

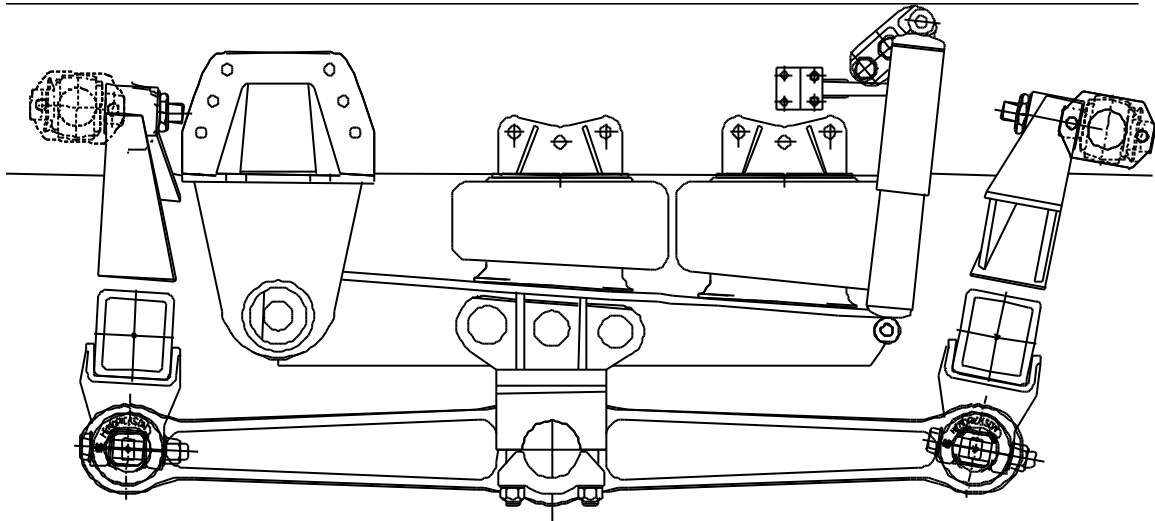
H TECHNICAL BULLETIN

AR2 SERIES TRUCK AIR SUSPENSION

No: TRUCK AUS-010
Subject: *Installation Guidelines*
Date: February 2002 **Revision:** B

NOTE: This technical publication is to be used in conjunction with the following Hendrickson Technical Publications:

- ? 17730-190: Basic Beam Components, RT Series Suspensions.
- ? 17730-213: Bar Pin Alignment, RT Series Suspensions



CONTENTS

<u>Subject</u>	<u>Page</u>
Description & Operation Guidelines	2
Important Safety Notice	3
Responsibilities of Suspension Installer	3
Suspension Installation Notes	4
Frame Hangers	4

<u>Subject</u>	<u>Page</u>
Beams, Bushes, Torque Rods & Chassis Modifications	5
Air Springs	5
Wheel Alignment	6
Welding Notes	7
Air Systems:	8
Installation Notes	9
Initial Set-Up & Ride Height Settings	9
Torque Settings	10

Suspension Description and Operation Guidelines

The AR2 Series of vocational air suspensions was designed, engineered and tested in Australia. The aim was to provide an air suspension that would prove ideal for vocational vehicles such as rigid tippers.

The Hendrickson AR2 400 suspension is a fully load-sharing air suspension for tandem axles in on/off road applications where the TGL (Tandem Ground Load) does not exceed 18,000 kg and the GVM (Gross Combination Mass) does not exceed 50,000 kg.

Testing by Hendrickson indicates that the AR2 400 suspension meets the criteria for "Road Friendly" suspensions and will therefore qualify for the proposed Australia mass limit increases.

It features the proven axle attachment connection as used on the famous RT Series. Upper longitudinal torque rods absorb axle braking and driving torques, and the transverse torque rods give positive lateral location of the axles.

The heavy duty pivot bush and shock absorbers combine to provide a combination of good roll stiffness, cross axle articulation and quiet operation.

The following AR2 400 suspension kits are designed for conversion of trucks with existing RT380 or RT400 suspensions:

AR2400-V201A

A suspension kit for Iveco Trucks Australia vehicles.
Reinforced frame, 879mm to 883mm width, 250mm ride height.

