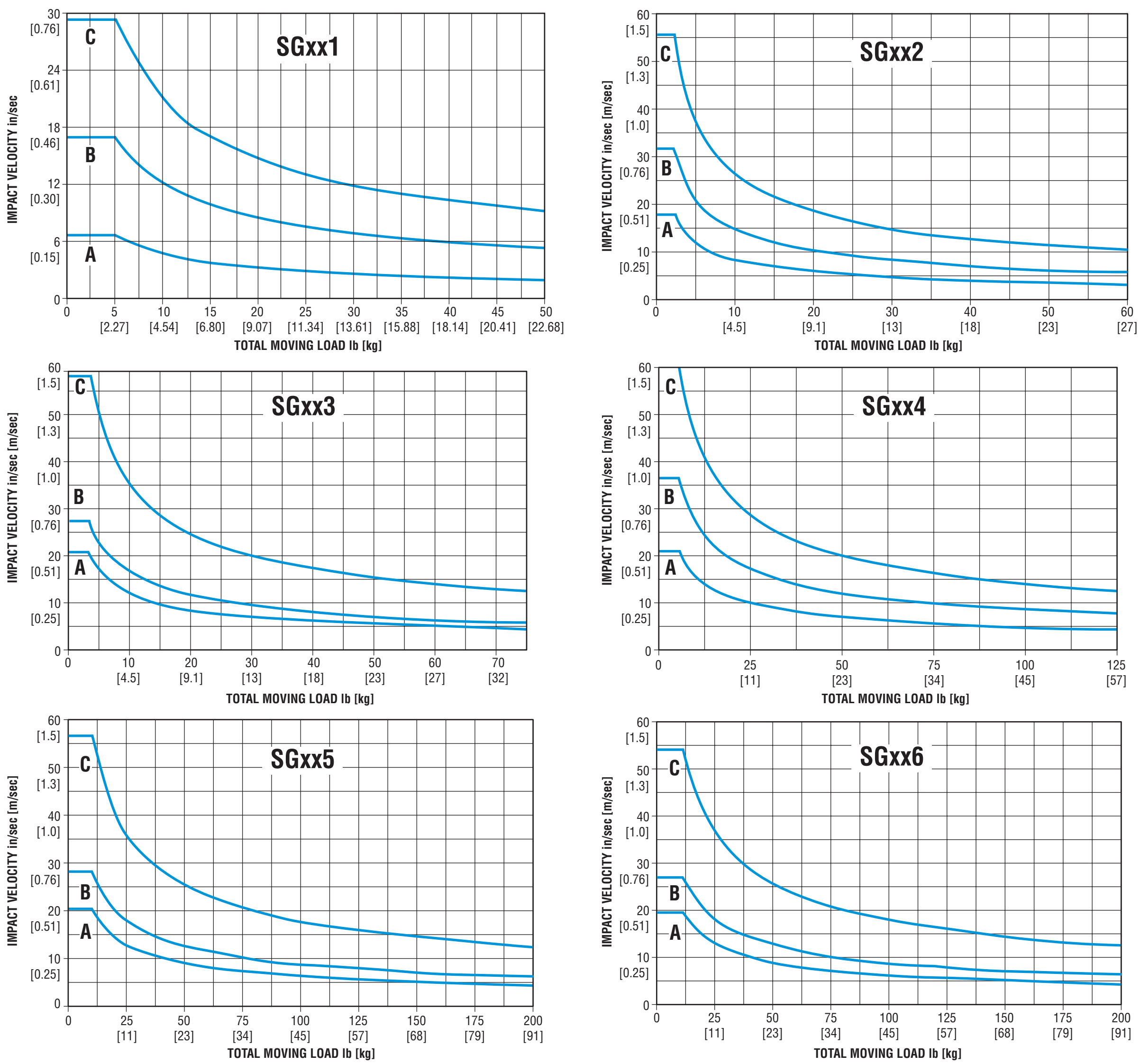
PHD suggests hydraulic shock absorbers for all applications where the center of gravity of the payload is off the slide centerline more than 2 inches [50 mm] travelling at speeds greater than 10 in/sec [0.25 m/sec].

TABLE 1

SLIDE MODEL	SADDLE WEIGHT		TRAVEL ADDER		CYL. BORE (PHD)		CYL. BORE (H11/H12)
	lb	kg	lb/in	kg/mm	in	mm	mm
SGxx1	1.39	0.63	0.022	3.9 x 10^{-4}	0.75	19	16
SGxx2	2.16	0.98	0.022	3.9 x 10^{-4}	0.787	20	20
SGxx3	3.50	1.59	0.034	6.1 x 10^{-4}	0.984	25	25
SGxx4	5.40	2.45	0.063	1.1 x 10^{-3}	1.260	32	32
SGxx5	8.50	3.86	0.087	1.6 x 10^{-3}	1.575	40	40
SGxx6	11.0	4.99	0.087	1.6 x 10^{-3}	1.575	40	40

Moving weight adder for slide kinetic energy calculation includes cylinder rod.

MAXIMUM KINETIC ENERGY GRAPHS



A = slide with cylinder, **B** = slide with cylinder with shock pad, **C** = slide with cylinder with cushions

SLIDE MODEL	PHD SHOCK ABSORBER NO.	ET TOTAL ENERGY/CYCLE		ETC TOTAL ENERGY/HOUR		FD PROPELLING FORCE		S SHOCK STROKE	
		in-lb	Nm	in-lb	Nm	lb	N	in	mm
1	57858-07-x (1, 2, 3)	65	7.3	300000	33900	120	530	0.63	16
2	57858-07-x (1, 2, 3)	80	9.0	300000	33900	120	530	0.63	16
3	57858-01-x	198	22	400000	45000	200	890	0.75	19
4	57858-02-x (1, 2, 3)	300	34	600000 800000	67800 90400	350 500	1550 2220	1.00	25
5	57858-02-x (1, 2, 3)	350	40	600000 800000	67800 90400	350 500	1550 2220	1.00	25
6	57858-02-x (1, 2, 3)	380	43	600000 800000	67800 90400	350 500	1550 2220	1.00	25

SHOCK ABSORBER SIZING CALCULATION:

Follow the next six steps to size shock absorbers.

Step 1: Identify the following parameters.
These must be known for all energy absorption calculations. Variations or additional information may be required in some cases.

A. The total moving weight (W_TM) to be stopped in lb [kg].
B. The slide velocity (V) at impact with the shock absorber in ft/sec [m/sec].
C. External propelling force (F_D) in lb [N].
D. Number of cycles per hour in in-lb/hr [Nm/hr].
E. Orientation of the application's motion (i.e. horizontal or vertical application). See next two pages.

Step 2: Calculate the kinetic energy of the total moving weight.
E_K in-lb = V^2 x W_TM x 0.2
[EK Nm = (W_TM / 2) x V^2]

Use Shock Absorber Specifications Chart to select a shock absorber with total energy (E_T) capacity greater than the value just calculated.

Step 3: Calculate the propelling force (F_D).
Horizontal application: F_D = 0.785 x d^2 x P [F_D = 0.0785 x d^2 x P]
Vertical application: F_D = (0.785 x d^2 x P) + W_TM
[F_D = (0.0785 x d^2 x P) + (9.8 x W_TM)]

Use Shock Absorber Specifications Chart to verify that the selected unit has an F_D capacity greater then the value just calculated. If not, select a larger shock absorber or slide.

Calculate the work energy input (E_W) from any external (propelling) forces acting on the load, using the stroke of the shock absorber selected. E_W = F_D x S

Step 4: Calculate the total energy. E_T = E_K + E_W

Use Shock Absorber Specifications Chart to verify that the selected unit has an E_T capacity greater then the value just calculated. If not, select a larger shock absorber or slide.

Step 5: Calculate the total energy that must be absorbed per hour (E_TC). E_TC = E_T x C

Use Shock Absorber Specifications Chart to verify that the selected unit has an E_TC capacity greater then the value just calculated. If not, select a larger shock absorber or slide.

