



## Damper Owner's Manual

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## **GENERAL INFORMATION**

- 1 This Gas charged Mono-tube damper is designed primarily for the Race-car industry and offers high performance with low friction and is manufactured to the highest standards. To operate at the design performance, all disassembly and assembly operations should be undertaken in a “clean” environment by skilled personnel.
- 2 At each stage, parts need to be checked for wear and abrasion and replaced if necessary. Some areas of wear can be detected externally; others can only be detected internally.
- 3 Before embarking upon an internal repair or alteration, read this manual and have ready the required special tools and soft fixtures for your vice jaws. Information on special tooling can be found at the rear of this manual.
- 4 Our technical department will always be happy to discuss and advise our customers; We offer a rebuild service to most specifications. Contact information can be found at the rear of this manual.
- 5 For spare parts – components – rebuild kit and tools consult Dynamic Suspensions or our distributors.
- 6 If you require to change the characteristics of the damper by re-valving, we can supply the required parts but would suggest that returning the damper to Dynamic Suspensions may be the most appropriate route.

## **GENERAL EXTERNAL MAINTENANCE**

### **External threads:**

Most Dynamic Suspensions dampers utilise an adjustable spring platform, or perch, which seats on an external screw thread over the main tube. This enables the engineer to use different length springs and also the pre-loading of these springs. This thread must be kept clean and dry to function properly. If greases or lubricants are used, the ingress of dirt can lead to the grease acting similar to a grinding paste and eventually binding.

### **Reservoir Gas charge:**

All Dynamic Suspensions Mono-tube Dampers use a Gas charge in the reservoir to charge the hydraulic oil to prevent or limit cavitation. This concept was developed and called the de Carbon damper.

Reservoir pressure must be checked prior to each test or race. Some teams check the pressure each morning. For charging device see the rear of the manual.

Most dampers with remote reservoir function adequately at 8 Bar (116 PSI). If the damper has no remote reservoir the pressure should be 16 Bar (232 PSI).

Use Nitrogen only.

Should you suspect a leaking valve, submersing in water after charging the unit is normal practice. If replacing is required, remember to de-pressurise the damper before removing and refit using the appropriate torque and loctite.

### **Shaft inspection:**

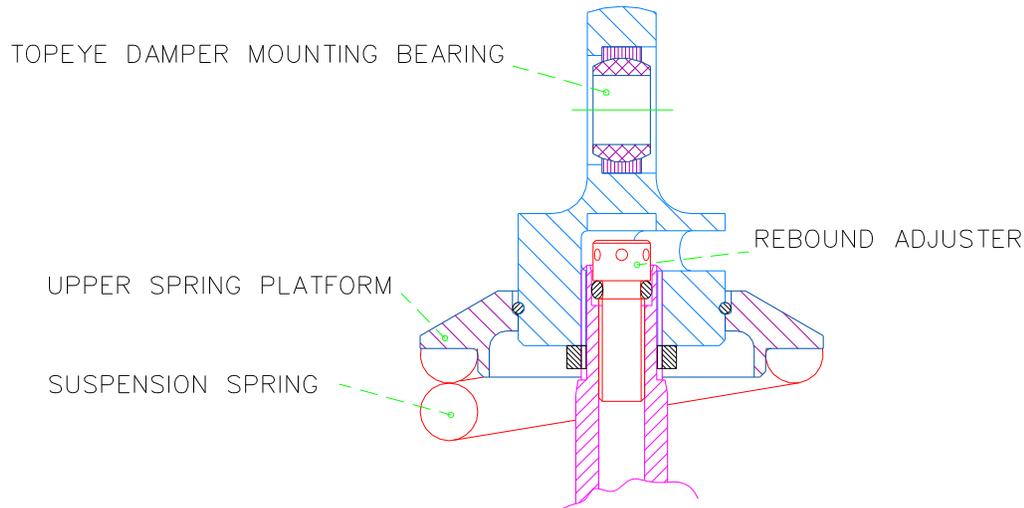
Monitoring the shaft during its normal life occasionally can be a good preventative maintenance inspection.

