



# **TRANSMISSION MOUNTING — GENERAL REQUIREMENTS —**

## **ALLISON ON-HIGHWAY TRANSMISSIONS**

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

### **Contents:**

#### **1.0 Introduction**

#### **2.0 Referenced Documents**

#### **3.0 General Mounting Considerations**

##### **3.1 Transmission Mounting Provisions**

##### **3.2 General Mounting Guidelines**

#### **4.0 Powertrain Bending Resonance Limitations**

#### **5.0 Ground Clearance**

#### **6.0 Mounting Auxiliary Equipment**

##### **6.1 Machining Lugs**

##### **6.2 Transmission Housing and Splitline Bolts**

###### **6.2.1 Oil Sump and Oil Pan Bolts**

###### **6.2.2 Converter Housing-to-Engine Flywheel Housing Bolts**

###### **6.2.3 Converter Housing-to-Main Case Bolts**

###### **6.2.4 Rear Cover and Retarder Housing Bolts**

###### **6.2.5 Speed Sensor Clamp Bolts**

###### **6.2.6 PTO Cover Bolts**

#### **7.0 Service Considerations**

#### **List of Referenced Documents**

#### **Revision History**

# **TRANSMISSION MOUNTING – GENERAL REQUIREMENTS**

## **1.0 INTRODUCTION**

The purpose of this document is to present general requirements and recommendations for designing the transmission mounting system. Use this document in conjunction with the document for your specific mounting system:

- [\*Transmission Mounting – Overhung\*](#)
- [\*Mounting Using the Transmission Side Pads\*](#)
- [\*Mounting the Transmission Remote from the Engine\*](#) (4000 Product Family only)

## **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 GENERAL MOUNTING CONSIDERATIONS**

### **3.1 TRANSMISSION MOUNTING PROVISIONS**

The transmission mounting provisions are summarized below by Product Family.

#### **1000/2000 PRODUCT FAMILY**

- The converter housings are designed to mate to standard SAE J617 flywheel housings. Both SAE No. 2 and SAE No. 3 converter housings are available. Refer to [\*Installation Drawing AS64-422\*](#) for the SAE No. 2 Housing. Refer to [\*AS64-423\*](#) for the SAE No. 3 Housing.
- The SAE No. 3 converter housing has four-bolt side mounting pads. Refer to the [\*Basic Installation Drawing AS64-401\*](#) for dimensional details.
- The SAE No. 2 converter housing does not have side mounting pads.
- A rear support bracket may be attached to either:
  - The rear cover bolts; refer to [\*Rear Support Installation Drawing, AS64-430\*](#).
  - The park brake mounting pads on the rear cover; refer to the [\*Park Brake Installation Drawing, AS64-450\*](#).

#### **2900 PRODUCT FAMILY**

- The converter housings are designed to mate to standard SAE J617 flywheel housings. Both SAE No. 2 and SAE No. 3 converter housings are available. Refer to [\*Installation Drawing AS64-422\*](#) for the SAE No. 2 Housing. Refer to [\*AS64-423\*](#) for the SAE No. 3 Housing.
- The SAE No. 3 converter housing has four-bolt side mounting pads. Refer to the [\*Basic Installation Drawing AS64-903\*](#) for dimensional details.
- The SAE No. 2 converter housing does not have side mounting pads.
- A rear support bracket may be attached to either:
  - The rear cover bolts; refer to [\*Rear Support Installation Drawing, AS64-930\*](#).
  - The park brake mounting pads on the rear cover; refer to the [\*Park Brake Installation Drawing, AS64-950\*](#).