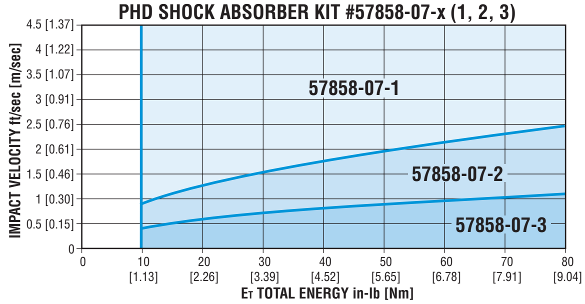
Step 6: Determine the damping constant for the selected shock absorber. Using the appropriate Shock Absorber Performance Graph, locate the intersection point for impact velocity (V) and total energy (E_T). The shaded area (-1, -2, or -3) that the point falls in is the correct damping constant for the application.

SYMBOLS DEFINITIONS

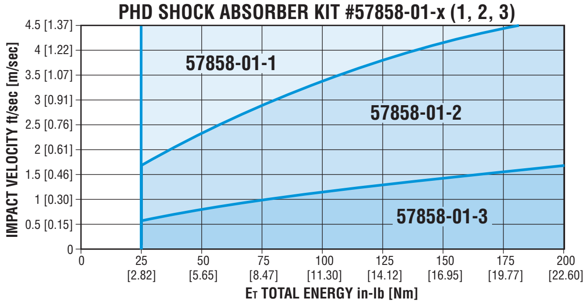
C = Number of cycles per hour
d = Cylinder bore diameter inch [mm]
E_K = Kinetic energy in-lb [Nm]
E_T = Total energy per cycle, E_K + E_W in-lb [Nm]
E_TC = Total energy per hour in-lb/hr [Nm/hr]
E_W = Work or drive energy in-lb [Nm]
F_D = Propelling force lb [N]
P = Operating pressure psi [bar]
S = Stroke of shock absorber inch [mm]
V = Impact velocity ft/sec [m/sec]
W_TM = Total moving weight lb [kg]

SHOCK ABSORBER PERFORMANCE GRAPHS

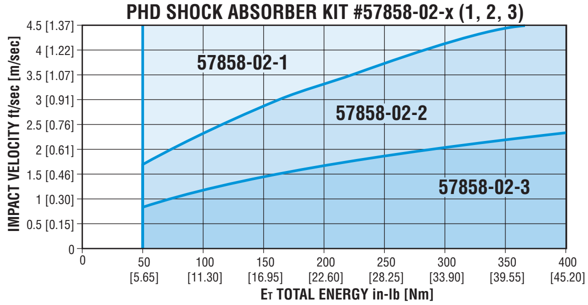
PHD SHOCK ABSORBER KIT #57858-07-x (1, 2, 3)



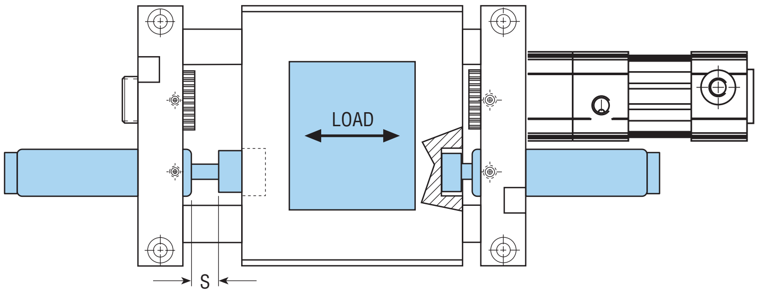
PHD SHOCK ABSORBER KIT #57858-01-x (1, 2, 3)



PHD SHOCK ABSORBER KIT #57858-02-x (1, 2, 3)



SIZING EXAMPLE: (IMPERIAL ONLY)



HORIZONTAL APPLICATION

Step 1: Application Data

Example: SGB45 x 18 inch travel and 22 lb payload

(W_TM) Weight = 32 lb (Total Moving Weight)
(V) Velocity = 3 ft/sec (Speed of Travel)
(d) Cylinder Bore Diameter = 1.574
(P) Operating Pressure = 80 psi
(C) Cycles/Hr = 800 c/hr

W_M = 8.50 + (0.087 x 18 in)
W_M = 10.0 lb
W_TM= 10.0 + 22.0
W_TM= 32.0 lb

Step 2: Calculate kinetic energy.

E_K = V^2 x W_TM x 0.2
E_K = 362 x 32 x 0.2
E_K = 57.6 in-lb

Select Shock Absorber #57858-02-x, because 57.6 < E_T in Shock Absorber Specifications Chart.

Step 3: Calculate work energy.

F_D = Effective Piston Area x P (See page 192)
F_D = 1.95 x 80
F_D = 156 in-lb

Since 156 is less than F_D in Shock Absorber Specifications Chart, proceed.

E_W = F_D x S
E_W = 156 x 1.00
E_W = 156 in-lb

Step 4: Calculate total energy.

E_T = E_K + E_W
E_T = 57.6 + 156
E_T = 213.6 in-lb

Since 213.6 is less than E_T in Shock Absorber Specifications Chart, proceed.

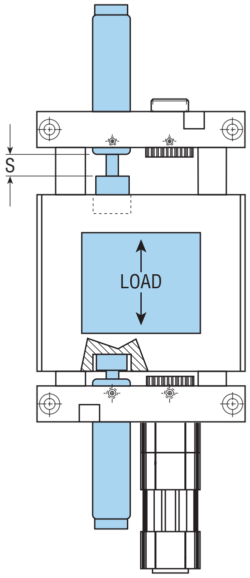
Step 5: Total energy absorbed per hour

E_TC = E_T x C
E_TC = 213.6 x 800
E_TC = 170880 in-lb/hr

Since 170880 is less than E_TC in Shock Absorber Specifications Chart, proceed.

Step 6: Choose proper damping constant for correct shock absorber on Shock Absorber Performance Graphs, page 202.
#57858-02-2 is the correct unit for the application.

SIZING EXAMPLE: (IMPERIAL ONLY)



VERTICAL APPLICATION

Step 1: Application Data

Example: SGB43 x 8 inch travel with an 8 lb payload

(W_TM) Weight = 11.77 lb (Total Moving Weight)
(V) Velocity = 3 ft/sec (Speed of Travel)
(d) Cylinder Bore Diameter = 0.984
(P) Operating Pressure = 80 psi
(C) Cycles/Hour = 600 c/hr

Step 2: Calculate kinetic energy.

E_K = $V^2 \times W_TM \times 0.2$
E_K = 32 x 11.77 x 0.2
E_K = 21.2 in-lb

Select Shock Absorber #57858-01-x, because 21.2 < E_T in Shock Absorber Specifications Chart.

Step 3: Calculate work energy. (RETRACT)

F_D = (Effective piston area x P) + W_TM (See page 190)
F_D = 51.2 + 11.77
F_D = 62.97 in-lb

Since 62.97 is less than F_D in Shock Absorber Specifications Chart, proceed.

E_W = F_D x S
E_W = 62.97 x 0.75
E_W = 47.2 in-lb

Step 4: Calculate total energy.

E_T = $E_K + E_W$
E_T = 21.2 + 47.2
E_T = 68.4 in-lb

Since 68.4 is less than E_T in Shock Absorber Specifications Chart, proceed.

Step 5: Total energy absorbed per hour

E_TC = E_T x C
E_TC = 68.4 x 600
E_TC = 41040 in-lb/hr

Since 41040 is less than E_TC in Shock Absorber Specifications Chart, proceed.

Step 6: Choose proper damping constant for correct shock absorber on Shock Absorber Performance Graphs, page 202.
#57858-01-1 is the correct unit for this application.

Step 3: Calculate work energy. (EXTEND)

F_D = (Effective piston area x P) - W_TM (See page 192)
F_D = 60.8 - 11.77
F_D = 49.03 in-lb

Since 49.03 is less than F_D in Shock Absorber Specifications Chart, proceed.

EW = F_D x S
EW = 49.03 x 0.75
EW = 36.8 in-lb

Step 4: Calculate total energy.

E_T = $E_K + E_W$
E_T = 21.2 + 36.8
E_T = 58 in-lb

Since 58 is less than E_T in Shock Absorber Specifications Chart, proceed.

Step 5: Total energy absorbed per hour

E_TC = E_T x C
E_TC = 58 x 600
E_TC = 34800 in-lb/hr

Since 34800 is less than E_TC in Shock Absorber Specifications Chart, proceed.

