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ANSI TSIC-1 RECOMMENDED PRACTICE Process Controls for Assembly of Wheels on Trailers 2008 Edition

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*Process Control for Assembly of Wheels on Trailers
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**Recommended Practice - Process Controls for Assembly of
Wheel on Trailers with Application for Manufacturers and Dealerships
Origin and Development of TSIC-1**

This ANSI TSIC-1 Recommended Practice was developed by the Trailer Safety Industry Coalition (TSIC) to address the proper assembly of trailer wheels. This document provides information on the recommended design and assembly of trailer wheel components and control processes intended to improve trailer reliability and enhance consumer safety. TSIC, an ad hoc coalition consisting of trailer industry members, ceased activities and disbanded upon completion of this Recommended Practice. RVIA will serve as the ANSI secretariat for the revision and publication of future editions.

It has long been considered a prudent standard practice to check trailer wheels and wheel lugs for tightness at specified intervals during the first several hundred miles of a trailer's life following its manufacture.

In the past, trailer manufacturers provided instructions to owners and users asking them to conduct these recommended checks of wheels and wheel lugs. In recent years, however, several incidents were reported in which wheels became detached from trailers. This prompted industry and government safety officials to seek information about this situation and to develop a remedial solution.

To more fully understand the dynamics of this issue, throughout 2005 representatives of trailer manufacturers, component part manufacturers such as wheel, hub, axle and tire suppliers, government officials and other interested parties conducted discussions, testing and engineering analysis to obtain reliable firsthand knowledge. Drawing on the resulting data, it was recognized that those individuals responsible for fastening wheels to hubs during the trailer manufacturing process needed more guidance than had readily been available in the past. With this in mind, the first edition of the "Process Controls for the Assembly of Wheels on Trailers" document was published in 2007 as a recommended practice.

Statement on Development Procedures and Disclaimer

This Recommended Practice was developed under the published procedures of the American National Standards Institute, Inc. utilizing the canvass method for developing evidence of a consensus. While these procedures assure the highest degree of care, based on information presently known by the participants in this canvass, neither the Recreation Vehicle Industry Association and its members, nor those participating in its activities or the development of this Recommended Practice accepts any liability resulting from compliance or non-compliance with the provisions herein, or from any restrictions imposed on materials or processes, or from any incompleteness of the text.

All questions or requests for information on obtaining formal interpretations, proposing amendments and appeals on matter relating to the contents of this document should be directed to Bruce A. Hopkins, RVIA,

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The design, manufacture, assembly, and maintenance of running gear, wheels, and fastener hardware needs to be performed under controlled conditions and as part of a system of quality control practices.

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This Recommended Practice has been developed as a voluntary guideline to clarify and assist in the proper assembly of components for steel and aluminum wheels to light-and medium-duty trailers. This Recommended Practice does not purport to state that any particular type of component or product should be used in any specific application or that any other particular practice, procedure, or methods will not achieve as good or better results, depending upon the particular circumstances involved, or will not be reasonably satisfactory for the type of operations the trailer manufacturer performs, the type and volume of trailers it produces, and other circumstances peculiar to its overall manufacturing and assembly processes. The user of this Recommend Practice, whether manufacturer, dealer, distributor, or assembler of these products, has the responsibility to select the proper components for the application intended, perform appropriate process controls, and exercise sound management oversight within its respective operations. This system works best when there is constant communication and flow of information between and among component manufacturers, their distributors, trailer manufacturers, transporters, dealers and end users.

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Chapter 1 Introduction

1-1 The proper assembly of wheels on trailers is of critical importance to consumer safety. The improper attachment of a wheel to an axle may lead to the loss of the wheel in service. This loss can lead to highway safety risks from flying debris or the loss of control of the trailer and/or towing vehicle. The careful design of the wheel assembly process and systematic control of that process will improve trailer reliability and enhance consumer safety.

1-2 Scope. The purpose of this Recommended Practice is to identify and define significant factors required for assembly process control.

Chapter 2 Use

2-1 This Recommended Practice is appropriately used as:

2-1.1 A guide for planning and implementing assembly process control in a trailer manufacturing or dealership environment;

2-1.2 An audit tool for confirming implementation of a suitable practice of assembly within a trailer manufacturing plant or within a dealership that has responsibility for service or assembly of wheel-ends; and

2-1.3 An instructional aid for management and supervisors responsible for trailer wheel attachment.

NOTE: "Initial Wheel Assembly Practice," a pictorial wall chart, is available from NATM as an instructional aid for wheel assembly operators and is available in English and Spanish.

Chapter 3 Definitions

3-1 General. The definitions contained in this chapter shall apply to the terms used in this Recommended Practice. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. Merriam-Webster's Collegiate Dictionary, 11th edition, shall be the source for the ordinary accepting meaning.

3-2 Definitions

3-2.1 Load Rating. The number of pounds (or kilograms) that an individual wheel is designed to carry.

