BASIC DRIVELINE DESIGN

ALLISON ON-HIGHWAY TRANSMISSIONS

APPLICABLE MODELS: 1000 Product Family
2000 Product Family
2900 Product Family
3000 Product Family
4000 Product Family

Contents:

DRIVELINE DESIGN – BASIC

1.0 INTRODUCTION

The purpose of this document is to present requirements and recommendations for designing a driveline that is compatible with Allison transmissions. *Driveline Design – Special Cases* contains additional guidelines for the following driveline systems:

- transfer case that is mounted remote from the transmission output
- split-shaft PTO installed in the output driveline
- auxiliary transmission installed in the output driveline
- retarder installed in the output driveline
- input driveline for 4000 Product Family models with the remote-mount option

For instructions for installing yokes and flanges refer to *Yoke / Flange Installation Instructions*. If the installation includes a transmission-mounted park brake, refer to the appropriate document for your transmission:

- *Park Brake Installation Instructions* for the 1000/2000/2900 Product Family
- *Park Brake Installation Instructions* for the 3000 Product Family

2.0 REFERENCED DOCUMENTS

Unless otherwise noted, all documents referenced in this document may be found in the Allison HUB website at https://hub.allisontransmission.com/login. To locate the referenced documents look for Tech Data under the Engineering heading on the Allison HUB home page. In this document, these references are identified by italic font. Contact your Allison Transmission representative if you do not have access to the Allison HUB. A list of all items referenced in this document can be found at the end of this document.

3.0 YOKES AND FLANGES

The hardware configuration at the rear of the transmission affects the interface of the driveline to the transmission. Optional output configurations include:

- integral retarder
- park brake
- provision to mount a non-Allison transfer case

For assistance in determining the available output provisions for your transmission, refer to *Transmission Product Description*, and to *Features and Options* for the various transmission families.

3.1 1000/2000/2900 PRODUCT FAMILIES

Allison Transmission does not supply yokes or flanges for the 1000/2000/2900 Product Family models. Several driveline component manufacturers produce yokes and flanges that fit the output shaft of these models. Refer to the following:

- *1000/2000 Product Family Installation Drawings*
  - *AS64-442, Available Output Yokes Installation Drawing* for a list of available yokes and their basic dimensions
  - *AS64-441, Available Output Flanges Installation Drawing* for a list of available output flanges and their basic dimensions. Includes flanges used with transmission-mounted park brakes.
- *2900 Product Family Installation Drawings*
  - *AS64-942, Available Output Yokes Installation Drawing* for a list of available yokes and their basic dimensions
  - *AS64-941, Available Output Flanges Installation Drawing* for a list of available output flanges and their basic dimensions. Includes flanges used with transmission-mounted park brakes.

- *Transmission Support Equipment* for sources of yokes and flanges

The yoke or flange is secured to the transmission output shaft by the following hardware:
- a washer-retainer which is pressed into the yoke or flange
- a special bolt
- a hardened washer with seal

The following dimensions must be carefully controlled:
- the outside diameter of the washer-retainer
- the depth and pilot diameter of the yoke or flange

Design requirements are shown on *AS64-440, Output Yoke/Flange Design Requirements Installation Drawing*. The washer-retainer, typically available from the yoke or flange manufacturer, is supplied and installed by the vehicle builder. The retaining bolt and hardened washer specified on *AS64-440* must be procured from Allison.

> **NOTE: The Allison bolt and hardened washer specified on *AS64-440* must be used to fasten the yoke or flange to the transmission output shaft.**

Some models in the 1000/2000/2900 Product Family are available with an optional provision to mount a non-Allison transfer case to the rear of the transmission. For more information, refer to *Provision for Non-Allison Transfer Case – Design* for the 1000/2000/2900 Product Families.

3.2 3000/4000 PRODUCT FAMILIES

It is Allison Transmission's policy that output yokes and flanges for 3000 and 4000 Product Family models must be supplied by Allison. Allison Transmission offers a variety of yokes and flanges for the 3000 and 4000 Product Families. For descriptions and dimensions of available yokes and flanges, refer to the following:
- *3000 Product Family Installation Drawings*
  - *AS66-442, Yoke Availability Installation Drawing*
  - *AS66-441, Flange Availability Installation Drawing*
- 4000 Product Family Installation Drawings
  - *AS67-442, Yoke Availability Installation Drawing*
  - *AS67-441, Flange Availability Installation Drawing*

If ordered with the transmission, selected yokes and flanges are available installed on the transmission by Allison. For a list of Allison-installed yokes and flanges, refer to the *Unit Customer Specification System (uCSS)* or contact your Allison representative.

To request a yoke or flange design that is not currently offered by Allison, contact your Allison Representative.

Yokes – The yokes for both the 3000 and 4000 Product Families can be used on both non-retarder transmissions and on transmissions with the integral retarder. The yoke includes a dust shield, or slinger, to protect the transmission output seal from dust and debris.

Companion Flanges – Flanges for both the 3000 and 4000 Product Families are available with thru-holes and with threaded holes.
- Both types of flanges may be used on non-retarder transmissions.
- Flanges with threaded holes are typically preferred for use with retarder-equipped transmissions. There is insufficient space between the retarder housing and the transmission-mounted flange to use nuts and bolts to attach the two companion flanges.

• For a few flanges, the dust shield must be ordered separately and installed by the vehicle builder. Refer to *Drawing AS66-441* or *AS67-441* to determine which flanges include the dust shield.

Park Brake Flanges – For the 3000 Product Family, Allison offers flanges that may be used with transmission-mounted park brakes. Due to close clearances and limited access to attaching bolts, the output flanges with threaded holes are used with transmission-mounted park brakes. Refer to *AS66-441, Flange Availability Installation Drawing* for details. Flanges used with park brakes do not include dust shields due to space claim.

Non-Allison Transmission-Mounted Transfer Case – Some models in the 3000 and 4000 Product Families are available with an optional provision to install a non-Allison transfer case. For more information, refer to *Provision for Non-Allison Transfer Case – Design* for the 3000 and 4000 Product Families.