Check for wear, scratches, or highly polished zones. A small amount of oil on the shaft is not of great concern. Should the presence of oil on the shaft persist to leak from the damper, a new seal is required. Very light scratches on the surface of the shaft can be lightly stoned using a very fine stone only. *A skilled technician who has experience with this type of repair must only undertake this operation.*

# EXTERNALLY ADJUSTING DAMPERS

## ONE-WAY ADJUSTABLE DAMPER

The adjuster is located in the top eye of the damper shaft.



To adjust the damper follow the instructions below:-

1. Fully close the adjuster turning clockwise, as viewed from the top of the adjuster. Or, from the window, swept from right to left. Do not over tighten the adjuster, as this will damage the valve face.
2. With the adjuster now closed, this is maximum damping this adjustment offers in this configuration.
3. This fully closed position is termed as 0 (zero). Each hole position is termed a 'sweep' or 'click'. One full revolution usually incorporates 6 clicks; the maximum soft setting this adjustment gives is 12 clicks.

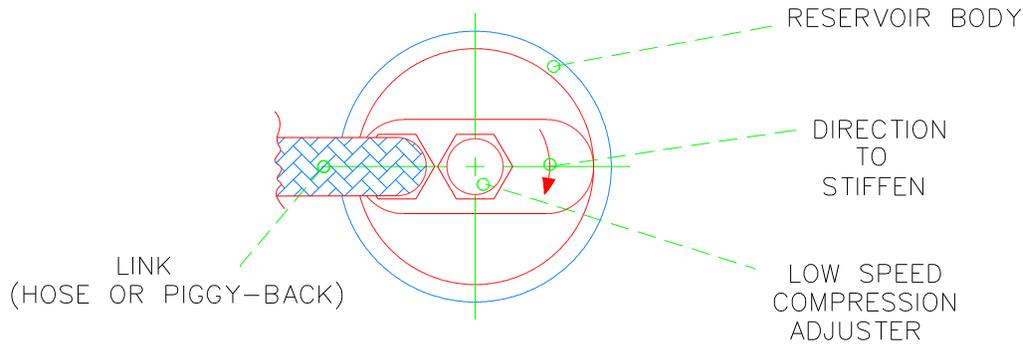
**Do not open more than this as damping can dramatically decrease and eventually lead to leakage through the adjuster system.**

4. We suggest a medium setting of 6 as an initial starting point. Each initial adjustment there after being  $\pm 2$  clicks.
5. **Note:** Adjustments have a greater effect as the adjustment system approaches full closed, compared to the softer of the positions.

## TWO-WAY ADJUSTABLE DAMPER

The two-way adjustable damper incorporates the same rebound adjuster system as described on Page 5.

In addition to this an extra adjuster is located on the reservoir close to the link to the main body.



1. Fully close the adjuster turning clockwise, as viewed from the top of the adjuster. Do not over tighten the adjuster, as this will damage the valve face.
2. With the adjuster now closed, this is maximum damping this adjustment offers in this configuration.
3. This fully closed position is termed 0 (zero). Each flat position is termed a 'sweep' or 'click'. One full revolution usually incorporates 6 clicks; the maximum soft setting this adjustment gives is 12 clicks.

