



OPERATING INSTRUCTIONS

GENERAL MAINTENANCE

WHEN ORDERING YOUR PARTS, SPECIFY MODEL NUMBER, PART NUMBER AND SERIAL NUMBER LISTED BELOW.

ART-60
Series

IMPORTANT

KEEP THIS MANUAL FOR FUTURE REFERENCE.

Study these instructions before operating and/or maintenance of this equipment

FACTORY:

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PARTS INFORMATION

TO THE OWNER

If you need information not given in this manual or require the service of a trained mechanic, we urge you to use the extensive facilities offered by the authorized Ace Distributor in your locality.

INSTRUCTIONS FOR ORDERING REPLACEMENT PARTS

For ease in ordering of Ace parts, a system of part and assembly numbers is used. It's important these numbers be used whenever and wherever possible.

All parts listed on the drawings, repair parts sheets or exploded views show parts in their proper relationship. Each individual part is identified by name and part number.

-Use the following suggestions and you should have little difficulty in getting quick and efficient parts delivery.

IMPORTANT

- 1) Give model, serial and identification numbers found on the Identification Plate of the unit. Be sure numbers are complete and include any prefix or suffix.
- 2) Order by part number only, NOT by item number.
- 3) Check every part number for accuracy. The part numbers can be very similar and can be easily transposed.
- 4) Be careful to order the correct quantity.
- 5) When ordering an assembly, make sure all the parts you need are included in the assembly.
- 6) Common hardware is not listed.
- 7) Say whether shipment is to be made express, parcel post or freight. Give freight shipping point if different from mailing point.
- 8) ORDER PARTS from your nearest ACE Distributor.

*****Note*****

Any and all warranty issues requesting parts or service **Must** be approved in writing for warranty consideration. If warranty is granted, Part and service will be shipped C.O.D or Net 30 Terms with invoice. Damaged parts must be returned within 30 days for credit to be issued. If Part is not returned within 30 days, Ace has the right to reject any unreturned part, and customer is responsible for invoice.

All pricing and specifications are subject to change without notice; the right is reserved by company to substitute material and modifications to specifications without prior notification. Please Contact Ace's parts and service regarding any questions parts, price, and service

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Product of

Brothers Equipment Inc.

LIMITED WARRANTY

Brothers Equipment warrants the reservoir, pump, hydraulic control valve, and hydraulic cylinders against operational failure caused by defective material or workmanship, **which occurs during normal use within one (1) years from date of shipment from our factory on all NEW equipment purchases, and 90 days of aftermarket part sales**

Brothers Equipment warrants all other products of it's manufacture against operational failure caused by defective material or workmanship, **which occurs during normal use within one year for new equipment and 90 days on aftermarket parts from date of shipment from our factory.**

Brothers Equipment will replace all parts of our manufacture free of charge that our inspection at our factory shows to us to be defective in accordance with the above paragraph. **Written permission must be obtained from authorized Brothers Equipment personnel for any repairs performed other than in our factory.** All claims for reimbursement must be filed with proper documentation no later than forty-five (45) days after occurrence to be allowed.

All products purchased by Brothers Equipment from an outside vendor shall be covered by the warranty of that respective vendor only, and Brothers Equipment does not participate in or obligate itself to any such warranty.

No freight, travel cost, meals, lodging, or loss of hydraulic oil shall be covered by this warranty, all labor costs allowed shall be in accordance with Brothers Equipment established rate; in case of alleged defect, product shall be returned to Brothers Equipment with transportation charges prepaid. No freight collect shipment will be accepted.

Brothers Equipment makes no warranty on any of it's equipment used in any way except as it was designed, intended, and sold to perform.

DISCLAIMER OF WARRANTIES. THE LIMITED AND CONDITIONAL WARRANTY AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ANY AND ALL REPRESENTATIONS, SPECIFICATIONS, WARRANTIES AND REMEDIES, EITHER EXPRESS OR IMPLIED, HEREIN OR ELSEWHERE, OR WHICH MIGHT ARISE UNDER LAW OR EQUITY, OR PURSUANT TO ANY COURSE OF DEALING OR CUSTOM OR USAGE OF TRADE, INCLUDING WITHOUT LIMITATION, ANY WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR ANY SPECIFIED OR INTENDED PURPOSE.

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PROPERTY, LOSS BY REASON OF PLANT SHUTDOWN, NON-OPERATION OR INCREASED EXPENSE OF OPERATION, SERVICE INTERRUPTIONS, CLAIMS OF CUSTOMERS, COST OF MONEY, LOSS OF USE OF CAPITAL OR REVENUE, OR FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL LOSSES OR DAMAGES OF ANY KIND WHATSOEVER.

All claims shall be processed through the Brothers Equipment Customer Service Department or your authorized Brothers Equipment dealer.

Brothers Equipment Revised 5/15/09

IMPORTANT SAFETY NOTICE

Proper service and repair to the safe, reliable operation of the Brothers Equipment Inc. "Ace" products. Service procedures recommended by Ace are described in this service manual and are effective for performing service operations. Some of these service operations may require the use of tools or blocking devices specially designed for the purpose. Special tools should be used when and as recommended. It is important to note that some warnings against the use of specific methods that can damage the product or render it unsafe are stated in the service manual. It is also important to understand these warnings are not exhaustive. Ace could not possibly know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, Ace has not undertaken any such broad evaluations. Accordingly, anyone who uses service procedures or tools which are not recommended by Ace must first satisfy himself thoroughly that neither his safety nor the product safety will be jeopardized by the method he selects.

WARNING!!!

Safety Decals

Must be on Each unit. Please call factory and get replacement decals if decals is unnoticeable

WARNING

Return line MUST be properly connected before operation

Do Not use less than 1-1/4 return line hose.

Do Not use quick connect fittings

Only Use 1-1/4 wing nut connectors

WARNING

Do Not operate or service this machine until Operations Manual supplied

with this unit has been fully read

Do Not operate any malfunctioning equipment

Replace unreadable safety decals

Failure to operate as instructed could result in serious damage to the machine, and result in death or serious injury to operator, helpers, and/or bystanders

Manuals can also be obtained from

ACE EQUIPMENT SALES.

WARNING

Do Not Drive Or Operate Machinery or Equipment when intoxicated or under the influence of drugs.

WARNING!

If used incorrectly, this equipment can cause severe injury. Those who use and maintain this equipment should be trained in its proper use and warned of its dangers.

THIS ENTIRE MANUAL SHOULD BE READ BEFORE ATTEMPTING TO SET UP, OPERATE, ADJUST OR SERVICE THE EQUIPMENT.

MAKE COPIES FOR ALL DRIVERS, MECHANICS AND OPERATORS.

THIS MANUAL SHOULD BE INCLUDED WITH THE EQUIPMENT IF IT IS EVER SOLD, LEASED OR OTHERWISE CHANGES OWNERSHIP.

Section 1

1.1 Introduction

This manual has Operation, Maintenance, and parts Lists information for Ace model ART-60 frameless rolloff trailers.

It's been prepared to acquaint you with the design features of the unit, and to instruct you in it's proper operation and maintenance. The ART-60 models are specialized equipment and should be treated with care.

All operator/service people should review it carefully and become familiar with the contents before it's filed for future use. This manual is as valuable to you as the trailer it describes. If equipment is used incorrectly, equipment can cause severe damage and possible death. Have all operators, Mechanics, and or anyone associated with equipment read toughly, Manual should be accompanied with equipment if unit is sold, Leased, and or otherwise change in operator control.

1.2 Specifications

a)	Capacity 60,000#	ART-60-36 ART-60-25 ART-60-25-BT ART-60-40	10-36 ft container 10-25 ft container 10-25ft container 10- 40ft container
b)	Length (Overall)	ART-60-36 ART-60-25 ART-60-25-BT ART-60-40	36 ft 25 ft 25 ft 40 ft
c)	Width (Overall) Rails		96" 35.5"
d)	Height		60 1/2" Front, 58" Rear
e)	Weight (Empty) Approximately *weight may change due to tires and options		12-600 Lbs. – 15,500.00
f)	Axles		25,000 lbs. Cap. Each
g)	Suspension		50,000 lbs. Rated Cap Single Point
h)	Wheel		uni-moount
i)	Tires		11.00xR22.5,
j)	Rim		22.25" x 8.25"
k)	Brakes		16 1/2 x 7" Air / ABS Front axle
l)	Kingpin Location		24" from front
m)	Tandem Location ART-60		26 1/2 center tandem to rear tire adjustable to 81" (87" on ART-60-40) center tandem to rear frame.
n)	Landing Gear		Heavy duty 2-speed with foot pad
o)	Lights		Federal standards
p)	Mud Flaps		Rear Rubber over tandem / 1/4 flap
q)	Lift Cylinders		(2) Double-acting 5-stage, 8" rated 111,000# each
r)	Hydraulic controls		Mounted on front of trailer
s)	Dual Revving Cylinders Winch (optional)		7" bore double acting 70,000 lb capacity 2-speed motor, 50,000 first layer
t)	Air Locks (b-train)		(2) 2" Pins 24 brake chambers
u)	Cable		7/8" IWRC with ring and loop

1.3 General Information

The Frameless Rolloff trailer provides a loading and unloading of scrap, solid waste, sludge, etc., for many of the collection and hauling companies.

The ART-60 Trailer(s) allows the hauler to load and unload a container safely, easily and effectively.

Extremely Important:

Make sure the 1-1/4 Return Line of the Trailer is securely and properly secure to the Oil tank, Leaving not restriction for the oil to return to tank with out and back pressure. (use only 1-1/4 wing type quick couplers). Do not use Quick couplers.

Unlock the air lock system allowing the driver to slide the axles forward. (only on sliding suspension models) Relock the air locks. Extend stinger tail (optional). Properly secure rear mud flaps. Raise the tilt frame of the unit up tilting the tail end almost hitting the ground. Lower the cable to the front of the container. Hook the container with ring. Lift the container up while wrapping the cable around the Revving Cylinder load container past the center tandem on suspension before lowering the tilt frame (NOTE) To lift heavy loads put winch(optional) in low speed. Have as little vertical lift as possible. Once the unit is all the way down, sliding the container forward until it rests upon the stops (movable optional). Unlock the airlock and slide the suspension back for legal bridge. Reposition mud flaps, Tie down container properly to conform to state and federal sacrament laws,

Arriving at the dump site the driver slides the axles forward, then lifting up the container in the dump position allowing the material to fall out the back of the container. Once the container is empty lower the container in the transport condition

1.3.1 Body Assemblies

Several body assemblies are available. ART-60, ART-60-BT, ART-60-BTR (BT, BTR, Complete B-Train) ART-60-25, ART-60-25, ART-60-25-BT, ART-60-36, ART-60-40, All are frameless rolloff trailers. All have a 24" king pin setting (other king pin settings are optional). Rollers are on both sides for container to rest on front 61", rear 58.5", 3.5" from top roller to top rail.

1.3.2 Tilt Frame (Optional) I-Beam Frame

Tilt frame is made of (2) 12x4 tubing on either side of trailer. Tilt frame is designed to carry the load of the container as if main frame. Tilt frame has top and bottom wraps for added strength and durability when loading or unloading container. Tilt frame is 35.5" wide for outside rail containers (inside rail optional).

1.3.3 Stabilizer Frame

Stabilizer frame is used as a third point of support. (2) 4 x 4 tubing on outside of the tilt for stability when raising and dumping.

1.3.4 Sliding Suspension (Optional)

Sliding the suspension is done by unlocking the air lock system. Once the airlocks are in position, lock the trailer brakes; slide the tilt frame forward for the suspension to be in the travel

position. Slide the tilt frame back for the suspension to be in the loading and dump position. Relock the airlocks.

1.3.5 Landing Gear

Two speed landing gear mounted on tilt frame rated at 120,000 static load with sand pads.

1.3.6 Winch

Winch is two speed hydraulic winch 70,000 lb. Capacity

1.3.7 Revving Cylinders

Double acting single stage independent cylinders 7" I.D Bore with 2.5 x 3.5 Chromed tubing shaft

1.3.8 Movable Stops

Moveable stops position containers for weight distribution. Various positions available per trailer model in order to locate container for proper weight distribution. Customer is responsible for proper weight distribution per State and Federal weight laws.

1.3.9 Air Pin Locks (Optional)

Stationary double acting pin locks are mounted on tilt frame with 4 collars mounted on sliding suspension, two in front, two in rear, for slide distance.

1.3.10 Hydraulic System

Hydraulic system pressure is 2200 psi (2) lift cylinders 2200 psi, (2) revving cylinders (1) 4-way two-spool, (1) extend cylinder (optional), All hoses 2500psi high pressure one wire brand.

1.4 Lights

Directional, clearance, run, stop, and license light all conform to federal standards.

1.5 Air Brakes

Both trailers have 6-1/2x7" Air brakes. ABS (anti-lock brake system) located on front axle

1.6 Cable

7/8" IWRC multi wire braid with 1" ring

Section 2

Frameless Rolloff Trailer Operation

2.1 General

Before operating the unit, read warning decals on trailer

***** WARNING *** MAKE SURE ALL ARTICLES AND PERSONS ARE CLEAR FROM UNIT WHEN IN OPERATION.**

*****IMPORTANT*****

Safety and good judgment is Ace's utmost importance. Please read carefully and Understand manuals and operation of equipment before operation of equipment

*****Modifications*****

Modification of any and all Ace's equipment is to be provided by the Ace Factory or with written approval from an Ace factory manager. Any modifications not approved by Ace will result in nullification of warranty and liability

*****Important*****

Always check for overhead obstructions, such as power lines, ceilings, bridges, etc.

2.2 Definition of an Operator

An operator referred to herein is a competent person who has read and understands the operator and maintenance manuals.

2.3 Rolloff Trailer Load operation (general)

Note:

There is not possible way to step by step every possible way to use Ace's equipment below is general operation, Please use good judgment when operating equipment

***** Important*****

Make sure equipment is on level solid ground, and container is properly loaded. Do not attempt to load, unload or dump container on unlevel ground or uneven container load. Could result in upset of trailer or container

Ace's Systems are designed to operate Rolloff style containers, for loading and unloading, and dumping that is in good condition. Any other uses are not warranted by manufactures warranty policy.

The operation of the unit is as follows:

- 1)* Lock tractor brake and activate air pin lock to release sliding suspension.
- 2)* Lock trailer brakes and slide the tilt frame back and relock trailer brakes.
- 3) Align trailer within 1 to 2 feet from container in reasonable straight alignment with container.
- 4) Lock trailer or tractor brakes (ONE OR THE OTHER – NOT BOTH)

- 4a) ART-60-BT dump the air out of rear axle. Raise any lift axles before loading
 - 5) Extend stinger tail (optional).
 - 6) Raise lift cylinder, extend lift cylinder till the stinger or end of frame lightly touches the ground.
 - 7) Unwrap winch and hook on end of container
 - 8) In low speed, coil cable tilt tight. Pull container up onto the tilt frame (make sure container rails are outside tilt frame rails).
 - 9) Raise container 3 to 5 feet up on tilt frame past trunion center. Then lower tilt frame parallel with container frame.
 - 10) Raise container frame in high or low, depending on weight of container (if container starts to lift off the front of the tilt frame, raise tilt frame to keep parallel).
 - 11) Once rear rollers of container come off the ground, lower the tilt frame.
 - 12) When tilt frame is fully down, finish sliding container up till it hits movable stops, and retract stinger tail.
 - 13)*Unlock air lock and slide tilt frame forward. Relock air locks.
 - 14) Tie down back of container with tie down strap or chains, (tie down load to conform with state and federal laws)
 - 15) Transport
- *For sliding suspension only*

B-Train Only

- 16) Back ART-60-BT trailer under ART-60-BTR frameless trailer, couple your air lock and air lines and transport.
- 17) When to operate rear trailer hook up operate third spool
- 18) Redo steps 3-15.

2.4 Rolloff Trailer Unloading

- 1)* Unlock air lock and slide suspension forward, the relock.
- 2) Release ratchet binders or container secure meant devices.
- 3) Back unit up to dump position or unloading spot
- 4) Extend stinger tail and lift unit.
- 5) When container gets ¼ way up, lower container until rear rollers of the container are past the end of the tilt frame. (If container is too far forward the rear rollers will hit fenders).
- 6) Lower container all the way down to position on ground.
- 7) Bring in stinger tail.
- 8) Lower tilt frame
- 8)* Unlock air lock pins, slide suspension, and relock.

2.5 Rolloff Trailer Dumping

When dumping, make sure suspension is slid forward, raise the tilt frame in order to slide container so that the rear rollers of content extend past rear fenders (if container is too far forward, container will hit the fenders), open container gate and lift unit. When container empties, lower tilt frame and slide containers forward, move suspension into transport position.

Dumping unit

- 1)* Unlock air pins, slide suspension forward, relock. Release ratchet binders.
- 2) Back unit up to dump position or unloading spot
- 3) Slide container back so that the rear rollers on container surpass the rear fenders. (NOTE: If container is forward, rear rollers of container will hit the fenders).
- 4) Open container gate, lift tilt frame unit, debris falls out.
- 5) Lower tilt frame, close gate
- 6) Unlock air pins, slide suspension, and relock air pins. Transport.

2.6 *Air Locks*

Air locks keep suspension from moving while in operation. ART-60 – Air locks are located at front suspension. ART-60-BT – Air lock located at king pin plate on front trailer.

2.7 *Sliding Suspension*

ART-60 Unlock air lock and slide suspension backward or forward in a straight line. The suspension has front stop and rear stops. The suspension must be all the way forward or back to lock pins.

ART-60-BT Air locks are the same as ART-60. Suspension is a tri-axle. (Optional) Air ride with a rear dump kit (NOTE: All air bags MUST be full while sliding.)

Air suspension- dump all air out of rear suspension, suspension should be resting on blocks before loading or dumping, inflated air suspension could cause a trailer upset, and will not be covered under warranty.

2.8 *Controls*

Operator controls, are located at front drives side of trailer.

- (1) up/down Lift cylinders
- (1) in/out revving cylinder
- (1) Extended tail (optional)
- (1) Gantry (optional)
- (1) Supply release brake

Section 3

Maintenance

3.1 General

Maintenance people whose job is the upkeep of this equipment should have a basic understanding of the equipment and normal sequence of operation.

Maintenance in this section is divided into two parts – Preventative Maintenance and Corrective Maintenance (Troubleshooting).

Preventative Maintenance is a series of routines that keep the equipment in proper working condition. Preventative Maintenance is not only desirable but is necessary, since scheduled inspection ensures continued, trouble-free operation of the equipment. It also prevents or at least detects at an early stage, mechanical or hydraulic troubles that might otherwise develop into equipment malfunction. Maintenance should do preventive maintenance every 40 hours of standard use.

Corrective Maintenance (Trouble-Shooting) is the examination and repair or replacement of the part or parts of the equipment that resulted in equipment malfunction.

3.2 Safety Precautions

Practice safe maintenance habits to prevent personal injury or equipment damage.
WARNING: BEFORE MAINTENANCE IS BEGUN, STUDY THE JOB CAREFULLY TO DETERMINE ALL THE HAZARDS PRESENT AND TO SEE THAT ALL NECESSARY SAFEGUARDS OR SAFETY LOCKOUT DEVICES ARE PROVIDED TO PROTECT YOURSELF AND THE EQUIPMENT.

Place (2) 4x4 hardwood or steel supports between the tilt frame and stabilizer frame as a safety precaution when unit is in the up position for repair.

3.3 Suggested Preventative Maintenance Program

Suggested preventative maintenance checks list are suggested. Perform these checks at the suggested time.

3.3.1 Lubrication and Maintenance Program

The entire unit should be checked daily, paying attention to the following:

- 1) Check hinges, welds, pivot pins, cylinders and retaining rings on pins, cotter pins and clips.
- 2) Inspect hydraulic lines for leaks or damage.
- 3) Check oil level in tank for correct height.
- 4) Inspect pump, valve and cylinders for leaks, and proper pressures
- 5) Check universal joint setscrews and lock wires for looseness (PTO). Check coupling on engine driven units.
- 6) Check electrical connections for corrosion.
- 7) Check control linkage for binding, corrosion and looseness, making certain all cotter pins are in place.
- 8) Check safety hooks and brakes for wear. Adjust brakes as required.
- 9) Check oil level in wheel bearing.
- 10) Check suspension parts and U-bolts. Per suspension requirements (see suspension addendums in manual and on trailer)
- 11) Check wheel or rim nuts for proper tightening

- 12) Check cable for fraise and splits
- 13) Lubricate air pin locks daily.
- 14) Grease ALL pulleys and ALL pivot pins weekly

Do's and Don'ts of Trailer

Don'ts

- 1) Do not lift, dump, load or unload when suspension is extended.
- 2) Do not travel with stinger tail out.
- 3) Do not jerk cable when loading or unloading as cable may snap and break.
- 4) Do not load, dump or unload unless rear axle air bag is emptied Air ride only.
- 5) Do not operate rear unit when operating front unit ART-60-BT Only.
- 6) Do not load, unload or dump unless air locks are locked.
- 7) Do not extend stinger tail when cable is around it
- 8) Do not slide suspension when hydraulic hoses or airs are connected.
- 9) Do not lower front of trailer while front of container is on the end of extended stinger tail.
- 10) Do not raise trailer with lift axle down, Raise lift axle before raising hoist
- 11) Do not lower tilt frame while loading heavy container till container is past hinge point
- 12)

Do's

- 1) Do tighten cable slowly until cable is tight (keep cable tight at all times)
- 2) Do make sure unit is on level ground when loading, unloading or dumping.
- 3) Do travel with all air bags leveled.
- 4) Do slide suspension when air bags are leveled.
- 5) Do make sure all landing gear is up when traveling.
- 6) Do make sure winch is in low speed while lifting heavy load.
- 7) Make sure container is proper secure before traveling
- 8)

3.3.2 Lubrication

General

When the unit is used regularly, it should be lubricated weekly or oftener if conditions warrant. Use grease recommended for truck chassis lubrication.

Grease Fitting

Lift Cylinders	4
Stabilizer Frame	4
Winch	2
Slack adjuster	4 – 6 Tri-Axle
Rollers	14
Landing Gear	2
Pulley	5
Air lock pins	2

**Grease sliding suspension and stinger tail daily.*

3.4 Hydraulic Oil

Check color of oil for possible contamination. If oil appears thick or dirty, drain system and refill. Clean and/or replace custom filter (optional). Change oil Three times a year.

When adding or replacing oil, use hydraulic oil that contains an anti-foamant, rust and oxidation inhibitor, and an antiwear additive. DO NOT use low viscosity naphtha base motor oil, hydraulic brake fluid, or aircraft hydraulic fluid.

WARNING: WHEN REPLACING OR ADDING Oil. BE VERY CAREFUL THAT FOREIGN MATTER IS KEPT OUT OF THE SYSTEM.

NOTE: For cold weather operation below 20 Degrees Fahrenheit, contact local oil distributor for proper low temperature oil.

All internal cylinder parts are lubricated by hydraulic oil in the circuit. Particular attention must be paid to the condition and level of the oil in the circuit. Dirty oil is one of the main causes of hydraulic component failure resulting in expensive downtime. Dirty oil is detectable; a sample on a dipstick will show its condition. Take the sample and put a drop on a blotter cloth or paper, any revealed residue means dirty oil. To replace the oil supply, drain and flush the entire system and clean or replace any filter screens. Fill the system with new oil suitable and recommended for use in circuits involving Ace Equipment Sales Inc. cylinders with the following specifications. These suggestions are intended as a guide only. When purchasing hydraulic oil, show these specifications to your oil supplier for final oil recommendations.

General Recommendations:

Oil should be checked daily, added to if needed and changed on a regular schedule along with filters and filter screens in accordance with the manufacturer's recommendations. Hydraulic system should be flushed periodically. Oil poured into the reservoir should pass through a 10 micron element. Pour only clean oil from clean containers into the reservoir. Reservoir capacity should equal, in gallons, the pump output in G.P.M. or the total G.P.M. of all pumps where there is more than one in the system. Oil operating temperature should not exceed 200°F (93°C) with a maximum of 180°F (82°C) usually recommended. 120°F (50°C) to 140°F (60°C) is usually considered optimum. High temperatures result in rapid oil deterioration and may indicate the system requires an oil cooler or larger reservoir. The closer to the optimum temperature, the longer the service life of the oil and the hydraulic components. Don't pollute. Conserve resources and return used oil to a collection center.

Viscosity Recommendations:

Approximately 100 SSU is considered optimum operating viscosity.

50 SSU Minimum @ Operating Temperature
7500 SSU Maximum @ Starting Temperature
150 to 225 SSU @ 100°F (37.8°C) (Generally)
44 to 48 SSU @ 210°F (98.9°C) (Generally)

• Approximate SSU at...

Oil Grade 100° F

(37.8° C)

210° F

(98.9° C)

SAE 10 150 43

SAE 20 330 51

Normal Temperature:

0°F (-18°C) to 100°F (37.8°C) Ambient

100°F (37.8°C) to 180°F (82.2°C) System

Note: Where sustained temperatures exceed the above, use an oil suitable to the ambient temperature of your region. For a suitable replacement, consult your oil supplier.

Other Desirable Properties and Characteristics:

Viscosity Index - 90 minimum.

Aniline Point - 175 minimum.

Stability of physical and chemical characteristics. High demulsibility (low emulsibility) for separation of water, contaminants and air. Resistant to the formation of gums, sludges, acids, tars and varnishes. High lubricity and film strength.

Notice

Never use a detergent oil, crank case drainings, kerosene, fuel oil, or any non-lubricating fluid (such as water) in the hydraulic system.

3.4.1 Draining Hydraulic System

The easiest and most effective way to drain the hydraulic system is to simply disconnect all hoses at their adapters and allow oil to drain into suitable containers.

Work controls through all positions in order to thoroughly drain the control valves.

After system has been drained, remove flange on side of tank. Flush out inside of tank with kerosene. Remove and clean suction filter and/or replace.

Reconnect all hoses at their adapters; replace flange and filter; refill tank with proper type oil to within 6 inches from the top with cylinders retracted. (West kit uses about 35 gallons, 50 gallons for ART-60-BT.)

With all controls in NEUTRAL, start hydraulic system and operate all cylinders at least three (3) cycles to remove all air from the lines. Check oil level and add if required.

WARNING!

Rollover or lateral tilt can cause severe injury or death and/or damage to the unit and cylinder.

The hydraulic cylinder will not prevent the dump body or trailer from rollover or lateral tilt. The cylinder is strictly a lifting device and is not a structural member of the unit. Cylinders are not to be used as a means of stabilizing the unit. The hydraulic cylinder mounted in the unit should be free to find its own trajectory line of extension, free of any lateral loading of the plungers. Misalignment of the top or bottom mountings, or mounting pins too tight, may cause scoring of the plungers, leaking, or improper sequencing which could cause the unit to upset. The hydraulic cylinder will not withstand lateral pressure when the unit is leaning. Only activate the cylinder when the tractor and trailer are in a straight line (not jack-knifed). Do not activate the cylinder while on unlevel or soft ground, or during heavy crosswinds. Doing so may cause the unit to upset. Do not activate the cylinder while personnel or equipment are alongside or behind the dump body or trailer.

The operator should stay at the controls during the entire dumping operation. If the body starts to lean, the operator should immediately lower the dump body or trailer. It is important to slowly position the cylinder control valve into the hold position to avoid subjecting the cylinder to high pressure. Do not overload the unit. The load must be distributed evenly during loading or unloading to avoid rollover and lateral tilt. Loads stuck while the cylinder is partially or completely extended increases the hazard of rollover and lateral tilt. Lower the dump body or trailer entirely with the cylinder control valve partially open (avoid lowering the dump body or trailer with the cylinder control valve completely open). Then unload the dump body or trailer manually or with an alternative mechanical aid.

WARNING!

Shock pressure can cause severe injury or death and/or damage to the unit and cylinder.

Do not use the cylinder to loosen loads stuck in the dump body or trailer. Lower the dump body or trailer entirely with the cylinder control valve partially open (avoid lowering the dump body or trailer with the cylinder control valve completely open). Then unload the dump body or trailer manually or with an alternative mechanical aid. Do not move the truck and jam the brakes while the cylinder is partially or fully extended to loosen loads stuck in the dump body or trailer.

Lower the dump body or trailer entirely with the cylinder control valve partially open (avoid lowering the dump body or trailer with the cylinder control valve completely open). Then unload the dump body or trailer manually or with an alternative mechanical aid. Do not move the truck until the dump body or trailer is lowered completely.

WARNING!

Over pressurizing the cylinder can cause severe injury or death and/or damage to the unit and cylinder.

Do not operate the cylinder at pressures greater than 2,000 P.S.I. unless otherwise approved in Ace Equipment Sales, Inc.

WARNING!

Worn or damaged hydraulic hoses can cause severe injury or death and/or damage to the unit and cylinder.

Hydraulic hoses should be checked regularly and replaced if worn out or damaged.

NOTICE!

Do not drive the unit while the P.T.O. or hydraulic pump is engaged. The hydraulic oil should be checked and changed regularly to avoid contamination leading to internal cylinder damage. A damp to light film of oil on each plunger indicates a good cylinder operation. A small accumulation of oil may be noticed on the plunger at the head nuts after many cycles. This should not be mistaken for packing leakage. It is advisable to bleed air from the cylinder weekly to free entrapped air. This will result in a smoother operation. Grease the pin mountings regularly.

3.5 Corrective Maintenance (Trouble Shooting)

The operation of any mechanical, hydraulic or electrical system depends on the care given to the various parts. This section is a general guide to the causes of equipment failure.

3.5.1 Safety

Respect the potential danger of the equipment.

3.5.2 Trouble Chart

To aid maintenance personnel in locating and correcting a problem, a trouble chart has been included.

Symptom	Likely Problem	Remedy
Failure to slide	Air bags deflated	Inflate bags
	Unit misaligned	Straighten suspension
	Airlock inlock	Check airline trailer brake off
	Obstruction	Remove item
	Pins will not move	Release pins, move trailer

forward

Airbags won't inflate	No air Loose Line Levelers in up position	Fill air tank Fix line Adjust lever rods
Won't dump air	Pilot valve closed Air leak	Check valve Fix air line
Failure to lift cylinder	No Oil Blown packing Busted line Pinched line Not enough pressure	Check Oil Replace packing Replace line Relocate hose Adjust pressure Check pump
Control valve not working	Not full stroke Not enough oil	Check controls Fill oil
Winch one speed	Selector not working	Check selector
Won't lift	No pressure	Check pressure Check oil Check pump

PARTS INFORMATION

TO THE OWNER

If you need information not given in this manual or require the service of a trained mechanic, we urge you to use the extensive facilities offered by the authorized Ace Distributor in your locality.

INSTRUCTIONS FOR ORDERING REPLACEMENT PARTS

For ease in ordering of Ace parts, a system of part and assembly numbers is used. It's important these numbers be used whenever and wherever possible.

All parts listed on the drawings, repair parts sheets or exploded views show parts in their proper relationship. Each individual part is identified by name and part number.

.-Use the following suggestions and you should have little difficulty in getting quick and efficient parts delivery.

IMPORTANT

- 1) Give model, serial and identification numbers found on the Identification Plate of the unit. Be sure numbers are complete and include any prefix or suffix.
- 2) Order by part number only, NOT by item number.
- 3) Check every part number for accuracy. The part numbers can be very similar and can be easily transposed.
- 4) Be careful to order the correct quantity.
- 5) When ordering an assembly, make sure all the parts you need are included in the assembly.
- 6) Common hardware is not listed.
- 7) Say whether shipment is to be made express, parcel post or freight. Give freight shipping point if different from mailing point.
- 8) ORDER PARTS from your nearest ACE Distributor.

*****Note*****

Any and all warranty issues requesting parts or service **Must** be approved in writing for warranty consideration. If warranty is granted, Part and service will be shipped C.O.D. Damaged parts must be returned within 30 days for credit to be issued. If Part is not returned within 30 days, Ace has the right to reject any unreturned part, and customer is responsible for invoice.

All pricing and specifications are subject to change without notice; the right is reserved by company to substitute material and modifications to specifications without prior notification. Please Contact Ace's parts and service regarding any questions parts, price, and service

Brothers Equipment Inc.

1335 East 171 Street
Cleveland, OH 44110
(216) 458-0180
(216) 458-0330 Fax
(800) 578-8471

www.theACEadvantage.com

Email sales@theACEadvantage.com

! CAUTION

**AIRBAGS MUST
BE DEFLATED WHEN
RAISING TRAILER**

! WARNING

Read ANSI 2245.1 1399 15.25 SI
**OPERATOR MUST REMAIN AT CONTROLS
WHEN OPERATING. DO NOT OPERATE
CONTROLS UNTIL ALL PERSONS ARE
CLEAR OF POINT OF OPERATION AREA(S).**

**FAILURE TO FOLLOW THESE INSTRUCTIONS CAN
CAUSE PERSONAL INJURY TO SELF OR OTHERS.**

! WARNING

**DO NOT OPERATE OR SERVICE THIS
MACHINE UNTIL YOU HAVE READ AND
UNDERSTAND THE OPERATIONS MANUAL
SUPPLIED WITH THIS EQUIPMENT.
MANUALS CAN ALSO BE OBTAINED
FROM BROTHERS EQUIPMENT INC.**

! WARNING

**RETURN LINE MUST BE PROPERLY
CONNECTED BEFORE OPERATION.
DO NOT USE LESS THAN 1-1/4
RETURN LINE HOSE. DO NOT
USE QUICK CONNECT FITTINGS.
ONLY USE MINIMUM 1-1/4
WING NUT CONNECTORS**

! CAUTION

**STAND CLEAR
WHEN CONTAINER
IS BEING LIFTED**

! CAUTION

**AIR LOCK MUST
BE IN BEFORE YOU
SLIDE THE
SUSPENSION**

! DANGER

**Hand Hazard.
Watch your
fingers and
hand.**

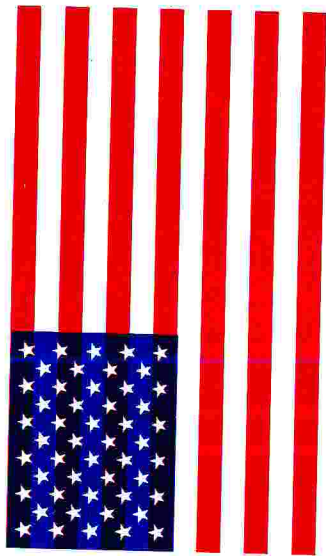


! DANGER

**KEEP AWAY FROM
MOVING PARTS:
DEATH OR
DISMEMBERMENT
MAY OCCUR**



MADE IN USA



**OVER 80 YEARS OF
DEDICATED SERVICE**

! WARNING

**DO NOT OPERATE MALFUNCTIONING EQUIPMENT.
REPLACE UNREADABLE SAFETY DECALS.
READ AND UNDERSTAND THE OPERATOR MANUAL
FAILURE TO OPERATE AS INSTRUCTED COULD
RESULT IN DEATH OR SERIOUS INJURY TO
OPERATOR, HELPERS AND/OR BYSTANDERS.**

! WARNING

**HYDRAULIC
OIL ONLY**

! WARNING

**DO NOT DRIVE OR
OPERATE MACHINERY
OR EQUIPMENT WHEN
INTOXICATED OR UNDER
THE INFLUENCE OF DRUGS.**

 **WARNING**

SAFETY ALERT! (1) FOLLOW ALL TORQUE REQUIREMENTS. (2) DO NOT USE ANY COMPONENT WITH VISIBLY WORN OR DAMAGED THREADS. FAILURE TO FOLLOW THESE SAFETY ALERTS CAN LEAD TO LOSS OF VEHICLE CONTROL, PROPERTY DAMAGE, SERIOUS PERSONAL INJURY OR DEATH.

**Hutchens Suspension Torque Requirements
9600-9700 Series (Decal Part Number 16086-01 Rev. J)**

After an initial break in period, approximately 1000 miles, and at least every 4 months periodically thereafter, ALL bolts and nuts should be checked to insure that recommended torque values are being maintained.

Oiled torque values listed are for new fasteners with lubricated threads. It is recommended that new installations be performed with oiled fasteners. For dry threads which have been in service, use the higher torque values which are noted below.

	OILED	DRY
1 1/8-7 (9600 / 9700 Rocker Bolt)	590 lb-ft	790 lb-ft
1-14 or 1-8 (9700 Radius Rod Bolt)	540 lb-ft	720 lb-ft
7/8-14 (Axle U-Bolts & 9600 Radius Rod Bolt)	350 lb-ft	470 lb-ft
3/4-16 (Axle U-Bolts)	310 lb-ft	420 lb-ft
5/8-18 (Radius Rod Clamp Bolt)	130 lb-ft	170 lb-ft
5/8-18 (Spring Retainer Bolt)	35 lb-ft	50 lb-ft



Hutchens Industries, Inc., P.O. Box 1427, Springfield, Missouri 65801-1427 Toll Free 1 (800) 654-8824



**RIDEWELL
SUSPENSIONS**

**MONOPIVOT 240 BOLT TORQUE
MINIMUM SPECIFICATIONS**

ECCENTRIC PIVOT BOLT	1,000 FT. LBS.	(1,350 N•m)
SHOCK BOLT	200 FT. LBS.	(270 N•m)
AIR SPRING CONNECTION-3/4"	50 FT. LBS.	(70 N•m)
AIR SPRING CONNECTION-1/2"	25 FT. LBS.	(35 N•m)

After suspension has been in operation for approximately 6,000 miles (10,000 km), all fasteners must be re-tightened to specified torque. Repeat every 50,000 miles (80,000 km). DO NOT OVER TORQUE!

See Service Manual for Details

#1990017 - Rev. A

⚠ WARNING
DO NOT DRIVE OR OPERATE MACHINERY OR EQUIPMENT WHEN INTOXICATED OR UNDER THE INFLUENCE OF DRUGS.

⚠ WARNING
DO NOT OPERATE MALFUNCTIONING EQUIPMENT.
REPLACE UNREADABLE SAFETY DECALS.
READ AND UNDERSTAND THE OPERATOR MANUAL
FAILURE TO OPERATE AS INSTRUCTED COULD RESULT IN DEATH OR SERIOUS INJURY TO OPERATOR, HELPERS AND/OR BYSTANDERS.

WARNING
WINCH MUST HAVE A MINIMUM OF 5 WRAPS AT ALL TIMES

NOTICE
AXLES MUST BE FORWARD WHEN LIFTING OR DUMPING

⚠ CAUTION
LIFT AXLE **MUST** BE DOWN WHEN SUSPENSION IS SLID BACK WITH LOADED CONTAINER

⚠ WARNING
RETURN LINE MUST BE PROPERLY CONNECTED BEFORE OPERATION. DO NOT USE LESS THAN 1-1/4" RETURN LINE HOSE. DO NOT USE QUICK CONNECT FITTINGS. ONLY USE MINIMUM 1-1/4" WING NUT CONNECTORS

⚠ WARNING
Read ANSI Z245.1 1999 (8.2.5.3)
OPERATOR MUST REMAIN AT CONTROLS WHEN OPERATING. DO NOT OPERATE CONTROLS UNTIL ALL PERSONS ARE CLEAR OF POINT OF OPERATION AREA(S).
Failure to follow these instructions can cause personal injury to self or others.

NOTICE:
If the ABS indicator lamp comes on *and* stays on when you apply the brakes to a *moving* vehicle, the trailer ABS is not working properly. The ABS must be serviced as soon as possible upon completion of your trip to ensure full anti-lock braking capability.
1P-95172 MERITOR WABCO Rev. 7/01

⚠ CAUTION
DO NOT LOAD, DUMP, OR RAISE TRAILER WHEN SUSPENSION IS SLID BACK

⚠ CAUTION
AIR LOCK MUST BE IN BEFORE YOU SLIDE THE SUSPENSION

! WARNING

KEEP ACCESS DOOR CLOSED WHEN IN OPERATION; STOP ENGINE AND REMOVE IGNITION KEY. LOCKOUT/TAGOUT REQUIRED BEFORE ENTERING.

! DANGER



**PINCH POINT
STAND CLEAR WHEN
PACKER PANEL IS
IN MOTION**

WARNING

DO NOT OPERATE OR SERVICE THIS MACHINE UNTIL YOU HAVE READ AND UNDERSTAND THE OPERATIONS MANUAL SUPPLIED WITH THIS EQUIPMENT. MANUALS CAN ALSO BE OBTAINED FROM ACE TRUCK BODY INC.

! DANGER



**KEEP AWAY FROM
MOVING PARTS:
DEATH OR
DISMEMBERMENT
MAY OCCUR**

! DANGER

**DO NOT CLIMB
ON OR AROUND
EQUIPMENT WHILE
IN OPERATION.**

**! CAUTION
MAXIMUM
VEHICLE HEIGHT
_____**

112131411234567890

! DANGER



! DANGER



**Hand Hazard.
Watch your
fingers and hand.**





Minimum Requirements for Wet line kit for ART-60-40 Ace Rolloff Trailer

**Pump 50 to 60 GPM @ 1300rpms
70 Gallon Oil Tank with sight gauge
Inline pressure relief return back to tank set @ 2,500psi
1" Pressure 2500psi 1" NPT 10ft
1" Wing nut quick couples series 6100
1-1/4 Return line hose 1-1/4" NPT 10ft direct to tank
1-1/4" wing type quick couples**

Trailer has 1" female pipe couple for pressure / 1-1/4" female pipe coupler return

Ace Recommends separate pump and valve combination

Example:

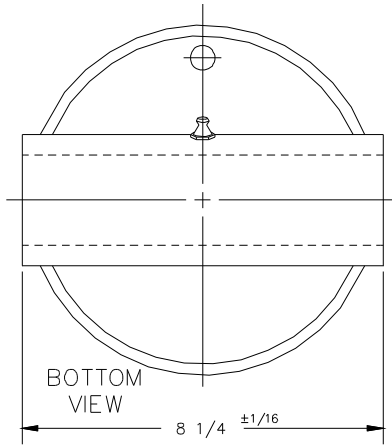
**P-51 Commercial Pump 50 GPM
Commercial DVG-35 Single Spool Valve with relief
This will supply for Rolloff and dump trailer if needed**

IMPORTANT

The return line should not have any restriction in the line of flow going back to tank

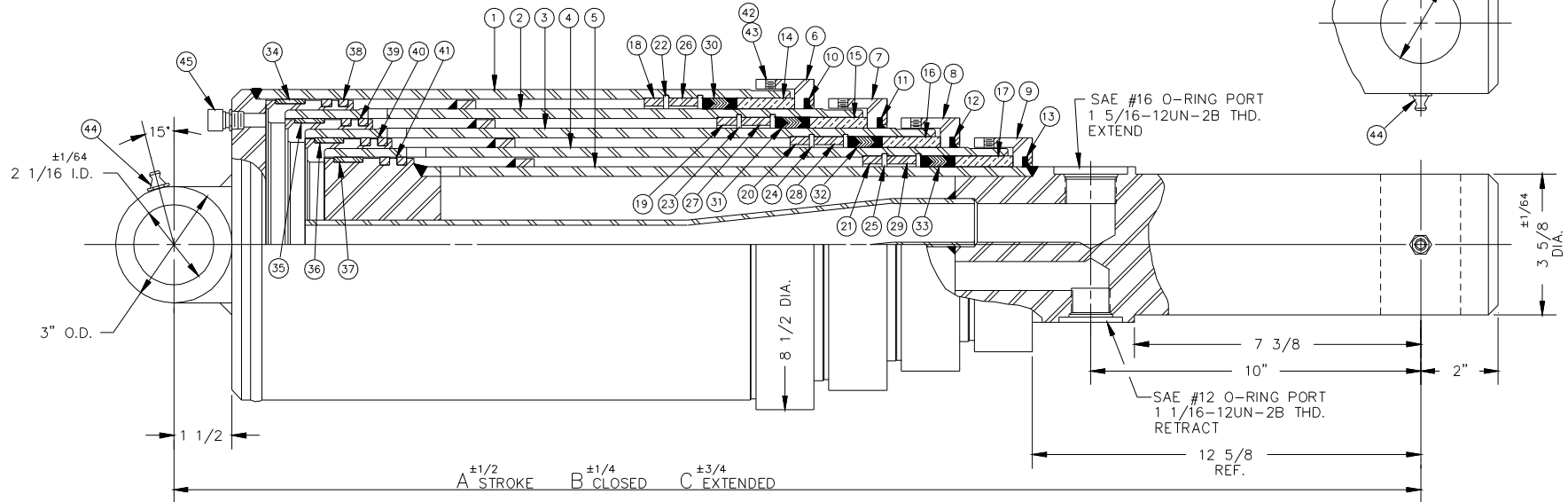
CYL NO.	A	B	C	ITEM #1 CYL. TUBE ASSY.	ITEM #2 1 ST PLUN. ASSY.	ITEM #3 2 ND PLUN. ASSY.	ITEM #4 3 RD PLUN. ASSY.	ITEM #5 LAST PLUN. ASSY.
DAT74-61-84	83 3/4	48 3/8	132 1/8	2CTA7-206-29 1/2	2PA7-20-29	2PA6-20-30 3/8	2PA5-22-31 3/4	2LPA4-452-44 1/2
DAT74-61-117	117 1/4	56 3/4	174	2CTA7-206-37 7/8	2PA7-20-37 3/8	2PA6-20-38 3/4	2PA5-22-40 1/8	2LPA4-452-52 7/8
DAT74-61-133	133 1/4	60 3/4	194	2CTA7-206-41 7/8	2PA7-20-41 3/8	2PA6-20-42 3/4	2PA5-22-44 1/8	2LPA4-452-56 7/8

CYL NO.	GAL. OF OIL		
	FILL	EXT.	RET.
DAT74-61-84	2.9	8.9	1.6
DAT74-61-117	4.1	12.4	2.2
DAT74-61-133	4.7	14.1	2.6



DAT SK-74 SEAL KIT
ITEMS: 10,11,12,13,30,31,32,33,42,43
DAT MPK-74B MINOR PACKING KIT
ITEMS: 14,15,16,17,DAT SK-74
DAT MRK-74B MAJOR REPAIR KIT
ITEMS: 18,19,20,21,22,23,24,25,26,27,28,29,
34,35,36,37,38,39,40,41,DAT MPK-74B

ITEM	PART NO.	DESCRIPTION	REQD	ITEM	PART NO.	DESCRIPTION	REQD
6	3-HN-1-8	HEAD NUT	1	26	2-SP-1-7	SPACER	1
7	3-HN-1-7	"	1	27	2-SP-1-6	"	1
8	3-HN-1-6	"	1	28	2-SP-1-5	"	1
9	3-HN-1-5	"	1	29	2-SP-1-4	"	1
10	1-WR-1-7	WIPER RING	1	30	1-PK-1-7	PACKING KIT	1
11	1-WR-1-6	"	1	31	1-PK-1-6	"	1
12	1-WR-1-5	"	1	32	1-PK-1-5	"	1
13	1-WR-1-4	"	1	33	1-PK-1-4	"	1
14	1-BU-3-7	BUSHING	1	34	2-WG-1-7	WEAR RING	1
15	1-BU-3-6	"	1	35	2-WG-1-6	"	1
16	1-BU-3-5	"	1	36	2-WG-1-5	"	1
17	1-BU-3-4	"	1	37	2-WG-1-4	"	1
18	2-PS-1-7	PLUNGER STOP	1	38	2-PR-3-7 1/2	PISTON RING	2
19	2-PS-1-6	"	1	39	2-PR-3-6 1/2	"	2
20	2-PS-1-5	"	1	40	2-PR-3-5 1/2	"	2
21	2-PS-1-4	"	1	41	2-PR-3-4 1/2	"	2
22	1-RR-1-7 1/2	RETAINER RING	2	42	1-SS-3-1	SET SCREW	4
23	1-RR-1-6 1/2	"	2	43	1-SL-2-1	SLUG (NYLON)	4
24	1-RR-1-5 1/2	"	2	44	1-GF-1-1	GREASE FITTING	2
25	1-RR-1-4 1/2	"	2	45	1-MBVA-2	BLEEDER SCREW	1



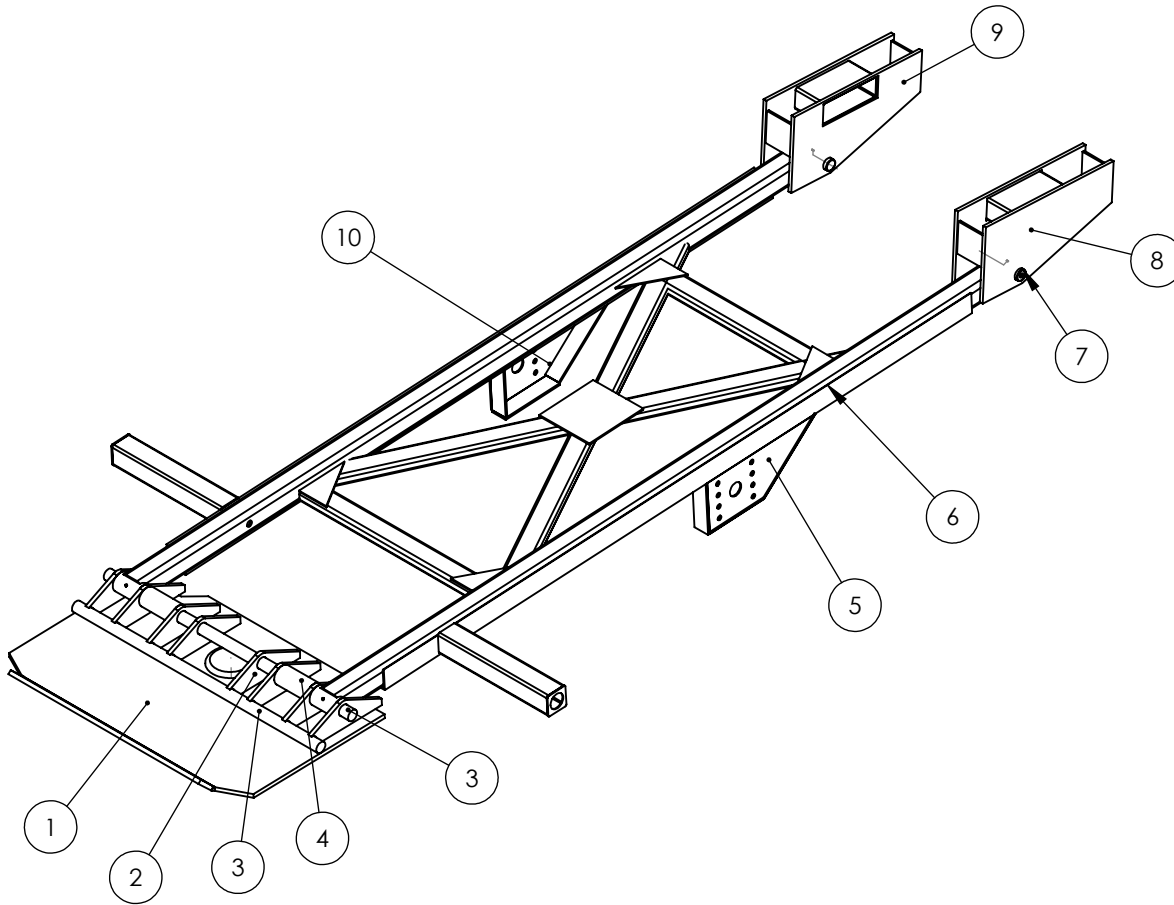
CYL. TUBE	O.D.	I.D.
8 1/8	7 1/2	
1 ST PLUN.	7"	6 1/2
2 ND PLUN.	6"	5 1/2
3 RD PLUN.	5"	4 1/2
LAST PLUN.	4"	3 1/2

RECOMMENDED MAX. FLOW - 50 GPM
RECOMMENDED MIN. FLOW - 15 GPM
TEST PER CHTS-3

WELDED DESIGN DAT74-71-

TITLE: DOUBLE ACTING TELESCOPIC CYLINDER			
CUSTOM HOISTS INC.			
P.O. BOX 98 HAYESVILLE, OHIO 44838			
DR.: MAH		MAX. OPERATING PRESSURE 200PSI	
DATE: 5-12-92		STATIC TEST PRESSURE 250PSI	
A ECN 1288		6-7-93 RBG	
SYM REVISION		DATE BY	
		DWG. NO.: DAT74-61-	
		REV. NO.:	

Stabilizer Frame Assembly



Item	Part	Description
1	17-3011	Fifth Wheel Plate
2	17-3016	Guide Plate
3	48-3008	Main Pin
4	40-3007	Collar
5	9-1005	Landing Gear Assy P-S
6	9-3011	Stabilizer Frame **
7	48-3009	Hinge Pin
8	9-3012-2	D-Plate Stabilizer assembly Right (D-S)
9	9-3012-1	D-Plate Stabilizer assembly Left (P-S)
10	9-1006	Landing Gear Assy D-S

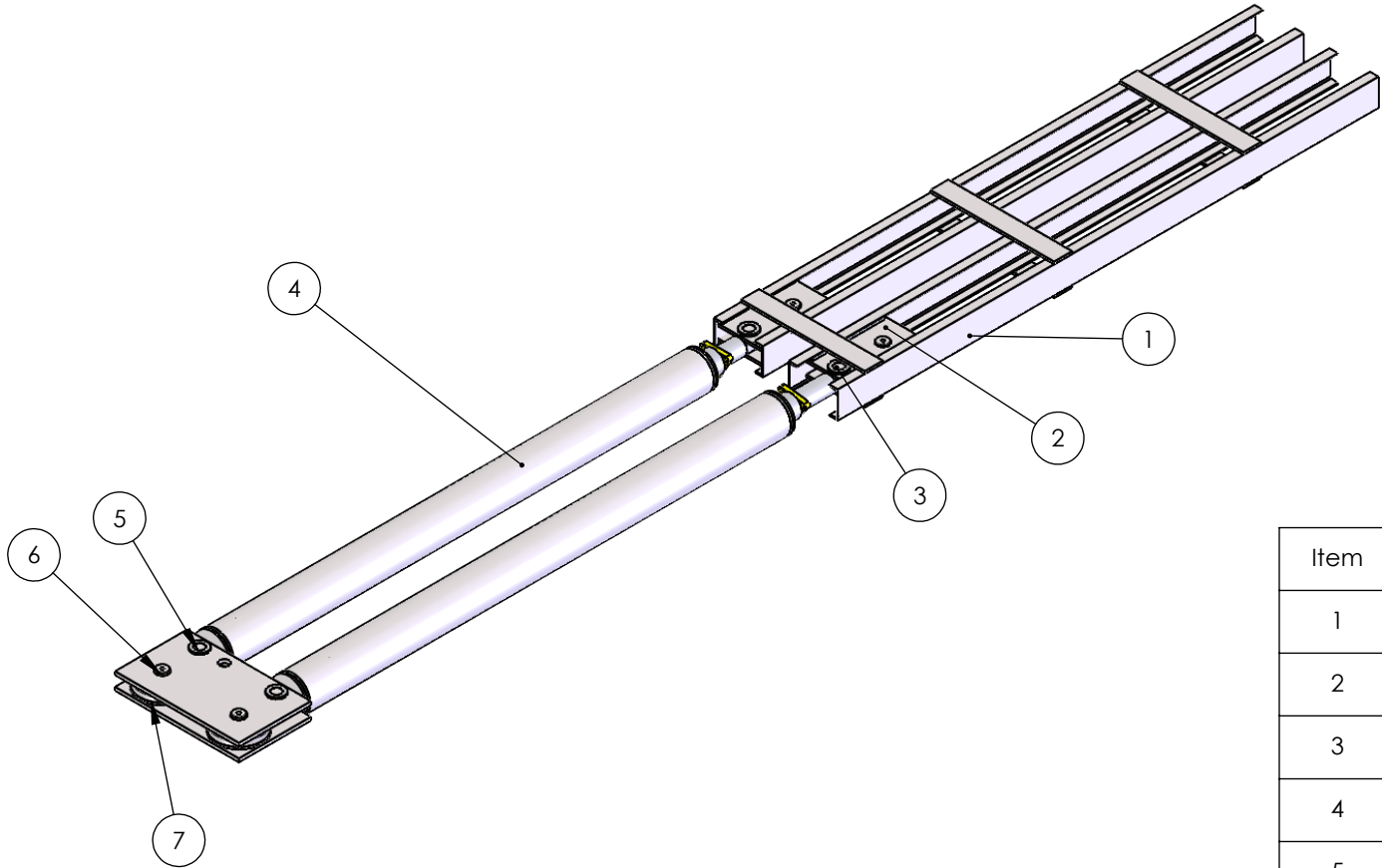
** Specify Trailer length and model number

The information contained in this drawing is for illustrated purpose only, Brothers Equipment reserves the right to make changes at any time without notice.



Brothers Equipment Inc.
 1335 East 171st Street, Cleveland, Oh. 44110
 800-578-8471 www.brosequip.com

Reeving Cylinder Assy



Item	Part Number	Description
1		Reeving Cage
2	350-3001	Pulley Blocks
3	48-3010	Pulley Block Pin
4	1-3007	Reeving Cylinder **
5	48-3011	Cylinder Pin
6	48-3004	Pulley Pin
7	72-3020	10" Pulley

** Specify length and model of trailer

The information contained in this drawing is for illustrated purpose only, Brothers Equipment reserves the right to make changes at any time without notice.

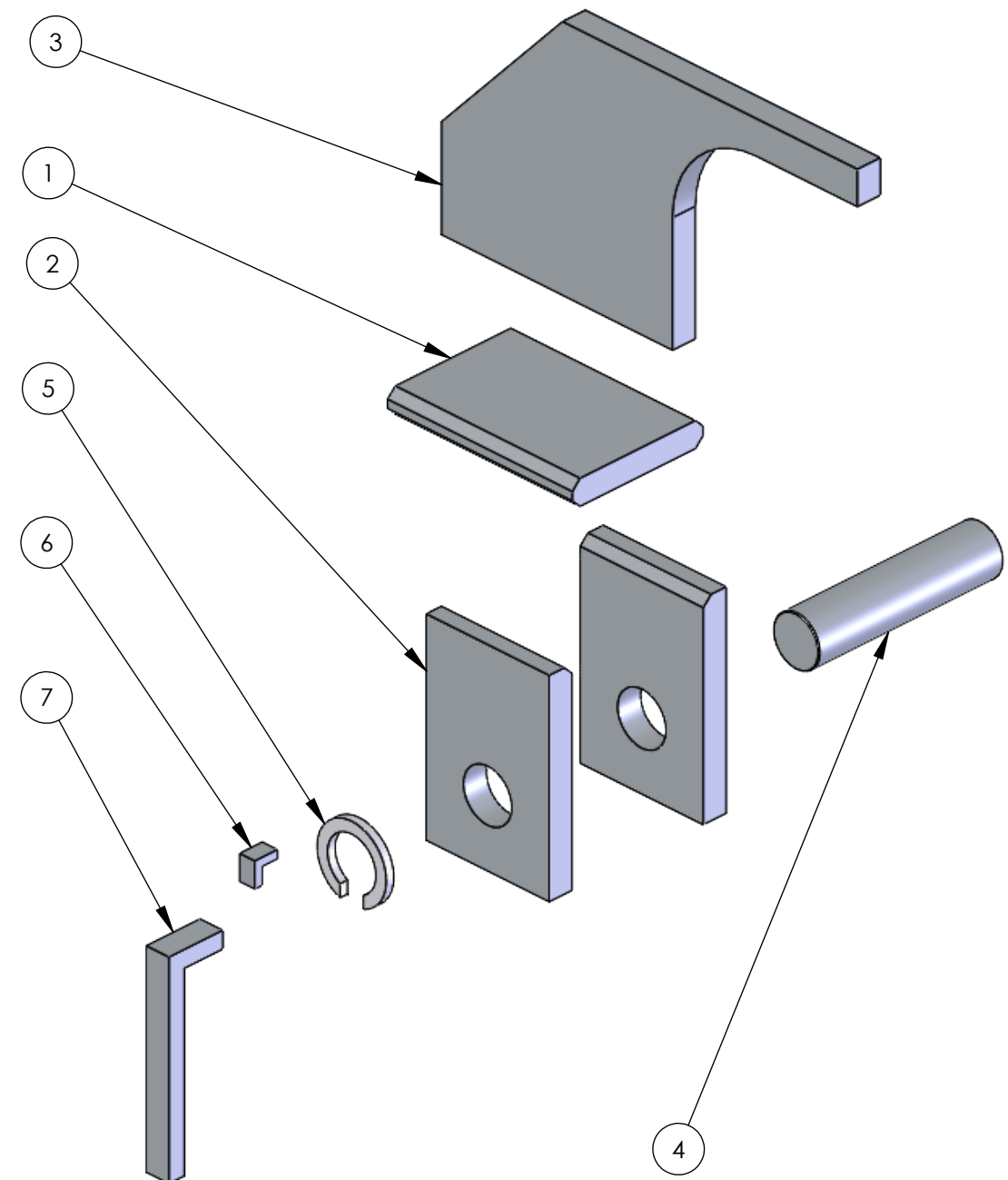
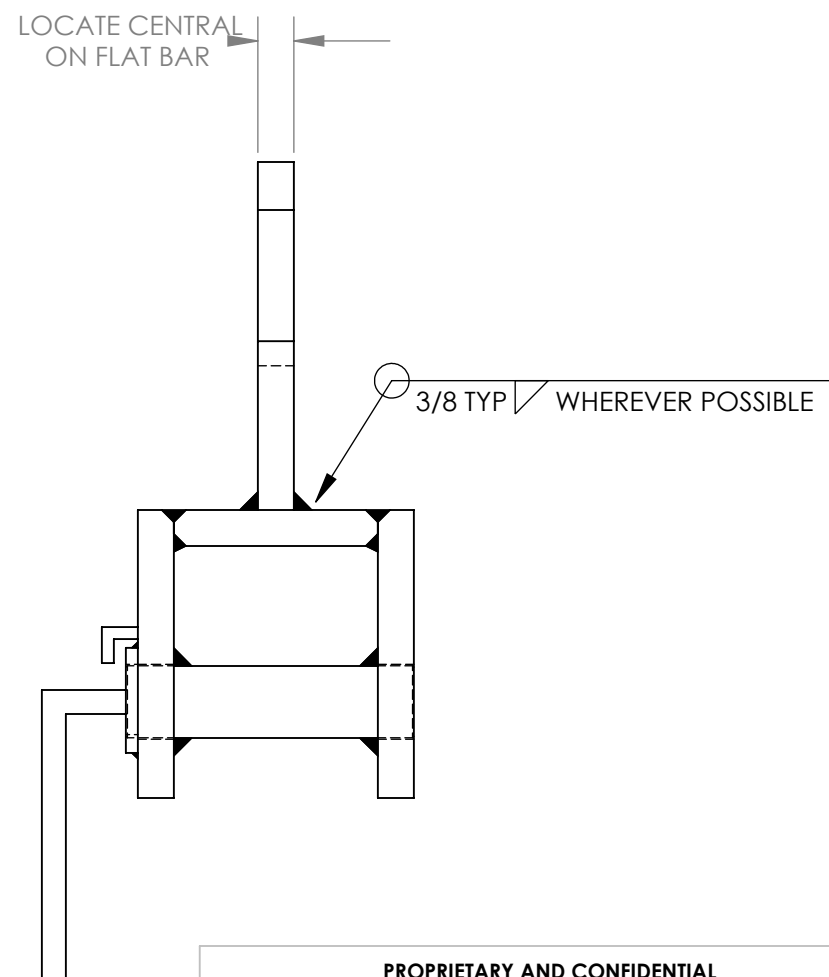
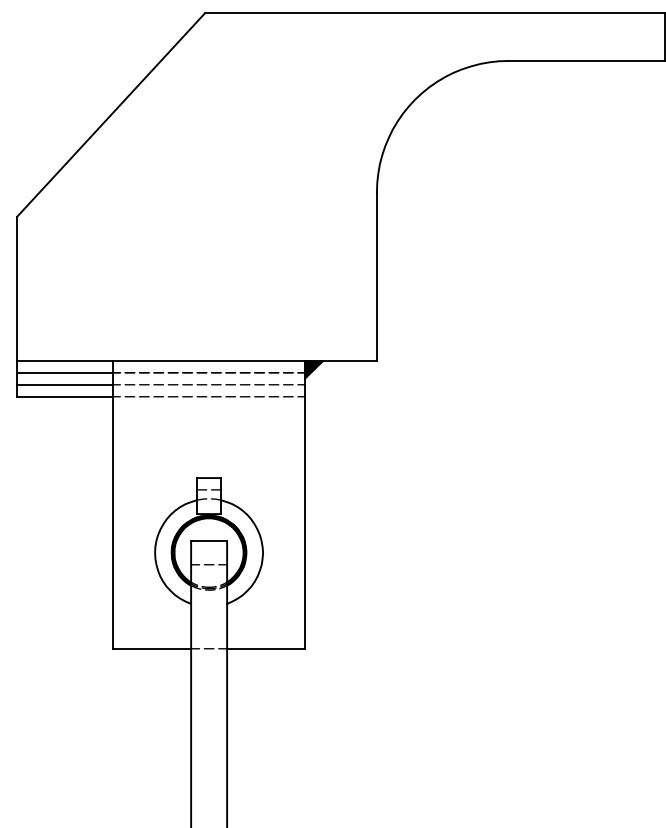
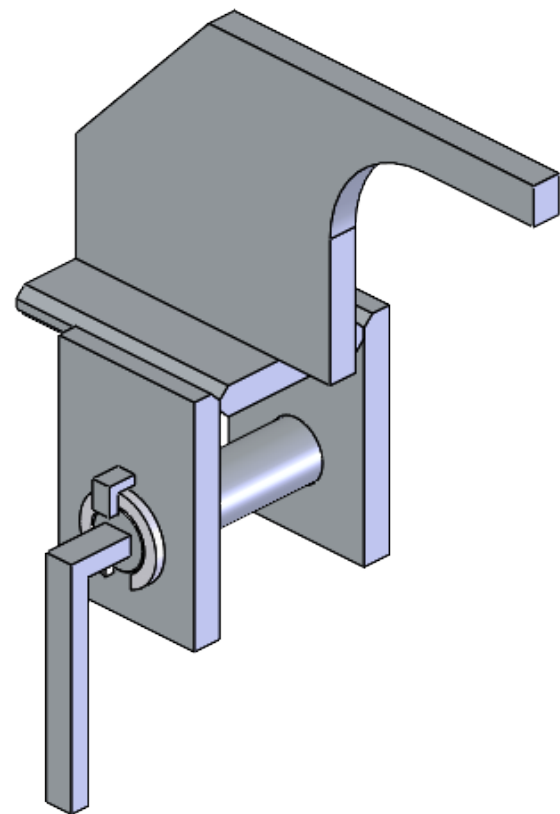


Brothers Equipment Inc.

1335 East 171st Street, Cleveland, Oh. 44110
 800-578-8471 www.brosequip.com

80-3004-1

ITEM NO.	QTY.	FILENAME	PART NO.	DESCRIPTION	MATERIAL	WT/PER UNIT
1	1	Flat Bar, 4.00 x .75	17-1003	6.00 Lg	Plain Carbon Steel	5
2	2	Flat Bar, 4.00 x .75	17-3010	6.00 Lg	Plain Carbon Steel	5
3	1	Front Stop	80-3003	3/4 Container Front Stop	Plain Carbon Steel	11
4	1	Round Bar, 1.50 Dia	71-1001	6.00 Lg	Plain Carbon Steel	3
5	1	Collar Stop, 2.25 OD x 1.56 ID	80-3005	End Stop with Cut Out	Plain Carbon Steel	0
6	1	Angle Burnout	53-3003	Angle Lock, Moveable Stop, .50 Wd	Plain Carbon Steel	0
7	1	Angle Burnout	70-3001	Handle, Moveable Stop, .75 Wd	Plain Carbon Steel	1



PROPRIETARY AND CONFIDENTIAL
 THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF ACE EQUIPMENT SALES INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF ACE EQUIPMENTSALES INC. IS PROHIBITED.

TOLERANCES:
 FRACTIONS: ± 1/16
 ANGLES: ± 1°
 .XX: ± .015
 .XXX: ± .005

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES



CAD FILE
 MATERIAL
 WEIGHT
 DRAWN

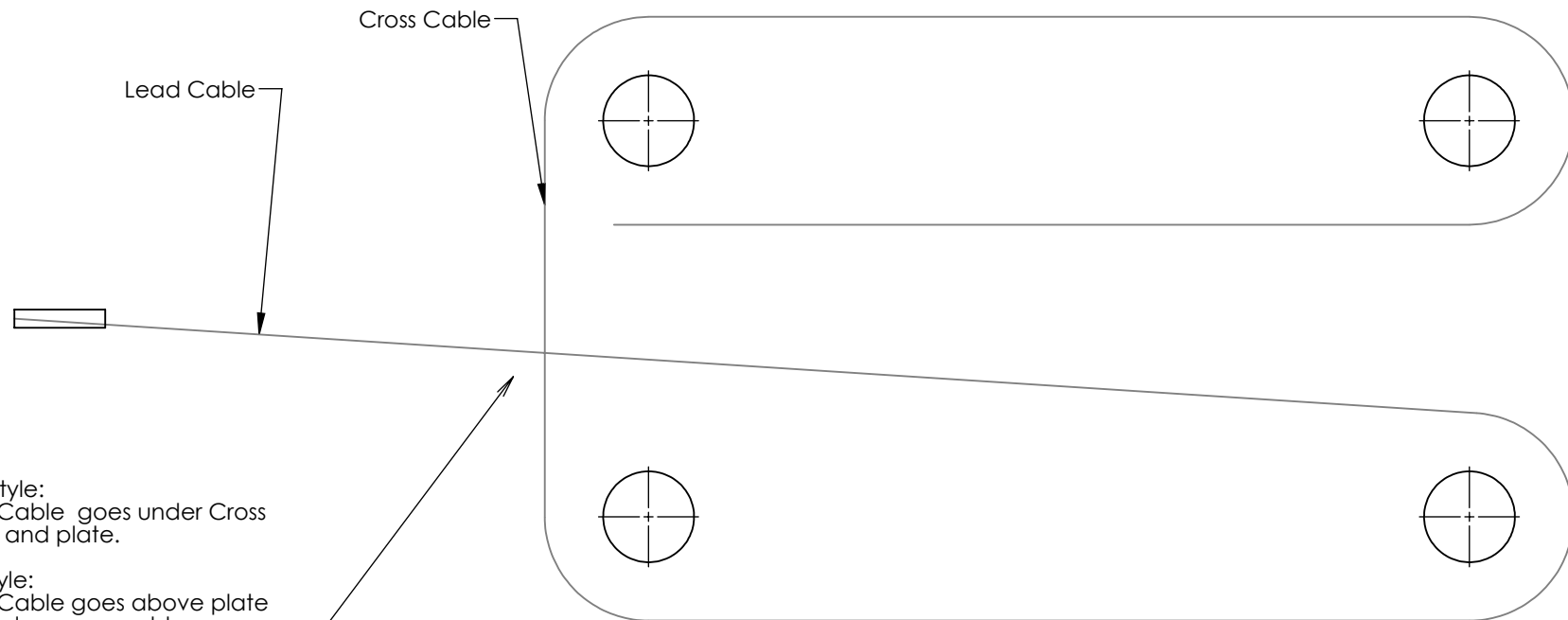
Movable Stop Assy
 See Details
 30 lb.
 LK

1/28/2021

ACE Equipment Sales Cleveland, OH
 www.aceequipmentsales.com

NAME **Movable Stop Assy**
 DESC. **Movable Stop Right (d-s)**
 PART NO. **80-3004-1**
 SIZE **T** SCALE 1:4 SHEET 1 OF 1 REV **A**

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED



Note
 New style:
 Lead Cable goes under Cross
 cable and plate.

Old style:
 Lead Cable goes above plate
 and below cross cable

7/8 Cable Length
 ART-60-40 125ft
 ART-60-32 115ft
 ART-60-25 95ft

ACE Equipment Sales Cleveland, OH
www.aceequipmentsales.com

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TOLERANCES
 FRACTIONS: ± 1/16
 ANGLES: ± 1°
 .XX: ± .015
 .XXX: ± .005

UNLESS OTHERWISE
 SPECIFIED DIMENSIONS
 ARE IN INCHES



CAD FILE	cable routing
MATERIAL	
WEIGHT	lb.
DRAWN	LK

General Cable Routing ART-60			
PART NO.			
8/21/2007	SIZE A	SCALE 1:48	SHEET 1 OF 1
REV	A		



HUTCHENS SUSPENSION WARRANTY

WARRANTY COVERAGE

Hutchens Industries, Inc. ("Hutchens") warrants, except with respect to leaf springs and pneumatic components, to the first purchaser only, that parts, suspension components and units sold by Hutchens will be free from defects in material and workmanship under normal and intended usage and service and proper operation for a period of five (5) years from the date of shipment. With respect to leaf springs and pneumatic components, Hutchens shall have no liability or duty except to assign to the Buyer any claim which Hutchens may have against the manufacturer thereof. **THIS WARRANTY SHALL NOT APPLY AND NO WARRANTY OF ANY KIND SHALL EXIST AS TO ANY PRODUCT WHICH HAS BEEN SUBJECT TO ABUSE, MISUSE, NEGLIGENCE OR ACCIDENT OF ANY TYPE OR CAUSE OR WHICH HAS BEEN REPAIRED, REPLACED, SUBSTITUTED OR USED WITH PARTS OTHER THAN GENUINE PARTS OF HUTCHENS OR ALTERED BY ANYONE.** In addition, Hutchens is not responsible for and shall have no liability with respect to damages resulting from improper installation or operations beyond design capability. Hutchens, in its sole discretion, shall determine whether or not any Product is defective or otherwise covered or not covered by this Warranty. No action for breach of this Warranty may be commenced more than one (1) year after the occurrence of the alleged breach. This Warranty is not transferable.

WARRANTY AND DAMAGE DISCLAIMERS

HUTCHENS SHALL NOT BE LIABLE FOR THE LOSS OF USE OF ANY PRODUCT, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS OR ANY OTHER INDIRECT, CONSEQUENTIAL, SPECIAL, PUNITIVE OR INCIDENTAL DAMAGES OF ANY KIND OR NATURE ARISING FROM A CLAIM UNDER THIS WARRANTY OR ANY OTHER FAILURE TO COMPLY WITH THE TERMS OF THE CONTRACT BETWEEN HUTCHENS AND THE BUYER WHETHER SUCH LIABILITY IS ASSERTED ON THE BASIS OF CONTRACT, TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE, EVEN IF THE BUYER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH LOSS OR DAMAGE. HUTCHENS MAKES NO WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, OTHER THAN AS HEREIN EXPRESSLY PROVIDED, AND HUTCHENS SPECIFICALLY DISCLAIMS AND BUYER EXPRESSLY WAIVES ALL SUCH WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDY

The Buyer's exclusive remedy for breach of Hutchens' warranty is limited to repair or replacement, at Hutchens' sole discretion, of any part not in compliance with Hutchens' warranty. In the event the buyer makes any claim under Hutchens' warranty, Hutchens reserves the right to require any Products to be returned for inspection, at the Buyer's expense, to Hutchens' facility in Springfield, Missouri.



Hutchens Industries

The Difference is Durability. The Quality is Hutchens.

215 North Patterson,
P.O. Box 1427
Springfield, Missouri 65801

Effective June 01, 2011



Warranty Information

Warranty

Custom Hoists, Inc. warrants only products of its manufacture against operational failure caused by defective materials or workmanship which occur during proper and normal use within 24 months from the date of purchase from Custom Hoists, Inc. Custom Hoist, Inc. reserves the right to determine what is proper and normal use.

Packing, wipers, bearings and bushings which are subject to wear caused by internal and external contamination, as well as from normal operating conditions, are not warranty items. Failures initiated by forms of oxidation are also not considered warranty failure.

Custom Hoists shall not, under any circumstances, be liable for labor for removal and installation expenses, loss of time, manufacturing costs, materials, loss of profits, incidental, special or consequential damages, direct or indirect.

Custom Hoists, Inc.'s only obligation is to repair or replace, at its election, free of charge, any part of the product that its inspection shows to be defective and, if appropriate, the lowest round trip transportation charges from Custom Hoists' original customer to Hayesville, Ohio and return, but excluding all transportation costs from Custom Hoists' customer to its customer.

A return authorization number must be obtained from authorized Custom Hoists' personnel prior to returning any products for warranty consideration. All claims must be accompanied by a complete written explanation of claimed defects and the circumstances of operational failure. Products returned for warranty consideration shall be shipped to Custom Hoists freight prepaid with the return authorization attached.

In the event that a product is repaired under warranty, that product shall carry the remainder of the original warranty period.

This limited warranty is in lieu of all other warranties of any nature, express or implied, including, but not limited to, warranties for merchantability or fitness or for any measure of service or suitability or for a specific purpose notwithstanding any disclosure to Custom Hoists of the use to which the product is to be put.

This express limited warranty is the sole warranty of Custom Hoists, Inc. There are no warranties which extend beyond the limited warranty herein expressly set forth.

Custom Hoists, Inc. shall not be liable for loss of time, manufacturing costs, labor, material, loss of profits, incidental, special or consequential damages, direct or indirect, because of defective products, whether due to claims arising under the contract of sale or independently thereof, and whether or not such claim is based on contract, tort or warranty.

The sale of products of Custom Hoists, Inc. under any other warranty or guarantee, expressed or implied, is not authorized and there are no warranties made to goods or products manufactured by anyone other than Custom Hoists, Inc.

SAFETY PRECAUTIONS FOR DOUBLE-ACTING TELESCOPIC CYLINDER

WARNING!

Rollover or lateral tilt can cause severe injury or death and/or damage to the unit and cylinder.

- The hydraulic cylinder will not prevent the unit from rollover or lateral tilt. The cylinder is strictly a lifting device and is not a structural member of the unit. Cylinders are not to be used as a means of stabilizing the unit.
- The hydraulic cylinder mounted in the unit should be free to find its own trajectory line of extension and retraction so as not to cause improper sequencing and excessive wear to the plungers and internal components. Misalignment could cause the unit to upset. On longer stroke cylinders mounted horizontally, supports should be added to the center of the extended cylinder to increase the column strength of the cylinder.
- The hydraulic cylinder will not withstand lateral pressure when the unit is leaning. Only activate the cylinder when the tractor and trailer are in a straight line (not jack-knifed). Do not activate the cylinder while on unlevel or soft ground, or during heavy crosswinds. Doing so may cause the unit to upset.
- Do not activate the cylinder while personnel or equipment are alongside or behind the unit.
- On roll-off units, if the container is not loaded evenly, the lift cylinder(s) may mis-stage which could cause the unit to upset and/or damage the cylinder when the plungers attempt to correct themselves.
- On roll-off units, lower the container with the control valve partially open (avoid lowering the container with the control valve completely open) to prevent pressure build-up in the reeving cylinders as gravity pulls the container to the ground.

WARNING!

Shock pressure can cause severe injury or death and/or damage to the unit and cylinder.

- Do not extend the cylinder until it has been fully retracted. A partially extended cylinder with pressure relieved may drift out of position. When the cylinder is later extended, the out of position plunger will reposition

rapidly and possibly cause high pressure trapped oil on the retract side of the cylinder.

- On roll-off units, do not pull a container onto the hoist until the lift cylinder(s) are completely extended. On roll-off units, care must be taken if a unit is moved with the lift cylinders extended. Avoid sudden stops or jolts.
- Check the cylinder operation to ensure the plungers extend in sequence with the largest diameter plunger moving first, then the next largest, etc. When retracting, the smallest plunger should move first, then the next smallest, etc. Mis-staging could cause the unit to upset and/or damage the cylinder due to excessive pressure build-up.

WARNING!

Over pressurizing the cylinder can cause severe injury or death and/or damage to the unit and cylinder.

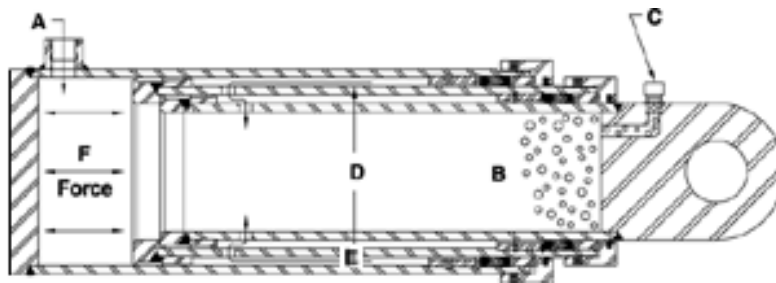
- Do not operate the cylinder at pressures greater than the pressure indicated on the cylinder name plate unless otherwise approved in writing by Custom Hoists, Inc.®
- Hydraulic hoses should be checked regularly and replaced if worn out or damaged.

NOTICE!

- Do not operate a packer/ejector cylinder with a mis-aligned blade. This can cause excessive lateral loading to the cylinder which could cause internal damage.
- If the hydraulic system uses quick disconnects or holding/lock type valves, make sure they are properly connected. If not, oil may become trapped in the cylinder which could cause internal damage.
- A double-acting telescopic cylinder normally requires at least 15 G.P.M. oil flow to retract properly. Make sure the hydraulic pump is developing the required flow.
- Most double-acting telescopic cylinders will bleed themselves of air. On a new cylinder installation, cycle the cylinder approximately ten times to the complete extend and retract positions with no load against it to remove the entrapped air.
- The hydraulic oil should be checked and changed regularly to avoid contamination leading to internal cylinder damage. For hydraulic oil recommendations
- Grease the pin mountings regularly.

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Cylinder Operation for Single-Acting Telescopic Cylinder



To Extend:

High pressure oil from the pump is directed by the control valve through port (A) to fill the cylinder. Any air in the hydraulic system will be trapped in the end of the cylinder (B) and may be bled off through the bleeder valve (C). It is advisable to bleed air from the cylinder on initial start up and on a weekly basis thereafter.

As the system pressure rises, the oil pushes on the bottom of the largest plunger (F) forcing it to move out. The outside diameter or sealing area of the plunger (D) determines the effective area.

As the plunger extends, the oil trapped between the plunger wall (E) is released through internal port holes in the plunger. When the largest stage is fully extended, the next largest will proceed to extend, etc.

To Retract:

A single-acting telescopic cylinder must be retracted by gravity or mechanical means.

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- We recommend field service repairs be limited to replacement of packing, bushings and wipers with initial setting of head nuts as described in this section.
- Before servicing the unit, check the plungers for damage. If the plunger is scored or scratched, smooth out marks with a fine stone or emery cloth to avoid damage to the new seals.
- After repair, a damp to light film of oil may be apparent on the plunger. A small accumulation of oil may be noticed on the plunger at the adjustable head nut after many cycles. This should not be mistaken for packing leakage.
- If a cylinder cannot be corrected by minor field repair, we recommend that the cylinder be returned to Custom Hoists, or a factory qualified service dealer.
- If necessary to disassemble a cylinder due to a damaged part such as a plunger, the cylinder should be completely disassembled and all parts inspected. When requesting information or ordering parts, refer to the cylinder and serial numbers located at the base end of the cylinder. A Major Repair Kit should be installed when rebuilding the cylinder.

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The following illustrations will serve as guide lines for the purpose of servicing a single-acting telescopic cylinder, and is intended to clearly show the essential steps to be taken for the complete disassembly.

- **Remember!**
Use proper safety equipment.

Step 1 - Parts Identification

The cylinder is best serviced mounted in the vertical position, for both disassembly and assembly. Also, it is best located where a hoist can be used directly overhead of the cylinder for removing the plungers if complete disassembly is required. A typical stand is shown in figure 1, made of angle welded to a base anchored to the floor and an adjustable wraparound chain to secure the cylinder to the stand. Because of oil spillage and safety, we recommend draining the cylinder of oil before disassembling. Lay the cylinder horizontally with the port down and open. Rotate the last plunger so the bleeder hole is on top and open. Rotate the last plunger so the bleeder hole is on top and open.

Figure 1



Figure 2 shows a typical sequence of disassembling the cylinder plungers in steps.

Figure 2



* Packing Set



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Step 2 - Set Screws

Figure 3



All head nuts are secured to the plunger by a set screw. Under the set screw is a nylon slug to protect the plunger threads. To remove the head nut, the set screw must be loosened using an allen wrench. (Refer to Figure 3).

Step 3 - Head Nuts

After the set screws have been loosened, tap head nut gently around its circumference and unscrew the head nut with a chain wrench, or an equivalent tool. Do not use a chisel, punch or weld any studs to the head nut to remove. (Refer to Figure 4)

Step 4 - Bushings

Using a small chisel, tap gently upward with a mallet uniformly around the circumference of the bushing. (Refer to Figure 5)

Step 5 - Packing, Wave Spring, Lower Bushing

To remove packing, wave spring and lower bushing, pull the plunger up about one foot. Add tape to a clean area as shown in Figure 6. Push the plunger down past the parts then pull the plunger up. The internal parts will stick to the tape and be pulled out of the plunger. Repeat as needed.

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Step 6 - Retainer Ring

The retaining ring has a small hole at each end. Insert a pointed screwdriver to move the hole out into the I.D. Place a steel shim behind the retainer. Using the Custom Hoists' retainer ring tool, insert the points into the retainer and close the retainer against the tube. Pull the tube to remove the retainer and plunger stop. (Refer to Figure 7)

Figure 4



Figure 5



Figure 6

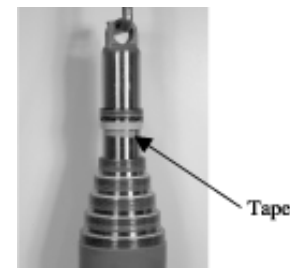


Figure 7



Figure 8

Reassembly of Cylinder

All bores in the packing area and plunger outside diameters must be free of tool marks and scratches. Polish with a fine paper, crocus cloth or a Scotch Brite pad. All parts should be clean and free of any contamination. A complete major repair kit is recommended. Drop all plungers into the body in the vertical position, as shown in Fig. 1. Assemble the remaining parts in the reverse sequence as listed in Fig. 2. The packing should be presoaked in oil before installing (do not use a detergent oil). Note, Fig. 2 for the direction of the packing. Using a tool similar to Fig. 9, seat each lip individually, making sure packing is nestled uniformly. After setting the head nuts (Step 7, Fig. 8), make sure there is a nylon slug under the set screw before securing the head nut to the plunger. After installing the cylinder in the unit, open the bleeder screw and extend the cylinder to bleed the air. More than one extension may be needed to assure all the air is removed and cylinder operates smoothly.

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Step 7 - Setting Head Nuts

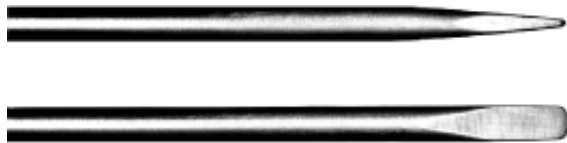
Remove the small slug located opposite the set screw. Using a 5/32" hex wrench (as shown in Figure 8), tighten the headnut down until the hex wrench bottoms out on the top of the plunger. Remove the hex wrench and replace the slug. Install the set screw using a nylon slug to protect the threads.

Typical Tool End Shape for Installing Packing:

Figure 9



5/32" Hex Wrench



Used for: Installing Packing

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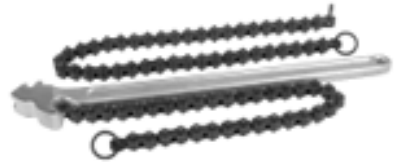
What's New

Disassembly/Assembly Tools

Tool Kits (Part No: 1-TK-1)
Used to install packing, remove retainers and spacers.



