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INTRODUCTION

Hendrickson presents this publication to aid in understanding the Hendrickson Trailer Axle product offering and application requirements. Hendrickson Trailer Axles are engineered to meet the demanding requirements of the industry and incorporate the latest design and manufacturing technologies. These products are built specifically to provide a durable trailer axle to the market.

GENERAL INFORMATION

The descriptions and specifications contained in this publication are current at the time of printing.

Hendrickson reserves the right to discontinue or modify its models and/or procedures and to change specifications at any time without notice.

Any reference to brand names in this publication are made as an example of the types of tools and materials recommended for use and should not be considered an endorsement. Equivalents may be used.

IMPORTANT NOTICE

Hazard signal words (such as Warning or Caution) appear in various locations throughout this publication. Information accented by one of these signal words must be observed at all times.

Additional notes are utilized to emphasize areas of procedural importance and provide suggestions for ease of repair. The following definitions indicate the use of these signal words as they appear throughout the publication.

⚠️ WARNING: INDICATES HAZARDS OR UNSAFE PRACTICES WHICH COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.

⚠️ CAUTION: Indicates hazards or unsafe practices which could result in damage to equipment or minor personal injury.

NOTE: Additional service information not covered in the service procedures.

Welding or machining on any axle component is prohibited unless noted otherwise in this document or other Hendrickson service literature.

Fixed (mechanical) axle stops are prohibited to contact the axle and limit travel.

Swing arm mechanisms are approved in some loading and unloading applications. Contact Hendrickson for assistance.

AXLE IDENTIFICATION

Standard Hendrickson trailer axles are available in various spindle and tube combinations and are designed for on-highway use. Axles can be ordered fully dressed with hubs and brake drums or with air disc brakes. Other miscellaneous components such as slack adjusters, air chambers, cam tubes, etc. can also be specified.
PURPOSE

The purpose of this document is to provide original equipment manufacturers (OEMs) of medium and heavy-duty vehicles with application guidelines for Hendrickson trailer axles. The user of this document can use charts found in this book to determine the Gross Axle Weight Rating, (GAWR) of his/her Hendrickson trailer axle in North America.

USE OF GUIDELINES

These guidelines apply to: on-, on-off and off-highway (AA) turnpike or interstate, (A) on-highway, (B) on- / off- highway or mountainous highway, (C) off-highway vocational categories and axle applications for vehicles operated in North America.

VOCATIONAL CATEGORIES:

Airport fueler, city delivery, construction, crane, fire truck, heavy haul, intra-city coach, line haul, logging, military, mining, motorhome, oil field, refuse, rescue / crash, school bus, shuttle bus, snow removal, transit bus and utility.

AXLE APPLICATIONS: Trailer axles used in trailer types such as the following in figure 1:

AXLE APPLICATIONS: Trailer axles used as AUXILIARY LIFT AXLES in vehicles:

VEHICLE TYPES include: dump trucks, bottom dump, bulk hauler, bus / coach, car carrier, end dump, mixer, RV with trailer, semi-end dump, straight truck, tanker, tractor with trailer, transfer-dump, truck with trailer and wrecker.

Figure 1: Trailer axles used in trailer types
These guidelines do not apply to the use of Hendrickson trailer axles outside of North America in vocational categories, axle applications (Trailer Types or Vehicle Types) other than those specified in this book or ratings other than those listed in this book. Approval for such uses may be requested on an individual basis by submitting an approval request to Hendrickson. To submit such request, please fill out the Hendrickson Trailer Axle Ordering Guide (L954). This form can be found online at www.hendrickson-intl.com.

WARRANTY

Hendrickson trailer axle warranties are set out in the Comprehensive Warranty Statement for USA and Canada (L583). Warranty statements can be obtained via the Hendrickson website at www.hendrickson-intl.com. Applications and installations must either meet the requirements of these guidelines for automatic approval or be approved in writing by Hendrickson’s engineering department. Failure to obtain application approval for the use of Hendrickson trailer axles or their components in non-approved applications will void the warranty. Modification of the vehicle or axle and brake configuration, changes in the vocational use or service outside the limits of these guidelines may void warranty coverage.