AR2400-F201A

A suspension kit for Ford Louisville models.
864mm frame width, 250mm ride height.

AR2400-K201A

Suspension kit for Kenworth and Western Star.
864mm frame width, 270mm ride height.

AR2400-G201A

Suspension kit for various older trucks with 864mm to 889mm frame width, 25mm ride height and with frame rail drillings that are different from the current Hendrickson BB drill pattern (see Figure 2).

AR2400-G202A

Suspension kit for various older trucks with 864mm to 889 frame width, 270mm ride height and frame rail drillings that are different from the current Hendrickson BB drill pattern (see Figure 2).

NOTE:

At the time of this release, kits are not available for Atkinson with 38" frame, ERF (New Zealand) with 37" or 40" frames, Volvo with 790/800mm frame, DAF with 800mm frame or any trucks with other than 864mm to 883mm wide frames.

In the above notes, frame width means width across the chassis at the suspension and ride height is a nominal vertical dimension from axle centre to chassis underside in a laden condition.

IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe and reliable functioning of the AR2 suspension.

The installation and service procedures recommended by Hendrickson, and described in this publication, are effective methods of performing maintenance.

Some of these operations may require the use of shop-made tools for the removal and installation of bushings.

There are various warnings and cautions that should be read carefully to minimise the risk of personal injury and to ensure proper methods are used.

Improper servicing may damage the vehicle or render it unsafe for operation.

Suspension installation and maintenance should only be carried out by suitably qualified personnel.

WARNING - HENDRICKSON REMINDS USERS TO ADHERE TO THE PUBLISHED CAPACITY RATINGS FOR SUSPENSIONS.

DO NOT MODIFY OR REWORK PARTS.
DO NOT SUBSTITUTE PARTS.

USE OF A MODIFIED OR SUBSTITUTE PART IS NOT RECOMMENDED BECAUSE THE PART MAY NOT MEET HENDRICKSON'S SPECIFICATIONS, WHICH COULD LEAD TO FAILURE OF THE PART, LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR DAMAGE OF PROPERTY.

DO NOT USE A CUTTING TORCH TO REMOVE ANY ATTACHING FASTENERS. THE USE OF HEAT ON SUSPENSION COMPONENTS WILL ADVERSELY AFFECT THE STRENGTH OF THESE PARTS. A COMPONENT DAMAGED IN THIS MANNER MAY RESULT IN LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR DAMAGE OF PROPERTY.

EXERCISE EXTREME CARE WHEN HANDLING OR PERFORMING MAINTENANCE IN THE AREA OF THE BEAM ASSEMBLY.

DO NOT CONNECT ARC WELDING GROUND LINE TO ANY BEAM. DO NOT STRIKE ARC WITH THE ELECTRODE ON THE BEAM. DO NOT USE HEAT NEAR THE BEAMS.

DO NOT NICK OR GOUGE THE BEAMS. A BEAM WHICH HAS BEEN SUBJECTED TO ANY OF THE CONDITIONS MAY FAIL, LEADING TO LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR DAMAGE OF PROPERTY.

RESPONSIBILITIES OF SUSPENSION INSTALLER

THE SUSPENSION INSTALLER IS RESPONSIBLE FOR THE FOLLOWING:

- ? Any approval given by Hendrickson applies to the suspension components only and requires that the installation complies with all Hendrickson engineering requirements.
- ? Approval and procedures for any modification or welding to the axle housing must be obtained from the axle / vehicle supplier.
- ? Supply of any additional chassis cross members or reinforcements.
- ? Confirmation that the chassis strength is satisfactory for the intended application.
- ? Clearance of all components throughout the full range of suspension movement.
- ? Relocation and remounting of mudguards or other ancillary items as may be required.
- ? Approval from relevant authority for any changes that relate to ADR compliance or other statutory requirements.

Suspension Installation

Before dismantling the existing RT Series suspension, all key dimensions, including axle angles, should be recorded with the vehicle on a flat and level surface.

All existing components that are to be re-used for the AR2 installation must be replaced if they are not in serviceable condition.

