PENSKE

RACING SHOCKS®

Technical Manual

7000, 7100, 7500 Series

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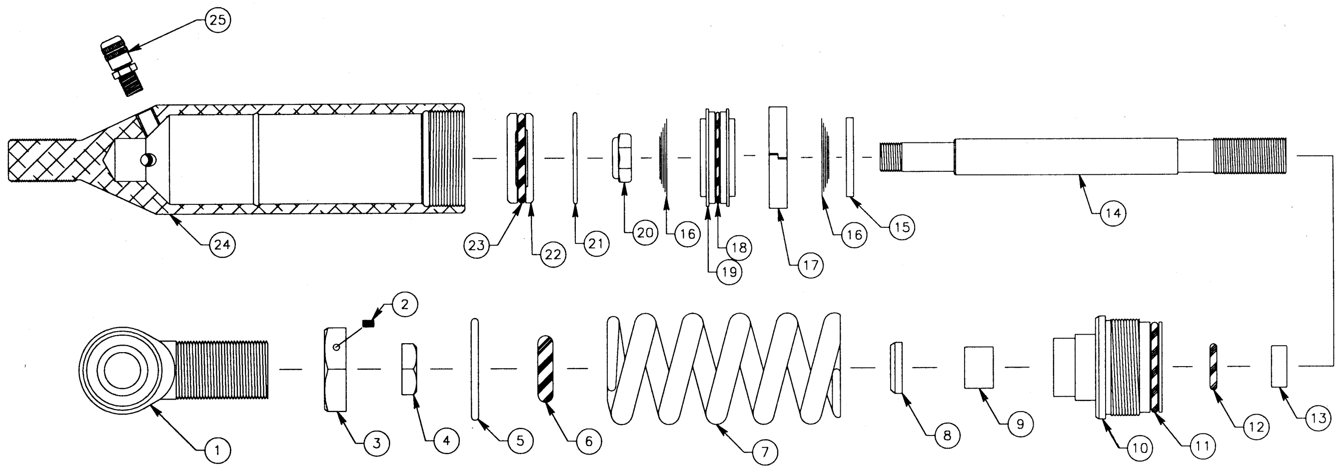
Hydraulic Tracking Damper (HTD)



ITEM NO.	PART NO.	DESCRIPTION
		Hydraulic Tracking Damper
1	MO-01	Rod End, .625
	MO-03	Rod End, .750
2	SC-01	Screw, Socket Set, 1/4” -20 x 1/4”
3	NT-01J	Jam Nut, 1” - 14
	NT-07J	Jam Nut, 1 1/8” - 12
4	NT-04J	Jam Nut, 5/8” - 18
5	VW-13	Washer, Flat, .925 ID
6	OR-2312-B	O_Ring, 2-312, Buna 70 Duro
7	SP-HTD600	Spring, 4.5” x 1.125 ID x 600 LB (Optional)
	SP-HTD900	Spring, 4.5” x 1.125 ID x 900 LB (Optional)
8	SL-09	Shaft Wiper, .625, Poly (Blue)
9	BU-10DU08	Bushing, DU .625 x .500
10	SB-HTD	Shaft Bearing, HTD
11	OR-2219-B	O-Ring, 2-219, Buna 70 Duro
12	OR-2114-V	O-Ring, 2-114, Viton 90 Duro

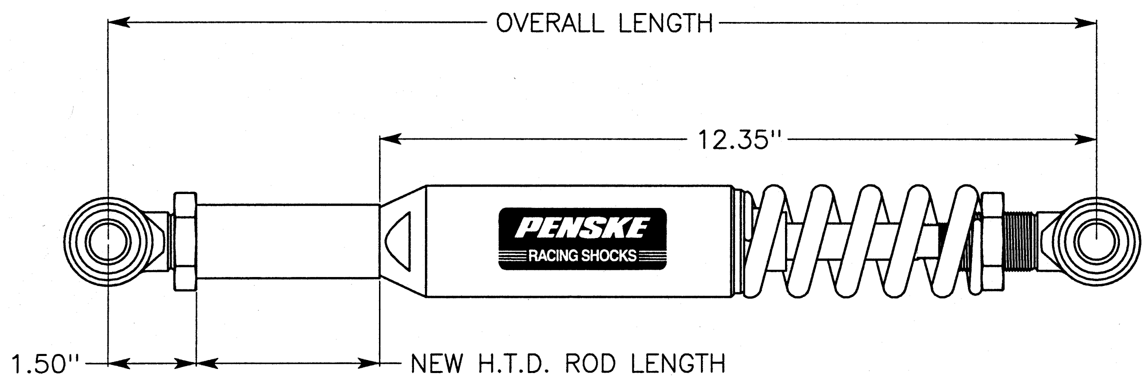
ITEM NO.	PART NO.	DESCRIPTION
13	BU-10DU04	Bushing, DU .625 x .250
14	SH-HTD	Shaft, HTD
15	VW-99	Top Out Plate, 1.375 x .504
16	VS-__	Valve Stack
17	PB-HTD	Piston Band, HTD
18	OR-2025-B	O-Ring, 2-025, Buna 70 Duro
19	PI-11004T	Piston, 1°/1°, .020 Bld 45mm, thin
20	NT-05R	Ring Nut, 1/2” - 18 (Nyloc)
21	RR-06	Wire Ring, .0625 Wire Diam x 1.900
22	PI-HTDR	Piston, Reservoir, HTD
23	OR-4219-B	Quad Ring, 4-219, Buna 70 Duro
24	BD-HTD	Body, HTD
25	IU-02	Air Valve, 1/8 NPT
	IU-04	Valve Core, 2000 psi
	IU-06	Valve Cap, High Temperature

HTD Specifications

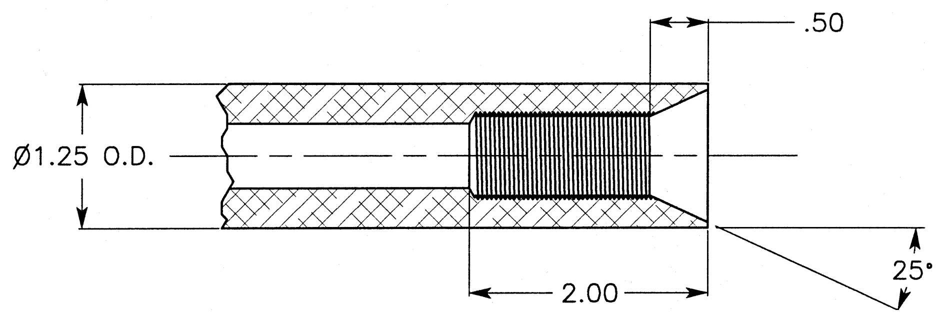
Type	Shock Series	Extended Length	Compressed Length	Shaft Travel	Spherical Bearing	Weight
HTD	7000	13.75"	12.5"	1.25"	.625"	2.5 lbs.

Installation Instructions

To ensure correct operation of the unit, please follow the instructions shown below carefully.



Existing Overall Length	New HTD Rod Length
26”	12.125”
27”	13.125”
28”	14.125”
29”	15.125”
30”	16.125”
31”	17.125”
32”	18.125”
33”	19.125”

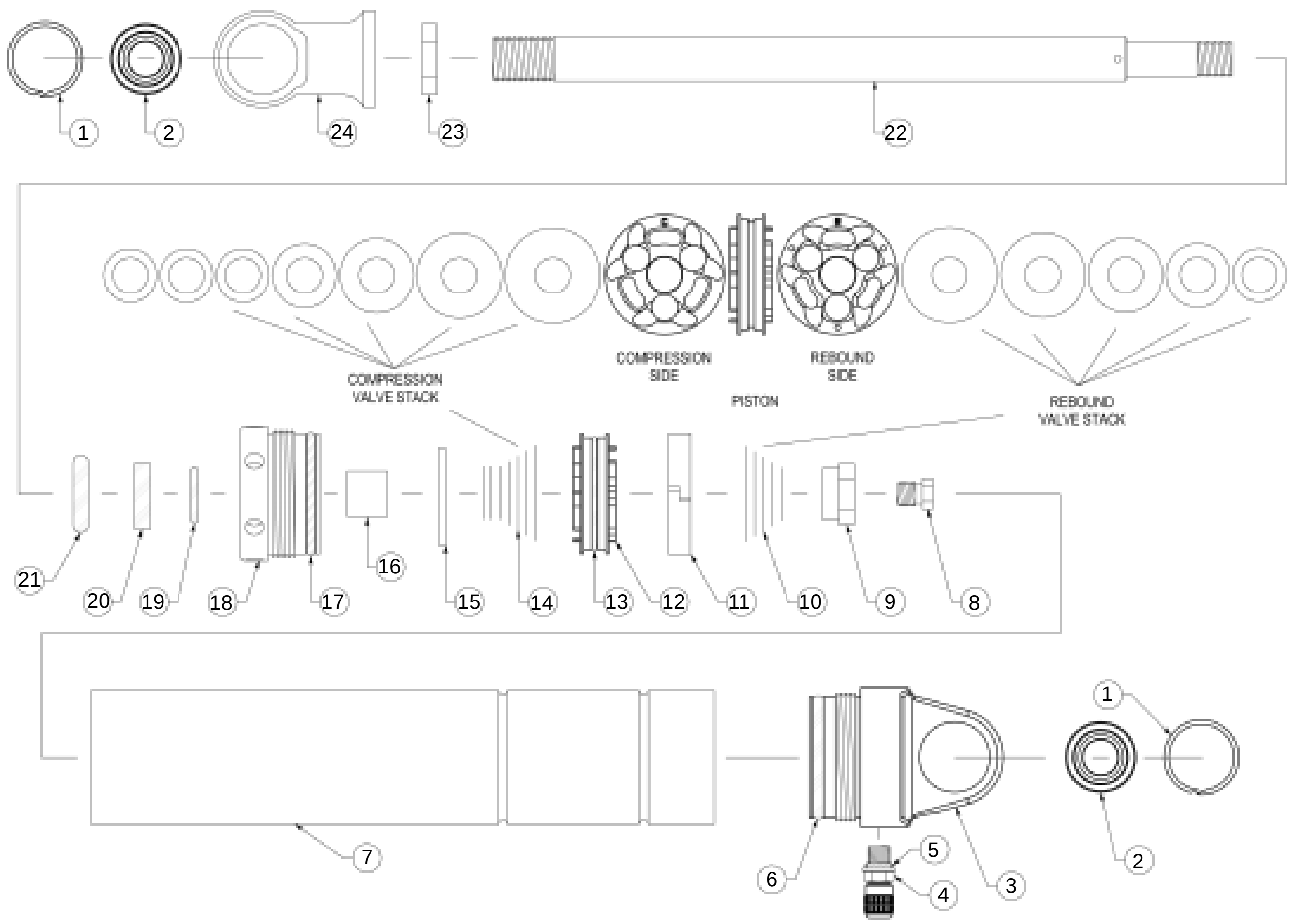


1. Cut radius rod to correct length.
2. Drill 11/16” hole, 2” deep.
3. Cut 25° chamfer .500” long.
4. Tap 3/4” - 16 UNF to bottom of 11/16” hole.
5. Make sure threads are straight and concentric.
6. Screw track rod firmly up against the body of the damper.