QUESTIONS

For answers to questions concerning the guidelines or to request a Hendrickson trailer axle Spec Form for a use not covered by these guidelines, contact:

Hendrickson Trailer Commercial Vehicle Systems
2070 Industrial Place S.E.
Canton, OH 44707-2641
Telephone: 866-743-3247 (866-RIDE-AIR)
Website: www.hendrickson-intl.com

CHANGES TO GUIDELINES

These guidelines are subject to change at any time without prior notice at the discretion of Hendrickson. To get the most up-to-date version of these guidelines visit www.hendrickson-intl.com.

LITERATURE TO REFERENCE

<table>
<thead>
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<th>Lit. #</th>
<th>Description</th>
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<tr>
<td>L964</td>
<td>TRLAXLE® Ordering Guide</td>
</tr>
<tr>
<td>L846</td>
<td>Wide Base Tire Configuration</td>
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<td>L961</td>
<td>TRLAXLE Flyer</td>
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<tr>
<td>L1200</td>
<td>RTR® Ready-to-Roll® Flyer</td>
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<td>L977</td>
<td>Identification Guide – Trailer Suspension Systems</td>
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<td>Comprehensive Warranty Statement</td>
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<td>L1239</td>
<td>MAXX22T™ Flyer</td>
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<tr>
<td>L1225</td>
<td>Air Disc Brake Application Guide</td>
</tr>
<tr>
<td>L809</td>
<td>Brake Certifications</td>
</tr>
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</table>
VALUE-ADDED OPTIONS

Hendrickson Trailer Commercial Vehicle Systems works closely with fleets and trailer manufacturers to create products that offer versatility in application, added reliability and reduced costs. These value added options are enhanced features that are designed to reduce life cycle costs.

WHEEL-END OFFERINGS

Hendrickson Trailer Commercial Vehicle Systems offers a variety of wheel-ends to fit your needs.

— HXL7® Hendrickson Extended-Life 7-year System™ uses semi-fluid grease and comes with a seven-year limited warranty*

— HXL5® Hendrickson Extended-Life 5-year System™ uses semi-fluid grease and comes with a five-year limited warranty*

— HXL3® Hendrickson Extended-Life 3-year System™ uses an oil bath method and comes with a three-year limited warranty*

— Hendrickson also offers a ConMet PreSet hub

TIREMAAX® TIRE INFLATION SYSTEMS

Hendrickson offers two TIREMAAX® tire inflation systems to suit your tire inflation needs.

TIREMAAX PRO – Constantly monitors and adjusts tire pressure

TIREMAAX CP – Constant pressure controlled by regulator

TIRE INFLATION PREP

Hendrickson trailer axles can be prepped for use with tire inflation systems. Axle spindles come without plugs installed and axles are pre-drilled to accept the hardware and fittings of various systems offered. Please check with your Customer Service Representative for available system preps.

CAM TUBES

Cam tubes cover the brake camshaft from the brake spider to the cam support bracket and are filled with grease. Cam tubes often extend the life of seals and bushings used on trailer axle brake spiders and cam brackets as well as reduce vibration in the axle. Cam tubes are particularly popular in the Northern United States and Canada where they are used to help keep road salts and other chemicals from contaminating the bushings and seals.

HXS® HENDRICKSON EXTENDED SERVICE™ BRAKES

HXS® Hendrickson Extended Service™ brakes extend intervals between brake service.

ANTI-LOCK BRAKE SYSTEMS (ABS)


BRAKE COATING

E-coat – All Hendrickson brake shoes utilize a high quality, e-coat process for improved resistance to rust-jacking

AAXTREME COAT® – Premium brake shoe coatings available and provide extreme corrosion protection in the toughest environments

* Contact your local Hendrickson representative for complete warranty terms, conditions and limitations.
GROSS AXLE WEIGHT RATING AND AXLE BEAM RATING

GROSS AXLE WEIGHT RATING

This section will help vehicle manufacturers determine the load carrying capacity of a Hendrickson trailer axle with easy-to-use reference charts, as well as explaining how the axle weight rating is determined. The gross axle weight rating (GAWR) is the load carrying capacity of an axle and is determined by the lowest rated component in the assembly.