Details for determining the condition of the various components are as shown in the Hendrickson Technical Publications related to the RT Series suspension.

An installation drawing of the AR2 suspension is normally supplied with a suspension kit. Installers should ensure that they have the correct assembly drawing for the truck to which the AR2 is to be fitted.

On vehicles which have had the ride height modified, such as by a change to the steer axle springs, the resulting rear suspension ride height may not give the required condition.

Details of suspension assembly drawings and associated documentation normally supplied with suspension kits are as follows:

Drawing No. Details

99014-001	Suspension assembly for 250mm ride height and BB frame hanger brackets.
99014-001	Suspension assembly for 250mm ride height and frame hanger bracket with no drilling.
99014-004	Suspension assembly for 270mm ride height and BB frame hanger brackets.
99014-005	Suspension assembly for 250mm ride height and frame hanger brackets with no drilling.
49441-211	Air system plumbing, supplied with all suspension kits.
49441-204	AR2 400 suspension parts list.

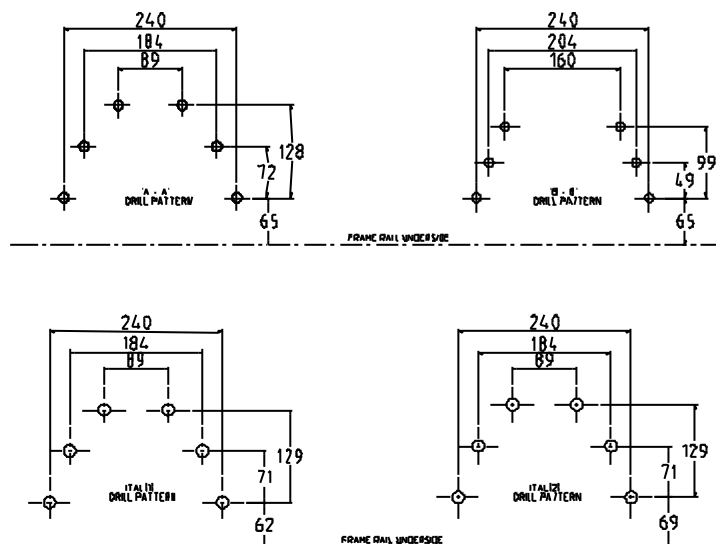


Figure 2

RT SUSPENSION, FRAME HANGER, DRILL PATTERNS

Frame Hangers

For the AR2400-G201A and AR2400-G202A kits, the frame hangers have to be drilled by the installer. These kits are used where the frame rail drilling is the older Hendrickson "AA" pattern, or the older unique International Harvester drill pattern, or any other non-standard drill pattern.

An identification drawing to assist with identification of drill pattern is show below:

All pre-drilled frame hangers have holes to suit $\frac{5}{8}$ " bolts and these will suit International, Kenworth, Western Star and White Truck chassis.

Ford's typically use $\frac{3}{4}$ " bolts and for these the installer must enlarge the holes in the frame hangers to suit.

All frame hangers have two vertical holes that are used to clamp the hangers to the lower chassis flange. Slots have been used on the AR2 frame hangers to give maximum compatibility but there may be cases where the position of chassis reinforcement holes still require some adjustment.

Equaliser Beams

The AR2 400 suspension kits cannot be used as updates to the following suspensions, unless the beams are changed to the 1321mm (52") steel beams:

- ? RT/RTE340 or U/UE3340 suspensions.
- ? Any suspension with aluminium alloy beams.
- ? Any suspension with 50" beams.

Beam Centre Bushes

The AR2 suspension uses transverse torque rods that are included in the above kits, together with axle brackets that have to be welded on to the axles by the installer. For

this reason the beam centre bushings must be rubber bushings.

Suitable centre bush parts numbers are:

- ? 49400L (RT400)
- ? 05919L (RT380)
- ? 29483-005 (RT460)

Transverse Torque Rod Installation

Kits are provided with two of the Hendrickson two-piece torque rods and two axle brackets that are to be welded to the axle housings.

Axle manufacturer instructions/ recommendations should be complied with in regard to preparation, materials and process for any welding to the axle housings.