4700 and 4800 Models – The 7-speed models in the 4000 Product Family have a different output shaft than the 6-speed models. Therefore, the yokes and flanges used with the 6-speed models are not interchangeable with the yokes and flanges used with the 7-speed models. Refer to *Installation Drawings* *AS67-442, Yoke Availability* and *AS67-441, Flange Availability*.

3700 Model – All 3700 transmissions are equipped with standard drive yokes when shipped from the Allison factory. Refer to the *3700 Model Installation Manual* and to *AS66-442, Yoke Availability Installation Drawing* for details.

Retention Hardware – The following hardware is used to retain the yoke or flange to the transmission output shaft:
- retention bolt
- O-rings
- retaining plug

This retention hardware is supplied with the transmission, even if the yoke or flange is not included with the transmission assembly. For a definition of the retention hardware, refer to the appropriate *Yoke or Flange Availability Installation Drawing* for your transmission. Refer to the *Yoke/Flange Installation Instructions* for the installation procedure.

4.0 DRIVELINE DESIGN CONSIDERATIONS

Proper design of the driveline is essential to assure minimum vibration and maximum component life. While the items discussed in this document are of concern to the transmission, all guidelines of the driveline manufacturer and of the engine manufacturer should be met as well. Factors to be considered in the driveline design are:
- shaft size
- speed
- angularity
- indexing
- balance and straightness
- use of slip joints

NOTE: Allison recommends a detailed review of the driveline design with your driveline component supplier. The driveline manufacturer may have more stringent requirements.

Application Considerations – Allison requires Customer Integration Engineering review of 1000/2000/2900 Product Family transmissions in vehicles with all-wheel drive or with multi-speed transfer cases.

Installation Considerations – If the transmission will be painted, the output seal and shaft must be protected against over-spray. Refer to the *Yoke / Flange Installation Instructions*.

Service Considerations – The Allison Transmission Service Department has established maximum removal and replacement (R&R) requirements for Allison transmissions and related components. For R&R information which relates to components discussed in this document, refer to *Technical Document 176 (TD-176), Service Requirements – Removal and Replacement Times for Allison Transmissions*.

4.1 SPEEDS

Driveline speed is a significant factor in the selection of driveline components. Allison transmissions have the capability for overdrive ratios in the upper gear ranges. Therefore, output driveline speeds can exceed maximum engine speed. Use the following formula to determine maximum driveline speed. For transmission gear ratios, refer to *Transmission Data* for the *1000/2000 Product Family*, *2900 Product Family*, the *3000 Product Family*, or the *4000 Product Family*.

Maximum Driveline Speed = Maximum Engine RPM / Highest Gear Ratio Used

Typically, the maximum engine RPM is the engine's full load governed speed (FLGS). If the vehicle could reasonably be expected to operate on the engine's droop between full load governed speed and no load governed speed (NLGS), speed-based driveline requirements should also be checked at no load governed speed.

CAUTION: For the 1000/2000 Product Families, drivetrain designs must limit the transmission output to a maximum rated speed. Refer to *1000/2000 Product Family Transmission Ratings* for transmission output speed ratings.

CAUTION: For the 2900 Product Families, drivetrain designs must limit the transmission output to a maximum rated speed. Refer to *2900 Product Family Transmission Ratings* for transmission output speed ratings.

CAUTION: For 3000 Product Family models with the output retarder, drivetrain designs must limit the transmission output to a maximum rated speed. Refer to *3000 Product Family Transmission Ratings* for transmission output speed ratings.

4.2 LENGTH

Allison Transmission strongly recommends that the unsupported length of the first driveshaft be 1450 mm (57 inches) or less. The first driveshaft is the driveshaft attached to the transmission. The length of the first driveshaft should adhere to the following:

- Driveline with a single shaft
  - The distance from the center of the bearing cross at the transmission output yoke or flange to the center of the bearing cross at the axle input should not exceed 1450 mm (57 inches).
- Driveline with multiple shafts
  - The distance from the center of the bearing cross at the transmission output yoke or flange to the middle of the support bearing should not exceed 1450 mm (57 inches).
  - The length from the middle of the support bearing to the joint at the next driveshaft should not exceed:
    - 178mm (7 inches) for the 1000, 2000, 2900, and 3000 Product Families
    - 216mm (8.5 inches) for the 4000 Product Family
  - The total length of the first driveshaft should not exceed 1600 mm (63 inches).

When length of the first driveshaft is greater than the above recommendation, the increased weight makes the driveline more susceptible to shaft whip and vibration. Inadequately balanced driveshafts and worn or loose slip joint splines also increase the susceptibility to driveshaft whip. Allison's experience is that the resulting shaft whip and vibration can cause transmission damage. Allison has tighter balance specifications when the first driveshaft exceeds the recommended maximum unsupported length of 1450 mm (57 inches); refer to 4.6, Balance and Straightness.

For multiple shaft drivelines, follow the driveline manufacturer's guidelines for the lengths of the driveshafts between the first driveshaft and the axle.

4.3 COMPONENT SELECTION

Follow the driveline manufacturer's requirements when selecting driveline components, including tube diameter, and yoke or flange type and size. The following factors can affect the size of the driveline components:

- maximum driveline speed; refer to 4.1, Speeds.
- the lengths of the individual driveshafts
- transmission output torque and power in propulsion
- transmission output torque and power in retardation, if the transmission has a retarder or if there is an engine brake

The transmission output torque and power, in both propulsion and retardation, can be obtained from *iSCAAN*, Allison's vehicle performance program.