Step 6: Choose proper damping constant for correct shock absorber on Shock Absorber Performance Graphs, page 202.
#57858-01-1 is the correct unit for this application.

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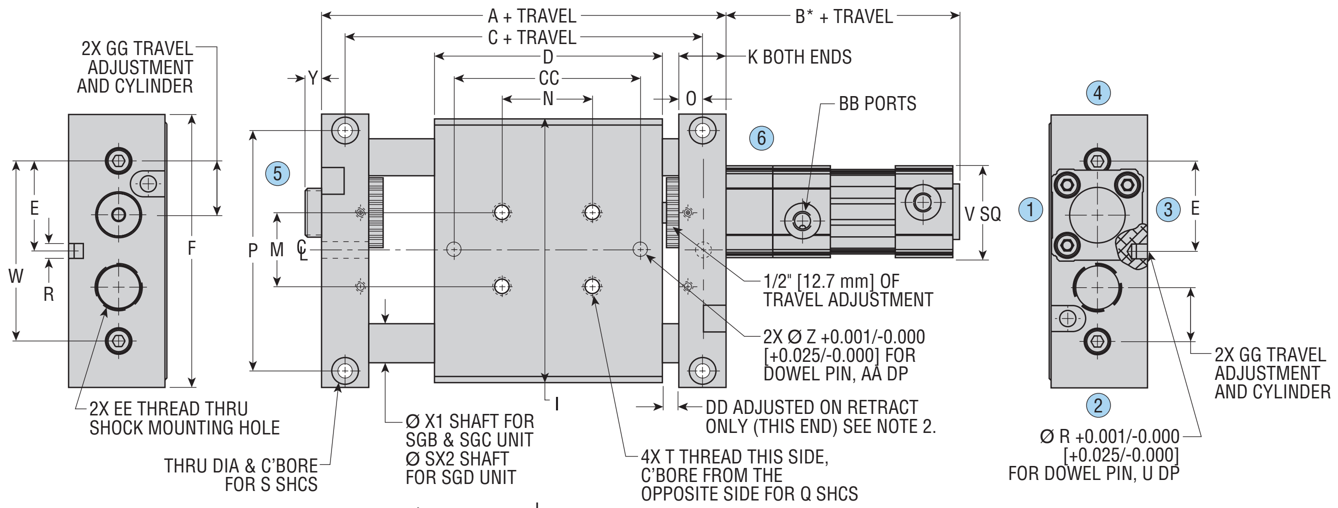
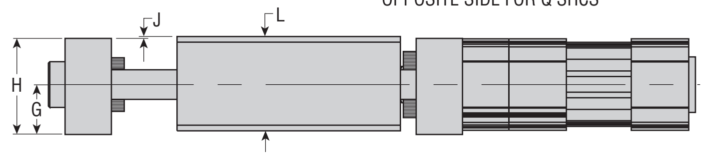
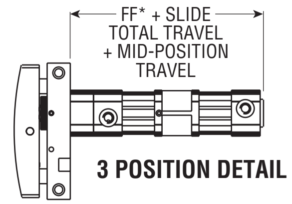






3 POSITION DETAIL

NOTES:
1) *ADD 0.500 [12.7 mm] TO DIMENSION "B" & "FF" FOR EACH CUSHION ON THE SGx41, 81 ONLY
2) DUE TO TRAVEL TOLERANCE ALLOWANCES, DIMENSION "DD" WILL NOT BE THE SAME ON BOTH ENDS OF UNIT.
3) ALL DIMENSIONS ARE CENTERED ON THE CENTERLINE OF THE SLIDE UNLESS OTHERWISE SPECIFIED.
4) CIRCLED NUMBERS INDICATE POSITION.
5) METRIC INFORMATION SHOWN IN [ ].

IMPERIAL [METRIC]	PHD BORE [ISO BORE]	LETTER DIMENSION																	
		A	B*	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
SGx41 [SGx91]	3/4 [19]	5.729 [145.5]	3.622 [92]	4.981 [126.5]	3.543 [90]	1.2106 [30.75]	3.661 [93]	0.688 [17.5]	1.259 [32]	3.543 [90]	0.039 [1]	0.748 [19]	1.220 [31]	1.358 [34.5]	1.516 [38.5]	0.374 [9.5]	3.130 [79.5]	#6 [M4]	0.1879 [5]	1/4 [M6]
SGx42 [SGx92]	0.787 [20]	5.729 [145.5]	3.366 [85.5]	4.981 [126.5]	3.543 [90]	1.4960 [38]	4.331 [110]	0.866 [22]	1.615 [41]	4.213 [107]	0.039 [1]	0.748 [19]	1.575 [40]	1.358 [34.5]	1.516 [38.5]	0.374 [9.5]	3.780 [96]	#6 [M4]	0.1879 [5]	1/4 [M6]
SGx43 [SGx93]	0.984 [25]	6.693 [170]	3.720 [94.5]	5.709 [145]	3.996 [101.5]	1.5945 [40.5]	4.960 [126]	0.965 [24.5]	1.811 [46]	4.803 [122]	0.039 [1]	0.984 [25]	1.772 [45]	1.378 [35]	1.968 [50]	0.492 [12.5]	4.252 [108]	#10 [M5]	0.3129 [8]	1/4 [M6]
SGx44 [SGx94]	1.260 [32]	7.441 [189]	4.843 [123]	6.457 [164]	4.744 [120.5]	1.9095 [48.5]	5.787 [147]	1.063 [27]	2.046 [52]	5.630 [143]	0.039 [1]	0.984 [25]	2.008 [51]	1.535 [39]	1.870 [47.5]	0.492 [12.5]	4.960 [126]	1/4 [M6]	0.3129 [8]	5/16 [M8]
SGx45 [SGx95]	1.575 [40]	8.445 [214.5]	5.217 [132.5]	7.461 [189.5]	5.748 [146]	2.0960 [53.25]	6.536 [166]	1.220 [31]	2.323 [59]	6.338 [161]	0.039 [1]	0.984 [25]	2.283 [58]	1.417 [36]	2.284 [58]	0.492 [12.5]	5.790 [147]	5/16 [M8]	0.3129 [8]	3/8 [M10]
SGx46 [SGx96]	1.575 [40]	9.449 [240]	5.217 [132.5]	8.465 [215]	6.752 [171.5]	2.3030 [58.5]	7.046 [179]	1.299 [33]	2.480 [63]	6.811 [173]	0.039 [1]	0.984 [25]	2.441 [62]	1.594 [40.5]	2.559 [65]	0.492 [12.5]	6.300 [160]	3/8 [M10]	0.3129 [8]	3/8 [M10]

IMPERIAL [METRIC]	PHD BORE [ISO BORE]	LETTER DIMENSION												
		T	U	V	W	X1	X2	Y	Z	AA	BB	CC	DD	EE	FF*	GG
SGx41 [SGx91]	3/4 [19]	10-24 x 0.63 [M5 x 0.8 x 16]	0.199 [5]	1.000 [25.4]	2.421 [61.5]	0.315 [8]	0.394 [10]	0.672 [17]	0.1879 [5]	0.453 [11.5]	1/8 NPT [1/8 BSP]	2.598 [66]	0.335 [8.5]	M14 x 1.5	5.653 [143.6]	0.760 [19.3]
SGx42 [SGx92]	0.787 [20]	10-24 x 0.63 [M5 x 0.8 x 16]	0.199 [5]	1.457 [37]	2.992 [76]	0.394 [10]	0.472 [12]	0.672 [17]	0.1879 [5]	0.453 [11.5]	1/8 NPT [G 1/8 BSPP]	2.598 [66]	0.335 [8.5]	M14 x 1.5	6.870 [174.5]	0.885 [22.5]
SGx43 [SGx93]	0.984 [25]	1/4-20 x 0.63 [M6 x 1.0 x 16]	0.236 [6]	1.575 [40]	3.189 [81]	0.472 [12]	0.630 [16]	0.354 [9]	0.3129 [8]	0.500 [12.7]	1/8 NPT [G 1/8 BSPP]	3.012 [76.5]	0.335 [8.5]	M20 x 1.5	7.343 [186.5]	0.984 [25.0]
SGx44 [SGx94]	1.260 [32]	5/16-18 x 1 [M8 x 1.25 x 25]	0.236 [6]	1.949 [49.5]	3.819 [97]	0.630 [16]	0.787 [20]	0.354 [9]	0.3129 [8]	0.500 [12.7]	1/8 NPT [G 1/8 BSPP]	3.956 [100.5]	0.335 [8.5]	M25 x 1.5	9.213 [234]	1.142 [29.0]
SGx45 [SGx95]	1.575 [40]	3/8-16 x 1 [M10 x 1.5 x 25]	0.236 [6]	2.205 [56]	4.192 [106.5]	0.787 [20]	0.984 [25]	0.354 [9]	0.3129 [8]	0.500 [12.7]	1/4 NPT [G 1/4 BSPP]	4.488 [114]	0.335 [8.5]	M25 x 1.5	10.000 [254]	1.226 [31.1]
SGx46 [SGx96]	1.575 [40]	1/2-13 x 1 [M12 x 1.75 x 25]	0.236 [6]	2.205 [56]	4.606 [117]	0.984 [25]	1.181 [30]	0.354 [9]	0.3129 [8]	0.500 [12.7]	1/4 NPT [G 1/4 BSPP]	5.492 [139.5]	0.335 [8.5]	M25 x 1.5	10.000 [254]	1.371 [34.8]