The transverse rods should be installed so that, at the normal suspension ride height, the rods are horizontal, or as close as it possible to horizontal.

Chassis Reinforcement and Modification

The chassis rail at the transverse rod end may require reinforcing to spread the transverse rod loading.

In addition to chassis rail reinforcing, the 10mm reinforcing spacers provided in the Hendrickson kit must be used outside the chassis rail.

Chassis rails which are not adequately reinforced may suffer cracking at the transverse rod end attachment.

The normal chassis reinforcement with RT Series suspension is typically referred to as an "H"-frame reinforcement. Apart from the requirement for additional holes to mount the air springs, shock absorbers and height control valves, the H-frame may require modification to clear the height control valve linkages.

Air Springs

The air springs specified for AR2 suspension, as supplied in the kits currently have two studs on the upper plate. One is a combined stud with a $\frac{3}{4}$ " UNF external thread for attachment to the upper air spring bracket and an internal thread of $\frac{1}{4}$ " NPTF for connection to the air system.

The other upper air spring stud is a $\frac{1}{2}$ " UNC stud which on other applications would be a fastening stud.

In the AR2 400 suspension the length of this $\frac{1}{2}$ " stud must be reduced to 6mm so that it locates in the air spring upper bracket but does not protrude through it.

The air spring piston (bottom end) is fastened to the trailing arm by two $\frac{1}{2}$ " UNC studs and also located by two additional studs.

On the higher ride height installations, as used for Kenworth and Western Star, there is a 19mm plastic spacer used between the air spring pistons and the trailing arm surface. Details of this installation are shown in Appendix 2.

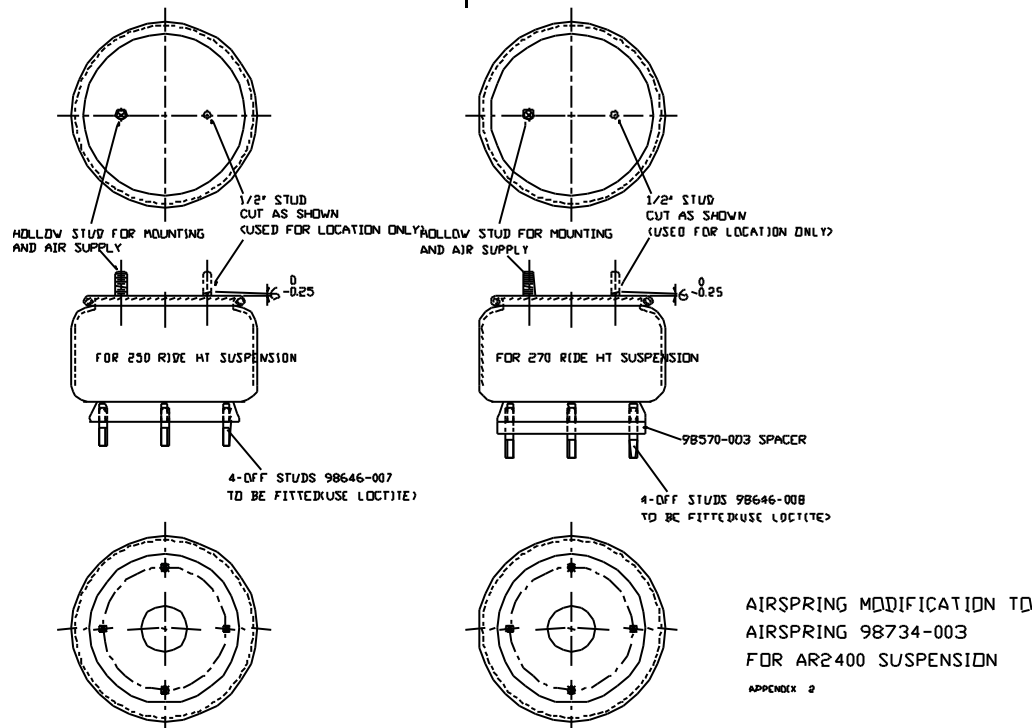
Details of the air spring modification are illustrated below (Figure 3).