* Recommended pressure: 100 psi

7100 Series Parts List

STANDARD STEEL BODY



NOTE: 7500 Series Smooth Body accepts a Coil-over Kit [Part # KT-75CO__ (5” or 7”)]

ITEM NO.	PART NO.	DESCRIPTION
		Standard Steel (5", 7", 8", and 9" Travel)
1	RR-16	Retaining Ring, 1.025 Spiroloc
2	MO-09	Monoball, .500 ID x 1.00 OD x .625W
3	BC-71__	Body Cap, 7100 (0°, 90°, or Sealed Valve)
4	IU-22S	Air Valve, Port O-Ring
	IU-04	Valve Core, 2000 psi
	IU-06	Valve Cap, High Temperature
5	OR-2010-B	O-Ring, 2-010, Buna 70
6	OR-2221-B	O-Ring, 2-221, Buna 70
7	BD-71__*	Body, Steel, 7100, (5", 7", 8", or 9")
8	JT-0__*	Jet, (.000, .020, .040, .070, or .086 Bleed)
9	NT-02R	Ring Nut, .500 x 20
10	VS-___*	Valve Stack
11	PB-55	Piston Band, 55mm

ITEM NO.	PART NO.	DESCRIPTION
12	PI-______*	Piston
13	OR-2028-B	O-Ring, 2-028, Buna 70
14	VW-99	Top Out Plate, 1.375 x .500
	AS-75THSB	**Assembly, Shaft Bearing Complete (Includes Items 15-17)**
15	BU-10DU10	Bushing, DU .625 x .625
16	OR-2221-B	O-Ring, 2-221, Buna 70
17	SB-75TH	Shaft Bearing, 55mm
18	OR-2114-V	O-Ring, 2-114, Viton 75
19	SL-09	Shaft Wiper, .625 Poly (Blue)
20	OR-2312-B	O-Ring, 2-312, Buna 70
21	SH-NA__*	Shaft, Non Adjustable, (5", 7", 8", or 9")
22	NT-04J	Jam Nut, .625 x 18
23	EY-75NA	Eyelet, Non Adjustable

See page 10 for Rebound Adjuster Option.

*** Incomplete Part Number**

7100 Series Specifications

Type	Shock Series	Extended Length	Compressed Length	Shaft Travel	Spherical Bearing	Weight
Standard Steel	7105	15.75"	10.75"	5"	.5"	3.25 lbs.
Standard Steel	7107	19.75"	12.75"	7"	.5"	3.75 lbs.
Standard Steel	7108	21.75"	13.75"	8"	.5"	4 lbs.
Standard Steel	7109	23.75"	14.75"	9"	.5"	4.25 lbs.
Standard Steel Single Adjustable	710_-SA	+ .25"	+ .25"	5", 7", 8", 9"	.5"	Same as Above Weights

Disassembly/Assembly Instructions

Disassembly Instructions

1. **Depressurize** the shock, with the shaft pointing down.
2. Clamp the body cap eyelet in the vise with the shaft pointing up.
3. Unscrew the shaft bearing assembly from the shock body and remove the shaft assembly.
4. Drain the oil, when needed. Please dispose of properly.
5. Clamp the shaft eyelet in the vise with the piston pointing up.
6. Remove the 3/4" ring nut to access valving or to change the seals in the shaft bearing.
7. Inspect and replace the damaged o-rings and wiper if needed.

Assembly Instructions

1. For revalving, refer to page 16 for additional information.
2. Reassemble the shaft, be sure that the piston is properly positioned. With the shaft still in the vise, the compression valve stack is on the bottom of the piston and the rebound on the top. It is very important that the piston is positioned with the compression ("C") facing down and the rebound ("R") facing up.
3. Torque 3/4" ring nut to 25 ft•lbs (300 in•lbs).
4. If the jet was removed, torque to 120 in•lbs.
5. Fill the shock body with oil* as follows, see figure 1:

   Oil level is from the open end edge of shock for specified travel lengths.

   5" SHOCK - Oil level should be 2.30" from the bottom of shock body

   7" SHOCK - Oil level should be 2.60" from the bottom of shock body

   8" SHOCK - Oil level should be 2.80" from the bottom of shock body

   9" SHOCK - Oil level should be 2.90" from the bottom of shock body

   9" SHOCK (8" shaft)-Oil level should be 3.35" from the bottom of shock body

   ***NOTE:** Penske Suspension Fluid (Silkolene Pro RSF 5 wt. or 2.5 wt.) is recommended. Use of alternate fluids may have an adverse effect on the damper's internal sealing components. (ie: o-rings)*
6. With the shock in the vise, thread the shaft bearing into the shock body and tighten. Not too tight.
7. With the shaft pointing down, pressurize to recommended psi for a specific track.

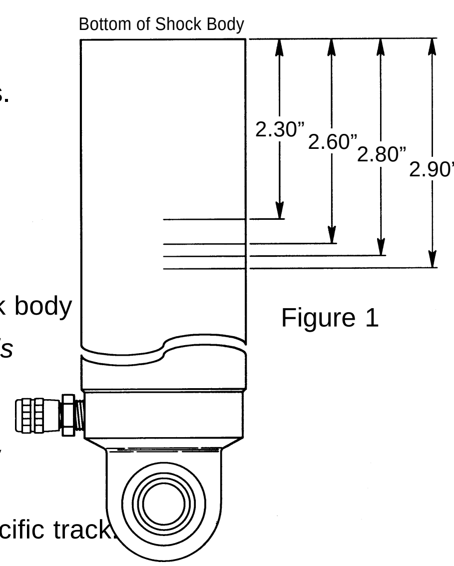
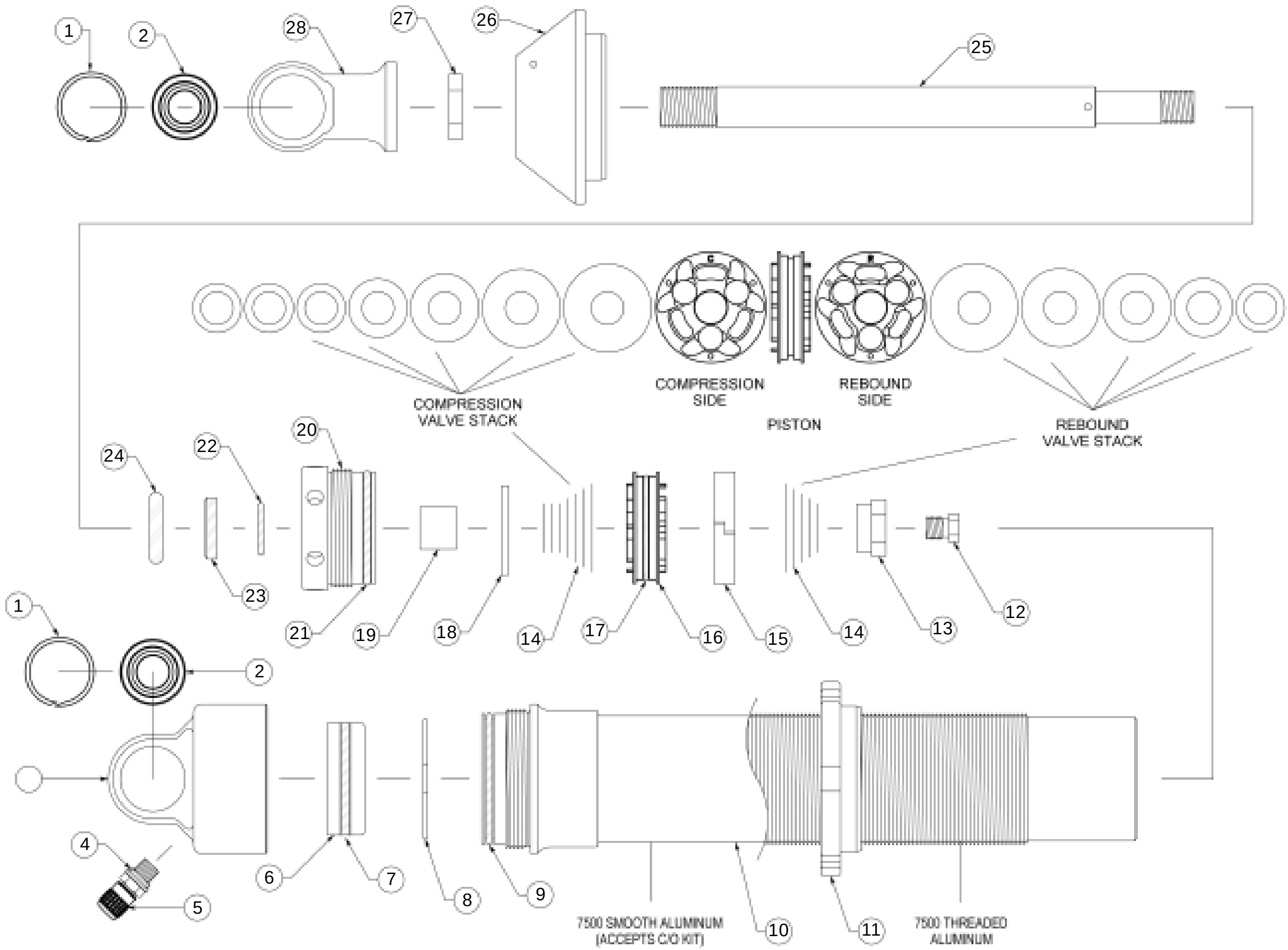


Figure 1

7500 Series Parts List



NOTE: 7500 Series Smooth Body accepts a Coil-over Kit [Part # KT-75CO__ (5" or 7")]

ITEM NO.	PART NO.	DESCRIPTION
		Short Track Special 5", 6", 7", 8", and 9" Travel (Rebuildable or Sealed)
1	RR-16	Retaining Ring,1.025 Spiroloc
2	MO-09	Monoball, .500 ID x 1.00 OD x .625W
3	BC-75NV	Body Cap, 7500, No Valve, Sealed
	BC-75TV	Body Cap, 7500, With Tank Valve
4	OR-2010-B	O-Ring, 2-010, Buna 70
5	IU-22-S	Air Valve, Port O-Ring, S.S.
	IU-04	Valve Core, 2000 psi
	IU-06	Valve Cap, High Temperature
6	PI-75	Piston, Floating, 7500 Series
7	OR-4221-B	Quad Ring, 4-221, Buna 70
8	RR-06	Wire Ring, .0625 Wire Diameter x 1.900
9	OR-2133-B	O-Ring, 2-133, Buna 70
10	BD-75__*	Body, 7500, (5", 6", 7", 8", or 9")
	BD-75__CO	Body, 7500, Coil-over, (5", 6", 7", 8", or 9")
11	RH-752__*	Ride Height Adjuster, 7500, (2.25" or 2.50")
12	JT-0__*	Jet, (.000, .020, .040, .070 or .086 Bleed)

ITEM NO.	PART NO.	DESCRIPTION
13	NT-02R	Ring Nut, .500 x 20
14	VS-___*	Valve Stack
15	PB-55	Piston Band, 55mm
16	PI-_______*	Piston
17	OR-2028-B	O-Ring, 2-028, Buna 70
18	VW-99	Top Out Plate, 1.375 x .500
	AS-75THSB	**Assembly, 7500 Threaded Shaft Bearing (Includes Items 19-23)**
19	BU-10DU10	Bushing, DU .625 x .625
20	SB-75TH	Shaft Bearing, Threaded, 7500
21	OR-2221-B	O-Ring, 2-221, Buna 70
22	OR-2114-V	O-Ring, 2-114, Viton 75
23	SL-09	Shaft Wiper, .625 Poly (Blue)
24	OR-2312-B	O-Ring, 2-312, Buna 70
25	SH-75NA__*	Shaft, 7500 Non Adjustable, (5", 6", 7", 8", or 9")
26	SR-752___*	Spring Retainer, 7500, (2.25" or 2.50")
27	NT-04J	Jam Nut, .625 x 18
28	EY-75NA	Eyelet, Non Adjustable

*** Incomplete Part Number**

See page 8 for Adjuster Option.

NOTE: 7500 Series Smooth Body accepts a Coil-over Kit.