If you are unsure how to use the charts in this section, or your axle is not included in the charts, contact Hendrickson. An axle rating provided by Hendrickson will only cover the axle beam and brake system, as these are the components that Hendrickson manufactures. Any components not manufactured by Hendrickson such as wheel ends, tires, vehicle, etc. should have ratings provided by the component or vehicle manufacturer.

AXLE BEAM CAPACITY

Axle Beam Capacity is a guideline for determining the amount of vertical load an axle can carry based simply on the axle wall thickness and the suspension category in which it's used. (Refer to table A on page 8)

AXLE BEAM RATING

Axle Beam Rating provides a vertical load rating for the axle, specific to the application in which it is used by accounting for additional factors such as track width, spindle type, suspension mounting centers, air spring centers and axle overhang. The AXLE BEAM RATING will never exceed the AXLE BEAM CAPACITY.

DIMENSIONAL REQUIREMENTS FOR AXLE BEAM RATING

SUSPENSION TYPE AND SUSPENSION MOUNTING CENTERS

It is important to understand the difference between mechanical spring centers or air suspension beam centers and vehicle frame centers. The mechanical spring centers distance is the distance from the centerline of the mechanical spring to the centerline of the other mechanical spring (figure 2).

Figure 2
## AXLE BEAM CAPACITIES

<table>
<thead>
<tr>
<th>SPINDLE TYPE</th>
<th>HN</th>
<th>HP</th>
</tr>
</thead>
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<tr>
<td>SPINDLE GRAPHIC</td>
<td><img src="image1.png" alt="HN Graphic" /></td>
<td><img src="image2.png" alt="HP Graphic" /></td>
</tr>
<tr>
<td>RECOMMENDED AXLE USE</td>
<td>On / Off Highway</td>
<td>On / Off Highway</td>
</tr>
<tr>
<td>APPLICATION</td>
<td>Dry Van, Reefers, Vocational (Flats, Dumps, Autohaulers, Tanks, Lowboys)</td>
<td>Dry Van, Reefers, Vocational (Flats, Dumps, Autohaulers, Tanks, Lowboys), super singles w/offset wheels</td>
</tr>
<tr>
<td>SUSPENSION</td>
<td>Mechanical Spring</td>
<td>Air Ride</td>
</tr>
<tr>
<td>AXLE DIAMETER</td>
<td>5&quot; round</td>
<td>5&quot; round</td>
</tr>
<tr>
<td>1/2&quot; NOM. WALL</td>
<td>Up to 22,500</td>
<td>Not allowed</td>
</tr>
<tr>
<td>5/8&quot; NOM. WALL</td>
<td>Up to 25,000</td>
<td>Up to 22,500</td>
</tr>
<tr>
<td>5/8&quot; HD WALL</td>
<td>Up to 25,400</td>
<td>Up to 23,000</td>
</tr>
<tr>
<td>3/4&quot; WALL</td>
<td>Up to 27,000</td>
<td>Up to 25,000</td>
</tr>
<tr>
<td>SOLID BAR</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Table A*
In air suspensions applications the “air suspension beam centers” are defined as distance from the centerline of the axle connection to the other centerline of the axle connection (as shown in figure 3).

Vehicle frame centers relate to the frame or chassis of the vehicle and not to the mechanical spring centers or air ride beam centers. It is important to provide the correct dimension when requesting a rating for a Hendrickson trailer axle.

**WALL THICKNESS**

Standard trailer axle product offerings are available with nominal wall thicknesses of $\frac{1}{2}$, $\frac{5}{8}$ and true/full wall thicknesses of $\frac{5}{8}$ and $\frac{3}{4}$ inches.