Wheel Alignment

Wheel alignment of the AR2 suspension on initial assembly is carried out at the trailing arm pivot connection, as shown in Figure 4, and in accordance with the following procedures:

1. The suspension should be completely installed except that the frame hanger bracket collars are not welded to the frame hangers.
2. The $\frac{3}{4}$ " nut of the adaptor should be tightened to 100 lb.ft. so that the adaptors grip the frame hanger bracket sides.
3. Axle alignment procedure can then be carried out using laser alignment of other appropriate methods.
4. The adaptors can be moved by up to 3mm to the front or rear, to achieve optimum alignment, using moderate impact with a drift against the adaptor flange.

Figure 3



5. When alignment is complete, tack weld all four of the frame hanger collars to the frame hangers.
6. Re-check the alignment to ensure that movement has not occurred.
7. Weld all round each of the four collars, taking care not to weld any of the adaptor flanges. See the "Welding Notes" section of this publication.
8. Tighten the adaptor nuts to the final torque of 210-240 lb.ft.

NOTE:

The additional axle alignment is available at the beam end connections if the bar pin type bushes and associated axle brackets are used. For details of procedures associated with the bar pin beam end connection refer to Hendrickson Technical Publication 17730-213.

Welding Notes

Frame Hanger Collars and Height Control Valve Link Brackets

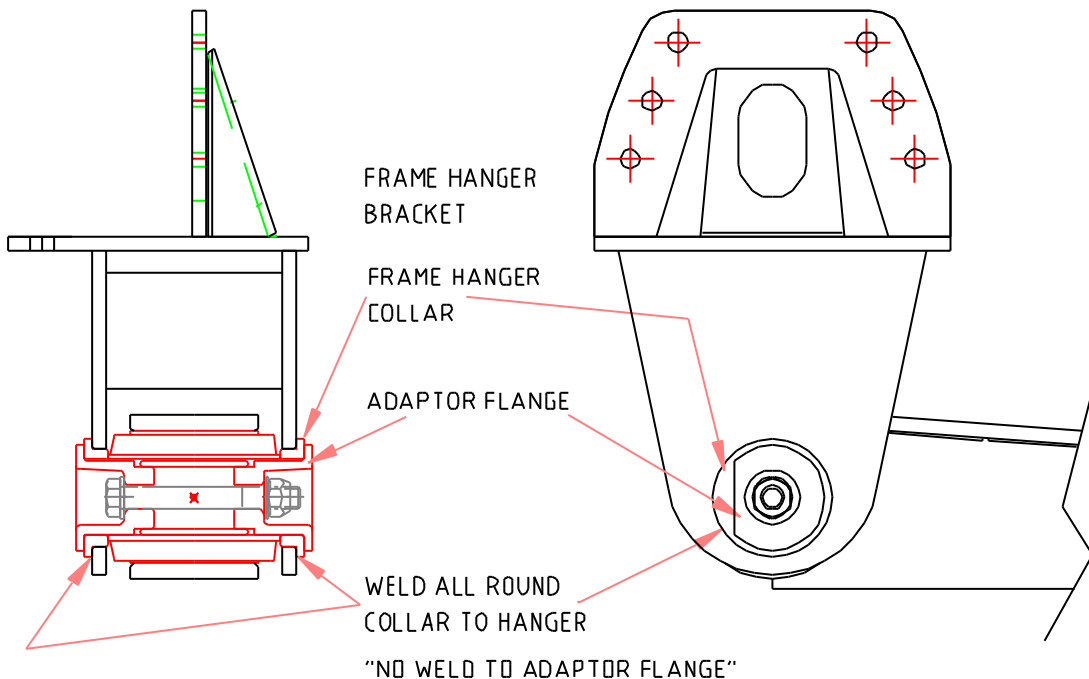
Welding is only to be carried out by a suitably qualified person.

Frame hanger and associated components should be at a temperature of not less than 15°C. In colder conditions, lightly pre-heat the hanger before welding.

The surfaces to be welded should be free from moisture, dirt, scale, paint and grease.

Preferred welding is by Argon shielded wire.