7500 Series Specifications

Type	Shock Series	Extended Length	Compressed Length	Shaft Travel	Spherical Bearing	Weight
Short Track Owner Rebuildable	7505 Smooth Body 7545 Coil-over Body	15.883"	11.178"	4.705"	.5", .625" w	2 lbs. 3 oz.
Short Track Owner Rebuildable	7506 Smooth Body 7546 Coil-over Body	17.816"	12.236"	5.580"	.5", .625" w	2 lbs. 8 oz.
Short Track Owner Rebuildable	7507 Smooth Body 7547 Coil-over Body	20.024"	13.444"	6.580"	.5", .625" w	2 lbs. 14 oz.
Short Track Owner Rebuildable	7508 Smooth Body 7548 Coil-over Body	21.957"	14.502"	7.455"	.5", .625" w	3 lbs. 2 oz.
Short Track Owner Rebuildable	7509 Smooth Body 7549 Coil-over Body	24.166"	15.711"	8.455"	.5", .625" w	3 lbs. 8 oz.
Short Track Owner Rebuildable Single Adjustable	750_-SA Smooth Body 754_-SA Coil-over Body	+.25"	+ .25"	5", 6", 7", 8" 9"	.5", .625" w	Same as Above Weights
Short Track Sealed Shock	7515 Smooth Body 7555 Coil-over Body	15.883"	11.178"	4.705"	.5", .625" w	2 lbs. 3 oz..
Short Track Sealed Shock	7516 Smooth Body 7556 Coil-over Body	17.816"	12.236"	5.580"	.5", .625" w	2 lbs. 8 oz.
Short Track Sealed Shock	7517 Smooth Body 7557 Coil-over Body	20.024"	13.444"	6.580"	.5", .625" w	2 lbs. 14 oz.
Short Track Sealed Shock	7518 Smooth Body 7558 Coil-over Body	21.957"	14.502"	7.455"	.5", .625" w	3 lbs. 2 oz.
Short Track Sealed Shock	7519 Smooth Body 7559 Coil-over Body	24.166"	15.711"	8.455"	.5", .625" w	3 lbs. 8 oz.

Disassembly/Assembly Instructions

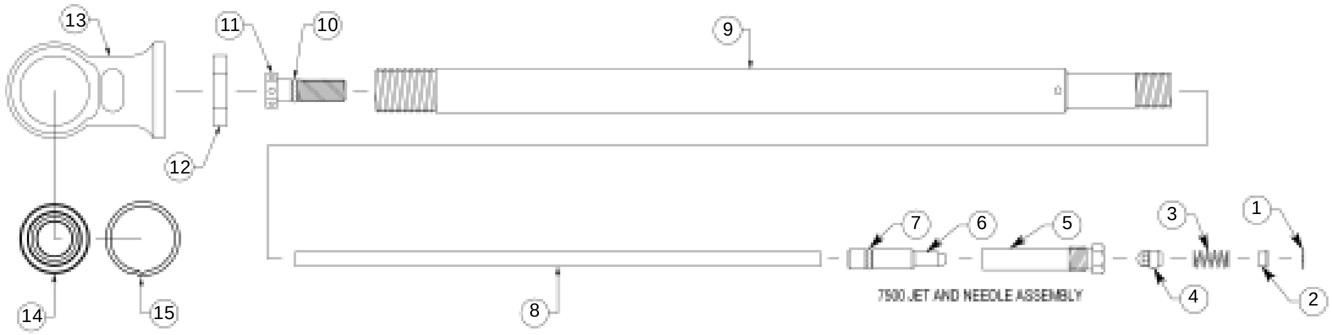
Disassembly Instructions

1. **Depressurize** the shock after backing the adjuster to full soft.
2. Clamp the body cap eyelet in the vise with the shaft pointing up. Place overflow ring on body.
3. Unscrew the shaft bearing assembly from the shock body and remove the shaft assembly.
4. Drain the oil, when needed (if it contains excessive air bubbles). Please dispose of properly.
5. Clamp the shaft eyelet in the vise with the piston pointing up.
6. Remove the 3/4" ring nut to access valving or to change the seals in the shaft bearing.
7. Inspect and replace the damaged o-rings and wiper if needed.

Assembly Instructions

1. For revalving, refer to page 12 for additional information.
2. Reassemble the shaft, be sure that the piston is properly positioned. With the shaft still in the vise, the compression valve stack is on the bottom and the rebound on top. It is very important that the piston is positioned with the (6) concave ports facing up on the rebound side and the (3) concave ports facing down on the compression side, see the following page.
3. Torque the 3/4" ring nut to 25 ft•lbs (300 in•lbs).
4. If the jet was removed, torque to 120 in•lbs.
5. Pressurize the reservoir to reposition floating piston (approx. 50 lbs.). **This step is very important.**
6. Fill the shock body with oil* to the bottom of the threads. (1/2" from the top of the body)
   ***NOTE:** *Penske Suspension Fluid (Silkolene Pro RSF 5 wt. or 2.5 wt.) is recommended. Use of alternate fluids may have an adverse effect on the damper's internal sealing components. (ie: o-rings)*
7. Insert the shaft and piston assembly into the shock body and begin to work out the air bubbles trapped in the piston, by using 1"-2" strokes. Move the shaft up and down a few times, making sure the two port holes in the shaft always remain below the surface of the oil or air will be sucked back into the piston assembly. Lightly tap the eyelet with a mallet a few times to assure all the air bubbles are gone. **Note: this step is very important, repeat as needed.**
8. Pull the shaft up until the two port holes in the shaft remain just below the surface of the oil.
9. Top off with oil and slide the shaft bearing down to seat the o-ring into the shock body without moving the shaft.
10. Depressurize the reservoir while asserting pressure to the shaft bearing and thread the shaft bearing into the shock body and tighten. Do not overtighten.
11. Pressurize to recommended nitrogen pressure for the specific track.

7100 and 7500 Single Adjustable Option



ITEM NO.	PART NO.	DESCRIPTION
	RF-602099	**Rebound Adjuster Option**
1	RR-05	Retaining Ring, .250 Internal
2	JT-76HAT	Jet, Top Hat
3	SP-15	Spring, (FF71)
4	JT-76POP	Jet, Poppet
5	JT-RDHSNG	Jet, Rebound, Straight Thru
6	NE-76	Needle
7	OR-2007-B	O-Ring,2-007, Buna 70
8	MR-8100	Metering Rod

ITEM NO.	PART NO.	DESCRIPTION
9	SH-____*	Shaft, Adjustable, (5", 7", 8", or 9")
	SH-75A__*	Shaft, 7500 Adjustable, (5", 6", 7", 8", or 9")
10	OR-2008-B	O-Ring, 2-008, Buna 70
11	RS-81	Rebound Screw, Adjustable Shaft
12	NT-04J	Jam Nut, .625 x 18
13	EY-75190	Eyelet, 7500, 1.60 Sweep, 90°
	EY-75160	Eyelet, 7500, 1.60 Sweep, 0°
14	MO-09	Monoball, .500 ID x 1.00 OD x .625W
15	RR-16	Retaining Ring, 1.025 Spiroloc

*** Incomplete Part Number**

Damping Adjusters

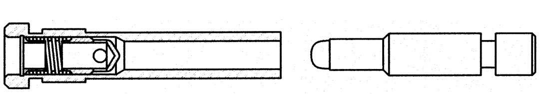
8760 Needle and Jet

The 8760 jet and needle combination have been designed to give the user a broader and more linear range of adjustment for bleed past the piston on rebound.

The 8760 jet utilizes a spring loaded poppet valve to check the flow. This gives a better seal against the flow and a quicker response time as the shaft changes direction.

This needle has a curved parabolic tip, which gives a very fine, linear adjustment in damping across the entire range provided by the jet. It can be thought of as a combination of the 10°, 5°, and 3° needles.

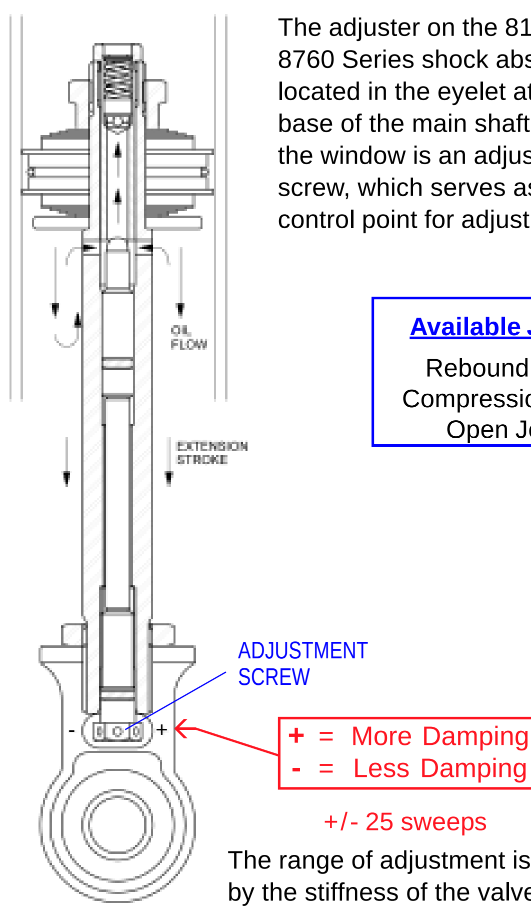
The 8760 needle and jet will fit any of our adjustable shafts, but they must be used together and cannot be interchanged with older style needles and jets.



The adjuster on the 8100 and 8760 Series shock absorber is located in the eyelet at the base of the main shaft. Inside the window is an adjustment screw, which serves as the control point for adjustments.

Available Jets:

Rebound Jet
Compression Jet
Open Jet



+/- 25 sweeps

The range of adjustment is affected by the stiffness of the valve stack.

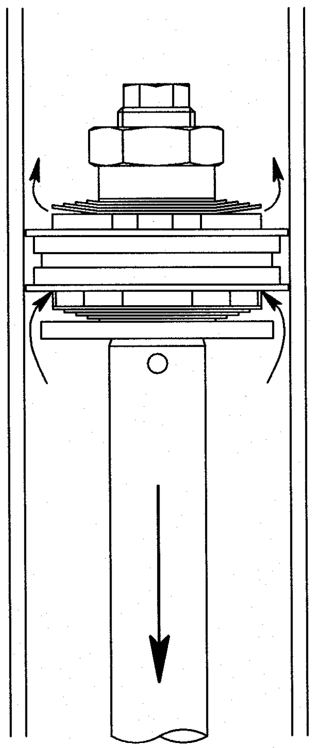
Suggested Maintenance

PRE RACE	Inspect for oil leakage. Check the nitrogen pressure.
EVERY 30 HOURS OF TRACK TIME OR YEARLY	Change oil. Replace the shaft seal o-ring, wiper, shaft bearing o-ring, reservoir cap o-ring and piston o-ring.

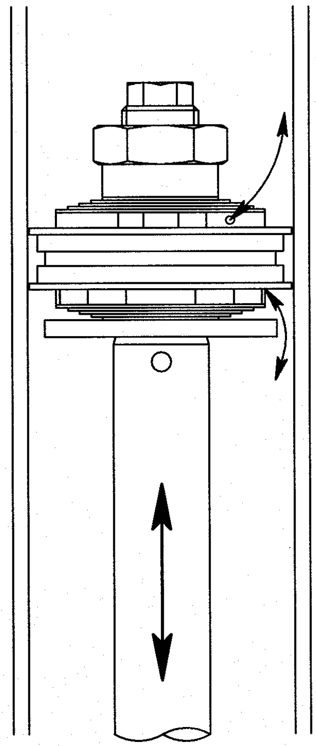
Trouble Shooting

LOSS OF NITROGEN PRESSURE	Valve core is not tight or needs replacing, teflon seal on air valve needs replacing, reservoir cap o-ring needs replacing.
OIL LEAK AROUND SHAFT	Shaft seal o-ring or wiper needs replacing. *Note: minimal oil seepage is normal.*
OIL LEAK BETWEEN SHAFT BEARING AND BODY	Shaft bearing o-ring needs replacing.
SHAFT WILL NOT FULLY EXTEND	Check for bent shaft, low nitrogen pressure, not enough oil. *Note: do not spray brake cleaner or solvent on the shaft wiper, it may cause it to swell and prevent proper movement.*

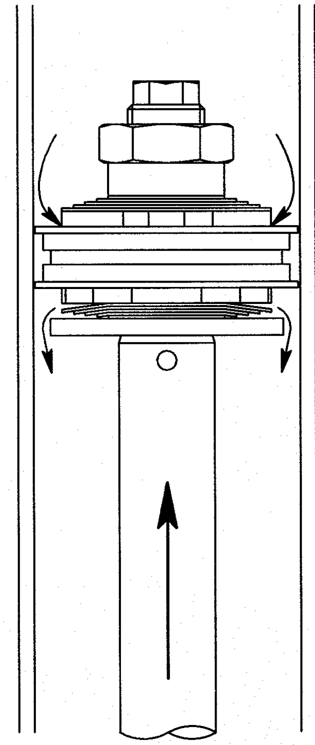
General Valving Characteristics



High Speed
Rebound



Low Speed*
Compression and Rebound



High Speed
Compression

The damping characteristics of your shock are determined by the compression and rebound valve stacks located on the main piston.