4.4 MAXIMUM ANGLES

A Cardan-type universal joint operating at an angle

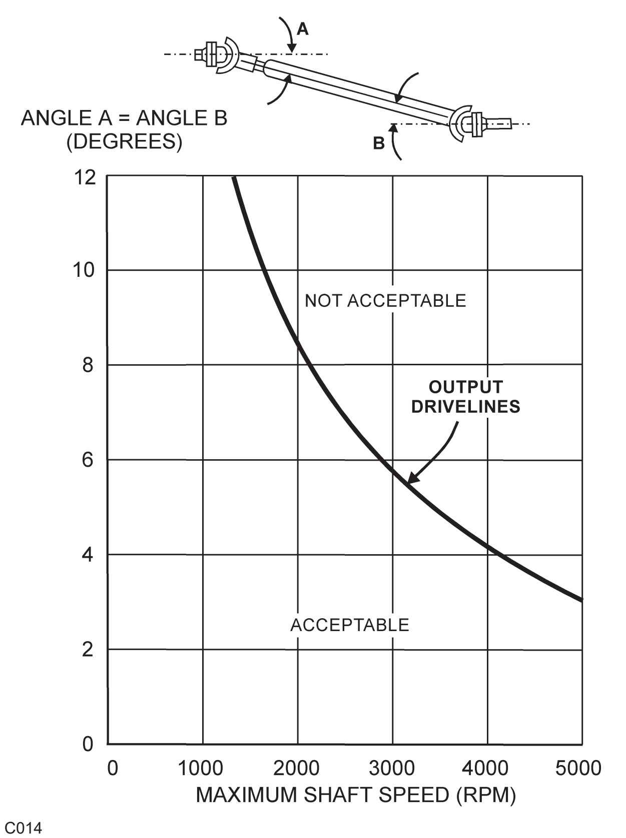


Figure 1: Driveline Angularity vs. Speed

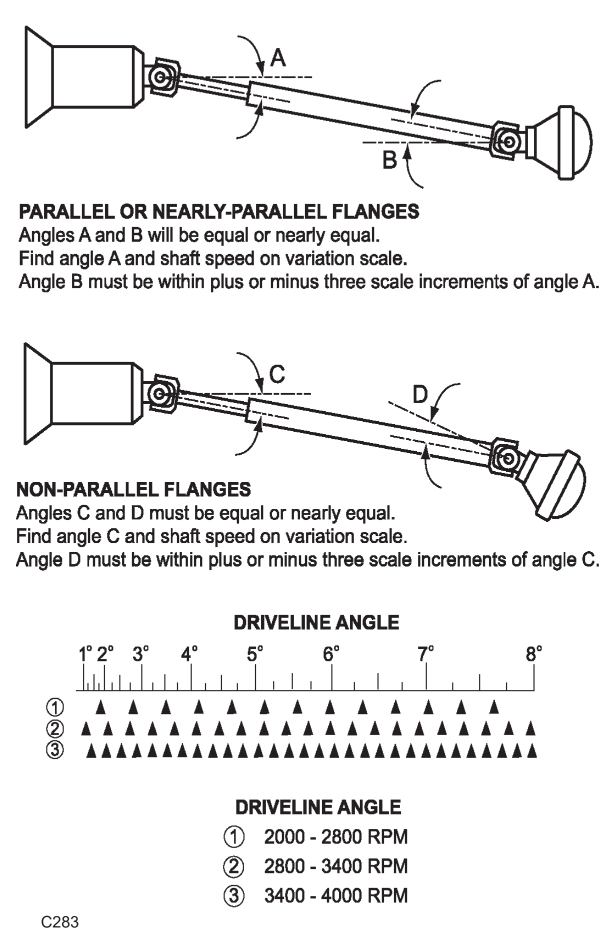


Figure 2: Angularity Limits, 2-Joint Driveline

is a source for non-uniform motion. This non-uniform motion creates continuous acceleration and deceleration of the driveline and the components connected to it. Noise and vibration may result. The maximum permissible installed angle for a driveline is determined by the maximum driveshaft speed.

The simplest driveline system consists of a single driveshaft in which the vertical operating angles at opposite ends of the shaft are equal. In this simple case, the driveshaft is parallel to the frame, which means that there is no horizontal offset in the driveline. All angularity in the driveline is therefore in only the vertical plane. Maximum allowable driveline angles are dependent upon maximum shaft speed. Refer to Figure 1 for acceptance criteria.

The potential ill effects of the non-uniform motion in the driveline are often compounded by other factors which are present in the vehicle driveline design:

- drivelines which operate at complex angles – for example, those which have working joint angles in both the horizontal and vertical directions. See paragraph 4.8.
- drivelines with unequal operating angles at opposite ends of a common shaft – for example, a single-shaft system in which the transmission-to-driveshaft angle is different than the driveshaft-to-axle angle. For guidance in determining maximum joint angles in this type of system, refer to Figure 2 for a two-joint system and to Figure 3 for a three-joint system.

