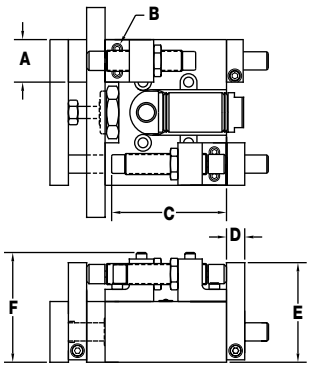
Shock Absorber Dimensions

Linear Thruster Cylinders



Bore	A	B	C	D	E	F
9/16" (02)	0.75	#6-32	1.14	0.25	1.65	1.88
3/4" (04)	0.88	#6-32	2.37	0.38	2.05	2.13
1-1/16" (09)	1	#8-32	3.68	0.38	2.87	3
1-1/2" (17)	1.25	#10-32	4.47	0.5	3.75	4
2" (31)	1.5	1/4-20	4.75	0.75	4.50 (TE) 5.50 (T)	4.75 (TE) 5.75 (T)

How to Size a Shock Absorber

Selecting the proper shock absorber model is accomplished using the shock absorber graph given for each Thruster bore. The intersection of the total energy per stroke "E_T", and velocity at shock absorber contact "V", indicates the proper shock absorber model. E_T is calculated by the equation given below using values determined for:

P	=	Air pressure (PSI)
V	=	Velocity at impact (in/sec)
S	=	Stroke of the Thruster (in)
W_U	=	Load attached to the Thruster mounting plate (lbs.)
C	=	Cycles per hour
SF	=	Shock factor
TF1	=	Thruster factor #1
TF2	=	Thruster factor #2
TF3	=	Thruster factor #3

E_T (Total energy) equals the sum of E_K (Kinetic energy) and E_W (Work energy)
Note the Work energy calculation varies with mounting position, E_{WH} Horizontal, or E_{WV} Vertical.

$E_K = ((W_U + (TF2 + (TF3 \times S))) / 772) \times V^2$ .....(Kinetic energy, in-lbs)

$E_{WH} = TF1 \times SF \times P$.....(Work energy, in-lbs) **HORIZONTAL**

$E_{WV} = ((TF1 \times P) + W_U + (TF2 + (TF3 \times S))) \times SF$ .....(Work energy, in-lbs) **VERTICAL**

$E_T = E_K + E_W$.....(Total energy per stroke, in-lbs)

$E_TC = E_T \times C$.....(Total energy per hour, in-lbs/hr)

E_T and E_TC .....must not exceed maximum listed in specifications

Example: determine the proper shock absorber for a model T-046 Thruster mounted vertically with an attached load of 15 lbs., operating air pressure of 80 PSI, and a velocity of 20 in/sec., at a cycle rate of 3,600 per hour.

P	=	80 PSI
V	=	20 in/sec
S	=	6 in
W_U	=	15 lbs
C	=	3,600 cycles / hr

From the charts for a 3/4" bore "T" series Thruster

SF	=	0.410
TF1	=	0.442
TF2	=	0.632
TF3	=	0.063

E_K = $((15 \text{ lbs} + (0.632 + (0.063 \times 6 \text{ in}))) / 772) \times (20 \text{ in/sec})^2$ .....E_K = 8.30 in-lbs

E_{WV} = $((0.442 \times 80 \text{ PSI}) + 15 \text{ lbs} + (0.632 + (0.063 \times 6 \text{ in}))) \times 0.410$ .....E_{WV} = 21.06 in-lbs

E_T = $E_K + E_{WV}$ = 29.36 in-lbs ..... $E_TC = E_T \times C$ = 105,685 in-lbs/hr

Checking specifications chart: both E_T and E_TC are less than maximum.

And per sizing graph for a model T-04: 29.36 in-lbs total energy at 20 in/sec velocity, use a heavy duty model HS-04 shock absorbers.