The valve stacks are made up of a series of high quality shims, which are made to flex under the force of oil flowing through the piston ports and then return to their original state.

The thickness of the individual shims determines the amount of damping force the shock will produce. By changing the thickness of the individual shims, damping forces will be altered. For example, if you are running an “A” compression valving, where all the shims in the stack are .006 thick and you replace them with a “B” compression valving, which consists of all .008 thick shims, the compression damping will increase.

* When the shaft is moving very slowly oil passes through the bleed hole and/or shaft bleed, if there is one, before it passes to the shims.

General Oval Track Tuning Tips

Bump in Front Usually Effects:

1. Middle
2. Entry

Rebound in Rear Usually Effects:

1. Middle
2. Entry

Rebound in Front Usually Effects:

1. Middle
2. Exit

Bump in Rear Usually Effects:

1. Middle
2. Exit

Push Off Exit of Corners

1. Decrease Rebound RR
2. Increase Rebound RF
3. Increase Rebound LR
4. Decrease Rebound LF
5. Increase Compression RR

Loose Off Exit of Corners

1. Decrease Rebound RF
2. Increase Rebound RR
3. Decrease Compression RR
4. Increase Rebound LF
5. Decrease Rebound LR

Push in Middle of Corners

1. Decrease Rebound LF
2. Increase Compression RR
3. Increase Rebound RF
4. Decrease Compression LF

Loose in Middle of Corners

1. Decrease Compression RR
2. Decrease Rebound RF
3. Decrease Rebound LR

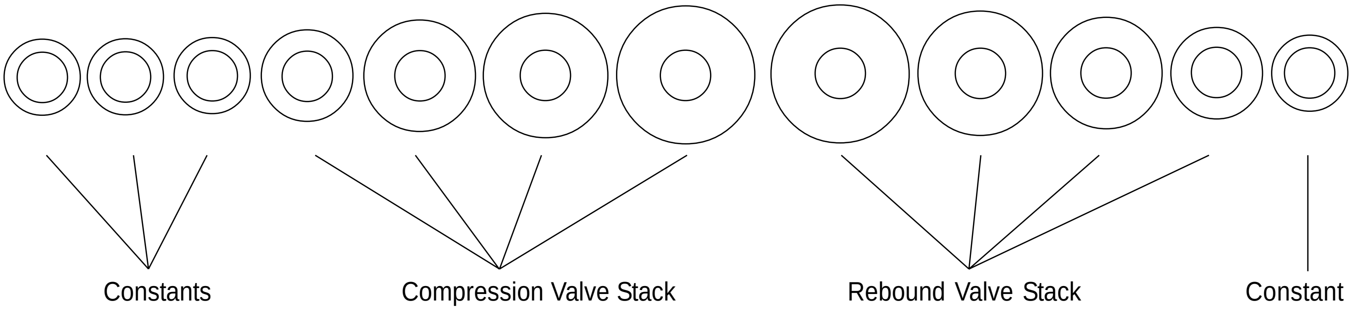
Push on Entry to Corners

1. Decrease Compression Both Front Shocks
2. Decrease Compression RF
3. Increase Rebound LR

Loose on Entry to Corners

1. Increase Compression Both Front Shocks
2. Increase Compression RF
3. Decrease Rebound LR

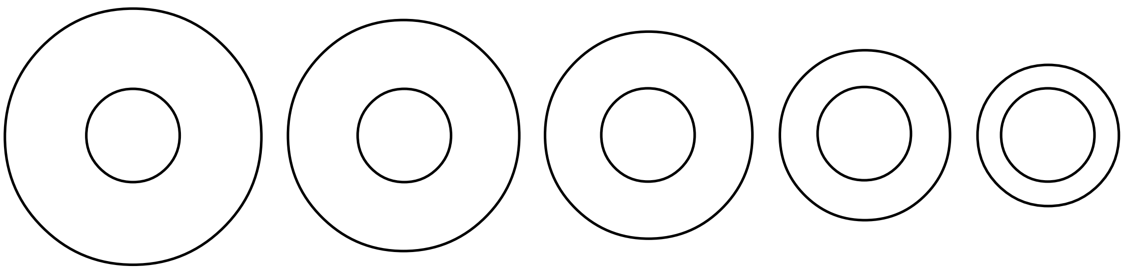
Valving



When refering to shock valving, (example: A/B), (A) refers to the compression valve stack and (B) refers to the rebound valve stack.

Valve Stacks

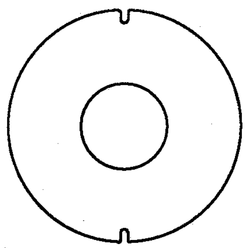
Standard Digressive Valve Stack



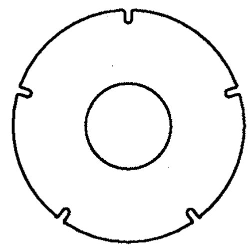
Part #		1.350 O.D.	1.200 O.D.	1.050 O.D.	.900 O.D.	.750 X .020
VS-AA	**AA**	.004	.004	.004	.004	Constant
VS-AAP	**AA+**	.004	.004	.006	.006	Constant
VS-AM	A-	.006	.006	.004	.004	Constant
VS-A	**A**	.006	.006	.006	.006	Constant
VS-AP	**A+**	.006	.006	.008	.008	Constant
VS-BM	B-	.008	.008	.006	.006	Constant
VS-B	**B**	.008	.008	.008	.008	Constant
VS-BP	**B+**	.008	.008	.010	.010	Constant
VS-CM	C-	.010	.010	.008	.008	Constant
VS-C	**C**	.010	.010	.010	.010	Constant
VS-CP	**C+**	.010	.010	.012	.012	Constant
VS-DM	D-	.012	.012	.010	.010	Constant
VS-D	**D**	.012	.012	.012	.012	Constant
VS-DP	**D+**	.012	.012	.015	.015	Constant
VS-EM	E-	.015	.015	.012	.012	Constant
VS-E	**E**	.015	.015	.015	.015	Constant
VS-EP	**E+**	.015	.015	.020	.020	Constant
VS-FM	F-	.020	.020	.015	.015	Constant
VS-F	**F**	.020	.020	.020	.020	Constant

1.350 O.D. and 1.200 O.D. primarily affects Low Speed
.900 O.D. and 1.050 O.D. primarily affects High Speed

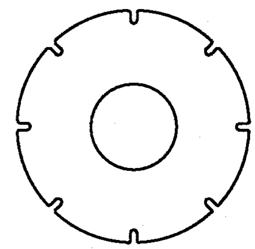
Digressive Valving Information Options



2 Notch
1.350 O.D.



5 Notch
1.350 O.D.



8 Notch
1.350 O.D.

	Part #		Part #		Part#
.004	**VW-2NX.004**	.004	**VW-5NX.004**	.004	**VW-8NX.004**
.006	**VW-2NX.006**	.006	**VW-5NX.006**	.006	**VW-8NX.006**
.008	**VW-2NX.008**	.008	**VW-5NX.008**	.008	**VW-8NX.008**

Flow Rate Through Slotted Shims

Shim Thickness	Number of Notches	Relative Flow Rate	Equivalent Bleed Hole Ø (1) Hole
0.004	2	0.48	0.022
0.004	5	1.20	0.035
0.004	8	1.93	0.044
0.006	2	0.64	0.025
0.006	5	1.61	0.040
0.006	8	2.57	0.051
0.008	2	0.86	0.029
0.008	5	2.14	0.046
0.008	8	3.42	0.059

These flow rate values are dimensionless and have no real meaning by themselves. They are simply used to cross-reference the amount of flow between different bleed hole or slot combinations. For example, four Ø.010” holes would have the same flow rate as one Ø.020” hole (with a flow rate of 0.40). The flow rates can also be added, so a piston with three Ø.015” and three Ø.020” holes would have a total flow rate value of 0.68 + 1.20 = 1.88 which would be the same as three Ø.025” holes.

Preload Shim Spacers

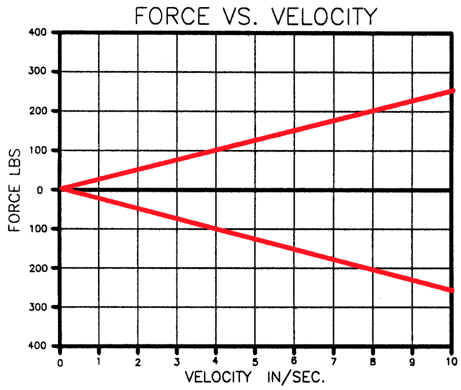
	Part#
.004 x .750	**VW-23**
.006 x .750	**VW-25**
.008 x .750	**VW-27**
.010 x .750	**VW-29**
.012 x .750	**VW-31**
.015 x .750	**VW-33**
.020 x .750	**VW-00**

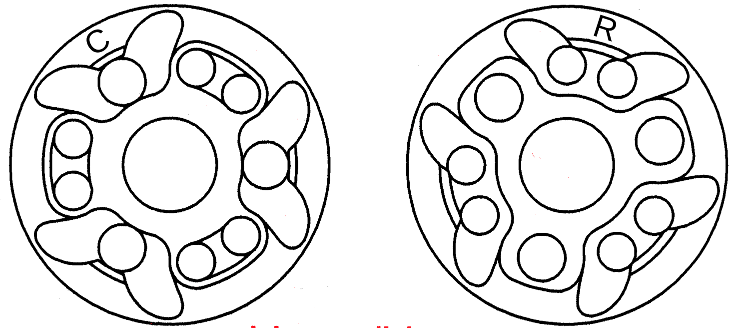
Flow Rate Through Multiple Bleed Holes

Hole Diameter	1 Hole	2 Holes	3 Holes	4 Holes	5 Holes	6 Holes	7 Holes	8 Holes	9 Holes
0.010	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90
0.012	0.14	0.29	0.43	0.58	0.72	0.86	1.01	1.15	1.30
0.015	0.23	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03
0.018	0.32	0.65	0.97	1.30	1.62	1.94	2.27	2.59	2.92
0.020	0.40	0.80	1.20	1.60	2.00	2.40	2.80	3.20	3.60
0.022	0.48	0.97	1.45	1.94	2.42	2.90	3.39	3.87	4.36
0.024	0.58	1.15	1.73	2.30	2.88	3.46	4.03	4.61	5.18
0.025	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63
0.026	0.68	1.35	2.03	2.70	3.38	4.06	4.73	5.41	6.08
0.028	0.78	1.57	2.35	3.14	3.92	4.70	5.49	6.27	7.06
0.030	0.90	1.80	2.70	3.60	4.50	5.40	6.30	7.20	8.10
0.032	1.02	2.05	3.07	4.10	5.12	6.14	7.17	8.19	9.22
0.034	1.16	2.31	3.47	4.62	5.78	6.94	8.09	9.25	10.40
0.035	1.23	2.45	3.68	4.90	6.13	7.35	8.58	9.80	11.03
0.036	1.30	2.59	3.89	5.18	6.48	7.78	9.07	10.37	11.66
0.038	1.44	2.89	4.33	5.78	7.22	8.66	10.11	11.55	13.00
0.040	1.60	3.20	4.80	6.40	8.00	9.60	11.20	12.80	14.40
0.045	2.03	4.05	6.08	8.10	10.13	12.15	14.18	16.20	18.23
0.050	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50
0.055	3.03	6.05	9.08	12.10	15.13	18.15	21.18	24.20	27.23
0.060	3.60	7.20	10.80	14.40	18.00	21.60	25.20	28.80	32.40
0.062	3.84	7.69	11.53	15.38	19.22	23.06	26.91	30.75	34.60
0.064	4.10	8.19	12.29	16.38	20.48	24.58	28.67	32.77	36.86
0.066	4.36	8.71	13.07	17.42	21.78	26.14	30.49	34.85	39.20
0.068	4.62	9.25	13.87	18.50	23.12	27.74	32.37	36.99	41.62
0.070	4.90	9.80	14.70	19.60	24.50	29.40	34.30	39.20	44.10
0.072	5.18	10.37	15.55	20.74	25.92	31.10	36.29	41.47	46.66