### **3000 PRODUCT FAMILY**

- The converter housings are designed to mount to standard SAE J617 No. 2 flywheel housings. Refer to [General Adaptation Installation Drawing, AS66-420](#).
- An SAE No. 1 to SAE No. 2 housing adapter may be used to mount a 3000 Product Family model to an SAE No. 1 flywheel housing. The specific housing adapter is defined by the adaptation design.
- Side mounting pads are **not** available on the following 3000 Product Family converter housings:
  - Non-PTO converter housing
  - Side/side PTO converter housing
- The top/side PTO converter housing includes cast features for side mounting pads as shown on [PTO Provision Installation Drawing, AS66-485](#). However, the mounting pads and bolt holes are unfinished unless the finished mounting pad option is specified when configuring the transmission. Refer to the [Customer Specification Sheet \(CSS\)](#) or an Allison representative for availability.
- A rear support bracket may be attached to the rear cover bolts or the retarder housing bolts. Refer to [Rear Support Installation Drawing, AS66-430](#).
- For non-retarder transmissions with the optional park brake rear cover, a rear support bracket may be attached to the park brake mounting pads. Refer to the [Park Brake Installation Drawing, AS66-450](#).
- The 3700 model, which has an integral transfer-case, has special mounting requirements. Refer to the [3700 Installation Manual](#).

### **4000 PRODUCT FAMILY**

- The converter housings are designed to mate to standard SAE J617 No. 1 flywheel housings. Refer to [General Adaptation Installation Drawing, AS67-420](#).
- A remote-mount option is available. Refer to [Remote Input Provision Installation Drawing AS67-425](#), and to [Mounting the Transmission Remote from Engine](#).
- The converter housings have six-bolt side mounting pads. Refer to the [Basic Installation Drawing](#).
- The adapter housing at the rear of each seven-speed transmission includes a six-bolt rear mounting pad on each side of the transmission. Refer to the [Basic Installation Drawing](#) for seven-speed transmission models.
- A rear support bracket may be attached to the rear cover bolts or to the retarder housing bolts. Refer to [Rear Support Installation Drawing, AS67-430](#).

### **3.2 GENERAL MOUNTING GUIDELINES**

Whether the transmission is mounted directly to the engine or remotely from the engine, the power-pack mounting system should provide several functions for the transmission installation to be considered acceptable:

- Support transmission weight without imparting undue loads on internal components.
- Provide a path to react vehicle driveline reaction torques to the vehicle frame.
- Absorb excess shock loads by vehicle impacts.
- Provide vibration damping between the power package (transmission) and vehicle frame.
- Locate and maintain transmission position, relative to engine and vehicle drive members, to assure driveline angularity requirements are met.
- Be within the transmission's limits for installed angles as defined in [Transmission Data](#).
- Compensate for frame twist/deflection without applying loads to mounts. The transmission must be isolated from torque induced by frame twist as described below.

When designing the powerpack mounting, it is important to remember that the transmission is not designed to act as a structural member in the vehicle frame. The transmission must be isolated from the torque induced by frame twist. This is the most easily accomplished using a three-point mounting arrangement.

**CAUTION:** If it is desired to use a four-point mount which utilizes the transmission mounting provisions as primary elements of the powerpack mount, care must be taken to isolate the transmission from frame twist. Otherwise, as the frame twists during vehicle operation, the powerpack mounts will resist the twist and be subjected to repeated, potentially high, stresses. The transmission has not been designed to withstand these conditions.

Several three-point mounting configurations are described in the Transmission Mounting documents:

- With all three mounts on the engine — one at the front, typically a front trunnion or block mount, and one at each side of the flywheel housing. In this configuration, the transmission is "overhung" from the flywheel housing and will normally require no additional support. This arrangement is discussed in [Transmission Mounting – Overhung](#).
- With the front powerpack mount at the front of the engine (block mount or trunnion), while the rear is supported by the mounting pad on each side of the transmission converter housing. Refer to [Mounting Using Transmission Side Pads](#).
- With a mount at the front of the engine (block mount or trunnion) and cradles which are attached to both the engine flywheel housing and the transmission housing on either side of the engine/transmission assembly. A single-point attachment is used to mount each of these cradles to the vehicle frame. Refer to [Mounting Using the Transmission Side Pads](#).