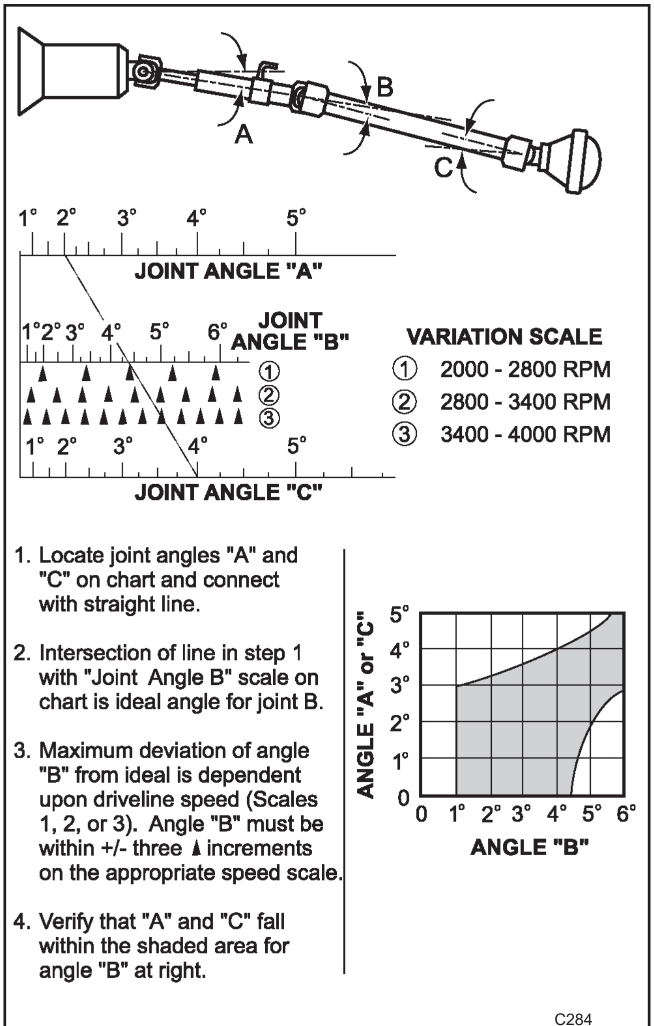


Figure 3: Angularity Limits, 3-Joint Drivelines

NOTE: The limitations shown in Figures 1 through 3 are applicable if the angularity is in one plane and the components are properly indexed. Any other design case involves a more complicated analysis. Refer to 4.8, Torsional Vibrations.

- exceedingly short driveshafts – driveline lengths less than 0.46 m (18 inches) should be avoided due to the large angular displacement which can result from even minor suspension travel.
- multi-shaft drivelines – frequently it is necessary to use a driveline with more than one driveshaft. The torsional vibrations produced by an improperly designed multi-shaft driveline, even with low joint angles, may have the same effect on the transmission as excessively large angles on a single-shaft driveline. See further discussion in paragraph 4.8.
- suspension travel – the driveline should be evaluated at the axle positions which relate to both loaded and empty vehicle configurations. In all-wheel-drive vehicles, the front driveline must be designed to clear the transmission at maximum suspension travel.

• mis-indexed components – when properly aligned in the same plane, the universal joints at opposite ends of a common shaft may provide advantageous cancelling effects to the non-uniform motion created when the shaft is rotated. Conversely, improper alignment, or mis-indexing, can cause additive effects — which may increase existing noise or vibration. See 4.5, Indexing.

• drivelines which employ more than the elementary driveshaft components – components such as transfer cases and driveline-mounted retarders may introduce effects such as significant additional mass or random component phasing. Refer to *Driveline Design – Special Cases* for additional guidelines.

4.5 INDEXING

The yokes at each end of a driveshaft should be indexed such that their universal joints are in the same plane. Mis-indexing can cause torsional vibration or noise problems. However, there are instances where mis-indexing may be utilized intentionally to correct a specific vibration or noise problem. This is normally done only in multi-piece drivelines which are not completely in the vertical plane. The driveline manufacturer should be consulted when mis-indexing is contemplated for this or other reasons. If a driveline is intentionally mis-indexed in this manner, a provision such as a blind spline must be added as a guide to subsequent reassembly.

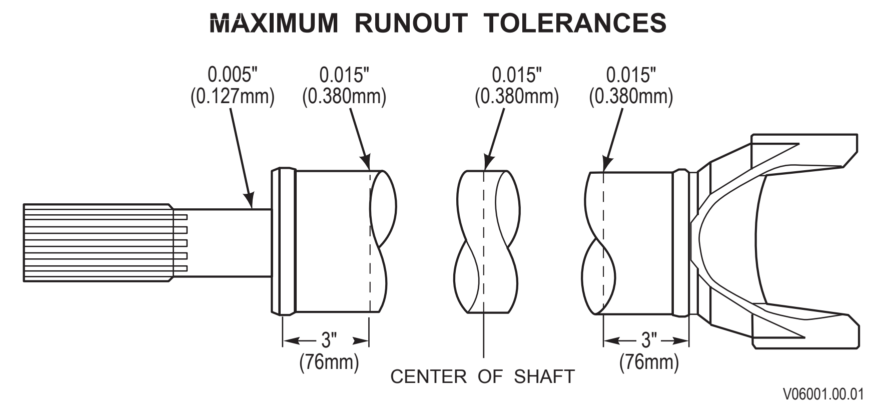


Figure 4: Runout Tolerances for Driveshafts

4.6 BALANCE AND STRAIGHTNESS

Drivelines must meet the driveline manufacturer's requirements for straightness and balance.

Balance weights should be divided and applied near both ends of the driveshaft. It is recommended that balance be controlled as follows:

- **Shafts equal to or less than 1450 mm (57 inches) in length:** Balance to less than 160 mg-m per kg (1.0 in-oz per 10.0 lb) of assembly weight (less flanges and yokes), evaluated at maximum driveline operating speed.
- **Shafts greater than 1450 mm (57 inches) in length:** Balance per ISO Standard 1940 for Grade 16 components, evaluated at maximum driveline operating speed. Refer to Appendix B for a graph of ISO 1940 driveline balance requirements.

Allison's maximum runout tolerances are shown in Figure 4. If the driveline manufacturer has tighter tolerances, the driveline must meet the manufacturer's requirements.

4.7 SLIP JOINTS

Slip joints must be designed into the driveline to absorb the axial travel which results from powertrain and axle movement. Generally, as the transmitted torque increases, so does the axial force required to cause a joint to slip. Thus, it is imperative to follow the driveline manufacturer's recommendations for lubrication and maintenance.

Vehicle design should minimize the potential for a hydraulic lock, or for the "bottoming out" of a slip joint. For vehicles with unusual driveline arrangements, such as pivot-steer vehicles, review of the axial forces with Allison Engineering is recommended.

4.8 TORSIONAL VIBRATIONS

Driveline-induced torsional vibrations are expressed in two basic terms – "torsional accelerations" and "inertial accelerations". Each may be reduced or eliminated through the proper selection of joint angles and shaft phasing. As might be expected, the mathematical analysis of any configuration beyond the simple one-shaft system can be quite complex – and beyond the scope of this document. The designer is encouraged to consult with the driveline manufacturer and to use readily-accessible programs which assist in the performance of these analyses in a consistent manner.

