



AIR BRAKE CORPORATION OF AUSTRALIA P/L

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IMPORTANT INFORMATION ABOUT FATIGUE MANAGEMENT

'FATIGUE MANAGEMENT' – the latest buzzword in road transport. But it's not just about keeping drivers awake! Fatigue affects equipment too. Metal fatigue can occur whenever components are subject to cyclic stress - *vibration* - and there's nothing like a heavy rig on an Aussie road for **VIBRATION!**

Springbrake actuators are at the pointy end of this vibration - mounted on the unsprung axle assembly and constantly shaken by every little bluemetall bump - and every gaping pothole - in our 'great' Australian 'highways'! Springbrakes are also the last link in the air brake system, converting air pressure into the force which actuates the foundation brake. The spring section provides a failsafe backup against loss of pressure in the air system, so failure of the springbrake mounting can render both normal service braking and the backup emergency braking function totally ineffective. Of course, you'd have to hope that all your springbrakes don't fall off at the same time, but the loss of air pressure from just one can cause all others to apply, locking wheels and destroying tyres. What's more, a springbrake bouncing down the road poses a serious hazard to other road users.

It is vitally important then that springbrakes are designed and built to withstand this vibration and deliver the force necessary to stop your rig, safely, reliably, and repeatedly, whenever you need it. Unfortunately, the Australian market is now flooded with springbrakes from various sources, some more concerned with cost than safety. Fact is, some of these just aren't up to the task, and some recent low cost springbrake imports are falling off axles with alarming frequency - sometimes within days of installation. The Australian Trucking Association (ATA) has recently investigated a number of such cases and has published an 'ALERT' about springbrake quality.

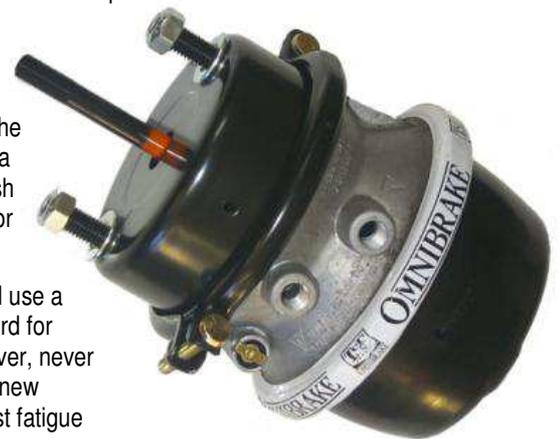
OK, we all want the best quality at the cheapest price. Springbrakes in particular have become a commodity item in recent years, but the old adage 'you get what you pay for' applies as much today as ever. The cheapest buy is rarely the best buy - a few dollars saved up front can cost dearly down the road when the product fails prematurely. Unfortunately, it's not always easy to assess the quality of a product at the point of sale. The quality of internal component design and construction is often only proven in service. This is where reputation comes in - the reputation of a proven name with longstanding experience and an established market presence.

TSE have been at the forefront of springbrake design and manufacture for over 30 years, and are now the brand of choice by most truck and trailer OEs, both here and in their North American home market. As their exclusive Australian agent for the last 12 years, AIR BRAKE CORPORATION have sold over half a million TSE springbrakes, and the experience gained in our harsh operating environment has been an invaluable proving ground for TSE's ongoing product improvement.

All TSE springbrakes sold through AIR BRAKE CORPORATION use a reinforced, full face mounting design, and have an enviable record for their mounting strength, reliability, and fatigue resistance. However, never content with 'good enough', TSE have introduced an innovative new 'gusseted' reinforcement that delivers the strongest, stiffest, most fatigue resistant springbrake mounting available.

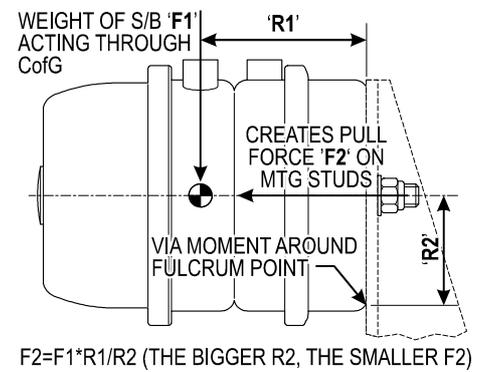
Arduous vibration testing has demonstrated a significant improvement in fatigue life over the already substantial reinforcement design used previously. The new design has been tested to over 3,000,000 cycles at increasing vibration amplitude from 20g to 50g without damage, which is far in excess of common industry standards and actual measured on-road vibration values.