Chain Wrench
with add'l Chain (Part No: 1-CW-19)
Used to tighten and remove head nuts.



Strap Wrench (Part No: 1-TL-19)
To hold plungers from turning during assembly or disassembly.



Thread Lift Rings
For lifting tubes.

- 3" Tubes (Part No: 2-TL-20-3)
- 4" Tubes (Part No: 2-TL-20-4)
- 5" Tubes (Part No: 2-TL-20-5)
- 6" Tubes (Part No: 2-TL-20-6)
- 7" Tubes (Part No: 2-TL-20-7)
- 8" Tubes (Part No: 2-TL-20-8)
- 8-1/4" Tubes (Part No: 2-TL-20-8 1/4)
- 9-1/8" Tubes (Part No: 2-TL-20-9 1/8-1)
(8-15/16" thd.)
- 9-1/8" Tubes (Part No: 2-TL-20-9 1/8)
(9-1/16" thd.)
- 9-3/4" Tubes (Part No: 2-TL-20-9 3/4)



Pushers

For installing plunger stops, spacers and new style retainers

3" Tubes (Part No: 2-TL-21-3)

4" Tubes (Part No: 2-TL-21-4)

5" Tubes (Part No: 2-TL-21-5)

6" Tubes (Part No: 2-TL-21-6)

7" Tubes (Part No: 2-TL-21-7)

8" Tubes (Part No: 2-TL-21-8)

8-1/4" Tubes (Part No: 2-TL-21-8 1/4)

9-1/8" Tubes (Part No: 2-TL-21-9 1/8)

9-3/4" Tubes (Part No: 2-TL-21-9 3/4)



Retainer Ring Tool

SN #400,000 and up (Part No: 2-TL-18)

Used to remove retainer ring

(Pat. Pending #09/005,880)



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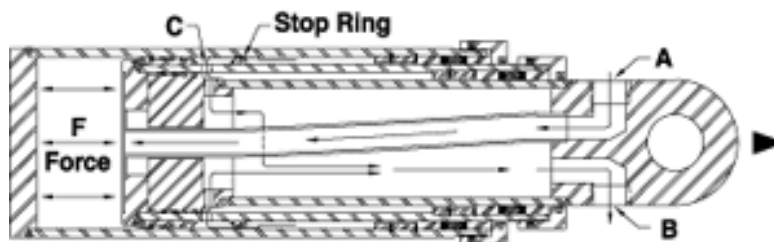
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Cylinder Operation

For Double-Acting Telescopic Cylinder

Extending



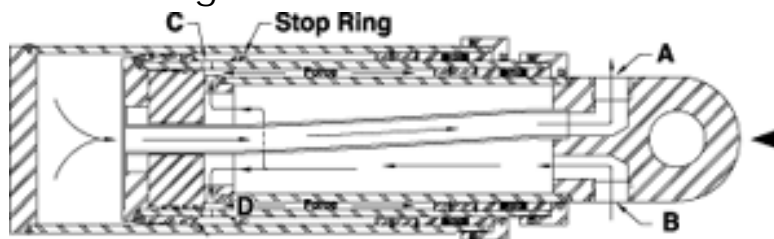
To Extend:

High pressure oil is directed by the control valve into extend port (A). The oil passes through an inner (transfer) tube in the smallest plunger to the base of the cylinder. The pressure acts on the effective area of the largest piston (F) and extends all stages to the first plunger stop.

The next stage then begins to extend. The effective area of each stage is figured from the inside diameter of the next largest stage. Each stage extends in its turn to the plunger stop.

Oil trapped between the plungers escapes through internal port holes (C) in each plunger and returns to tank through retract port (B).

Retracting



To Retract:

High pressure oil is directed by the control valve into retract port (B). The pressure is applied to the effective area of the smallest plunger (D) which retracts first. Each stage from the smallest to the largest retracts in its turn. The effective area for retracting each stage is the area of the plunger (D).

Oil inside the cylinder is forced out of extend port (A). Because of the area differential between the retract side and extend side the flow into retract port (B) must be multiplied by this differential to determine the flow out of port. It may be necessary to install a dump-to-tank valve to speed up the retracting cycle.

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Disassembly/Reassembly Instructions

Serial Numbers 400,000 and above



Warning



Step 1 - Parts Identification



Step 2 - Set Screws



Step 3 - Head Nuts



Step 4 - Bushings



Step 5 - Packing, Wave Spring, Lower Bushing



Step 6 - Retainer Rings



Reassembly of Cylinder



Step 7 - Setting Head Nuts



Typical Tool End Shapes
for installing packing



Warning!


Before making adjustments or repairs to the cylinder when mounted in the unit, use strong, heavy, positive supports to hold the body from accidentally lowering. Place the cylinder valve in the "LOWER" position to ensure the pressure is relieved in the cylinder.

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Lifting Capacities

Individual plunger lifting capacities, multiple stage cylinders.

Click the links below for samples.

-  ["400" Series Single-Acting Telescopic Cylinders](#)
-  ["700" Series Single-Acting Telescopic Cylinders](#)
-  [Double-Acting Telescopic Cylinders](#)
-  [Extend Capacities of Piston Rod Cylinders](#)
-  [Retract Capacities](#)

"400" Series Single-Acting Telescopic Cylinders Specific Operating Pressures

Plunger Diameter (in.)	Cross Sectional Area (Sq. In.)	1,500 PSI (lbs.)	1,800 PSI (lbs.)	2,000 PSI (lbs.)	2,500 PSI (lbs.)
2	3.14	4,710	5,672	6,280	7,850
3	7.06	10,590	12,708	14,120	17,650
4	12.56	18,840	22,608	25,120	31,400
5	19.63	29,445	35,334	39,260	49,075
6	28.27	42,405	50,886	56,540	70,675
7	38.48	57,720	69,264	76,960	Consult Factory
8	50.26	75,390	90,468	100,520	Consult Factory
8-1/4	53.50	80,250	96,300	107,000	Consult Factory
9-1/8	65.40	98,100	117,720	130,800	Consult Factory
9-3/4	74.50	111,750	134,100	149,000	Consult Factory

"700" Series Single-Acting Telescopic Cylinders Specific Operating Pressures

Plunger Diameter (in.)	Cross Sectional Area (Sq. In.)	1,500 PSI (lbs.)	1,800 PSI (lbs.)	2,000 PSI (lbs.)	2,500 PSI (lbs.)	3,000 PSI (lbs.)
2-1/4	3.97	5,955	7,146	7,940	9,925	11,910
3-3/16	7.98	11,970	14,364	15,960	19,950	23,940
4-1/8	13.36	20,040	24,048	26,720	33,400	40,080
5-1/16	20.13	30,195	36,234	40,260	50,325	60,390
6	28.27	42,405	50,886	56,540	70,675	84,810

Double-Acting Telescopic Cylinders

Specific Operating Pressures

Bore (Piston) Diameter (in.)	Cross Sectional Area (Sq. In.)	Plunger Diameter (in.)	Cross Sectional Area (Sq. In.)	1,500 PSI (lbs.)	1,800 PSI (lbs.)	2,000 PSI (lbs.)
2-1/2	4.90	2	3.14	7,350	8,820	9,800
3-1/2	9.62	3	7.06	14,340	17,316	19,240
4-1/2	15.90	4	12.56	23,850	28,620	31,800
5-1/2	23.75	5	19.63	35,625	42,750	47,500
6-1/2	33.18	6	28.27	49,770	59,724	66,360
7-1/2	44.17	7	38.48	66,255	79,506	88,340
8-1/2	56.74	8	50.26	85,110	102,132	113,480
9-3/4	74.50	9-1/8	65.39	111,170	134,100	149,000
10-1/2	86.59	9-3/4	74.50	129,885	155,862	173,180

Extend Capacities of Piston Rod Cylinders

Specific Operating Pressures

Rod Bore Diameter (in.)	Cross Sectional Area (Sq. In.)	1,800 PSI (lbs.)	2,000 PSI (lbs.)	2,500 PSI (lbs.)	3,000 PSI (lbs.)
2	3.14	5,672	6,280	7,850	9,420
2-1/2	4.90	8,820	9,800	12,250	14,700
3	7.06	12,708	14,120	17,650	21,180
3-1/2	9.62	17,316	19,240	24,050	28,860
4	12.56	22,608	25,120	31,400	37,680
4-1/2	15.90	28,620	31,800	39,750	47,700
5	19.63	35,334	39,260	49,075	58,890
5-1/2	23.75	42,750	47,500	59,375	71,250
6	28.27	50,886	56,540	70,675	84,810
6-1/2	33.18	59,724	66,360	82,950	99,540
7	38.48	69,264	76,960	96,200	115,440
7-1/2	44.17	79,506	88,340	110,425	132,510
8	50.26	90,468	100,520	125,650	150,780
8-1/4	53.50	96,300	107,000	133,750	160,500
8-1/2	56.74	102,132	113,480	141,850	170,220
9	63.61	114,498	127,220	159,025	190,830
9-1/2	71.00	127,800	142,000	177,500	213,000
9-3/4	74.50	134,100	149,000	186,250	223,500
10	78.54	141,372	157,080	196,350	235,620
10-1/2	86.59	155,862	173,180	216,475	259,770

Retract Capacities

To find the retract capacity of a standard double-acting cylinder, subtract the piston rod or plunger cross sectional area from the bore cross sectional area. Multiply the difference by the desired operating pressure. The result is the retract capacity in pounds.

Example:

Bore (5" dia.) C.S. area	19.63 sq. in.
Rod (2" dia.) C.S. area	- <u>3.14 sq. in.</u>
Difference	16.49 sq. in.
Desired operating pressure	<u>x 1800 p.s.i.</u>
Retract capacity	29,682 lbs.

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Hydraulic Oil Recommendations

All internal cylinder parts are lubricated by hydraulic oil in the circuit. Particular attention must be paid to the condition and level of the oil in the circuit. Dirty oil is one of the main causes of hydraulic component failure resulting in expensive downtime. Dirty oil is detectable, a sample on a dipstick will show its condition. Take the sample and put a drop on a blotter cloth or paper, any revealed residue means dirty oil. To replace the oil supply, drain and flush the entire system and clean or replace any filter screens. Fill the system with new oil suitable and recommended for use in circuits involving Custom Hoists, Inc. cylinders with the following specifications.

These suggestions are intended as a guide only. When purchasing hydraulic oil, show these specifications to your oil supplier for final oil recommendations.

General Recommendations:

Oil should be checked daily, added to if needed and changed on a regular schedule along with filters and filter screens in accordance with the manufacturer's recommendations.

Hydraulic system should be flushed periodically.

Oil poured into the reservoir should pass through a 10 micron element. Pour only clean oil from clean containers into the reservoir.

Reservoir capacity should equal, in gallons, the pump output in G.P.M. or the total G.P.M. of all pumps where there is more than one in the system.

Oil operating temperature should not exceed 200°F (93°C) with a maximum of 180°F (82°C) usually recommended. 120°F (50°C) to 140°F (60°C) is usually considered optimum. High temperatures result in rapid oil deterioration and may indicate the system requires an oil cooler or larger reservoir. The closer to the optimum temperature, the longer the service life of the oil and the hydraulic components.

Don't pollute. Conserve resources and return used oil to a collection center.

Viscosity Recommendations:

Approximately 100 SSU is considered optimum operating viscosity.

50 SSU Minimum @ Operating Temperature

7500 SSU Maximum @ Starting Temperature

150 to 225 SSU @ 100°F (37.8°C) (Generally)

44 to 48 SSU @ 210°F (98.9°C) (Generally)

• Approximate SSU at...

Oil Grade	100° F (37.8° C)	210° F (98.9° C)
SAE 10	150	43
SAE 20	330	51

Normal Temperature:

0°F (-18°C) to 100°F (37.8°C) Ambient

100°F (37.8°C) to 180°F (82.2°C) System

Note: Where sustained temperatures exceed the above, use an oil suitable to the ambient temperature of your region. For a suitable replacement, consult your oil supplier.

Other Desirable Properties and Characteristics:

Viscosity Index - 90 minimum.

Aniline Point - 175 minimum.

Stability of physical and chemical characteristics.

High demulsibility (low emulsibility) for separation of water, contaminants and air.

Resistant to the formation of gums, sludges, acids,

tars and varnishes.
High lubricity and film strength.

Notice

Never use a detergent oil, crank case drainings, kerosene, fuel oil, or any non-lubricating fluid (such as water) in the hydraulic system.

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Safety Precautions for Single-Acting Telescopic Cylinder

WARNING!

Rollover or lateral tilt can cause severe injury or death and/or damage to the unit and cylinder.

-  The hydraulic cylinder will not prevent the dump body or trailer from rollover or lateral tilt. The cylinder is strictly a lifting device and is not a structural member of the unit. Cylinders are not to be used as a means of stabilizing the unit.
-  The hydraulic cylinder mounted in the unit should be free to find its own trajectory line of extension, free of any lateral loading of the plungers. Misalignment of the top or bottom mountings, or mounting pins too tight, may cause scoring of the plungers, leaking, or improper sequencing which could cause the unit to upset.
-  The hydraulic cylinder will not withstand lateral pressure when the unit is leaning. Only activate the cylinder when the tractor and trailer are in a straight line (not jack-knifed). Do not activate the cylinder while on unlevel or soft ground, or during heavy crosswinds. Doing so may cause the unit to upset.
-  Do not activate the cylinder while personnel or equipment are alongside or behind the dump body or trailer.

- The operator should stay at the controls during the entire dumping operation. If the body starts to lean, the operator should immediately lower the dump body or trailer. It is important to slowly position the cylinder control valve into the hold position to avoid subjecting the cylinder to high pressure.
- Do not overload the unit. The load must be distributed evenly during loading or unloading to avoid rollover and lateral tilt. Loads stuck while the cylinder is partially or completely extended increases the hazard of rollover and lateral tilt. Lower the dump body or trailer entirely with the cylinder control valve partially open (avoid lowering the dump body or trailer with the cylinder control valve completely open). Then unload the dump body or trailer manually or with an alternative mechanical aid.

! WARNING!

Shock pressure can cause severe injury or death and/or damage to the unit and cylinder.

- Do not use the cylinder to loosen loads stuck in the dump body or trailer. Lower the dump body or trailer entirely with the cylinder control valve partially open (avoid lowering the dump body or trailer with the cylinder control valve completely open). Then unload the dump body or trailer manually or with an alternative mechanical aid.
- Do not move the truck and jam the brakes while the cylinder is partially or fully extended to loosen loads stuck in the dump body or trailer. Lower the dump body or trailer entirely with the cylinder control valve partially open (avoid lowering the dump body or trailer with the cylinder control valve completely open). Then unload the dump body or trailer manually or with an alternative mechanical aid.
- Do not move the truck until the dump body or trailer is lowered completely.

! WARNING!

Over pressurizing the cylinder can cause severe injury or death and/or damage to the unit and cylinder.

- Do not operate the cylinder at pressures greater than 2,000 P.S.I. unless otherwise approved in writing by Custom Hoists, Inc.

 **WARNING!**

Worn or damaged hydraulic hoses can cause severe injury or death and/or damage to the unit and cylinder.

- Hydraulic hoses should be checked regularly and replaced if worn out or damaged.

 **NOTICE!**

Do not drive the unit while the P.T.O. or hydraulic pump is engaged.

The hydraulic oil should be checked and changed regularly to avoid contamination leading to internal cylinder damage. For hydraulic oil recommendations click [here](#).

A damp to light film of oil on each plunger indicates a good cylinder operation. A small accumulation of oil may be noticed on the plunger at the head nuts after many cycles. This should not be mistaken for packing leakage.

It is advisable to bleed air from the cylinder weekly to free entrapped air. This will result in a smoother operation. For procedures to bleed air from a single-acting telescopic cylinder click [here](#).

Grease the pin mountings regularly.

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Normal Service Items

- [Procedure for adjusting headnuts on telescopic cylinders .](#)
- [Bleeding air from Single-Acting Telescopic Cylinders.](#)

Packing, wipers and bushings are considered normal service or replacement items. These items are subject to contamination from external and internal foreign materials, many of which are abrasive in nature, causing abnormal wear or damage to the parts, to the extent replacements are required.

Cylinders may be subject to leaking oil past the seal for various reasons requiring adjustment of the head/packing nuts. This is considered a normal installation and field service adjustment to correct the leakage.

! Warning!

Before making adjustments or repairs to the cylinder when mounted in the unit, use strong, heavy, positive supports to hold the body from accidentally lowering which can cause severe injury or death and/or damage to the unit and cylinder. Place control valve in the lower position to insure the pressure is relieved in the cylinder. High pressure can cause severe injury or death and/or damage to the unit and cylinder.

Procedure for adjusting headnuts on telescopic cylinders.

A. For leaking cylinders:

1. Loosen set screw(s) in headnut of leaking stage(s).
2. Tap headnut lightly around circumference with a hammer.
3. Using a chain wrench, back headnut off one half to one full turn. If plunger turns as you are turning the headnut, the plunger will have to be held, preferably with a strap wrench.
4. Cycle cylinder two or three times to reset vee ring packing.
5. Tighten headnut one half turn farther than it was loosened.
6. Tighten set screw(s).

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B. For mis-sequencing cylinders:

1. Loosen set screw in headnut on stage that is sticking.
2. Tap headnut lightly around circumference with a hammer.
3. Using a chain wrench, back off headnut one half turn.
4. Cycle cylinder. If cylinder still mis-stages, turn headnut another half turn.
5. Cycle cylinder. If cylinder still mis-stages, tighten the headnut on the next stage that is extending. If plunger turns as you are turning the headnut, the plunger will have to be held, preferably with a strap wrench.
6. Tighten set screw(s).

Bleeding air from Single-Acting Telescopic Cylinders.

1. Empty the dump body of any material.
2. Remove the cover plate from the doghouse of the dump body to access the cylinder bleeder valve.
3. Fully extend the cylinder, raising the empty dump bed.
4. Lower the dump bed to within one foot from the frame.
5. Turn the bleeder valve in a counterclockwise direction. This opens the valve and allows the air to escape from the cylinder.
6. When a steady stream of oil comes from the bleeder, turn the valve in a clockwise direction until it is closed.

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NOTE:

For consistent operation of telescopic cylinders, it is advisable to bleed the air from the cylinder weekly.

If these procedures fail to correct the problem, contact the factory or an authorized service center for further instructions.

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Limited Warranty

Custom Hoists, Inc. warrants only products of its manufacture against operational failure caused by defective materials or workmanship which occur during proper and normal use within 24 months from the date of purchase from Custom Hoists, Inc. Custom Hoist, Inc. reserves the right to determine what is proper and normal use.

Packing, wipers, bearings and bushings which are subject to wear caused by internal and external contamination, as well as from normal operating conditions, are not warranty items. Failures initiated by forms of oxidation are also not considered warranty failure.

Custom Hoists shall not, under any circumstances, be liable for labor for removal and installation expenses, loss of time, manufacturing costs, materials, loss of profits, incidental, special or consequential damages, direct or indirect.

Custom Hoists, Inc.'s only obligation is to repair or replace, at its election, free of charge, any part of the product that its inspection shows to be defective and, if appropriate, the lowest round trip transportation charges from Custom Hoists' original customer to Hayesville, Ohio and return, but excluding all transportation costs from Custom Hoists' customer to its customer.

A return authorization number must be obtained from authorized Custom Hoists' personnel prior to returning any products for warranty consideration. All claims must be accompanied by a complete written explanation of claimed defects and the circumstances of operational failure. Products returned for warranty consideration shall be

shipped to Custom Hoists freight prepaid with the return authorization attached.

In the event that a product is repaired under warranty, that product shall carry the remainder of the original warranty period.

This limited warranty is in lieu of all other warranties of any nature, express or implied, including, but not limited to, warranties for merchantability or fitness or for any measure of service or suitability or for a specific purpose notwithstanding any disclosure to Custom Hoists of the use to which the product is to be put.

This express limited warranty is the sole warranty of Custom Hoists, Inc. There are no warranties which extend beyond the limited warranty herein expressly set forth.

Custom Hoists, Inc. shall not be liable for loss of time, manufacturing costs, labor, material, loss of profits, incidental, special or consequential damages, direct or indirect, because of defective products, whether due to claims arising under the contract of sale or independently thereof, and whether or not such claim is based on contract, tort or warranty.

The sale of products of Custom Hoists, Inc. under any other warranty or guarantee, expressed or implied, is not authorized and there are no warranties made to goods or products manufactured by anyone other than Custom Hoists, Inc.

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Danger

Do Not Climb on or Around Equipment While in Operation.

Caution

Don't transport until unit is in the full safe travel position. Cargo is properly secured and PTO Disengaged



Hydraulic Oil Recommendations

All internal cylinder parts are lubricated by hydraulic oil in the circuit. Particular attention must be paid to the condition and level of the oil in the circuit. Dirty oil is one of the main causes of hydraulic component failure resulting in expensive downtime. Dirty oil is detectable, a sample on a dipstick will show its condition. Take the sample and put a drop on a blotter cloth or paper, any revealed residue means dirty oil. To replace the oil supply, drain and flush the entire system and clean or replace any filter screens. Fill the system with new oil suitable and recommended for use in circuits involving Custom Hoists, Inc. cylinders with the following specifications.

These suggestions are intended as a guide only. When purchasing hydraulic oil, show these specifications to your oil supplier for final oil recommendations.

General Recommendations:

Oil should be checked daily, added to if needed and changed on a regular schedule along with filters and filter screens in accordance with the manufacturer's recommendations.

Hydraulic system should be flushed periodically.

Oil poured into the reservoir should pass through a 10 micron element. Pour only clean oil from clean containers into the reservoir.

Reservoir capacity should equal, in gallons, the pump output in G.P.M. or the total G.P.M. of all pumps where there is more than one in the system.

Oil operating temperature should not exceed 200°F (93°C) with a maximum of 180°F (82°C) usually recommended. 120°F (50°C) to 140°F (60°C) is usually considered optimum. High temperatures result in rapid oil deterioration and may indicate the system requires an oil cooler or larger reservoir. The closer to the optimum temperature, the longer the service life of the oil and the hydraulic components.

Don't pollute. Conserve resources and return used oil to a collection center.

Viscosity Recommendations:

Approximately 100 SSU is considered optimum operating viscosity.

50 SSU Minimum @ Operating Temperature

7500 SSU Maximum @ Starting Temperature

150 to 225 SSU @ 100°F (37.8°C) (Generally)
44 to 48 SSU @ 210°F (98.9°C) (Generally)
• Approximate SSU at...

Oil Grade	100° F (37.8° C)	210° F (98.9° C)
SAE 10	150	43
SAE 20	330	51

Normal Temperature:

0°F (-18°C) to 100°F (37.8°C) Ambient
100°F (37.8°C) to 180°F (82.2°C) System

Note: Where sustained temperatures exceed the above, use an oil suitable to the ambient temperature of your region. For a suitable replacement, consult your oil supplier.

Other Desirable Properties and Characteristics:

Viscosity Index - 90 minimum.

Aniline Point - 175 minimum.

Stability of physical and chemical characteristics.

High demulsibility (low emulsibility) for separation of water, contaminants and air.

Resistant to the formation of gums, sludges, acids, tars and varnishes.

High lubricity and film strength.

Notice

Never use a detergent oil, crank case drainings, kerosene, fuel oil, or any non-lubricating fluid (such as water) in the hydraulic system.

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PREVENTIVE MAINTENANCE

TECHNICAL TIPS

Never use a test probe to pierce wire insulation when troubleshooting lighting complaints. Wicking action takes place, which causes moisture to travel along the wire strands and corrode critical connections. If probing a harness or wire is necessary, make sure the puncture is properly sealed.

To correct voltage problems, discover the real cause. Under-voltage often is caused by poor electrical connections. To correct under-voltage, don't just turn up the voltage - find out what caused the under-voltage problem.

Many discarded lamps are still in good condition. Play detective when solving lamp problems. First, test with either a meter, power supply, or battery. Our 97100 tester is an excellent tool for this. Then if you desire, open the lens on a discarded lamp and examine the bulb. It will tell you why it failed. For example:

- A bulb with stretched or broken filaments was subjected to vibration.
- A yellowish, whitish or bluish glaze on the bulb indicates a rupture in the bulb glass envelope.
- A dark metallic finish indicates old age.
- A black, sooty bulb indicates a poor seal in bulb.

Test all lamps one more time before you discard them. Truck-Lite's warranty department reports that up to 20 percent of all lamps sent back are still in good operating condition. The ones that aren't working can be turned over to your lamp supplier.

All lamps will live longer if they run cool. Dirt on the lens increases the heat, so keep them as clean as possible. Other people can see your rig, and that is one of the purposes of the lighting system - to be seen. Certain lighting products generate heat. Care should be taken to avoid contact with flammable materials.

Treat the electrical system as you would the chassis. Lubricate sockets, pigtailed, battery terminals and connections with NYK 77 "non-conductive" anti-corrosion compound. The purpose of the sealant is to totally encapsulate and protect against corrosion and water.

Inspect for improper ground connections. This is a major cause of lamp failure, especially when the trailer is used for a ground. When lamps are grounded through the lamp housing, make sure there is a clean connection (i.e., metal-to-metal). Also, a fifth wheel ground strap may be used for added protection on the chassis ground system.

Look for loose, bare or unsupported wire, and fixtures. Harnesses and wiring should be on the underside of top frame members rather than on the bottom where dirt and road splash collect.

Always replace wiring, trailer light cables, and harnesses with an equal or heavier gauge of wire than was used in the original specifications. If you don't, you may cause unnecessary problems.

On older trucks, you should never crank the truck when any lights or accessories are on. Also, never leave markers and hazard lights on when parked against a dock. Melted lenses are a sure sign that the vehicle has been parked against the dock while the lights were on.

Inspect the grommets that house the lamps. As they age, they eventually will deteriorate from sunlight, ozone and harmful chemicals. New grommets restore shock protection, security and improves appearance.

CLEANING MATERIALS

The use of solvents that are not compatible with polycarbonate will result in the softening, crazing, and/or cracking of the plastic part. This is especially true of polycarbonate lamps and mounting bases which may be under stress in their normal applications.

The following solvents/cleaners ARE COMPATIBLE with polycarbonate:

- Mild soap and water
- Mineral Spirits
- Hexane
- VM and P Naphtha
- Varsol No. 2
- #1 and #3 denatured alcohol
- Freon TF and TE-35
- Ethanol
- 10% Sol Ban Ami®
- Dirtex®
- 2% Sol. Reg. Joy
- Heptane
- White Kerosene
- Methyl, isopropyl and isobutyl alcohols
- Lacryl® PCL-2035 polycarbonate cleaner
- Petroleum Ether/65 degrees C boiling point

The following solvents/cleaners MUST NOT BE USED with polycarbonate:

- Triclor (Trichlorethylene)
- Acetone
- Triclene®
- Methyl Ethyl Keytone (MEK)
- MIBK
- Toluol
- Benzol (Benzene)
- Gasoline
- Carbon Tetrachloride
- Chlorinated Hydrocarbons
- Texine-8006, 8129, 8758
- Liquid Cleaner - 8211
- Agitene®>
- AJAX®
- All liquid detergents
- Pink Lux® (phosphate free)
- Diversol®
- Lemon Joy® (phosphate free)
- Kleenol Plastics
- Lestoil®
- Stanisol Naphtha®

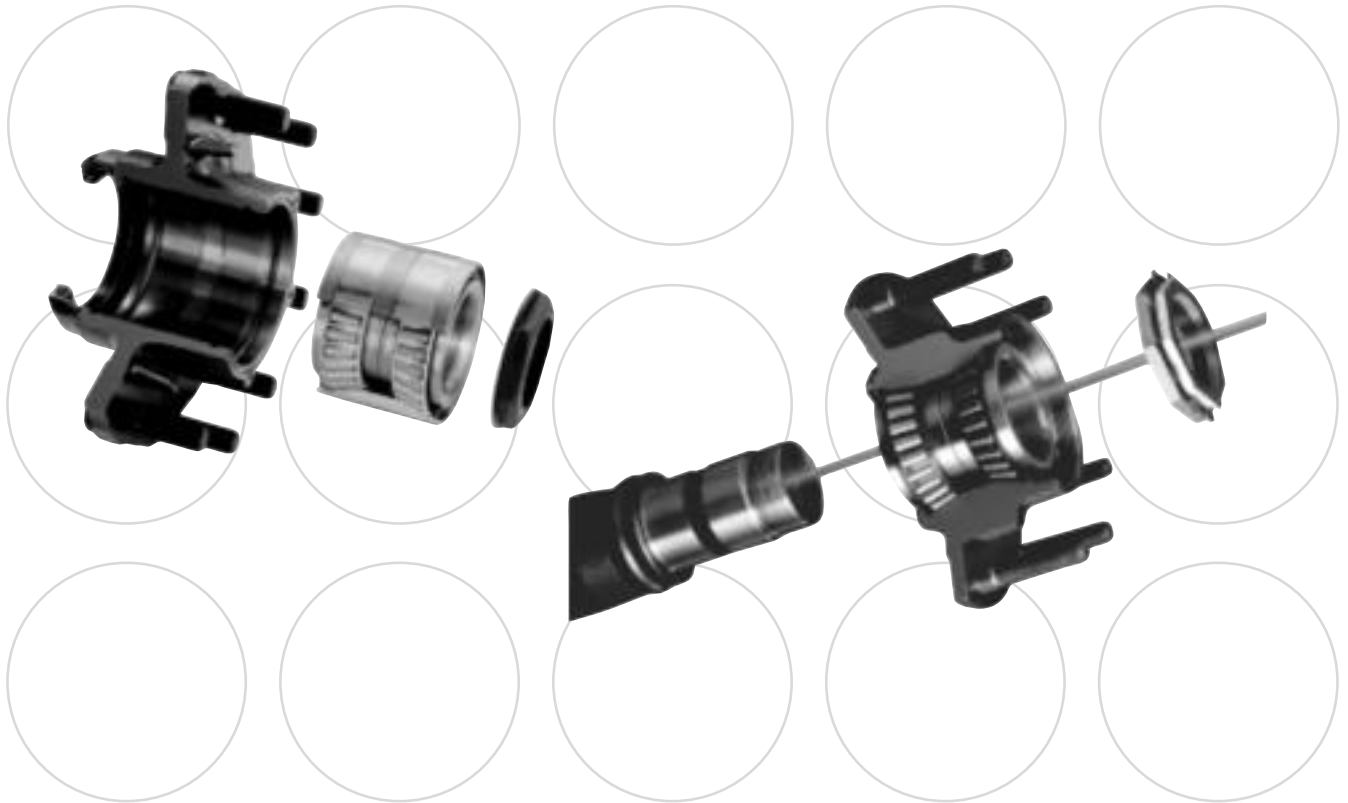


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Maintenance Manual MM-0420

Trailer Axles with Unitized Wheel Ends

Issued 05-04



Service Notes

About This Manual

This manual provides wheel-end maintenance and service instructions for Meritor trailer axles with unitized wheel ends.

Before You Begin

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.


Hazard Alert Messages and Torque Symbols

WARNING

A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury and damage to components.

CAUTION

A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components.

 This symbol alerts you to tighten fasteners to a specified torque value.

How to Obtain Additional Maintenance and Service Information

On the Web

Visit the DriveTrain Plus™ by ArvinMeritor Tech Library at arvinmeritor.com to easily access product and service information. The Library also offers an interactive and printable Literature Order Form.

ArvinMeritor's Customer Service Center

Call ArvinMeritor's Customer Service Center at 800-535-5560.

Technical Electronic Library on CD

The DriveTrain Plus™ by ArvinMeritor Technical Electronic Library on CD contains product and service information for most Meritor and Meritor WABCO products. \$20. Specify TP-9853.

How to Obtain Tools and Supplies Specified in This Manual

Call ArvinMeritor's Commercial Vehicle Aftermarket at 888-725-9355 to obtain Meritor tools and supplies.

Information contained in this publication was in effect at the time the publication was approved for printing and is subject to change without notice or liability. Meritor Heavy Vehicle Systems, LLC, reserves the right to revise the information presented or to discontinue the production of parts described at any time.

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ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA.

2. **Respiratory Protection.** Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.
3. **Procedures for Servicing Brakes.**
 - a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
 - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.
 - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
 - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.
2. **Respiratory Protection.** OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m³ as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.

Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposure levels may exceed OSHA or manufacturers' recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.

3. **Procedures for Servicing Brakes.**
 - a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.
 - b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.
 - d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.
 - e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.
4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.
5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.
6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

Overview

Meritor offers two trailer axle models equipped with unitized wheel ends.

- TB model
- TL model

These models feature permanently sealed and lubricated hub assemblies designed to help reduce wheel-end maintenance when compared to axles equipped with conventional wheel-end equipment.

On unitized wheel ends, the hub, seal, lubricant and bearings are installed onto the trailer axle as an assembly. Figure 1.1. On conventional wheel ends, the hub, seal, lubricant and bearings are installed onto the trailer axle as separate components. Figure 1.2.

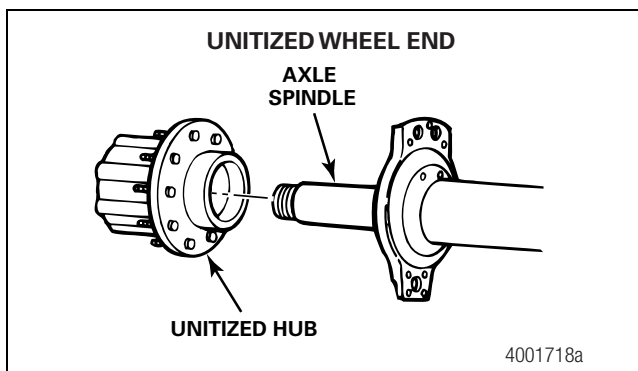


Figure 1.1

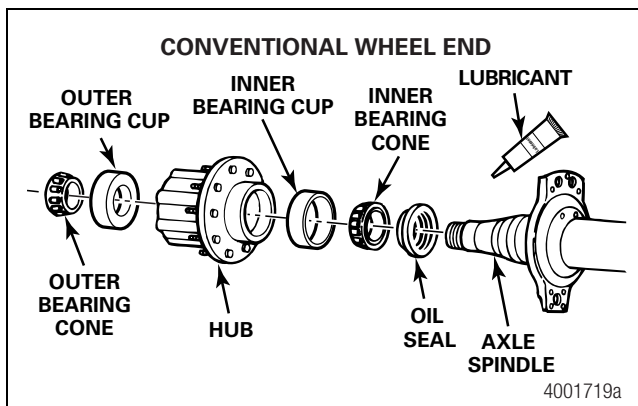


Figure 1.2

Scope

This manual is intended to provide service information on the unitized wheel ends installed on Meritor TB and TL trailer axle models.

Refer to Maintenance Manual 14, Trailer Axles, for maintenance information on the conventional wheel ends installed on all other Meritor trailer axle models to include TN, TP and TR Series axles. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

Refer to Maintenance Manual 14, Trailer Axles, for the following maintenance information on all trailer axles including those equipped with both unitized and conventional wheel ends.

- Installing axles
- Inspecting axles
- Aligning axles
- Performing bearing adjustments
- Welding brackets to axle beams
- Servicing cam brakes
- Lubricating axle components

Refer to Maintenance Manual 14, Trailer Axles; and Maintenance Manual 4, Cam Brakes and Automatic Slack Adjuster, for maintenance information on the cam brakes and automatic slack adjusters installed on trailer axles. To obtain these publications, refer to the Service Notes page on the front inside cover of this manual.

Refer to the service publications from the wheel manufacturer to service the tire and wheel assemblies installed on trailer axles.

Axle Identification

Identification Tag

An identification tag is attached to the center of the axle beam on all Meritor trailer axles. All of the information necessary to identify a particular trailer axle is located on this tag including the axle model number, serial number and date of manufacture. Figure 1.3.

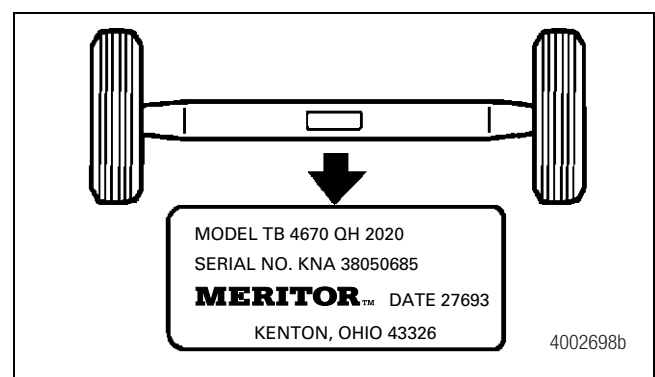


Figure 1.3

1 Introduction

The model number is composed of letters and digits; for example, TB 4670 QH 2020. This number is used to identify the axle assembly when obtaining replacement parts.

The serial number is composed of letters and digits; for example, KNA-38050685. This number is used to identify a particular trailer axle, and the material and components used to build the axle.

The date of manufacture is indicated by a conventional or Julian date. A conventional date is 10/03/00. A Julian date is 27600. The first three digits (276) indicate the 276th day of the year, or October 3. The last two digits (00) indicate the year, or 2000.

Production Model Numbers

Model numbers for Meritor production trailer axles are composed of letters and digits; for example, TQD 4670 QH 2020. These letters and digits indicate the weight capacity and type of components installed on the axle as detailed below. For a more comprehensive list of Meritor current production trailer axle models, refer to publication TP-8301, Trailer Axle Specifications. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

TQD 4670 QH 2020

The first position indicates the geometry of the steel tube. Figure 1.4.

- T is for tubular.
- S is for square.
- R is for rectangular.
- W is for axles built for Wabash National, a trailer manufacturer.

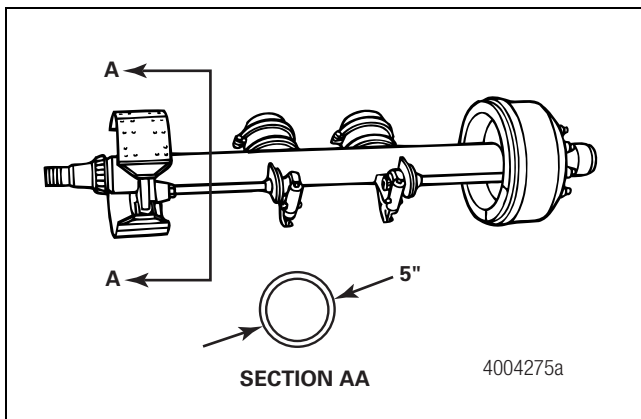


Figure 1.4

TQD 4670 QH 2020

The second position indicates the type of bearings and spindle design used. Figure 1.5.

- TN and TQ Series axles use the most common bearings in the trailer industry.
- TP Series axles use bearings compatible with Fruehauf axles.
- TR Series axles use bearings compatible with drive axles.
- TB and TL Series axles use unitized bearings.

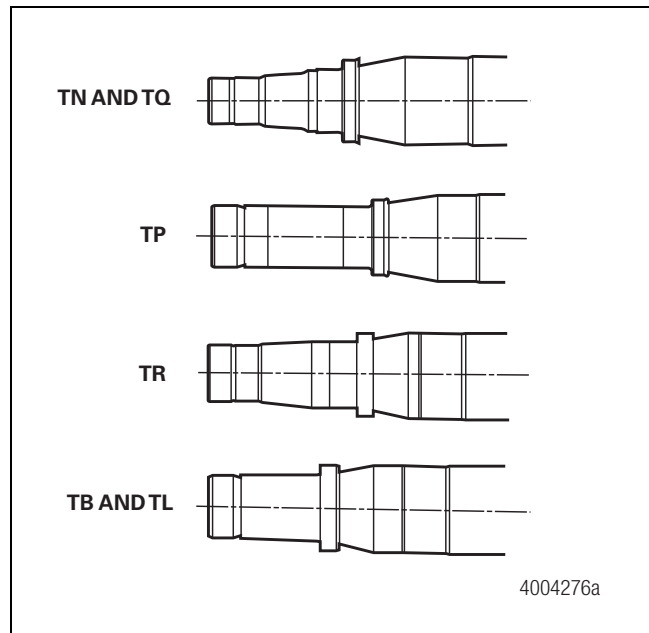


Figure 1.5

TQD 4670 QH 2020

The third position indicates whether the axle is a straight, drop or crank model. Figure 1.6.

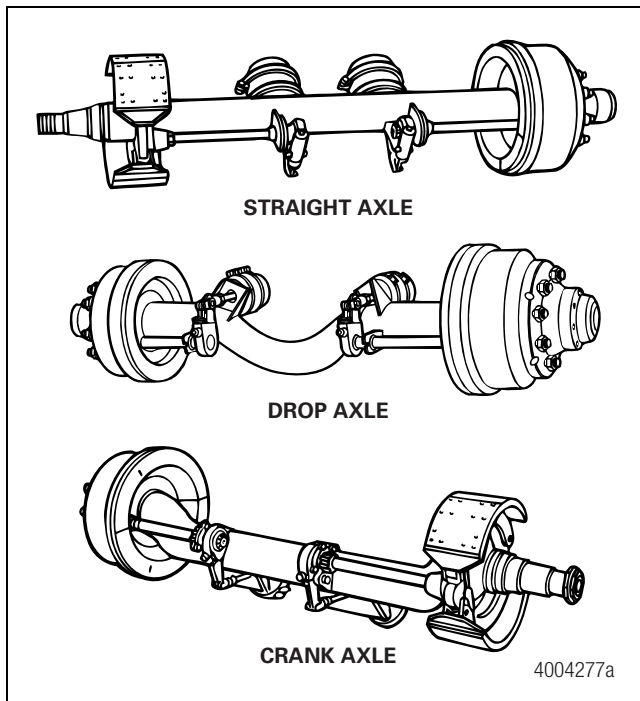


Figure 1.6

TQD 4670 QH 2020

The fourth position identifies the type of bearing adjustment and the axle tube wall thickness. Figure 1.7.

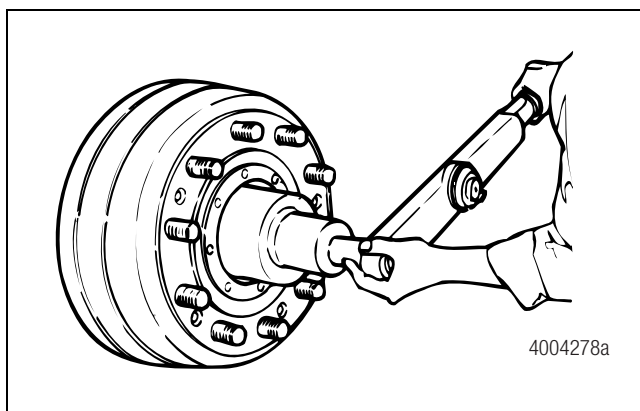


Figure 1.7

TQD 4670 QH 2020

The fifth and sixth positions indicate the brake size. Figure 1.8.

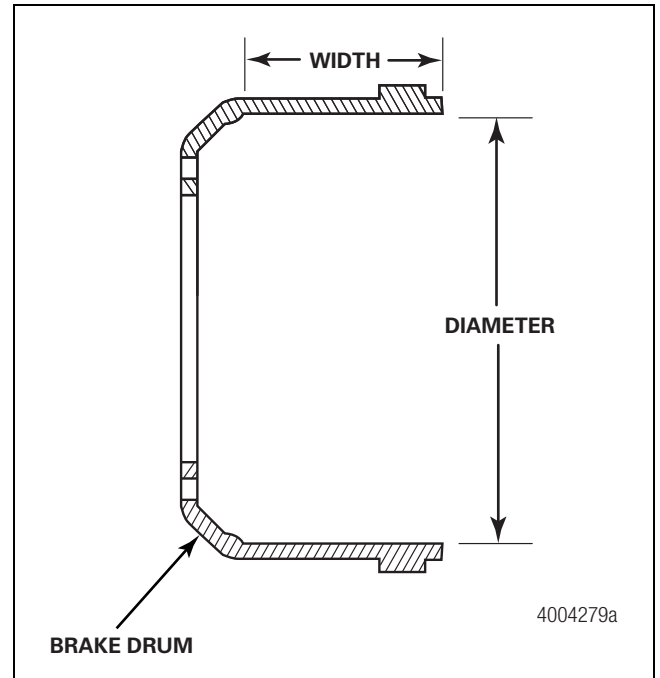


Figure 1.8

TQD 4670 QH 2020

The seventh position indicates whether the axle is built with ABS provisions. Figure 1.9.

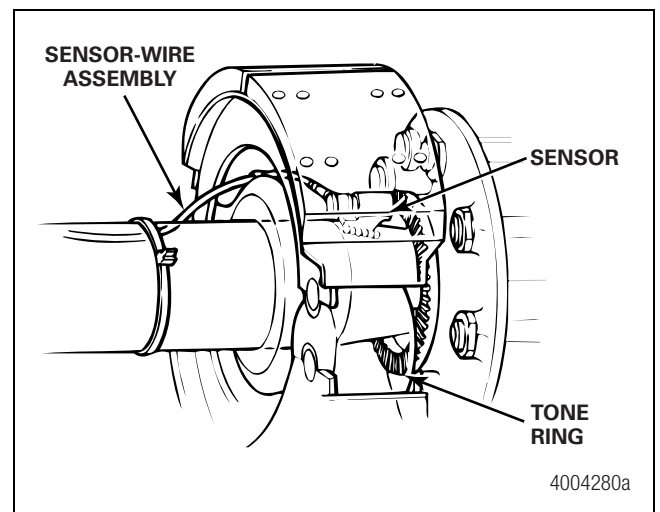


Figure 1.9

1 Introduction

TQD 4670 QH 2020

The eighth position indicates whether the axle is built with cam, disc or wedge brakes. Figure 1.10.

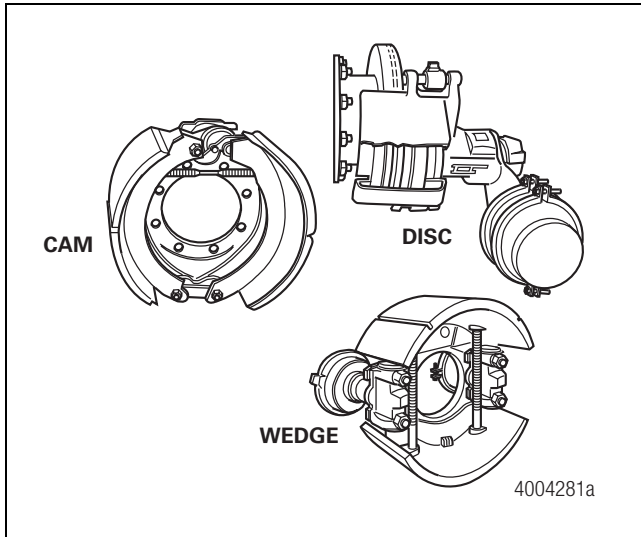


Figure 1.10

TQD 4670 QH 2020

The ninth position indicates whether Meritor furnished the axle with a hub or a spoke wheel. Figure 1.11.

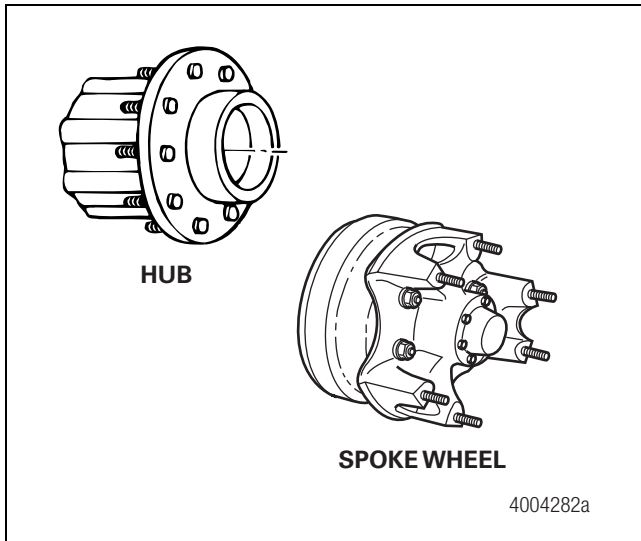


Figure 1.11

TQD 4670 QH 2020

The final number group completes the trailer axle model number. Axle parameters described include, but are not limited to, the following items: axle track, Figure 1.12; brake linings, Figure 1.13; camshaft length, Figure 1.14; air chamber and slack provisions, Figure 1.15; tire inflation system provisions, Figure 1.16; camshaft bushings, Figure 1.17; brake clocking, Figure 1.18; or spider, Figure 1.19. These digits together with the other letters and digits identify all parameters which completely describes the trailer axle. Figure 1.20.

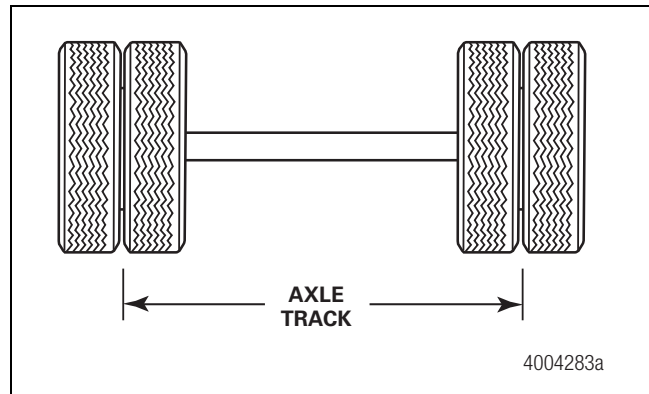


Figure 1.12

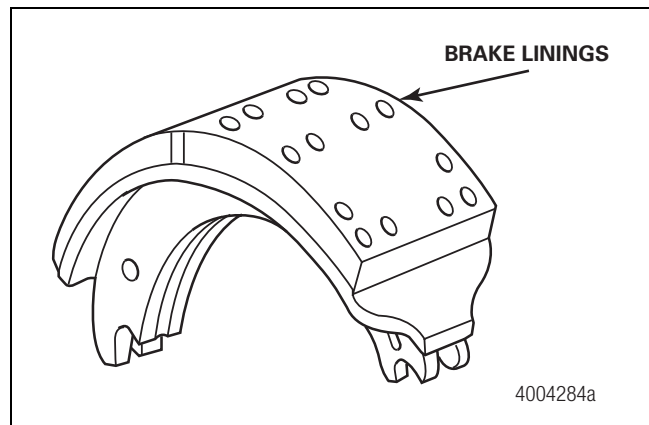


Figure 1.13

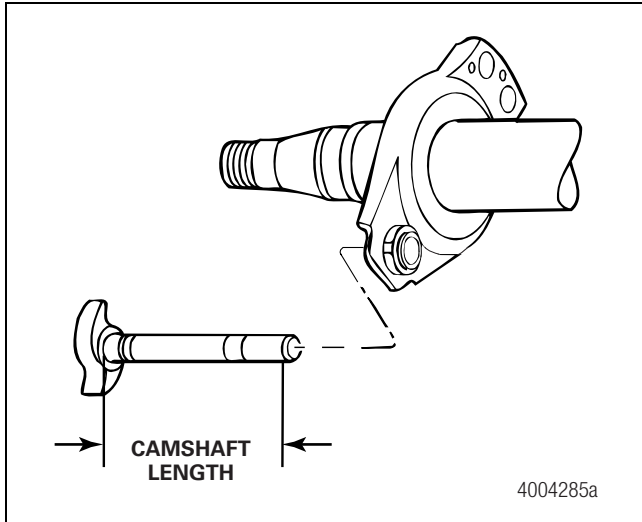


Figure 1.14

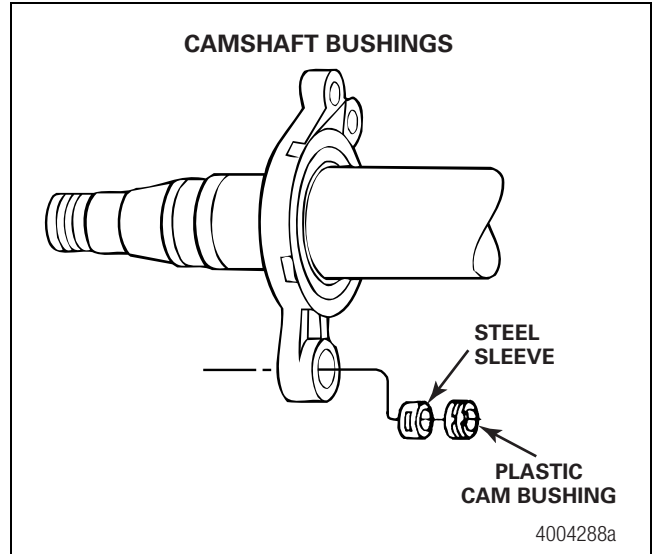


Figure 1.17

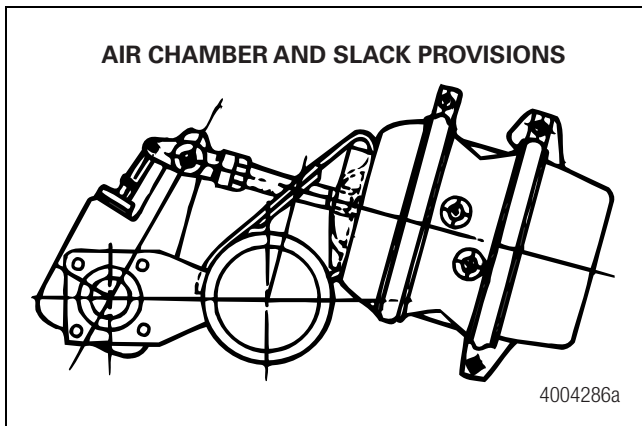


Figure 1.15

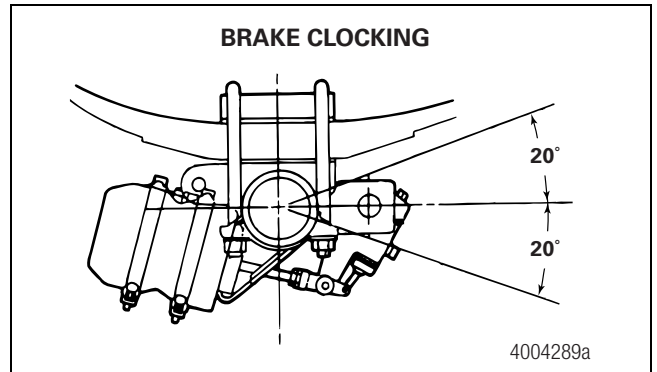


Figure 1.18

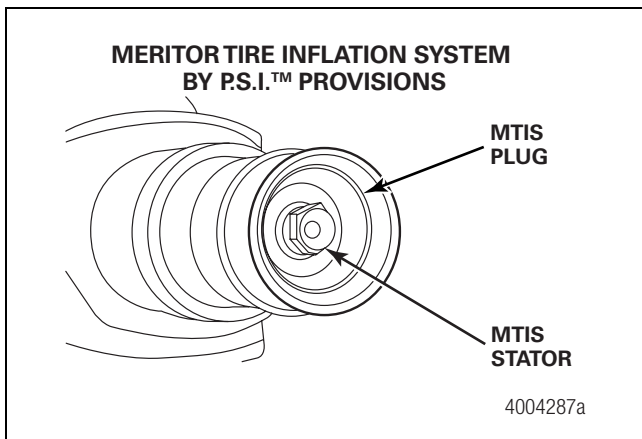


Figure 1.16

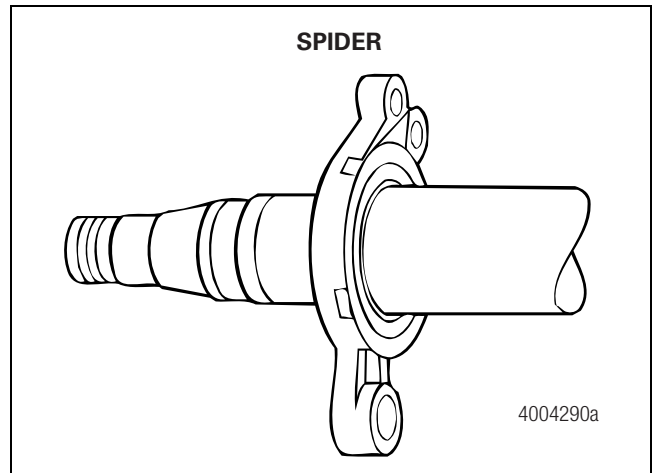


Figure 1.19

1 Introduction

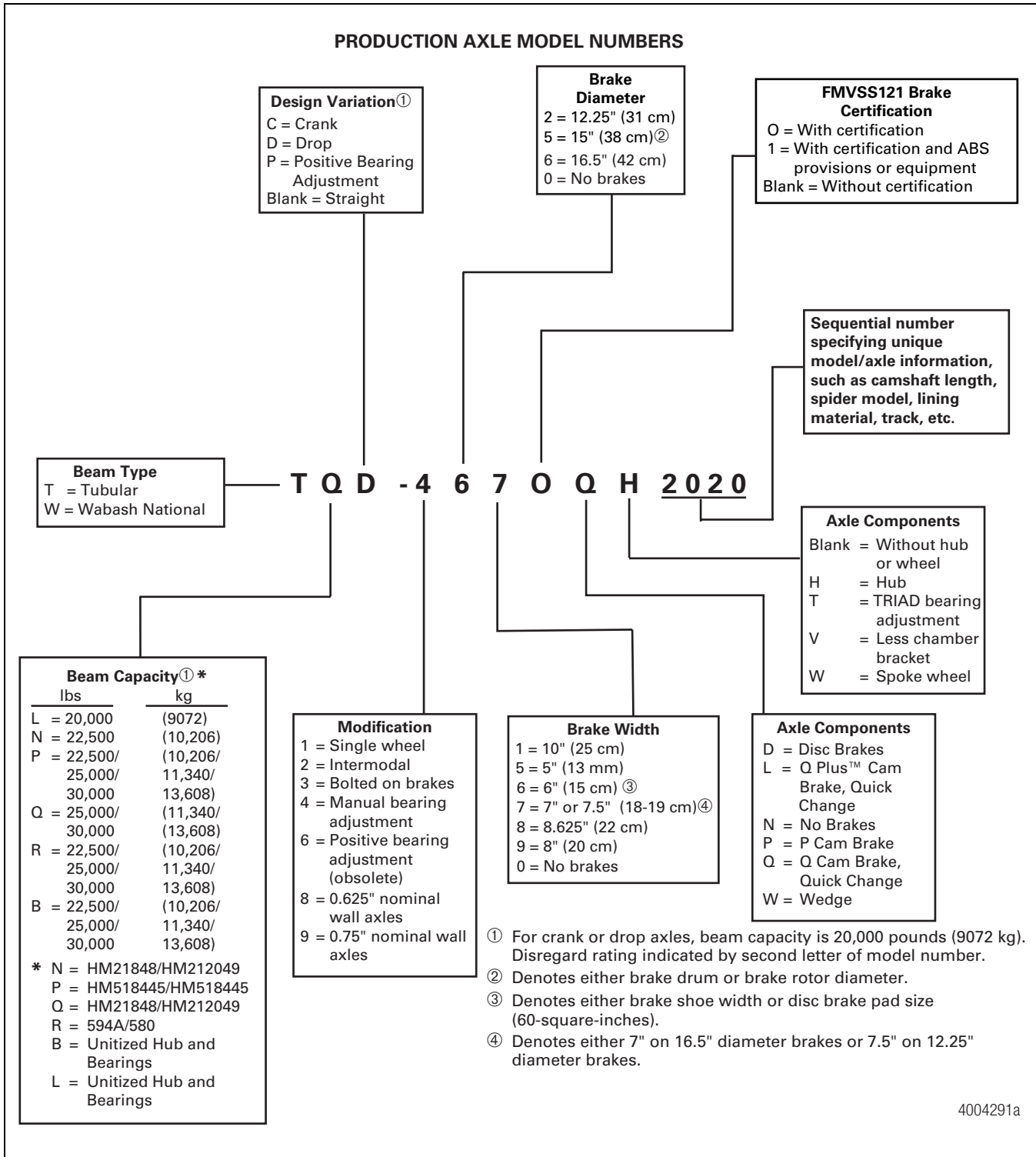


Figure 1.20

Aftermarket Model Numbers

Model numbers for Meritor aftermarket trailer axles are composed of letters and digits; for example, TQD 4670 QR 1120. When compared to the production numbering system, the aftermarket numbering system provides a more complete description of the axle.

TQD 4670 QR 1120

The highlighted group above describes the same information as detailed previously for production model numbers.

TQD 4670 **QR** 1120

The second group indicates the type of brake and identifies the axle as an aftermarket model.

TQD 4670 QR **1120**

The third group identifies the specific axle track, camshaft, lining mix and Meritor suspension brackets provided. Figure 1.21.

1 Introduction

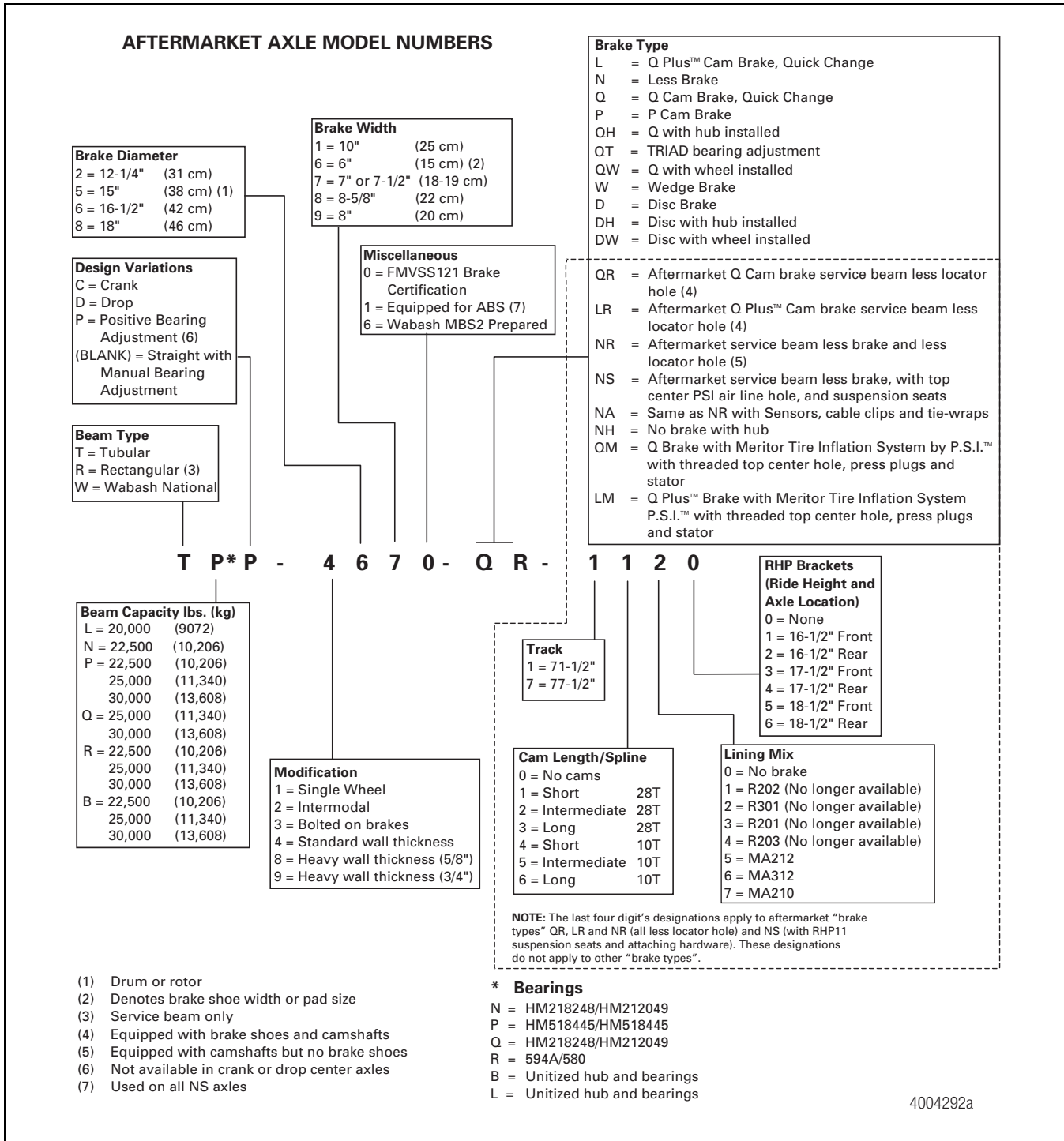


Figure 1.21

Inspect the Unitized Wheel End

Trailer axles built with unitized wheel ends provide extended warranties and reduced maintenance requirements when compared to trailer axles built with conventional wheel-end equipment. Note, however, that while the maintenance requirements for unitized wheel ends is reduced, this equipment must still be regularly inspected. Use the following procedure to inspect unitized wheel ends.

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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.

Inspection Intervals

Scheduled Inspections

The following is intended as a general guideline for scheduled wheel-end inspections. Note that the recommended frequency of these inspections depends on such service factors as the environment, mileage, speed and loading. For example, container chassis service is considered to be a light-duty application since it generally involves an on-highway environment and low mileage. This allows wheel-end inspection intervals to be extended. Dump trailer service is considered to be a heavy-duty application since it generally involves an off-highway environment and heavy loading. This requires that wheel-end inspection intervals be reduced.

Inspect the wheel end for smooth rotation, movement, seal leaks and bearing end play on the following schedule.

- Light-duty service — Inspect the wheel end every 100,000 miles (160 000 km) or 24 months, whichever comes first.
- Standard-duty service — Inspect the wheel end every 100,000 miles (160 000 km) or 12 months, whichever comes first.
- Heavy-duty service — Inspect the wheel-end every 50,000 miles (80 000 km) or six months, whichever comes first.

Scheduled Maintenance

Inspect the wheel end for smooth rotation, movement and seal leaks at each brake reline or regularly scheduled preventive maintenance.

ABS Warning Signal

Inspect the wheel end for smooth rotation, movement and bearing end play if a driver reports that an ABS light has been coming on and ABS diagnostics indicates excessive sensor gap.

Prepare the Trailer for Inspection

⚠ CAUTION

A unitized hub is permanently sealed and lubricated as an assembly. Do not attempt to remove the hub bearings, seals or lubricant. You cannot service or reinstall these components back into a unitized hub. Damage to components can result. Removal of the long-life bearings, seals or lubricants from the Meritor TB model unitized hub will void the warranty.

⚠ WARNING

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.

1. Park the trailer on a level surface.
2. Use a jack to raise the trailer until the tires are off the ground. Place safety stands under the trailer frame or axles.
3. Attach an air line to the trailer emergency glad hand connection to back the brake linings off the drums. The linings must completely clear the drums prior to inspection. If the linings are rubbing on the drums, the inspection results may be incorrect. Figure 2.1.
 - If the linings still touch the drums: Use the slack adjusters to manually back off the linings.

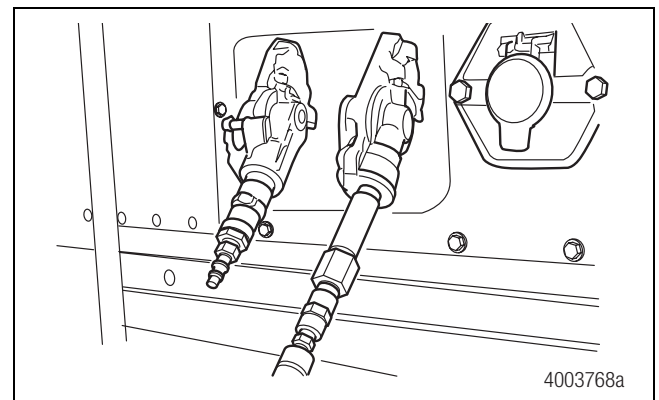


Figure 2.1

2 Unitized Wheel Ends

Check for Smooth Rotation and Movement

You can perform the following inspections for smooth rotation and movement with or without the tire and wheel assembly installed.

1. Rotate the hub. Figure 2.2.

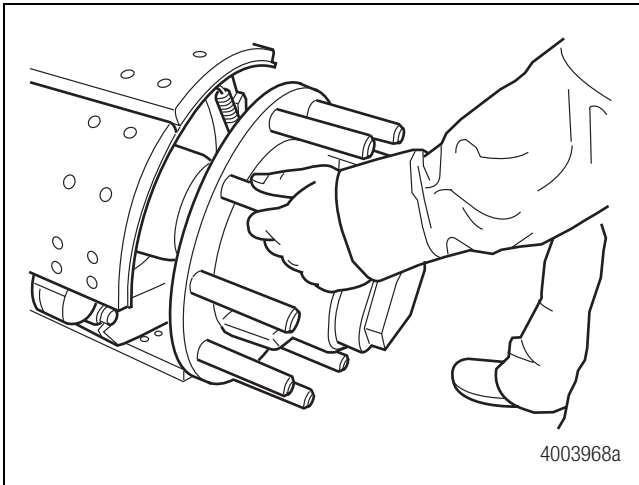


Figure 2.2

2. Listen for worn bearings that make a low-pitched grinding sound as the hub is rotated. If the tires are installed, the wheel will amplify the wheel-end noise. Figure 2.3.
 - **If the bearing sounds noisy:** Check the bearing end play. Refer to the procedure in this section.

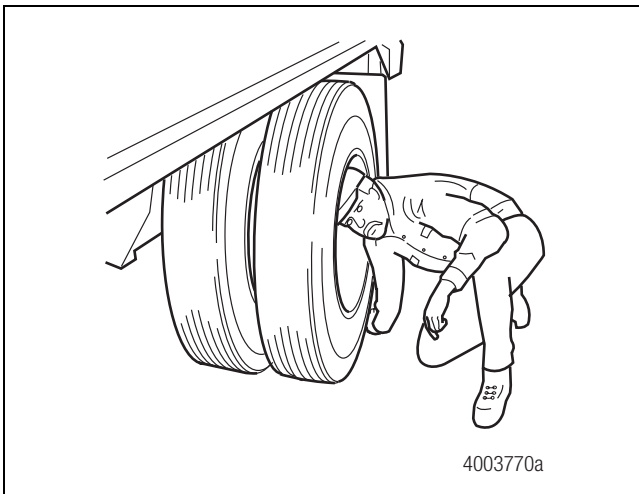


Figure 2.3

3. Place your hand on the brake air chamber that services the wheel end. Feel for any bearing vibration as the hub is rotated. The air chamber will amplify any vibration. Rely more on vibration than noise since dirt in the hub seal can make a noise similar to a worn bearing. Figure 2.4.

- **If the bearing feels rough:** Check the bearing end play. Refer to the procedure in this section.

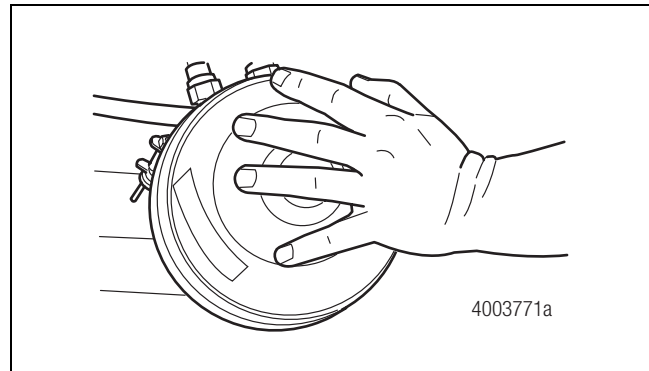


Figure 2.4

4. If the tires are installed, insert a pry bar under the tires. Lift the pry bar and examine the wheel end for movement. Figure 2.5.
 - **If you detect movement:** Check the bearing end play. Refer to the procedure in this section.

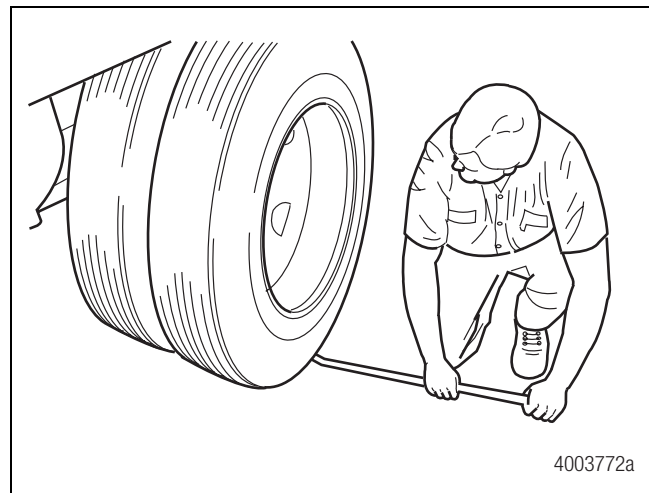


Figure 2.5

- If the tires are not installed, push and pull on opposite sides of the hub flange and examine the wheel end for movement. Figure 2.6.

- If you detect movement:** Check the bearing end play. Refer to the procedure in this section.

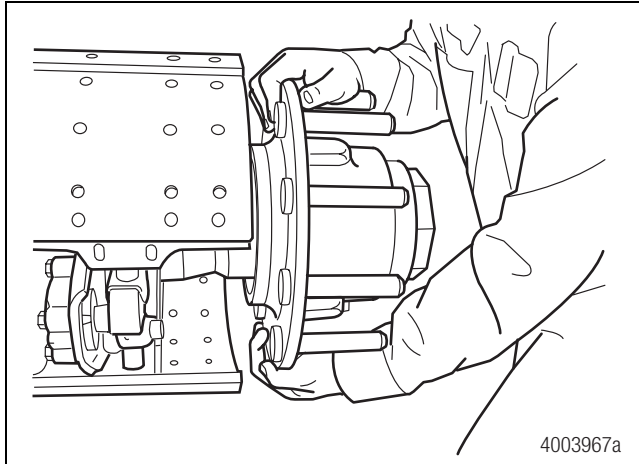


Figure 2.6

Check the Seals

- Check the hub inner grease seal for leakage. A leaking seal will stain the backside of the unitized hub with lubricant, similar to a conventional hub. Figure 2.7.

- If the seal is leaking:** Replace the hub.

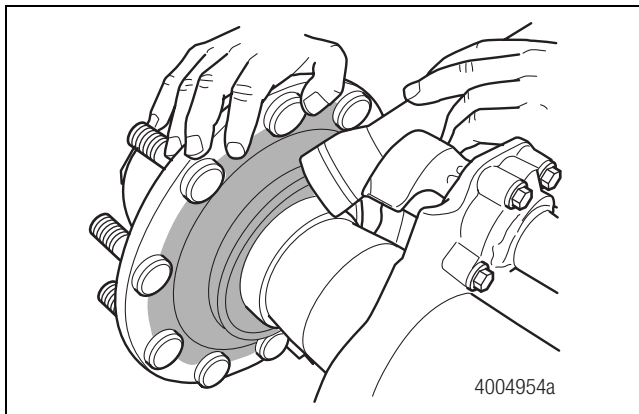


Figure 2.7

- On the TB model, when the hub is installed, a small bead of grease may appear at the spindle backup collar-to-hub joint. This is normal and does not indicate a seal leak. Figure 2.8.

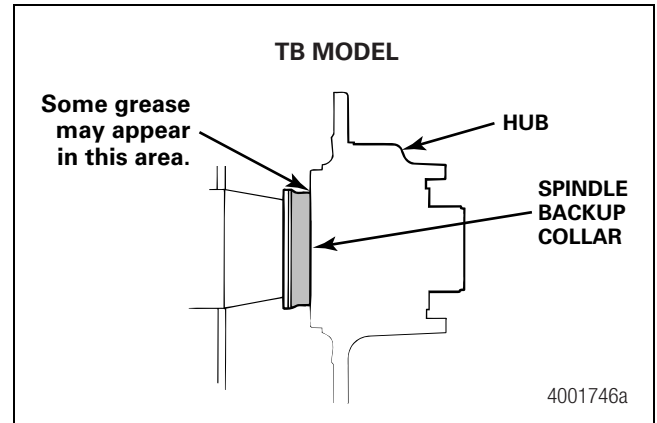


Figure 2.8

- Check the hub outer grease seal for leakage. A small bead of grease around the perimeter of the seal is normal. Figure 2.9.

- If you detect a large amount of grease staining the entire surface of the outer grease seal and the surrounding hub surfaces:** Replace the hub.

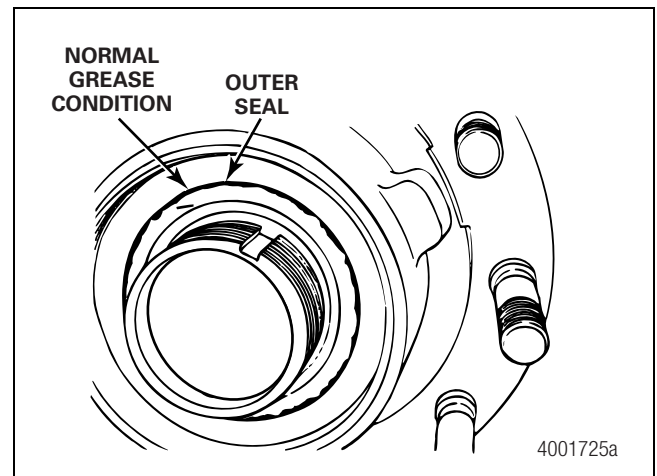


Figure 2.9

- On the TB model, check the hubcap O-ring for splitting or cracking. Figure 2.10.

- If the O-ring is damaged:** Replace the O-ring.

2 Unitized Wheel Ends

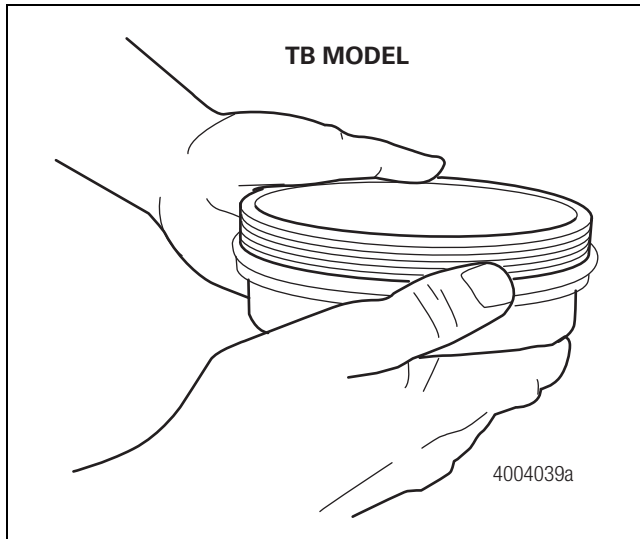


Figure 2.10

Check the Bearing End Play

1. Remove the tire and wheel assembly and the brake drum.
2. Attach the magnetic base of a dial indicator to the end of the axle spindle and touch the dial indicator stem against the hub. Figure 2.11.

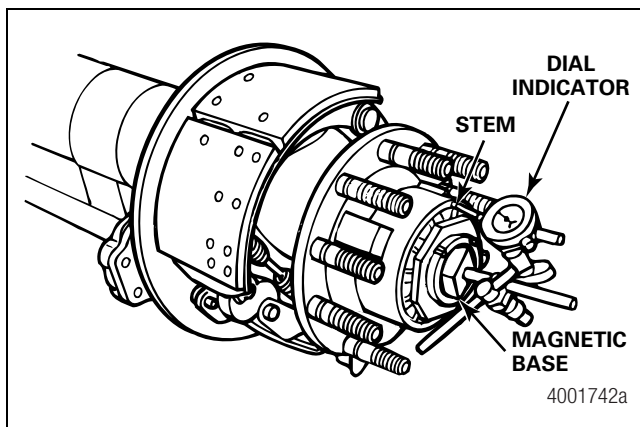


Figure 2.11

3. Push the hub INWARD until the dial indicator does not change. Do not rotate the wheel end. Set the dial indicator to ZERO. Figure 2.12.

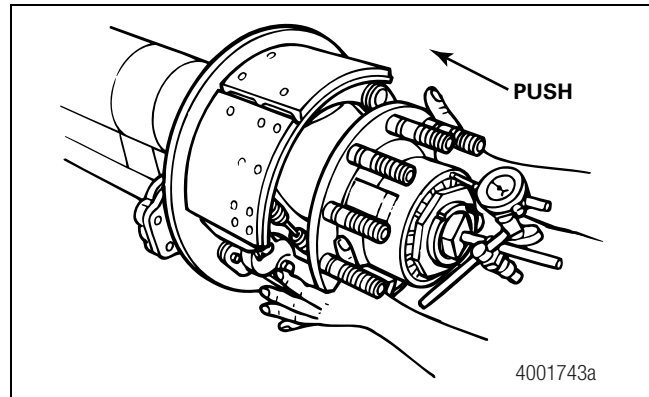


Figure 2.12

4. Pull the hub OUTWARD until the dial indicator does not change. Do not rotate the wheel end. Figure 2.13. The difference in readings between pushing INWARD and pulling OUTWARD is the end play.

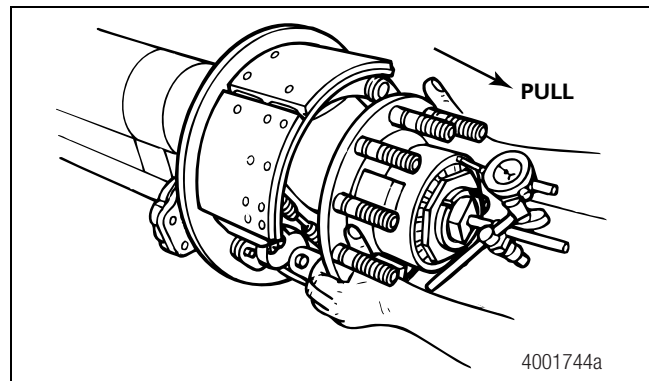


Figure 2.13

5. Proceed as follows based on the end play measurement.
 - **If the end play is less than 0.003-inch (0.0762 mm):** No further action is required.
 - **If the end play is 0.003-inch (0.0762 mm) or greater:** Take the appropriate action.
 - On the TB model, remove the outer nut and lock washer. Tighten the inner nut to 700-750 lb-ft (952-1020 N•m) while rotating the wheel end a minimum of five rotations. **T**
 - On the TL model, lever back the retaining washer flange from where it was staked at the spindle nut slot. Tighten the spindle nut to 525-550 lb-ft (714-748 N•m) while rotating the wheel end a minimum of five rotations. **T**
 - **If the end play is 0.006-inch (0.1524 mm) or greater after you tighten the nut:** Replace the hub.

Description

TB model trailer axles feature unitized hub assemblies fully assembled at the factory for simple installation and reduction of wheel-end maintenance. Figure 3.1.

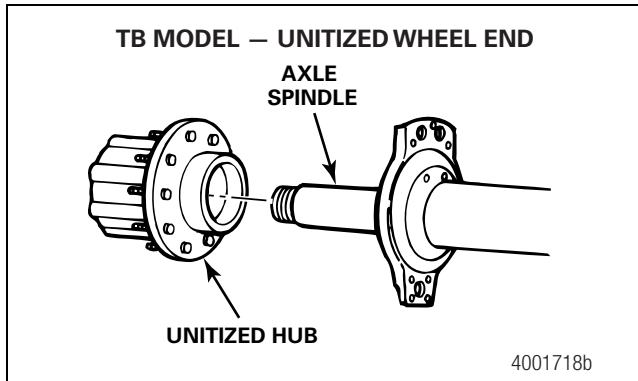


Figure 3.1

TB unitized hubs provide the following features.

- Built with factory-installed inner and outer seals
- Built with the correct lubricant installed at the factory to the correct levels
- Built with bearings that are automatically adjusted as the retention hardware is tightened

These features eliminate the need for adjusting bearings, installing seals and installing lubricant in the field. These features also greatly reduce the need for periodic maintenance and the possibility of incorrect maintenance being performed in the field.

Identification

TB model trailer axles can be identified as follows.

- The axle model number will have the letter B at the second position; for example, TB 4670 QH 2000.
- The axle spindles are straight and shorter than conventional spindles. Figure 3.2.
- The hub is a one-piece assembly containing non-serviceable bearings, seals and lubricant. Seals are located on the inboard and outboard sides of the hub. Figure 3.3.
- The hubcaps are a screw-on type with no provisions for adding lubricant. Plastic hubcaps are standard. Aluminum hubcaps are optional and are used primarily with hubodometers and the Meritor Tire Inflation System by P.S.I.™ Figure 3.4.
- Warranty and service information is marked on the hubcap. Figure 3.5.

- The retention hardware consists of a four-piece system including two nuts, a bendable lock washer and a hardened washer. Earlier versions of the retention hardware did not use a hardened washer. Figure 3.6.
- The retention hardware inner nut is thicker than a conventional nut and is stamped with installation information. Figure 3.2.

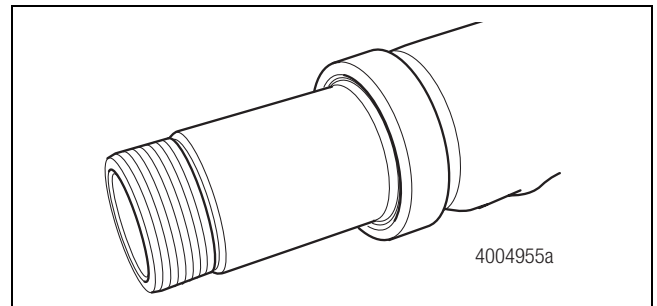


Figure 3.2

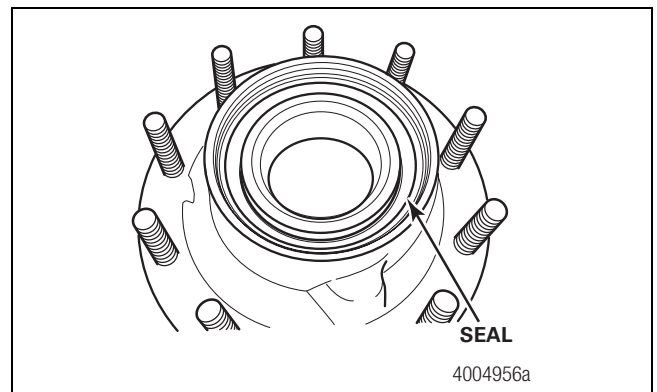


Figure 3.3

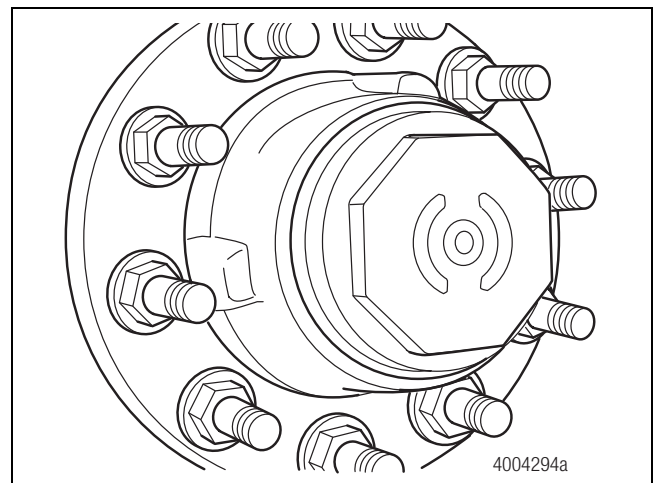


Figure 3.4

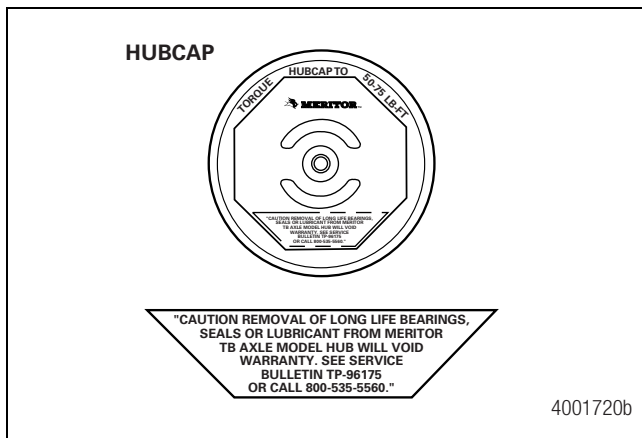


Figure 3.5

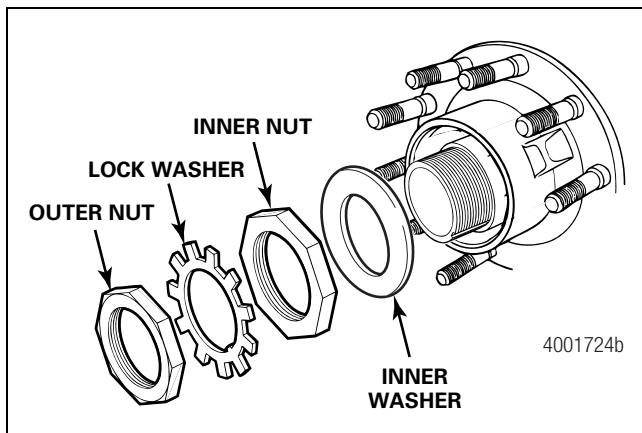


Figure 3.6

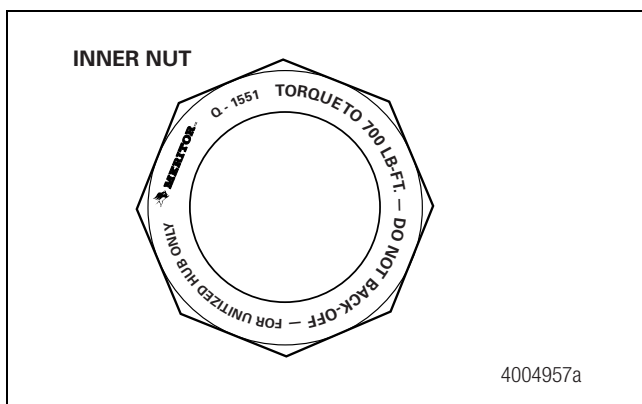


Figure 3.7

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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.