**NOTE:** Regardless of the mounting arrangement used, all fasteners used to attach the transmission to the engine, and for mounting the engine/transmission package in the chassis must be SAE Grade 8, ISO Grade 10.9, or equivalent.

For the only exception to this requirement, refer to [1000/2000/2900 Product Families Engine-Transmission Adaptation Design](#), section 5.1, Transmission Housing to Flywheel Housing.

#### **4.0 POWERTRAIN BENDING RESONANCE LIMITATIONS**

The vehicle manufacturer is responsible for assuring that the vehicle's drivetrain does not operate at or near the bending natural frequency or bending resonance of the powerpack. This is particularly important for the following situations:

- New engine-transmission combinations; particularly seven-speed transmissions and transmissions with both the PTO provision and the output retarder option
- New mounting arrangements for existing engine-transmission combinations
- Driveline speeds greater than 3300 rpm, especially when the propshaft is longer than 1450 mm (57 inches) or heavier than the typical driveline size for the rated power and torque; for a 4000 Product Family transmission, a driveline larger than an 1810 or SPL170.
- Addition to the powertrain of a component that lengthens the powerpack, such as a power-divider or a rear engine PTO

Do not confuse powerpack bending resonance with propshaft critical speeds. Refer to [Driveline Design](#) for information on propshaft critical speeds. Depending upon the mounting arrangement, powerpack bending resonance can occur at a driveline speed below the first propshaft critical speed. Powerpacks with the following properties are particularly susceptible when bending resonance or near resonance occurs within the propshaft operating speed range:

- Overhung transmission mounting arrangement
- Transmission with overdrive gear ratios
- Aluminum flywheel housing
- Auxiliary equipment mounted near the rear of the powerpack; for example, a cooler mounted directly to the transmission, a retarder accumulator mounted on the transmission, or hydraulic pumps mounted near the rear of the transmission

Further, longer propshafts can magnify the associated propshaft driven loads that act on the rear end of the powerpack.

The vehicle manufacturer must determine the resonant frequency of the powertrain as installed in the vehicle. The resonant frequency may be determined by test or analysis. The maximum propshaft speed must not occur at powerpack resonance nor on the flank of the resonance curve. If the shape of the resonance curve is unknown, limit the propshaft speed per the following formula:

$$\begin{aligned}\text{Maximum Propshaft Speed (rpm)} &= [(\text{Resonant Hz}) \times (60)] / (\text{square root of } 2) \\ &= (\text{Resonant Hz}) \times 42.43\end{aligned}$$

If required to avoid resonance, the propshaft speed may be limited by one of the following methods:

- With the use of a road-speed limiter
- Selection of a lower engine governed speed
- The prevention of transmission operation in higher ranges

Because the mounting arrangement of the powerpack affects the natural bending resonant frequency, modifying the mounting arrangement may move the resonant frequency out of the operating range. For example, changing from an overhung transmission mount to a configuration which uses the transmission side pads or cradle mount can change the powerpack resonant frequency. The vehicle builder must verify that the new mounting arrangement avoids the powerpack resonant frequency as discussed above.

Powerpack bending resonance is primarily a concern for installations where the transmission is mounted directly to the engine. Bending resonance is rarely a concern for transmissions mounted remotely from the engine.

Consult the manufacturers of other powertrain components for their requirements related to drivetrain bending resonance.

## **5.0 GROUND CLEARANCE**

The transmission is not designed to withstand contact with the ground. Ground clearance must be verified with vehicle suspension at its lowest possible travel, and must consider the effects of approach, break-over, and departure angles. If the transmission is the lowest point on the vehicle's undercarriage, a skid plate should be installed to protect the transmission.