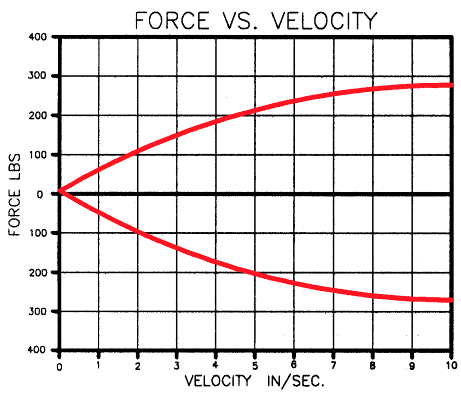
Piston Selection

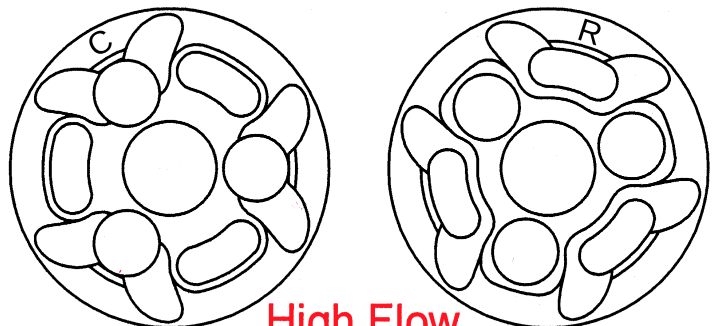
Compression Face | Rebound Face



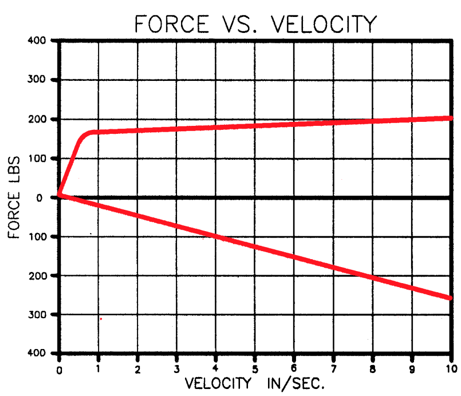


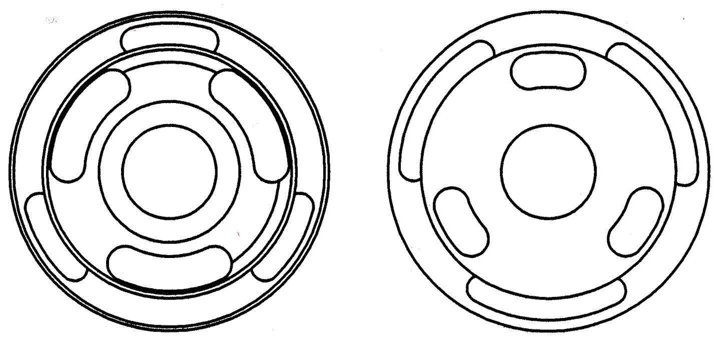
Linear/Linear





High Flow Linear/Linear

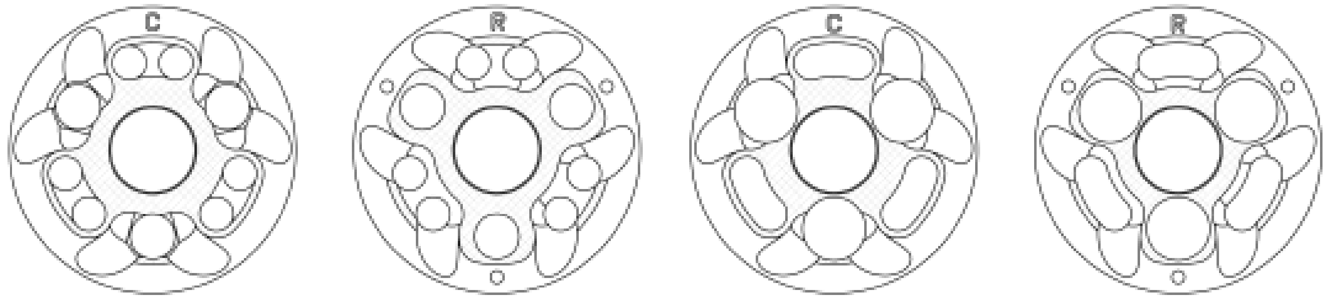




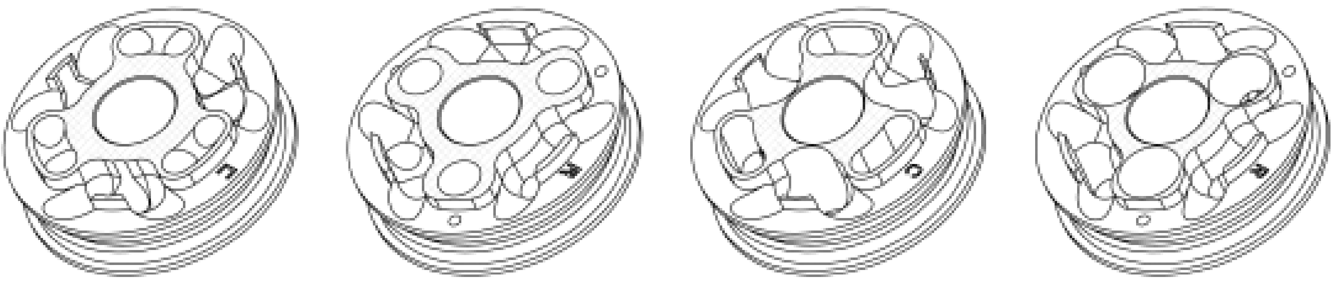
Digressive/Linear

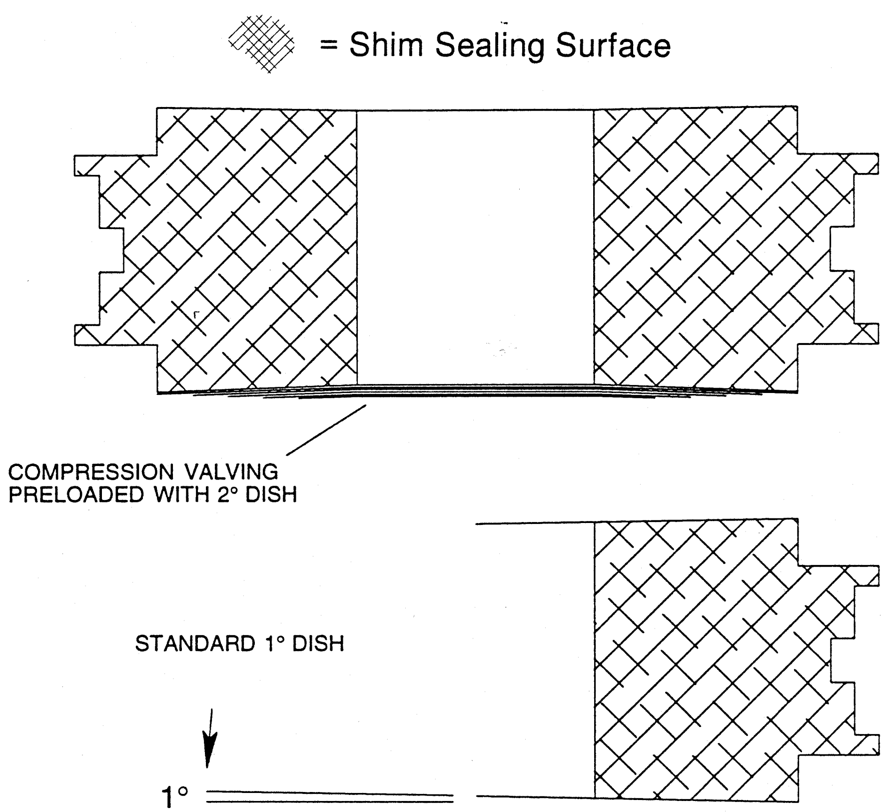
PART NO.	DESCRIPTION
PI-11005	Linear Piston, $1^\circ/1^\circ$, 55mm
PI-12005	Linear Piston, $1^\circ/2^\circ$, 55mm
PI-21005	Linear Piston, $2^\circ/1^\circ$, 55mm
PI-22005	Linear Piston, $2^\circ/2^\circ$, 55mm
PI-HF12005	High Flow Linear Piston, $1^\circ/2^\circ$, 55mm
PI-HF14005	High Flow Linear Piston, $1^\circ/4^\circ$, 55mm
PI-HF21005	High Flow Linear Piston, $2^\circ/1^\circ$, 55mm
PI-HF22005	High Flow Linear Piston, $2^\circ/2^\circ$, 55mm
PI-DL005	Digressive/Linear Piston, 55mm
PI-DL005-1DG	Digressive/Linear Piston, 1°, 55mm

Linear Piston / High Flow Piston



Linear Piston High Flow Piston



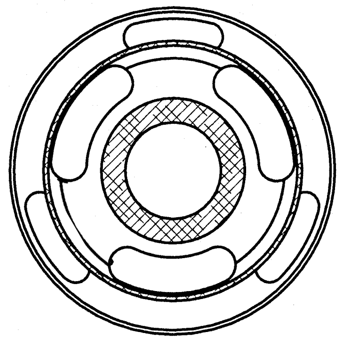


Each piston face has a dished surface, to preload the valve shims flat against the piston face. The standard dishing is 1° on both the compression and rebound sides of the piston. By increasing the compression side dishing to 2°, the shims become increasingly preloaded, causing a slight delay in opening during compression movement. The dishing causes the shims to “snap” open, in return giving the car a “snappier” feel as opposed to a smooth roll, once again this modification is for driver feel. Dishing increases low speed control. If you have questions on piston dishing, call our technical staff for information and recommendations.

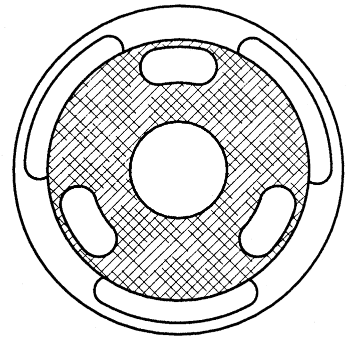
Digressive Piston

The digressive design incorporates larger ports on the face of the piston to increase the flow of oil throughout the shocks high speed action. When the shim stack opens, oil is “dumped” through the piston in large capacities. The increased flow of oil reduces the progressive damping characteristics of the linear side of the piston.

In addition to the larger ports, the face of the piston is designed to allow adjustments to the preload on the shim stack. Increased preload delays the opening of the shim stack, causing an increased damping force at low shaft speeds. When the shims crack open, oil is “dumped” at a high rate, reducing the progressive damping characteristics.