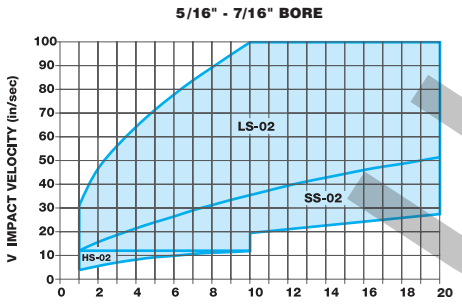
T Series Thruster Calculation Constants

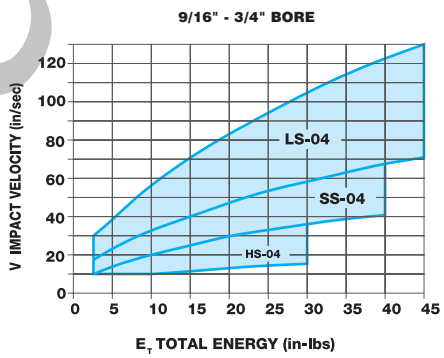
Model T					
Factor	**9/16"**	**3/4"**	**1-1/16"**	**1-1/2"**	**2"**
SF	0.250	0.410	0.630	0.880	1.000
TF1	0.249	0.442	0.887	1.767	3.142
TF2	0.310	0.632	1.675	3.874	7.444
TF3	0.028	0.063	0.111	0.174	0.250
(E_T) Max. in.-lbs. per cycle	20	45	190	400	650
(E_T - C) max. in.-lbs. per hour	36,000	125,000	300,000	475,000	622,000

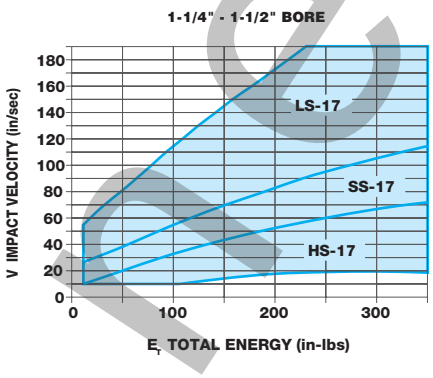
TE Series Thruster Calculation Constants

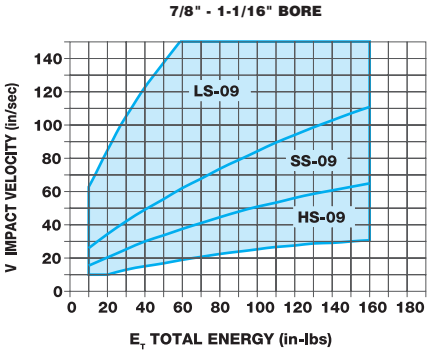
Model TE					
Factor	**9/16"**	**3/4"**	**1-1/16"**	**1-1/2"**	**2"**
SF	0.250	0.410	0.630	0.880	1.000
TF1	0.249	0.442	0.887	1.767	3.142
TF2	0.434	0.905	2.075	4.033	6.754
TF3	0.063	0.111	0.174	0.250	0.340
(E_T) Max. in.-lbs. per cycle	20	45	190	400	650
(E_T - C) max. in.-lbs. per hour	36,000	125,000	300,000	475,000	622,000

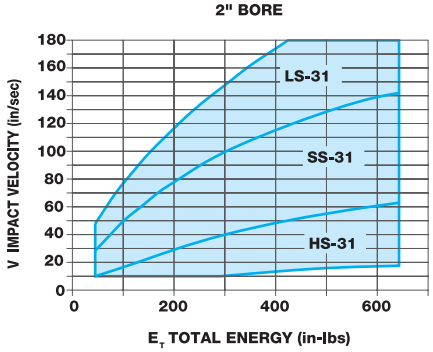
Velocity vs. Load for Shock Absorbers











Shock Absorber Dimensions

Ultran Slide and Ultran Rodless Cylinders

For each model, dimensions and engineering specifications are the same for Light, Standard, and Heavy Duty Shock Absorbers. (LS, SS and HS model numbers).

Shock Absorber Selection Guide

Bore	Ultran	Ultran Slide
5/16" (007)	N/A	☐ S-02
7/16" (01)		
9/16" (02)	☐ S-02	☐ S-04
3/4" (04)	☐ S-04	
7/8" (06)	☐ S-09	☐ S-09
1-1/16" (09)		
1-1/4" (12)	☐ S-17	☐ S-17
1-1/2" (17)		
2" (31)	☐ S-31	☐ S-31

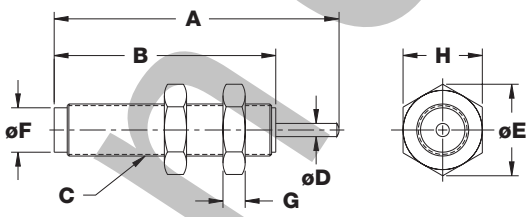
Note: Do not let shock absorbers bottom out. The shock should not be used as a stroke adjuster. A stop collar is needed for the shock if stroke adjustment is required.

Dimensions (in.)