Remove the Unitized Hub

Under normal operating conditions, you are not required to remove the TB model unitized hub from the axle spindle. However, maintenance procedures, such as replacing damaged wheel studs, require that you remove the hub.

⚠ CAUTION

A unitized hub is permanently sealed and lubricated as an assembly. Do not attempt to remove the hub bearings, seals or lubricant. You cannot service or reinstall these components back into a unitized hub. Damage to components can result. Removal of long-life bearings, seals or lubricant from the Meritor TB model unitized hub will void the warranty.

⚠ WARNING

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.

1. Park the trailer on a level surface.
2. Use a jack to raise the trailer until the tires are off the ground. Place safety stands under the trailer frame or axles. Figure 3.8.

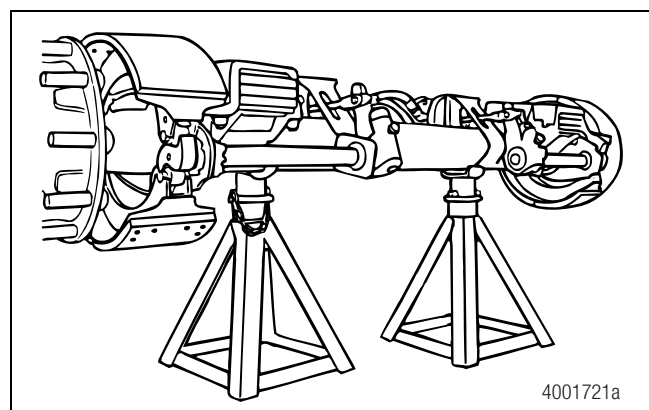


Figure 3.8

⚠ WARNING

Do not attempt to remove the tire and wheel, and hub and drum, as an assembly from the spindle. The clip inside the hub bore can dislodge, and the hub can disassemble. Serious personal injury and damage to components can result.

ASBESTOS AND NON-ASBESTOS FIBERS

⚠ WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

3. Remove the tire and wheel assembly. Figure 3.9.

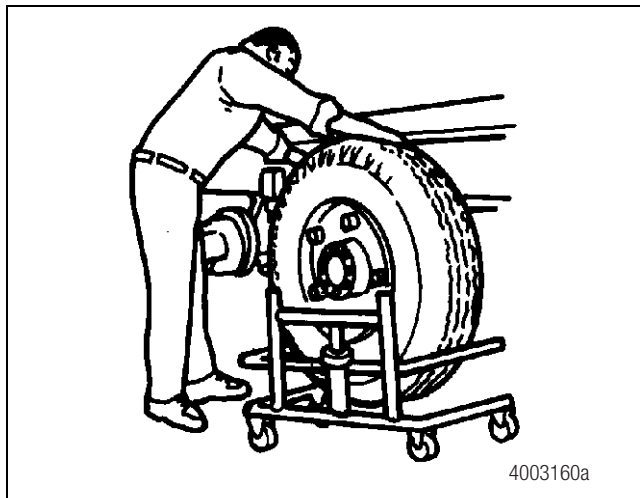


Figure 3.9

4. Release the brakes and remove the brake drum. Figure 3.10.

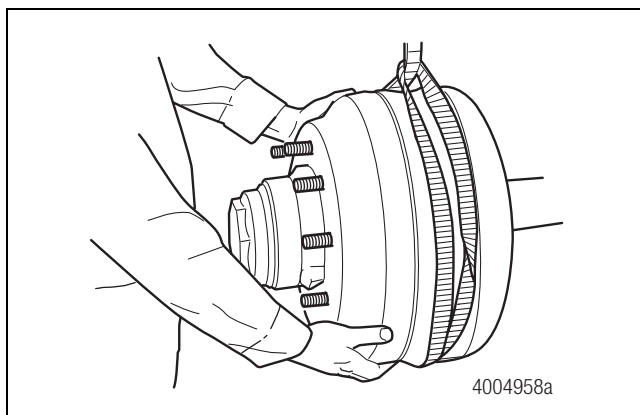


Figure 3.10

5. Remove the hubcap. Figure 3.11.

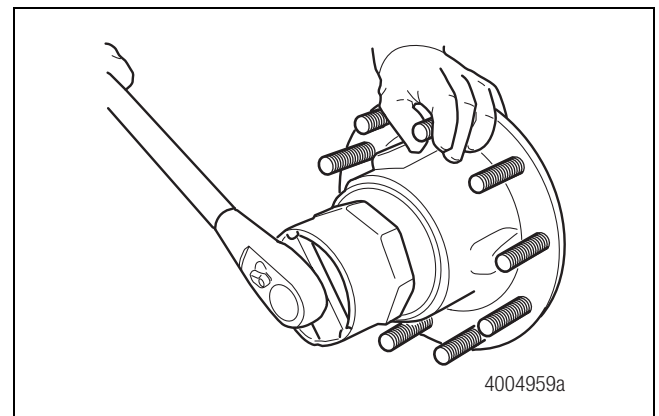


Figure 3.11

6. Use a tool to straighten the two opposing flattened lock washer tabs until they clear the outer nut. Keep the tool securely on the tabs. If the tool slips off the tabs, you can damage the hub seal. Figure 3.12.

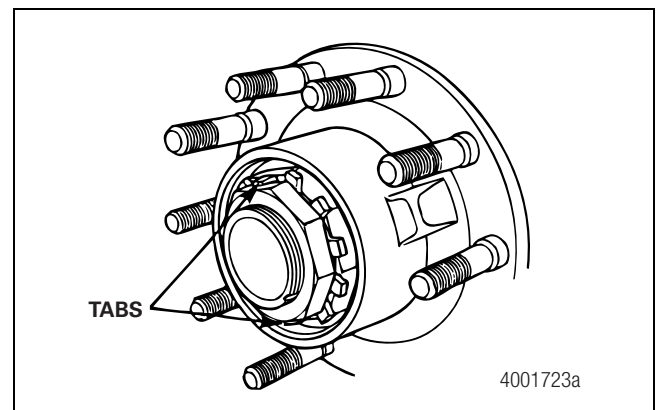


Figure 3.12

⚠ CAUTION

Prevent contaminants from entering the seal on the back side of the hub when you remove the hub. This will help prevent damage to the seal.

7. If you are going to reuse the hub, clean the back of the hub to help prevent contaminants from entering the seal during removal. Figure 3.13.

3 TB Model

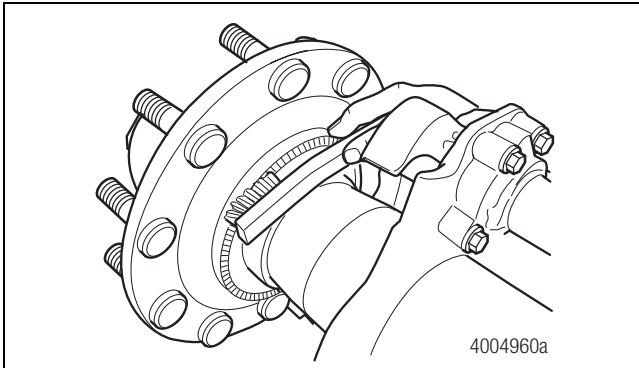


Figure 3.13

8. Remove the outer nut, lock washer, inner nut and inner washer, if provided. Early TB model axles did not use the inner washer. Figure 3.14.

Take care when you remove the inner nut to prevent damage to the hub seal. Because of the high installation torque, a torque multiplier may be useful in removing the inner nut.

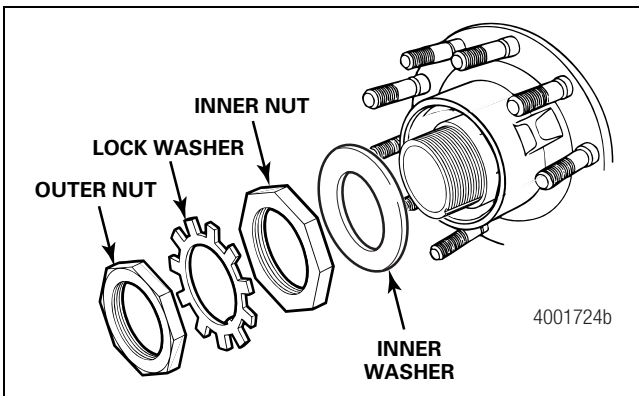


Figure 3.14

⚠ WARNING

When you remove the hub from the axle spindle, carefully pull the hub off the spindle as straight as possible to help avoid dislodging the clip inside the hub bore. If the clip becomes dislodged, the hub will disassemble, which will contaminate the interior of the hub and void the warranty. Do not attempt to rebuild a hub that has disassembled. If the hub disassembles, you must install a new hub to avoid serious personal injury and damage to components.

9. Grasp the hub assembly with both hands and pull the hub as straight as possible to avoid dislodging the clip inside the hub bore. Figure 3.15 and Figure 3.16.

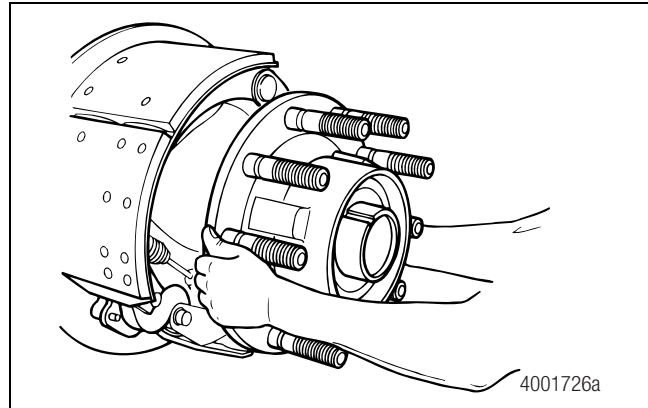


Figure 3.15

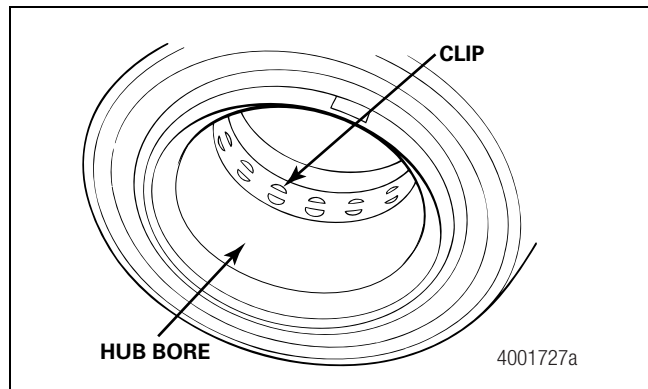


Figure 3.16

10. If the hub sticks to the axle spindle, use one of the following procedures to remove the hub from the spindle.
- A. Tap lightly on the rough part of the axle with a hammer while pulling the hub from the spindle. Tapping may loosen the hub assembly for easier removal. Figure 3.17.

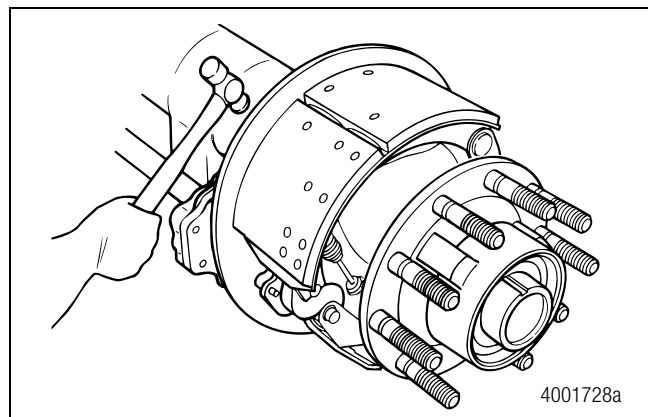


Figure 3.17

⚠ CAUTION

Always use a metal plate at the end of the spindle when you use a puller to remove a hub to prevent damage to the spindle end plug.

- B. Use a puller to remove a hub that sticks to the axle spindle.
 - Install a metal plate onto the end of the spindle. Figure 3.18.
 - Attach a three-pronged puller to the hub. Figure 3.18.
 - While holding the puller screw stationary, spin the hub to break it free from the axle. Figure 3.18.
 - Remove the puller from the axle.
 - Pull the hub as straight as possible off the spindle to avoid dislodging the clip inside the hub bore. Figure 3.15 and Figure 3.16.

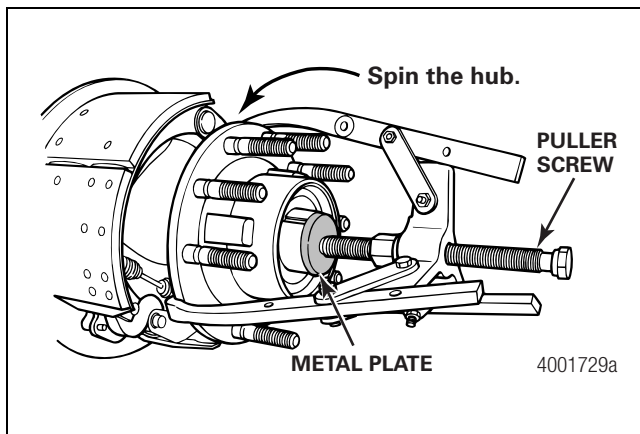


Figure 3.18

Install the Unitized Hub**⚠ WARNING**

You must follow the installation procedures outlined below when you install a unitized hub. Wheel separation, damage to components and serious personal injury can result if you do not carefully follow these procedures.

Do not attempt to install a hub and drum, and tire and wheel, as an assembly onto the spindle. The clip inside the hub bore can dislodge, and the hub can disassemble. Serious personal injury and damage to components can result.

⚠ CAUTION

When you install the hub, prevent contaminants from entering the hub inner seal to help prevent damage to the seal.

Do not use solvents to clean the hub bore. Solvents can enter the hub and contaminate the lubricant. Damage to components can result.

1. Clean the axle spindle and hub bore by wiping them with a clean rag. Figure 3.19 and Figure 3.20.

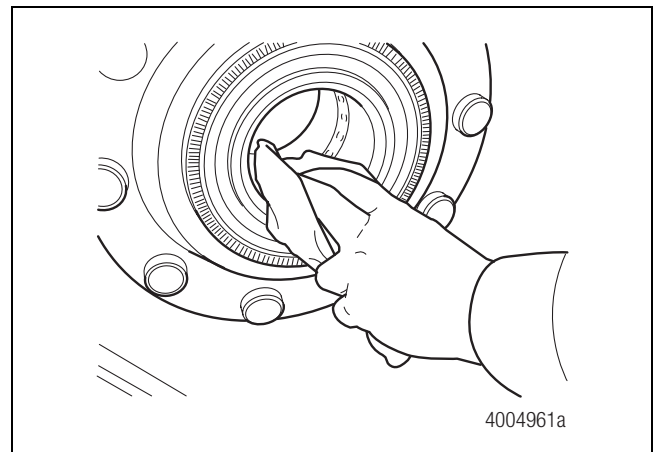


Figure 3.19

3 TB Model

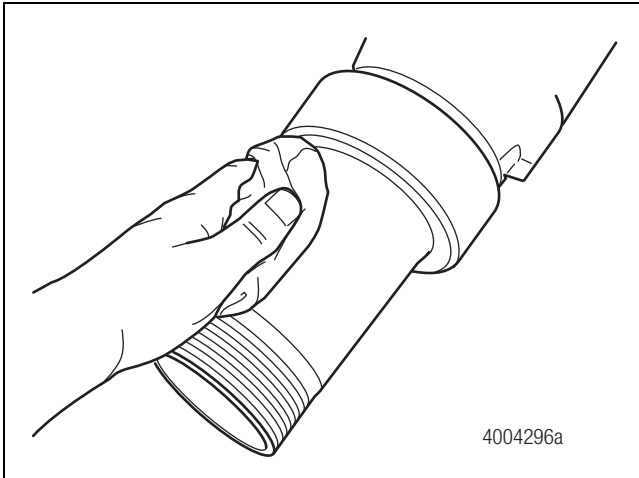


Figure 3.20

2. Check the axle spindle and hub bore for scratches, nicks or marks. Repair them with a crocus or emery cloth. Figure 3.21.

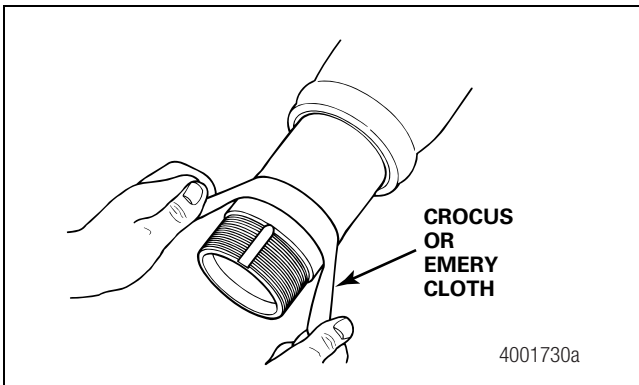


Figure 3.21

⚠ CAUTION

Remove all debris from the joint between the hub and axle backup collar. If debris is trapped in this joint, it could create a condition in which clamp on the hub is lost resulting in damage to components.

3. Use your finger to verify that the hub side of the axle backup collar and the edge of the hub that contacts the backup collar are clear of debris. Figure 3.22 and Figure 3.23.

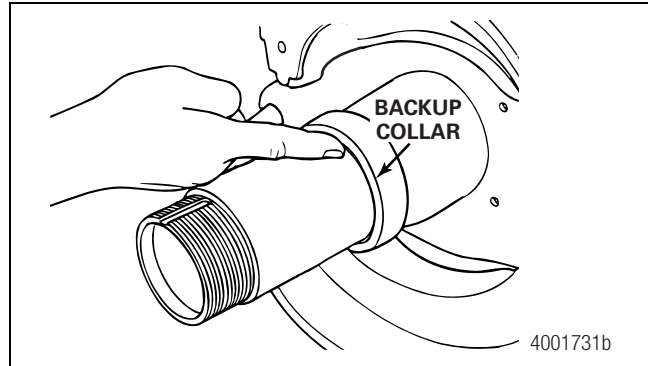


Figure 3.22

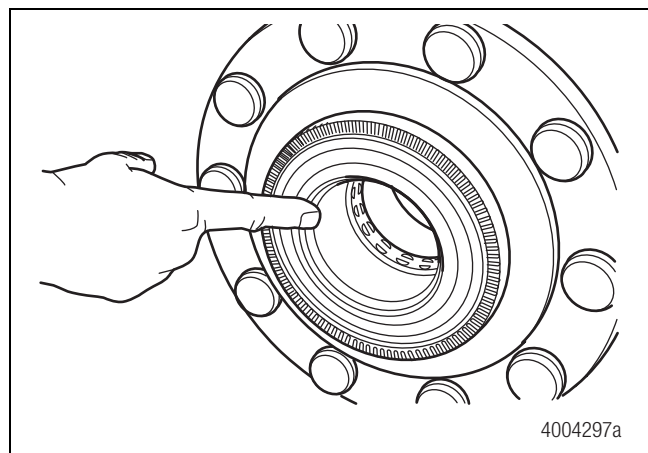


Figure 3.23

4. Prepare the spindle and hub as follows.

- If the wheel end uses a spindle O-ring, Meritor part number 5X-1329, to seal the hub-spindle joint: Use the following procedure.
 - A. Apply a light coating of bearing grease to the O-ring. Figure 3.24.

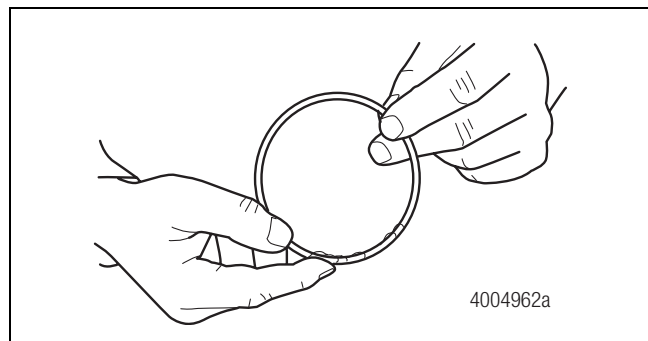


Figure 3.24

- B. Slide the O-ring onto the spindle. Figure 3.25. The O-ring must be positioned so it rests at the corner radius of the backup collar. Figure 3.26.

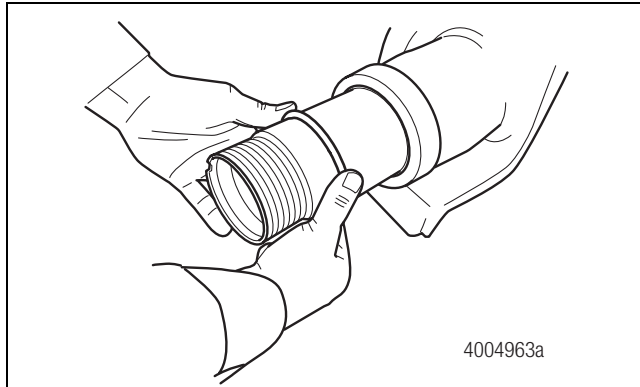


Figure 3.25

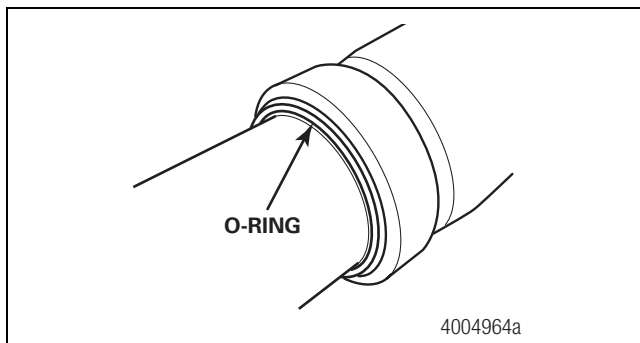


Figure 3.26

- C. Apply a light coating of bearing grease to the hub bore. The entire hub bore which comes in contact with the spindle should be covered. This grease will help reduce spindle wear, assist in hub removal, and help seal the hub-spindle joint. Figure 3.27.

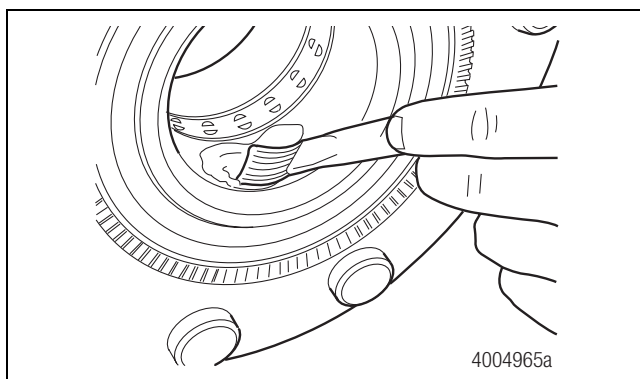


Figure 3.27

- **If the hub assembly does not use a spindle O-ring:** Apply a light coating of bearing grease to the axle spindle bearing journals and the hub side of the backup collar. This grease will help reduce spindle wear, assist in hub removal, and help seal the hub-spindle joint. Figure 3.28.

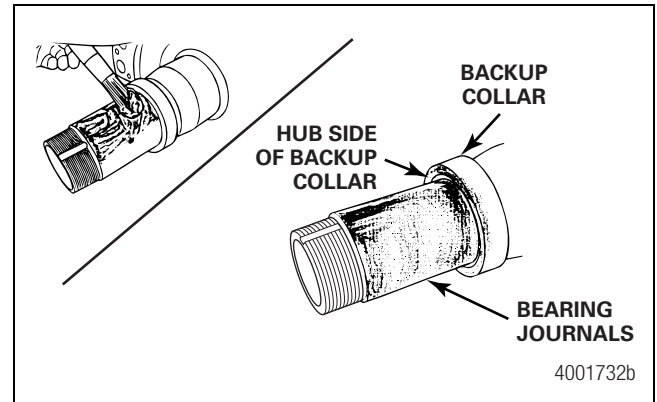


Figure 3.28

⚠ WARNING

You must align the hub bore straight to the axle spindle to help avoid dislodging the clip inside the hub bore. If the clip becomes dislodged, the hub will disassemble, which will contaminate the interior of the hub and void the warranty. Do not attempt to rebuild a hub that has disassembled. If the hub disassembles, you must install a new hub to avoid serious personal injury and damage to components.

⚠ CAUTION

Do not force the hub onto the axle spindle. The hub can jam on the spindle. Damage to components can result.

5. Carefully align the hub bore to the axle spindle and slide the hub straight onto the axle spindle. The hub is correctly installed when it bottoms-out against the spindle backup collar. When you install the hub, it is normal for a small bead of grease to appear at the hub-spindle backup collar joint. Figure 3.29 and Figure 3.30.

- **If the hub becomes jammed:** Carefully remove the hub so the clip in the hub bore is not dislodged and repeat the installation step by aligning the hub bore to the spindle.

3 TB Model

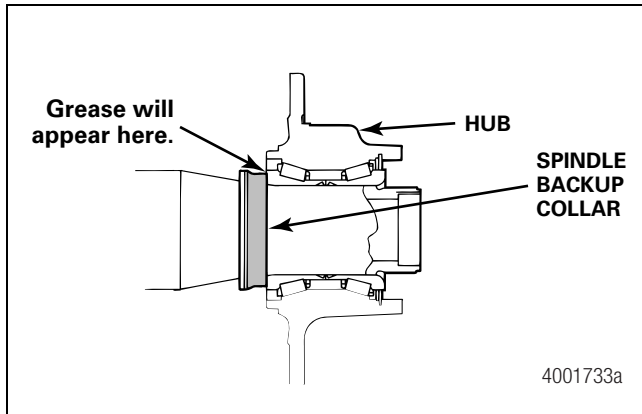


Figure 3.29

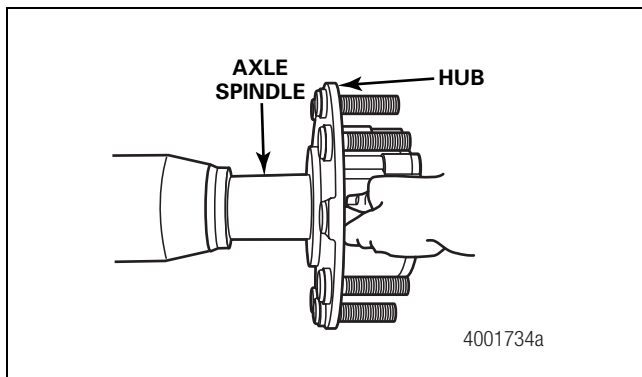


Figure 3.30

6. Install the inner washer, if provided. Figure 3.31.

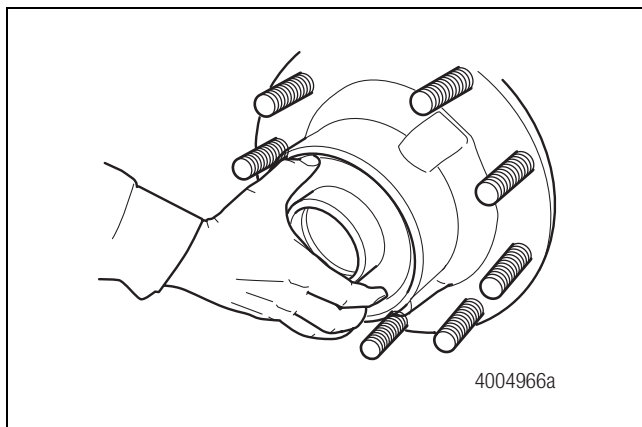


Figure 3.31

⚠ WARNING

The hub must be rotated while the spindle nut is tightened to the correct torque specification. The nut can loosen if it is not tightened correctly. The bearings may not seat correctly if the hub is not rotated. Serious personal injury and damage to components can result.

7. Use a torque wrench to tighten the inner nut to 700-750 lb-ft (952-1020 N•m) while rotating the hub a minimum of five complete turns. Because of the high torque values required, using a torque multiplier is helpful. Take care when you install the inner nut to ensure the socket does not damage the hub outer seal. Figure 3.32. **ⓘ**

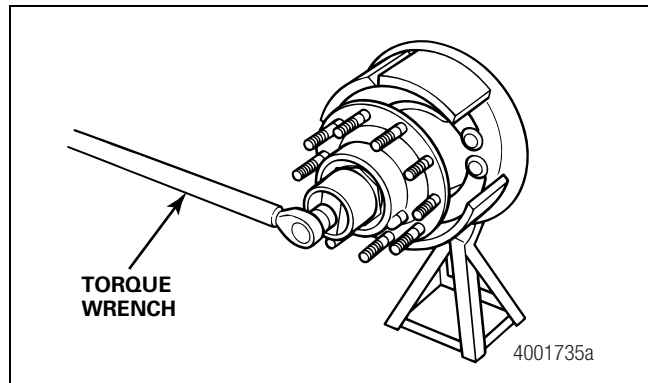


Figure 3.32

8. Check the hub to verify that it rotates freely.

- **If the hub assembly does not rotate freely:** Perform the hub inspection procedures in Section 2 of this manual.

9. Install the lock washer and verify that the tab is correctly inserted into the spindle keyway.

10. Use a torque wrench to tighten the outer nut to 250-300 lb-ft (340-408 N•m). **ⓘ**

11. Use a tool to bend two lock washer tabs over the opposite flats of the outer nut. Keep the tool securely on the tabs. If the tool slips off the tabs, you could damage the hub outer seal. Figure 3.33.

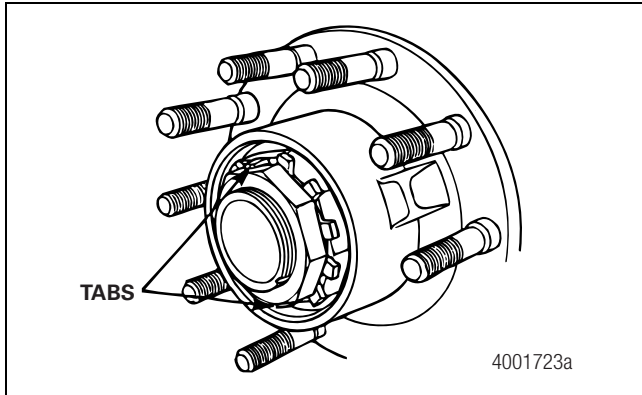


Figure 3.33

12. Lightly lubricate the hubcap O-ring and the hubcap threads with bearing grease. Figure 3.34.

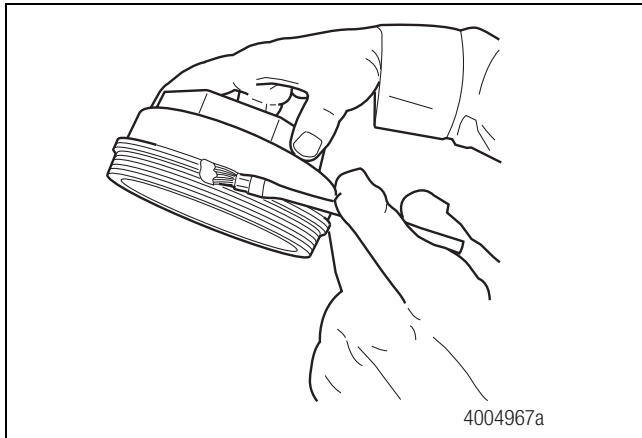


Figure 3.34

13. Install the hubcap and tighten it to 50-75 lb-ft (68-102 N•m). Figure 3.35. **ⓘ**

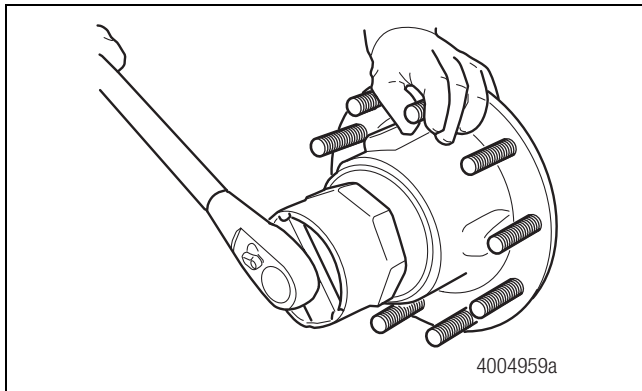


Figure 3.35

14. Install the brake drum and the tire and wheel assembly. Figure 3.36.

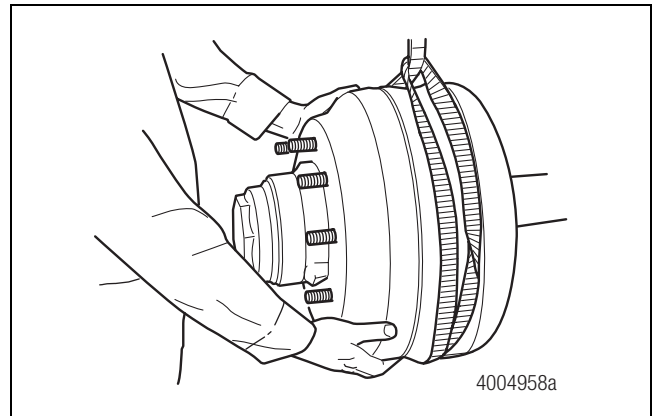


Figure 3.36

15. Adjust the brakes.

4 TL Model

Description

TL model trailer axles feature unitized hub assemblies fully assembled at the factory for simple installation and reduction of wheel-end maintenance. Figure 4.1.

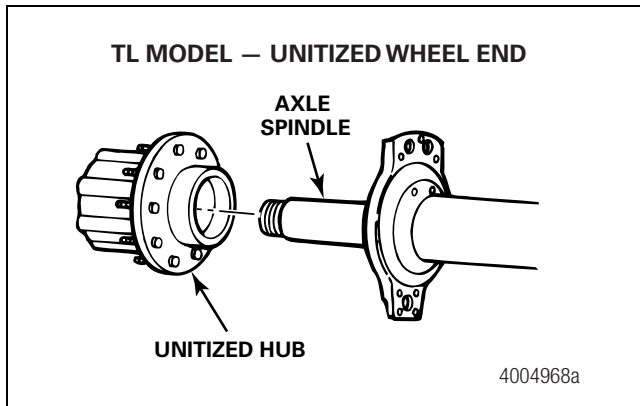


Figure 4.1

TL unitized hubs provide the following features.

- Built with a factory-installed bearing cartridge that is pressed into the hub. This cartridge is non-serviceable and cannot be removed from the hub.
- Built with factory-installed inner and outer seals
- Built with the correct lubricant installed at the factory to the correct levels
- Built with bearings that are automatically adjusted as the retention hardware is tightened

These features eliminate the need for adjusting bearings, installing seals and installing lubricant in the field. These features also greatly reduce the need for periodic maintenance and the possibility of incorrect maintenance being performed in the field.

Identification

TL model trailer axles can be identified as follows.

- The axle model number will have the letter L at the second position; for example, TL 4670 QH 2000.
- The axle spindles are straight and shorter than conventional spindles. Figure 4.2.
- The hub is a one-piece assembly containing non-serviceable bearings, primary seals and lubricant. Primary seals are located on the inboard and outboard sides of the hub. Figure 4.3.

- The inboard side of the hub contains a secondary seal designed to protect the primary inboard seal. Figure 4.4.
- The non-serviceable bearing cartridge is held in place by a heavy-duty snap ring visible from the outboard side of the hub. Figure 4.5.
- The hubcap is a stamped steel bolt-on design with embossed semi-circles on the face and no provisions for adding lubricant. Figure 4.6.
- The hubcap has a decal on the side with warranty and service information. Figure 4.7.
- The retention hardware consists of a two-piece system including a spindle nut and a retaining washer. Figure 4.8.

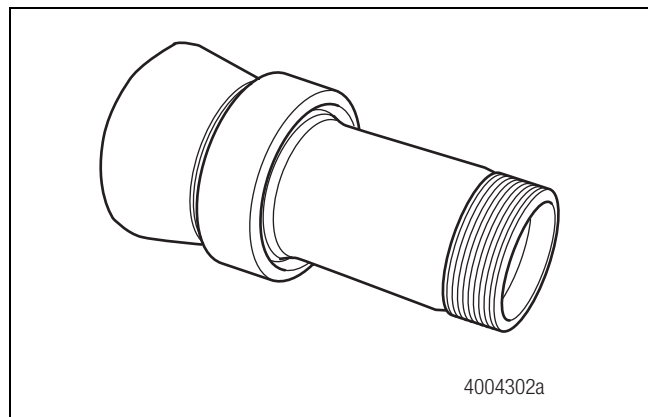


Figure 4.2

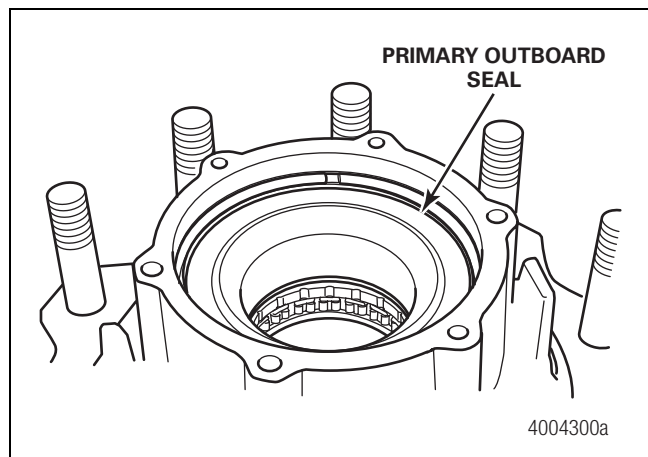


Figure 4.3

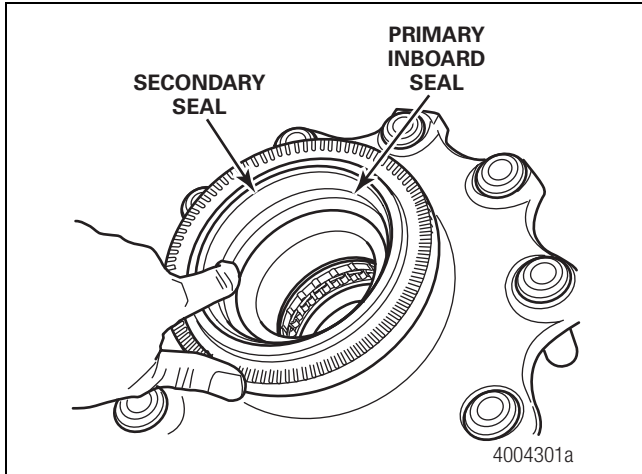


Figure 4.4

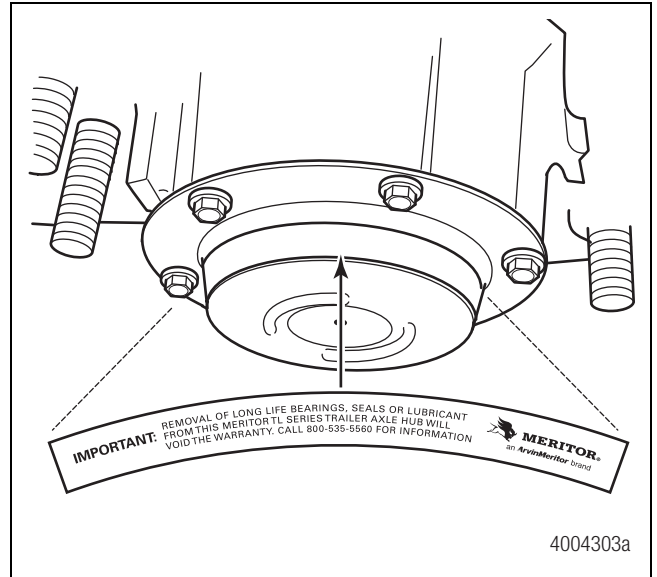


Figure 4.7

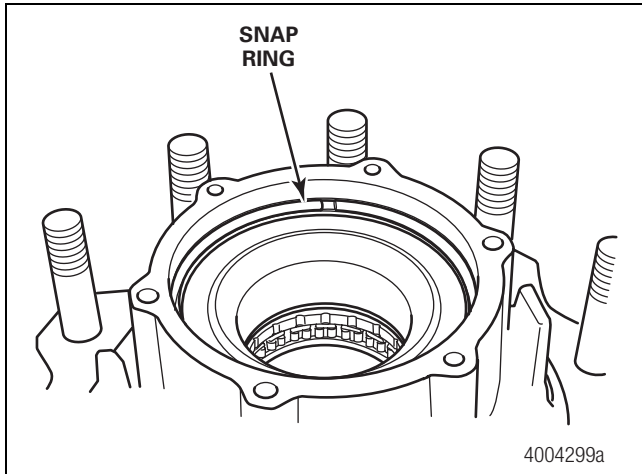


Figure 4.5

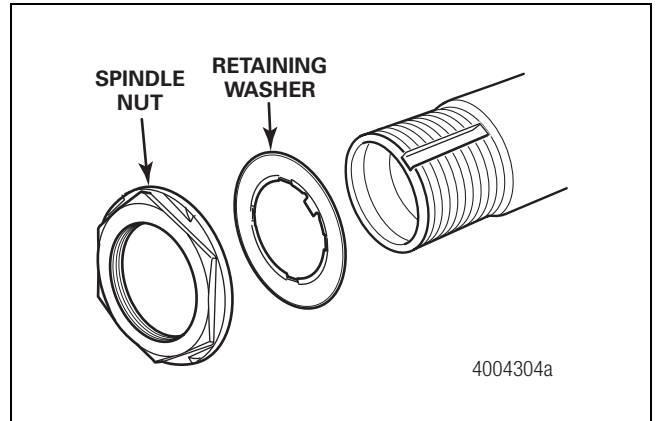


Figure 4.8

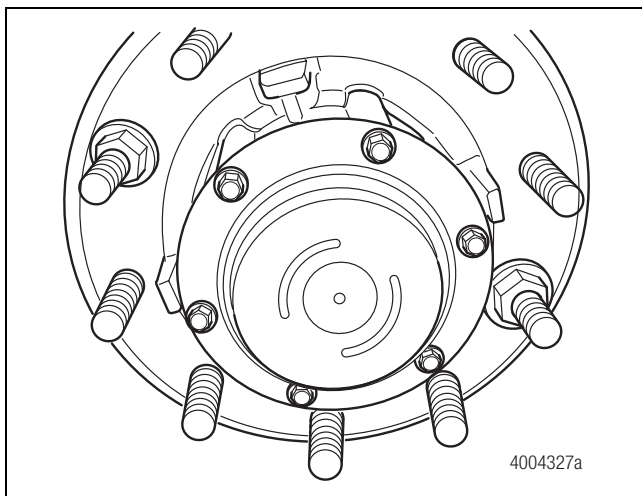


Figure 4.6

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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.

4 TL Model

Remove the Unitized Hub

Under normal operating conditions, you are not required to remove the TL model unitized hubs from the axle spindle. However, maintenance procedures, such as replacing damaged wheel studs, require that you remove the hub.

CAUTION

A unitized hub is permanently sealed and lubricated as an assembly. Do not attempt to remove the hub bearings, primary seals or lubricant. You cannot service or reinstall these components back into a unitized hub. Damage to components can result. Removal of long-life bearings, primary seals or lubricant from the Meritor TL model unitized hub will void the warranty.

WARNING

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.

1. Park the trailer on a level surface.
2. Use a jack to raise the trailer until the tires are off the ground. Place safety stands under the trailer frame or axles. Figure 4.9.

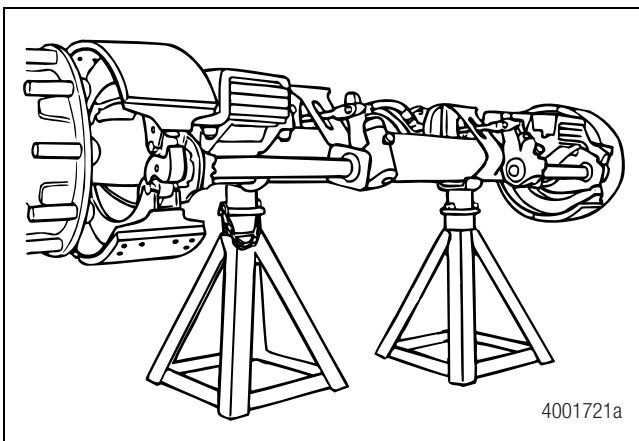


Figure 4.9

WARNING

Do not attempt to remove the tire and wheel, and hub and drum, as an assembly from the spindle. The clip inside the hub bore can dislodge, and the hub can disassemble. Serious personal injury and damage to components can result.

ASBESTOS AND NON-ASBESTOS FIBERS **WARNING**

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

3. Remove the tire and wheel assembly. Figure 4.10.

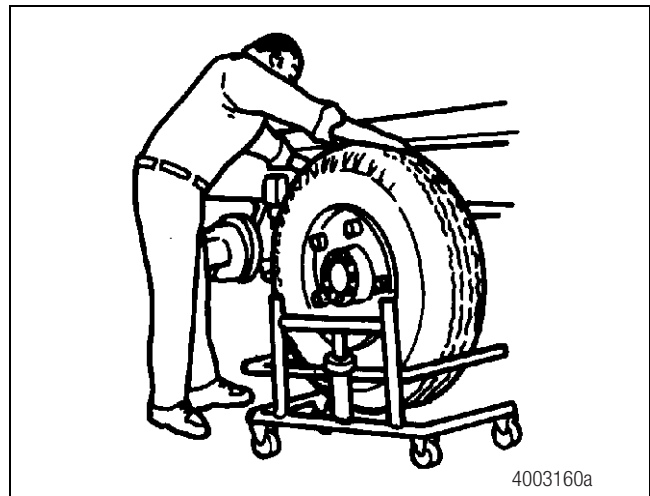


Figure 4.10

4. Release the brakes and remove the brake drum. Figure 4.11.

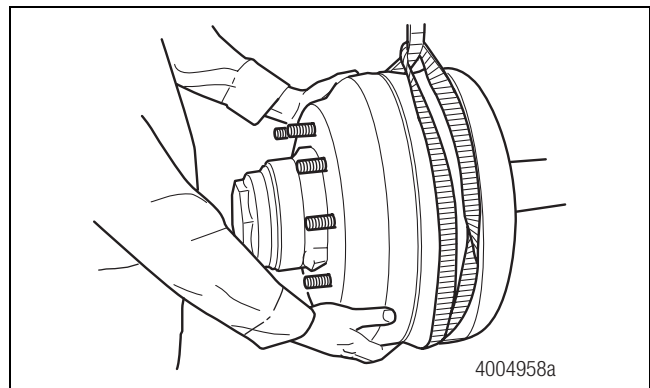


Figure 4.11

- Remove the hubcap and hubcap gasket. Figure 4.12.

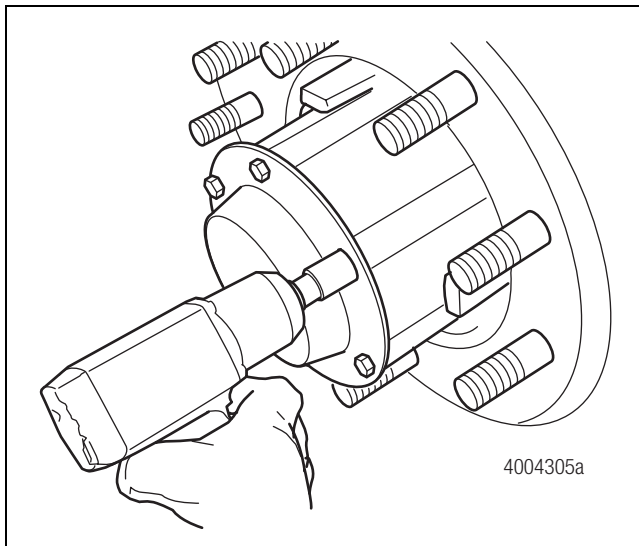


Figure 4.12

- Use a small chisel or screwdriver to lever back the retaining washer flange from where it was staked at one of the spindle nut slots. The retaining washer flange must be completely clear of the spindle nut flange. Figure 4.13.

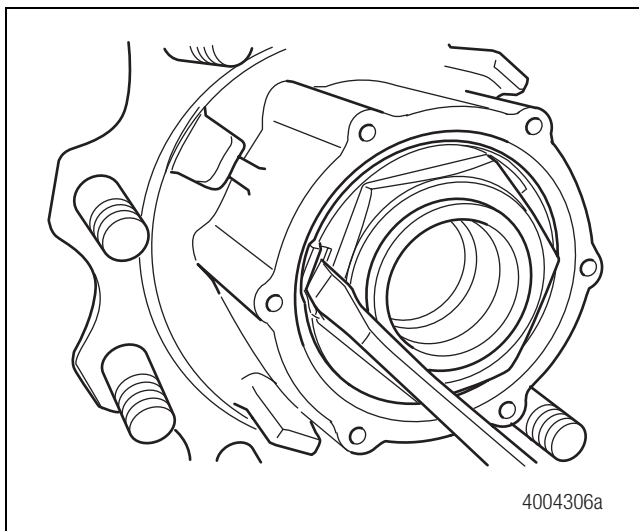


Figure 4.13

- Remove the spindle nut and retaining washer. Because of the high installation torque, a torque multiplier may be useful in removing the spindle nut. Figure 4.14.

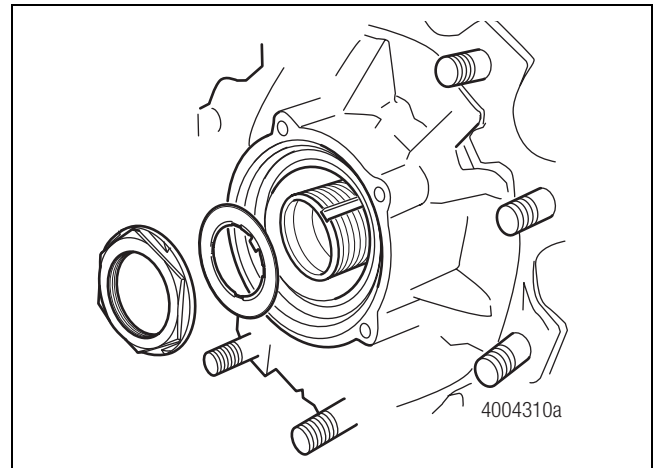


Figure 4.14

CAUTION

Always use a metal plate at the end of the spindle when you use a puller to remove a hub to prevent damage to the spindle end plug.

- Normally you will need to use a puller to remove the hub from the axle spindle. On a conventional wheel end, removing the outer bearing allows the hub to drop relative to the axle and break the oil seal free of the oil seal collar. The non-serviceable unitized hub keeps this equipment in line and a hub puller is normally needed to break the hub free of the spindle.
 - Install a metal plate onto the end of the spindle. Figure 4.15.
 - Attach a three-pronged puller to the hub. Figure 4.15.
 - While holding the puller screw stationary, spin the hub to break it free from the axle. Figure 4.15.
 - Remove the puller from the axle.

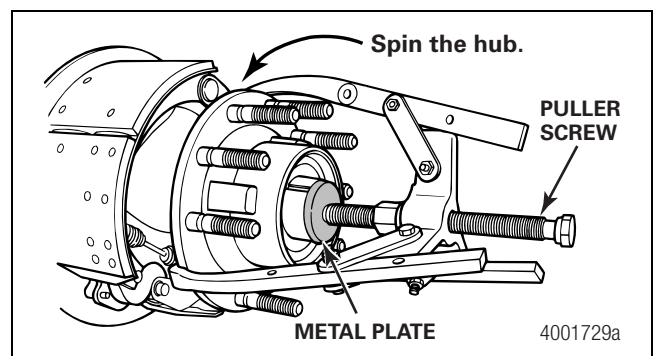


Figure 4.15

4 TL Model

⚠ WARNING

When you remove the hub from the axle spindle, carefully pull the hub off the spindle as straight as possible to help avoid dislodging the clip inside the hub bore. If the clip becomes dislodged, the hub will disassemble, which will contaminate the interior of the hub and void the warranty. Do not attempt to rebuild a hub that has disassembled. If the hub disassembles, you must install a new hub to avoid serious personal injury and damage to components.

9. Pull the hub as straight as possible off the spindle to avoid dislodging the clip inside the hub bore. Figure 4.16 and Figure 4.17.

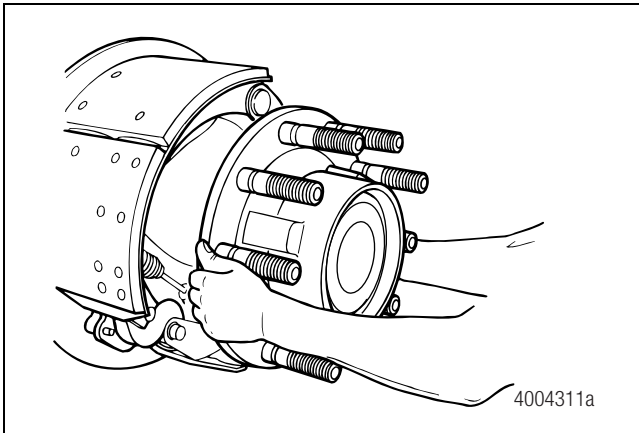


Figure 4.16

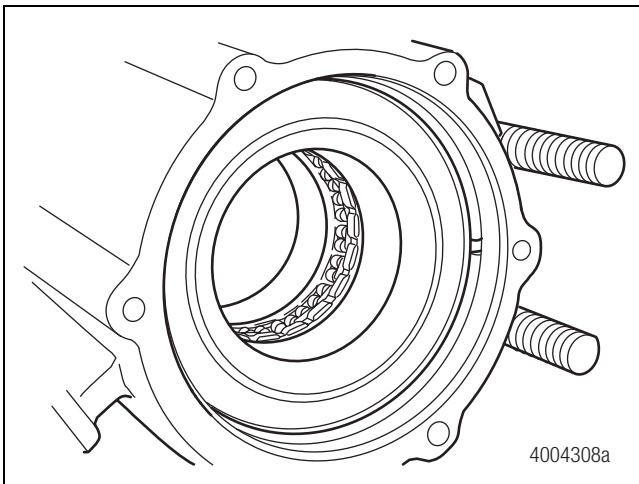


Figure 4.17

10. Remove the secondary oil seal from the hub. When you remove the secondary seal, you must protect the interior of the unitized hub with a plate. Figure 4.18.

The secondary seal at the back of the hub must be replaced whenever the hub is removed from the spindle. Do not confuse this seal with the primary inner and outer hub seals that are integral to the unitized hub and cannot be serviced.

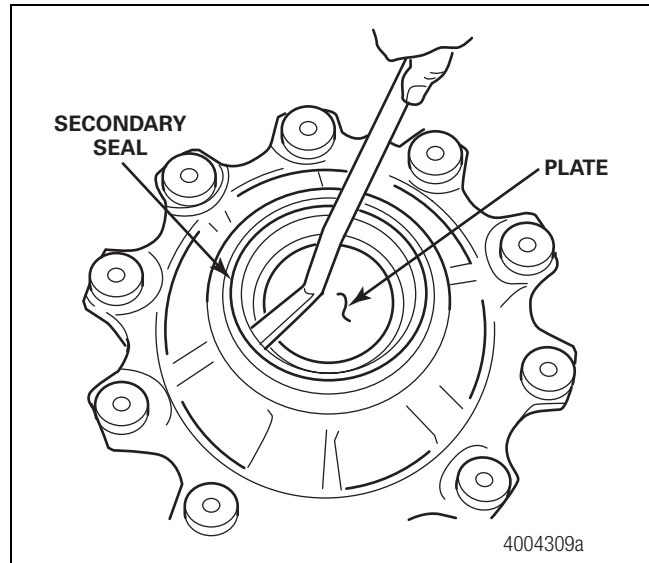


Figure 4.18

Install the Unitized Hub

⚠ WARNING

You must follow the installation procedures outlined below when you install a unitized hub. Wheel separation, damage to components and serious personal injury can result if you do not carefully follow these procedures.

Do not attempt to install a hub and drum, and tire and wheel, as an assembly onto the spindle. The clip inside the hub bore can dislodge, and the hub can disassemble. Serious personal injury and damage to components can result.

⚠ CAUTION

Do not use solvents to clean the hub bore. Solvents can enter the hub and contaminate the lubricant. Damage to components can result.

1. Clean the axle spindle and hub bore by wiping them with a clean rag. Figure 4.19 and Figure 4.20.

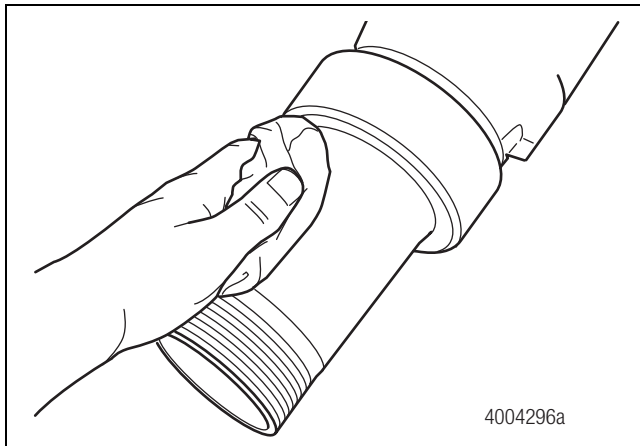


Figure 4.19

⚠ CAUTION

Remove all debris from the joint between the hub and axle backup collar. If debris is trapped in this joint, it could create a condition in which clamp on the hub is lost resulting in damage to components.

- Use your finger to verify that the hub side of the axle backup collar and the edge of the hub that contacts the backup collar are clear of debris. Figure 4.22 and Figure 4.23.

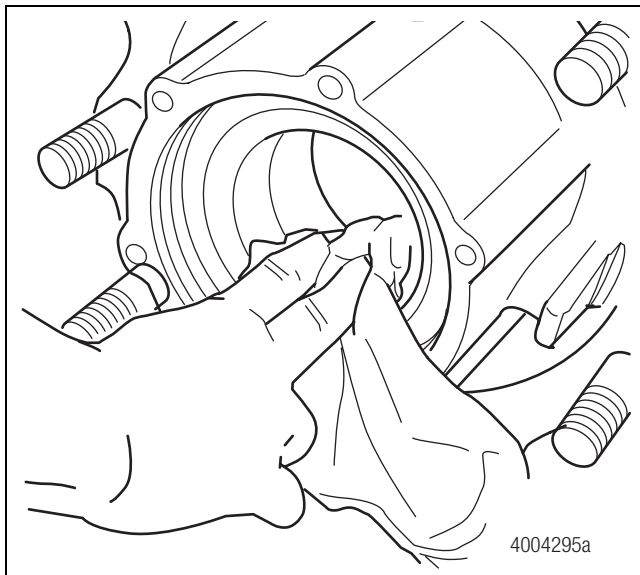


Figure 4.20

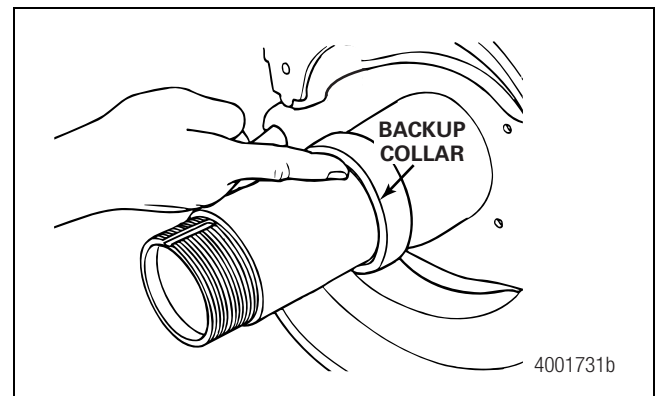


Figure 4.22

- Check the axle spindle and hub bore for scratches, nicks or marks. Repair them with a crocus or emery cloth. Figure 4.21.

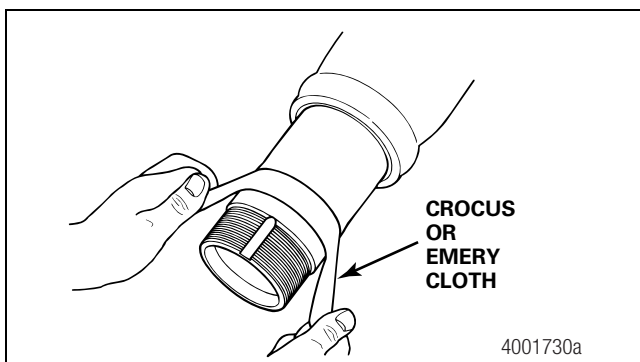


Figure 4.21

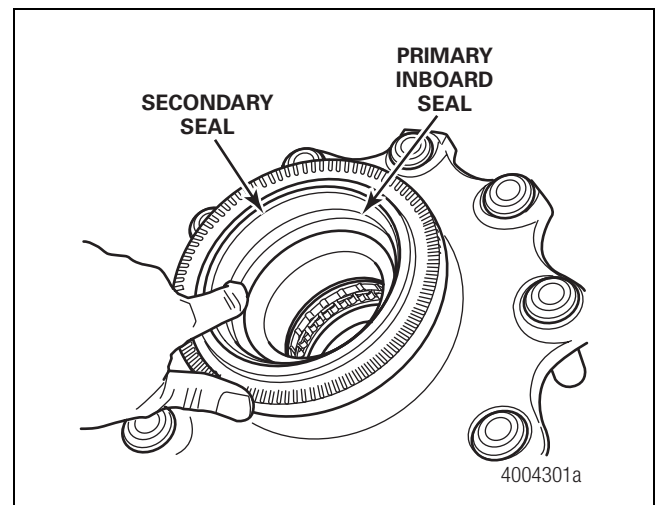


Figure 4.23

4 TL Model

4. Install a new secondary seal into the hub. Figure 4.24.
 - A. Install the seal on the correct driver with the “oil side” mark facing the interior of the hub.
 - B. Locate the nose of the driver into the bore of the inner bearing cone.
 - C. Drive the seal fully into the hub. The seal must remain square to the hub at all times. The seal will bottom out on the inner hub shoulder and the outer face will remain outside of the hub when the seal is fully installed.

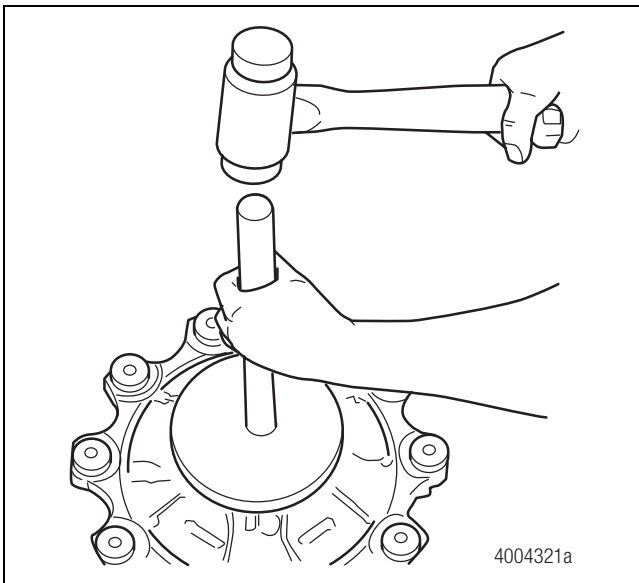


Figure 4.24

5. Apply a light coating of bearing grease to the hub bore. The entire hub bore which comes in contact with the spindle should be covered. This grease will help reduce spindle wear, assist in hub removal, and help seal the hub-spindle joint. Figure 4.25.

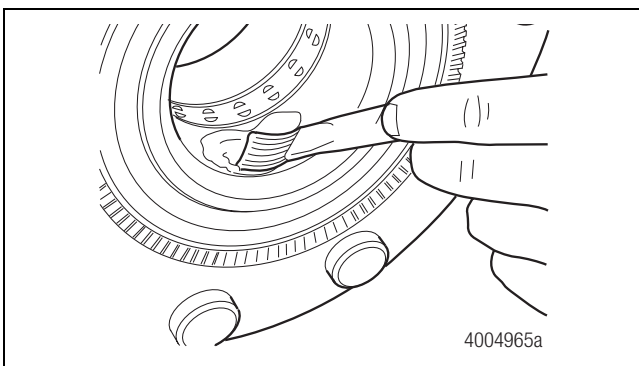


Figure 4.25

⚠ WARNING

You must align the hub bore straight to the axle spindle to help avoid dislodging the clip inside the hub bore. If the clip becomes dislodged, the hub will disassemble, which will contaminate the interior of the hub and void the warranty. Do not attempt to rebuild a hub that has disassembled. If the hub disassembles, you must install a new hub to avoid serious personal injury and damage to components.

⚠ CAUTION

Do not force the hub onto the axle spindle. The hub can jam on the spindle. Damage to components can result.

6. Carefully align the hub to the axle spindle and slide the hub straight onto the axle spindle taking care not to damage the secondary seal. Figure 4.26.
 - **If the hub becomes jammed:** Carefully remove the hub so the clip in the hub bore is not dislodged and repeat the installation step by aligning the hub bore to the spindle.

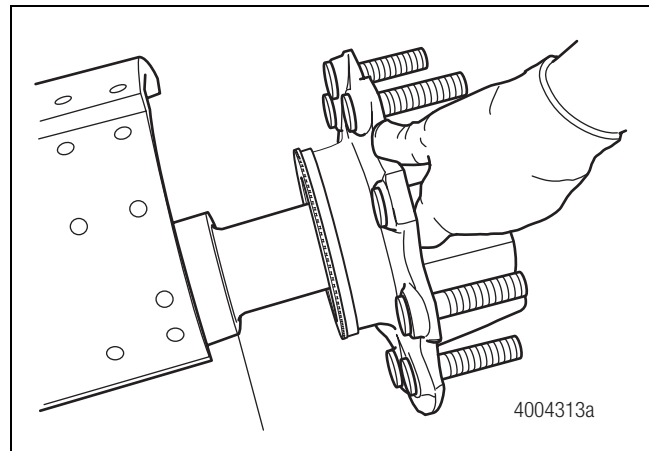


Figure 4.26

7. Use bearing grease to lightly lubricate the face of the retaining washer that contacts the spindle nut. Install the washer onto the spindle so that the washer tab is inserted into the keyway and the washer dish is facing OUTWARD. Figure 4.27.

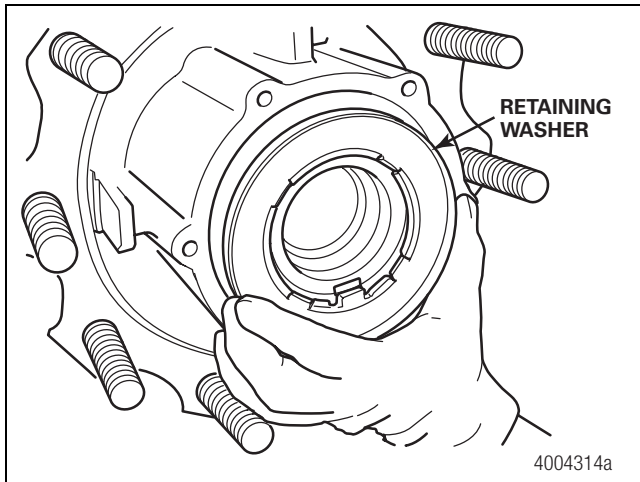


Figure 4.27

⚠ WARNING

The hub must be rotated while the spindle nut is tightened to the correct torque specification. The nut can loosen if it is not tightened correctly. The bearings may not seat correctly if the hub is not rotated. Serious personal injury and damage to components can result.

8. Install the spindle nut and turn it down the spindle threads while rotating the hub until the nut drives the seal onto the axle oil seal collar and drives the hub against the spindle backup collar. A minimum of five turns should be made during this tightening. Figure 4.28.
9. Use a torque wrench to tighten the spindle nut to 525-550 lb-ft (714-748 N•m) while rotating the hub a minimum of five complete turns. Because of the high torque required, a torque multiplier is helpful. Figure 4.28. **ⓘ**

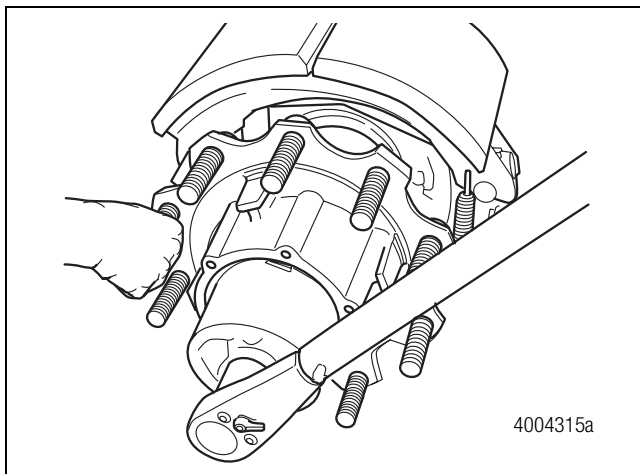


Figure 4.28

10. Check the hub to verify that it rotates freely.
 - **If the hub assembly does not rotate freely:** Perform the hub inspection procedures in Section 2 of this manual.
11. Stake a previously unused section of the outer flange of the retaining washer into only ONE of the slots on the face of the nut flange.

Place the staking tool on an angle against the outer flange of the retaining washer at the flat end of the slot in the nut flange. Strike the staking tool with a hammer to split the washer along the flat edge of the slot in the nut. Form the retainer washer material progressively down into the remaining length of the slot using the staking tool and hammer. This will resist nut unwinding if the nut torque is lost. Figure 4.29.

A 0.375-square-inch steel bar should be used in the staking operation. Do not use a sharp-bladed tool such as a chisel or screwdriver. Figure 4.30.

Correct and incorrect staking of the retaining washer flange is shown in Figure 4.31, Figure 4.32 and Figure 4.33.

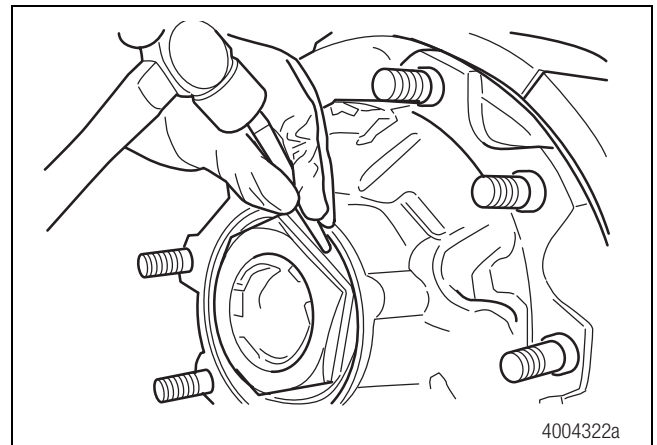


Figure 4.29

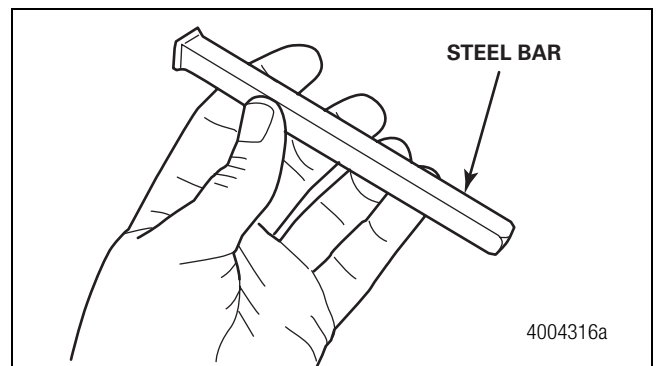


Figure 4.30

4 TL Model

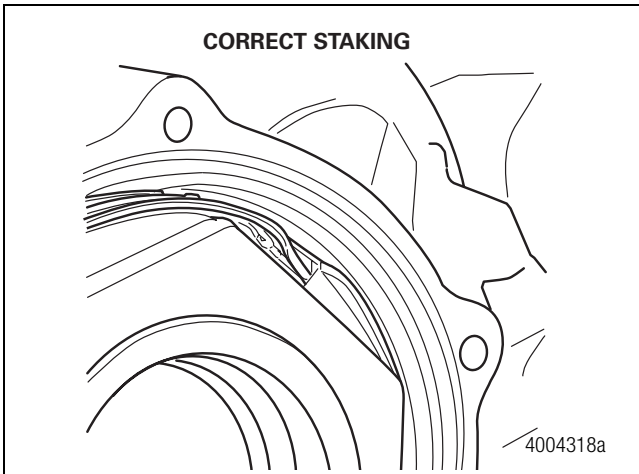


Figure 4.31

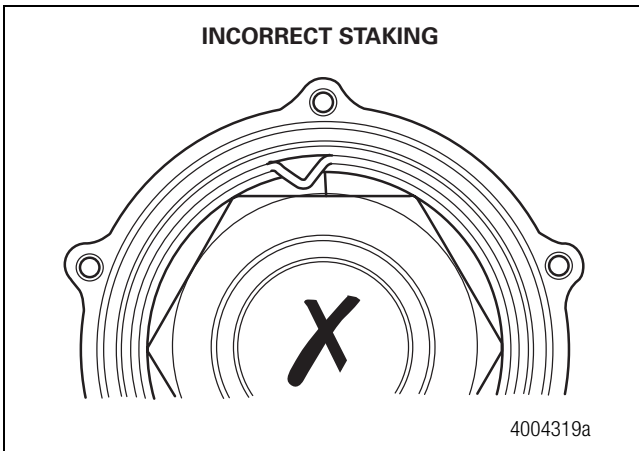


Figure 4.32

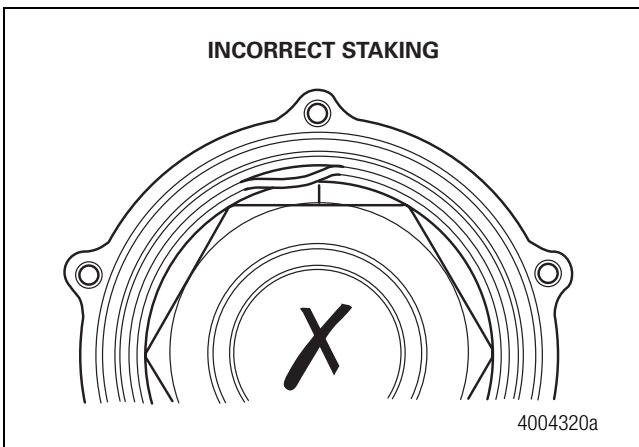



Figure 4.33

12. Install the hubcap by tightening the capscrews to 10-15 lb-ft (13-20 N•m) in a crisscross pattern. Use a new hubcap gasket. Figure 4.34. 

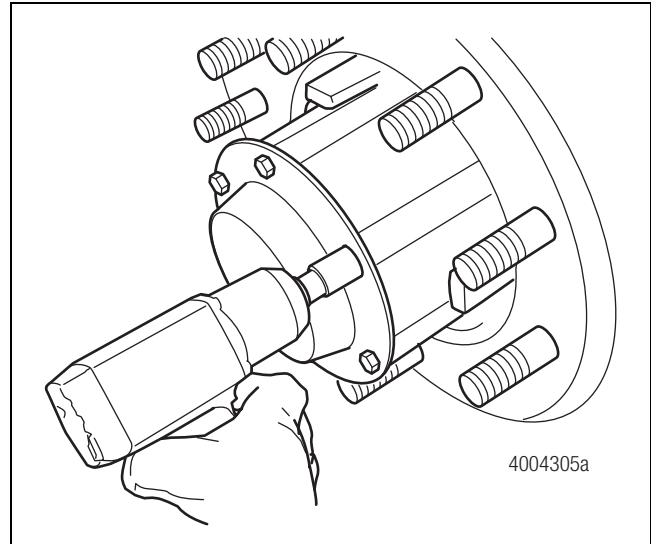


Figure 4.34

13. Install the brake drum and the tire and wheel assembly. Figure 4.35.

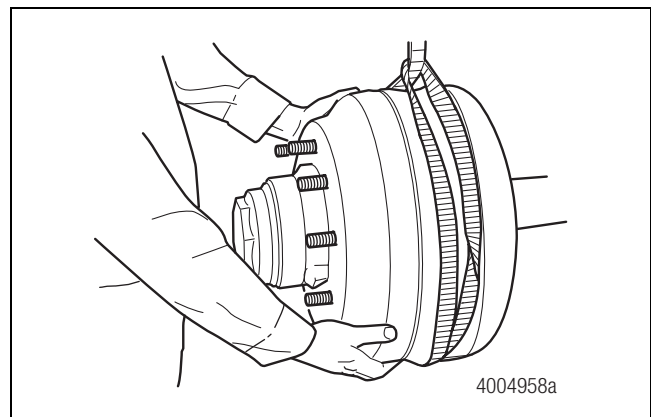


Figure 4.35

14. Adjust the brakes.

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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.

Remove and Install the Studs

⚠ WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

1. Follow the instructions in this manual to remove the unitized hub.
2. Support the INBOARD side of the hub flange perpendicular to the press cylinder.
3. Use the press cylinder to push on the threaded end of the stud to force it out of the hub flange. Figure 5.1.

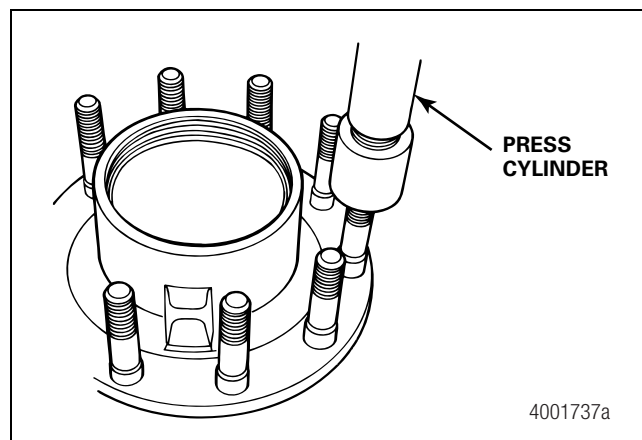


Figure 5.1

4. Turn the hub over. Support the OUTBOARD side of the hub flange perpendicular to the press cylinder.
5. Use the press cylinder to push on the stud head, applying no more than 10,000 pounds (44 500 N) of force to seat the new stud.
6. Follow the instructions in this manual to install the hub.

Brakes

Service Brakes Without Removing Hubs

Trailer axles equipped with unitized wheel-end systems and cam brakes feature outboard-mounted drums and bolt-on bushings at the brake spider. These components allow you to remove all brake equipment including the shoes, camshaft bushings and camshaft without removing the hub. Figure 5.2. This is important because unitized wheel-end systems require that the hub not be disturbed in order to receive the extended wheel-end warranty.

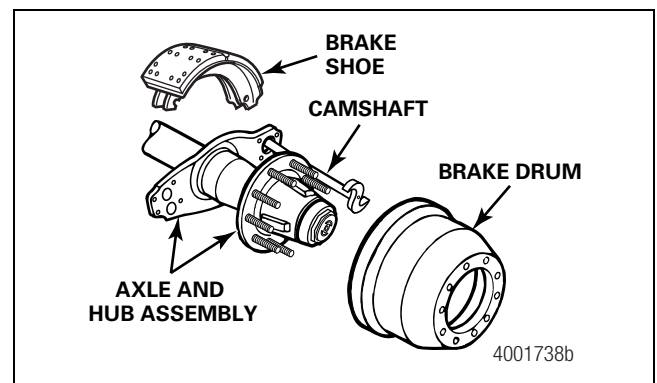


Figure 5.2

To remove all brake equipment without removing the hub, proceed as follows.

1. Remove the brake drum, slack adjuster and brake shoes using procedures in Maintenance Manual 14, Trailer Axles. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.
2. Remove the snap ring at the INBOARD side of the bolt-on bushing. Remove the four capscrews from the bolt-on bushing. Figure 5.3.

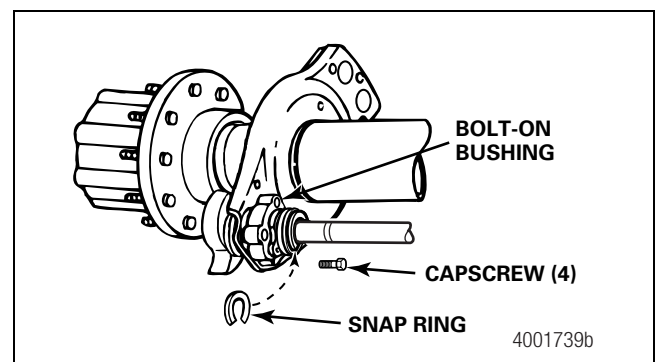


Figure 5.3

5 Component Service

3. Use a screwdriver to pry the bolt-on bushing out of the spider retainer hole. The bushing has recesses to help you remove it. Figure 5.4.

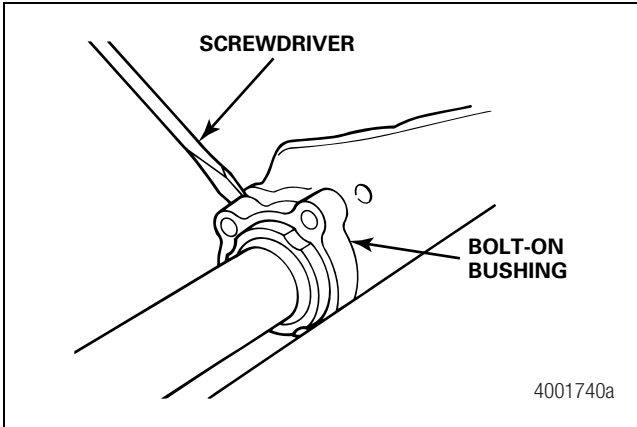


Figure 5.4

4. Move the camshaft head AWAY from the axle, so that the camshaft head clears the hub flange. Figure 5.5.

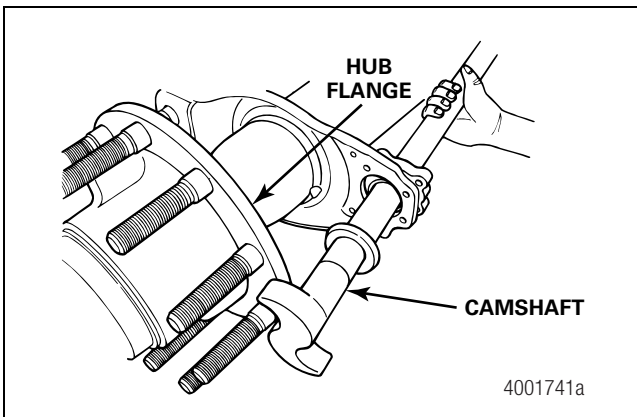



Figure 5.5

5. Pull the camshaft from the bushing.
6. Install the new brake components.
7. Return the camshaft head into the correct position.
8. Seat the bolt-on bushing into the spider using the capscrews. Tighten the capscrews to 25-30 lb-ft (34-41 N•m). 
9. Install the snap ring at the INBOARD side of the bolt-on bushing.



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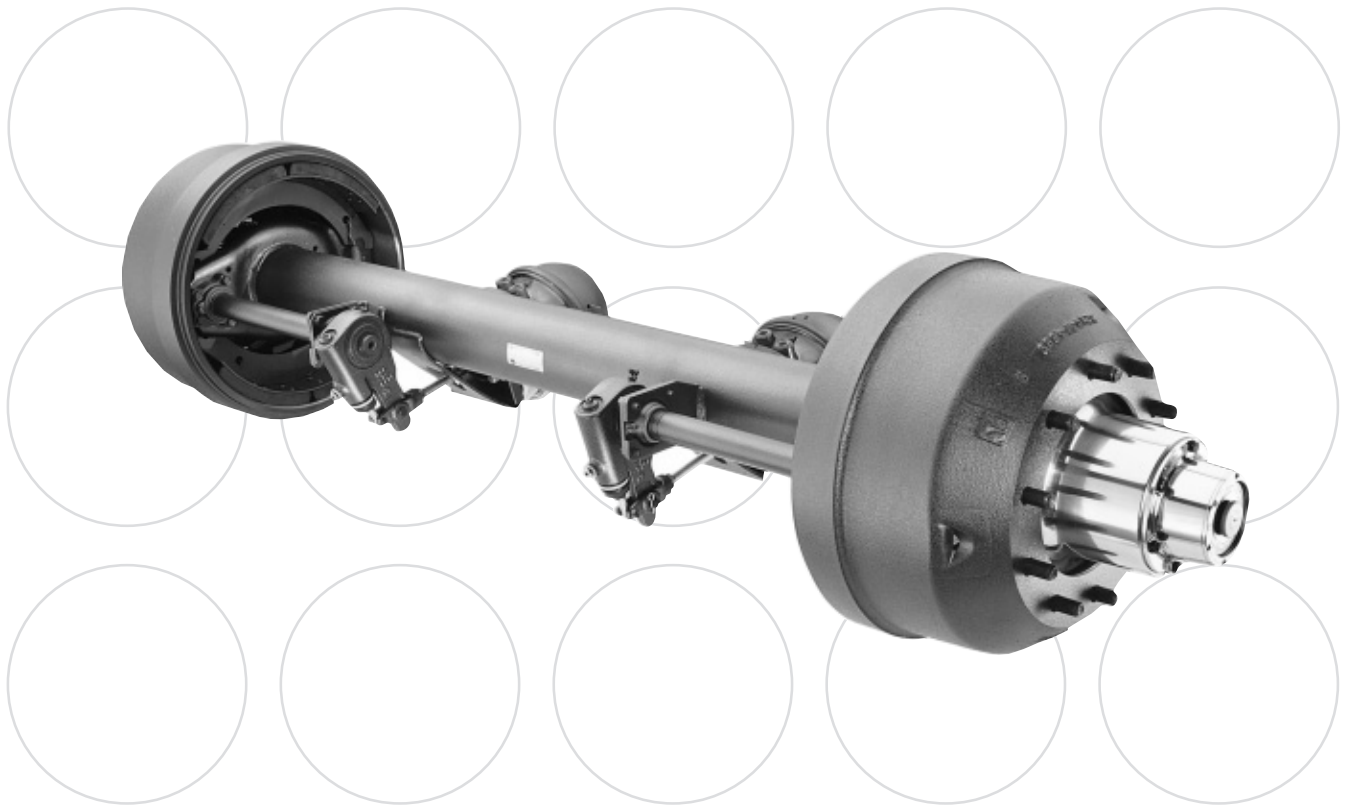
Issued 05-04
Maintenance Manual MM-0420 (16579/24240)

ArvinMeritorTM

Maintenance Manual 14

Trailer Axles

Revised 03-07



Service Notes

About This Manual

This manual provides maintenance and service information for Meritor trailer axles.

