

Period Specification of Dampers

The ethos of Historic Motorsport is that unless otherwise clearly permitted in the regulations components and the technology used are to a specification permitted and used in period. Dampers are a very important factor in the performance of any competition car and as damper technology has improved immeasurably over the last 70 or so years so it is very important that what is used now reflects what was available and used in period. MSA Blue Book regulation R49.6 restricts the specification of replacement components to a proven period specification, Appendix K takes the same stance and goes into more detail about period specification and in addition gives guidance on replacement parts. (App K Article 3.3) Damper technology has changed enormously since 1946 and this document provides guidance on what was available in period and how to identify what may be used.

Features that should be carefully considered prior to purchasing dampers are:-

- Twin tube or monotube construction
- Atmospheric, low pressure gas or high pressure gas
- Body material
- Fixed, single adjustable or double adjustable damping
- Remote reservoirs
- Mounting type

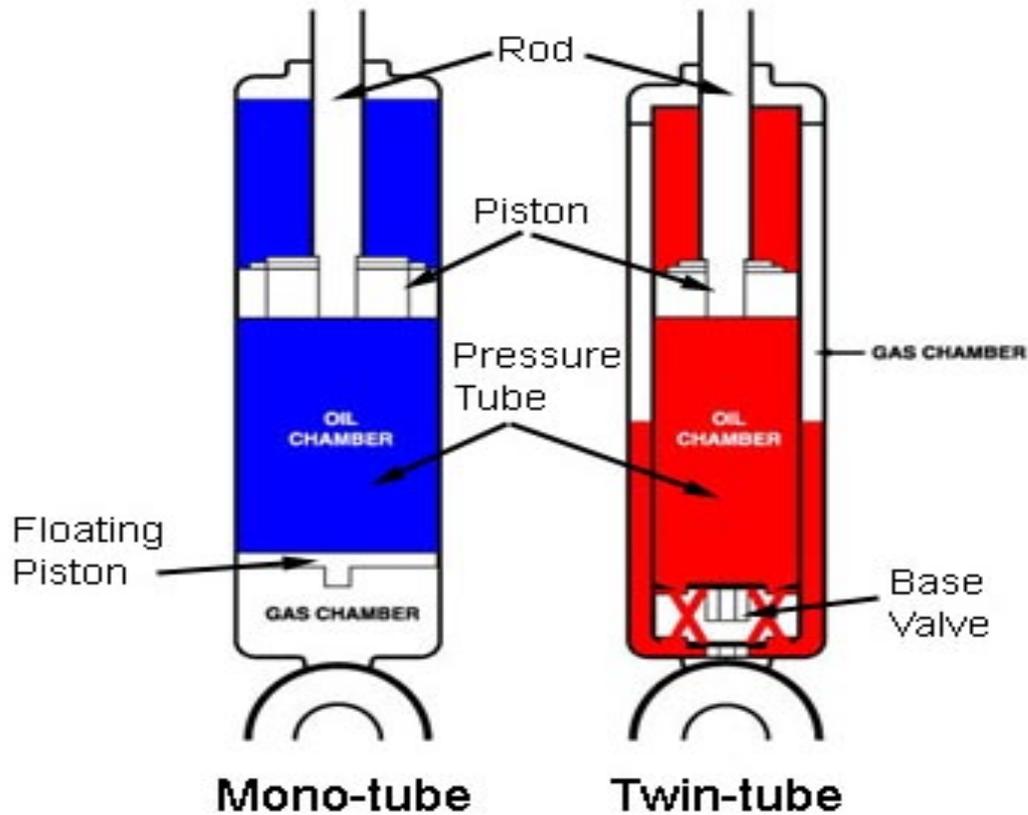
Note that it is quite often impossible to determine visually whether a damper is of twin tube or monotube construction without removing the unit from the car.

Twin tube telescopic dampers (the original telescopic damper system) have a central oil filled chamber with a piston that moves up and down, thereby moving the oil through valves and creating a damping resistance (cross section diagram with red to indicate oil). The total volume of oil and metal within the damper body increases as the damper is compressed, to accommodate this increase in total volume a reservoir containing both oil and gas (traditionally at atmospheric pressure but more recently pressurised to a low pressure) surrounds the central cylinder and provides a space into which the oil can expand. Twin tube dampers with a single adjuster were available from Koni from 1946 (developed initially for railway rolling stock) and they introduced their double adjustable coil spring damper unit in 1965, this replaced the Armstrong competition unit to become the definitive unit in racing cars for the next 15 years.

A monotube telescopic damper (first used at least 20 years after the introduction of the original twin tube telescopic damper) is one where there is no oil/gas interface and normally only one tube (cross section diagram with blue to indicate oil). The oil is kept under pressure by a floating piston behind which is chamber filled with high pressure gas. As the damper is compressed, the volume of the gas chamber is reduced. Maintaining a high pressure in the oil chamber reduces or eliminates foaming or aeration of the oil. More recent designs incorporate high pressure gas in a twin tube design, this technology is later than any category currently racing in historic motorsport.

Identifying which type of damper is fitted to a car can be difficult but, as a rule, a monotube damper, if fully compressed and then released, will at least partially open when released. Twin tube dampers will not work if mounted horizontally or upside down. If a damper is mounted "upside down" or horizontally it must be monotube (or not working!) Twin tube dampers will not function properly if mounted upside down. MacPherson struts with what appears to be a large diameter piston rod are in fact monotube dampers mounted upside down and the visible moving tube is the outside of the damper cartridge. This has a rigidity advantage as the large diameter tube has a greater resistance to bending (under braking or cornering) than the much smaller diameter piston rod of a twin tube damper.