## **6.0 MOUNTING AUXILIARY EQUIPMENT**

### **6.1 MACHINING LUGS**

Machining lugs, described on the [Basic Installation Drawings](#), are located on each side of the main case for use during the manufacture of the transmission. Transmission service facilities also use the lugs to mount the transmission on a rebuild stand, and they may be used to lift and handle the transmission during vehicle assembly.

These lugs were not designed to provide structural support for auxiliary equipment. Therefore, use of the lugs to support any significant mass is limited. The limitations may include the requirement to evaluate possible system vibrations, bending moments and reaction loads.

**For 1000 & 2000 Product Family models:** Allison is developing detailed guidelines for the use of the 1000/2000 machining lugs to mount auxiliary equipment. Contact your Allison representative before initiating a design which uses the machining lugs to support auxiliary equipment.

**For 3000 & 4000 Product Family models:** If the machining lugs are used to mount auxiliary equipment, the design must meet the following stringent requirements:

- Vertical reaction force (share of supported weight), centered on any one lug hole, must not exceed 267 N (60 lb<sub>f</sub>)
- Bending moment  $M_y$ , around an axis parallel to the transmission center-line and in a plane including the geometric center-line of the subject lug hole, must not exceed 3.4 N-m (30 lb<sub>f</sub>-in).
- A mounting bracket must not engage all four machining lugs.
- With the remaining bracket feet firmly attached, the gap at any single lug face must not exceed 0.6 mm (0.024 in). Brackets may be hard-mounted to the lugs.
- Natural frequencies of the supported system must not be excited by the transmission operating conditions.
- Reaction loads generated by the supported system's power transfer conditions (actuation forces, pressure loads, etc.) are considered additional loads and must be reviewed on a duty cycle basis by Allison Engineering.
- In-plane stiffness for the mounting bracket, lug-to-lug, must be significantly less than that of the transmission housing in order to protect the housing structure from differential thermal stress cycles. The in-plane stiffness (foot-to-foot, faces held in plane) for the bracket must be limited to 20,000 N/mm (114,200 lb<sub>f</sub>/in). This limit may still allow bolt slip loads beyond the capacity of the bolted joint designs used.

### **6.2 TRANSMISSION HOUSING AND SPLITLINE BOLTS**

Many bolts used for assembly of the transmission are readily accessible on the exterior of the finished transmission assembly. In order to maintain the structural integrity of the transmission and minimize the potential for fluid leaks, many of these bolts may be loosened or removed only by an authorized technician when servicing or repairing the transmission.

**NOTE: Do not attach brackets or auxiliary equipment to the transmission using the bolts that are used to assemble the transmission. The only exceptions are those described in this section or indicated specifically on Installation Drawings.**



A limited number of transmission fasteners are available for use to attach hoses, brackets, wiring harnesses, or other auxiliary equipment. Even in these circumstances, special attention is required in order to maintain the integrity of the transmission assembly when the bolts are used for this purpose. The transmission housings are made from castings. The castings may have gates and fins of up to 1.0 mm (0.04 inch). Die cast housings may also have flash at the die split lines. Some of these raised areas may be adjacent to bolt bosses. The vehicle builder must take these characteristics into account when designing brackets that will be attached to the transmission.

If the bracket attached to the transmission will support equipment that is heavier than a wiring harness or cooler line, the loads on the bolted joint must be evaluated. Excessive loads on bolted joints can shear bolts or damage the transmission. Consult your Allison representative for assistance with *Engineering Memorandum (EM) 76: Calculating Allowable Bolt Joint Loads for Brackets*.

**CAUTION:** Attachment of a relatively large component to the transmission demands consideration of the thermal properties. The thermal expansion and contraction rate frequently differs from that of transmission housings due to differences in the thermal properties of the two components. The solid attachment of such a component will result in bracket deflections and stresses at the attachment points — which could eventually result in failure of the component, transmission housing, or the mount for the component. The recommended solution is to include a provision in the mount design, such as a bushing or sleeve, to provide the required vertical support while accommodating dimensional fluctuations.