Allison provides a PC-based program, *AllisonCalc*, which includes a driveline analysis program. This program can analyze drivelines with up to eight-joints. The analysis considers all applicable system parameters, including axle offset and yoke indexing. *AllisonCalc* is downloadable from the Extranet. Select "Installation Design Calcs" from the Engineering menu on the Extranet home page. Note that this is a downloadable program – it does not run interactively from the website. *Technical Document 167 (TD-167), Installation Design Calculations User's Guide*, is available at the same location on the Extranet.

Contact your driveline manufacturer for more detailed information regarding driveline vibration and its control.

4.8.1 TORSIONAL ACCELERATIONS

Torsional acceleration refers to the non-uniform motion which would be measured at the input of the driven component (e.g. axle) when the driving component (e.g. transmission output shaft) was rotating uniformly. The torsional acceleration of the system is the same regardless of which end of the shaft is driven uniformly.

Many analyses, including those normally used by Allison, ignore the effects of component mass in the calculation of torsional activity — concentrating instead on the more critical effects of speed and angularity. This approach represents a good trade-off for most analyses. Although it ignores the effects of some lesser factors such as component mass, the relative simplicity of the calculation is much less demanding mathematically.

4.8.2 INERTIAL ACCELERATIONS

Inertial accelerations are a measure of non-uniform motion imparted by the U-joint angles. These values are dependent upon the source of the rotation, and are calculated from both the front ("drive" mode), and rear ("coast") perspectives.

4.8.3 ACCEPTANCE CRITERIA

Figure 5 summarizes Allison's limits for driveline-induced torsional vibrations. The driveline as measured in the vehicle will rarely agree exactly with the driveline design. For example, most in-vehicle driveline measurements are subject to a small degree of error due to the difficulty of reading obstructed instrumentation, less than ideal measurement procedures and other environmental conditions. Even if a driveline has been designed and installed properly, the introduction of these small errors may result in calculated levels in excess of the design guidelines.

CHARACTERISTIC	MAXIMUM ACCEPTABLE (Radians / Sec²)
Torsional Accelerations	
Design and Measured in Vehicle	500 max.
Inertial Accelerations	
Design Requirements	
Drive mode	1000 max.
Coast mode	1000 max.
As Measured in Vehicle	
Drive mode	1200 max.
Coast mode	1200 max.

Figure 5: Torsional Vibration Acceptance Criteria

For this reason, Allison uses a two-tier guideline to determine the acceptability of driveline-induced torsional vibrations:

- The driveline design should be evaluated for acceptability per the appropriate Design Requirements values shown in Figure 5. Adequate control of variation in the vehicle assembly process should be implemented to assure that these values represent production vehicles.
- When evaluating the acceptability of a driveline based on in-vehicle measurements, a slightly relaxed set of criteria is be used to determine acceptability. See the As Measured in Vehicle values shown in Figure 5.

4.8.4 SPECIAL CASES

If the driveline includes a driveline retarder, transfer case, or other large-inertia component, additional concerns must be addressed. Refer to *Driveline Design – Special Cases* for details.

4.8.5 DRIVELINE DAMPERS

In some rare instances, the engine torsional activity may be transmitted through the transmission into the axle and the vehicle, resulting in a torsional noise or "growl." This can sometimes be eliminated or reduced with a driveline damper.

Consult the driveline supplier or a vibration damper manufacturer for assistance in selecting a damper that will mitigate the problem and is appropriate for your installation. Follow the installation guidelines provided by the component manufacturers. All installations which use a vibration damper should be reviewed with Allison Engineering.

From Allison experience, the most frequent problem with vibration dampers is the loosening of mounting bolts. To maximize clamping capacity, the use of aircraft-quality mounting bolts and thread locking compound should be considered if a damper is used.

4.9 SECONDARY COUPLES

Another consideration in the design of a driveline is a secondary couple. A secondary couple is a bending moment that acts on the supporting members of the driveline. Refer to Figure 6. These forces vary with the length and angle of the driveline, and with the torque transmitted by the driveline. The sum of the forces is greater for intersecting shafts than for parallel shafts. Secondary couples fluctuate in direction and amplitude. The frequency of the disturbance is twice per shaft revolution.

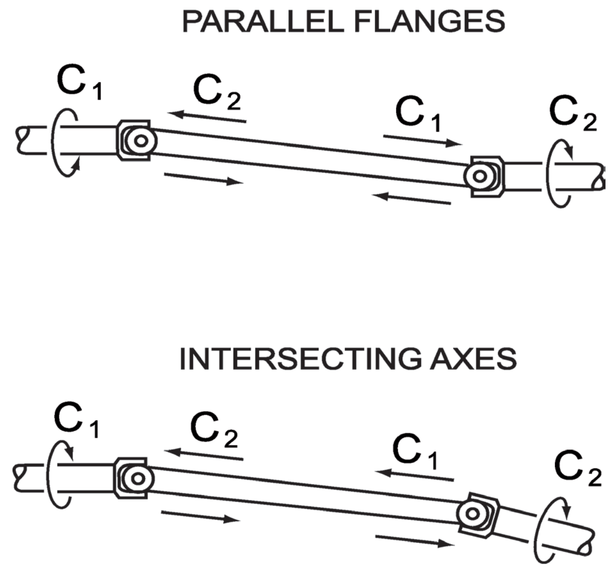


Figure 6: Influence of Secondary Couple on a Driveline

Based on experience, the following guidelines will minimize the effects of secondary couples:

- Parallel flanges with shafts greater than 1016 mm (40 inches) – the maximum joint angle should be less than 8º.
- Parallel flanges with shafts less than 1016 mm (40 inches) – the maximum joint angle should be less than the shaft length divided by 127 mm/degree (5 inches/degree)
- Intersecting shafts – maximum continuous running joint angle should be less than the shaft length divided by 254 mm/degree (10 inches/degree)

4.10 INTER-AXLE PROPSHAFT CONCERNS IN TANDEM AXLE INSTALLATIONS

A tandem axle will generate angular accelerations, through the working angles at each end of the inter-axle propshaft, similar to any other driveshaft. These angular accelerations are transmitted through the axle to the main driveline and to the transmission. Thus, an improper inter-axle driveshaft design or installation will generate the same damaging vibrations as an improperly designed or installed driveshaft between the transmission and axle.