Before You Begin

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.


Hazard Alert Messages and Torque Symbols

WARNING

A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury and damage to components.

CAUTION

A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components.

 This symbol alerts you to tighten fasteners to a specified torque value.

How to Obtain Additional Maintenance and Service Information

On the Web

Visit Literature on Demand at meritorhvs.com to access product, service, aftermarket, and warranty literature for ArvinMeritor's truck, trailer and specialty vehicle components.

ArvinMeritor's Customer Service Center

Call ArvinMeritor's Customer Service Center at 800-535-5560.

Technical Electronic Library DVD

The DriveTrain Plus™ by ArvinMeritor Technical Electronic Library DVD contains product and service information for most Meritor and Meritor WABCO products. Specify TP-9853.

How to Obtain Tools and Supplies Specified in This Manual

Call ArvinMeritor's Commercial Vehicle Aftermarket at 888-725-9355 to obtain Meritor tools and supplies.

Information contained in this publication was in effect at the time the publication was approved for printing and is subject to change without notice or liability. Meritor Heavy Vehicle Systems, LLC, reserves the right to revise the information presented or to discontinue the production of parts described at any time.

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ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Because some brake linings contain asbestos, workers who service brakes must understand the potential hazards of asbestos and precautions for reducing risks. Exposure to airborne asbestos dust can cause serious and possibly fatal diseases, including asbestosis (a chronic lung disease) and cancer, principally lung cancer and mesothelioma (a cancer of the lining of the chest or abdominal cavities). Some studies show that the risk of lung cancer among persons who smoke and who are exposed to asbestos is much greater than the risk for non-smokers. Symptoms of these diseases may not become apparent for 15, 20 or more years after the first exposure to asbestos.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons. OSHA has set a maximum allowable level of exposure for asbestos of 0.1 f/cc as an 8-hour time-weighted average and 1.0 f/cc averaged over a 30-minute period. Scientists disagree, however, to what extent adherence to the maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling asbestos dust. OSHA requires that the following sign be posted at the entrance to areas where exposures exceed either of the maximum allowable levels:

DANGER: ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA.

2. **Respiratory Protection.** Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA for use with asbestos at all times when servicing brakes, beginning with the removal of the wheels.

3. **Procedures for Servicing Brakes.**

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, employers may adopt their own written procedures for servicing brakes, provided that the exposure levels associated with the employer's procedures do not exceed the levels associated with the enclosed vacuum system or brake washing equipment. Consult OSHA regulations for more details.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA for use with asbestos. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

NON-ASBESTOS FIBERS WARNING

The following procedures for servicing brakes are recommended to reduce exposure to non-asbestos fiber dust, a cancer and lung disease hazard. Material Safety Data Sheets are available from ArvinMeritor.

Hazard Summary

Most recently manufactured brake linings do not contain asbestos fibers. These brake linings may contain one or more of a variety of ingredients, including glass fibers, mineral wool, aramid fibers, ceramic fibers and silica that can present health risks if inhaled. Scientists disagree on the extent of the risks from exposure to these substances. Nonetheless, exposure to silica dust can cause silicosis, a non-cancerous lung disease. Silicosis gradually reduces lung capacity and efficiency and can result in serious breathing difficulty. Some scientists believe other types of non-asbestos fibers, when inhaled, can cause similar diseases of the lung. In addition, silica dust and ceramic fiber dust are known to the State of California to cause lung cancer. U.S. and international agencies have also determined that dust from mineral wool, ceramic fibers and silica are potential causes of cancer.

Accordingly, workers must use caution to avoid creating and breathing dust when servicing brakes. Specific recommended work practices for reducing exposure to non-asbestos dust follow. Consult your employer for more details.

Recommended Work Practices

1. **Separate Work Areas.** Whenever feasible, service brakes in a separate area away from other operations to reduce risks to unprotected persons.

2. **Respiratory Protection.** OSHA has set a maximum allowable level of exposure for silica of 0.1 mg/m³ as an 8-hour time-weighted average. Some manufacturers of non-asbestos brake linings recommend that exposures to other ingredients found in non-asbestos brake linings be kept below 1.0 f/cc as an 8-hour time-weighted average. Scientists disagree, however, to what extent adherence to these maximum allowable exposure levels will eliminate the risk of disease that can result from inhaling non-asbestos dust.

Therefore, wear respiratory protection at all times during brake servicing, beginning with the removal of the wheels. Wear a respirator equipped with a high-efficiency (HEPA) filter approved by NIOSH or MSHA, if the exposure levels may exceed OSHA or manufacturers' recommended maximum levels. Even when exposures are expected to be within the maximum allowable levels, wearing such a respirator at all times during brake servicing will help minimize exposure.

3. **Procedures for Servicing Brakes.**

a. Enclose the brake assembly within a negative pressure enclosure. The enclosure should be equipped with a HEPA vacuum and worker arm sleeves. With the enclosure in place, use the HEPA vacuum to loosen and vacuum residue from the brake parts.

b. As an alternative procedure, use a catch basin with water and a biodegradable, non-phosphate, water-based detergent to wash the brake drum or rotor and other brake parts. The solution should be applied with low pressure to prevent dust from becoming airborne. Allow the solution to flow between the brake drum and the brake support or the brake rotor and caliper. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

c. If an enclosed vacuum system or brake washing equipment is not available, carefully clean the brake parts in the open air. Wet the parts with a solution applied with a pump-spray bottle that creates a fine mist. Use a solution containing water, and, if available, a biodegradable, non-phosphate, water-based detergent. The wheel hub and brake assembly components should be thoroughly wetted to suppress dust before the brake shoes or brake pads are removed. Wipe the brake parts clean with a cloth.

d. Wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA when grinding or machining brake linings. In addition, do such work in an area with a local exhaust ventilation system equipped with a HEPA filter.

e. **NEVER** use compressed air by itself, dry brushing, or a vacuum not equipped with a HEPA filter when cleaning brake parts or assemblies. **NEVER** use carcinogenic solvents, flammable solvents, or solvents that can damage brake components as wetting agents.

4. **Cleaning Work Areas.** Clean work areas with a vacuum equipped with a HEPA filter or by wet wiping. **NEVER** use compressed air or dry sweeping to clean work areas. When you empty vacuum cleaners and handle used rags, wear a respirator equipped with a HEPA filter approved by NIOSH or MSHA, to minimize exposure. When you replace a HEPA filter, wet the filter with a fine mist of water and dispose of the used filter with care.

5. **Worker Clean-Up.** After servicing brakes, wash your hands before you eat, drink or smoke. Shower after work. Do not wear work clothes home. Use a vacuum equipped with a HEPA filter to vacuum work clothes after they are worn. Launder them separately. Do not shake or use compressed air to remove dust from work clothes.

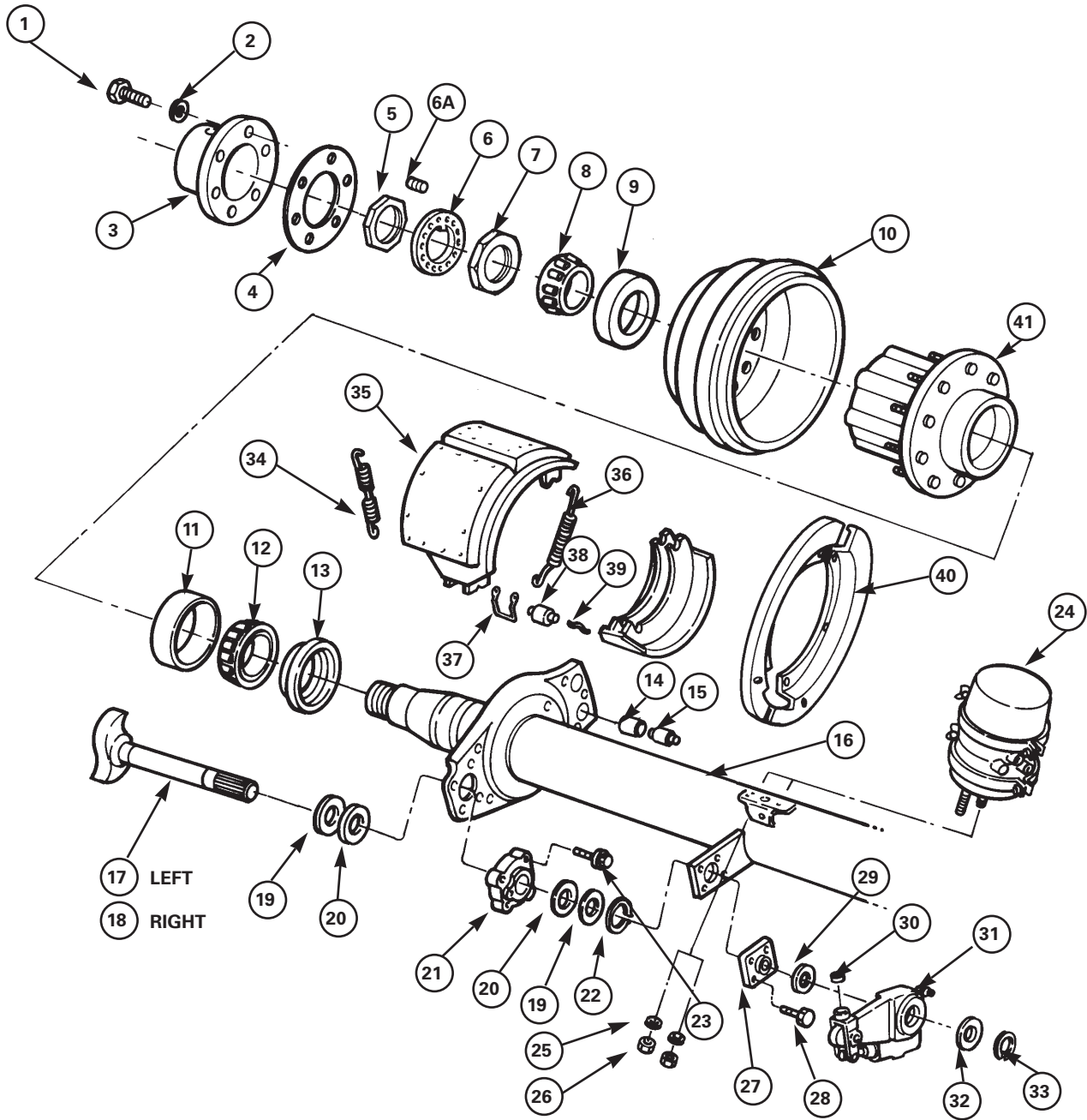
6. **Waste Disposal.** Dispose of discarded linings, used rags, cloths and HEPA filters with care, such as in sealed plastic bags. Consult applicable EPA, state and local regulations on waste disposal.

Regulatory Guidance

References to OSHA, NIOSH, MSHA, and EPA, which are regulatory agencies in the United States, are made to provide further guidance to employers and workers employed within the United States. Employers and workers employed outside of the United States should consult the regulations that apply to them for further guidance.

1 Exploded View

Typical 16.5" x 7" Q Series Brake Installation



4003153a

1 Exploded View

Item	Description
1	Capscrew
2	Lock Washer
3	Hubcap
4	Gasket
5	Wheel Bearing Jam Nut
6	Lock Washer
6A	Set Screw
7	Wheel Bearing Adjusting Nut
8	Outer Wheel Bearing Cone
9	Outer Bearing Cup
10	Brake Drum
11	Inner Bearing Cup
12	Inner Bearing Cone
13	Wheel Bearing Seal
14	Bushing Anchor Pin
15	Pin Anchor
16	Beam Axle
17	Left Camshaft
18	Right Camshaft
19	Washer
20	Seal
21	Bushing
22	Snap Ring
23	Capscrew
24	Air Chamber
25	Lock Washer
26	Locknut
27	Camshaft Bushing Assembly
28	Capscrew
29	Slack Adjuster Washer
30	Slack Adjuster Locknut
31	Automatic Slack Adjuster
32	Slack Adjuster Washer
33	Slack Adjuster Snap Ring
34	Brake Shoe Return Spring

Item	Description
35	Brake Shoe and Lining Assembly
36	Brake Shoe Retaining Spring
37	Brake Shoe Roller Retainer
38	Brake Shoe Roller
39	Shoe Return Spring Pin
40	Dust Shield
41	Hub

2 Introduction

Important Information

Meritor automatic slack adjusters (ASAs) should not need to be manually adjusted in service. ASAs should not have to be adjusted to correct excessive pushrod stroke. The excessive stroke may be an indication that a problem exists with the foundation brake, ASA, brake actuator or other system components.

Meritor recommends troubleshooting the problem, replacing suspect components and then confirming proper brake operation prior to returning the vehicle into service.

In the event that a manual adjustment must be made (although not a common practice), a service appointment and full foundation brake, ASA, and other system component inspection should be conducted as soon as possible to ensure integrity of the overall brake system.

For Meritor brake adjustment, refer to the brake adjustment tables in this manual. For non-Meritor brake adjusters, refer to the brake manufacturer's service procedures.

Description

Axle Models

The maintenance procedures detailed in this manual apply to the following Meritor trailer axles.

- Axles currently in production, such as TN, TP, TQ, TR, TQC, TQD and TRD models. These axle models are available either for installation on new trailers or as service replacement parts.
- Axles no longer in production, such as TK, TKN, RN and RQ models. These axle models are available only as service replacement parts.

About This Manual

The procedures for removal, disassembly, assembly and installation in this manual are for current production Meritor trailer axles equipped with the following components.

- Disc wheel-end equipment
- Q Series cam brakes
- Meritor automatic slack adjusters
- TN and TQ axle spindles with standard retention hardware
- Oil-lubricated wheel ends

Axle Designs

Meritor trailer axles are available in the following designs.

Beam Designs

- Straight beams, such as the TN, TP, TQ and TR models. Figure 2.1.

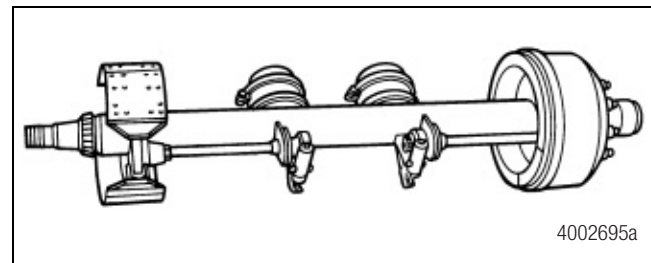


Figure 2.1

- Crank beams, such as the TQC model. Figure 2.2.

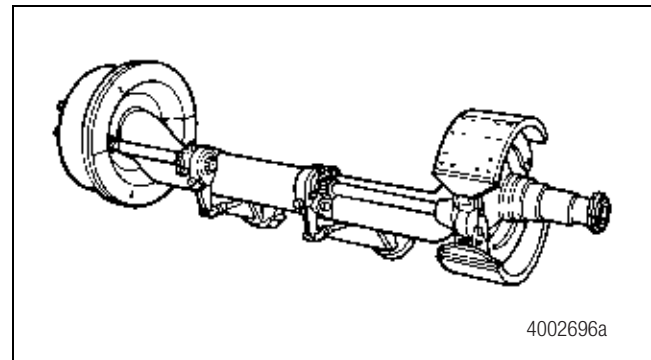


Figure 2.2

- Drop center beams, such as the TQD and TRD models. Figure 2.3.

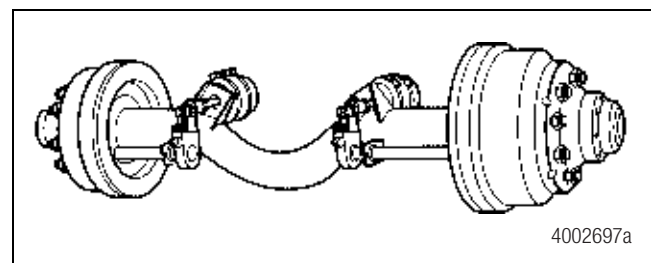


Figure 2.3

Beam Cross Sections

- Round
- Rectangular, available only as service replacement beams

Spindle Designs

- The TN/TQ Series axles use the most common wheel bearings in the trailer industry.
- The TR Series axles use wheel bearings compatible with drive axles.
- The TP Series axles use bearings compatible with Freuhauf axles.
- The TB Series axles use unitized bearings.

Brakes

- Cam — Meritor cam brakes
- Wedge — Meritor Stopmaster® brakes
- Air Disc — Meritor Dura-Master® brakes

Identification

All of the information necessary to identify a particular trailer axle is indicated on the trailer axle identification tag. Located at the center of the axle beam, this ID tag is stamped with the axle model number, serial number and date of manufacture. Figure 2.4.

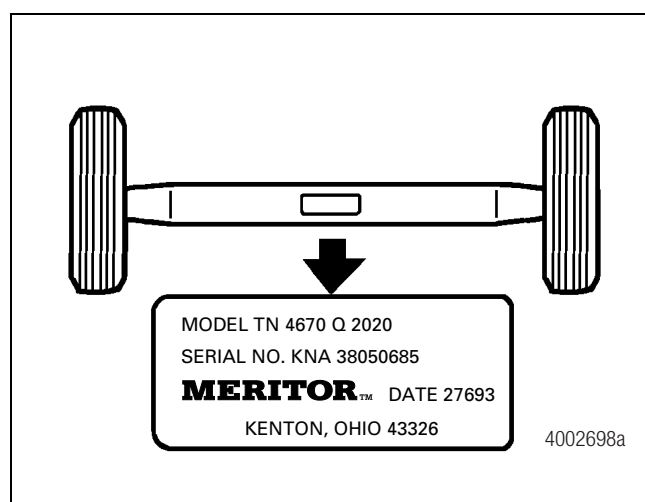


Figure 2.4

The model number is composed of letters and digits; for example, TN-4670-Q-2020. This number is used to identify the axle assembly when obtaining replacement parts.

The serial number is composed of letters and digits; for example, KNA-38050685. This number can be used to identify a particular trailer axle, and the material and components used to build the axle.

The date of manufacture is indicated by a Julian date; for example, 27693. The first three digits (276) indicate the 276th day of the year, or October 3. The last two digits (93) indicate the year, or 1993.

Model Nomenclature

Model numbers for Meritor trailer axles are composed of letters and digits; for example, TQD 4670 Q 52. These letters and digits indicate the weight capacity and type of components installed on the axle. For a more comprehensive list of Meritor current production trailer axle models, refer to TP-8301, Trailer Axle Specifications. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

Meritor aftermarket model numbers differ from the current production model numbers detailed below. Refer to Parts Catalog PB-8857, Brake, Trailer Axle and Wheel Attaching Parts, for a chart detailing these numbers. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

2 Introduction

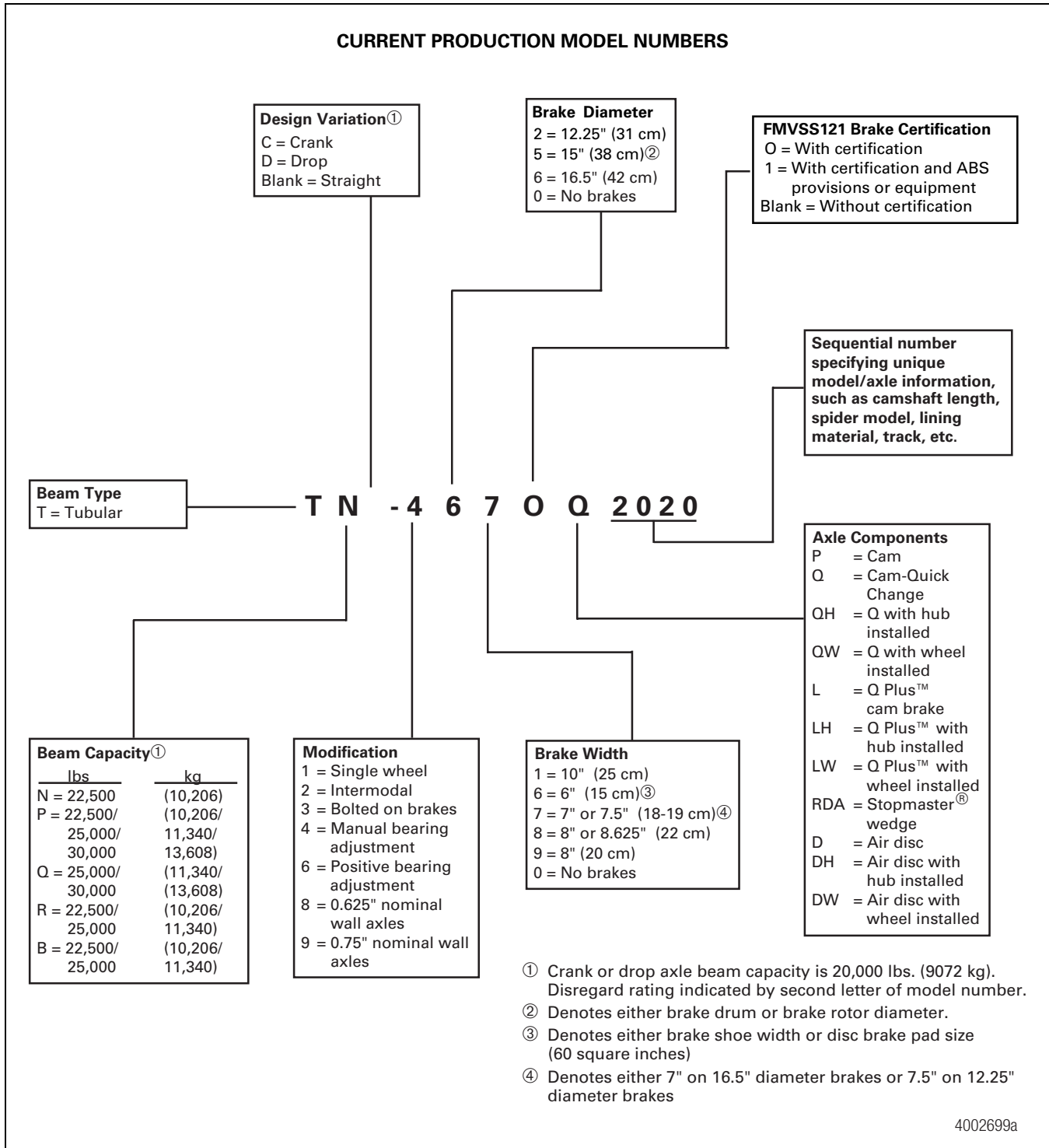


Figure 2.5

Important Information

Meritor automatic slack adjusters (ASAs) should not need to be manually adjusted in service. ASAs should not have to be adjusted to correct excessive pushrod stroke. The excessive stroke may be an indication that a problem exists with the foundation brake, ASA, brake actuator or other system components.

Meritor recommends troubleshooting the problem, replacing suspect components and then confirming proper brake operation prior to returning the vehicle into service.

In the event that a manual adjustment must be made (although not a common practice), a service appointment and full foundation brake, ASA, and other system component inspection should be conducted as soon as possible to ensure integrity of the overall brake system.

For Meritor brake adjustment, refer to the brake adjustment tables in this manual. For non-Meritor brake adjusters, refer to the brake manufacturer's service procedures.

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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.

Removal

Wheel Ends

1. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Set the parking brake.
2. Raise the trailer until the tires are off the floor.
3. Place safety stands under the trailer frame or under each axle spring seat. Figure 3.1.

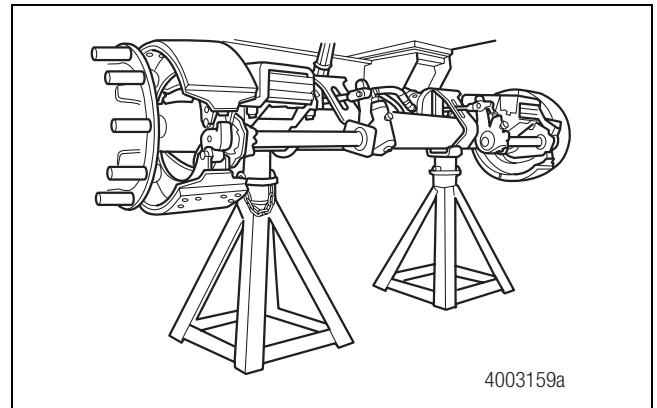


Figure 3.1

4. Remove the tire and wheel assembly, using procedures specified by the wheel manufacturer. Figure 3.2.

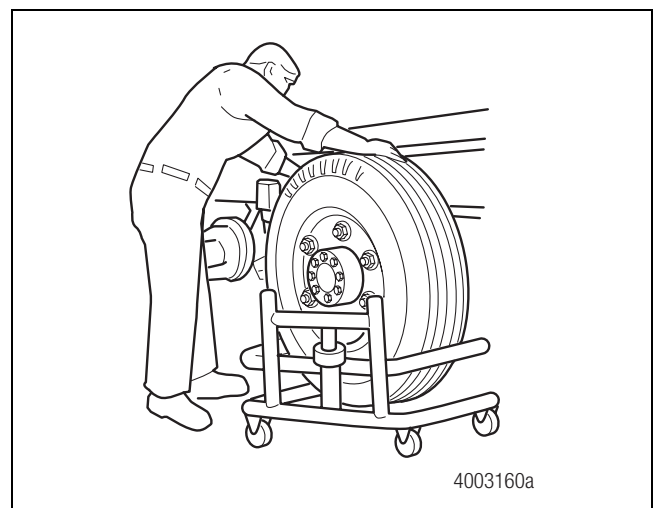


Figure 3.2

WARNING

Before you service a spring chamber, carefully follow the manufacturer's instructions to compress and lock the spring to completely release the brake. Verify that no air pressure remains in the service chamber before you proceed. Sudden release of compressed air can cause serious personal injury and damage to components.

5. If the axle is equipped with spring brake chambers, carefully compress and lock the springs so that they cannot actuate. Figure 3.3.

3 Removal and Disassembly

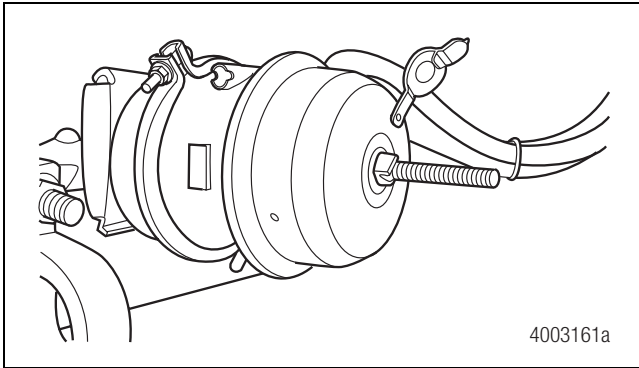


Figure 3.3

6. There are two automatic slack adjuster designs: handed and unhanded. For most applications, install a handed slack adjuster so that the pawl faces INBOARD on the vehicle. The pawl can be located on either side or on the FRONT of the slack adjuster. Figure 3.4.

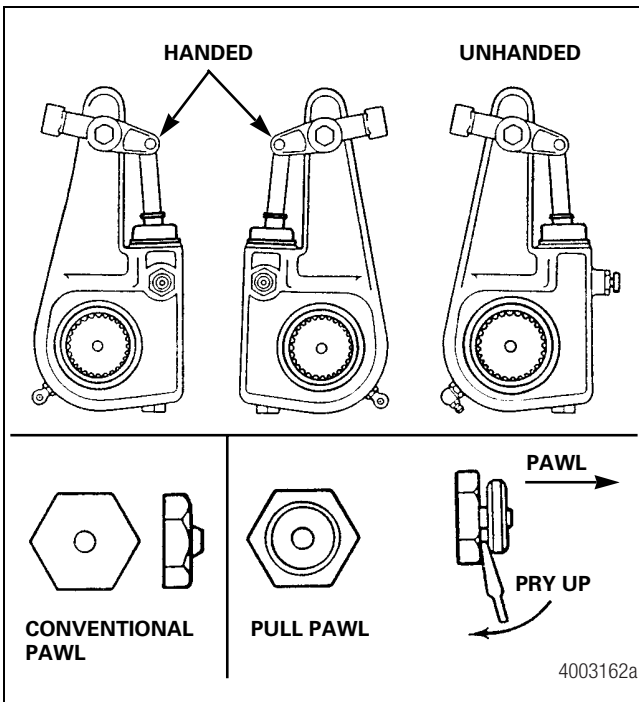


Figure 3.4

⚠ CAUTION

You must disengage a pull pawl or remove a conventional pawl before rotating the manual adjusting nut, or you will damage the pawl teeth. A damaged pawl will not allow the slack adjuster to automatically adjust brake clearance. Replace damaged pawls before putting the vehicle in service.

7. Rotate the manual adjusting nut **CLOCKWISE** until the linings clear the drums. Disengage the pawl.
 - **For a conventional pawl:** Remove the pawl from the slack adjuster.
 - **For a pull pawl:** Pry the pawl at least 1/32-inch (0.794 mm) to disengage the teeth. Replace a conventional pawl with a pull pawl. Figure 3.5.

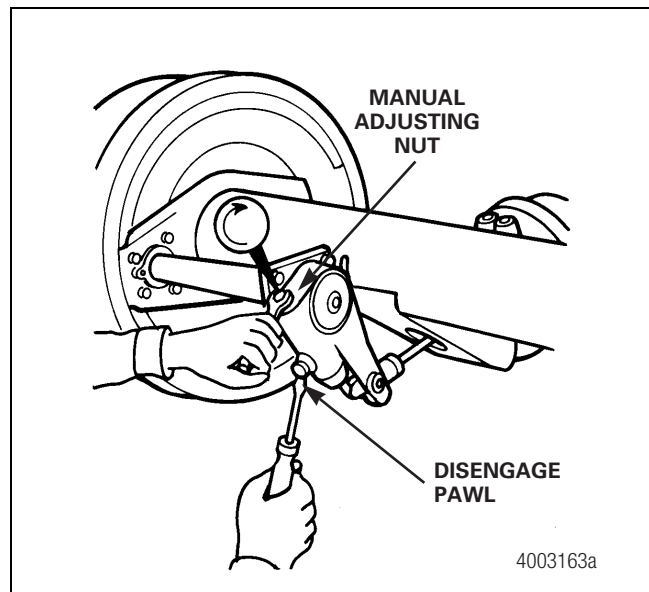


Figure 3.5

NOTE: Do not reuse either the hubcap gasket or the oil.

8. Place a container under the hubcap to receive the draining oil, then remove the hubcap and hubcap gasket. Figure 3.6.

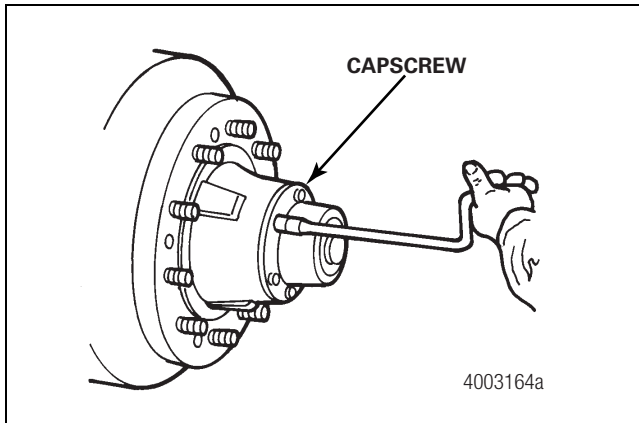


Figure 3.6

⚠ WARNING

Do not loosen the axle spindle nuts by either striking them directly with a hammer, or striking a drift or chisel placed against them. Damage to the parts will occur causing possible loss of axle wheel-end components and serious personal injury.

9. Remove the set screw from the lock washer. Then remove the jam nut, lock washer and adjusting nut. Figure 3.7.

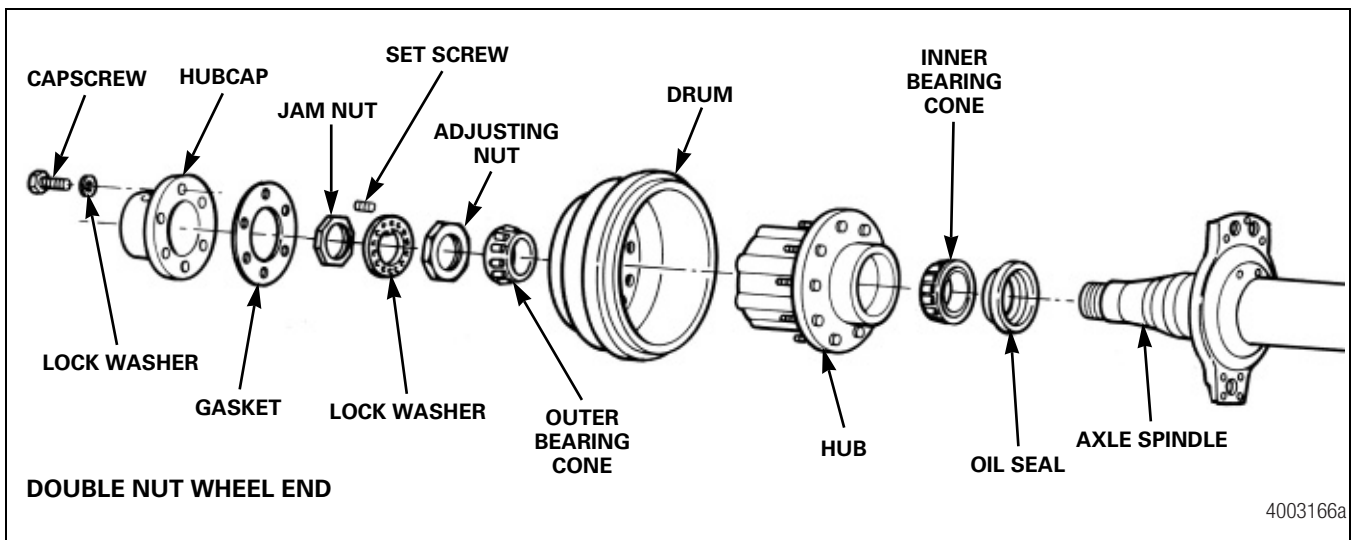


Figure 3.7

3 Removal and Disassembly

⚠ CAUTION

Be careful when you remove the hub and drum assembly that you do not damage the outer bearing by dropping it on the floor.

10. Remove the outer bearing cone, then the hub and drum assembly from the axle spindle. Support the hub and drum assembly during the entire removal process, as failure to do so may result in damage to the axle spindle threads. Figure 3.8.

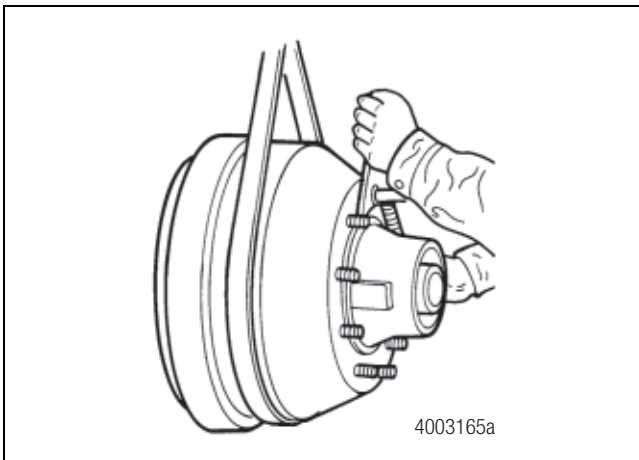


Figure 3.8

11. Remove the inner bearing cone and seal from either the spindle or hub. Discard the seal. Figure 3.7.

⚠ CAUTION

Never remove a seal wiper with a hammer and chisel or other sharp tool. Damage to the axle oil seal collar will occur.

12. If the seal incorporates a separate wiper on the oil seal collar, loosen it by lightly striking with the round end of a ball-peen hammer, then remove it and discard. Figure 3.9.

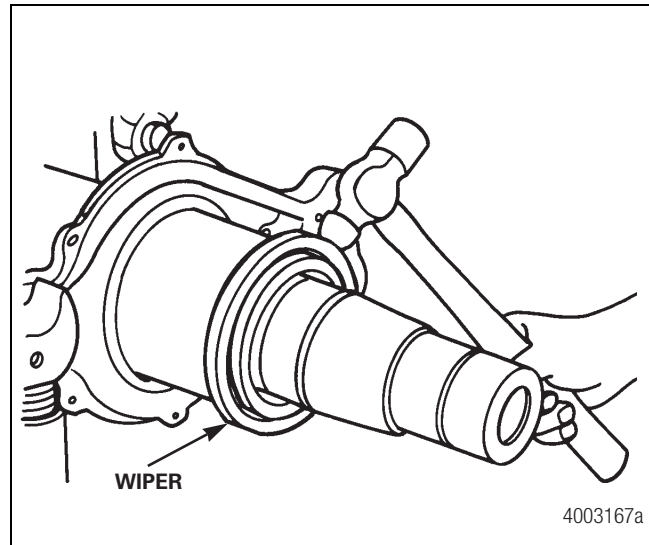


Figure 3.9

13. An alternate method is to use a slide hammer with a hook on the end of the tool. Figure 3.10.

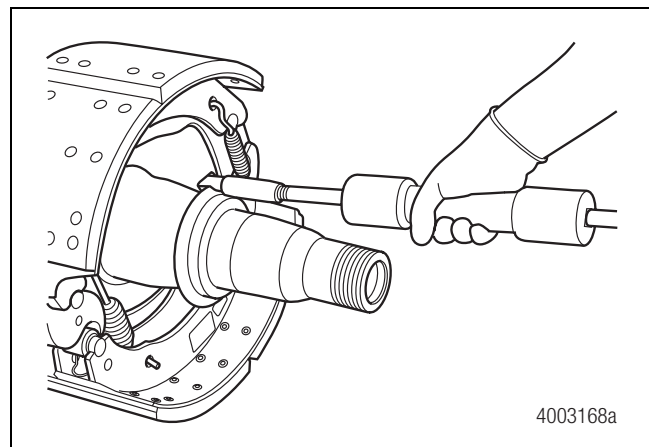


Figure 3.10

Brakes

⚠ ASBESTOS AND NON-ASBESTOS FIBERS WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

1. Push down on the bottom brake shoe and pull on the roller retaining clip to remove the bottom cam roller. Figure 3.11.

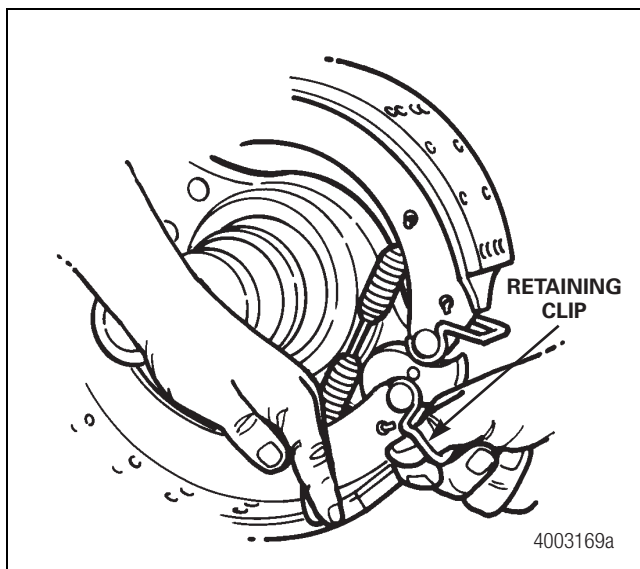


Figure 3.11

2. Lift the top brake shoe and pull on the roller retaining clip to remove the top cam roller.

NOTE: You can remove a standard return spring by hand, if one is installed. If a heavy-duty spring is installed, you will need a tool to remove the spring.

3. Lift the bottom shoe to release tension on the brake return spring. Remove the spring. Figure 3.12.

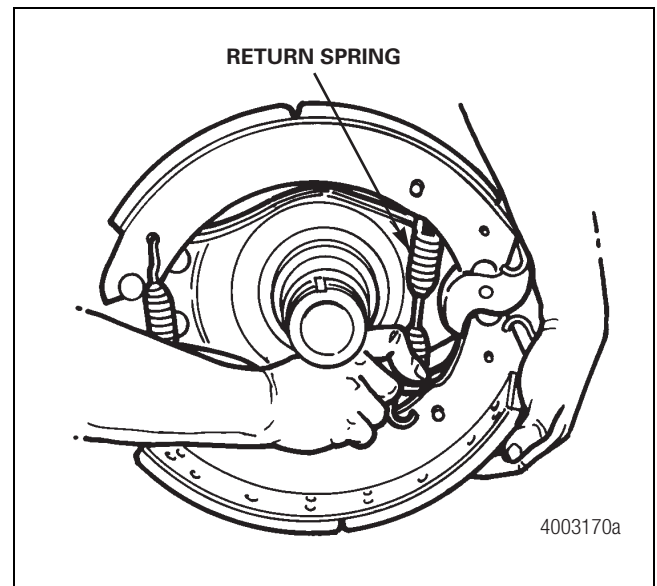


Figure 3.12

4. Rotate the bottom shoe to release tension on the two retaining springs. Remove the springs and brake shoes. Figure 3.13.

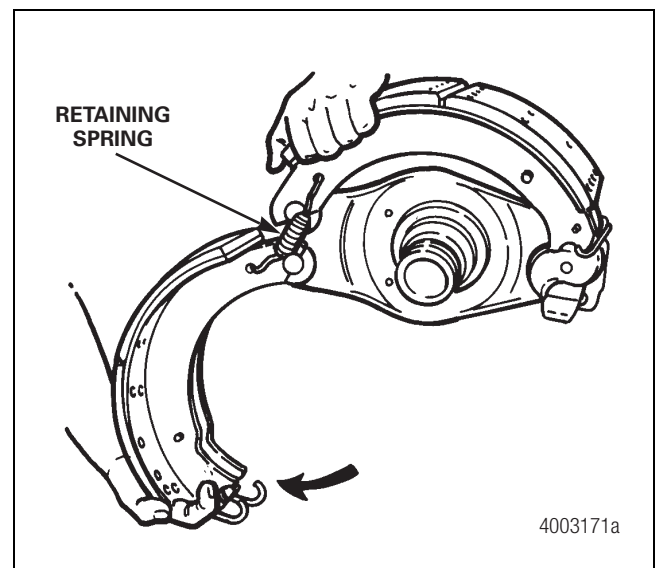


Figure 3.13

3 Removal and Disassembly

5. Disengage the slack adjuster from the air chamber push rod by removing the two slack adjuster clevis pins. Discard the two cotter pins that secure the clevis pins.

CAUTION

You must disengage a pull pawl or remove a conventional pawl before rotating the manual adjusting nut, or you will damage the pawl teeth. A damaged pawl will not allow the slack adjuster to automatically adjust brake clearance. Replace damaged pawls before putting the vehicle in service.

6. Remove a conventional pawl or pry a pull pawl at least 1/32-inch (0.794 mm) to disengage the teeth. Rotate the manual adjusting nut **CLOCKWISE** to move the slack adjuster away from the clevis. Figure 3.14.

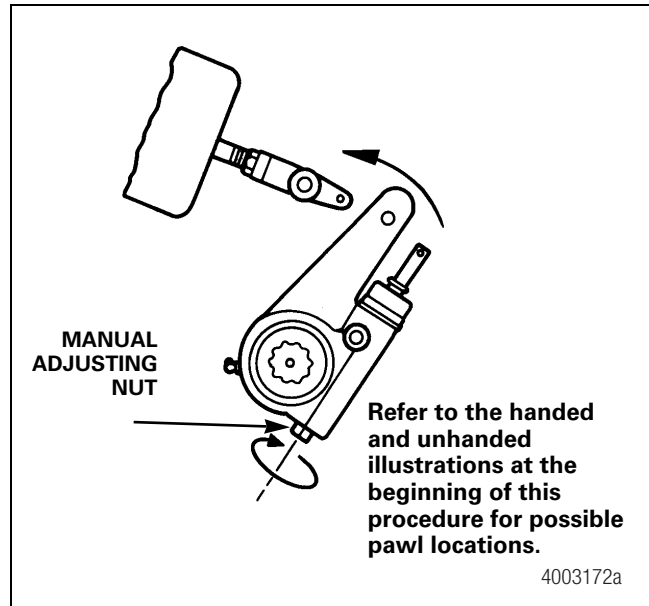


Figure 3.14

7. Remove the snap ring, slack adjuster and spacer washers from the camshaft spline. Figure 3.15.

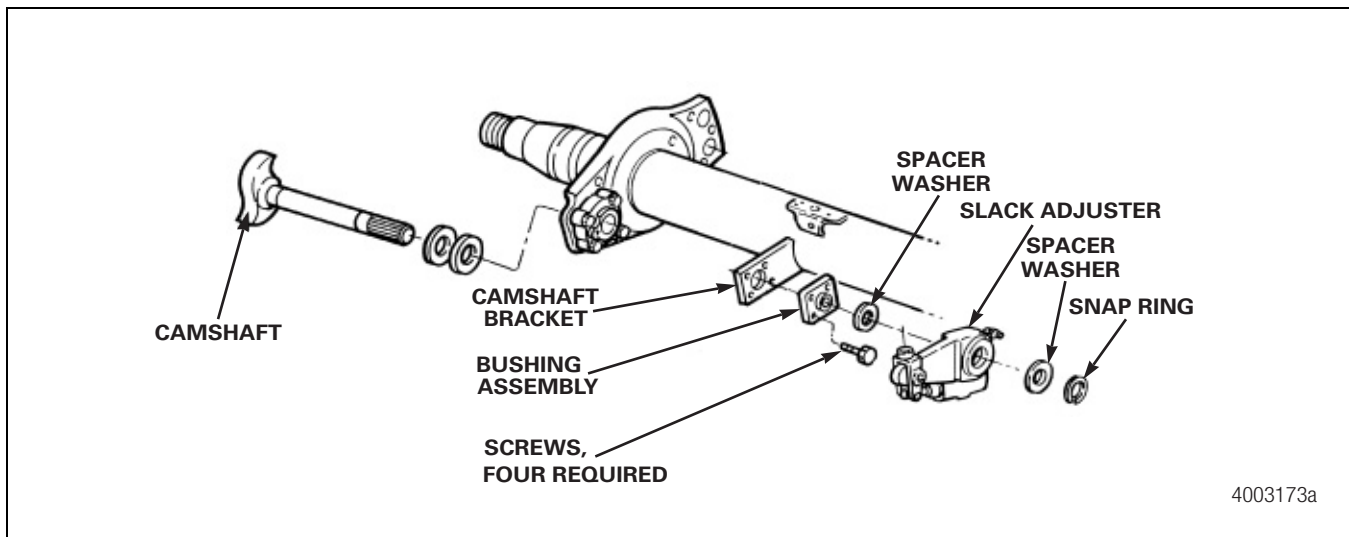


Figure 3.15

8. Remove the camshaft and camshaft bushings as detailed in Section 12.

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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.

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, and emulsion-type and petroleum-base cleaners. Read the manufacturer's instructions before using a solvent cleaner, then carefully follow the instructions. Also follow the procedures below.

- Wear safe eye protection.
- Wear clothing that protects your skin.
- Work in a well-ventilated area.
- Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.
- You must use hot solution tanks or alkaline solutions correctly. Read the manufacturer's instructions before using hot solution tanks and alkaline solutions. Then carefully follow the instructions.

Clean, Dry and Inspect Parts

Steam Clean the Axle Assembly

Steam clean a complete axle assembly to remove heavy dirt.

- **Before steam cleaning the assembly:** Cover all axle assembly openings, such as vents in the hubcaps and air chambers, to help keep water out of these openings during high-pressure steam cleaning.
- **After steam cleaning the assembly:** Grease camshaft bushings and automatic slack adjusters until new grease flows from these parts. The grease will help to remove water that may have entered the parts during steam cleaning.

Clean Smooth Parts

⚠ CAUTION

Do not use hot solution tanks or water and alkaline solutions to clean ground or polished parts. Damage to parts can result.

1. Use a solvent cleaner to clean machined parts and surfaces, such as axle spindles and camshaft journals. Do not use a hot solution tank with water, steam or alkaline solutions. This will cause corrosion. Figure 4.1.

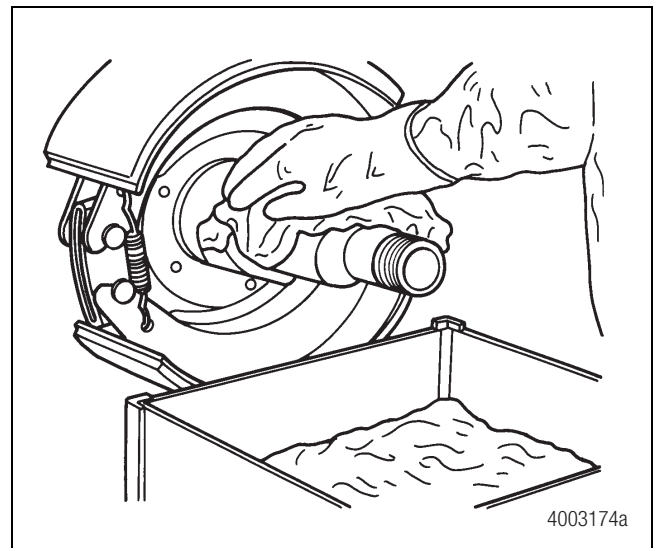


Figure 4.1

2. Remove gasket material from parts such as the hubcap gasket mounting face. Be careful not to damage machined surfaces.

Clean Rough Parts

1. Clean rough parts with either solvents or in hot solution tanks with a weak alkaline solution.
2. Leave parts in the tank until they are completely cleaned and heated. When the parts are clean, remove them from the tank and wash them with water until the hot solution is removed.

Dry Cleaned Parts

1. Dry parts immediately after cleaning using clean paper, rags or compressed air.
2. Do not use compressed air to dry bearings. This may cause small abrasive particles to contaminate the bearings and may result in reduced bearing life.

4 Clean and Inspect Parts

Prevent Corrosion

1. If parts are to be immediately assembled, apply lubricant to all machined surfaces.
2. If parts are to be stored, apply a coating that prevents corrosion to all machined surfaces.

Inspect Parts

It is important to inspect all axle components for damage or wear, and to repair or replace them as required before assembly. Performing these procedures now can help prevent future problems.

1. Inspect all machined surfaces of the axle assembly. Repair any scratches, nicks or mars with a crocus or emery cloth. Figure 4.2.

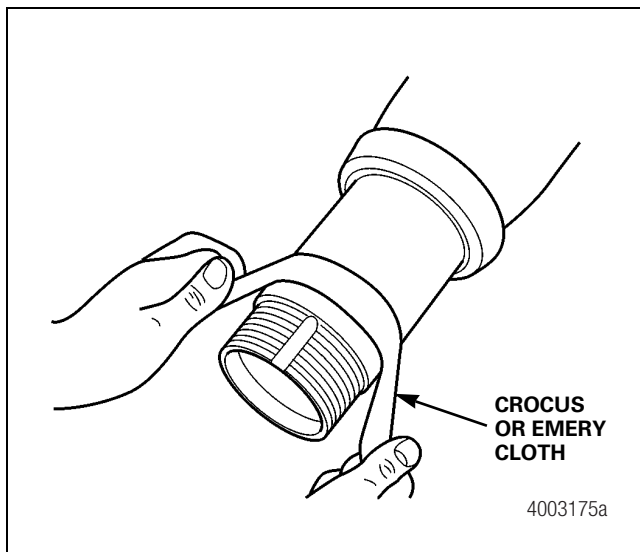


Figure 4.2

2. Inspect the axle spindle threads. Repair the damaged threads with a correct sized die.
3. Inspect the wheel-end retention hardware including nuts, washers and set screws. Replace them if any of this equipment is worn or damaged.
4. Inspect all fasteners and tapped holes. Replace damaged fasteners and repair damaged tapped hole threads with a correct sized die.
5. Inspect the entire axle assembly for cracks.
 - **If a crack is found in the axle tube, brake spider or axle spindle:** Replace the axle.

- **If a crack is found in a weld attaching any component to the axle, and if this crack extends into the axle tube:** Replace the axle.
- **If a crack is found in a weld that attaches a vendor-supplied component such as a spring seat to the axle, and if this crack is confined to the weld:** It may be repaired using the information in Section 7.
- **If a crack is found in a weld that attaches the brake spider, air chamber brackets or camshaft brackets to the axle, and if the crack is confined to the weld:** It may be repaired using the information in Section 7. Note that judgment must be used in this repair. These components are precisely located. If any question exists regarding whether these components can be correctly located, replace the axle.

6. Periodic removal of the wheel-end equipment either for maintenance or repair presents the opportunity for axle spindle inspection.

Visually inspect the spindle for cracks.

Surface rust, scratches, or slight pitting on the wheel spindle bearing or seal journals may be polished or sanded out with an emery or crocus cloth. Do not reduce the diameters of the journals beyond the axle manufacturer's specifications. Excessive pitting, scratches or fretting on the spindle bearing or seal journals covering more than 50 percent of the surface require axle replacement.

Spindle threads may be cleaned with a wire brush or chased with a die. Repair welding of the spindle threads is not permitted. Consult the trailer axle manufacturer if any wear is questionable.

- **If any crack is found in the spindle:** Immediate axle replacement is necessary. Neither in-house repair, nor repair by an outside contractor specializing in spindle welding repairs, is allowed.
7. Inspect the hubs or spoke wheels. If damaged or worn, repair or replace as outlined in the appropriate component manufacturer's maintenance manual.
 8. Measure the axle camber and toe as outlined in Section 8.
 - **If either of these parameters is out of specification:** Replace the axle.
 9. Inspect the dust shields if installed. Repair or replace damaged shields as necessary.

4 Clean and Inspect Parts

10. Inspect the brake equipment. Repair or replace damaged components. Refer to the Service Notes page on the front inside cover of this manual for instructions on how to obtain the correct Meritor maintenance manual for the brake you are servicing. Follow the manufacturer's instructions for components that are not supplied by Meritor.
11. If the trailer axle is equipped with cam brakes perform the following.
 - Check the up-and-down and side-to-side end play of the camshaft. If total movement is more than 0.030-inch (0.76 mm) in either direction, replace the bushings or camshaft as detailed in Section 12. Figure 4.3.

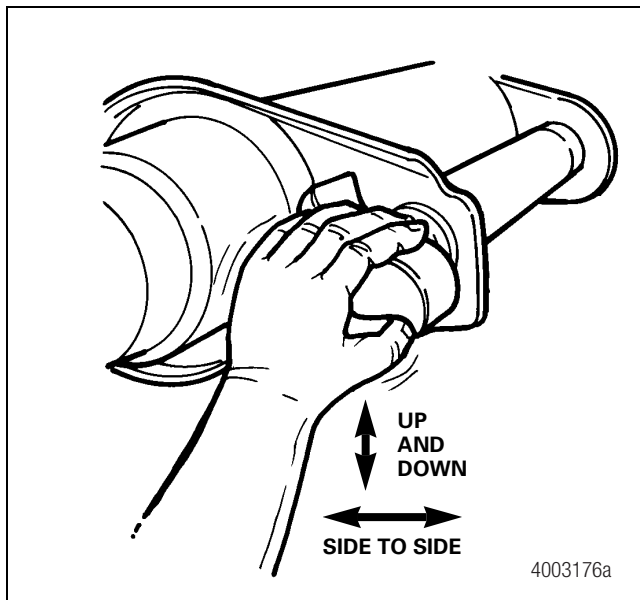


Figure 4.3

- Check the axial end play of the camshaft. If total movement is more than 0.060-inch (1.52 mm), replace the bushings, camshaft or both as specified in Section 12. Figure 4.4.

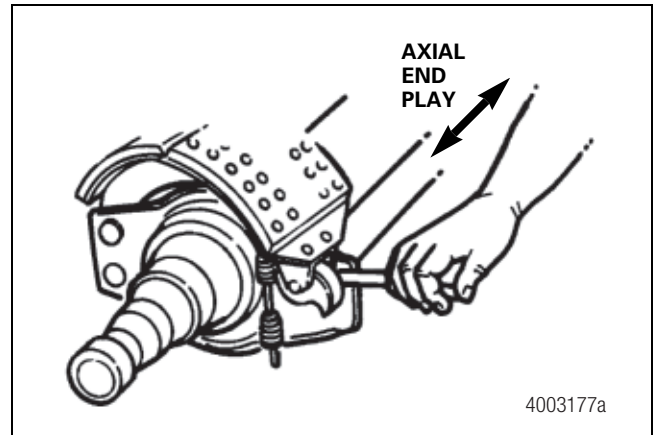


Figure 4.4

12. Inspect the bearings using the guidelines detailed below or literature published by the bearing manufacturer.
 - **If any of the conditions shown exist:** Replace the bearings.
 - **If there is a question as to whether any of these conditions exist:** It makes sense to replace bearings, since bearing costs are small compared to the potential cost of a breakdown.
 - In many instances, the conditions shown are caused by problems such as debris or water contaminating the lubricant, incorrect bearing adjustment, or inadequate lubricant. If these problems are not corrected, the conditions will persist.
- A. The roller ends are worn. Figure 4.5.

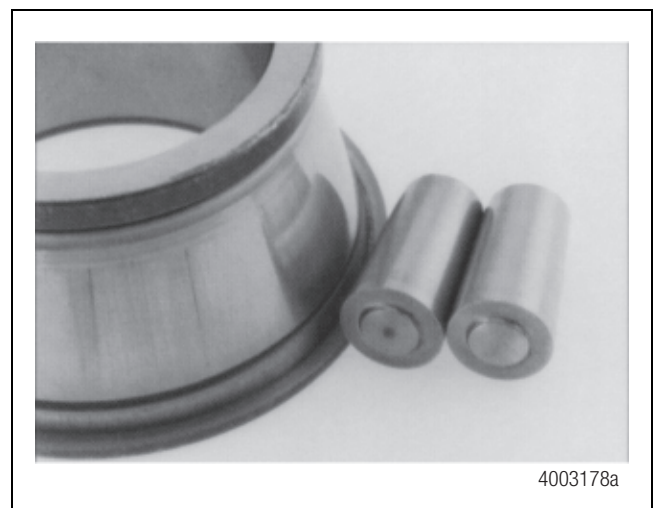


Figure 4.5

4 Clean and Inspect Parts

B. The rib is worn. Figure 4.6.

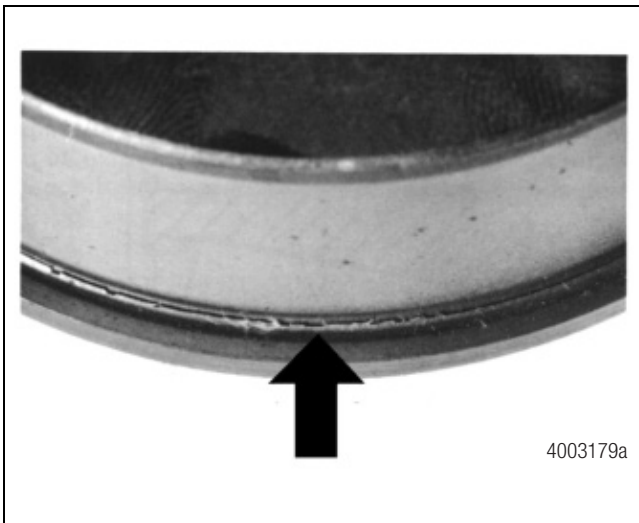


Figure 4.6

C. The roller cage is damaged. Figure 4.7 and Figure 4.8.

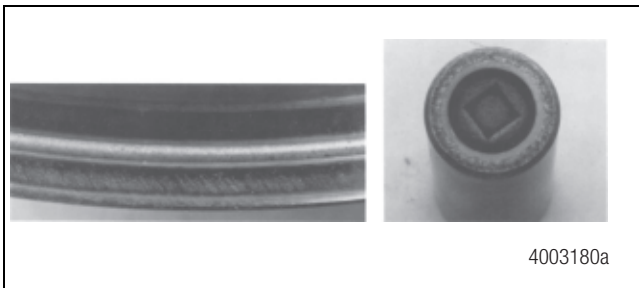


Figure 4.7

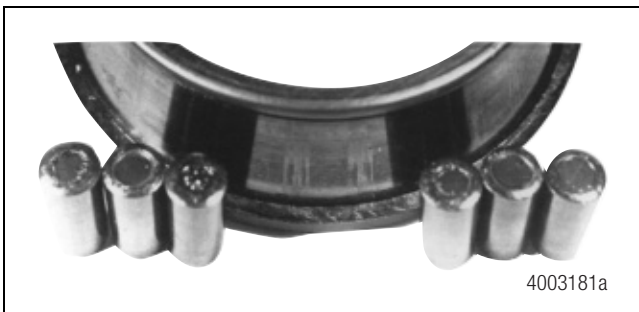


Figure 4.8

D. The roller ends and the ribs are scored. Figure 4.9 and Figure 4.10.



Figure 4.9



Figure 4.10

E. The bearing is discolored. Figure 4.11.



Figure 4.11

4 Clean and Inspect Parts

F. The cage, cup, cone or rollers are grooved. Figure 4.12.

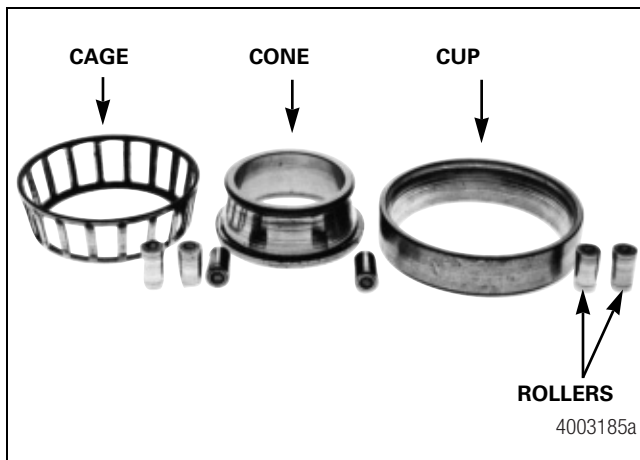


Figure 4.12

G. The races or rollers are bruised with deep indentations. Figure 4.13.



Figure 4.13

H. The races or rollers are etched. Figure 4.14.



Figure 4.14

I. The races or rollers are spalled. Figure 4.15 and Figure 4.16.



Figure 4.15

4 Clean and Inspect Parts



Figure 4.16

J. The races or rollers are gouged or nicked. Figure 4.17 and Figure 4.18.



Figure 4.17

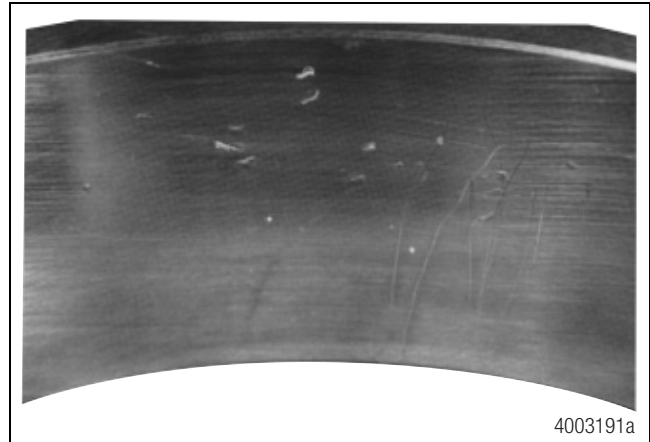


Figure 4.18

K. The races or rollers are brinelled. Figure 4.19.

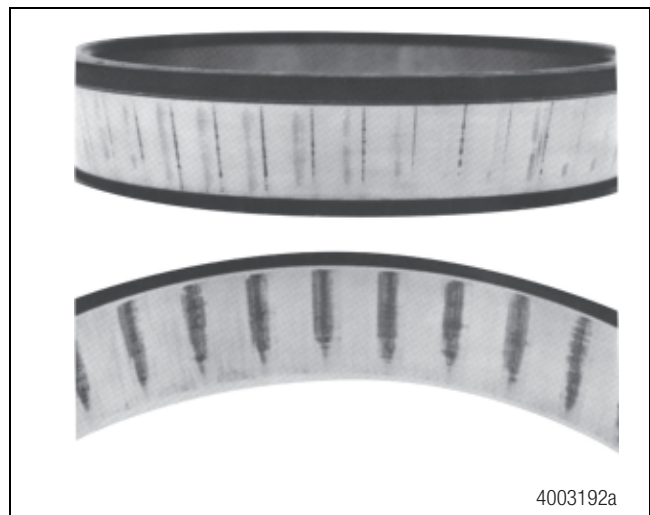


Figure 4.19

L. The races or rollers are cracked. Figure 4.20.

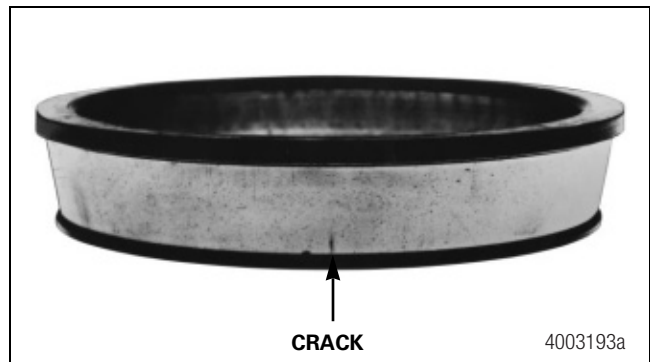


Figure 4.20

Important Information

Meritor automatic slack adjusters (ASAs) should not need to be manually adjusted in service. ASAs should not have to be adjusted to correct excessive pushrod stroke. The excessive stroke may be an indication that a problem exists with the foundation brake, ASA, brake actuator or other system components.

Meritor recommends troubleshooting the problem, replacing suspect components and then confirming proper brake operation prior to returning the vehicle into service.

In the event that a manual adjustment must be made (although not a common practice), a service appointment and full foundation brake, ASA, and other system component inspection should be conducted as soon as possible to ensure integrity of the overall brake system.

For Meritor brake adjustment, refer to the brake adjustment tables in this manual. For non-Meritor brake adjusters, refer to the brake manufacturer's service procedures.

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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.

⚠ ASBESTOS AND NON-ASBESTOS FIBERS WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Installation

Brakes

Most Meritor trailer axles are equipped with Q Series cam brakes. This section details procedures for installing this brake. For information on lubricants specified, refer to Section 14.

1. Install the camshaft and camshaft bushings as detailed in Section 12.

NOTE: Only one washer is needed on each side of the slack adjuster.

2. Lubricate the camshaft and slack adjuster splines with anti-seize compound. Install the slack adjuster, washers and snap ring. Figure 5.1.

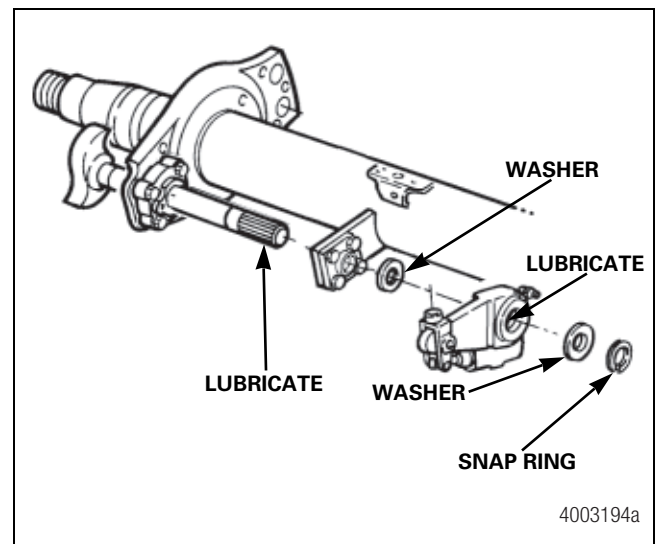


Figure 5.1

⚠ CAUTION

You must disengage a pull pawl or remove a conventional pawl before rotating the manual adjusting nut, or you will damage the pawl teeth. A damaged pawl will not allow the slack adjuster to automatically adjust brake clearance. Replace damaged pawls before putting the vehicle in service.

3. Rotate the slack adjuster manual adjusting nut CLOCKWISE to align the holes in the slack with the holes in the push rod clevis. Figure 5.2.

5 Assembly and Installation

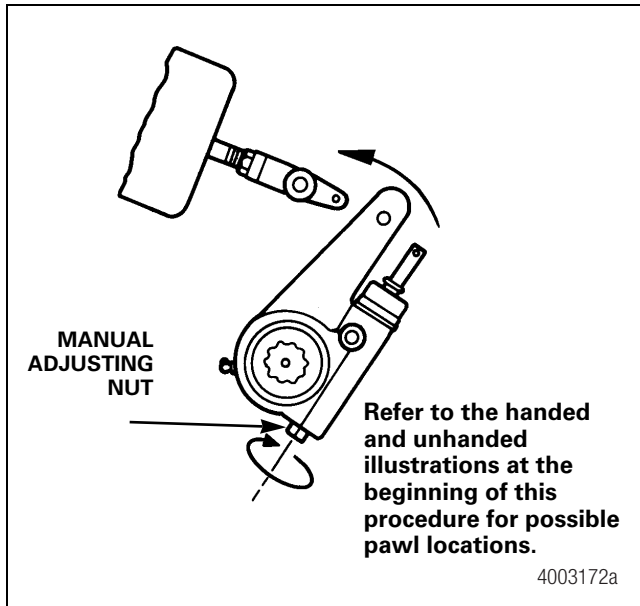


Figure 5.2

⚠ CAUTION

Always replace used clevis pin retainer clips with new ones when you service an automatic slack adjuster or air chamber. Do not reuse retainer clips. When you remove a retainer clip, it can bend out of shape and lose retention. Damage to components can result.

4. Lubricate both slack adjuster clevis pins with anti-seize compound, then install through the holes in the clevis and slack. Secure in place with clevis pin retainer clips. Replace used cotter pins with clevis pin retainer clips. Do not reuse cotter pins.
5. Lubricate anchor pins with Meritor specification 0-616-A grease where the brake shoes touch them. Place the upper shoe in position on the top anchor pin. Hold the lower brake shoe on the bottom anchor pin and install two new brake shoe retaining springs. Figure 5.3.

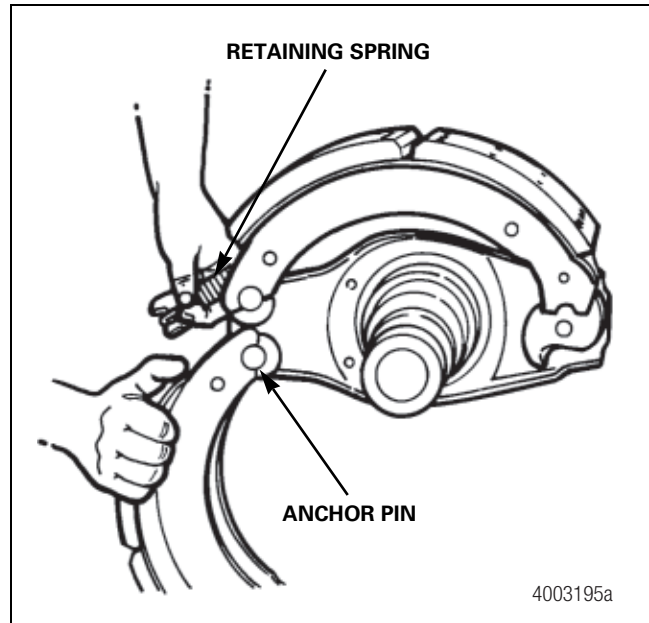


Figure 5.3

NOTE: You can remove a standard return spring by hand, if one is installed. If a heavy-duty spring is installed, you will need a tool to remove the spring.

6. Rotate the lower brake shoe FORWARD to place tension on the retaining springs and install a new return spring. Figure 5.4.

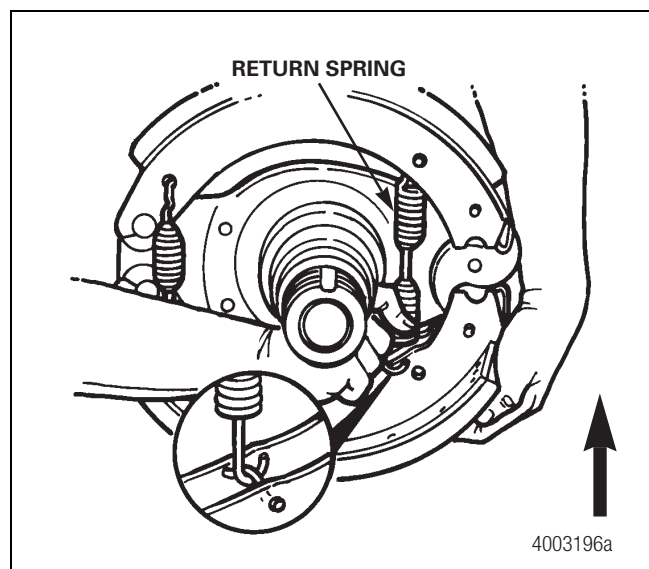


Figure 5.4

5 Assembly and Installation

7. Lubricate the cam rollers with grease where they touch the brake shoe webs, making sure not to get lubricant on the outer diameter of the roller that touches the camshaft head.
8. Pull each brake shoe away from the cam permitting enough space to install the cam rollers. Press the ears of the roller retainer clip together to fit the retainer between the brake shoe webs. Figure 5.5.

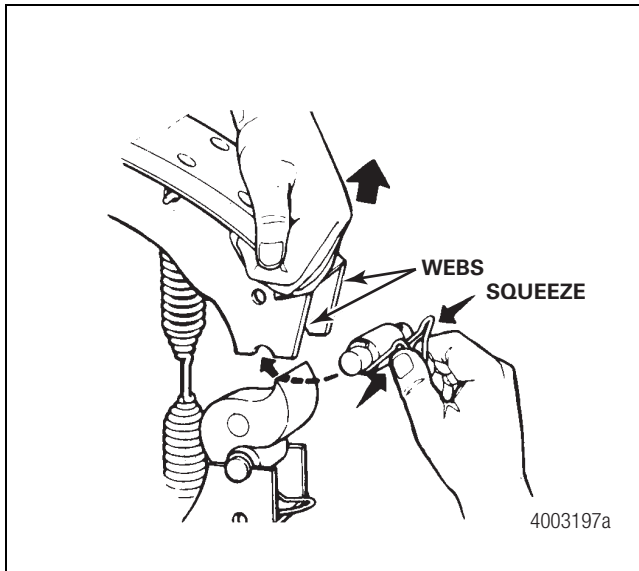


Figure 5.5

9. Push each roller retainer clip into the brake shoe until its ears lock in the holes in the shoe webs. Figure 5.6.

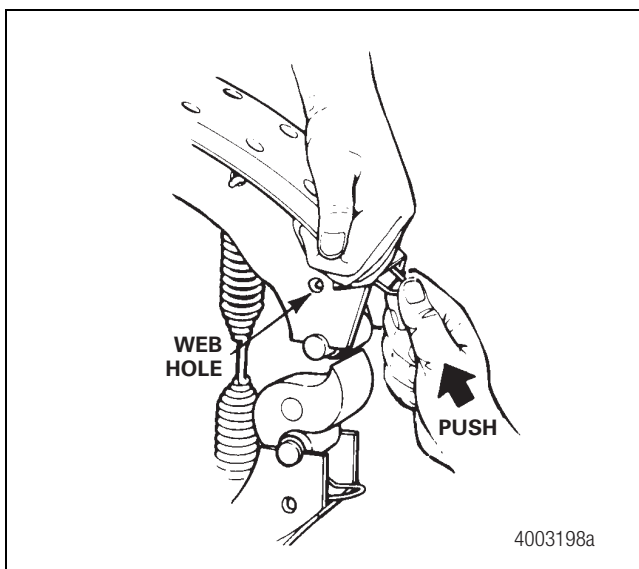


Figure 5.6

10. Lubricate the camshaft bushings and slack adjusters as follows.

- Wipe off the grease fittings to prevent contamination from being injected into the joints along with grease.
- Grease the camshaft bushings until new grease flows from the seals. If the cam bushing seals at the spider end of the cam are installed correctly, grease will flow out toward the slack adjuster.
- Grease the slack adjuster until new grease flows from around the inboard splines and from the pawl assembly.
- Wipe away excess grease that purges from the joints. This helps ensure that road dirt is not attracted to the lube point and that grease does not drop onto either the brake linings or road surface.

Wheel Ends

1. If the seal incorporates a separate wiper, apply a thin coat of sealant around the axle oil seal collar. Then using an installation tool, drive the wiper onto the oil seal collar until its edge is flush with the bearing shoulder. Figure 5.7.

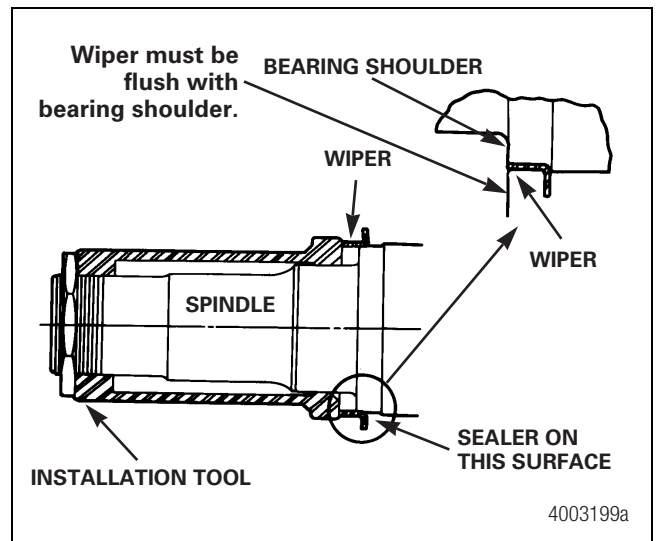


Figure 5.7

2. Coat the bearing cones with oil. Apply a light film of grease to the axle spindle bearing journals to help protect them from fretting corrosion. Do not use oil on the spindle bearing journals.

5 Assembly and Installation

⚠ WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

3. Install the seal and inner bearing cone. Follow the seal manufacturer's instructions to install the seal.
 - A. **For hub-mounted seals:** Install the inner bearing cone inside the hub. Lubricate the seal according to the seal manufacturer's recommendations, then place it onto the installation tool. Align the tool with the hub seal bore and drive the seal until it bottoms out in the hub seal bore. Rotate the tool and apply several light blows to ensure the seal is correctly seated. Check the bearing to verify it rotates freely. Figure 5.8.

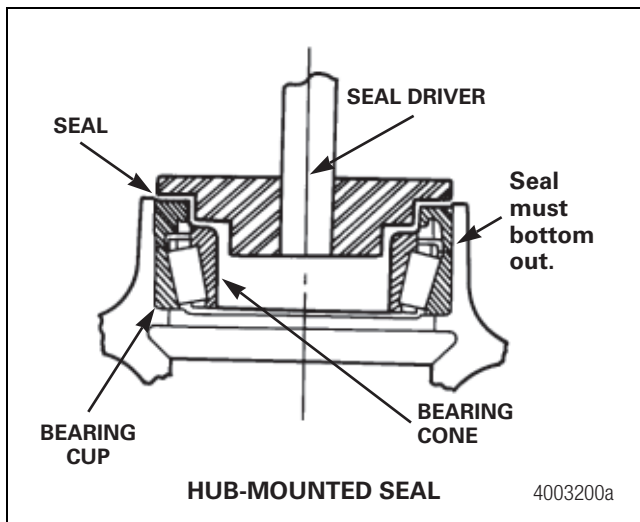


Figure 5.8

- B. **For spindle-mounted seals:** Lubricate the seal according to the seal manufacturer's recommendations, then place it onto the axle oil seal collar. Place the installation tool over the spindle and drive the seal until it is flush with the bearing shoulder. Rotate the tool and apply several light blows to ensure the seal is correctly seated. Figure 5.9.

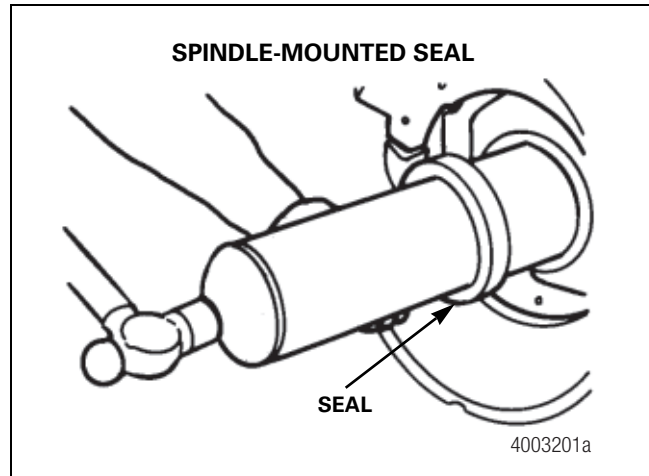


Figure 5.9

- C. Install the inner bearing cone onto the spindle. If it becomes misaligned, lightly tap the rough part of the axle tube with a hammer to create vibrations which will help realign it on the spindle and ease installation. Figure 5.10.

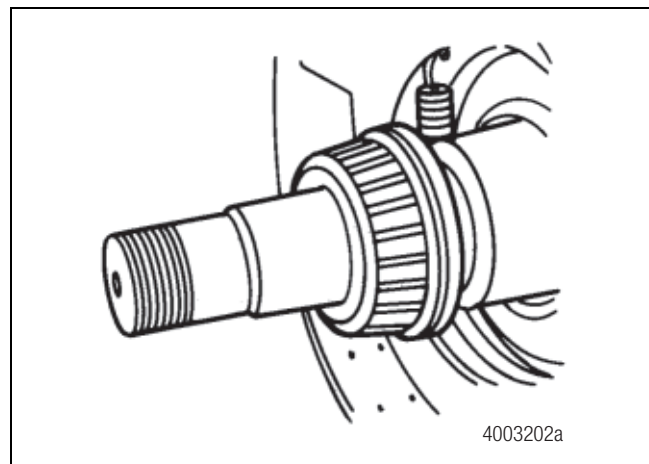


Figure 5.10

4. Support the hub and drum assembly using a sling or other appropriate method. Failure to do so may result in damage to the spindle threads or seal. Figure 5.11.

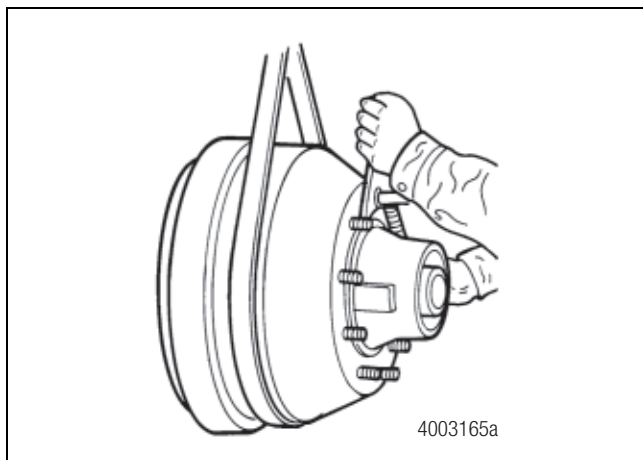


Figure 5.11

⚠ CAUTION

When you tighten the spindle nuts, the hub and drum assembly will seat to the correct position. Do not try to completely seat the hub and drum assembly by hand. Damage to components can result.

5. Install the hub and drum assembly as follows.
 - A. **For spindle-mounted seals:** Align the hub bore with the spindle and push the assembly into position until the bearing cone on the spindle fits into the bearing cup in the hub. The brake drum will help maintain alignment of the assembly during this operation.
 - B. **For hub-mounted seals:** Align the hub bore with the spindle and push the assembly into position until the bearing cone in the hub bottoms out against the oil seal collar. The bearing cone in the hub will help maintain alignment of the assembly during this operation.
6. Install the outer bearing cone, then tighten the adjusting nut until it is snug against the outer bearing cone. Remove the hub support so the hub rests on the bearings. Figure 5.12.

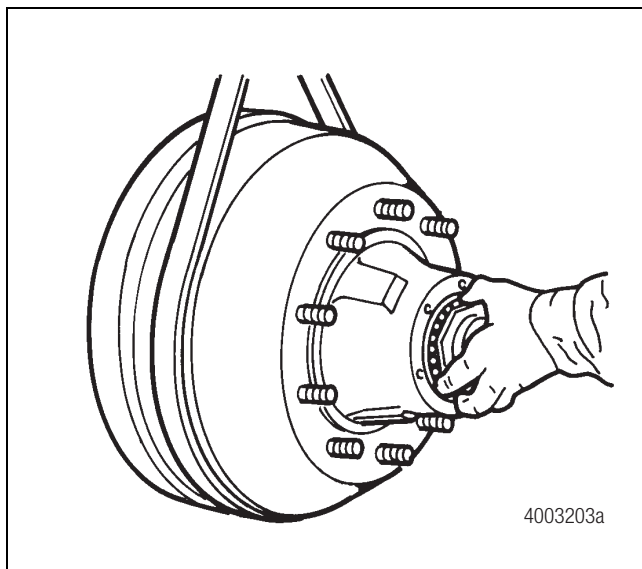


Figure 5.12

7. Adjust the bearings as specified in Section 10.
8. Install the hubcap by tightening the capscrews to 15-30 lb-ft (20-41N•m) in a criss-cross pattern. Use a new hubcap gasket. Figure 5.13. **ⓘ**

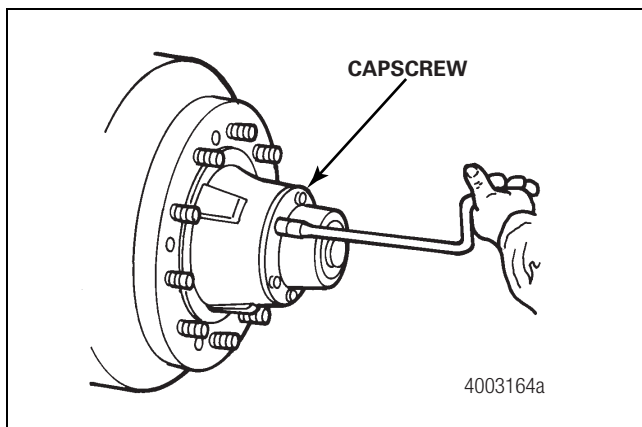


Figure 5.13

5 Assembly and Installation

⚠ CAUTION

Add wheel-end lubricant only to the hubcap fill line. Do not overfill the hubcap. Wipe off excess lubricant, which can contaminate brake linings and cause reduced brake performance. Damage to components can result.

