Taking the strain: antivibration specification for industry

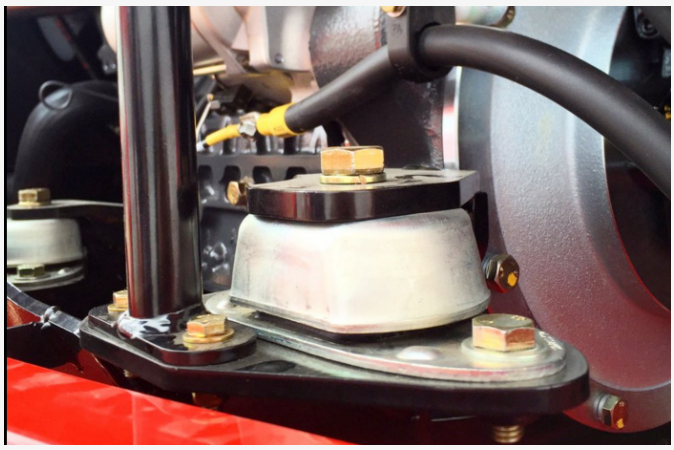
Antivibration mounts protect both people and assets by isolating and attenuating vibration and noise, preventing damage to both moving machinery and the environment in which it works. Optimum performance service life is however only guaranteed if the mount is both specified and installed correctly. Geert Keustermans, Market Manager – General Industry and Distribution at Trelleborg's industrial antivibration solutions operation, looks at the best-practice process for selecting and fitting antivibration mounts.

With such a wide variety of antivibration products on the market – antivibration mounts, buffers and pads to name a few – specification can, at the outset, feel like a minefield. How can design engineers ensure their mount delivers the right performance characteristics and are not hampered by incorrect installation, misuse or environmental factors? By working through the following best practice guidelines, engineers can rest assured that their mounts will continue to perform over a long and arduous life cycle.

Operating conditions, such as the temperature and environment of the application, will help determine the most suitable solution. However, other factors must be assessed through calculation & analysis to narrow the field and enable informed specification of a suitable antivibration mounting solution, such as:

- DEFLECTION
- CENTRE OF GRAVITY
- EQUIPMENT CONFIGURATION
- DISTURBING FREQUENCY
- MASS MOMENT OF INERTIA
- STATIC LOADING
- SHOCK/THRUST LOADING
- ALIGNMENT
- NATURAL FREQUENCY

Assessed alone, none of the above will provide a complete picture of the system performance and if any of the input data is inaccurate, then the selected mount may not give the optimal performance characteristics. For example, understanding the centre of gravity helps to determine the loading at each mounting position, and as the loading at each position may vary, it may be necessary to select different products across the mounting system. Calculations also help ensure that mounts are not overloaded – either statically or dynamically – which will hamper performance. Ideally, all calculations should be balanced with other aspects of a system's design, such as gross motion and dynamic conditions, to achieve the best possible isolation of vibration once the mount is installed.



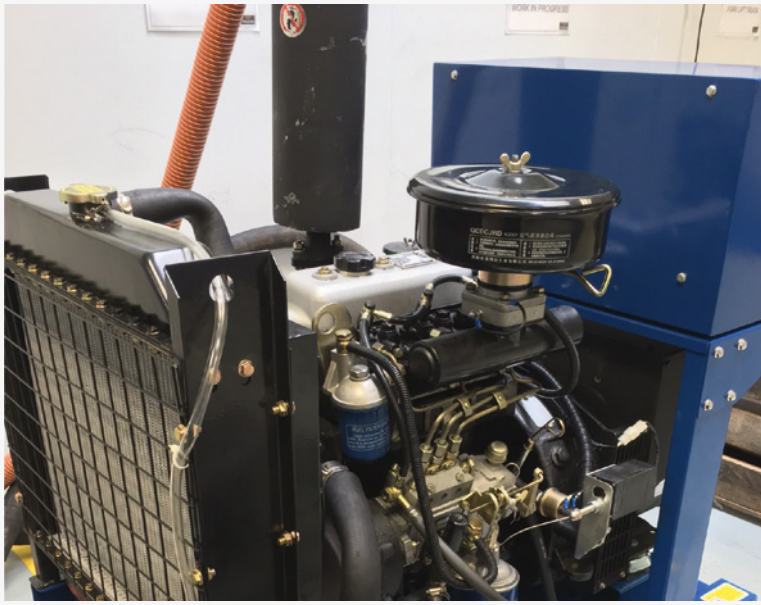
The composition of a mount is an important consideration. Solutions based on rubber to metal products offer the greatest benefits, for a number of reasons. Foremost is the high load bearing capacity of rubber coupled with its low modulus of elasticity, which allows the natural frequency of the mount to be optimised. The type of rubber selected can be fine tuned to provide a broad range of characteristics through the introduction of specific additives. These achieve different hardness grades, damping capabilities and environmental performance according to the application. The use of bonded products enables enhanced performance and service life. When compared with metal springs the internal damping prevents excessive movement if a resonate situation should occur.