**NOTE:** The $\frac{1}{2}$ inch nominal wall thickness trailer axle is approved for mechanical spring suspensions only.

**AXLE TRACK**

For dual wheels with HP spindles, track is measured from center to center of the dual wheel set-up. For axles using single tires, track is measured from the center of the tire or wheel to the center of the other tire or wheel. (figure 5)
AXLE BEAM RATING — SINGLE OFFSET TIRES

The use of offset tires can affect the axle beam rating. For applications where dual wheels are utilized or an application that uses a zero offset single tire, the axle rating will not be affected. However, the use of an outset or inset single tire does change the way in which the axle is loaded and therefore affects how the axle will be rated.

Inset single tires move the point at which the axle is loaded inboard towards the center of the vehicle. Using this type of wheel will not affect the axle beam rating, but can reduce bearing life.

The use of a single outset tire configuration moves the load point out away from the center of the vehicle, which increases the bending load in the axle and also reduces bearing life.

To determine the rating for an axle that uses inset or outset wheels, contact Hendrickson engineering for assistance.

**NOTE:** HN spindles are not approved for use with 2-inch outset super-single wheels. Use HP spindles for applications where 2-inch outset super-singles are required.
AXLE BEAM RATING — STRAIGHT AXLES

The charts at the end of this section should be used to determine an axle beam rating for straight axles only, assuming a particular suspension mounting center dimension. The graph provides ratings for HN and HP model axles in all available wall thicknesses for use in mechanical spring or air suspensions.

In order to use the graph, the following is needed:

- Axle wall thickness
- Nominal axle rating
- Suspension mounting centers
- Air spring centers (air suspension only)
- Suspension pivot to axle center (air suspension only)
- Suspension pivot to air spring center (air suspension only)
- Axle overhang

With all of this information, the axle beam rating can easily be determined from the beam rating graph to follow.

NOMINAL BEAM RATINGS

For the purposes of calculating axle beam ratings for straight axles in both mechanical spring and air suspension applications, the nominal axle ratings are as follows:

<table>
<thead>
<tr>
<th>Nominal Axle Ratings</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>⅛&quot; Wall</td>
<td>22,500 lbs</td>
</tr>
<tr>
<td>⅜&quot; Wall</td>
<td>25,000 lbs</td>
</tr>
<tr>
<td>⅜&quot; Wall</td>
<td>27,000 lbs</td>
</tr>
</tbody>
</table>

Table B

MECHANICAL SPRING SUSPENSIONS

To calculate the axle beam rating on a mechanical spring suspension, use the following technique:

1. Determine the axle’s nominal rating from Table B.
2. Determine the suspension mounting centers. For a mechanical spring suspension, the suspension mounting centers are equal to the spring centers.
3. Determine the axle track.
4. Determine the axle overhang by subtracting the mounting centers from the axle track and dividing by two.
5. Refer to the “Hendrickson Trailer Axle Beam Ratings” graph to determine the percentage of nominal rating (page 14).
6. Multiply the axle nominal rating by the percent of nominal rating.

EXAMPLE 1
To find the axle beam rating for an application that uses a mechanical spring suspension with an axle that has a ½ inch wall thickness and a 71½-inch track length with suspension mounting centers of 34½ inches, the axle beam rating can be determined as follows:

1. Nominal rating ½ inch wall axle = 22,500 pounds
2. Suspension mounting centers = 34½ inches
3. Axle track = 71½ inches
4. Axle Overhang = ½ x (71½ - 34½) = 18½ inches
5. From graph, percent of nominal rating = 95 percent
6. Axle beam rating = 22,500 x (0.95) = 21,375 pounds

EXAMPLE 2
To find the axle beam ratings for an application that uses a mechanical spring suspension with an axle that has a 5/8 inch wall thickness and a 71½-inch track length with suspension mounting centers of 37 inches, the axle beam rating can be determined as follows:

1. Nominal rating 5/8 inch wall axle = 25,000 pounds
2. Suspension mounting centers = 37 inches
3. Axle track = 71½ inches
4. Axle Overhang = ½ x (71½ - 37) = 17¾ inches
5. From graph, percent of nominal rating = 95 percent
6. Axle beam rating = 25,000 x (0.95) = 23,750 pounds
AIR SUSPENSIONS

For air suspensions, axle ratings are based on the location of the suspension attachment relative to the axle spindles. The suspension location is defined as the effective suspension centers.