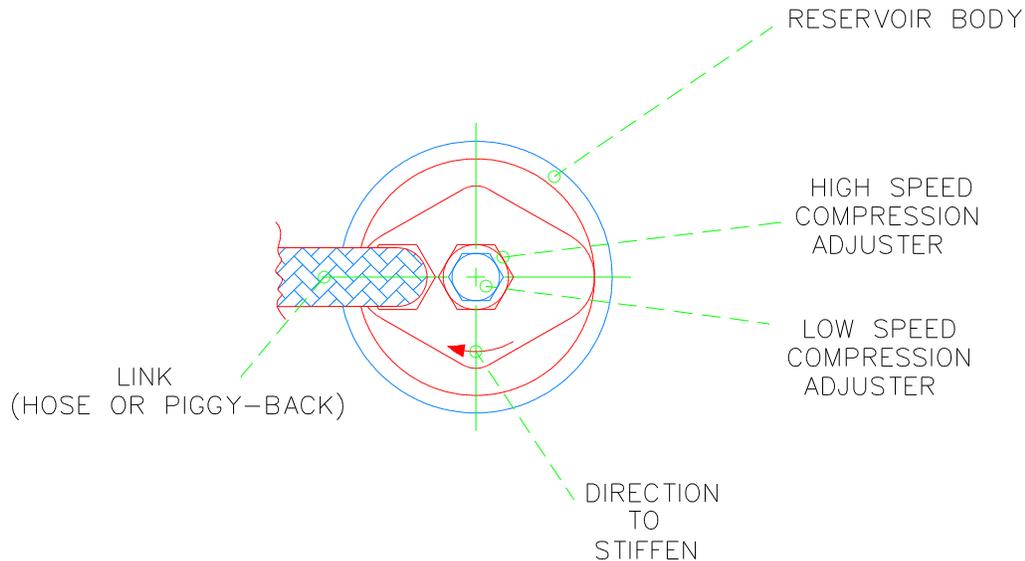
**Do not open more than this as damping can dramatically decrease and eventually lead to leakage through the adjuster system.**

4. We suggest a medium setting of 6 as an initial starting point. Each initial adjustment there after being  $\pm 2$  clicks.
5. **Note:** *Adjustments have a greater effect as the adjustment system approaches full closed, compared to the softer of the positions.*

## THREE-WAY ADJUSTABLE DAMPER

The three-way adjustable damper incorporates the same rebound adjuster system as described on Page 5 and the low speed compression (8mm A/F) described on Page 6.

In addition to this, an extra adjuster is located on the reservoir close to the link to the main body.



### High speed compression control (11mm A/F Spanner)

1. Fully open the adjuster turning anti-clockwise, as viewed from the top of the adjuster. Do not over tighten the adjuster, as this will damage the valve face.
2. With the adjuster now fully open this is minimum damping this adjustment offers in this configuration.
3. This fully open position is termed as 14. Each flat position is termed a 'sweep' or 'click'. One full revolution usually incorporates 6 clicks; the maximum stiff setting this adjustment gives is 14 clicks.

**Do not open more than this as damping can dramatically decrease and eventually lead to leakage through the adjuster system.**

4. We suggest a medium setting of '7' as an initial starting point. Each initial adjustment there after being  $\pm 2$  clicks.

# **REBUILDING PROCEDURES**

## **GENERAL DISASSEMBLY**

- 1 Remove the springs and spring retainers.
- 2 Open all adjusters to their full soft settings. This makes re-assembly of the damper easier. Depressurise the reservoir; be sure to do this before further disassembly.
- 3 Clean the exterior of damper and reservoir thoroughly. Remove all dirt and grit.

*Extreme cleanliness is crucial to prevent any dirt from getting inside the damper during disassembly or assembly. Any foreign particles, for example a single grain of sand, can effect the valving and cause incorrect or erratic damping.*

- 4 Hold the damper in a vice and unscrew the end (cover) of the damper complete with the shaft bearing using the special wrench. Keep the shaft fully extended during this operation to prevent oil spills.
- 5 Keeping the shaft fully extended, remove the shaft assembly from the body. Some designs use a step-cut piston bearing ring, which may fall off the piston at this stage.
- 6 Inspect for any remaining dirt at the end of the body (caught between the bearing and the end of the body), and very carefully wipe away. Cover the end of the body with a 'red-cap' or similar to prevent the ingress of foreign particles.
- 7 Remove the body from the vice and support vertically. Vertical support racking can be purchased from Dynamic Suspensions.
- 8 At this stage seals, bearing and oil contamination can be inspected.