9. Fill the wheel end with oil to the hubcap fill line. Note that the oil must be given sufficient time to settle prior to the final check of the oil level. This is especially important in cold conditions. Install the hubcap plug, verifying that the vent hole, if present, is not clogged with debris. Figure 5.14.

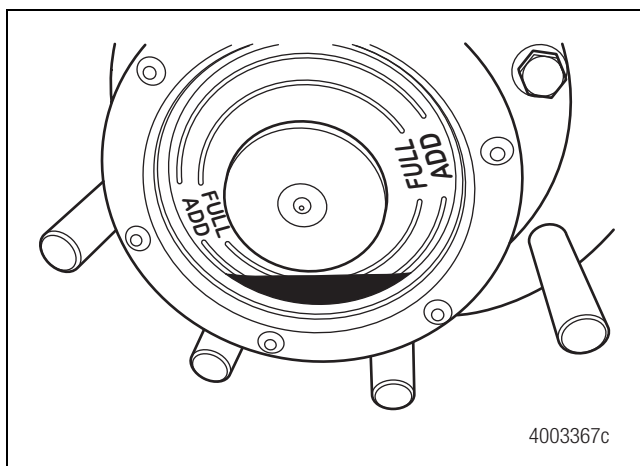


Figure 5.14

10. Install the tire and wheel assembly using the procedures specified by the wheel manufacturer.
11. Remove the safety stands and lower the vehicle.
12. Adjust the brakes using the procedures detailed in Maintenance Manual 4, Cam Brakes and Automatic Slack Adjusters. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

⚠ WARNING

Before you service a spring chamber, carefully follow the manufacturer's instructions to compress and lock the spring to completely release the brake. Verify that no air pressure remains in the service chamber before you proceed. Sudden release of compressed air can cause serious personal injury and damage to components.

13. If the axle is equipped with spring brake chambers, carefully release the springs.

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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.

Guidelines

Axle Installation

1. Refer to the procedures in this section to locate the top and front of the axle, as well as the allowable axle rotation. Using this information, position the suspension brackets onto the axle.
2. Verify that the brackets fit the axle correctly, then weld the brackets to the axle. Refer to Section 7.
3. Position the axle assembly under the vehicle, then tighten the suspension installation fasteners. Note that the final tightening must be done to the manufacturer's specifications with a calibrated torque wrench. Follow the recommended procedures protecting certain axle models from overtorquing.
4. Align the axle using the information in Section 8.
5. Inspect the assembly to ensure the following.
 - Suspension springs are correctly located on their wear pads.
 - Adequate clearances exist between the axle and vehicle components in both loaded and unloaded conditions.
 - All fasteners are tightened to the correct torque values.
6. After an initial break-in period and then at regular intervals, inspect all suspension fasteners to ensure that correct torque values are maintained according to the manufacturer's specifications.

Axle Positioning

⚠ CAUTION

Follow these instructions to correctly position an axle. An axle can crack from brake component welds that are in unauthorized locations, or because the axle was not positioned correctly. Excessive tire wear can result from incorrect axle camber or toe due to incorrect axle positioning. Damage to other components can also result.

The following provides detailed instructions on locating the top and bottom of the axle, locating the front and rear of the axle and determining the amount the axle can be rotated.

It is important to follow these instructions to help prevent the following conditions.

- Axle cracking due to incorrectly located brake component welds.
- Excessive tire wear due to incorrect axle camber or toe.

Follow the procedure below to correctly install most trailer axles. For additional assistance, contact ArvinMeritor's Customer Service Center at 800-535-5560. Figure 6.1.

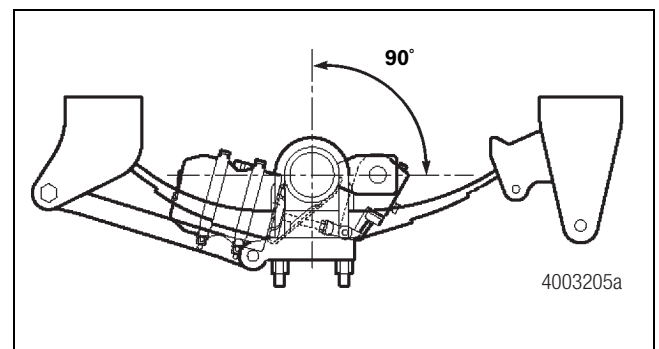


Figure 6.1

6 Additional Installation Information

Axle Top and Bottom

1. Most Meritor trailer axles are built with a 0.31-inch (7.874 mm) diameter hole partially drilled through the axle tube. This hole identifies the top of the axle. Figure 6.2.

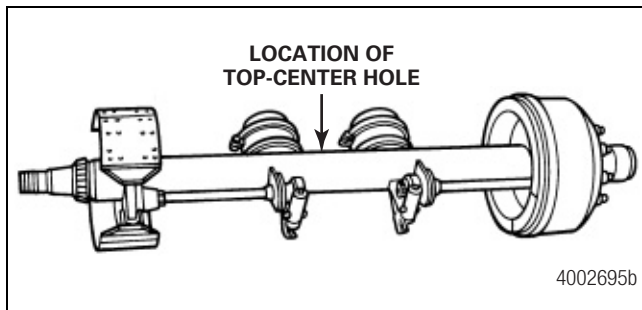


Figure 6.2

2. On axles built without a top-center hole, the axle can be rotated 180 degrees. Therefore, the axle top and bottom are interchangeable. Figure 6.3.

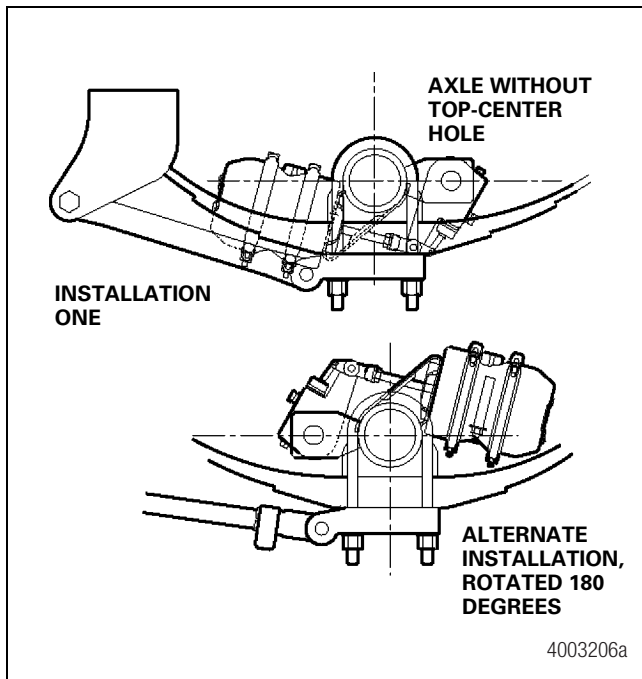


Figure 6.3

Axle Front and Rear

The front and rear of the axle can be identified using the location of the ID tag or embossing along with information regarding the correct brake equipment installation.

1. On axles built with a top-center hole, the ID tag or embossing is located toward the axle rear. Figure 6.4.

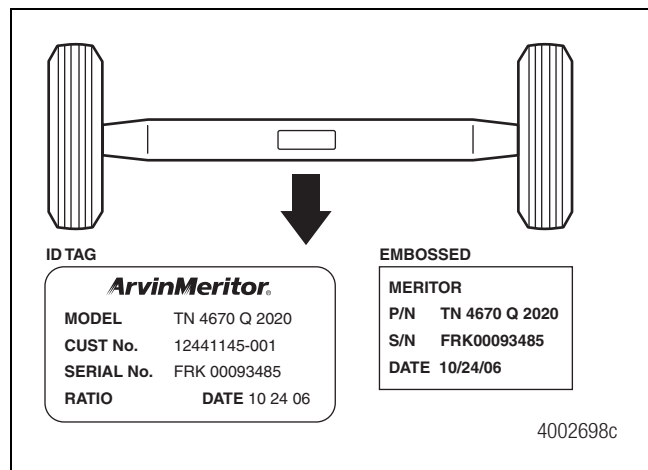


Figure 6.4

2. On axles built without a top-center hole, the axle can be rotated 180 degrees. Therefore, the axle front and rear are interchangeable. Figure 6.3. For these models, use the brake installation guidelines in this section.

Important Information

Meritor automatic brake adjusters (ABAs) should not need to be manually adjusted in service. ABAs should not have to be adjusted to correct excessive pushrod stroke. The excessive stroke may be an indication that a problem exists with the foundation brake, ABA, brake actuator or other system components.

Meritor recommends troubleshooting the problem, replacing suspect components and then confirming proper brake operation prior to returning the vehicle into service.

In the event that a manual adjustment must be made (although not a common practice), a service appointment and full foundation brake, ABA, and other system component inspection should be conducted as soon as possible to ensure integrity of the overall brake system.

For Meritor brake adjustment, refer to the brake adjustment information in this section. For non-Meritor brake adjusters, refer to the brake manufacturer's service procedures.

Brake Installation

- Trailer axles built with cam brakes should be installed so that the camshaft rotates in the same direction as the tires when the vehicle is moving forward. Figure 6.5.
- Trailer axles built with wedge brakes must be installed so that the tires rotate in the direction indicated on the brake shoe webs. Figure 6.6.

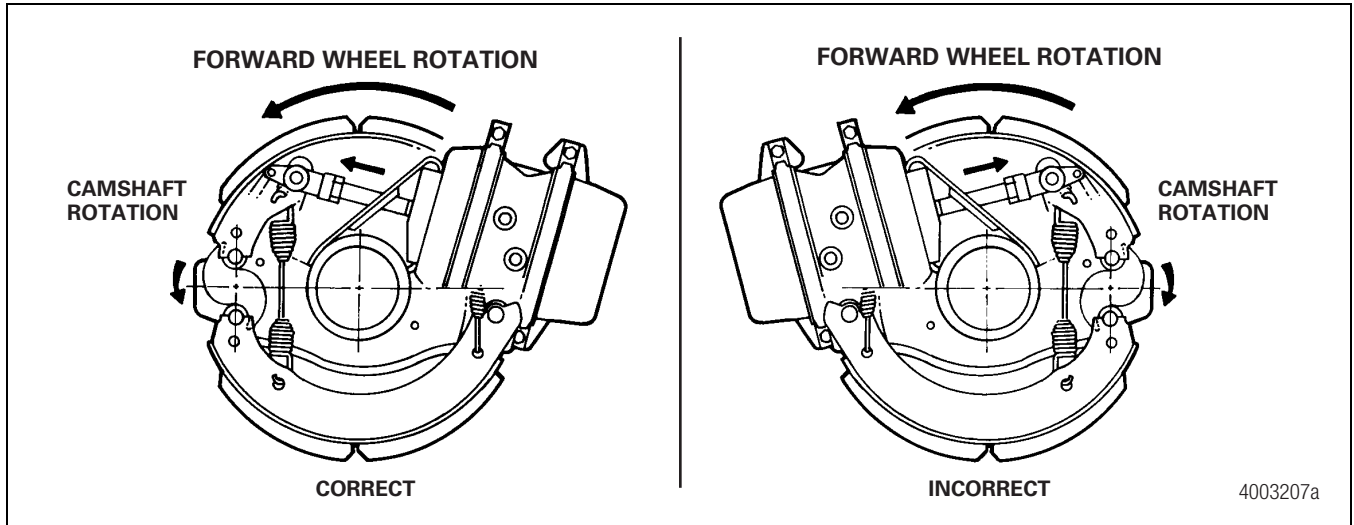


Figure 6.5

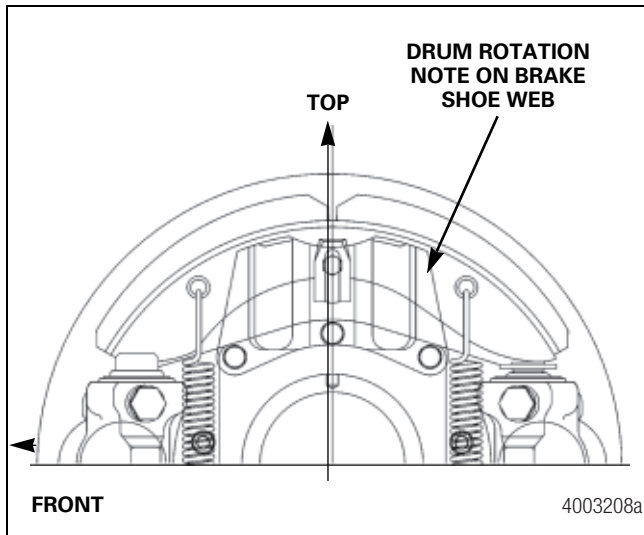


Figure 6.6

Axle Rotation

Trailer axles are available in both cambered and non-cambered models. Allowable axle rotation for these two models is different.

Refer to Figure 8.15 for the definition of camber. Note that a cambered axle cannot be identified by simple visual inspection. Rather, the Bill of Materials for a particular Engineering Axle Specification (EAS) must be checked to identify the axle as being either cambered or non-cambered.

All cambered axles are built with a top-center hole. These models must be installed so that this hole is located at the exact top position. Figure 6.7.

6 Additional Installation Information

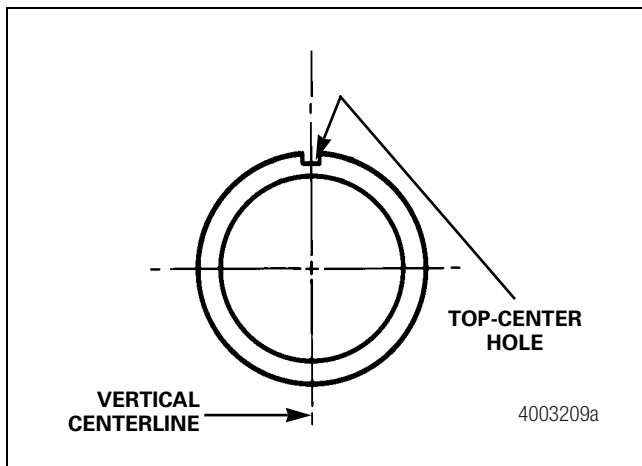


Figure 6.7

Non-cambered axles may be built either with or without a top-center hole. These models must be installed as follows:

- **On models with a top-center hole:** The top-center hole must be located within 20 degrees of vertical and the brake hardware must be located within 20 degrees of horizontal as described in this section.
- **On models without a top-center hole:** Brake hardware must be located within 20 degrees of horizontal as described in this section.

⚠ WARNING

When you install an axle with a top-center hole, you must locate the top-center hole within 20 degrees of the axle vertical centerline. You must locate brake components within 20 degrees of the axle horizontal centerline. An installation that does not comply with these specifications will void the warranty. Axle fatigue, damage to components and serious personal injury can result.

On non-cambered axles, observe the following for correct positioning.

- **Top-center hole:** The top-center hole must be within 20 degrees of the axle vertical centerline. Figure 6.8.

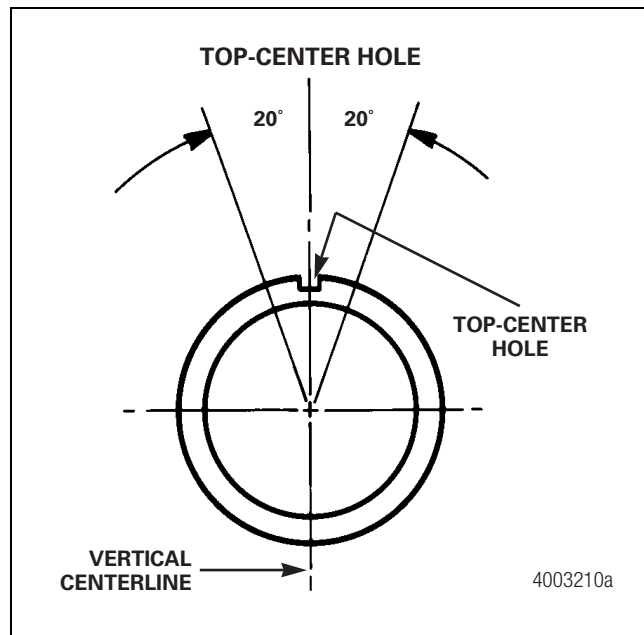


Figure 6.8

- **Cam brakes:** The centerline of the camshaft bracket must be located within 20 degrees of the axle horizontal centerline. Figure 6.9.

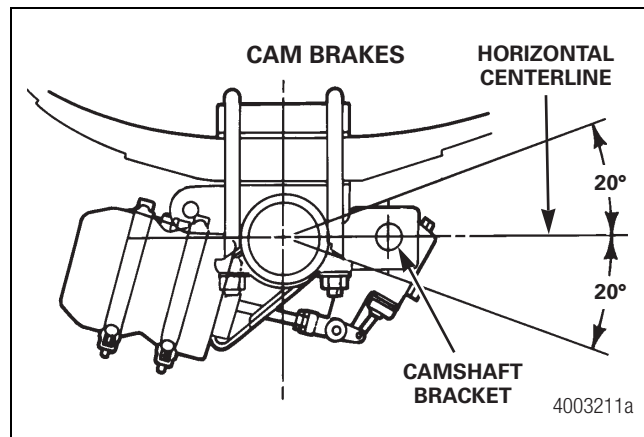


Figure 6.9

- **Disc brakes:** The centerline of the power screw must be located within 20 degrees of the axle horizontal centerline. Figure 6.10.

6 Additional Installation Information

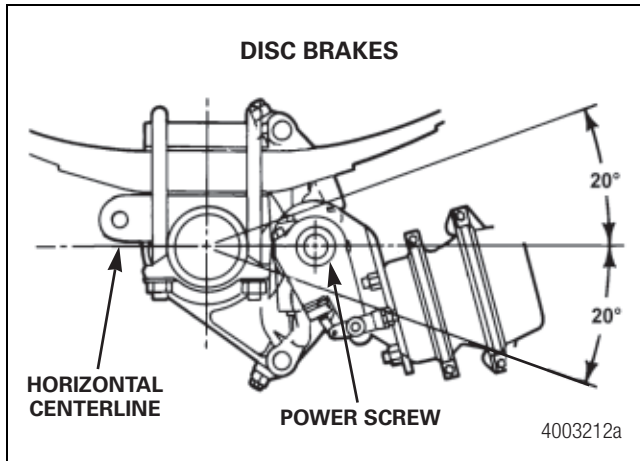


Figure 6.10

- Wedge brakes with air chamber tube support brackets:**
 When wedge brakes are equipped with air chamber support brackets, the centerline of the brackets must be located within 20 degrees of the axle horizontal centerline. Figure 6.11 and Figure 6.12.

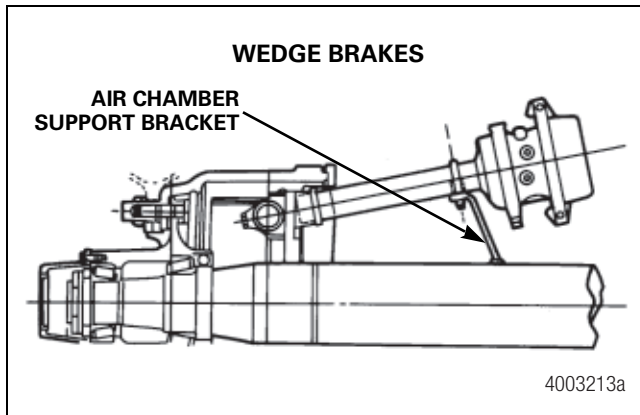


Figure 6.11

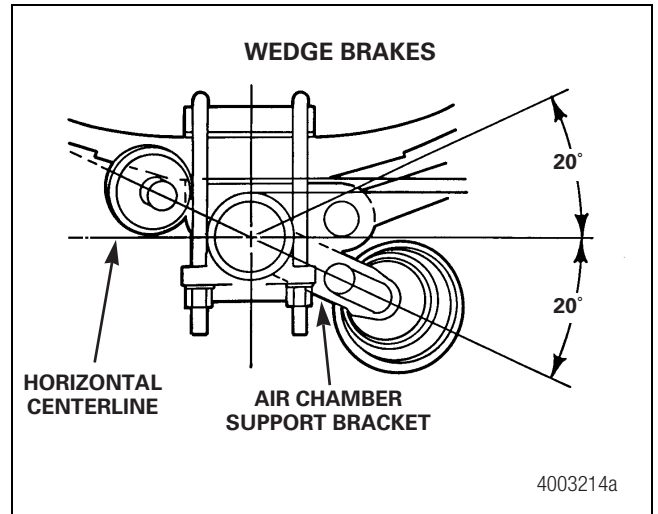


Figure 6.12

Suspension

⚠ CAUTION

You must tighten U-bolts to the manufacturer's specifications. U-bolts that are overtightened can damage the axle at the point the bolts contact the axle.

Special pressure plates may be required when installing rectangular axles on some suspensions.

On the mounting set-up shown in Figure 6.13, the spring seat and axle bracket isolate the top and bottom of the axle from the compression forces exerted by tightening the U-bolts. No pressure plates are required.

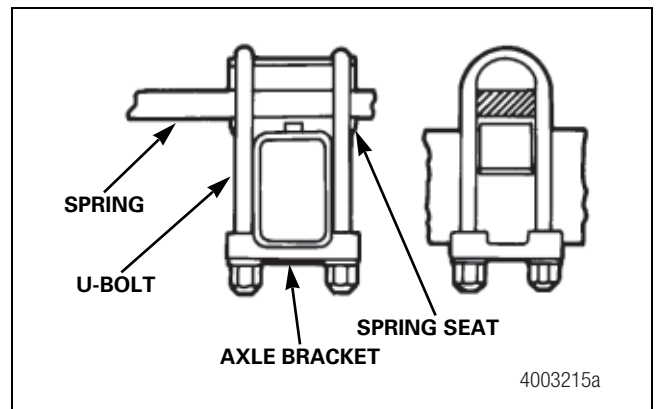


Figure 6.13

6 Additional Installation Information

On the mounting set-up shown in Figure 6.14, a suspension bracket does not isolate the bottom of the axle from compression forces exerted by tightening the U-bolts. This isolation must be obtained by installing plates, at least 0.25-inch (6.3 mm) thick, between the axle and the U-bolts.

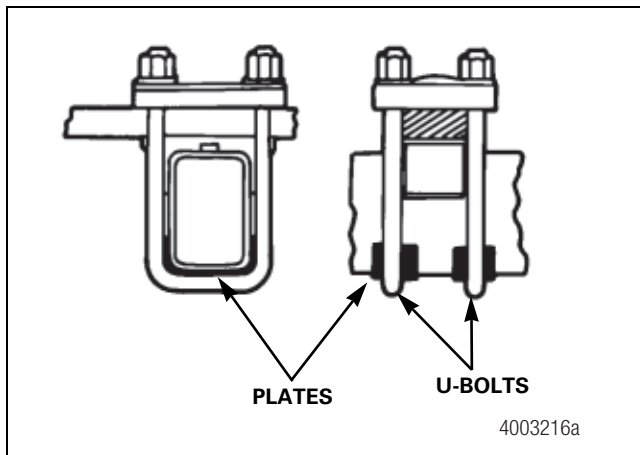


Figure 6.14

To correctly distribute axle loads on some suspension models, the chassis angle, or angle of the trailer relative to the ground, must be correct.

- **If the tractor fifth wheel height is correct:** The trailer chassis angle will be correct and the suspension load will be correctly distributed to the axles.
- **If the tractor fifth wheel height is incorrect:** The chassis angle will be incorrect and the suspension load will be incorrectly distributed to the axles.
- On the suspension shown in Figure 6.15, the fifth wheel is too high, resulting in an overload of the rear axle. If the fifth wheel had been too low, the front axle would have been overloaded.
- Correct distribution of suspension loads can be achieved by either setting the tractor fifth wheel to the height recommended by the trailer manufacturer, or by adjusting the suspension by installing shims between the axle and the suspension springs.

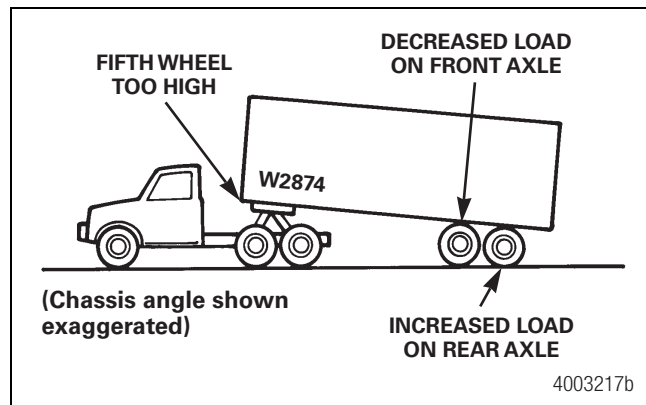


Figure 6.15

Dust Shields

NOTE: Refer to Section 12 for more information on forged and stamped spiders.

Dust shield installation kits for trailer axles equipped with cam brakes are available from Meritor's Aftermarket Service. To obtain this kit, refer to the Service Notes page on the front inside cover of this manual.

Dust shields are mounted to forged spiders with six fasteners. Figure 6.16.

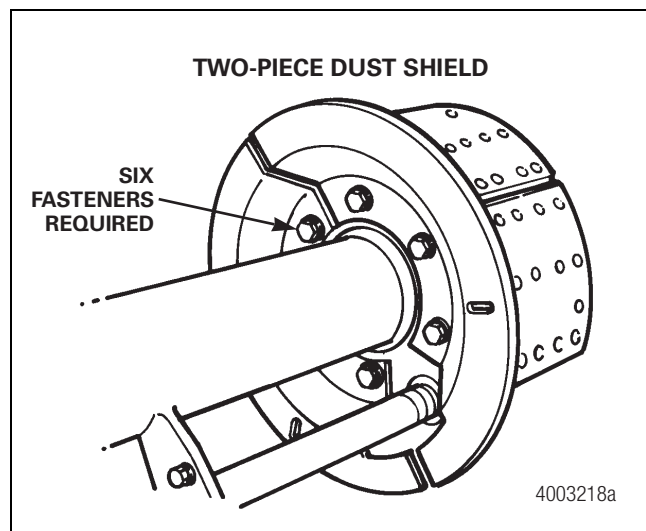


Figure 6.16

Two dust shield designs are available for use on forged spiders depending on whether 16.5 x 7-inch or 16.5 x 8-5/8-inch brakes are installed onto the axle. Both of these designs are mounted directly to the spider.

6 Additional Installation Information

Dust shields are mounted to stamped spiders with four fasteners. Figure 6.17.

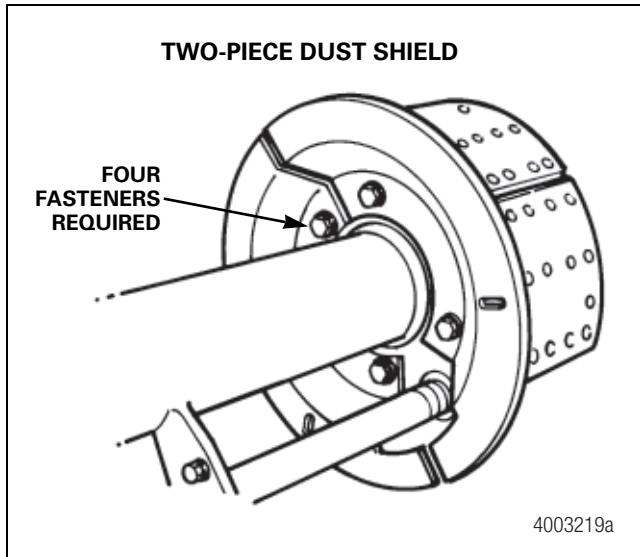


Figure 6.17

- One dust shield design is available for use on stamped spiders. On axles built with 16.5 x 7-inch brakes, the dust shield is fastened directly to the spider.
- On axles built with 16.5 x 8, 8.625-inch and 10-inch brakes, a spacer assembly is installed to space the dust shield to accommodate the wider brake equipment. Figure 6.18.

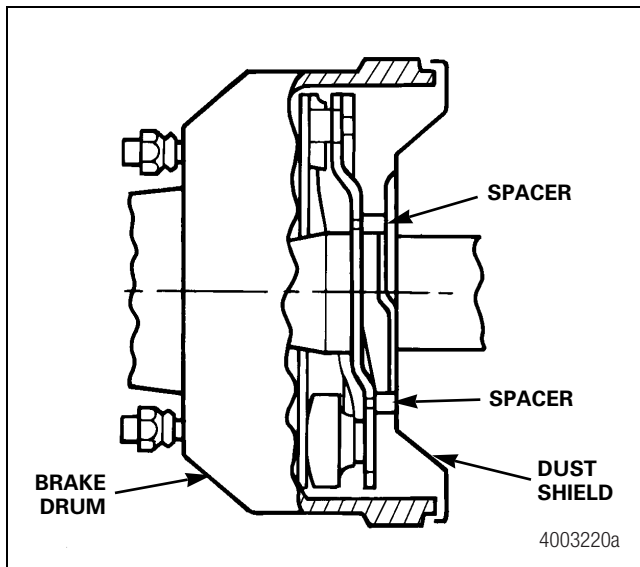


Figure 6.18

Dust shields are mounted to a separate welded-on bracket on axles built with 12-1/4 x 7-1/2-inch brakes. Refer to Figure 6.19 and Section 7 for detailed instructions on locating and welding this bracket to the trailer axle.

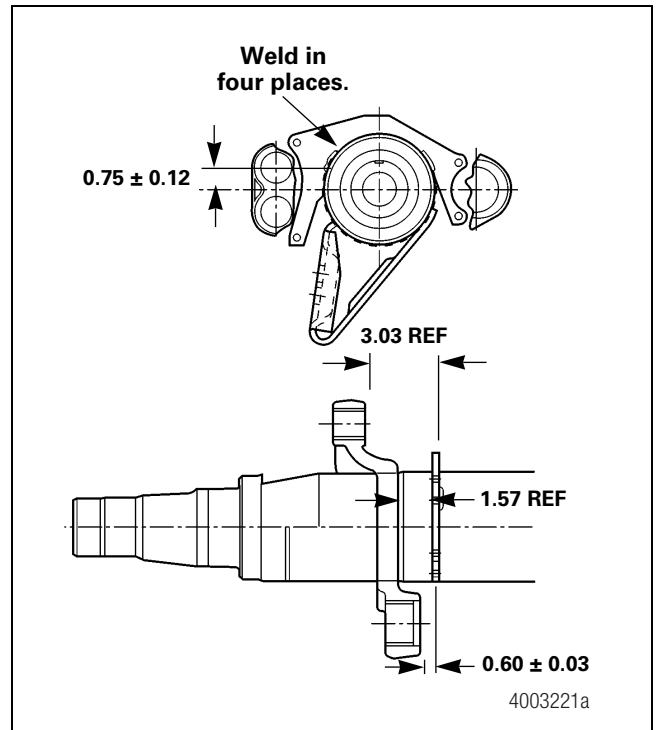



Figure 6.19

When installing a dust shield, tighten all dust shield attachment fasteners to 25-35 lb-ft (34-47 N•m). 

Dust shield kits include four loose spacers that can be used to fine tune the installation. For example, if the dust shield rubs on the brake drum after installation, remove the fasteners and install the washers to space the shields away from the drum.

Centrifuse drums are typically 0.25-inch (6.35 mm) wider than comparable cast drums. Therefore, these loose spacers must be installed between the dust shield and spider when centrifuse drums are used.

Spindle Protection

Two methods are used to protect trailer axle spindles from damage and corrosion during shipping, when axles are built without wheel-end equipment. A plastic sleeve or chemical protectant may be used.

6 Additional Installation Information

Plastic Sleeve

The most common method is to fit a plastic sleeve over the spindle.

⚠ CAUTION

To remove a plastic sleeve from an axle spindle, pull the sleeve off the spindle to break the sleeve vacuum. Do not use a knife to cut a plastic sleeve. Damage to the axle spindle can result.

1. To remove the sleeve, pull on it and break the sleeve vacuum by either deflecting it slightly at the oil seal collar, Figure 6.20, or applying clean dry air into the slit on the end of the sleeve, Figure 6.21.

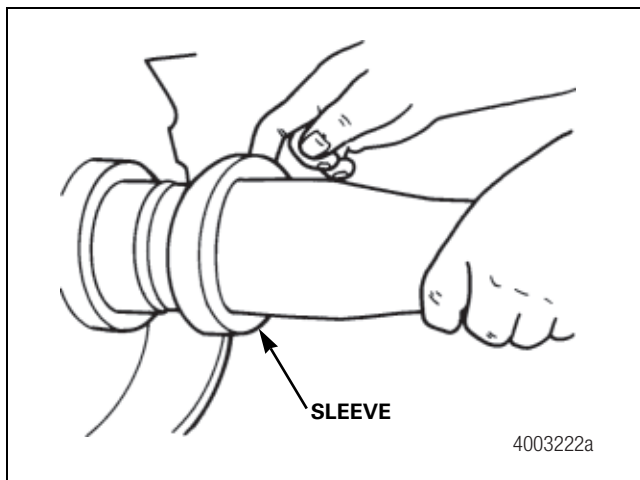


Figure 6.20

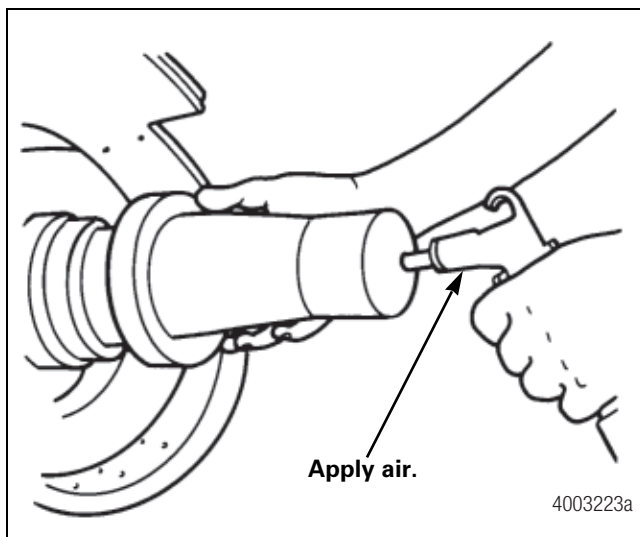


Figure 6.21

2. Remove moisture or contamination found on the spindle with a clean rag.
3. Coat the axle spindle with axle lubricant as specified in Section 5. The light coating of oil on the spindle does not have to be removed.
4. Sleeves are non-hazardous and recyclable. Sleeve color will vary, but this has no significance. Undamaged sleeves can be returned to the Meritor manufacturing plant in Kenton, Ohio, for credit. Call Meritor's Customer Service Center at 800-535-5560 for instructions.

The plastic sleeves are not designed to protect spindles indefinitely. If axles are stored outside for extended periods of time, water can enter through the sleeve into the spindle cavity and cause some minor rusting. To remove this rust, use a crocus or emery cloth as detailed in Section 4. Lubricate the spindle prior to installing the wheel-end equipment.

Chemical Protectant

Another method of protecting spindles is to apply a chemical protectant directly to the axle spindle.

1. Use a clean rag and solvent to remove protectant prior to service.
2. After removing the solvent, coat the spindle with axle lubricant as detailed in Section 5.

Unit-Mounted Brakes

On some axle models, brake flanges are welded to the axle INBOARD of the spindle. Figure 6.22.

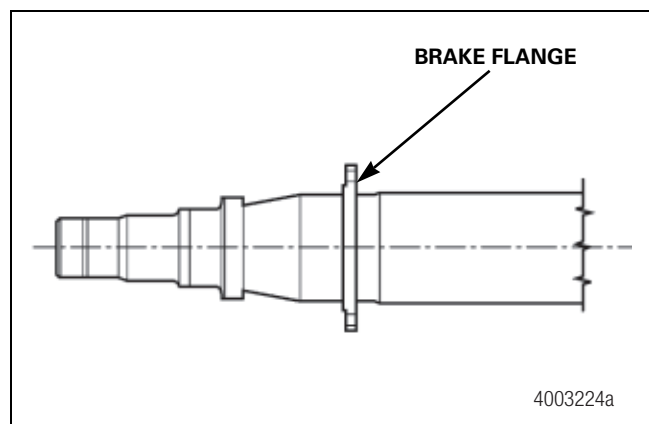


Figure 6.22

6 Additional Installation Information

Unit-mounted brakes, standard on drive axles, are then mounted to the trailer axle by bolting the brake spider to this flange. Figure 6.23.

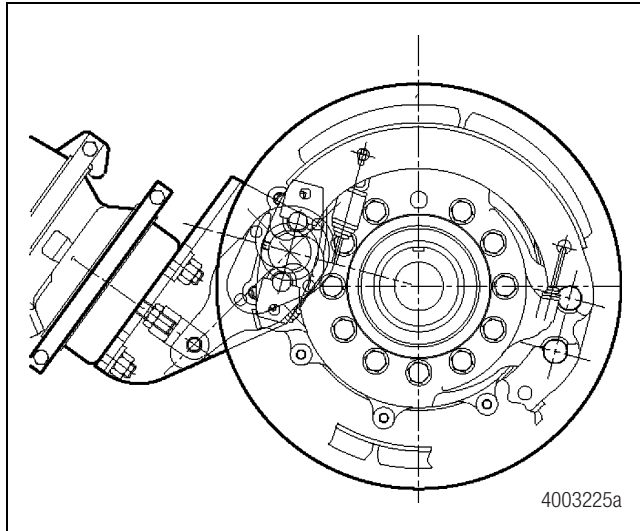


Figure 6.23

Three different flange designs are currently available. Each has one 0.8125-inch (20.638 mm) hole for the anti-lock braking system (ABS) sensor wire and additional holes for fastening the brakes.

- **For a nine-hole flange:** Fasten the brake by installing the correct 5/8-inch (15.875 mm) diameter fasteners through the eight 0.656-inch (17 mm) holes. Tighten the fasteners to 180-230 lb-ft (244-312 N•m). Figure 6.24. 🔧

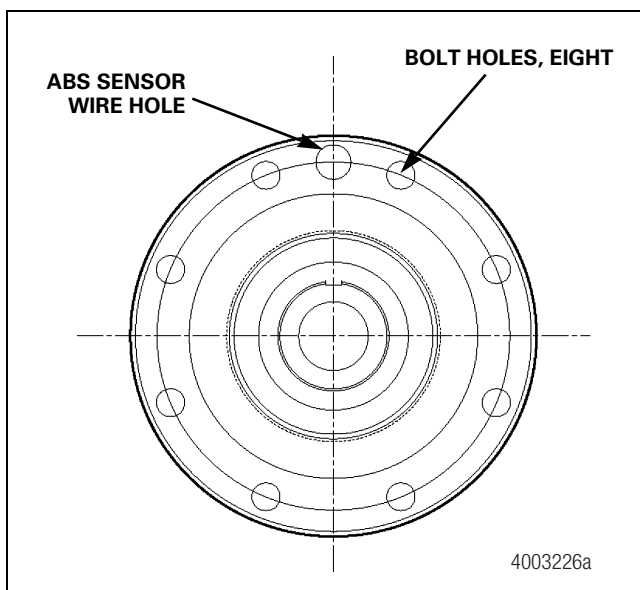


Figure 6.24

- **For a 12-hole flange:** Fasten the brake by installing the correct 9/16-inch (14.288 mm) diameter fasteners through the 11 0.594-inch (15 mm) holes. Tighten the fasteners to 130-165 lb-ft (176-224 N•m). Figure 6.25. 🔧

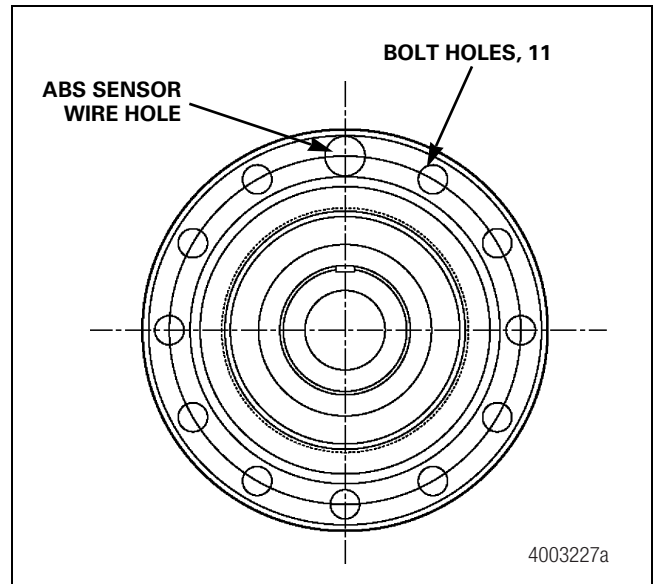


Figure 6.25

- **For a 16-hole flange:** Fasten the brake by installing the correct 5/8-inch (15.875 mm) diameter fasteners through the 15 0.656-inch (17 mm) holes. Tighten the fasteners to 180-230 lb-ft (244-312 N•m). Figure 6.26. 🔧

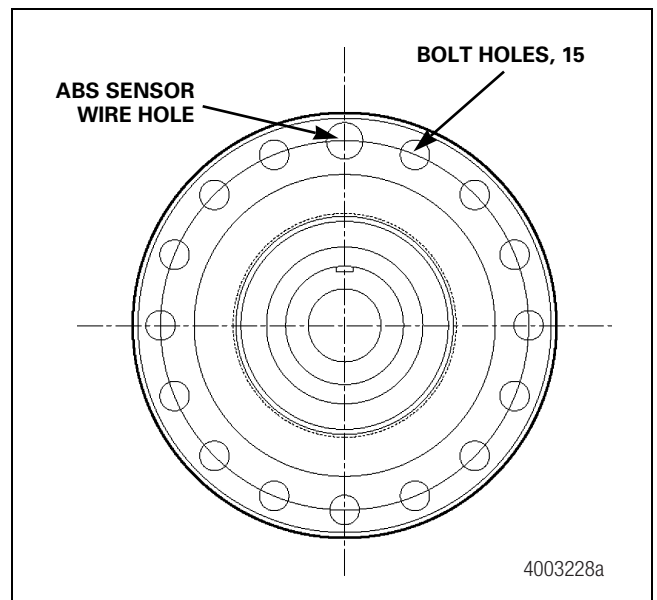


Figure 6.26

7 Welding

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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.

Guidelines

For complete welding instructions, refer to technical bulletin TP-9421, Instructions for Welding Brackets on All Drive Axles. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

Only Use Certified Welders

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

Methods

- Four methods can be used to weld hardware to trailer axles.
 - Shielded Metal Arc (Stick electrodes)
 - Gas Metal Arc (MIG — Solid Wire)
 - 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 Preparation

- The area to be welded must be free of 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.

Hardware Fit

- Hardware at the weld site should fit as close as possible to the axle. This will prevent the necessity for excessive welding. Figure 7.1.

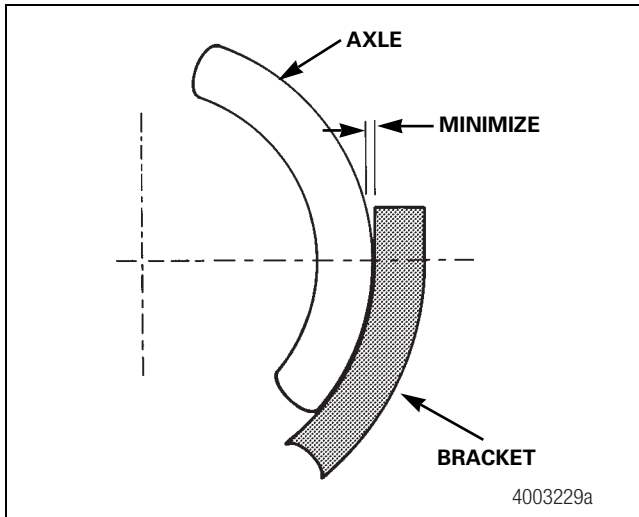


Figure 7.1

- Hardware, such as suspension spring seats and trailing arms, must be accurately positioned parallel to each other. Use the axle top-center hole, when available, for reference in locating this hardware, then C-clamp components in position prior to welding.
- Brackets that wrap around the axle should fit the axle so that the point of contact is at the base of the bracket as shown in View A. Here the fit is such that loads imposed on the bracket are transferred directly to the axle. A fit as shown in View B is such that both vehicle loads or loads imposed by tightening U-bolts are transferred through the weld. This may cause the weld to crack. Figure 7.2.

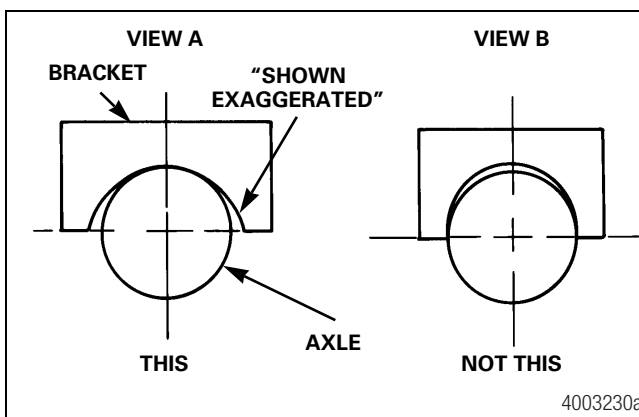


Figure 7.2

- Brackets on rectangular axles should fit the axle so that the point of contact is at the tangent point of the axle radius. Figure 7.3.

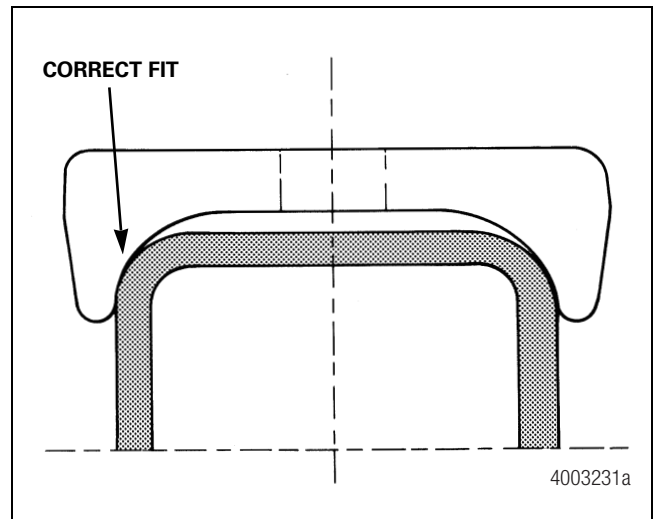


Figure 7.3

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 one of the parts welded to the axle such as the camshaft bracket, air chamber bracket or brake spider. It should not be located at a suspension spring, a U-bolt or a point that will place a wheel bearing between the ground connection and weld area. Figure 7.4.

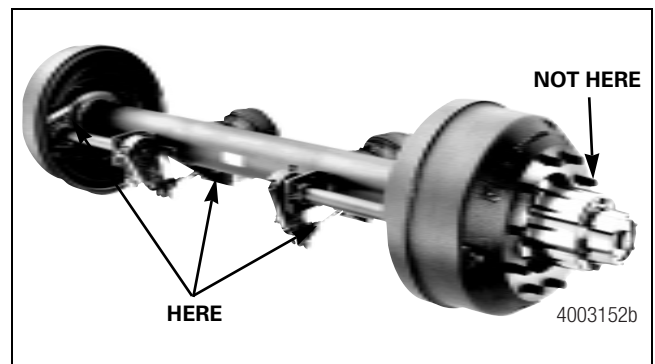


Figure 7.4

- 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 7.5.

7 Welding

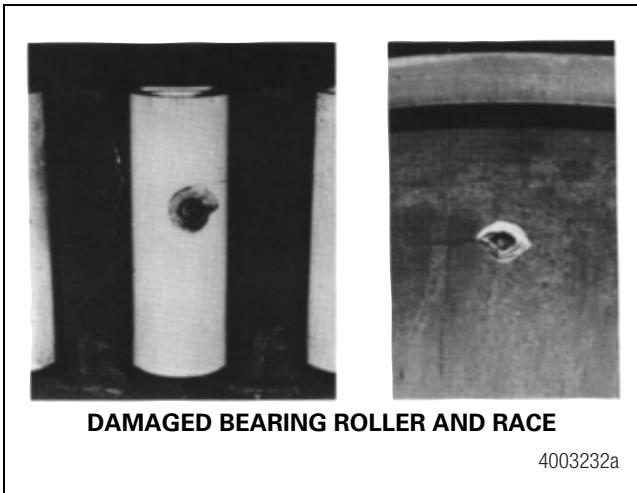


Figure 7.5

- 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 7.6.

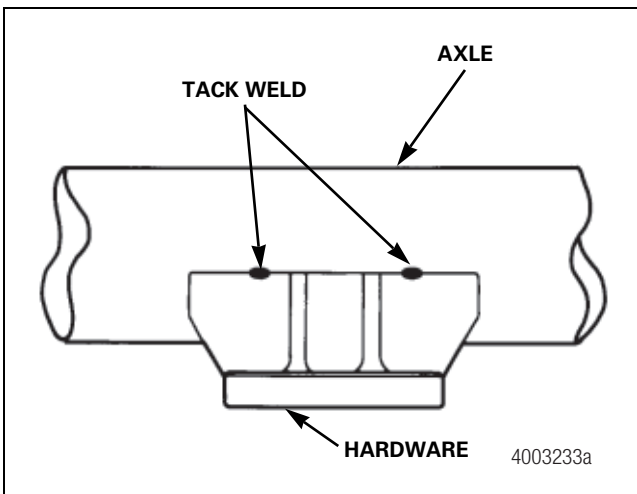


Figure 7.6

- Do not locate tack welds at the ends of the bracket. Rather, they should be located toward the center of the brackets. Figure 7.7.

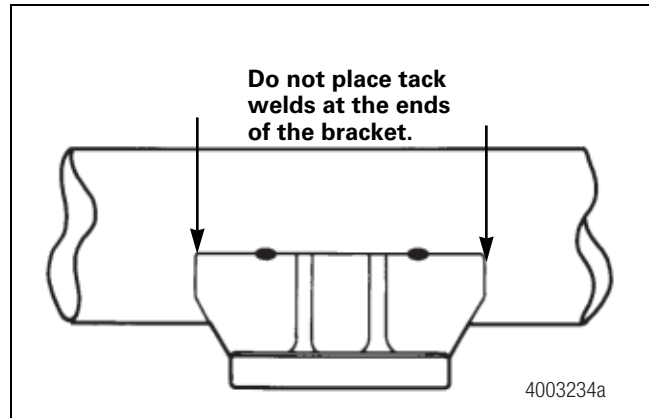


Figure 7.7

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 7.8.

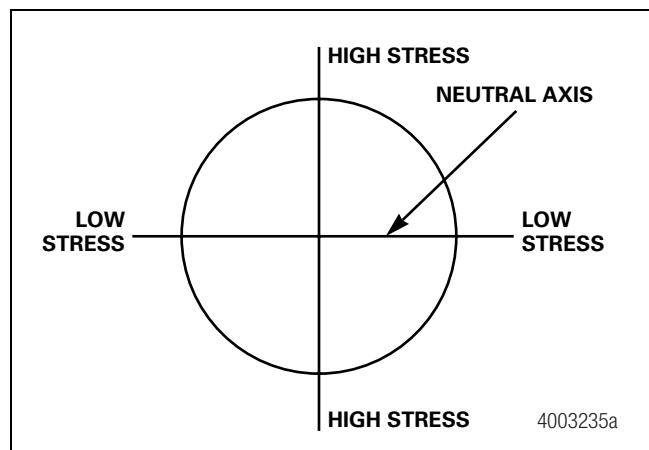


Figure 7.8

⚠ 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 within 1.50-inches (38.1 mm) of the top-center of the axle. Figure 7.9.

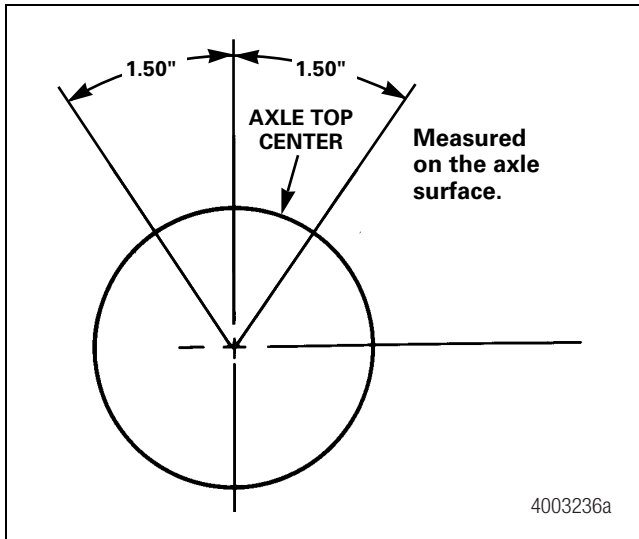


Figure 7.9

- Horizontal welding is not allowed more than 1.50-inches (38.1 mm) below the axle horizontal centerline. Figure 7.10.

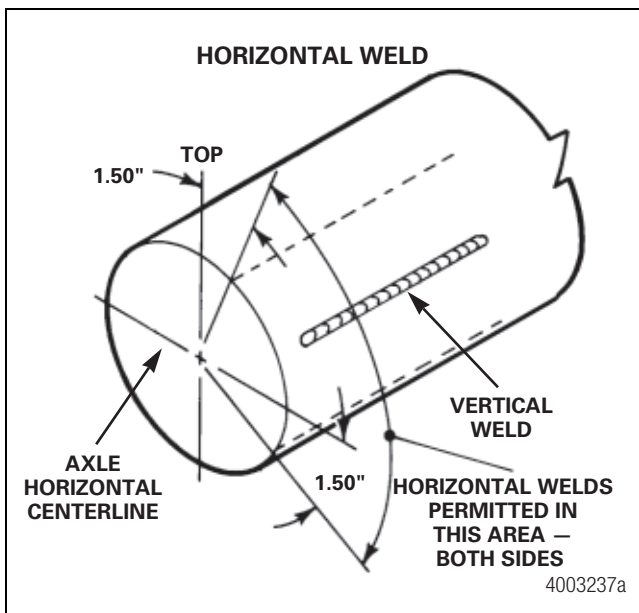


Figure 7.10

- Vertical welding is not allowed more than one-inch (25.4 mm) below the axle horizontal centerline. Figure 7.11.

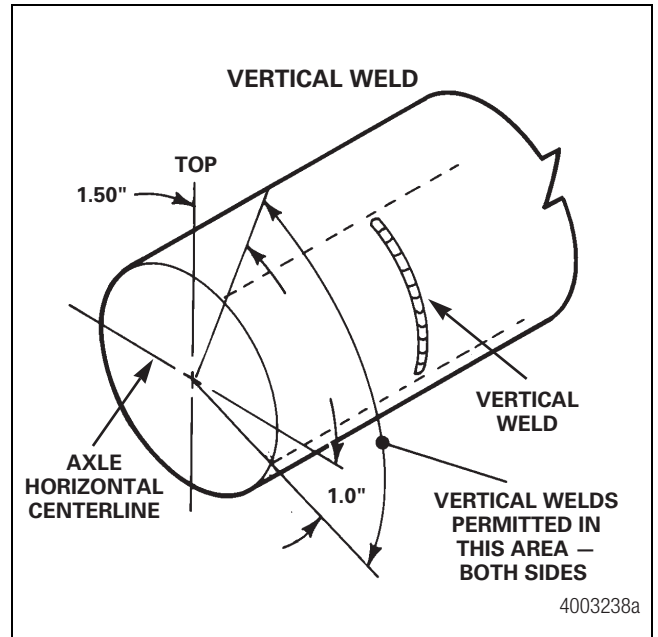


Figure 7.11

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

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 7.12.

7 Welding

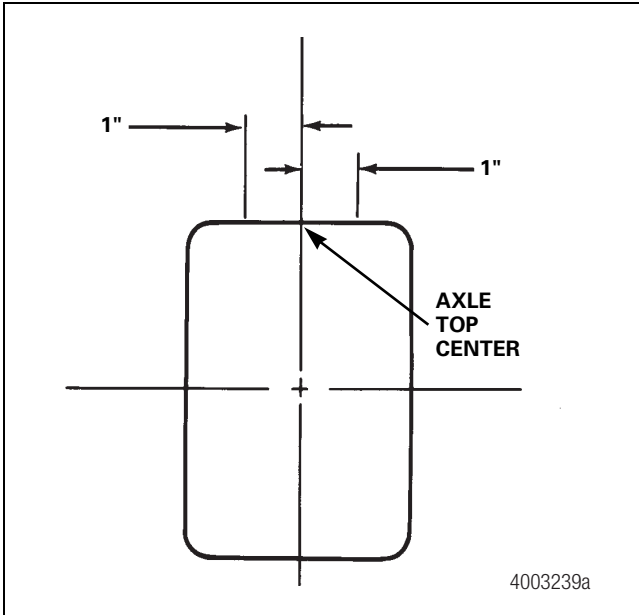


Figure 7.12

- Horizontal welding is not allowed more than 1.50-inches (38.1 mm) below the axle horizontal centerline. Figure 7.13.

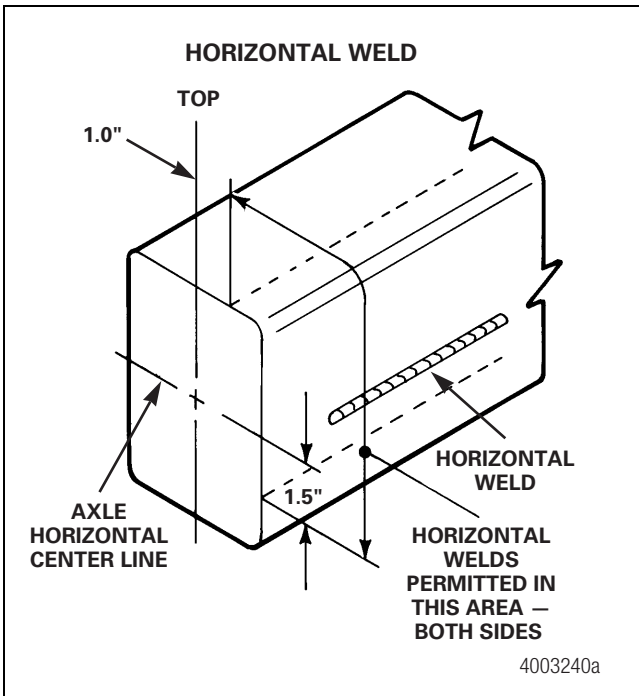


Figure 7.13

- Vertical welding is not allowed more than one-inch (25.4 mm) below the axle horizontal centerline. Figure 7.14.

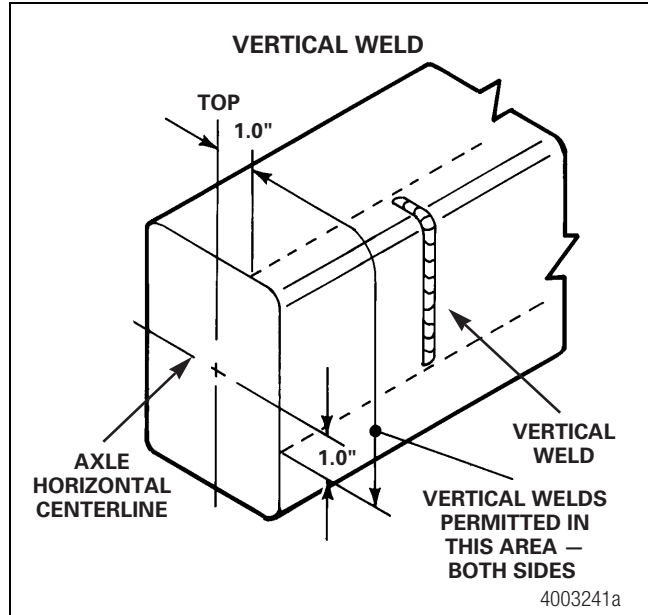


Figure 7.14

- 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 7.15.

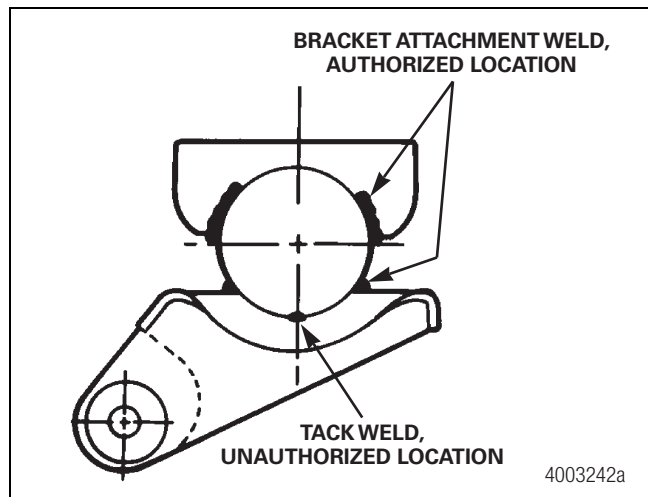


Figure 7.15

- 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.

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 7.16.

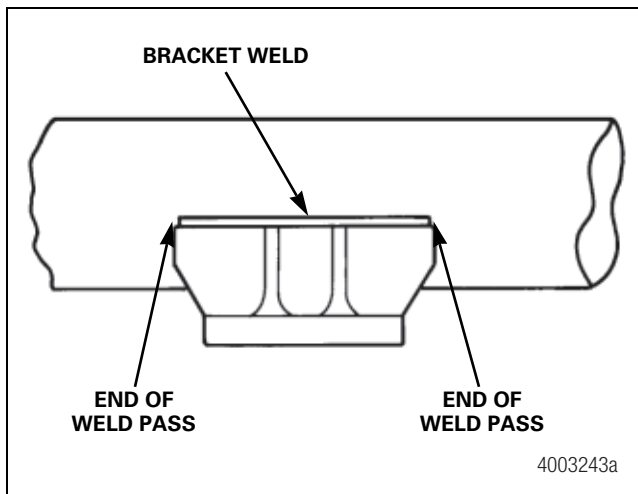


Figure 7.16

- Some brackets are attached to trailer axles with multiple welds. For example, at each of the weld locations shown in Figure 7.17, 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.

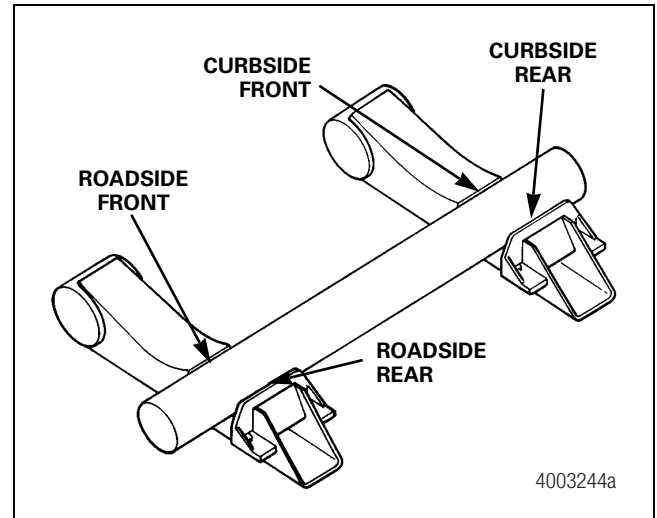


Figure 7.17

- 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.

Bead Size

- The maximum weld bead size allowed, regardless of whether the weld is achieved with a single or multiple passes, is 3/8-inch (9.5 mm) on rectangular axles and 1/2-inch (12.7 mm) on round axles.

8 Alignment

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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.

Alignment

Alignment is a function of three parameters:

- Axle orientation
- Axle camber
- Axle toe

Alignment should be checked whenever major axle or suspension components are replaced or if vehicle tracking or excessive tire wear problems exist. Note, however, that these problems can also be caused by other factors such as:

- An axle that is installed with its centerline located more than 0.25-inch (6.3 mm) from the trailer centerline. Figure 8.1.

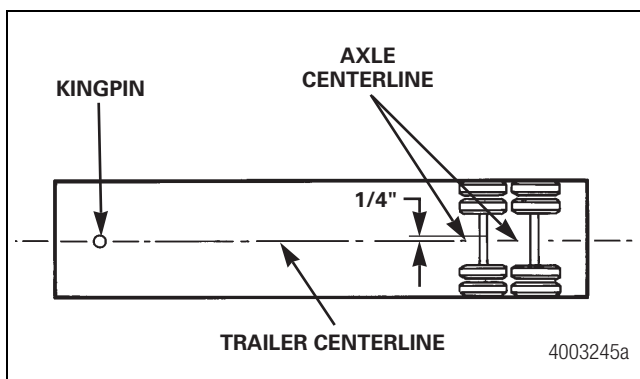


Figure 8.1

- Incorrect tire inflation pressure.
- The rolling radii of a set of dual tires on a wheel end not matching within 0.125-inch (3.1 mm). Figure 8.2.

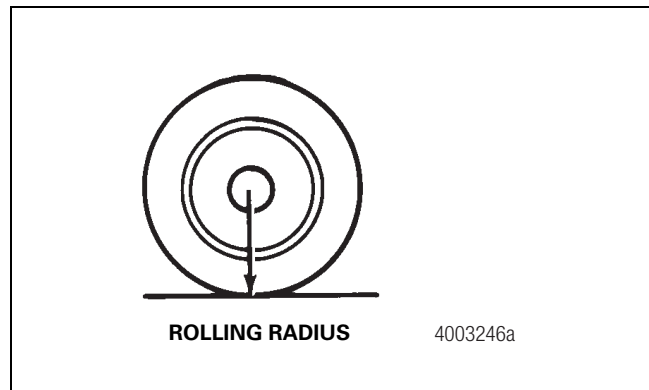


Figure 8.2

- Damaged or worn suspension components or incorrectly tightened suspension fasteners.
- Incorrect chassis angle. Refer to Section 6 for additional information on obtaining a correct chassis angle.

Before performing an alignment, replace damaged or worn components with the parts that match the manufacturer specifications and tighten the fasteners to specifications.

Alignment should be performed with the vehicle empty and the brakes released.

Axle Orientation

Axle orientation is defined as the positioning of the axle assembly relative to the vehicle on which it is installed.

Correctly oriented axles must be positioned as follows. Figure 8.3.

- On a single-axle vehicle, the axle is positioned relative to the vehicle.
- On a multiple-axle vehicle, the front axle is positioned relative to the vehicle, then the remaining axles are positioned so they are parallel to this axle.

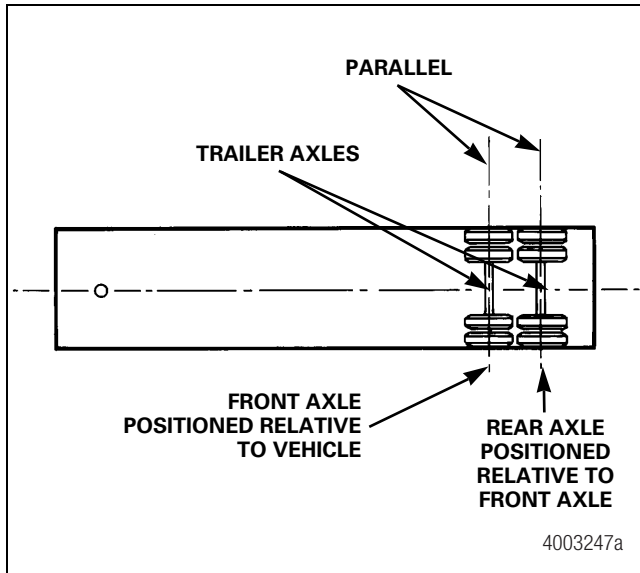


Figure 8.3

Before performing an axle orientation, the vehicle suspension must be in its “as run” condition. This is accomplished by positioning the vehicle on a level floor and moving it forward and backward several times in a straight line. Verify that the last movement is forward.

On a slider suspension, the suspension should be placed in its “as run” condition by applying the trailer brakes and pulling the trailer forward, causing the tires to slide. This step is designed to stabilize the slider subframe by forcing the slider locking pins to the rear within their retention holes.

On a slider suspension, the lower subframe is designed to move within the confines of the trailer longitudinal body rails. Therefore, lateral clearances must be present between these members. On some slider suspensions, this clearance may be excessive and it may be necessary to center the system before orienting the axles by installing temporary shims between these members at all four corners.

Spindle extenders are designed to ease axle orientation by eliminating the requirement for removing the outer wheel when orienting the front trailer axle. Figure 8.4. Made from tubular stock approximately 12 to 15-inches long, the devices are designed to be attached to the spindle end. Once in place, the devices position the axle reference points far enough outside the trailer to allow the measuring tape to clear the tires when measuring the dimensions from the kingpin to the axle ends.

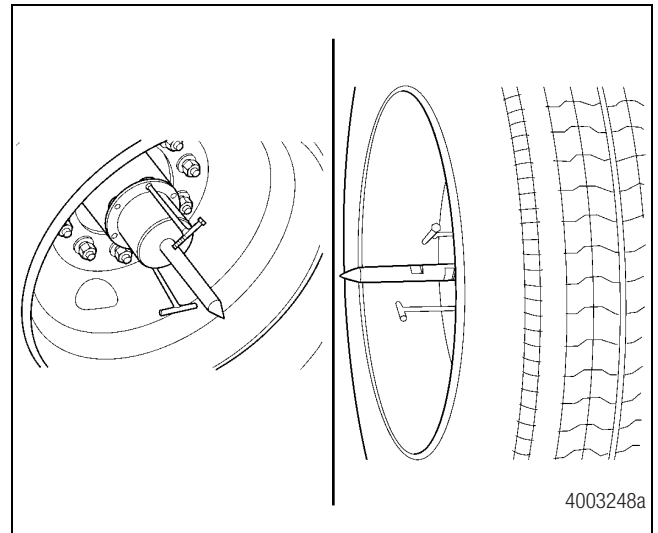


Figure 8.4

Kingpin extenders are designed to ease axle orientation by allowing the measuring device used to orient the front trailer axle to clear obstructions under the trailer. Made from tubular steel, the device provides a vertically oriented adjustable length rod below the kingpin. Bubble-type level gauges should be attached to allow the vertical position to be checked. Once in place, the device provides a location far enough below the kingpin to allow the measuring device to clear under trailer obstructions when measuring the dimensions from the kingpin to the axle ends. Figure 8.5.

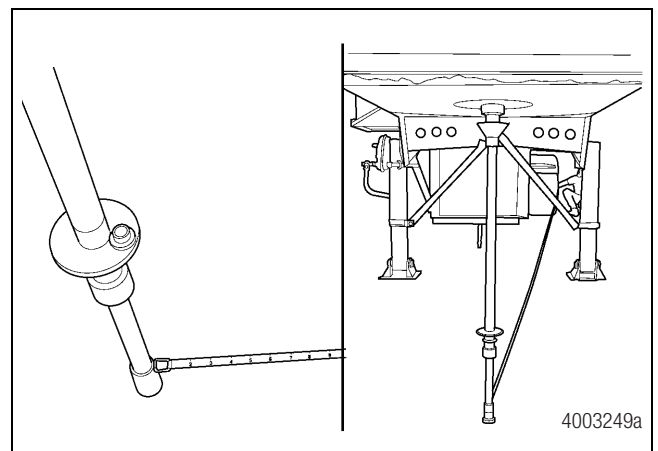


Figure 8.5

To facilitate alignment, a commercially available alignment gauge, generally found in automotive maintenance shops can be used. Otherwise, a trammel bar can be readily fabricated from a drill rod. The pointers of the gauge must be straight and true, as well as aligned with each other. Figure 8.6.

8 Alignment

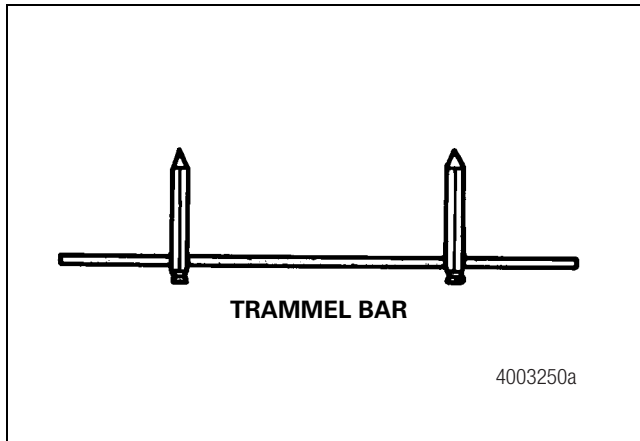


Figure 8.6

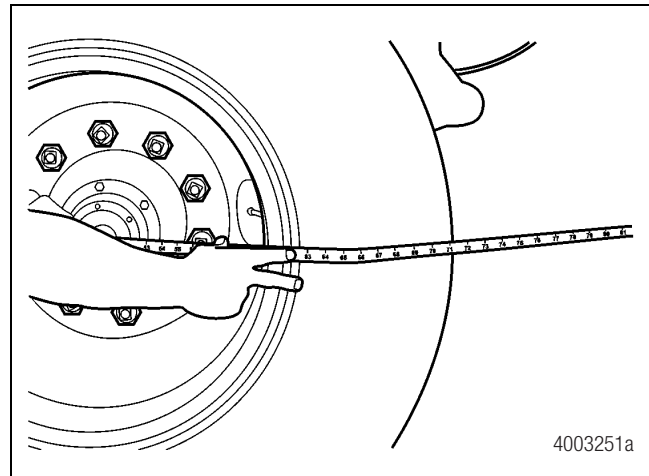


Figure 8.7

Single-Axle Trailers

1. Prepare the suspension by positioning the trailer on a level floor and moving it forward and backward several times in a straight line. Verify that the last movement is forward.
2. Uncouple the tractor and use the support legs to raise or lower the front of the trailer to position the kingpin in its “as used” or design fifth wheel height.
3. Remove the outer tires and any other parts from under the chassis that obstruct the measuring distances between the kingpin and the axle ends. If using commercially available kingpin and axle spindle extenders or the edge of the wheel rim as detailed in this section, you will not need to remove this equipment.

NOTE: An acceptable gauge point for measuring “A” and “B” is the edge of the wheel rim. This measurement should be made at the height of the axle spindles. Verify that the rim is not damaged, the same tires and rims are mounted on each side of the vehicle and the tires are correctly inflated. Figure 8.7.

4. Attach a steel measuring tape to a hook. Attach the hook to the kingpin and measure distance “A” on the roadside and “B” on the curbside of the trailer. Figure 8.8. The difference between these dimensions must not exceed ± 0.0625 inch (± 1.59 mm). Adjust the axle, if necessary, to bring this difference within specification.

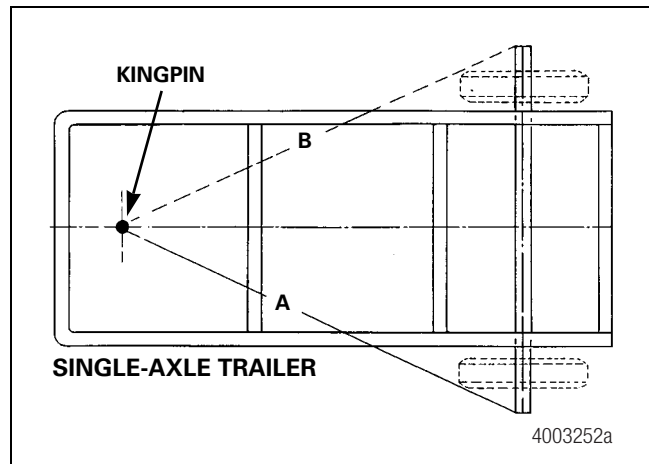


Figure 8.8

Multiple-Axle Trailers

1. Orient the front axle as detailed in the single-axle trailer procedure in this section.
2. Measure “C” and “D”, the distances between the front and rear axles on the trailer roadside and curbside. The difference between these dimensions must not exceed ± 0.03125 -inch (± 0.79 mm). Adjust the rear axle, if necessary, to bring this difference within specification. Figure 8.9.

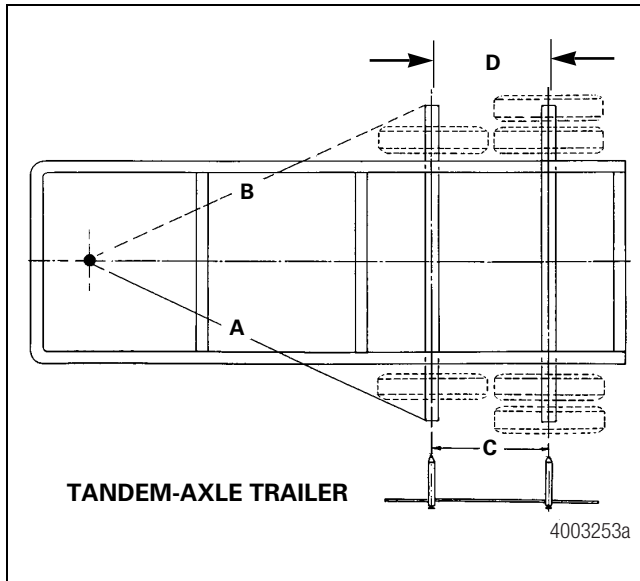


Figure 8.9

3. An acceptable gauge point for measuring “C” and “D” is the dimple in the spindle end plug located on most trailer axles. To reach this plug, remove the rubber hubcap oil filler plugs. Other acceptable gauge points are the edges of the wheel rims as noted earlier. Figure 8.10.

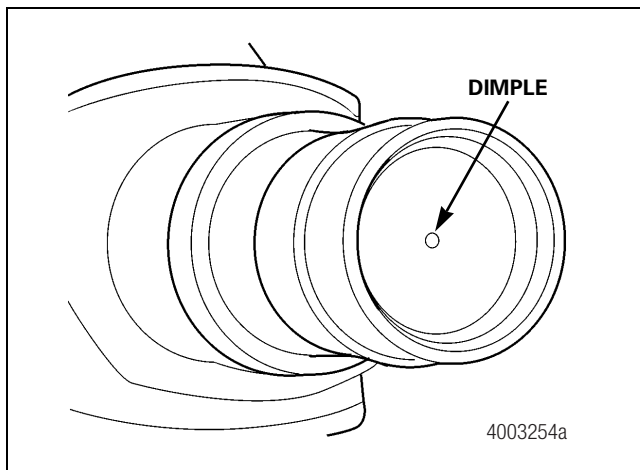


Figure 8.10

4. On trailers equipped with more than two axles, measure and adjust each additional axle. To ensure that these additional axles are accurately adjusted, measurements should be made from the front axle to each additional axle.

Double or Triple Trailers

In most cases, the previous two procedures can be used to orient axles on double or triple trailers. However, if these procedures are used and problems with tire wear or tracking persist, use the following procedure to orient axles to the pull line of the trailer.

1. Prepare the suspension by positioning the trailer on a level floor and moving it forward and backward several times in a straight line. Verify that the last movement is forward.
2. Measure the radius of the tires from the center of the axle to the floor.
3. Uncouple the tractor and use the support legs to raise or lower the front of the trailer to position the kingpin in its “as used” or design fifth wheel height.
4. Raise the rear of the trailer and remove the wheel-end equipment. Place supports under the axle at the spring seat or trailing arm locations so that when the trailer is lowered, the axle spindle centers will be positioned at the height of the radius of the tires, measured in Step 2.
5. Lower the trailer onto the supports.
6. Hang plumb lines from the exact centers of the kingpin and pintle hook. Establish the trailer pull line by marking these points on the floor and snapping a chalk line through them. Figure 8.11 and Figure 8.12.

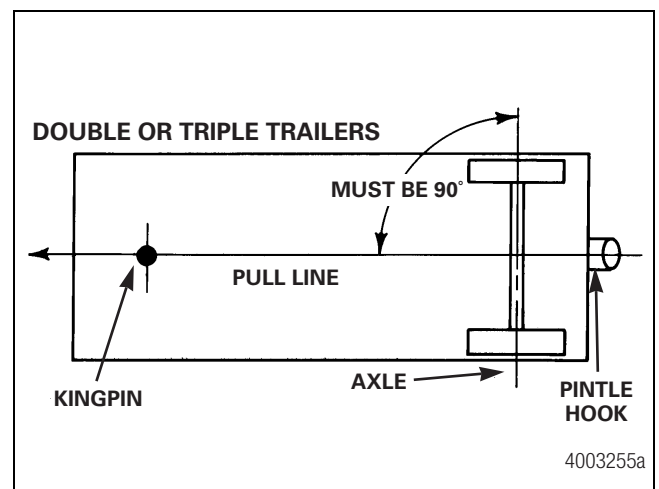


Figure 8.11

8 Alignment

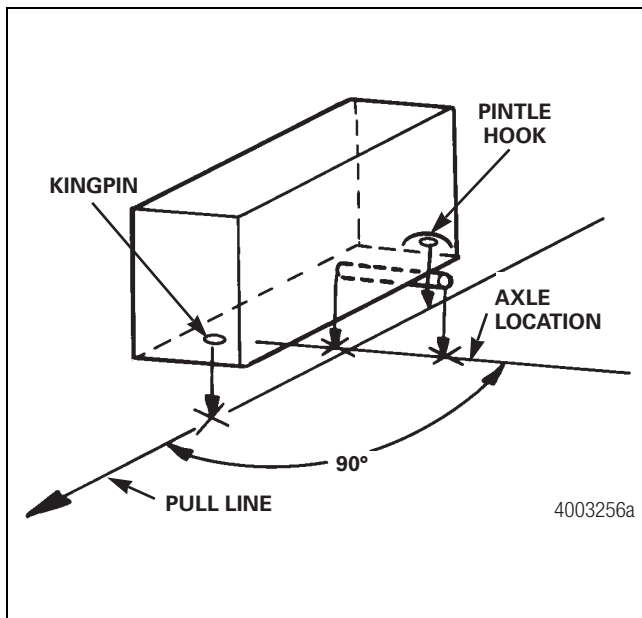


Figure 8.12

7. Hang plumb lines from the exact centers of the roadside and curbside front axle spindles. Establish the axle location by marking these points on the floor and snapping a chalk line through them.
8. Use a large carpenter's square to measure the angle where the chalk lines cross. Adjust the axle, if necessary, until this angle is 90 degrees.
9. If the trailer is equipped with additional axles, measure and adjust them relative to the front axle, as outlined in the multiple-axle trailers procedure in this section.

Converter Dollies

1. Prepare the suspension by positioning the dolly on a level floor and moving it forward and backward several times in a straight line. Verify that the last movement is forward.
2. Measure the radius of the tires from the center of the axle to the floor.
3. Support the front of the dolly to position the lunette eye in its "as used" height.
4. Raise the rear of the dolly and remove the wheel-end equipment. Place supports under the axle at the spring seat or trailing arm locations so that when the dolly is lowered, the axle spindle centers will be positioned at the height of the radius of the tires, measured in Step 2.

5. Lower the dolly onto the supports.
6. Hang plumb lines from the exact centers of the lunette eye and fifth wheel where it holds the trailer kingpin. Establish the pull line by marking these points on the floor and snapping a chalk line through them. Figure 8.13 and Figure 8.14.

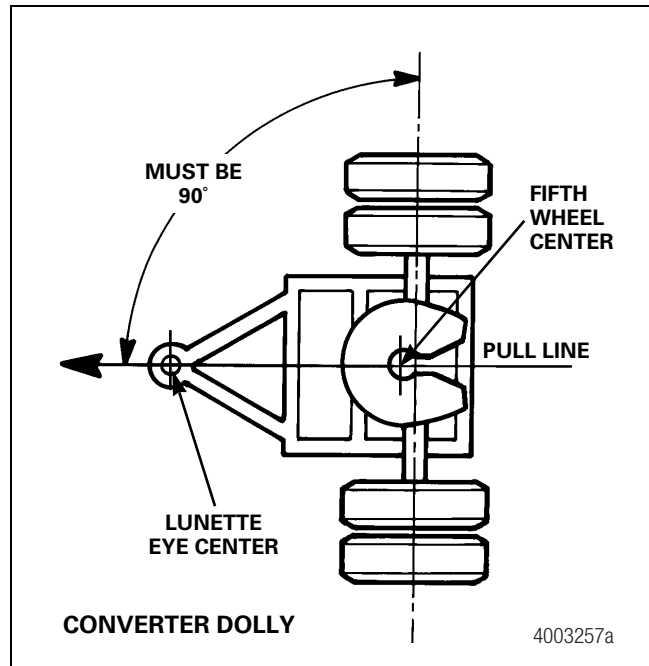


Figure 8.13

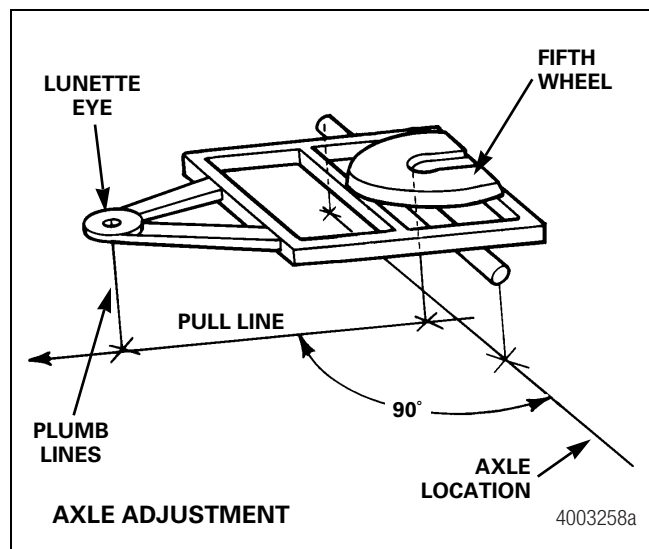


Figure 8.14

7. Hang plumb lines from the exact centers of the roadside and curbside front axle spindles. Establish the axle location by marking these points on the floor and snapping a chalk line through them. Figure 8.14.
8. Use a large carpenter's square to measure the angle where the chalk lines cross. Adjust the axle, if necessary, until this angle is 90 degrees. Figure 8.14.
9. If the dolly is equipped with an additional axle, measure and adjust it relative to the front axle as outlined in the multiple-axle trailers procedure in this section.

Axle Camber

WARNING

Axle camber angle is not adjustable. Do not change the axle camber angle or bend the axle beam. Bending the axle beam to change camber angle can damage the axle and reduce axle strength, and will void Meritor's warranty. A bent axle beam can also cause a vehicle accident and serious personal injury.

- Axle camber is defined as the inward or outward angle of the tires with respect to vertical. With positive camber, the top of the tires are farther apart than the bottom. Negative camber is the opposite. Figure 8.15.

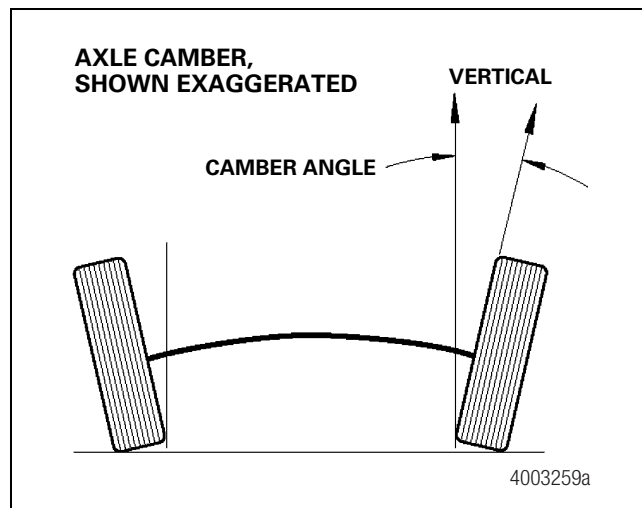


Figure 8.15

- Meritor builds both cambered and non-cambered trailer axles.
 - Camber is currently available on crank axles and straight axles with round cross sections.
 - Camber is not currently available on drop axles or straight axles with rectangular cross sections.
- A cambered axle cannot be identified by simply inspecting the axle. Instead, the Meritor Bill of Materials for a particular Engineering Axle Specification (EAS) must be accessed to determine whether the axle is built either with or without camber.
- Trailer axle camber specifications are detailed in Table A. This data is for the following:
 - The camber built into the axle at the manufacturing plant
 - With an unloaded axle
 - The camber measured in minutes of angle (Note that 60 minutes equals one degree of angle.)