CAD & Sizing Assistance

Use PHD's free online Product Sizing and
CAD Configurator at **phdinc.com/myphd**

All dimensions are reference only unless specifically toleranced.

DB — CUSHION CONTROL IN BOTH DIRECTIONS
(Standard location 1 & 5)

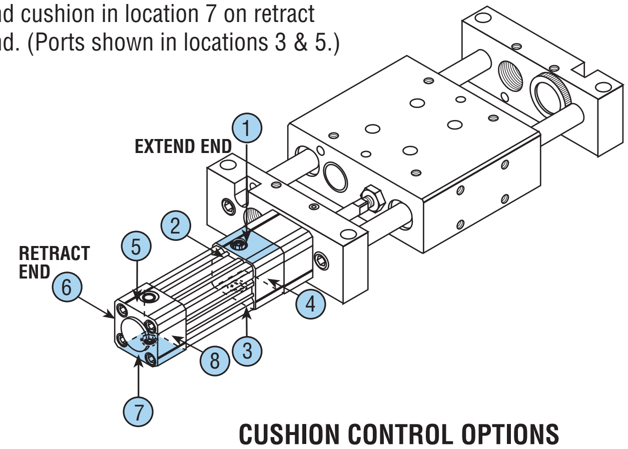
DE — CUSHION CONTROL ON EXTEND ONLY
(Standard location 1, N/A on 3-position units)

DR — CUSHION CONTROL ON RETRACT ONLY
(Standard location 5, N/A on 3-position units)

PHD cushions are designed for smooth deceleration at the ends of cylinder stroke. When the cushion is activated, the remaining volume in the cylinder must exhaust past an adjustable needle valve which controls the amount of deceleration. The effective cushion length for each bore size is shown in the table below. To specify alternative cushion control locations on the head or cap, see the option code at right.

NOTE: Cushions add 0.500 in [12.7 mm] to the cylinder length for each direction ordered on size 1 slide only.

Unit shown is -DB17, cushion in location 1 (standard) on extend end and cushion in location 7 on retract end. (Ports shown in locations 3 & 5.)

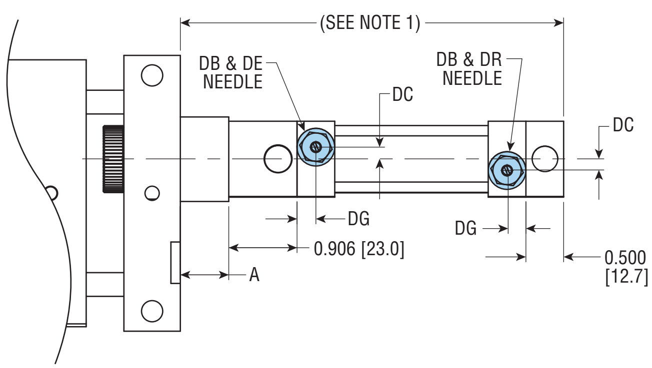


CUSHION CONTROL OPTIONS

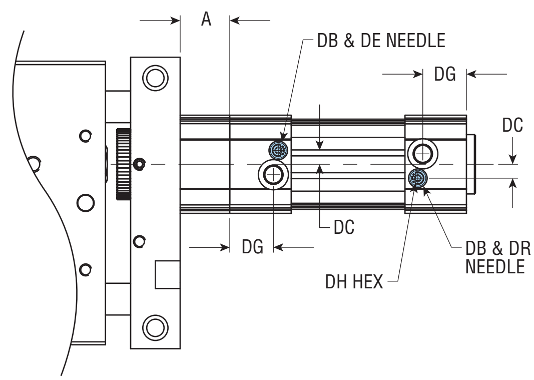
-D x x x

CUSHION CONTROL LOCATIONS	EXTEND LOCATION	RETRACT LOCATION
B - Both ends E - Extend end only R - Retract end only	(1, 2, 3, 4) **Omit if -DRx**	(5, 6, 7, 8) **Omit if -DEx**

SIZE 1



SIZE 2 THRU 6



LETTER DIM	SIZE					
	1	2	3	4	5	6
A	0.642 [16.3]	0.650 [16.5]	0.878 [22.3]	0.984 [25.0]	0.906 [23.0]	0.906 [23.0]
DC	0.156 [3.9]	0.190 [4.8]	0.226 [5.7]	0.276 [7.0]	0.374 [9.5]	0.394 [10.0]
DG	0.250 [6.0]	0.581 [14.8]	0.561 [14.2]	0.965 [24.5]	1.083 [27.5]	1.043 [26.5]
DH	—	0.098 [2.5]	0.098 [2.5]	0.098 [2.5]	0.098 [2.5]	0.098 [2.5]
EFFECTIVE CUSHION LENGTH	0.787 [20.0]	0.441 [11.2]	0.469 [11.9]	0.598 [15.2]	0.807 [20.5]	0.870 [22.1]

NOTES:
1) For -DE & -DR add 0.500 [12.7] to standard length, and for -DB add 1.000 [25.4] to standard length on size 1 only.
2) Use of travel adjustment screws may decrease effective cushion length.
3) Numbers in [ ] are for metric units and are in mm.

All dimensions are reference only unless specifically toleranced.

FOR SIZES 2 - 6 (not available on Size 1)

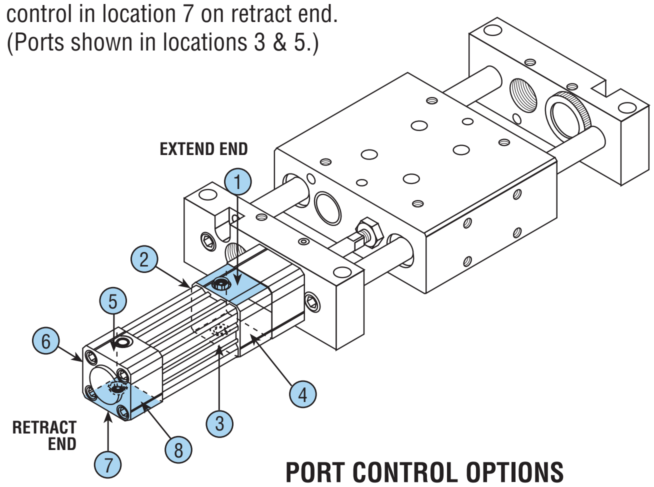
PB — **PORT CONTROLS® ON BOTH ENDS**
(Standard location 1 & 5)

PE — **PORT CONTROLS® ON EXTEND ONLY**
(Standard location 1, N/A on 3-position units)

PR — **PORT CONTROLS® ON RETRACT ONLY**
(Standard location 5, N/A on 3-position units)

PHD's Port Control® is a built-in flow control for regulating the speed of the slide through its entire stroke. The Port Control operates on the "meter-out" principle and features an adjustable needle in a cartridge with a check seal. The self-locking needle has micrometer threads and is adjustable under pressure. The needle determines the orifice size which controls the exhaust flow rate of the actuator. The check seal expands while air is exhausting from the actuator, forcing the air to exhaust past the adjustable needle. The check seal collapses to allow a free flow of incoming air. The PHD Port Control saves space and eliminates the cost of fittings and installation for external flow control valves. Refer to option code at right to specify port control locations.