## **TO REPLACE THE ASSEMBLY**

9 Pressurise the reservoir to approx. 3.5 – 7.7 Bar (50-100 PSI).

### **Notes**

- a) *The purpose of this is to push the reservoir piston all the way to the end of the reservoir. This gives maximum air volume in the reservoir, which minimises pressure changes or “pump-up” when the dampers heat up.*
- b) *When the shaft assembly is installed later, oil will be displaced as the bearing cover is screwed in. This moves the reservoir piston back slightly to provide a small volume of oil to make up for slight oil loss at the shaft during normal operation of the damper over a period of time.*
- c) **WARNING** *never skip this step. If dampers are assembled with the reservoir piston in the wrong position, it could cause extreme hydraulic pressure due to the lack of air space available to compensate for shaft inward travel. This could possibly blow out the end of the reservoir, which could cause injury.*

10 Add oil until level is about 13 mm (½”) from top of the body.

11 Take the piston and shaft assembly and slide on the bearing cover, if not already done, ensuring there are sufficient tapers to guide the sealing system on to the chromed section of the shaft.

12 If using a step-cut piston bearing ring, reinstall on the piston.

13 Install the shaft assembly in the body. If using a step-cut piston bearing ring be sure to hold the piston ring firmly on the piston – especially the ends of the piston ring – so it does not come out of its groove. After the piston is fully immersed in oil, push shaft in further until bearing contacts end of body.

14 Gently reciprocate the piston and shaft assembly to expel any air trapped in the assembly. With a redundant top eye screwed to the shaft thread gently tap using a nylon mallet. This removes air trapped beneath the shim pack. Repeat this process a few times until all the air is removed from the piston and shaft assembly. Ensure the cross-drilled bleed holes never reach the surface of the fluid, should this happen repeat the bleed process.

15 Top-up the damper body with oil to the brim of the tube. Raise the piston/shaft assembly until the cross-drilled bleed holes are within 3mm (1/8”) from the top of the fluid. If necessary replenish with oil.

16 Push down slowly on the damper bearing cover to allow any trapped air to escape. Ensure that oil is overflowing from the body during this operation (otherwise there may be an air pocket under the bearing). Now depressurise the reservoir and screw in the bearing cover and tighten. Do not use ‘Loctite’ on the bearing threads. Clean off excess oil with paper towels and charge to the specified pressure. Replace the air valve cap.

### **Note**

*To ensure elimination of all air, the entire shaft installation should be done slowly and smoothly. Do not pull the shaft partially back out after piston is immersed in the oil as this may cause air pockets. If for some reason you have to pull back on the shaft, it should be removed and the*

*procedure started again. Although a small amount of air in the oil will not degrade the performance of your Dynamic Suspensions damper, it is still best to try to eliminate all the air completely.*

## **REVALVING THE PISTON ASSEMBLY**

- 17 Clamp the shaft in the vice, using the specific tooling manufactured for that diameter shaft. See the rear of this manual for Part No. With a 19mm (¾”) socket and wrench, remove the shaft lock nut. The first shim pack removed and the one in view whilst removing the shaft nut is the Rebound high speed valving. Remove the piston valve assembly, being careful to note the arrangement of all parts. Clean and inspect piston for any small particles of dirt embedded in the surfaces that the valves seat on. The second shim pack in view after removing the piston is the compression (bump) high speed shim pack.
- 18 Install the new shims ensuring they are in the correct order. Make sure any top plates or stop plates are reinstalled in the direction they were removed. Ensure no shims are ‘hung-up’ on any threads or grooves.
- 19 Tighten the shaft lock nut to the correct torque; see technical specifications. If the nut has a domed end install so that the ‘dome’ is uppermost.
- 20 Remove the shaft assembly from the clamping system and store in a jug of damper fluid until ready to submerge into the damper body. This also helps to remove some of the air from the piston assembly.
- 21 Repeat steps 9 to 16 inclusive to re-assemble the damper.
- 22 Holding the damper with shaft end UP, push the shaft in a few times. Check that the shaft returns smoothly to fully extended position. Also check that the damper does not have a “soft spot” or mushy feeling during the first inch or so of travel. This would indicate a large air pocket in the unit.
- 23 If possible, test the assembled Damper on a Dynamic Suspensions Damper Dynamometer.

