HDNABI™
NORTH AMERICA BRAKE INDUSTRY

Axle Application Guide

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AIR DISC BRAKE & AXLE

050120 AG-1021-Rev1

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Introduction

1. INTRODUCTION

HDNABI™ provides guides to help you understand HDNABI™ Trailer Axle products and requirements. These products are specially designed to provide a durable Trailer Axle to the market. This document provides information to properly mount the HDNABI™ Trailer Axle with Air Disc Brake (ADB) to the suspension.

1.1 GENERAL INFORMATION

The descriptions and specifications contained in this guide are current at the time of publication. HDNABI™ reserves the right to discontinue the process and change specifications at any time without notice. References to brand names in this guide are given as examples of the types of tools and materials recommended for use, and should not be regarded as warranties.

1.2 HAZARD SIGNALS

Hazard signals (such as **Warnings** or **Cautions**) appear in various places in this document and other HDNABI publications. Always pay attention to the information emphasized by these signals. Additional information not covered by the service procedure.

⚠ 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.

Welding or machining of Axle components is prohibited unless otherwise specified in this document or other HDNABI™ service documents.
Fixed(mechanical) axle stops are prohibited to contact the axle and limit travel.

1.3 AXLE IDENTIFICATION

HDNABI™ Trailer Axle is available in various spindle and thickness / length combinations and is designed for use on highways.

Axle can be ordered with Air Disc Brake or Chamber. Other components such as Hub & Disc Assy, Bearing, Hub Cap, and Spindle Nut can also be specified.

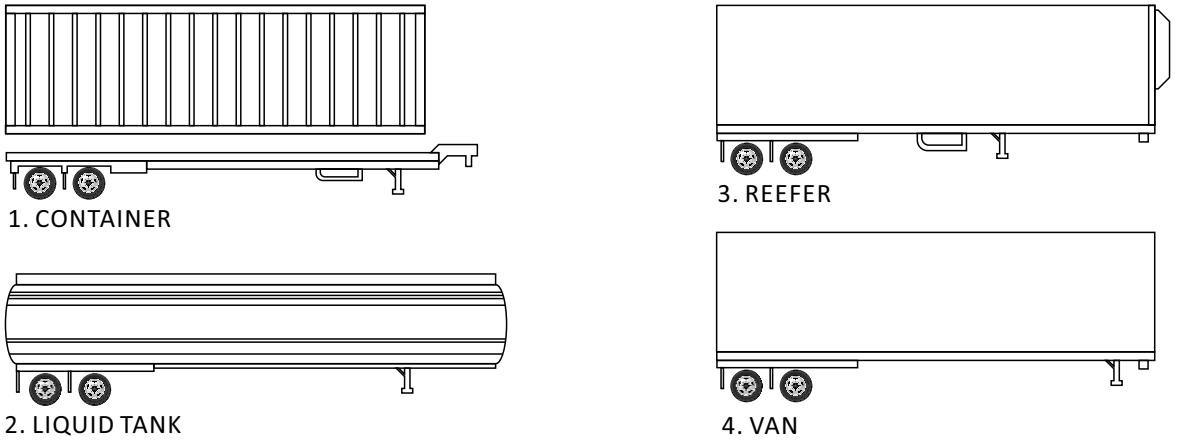


FIGURE 1. Trailer axles used in trailer types

Purpose

2. PURPOSE

The purpose of this document is to provide original equipment manufacturers (OEMs) with instructions for the HDNABI™ Trailer Axle. You can use the charts in this document to determine the "GROSS AXLE WEIGHT RATING (GAWR)" of the North American HDNABI™ Trailer Axle.

2.1 USE OF GUIDELINES

This guide applies to Axle operating on North American on-, on-off and off- highway turnpike or interstate, on-highway, on- / off- highway or mountainous highway, off-highway.

Axle Applications: See FIGURE 1.

This guideline does not apply to a class or does not apply to Trailer Axles outside of North America. Approval for these uses should be requested from HDNABI™.
More information can be found at www.hdnabi.com.

2.2 WARRANTY

The HDNABI™ Trailer Axle warranty is specified in HDNABI™ document number xxx.
The warranty can be obtained through the www.hdnabi.com website.
The guide is for North American on-, on-off and off-highway turnpike or interstate, on-highway, on- / off-highway or mountainous. Approval for these uses should be requested from HDNABI™.
More information can be found at www.hdnabi.com.
The warranty must be approved in writing by the HDNABI™ Engineering department.
If not approved, the warranty for the use of HDNABI™ Trailer Axle or its components will be void.

2.3 QUESTIONS

If you have any questions regarding the guide or request a Trailer Axle specification for an out-of-coverage specification, please contact:

North Americal Brake Industry
1865 Corporate Drive, Ste 230
Norcross, GA 30093
Toll free: 888.693.7073
Office: 470.375.8566 (ext. 701)
Email: info@hdnabi.com
Website: www.hdnabi.com

2.4 CHANGES TO GUIDELINES

This document is subject to change at any time without notice at HDNABI™'s discretion.
For the latest version of this document, please visit www.hdnabi.com.

Value - Added Option

3.VALUE-ADDED OPTIONS

HDNABI™ Trailer Commercial Vehicle Systems works closely with vehicle and trailer manufacturers to create products that offer a variety of uses, reliability and cost savings.
These options are designed and enhanced to reduce life cycle costs.

3.1 WHEEL-END OFFERINGS

HDNABI™ Trailer Systems offers a variety of wheel-ends to suit your needs.
- Hub Cap: STEMCO Sentinel™ & PSI Ready Hub Caps / Defender / SKF Zytel, etc…
- Hub Seal: SKF X-Treme / Discover, etc…
- Spindle Nut: Pro-Torq / Zip-Torq

Extended W/E Options 5yr. and 7yr.

3.2 TIRE INFLATION PREP

HDNABI™ provides Tire Inflation System to meet your needs.

P.S.I-Company: P.S.I
HDNABI™ Trailer Axle can provide axle with PSI tire inflation prep.
Axle Spindle comes pre-drilled (1 Hole), Therm-Alert™ axle plug and stator tubes and PSI ready hub caps installed. If you have any questions about the Tire Inflation System, please contact HDNABI™.
- Tap specification: 1 / 8-27 NPT

3.3 ANTI-LOCK BRAKE SYSTEMS (ABS)

Since January 1998, the U.S. government has made the new Semi-Trailer an Anti-Lock Brake System mandatory.
HDNABI™ offers Trailer Axle with Hub Pulse-Ring and ABS Bracket with optional ABS Sensor.

3.4 BRAKE COATING

Black Painting-Basic Specifications / 5-year warranty
ULTRATEK Coating-Premium Specification / 7 year warranty

Gross Axle Weight Rating (GAWR) and Axle Beam Rating

4.GROSS AXLE WEIGHT RATING (GAWR) AND AXLE BEAM RATING

4.1 GROSS AXLE WEIGHT RATING

The above section explains how vehicle manufacturers use the reference chart to determine the HDNABI™ Trailer Axle's Load Carrying Capacity and Axle Weight Rating.
Gross Axle Weight Rating (GAWR) is Axle's Load Carrying Capacity and is determined by the lowest rated component in assembly.

If you don't know how to use the charts in the section above, contact HDNABI™.
The chart provided by HDNABI™ only includes the Axle Beam and Brake systems.
Value-Added Options, such as Wheel-End and Tire, should check the data provided by the vehicle manufacturer.

4.2 AXLE BEAM CAPACITY

Axle Beam Capacity is the vertical load amount based on the Axle Beam thickness and suspension specifications. (See Table 1 on page 7.)

4.3 AXLE BEAM RATING

Axle Beam Rating provides the Vertical Load Rating according to the specification taking into account additional factors for Axle (ex. Track Width, Spindle Type, Suspension Mounting Centers, Air Spring Centers, Axle Overhang…).
Axle Beam Rating does not exceed Axle Beam Capacity.