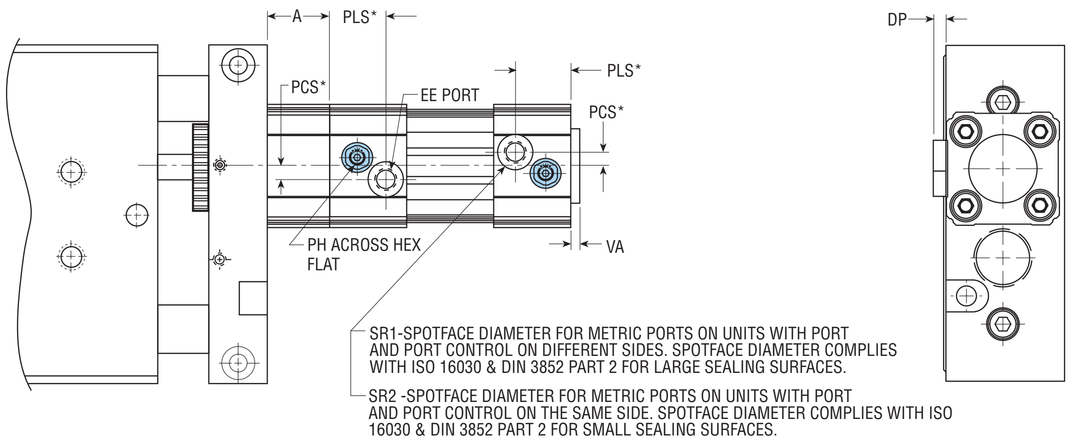
Unit shown is -PB17, port control in location 1 on extend end and port control in location 7 on retract end. (Ports shown in locations 3 & 5.)



PORT CONTROL OPTIONS

-P x x x

PORT CONTROL LOCATIONS	EXTEND LOCATION	RETRACT LOCATION
B - Both ends E - Extend end only R - Retract end only	(1, 2, 3, 4) **Omit if -PRx**	(5, 6, 7, 8) **Omit if -PEx**



LETTER DIM	SIZE									
	2		3		4		5		6	
	in	mm	in	mm	in	mm	in	mm	in	mm
A	0.650	16.5	0.878	22.3	0.984	25.0	0.906	23.0	0.906	23.0
EE*	10-32	M5	10-32	M5	1/8 NPT	G 1/8	1/4 NPT	G 1/4	1/4 NPT	G 1/4
PCS*	0.276	7.0	0.276	7.0	0.197	5.0	0.236	6.0	0.236	6.0
PH	0.098	2.5	0.098	2.5	0.098	2.5	0.098	2.5	0.098	2.5
PLS*	0.571	14.5	0.571	14.5	0.866	22.0	0.925	23.5	0.925	23.5
SR1*	—	16.5	—	16.5	—	19.0	—	25.0	—	25.0
SR2*	0.354	9.0	0.354	9.0	—	16.5	—	19.0	—	19.0
DP	0.067	1.7	0.055	1.4	0.130	3.3	0.201	5.1	0.122	3.1

*Dimensions shown are for units with port and port control in the same location. For units with other port and port control combinations, standard port location dimensions apply. Ports may be located on either side of the slide centerline depending on port control and cushion option combinations.
in = Table information for imperial units   mm = Table information for metric units

All dimensions are reference only unless specifically toleranced.

FOR SIZE 1 ONLY

E — MAGNETIC PISTON FOR SERIES JC1 RADIAL SENSING SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD Series JC1 radial sensing switches.

M — MAGNETIC PISTON FOR SERIES JC1 REED & TEACHABLE SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD Series JC1 reed and teachable switches.

SERIES JC1xDx MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1RDU-5	PNP or NPN DC Reed, 5 meter cable
JC1RDU-K	PNP or NPN DC Reed, Quick Connect
JC1ADU-K	AC Reed, Quick Connect (M12)
JC1HDP-5	PNP (Source), Radial Sensing, 5 meter cable
JC1HDP-K	PNP (Source), Radial Sensing, Quick Connect
JC1HDN-5	NPN (Sink), Radial Sensing, 5 meter cable
JC1HDN-K	NPN (Sink), Radial Sensing, Quick Connect

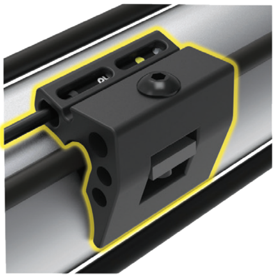
NOTE: Switches must be ordered separately.

CORDSETS FOR SERIES JC1xDx SWITCHES

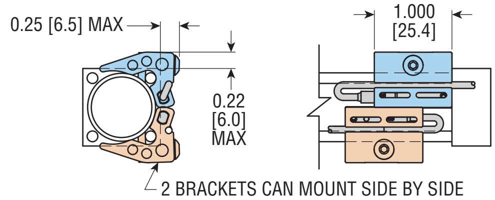
PART NO.	DESCRIPTION
63549-02	M8, 3 pin, Straight Female Connector, 2 meter cable
63549-05	M8, 3 pin, Straight Female Connector, 5 meter cable
81284-1-010	M12, 4 pin, Straight Female Connector, 2 meter cable

NOTE: Cordsets are ordered separately.

Cylinder-mounted switches are an easy and convenient way of interfacing the slide to various programmable controllers or logic systems. **See the Switches section for specific switch information.**



SWITCH BRACKET 92100



SERIES JC1ST TWO POSITION TEACHABLE MAGNETIC SWITCHES

PART NO.	DESCRIPTION
JC1STP-2	PNP (Source), Solid State, 12-30 VDC, 2 meter cable
JC1STP-K	PNP (Source), Solid State, 12-30 VDC, Quick Connect

NOTE: Switches must be ordered separately.

CORDSET FOR SERIES JC1ST SWITCHES

PART NO.	DESCRIPTION
81284-1-001	M8, 4 pin, Straight Female Connector, 5 meter cable

NOTE: Cordsets are ordered separately.

FOR SIZES 2 - 6

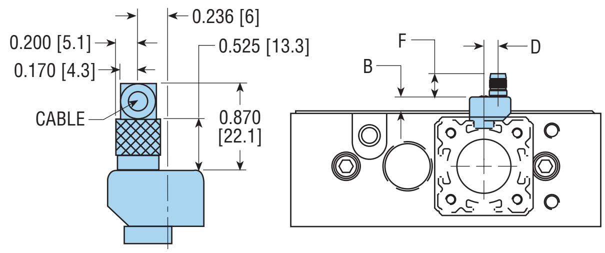
M — MAGNET FOR SERIES 6250 REED AND SOLID STATE SWITCHES

This option equips the cylinder with a magnetic band on the piston for use with PHD Reed and Solid State Switches listed below. These switches mount easily to the cylinder using “T” slots in the body. **See Switches and Sensors section for complete switch information.**

PART NO.	DESCRIPTION	COLOR
62505-1-02	NPN (Sink) DC Solid State, 2 meter cable	Brown
62506-1-02	PNP (Source) DC Solid State, 2 meter cable	Tan
62515-1	NPN (Sink) DC Solid State, Quick Connect	Brown
62516-1	PNP (Source) DC Solid State, Quick Connect	Tan

PART NO.	DESCRIPTION	COLOR
62507-1-02	AC/DC Reed, 2 meter cable	Silver
62517-1	AC/DC Reed, Quick Connect	Silver

Connector Detail



LETTER DIM	SIZE				
	2 mm	3 mm	4 mm	5 mm	6 mm
B	0.236 [6.0]	0.236 [6.0]	0.236 [6.0]	0.276 [7.0]	0.197 [5.0]
D	0.228 [5.8]	0.228 [5.8]	0.228 [5.8]	0.228 [5.8]	0.228 [5.8]
F	0.374 [9.5]	0.374 [9.5]	0.374 [9.5]	0.374 [9.5]	0.374 [9.5]

Numbers in [ ] are for metric units and are in mm.