## REPLACING THE OIL

Refer to GENERAL DISASSEMBLY and follow steps 1 to 8 to remove the shaft assembly from the body, then:-

- 24 Pour the oil out of the damper.
- 25 Push the reservoir end cap about one inch further into the reservoir body. Depress the air valve to allow air to escape as you do this.
- 26 Remove the reservoir snap ring.
- 27 Pull out the reservoir piston and end cap using the specific tools.
- 28 After removal, clean all parts thoroughly and inspect the 'O' rings carefully for any cuts or nicks. Replacement of the 'O' rings is recommended, but not absolutely necessary if they are not damaged.
- 29 Flush out the body and reservoir thoroughly, using new damper oil only.
- 30 With the damper held in the vice, pour fresh oil into the reservoir down the side wall of the cylinder tube to lessen the ingress of air into the oil. Dynamic Suspensions fluid is recommended.
- 31 When filling with oil, make sure the bump adjuster valve/valves are open – i.e. the adjusters open 12 clicks.
- 32 Hold the reservoir a little below level of top of damper body.
- 33 Pour oil in until it is about 3mm to 6mm (1/8" to 1/4") from the top of the reservoir. Wait about 15 seconds and add more oil if the level goes down (note that the oil is also flowing through the hose into the body). Hold the reservoir at a steady height while doing this, or the oil level will go up and down as the levels in the damper body and reservoir keep trying to balance. Using this balancing of fluid levels to flow the oil from one chamber to another.
- 34 If there are any bubbles in the oil, wait until they rise to the surface and dissipate before proceeding with the next step.
- 35 The reservoir must be filled with oil right up to the top.
- 36 Holding the reservoir in one hand and the reservoir piston in the other (with 'O' ring and piston ring installed), slowly push the piston into the reservoir until the 'O' ring has sealed.

### Notes

- a) *The piston should be oriented so that the piston ring goes in first, then the O-ring.*
- b) *Take care that the piston ring does not come out of its groove. Hold in the ends of the piston ring to prevent this. Check visually when the ring is about 3/4 of the way in that the ends have not come partially out of the groove.*

- c) *It is a little tricky to hold and install the piston with one hand if you haven't done it before. If a friend is handy to hold the reservoir, use both hands to install the piston, it is easier.*

37 Turn the reservoir upside down and let it hang vertically from the hose. (The piston will not fall out – the O-ring holds it in.) Let the reservoir hang for about 1 minutes whilst tapping lightly on the sides with the plastic end of a screwdriver or similar object to dislodge air bubbles. Now hold the reservoir *vertically* with the ‘hose’ end upwards and *slowly* push piston *all the way in* until it contacts the far end of the reservoir. Use the specific reservoir piston tool.

**Note**

*By letting the reservoir hang vertically from the hose, any air bubbles travel to the other end of the reservoir (hose end). When the piston is pushed in, the air pocket travels through the hose and out through the oil in the damper body. It is important to push the piston up slowly (it should take 10 or 15 seconds), since, if the piston is pushed up in one quick stroke, the air pocket will create turbulence which will generate small bubbles in the oil. If some bubbles do occur, it is OK, but you will have to wait several minutes for them to rise to the surface and dissipate before continuing.*

38 Install the reservoir end cap in the reservoir. Push in about 1”.

39 Install the snap ring in the reservoir. Note that edges on snap ring are quite square on one side and slightly rounded on other side. Install so that the side with square edge faces outward. Be sure the snap ring is properly seated in its groove (WARNING: end cap could blow out during pressurisation if the snap ring is not properly seated.)