Table A: Camber Specifications

<u>Axle Model</u>	<u>Top-Center Hole</u>	<u>Camber (Minutes)</u>
Cambered	with	+20/+40
Non-Cambered	with	-2.5/+10
Non-Cambered	without	-5/+5

- Camber specifications detailed in Table A are for axles prior to welding on suspension brackets. Note the following in regard to bracket welding:
 - The heat generated during bracket welding has been found to induce up to four minutes of additional positive or negative axle camber. This will cause an expansion of the camber range for all the axles listed in Table A. For example, the range for non-cambered axles without a top-center hole will expand from -5/+5 to -9/+9.
 - This information is provided for reference only since Meritor cannot determine the effect on camber of every bracket weld pattern.
 - Refer to Section 7 for guidance on minimizing welding distortion.

8 Alignment

- When a commercial alignment machine is used to measure the camber of a trailer axle assembly installed onto a vehicle, the measurement obtained is vehicle camber. Vehicle camber includes the camber of the bare axle beam, as well as the effect on camber of the following.
 - Hub and bearing runouts
 - Wheel-end equipment end play
 - Wheel and rim runouts
 - Tire concentricity, as well as other factors

Meritor does not design, manufacture or sell all of these components, and therefore, cannot provide vehicle camber specifications. Contact the vehicle manufacturer for this information.

Axle Camber Measurement

1. Remove the axle assembly from the trailer. Remove the wheel-end equipment. Clean the beam and spindle area.
2. Cut four pieces of 0.5-inch (12.7 mm) diameter rod to a length of three-inches (76.2 mm). Grind a 0.1875-inch (4.8 mm) flat side on the rods so they do not roll.
3. Place a set of V-blocks on a stationary surface. Set the rods in the V-blocks with the flat side down.
4. Apply several drops of machine oil to the inner bearing journals of the axle ends. Set the axle down so that its inner bearing journals touch the rods.
5. Rotate the axle several turns. Adjust the rods until a single line is marked on the inner bearing journals. Continue to rotate the axle until the top of the axle is positioned exactly on top.
6. At the top of the axle, measure exactly five-inches (127 mm) from the line on the inner bearing journal to the outer bearing journal. Mount a dial indicator so that the stem measures vertical run out. Figure 8.16.

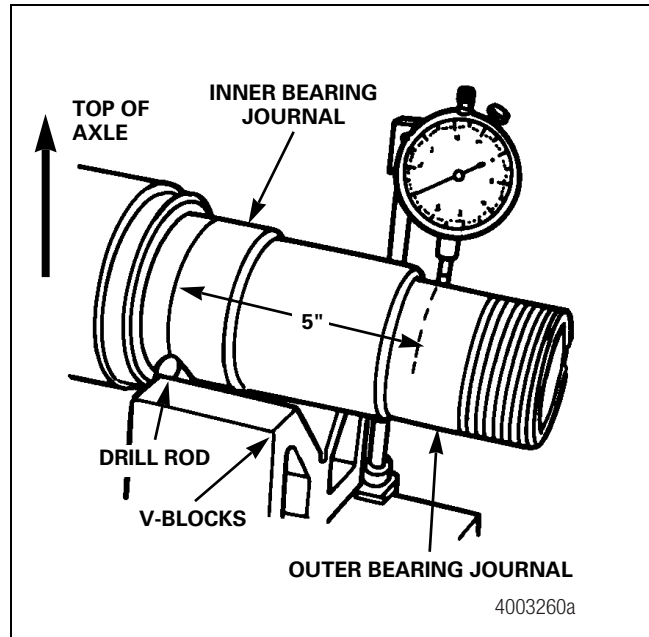


Figure 8.16

7. Set the dial indicator to ZERO. Rotate the axle 180 degrees until the top of the axle is toward the bottom.

NOTE: Table B is based on an accurate measurement of five-inches (127 mm) between points on the inner and outer bearing journals. If this measurement is not exactly five-inches (127 mm), the axle camber read from the chart will be incorrect.

8. Read the dial indicator and use Table B to convert this reading into axle camber. For example, a dial indicator reading of 0.0727-inch converts to 25 minutes of axle camber.
 - **If the stem of the dial indicator rises after rotation:** The axle camber is positive.
 - **If the stem of the dial indicator lowers after rotation:** The axle camber is negative.
 - **If the dial indicator reading does not change after rotation:** The axle camber is ZERO.

Table B: Axle Camber

Dial Indicator Reading (Inches)	Axle Camber (Minutes)
0.0000	0
0.0145	5
0.0291	10
0.0436	15
0.0582	20
0.0727	25
0.0873	30
0.1018	35
0.1163	40
0.1309	45
0.1454	50
0.1600	55
0.1745	60

- Check the camber on the opposite end of the axle using the same procedure.

Axle Toe

⚠ WARNING

Axle camber angle is not adjustable. Do not change the axle camber angle or bend the axle beam. Bending the axle beam to change camber angle can damage the axle and reduce axle strength, and will void Meritor’s warranty. A bent axle beam can also cause a vehicle accident and serious personal injury.

- Axle toe is defined as the inward and outward angle of the tires with respect to horizontal. With toe-in, the front of the tires are closer together than the rear. Toe-out is the opposite. Figure 8.17.

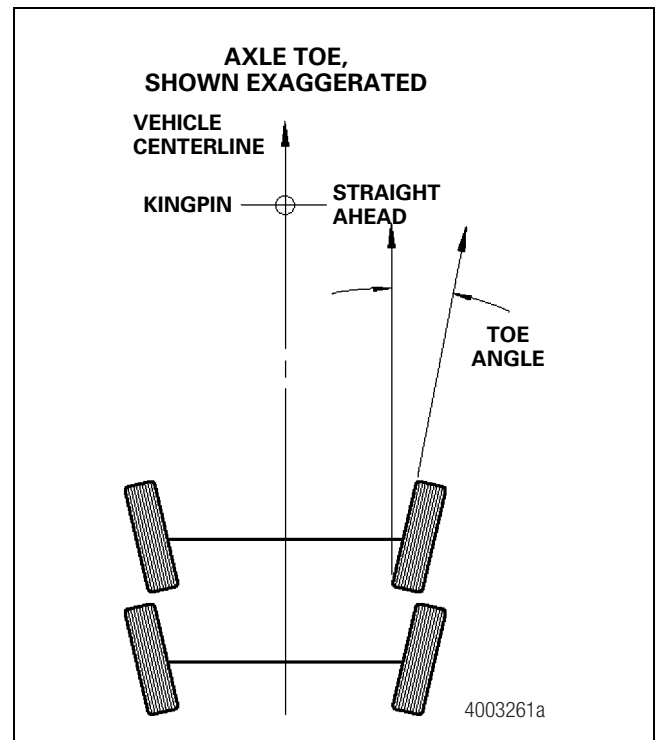


Figure 8.17

- Trailer axle toe specifications are detailed in Table C. This data is for the following.
 - The toe built into the axle at the manufacturing plant
 - With an unloaded axle
 - The toe measured in minutes of angle (Note that 60 minutes equals one degree of angle.)

Table C: Toe Specifications

Top-Center Hole	Toe-In (minutes)	Toe-Out (minutes)
With	6.5	2.5
Without	5.0	5.0

8 Alignment

- Toe specifications detailed in Table C are for axles prior to welding on suspension brackets. Note the following in regard to bracket welding.

— The heat generated during bracket welding has been found to induce up to three minutes of additional toe-in and toe-out. This will cause an expansion of the toe range for all the axles listed in Table C. For example, the range for axles without a top-center hole will expand from five minutes toe-in and toe-out to eight minutes toe-in and toe-out.

— This information is provided for reference only since Meritor cannot determine the effect on toe of every bracket weld pattern.

— Refer to Section 7 for guidance on minimizing welding distortion.

- Note the following with respect to axles built with and without a top-center hole.

— Axles built with a top-center hole are manufactured with a bias toward toe-in. This bias orients the tires in the optimum position for achieving maximum tire life.

— Axles built without a top-center hole are manufactured with a toe tolerance centered around zero toe. On the positive side, this tolerance allows the axle to be rotated 180 degrees during installation. On the negative side, this tolerance can compromise the position of the tires with respect to achieving maximum tire life.

— Note that it is especially important to ensure that axles built without a top-center hole are oriented correctly, since tires installed onto these axles will be more susceptible to tire wear due to axle misalignment.

- When a commercial alignment machine is used to measure the toe of a trailer axle assembly installed onto a vehicle, the measurement obtained is vehicle toe. Vehicle toe includes the toe of the bare axle beam, as well as the effect on toe of the following.

— Hub and bearing runouts

— Wheel-end equipment end play

— Wheel and rim runouts

— Tire concentricity, as well as other factors

Meritor does not design, manufacture, or sell all of these components, and therefore, cannot provide vehicle toe specifications. Contact the vehicle manufacturer for this information.

- Excessive axle toe is generally due to a spindle bent from a tire impact. The wheel position shown to sustain the most impacts is the curbside front. Since tire impacts are an individual incident generally occurring at only one wheel position at a time, excessive axle toe is often isolated to a single wheel position.
- Axles bent beyond the recommended axle toe limits should be replaced since any attempt to reshape them by bending could cause fractures.
- A trailer in which the curbside front spindle has been bent into an excessive toe-out condition is shown in Figure 8.18. If this bent axle is oriented so the “A” and “B” dimensions are equal:
 - The excessive curbside toe will be equalized between both sides of the trailer. Tire wear due to toe will then be equalized between both sides of the trailer.
 - The axle track line will be directed away from the centerline of the trailer, causing a “dog tracking” condition.

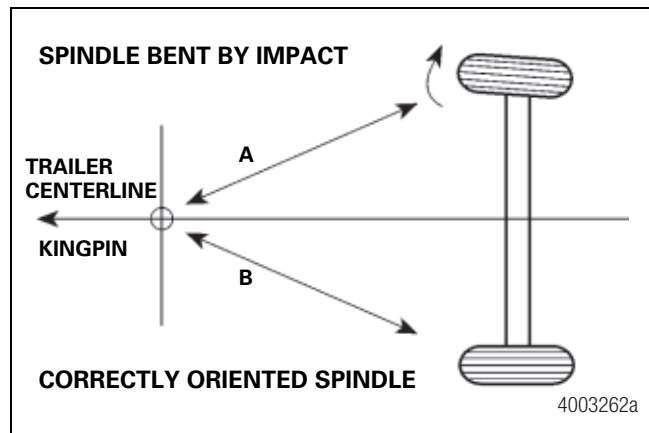


Figure 8.18

Axle Toe Measurement

1. Prepare the axle as outlined in Step 1 through Step 5 of the axle camber measurement procedure in this section.
2. At the front of the axle, measure exactly five-inches (127 mm) from the line on the inner bearing journal to the outer bearing journal. Mount a dial indicator so that the stem measures horizontal runout. Figure 8.19.

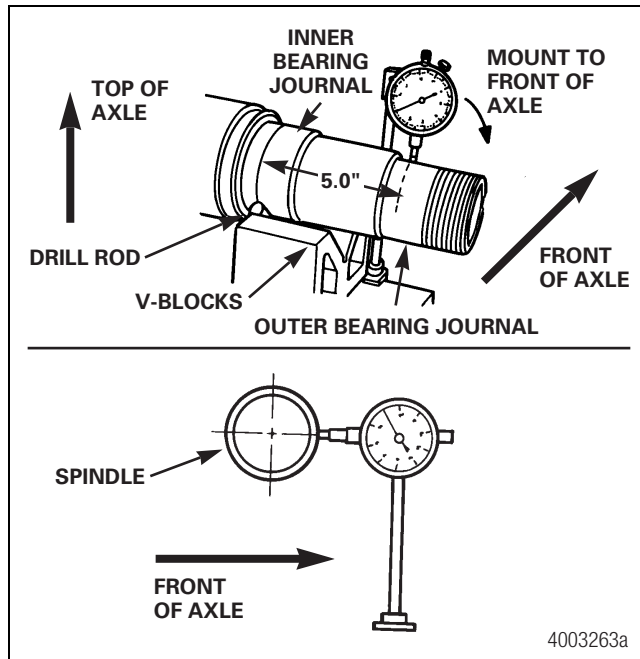


Figure 8.19

3. Set the dial indicator to ZERO. Rotate the axle 180 degrees until the front of the axle is toward the rear.

NOTE: Table D is based on an accurate measurement of five-inches (127 mm) between points on the inner and outer bearing journals. If this measurement is not exactly five-inches (127 mm), the axle toe read from the chart will be incorrect.

4. Read the dial indicator and use Table D to convert this reading into axle toe. For example, a dial indicator reading of 0.0175-inch converts to six minutes of axle toe.
 - **If the stem of the dial indicator moves BACKWARD after rotation:** The axle is toed-in.
 - **If the stem of the dial indicator moves FORWARD after rotation:** The axle is toed-out.
 - **If the dial indicator does not change after rotation:** Axle toe is ZERO.

Table D: Axle Toe

Dial Indicator Reading (Inches)	Axle Toe (Minutes)
0.0000	0
0.0058	2
0.0116	4
0.0175	6
0.0233	8
0.0291	10
0.0349	12
0.0407	14
0.0465	16
0.0524	18
0.0582	20
0.0640	22
0.0698	24
0.0756	26
0.0815	28
0.0873	30

5. Check toe on the opposite end of the axle using the same procedure.

9 Conventional Wheel-End Equipment

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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 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.

Guidelines

Trailer axles may be built either with conventional or unitized wheel ends.

- With conventional wheel ends, the hub, seal, lubricant and bearings are installed as separate components. Figure 9.1.
- With unitized wheel ends, these components are installed as an assembly. Figure 9.2.

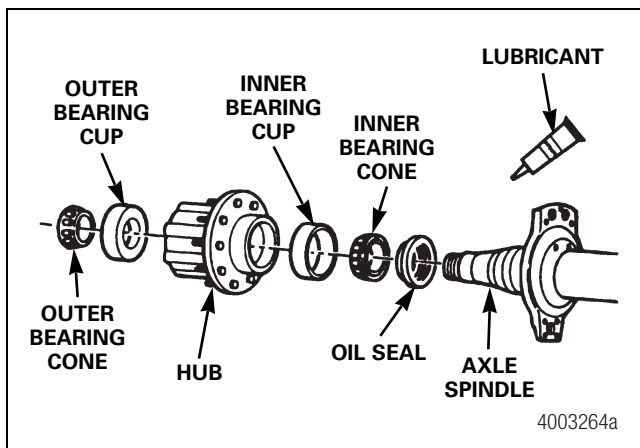


Figure 9.1

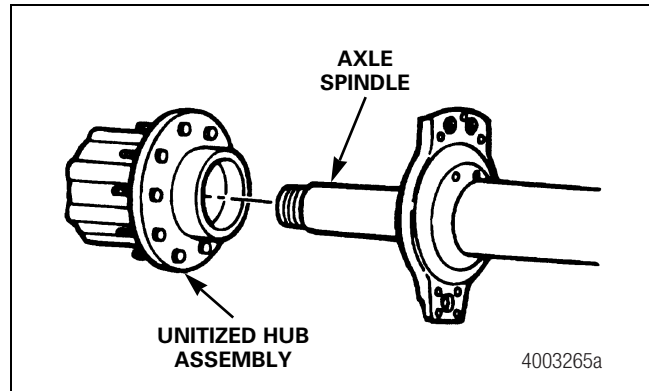


Figure 9.2

⚠ WARNING

There are two basic wheel bearing adjustment procedures for Meritor axles: The POSITIVE adjustment procedure and the MANUAL adjustment procedure. You must use the correct wheel bearing adjustment procedures for the type of axle that you are servicing. Loss of wheel-end components, serious personal injury and damage to components can occur if you use the incorrect adjustment procedure on an axle.

For more information on the unitized hub assembly, refer to technical bulletin TP-96175, Servicing Meritor's TB Series Trailer Axles with Unitized Hub Assemblies. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

Bearing Adjustment

Two different wheel bearing adjustment methods are available on conventional trailer axle equipment. Most axles use the manual wheel bearing adjustment method. Axles are available, however, that use the positive wheel bearing adjustment method. The procedures for these two wheel bearing adjustments are different, as detailed in Section 10 and Section 11. Therefore, the technician must be able to identify which method to use on the equipment to be serviced.

The information presented in this section provides the following.

- A listing of the conventional equipment used for both bearing adjustment methods so the technician can identify the correct adjustment method to be used on a particular axle.
- General information on the wheel-end equipment used on trailer axles built with conventional wheel-end equipment.

9 Conventional Wheel-End Equipment

Meritor Axles

To determine whether a particular axle uses the manual or positive bearing adjustment method, refer to the Model Numbers chart in Section 2 as well as the following guidance.

- Manual bearing adjustment is used on axles where the first number in the model number is a “4” as in TN-4670.
- Positive bearing adjustment is used on axles where the first number in the model number is a “6” as in TN-6670.

Positive and manual bearing adjustment axles can also be identified as follows.

- On positive adjust axles, a shoulder is machined into the spindle. Figure 9.3.

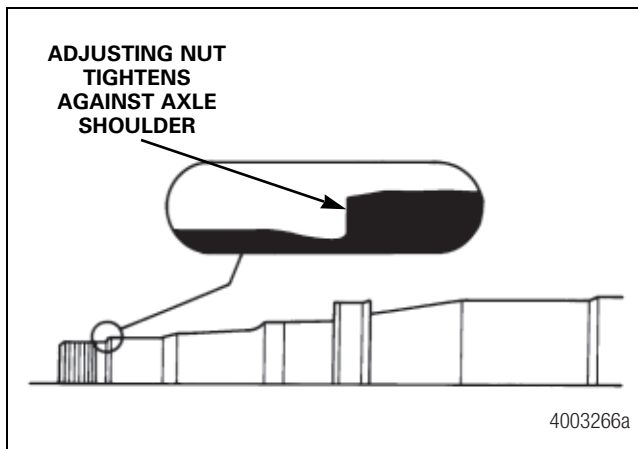


Figure 9.3

- On manual adjust axles, no shoulder is present. Figure 9.4.

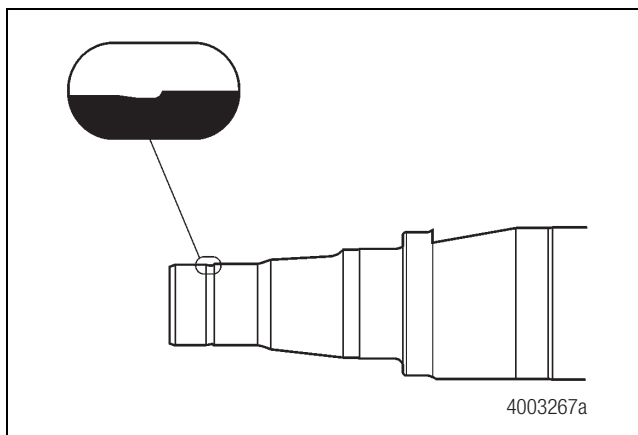


Figure 9.4

- On positive adjust axles, the inner nut of the wheel retention hardware does not have an alignment pin and is marked as shown. Figure 9.5.

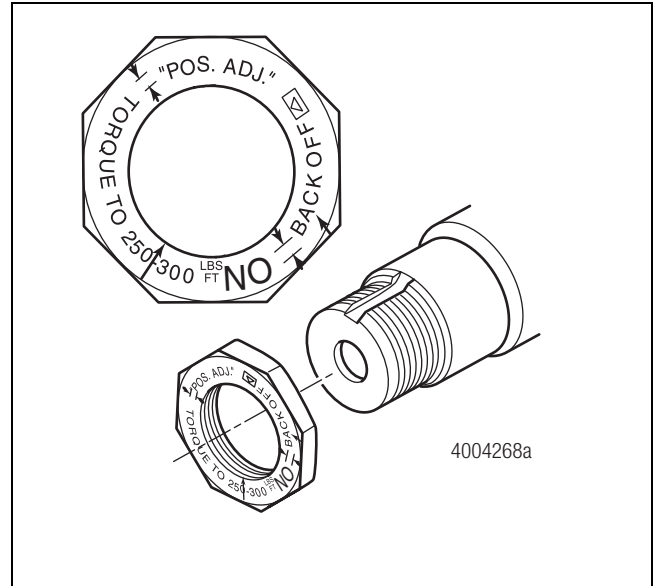


Figure 9.5

- On manual adjust axles, the inner nut of the wheel retention hardware has an alignment pin. Figure 9.6.

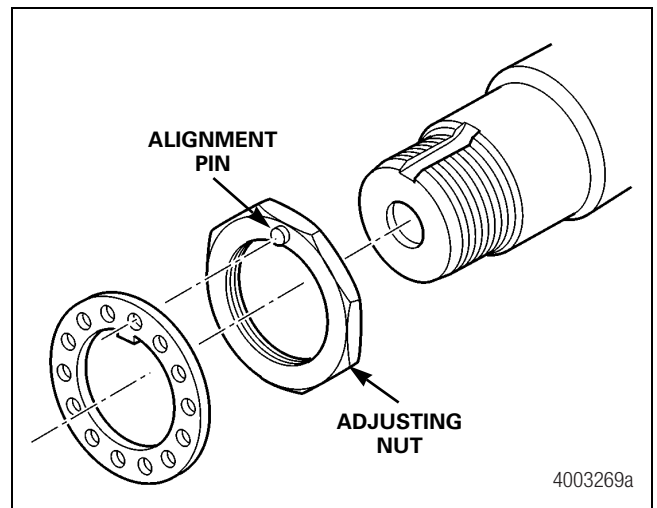


Figure 9.6

- On all positive adjust axle models, except the TP, the spindle threads are smaller than the manual adjust threads. Figure 9.7.

9 Conventional Wheel-End Equipment

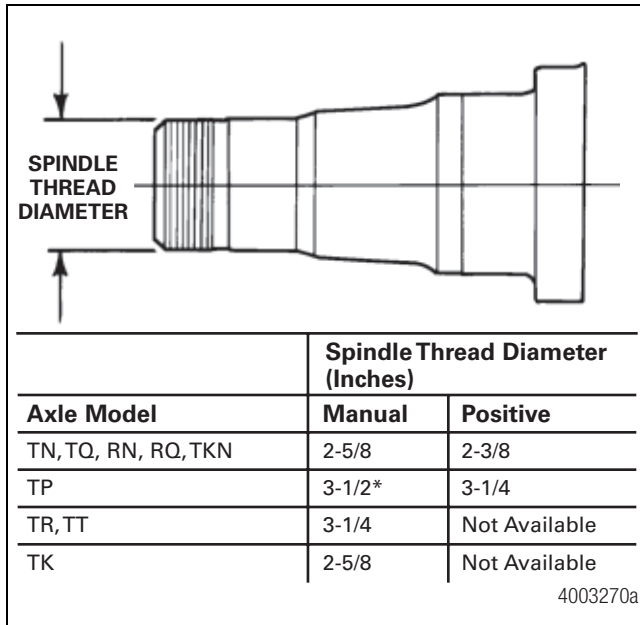


Figure 9.7

Axle Model	Spindle Thread Diameter (Inches)	
	Manual	Positive
TN, TQ, RN, RQ, TKN	2 5/8	2 3/8
TP	3 1/2*	3 1/4
TR, TT	3 1/4	Not available
TK	2 5/8	Not available

* One exception to the smaller thread size is the manual adjust TP axle model which was built for a short time with 3.25-inch threads. Therefore, for TP model axles, use one of the other methods for identifying the adjustment method.

WP Axles

Meritor builds, on a contract basis, a trailer axle for Wabash National, a trailer component equipment manufacturer. This model can be recognized by:

- The model number, “WP 4670” or “WP 8670.”
- The spindle, consisting of a “TP” style axle drilled with three adjustment holes. Figure 9.8.

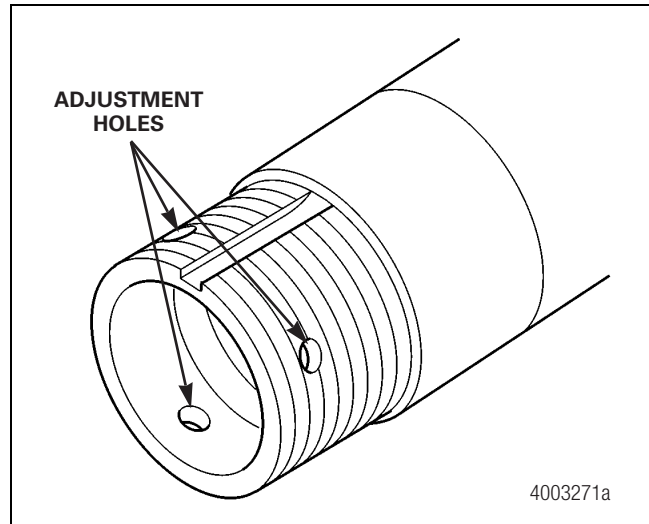


Figure 9.8

Note that the wheel-end configuration for this model was designed, tested and assembled by Wabash National. Therefore, bearing adjustment procedures for this model are not provided in this manual. Contact Wabash National for this information.

Bearings

The correct bearings to use on various trailer axle models are tabulated below in either Anti-friction Bearing Manufacturers Association (AFBMA) or Meritor part numbers.

⚠ WARNING

There are two basic wheel bearing adjustment procedures for Meritor axles: The POSITIVE adjustment procedure and the MANUAL adjustment procedure. You must use the correct wheel bearing adjustment procedures for the type of axle that you are servicing. Loss of wheel-end components, serious personal injury and damage to components can occur if you use the incorrect adjustment procedure on an axle.

Positive adjust axles must use special close tolerance bearings. These bearings can be identified by first noting the model number stamped into the part and then referring to Table E.

Table E: Trailer Axle Bearings

Axle Series	Adjustment Method	Inner		Outer	
		Cup	Cone	Cup	Cone
TN/TQ/TKN	Manual	HM218210	HM218248	HM212011	HM212049
TN/TQ/TKN	Positive	1228-P-406	1228-Q-407	1228-M-403	1228-N-404
RN/RQ	Manual	HM218210	HM218248	HM212011	HM212049
RN/RQ	Positive	1228-P-406	1228-Q-407	1228-M-403	1228-N-404
TP	Manual	HM518410	HM518445	HM518410	HM518445
TP	Positive	1228-J-634	1228-H-623	1228-J-634	1228-H-623
TR	Manual	592A	594A	572	580
TK	Manual	653	663	HM212011	HM212049

Do not use a bearing in positive adjust service if a question exists regarding whether bearing is appropriate for this service.

Discard the bearing cup or cone if the number stamped into these parts cannot be read. Figure 9.9.

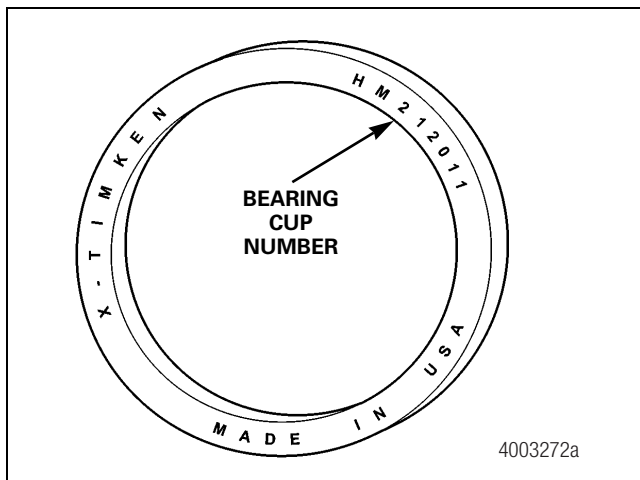


Figure 9.9

Replace the cups and cones as an assembly. For example, if a cone must be replaced, also replace the matching cup.

Do not mix the bearing cups and cones from different manufacturers.

Hubs and Spoke Wheels

Manual bearing adjustment is available on trailer axles fitted with either spoke or disc wheel-end equipment. Figure 9.10 and Figure 9.11.

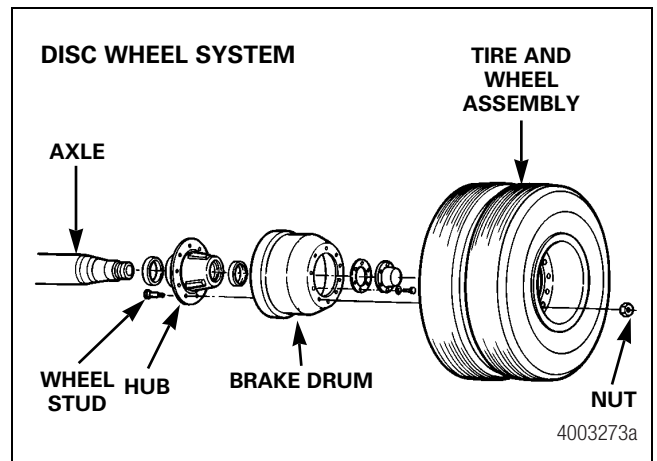


Figure 9.10

9 Conventional Wheel-End Equipment

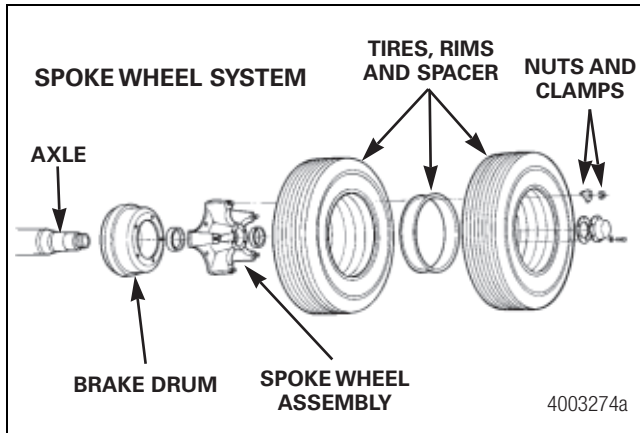


Figure 9.11

Positive bearing adjustment is only available on trailer axles fitted with disc wheel-end equipment. Figure 9.10.

⚠ WARNING

There are two basic wheel bearing adjustment procedures for Meritor axles: The **POSITIVE** adjustment procedure and the **MANUAL** adjustment procedure. You must use the correct wheel bearing adjustment procedures for the type of axle that you are servicing. Loss of wheel-end components, serious personal injury and damage to components can occur if you use the incorrect adjustment procedure on an axle.

Positive adjust axles must use special close tolerance hubs.

Positive adjust hubs can be identified by first noting the model number stamped into the part, then contacting the hub supplier for clarification. Do not use a hub in positive adjust service if a question exists regarding whether the hub is appropriate for this service.

Disc Wheel Equipment

Disc wheel equipment incorporates a hub that is mounted onto the axle spindle. Brake drums and tire-wheel assemblies or brake rotors and tire-wheel assemblies are then fastened to this hub.

Figure 9.12.

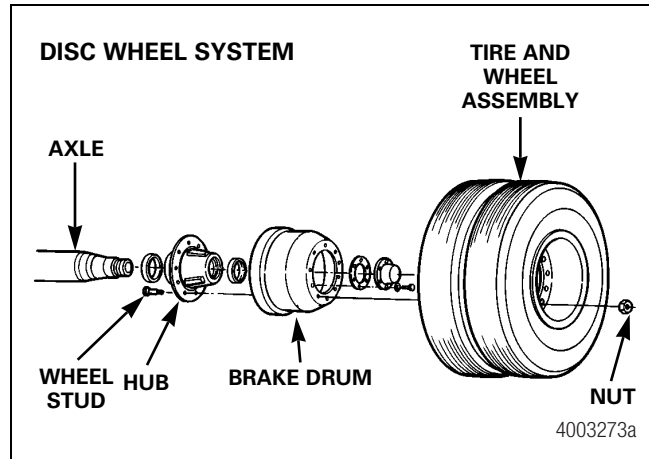


Figure 9.12

Brake drums used on disc wheel equipment may be mounted either inboard or outboard of the hub flange.

- **On inboard-mounted drums:** With this configuration, the brake drum is mounted inboard of the hub flange. Therefore, the hub must be removed prior to removing the brake drum. The main disadvantage of this design is that wheel-end bearings, seals and lubricant must be disturbed during brake maintenance. Figure 9.13.

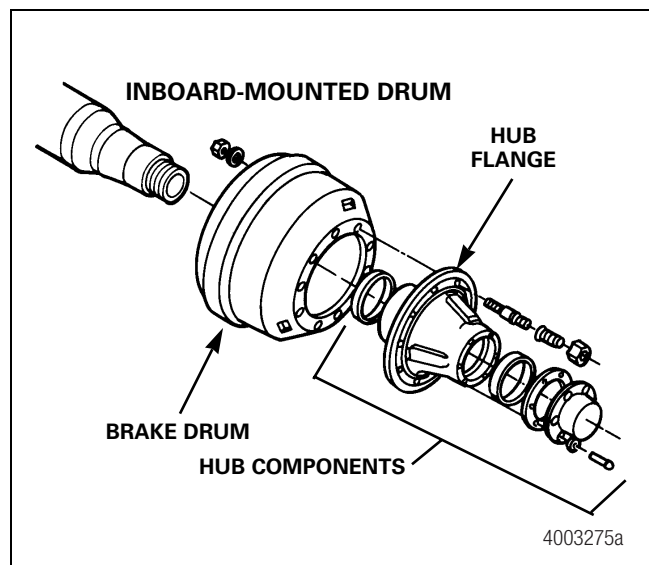


Figure 9.13

9 Conventional Wheel-End Equipment

- **On outboard-mounted drums:** With this configuration, the brake drum is mounted outboard of the hub flange. Therefore, the hub can remain in place when removing the brake drum. The main advantage of this design is that wheel-end bearings, seals and lubricant can remain in place during brake maintenance. Figure 9.14.

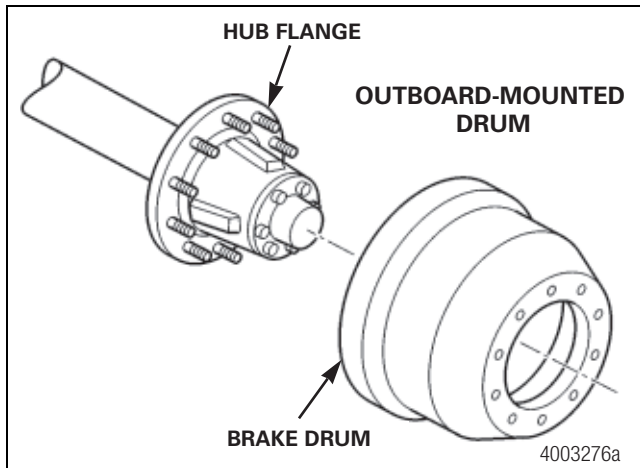


Figure 9.14

- Brake rotors are always mounted inboard of the hub. Therefore, the hub must be removed prior to removing the brake rotor, thus disturbing bearings, seals and lubricant. Figure 9.15. Note, however, that the Meritor Dura-Master® air disc brake design allows brake linings to be replaced without removing the hub. For more information, refer to Maintenance Manual 4M, Air Disc Brakes. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

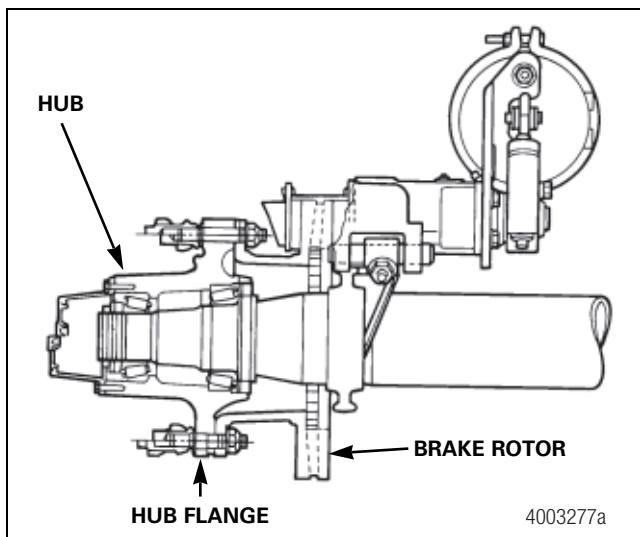


Figure 9.15

- **Do not mix hub-piloted and stud-piloted wheel-end equipment. Mixing this equipment can result in damage to the wheel end and serious personal injury.**

Two mounting methods are available for installing tire-wheel assemblies onto the disc wheel equipment. Hardware for these two mounting systems should never be mixed.

Stud Pilot

With this method, the tire-wheel assembly is centered on hub by piloting the spherical radii built into the mounting nuts into a matching spherical radii machined into the wheel. A separate nut is required for each wheel at each stud location. Thus, single wheels require a single nut at each stud and dual wheels require two nuts at each stud. This method incorporates ball seat nuts, designed to use right- and left-hand threads on opposite sides of the vehicle. Figure 9.16.

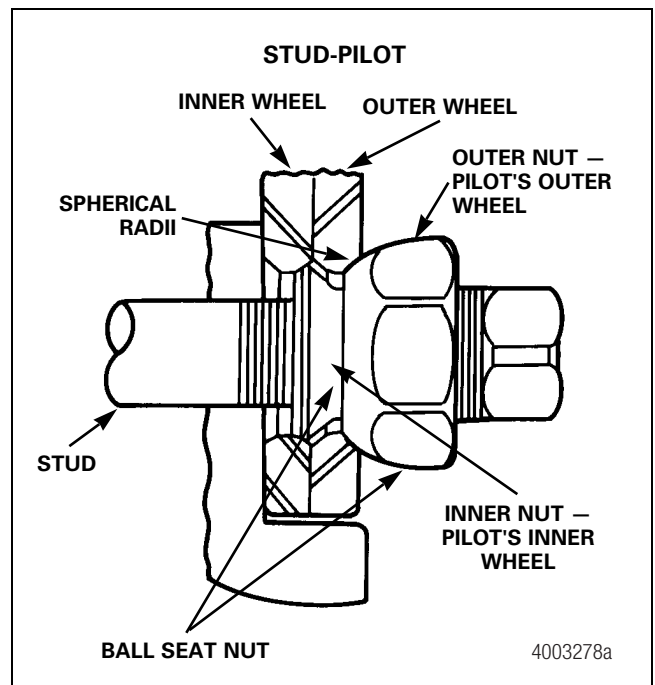


Figure 9.16

9 Conventional Wheel-End Equipment

Hub Pilot

With this method, the tire-wheel assembly is centered on the hub by piloting the wheel over a pilot diameter machined into the hub. Only a single nut is required at each stud location regardless of whether single or dual wheels are used. This method incorporates flange nuts which are designed to use only metric right hand threads on both side of the vehicle. Figure 9.17.

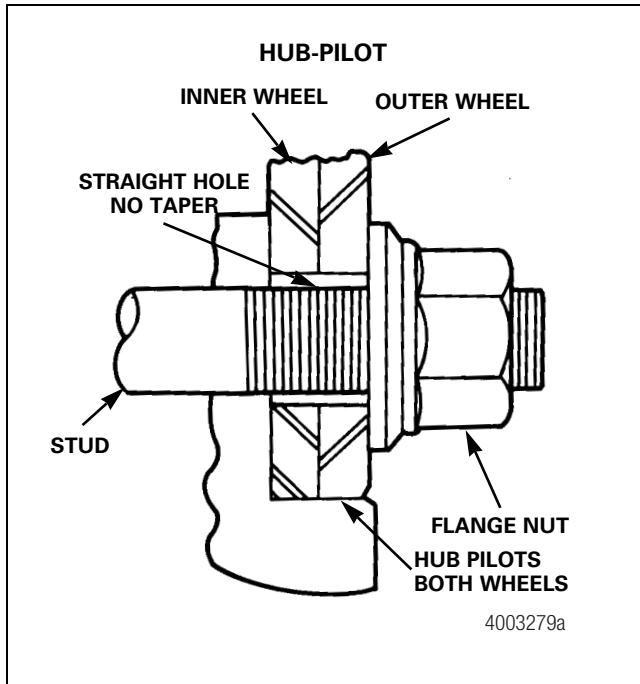


Figure 9.17

Spoke Wheel Equipment

Spoke wheel equipment incorporates a cast wheel built with either three, five or six spokes that mounts onto the spindle. Brake drums or rotors are bolted to the wheel, and tire-rim assemblies are mounted to the wheel using rim spacers, clamps and nuts. Figure 9.18.

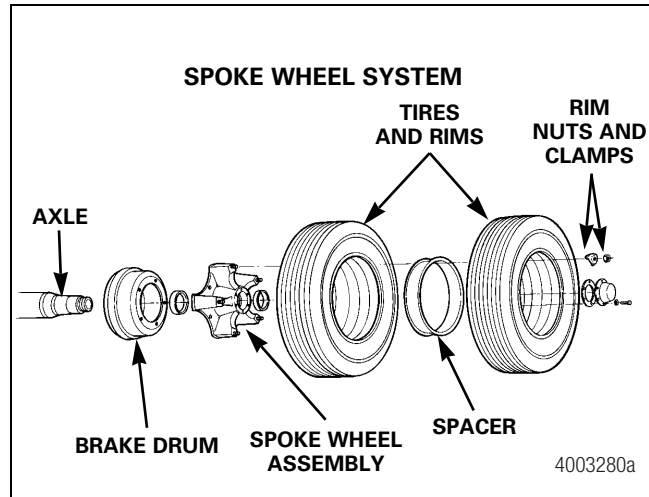


Figure 9.18

Brake drums or rotors are always mounted on the inboard side of the wheel. To remove this equipment, the wheel must be removed, thus disturbing the bearings and seals. Note, however, that the design of Meritor Dura-Master® air disc brakes allows brake linings to be replaced without removing the wheel. Figure 9.19.

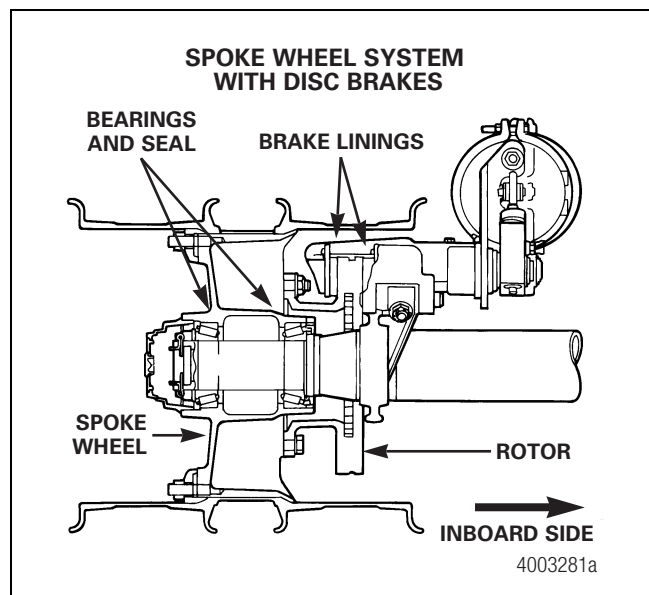


Figure 9.19

Hazard Alert Messages

Read and observe the Warning and Caution hazard alert messages in this 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.

Adjustment

Manual Bearing Adjustment

- Manual bearing adjustment is the current production standard. The goal of this procedure is to obtain a wheel bearing end play of 0.001-0.005-inch (0.025-0.127 mm). This is achieved by first tightening the adjusting nut against the bearing cone, then backing it off a prescribed amount. Figure 10.1.

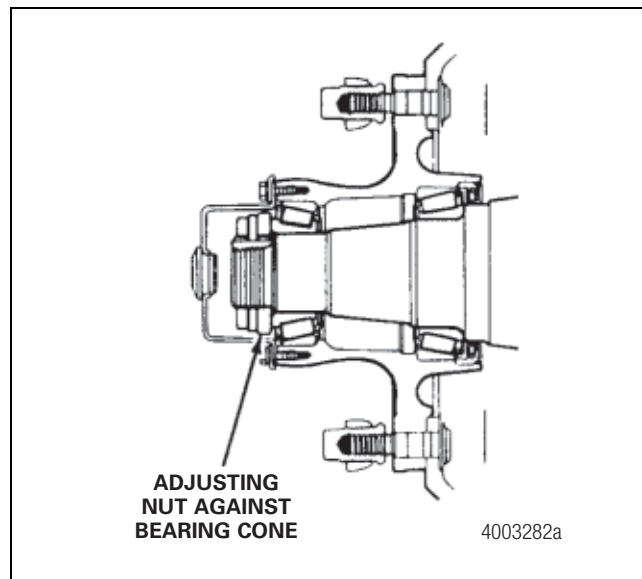


Figure 10.1

- To help ensure that a correct bearing adjustment can be achieved, be sure to do the following prior to performing this adjustment:
 - A. Release the brakes.
 - B. Inspect the wheel-end equipment, especially the axle and wheel retention hardware threads.
 - C. Repair or replace any damaged parts as detailed in Section 4.
- Wheel-end components can wear, causing correctly adjusted bearings to loosen. Wheel bearing end play should therefore be periodically checked and re-adjusted if necessary.
- The procedures detailed in this section apply to both grease and oil lubricated wheel ends.
- When installing spoke wheels onto Meritor trailer axles, Meritor requires that the wheel rim clamps be tightened prior to adjusting wheel bearings. This helps eliminate excessive bearing and spindle stresses resulting from wheel clamping pressures. Figure 10.2.

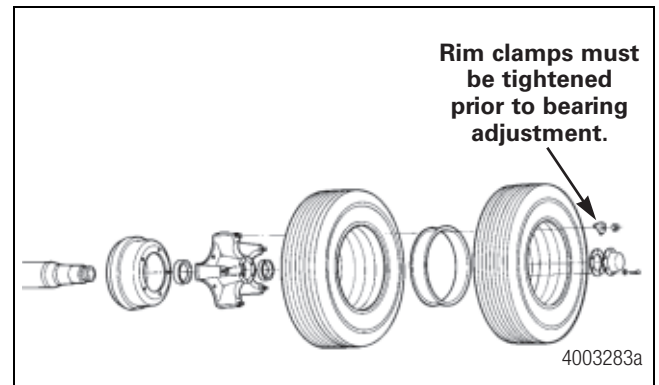


Figure 10.2

Note that this only applies when the entire wheel end is disassembled. If only the rim clamps are removed as is necessary when replacing a flat tire, a new bearing adjustment is not necessary if rim clamp fasteners are retightened in the correct sequence and with the correct torque.

- Meritor Video 89158 details wheel bearing adjustment procedures. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.
- Use the correct size socket to remove or install the spindle nuts. Figure 10.3.

10 Manual Bearing Adjustment

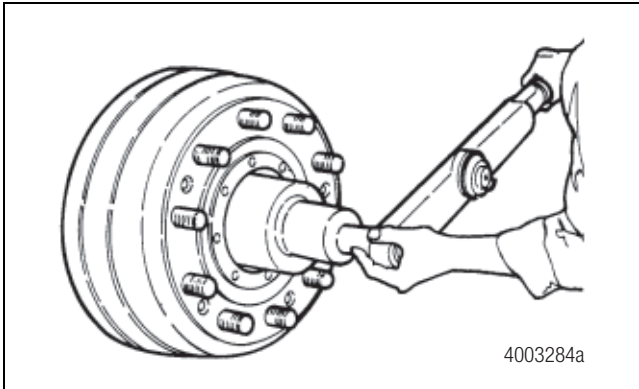


Figure 10.3

⚠ WARNING

Use the correct sockets when you remove and install axle spindle nuts. Do not try to remove the spindle nuts by striking them with a hammer or by striking a chisel or other tool that has been placed against the spindle nuts to loosen them. Loss of wheel-end components, serious personal injury and damage to components can result.

Double Nut Adjustment Procedure

The most common version of the double nut design consists of an adjusting nut, lock washer, jam nut and set screw. Figure 10.4.

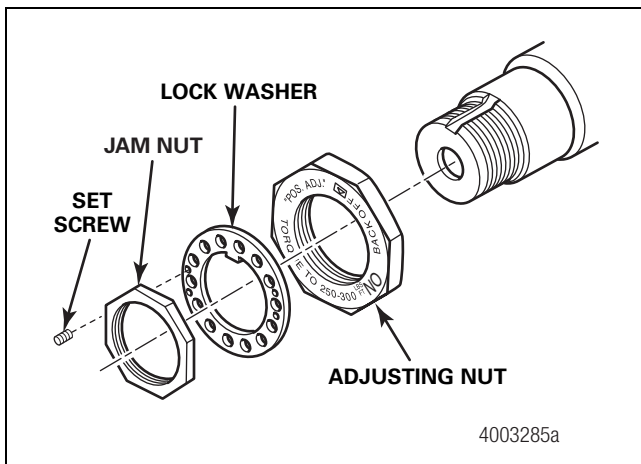


Figure 10.4

Other versions of the double nut design are either currently available or were available in the past.

- A washer was installed before the adjusting nut on an earlier version of the manual adjust TP axle model.

- A set screw was not used on an earlier manual adjust TP axle model.
- A bendable tab lock washer, rather than a set screw, is used on the current production TR axle model.

Use the following procedure to adjust the wheel bearings.

1. Install the adjusting nut so that the pin on the nut faces away from the wheel-end equipment. Tighten the nut to 200 lb-ft (271 N•m) while rotating the wheel end in both directions. Figure 10.5. ⚙

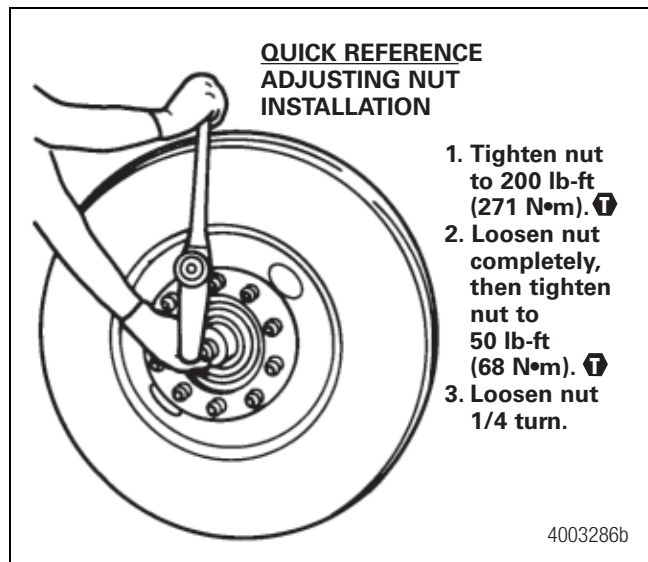


Figure 10.5

2. Completely loosen the nut, then tighten it to 50 lb-ft (68 N•m) while rotating the wheel end. ⚙
3. Loosen the nut 1/4 turn. Do not include socket backlash in the 1/4 turn.
4. Install the lock washer. If the hole in the washer is not aligned with the adjusting nut pin, remove the washer, turn it around and reinstall. The pin and hole should now be aligned. If not, slightly adjust the parts to align them. Figure 10.6.

10 Manual Bearing Adjustment

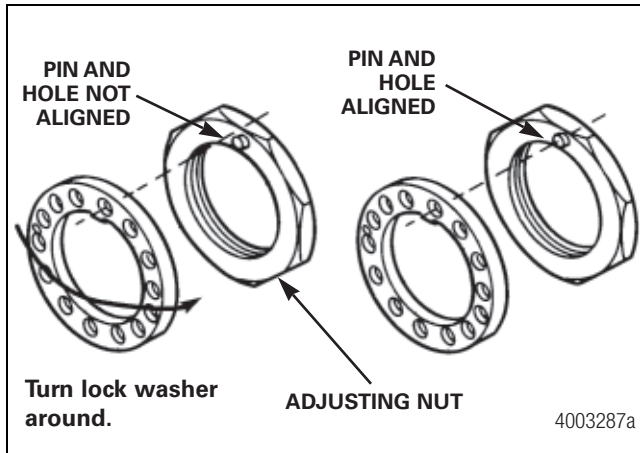



Figure 10.6

5. Install the jam nut and tighten the nut to 250-300 lb-ft (340-408 N•m). 

CAUTION

Too loose an adjustment will reduce bearing life, increase spindle wear and cause seal leaks. Too tight an adjustment will reduce bearing life and increase spindle wear. Extremely tight adjustments can cause complete bearing failure and possible loss of wheel-end equipment.

6. Check the wheel bearing end play as follows.
 - A. Attach the magnetic base of a dial indicator to the spindle. Touch the dial indicator stem to the hubcap gasket face. Figure 10.7.

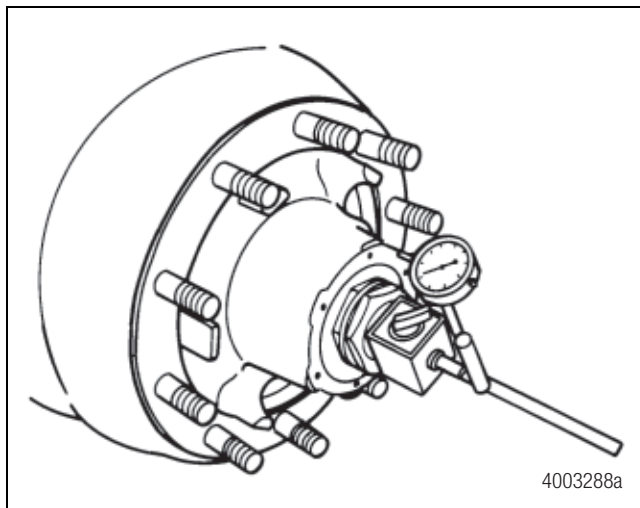


Figure 10.7

- B. Slightly rotate the wheel end in both directions while pushing inward until the dial indicator does not change. Set the dial indicator to ZERO. Figure 10.8.

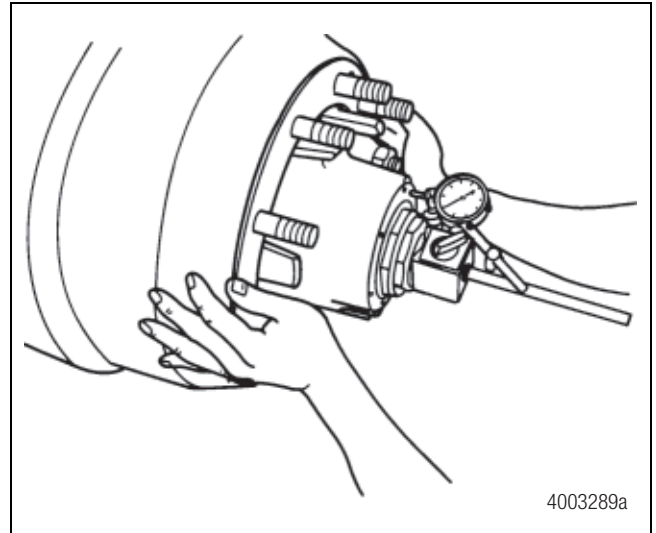


Figure 10.8

- C. Slightly rotate the wheel end in both directions while pulling outward until the dial indicator does not change. Figure 10.9.

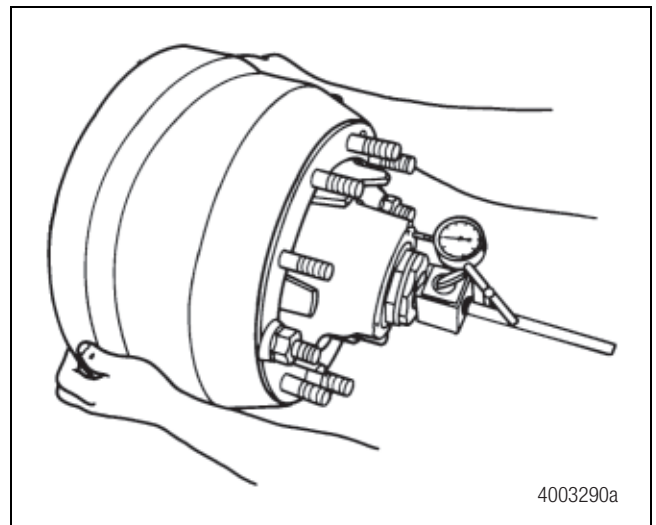


Figure 10.9

10 Manual Bearing Adjustment


D. End play is the difference between the two readings.

⚠ WARNING

You must adjust wheel bearing end play to within 0.001-0.005-inch (0.025-0.127 mm). An adjustment that is too loose will reduce wheel-end bearing life, increase spindle wear and cause seal leakage. An adjustment that is too tight can affect wheel-end bearing performance. Loss of wheel-end components, serious personal injury and damage to components can result.

7. If end play falls within 0.001-0.005-inch (0.025-0.127 mm), go to Step 8.

If end play does not meet this requirement:

- A. Remove the jam nut and lock washer.
- B. Tighten or loosen the adjusting nut as required to achieve the correct end play.
- C. Install the lock washer.
- D. Tighten the jam nut to 250-300 lb-ft (339-407 N•m). 
- E. Check end play.
- F. Continue to adjust until end play meets specifications. Then go to Step 8.

8. Using an Allen wrench, tighten the set screw into the lock washer until it is seated. Figure 10.10. If the axle is fitted with the bendable tab lock washer, bend two tabs over opposite flats of the jam nut. Figure 10.11.

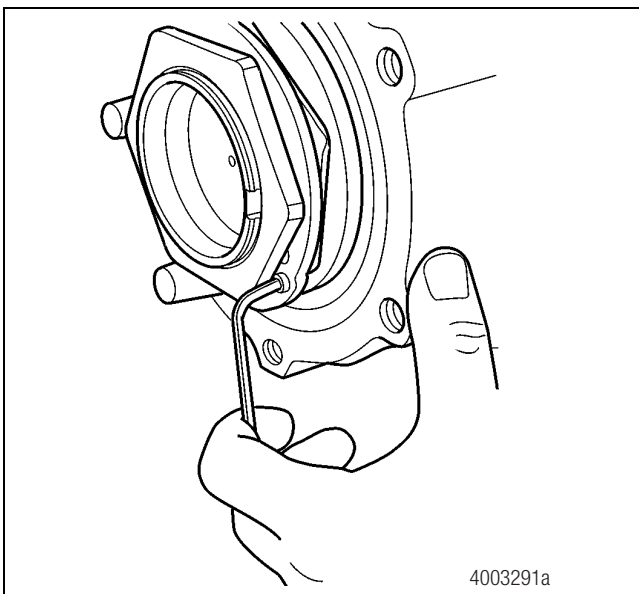


Figure 10.10

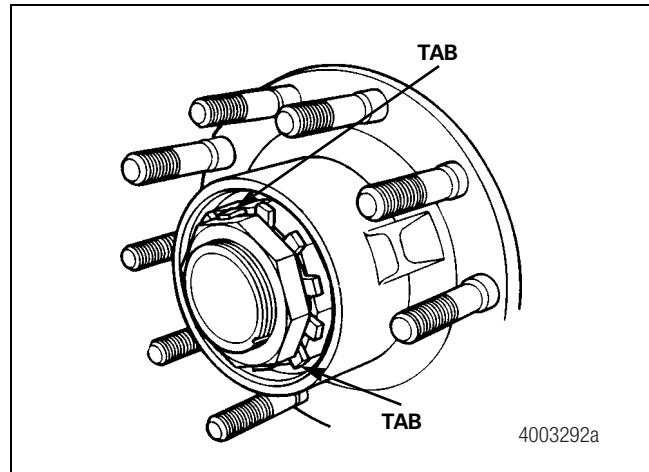


Figure 10.11

Single Nut Adjustment Procedure

The Meritor single nut model consisting of a washer, castellated nut and cotter pin is no longer in production. It was available on manual adjust TP model axles. Figure 10.12.

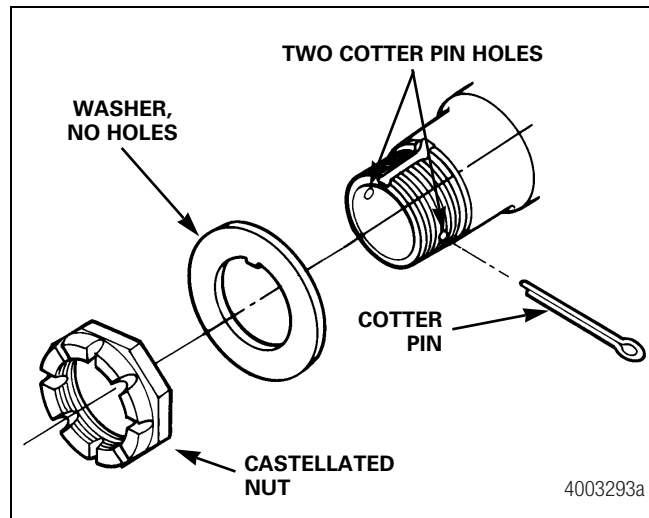



Figure 10.12

Use the following procedure to adjust the wheel bearings.

1. Install the washer and castellated nut. Tighten the nut to 200 lb-ft (271 N•m) while rotating the wheel end in both directions. Figure 10.13. 

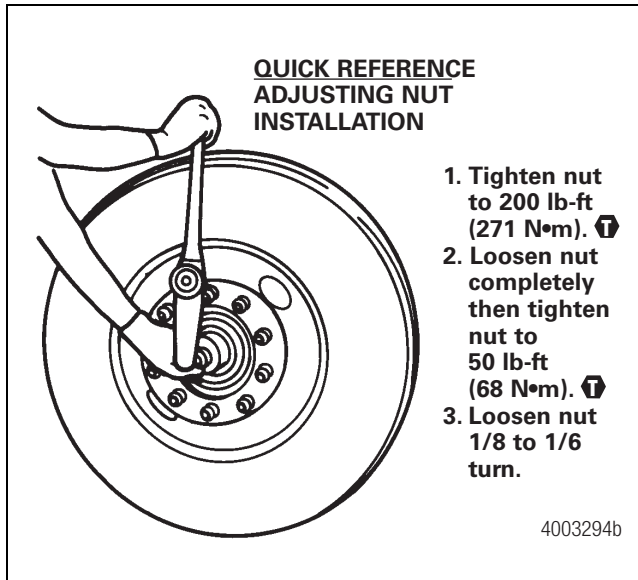



Figure 10.13

2. Completely loosen the nut, then tighten it to 50 lb-ft (68 N•m) while rotating the wheel end in both directions. 
3. Loosen the nut 1/8 to 1/6 turn. Do not include socket backlash in the 1/8 to 1/6 turn.

CAUTION

Always replace used cotter pins with new ones when servicing the axle spindle. Do not reuse cotter pins after removing them. Discard used cotter pins. When removed for maintenance or service, cotter pins can be bent or “gapped apart” and can lose retention. Damage to components can result.

4. Install a new cotter pin into the axle spindle hole, but do not bend.

WARNING

You must adjust wheel bearing end play to within 0.001-0.005-inch (0.025-0.127 mm). An adjustment that is too loose will reduce wheel-end bearing life, increase spindle wear and cause seal leakage. An adjustment that is too tight can affect wheel-end bearing performance. Loss of wheel-end components, serious personal injury and damage to components can result.

5. Check the end play using procedure detailed in this section. If end play falls within 0.001-0.005-inch (0.025-0.127 mm), go to Step 6.

If end play does not meet this requirement:

- A. Remove the cotter pin.
- B. Tighten or loosen the castellated nut as required to achieve the correct end play.
- C. Install the cotter pin.
- D. Check end play.
- E. Continue to adjust until the end play meets specifications. Then go to Step 6.

CAUTION

When you install a new cotter pin into the axle spindle hole, only bend one leg of the pin 90 degrees. If you bend both cotter pin legs in the same direction, the cotter pin can fall out of the spindle. Damage to components can result.

6. Bend one leg of the cotter pin 90 degrees. Do not bend both legs. If both legs are bent in the same direction, the cotter pin could fall out.

Single-to-Double Nut Conversion

The single nut design can be converted to the double nut by simply removing the single nut equipment and replacing with the correct double nut equipment. Conversions in the other direction are not recommended since the axle will not have a hole for the cotter pin.

11 Positive Bearing Adjustment

Hazard Alert Messages

Read and observe the Warning and Caution hazard alert messages in this 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.

Positive Bearing Adjustment

⚠ WARNING

Use the correct sockets when you remove and install axle spindle nuts. Do not try to remove the spindle nuts by striking them with a hammer or by striking a chisel or other tool that has been placed against the spindle nuts to loosen them. Loss of wheel-end components, serious personal injury and damage to components can result.

1. Positive bearing adjustment is available as an option on most trailer axles. With this method, wheel bearing end play of 0.005-0.007-inch (0.127-0.178 mm) is automatically obtained by tightening the adjusting nut against a shoulder machined into the axle spindle. Figure 11.1.

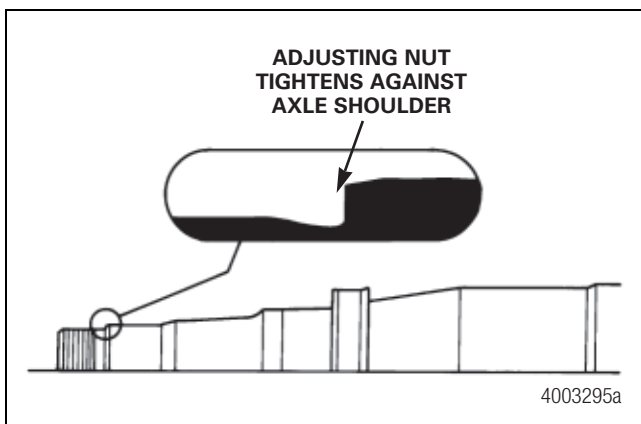


Figure 11.1

2. If the correct end play is not achieved after following this procedure, the axle must either be converted to a manual adjust system or new close tolerance hubs and bearings must be installed.
3. To ensure that the correct bearing adjustment can be achieved, be sure to do the following before performing the adjustment:
 - A. Release the brakes.
 - B. Inspect the wheel-end equipment, especially the threads of the axle and wheel-retention hardware.
 - C. Repair or replace any damaged parts as detailed in Section 4.
4. Wheel-end components can wear, causing correctly adjusted bearings to loosen. Wheel bearing end play should therefore be periodically checked and re-adjusted if necessary.
5. The procedures detailed in this section apply to both grease and oil-lubricated wheel ends.

Adjustment

The most common version of the double nut design consists of an adjusting nut, lock washer, jam nut and set screw. Figure 11.2.

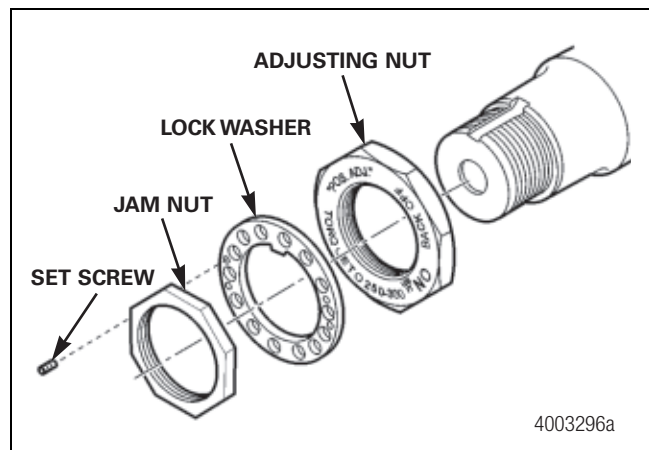


Figure 11.2

Another version of the double nut design is used on the TP positive adjust model where a washer is installed before the adjusting nut.

Use the following procedure to adjust the wheel bearings.

1. Install the adjusting nut and tighten it to 250-300 lb-ft (340-408 N•m) while rotating the hub in both directions. Figure 11.3. **ⓘ**

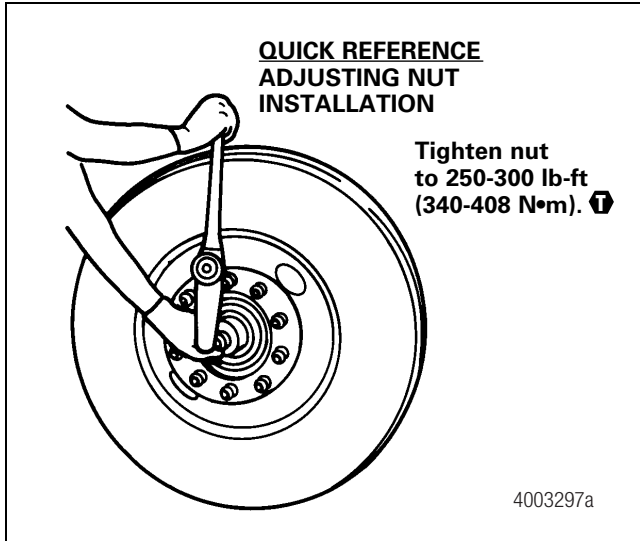


Figure 11.3

2. Install the lock washer. Figure 11.4.

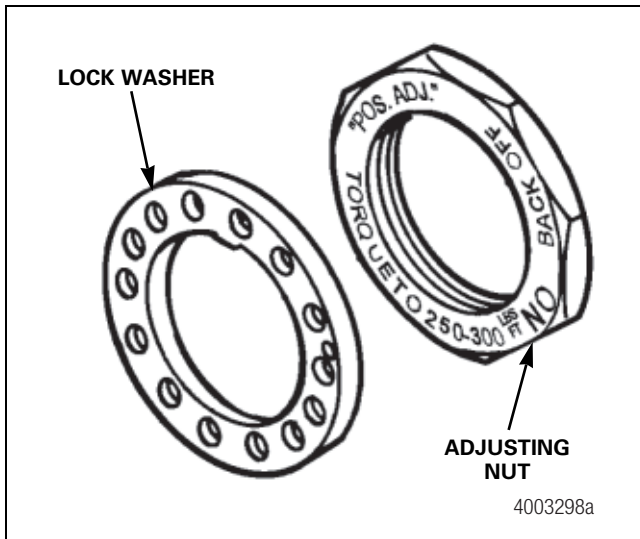


Figure 11.4

3. Install the jam nut and tighten to 250-300 lb-ft (340-408 N•m).

WARNING

You must adjust wheel bearing end play to within a 0.001-0.005 inch (0.025-0.127 mm) specification. An adjustment that is too loose will reduce wheel-end bearing life, increase spindle wear and cause seal leakage. An adjustment that is too tight can affect wheel-end bearing performance. Loss of wheel-end components, serious personal injury and damage to components can result.

4. Install the set screw into the lock washer and tighten it until it seats against the nut.
5. Check end play as detailed in the procedure for manual bearing adjustment. End play must be less than 0.005-inch (0.127 mm). If end play exceeds this standard, either replace the bearings or hub with new close-tolerance equipment or keep the same equipment if undamaged and convert the axle to a manual adjust system as detailed in the procedure below.

Positive-to-Manual Conversion

1. Conversions from positive-to-manual adjustment must be made if the wheel bearing end play exceeds 0.010-inch (0.25 mm) or if the manual adjust bearings or hubs are to be installed onto a positive adjust axle.
2. Conversions from positive-to-manual adjust are made by replacing the innermost component of the wheel-retention hardware with parts built with a recess designed to clear the shoulder machined into the positive adjust axle spindle.
3. On TN, TQ, RN, RQ and TKN axle models where the innermost component is a nut, replace with part number A-1227-S-877. Be sure the recess in the nut faces toward the wheel-end equipment. Figure 11.5.

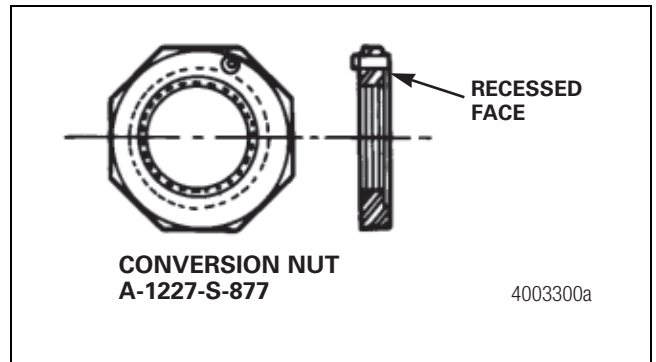


Figure 11.5

11 Positive Bearing Adjustment

4. On TP axle model where the innermost component is a washer, replace with part number 1229-B-3122 and the adjusting nut with part number 1227-W-517. Figure 11.6.

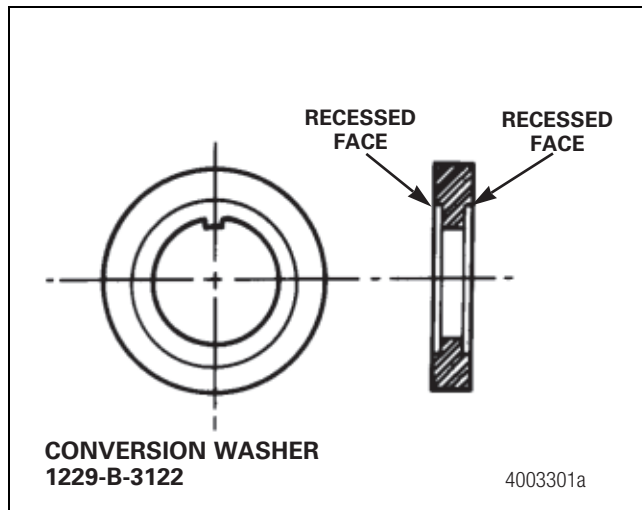


Figure 11.6

5. After changing this equipment, adjust the bearings using the manual adjustment method detailed in the procedure for manual bearing adjustment.

Important Information

Meritor automatic slack adjusters (ASAs) should not need to be manually adjusted in service. ASAs should not have to be adjusted to correct excessive pushrod stroke. The excessive stroke may be an indication that a problem exists with the foundation brake, ASA, brake actuator or other system components.

Meritor recommends troubleshooting the problem, replacing suspect components and then confirming proper brake operation prior to returning the vehicle into service.

In the event that a manual adjustment must be made (although not a common practice), a service appointment and full foundation brake, ASA, and other system component inspection should be conducted as soon as possible to ensure integrity of the overall brake system.

For Meritor brake adjustment, refer to the brake adjustment tables in this manual. For non-Meritor brake adjusters, refer to the brake manufacturer's service procedures.

Hazard Alert Messages

Read and observe the Warning and Caution hazard alert messages in this 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.

ASBESTOS AND NON-ASBESTOS FIBERS WARNING

Some brake linings contain asbestos fibers, a cancer and lung disease hazard. Some brake linings contain non-asbestos fibers, whose long-term effects to health are unknown. You must use caution when you handle both asbestos and non-asbestos materials.

Cam Brakes

Repair kits are available from Meritor Aftermarket Services and can be found in Meritor's Parts Book PB-8857, Brake, Trailer and Wheel Attaching Parts. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual. To obtain kits, call ArvinMeritor's Customer Service Center at 800-535-5560.

Components

Trailer Axles with Cam Brakes

A trailer axle equipped with cam brakes is shown in Figure 12.1. Reference will be made in this section to the highlighted components.

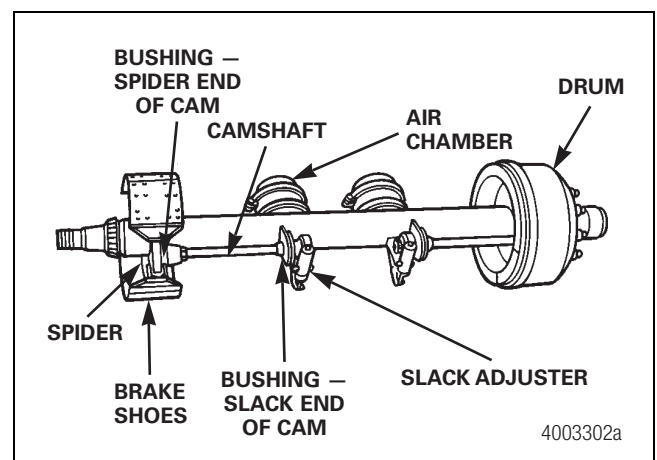


Figure 12.1

12 Cam Brakes

Spiders

Brake spiders are welded to the axle just inboard of the spindle. Three models may be encountered.

A forged spider model is currently used when a brake rating must exceed 23,000 pounds (8585 kg). Figure 12.2.

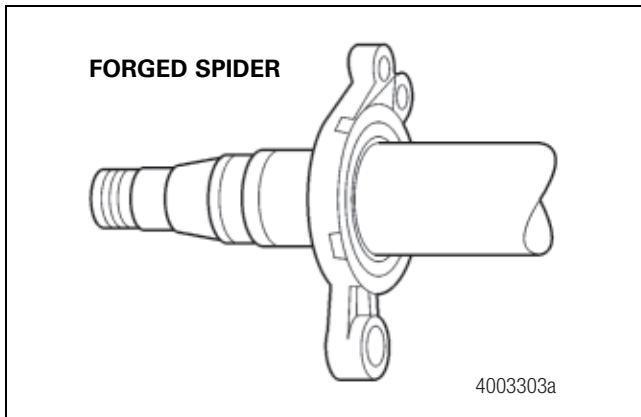


Figure 12.2

A stamped spider with four holes is the current production standard. Figure 12.3.

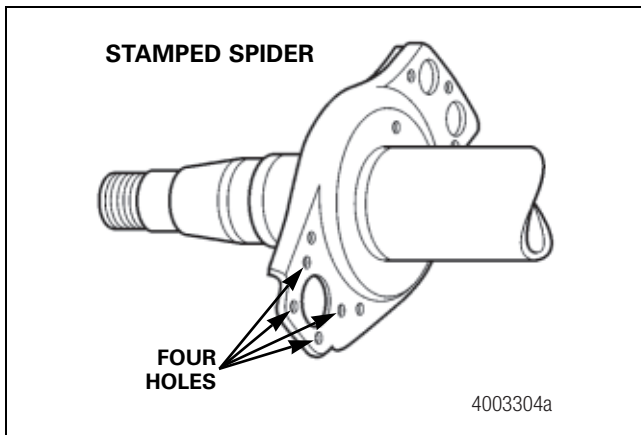


Figure 12.3

A stamped spider without holes is no longer in production. This model was replaced by the model with four holes. Figure 12.4.

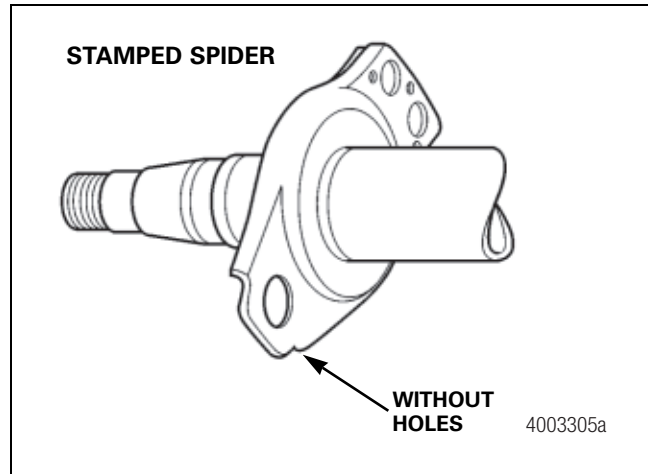


Figure 12.4

On some stamped spider models, a retainer is pressed into a hole in the spider and then welded in place. This retainer is designed to hold the cam bushings. The stamped spider models without holes and with four holes use different retainers. Figure 12.5.

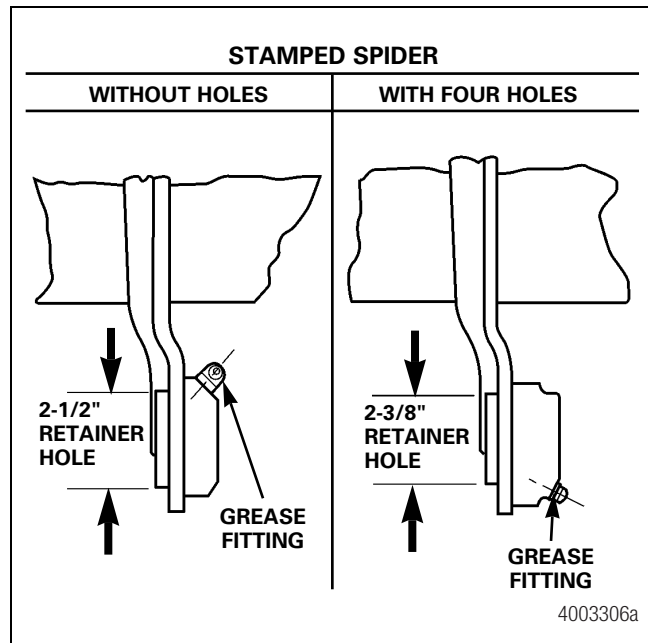


Figure 12.5

Cam Bushings

Cam bushings are installed at the spider and slack adjuster ends of the cam.

Three bushings may be encountered at the spider.

- A plastic sleeve bushing can be installed onto all three spider models. Note that a steel sleeve is pressed into the spider before this bushing is installed. Figure 12.6.

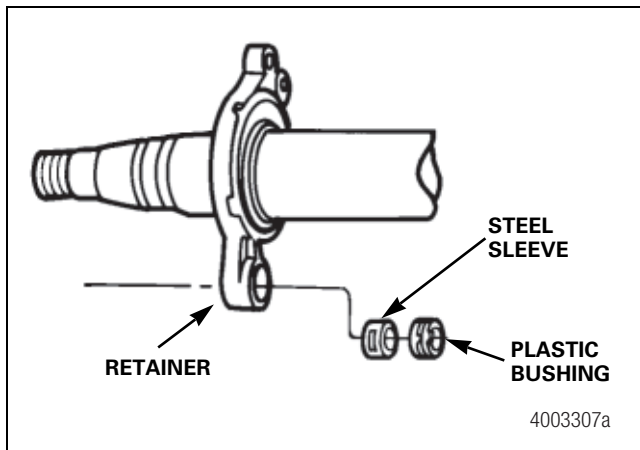


Figure 12.6

- A metal sleeve bushing can be installed onto all three spider models. Figure 12.7.

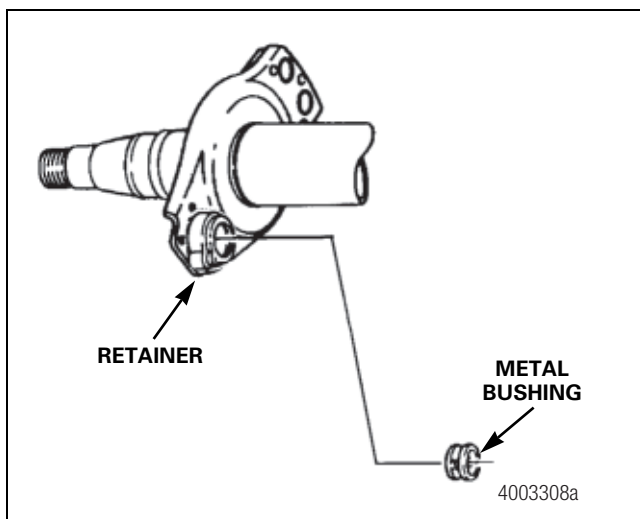


Figure 12.7

- A bolt-on bushing can only be installed onto the stamped spider with four holes. Figure 12.8.

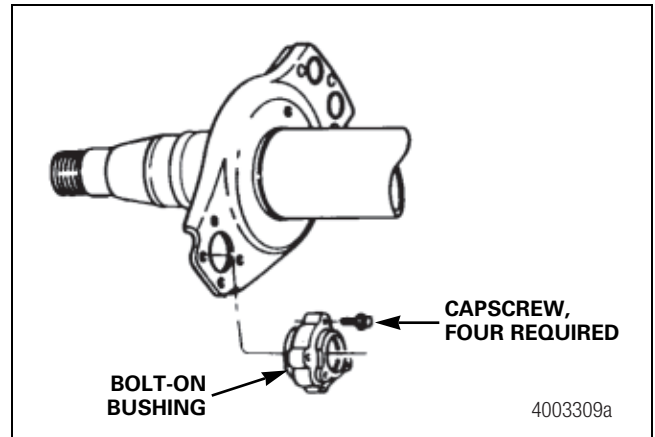


Figure 12.8

Two bushing models may be encountered at the slack.

- The current production arrangement consists of a bushing with a straight grease fitting installed onto a camshaft bracket with a slotted hole. When assembled, the grease fitting is oriented away from the slack adjuster. Figure 12.9.

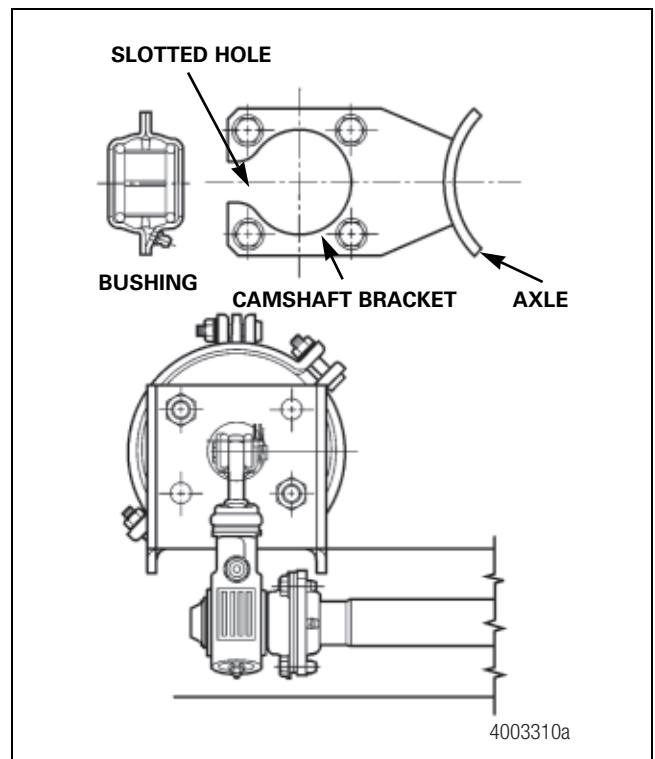


Figure 12.9

12 Cam Brakes

- An arrangement used in the past consists of a bushing with a 90-degree grease fitting installed onto a camshaft bracket with a round hole. When assembled, the grease fitting is oriented toward the slack adjuster. Figure 12.10.

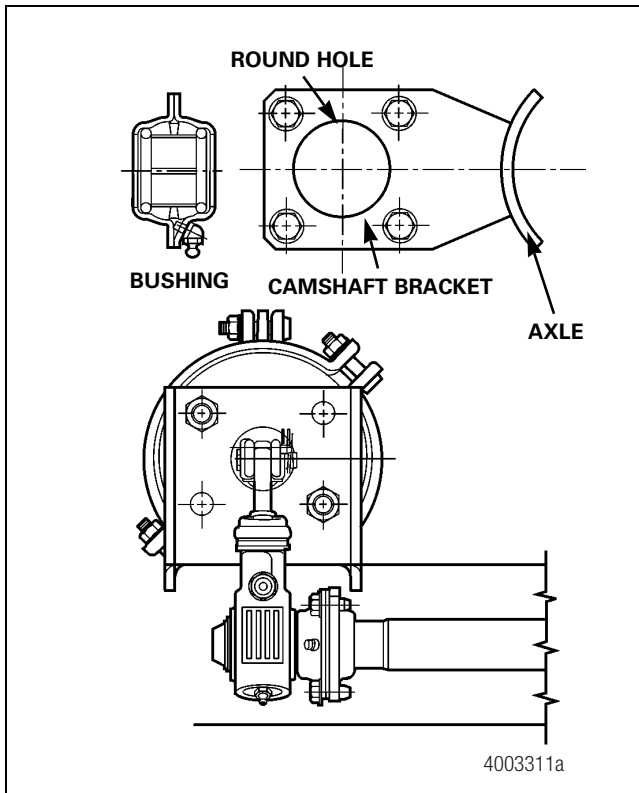


Figure 12.10

NOTE: The bushing with the 90-degree grease fitting will fit either of the camshaft bracket designs. The bushing with the straight grease fitting will not fit the camshaft bracket with the round hole.