All dimensions are reference only unless specifically toleranced.

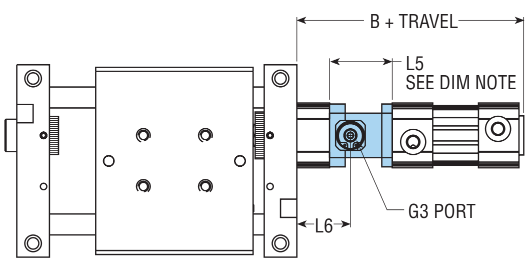
FOR SIZES 2 - 6 (not available on size 1)

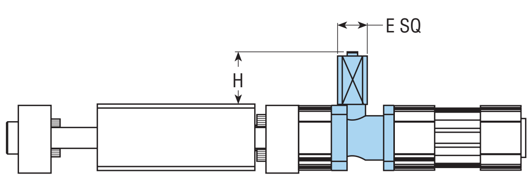
H47 RODLOK SLIDE AND RODLOK

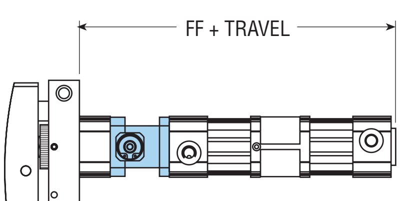
PHD's Rodlok is ideal for locking the housing while in a static/stationary position. When the pressure is removed from the port of the Rodlok, the mechanism will grip the piston rod of the cylinder and prevent it from moving. The loads are held indefinitely without power. Rodlok performance is application and environment sensitive (cleanliness of rod or Rodlok will also affect performance). THE RODLOK IS NOT DESIGNED TO BE USED AS A PERSONAL SAFETY DEVICE.

SIZE	STATIC LOCKING FORCE*	
	lbf	N
2	79	350
3	90	400
4	135	600
5	225	1000
6	337	1500

NOTE: *Locking force indicated above is the actual locking force with a dry, clean rod and does not include any safety factor.

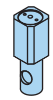
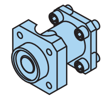
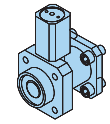






3 POSITION DETAIL

RODLOK KITS

				
SIZE	**LOCKING DEVICE KIT**	**ADAPTOR KIT***	**COMPLETE RODLOK***	**IMPERIAL PORT ADAPTOR****
2	63459-07-1	63460-07-1	63461-07-1	—
3	63459-08-1	63460-08-1	63461-08-1	—
4	63459-01-1	63460-01-1	63461-01-1	63465-1
5	63459-02-1	63460-02-1	63461-02-1	63465-1
6	63459-02-1	63460-02-1	63461-02-1	63465-1

NOTES:
1) *Kits ship with cylinder mounting hardware
2) Part numbers listed above are intended for replacement purposes only and are to be used specifically on slides with the -H47 option.
3) **Adaptor must be ordered separately. Required to convert to imperial port.

SIZE	DEVICE WEIGHT		ADAPTOR WEIGHT		TOTAL WEIGHT	
	lb	kg	lb	kg	lb	kg
2	0.14	0.06	0.14	0.06	0.31	0.14
3	0.14	0.06	0.16	0.07	0.36	0.16
4	0.20	0.09	0.28	0.13	0.57	0.26
5	0.30	0.14	0.44	0.20	0.93	0.42
6	0.54	0.24	0.84	0.38	1.76	0.80

NOTE: Total weight includes rod adder for -H47 cylinder.

OPERATING PRESSURE

The operating pressure for the locking device is different than the operating pressure for the slide to which it is attached. The locking device of the Rodlok is designed with an operating pressure range of 60 psi minimum to 150 psi maximum [4 to 10 bar]. The Series SG Slide with a Rodlok attached has an operating pressure range of 45 psi minimum to 150 psi maximum [3 to 10 bar].

The Rodlok locking device and adaptor can be purchased separately as kits. See Rodlok kits chart. The locking device and adaptor are not available with a corrosion resistant (-Z1 option) finish.

LETTER DIM	SIZE				
	2	3	4	5	6
PHD BORE	0.787 [20]	0.984 [25]	1.260 [32]	1.575 [40]	1.575 [40]
B	4.941 [125.5]	5.453 [138.5]	6.732 [171]	7.382 [187.5]	7.382 [187.5]
E	0.807 [20.5]	0.807 [20.5]	0.984 [25.0]	1.083 [27.5]	1.083 [27.5]
G3	[M5 x 0.8]*	[M5 x 0.8]*	[G 1/8]*	[G 1/8]*	[G 1/8]*
H	1.555 [39.5]	1.457 [37]	1.791 [45.5]	1.811 [46]	1.732 [44]
L5	1.575 [40]	1.732 [44]	1.890 [48]	2.165 [55]	2.165 [55]
L6	1.083 [27.5]	1.398 [35.5]	1.614 [41]	1.673 [42.5]	1.673 [42.5]
FF	8.445 [214.5]	9.075 [230.5]	11.102 [282]	12.165 [309]	12.165 [309]

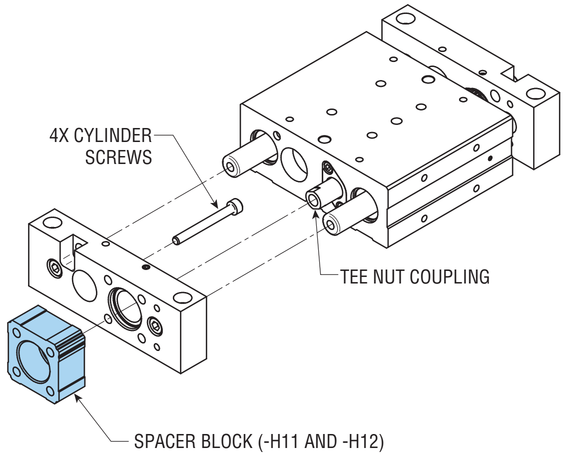
NOTES:
1) L5 Dim is the amount added to the standard unit for the -H47 option
2) Numbers in [ ] are for metric units and are in mm.
3) *Port supplied on Rodlok device requires port adaptor to convert to 1/8 NPT. M5 may be used with 10-32 THD NPT.

All dimensions are reference only unless specifically toleranced.

H11 SLIDE ONLY (WITHOUT CYLINDER) SIZES 94, 95, AND 96
for VDMA/ISO cylinders 32, 40 mm bores

H12 SLIDE ONLY (WITHOUT CYLINDER) SIZES 91, 92, AND 93
for ISO 6432 cylinders 19, 20, 25 mm bores

These options provide the slide mechanism only without a cylinder. Included with options -H11 and -H12 is all the hardware required for mounting standard VDMA/ISO cylinders to the slide. A self-aligning rod coupling is also provided, making it easy to attach the appropriate VDMA/ISO cylinder. (No extra rod extension required.)



L9 NPT PORTS

This option provides NPT ports on metric units instead of the standard BSPP ports. The NPT ports are located in the same location as the BSPP ports.

NOTE: NPT ports are standard on imperial units.

METRIC SIZE	OPTIONAL NPT PORT	STANDARD BSPP PORT
1	1/8	G 1/8
2	1/8*	G 1/8*
3	1/8*	G 1/8*
4	1/8	G 1/8
5	1/4	G 1/4
6	1/4	G 1/4

*When port controls are specified on the same face as ports, the standard metric port is M5 and the -L9 option provides a 10-32 port.

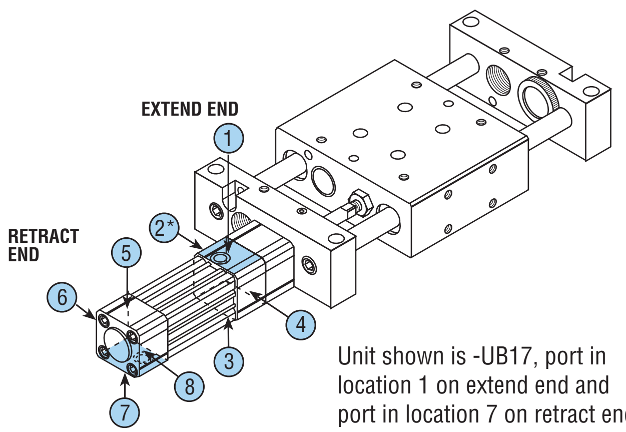
UB ALTERNATE PORT LOCATION
(N/A on 3-position units)

With this option, alternate port locations can be specified, providing increased flexibility and customer convenience. See option code below to specify port locations.