4.4 DIMENSIONAL REQUIREMENTS FOR AXLE BEAM RATING

Under Suspension Type, it is important to understand the names and dimensions.
Refer to the figure 2 for dimensional information on Track, Spring Centers, and Overhang in Mechanical Spring Type. The section explains how vehicle manufacturers use the reference chart to determine the HDNABI™ Trailer Axle's Load Carrying Capacity and Axle Weight Rating. Gross Axle Weight Rating (GAWR) is Axle's Load Carrying Capacity and is determined by the lowest rated component in assembly.

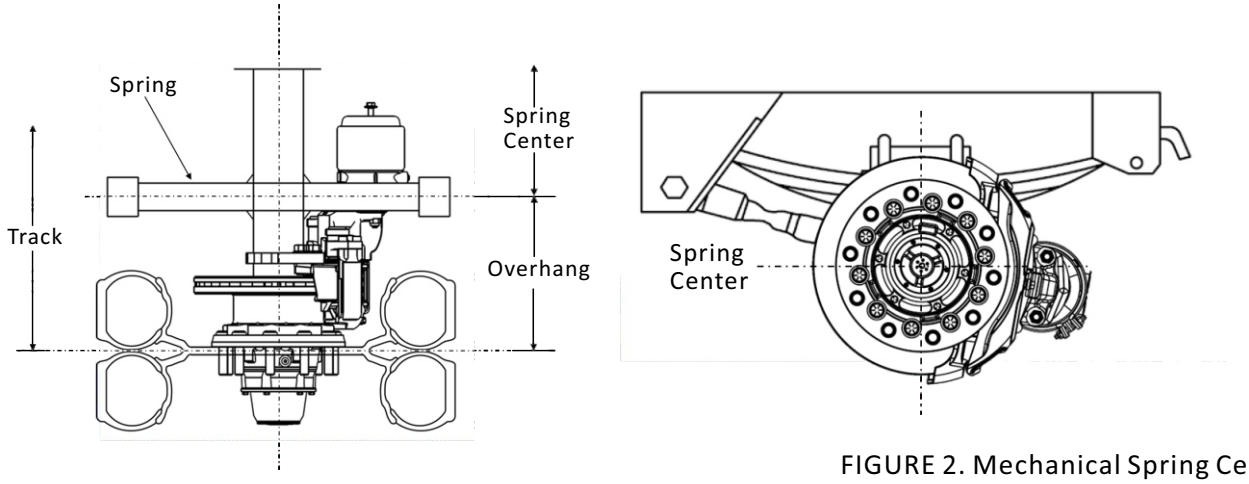


FIGURE 2. Mechanical Spring Centers

Gross Axle Weight Rating (GAWR) and Axle Beam Rating

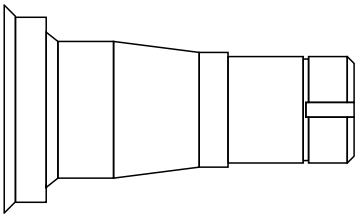
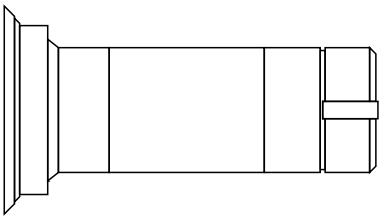
SPINDLE TYPE		TN		TP	
SPINDLE GRAPHIC					
RECOMMENDED AXLE USES		On / Off Highway		On / Off Highway	
SUSPENSION		Mechanical Spring	Air Ride	Mechanical Spring	Air Ride
AXLE DIAMETER		5” Round	5” Round	5” Round	5” Round
AXLE BEAM CAPACITIES IN POUNDS (unless otherwise noted)	**1/2” NOM.WALL**	Up to 22,500	Not allowed	Up to 22,500	Not allowed
	5/8” NOM.WALL	Up to 25,000	Up to 22,500	Up to 25,000	Up to 22,500
	5/8” HD WALL	Up to 25,400	Up to 23,000	Up to 25,400	Up to 23,000
	3/4” WALL	Up to 27,000	Up to 25,000	Up to 27,000	Up to 25,000
	SOLID BAR	N/A	N/A	N/A	N/A

Table 1

Gross Axle Weight Rating (GAWR) and Axle Beam Rating

4.5 WALL THICKNESS

- Nominal Wall Thickness: 1/2 ", 5/8"

- True / Full Wall Thickness: 5/8 ", 3/4"

NOTE: Nominal Wall Thickness 1/2 "Axle only applies to Mechanical Spring Suspension.

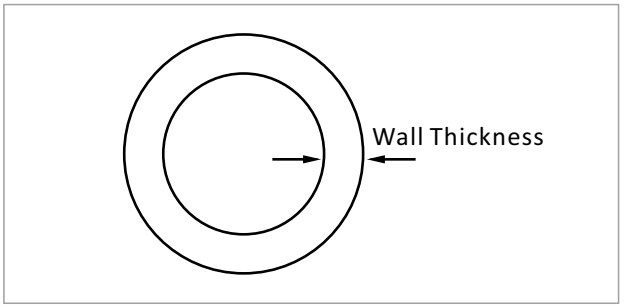


FIGURE 3. Axle Wall Thickness

4.6 AXLE TRACK

For Dual Tires, Track Length is the distance between the middle and the middle of the dual wheels. For single tires, Track Length is the distance between the middle and the middle of the tire. (See FIGURE 4.)

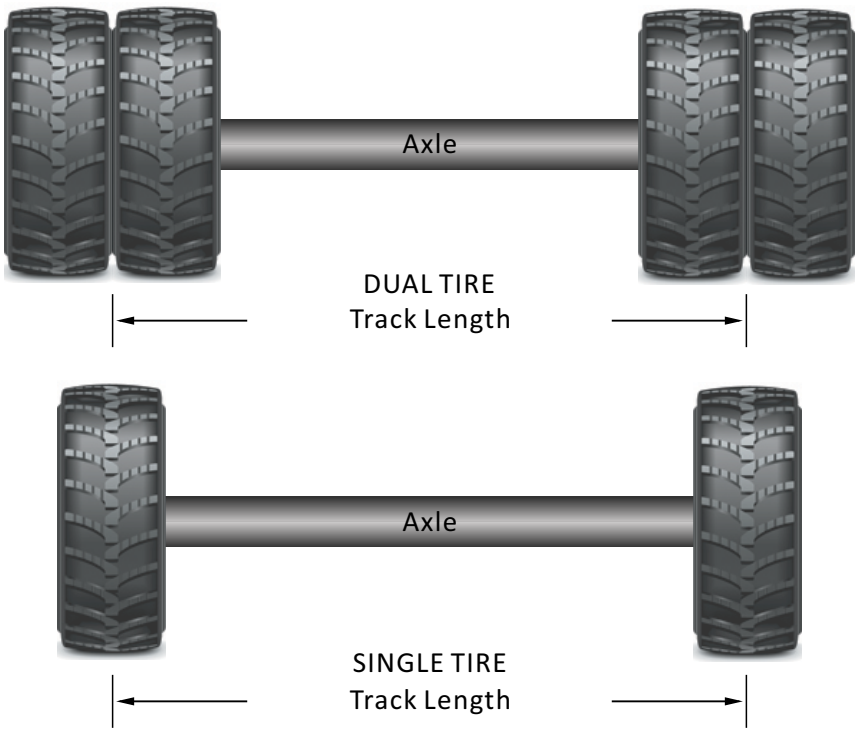


FIGURE 4. Axle Track

Axle Beam Rating - Single Offset Wheels

5. AXLE BEAM RATING – SINGLE OFFSET WHEELS

Using the Offset Wheel can affect the Axle Beam Rating.
Dual Tires or Zero Offset Single Wheel do not affect Axle Beam Rating.
However, Outset or Inset Single Tire affects Axle Beam Rating.