Camshafts

Meritor camshafts are available with both heat-treated and non-heat-treated journals. These two models can be identified by the length of the journal. Figure 12.11.

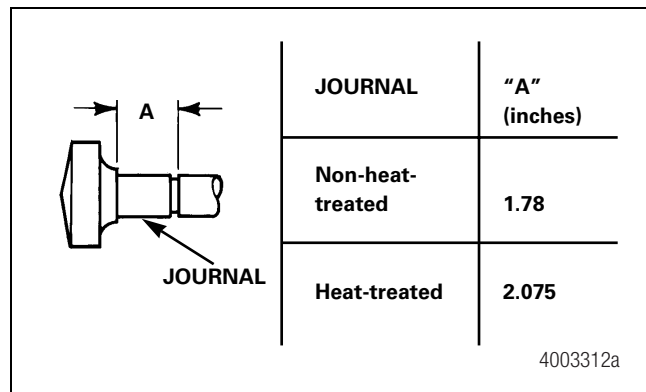


Figure 12.11

The correct cam and bushing match-ups are as follows:

- Cams with non-heat-treated journals are used with plastic sleeve bushings. Figure 12.12.

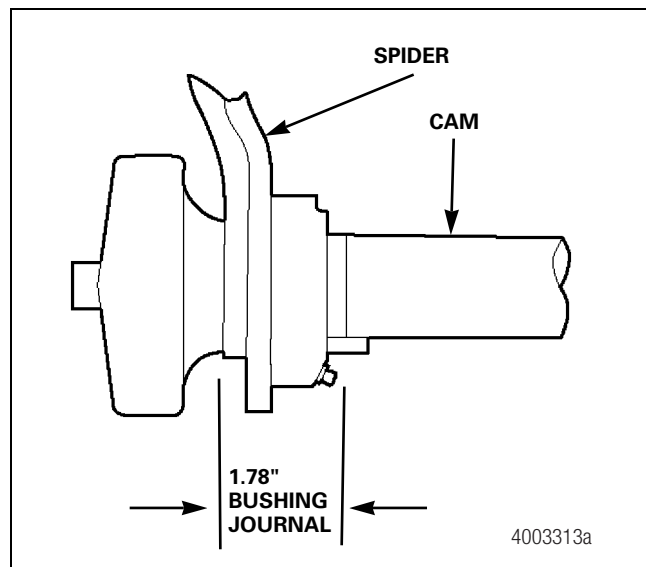


Figure 12.12

- Cams with heat-treated journals are used with metal sleeve bushings. A spacer washer is used to make up the difference in width between the cam bushing and journal. Figure 12.13.

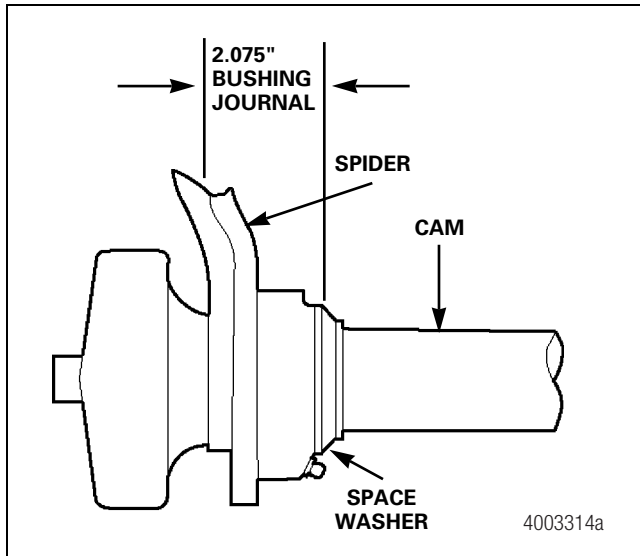


Figure 12.13

- Cams with heat-treated journals are used with bolt-on bushings. Figure 12.14.

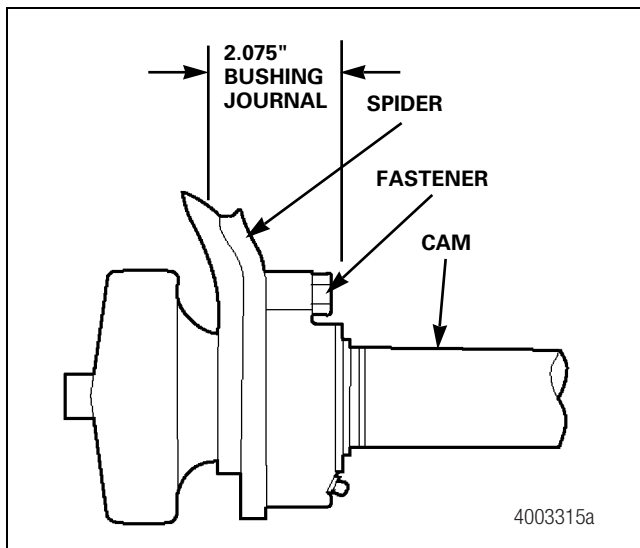


Figure 12.14

Air Chamber Brackets

Trailer axles are available with a variety of air chamber brackets. Information on the two most popular models is provided below. For information on other models, contact Meritor Trailer Products Engineering at 800-535-5560.

The most widely used bracket is the “V-Type.” Figure 12.15.

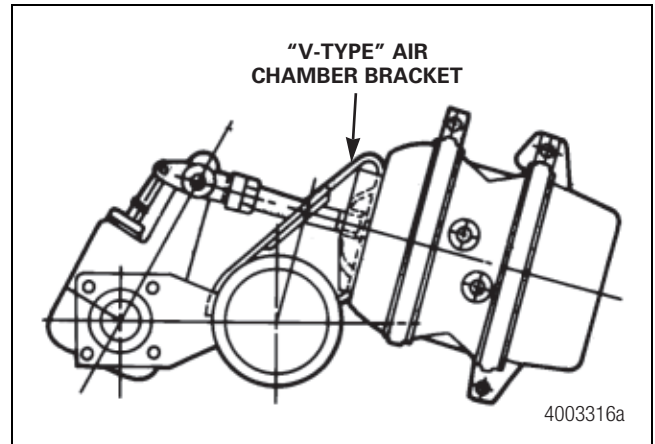


Figure 12.15

There are old and new versions of the “V-Type” bracket. Both make provisions for the use of three different slack lengths as stamped into the bracket. The new version was made standard in 1985. Figure 12.16.

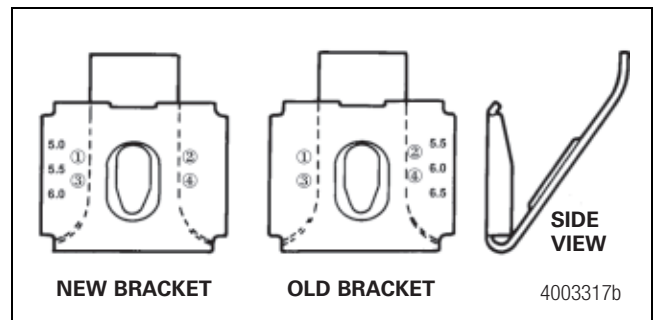


Figure 12.16

The three different slack lengths are obtained by installing the air chamber mounting studs through the different hole combinations. Refer to Table F.

Table F: Mounting Hole Combinations

Air Chamber Mounting Position	Slack Adjuster Length (inches)	
	New Bracket	Old Bracket
Holes 1 and 2	5.0	5.5
Holes 1 and 4 or 2 and 3	5.5	6.0
Holes 3 and 4	6.0	6.5

Another popular bracket is the “Channel-Type.” This bracket is only set up for one slack adjuster length. Figure 12.17.

12 Cam Brakes

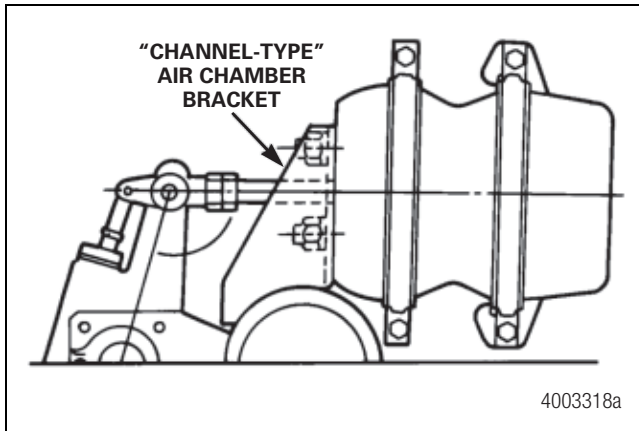


Figure 12.17

Important Information

Meritor automatic slack adjusters (ASAs) should not need to be manually adjusted in service. ASAs should not have to be adjusted to correct excessive pushrod stroke. The excessive stroke may be an indication that a problem exists with the foundation brake, ASA, brake actuator or other system components.

Meritor recommends troubleshooting the problem, replacing suspect components and then confirming proper brake operation prior to returning the vehicle into service.

In the event that a manual adjustment must be made (although not a common practice), a service appointment and full foundation brake, ASA, and other system component inspection should be conducted as soon as possible to ensure integrity of the overall brake system.

For Meritor brake adjustment, refer to the brake adjustment tables in this manual. For non-Meritor brake adjusters, refer to the brake manufacturer's service procedures.

Air Chambers and Slack Adjusters

When Meritor automatic slacks and cam brakes are installed onto a trailer axle, there must be a 105-degree angle between the air chamber push rod and the slack adjuster. Figure 12.18.

NOTE: This angle is with the service and spring brakes in the fully released or "Brakes Off" position.

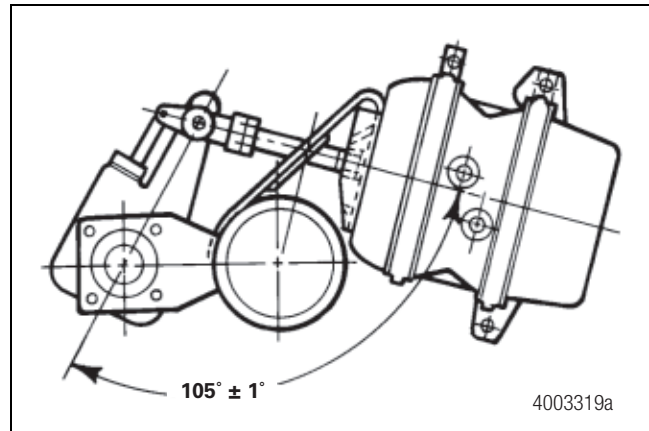


Figure 12.18

⚠ CAUTION

Five different installation templates are available from Meritor. These templates are designed to be used with specific model brakes and are not interchangeable. If the correct template is not used when adjusting the brakes, the slack adjuster will not be correctly set-up and brake performance will be affected.

To set up the required 105-degree angle between the air chamber push rod and the slack adjuster, use the tan-colored Meritor slack adjuster template, Meritor part number TP-4787. Figure 12.19.

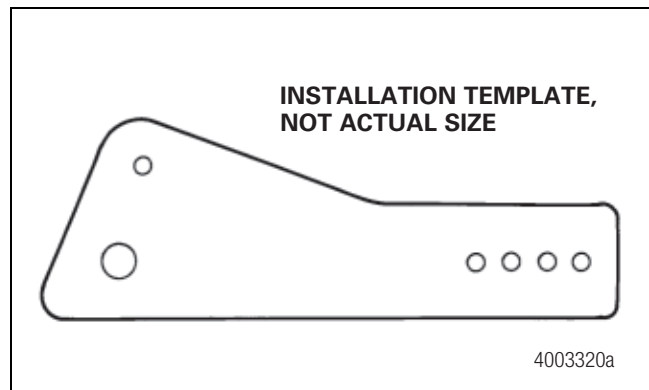


Figure 12.19

To use the template, insert the two slack adjuster clevis pins into the matching template holes. Adjust the slack until the bottom hole aligns with the cam centerline. Figure 12.20. Detailed instructions are in Maintenance Manual 4, Cam Brakes and Automatic Slack Adjusters. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

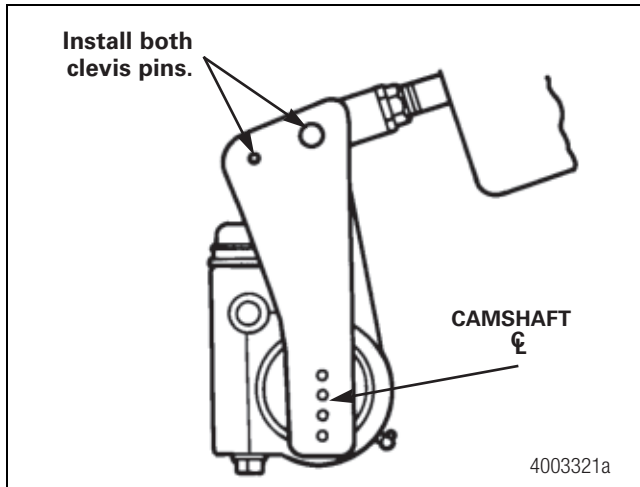


Figure 12.20

To achieve the required 105-degree angle, the air chamber push rod length must be correct. Table G details the correct length for various combinations of axles, cam brakes and air chamber brackets. Figure 12.21.

NOTE: These lengths are with the service and spring brakes in the fully released or “Brakes Off” position.

Axle Model	Cam Brake Model	Air Chamber Bracket	Push Rod Length (inches)
TN, TQ, TP, TR, TKN, TK, TT	16.5	“V-Type”	5.75
TN, TQ, TP, TR, TKN, TQD, TND	16.5	“Channel Type”	4.25
RN, RQ	16.5	“V-Type”	5.25
TQC, TNC	16.5	“V-Type”	5.09
TN, TQ, TK, TKN	12.25	“V-Type”	3.90
TN, TQ, TP, TR	15	“V-Type”	5.75

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Figure 12.21

Table G: Push Rod Length

Axle Model	Cam Brake Model	Air Chamber Bracket	Push Rod Length (Inches)
TN, TQ, TP, TR, TKN, TK, TT	16.5	“V Type”	5.75
TN, TQ, TP, TR, TKN, TQD, TND	16.5	“Channel Type”	4.25
RN, RQ	16.5	“V Type”	5.25
TQC, TNC	16.5	“V Type”	5.09
TN, TQ, TK, TKN	12.25	“V Type”	3.90
TN, TQ, TP, TR	15	“V Type”	5.75

It is acceptable to cut an air chamber push rod to length. Most aftermarket air chambers have extra-long threaded push rods so this can be done. Figure 12.22.

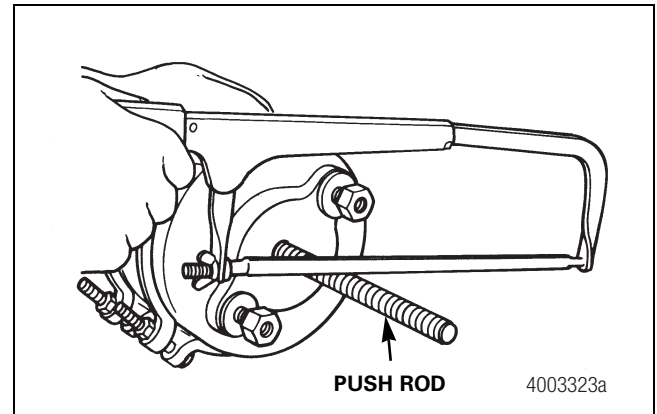


Figure 12.22

The air chamber clevis must be assembled to the push rod as follows.

- There must be at least 0.5-inch (12.7 mm) of thread engagement between the clevis and push rod.
- The push rod must not extend through the clevis more than 0.125-inch (3.18 mm). Figure 12.23.

12 Cam Brakes

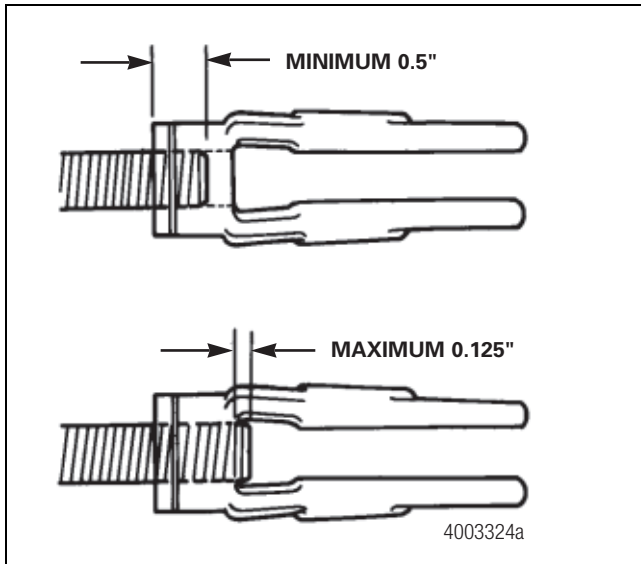


Figure 12.23

Q Series and Q Plus™ Brakes

Meritor trailer axles may be installed with either Q Series or Q Plus™ cam brakes.

Q Plus™ brakes are designed to reduce maintenance costs by providing thicker linings when compared to Q Series brakes. Figure 12.24.

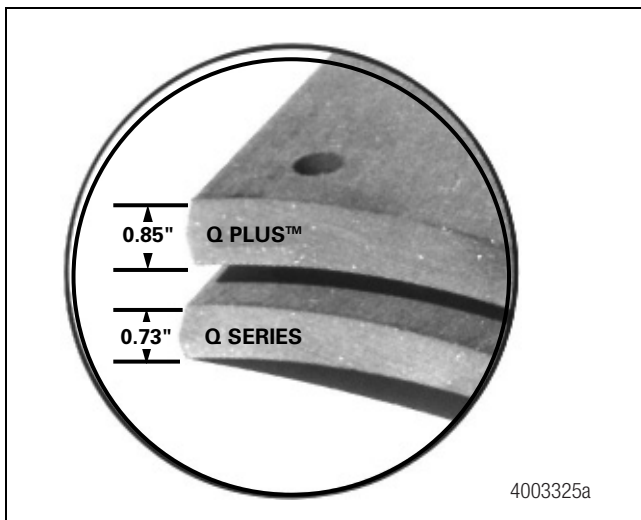


Figure 12.24

The equipment required for Q Series and Q Plus™ brakes is detailed below and shown in Table H.

- Camshafts — Q Series brakes can use either Q Series or Q Plus™ camshafts. Q Plus™ brakes must use Q Plus™ camshafts in order to accommodate the greater shoe travel as the thicker linings wear.
- Return Springs — Q Series brakes may use either standard or heavy-duty return springs. Q Plus™ brakes must use heavy-duty return springs in order to accommodate the greater shoe travel as the thicker linings wear.
- Brake Drums — Both Q and Q Plus™ brakes use standard brake drums.

Table H: Brake Equipment

Brake Component	Q Series	Q Plus™
Shoes	Q Series	Q Plus™ or Q Series
Cam	Q Series or Q Plus™	Q Plus™
Return Springs	Standard or Heavy-Duty	Heavy-Duty
Drums	Standard	Standard

Q Series and Q Plus™ brake equipment can be identified as follows. Figure 12.25.

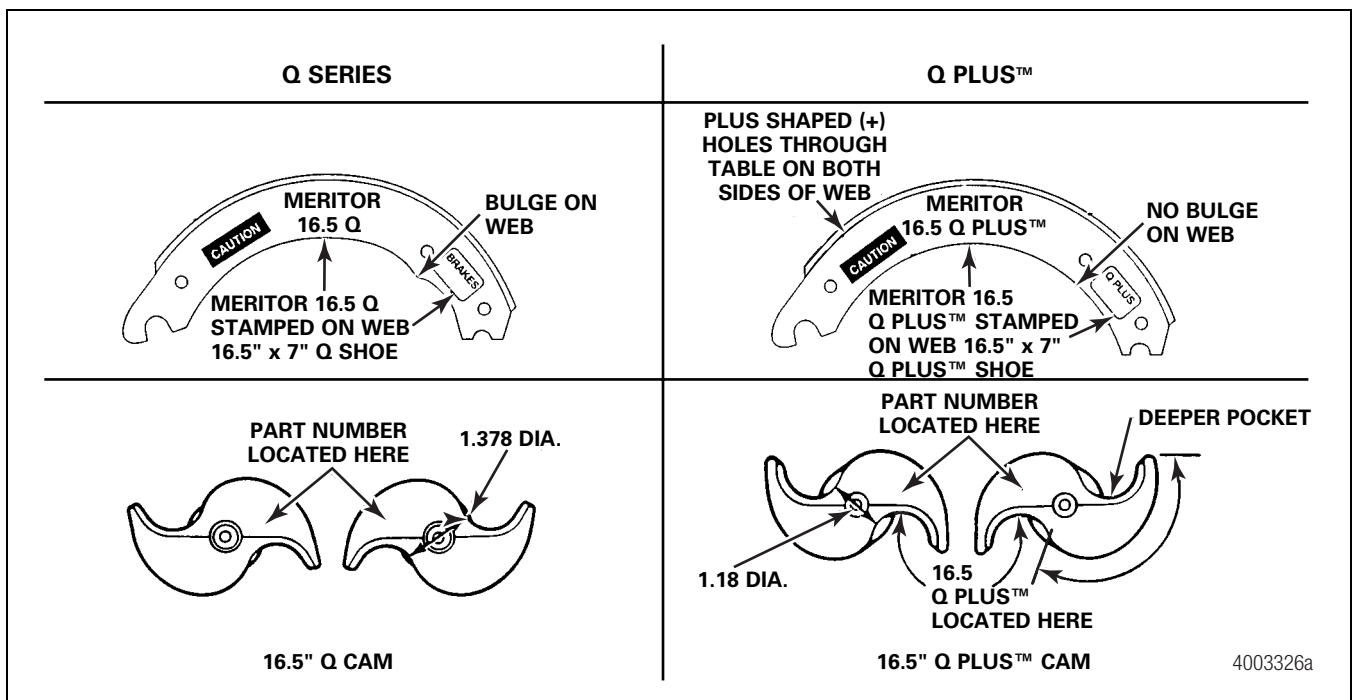


Figure 12.25


Since March 1995, Q Plus™ camshafts have been standard on all trailer axles built with 16.5 inch Q Series and Q Plus™ brakes and 28-tooth spline cams. This has reduced part numbers and eliminated the need to replace cams during a Q Series-to-Q Plus™ brake retrofit.

To retrofit from Q Series-to-Q Plus™ brakes, refer to the procedure in this section and then install the appropriate equipment. To obtain maximum benefit from this retrofit, Meritor recommends that plastic sleeve bushings be replaced with bolt-on bushings.

Cam Bushings

Refer to Section 4 for information regarding when to replace the cam bushings.

Cam Bushings at the Slack End

To replace the bushing at the slack end of the cam, remove and replace the four fasteners, making sure to tighten them to 25-35 lb-ft (34-48 N•m). Figure 12.26. 

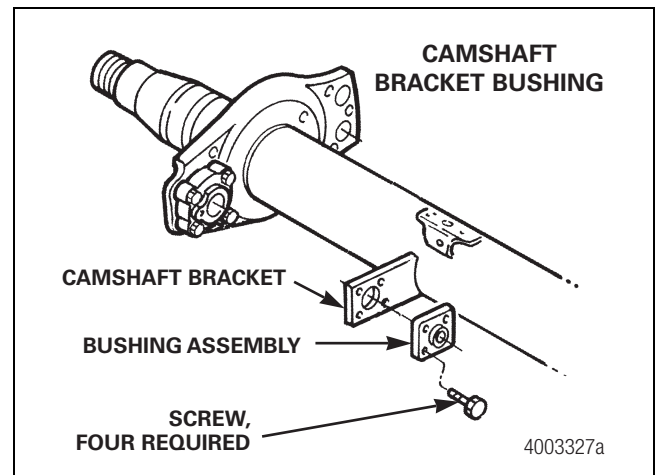


Figure 12.26

12 Cam Brakes

Cam Sleeve Bushings at the Spider End

1. Remove the snap ring, then pull the camshaft from the axle.
2. Remove all loose parts from the camshaft and retainer bore including the grease seals and washers. Figure 12.27.

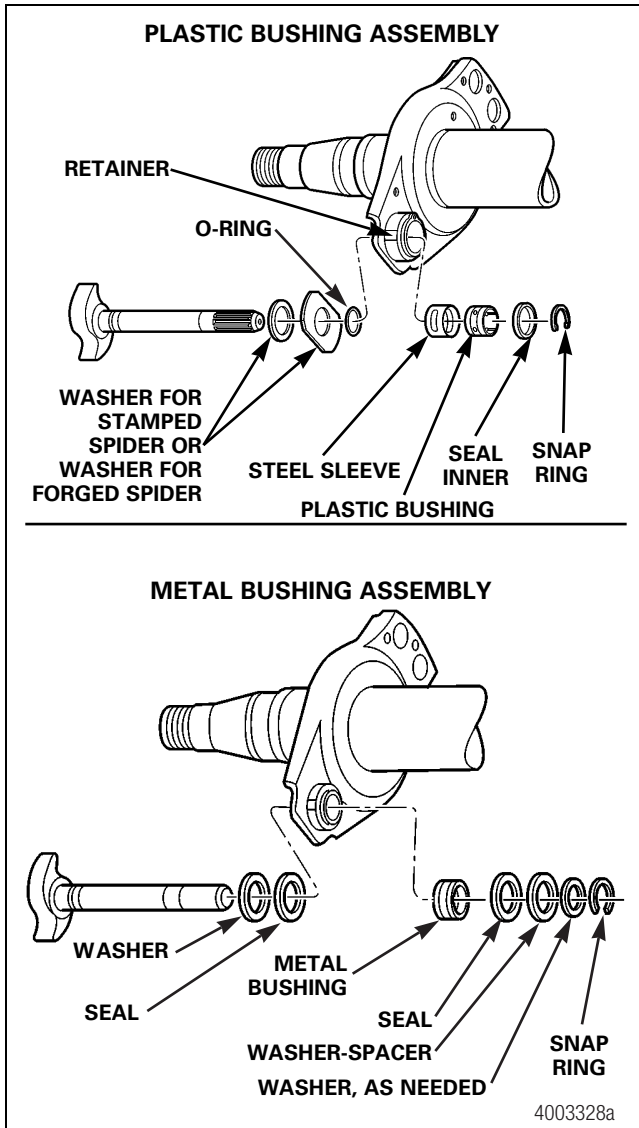


Figure 12.27

3. Drive the following components out of the retainer bore. Verify that the correct size driver is used and care is taken to ensure the bore is not damaged. Figure 12.28.
 - A. For plastic bushings, drive the steel sleeve out of the retainer bore.
 - B. For metal bushings, drive the metal bushing out of the retainer bore.

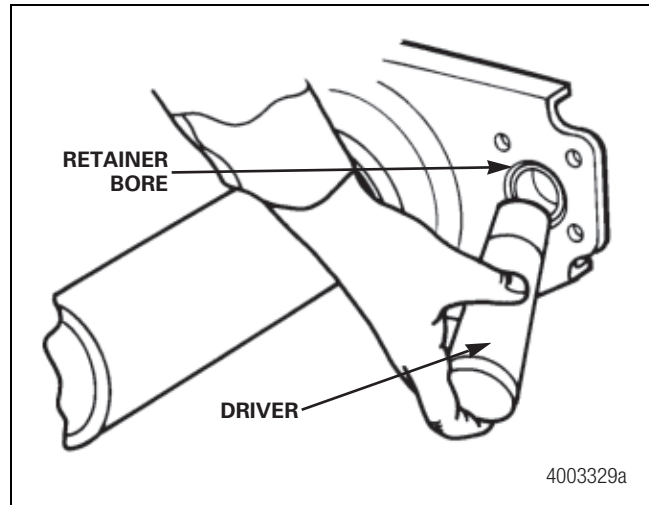


Figure 12.28

4. Install the following components into the retainer.
 - A. For plastic bushings, drive a steel sleeve into the retainer bore until it is flush with the outboard edge, tire side, of the retainer. Verify that the slot in the steel sleeve lines up with the grease fitting delivery hole. Then install the plastic bushing. Figure 12.29.

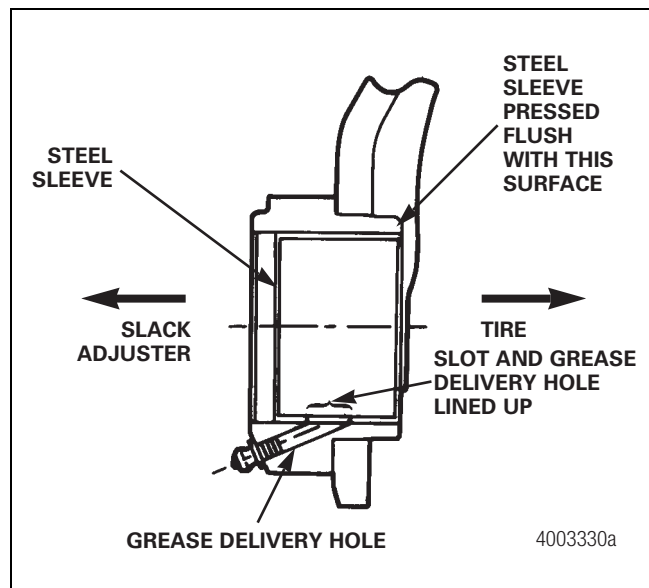


Figure 12.29

- B. For metal bushings, drive a metal bushing into the retainer bore until it is centered in the retainer as detailed below. Figure 12.30.

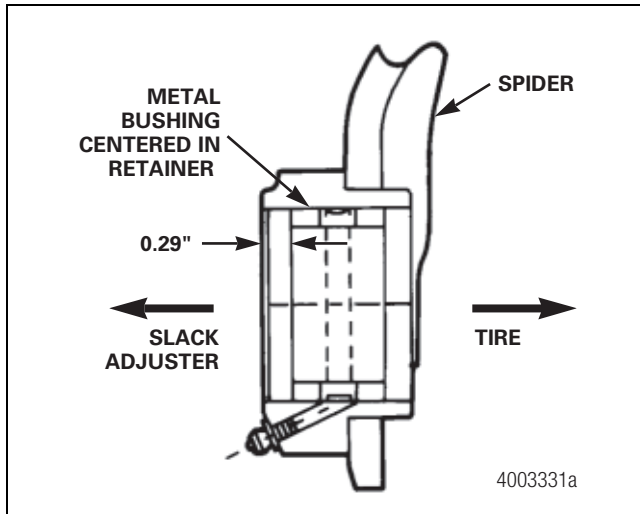


Figure 12.30

5. Install the grease seals. Be careful not to crimp or damage the metal flange of the seals.
 - A. For plastic bushings, install one grease seal. Verify that the seal lip faces toward the slack adjuster and that the seal body is pressed against the steel sleeve. Figure 12.31.

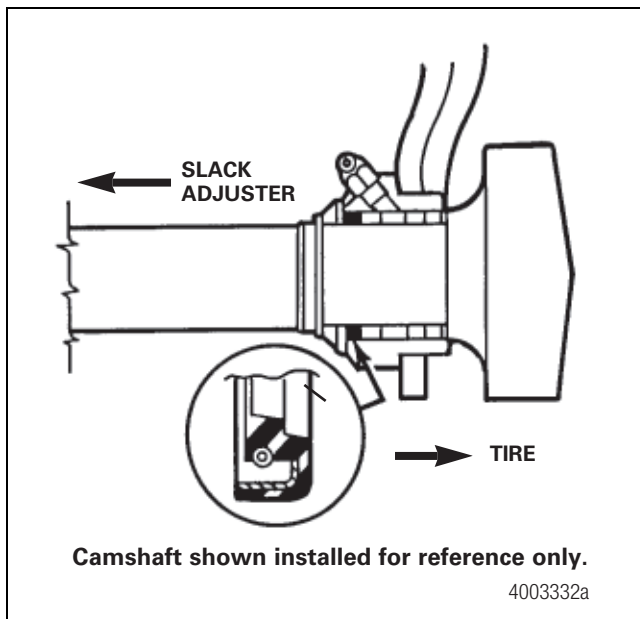


Figure 12.31

- B. For metal bushings, install two grease seals. Verify that the seal lips face toward the slack adjuster and that the seal bodies press against the metal bushing. Figure 12.32.

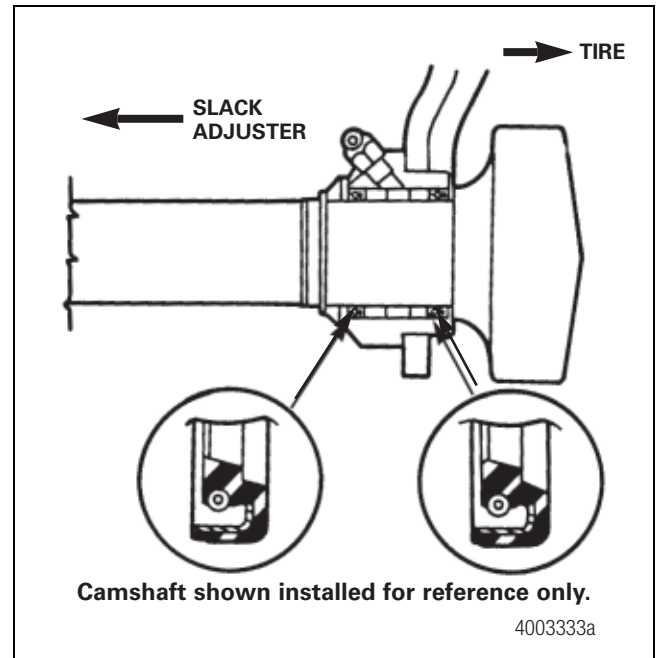


Figure 12.32

NOTE: Cleaning the cam before installation will ensure that bushings are not contaminated as the cam is pushed through them.

6. Clean the entire camshaft, then grease the cam bushings and journals.
7. Install the following equipment onto camshaft, then install the camshaft through the spider bushing.
 - A. For plastic bushings, install the cam head washer and O-ring onto the camshaft.
 - B. For metal bushings, install the cam head washer onto the camshaft.

NOTE: The metal bushing replacement kit includes an optional washer. If there is excessive axial end play, install the washer during Step 8.

12 Cam Brakes

8. Install the following equipment onto the camshaft and then install the camshaft through the second bushing.
 - A. For plastic bushings, install the washer onto the camshaft.
 - B. For metal bushings, install the washer and spacer onto the camshaft.
9. Install the snap ring. When the camshaft is correctly installed, you should be able to turn it by hand.
10. Grease the cam bushings as detailed in the procedure in this section.

Bolt-On Bushing Replacement

1. Remove the snap ring, camshaft, washers and seals.
Figure 12.33.

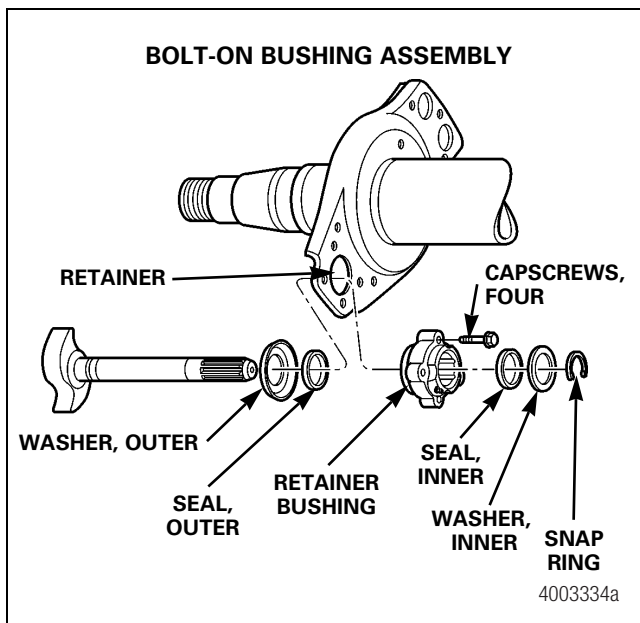


Figure 12.33

2. Remove the four fasteners attaching the bolt-on bushing, then pry the bushing from the spider. Figure 12.33.
3. Position a new bushing onto the spider making sure the four bushing holes line up with the four matching spider holes, then press a new bushing into the spider with a C-clamp until it is completely seated. Figure 12.34.

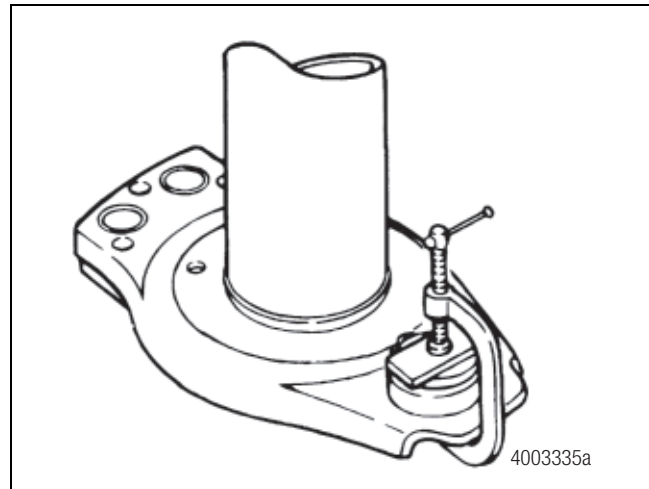



Figure 12.34

4. Tighten the four capscrews to 25-35 lb-ft (34-48 N•m).
Figure 12.35. 

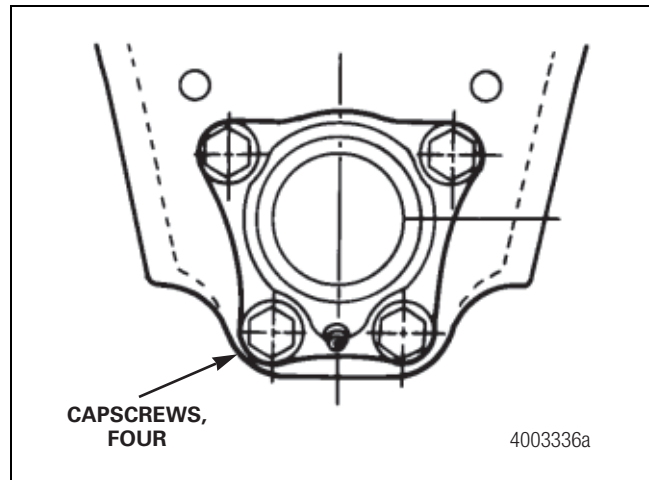


Figure 12.35

5. Replace all camshaft assembly parts as shown in Figure 12.33. Verify that the seals align in the correct direction. Figure 12.36.

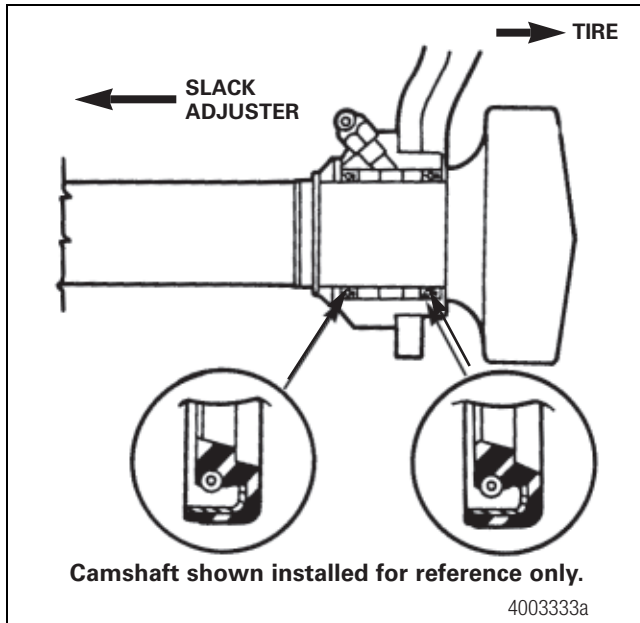


Figure 12.36

Replacing the Cam Without Removing the Hub

On most trailer axles equipped with outboard-mounted brake drums and bolt-on bushings, the camshaft and bolt-on bushing can be removed without removing the hub. This allows service to be performed on these components without disturbing the wheel-end lubricant, bearings and seals.

Proceed as follows, using the assembly and disassembly procedures as reference.

1. Remove the brake drum, slack adjuster and brake shoes. Figure 12.37.

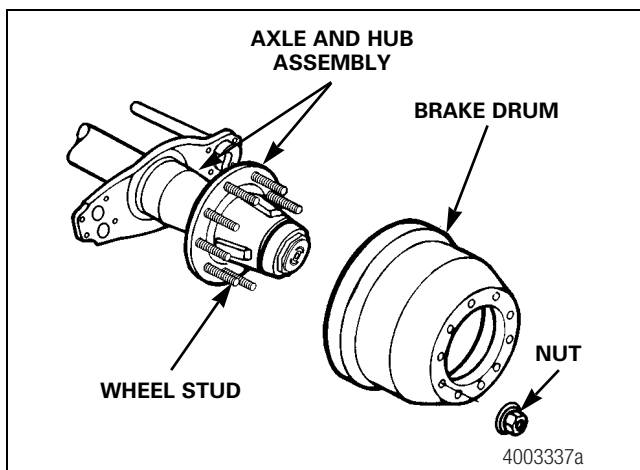


Figure 12.37

2. Remove the snap ring at the inboard side of the bushing and the four capscrews from the bushing. Figure 12.38.

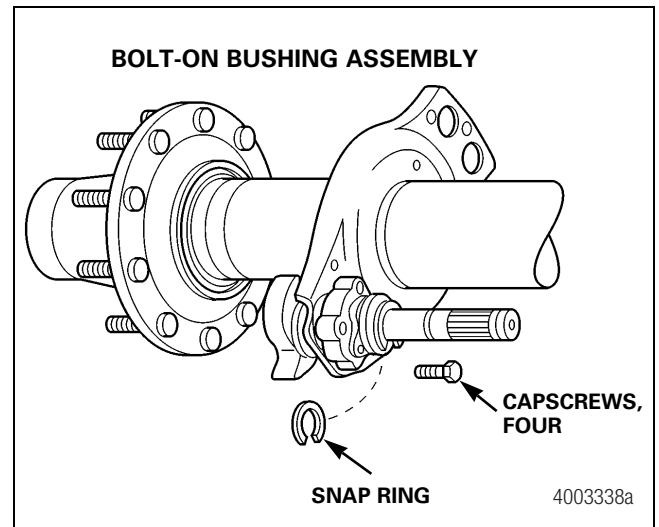


Figure 12.38

3. Pry the bushing out of the spider retainer hole. Figure 12.39.

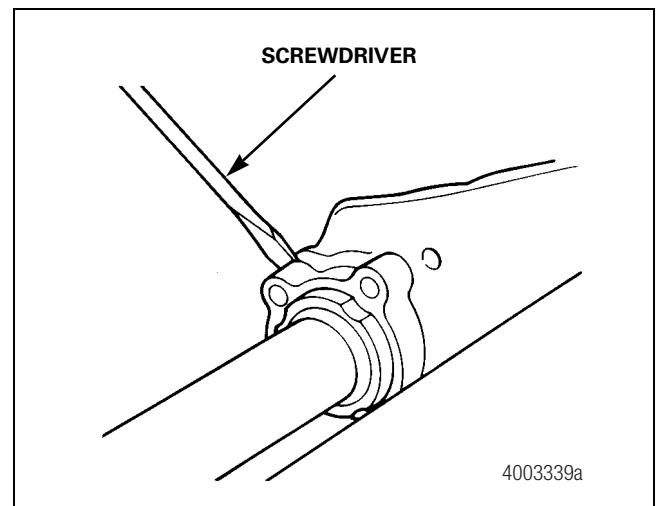


Figure 12.39

4. Move the camshaft head away from the centerline of the axle so it clears the hub flange, then pull the camshaft from the bushings. Figure 12.40.

12 Cam Brakes

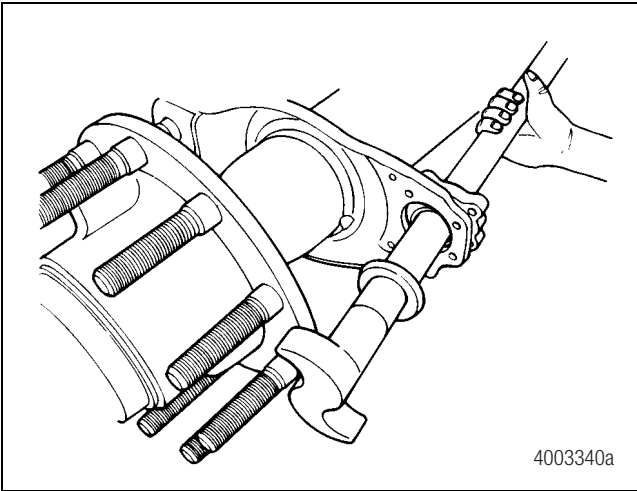


Figure 12.40

5. Install the new bolt-on bushing and cam by reversing the procedure.
6. Tighten the four bolts to draw the bolt-on bushing into its seated position. Figure 12.41.

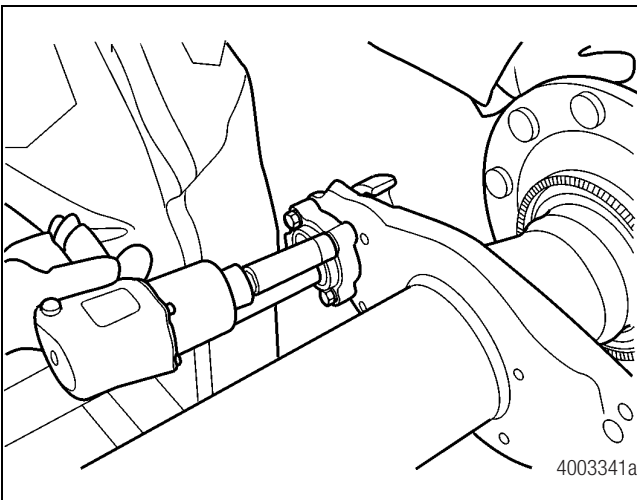


Figure 12.41

7. Install the remaining components.

Replacing the Weld-On Retainer

If the weld-on retainer used on the stamped spiders is either damaged or worn, it can be replaced. Figure 12.42.

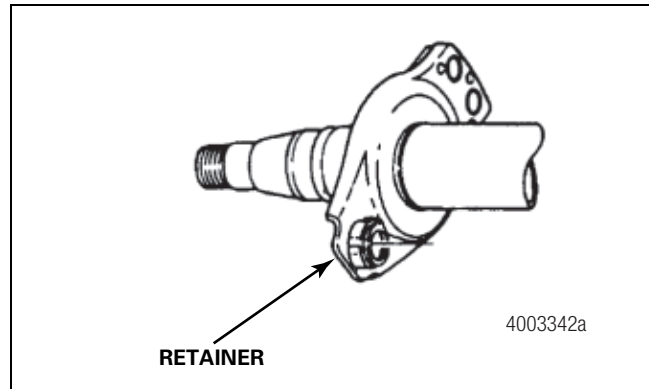


Figure 12.42

Although the two stamped spider designs use different weld-on retainers, the replacement procedure is the same for both.

1. Remove the camshaft assembly parts as detailed in this section.
2. Grind the welds that attach the retainer to the spider. Grind only to the base metal of the spider. Position the grinding toward the retainer, since this item will be scrapped. Figure 12.43.

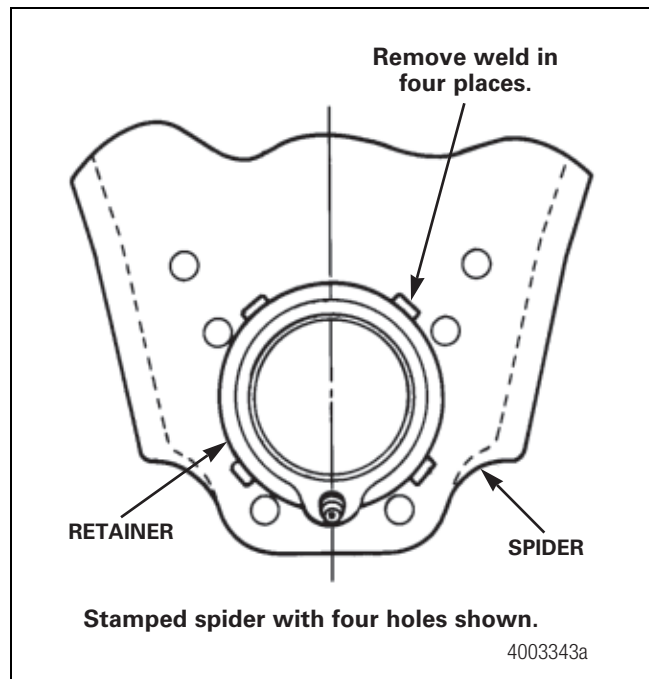


Figure 12.43

3. Press the old retainer out of the spider with a C-clamp.
4. Press a new retainer into the spider with a C-clamp.
Figure 12.44. Verify that the grease fitting is positioned correctly. Figure 12.45.

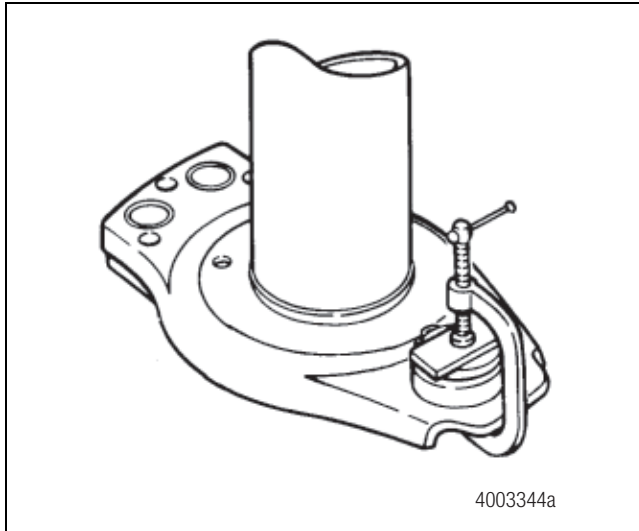


Figure 12.44

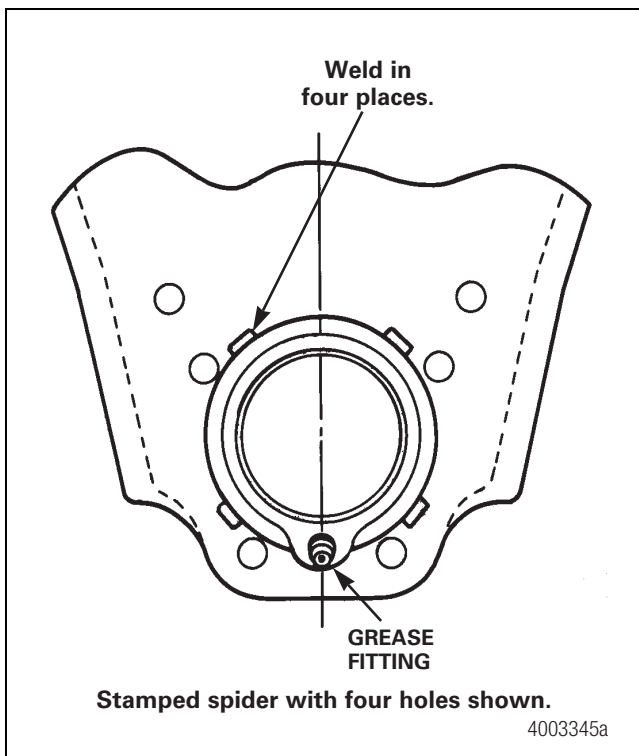


Figure 12.45

5. Weld the retainer in four places using AWS E70S3 or E70S6 electrodes. Each weld should have a 0.1875-inch (4.76 mm) fillet and be 0.375-inch (9.52 mm) long. Figure 12.45.
6. Replace the camshaft assembly parts using the procedures in this section.

Upgrading the Bushing on the Spider End of the Cam

If plastic sleeve bushings are installed at the spider end of the camshaft, service life can be increased by replacing them with metal bushings.

The equipment changes allowed depend on the spider model installed onto the axle.

- **For forged spiders:** Remove the plastic sleeve bushing and replace with the metal sleeve bushing.
- **For stamped spiders without holes:** Remove the plastic sleeve bushing and replace with a metal sleeve bushing.
- **For stamped spiders with four holes:** Use one of the following two methods. Remove the plastic sleeve bushing and replace it with a metal sleeve bushing. As an alternative method, remove the plastic sleeve bushing and weld-on retainer and replace it with a bolt-on bushing.

Use the maintenance procedures detailed in this section to perform these operations.

Whenever plastic sleeve bushings are replaced with a metal sleeve bushing, Meritor recommends that the non-heat-treated cam be replaced with a heat-treated cam. This will ensure that wear occurs to the bushing, not the cam.

Whenever plastic bushings are replaced with a bolt-on bushing, the non-heat-treated cam must be replaced with a heat-treated cam, since the non-heat-treated cam will not fit the bolt-on bushing.

13 Anti-Lock Braking System

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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 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.

Installation

Anti-Lock Braking System (ABS) Components

For complete information on Meritor WABCO anti-lock braking system (ABS) components, refer to the Service Notes page on the front inside cover of this manual.

Equipment

An ABS-equipped trailer axle will be installed with the wheel speed monitoring components located at the axle spindle. Figure 13.1.

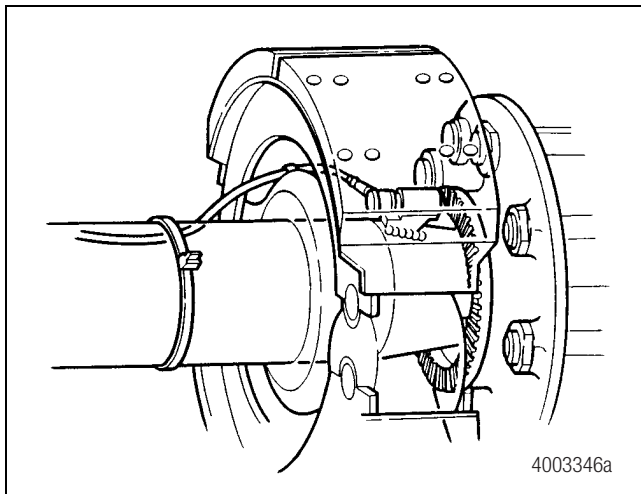


Figure 13.1

This wheel speed monitoring equipment consists of the following components.

- Tooth Wheel — A 100 tooth wheel mounted to the hub or spoke wheel. Working with the sensor, it provides an AC voltage that represents wheel speed. Figure 13.2.

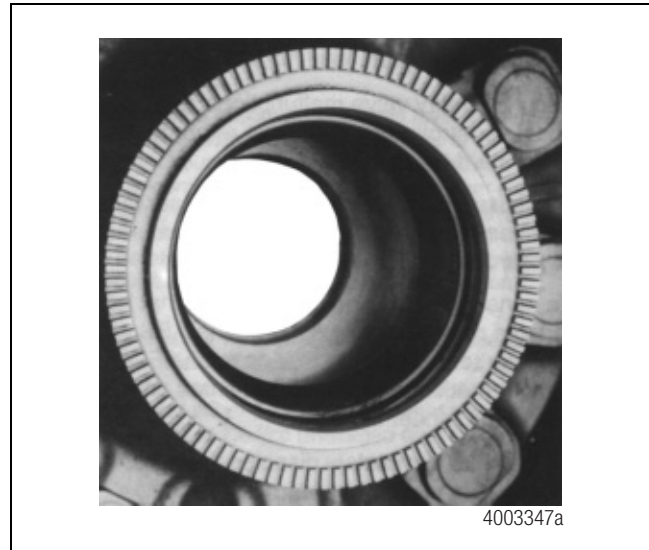


Figure 13.2

- Sensor — An electro-mechanical device mounted to the axle. Working with the tooth wheel, it provides an AC voltage that represents wheel speed. Figure 13.3.



Figure 13.3

- Sensor Block — Welded to the axle between the spider and oil seal collar, the sensor block holds the sensor in correct position relative to the tooth wheel. Figure 13.4.

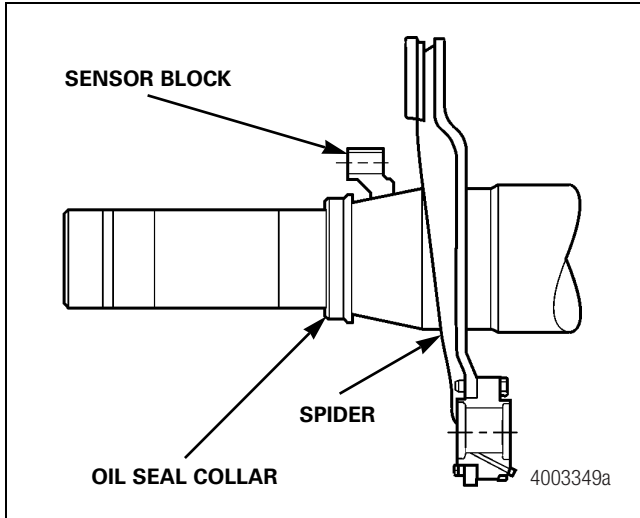


Figure 13.4

- Sensor Spring Clip — Retains the sensor in the sensor block. Figure 13.5.

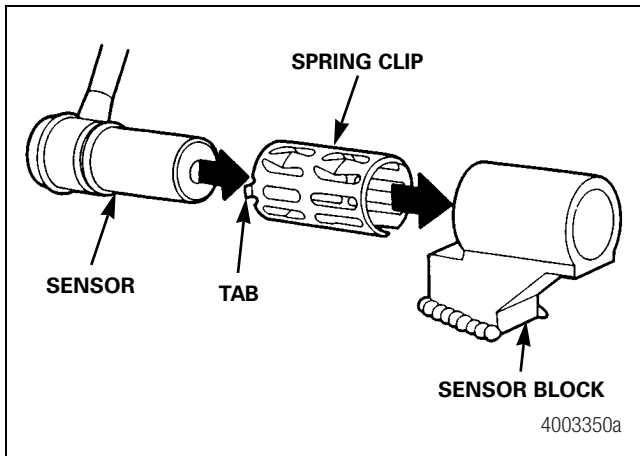


Figure 13.5

Sensor Block Location

Sensor blocks can be located at the three, six, nine or 12 o'clock positions. Any of these positions will provide acceptable sensor performance.

Sensor block locations at either three or nine o'clock are the most common positions. Figure 13.6.

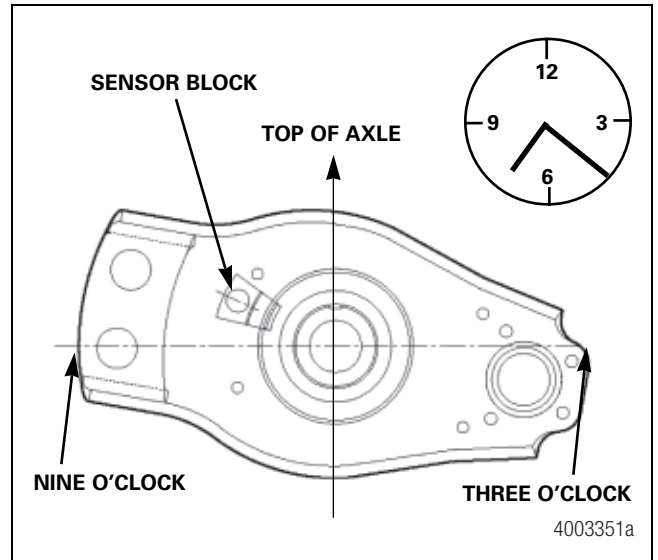


Figure 13.6

Less common is the 12 o'clock position. Some blocks are located in this position to provide access to the sensor for service. Figure 13.7.

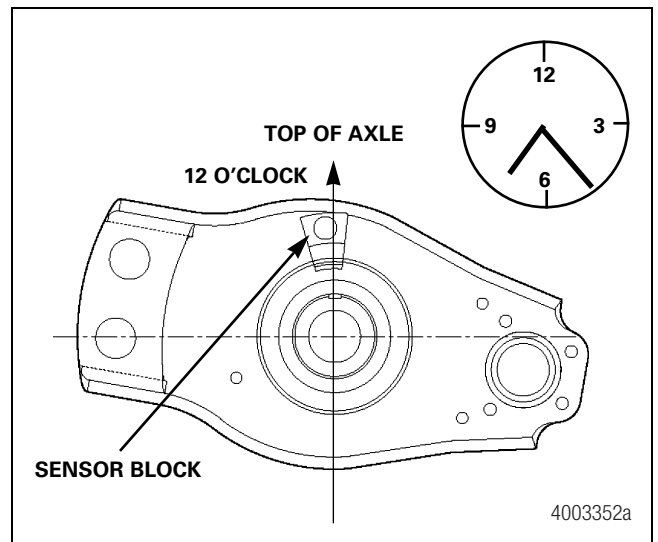


Figure 13.7

13 Anti-Lock Braking System

The least common position is near six o'clock. A sensor can end up in this area when an ABS-equipped axle is rotated 180 degrees prior to installation. Refer to the axle rotation information in Section 6. Figure 13.8.

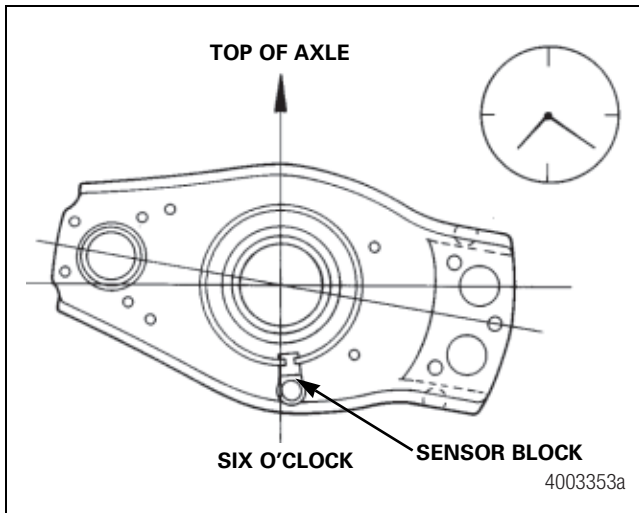


Figure 13.8

Sensor Gap

The sensor should contact the tooth wheel at the initial installation. A gap may develop during trailer operations. If this gap exceeds 0.040-inch (1 mm), the system may not function correctly. To readjust, push the sensor through the sensor block until it contacts the tooth wheel. Figure 13.9.

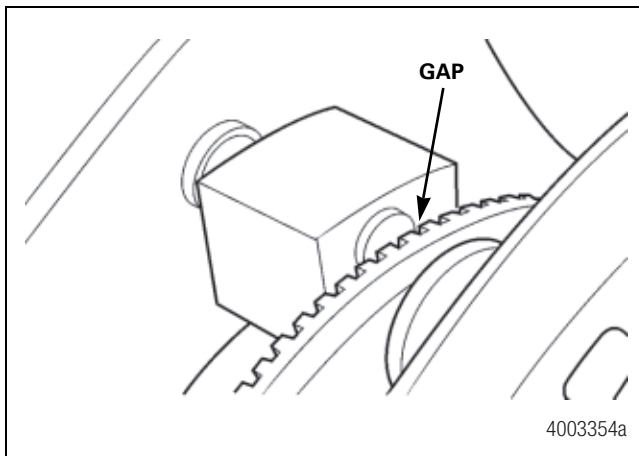


Figure 13.9

You can make a special tool to reach the back of the sensor through the brake equipment. Be careful not to damage the sensor when pushing on it. Figure 13.10.

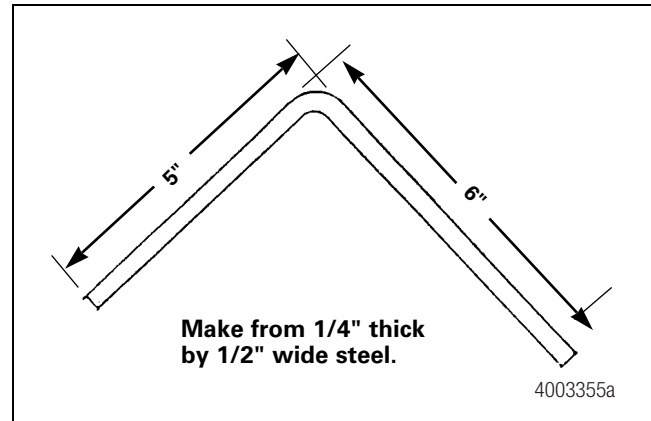


Figure 13.10

Wire Routing

This section details the correct methods for routing wiring within the brake cavity so that the correct clearance between the ABS wiring and brake equipment is provided.

Note the following in regard to this information.

- If the sensor is to be located at the bottom of an axle, first route the sensor wire to the top of the axle within the brake cavity. Then route it through the brake equipment. Figure 13.11.
 - Refer to the appropriate ABS maintenance manuals for information on routing wires beyond the areas shown here.
 - Information shown is for typical applications. Alternate routing may be used if either improved clearances can be obtained or if optional equipment is installed which requires different routing.
 - In order to route ABS wiring on trailer axles equipped with 12.25 x 7.5 inch cam brakes, modifications must be made to the brake structural components. Therefore, this installation must be performed at the Meritor manufacturing plant.
1. Current production cam brakes are built with a hole in the spider for routing the ABS wire. Figure 13.11.

13 Anti-Lock Braking System

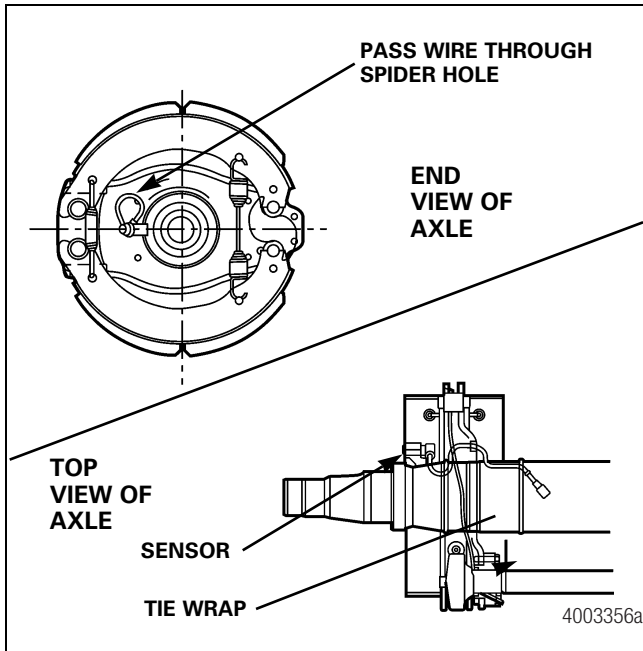


Figure 13.11

2. Route the ABS wires on TN and TQ model axles equipped with cam brakes without an ABS spider hole as follows. Figure 13.12.

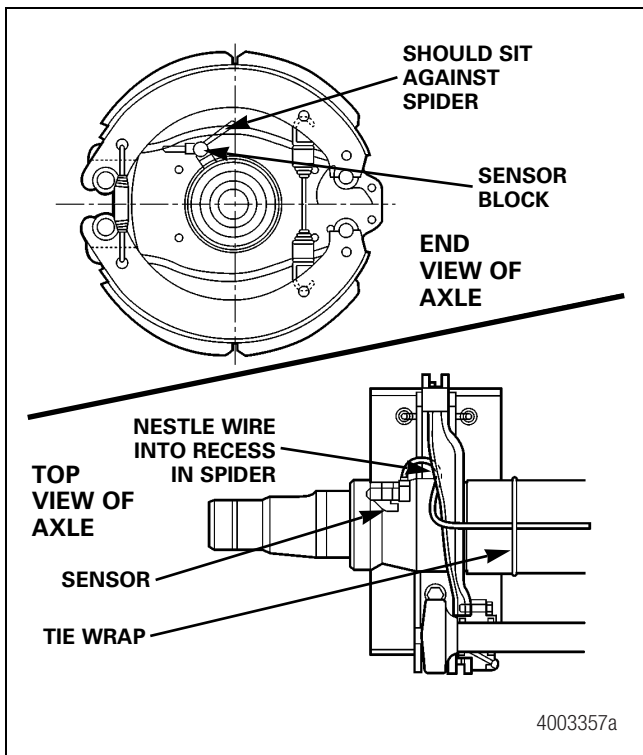


Figure 13.12

3. Route the ABS wires on TP and TR model axles equipped with cam brakes without an ABS spider hole as follows. Figure 13.13.

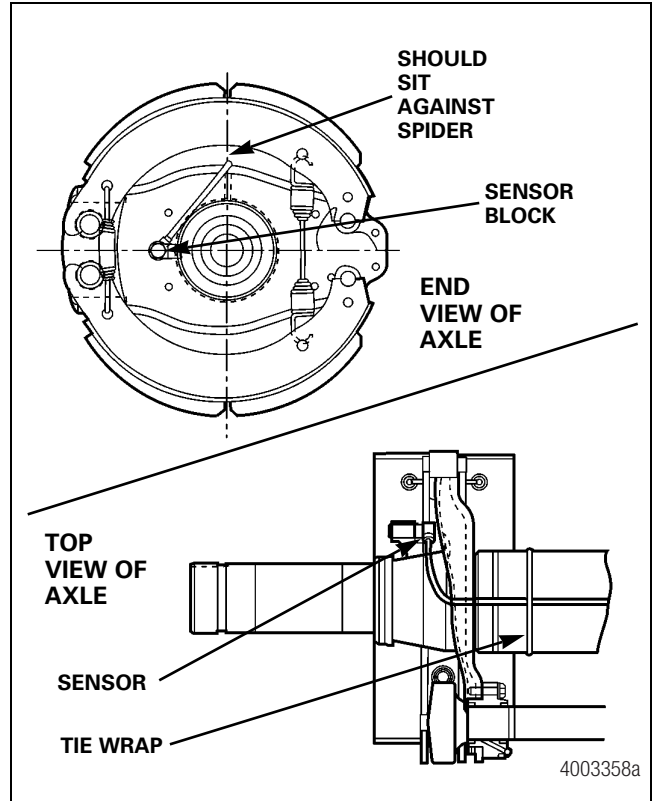


Figure 13.13

13 Anti-Lock Braking System

4. Route the ABS wires on axles equipped with disc brakes as follows. The sensor must be completely clear of the spinning disc brake rotor, otherwise it will be damaged. Figure 13.14.

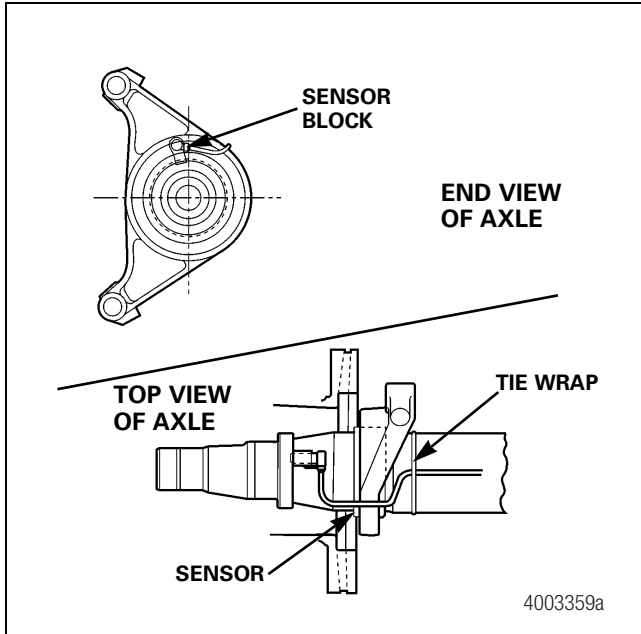


Figure 13.14

5. Route the ABS wires on axles equipped with wedge brakes as follows. Figure 13.15.

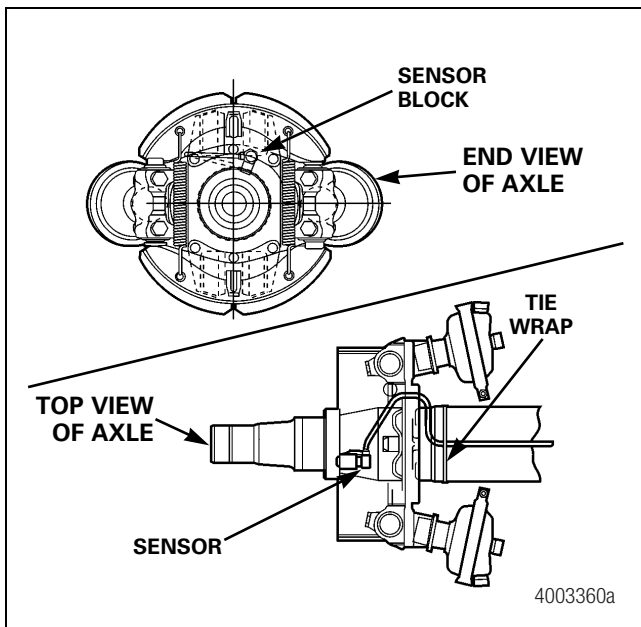


Figure 13.15

6. Meritor current production two-piece dust shields are designed to be used either with or without ABS equipment. Each dust shield section contains a hole for passing an ABS wire.

- On ABS-equipped axles, insert a grommet for wire protection into the hole in which the wire will be passed and a plug into the remaining hole.
- On axles not equipped with ABS, insert plugs into both holes. Figure 13.16.

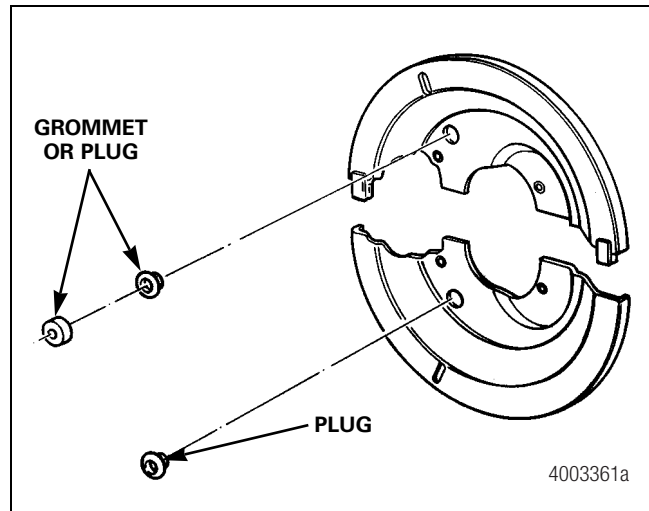


Figure 13.16

7. On some axle models, unit-mounted brakes, standard on drive axles, are fastened to the trailer axle by bolting the spider to a brake flange. Figure 13.17.

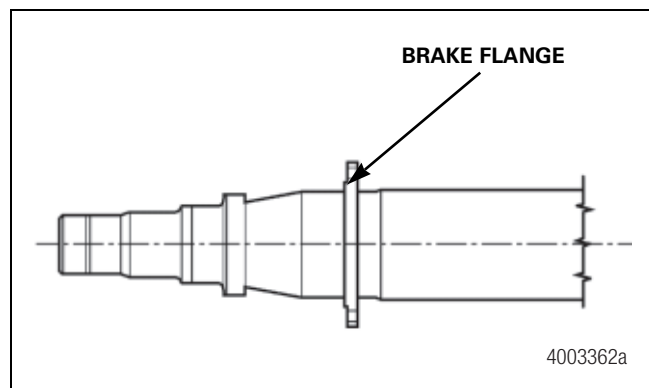


Figure 13.17

8. Currently brake flanges are available with nine, 12 and 16 hole patterns. For all three designs, the ABS wire should pass through the 0.8125-inch diameter hole and the remaining holes should be used for fastening the brake spider as detailed in Section 6. Figure 13.18.

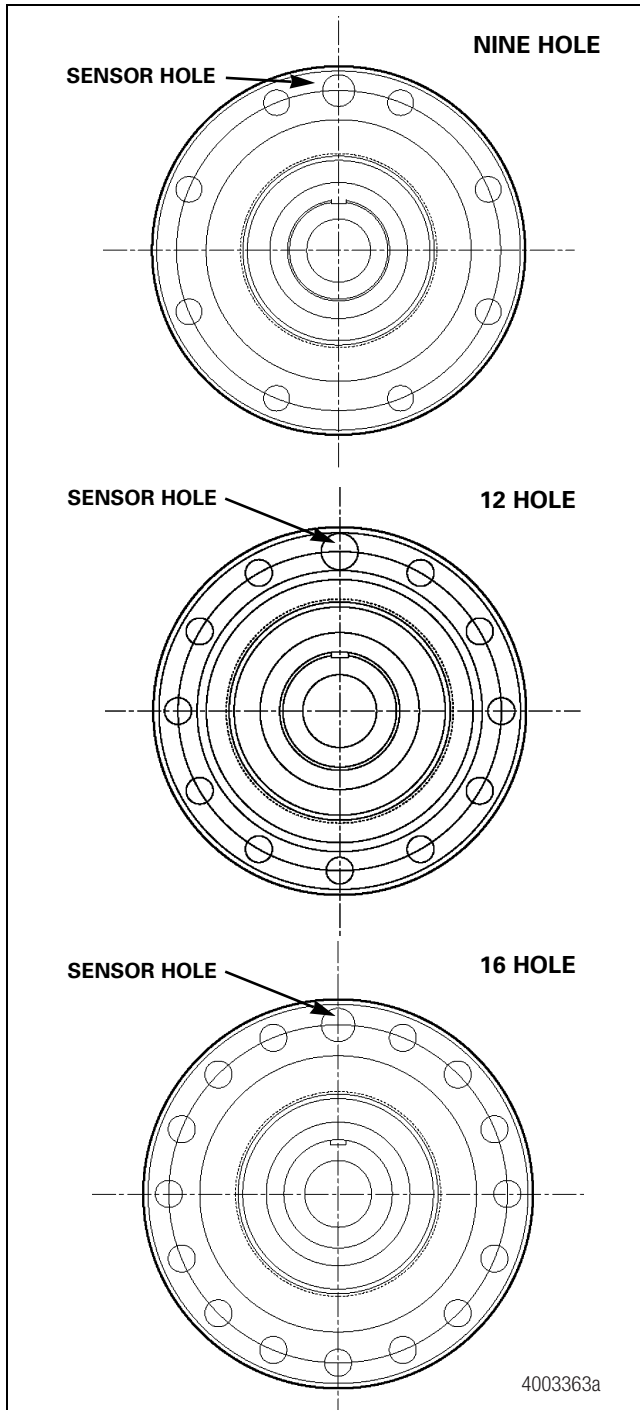


Figure 13.18

14 Lubrication

Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this 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 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.

Lubrication

Lubricants increase the efficiency and extend the life of mechanical components by providing a lubricating film which:

- Reduces friction and wear
- Removes heat
- Inhibits corrosion
- Flushes contaminants away from moving parts

Many service problems can be traced to incorrect lubrication procedures; therefore, it is essential that trailer axle and brake components be filled:

- To the correct capacity
- With the specified lubricants
- At the required maintenance intervals

Refer to Maintenance Manual 1, Lubrication, for additional information on lubricants specified for Meritor trailer axles and brakes. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

Seals protect components by keeping lubricants in and contaminants out. Seals should be periodically inspected for wear, damage or leaks. Note that many lubricants are colorless or semi-transparent and are difficult to see.

The use of synthetic lubricants is approved, provided they meet Meritor specification requirements. Note that these lubricants must either be compatible with standard commercial seals or special seals must be used.

Cam Brakes

The following provides information on lubricating Meritor cam brake components installed onto trailer axles.

Specified lubrication intervals are for standard-duty on-highway service. Lubricate more frequently for heavy-duty on-highway, off-highway and combined on/off-highway service.

Lubricants to be used are specified in the tables in this section.

CAUTION

Grease or oil on the brake rotors, drums or linings can cause poor brake performance. If lubricant contaminates brake components, be sure to clean the brake rotors or brake drums and replace contaminated linings.

Cam Bushings and Meritor Slack Adjusters

Lubricate the camshaft bushings and Meritor automatic slack adjusters as specified in Section 5.

Three possible lubrication schedules are shown below. Use the one that gives the most frequent interval.

- The schedule of chassis lubrication used by your fleet
- The schedule of chassis lubrication recommended by your vehicle manufacturer
- A minimum of four times during the life of the brake linings

Camshaft Splines

Lubricate the entire area of the spline in contact with the slack adjuster.

Lubricate when the brake is disassembled or as necessary.

Anchor Pins

Lubricate the anchor pins where they touch the brake shoes.

Lubricate when the brake is disassembled or as necessary.

Shoe Rollers

Lubricate the rollers where they touch the brake shoes. Do not get grease on the outer diameter of the roller that touches the cam head.

Lubricate when the brake is disassembled or as necessary.

Slack Adjuster Clevis Pins

Lubricate the entire pin.

Lubricate when the brake is disassembled or as necessary.

Camshaft Bushings

Apply the specified grease at the grease fitting on the spider. Apply grease until new grease purges from all the seals. Figure 14.1 and Table J.

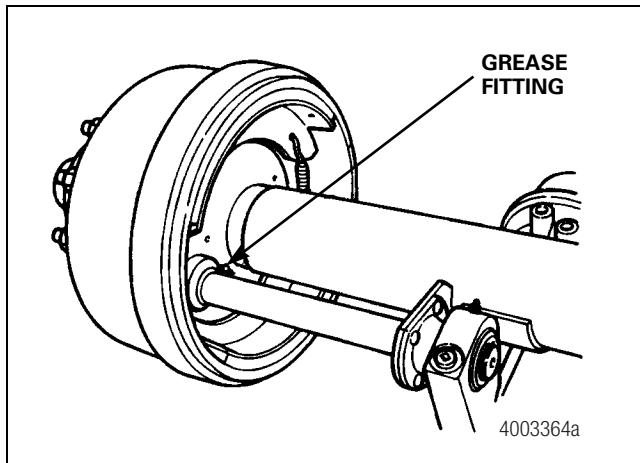


Figure 14.1

Approved Lubricants, Intervals and Specifications

Table I: Approved Lubricants

Lubricant Specification	Recommendation
0-616-A	Shell Darina Grease 1 Texaco Thermatex EP-1 Texaco Hytherm EP-1 Aralub 3837
0-617-A	Multipurpose Chassis Grease
0-617-B	
0-637	Witco Chemical Corp. SA-824946
0-641	Never-Seez Anti-Seize
0-645	Mobilgrease 28 (Military) Mobiltemp SHC 32 (Industrial) Aerospace Lubricants Inc. Tribolube 12 — Grade 1
0-692	Amoco Super Permalube, 2 Citgo Premium Lithium EP-2, 2 Exxon Ronex MP-2, 2 Kendall L-427 Super Blu, 2 Mobilith AW-1, 1 Sohio Factran EP-2, 2

⚠ WARNING

If grease flows from the seal near the cam head, replace the seal. Remove any grease or oil from the cam head, rollers and linings. Always replace contaminated linings. Grease on the linings can increase stopping distances. Serious personal injury and damage to components can result.

14 Lubrication

Table J: Cam Brake Grease Specifications

Components	Meritor Specification	NLGI Grade	Grease Type	Outside Temperature
Retainer Clips Anchor Pins Roller, Journals Only, Camshaft Bushings	0-616-A	1	Clay Base	Down to –40°F (–40°C)
When the brake is disassembled, or when necessary, lubricate the anchor pins and rollers where they touch the brake shoes.	0-617-A or	1	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
	0-617-B	2		
Do not allow grease to come in contact with the part of the cam roller that touches the cam head. Refer to the WARNING above.	0-645	2	Synthetic Oil, Clay Base	Down to –65°F (–54°C)
	Any of Above	Refer to Above	Refer to Above	Refer to Above
Camshaft Splines	0-637*	1-1/2	Calcium Base	Refer to the grease manufacturer's specifications for the temperature service limits.
	0-641	—	Anti-Seize	

* Do not mix 0-637 calcium-base, corrosion-control grease with other greases.

Table K: Conventional Automatic Slack Adjuster Grease Specifications

Components	Meritor Specification	NLGI Grade	Grease Type	Outside Temperature
Automatic Slack Adjuster	0-616-A	1	Clay Base	Down to –40°F (–40°C)
	0-692	1 and 2	Lithium Base	Down to –40°F (–40°C)
	0-645	2	Synthetic Oil, Clay Base	Down to –65°F (–54°C)
Clevis Pins	Any of Above	Refer to Above	Refer to Above	Refer to Above
	0-637*	1-1/2	Calcium Base	Refer to the grease manufacturer's specifications for the temperature service limits.
	0-641	—	Anti-Seize	

* Do not mix 0-637 calcium-base, corrosion-control grease with other greases.

Wheel-End Maintenance

This section provides information on lubricating Meritor trailer axle wheel ends with either grease or oil. Figure 14.2.

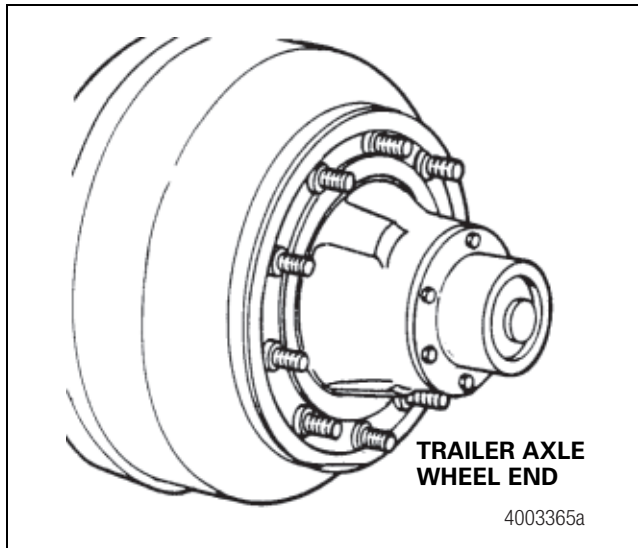


Figure 14.2

Oil-Lubricated Wheel Ends

The most common oils used in Meritor trailer axle wheel ends have a designation of API-GL-5 (American Petroleum Institute — Gear Lubricant 5). This oil is also approved under military specification MIL-2105D. Refer to Table L.

In addition to the GL-5 oils listed, oils with API grades GL-1, GL-2, GL-3 and GL-4 can also be used in trailer axle wheel ends. These oils cannot be used in drive axles, or any application which employs hypoid, amboid, spiral, bevel or planetary gearing.

Oil viscosity should be suitable for the climate in which the axle will be operated. Do not use thinning agents such as kerosene, gasoline or other solvents that lower the viscosity of lubricants.

- Low viscosity single grade gear oils, such as SAE 75W (Society of Automotive Engineers), should only be used in cold climates. Oil seals must be in excellent condition when using low viscosity oils to ensure against loss of these thin fluids.
- Multigrade oils, such as 80W/90, should be used where vehicles operate in both warm and cold climates.