In order to minimize the effects of these potentially damaging vibrations on the transmission, the maximum joint working angles must meet the requirements described below.

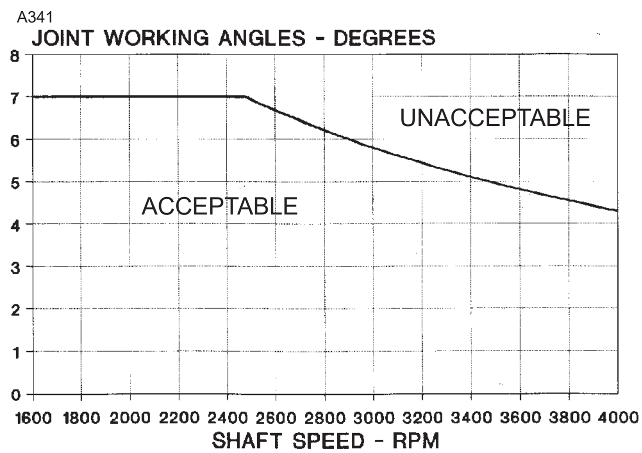


Figure 7: Determining Maximum Inter-axle Driveshaft Angularity Based On Speed

NOTE: These requirements are for "working" angles, which are calculated composite angles based on vertical and horizontal angular components. These guidelines are not directly applicable to the measured horizontal and vertical angles of an installation.

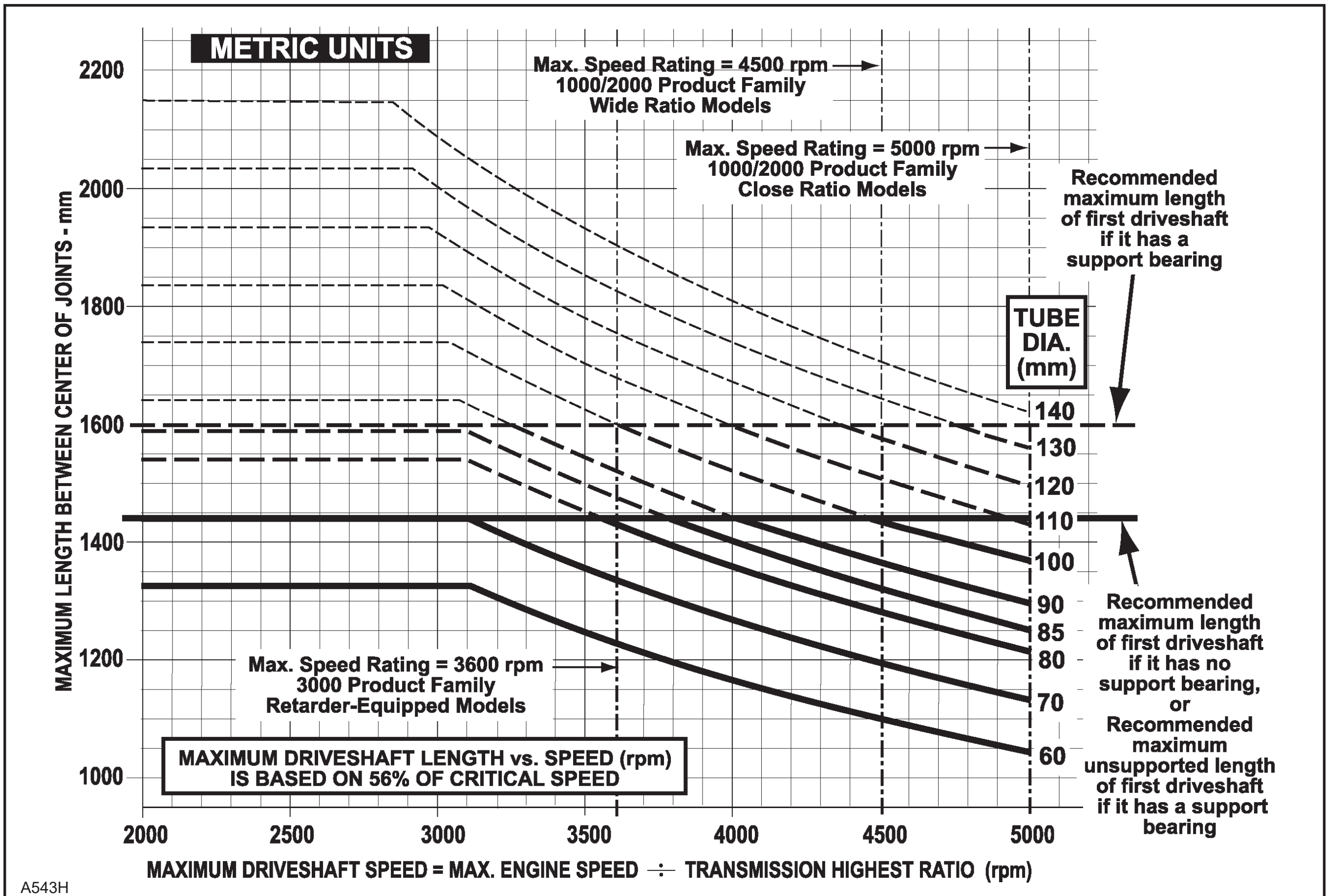
For assistance in determining working joint angles, consult the driveline manufacturer or refer to the Driveline Analysis program in *AllisonCalc* (refer to paragraph 4.8). In making these calculations, the inter-axle driveshaft should be analyzed independently as a two-joint driveline system.