Inset Single Tire moves the point where the Axle is loaded from the center of the vehicle inward. Inset Type does not affect Axle Beam Rating, but it reduces bearing life.

Outset Single Tire moves the point where the Axle is loaded from the center of the vehicle to the outside. Outset type not only increases the bending load of the axle, but also reduces the bearing life.

If you have any questions before deciding on the Offset Wheel, please contact HDNABI™.

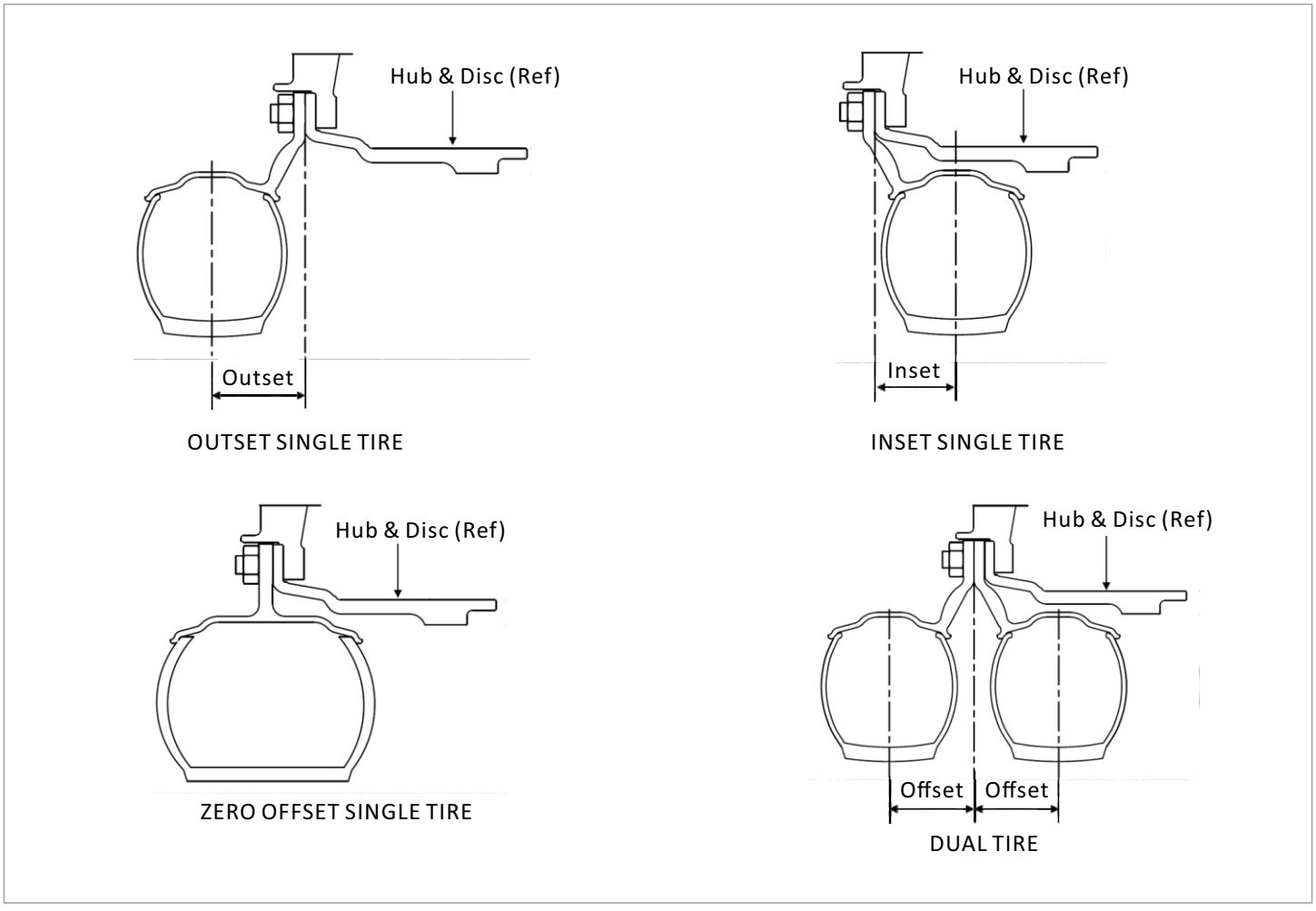


FIGURE 5. Wheel Offset

Axle Beam Rating - Straight Axle

6. AXLE BEAM RATING – STRAIGHT AXLES

In (FIGURE 6) chart on page 12, it is possible to determine the Axle Beam Rating by assuming the central dimension of the suspension mounting. This chart provides the Axle Beam Rating according to the Wall Thickness of the TN / TP Spindle Type Axle with Suspension.

You need the following values to read the chart.

- Axle Wall Thickness
- Nominal Axle Rating
- Suspension Mounting Centers
- Axle Overhang

With the above information, the Axle Beam Rating can be easily checked through the chart.

6.1 NOMINAL BEAM RATINGS

Refer to Table 2 for the Nominal Axle Rating for calculating the Axle Beam Rating of the Straight Axle to which Suspension is applied.

NOMINAL AXLE RATING	
1/2” Wall	22,500 lbs
5/8” Wall	25,000 lbs
5/8” HD Wall	24,400 lbs
3/4” Wall	27,000 lbs

Table 2

Mechanical Spring Suspension

7. MECHANICAL SPRING SUSPENSIONS

To calculate the Axle Beam Rating of Mechanical Spring Suspension, refer to the procedure below.

1. Determine Nominal Axle Rating in Table 2.
2. Determine the Suspension Mounting Center.
   In Mechanical Spring Suspension, Mounting Center is the same as Spring Center.
3. Decide on Axle Track.
4. Calculate Overhang. [Overhang = (Axle Track–Mounting Center) / 2]
5. Refer to the "HDNABI™ TRAILER AXEL BEAM RATINGS" FIGURE to determine the Percentage of Nominal Rating. (See FIGURE 6 on Page 12)
6. Multiply Axle Nominal Rating by Percentage of Nominal Rating.

EXAMPLE 1 : 15T(5/8") Axle Wall Thickness

1. Nominal Rating 5/8" Wall Axle = 25,000 lbs
2. Suspension Mounting Centers = 40"
3. Axle Track = 77.5"
4. Axle Overhang = (77.5"-40") / 2 = 18.75"
5. From Graph, Percent of Nominal Rating = 94%
6. Axle Beam Rating = 25,000 x 0.94 = 23,500 lbs

EXAMPLE 2 : 12T(1/2") Axle Wall Thickness

1. Nominal Rating 1/2" Wall Axle = 22,500 lbs
2. Suspension Mounting Centers = 35"
3. Axle Track = 71.5"
4. Axle Overhang = (71.5"-35") / 2 = 18.25"
5. From Graph, Percent of Nominal Rating = 96%
6. Axle Beam Rating = 22,500 x 0.96 = 21.600 lbs

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8. HDNABI™ TRAILER AXLE BEAM RATINGS

The data in this graph is applied to the TN / TP Spindle Type used by HDNABI™.