Figure 4



Spray transfer should be achieved with the following welding parameters:

- Standard Electrode: AWS E0-7018 (oven dried)
 .125" dia, 120-140 AMP, DC Electrode Positive
 .156" dia, 120-160 AMP, DC Electrode Positive
- Standard Wire: AWS ER-70S-6
 .045" dia
 (i.e. LA-56 or NS-115)
- Optional Wire: AWS ER70S-3
 .045" dia
 (i.e. LA-50 or NS-101)
- Volts: 26-30 DCRP
- Current: 275-325 AMP
- Gas: 86% Ar, 14% CO₂ at 30 to 35 CFH

NOTE:
 Any deviations from these welding parameters must be approved by Hendrickson.

Axle Bracket Welding

In regard to welding of transverse rod brackets to axle housings, installers must refer to welding recommendations of the relevant axle manufacturer.

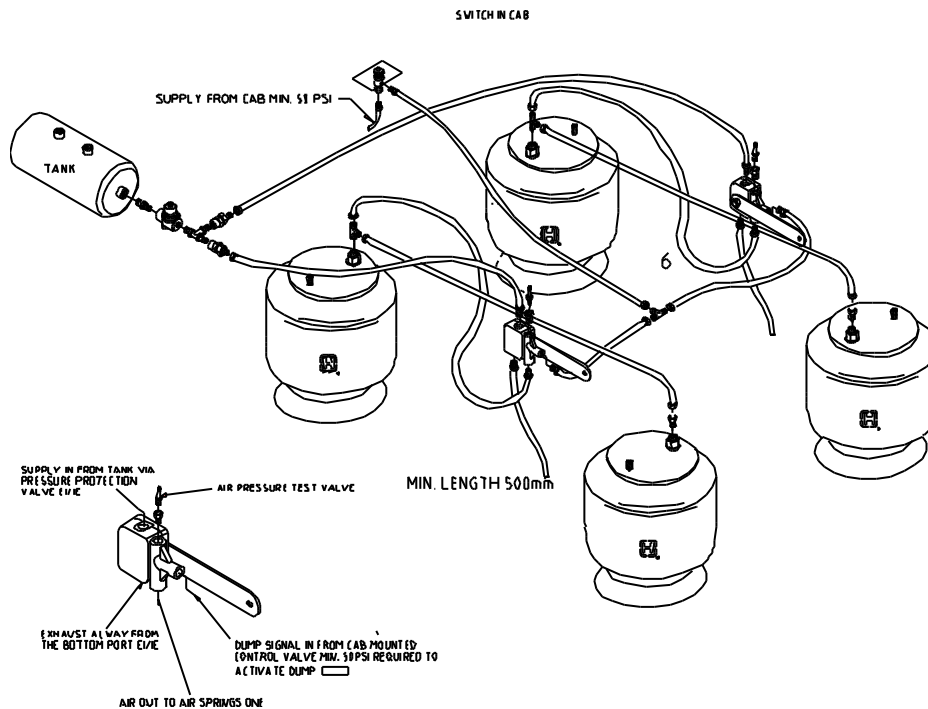
Air System

The air system of the AR2 Series suspension utilises a dual circuit configuration with two height control valves (Hendrickson Part # 57977) for Increased roll control. Refer to Figure 5.

The following guidelines should be followed when installing an air system for use with the AR2 Series of suspension:

1. From the point where the main supply line is taken, you should always ensure that there is a pressure protection valve fitted. This will protect the main air supply from the truck should an air spring, or an air line, be damaged. A Hendrickson pressure protection valve is included in the AR2 suspension kit.

Figure 5



- The use of two (2) height control valves requires a high volume of air. It is recommended that the supply line size from the truck air supply to the height control valves be 1/2" OD nylon tubing. This will ensure that both valves are supplied with sufficient air volume. The delivery line size, from each HF-HCV to the air springs, is to be 3/8" OD nylon tubing.

Air System Installation Procedure

- Identify required components. There are two brackets for each valve. Their purpose is as follows:
 - The upper HCV mounting bracket bolts directly to the chassis. The chassis rail should be pre-drilled according to the rail drilling drawing supplied with the kit.
 - The lower HCV linkage bracket attaches by welding to the rear of the main suspension beam. Refer to Figure 2.
- Attach the HCVs to the upper mounting brackets and then attach the brackets to the vehicle's chassis rails. Fasten all bolts to the required torque (see Torque Table at the end of this Technical Publication).
- Attach air lines to height control valve ports. Refer to Figure 5.

