

Helping New Zealanders Build & Modify Safe Vehicles



STEERING COLUMN TEST

► Introduction

Coinciding with general concerns around poor quality and welding within aftermarket steering columns in 2013, there was a catastrophic failure of a poor-quality aftermarket tilt steering column. In response, LVVTA produced [LVVTA Information Sheet # 01 - 2013 Unsafe Aftermarket Steering Columns](#), which included a list of recognised steering column manufacturers who had provided LVVTA with suitable confirmation of quality assurance and technical information that allowed LVV Certifiers to accept their steering columns without the need for further assessment or dismantling. At the time, LVVTA also advised that more in-depth assessment and testing may take place.

While LVVTA continues to have confidence in those manufacturers, verifying the durability and strength of the steering columns was seen by LVVTA as an important final part of the validation process to confirm that the design and construction (particularly of the tilt-mechanisms and welded parts) were fit for purpose, and safe.



Image 1: Cyclic test rig.

► Executive Summary

LVVTA has completed testing and found that the following brands of steering columns (excluding any electric power assist/EPAS aspects which require separate assessment by an LVV Certifier) are acceptable and can continue to be treated by LVV Certifiers as recognised aftermarket steering column manufacturers, meaning that no disassembly for inspection is required - provided that the brand can be positively identified, and the LVV Certifier has no reason to believe that post-manufacture modifications exist.

Tilt column brands (which include a tilt-mechanism and/or welded internals):

- 'Ididit'
- 'Flaming River'
- 'Billet Specialties' (no longer being produced).

Non-tilt column brands (which incorporate welded internals):

- 'Limeworks'
- 'Woodward'.

► Background

In order to carry out in-house testing, LVVTA, with the help of a design engineer, a local engineering firm (Metal Construction Company), and electronics specialists, designed and constructed a custom cyclic test rig, capable of reconfiguration to allow the testing cyclic durability of components, as well as a floor-mounted fixture, for maximum load-testing of steering columns.

► Test Procedures

Cyclic Test

A cyclic test is a durability test that applies simulated loads over a large number of cycles, helping to identify any potential fatigue-related points of failure/failure points).

A wide range of factors were considered when developing a suitable cyclic test procedure. LVVTA researched overseas steering column and steering system standards and engineering studies, identified peak loads expected during an emergency manoeuvre, and physically measuring steering input loads on various vehicles. Eventually it was agreed that a load of 40 Nm would be applied over one million cycles, providing medium-level loads, which are seen as a good representation of a non-power steer vehicle during common manoeuvres such as parking and low speed turns, which would regularly occur during normal use.

For the cyclic test the tilt mechanism would be set in its fully tilted position, which is the worst-case scenario. The cyclic test duration is approximately three months with the test rig running non-stop. Any wear that takes place throughout the duration of the test is recorded within the test rig's data-logging system, and once the cyclic test has concluded the column is stripped, measured, and inspected for wear or damage. If it is still serviceable it is reassembled and fixed into the floor-mounting fixture for the maximum load-test.

Maximum Load Test

A maximum load-test is where a one-off load is applied, either to ensure a specific load rating can be achieved, or to take a component to ultimate failure.

For the maximum load test, a range of overseas steering load requirements were considered, including UN/ECE, SAE, and Australian Code of Practice 'VSB' requirements. The Australian VSB test figure of 200 Nm was adopted.

For the maximum load test, two separate tests are conducted; one with the column set in the 'straight' position, and the other set to its full tilt position*.

**Note that the tilt part of the test cannot be applied to a non-tilt column.*

General

For both types of test, the lower end of the column was clamped into a specially made fixture that secures the column housing, and locks the shaft (preventing shaft rotation). The torque load was then applied through the input spline. This means all the internal parts of the column, (in particular the tilt mechanism and welds), were subjected to the full torque loads, replicating how the column is loaded when it's fitted in a vehicle.

Prior to any testing, electronic measuring equipment was calibrated, and all test parameters and outcomes were recorded for future reference.



Image 2: LVVTA's custom-built cyclic test rig, with the 'Flaming River'-brand column mounted and ready to begin testing.



Image 3: Dylan (Left) and Andrew conduct the maximum load test on an 'Ididit'-brand tilt column.