PORT LOCATION OPTIONS

-UB x x

EXTEND LOCATION	RETRACT LOCATION
(Head) (1, 2, 3, 4)	(Cap) (5, 6, 7, 8)



Unit shown is -UB17, port in location 1 on extend end and port in location 7 on retract end.

*Do not use ports in position 2 with shock absorber options.

Q1 CORROSION RESISTANT GUIDE SHAFTS

Extremely hard corrosion resistant coating on the guide shafts for use in applications where moisture may corrode untreated hardened ground shafts. End faces of the shafts remain uncoated. Consult PHD for fully coated shafts.

Z1 ELECTROLESS NICKEL PLATING

This option provides electroless nickel plating on all externally exposed ferrous parts except the guide shafts and cylinder rod end. This optional plating can be used for protecting the slide from severe or corrosive environments. The guide shafts can be made corrosion-resistant by specifying the -Q1 shaft option.

NOTE: Shock absorbers are not plated with -Z1 option.

BB SHOCK PAD BOTH DIRECTIONS

BE SHOCK PAD ON EXTENSION

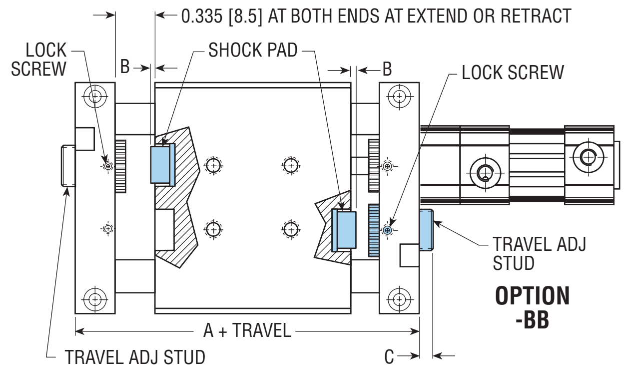
BR SHOCK PAD ON RETRACTION

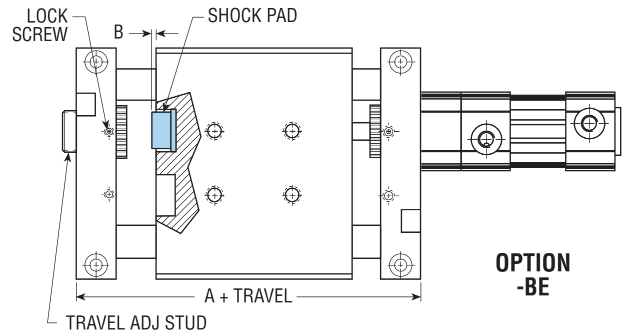
This option provides urethane pads for absorption of shock and noise reduction on the slide saddle. Reducing shock permits higher slide velocities or higher kinetic shock loads. This option actually eliminates metal-to-metal contact at the end of slide travel. Shock pads do not affect the overall slide length.

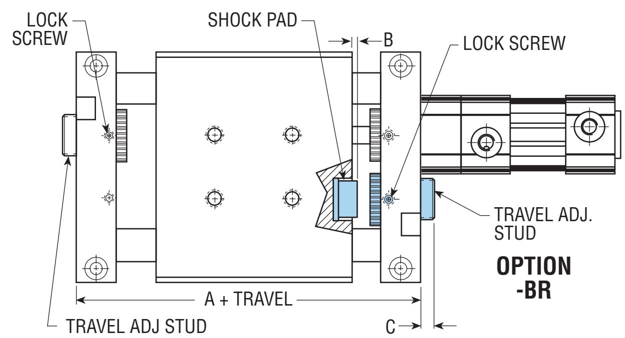
NOTE: Lock screw torque is 30 in-lb [3.39 Nm].

SIZE	A	B	C
1	5.729 [145.5]	0.217 [5.5]	0.672 [17]
2	5.729 [145.5]	0.217 [5.5]	0.672 [17]
3	6.693 [170]	0.217 [5.5]	0.354 [9]
4	7.441 [189.5]	0.118 [3]	0.354 [9]
5	8.445 [214.5]	0.118 [3]	0.354 [9]
6	9.449 [240]	0.118 [3]	0.354 [9]

Numbers in [ ] are for metric units and are in mm.





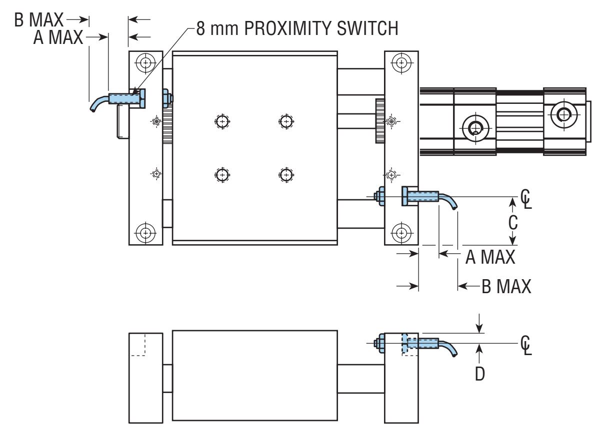


CB PROXIMITY SWITCH READY BOTH ENDS

This option provides targets in the slide saddle for use with 8 mm inductive proximity switches. The end plates of the slide come standard with provisions for mounting the 8 mm proximity switches on both ends. Proximity switches must be ordered separately.

SIZE	A	B	C	D
1	0.81 [20.5]	1.34 [34]	0.906 [23]	0.967 [24.5]
2	0.81 [20.5]	1.34 [34]	1.083 [27.5]	0.295 [7.5]
3	0.57 [14.5]	1.10 [28]	1.260 [32]	0.354 [9]
4	0.57 [14.5]	1.10 [28]	1.476 [37.5]	0.354 [9]
5	0.57 [14.5]	1.10 [28]	1.693 [43]	0.315 [8]
6	0.57 [14.5]	1.10 [28]	2.008 [51]	0.315 [8]

Numbers in [ ] are for metric units and are in mm.

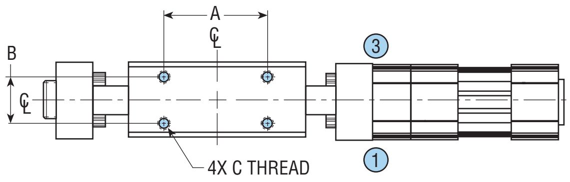


All dimensions are reference only unless specifically toleranced.

GX — SADDLE MOUNTING IN POSITION 4

This option provides an additional mounting pattern on one side (position 4) of the slide saddle. These four threaded holes can be used for mounting a variety of fixturing or tooling.

NOTE: Mounting holes are centered on centerline of saddle.



View from position 4

SIZE	A	B	C
1	2.913 [74]	0.689 [17.5]	M5 x 0.8 x 6 [M5 x 0.8 x 6]
2	2.913 [74]	0.689 [17.5]	M5 x 0.8 x 6 [M5 x 0.8 x 6]
3	2.756 [70]	1.161 [29.5]	M6 x 1.0 x 9 [M6 x 1.0 x 9]
4	1.988 [50.5]	1.339 [34]	M6 x 1.0 x 9 [M6 x 1.0 x 9]
5	2.992 [76]	1.437 [36.5]	M6 x 1.0 x 9 [M6 x 1.0 x 9]
6	3.996 [101.5]	1.437 [36.5]	M6 x 1.0 x 9 [M6 x 1.0 x 9]

Numbers in [ ] are for metric units and are in mm.