Digressive Face



Linear Face

To visually explain piston preload, Figure 3, shows a digressive/linear piston with zero preload on the shim stack. Figure 4, shows a digressive/linear piston with an exaggerated amount of preload. The preload cups the shim stack, energizing the shims until the instant high shaft velocity snaps them open. The preload may be varied by adding or subtracting a series of shims under the main shim stack.

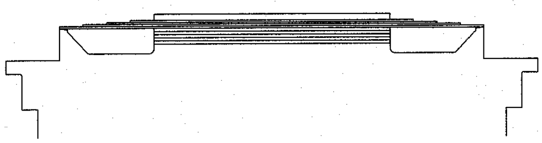


FIGURE 3
NON-PRELOADED
SHIM STACK

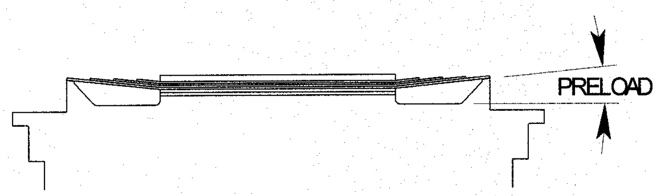
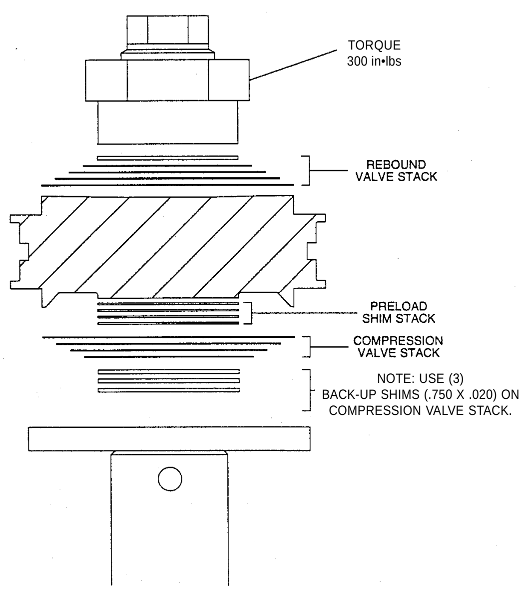


FIGURE 4
PRELOADED
SHIM STACK

The digressive piston design is offered in two variations. The double digressive piston is preload variable on both the compression and rebound sides. The digressive / linear piston is preload variable on the digressive side only, leaving the other side with linear characteristics. In most cases, the linear side of the piston would be rebound, however, it can be used either way.

Digressive/Digressive

The double digressive piston has .050 of available preload as shown in Figure 1. Stacking preload shims between the piston and the shim stack varies the amount of preload on the shim stack. When referring to the amount of preload on a shim stack, you’re referring to the amount of preload on the piston face of the shim stack. For example; .010 preload = .050 (total available preload) minus .040 (the combined thickness of the preload stack).



DIGRESSIVE/LINEAR
VALVING ILLUSTRATION

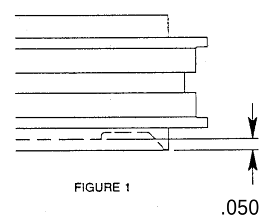


FIGURE 1

Digressive/Linear

The linear side of the digressive/linear piston is treated as a standard linear piston. Due to the higher flow when running the linear side on rebound, it is a rule of thumb to run (1) step stiffer on the rebound side than what was used on a standard linear piston (example: A up to B).

Damping Adjustments

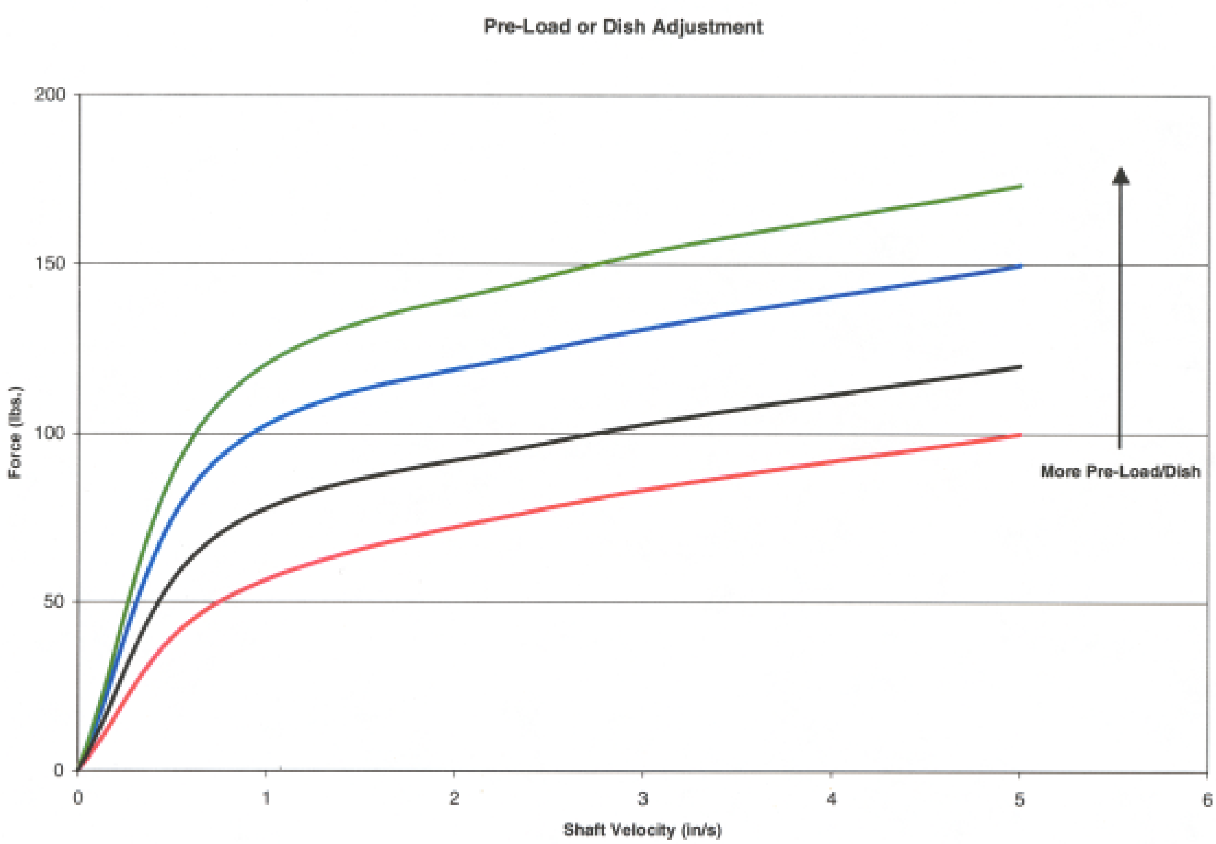
There are three major ways in which you can vary the damping produced by the main piston: Shim stiffness, shim pre-load and the amount of bleed past the shims. These graphs help to visualize the way in which the damping is affected by each of these changes.

Figure 1 shows the effect of changing the pre-load (on digressive or VDP pistons) or dish (on linear or high flow pistons). Adding pre-load or dish will create a lot more low speed damping. In compression, it will cause the tire to be loaded quicker and give a “snappy” feel. In rebound, it will help to tie the vehicle down and let it take a set quicker.

Figure 2 shows the effect of increasing the stiffness of the shim stack. Increasing the thickness of the shim stack (i.e., .004 to .010) stiffens the damping rate of the shock across the whole velocity range. While the other two adjustments only affect the lower shaft speeds, the shim stiffness is the best way to adjust damping at higher shaft speeds. The shims give the damping that chassis dynamics require.

Figure 3 shows the effect of adding bleed to the piston or through the shaft. Bleed is simply a low speed bypass for the shims and softens the shock at lower shaft speeds. This will improve the compliance of the chassis to the ground under low amplitude movements which can improve grip. It will give the driver a softer ride, but will let the chassis move more and take away support. (This is what the driver feels)