▶ Testing Summary

Tilt Columns

All of the tilt steering columns passed the million-cycle durability test at full tilt setting, with no failures and no significant wear (in other words all would still have passed a WoF inspection).

All of the tilt steering columns were tested using the maximum load test, and all were found to meet the 200 Nm loading.

The only column that developed any discernible wear or movement during its million cycles was the 'Billet Specialties'-brand column (which somewhat ironically uses OEM General Motors internals, and are also no longer in production). The wear was relatively minor and was found to be due to a loose-fitting double-D shaft connection.

The following brands of tilt steering columns can be accepted by LVV Certifiers without the need for dismantling or further inspection (provided proof of purchase or visibly identified and no modifications have been made):

- 'Ididit'
- 'Flaming River'
- 'Billet Specialties' (no longer being produced).

Non-tilt Columns

Both non-tilt steering columns were tested using the maximum load test, and both were found to meet the 200 Nm loading.

The following brands of non-tilt steering columns can be accepted by LVV Certifiers without the need for dismantling or further inspection (provided proof of purchase or visibly identified and no modifications have been made):

- 'Limeworks'
- 'Woodward'.

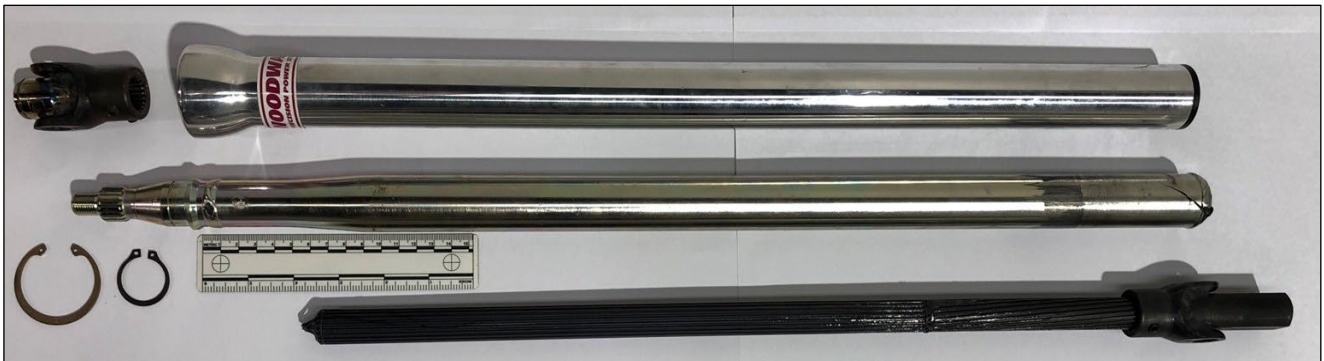


Image 4: 'Woodward'-brand non-tilt column, dismantled for inspection following a successful maximum load test.

▶ Important Notes

LVVTA expects that each of the manufacturers listed above will continue to produce high quality components, and that the design, construction, and materials used in the manufacture of these parts will remain unchanged. However, while every effort to ensure the parts are safe and fit for purpose has been made, LVVTA has no way of ensuring that companies continue to produce quality components, and that the design, construction, and materials used in the manufacture of these parts will remain unchanged. LVVTA asks that LVV Certifiers are vigilant and where they identify any changes in any aspects of these steering columns, they contact LVVTA with details.

LVVTA has also asked that the steering column manufacturers themselves notify LVVTA of any changes they make to the design and construction of their component.

LVVTA reserves the right to remove any manufacturer from this list without notice. Removal could be due to a component failure, the design or construction of an assembly is found to have undergone substantive change, a manufacturer fails to

provide information requested by LVVTA, or information provided is not found to be satisfactory. Should this occur, details will be published on the LVVTA website, and LVV Certifiers will be advised accordingly.

▶ **Acknowledgements**

LVVTA's cyclic test rig was completed thanks to the help of several key people, but especially Wellington based Metal Construction Company (Metcon) who was a huge contributor to the project, donating materials, fabrication, and machining of the test rig parts. The electronic 'brain' of the system was also extremely complex and LVVTA is grateful for Dave at Absolute Automation for his contribution to the project.

 FOR FURTHER INFORMATION PLEASE CONTACT YOUR LVV CERTIFIER, OR LVVTA.