The effective suspension centers are determined using the front and rear suspension mounting locations to determine where the effective suspension center crosses the axle center (figure 7).

To calculate the axle beam rating on an air suspension, use the following technique: (Refer to figure 7)

1. Determine the Nominal Rating
2. Calculate dimension A
   \[ \frac{(\text{Front Mounting Centers} - \text{Rear Mounting Centers})}{2} = A \]
3. Calculate dimension D
   \[ \frac{B}{C} \times A = D \]
4. Calculate effective beam centers
   \[ \frac{(D \times 2) - \text{Effective Beam Centers}}{2} = \text{EFFECTIVE BEAM CENTERS} \]
5. Calculate the overhang
   \[ \frac{(\text{Track} - \text{Beam Centers})}{2} = \text{OVERHANG} \]
6. Refer to the "Hendrickson Trailer Axle Beam Ratings" graph to determine the percentage of nominal ratings (Refer to figure 8 on page 14)
7. Multiply the axle nominal rating by the percent of nominal rating

NOTE: The use of trailer axles with a \( \frac{1}{2} \) inch nominal wall thickness in air suspensions requires approval from Hendrickson application engineering.

NOTE: The graphs on the following page for axle beam ratings assume the axle uses standard dual offset wheels, or single wheels with no offset and are for on-highway applications only.

EXAMPLE 1

To find the axle beam ratings for an application that uses an air suspension with an axle that has a \( \frac{5}{8} \) inch wall thickness and a 71\( \frac{1}{2} \) inch track length with front mounting centers of 35 inches, rear mounting centers of 30 inches, \( B = 20 \) inches and \( C = 35 \) inches, the axle beam rating can be determined as follows:

1. Nominal rating \( \frac{5}{8} \) inch wall axle = 25,000 pounds.
2. Calculate dimension A
   \[ \left( \frac{35 - 30}{2} \right) = 2.5 \text{ inches} \]
3. Calculate dimension D = \( \frac{20}{35} \times 2.5 = 1.43 \) inches
4. Calculate effective beam centers = 35 - (1.43 \times 2) = 32.14 inches
5. Axle overhang = \( 71.5 - 32.14 \) \times \( \frac{1}{2} \) = 19.68 inches
6. Refer to the "Hendrickson Trailer Axle Beam Ratings" graph to determine the percentage of nominal rating (page 14)
7. Multiply the axle nominal rating by the percent of nominal rating
AIR SUSPENSION DIAGRAM

Figure 7
HENDRICKSON TRAILER AXLE BEAM RATINGS

FOR AXLES UTILIZING HN AND HP SPINDLES

Figure 8
S-CAMS AND BRAKES

SERVICE BRAKE REQUIREMENTS

Hendrickson offers a variety of sizes and models of brakes. Federal law requires all brakes / axles meet the performance standard set by FMVSS-121 regulations. FMVSS-121 is applicable to vehicles that travel more than 55 MPH and brakes that are rated less than 29,000 pounds.

Canadian law requires brakes to meet CMVSS-121. CMVSS-121 requires that all brakes meet a draw bar requirement. If a trailer brake assembly will be used in Canada, it must meet Canadian draw bar certification requirements.

The original equipment manufacturer (OEM) has the responsibility of ensuring that its trailers meet the certification requirements. For additional information regarding brake certifications contact Hendrickson engineering.

The following section is to be used to aid in the selection of the appropriate brake for the application. Each brake approval shown is based on gross axle weight rating (GAWR), static loaded radius (SLR), air chamber size, brake adjuster length (S-cam brake only) and the brake lining material.