Figure 1



Damping Adjustments

Figure 2

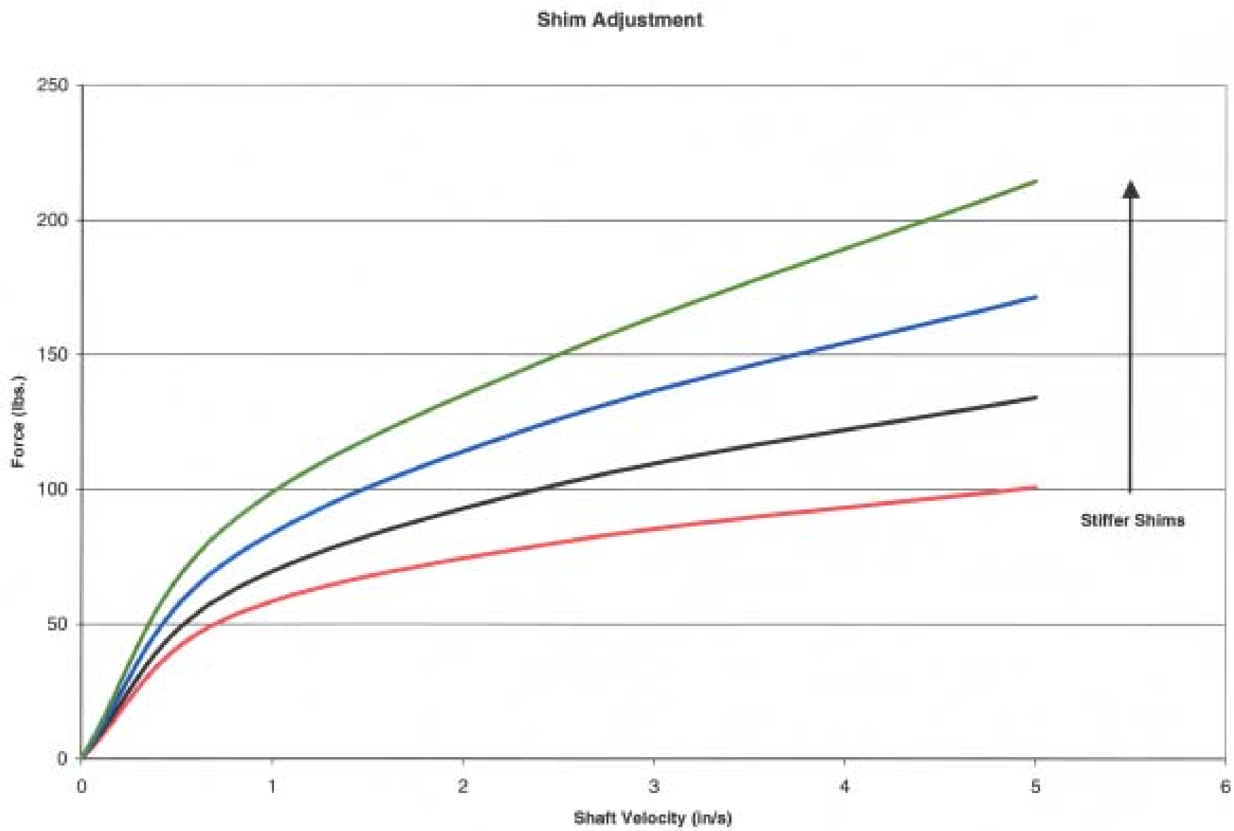
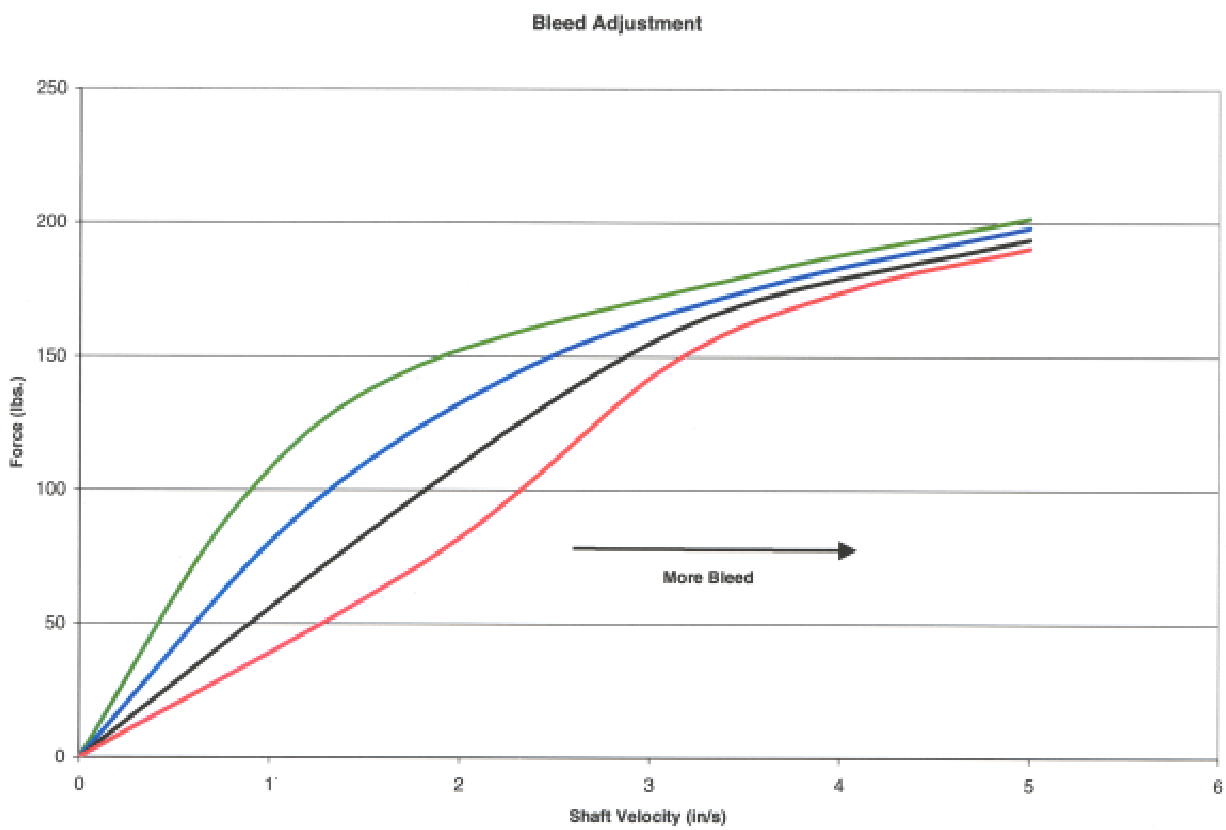
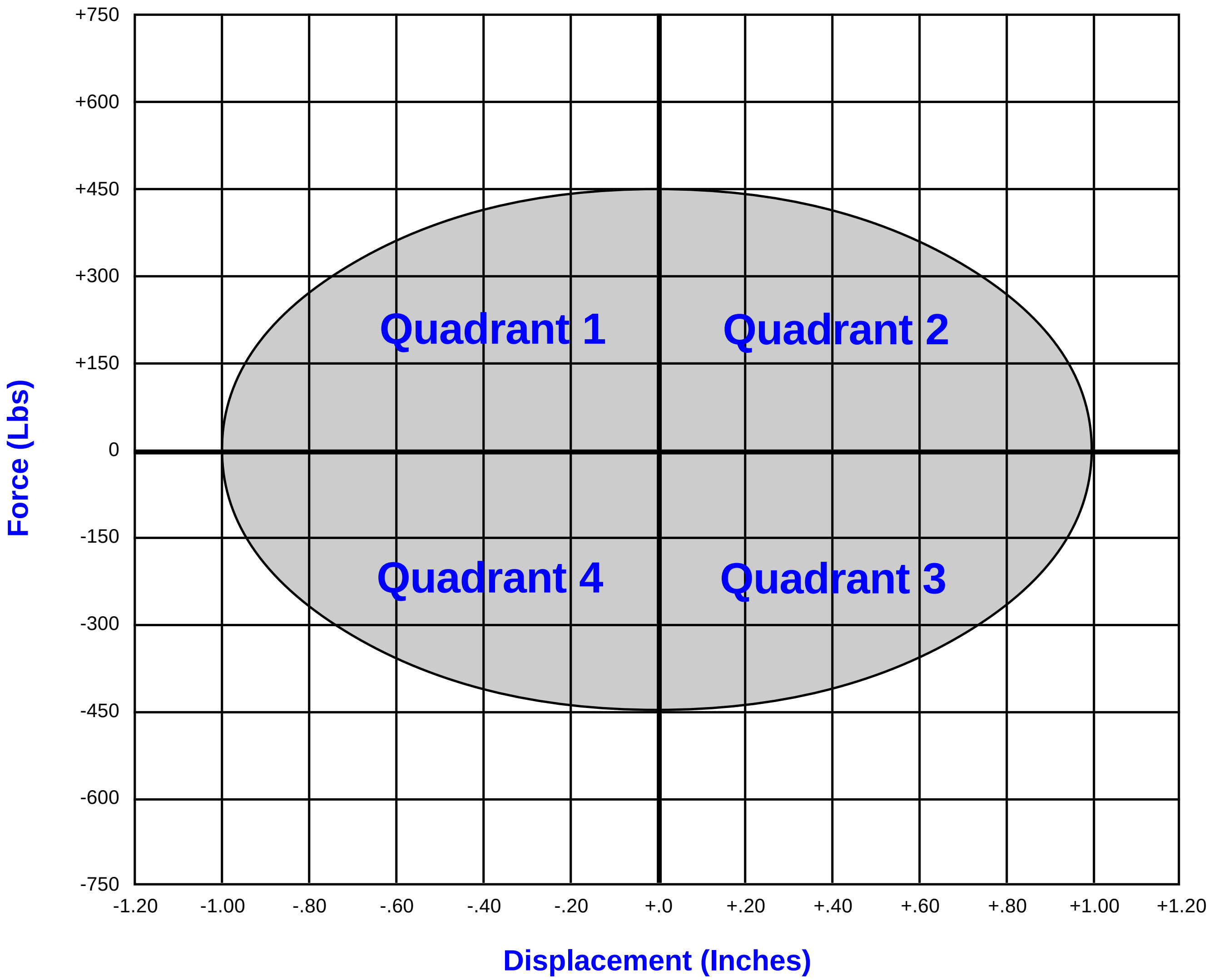


Figure 3

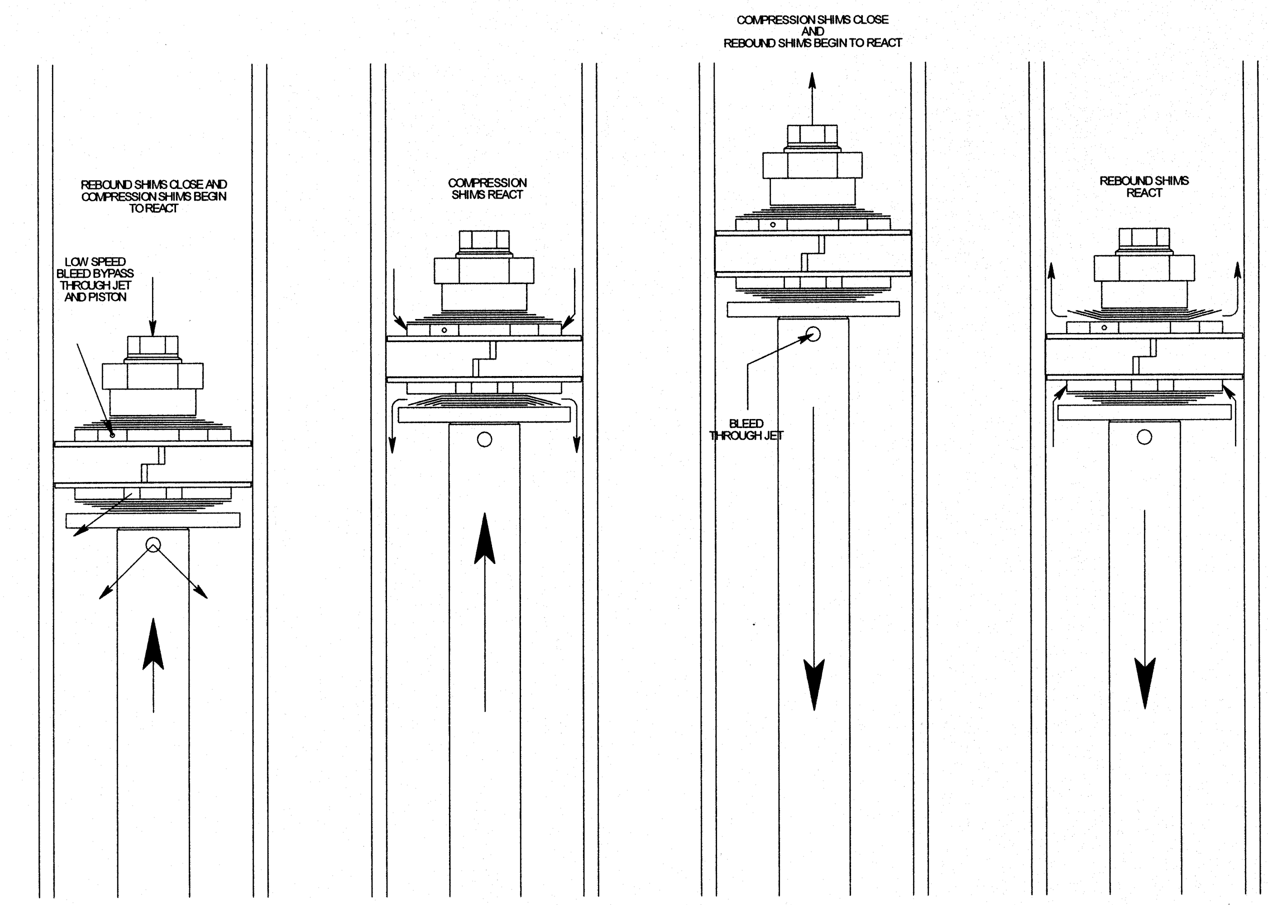


Dyno Graph Overview



This section of the manual illustrates different valving combinations in the form of graphs. The graph shown is force vs. displacement graph. The force vs. displacement graph is a very accurate and simple way to assess valving characteristics. If you are not familiar with this type of graph, it is explained on the following page along with the graph above, showing the four different quadrants.

Dyno Graph Overview



QUADRANT #1

This is the beginning of the compression stroke. Where the graph crosses the zero line (pounds) in quadrant #1 begins the compression stroke. Approximately the first 1/2" of displacement is formed with relation to the low speed bleed bypass. When the shaft reaches a certain velocity, the low speed bleed bypass shuts off and the compression valve stack begins to react.

