

SECTION 5: STEERING

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**i. 5.1 STEERING MODIFICATION REQUIREMENTS**

- 5.1.1 Steering boxes and components from various donor vehicles may be used. The steering components must be of adequate strength for the intended Street Rod and the steering ratio must be suitable to permit safe manoeuvring and Street Rod control. The steering box ratio and steering arm length must be compatible so that excessive force is not required to operate the steering.
- 5.1.2 Steering components must all be compatible. This should be achieved by selecting a single donor vehicle. A clear record should be kept of the make, model, year and identifier to enable parts to be sourced in the future.  
Note: Steering components should not be lightened; the donor vehicle should be of at least the same size and mass as the Street Rod under construction
- 5.1.3 At least 10mm clearance must be maintained around all steering components throughout the operational range of the steering and suspension.
- 5.1.4 Lock stops must be fitted to prevent over-lock and maintain steering component clearances if they are not integral to the rack or steering box design. These may be fixed or adjustable and locked.
- 5.1.5 Fabric steering joints shall be heat shielded if less than 50mm from the exhaust
- 5.1.6 The street rod must be able to turn in a circle not over 25 metres in diameter, measured by the outer edge of the tyre track at ground level, whether it turns to the left or to the right.
- 5.1.7 Examiners may require an engineer's report if there is any concern about any aspect of the design, strength, integrity operation of the steering.

**ii. 5.2 HEAT TREATMENT AND CHROME PLATING**

- 5.2.1 It is critically important that the strength and fatigue resistance of all steering components is maintained, therefore forged or cast steering components must not be reworked by welding or heating unless the component has subsequently been appropriately treated and approved in accordance with Appendix C to Section LZ of VSB 14.
- 5.2.2 Due to the risk of hydrogen embrittlement, stub axles and other critical steering components must not be chrome plated.  
Note: Hydrogen embrittlement is a potential side effect of chrome plating. It occurs when the hydrogen produced as a result of the plating process causes weak spots in the base metal. It is undetectable as embrittlement occurs under the surface of the chrome plating.
- 5.2.3 Heat treated suspension components should not be polished, sand, or bead blasted except by a skilled and experienced supplier. Stainless steel suspension components may be supplied in a coarse matt or polished finish, and should only be polished by the manufacturer or a competent person. Evidence may be sought to confirm the material, and the supplied finish of any suspension component; e.g.. Original invoices or receipts and manufacturer's specifications

Note: Refer to Appendix C to Section LZ of VSB 14 for guidance on welding techniques and procedures and to Appendix D to Section LZ of VSB 14.

**iii. 5.3 STEERING RACK SHORTENING**

- 5.3.1 If steering racks are shortened, the modification must be carried out without any welding of the critical components.

- 5.3.2 The rack assembly may be shortened by removal of material on the near (kerb) side of the rack and the subsequent remanufacture of the cut end to duplicate the original manufacturers' design.
- 5.3.3 Cutting of additional teeth is not permitted unless the modifier can prove that no strength has been lost and that the heat treatment is still intact or has subsequently been treated appropriately.
- 5.3.4 If it is intended to modify outer housings with welding, a suitable jig must be used to ensure alignment of bushes is unaffected.
- 5.3.5 The welded area should be reinforced with a sleeve or suitable reinforcement. The shortening should be done by a competent machine shop.
- 5.3.6 Persons not familiar with determining rack length as described in Appendix 1 must consult an Examiner or an experienced Street Rod builder before shortening the rack.