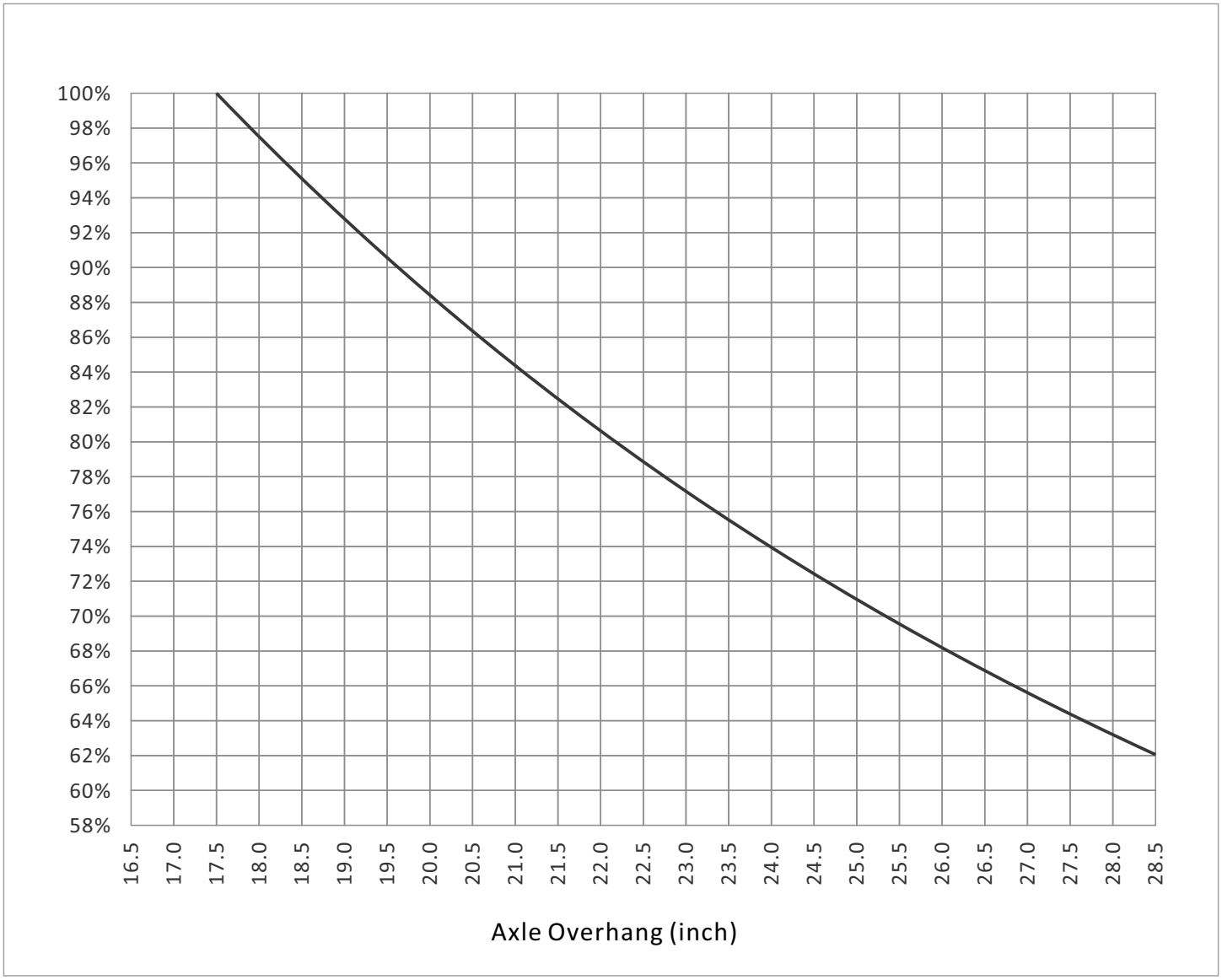


FIGURE 6. Percentage of Nominal Beam Rating

Axle Beam Welding

9. AXLE BEAM WELDING

9.1 Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in his publication. They provide information that can help prevent serious personal injury, damage to components, or both.

WARNING To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result. When raising the trailer/axle, place lifting devices and/or jack stands directly under the spring seat bracket or other area of the trailer frame. Do not place lifting devices or jack stands directly on the axle beam or damage to the axle may result.

9.2 Guidelines

The installation and service performance of all suspension system brackets welded to HDNABI™ axles are the responsibility of the system integrator.

9.3 Only Use Certified Welders

The American Welding Society's (AWS) Document D1.1 requires that you only use certified welders.

9.4 Methods

» Four methods can be used to weld hardware to trailer axles.
- Shielded Metal Arc (Stick electrodes)
- Gas Metal Arc (MIG-Solid Wird)
- Gas Tungsten Arc (TIG)
- Flux Cored Arc (Tubular Wire)

» Refer to the following table for the American Welding Society (AWS) classifications and specifications.

Method for Welding Carbon and Low Alloy Steels	AWS Electrode Classification	AWS Specification
Shielded Metal Arc	E70XX	A5.1 / A5.5
Gas Metal Arc	ER70S-X	A5.18
Gas Tungsten Arc	ER70S-X	A5.18
Flux Cored Arc	E70T-X	A5.20

» The AWS requires that weld tensile strength must be 70,000 psi(4826.33 bar). Weld tensile strengths that are either higher or lower than this rating are not acceptable.

» The best fusion and strength will be obtained using the voltage, current and shielding medium recommended by the electrode manufacturer.

» If the Shielded Metal Arc method is used, electrodes must be clean, dry and come from stock that has been stored according to AWS specifications

Axle Beam Welding

9.5 Axle Preparation

» The area to be welded must be free of paint, grease, dirt, slag and other contaminants that can affect weld quality.

» The axle tube and the hardware to be welded to the axle must be at a temperature of at least 60°F (15°C). Welds made with the axle components at the correct temperature will perform better, since there is less of a tendency to form an area of brittle material next to the weld.

» Never bring an axle into a factory or repair facility from the cold and immediately weld. Rather, the axle and brackets to be welded should be stored overnight in a correctly heated room.

» If temperature requirements are not met, pre-heat the weld area to a temperature of at least 200°F (93°C) using a "rosebud." Do not concentrate heat in one area. Rather, slowly heat a wide area around the joint to be welded. Verify the temperature with a temperature-sensitive crayon or other appropriate means.

9.6 Hardware Fit

» Refer to the axle and suspension manufacturer's installation documentation for weld zones and locations.

9.7 Welding Preparation

» Welding equipment should be grounded to the axle through a cable connection that is both clean and tight. The connection should be located at a point that will place a 300mm from the torque plate. It should not be located at a point that will place a wheel bearing between the ground connection and weld area. (Figure 7)

» A connection that places a wheel bearing between the ground cable connection and the weld area can damage the bearing by electric arcing as shown below. (Figure 8)

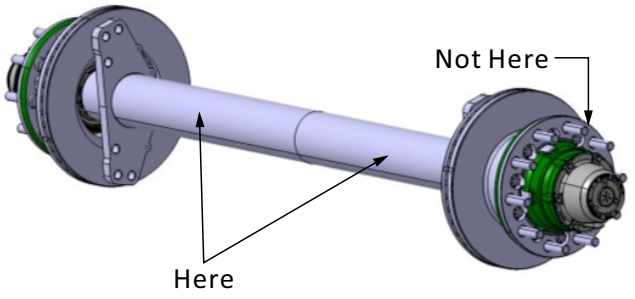


FIGURE 7

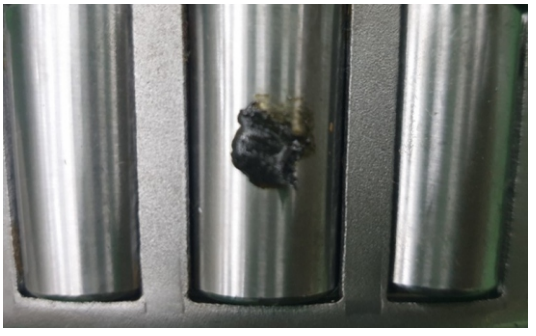


FIGURE 8

Axle Beam Welding

» Prior to applying final welds, hardware should be tack welded to the axle following recommendations provided by the component manufacturer. This will help minimize both axle distortion and residual stresses caused by final welds. After tack welding, clean up any weld slag, then fuse the tack welds into the final welds. (Figure 9)