3-2.2 Ornamental Center Cap. Any piece of metal, plastic or assembly of metal and plastic that covers the hub hole and exposed axle end.

3-2.3 Trailer Designation. A series of numbers, letters or names used to indicate or identify a specific trailer.

3-2.4 Shall. Indicates a mandatory requirement.

3-2.5 Should. A recommendation or that which is advised but not required.

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3-2.6 Wheel Finish. The coating that has been applied to a wheel, such as paint, chrome-plating or galvanization.

3-2.7 Wheel Type. The material of which the wheel is made (e.g., steel or aluminum)

Chapter 4 Guidelines

4-1 Management responsibility. It is desirable that top management in the organization ensure:

4-1.1. The assembly process is competently planned, using technical input from component suppliers, the trailer manufacturer and/or internal resources.

4-1.2 Suitable training is provided to everyone performing or supervising wheel attachment or inspection.

4-1.3 Effective actions are taken to investigate and correct identified nonconformance to the assembly process control procedures or criteria for assembled products or components in the assembly adopted by the trailer manufacturer or dealership.

4-1.4 Necessary time and resources are devoted to the proper assembly and confirmation of torque within the manufacturing process and the supply chain leading to the purchase of the trailer.

4-1.5 The provisions of this Recommended Practice are understood and applied appropriately within the organization.

4-1.6 Appropriate, documented review of the organization's conformance to this Recommended Practice is undertaken at least annually.

4-2 Documentation and Records

4-2.1 Written materials used to control the assembly process should be:

4-2.1.1 Reviewed and approved prior to use; revisions to approved documents should be reviewed and approved prior to implementation.

4-2.1.2 Prevented from the unintended use of obsolete or unapproved documents through the application of suitable methods.

4-2.2 Records created in applying this Recommended Practice should be:

4-2.2.1 Maintained in such a manner that they may be retrieved and read during the planned retention period;

4-2.2.2 Retained a minimum of two years or as directed by the company's retention policy. Retained records should include:

4-2.2.2.1 Torque confirmation checks

4-2.2.2.2 Instrument/tool calibration records

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4-2.2.2.3 Audit or review records

4-2.2.2.4 Corrective action reports

4-2.2.2.5 Employee training records

4-2.2.3 Disposed of at the end of the pre-determined record retention period.

4-3 Planning

4-3.1 The assembly of the wheel-end components should be a planned and documented process.

4-3.2 Assembly plans should be provided to assembly operators and assembly supervision personnel.

4-3.3 Assembly plans should be dated and include:

4-3.3.1 A listing of the components within the assembly, including the trailer designation, the axle/hub, the stud type and length; the wheel type, load rating and finish; the ornamental center cap type and finish; and the lug nut type and finish; as applicable.

4-3.3.2 The torque range to be achieved at intermediate (if any) and final stages of production;

4-3.3.3 The tools used to apply and/or measure the torque value;

4-3.3.4 Any lubricant type and the specific areas where it shall be applied; and

4-3.3.5 The effective date and revision of the plan.

NOTE: Appendix A to this Recommended Practice provides an example of a suitable assembly plan format.

4-4 Training

4-4.1 Operators responsible for the assembly of wheel-end components should be internally qualified by the demonstration of an appropriate combination of education, experience, skill and/or training.

4-4.1.1 Qualification should be confirmed by demonstrated competence in the assembly task, including observation of the use of specified methods and verification of the achievement of the specified torque range.

4-4.1.2 Qualification criteria and individual operator achievement should be documented.

4-4.2 Training should be provided to assembly operators. Training should include:

4-4.2.1 A review of the assembly plan; and

4-4.2.2 A review of the proper wheel assembly (see Section 4-5.); and

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4-4.2.3 Observation of the proper wheel assembly as performed by a qualified individual; and

4-4.2.4 Successful performance by the trainee, under the supervision of a qualified person, of the wheel assembly process.

4-4.3 Training effectiveness should be evaluated by an audit of the trainee's work. Audits should include:

4-4.3.1 Verification of the torque achieved. All lugs tightened shall be within the specified torque range.

4-4.3.2 Observation of the adherence of the operator's practice of assembly to the requirements of proper wheel assembly (see Section 4-5). Practice should conform in each case.

4-4.3.3 Observation of practice and verification of torque should include a minimum of 6 trailers' wheels.

Each lug nut torque shall be verified on each of the wheels of these trailers. The trailers may be consecutively assembled.

4-4.4 Operators who are effectively trained and pass the audit should be considered qualified.

4-4.5 Trainers should be qualified and possess a minimum of one year of experience with the assembly job function.

4-4.6 A record of the operator's training and qualification should be maintained, noting as a minimum:

4-4.6.1 Operator's name.

4-4.6.2 Trainer's name.

4-4.6.3 Date(s) of training.

4-4.6.4 Date(s) of audit.

4-5 Assembly Process

4-5.1 Completion of the assembly process may be accomplished in one assembly step or two assembly steps as shown in Figure 1.

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Figure 1. The two methods typically used in manufacturing and wheel assembly.