BRAKE TYPE

Hendrickson trailer axles can be ordered with dual anchor pin (DAP) S-cam drum brakes or air disc brakes, including Hendrickson’s MAXX22™ optimized trailer air disc brakes. Each of these brakes can be configured to meet a variety of performance and packaging considerations (figure 9).
BRAKE SETUP CONFIGURATIONS

A typical trailer axle is set up so that the horizontal axis passing through the axle assembly will also pass through the centerline of the brake cam. In a typical setup (figure 10 and 11), the brake cams are set to the front or rear of the axle with the slack adjuster pointed up away from the road for “Cam Forward Orientation” (figure 11) or down towards the road for “Cam Rearward Orientation” (figure 10). Using these two orientations allows the cam to rotate (open) in the same direction of travel as the tires. Using an opposite orientation (i.e. cams to the rear with the slacks pointing up away from the road) causes the cam to open against the rotation of the tires. This condition is known as “cam opposite,” or “reverse cam rotation.” For more information on reverse cam rotation, refer to the “cam same vs. cam opposite” section of this guideline.

The use of different types of suspensions sometimes require that the brake cams, air chambers, etc. be located in a position off the horizontal centerline of the axle. For straight axles, the axle can be clocked to any position within 10 degrees of the horizontal centerline (figure 12). Drop center axles and axles with tire inflation systems require the customer to specify the orientation of the drop center portion of the axle as well as the orientation of the brake cam.
CAM SAME VS. CAM OPPOSITE

To ensure safe operation and maximum durability of parts such as brake linings and tires, it is necessary to position and install the axle with the proper cam rotation. It is required that the axle assembly be installed so that, in the forward direction of the vehicle, the cams rotate in the same direction as the wheels. When the brake is installed in this configuration it is known as “cam same.” When the wheel rotation is opposite of the cam rotation, the brake is considered “cam opposite.” Examples of “cam same” are shown below (figure 13).

Installation in which the camshaft rotation is opposite of wheel rotation can cause brake noise, chatter and wheel “hop.” To avoid these conditions Hendrickson recommends "cam same" installations to meet these requirements. However, some suspension systems do not have enough clearance to allow the axle to be mounted with “cam same.” Approval for “cam opposite” use is rarely granted, but may be requested on an individual basis by contacting Hendrickson engineering.

Failure to obtain application approval or the use of Hendrickson brakes or their components in non-approved applications will void Hendrickson’s warranty coverage.

EXAMPLES OF “CAM SAME”
The axle beam rating considers the structural strength of the axle and is essentially the load carrying capability of the axle. Specifically, it is how much weight the axle can carry (as shown below).

The brake rating is the maximum load the brake is capable of stopping, while meeting FMVSS-121 requirements. In short, it is the stopping power. Brake rating is dependent on brake size, lining type, brake power and tire static loaded radius (as shown below in figure 14).

The gross axle weight rating (GAWR) must be the value of the lowest rated component of the axle assembly. This includes all weight rated components of the axle such as the brake components, brake lining, tires, hubs and drums. It is common practice to have an axle with an axle beam rating at 23,000 pounds used in conjunction with a brake configuration with a brake rating at 20,000 pounds. In this case, the GAWR would be that of the lowest rated component or 20,000 pounds.
S-CAM DRUM BRAKE RATINGS

The performance of an S-cam drum brake is determined by the brake diameter, brake width, input torque, lining type and the static loaded radius of the tire. The nomenclature used to identify the size of the brake is to specify the diameter of the brake by the width of the brake. For example, a 16.5 x 7 brake refers to a 16.5-inch diameter brake that has a width of 7 inches as shown in the figure below. Brake certification is available from Hendrickson engineering.

For a complete list of brake rating certifications please reference Hendrickson literature number L809 – Brake Certifications.
BRAKE CHAMBER BRACKETS AND SLACK ADJUSTER CLEARANCE

Hendrickson has two styles of brake chamber brackets: standard and high rise (figure 16). Slack selection depends on the brake chamber bracket selected. On 12.25-inch brakes, for both standard or high rise brake chamber brackets, curved slacks must be specified to ensure adequate clearance between the slack body and axle tube.

12.25" Brake

High Rise Brake Chamber Bracket

Standard Brake Chamber Bracket

Call your trailer dealer or Hendrickson at 330.489.0045 or 866.RIDEAIR (743.3247) for additional information.