40 Now pull the reservoir end cap back out using the specific schrader tool.

41 Slowly pour oil into the damper body until it is about 13mm to 19mm from the top. Check for air bubbles in the oil before continuing. If bubbles exist, wait for them to rise to the surface and dissipate. (This may take several minutes if there are a lot of small bubbles.)

42 Now complete reassembly by following steps 9 through to 16 in GENERAL DISASSEMBLY.

# **TECHNICAL SPECIFICATIONS**

## **TORQUE FIGURES**

<b><u>ITEM</u></b>	<b><u>TORQUE Nm</u></b>	<b><u>LOCTITE</u></b>
Shaft nut M14 x 1.25 (Standard)	34.5 (25.5 lbs-ft)	None
Shaft nut M14 x 1.25 (Rally)	41 (30 lbs-ft)	None
Shaft nut M10 x 1.0	14 (10.5 lbs-ft)	None
2-Way CV nut	10 (7.3 lbs-ft)	None
3-Way CV nut	4.5 (40 lbs-ins)	None
Rebound jet for M14 x 1.25 shaft	20 (15 lbs-ft)	None
Rebound jet for M10 x 1.0 shaft	5 (47 lbs-ins)	None
M5 x 0.8 Caphead screws for connecting studcaps to reservoirs	6 (54 lbs-ins)	Loctite 270 (Studlock)
M4 x 0.7 Caphead screws for 3- Way CV piston	3 (26 lbs-ins)	Loctite 270 (Studlock)
Schrader Valve & hose fittings	4.5 (40 lbs-ins)	Loctite 542 (Hydraulic sealant)

## **TOOLING SPECIFICATIONS**

<b><u>ITEM</u></b>	<b><u>SIZE</u></b>	<b><u>D.S. TOOL PART No.</u></b>
Shaft Clamp	Ø 12.0	TL0016
Shaft Clamp	Ø 16.0	TL0017
Shaft Clamp	Ø 18.0	TL0018
Shaft Clamp	Ø 25.0	TL0019
Shaft Clamp	Ø 14.0	TL0094
Body Clamp	Ø 40.0	TL0031
Body Clamp	Ø 41.0	TL0032
Body Clamp	Ø 45.0	TL0033
Body Clamp	Ø 50.0	TL0034
Reservoir charging tool		TL0035
Cover tightening tool	Ø 5.0 on 30.0 PCD Ø 4.0 on 26.5 PCD	TL0071
Piston seal resizing tool	Ø 40.0	TL0050
B05 Threaded body clamp	M46 x 16 TPI	TL0051
Reservoir tube clamp	Ø 43.8	TL0095
2-Way Compression valve tightening tool		TL0070
Reservoir cap puller	Schrader thread	TL0117

# **Dynamic Suspensions Agents Worldwide**

## **Dynamic Suspensions Factory and Headquarters**

20 Fison Way  
Thetford  
Norfolk  
IP24 1HJ  
United Kingdom  
Tel. 011 44 1842 755744  
Fax 011 44 1842 752626

## **Dynamic Suspensions North America**

85 Valleywood Drive  
Markham  
Ontario  
Canada  
Tel. (905) 470 0025  
Fax (905) 470 9579

## **Asia & Pacific Rim**

Le Mans Company Ltd.  
Le Mans Building  
3-2-15 Hiroo  
Shibuya-Ku  
Tokyo  
Japan  
Tel. 550 840 100  
Fax 550 840 101

## **Dynamic Suspensions World Wide Web homepage:**

[www.dynamicsuspensions.com](http://www.dynamicsuspensions.com)