Ideally, the operating angles on each end of the Inter-axle driveshaft should meet the following guidelines:

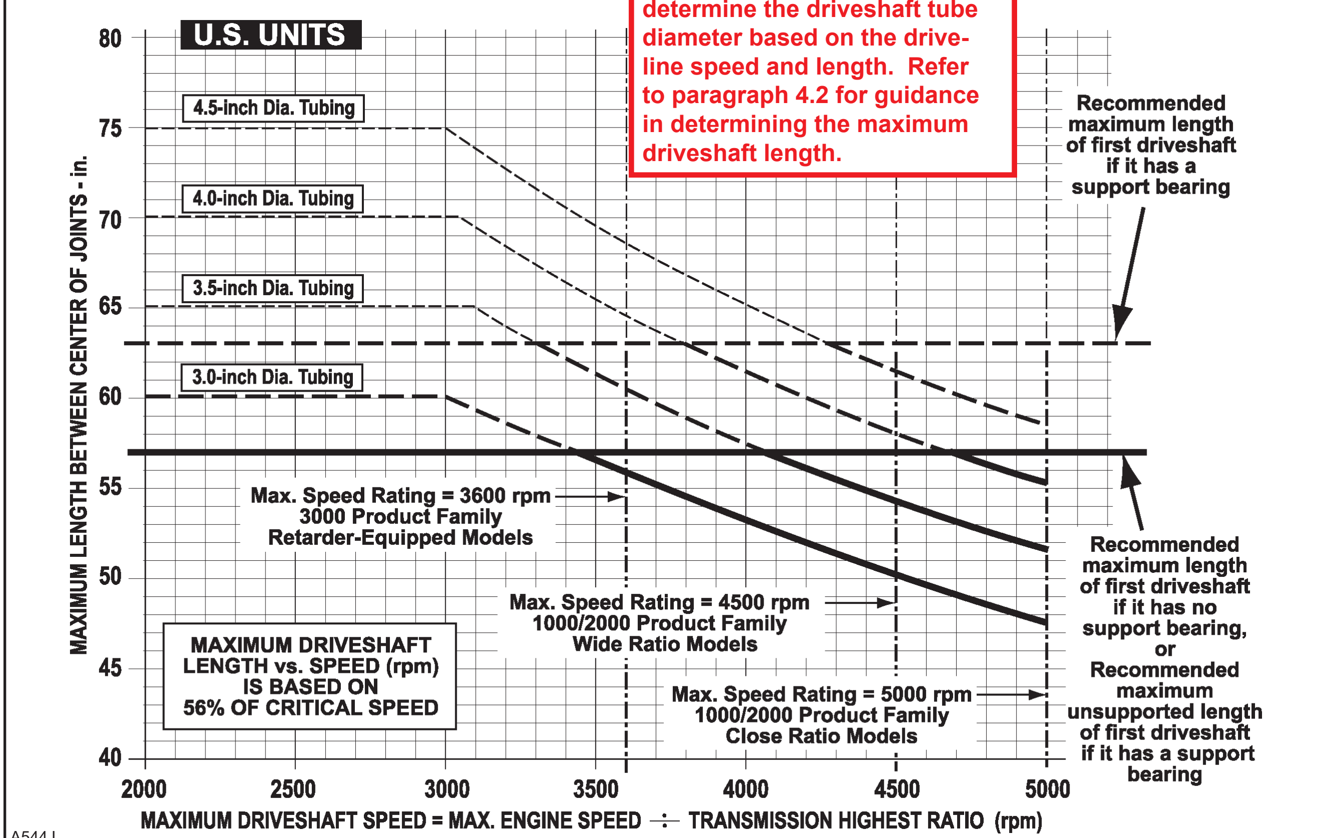
- be equal to or within one degree of each other
- have a maximum operating angle of 3º
- have a minimum continuous operating angle of 0.5º

In addition, use Figure 7 to determine the maximum permissible shaft working joint angle as a function of the maximum driveshaft speed. The combination of inter-axle shaft length, maximum driveline speed, and working angle should be reviewed with the axle manufacturer.

APPENDIX A - DETERMINING DRIVELINE TUBE SIZE



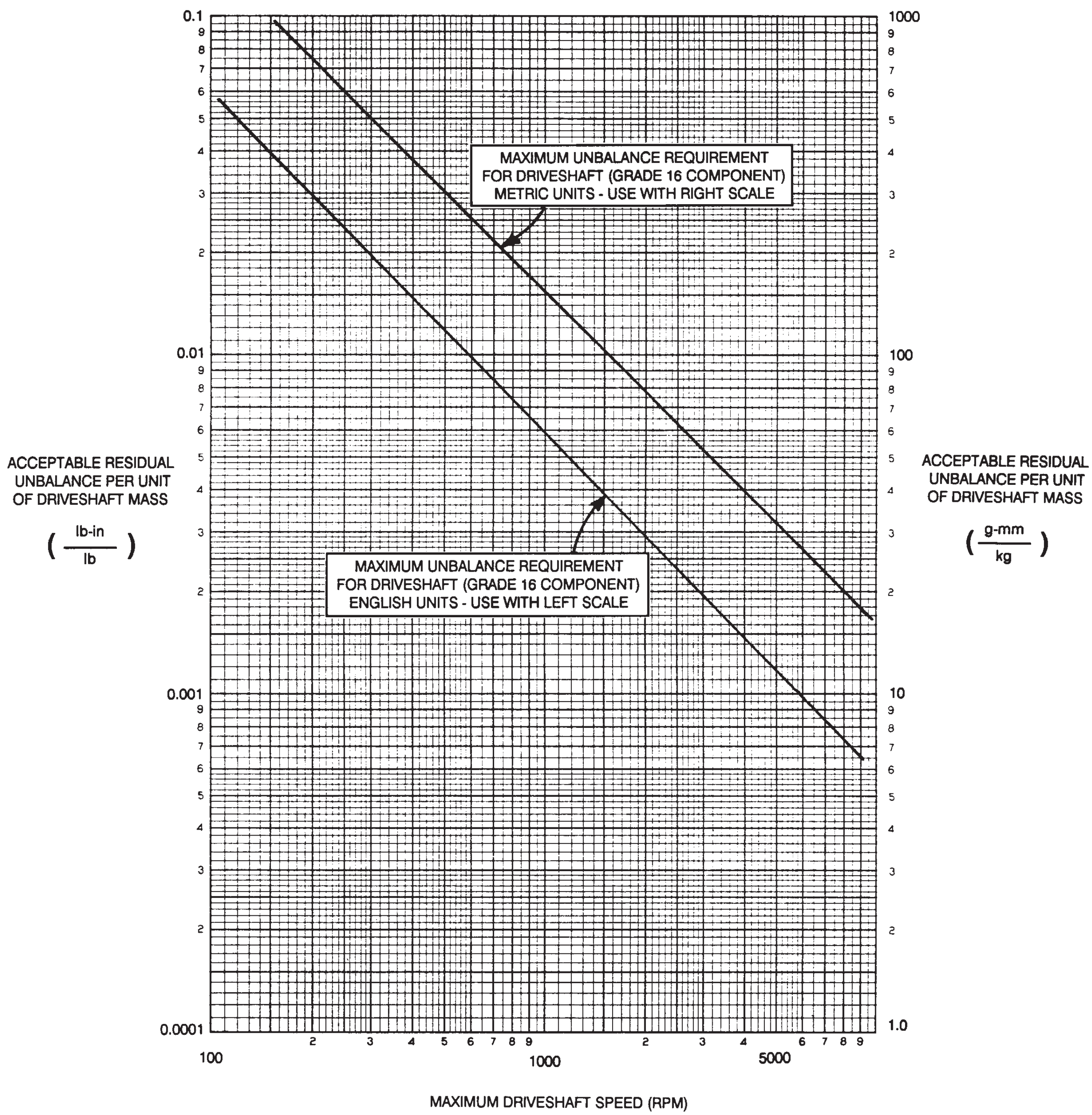
NOTE: Use these charts to determine the driveshaft tube diameter based on the driveline speed and length. Refer to paragraph 4.2 for guidance in determining the maximum driveshaft length.