**iv. 5.4 MANUFACTURED STEERING LINKAGES**

- 5.4.1 Components must be of an appropriate design, material and dimension for the size and mass of the Street Rod and for the steering loads likely on components. Persons not familiar with construction of such components must consult an Examiner or experienced constructor for guidance.
- 5.4.2 Fabricated steering pitman arms must have a minimum plate thickness of 19mm. Fabricated spindle steering arms must have a minimum plate size of 12.5mm.
- 5.4.3 Correct toe-out on turns must be maintained with the use of Ackerman's Principle. Ackerman's Principle states - "A line drawn through the centre of the steering axis and the steering pivot on each wheel should intersect at a point in line with the centre of the rear axle". This means that steering arms positioned rearward of the front axle centreline must angle inwards and steering arms positioned forward of the axle centreline must angle outwards; refer to Figure 5.1 (see overleaf). Consideration should be given to the position of steering components and the effects of the full range of suspension travel to introduce bump steer; refer to Section 6.10.
- 5.4.4 If tie rods or drag links are bent or cranked to clear components, the tie rods or drag links must satisfy the strength requirement of the task it is intended for. In many cases original equipment manufacturer (OEM) tie rods or drag links which feature increased wall thickness may be used.
- 5.4.5 Table 5.1 lists the minimum sizes required for mild steel seamless tubing steering linkages:

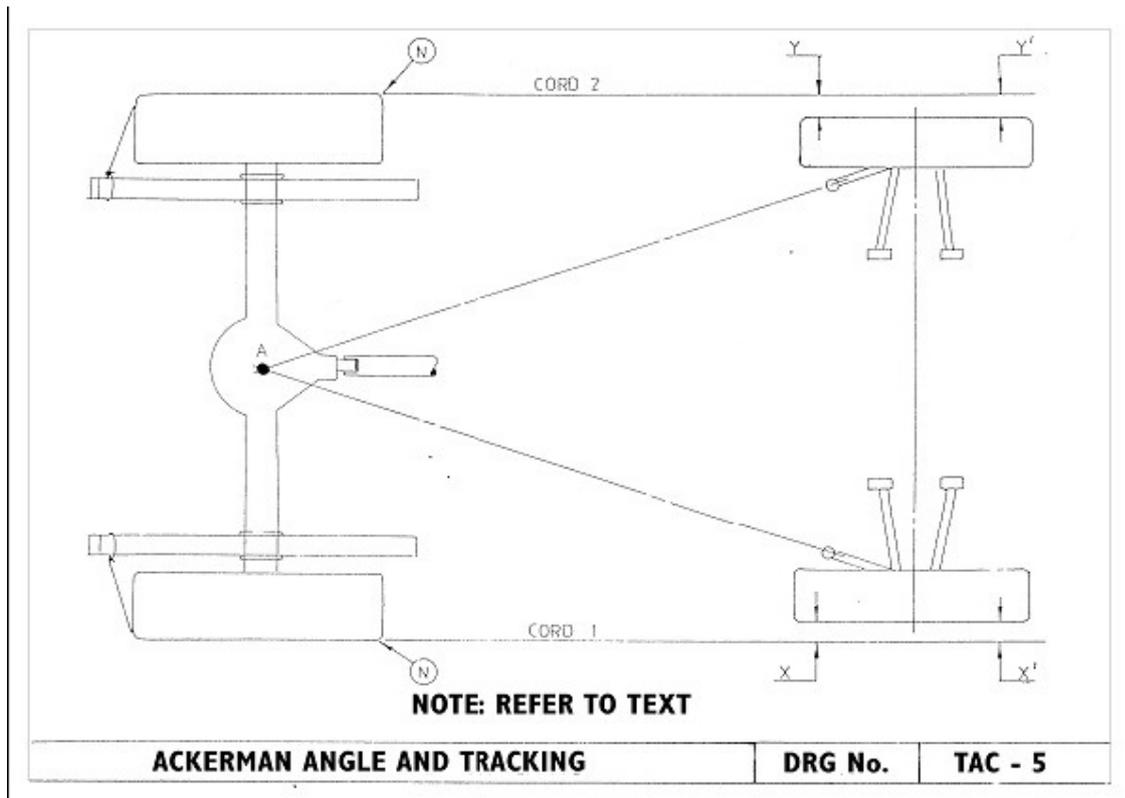
Length	Diameter	Wall Thickness
Up to 1200mm	22mm	3mm
1200mm to 1800mm	32mm	3mm
1800mm is the recommended maximum length for any steering linkage tubing.		