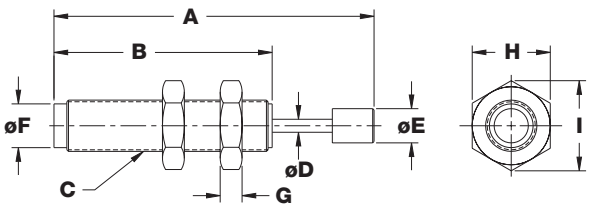
Model	A	B	C	D	E	F	G	H	I
☐ S-02	1.39	1.13	3/8-32 UNEF	0.12	N/A	0.32	0.09	0.50	0.58
☐ S-04	2.74	1.96	7/16-28 UNEF	0.12	0.40	0.39	0.16	0.56	0.65
☐ S-09	4.25	3.24	1/2-20 UNF	0.16	0.44	0.43	0.12	0.63	0.72
☐ S-17	5.38	3.89	3/4-16 UNF	0.19	0.50	0.64	0.18	0.94	1.08
☐ S-31	7.93	5.00	1-12 UNF	0.31	0.88	1.22	0.18	1.30	1.30

Model

☐ S-02



☐ S-04, ☐ S-09, ☐ S-17, ☐ S-31



Engineering Specifications

Model	Shock Absorber Bore	(S) Stroke Inches	Thread Type	(E_T) Max. In-Lbs. Per Cycle	(E_T-C) Max. In-Lbs. Per Hour	(F_p) Max Shock Force Lbs.	Nominal Coil Spring Force		(F_D) Max. Propelling Force (Lbs.)	Model Weight (Oz.)
							Extension (Lbs.)	Compression (Lbs.)		
☐ S-02	0.28	0.25	3/8-32 UNEF	20	36,000	160	0.65	1.13	20	0.4
☐ S-04	0.25	0.41	7/16-28 UNEF	45	125,000	225	0.7	1.6	50	2
☐ S-09	0.28	0.63	1/2-20 UNF	190	300,000	500	1	3.6	120	3
☐ S-17	0.44	0.88	3/4-16 UNF	400	475,000	700	2	6.8	200	7
☐ S-31	0.56	1.56	1-12 UNF	1,700	670,000	1,700	4	11	500	16

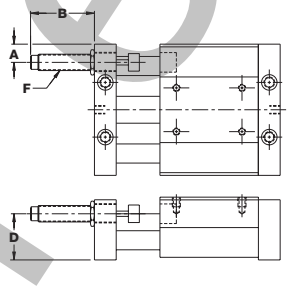
Shock Absorber Dimensions

Shock Absorber/Stroke Adjustment (in.)

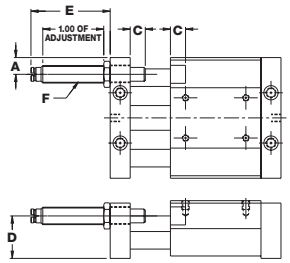
Bore	A	B	C	D	E	F
5/16" (007)	0.215	0.750	0.000	0.785	1.093	3/8-32 UNEF
7/16" (01)	0.218	0.750	0.000	0.780	1.093	3/8-32 UNEF
9/16" (02)	0.406	1.460	0.375	1.094	1.594	7/16-28 UNEF
3/4" (04)	0.406	1.335	0.375	1.438	1.469	7/16-28 UNEF
7/8" (06)	0.500	2.490	0.375	1.562	1.438	1/2-20 UNF
1-1/16" (09)	0.594	2.490	0.375	1.875	1.438	1/2-20 UNF
1-1/4" (12)	0.656	2.890	0.500	2.062	1.500	3/4-16 UNF
1-1/2" (17)	1.000	2.890	0.562	2.219	1.438	3/4-16 UNF
2" (31)	1.125	3.500	0.562	3.312	1.563	1-12 UNF

Note: Do not let the shock absorbers bottom out. The shock should not be used as a stroke adjuster. A stop collar is needed for the shock if stroke adjustment is required.

Shock Absorber



Stroke Adjustment



How to Size a Shock Absorber

Selecting the proper shock absorber model is accomplished using the shock absorber graph given for each Ultran bore. The intersection of the total energy per stroke "E_T", and velocity at shock absorber contact "V", indicates the proper shock absorber model. E_T is calculated by the equation given below using values determined for:

P = Air pressure (PSI)
V = Velocity at impact (in/sec)
W_U = Load attached to the Ultran mounting plate (lbs.)
C = Cycles per hour
SF = Shock factor
UF1 = Ultran factor #1
UF2 = Ultran factor #2

E_T (Total energy) equals the sum of E_K (Kinetic energy) and E_W (Work energy) Note the Work energy calculation varies with mounting position, E_{WH} Horizontal, or E_{WV} Vertical.