### **6.2.1 OIL SUMP AND OIL PAN BOLTS**

The oil sump or oil pan-to-main case splitline is below the level of the transmission fluid, and the integrity of this interface is therefore critical in the prevention of fluid leaks. For this reason, the bolts which retain the oil sump or oil pan to the transmission main case must not be used for attachment of auxiliary equipment to the transmission, and may only be removed when performing transmission service.

Additionally, for transmissions in the 3000 and 4000 Product Families, the bolts that attach the oil filter covers to the transmission sump must only be removed when performing transmission service and must not be used for attachment of auxiliary equipment to the transmission. The filter covers are illustrated on the *Basic Installation Drawings* for the [3000](#) and [4000](#) Product Families.

### **6.2.2 CONVERTER HOUSING-TO-ENGINE FLYWHEEL HOUSING BOLTS**

The bolts at this splitline are installed by the vehicle builder when mating the transmission to the engine. Although Allison does not provide any brackets which are specifically designed for installation at this location, it is a commonly used attachment point for non-Allison brackets. These are commonly used as tie-down points for wiring harnesses, hoses, etc. Be certain to investigate the possible need for a longer bolt (to accommodate the added thickness of the attached component) and follow the engine manufacturer's recommendations for bolt torque. If a bracket will support any significant mass, a bracket configuration which utilizes two attaching bolts should be considered to reduce the risk of loosening due to vibration.

### **6.2.3 CONVERTER HOUSING-TO-MAIN CASE BOLTS**

For the 3000 and 4000 Product Families, the bolts that attach the converter housing to the main case may be used to attach a bracket to the transmission. The bracket may support auxiliary equipment, such as a harness, heat shield or PTO pump. For bracket and bolt requirements, refer to the [\*Basic Installation Drawings\*](#) for the [3000](#) and [4000](#) Product Families.

An L-shaped bracket is available from Allison for attaching a harness at this location. Source information is included in [\*Support Equipment\*](#).

### **6.2.4 REAR COVER AND RETARDER HOUSING BOLTS**

Specific bolts on the transmission rear cover and retarder housing may be used to attach brackets to the transmission. The bracket may be a rear support bracket, or it may be a bracket used for the attachment or support of auxiliary equipment such as a harness, heat shield or PTO pump. Only those bolt locations identified on the [\*Rear Support Installation Drawings\*](#) may be used to attach brackets to the rear cover or to the retarder. Do not use any other bolt locations on the rear cover, on the retarder, the retarder accumulator or the retarder valve body. The Rear Support Installation Drawings are:

- [AS64-430](#) for 1000/2000 Product Family models
- [AS64-930](#) for 2900 Product Family models
- [AS66-430](#) for 3000 Product Family models
- [AS67-430](#) for 4000 Product Family models

A rear cover-mounted harness tie-down bracket is available for some transmission models. Refer to the [\*Connector and Harness Attachment Information Installation Drawings\*](#):

- [AS66-431](#) for 3000 Product Family models
- [AS67-431](#) for 4000 Product Family models

Source information for this bracket is included in [\*Support Equipment\*](#).

At least two bolts must be used when attaching a bracket to the transmission rear cover.

### **6.2.5 SPEED SENSOR CLAMP BOLTS**

The bolts that retain the input speed sensor, turbine speed sensor, and output speed sensor to the transmission must not be used for any other purpose. These bolts not only hold the sensors in the transmission housings, they also:

- Maintain the proper clearance between the sensors and the internal transmission components
- Establish the proper angular orientation for each sensor

Do **not** remove and reinstall these bolts to attach p-clamps, brackets or any other item.

### **6.2.6 PTO COVER BOLTS**

Do not attach brackets or auxiliary equipment to the transmission using the bolts that retain the PTO cover to the transmission. The bracket or equipment would have to be removed if a PTO unit were installed, typically by a body builder or end-user. The PTO cover gasket is susceptible to leaks if the torque on the bolts is unequal or if damaged when the bolts are removed and replaced. When installing a PTO unit on the transmission, use the bolts and replacement gasket provided in the kit from the PTO supplier.

