



SURFACE VEHICLE RECOMMENDED PRACTICE



J193 OCT2012

Issued 1970-08
Stabilized 2012-10

Superseding J193 JUN1996

Ball Stud and Socket Assembly - Test Procedures

RATIONALE

The committee cannot find users for the technical report.

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE Materials, Processes and Parts Council and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2012 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
http://www.sae.org

SAE WEB ADDRESS:

**SAE values your input. To provide feedback
on this Technical Report, please visit
http://www.sae.org/technical/standards/J193_201210**

1. **Scope**—The test procedures describe a method to laboratory test suspension and steering system ball stud and/or socket assemblies for functional characteristics. This procedure is an extension of SAE J491b recommended practice on dimensional recommendations for ball studs towards a vehicle application. The tests are conducted either on ball studs individually or on complete integral assemblies representing the application.
 - 1.1 **Objective**—To provide a uniform method of testing ball studs and ball stud and socket assemblies to ensure that the parts will meet functional requirements of the application.
2. **References**
 - 2.1 **Applicable Publications**—The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.
 - 2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.
 - SAE J491—Steering Ball Studs and Socket Assemblies
 - SAE Paper #660102—Simulation of Field Loading in Fatigue Testing
3. **Test Procedures**—The test procedures for suspension and steering components with few exceptions can be similar because all ball stud and socket assemblies are subject to axial, lateral, and longitudinal forces, differing only in the direction and magnitude of loading depending on the application.

The test procedures cover the following characteristics:

5.1 Ball Stud

5.1.1 Ball Stud Impact Strength

5.1.2 Ball Stud Yield

5.1.3 Ball Stud Tensile Load

5.2 Ball Stud and Socket

- 5.2.1 Ball Stud to Socket Rotating and Oscillating Torque
- 5.2.2 Ball Stud to Socket Axial End Movement
- 5.2.3 Ball Stud to Socket Cam-Out Strength
- 5.2.4 Ball Stud and Socket Assembly Fatigue and Heat Test
- 5.2.5 Ball Stud and Socket Pull-Out and Push-Out Strength
- 5.2.6 Ball Stud and Socket Angularity

- 4. Loading and Cycle Life**—The loading used in the test procedures should be as representative as possible in magnitude and direction with loads encountered in the design application. Recommended cycle life is provided where applicable with each procedure.

To determine preliminary loading magnitude and direction, a layout design model of the complete suspension and steering system, possibly computerized, should be utilized. A paper analysis can be made solving for the component loading by assuming maximum "G" forces at the wheel/ground contact.

Using a vehicle with a similar suspension and/or steering system design, a program loading procedure can be utilized to obtain a more realistic loading assessment. With this procedure, key load carrying components are strain gaged to measure the load magnitudes, direction, frequency of load application and phasing (timing of load application). The vehicle is driven over a circuit of road input events that simulate expected usage. From this data, histograms of loading magnitude versus cumulative load application cycles can be obtained that will establish the laboratory ultimate strength peak loads as well as a group of fatigue and wear test loads and associated cycles for a specific vehicle life.

Representative program loading procedures are described in many SAE reports (SAE Report #660102).

5. Objectives and Test Procedures

5.1 Ball Stud—Tests conducted on individual ball studs.

5.1.1 BALL STUD IMPACT STRENGTH

5.1.1.1 *Objective*—To determine the impact strength of the ball stud.

5.1.1.2 *Procedure*—The test is applicable to either suspension or steering system studs. Mount the stud in a rigid fixture as shown in Figure 1. Lock stud in fixture by torquing the retaining nut to design specifications.

Apply an impact load to exceed the expected impact load in the vehicle application.

Increase the impact load incrementally until a separation occurs to determine the load capability. Only one impact per stud is permissible.

The stud must not fail by brittle fracture. Bending deflection must be 10 degrees minimum.