» Do not locate tack welds at the ends of the bracket. Rather, they should be located toward the center of the brackets. (Figure 10)

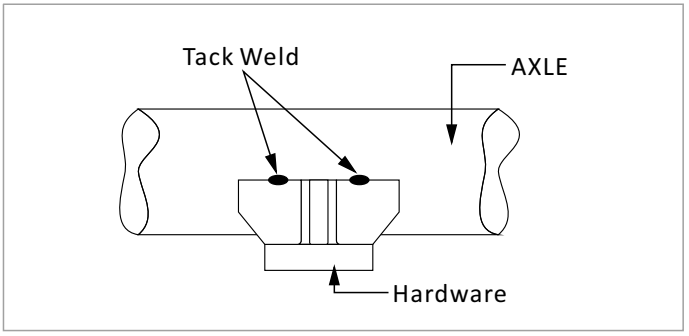


FIGURE 9

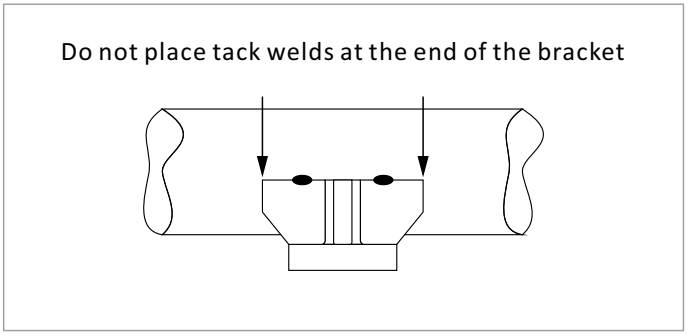


FIGURE10

9.8 Location

Axles are more likely to crack at a weld location, since welds lower the strength of the axle material adjacent to the weld and set up a stress riser at the weld site. You must confine welding to areas of relatively low stress near the center or neutral axis of the beam. (Figure 11)

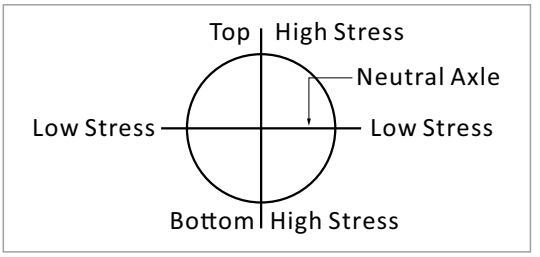


FIGURE 11

⚠ **WARNING** An incorrect weld location will void the axle warranty and can result in reduced fatigue life of the trailer axle beam. Serious personal injury and damage to components can result.

The following guidelines are for welding locations on round axles.

» Welding is not allowed on 5-inch (127 mm) diameter axles within 1.50-inches (38.1 mm) of the top-center of the axle. (Figure 12)

» Horizontal welding is not allowed on 5-inch (127 mm) diameter axles more than 1.50-inches (38.1 mm) below the axle horizontal centerline. (Figure 13)

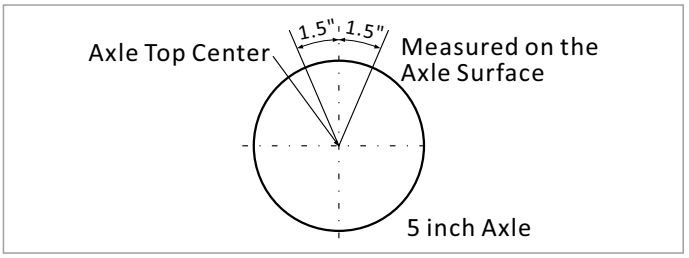


FIGURE 12

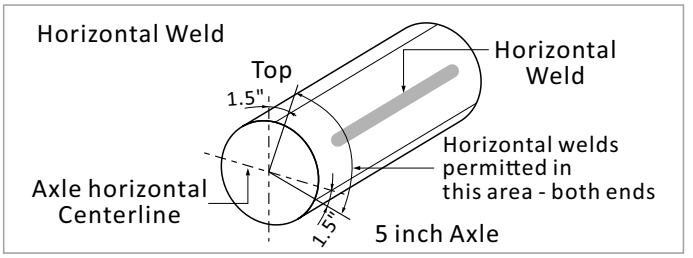


FIGURE 13

Axle Beam Welding

» Vertical welding is not allowed on 5-inch (127 mm) diameter axles more than one-inch (25.4 mm) below the axle horizontal centerline. (Figure 14)

» The round axle welding locations are in reference to their position when installed onto the vehicle.

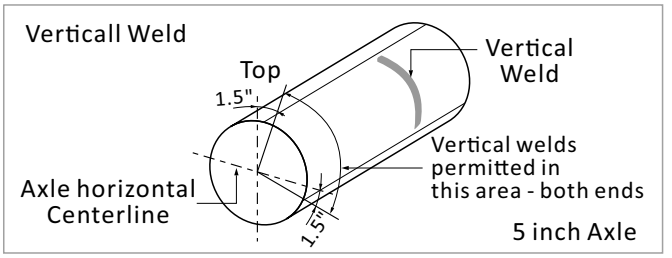


FIGURE 14

NOTE: Axles can be rotated up to 20 degrees. Do not install the brackets with the correct welds, then rotate them out of the correct positions.

The following procedures are for welding locations on rectangular axles.

» Welding is not allowed within one-inch (25.4 mm) of the top-center of the axle. (Figure 15)

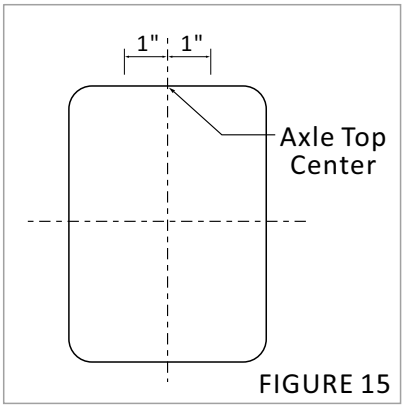


FIGURE 15

» Horizontal welding is not allowed more than 1.50-inches (38.1 mm) below the axle horizontal centerline. (Figure 16)

» Vertical welding is not allowed more than one-inch (25.4 mm) below the axle horizontal centerline. (Figure 17)

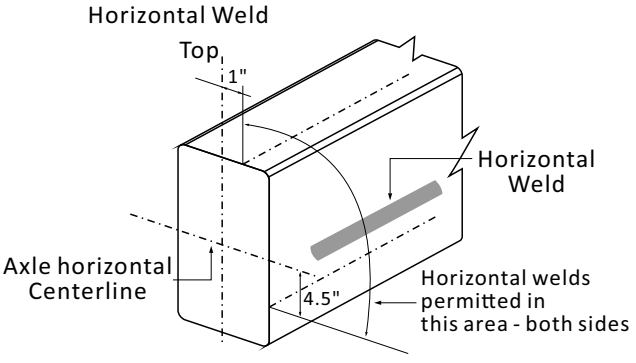


FIGURE 16

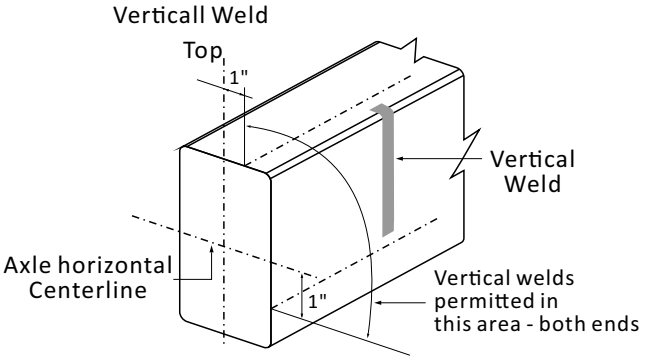


FIGURE 17

» Weld location requirements in this section apply to all welds. In some instances, axles have been found with bracket attachment welds in authorized locations, but with tack welds in unauthorized locations. Neither tack welds nor brackets attachment welds are allowed in unauthorized locations. This can cause a material change that can reduce axle fatigue life. (Figure 18)

» Do not test the weld arc on the axle beam in unauthorized locations. This can cause a material change that can reduce axle fatigue life.