## **7.0 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 section, refer to [\*Technical Document \(TD\) 176. Service Requirements – Removal and Replacement Times for Allison Transmissions\*](#).



## LIST OF REFERENCED DOCUMENTS

- [Transmission Mount – Overhung](#)
- [Mounting Using Transmission Side Pads](#)
- [Mounting the Transmission Remote from Engine](#) (4000 Product Family only)
- [Customer Specification Sheet \(CSS\)](#)
- [3700 Model Installation Manual](#)
- [Transmission Data](#)
- [1000/2000 and 2900 Product Family Engine-Transmission Adaptation Design](#)
- [Driveline Design](#)
- [Support Equipment](#)

### **Installation Drawings for the 1000/2000 Product Family**

- [Basic Installation Drawings](#) for the 1000/2000 Product Family: [AS64-401](#), [AS64-403](#)
- [AS64-422, General Adaptation Installation Drawing for SAE No. 2 Housing](#)
- [AS64-423, General Adaptation Installation Drawing for SAE No. 3 Housing](#)
- [AS64-430, Rear Support](#)
- [AS64-450, Park Brake Options](#)

### **Installation Drawings for the 2900 Product Family**

- [Basic Installation Drawings](#) for the 2900 Product Family: [AS64-902](#), [AS64-903](#)
- [AS64-422, General Adaptation Installation Drawing for SAE No. 2 Housing](#)
- [AS64-423, General Adaptation Installation Drawing for SAE No. 3 Housing](#)
- [AS64-930, Rear Support](#)
- [AS64-950, Park Brake Options](#)

### **Installation Drawings for the 3000 Product Family**

- [Basic Installation Drawings](#): [AS66-401](#) through [AS66-404](#), [AS66-411](#) through [AS66-414](#)
- [AS66-420, General Adaptation Installation Drawing](#)
- [AS66-430, Rear Support](#)
- [AS66-431, Harness Attachment](#)
- [AS66-450, Park Brake Requirements](#)
- [AS66-485, PTO Provision Installation Drawing](#)

### **Installation Drawings for the 4000 Product Family**

- [Basic Installation Drawings](#): [AS67-401](#) through [AS67-404](#), [AS67-407](#) through [AS67-414](#)
- [AS67-420, General Adaptation Installation Drawing](#)
- [AS67-425, Remote Input Provision](#)
- [AS67-430, Rear Support](#)
- [AS67-431, Harness Attachment](#)

### **Technical Documents (TDs)**

- [TD-176, Service Requirements – Removal and Replacement Times for Allison Transmissions](#)

### **Engineering Memorandums (EMs)**

- [EM-76: Calculating Allowable Bolt Joint Loads for Brackets](#)

## REVISION HISTORY

### **April 11, 2022**

- Added 2900 Product Family.

### **November 7, 2016**

- Updated the document to reflect the new consolidated 3000 and 4000 Installation Drawings; AS66-416, AS66-417, AS66-418, AS67-416, AS67-417, AS67-418.

### **February 6, 2014**

- In 6.2, added the following:
  - NOTE clarifying that bolts used to assemble the transmission must not be used for attaching brackets or auxiliary equipment to the transmission unless indicated in this document or on an Installation Drawing.
  - Information about the cast features that must be taken into account when attaching brackets to the transmission housings.
  - Requirement to evaluate bolt loads when heavy items are attached to transmission bolts.
- Added 6.2.6, PTO Cover Bolts

### **August 27, 2008**

- Added paragraph 6.2.5, Speed Sensor Clamp Bolts

### **July 17, 2008**

- Prepared document for Extranet Publication.

### **June 19, 2008**

- Created new module, *Transmission Mounting – General*.