**Table 5.1: Minimum sizes for mild steel seamless tubing steering linkages.**

**v. 5.5 CHECKING THE TRACKING OF ALL FOUR WHEELS**

Prior to checking the tracking, the street rod must be checked to verify that the wheelbase is symmetrical about its centreline, and that the front and rear axles are installed perpendicular.

For safe handling and appropriate tyre wear, all four wheels should track in the same line. Drawing TAC-5 illustrates how this can be achieved. Commence by disconnecting one tie rod end then fixing a cord at the first cord position, fix the free end of the cord to a moveable object and move the object until the cord just touches point "N". Straighten the front wheel until distances "X" and "X1" are equal. Fix a second cord in the same way and repeat the procedure applied to the first cord. The measurements of "Y" and "Y1" should be equal to "X" and "X1".



**Figure 5.1 Ackerman Angle and Tracking (TAC-5)**

**vi. 5.6 STEERING COLUMNS**

- 5.6.1 The following applies to all replica Street Rods and to other Street Rods if the steering column is modified or replaced. Either:
- (a) Collapsible steering columns must be fitted. Vertical columns must not be fitted, and the steering column angle must not be less than 30° from the vertical.
  - or
  - (b) Universals sections and a section of intermediate shaft between the bottom of the steering column and the steering box or rack must be fitted. The intermediate shaft/s must be designed to ensure the rearward displacement of the steering column is minimised relative to the driver in a frontal collision.
- 5.6.2 The steering column must not impede access to any of the foot controls

**vii. 5.7 STEERING UNIVERSAL JOINTS AND COUPLINGS**

- 5.7.1 All steering universal joints and couplings must be of an automotive type. Industrial and agricultural joints must not be used. The number of joints used must be consistent with safe and smooth operation and all shafts must be supported where required. For example, a system with more than two universal joints must have at least one self-aligning support bearing on the lower shaft.
- 5.7.2 Flexible fabric or rubber disc universal couplings are not designed to operate through a greater change of angle than 5 degrees and must be installed with a supporting self-aligning bearing to prevent any out of fixed line movement. These

couplings must also be fitted with a device that prevents coupling separation in the event of failure of the fabric.

- 5.7.3 Ball joints (ball and cup couplings) as used on HQ Holden steering column ends must be installed with an operating angle of no more than 5 degrees.
- 5.7.4 Where universal joints are installed in pairs they must be installed at right angles (phased) to allow smooth operation and to prevent binding. The angle of steering universal joints must be such that the universal joints move freely with no binding.
- 5.7.5 Steering universal joints must be installed with the minimum operating angle to ensure that they rotate smoothly without binding.

**viii. 5.8. LOCKING OF STEERING COMPONENTS**

- 5.8.1 Castellated nuts used for steering components must be locked with split pins.
- 5.8.2 If nyloc or deformed thread nuts are used, the thread must protrude at least one clear turn beyond the end of the nut.
- 5.8.3 Other means of locking may be used provided that the application is appropriate. Note: Refer to Appendix A to Section LZ of VSB 14 for guidance on the use of fasteners.

**ix. 5.9. STEERING WHEELS**

- 5.9.1 A steering wheel manufactured for automotive use must be used. Novelty steering wheels – e.g. one manufactured from welded chain – must not be used.
- 5.9.2 The diameter of a steering wheel, measured from centre to centre of the rim, must be at least 13 inches or 330mm.

**x. 5.10. STEERING POSITION**

Street Rods must be configured as right-hand drive vehicles.

**xi. 5.11. ILLUSTRATIONS/DIAGRAMS**

Other steering illustrations and diagrams are included as part of Section 6, Suspension.