Mono-tube vs. Twin-tube Design



A damper that incorporates two adjusters in one mounting eye (as seen on the right but numerous versions exist) will be a monotube damper. To give an idea of scale, the holes in the adjuster wheels on this particular unit are just over 1 mm in diameter.

Monotube dampers are now being made with the adjusters hidden under the top gland nut or base or plugged. This would not be acceptable for a period where the adjustment is not accepted as a period specification.





Twin tube dampers may incorporate valves in the base, the top gland and the piston. It is relatively simple to manufacture a damper with a user adjustable bump valve in the base and this technology was certainly in use on cars from the early 1950s.

Armstrong had, as early as 1956, a more sophisticated twin tube damper adjuster mechanism which adjusted bump and rebound together by means of one adjuster knob on the base of the unit, as seen on the left. An almost flush adjuster was also available. The bump to rebound ratio was fixed during manufacture and the adjuster altered both rates simultaneously.

Koni first made a twin tube damper with a single adjuster in 1946. This was the type where the bump rubber had to be removed, the damper fully compressed and the top rotated to adjust, still being made today although with improved internals. Making bump and rebound independently user adjustable was more difficult and Koni were first to achieve this with their 8211 damper. Monotube dampers, having both valves incorporated in the moving piston, presented a challenge to the manufacturers. There were no user adjustable monotube dampers available until the 1980s and it wasn't until the 1983 that double adjustable monotube units were available. Remote reservoirs for monotube dampers soon followed, and we now have twin tube, gas pressurised 4 way adjustable units, obviously not appropriate for any form of historic motor sport.

MacPherson struts are found in two forms. Early and now relatively rare struts where the visible external case forms the external tube of the damper unit. The components are assembled into the case and there is invariably a filler plug visible on the strut body. (left photo below) More common is the unit with a complete damper cartridge (twin tube or monotube) housed within the strut casing and held in place by a retaining gland nut (right hand photo below). Both of the units shown below are twin tube non adjustable.

Where MacPherson strut monotube cartridge inserts (upside down installation) are used, the diameter of the visible tube (not the strut body) must be to a period diameter. Escorts, both Mark 1 and 2, commonly used Bilstein inserts in period, monotube, non-adjustable, with a maximum tube diameter of 41 mm. 50 mm non adjustable monotube inserts were used on the Lancia Stratos and Fiat 131. An adjuster on the top of the strut indicates an adjustable monotube design. Remote reservoirs are a later specification.

Spring platforms must be to the period specification. The regulations make no distinction between platforms integral with a damper and other types of spring mountings on the chassis. For homologated cars, in many periods, Appendix J states that the original spring mountings must be retained so unless the manufacturer has homologated adjustable platforms these may not be used. Appendix K Appendix IX article 2.3.1 also covers this point for CT and GTS cars of periods E, F and G1. Racing cars, from period F onwards, very commonly had adjustable spring platforms on coil spring damper units. There is to date no evidence of any homologated car in period F having adjustable platforms homologated.



The chart below is taken from the Damper supplement in Appendix K but is equally applicable to MSA Historic cars.

Period	E	F	G	H	I	J
Mounting eyes, all categories, metalastic bush	Yes	Yes	Yes	Yes	Yes	Yes
Mounting eyes, Uniball, homologated cars	No	No	Regs	Regs	Regs	Regs
Mounting eyes, Uniball, Single Seater & TSRC	No	Yes	Yes	Yes	Yes	Yes
Twin tube, steel body non adjustable damping	Yes	Yes	Yes	Yes	Yes	Yes
Twin tube, steel body single adjustable damping control	Yes	Yes	Yes	Yes	Yes	Yes
Twin tube, steel body double adjustable damping controls	No	Yes	Yes	Yes	Yes	Yes
Twin tube, alu body, double adjustable damping controls	No	No	Yes	Yes	Yes	Yes
Monotube, steel body, non adjustable damping	No	1	Yes	Yes	Yes	Yes
Monotube, alu body, non adjustable damping	No	No	Yes	Yes	Yes	Yes
Monotube, steel body adjustable damping	No	No	No	No	No	Yes
Monotube aluminium body adjustable damping	No	No	No	No	No	Yes
Monotube remote reservoir	No	No	No	No	No	Yes

The Appendix K periods for production/homologated cars are:-

E	1947 – 1961
F	1962 – 1965
G	1966 – 1971
H	1972 – 1976
I	1977 – 1981
J	1982 – 1990

As usual, only damper types and technology used in period may be used now and if there is any doubt as to the legality of a damper it is the responsibility of the competitor to prove period use.

Note 1:- Although monotube dampers were available they were to a very basic specification and their use in motorsport was limited in Period F.

Items marked “Regs” may be “Yes” or “No”. Uniball mounting eyes were used in racing cars from Period F, but their use on production (usually homologated) cars depends on the Period and Category applicable to the car, as the applicable regulations did not always give freedom of suspension mountings. Applicable Appendix J regulations and period specification for the specific vehicle should be checked before using Uniball mounted units.

It was the writer’s intention to list the different manufacturers with an indication of their type and acceptability by period but it became clear that there are too many manufacturers to list. Some manufacturers make twin tube and monotube with and without adjusters and some manufacturers make units with hidden or disguised adjusters. Many specialist competition damper manufacturers have no long history and do not manufacture twin tube units. The competitor should always ask for the specification before choosing a damper and if in doubt seek advice.