So then, we've established that springbrake mounting is of foremost importance - if the springbrake falls off the axle, it obviously won't work! Trailer axles are the worst case scenario - they suffer the effects of rough roads more than truck axles, and they mount springbrakes in the horizontal plane, greatly amplifying the load on the mounting studs. Installation procedures and operating environment can certainly contribute to mounting failure, but starting with a quality engineered springbrake is the first vital step...



A springbrake is essentially a canter-levered weight hanging off the axle beam. The diagram at right illustrates the forces acting on the springbrake mounting. The tensile forces imposed on the mounting studs ('F2') are determined by a number of factors in combination as follows...

- weight of springbrake ('F1')
- distance from springbrake centre of gravity to mounting face ('R1')
- distance from mounting stud centreline to 'fulcrum point' ('R2')
- severity of vibration (acceleration amplitude, frequency, and duration)



The larger the contact area between the mounting face of the springbrake and the axle bracket, the further away the 'fulcrum point', and the lower the tensile stresses imposed on the mounting studs.

TSE (near left) use a flat full face design for maximum contact area. Some other brands (far left) use a 'profiled' mounting face with much smaller contact area, resulting in a much higher moment or leverage force at the mounting studs. Worse still, these cheap imports have no reinforcement at all under the mounting studs, making catastrophic failure such as that shown almost inevitable!

That said, a large flat mounting face is prone to more flexing under load than a 'profiled' shape, with attendant increase in the risk of fatigue. TSE's new patented 'gusseted' reinforcing pads pictured below tie the flat mounting face and studs into the adjacent vertical wall section, greatly increasing mounting rigidity and strength - the best of both worlds.

Of course, both springbrake mounting surface and axle bracket must be as flat as possible to ensure full contact, especially around the 'fulcrum point' - the smallest gap will allow the springbrake to rock up and down under vibration, flexing the mounting face and promoting fatigue. Even fractions of a millimetre in movement can initiate microscopic fatigue cracks when repeated millions of times. Hence axle mounting brackets should also be free from excessive paint (less than 0.25mm thick) - thick paint will compress under vibration induced loading, allowing the springbrake to rock.

The mounting nuts also play an important role. They should be positively locked against loosening under vibration (TSEs use 'stover' locking nuts), and the mounting washers should be of heavy gauge material, and preferably hardened, to prevent deformation and loosening under load.



STANDARDS

On the subject of standards, the aforementioned ATA 'ALERT' bulletin references SAE standard J2318. This is one of several SAE standards which specify performance requirements and test procedures relevant to springbrakes.

Unfortunately, the one performance measure that could provide a useful indicator of springbrake mounting strength - vibration - is conspicuously inadequate in the SAE standards. Section 19 of SAE performance standard J2318 is titled 'vibration', but it simply refers to section 20 of J1469, which describes the test equipment and method for conducting vibration testing. Neither of these SAE standards, or any other SAE standards, actually specify test parameters that would determine the severity of vibration testing - parameters such as acceleration amplitude, frequency, or cycle count. These critical details are left to the vehicle or *springbrake manufacturer* to decide!

Most OE truck manufacturers have independently developed their own in-house vibration specifications for validating springbrake mounting strength, but these vary from manufacturer to manufacturer, and in any case are arguably somewhat irrelevant to trailer axle installations, as the vertical mounting orientation of most truck axle booster brackets is generally more favourable to vibration resistance.

The only 'independent' industry 'standard' for springbrake vibration testing of any relevance that specifies realistic test requirements is published by the US Truck Trailer Manufacturers Association (TTMA), an association of US trailer manufacturers. Their 'recommended practice' RP62-05 basically uses the SAE J1469 test method, but goes one vital step further by actually specifying the performance requirements - 1 million cycles of 8.5g input acceleration at the resonant frequency of the actuator without visible damage.

Note that the input acceleration is applied at the axle beam - the resulting acceleration at the extreme end of the actuator is typically much higher. TSEs own test regime involves increasing the input value until acceleration measured at the extremity of the springbrake reaches 20g, which not only equals but invariably exceeds the TTMA test specification, providing proven assurance of the highest standard of performance available. What's more, they have pushed their testing of the new gusseted reinforcement design further still, up to 50g without failure - 2½ times the usual specification.

The end result of TSE's innovative design and extreme approach to product testing is that TSE springbrakes are now being specified by an increasing number of OE truck, trailer, and axle manufacturers, both in the US, Europe, and Australia. When you specify TSE, you specify a springbrake that is the result of over 30 years of the most thorough and arduous testing and development possible.