$E_K = ((W_U + UF2) / 772) \times V^2$ .....(Kinetic energy, in-lbs)

$E_{WH} = UF1 \times SF \times P$ .....(Work energy, in-lbs) **HORIZONTAL**

$E_{WV} = ((UF1 \times P) + W_U + UF2) \times SF$ .....(Work energy, in-lbs) **VERTICAL**

Example: determine the proper shock absorber for a model Ultran Slide mounted vertically with an attached load of 15 lbs., operating air pressure of 80 PSI, and a velocity of 20 in/sec., at a cycle rate of 3,600 per hour.

P = 80 PSI
V = 20 in/sec
S = 6 in
W_U = 15 lbs
C = 3,600 cycles / hr

From the charts for a 3/4" bore Ultran Slide

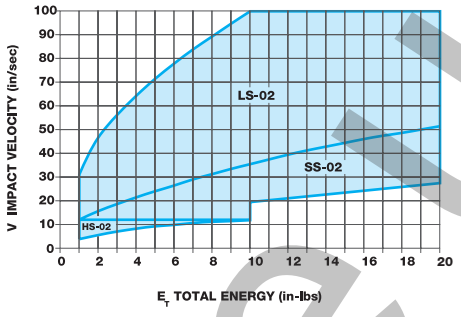
SF = 0.410
UF1 = 0.442
UF2 = 1.565
E_K = $(15 \text{ lbs} + 1.565) / 772) \times (20 \text{ in/sec})^2$ ..... E_K = 8.56 in-lbs
E_{WV} = ((0.442 x 80 PSI) + 15 lbs + 1.565 x 0.410 ..... E_{WV} = 21.29 in-lbs
E_T = $E_K + E_{WV}$ = 29.85 in-lbs ..... $E_TC = E_T \times C$ = 107,457 in-lbs/hr

Checking specifications chart: both E_T and E_TC are less than maximum.

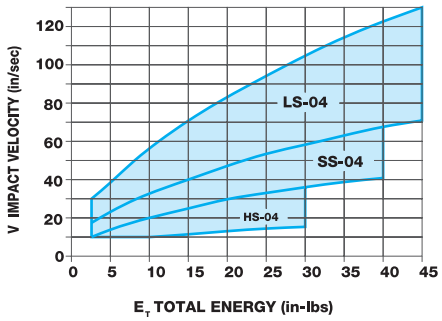
And per sizing graph for a model UGS-04: 21.29 in-lbs total energy at 20 in/sec velocity, use a heavy duty model HS-04 shock absorbers