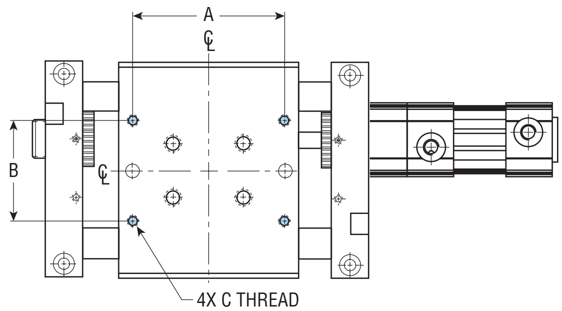
GY — SADDLE MOUNTING IN POSITION 1

This option provides an additional wide spread mounting pattern on the top surface (position 1) of the slide saddle. These four threaded holes are farther apart than the standard hole pattern for added mounting stability. (Not available on sizes 1, 2, and 3 slides.)

NOTE: Mounting holes are centered on centerline of saddle.

SIZE	A	B	C
4	3.956 [100.5]	2.658 [67.5]	1/4-20 x 0.50 [M6 x 1.0 x 12]
5	4.488 [114]	2.795 [71]	5/16-18 x 0.50 [M8 x 1.25 x 12]
6	5.492 [139.5]	2.834 [72]	3/8-16 x 0.59 [M10 x 1.50 x 15]

Numbers in [ ] are for metric units and are in mm.

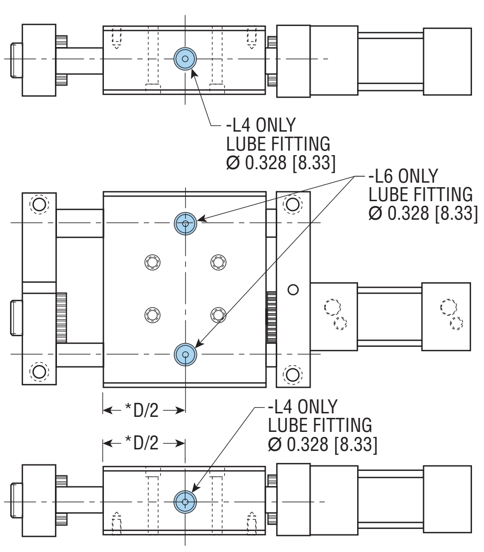


L4 — LUBE FITTING IN SADDLE PORT POSITION 2 AND 4

L6 — LUBE FITTING IN SADDLE PORT POSITION 3

Lube fittings provide an easy efficient method for lubricating the bearings and shafts for extended life beyond the normal catalog specifications. Periodic lubrication (every 25 million inches of travel [0.6 million meters]) is recommended for applications where heat, dust, or other conditions will tend to dry out the bearings and shafts. PHD suggests a lightweight oil. Silicon-based lubricants should **NOT** be used on units with PHD's **TC** bushings.

NOTE: *See catalog dimension page 205 for dimension "D."



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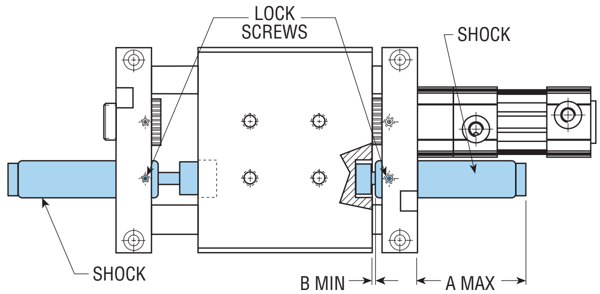
SHOCK ABSORBERS

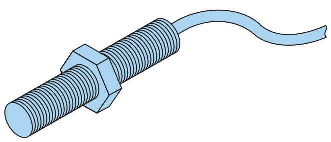
Shock absorbers provide the optimum means for decelerating loads at the end of travel and absorbing the kinetic energy associated with decelerating the load. PHD offers nine different shock absorbers to cover a wide range of applications. See shock absorber sizing information in the Sizing section to determine which size will work for your application.

NOTE: Lock screw torque is 30 in-lb [3.39 Nm]. Do not allow shock absorber to bottom out. Take care to properly adjust dimension B.



SHOCK ABSORBER KIT SPECIFICATIONS

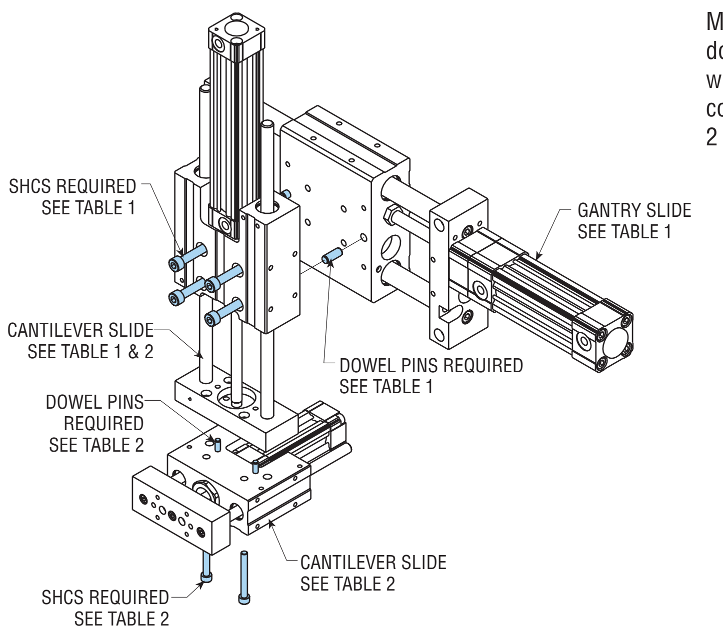
SIZE	PHD SHOCK ABSORBER NUMBER	TRAVEL		THREAD TYPE	SHOCK ABSORBER WEIGHT		DIMENSION A		DIMENSION B	
		in	mm		lb	kg	in	mm	in	mm
1, 2	57858-07-1, -2, -3	0.63	16	M14 x 1.5	0.18	0.08	2.625	67	0.079	2
3	57858-01-1, -2, -3	0.75	19	M20 x 1.5	0.25	0.11	2.750	70	0.079	2
4, 5, 6	57858-02-1, -2, -3	1.00	25	M25 x 1.5	0.67	0.30	4.200	106.5	0.079	2



INDUCTIVE PROXIMITY SWITCHES

Two models of threaded inductive proximity switches are available for use with PHD Series SG Slides (with option -CB). **See Switches and Sensors section for complete switch specifications.**

PART NO.	DESCRIPTION
51422-005-02	8 mm Inductive Proximity Switch NPN (Sink), 10-30 VDC, 2 m cable
51422-006-02	8 mm Inductive Proximity Switch PNP (Source), 10-30 VDC, 2 m cable



Modular design of the SK/SL housing allows the unit to bolt and dowel directly to the saddle of the metric Series SG gantry slide without the need for a transition plate. See the chart below for slide compatibility and hardware required. Each kit includes 4 SHCS and 2 dowel pins.

TABLE 1: SERIES SK/SL SLIDE TO SERIES SG SLIDE

MODULAR DESIGN		HARDWARE KITS	
CANTILEVER	GANTRY	STANDARD	-Z1 OPTION
SK/SLxx81	SGxx92	65578-01-1	65578-01-2
SK/SLxx82	SGxx93	65578-02-1	65578-02-2
SK/SLxx83	SGxx94	65578-03-1	65578-03-2
SK/SLxx84	SGxx95	65578-04-1	65578-04-2
SK/SLxx85	SGxx96	65578-05-1	65578-05-2

TABLE 2: SERIES SK/SL SLIDE TO SERIES SK/SL SLIDE

MODULAR DESIGN		HARDWARE KITS	
CANTILEVER HOUSING	CANTILEVER TOOL PLATE	STANDARD	-Z1 OPTION
SK/SLxx81	SK/SLxx82	65547-01-1	65547-01-2
SK/SLxx82	SK/SLxx83	65547-02-1	65547-02-2
SK/SLxx83	SK/SLxx84	65547-03-1	65547-03-2
SK/SLxx84	SK/SLxx85	65547-04-1	65547-04-2
SK/SLxx85	SK/SLxx86	65547-05-1	65547-05-2

NOTE: Series SK/SL Slide tool plate may retract past edge of Series SG Slide saddle without tool plate extension or -AR options.

All dimensions are reference only unless specifically toleranced.

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