Specification of material combined with the mount can be a complex process. For instance, Trelleborg's range of rubber compounds exceeds 300 different formulations along with many different mount designs. The assistance of a supplier's expert applications engineers can demystify the specification process based on the desired performance characteristics.

The final stage of specification concerns the sundry equipment – bolts, washers and brackets – which may be overlooked as insignificant but can seriously hamper performance of the mount if they're not the correct size or strength. Other considerations include high torque standards for fixing bolts to a foundation which should have rigidity ten times the stiffness of the mounts, and equipment bracketry which is also rigid.

While mounts can be specified at any stage of a project, there are typically fewer restrictions if they are considered at the outset of the design phase. If factored in too late, costs may be prohibitive to modify the space envelope or available positions for the mount to be installed. And, if antivibration solutions don't feature at all until the equipment begins to run, expensive maintenance, repairs or replacements may be required. Early involvement from antivibration specialists allows a combination of empirical calculations and specialist modelling software to carry out multi-degree of freedom calculations which will ensure the optimum mounting system is selected. Testing can also then be carried out to validate a mount design – analysing static and dynamic characteristics and fatigue as well as the operating environment can prove the performance of the selected mount and justify its use.

Even after a robust specification process, the performance of an antivibration mount can be hindered by incorrect installation. Firstly, all surfaces must be clean, dry and free from debris before the device can be fitted. The equipment to be mounted must be lifted carefully onto sufficient supports both to maintain correct alignment when lowered on to the mounts, and also to prevent damage to the asset or to individuals during installation.