Velocity vs. Load for Shock Absorbers

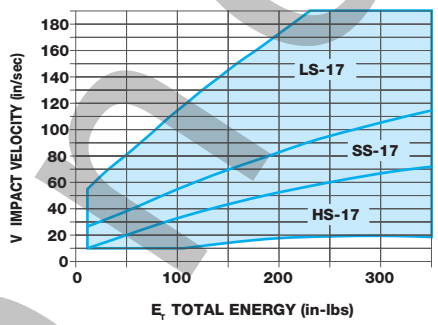
5/16" - 7/16" BORE



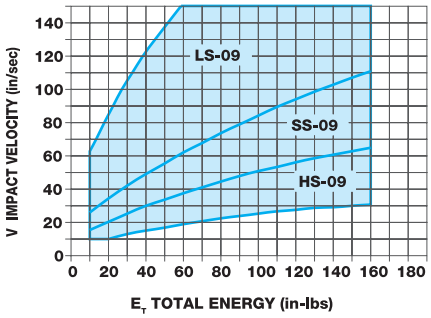
9/16" - 3/4" BORE



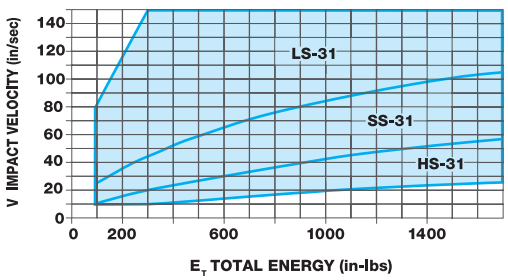
1-1/4" - 1-1/2" BORE



7/8" - 1-1/16" BORE



2" BORE

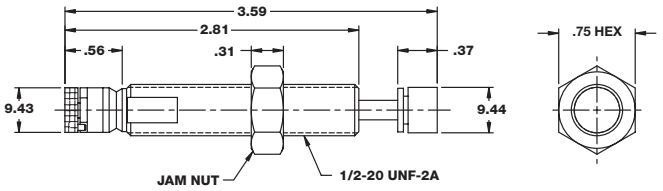


**Ultran Maximum Velocity*
20 inches per second or cycle rate
not to exceed 15 per minute

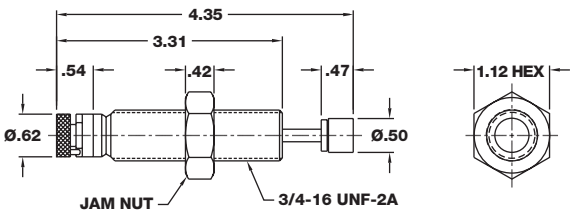
Shock Absorber

High Load Ultran

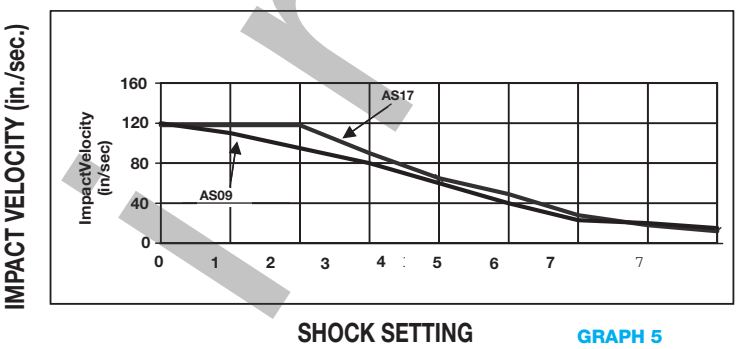
Dimensions (in.)
1-1/16" bore



Dimensions (in.)
1-1/2" bore



Shock Absorber Adjustment Range



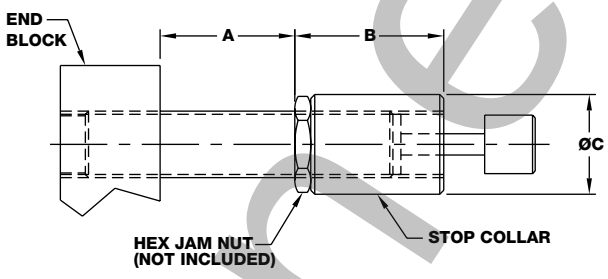
GRAPH 5

Table 3. Shock Absorber Ratings

Model	Shock Absorber Bore	(S) Stroke	Thread Type	(E_T) Max. In-Lb. Per Cycle	(E_T-C) Max. In-Lb. Per Cycle	(F_P) Max. Shock Force	Normal Coil Spring Force		(F_D) Max. Propelling Force	Weight
							Extension	Compression		
AS-09	.25	.38	1/2"-20 UNF	50	178,000	200	.8	1.7	8	2
AS-17	.28	.5	3/4"-16 UNF	100	284,000	300	1.5	2.0	150	5

Stop Collar

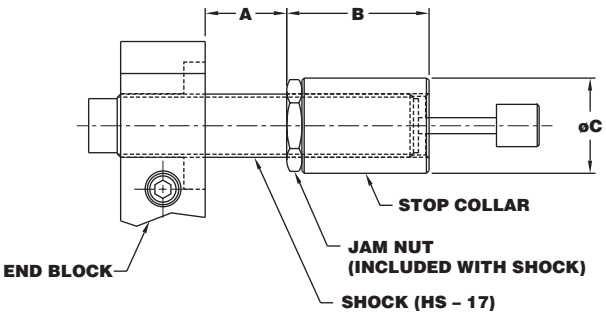
Ultran Slide & Ultran Rodless Cylinders



Model	A	B	øC
USC-04	1.0	.91	.63
USC-09	1.5	1.12	.69
USC-17	2.0	1.68	1.12
USC-31	3.0	1.93	1.50

Note: The Ultran Stroke Length needs increased by the B dimension in order to maintain intended stroke length. The overall length increases by the same amount. The A dimension indicates maximum amount of stroke adjustment attainable. The Hex Jam Nut is included with the shock absorber.

High Load Ultran



Model	A	B	øC
USC-09	.96	1.12	ø1.69
USC-17	.96	1.68	ø1.12

Note: The High Load Ultran Slide needs increased by the B dimension in order to maintain intended stroke length. The overall length increases by the same amount. The A dimension indicates maximum amount of stroke adjustment attainable.