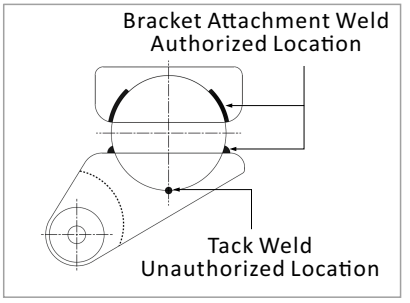


FIGURE 18

Axle Beam Welding

9.9 Welding Procedures

Observe the following when performing welding procedures.

» Axles are more likely to crack at the end of the bracket attachment welds. It is critical to avoid welding imperfections such as craters, undercuts and poor fusion at these locations. Some methods of avoiding these imperfections include using correct welding parameters, starting and stopping the arc a short distance away from the ends of the weld pass and maintaining correct arc position and length. (Figure 19)

» Some brackets are attached to trailer axles with multiple welds. For example, at each of the weld locations shown in (Figure 20), roadside front, curbside rear, etc., three weld passes are applied. Axle distortion can be minimized in this situation by sequencing the welds. This involves alternating weld passes from the front to the rear of an individual bracket and between the brackets located on the axle roadside and curbside. This is in contrast to applying all the welds at one bracket location prior to applying the welds at other locations.

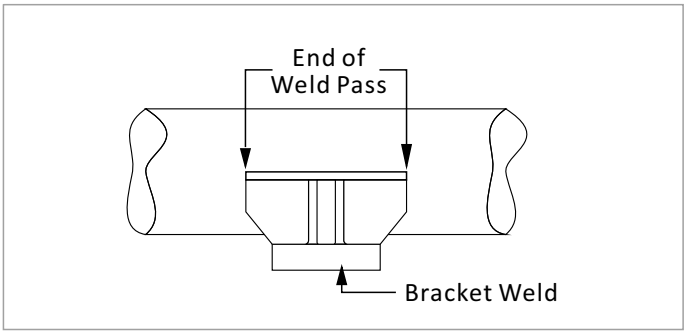


FIGURE 19

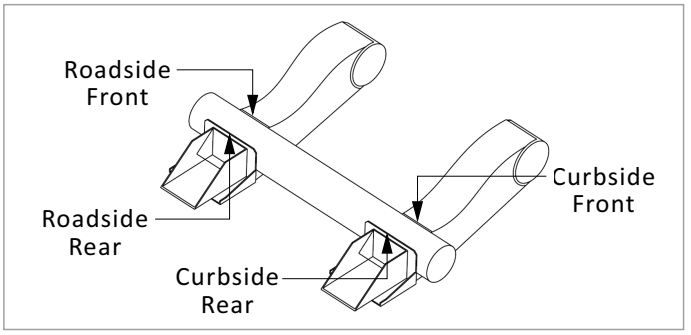


FIGURE 20

» When attaching a bracket, the first weld pass should be made on the front side of the bracket. This will result in any distortion causing the more desirable toe-in rather than the less desirable toe-out condition.

» It is good manufacturing practice to specify a welding procedure that prevents excessive distortion and to periodically check this procedure to ensure that it is understood and is being followed.

Brake Application

10. BRAKE APPLICATIONS

10.1 SERVICE BRAKE REQUIREMENTS

HDNABI™ offers brakes in a variety of sizes and models. Federal law requires that all brakes / axles meet the performance requirements set in FMVSS-121. FMVSS-121 applies to vehicles driving over 55 MPH and brakes under 29,000 pounds.

The original equipment manufacturer (OEM) is responsible for guaranteeing that the trailer meets the Certification Requirement. Please contact HDNABI™ Engineering for additional information on brake warranty.

10.2 BRAKE TYPE

HDNABI™ Trailer Axle has various specifications according to GAWR and Air Chamber Size, including specifications optimized for ADB XS5 22XLT™ and XS7 22XLT™.