- A plastic locating pin is supplied with each valve to help simplify the installation and ride height adjustment. See Figure 5.

NOTE:
A complete plumbing drawing is normally supplied with each suspension kit.

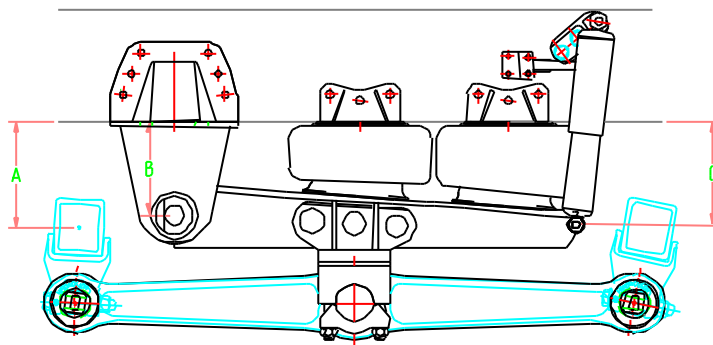
Air System Initial Set-Up and Ride Height Settings

- When both valves are mounted, complete with link rods and control arms. Ensure that:
 - Both control arms are positioned out as long as possible facing towards the air springs on each side.
 - Both control arms are of the same height. This can be checked by running a straight edge from the top side of the chassis and measuring down to a given point on the control arm. If it is found that the control arms are not the same, loosen the HCV bolts and readjust the HCV.
- A given ride height must be obtained as shown in the tabulation in Figure 6.
- This ride height is measured from the centre of the lower shock mount to the underside of the chassis when the vehicle brakes have been disengaged and the truck is on flat ground. See Figure 6.

RIDE HEIGHT SETTINGS AIR2400 SUSPENSION:
 RIDE HEIGHTS ARE MEASURED FROM THE AXLE CENTRE LINE TO THE CHASSIS UNDERSIDE. THIS DETERMINES WHICH OF THE 7 AVAILABLE HEIGHTS SHOULD BE USED.
 ADJUSTMENTS TO THE RIDE HEIGHT CAN BE MADE WITH THE HEIGHT CONTROL VALVE LINKAGE TO SET DIMENSION 'C'. DIMENSION 'C' SHOULD BE SET TO WITHIN PLUS OR MINUS 8mm OF THE DIMENSION SHOWN ON THE TABLE.

A	B	C	TYPICAL USAGE
230	224	263	TYPICAL OPERATIONAL
710	261	260	ADDITIONAL WEIGHTS

Figure 6



4. When the correct ride height is achieved:
 - a) Deflate the suspension in the cab of the vehicle with the pilot valve switch button.
 - b) Allow the suspension to deflate.
 - c) Allow the suspension to return to the pre-set ride height.

NOTE:

Ensure that the truck has sufficient air in the air system.

5. Check that the ride height, both left and right hand sides, are the same. You can also take a measurement from the concrete pad surface to the underside of the chassis. If this is not correct, adjust your link rod on the side that is not correct.
6. As well as setting the ride height to be equal, left and right, it is imperative that air system pressures are equal. Included in the suspension kit are two air test fittings with adaptors for assembly into the height control valve (see Figure 7). When adjusting the ride heights, use a tyre pressure gauge to measure the pressures comparing left to right. The pressures should be matched to within 2psi.

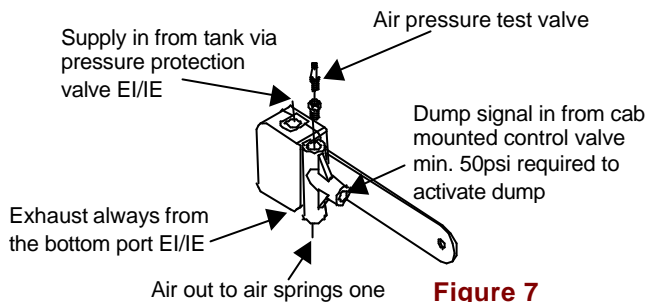


Figure 7

7. Be aware that the valve used on the AR2 suspension range has a very small neutral area in the movement of the control arm. Make sure when you set each valve that you set both valves either at the top or bottom of this area.