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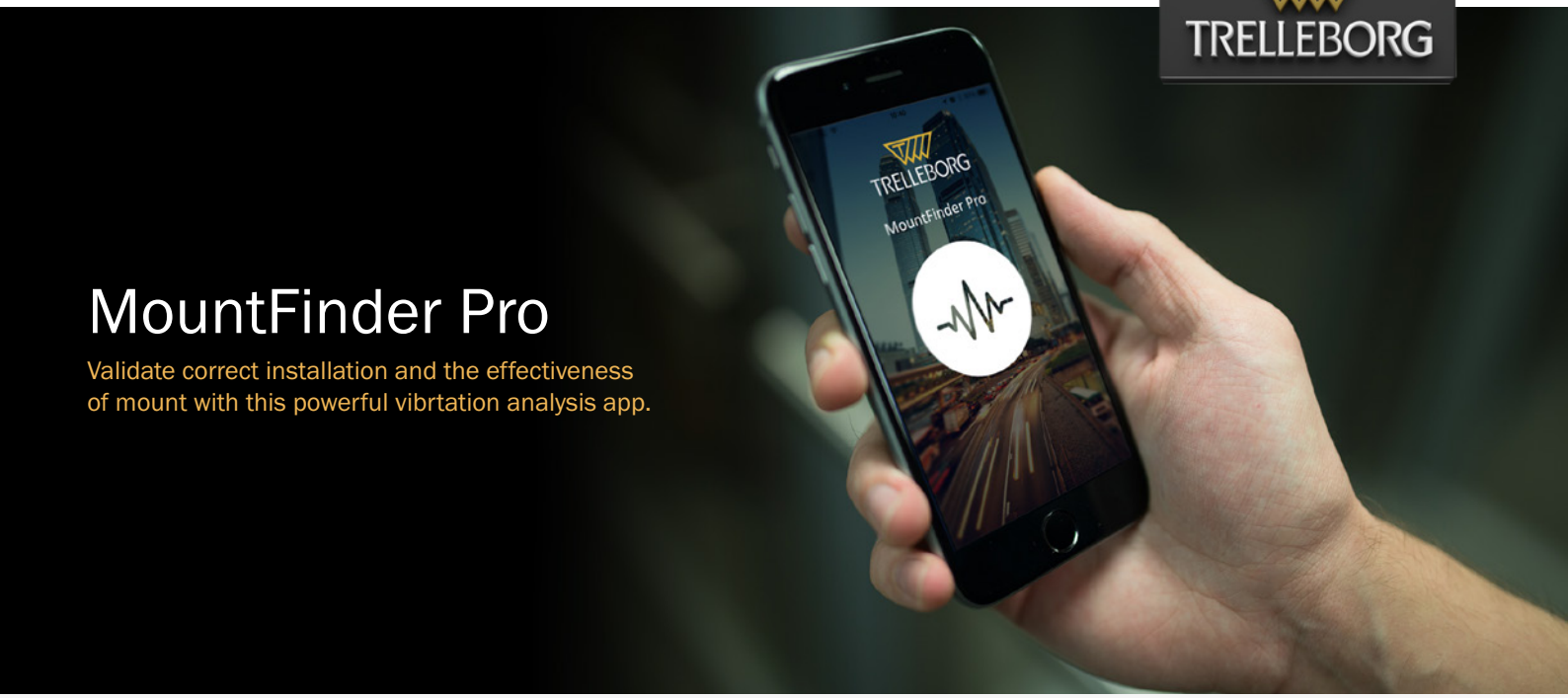
Different Formulations



MountFinder Pro

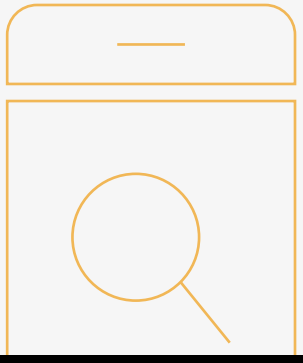
Validate correct installation and the effectiveness of mount with this powerful vibrtation analysis app.

Once installed, simple checks can be made to assess success before the equipment is ready for use. A straightforward visual inspection can flag misalignment, missed fasteners, fixings or any damage that may have been caused during installation. Take care to ensure that all flexible connections for other services to the engine e.g. oil, water, hydraulics, exhausts, are operating effectively. Following this, it's a case of taking a series of measurements and comparing them to the original calculations – deflection under static load should be checked, as well as measuring vibration velocity and frequency through the use of a fast Fourier transform (FFT) spectrum analyser. Using a modal hammer, impact can be applied to the equipment too to determine natural frequencies.

As incorrect usage can lead to excessive noise, vibration and harshness (NVH) and decreased vibration isolation, ongoing monitoring is recommended. Typically, such issues would manifest themselves in terms of higher levels of noise or harsh movement, however these may not be the first indication of damage. Periodic inspection through visual checks will reveal loosening of bolts, while the rubber and metal parts should be examined for any signs of damage such as rust, wear or dents. If there are signs of excessive deflection, at any mounting position, inspection should be handed over to the mount's manufacturer who can advise on remedial action.

Machinery and components which are properly protected through the use of antivibration mounts will last longer and operate more efficiently – but only if these mounts are specified correctly using in-depth calculations; installed with care and checked against those calculations; and periodically monitored to flag any issues before they become critical. Trelleborg's industrial antivibration engineers can assist with every stage of the project, from bespoke mount design through to testing, training and aftercare.

MountFinder Pro, a powerful app developed to combine vibration analysis and mount selection technology, can help to validate correct installation and the effectiveness of a mount. Compatible with iPhone and Android, the free app simply needs to be held on top of the asset for the built-in accelerometer to measure vibration levels. Once machine weight and number of mounts are input to the app, it can identify and recommend the correct mount for the individual application.



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