4-5.2 Assembly steps should be carried out as follows:

4-5.2.1 Remove contaminants, excessive rust, paint runs or drips, and other debris from parts to be assembled;

4-5.2.2 Install ornamental center caps, if provided, into the wheel in such a manner that the ornamental center cap does not interfere with the flush fit of the wheel against the hub;

4-5.2.3 Apply stud lubrication, if specified, in the areas directed;

4-5.2.4 Place the wheel/tire assembly on the axle in such a way that flush contact is made between the wheel and the hub surface;

4-5.2.5 Start lug nuts on the stud by hand, assuring that cross-threading does not take place;

4-5.2.6 Drive lug nuts down to the specified torque in a criss-cross pattern (see Figure 2.), gradually increasing the torque on each lug as the pattern is repeated around the bolt circle; and

4-5.2.7 Verify lug nut torque at the conclusion of the tightening process, using a calibrated torque wrench or equivalent on each lug nut.

NOTE: Impact wrenches may be used only with torque-limiting devices such as "torque-sticks." The torque

range for the limiter should fall within the specified torque range.

NOTE: Torque may be applied by the same tool that measures the torque value, for example, a "click-type" torque wrench.

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Figure 2. These examples of criss-cross patterns shown or equivalent should be followed during the tightening sequence.

4-5.3 The confirmation step should be carried out as follows:

4-5.3.1 Confirmation of torque should occur on all wheels and lugs on at least one trailer per shift or every ten trailers processed, whichever is greater;

4-5.3.2 Confirmation of torque should be carried out by a qualified individual independent of the assembly process (i.e. not by the same person who performed the assembly);

4-5.3.3 Each confirmation shall be performed using a display-type torque gage. Both analog (dial type) and digital gages are acceptable. Gages must read to the nearest 1 (one) unit of pounds-feet or newtonmeters;

4-5.3.4 Gages must equate to the units of measure specified on the assembly plan; and

4-5.3.5 Confirmation inspections should be documented and traceable to the trailer design and trailer identification number.

4-6 Nonconformance Actions

4-6.1 Remedial and corrective action should be taken on identified nonconformances, with those actions documented. The existing statement should be kept regarding "as-received" and "as-corrected" conditions without this documentation there would be insufficient records to show was needed or taken.

4-6.2 Corrective action should consider units not inspected under a sampling scheme, if applicable.

4-6.3 Corrective action should address the process cause of the nonconformance as well as the product affected.

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4-7 Measurement and Calibration

4-7.1 Gages that determine or measure torque should be uniquely serialized or numbered to provide traceability for calibration.

4-7.2 Gages should be inspected, calibrated and, as necessary, adjusted periodically by a qualified laboratory or other qualified facility.

4-7.3 The calibration interval should be determined by the user of the gage based on its frequency of use, but should occur at least annually.

4-7.4 Gages should be maintained in good condition and stored appropriately. Damaged gages should be removed from service for evaluation and either repaired and recalibrated or replaced.

4-8 Transporter Responsibilities

4-8.1 Transporters provide a delivery service for the manufacturer that may put assembled trailers on the roadways.

4-8.2 Manufacturers shall specify requirements for periodic confirmation of torque, along with other expectations, in writing to the transporter. This specification shall include:

4-8.2.1 The torque range to be maintained.

4-8.2.2 The method of measurement to be employed.

4-8.2.3 The frequency of, or mileage for torque checks.

4-8.2.4 The procedure for adjusting the torque should it be found outside the specified range.

4-8.2.5 The records to be made.

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APPENDIX A

Assembly Plan Example Format

NOTES:

1. The vehicle type, model or option level of the trailer applicable to this assembly plan is indicated in this block.
2. The axle type and specification is indicated in this block.
3. The type, grade and finish of studs may be indicated in this block, if these vary with the same axle type.
4. The wheel brand, material, finish, size, offset and bolt designation along with the tire designation and brand are indicated in this block.
5. The ornamental center cap to be used in the assembly is specified in this block.
6. The type, size and finish of lug nuts to be employed in the assembly are indicated in this block.
7. The range of acceptable finish torque is indicated in this block.

COMPANY XYZ PLAN

Trailer: (1)

Axle/Hub: (2) Studs: (3) Wheel/Tire: (4)

Ornamental Center Cap:

(5)

Lug nuts: (6) Torque Range: (7)

Tools: (8) Lubricant: (9)

Location: (10)

Effective date: (11) Revision: (12)

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8. The type of tool used to provide and measure torque is indicated in this block. The nut dimension, as well as any adaptive equipment (such as torque limiting equipment on impact wrenches) should be indicated.

9. If lubricant, anti-seize or other chemical compound is specified for the assembly, it is indicated in this block.

10. The location of any lubricant or added chemical on the assembly (e.g. on the stud threads only) is indicated in this block.

11. The effective date indicates the date the assembly plan was initially used in manufacturing.

12. The revision refers to the assembly plan change level.