QUADRANT #2

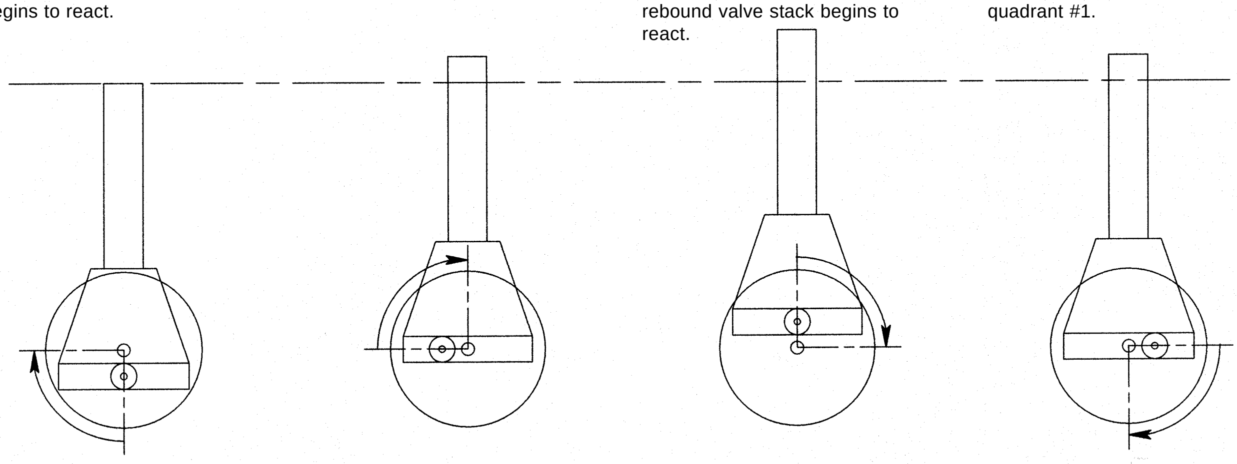
This quadrant begins with the compression valve stack open. Where the graph crosses the zero line (inches) in quadrant #2 is the maximum force produced by the compression valving. As the shock approaches the full compression point, the compression valve stack begins to close as it approaches the rebound movement.

QUADRANT #3

This quadrant begins with the shock at full compression and the compression valve stack closed. Where the graph crosses the zero line (pounds) in quadrant #3 begins the rebound stroke. Approximately the first 1/2" of displacement is formed with relation to the rebound bleed through the shaft and jet. When the shaft reaches a certain velocity, the bleed shuts off and the rebound valve stack begins to react.

QUADRANT #4

This quadrant begins with the rebound valve stack open. Where the graph crosses the zero line (inches) in quadrant #4 is the maximum force produced by the rebound valving. As the shock approaches the full extension point, the rebound valve stack begins to close as it approaches the compression movement. At this point the cycle starts over again in quadrant #1.

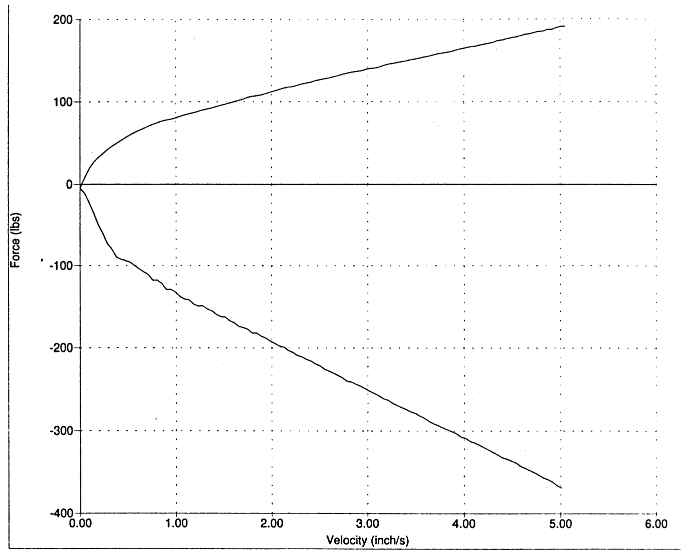


An easy way to help picture what is going on here is to relate the graph's shape to what the dyno is doing to the shock. The dyno uses a scotch yoke system (shown above), where the motor turns a crank and the sliding yoke allows the main dyno shaft to make the up and down movement at the preset stroke. The dyno software takes thousands of measurements throughout a single revolution of the crank. The sampled points are connected to form the graph. By relating the crank's position to the corresponding graph quadrant and the circular crank movement may help in reading the graphs.

Dyno Graph Overview

Force / Velocity Average

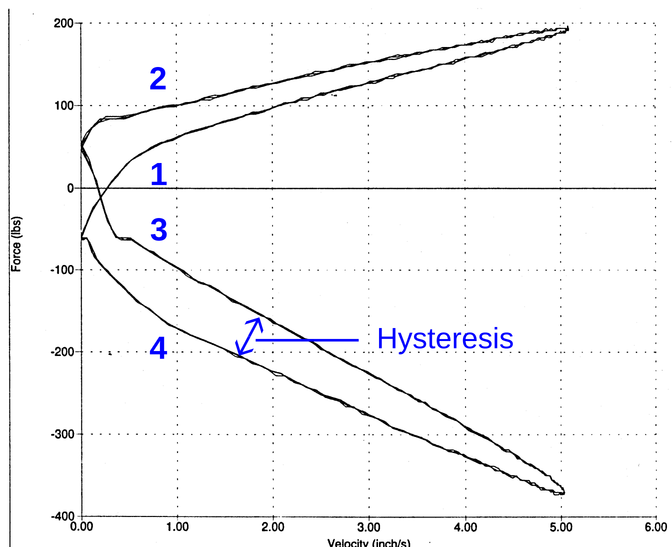
This graph shows the averages of the accelerating and decelerating compression and rebound forces. It is a good quick, general review of the shock curve, but is the least accurate of the options displayed.



Force / Velocity

This graph displays the accelerating and decelerating compression and rebound forces. Think of this graph as the Force / Displacement graph (below) folded in half.

* Hysteresis is the gap between accelerating and decelerating compression and rebound damping. It is affected by the type of piston, the shims used and the relative position of high and low speed adjusters. The bleed hole will close the gap or soften the low speed forces.



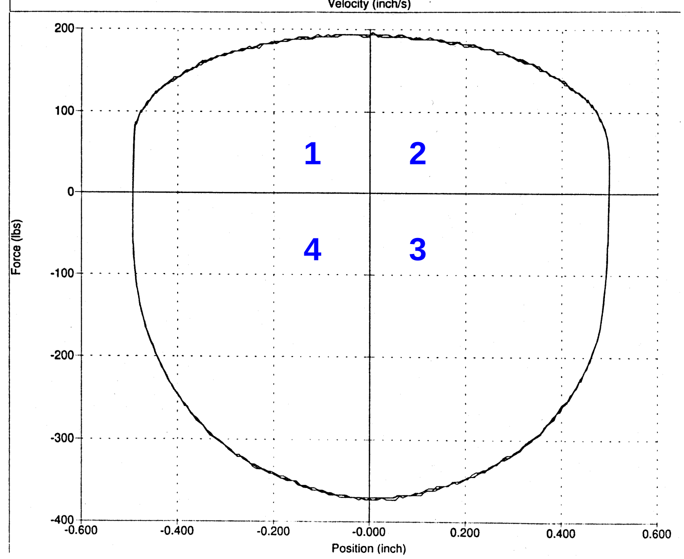
OVAL (Force / Displacement)

QUADRANT #1
This is the beginning of the compression stroke. Where the graph crosses the zero line (pounds) in quadrant #1 begins the compression stroke. Approximately the first 1/2" of displacement is formed with relation to the low speed bleed bypass. When the shaft reaches a certain velocity, the low speed bleed bypass chokes off and the compression valve stack begins to react.

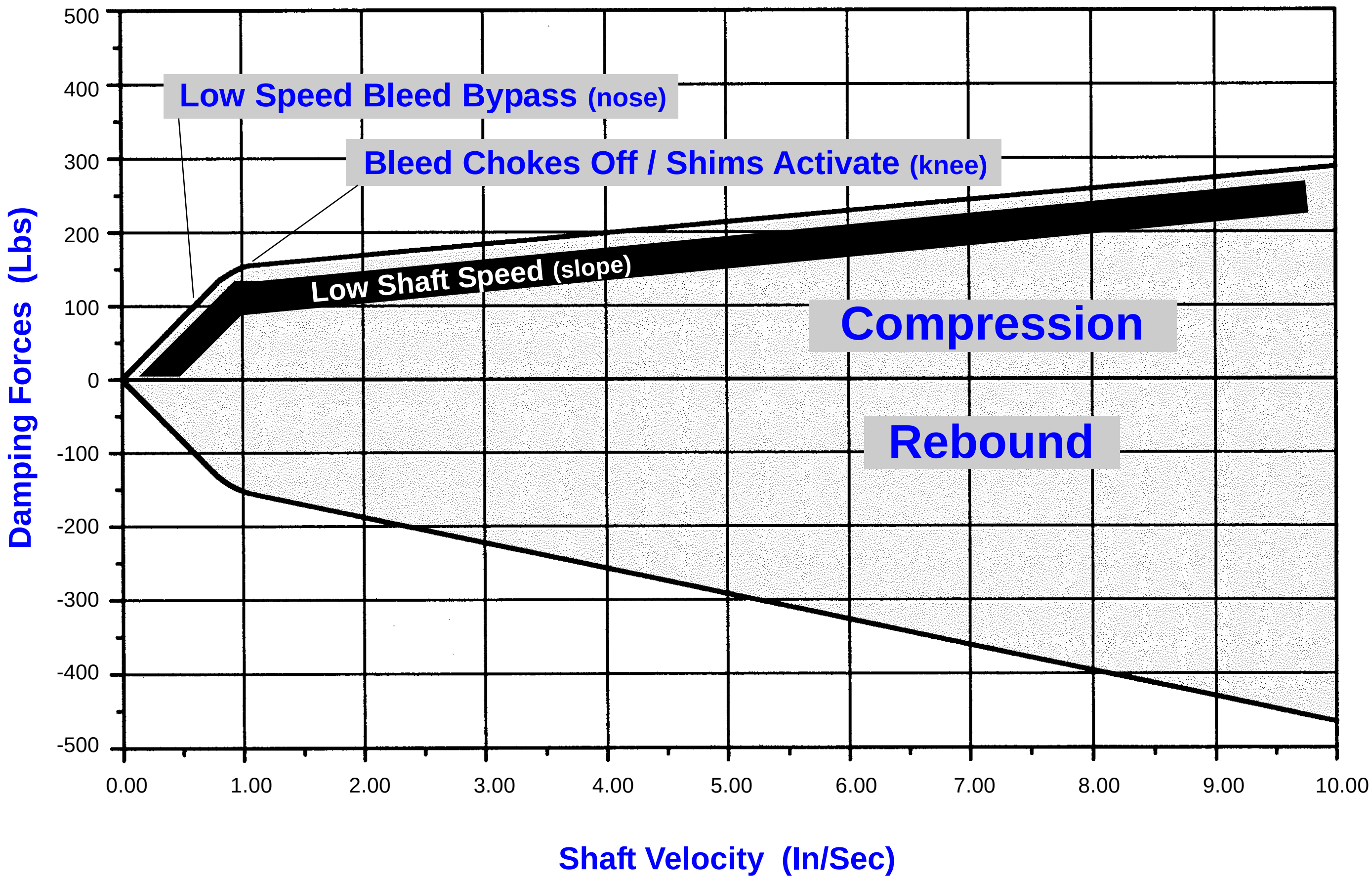
QUANDRANT #2
This quadrant begins with the compression valve stack open. Where the graph crosses the zero line (inches) in quadrant #2 is the maximum force produced by the compression valving. As the shock approaches the full compression point, the compression valve stack begins to close as it approaches the rebound movement.

QUADRANT #3
This quadrant begins with the shock at full compression and the compression valve stack closed. Where the graph crosses the zero line (pounds) in quadrant #3 begins the rebound stroke. Approximately the first 1/2" of displacement is formed with relation to the rebound bleed through the shaft and jet. When the shaft reaches a certain velocity, the bleed chokes off and the rebound valve stack begins to react.

QUADRANT #4
This quadrant begins with the rebound valve stack open. Where the graph crosses the zero line (inches) in quadrant #4 is the maximum force produced by the rebound valving. As the shock approaches the full extension point, the rebound valve stack begins to close as it approaches the compression movement. At this point the cycle starts over again in quadrant #1.



Dyno Graph Overview



Note: Remember that low speed damping characteristics are controlled by bleed through the adjuster and the bleed hole in the piston, not the valve stacks.

Notes