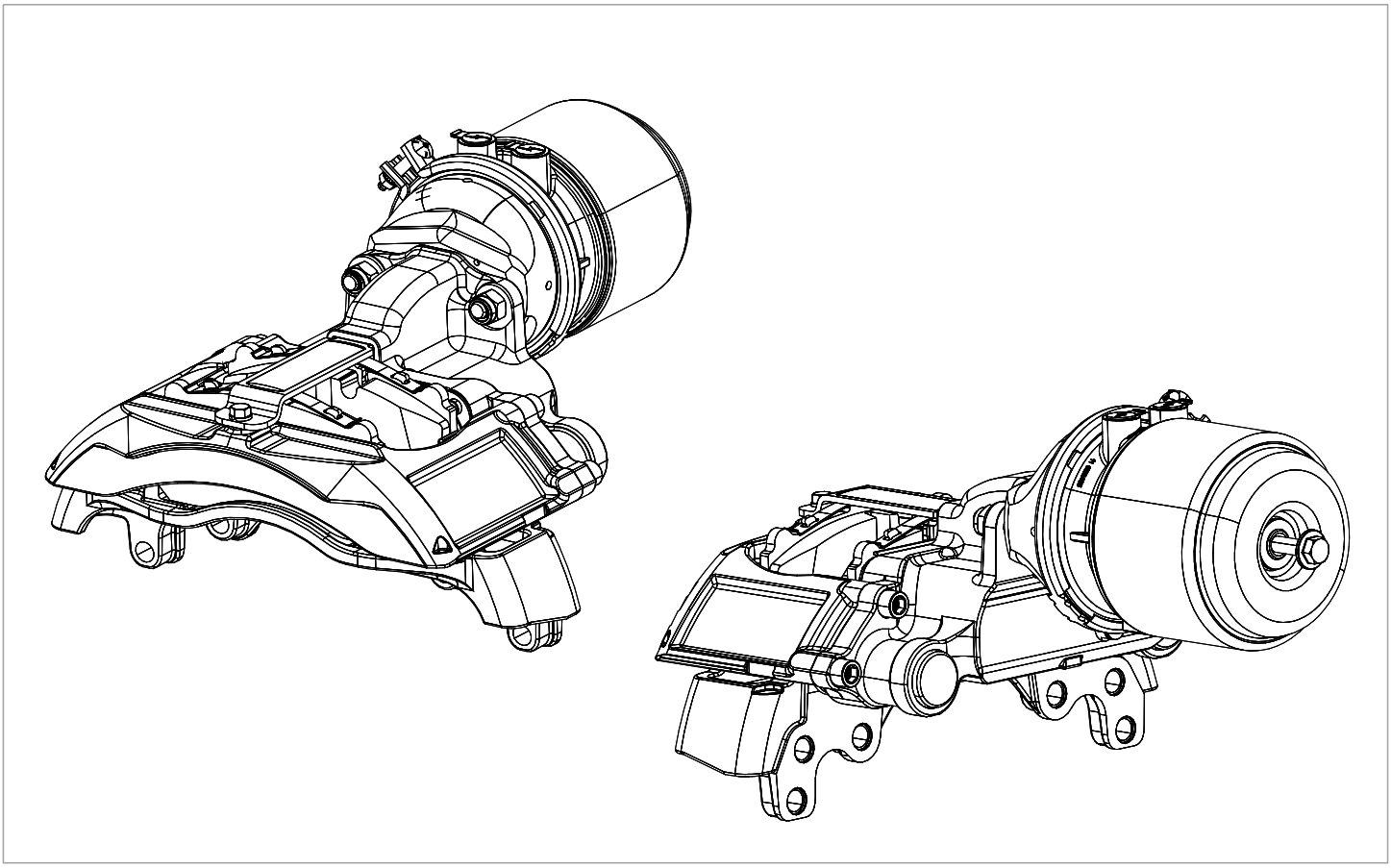


FIGURE 21 ADB/Air Disc Brake Assembly

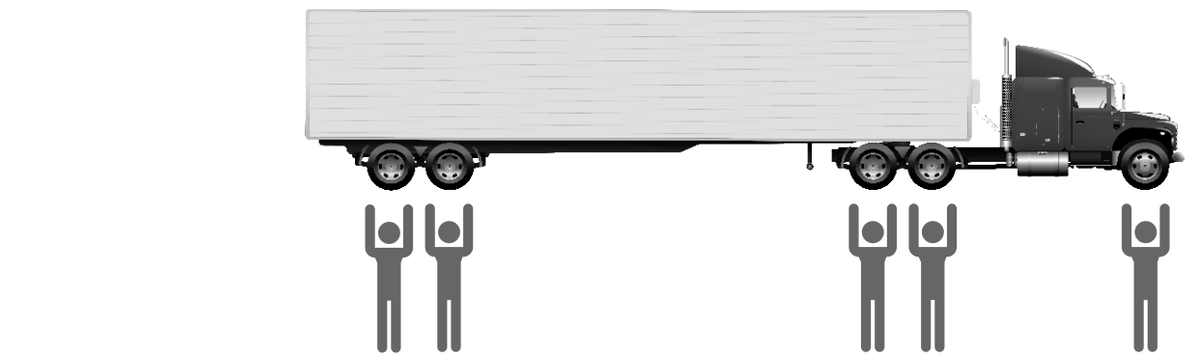
Axle Structural Rating vs. Brake Performance Rating

11.AXLE STRUCTURAL RATING VS. BRAKE PERFORMANCE RATING

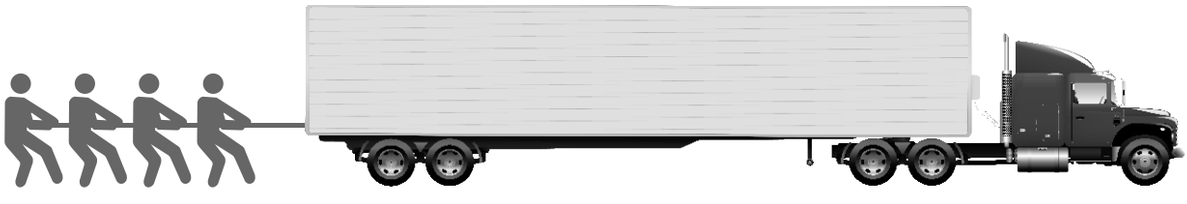
The Axle Beam Rating is called the structural strength of Axle, and is essentially Axle's Load Carrying capability. (see Figure 22) Specifically, it indicates how much weight the Axle can carry.

Brake Rating is the maximum load that the brake can brake within the range that satisfies the FMVSS-121 condition. Brake Rating varies depending on the brake size, brake power, and Tire Static Loaded Radius.

GAWR (Page 7) should be expressed as the lowest rated Axle Assembly component. This includes all weight classes such as brake components, tires, hubs and pads. It is common for Axle with a Beam Rating of 23,000 pounds and Brake Rating with a brake configuration of 20,000 Pounds.
In this case, GAWR is the lowest rated component value of 20,000 pounds.



AXLE BEAM RATING - Load Carrying



BRAKE RATING - Stopping Power

FIGURE 22 Axle Performance Ratings

ADB Mounting

12. ADB MOUNTING REQUIREMENTS

This information is to ensure:
- Proper gap between Suspension component, Trailer structure and ADB
- Right direction of ADB LH / RH

There are many things to consider for this.

12.1 CALIPER ROTATION

Most ADBs are designed by classifying LH / RH according to the direction of suspension and trailer. Based on the driver's seat, LH means the left or road side of the vehicle. RH stands for the right side of the vehicle or Curbside. Most ADBs are marked with an arrow indicating the "Direction of Rotation". This arrow indicates the direction of rotation of the disc as the vehicle moves forward. (See Figure 24)

ADB that does not distinguish the direction can be mounted on the Axle. These ADBs have the same length guide pins. If you can't tell the direction or need information, please contact HDNABI™.

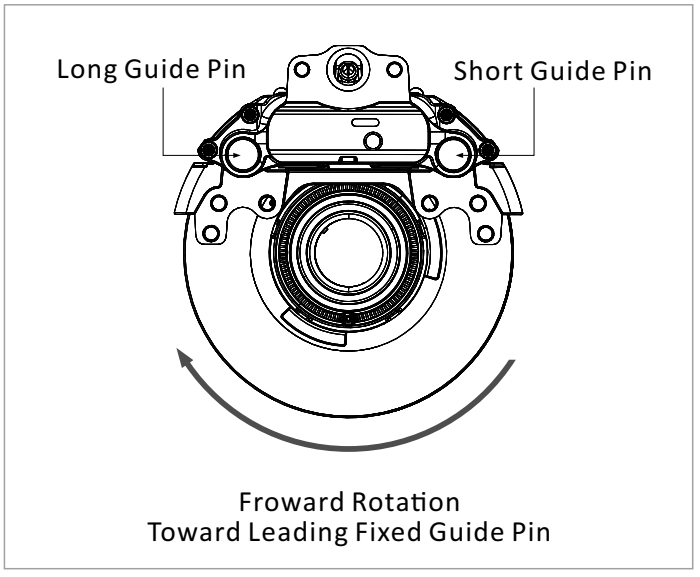


FIGURE 23 ADB LH & RH Orientation (LH shown)

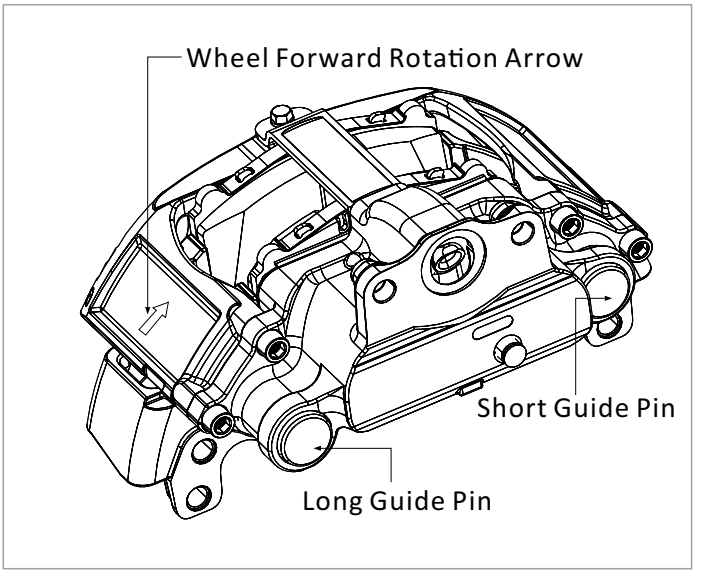


FIGURE 24 Disc Rotation when Vehicle is Moving Forward

ADB Mounting

12.2 CLEARANCE REQUIREMENTS

In order for the disc brakes to move properly, there must be adequate clearance between the brakes, suspension components and the trailer structure. The ADB and Chamber wear toward the Trailer Center when the brake PAD and DISC wear out during normal operation. (see Figure 25)

In order to always ensure the proper functioning of the brakes (from jounce to rebound), you need to keep a gap. In addition, you must have enough free space to use the ADB maintenance tool.