NOTE:

The neutral area is found between inflation and deflation areas of the valve.

In the event of pressure loss in the suspension the vehicle can be driven for short distances only, at low speed, on the bump stops. The vehicle should have been fitted with a brake pressure protection valve so pressure should always be available to the braking system.

If the air springs deflate then the following should be checked:

- a) Air supply is sufficient from the compressor.
- b) Pressure protection valve is functioning.
- c) Height control valve fittings are not clogged.
- d) There are no leaks from connections or the height control valve.

NOTE:

The use of a good quality air filter / dryer system is strongly recommended to provide clean, dry air to the suspension system.

Torque Settings

All threads must be clean and lubricated with SAE 20 oil before assembly to obtain the correct relationship of torque and fastener tension.

To obtain maximum service life from the suspension system, mounting bolts and nuts should be checked at least once a year, and re-tightened if required to ensure correct torque.

The torque values listed on the next page only apply if Hendrickson-supplied fasteners are used. If non-Hendrickson fasteners are used, follow torque specifications listed in the vehicle manufacturer's service manual.

Any fasteners supplied by the installer or service personnel must be to SAE Grade 8 specification, or equivalent.

Torque Values Table:

Description	Size	N.m	lb.ft.
Beam end connection Bar pin type	1"	610 - 814	450 - 600
Beam end connection # piece adaptor type	1"	603 - 671	445 - 495
Pivot adaptor 3-piece type	¾"	285 - 325	210 - 240
Saddle cap nut	7/8"	370 - 406	275 - 300
Shock absorber nut	½"	68 - 95	50 - 70
Air spring to frame hanger	¾"	54 - 60	40 - 45
Torque rod nut	1¼"	237 - 305	175 - 225
Height control link	5/16"	11 - 17	100 - 150 lb.inch
Torque rod to chassis	5/8"	203 - 278	150 - 205

APENDIX A

AR2 400 Suspension Notes

NOTES FOR INSTALLERS:

GENERAL NOTES :

The AR2400 aftermarket suspension kits do not include beams, beam end connections, cross tube, longitudinal torque rods, on the basis that the existing RT suspension components will be re used.

Note that all existing RT components should be in serviceable order & bushes in particular should be replaced with appropriate Genuine Hendrickson parts as required.

AR2400 suspension kits also exclude chassis attachment hardware that can be supplied by the installer or is available from Hendrickson as an extra kit. Height control valves are included but airlines & airline fittings are not.

BRAKES :

When the existing suspension is a Hendrickson RT series , the brake camshafts & chambers will be in the correct location for AR2400 suspension. Installation of the transverse torque rods may require relocation &/or modification to the mounting of the brake quick release valve(s) or airline support brackets that are normally mounted on the axle housing. Brake valves mounted on the chassis may also require relocation to accommodate the transverse torque rods at the chassis end.

CHASSIS REINFORCE MENT MODIFICATION :

The normal chassis reinforcement with RT series suspension is typically referred to as an "H" frame reinforcement. Apart from the requirement for additional holes to mount the airsprings, shockabsorbers & height control valves, the H-frame may require modification to clear the height control valve linkages.

THE INSTALLER IS RESPONSIBLE FOR THE FOLLOWING :

- ✍ Any approval given by Hendrickson applies to the suspension components only & requires that the installation complies with all Hendrickson engineering requirements
- ✍ Approval & procedures for any modification or welding to the axle housing must be obtained from the axle/vehicle supplier.
- ✍ Supply of any additional chassis cross members or reinforcements
- ✍ Confirmation that the chassis strength is satisfactory for the intended application
- ✍ Clearance of all components throughout the full range of suspension movement.
- ✍ Relocation & remounting of mudguards that may be required.
- ✍ Approval from relevant authority for any changes that relate to ADR compliance.