APPENDIX B - DRIVELINE BALANCE REQUIREMENTS

TO USE THIS CHART: (NOTE: Chart is based on ISO 1940 Standard)

1. Locate maximum driveshaft speed on scale at bottom of chart.
2. Note the intersection of maximum driveshaft speed with the two diagonal lines on the chart. Use top diagonal line if calculations are in Metric units, bottom line if using English units.
3. From intersection point determined in (2), read Acceptable Unbalance Per Unit of Driveshaft Mass from vertical scale. Use right scale for Metric units, left scale for English units.
4. Multiply Acceptable Unbalance Per Unit of Driveshaft Mass by actual driveshaft mass to determine maximum acceptable unbalance for the shaft.



LIST OF REFERENCED DOCUMENTS

- *1000/2000/2900 Product Family Park Brake Installation Instructions*
- *1000/2000 Product Family Transmission Ratings*
- *2900 Product Family Transmission Ratings*
- *3000 Product Family Park Brake Installation Instructions*
- *3000 Product Family Transmission Ratings*
- *3700 Model Installation Manual*
- *AllisonCalc, Installation Design Calculation Program*
- *Application Requirements*
- *Unit Customer Specification System (uCSS)*
- *Driveline Design – Special Cases*
- *Features and Options* for the *1000/2000*, *2900*, *3000* or *4000* Product Family
- *iSCAAN*, Allison's Vehicle Performance Calculation Program
- *Provision for Non-Allison Transfer Case – Design* for the 1000/2000/2900 Product Family
- *Provision for Non-Allison Transfer Case – Design* for the 3000 and 4000 Product Families
- *Support Equipment for the 1000/2000, 2900, 3000 and 4000 Product Families*
- *Transmission Data* for the *1000/2000*, the *2900*, the *3000* or the *4000* Product Family
- *Transmission Product Description*
- *Yoke / Flange Installation Instructions*

1000/2000 Product Family Installation Drawings

- *AS64-440, Output Flange / Yoke Design Requirements* for 1000/2000/2900 Product Family
- *AS64-441*, *Available Output Flanges* for 1000/2000 Product Family
- *AS64-442, Available Output Yokes* for 1000/2000 Product Family

2900 Product Family Installation Drawings

- *AS64-440, Output Flange / Yoke Design Requirements* for 1000/2000/2900 Product Family
- *AS64-941*, *Available Output Flanges* for 1000/2000 Product Family
- *AS64-942, Available Output Yokes* for 1000/2000 Product Family

3000 Product Family Installation Drawings

- *AS66-441, Available Output Flanges* for 3000 Product Family
- *AS66-442, Available Output Yokes* for 3000 Product Family

4000 Product Family Installation Drawings

- *AS67-441, Available Output Flanges* for 4000 Product Family
- *AS67-442, Available Output Yokes* for 4000 Product Family

Technical Documents (TDs)

- *TD-167, Installation Design Calculations User's Guide*
- *TD-176, Service Requirements – Removal and Replacement Times for Allison Transmissions*

REVISION HISTORY

April 8, 2022

- Added 2900 Product Family

December 20, 2021

- In 4.2, added maximum length of 216 mm (8.5 inches) from the middle of the support bearing to the joint at the next driveshaft for the 4000 Product Family.
- Added reference to the Allison HUB.

December 11, 2015

- Typo correction in 4.8.3. Refer to Figure 5 for this paragraph. Previously, incorrectly referred to Figure 4.

January 8, 2014

- In 4.2, for the recommendation that first driveline be 1450 mm (57 inch) or less, removed the qualification "if the transmission has overdrive ranges." The recommendation applies to all ranges.
- In 4.6, added maximum runout tolerances for driveshafts.

September 19, 2008

- In 4.2, Length, for drivelines with multiple shafts, changed the maximum length from the middle of the support bearing to the joint at the next driveshaft from 150 mm (6 in) to 178 mm (7 in).

July 17, 2008

- Prepared document for Extranet publication

May 12, 2008

- Created new document, Basic Driveline Design