12.3 CALIPER AND BRAKE CHAMBER TRAVEL

As the PAD and DISC can be moved up to 28 mm when worn, the clearance must be kept taking into account the above (see Figure 25).

In order for the disc brakes to move properly, there must be adequate clearance between the brakes, suspension components and the trailer structure. Sufficient chamber hose length and routing should be provided so that there is no restriction on the movement of the ADB.

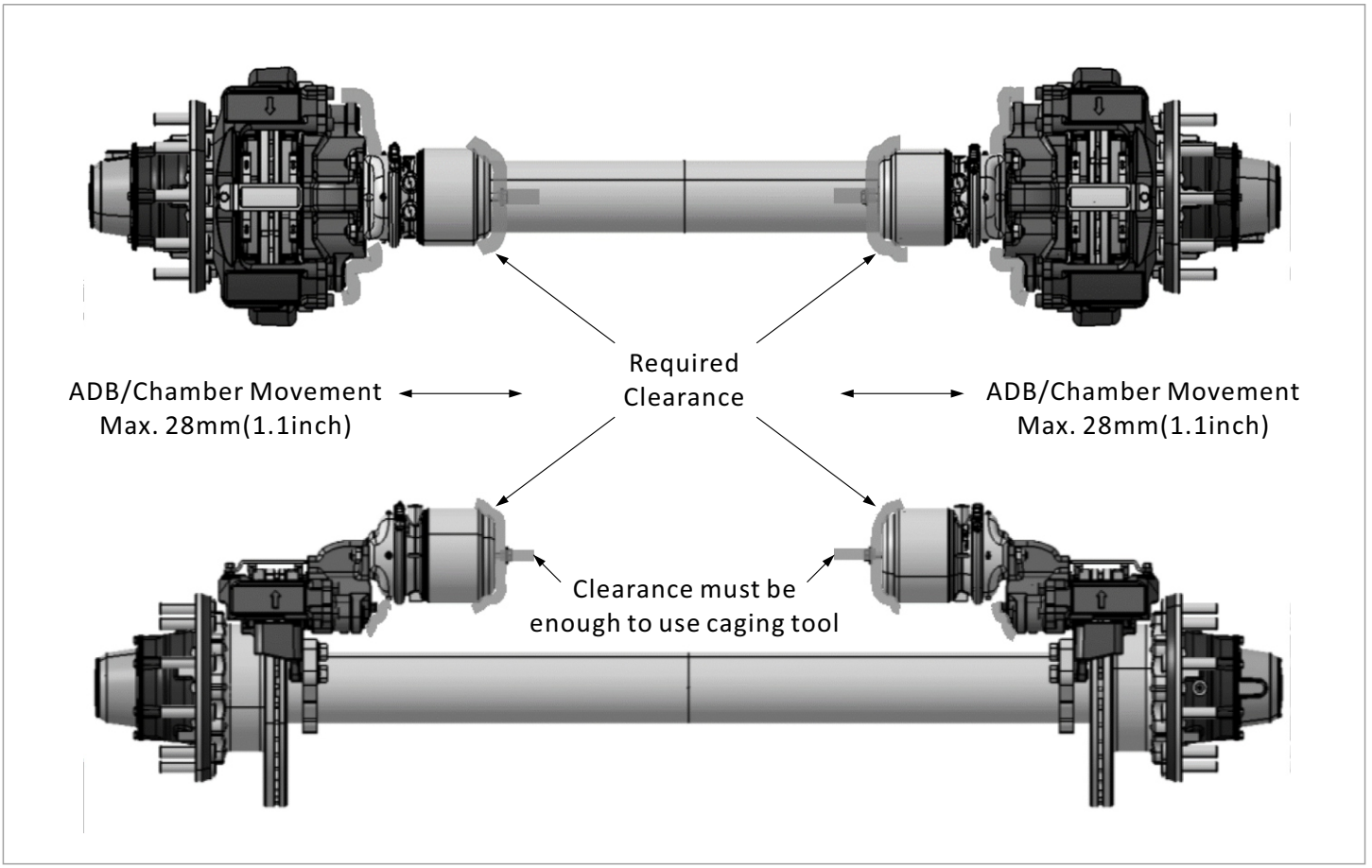
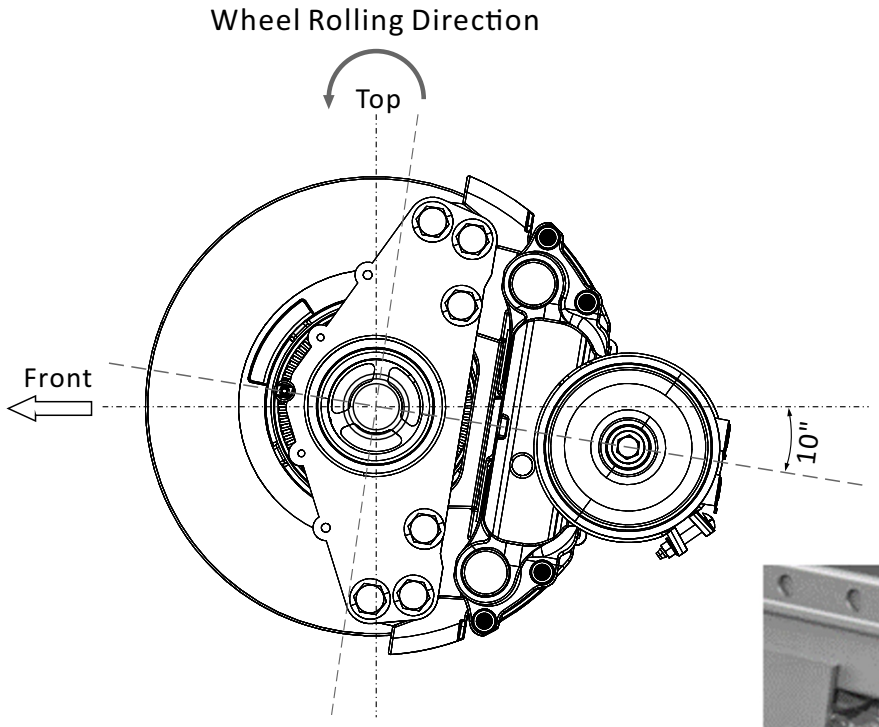


FIGURE 25. ADB caliper travel

ADB Mounting

12.4 CLOCKING ANGLE

When mounting the Axle Assembly to the suspension, the ADB mounting angle and clocking angle must be considered. In the case of mechanical suspension, the chamber should be located at the back of the axle (see Figure 26). Contact HDNABI™ for information on mounting the suspension.



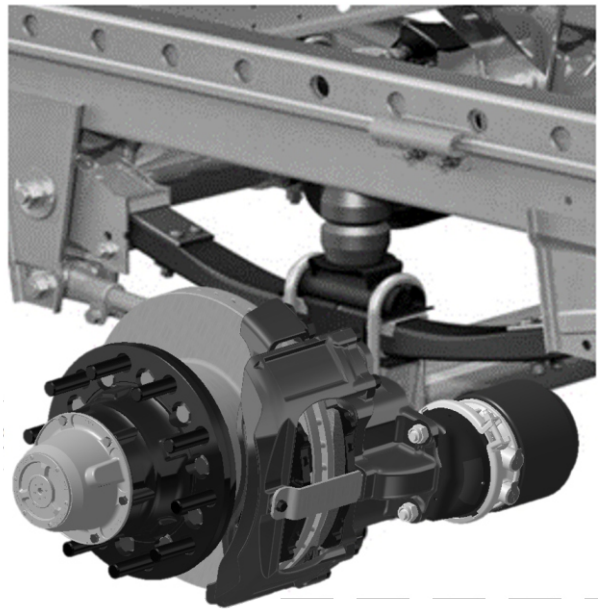


FIGURE 26. Mechanical suspension with air chamber to the rear of the axle