Steering Universal Joint Phasing

Please note that this Information Sheet # 04-2009 is a second version (V2), as a result of some misleading information that was contained in the original Information Sheet #04-2009.

Introduction:

The principles of correct phasing of universal joints within a steering system are commonly unknown and misunderstood. The NZ Car Construction Manual (NZCCM) covers the correct phasing of universal joints in paragraph 7.9.3, however LVVTA wishes to highlight this situation to ensure that all LVV Certifiers are aware of the existence of the information in 7.9.3.

A common problem:

Numerous vehicles with modified or custom-engineered steering systems that incorporate more than one universal joint, and which have undergone LVV certification, have exhibited a 'notchiness' when turning the steering system throughout its range of travel. This notchiness is usually more pronounced as the universal joint angle incorporated within the system increases. Often, to try to overcome this problem, modifiers redesign the steering system so as to reduce the universal angle, however the notchiness doesn't entirely go away.

Correct universal joint phasing:

Contrary to common belief, and information supplied by some of the larger manufacturers of aftermarket steering components, steering universals should never be phased (or 'timed') in-line with each other like a vehicle drive-shaft. This should be avoided at all costs, for the following two reasons:

1. Universal joints are not constant velocity joints, and will rotate with a fast and then slow rotation on the output side, with a constant speed rotation on the input side.
2. Universal joints do not rotate without the shaft lengths changing.

Correct installation of more than one cross-bores when timing universals is done by advancing either the top or bottom unit by 15° to 45° clockwise or anti-clockwise, depending if it's a left or right-hand-drive application, or a steering rack or steering box, to prevent the fast/slow velocity, and the shafts from changing length while rotating.

In order to work well from a practical point of view, the universal joints may need to be out of phase by anywhere up to 45° in order to achieve a smooth steering feel. Trial and error is sometimes required to achieve the perfect end result, however it's worth putting the time in to get this right. For more detailed information and diagrams, refer to 7.9.3 of the NZ Car Construction Manual.

If you have any queries or require any further clarification relating to this Information Sheet, please feel free to contact a member of the technical team in the Wellington LVVTA office on (04) 238-4343.

LVVTA acknowledges the technical expertise and assistance from steering system expert Phil Game of PG Hydraulics Ltd East Tamaki Auckland (09 274-5871) in compiling this LVVTA Information sheet.