Guidelines

Service environment, mileage, speed and axle load are some factors that determine how often you should change wheel-end lubricant. For example, a heavy-service application, such as an off-highway dump trailer, stresses the lubricant, and requires you to perform wheel-end maintenance more frequently.

Refer to the following table for guidelines.

Linehaul and General Service	Change the lubricant at every 100,000 miles (160 934 km) or 12 months, whichever comes first.
Heavy Service	Change the lubricant at every 30,000 miles (48 280 km) or six months, whichever comes first.
Conditions That Require a Lubricant Change	The lubricant is contaminated. The spoke wheel or hub has been removed, which disrupts the lubricant.

Lubricate the Wheel End

Also refer to Table L, Conventional Trailer Axle Wheel-End Oil Change Intervals and Specifications; and Section 5, Assembly and Installation, for procedures to install seals, bearings, hubcaps and hubs.

1. Coat the bearing cones with oil.
2. Apply a light film of NLGI 1 or 2 grease, not oil, to the axle spindle bearing journals to help protect them from fretting corrosion. Figure 14.3.

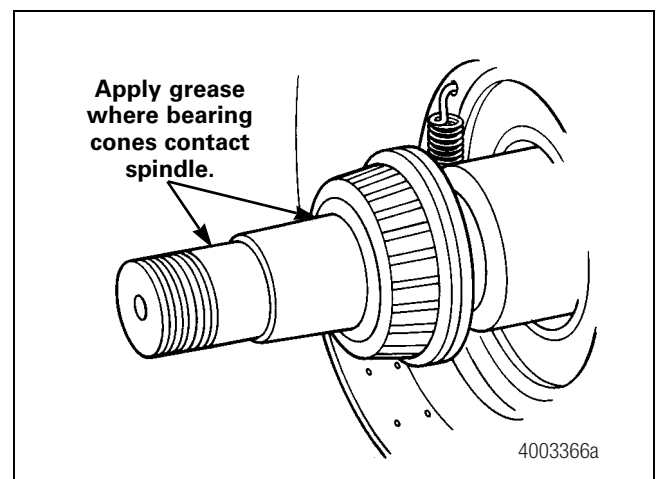


Figure 14.3

14 Lubrication

⚠ CAUTION

It is important not to overfill the wheel-end cavity with lubricant. Wheel-end oil level should never exceed the middle of the hubcap. Also, verify that any excess oil is wiped away since it can contaminate the brake linings and cause poor brake performance.

3. Fill the wheel end with an approved gear oil to the hubcap fill line. The oil must be given sufficient time to settle prior to a final check of the oil level. This is especially important in cold conditions. Figure 14.4.

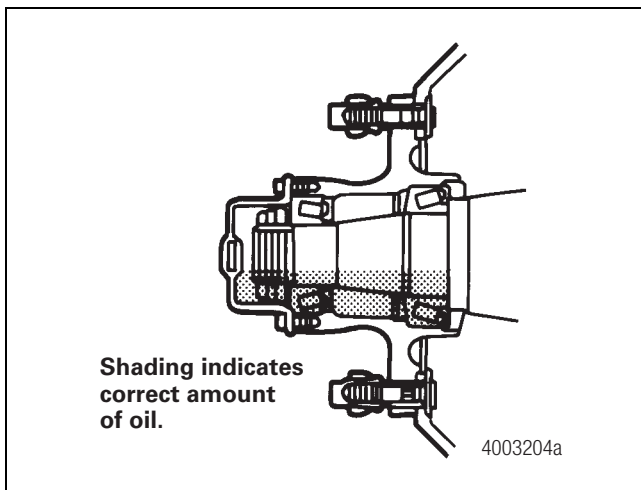


Figure 14.4

4. Inspect the wheel-end oil level at least every 1,000 miles (1600 km). To check, verify that the vehicle is on level ground, then clean the hubcap window and observe the oil level. Add lubricant if the oil level is down more than 0.25-inch (6.3 mm) from the full line. Figure 14.5.

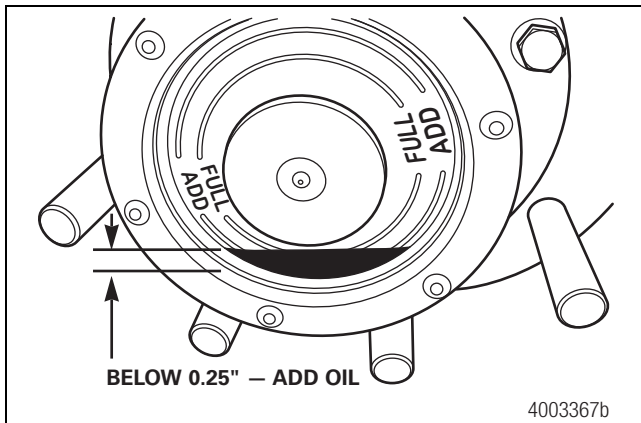


Figure 14.5

Grease-Lubricated Wheel Ends

The most common greases used in Meritor trailer axle wheel ends have a designation of NLGI (National Lubricating Grease Institute) grade 1 or 2. Refer to Table M.

Refer to the grease manufacturer specifications for temperature service limits.

Grease recommendations are based on commercial products that have given satisfactory results under normal conditions. There are, however, many proprietary grease products on the market that will perform satisfactorily and may be preferable because of supply problems or common usage with other vehicle components. Where such products are recommended by reputable suppliers for the specific lubrication of our components, Meritor has no objections, provided that these substitute products are equal to or better than the Meritor recommendations in regard to lubrication properties, water resistance, corrosion protection, high and low temperature characteristics, oxidation stability, shear stability, etc. All substitute products are subject to Meritor approval.

Guidelines

Service environment, mileage, speed and axle load are some factors that determine how often you should change wheel-end lubricant. For example, a heavy-service application, such as an off-highway dump trailer, stresses the lubricant, and requires you to perform wheel-end maintenance more frequently.

Refer to the following table for guidelines.

Linehaul and General Service	Change the lubricant at every 100,000 miles (160 934 km) or 12 months, whichever comes first.
Heavy Service	Change the lubricant at every 30,000 miles (48 280 km) or six months, whichever comes first.
Conditions That Require a Lubricant Change	The lubricant is contaminated. The spoke wheel or hub has been removed, which disrupts the lubricant.

⚠ WARNING

Do not use gasoline to clean parts. Gasoline can explode or burn and cause serious personal injury.

To remove grease from a wheel end, use a stiff fiber brush, not steel, and kerosene or diesel fuel oil, not gasoline. Allow clean parts to dry, then wipe them with a clean, absorbent cloth. Any solvent residue must be completely wiped dry since it may either dilute the grease or prevent it from correctly adhering to the wheel-end components.

Lubricate a Wheel End with Approved NLGI 1 or 2 Grease

Refer to Table M for lubrication specifications and intervals for conventional trailer axles. Refer to Section 5 for information to install components such as seals, bearings and hubs.

1. Use a pressure packer to pack the bearing cones with grease by forcing grease into the cavities between the rollers and cage from the large end of the cone. If a pressure packer is not available, pack the bearings by hand.
2. Apply a light coat of grease to the spindle bearing journals.

⚠ CAUTION

When you lubricate the wheel-end cavity with approved grease, pack the area of the hub between the two bearings with grease only up to the smallest diameter of the bearing cups. Do not install too much grease in the wheel-end cavity. Remove excess grease, which can contaminate the brakes and affect bearing life and braking performance. Damage to components can result.

3. Pack the area of the hub between the two bearings with grease up to the smallest diameter of the bearing cups. Remove excess grease. Figure 14.6.

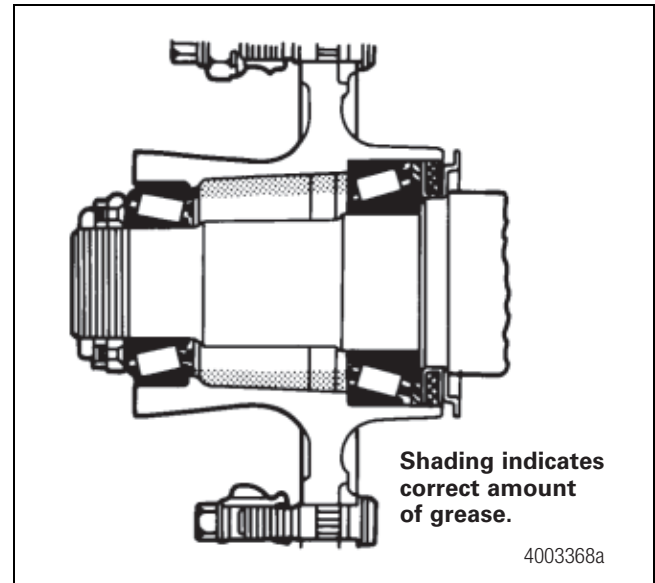


Figure 14.6

4. Install and tighten the hub retention hardware. Apply a light coat of approved NLGI 1 or 2 grease to the hubcap interior and across the face of the outer locknut. This will indicate that NLGI 1 or 2 grease was used, as well as help prevent corrosion of these parts.

Lubricating a Wheel End with Approved NLGI 00 Grease

To lubricate a wheel end with approved NLGI 00 grease, Table M, refer to the following.

Detailed information for installing components such as seals, bearings and hubs is located in Section 5.

1. Pack the bearing cones with grease by forcing grease into the cavities between the rollers and cage from the large end of the cone. The use of a pressure packer is recommended; otherwise, pack the bearings by hand.
2. Apply a light coat of synthetic grease to the spindle bearing journals. Refer to "A" in Figure 14.7.

14 Lubrication

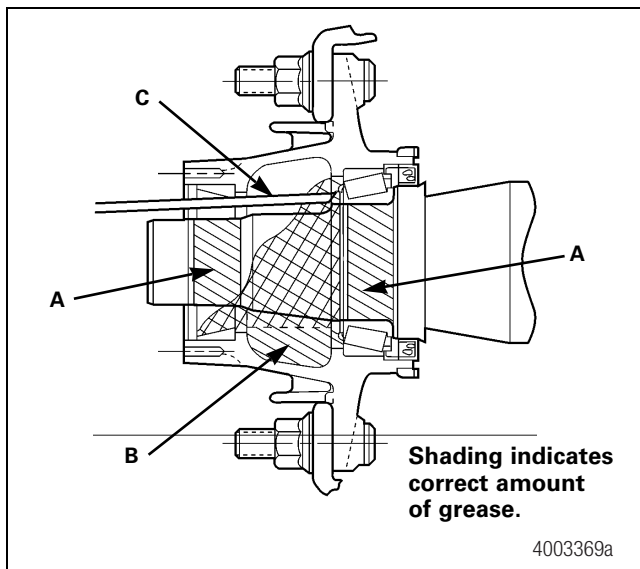


Figure 14.7

3. Install the hub onto the spindle without the outer bearing cone in place.

⚠ CAUTION

When you lubricate the wheel-end cavity with approved grease, fill the hub cavity with grease to the outer cup's smallest diameter. Do not install too much grease in the wheel-end cavity or add grease to the hubcap, which can plug the vent hole, prevent the hubcap from venting correctly, and affect bearing life and braking performance. Damage to components can result.

4. Fill the hub cavity with the approved grease to the outer cup's smallest diameter. Refer to "B" in Figure 14.7.
5. At the top of the spindle and as far back as possible, pump additional synthetic grease until it appears that the grease will run out. Install the outer bearing cone quickly. Refer to "C" in Figure 14.7.
6. The hub cavity will be filled approximately 1/3 full with grease, from the four to the eight o'clock positions. This will involve installation of approximately 1.5 pounds of grease. However, different hub designs may require that either more or less grease be installed. Figure 14.7.
7. Install and tighten the hub retention hardware. Apply a light coat of approved NLGI 00 grease across the face of the outer locknut. This will indicate that NLGI 00 grease was used, as well as help prevent corrosion of these parts. Do not install grease in the hubcap.

Conventional Trailer Axle Wheel-End Lubrication Intervals and Specifications

Table L: Conventional Trailer Axle Wheel-End Oil Change Intervals and Specifications

Check Oil Level	Oil Change*	Meritor Specification	Specification Approval	Oil Description	Outside Temperature			
					°F		°C	
					Min.	Max.	Min.	Max.
1,000 miles (1600 km)	Linehaul and General Service: For 100,000 miles (160 000 km) or more a year, change the oil every 100,000 miles (160 000 km). For less than 100,000 miles (160 000 km) a year, change the oil once a year.	0-76-A Gear Oil	MIL-PRF-2105 -E and SAE J2360	GL-5 SAE 85W/140	-10	None	-12	None
		0-76-D Gear Oil		GL-5 SAE 80W/90	-15	None	-26	None
		0-76-E Gear Oil		GL-5 SAE 75W/90	-40	None	-40	None
		0-76-J Gear Oil		GL-5 SAE 75W	-40	35	-40	2
		0-76-L Gear Oil		GL-5 SAE 75W/140	-40	None	-40	None
		0-76-M Full-Synthetic Gear Oil		GL-5 SAE 75W/140	-40	None	-40	None
		0-76-N Full-Synthetic Gear Oil		GL-5 SAE 75W/90	-40	None	-40	None
		0-81 Full-Synthetic Oil		SAE 50	-40	None	-40	None
	Heavy Service: For 60,000 miles (96 000 km) or more a year, change the oil every 30,000 miles (48 000 km). For less than 60,000 miles (96 000 km) a year, change the oil every six months.							
	Conditions That Require an Oil Change: Change the oil if the wheel end is disturbed during wheel or hub removal or if the oil is contaminated.							

* The recommended greasing interval is based on operating conditions, mileage, speeds and loads. Limited service applications may allow the recommended interval to be increased. Severe or heavy service applications may require the recommended interval to be reduced. For more information, contact ArvinMeritor's Customer Service Center at 800-535-5560.

14 Lubrication

Table M: Conventional Trailer Axle Greasing Intervals and Specifications

Greasing Interval*	Grease	Meritor Specification	NLGI Grade	Grease Description	Outside Temperature
Linehaul and General Service: For 100,000 miles (160 000 km) or more a year, grease the bearings every 100,000 miles (160 000 km). For less than 100,000 miles (160 000 km) a year, grease the bearings once a year.	Multi-Purpose Grease	0-617-A or 0-617-B	1 or 2	Lithium 12-Hydroxy Stearate or Lithium Complex	Refer to the grease manufacturer's specifications for the temperature service limits.
	Trailer Axle Bearing	0-647	00	Lithium Complex	

Heavy Service: For 60,000 miles (96 000 km) or more a year, grease the bearings every 30,000 miles (48 000 km). For less than 60,000 miles (96 000 km) a year, grease the bearings every six months.

Conditions That Require a Grease Change:

Grease the bearings if the wheel end is disturbed during wheel or hub removal or if the grease is contaminated.

* The recommended greasing interval is based on operating conditions, mileage, speeds and loads. Limited service applications may allow the recommended interval to be increased. Severe or heavy service applications may require the recommended interval to be reduced. For more information, contact ArvinMeritor's Customer Service Center at 800-535-5560.

Torque Specifications

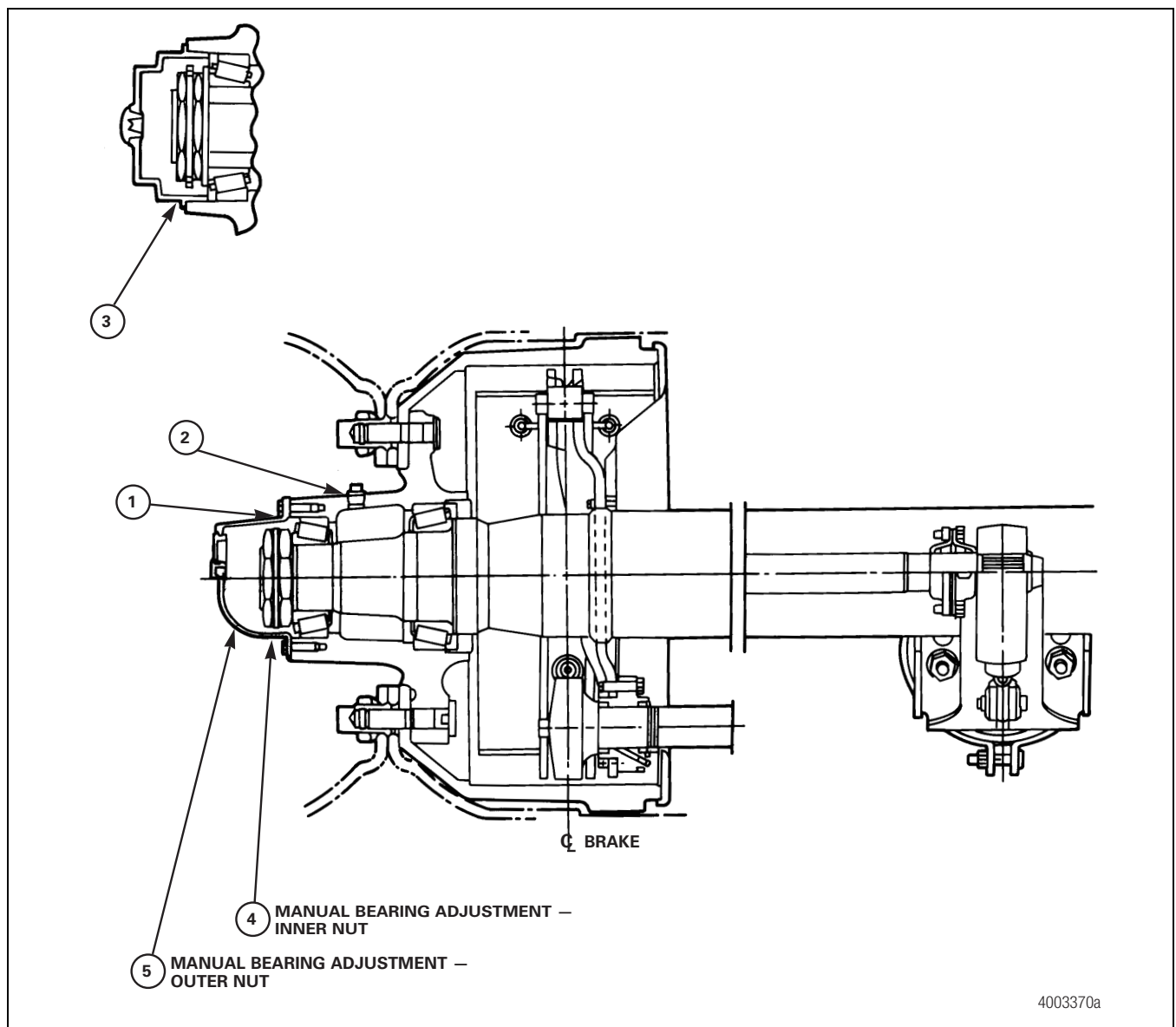


Table N: Axle Torque Values

Description	Torque Range		
	Lb-Ft	N•m	Fastener Size
1. Hubcap bolts	15-30	20-41	0.31-18
2. Hub fill plug	15-20	20-27	0.62-11 (TR Model)
3. Hubcap, screw-type	50-75	68-102	0.38-18 PTF
4. Adjustment nut, manual bearing adjustment, double nut	Tighten to 200, loosen, tighten to 50, loosen 1/4 turn.	271, 68	Size depends on axle model and adjustment method.
5. Jam nut, manual bearing adjustment	250-300	340-408	

15 Specifications

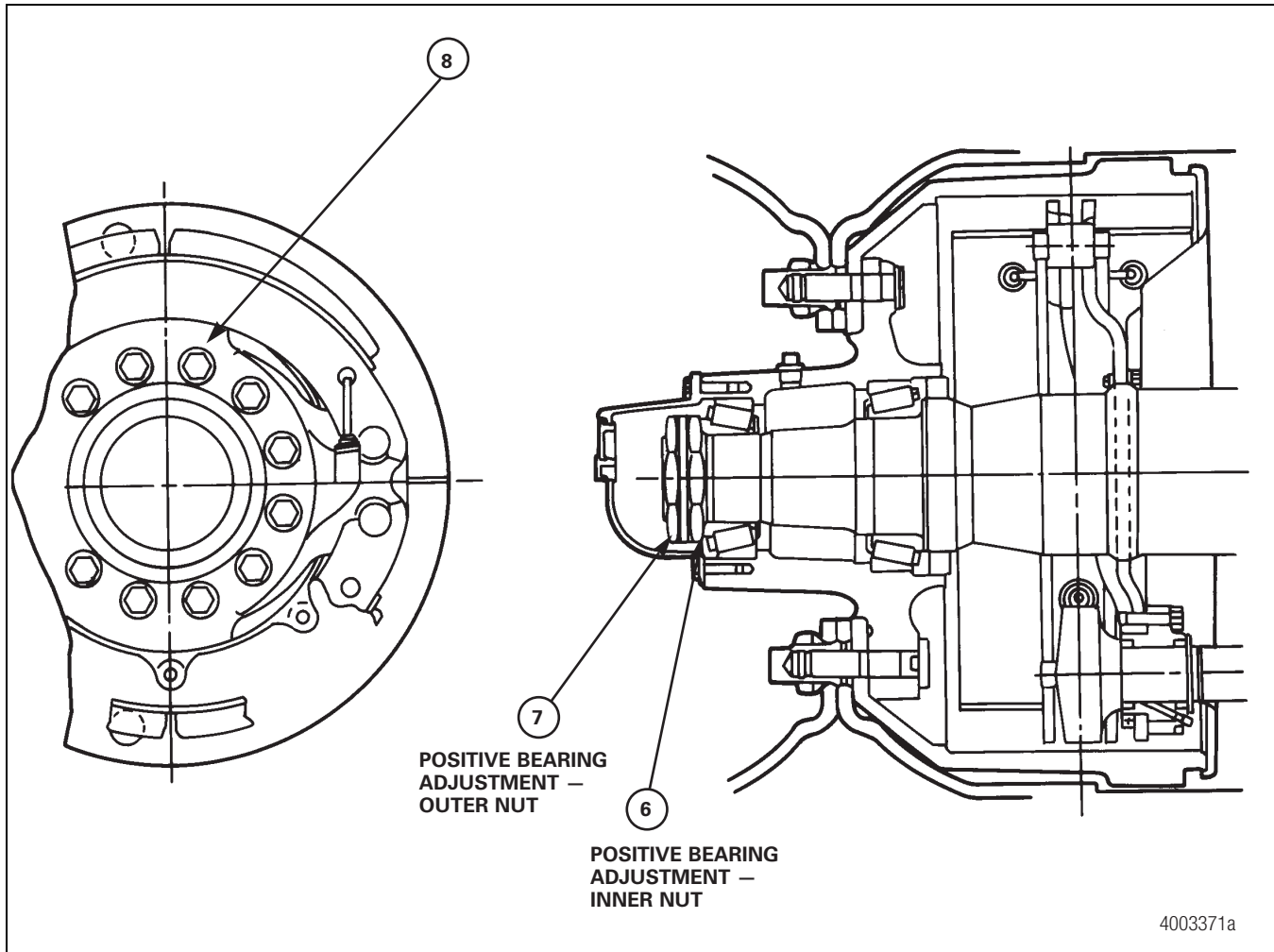
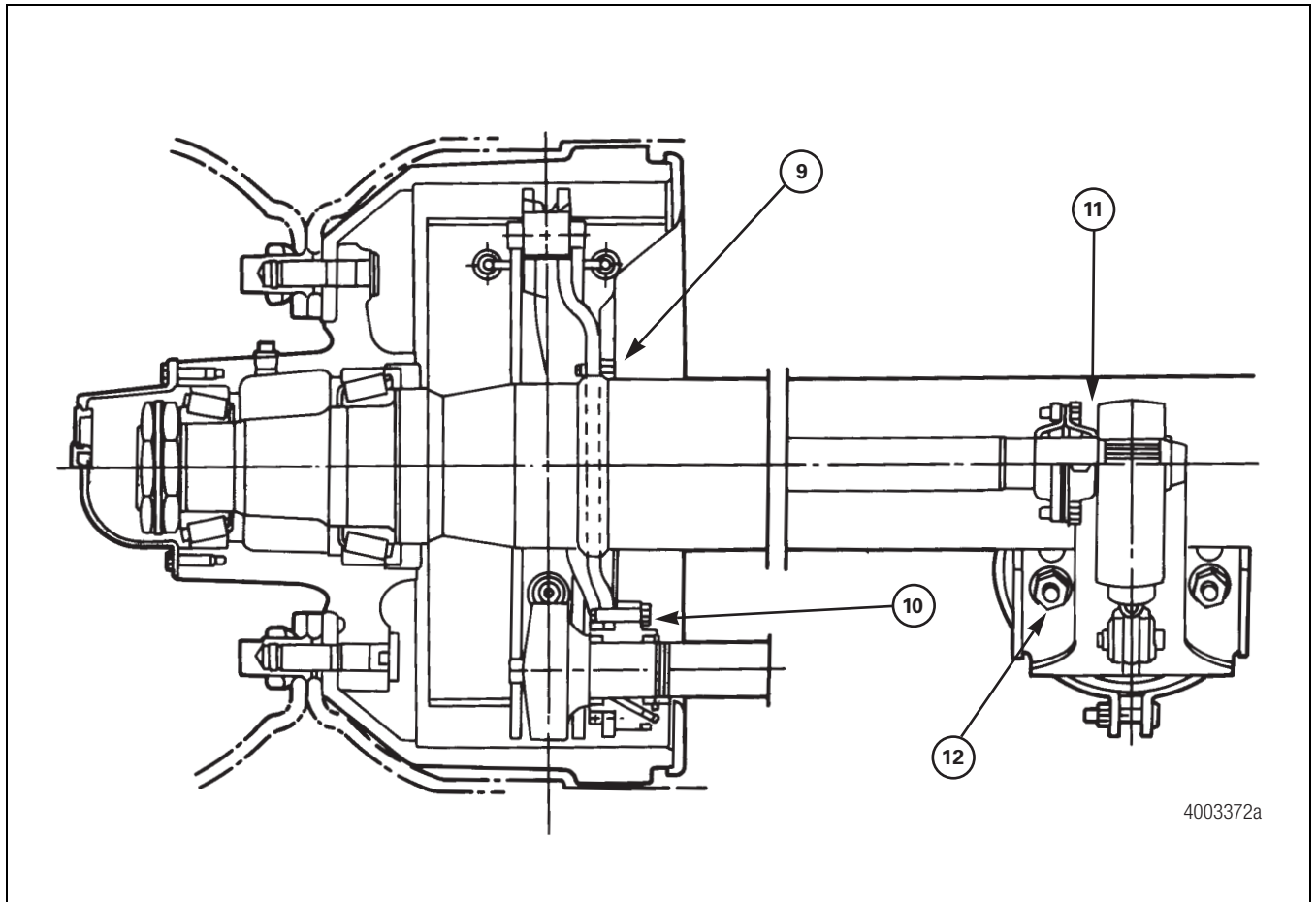


Table O: Axle Torque Values

Description	Torque Range		Fastener Size
	Lb-Ft	N•m	
6. Adjusting nut, positive bearing adjustment	250-300	340-408	Size depends on axle model and adjustment method.
7. Jam nut, positive bearing adjustment	250-300	340-408	
8. Brake mounting bolt	130-165	177-224	9/16
	180-230	245-313	5/8

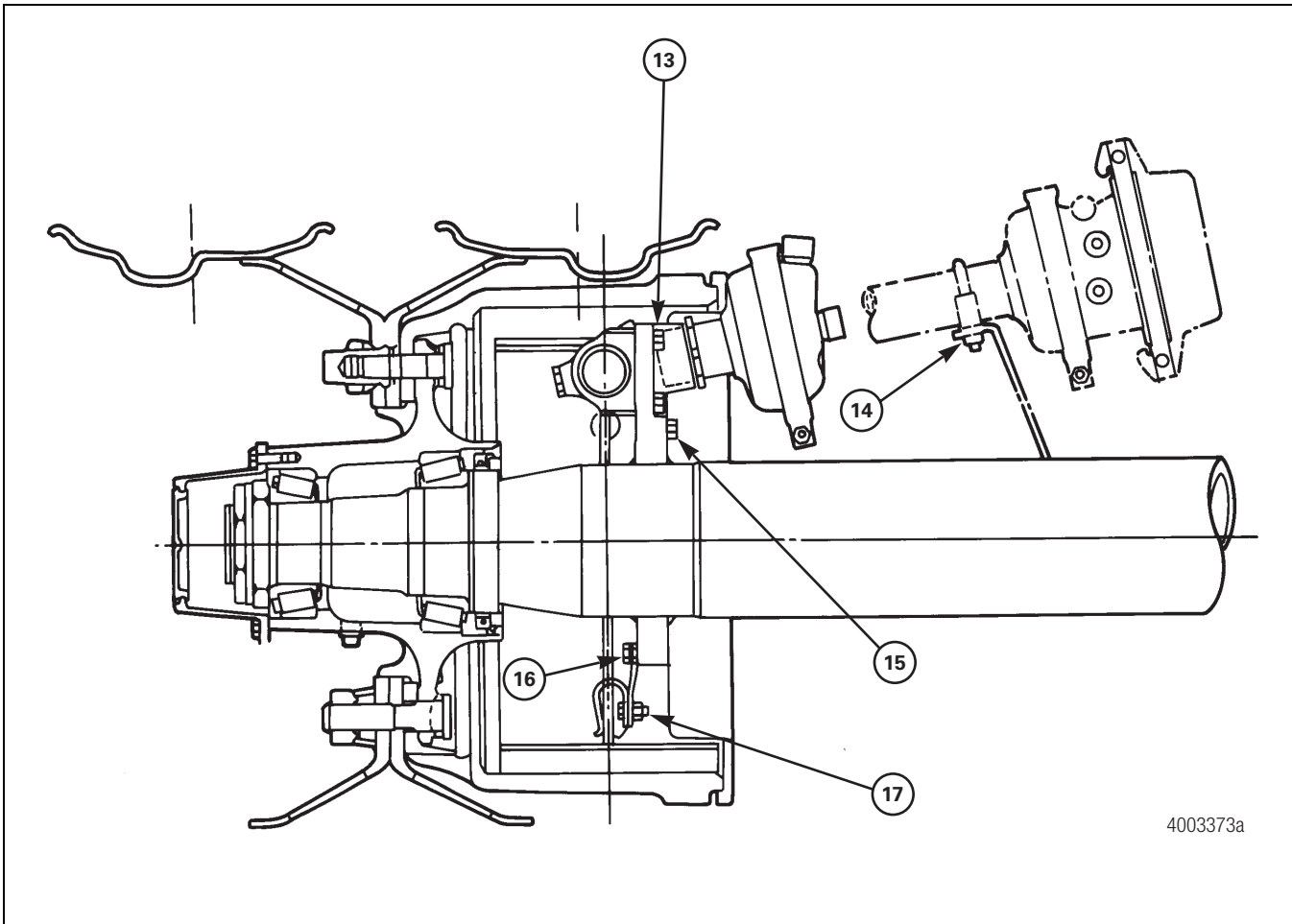


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Table P: Cam Brake Torque Values

Description	Torque Range		Fastener Size
	Lb-Ft	N•m	
9. Two-piece dust shield bolts, shown	25-35	34-48	0.38-16
10. Bolt-on bushing bolts	25-35	34-48	0.38-16
11. Cam bushing bolts	25-35	34-48	0.38-16
12. Air chamber nuts	80-125	109-170	0.62-11

15 Specifications



4003373a

Table Q: Wedge Brake Torque Values

Description	Torque Range		Fastener Size
	Lb-Ft	N•m	
13. Actuator bolts	30-40	41-54	0.38-16
14. Support locknuts	10-15	13-20	0.31-16
15. Dust shield bolts	15-20	13-20	0.38-24
16. Support bolts	30-40	41-54	0.38-24
17. Clip bolt	15-20	20-27	0.31-18

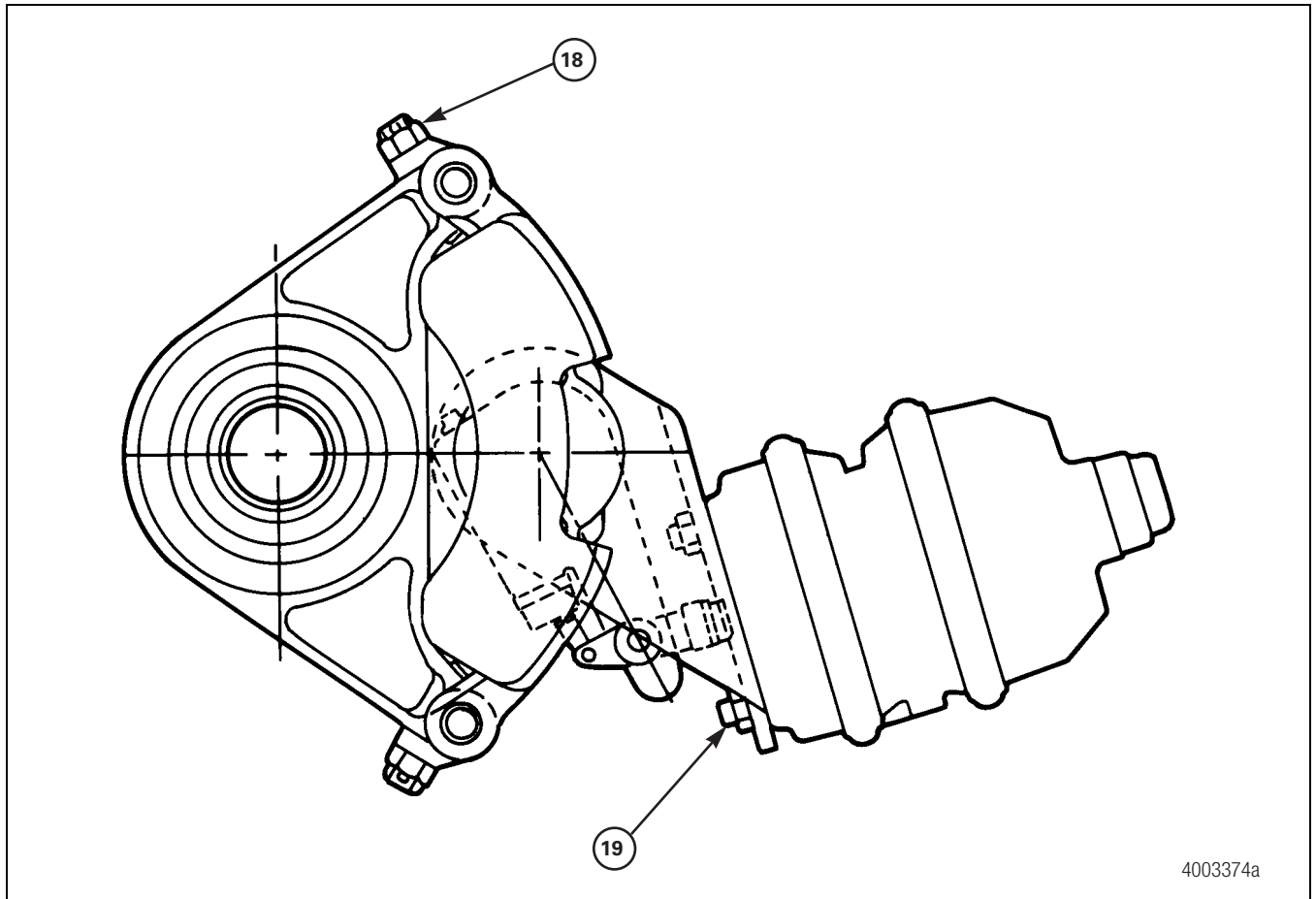


Table R: Disc Brake Torque Values

Description	Torque Range		Fastener Size
	Lb-Ft	N•m	
18. Slide pin retainer nut	60-80	82-109	0.75-16
19. Air chamber nut	80-125	109-170	0.62-11

Introduction

This publication is to acquaint and assist you in installing and operating the Watson & Chalin SP Series suspension product line and is intended for use only with this product line. This manual includes installation and operating information on Watson & Chalin model numbers:

Single Point Pedestal Mount	Single Point Straddle Mount
HDTS	HDSM
LWTS	LWSM
HDUS	HDSMUS
LWUS	LWSMUS
HDTSR	HDSMR
LWTSR	LWSMR
HDUSR	PPSM
LWUSR	SMRPAR

Watson & Chalin reserves the right to change its products or manuals at any time. Contact Watson & Chalin at 1.800.445.0736 for information on recent changes to products.

Defective or damaged components should be returned to Watson & Chalin with a pre-arranged Returned Goods Authorization (RGA) number through the Warranty Department. The damaged or defective component may then be replaced; when in compliance with warranty conditions.

Important

The entire manual must be read and understood before proceeding with installation or service of any components.

This manual should be used in conjunction with corresponding drawings that come with Watson & Chalin suspensions upon delivery.

Any changes to the trailer frame must be approved by the manufacturer before the changes are done. Cutting or altering the vehicle's frame is normally not permitted and affects the warranty coverage.

Installer Responsibility

The installer of the suspension system must:

- ensure that the trailer will function properly with the new suspension.
- ensure that beams, crossmembers and suspension attachment are adequate for the suspension.
- determine the correct location of the suspension to provide the proper load distribution as to not exceed the rated capacity of the components involved.
- ensure the installation of the correct brake system components to guarantee proper braking performance.
- ensure axles are welded properly to suspension if purchasing axles separate or not purchasing pre-welded by Watson & Chalin

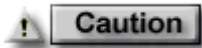
Before You Begin

Before you begin to install the Watson & Chalin suspension system, you must:

- Check your company specifications on suspension systems to be sure that the correct suspension system was chosen for the trailer.
- Verify the frame width is within the allowable mounting range of the suspension and that the trailer crossmembers are correctly positioned.
- Mark the location of the suspension and check for interferences with existing components.

Safety Explanations

Watson & Chalin uses the following types of notes to warn against possible safety problems and to give information that helps to prevent damage to equipment.



A caution indicates hazards or unsafe practices which could result in damage to equipment or minor personal injury if the procedure is not followed exactly.



A WARNING INDICATES HAZARDS OR UNSAFE PRACTICES WHICH COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH IF THE PROCEDURE IS NOT FOLLOWED EXACTLY.

Important

An important message which indicates that the procedure should be followed exactly.

All safety statements should be read carefully to prevent bodily injury, to assure that parts are assembled properly, and to retain the manufacturer's warranty.

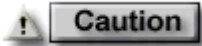
Cautions & Warnings



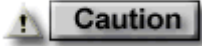
PROPER AXLE ATTACHMENT WELDS ARE REQUIRED FOR SAFE OPERATION OF THE VEHICLE.



NO ALTERATION OF ANY WATSON & CHALIN SUSPENSION COMPONENTS IS PERMITTED WITHOUT PROPER AUTHORIZATION FROM QUALIFIED WATSON & CHALIN PERSONNEL.



No welding of any suspension components is permitted except when specified by Watson & Chalin.



Do not add lubrication to any air control systems as it can cause damage.

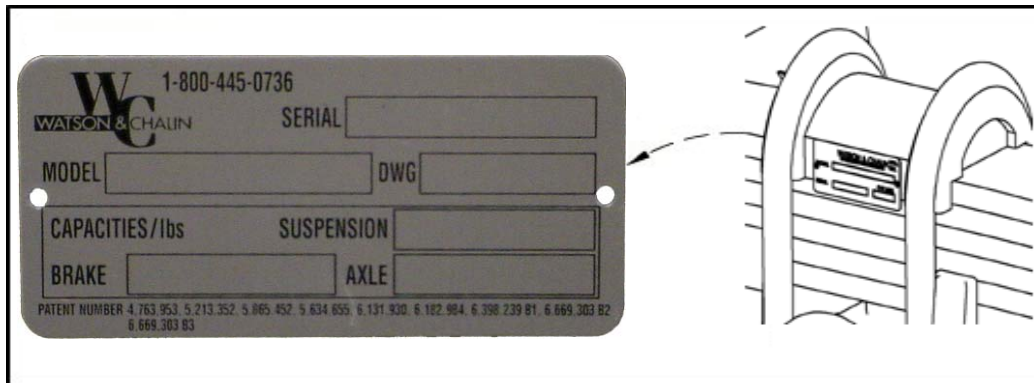
Identifying Your Model

It is important that you know what model number has been assigned to your assembly in case you ever need to contact Watson & Chalin.

Identification Plate

Each assembly has an identification plate located near the spring cap of the suspension (see below), on the driver's side of the vehicle, which identifies it. The plate includes the model number, serial number, and capacity in pounds for the assembly. It is important to record the model number for future reference.

Figure 1: Identification Plate



Parts List

The following section shows exploded views of various SP Series suspensions and corresponding parts lists that describe each of the numbered parts. Some Single Point series models also have an additional table that corresponds to the main parts list. The exploded views of the Single Point, the parts lists and the corresponding tables are intended to help you identify parts and part numbers that may need to be replaced.

Note

Some part numbers need more explanation; therefore, references have been given as a link to lead you to more details. Click the link to jump to the information or go to the page that contains the referenced information.

Figure 2: Exploded View-TS Single Point

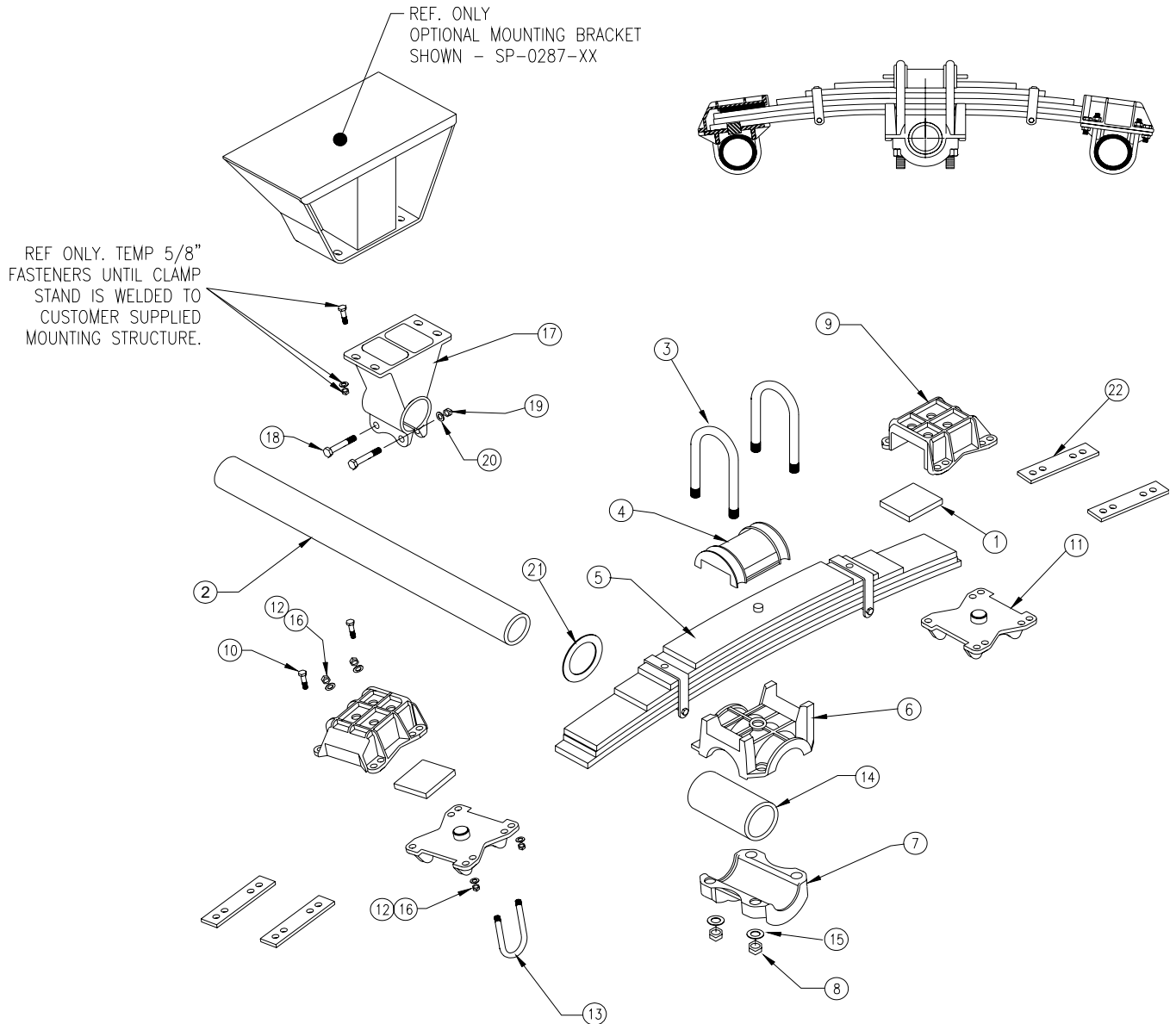


Table 1 TS Single Point Parts List

Item #	Description	Quantity	Part #
1	Polyurethane Pad	4	SP-0193
2	Trunnion Tube	1	Part number depends on spring centers
3	U-bolt	4	See Chart 1

SP Series

Item #	Description	Quantity	Part #
4	Spring Cap	2	SP-0003
5	Spring	2	See Chart 1
6	Trunnion Cap/Spring Seat	2	SP-0001
7	Trunnion Cap	2	SP-0006
8	High Nut 1.125 UNF. Grade 8	8	10003
9	Cap Spring End	4	See Chart 1
10	Capscrew .625 X 2.00 UNF. Grade 8	16	10034
11	Axle Seat/Spring Pin Assembly	4	See Chart 1
12	Locknut .625 UNF. Grade 8	32	10029
13	U-bolt	8	See Chart 1
14	Polyurethane Bushing	2	SP-0192
15	Washer, 1.125 Hardened	8	10045
16	Washer, .625 Hardened	32	10032
17	Trunnion Clamp Stand	2	See Chart 1A
18	Capscrew .75 UNF. 5.0 Long Grade 8	4	10033
19	Locknut, .75 UNF Grade C	4	10028
20	Flat Washer, .75 Hardened	4	10043
21	Washer Flat 4.12X6.00X.12	2	SP-0038
22	Shim Spacer .25" End Cap	8	See Chart 1

Chart 1

Model	Item 3	Item 5	Item 9	Item 11		Item 13		Item 22
				5" Rd Axle	5" Sq Axle	5" Rd Axle	5" Sq Axle	
HDS44	SP-0023	SP-0056	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	N/A
HDS50	SP-0023	SP-0057	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	N/A
HDS60	SP-0022	SP-0243	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	N/A
LWTS44	SP-0023	SP-0058-01	SP-0016	SP-0036	SP-0048	SP-0021	SP-0052	N/A
LWTS50	SP-0023	SP-0061	SP-0016	SP-0036	SP-0048	SP-0021	SP-0052	SP-0083
LWTSPAR50	SP-0249	SP-0056	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	SP-0083
HDS70	SP-0187	SP-0170	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	N/A
HDS70-60AC	SP-0187	-	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	N/A

Chart 1A

Item 17	
Clamp Stand Height	Part No.
8.5"	SP-0009
6.5"	SP-0010
4.5"	SP-0011
2.5"	SP-0012

Figure 3: Exploded View-SM Single Point

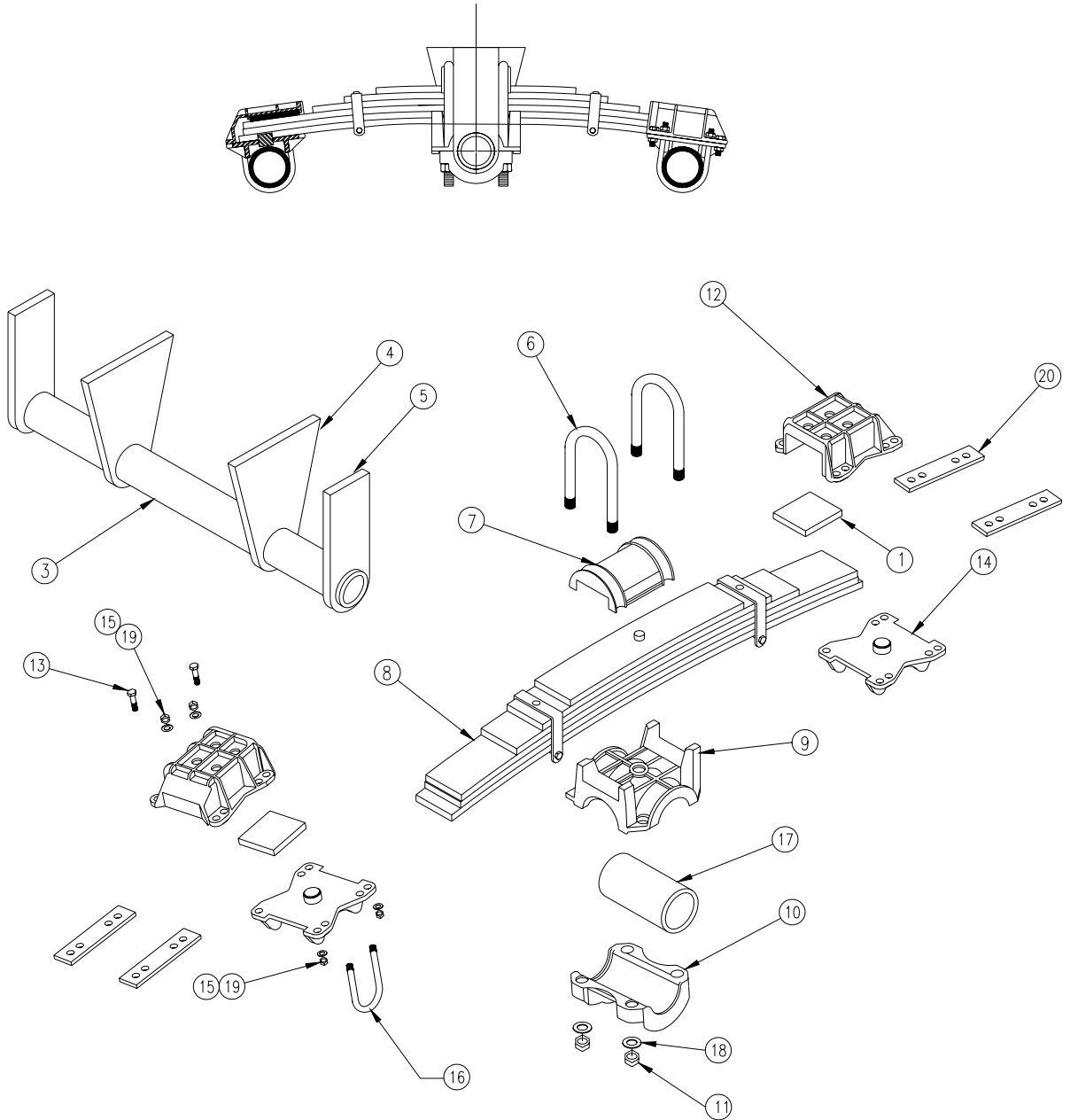


Table 2 SM Single Point Parts List

Item #	Description	Quantity	Part #
1	Polyurethane Pad	4	SP-0193
2	-	-	-
3	Straddle Trunion Tube Assembly	1	Part number depends on spring centers
4	Inner Straddle Plate	1	Application Specific
5	Outer Straddle Plate	1	Application Specific
6	U-bolt	4	See Chart 2

SP Series

Item #	Description	Quantity	Part #
7	Spring Cap	2	SP-0003
8	Spring	2	See Chart 2
9	Trunnion Cap/Spring Seat	2	SP-0001
10	Trunnion Cap	2	SP-0006
11	High Nut 1.125 UNF. Grade 8	8	10003
12	Cap-spring End	4	See Chart 2
13	Capscrew .625 X 2.00 UNF. Grade 8	16	10034
14	Axle Seat/Spring Pin Assembly	4	See Chart 2
15	Lock Nut .625 UNF. Grade C	32	10029
16	U-bolt	8	See Chart 2
17	Polyurethane Bushing	2	SP-0192
18	Washer 1.125 Hardened	8	10045
19	Washer .625 Hardened	32	10032
20	Shim Spacer .25" End Cap	8	See Chart 2

Chart 2

Model	Item 6	Item 8	Item 12	Item 14		Item 16		Item 20
				5" Rd. Axle	5" Sq Axle	5" Rd Axle	5" Sq Axle	
HDSM44	SP-0023	SP-0056	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	N/A
HDSM50	SP-0023	SP-0057	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	N/A
HDSM60	SP-0022	SP-0243	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	N/A
LWSM44	SP-0023	SP-0058-01	SP-0016	SP-0036	SP-0048	SP-0021	SP-0052	N/A
LWSM50	SP-0023	SP-0061	SP-0016	SP-0036	SP-0048	SP-0021	SP-0052	SP-0083
LWSMPAR50	SP-0249	SP-0238	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	SP-0083
HDSM70	SP-0187	SP-0277	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	N/A
LWSM44-18-5R-60	SP-0023	SP-0212	SP-0007	SP-0036	SP-0048	SP-0021	SP-0052	N/A

Figure 4: Exploded View–SMR PAR Single Point

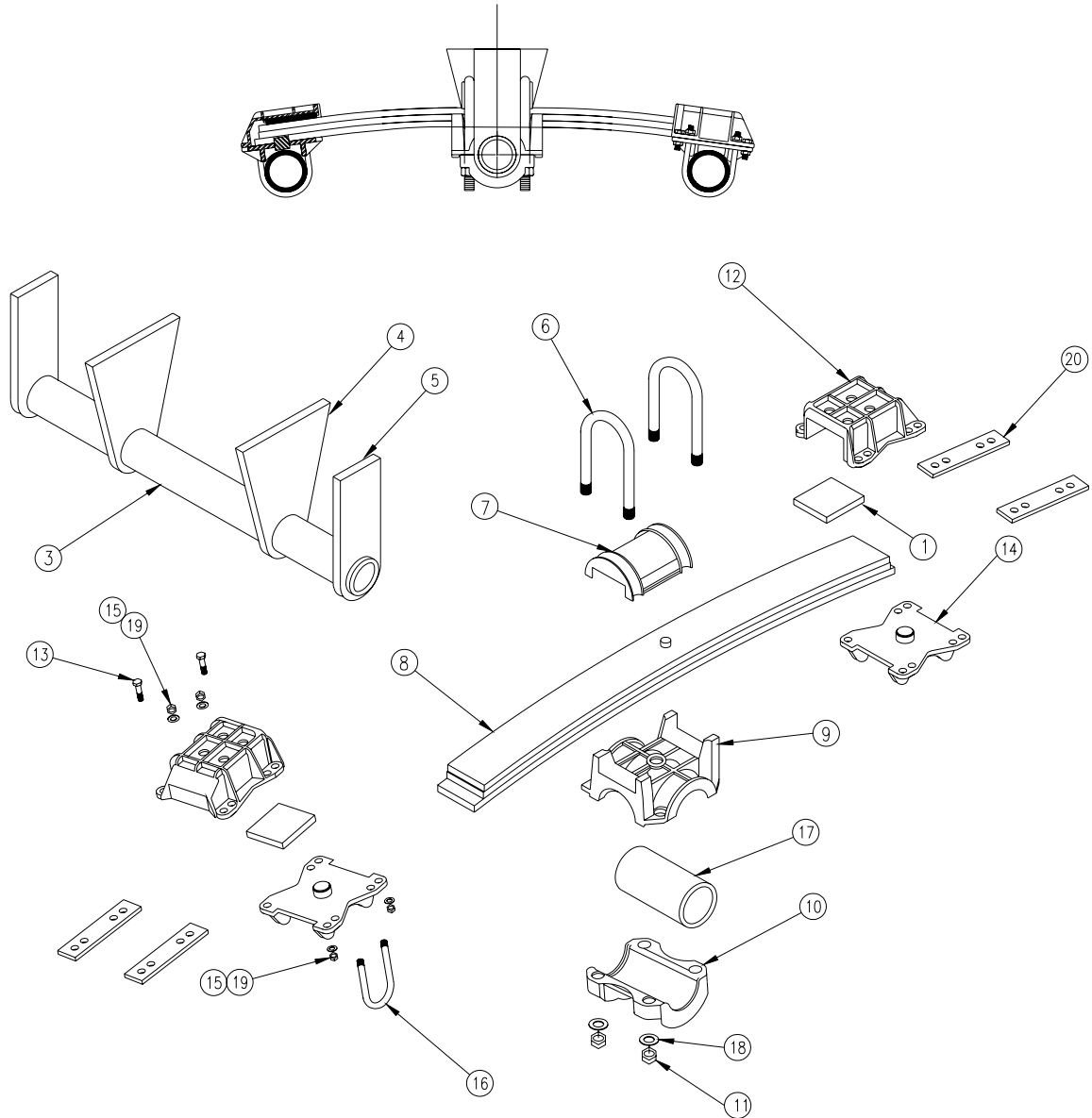


Table 3 SMR PAR Single Point Parts List

Item #	Description	Quantity	Part #
1	Polyurethane Pad	4	SP-0193
2	-	-	-
3	Straddle Trunnion Tube Assembly	1	Part number depends on spring centers
4	Inner Straddle Plate	1	Application Specific
5	Outer Straddle Plate	1	Application Specific
6	U-bolt 1.125UNFX12.5X5.75 Grade 8	4	SP-0249
7	Trunnion Cap (USR Model)	2	SP-0171
8	Spring	2	SP-0056
9	Trunnion Cap/Spring Seat	2	SP-0001

SP Series

Item #	Description	Quantity	Part #
10	Lower Spring Cap (USR)	2	SP-0177
11	High Nut 1.125 Unf.	8	10003
12	Cap-spring End	4	SP-0007
13	Capscrew .625 X 2.00 UNF. Grade 8	16	10034
14	Axle Seat/Spring Pin Assembly	4	SP-0136
15	Lock Nut .625 UNF Gr C	32	10029
16	U-bolt .62X7.72 Grade 8	8	SP-0021
17	Polyurethane Bushing	2	SP-0225
18	Washer 1.125 Hardened	8	10045
19	Washer .625 Hardened	32	10032
20	Shim Spacer .25" End Cap	8	SP-0083

Figure 5: Exploded View-US Single Point

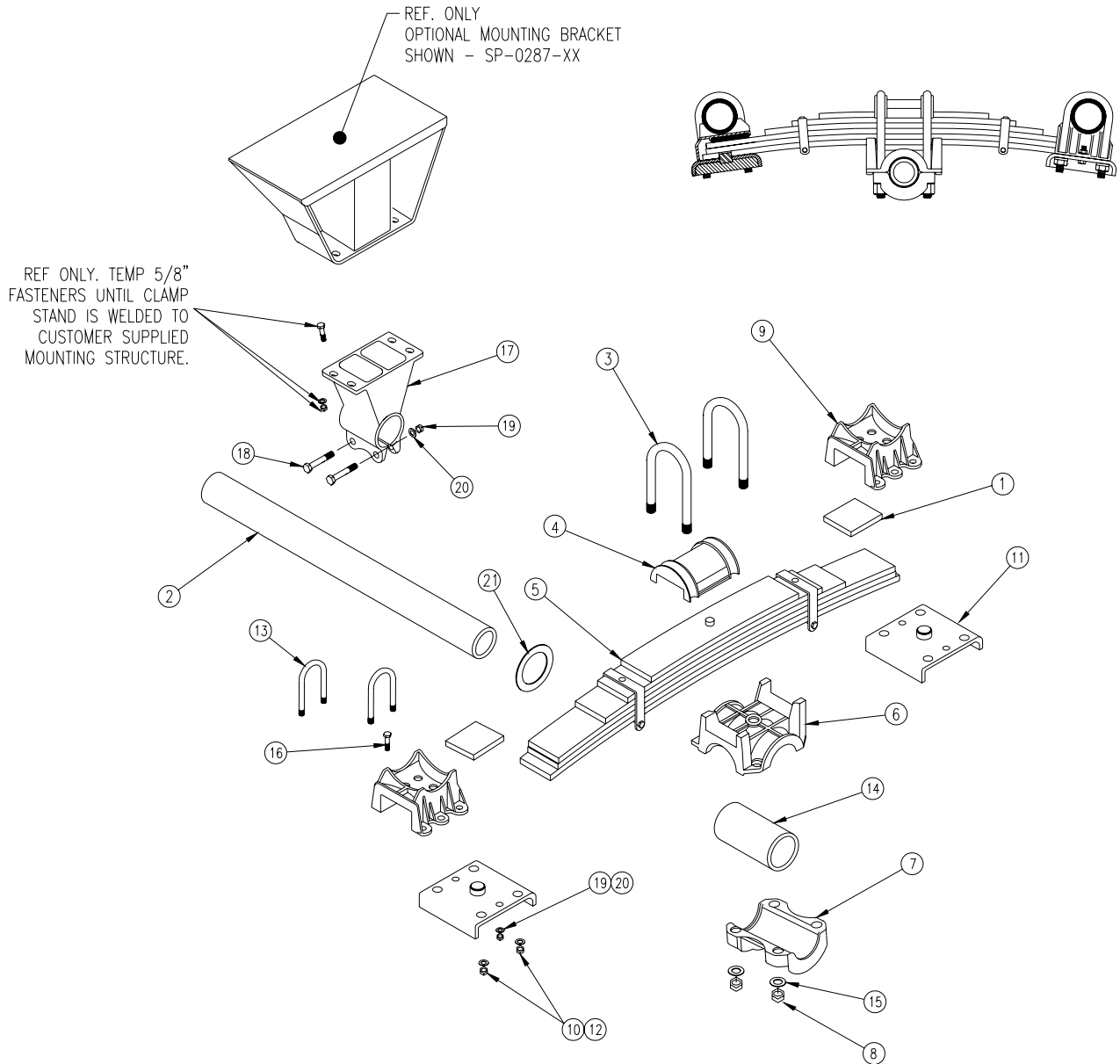


Table 4 US Single Point Parts List

Item #	Description	Quantity	Part #
1	Polyurethane Pad	4	SP-0193
2	Trunnion Tube	1	Part number depends on spring centers
3	U-bolt	4	See Chart 3
4	Spring Cap	2	SP-0003
5	Spring	2	See Chart 3
6	Trunnion Cap/Spring Seat	2	SP-0001
7	Trunnion Cap	2	SP-0006
8	High Nut 1.125 UNF Grade 8	8	10003

SP Series

Item #	Description	Quantity	Part #
9	Axle Seat/Spring End Cap	4	See Chart 3
10	High Nut 1.00 Unf.	16	See Chart 3
11	Bottom Plate / Pin Assembly	4	See Chart 3
12	Washer 1.00	16	See Chart 3
13	U-bolt	8	See Chart 3
14	Polyurethane Bushing	2	SP-0192
15	Washer 1.125 Hardened	8	10045
16	Capscrew .75 UNF 2.50 Long Grade 8	8	10896-01
17	Trunnion Clamp Stand	2	See Chart 3A
18	Capscrew .75 X 5.0 UNF Gr. 8	4	10033
19	Lock Nut .75 UNF Grade C	12	10028
20	Washer .75 Hardened	12	10043
21	Washer Flat 4.12X6.00X.12	2	SP-0038

Chart 3

Model	Item 3	Item 5	Item 9			Item 10		Item 11		Item 12		Item 13		
			5" Rd. Axle	5" Sq. Axle	5.75" Rd. Axle	5" Rd. Axle	5.75" Rd. Axle	5" Rd. Axle	5.75" Rd. Axle	5" Rd. Axle	5.75" Rd. Axle	5" Rd. Axle	5" Sq. Axle	5.75" Rd. Axle
HDUS44	SP-0023	SP-0056	SP-0013	SP-0345	SP-0327	10031	10003	SP-0029	SP-0316	17099	10045	SP-0020	SP-0348	SP-0227
HDUS50	SP-0023	SP-0057	SP-0013	SP-0345	SP-0327	10031	10003	SP-0029	SP-0316	17099	10045	SP-0020	SP-0348	SP-0227
HDUS60	SP-0022	SP-0243	SP-0013	SP-0345	SP-0327	10031	10003	SP-0029	SP-0316	17099	10045	SP-0020	SP-0348	SP-0227
HDUS70	SP-0022	SP-0277	SP-0013	SP-0345	SP-0327	10031	10003	SP-0029	SP-0316	17099	10045	SP-0020	SP-0348	SP-0227
LWUS44	SP-0022	SP-0058-01	SP-0086-01	N/A	N/A	10031	N/A	SP-0029	N/A	17099	N/A	SP-0020	N/A	N/A
LWUS50	SP-0023	SP-0061	SP-0084	N/A	N/A	10031	N/A	SP-0029	N/A	17099	N/A	SP-0020	N/A	N/A

Chart 3A

Item 17	
Clamp Stand Height	Part No.
8.5"	SP-0009
6.5"	SP-0010
4.5"	SP-0011
2.5"	SP-0012

Figure 6: Exploded View-SMUS Single Point

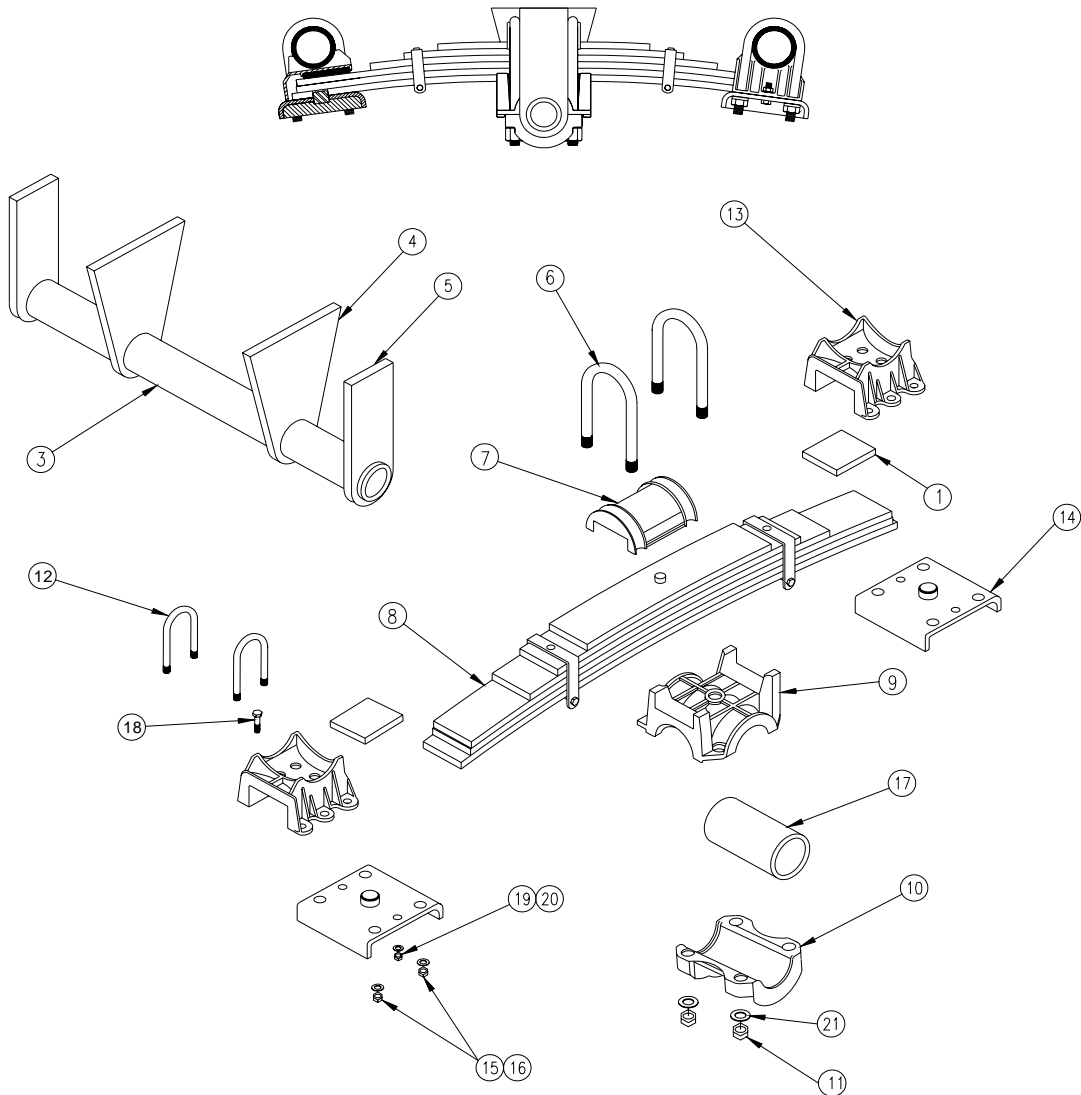


Table 5 SMUS Single Point Parts List

Item #	Description	Quantity	Part #
1	Polyurethane Pad	4	SP-0193
2	-	-	-
3	Trunnion Tube	1	Part number depends on spring centers
4	Inner Straddle Plate	1	Application Specific
5	Outer Straddle Plate	1	Application Specific
6	U-bolt	4	See Chart 4
7	Spring Center Cap	2	SP-0003
8	Spring	2	See Chart 4

SP Series

Item #	Description	Quantity	Part #
9	Trunnion Cap/Spring Seat	2	SP-0001
10	Trunnion Cap	2	SP-0006
11	High Nut 1.125 UNF Grade 8	8	10003
12	U-bolt 1.00-14X11 Grade 8	8	SP-0020
13	Axle Seat/Spring End Cap	4	See Chart 4
14	Bottom Plate Pin Assembly	4	SP-0029
15	High Nut 1.00 UNF.	16	10031
16	Washer 1.00	16	17099
17	Polyurethane Bushing	2	SP-0225
18	Capscrew .75 UNF 2.50" Long	8	10896-01
19	Flat Washer .75 Hardened	8	10043
20	Locknut .75 UNF GR C	8	10028
21	Washer. 1.125 Hardened	8	10045

Chart 4

Model	Item 6	Item 8	Item 13	
			5" Rd Axle	5" Sq Axle
HDSUSM44	SP-0023	SP-0056	SP-0013	N/A
HDSMUS50	SP-0023	SP-0057	SP-0013	N/A
HDSMUS60	SP-0022	SP-0060	SP-0013	N/A
LWSMUS44	SP-0023	SP-0058-01	SP-0086-01	N/A
LWSMUS50	SP-0023	SP-0061	SP-0084	N/A
HDSMUS70	SP-0187	SP-0170	SP-0013	N/A

Figure 7: Exploded View–SM Single Point with End Caps

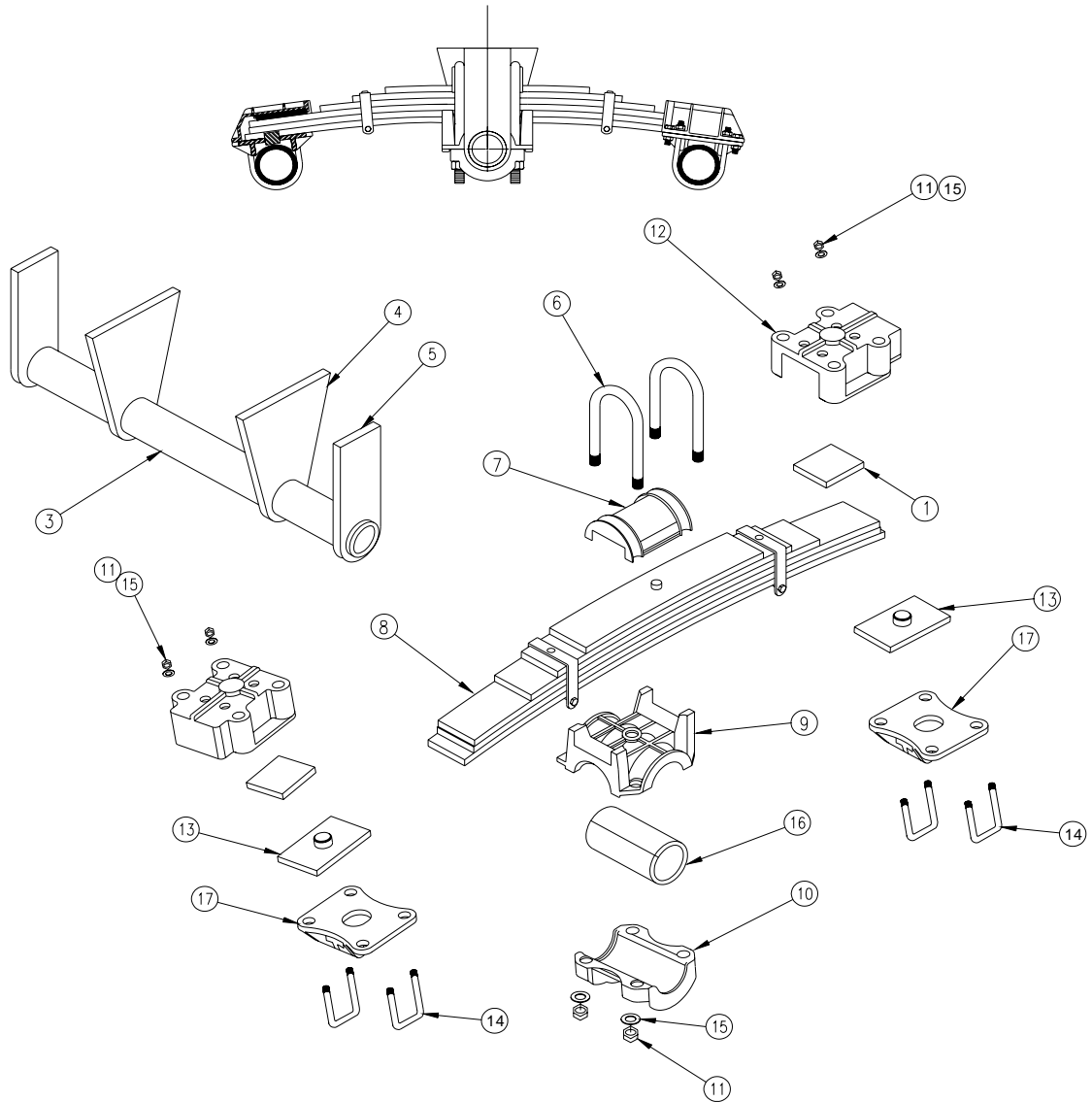


Table 6 SM Single Point with End Caps Parts List

Item #	Description	Quantity	Part #
1	Polyurethane Pad	4	SP-0039
2	-	-	-
3	Trunnion Tube	1	Part number depends on spring centers
4	Inner Straddle Plate	1	Application Specific
5	Outer Straddle Plate	1	Application Specific
6	U-bolt	4	See Chart 5
7	Spring Cap	2	SP-0003
8	Spring	2	See Chart 5
9	Trunnion Cap/Spring Seat	2	SP-0001
10	Trunnion Cap	2	SP-0006

SP Series

Item #	Description	Quantity	Part #
11	High Nut 1.125 UNF Grade 8	8	10003
12	Cap-spring End	4	SP-0015
13	Slide Plate Pin Assembly	4	SP-0195
14	U-bolt 1.12-12X12 Grade 8	8	SP-0094
15	Washer 1.125 Hardened	8	10045
16	Polyurethane Bushing	2	SP-0225
17	Axle Seat Propar 5" Dia.	4	SP-0092

Chart 5

Model	Item 6	Item 8
PPSM50	SP-0023	SP-0058
PPSM-60	SP-0022	SP-0060
PPSM-70	SP-0187	SP-0170

Figure 8: Exploded View-TSR Single Point

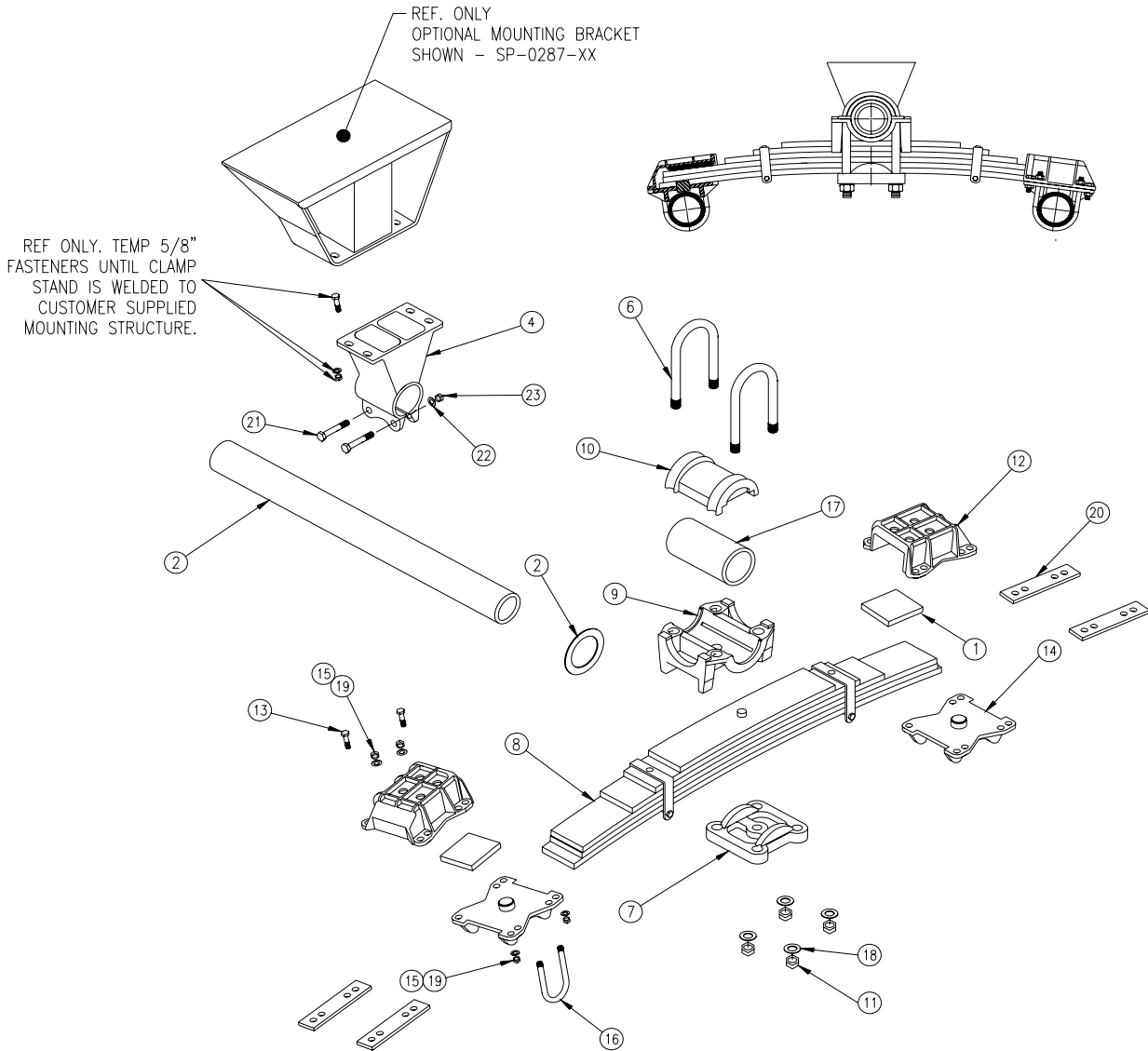


Table 7 TSR Single Point Parts List

Item #	Description	Quantity	Part #
1	Polyurethane Pad	4	SP-0193
2	Washer Flat 4.12X6.00X.12	4	SP-0038
3	Trunnion Tube	1	Part number depends on spring centers
4	Trunnion Clamp Stand	1	See Chart 6A
5	-	-	-
6	U-bolt	4	See Chart 6
7	Spring Cap	2	SP-0177
8	Spring	2	See Chart 6
9	Trunnion Cap/Spring Seat	2	SP-0001
10	Trunnion Cap	2	SP-0171

SP Series

Item #	Description	Quantity	Part #
11	High Nut 1.125 UNF	8	10003
12	Cap-spring End	4	See Chart 6
13	Capscrew .625 UNF	16	See Chart 6
14	Axle Seat/Spring Pin Assembly	4	See Chart 6
15	Lock Nut .625 UNF Grade 8	32	10029
16	U-bolt	8	See Chart 6
17	Polyurethane Bushing	2	SP-0193
18	Washer 1.125 Hardened	8	10045
19	Washer .625 Hardened	32	10032
20	Shim Spacer .25" End Cap	8	See Chart 6
21	Capscrew .75 X 5.0 UNF Grade 8	4	10033
22	Washer .75	12	10043
23	Lock Nut .75 UNF Grade 8	12	10028

Chart 6

Model	Item 6	Item 8	Item 12	Item 13	Item 14		Item 16		Item 20
					5" Rd Axle	5" Sq Axle	5" Rd Axle	5" Sq Axle	
HDTSR44	SP-0023	SP-0056	SP-0007	10034	SP-0036	SP-0048	SP-0021	SP-0052	N/A
HDTSR50	SP-0022	SP-0057	SP-0007	10034	SP-0036	SP-0048	SP-0021	SP-0052	N/A
HDTSR60	SP-0022	SP-0060	SP-0007	10034	SP-0036	SP-0048	SP-0021	SP-0052	N/A
LWTSR44	SP-0023	SP-0058-01	SP-0016	10034	SP-0036	SP-0048	SP-0021	SP-0052	N/A
LWTSR50	SP-0023	SP-0061	SP-0016	10396	SP-0036	SP-0048	SP-0021	SP-0052	SP-0083
LWTSRPAR50	SP-0249	SP-0056	SP-0007	10034	SP-0036	SP-0048	SP-0021	SP-0052	SP-0083

Chart 6A

Item 4	
Clamp Stand Height	Part No.
8.5"	SP-0009
6.5"	SP-0010
4.5"	SP-0011
2.5"	SP-0012

Figure 9: Exploded View–USR Single Point

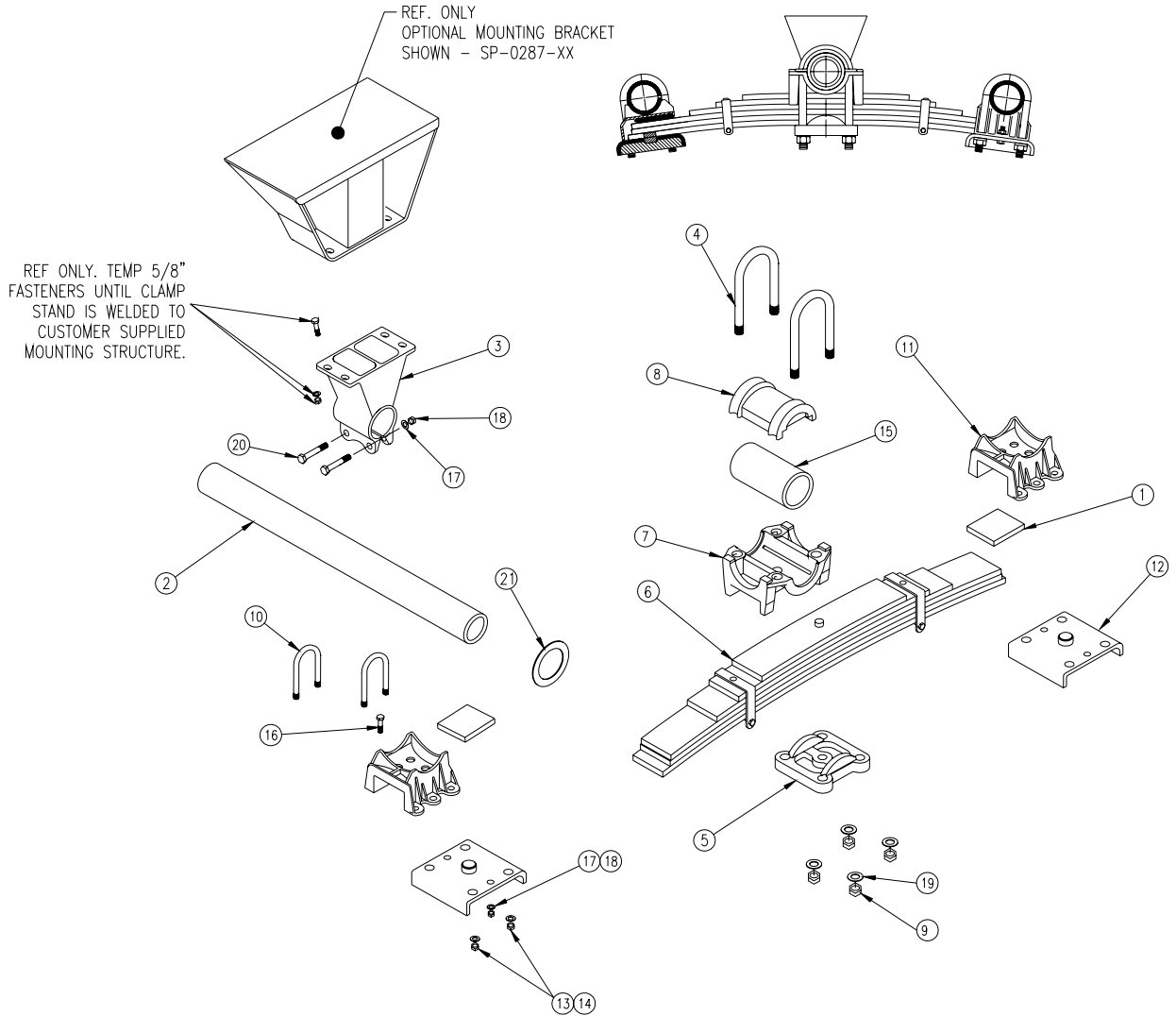


Table 8 USR Single Point Parts List

Item #	Description	Quantity	Part #
1	Polyurethane Pad	4	SP-0193
2	Trunnion Tube	1	Part number depends on spring centers
3	Trunnion Clamp Stand	2	See Chart 7A
4	U-bolt	2	See Chart 7
5	Lower Spring Cap (USR)	2	SP-0177
6	Spring	2	See Chart 7
7	Trunnion Cap/Spring Seat	2	SP-0001
8	Trunnion Cap (USR Model)	2	SP-0171
9	High Nut 1.125 UNF Grade 8	8	10003
10	U-bolt 1.00-14X11 Grade 8	8	SP-0020

SP Series

Item #	Description	Quantity	Part #
11	Axle Seat/Spring End Cap	4	See Chart 7
12	Bottom Plate / Pin Assembly	4	SP-0029
13	High Nut 1.00 UNF	16	10031
14	Washer Flat 1.06X1.75 Hardened	16	17099-01
15	Polyurethane Bushing	2	SP-0192
16	Capscrew .75 UNF 2.50 Long Hardened	8	10896-01
17	Washer .75 Hardened	12	10043
18	Lock Nut .75 UNF Grade 8	12	10028
19	Washer 1.125 Hardened	8	10045
20	Capscrew .75 X 5.0 UNF Grade 8	4	10033
21	Washer Flat 4.12X6.00X.12	2	SP-0038

Chart 7

Model	Item 4	Item 6	Item 11	
			5" Rd Axle	5" Sq Axle
HDUSR44	SP-0023	SP-0056	SP-0013	N/A
HDUSR50	SP-0023	SP-0057	SP-0013	N/A
HDUSR60	SP-0022	SP-0243	SP-0013	N/A
HDUSR70	SP-0187	SP-0277	SP-0013	N/A
LWUSR44	SP-0023	SP-0058-01	SP-0086-01	N/A
LWTSR50	SP-0023	SP-0061	SP-0084	N/A

Chart 7A

Item 3	
Clamp Stand Height	Part No.
8.5"	SP-0009
6.5"	SP-0010
4.5"	SP-0011
2.5"	SP-0012

Installation

The following instructions are for installing the components of the Watson & Chalin SP Series Suspension systems. All model numbers in the series are installed using the same set of instructions. Watson & Chalin assumes that the correct suspension and axle were chosen based on the individual design criteria.

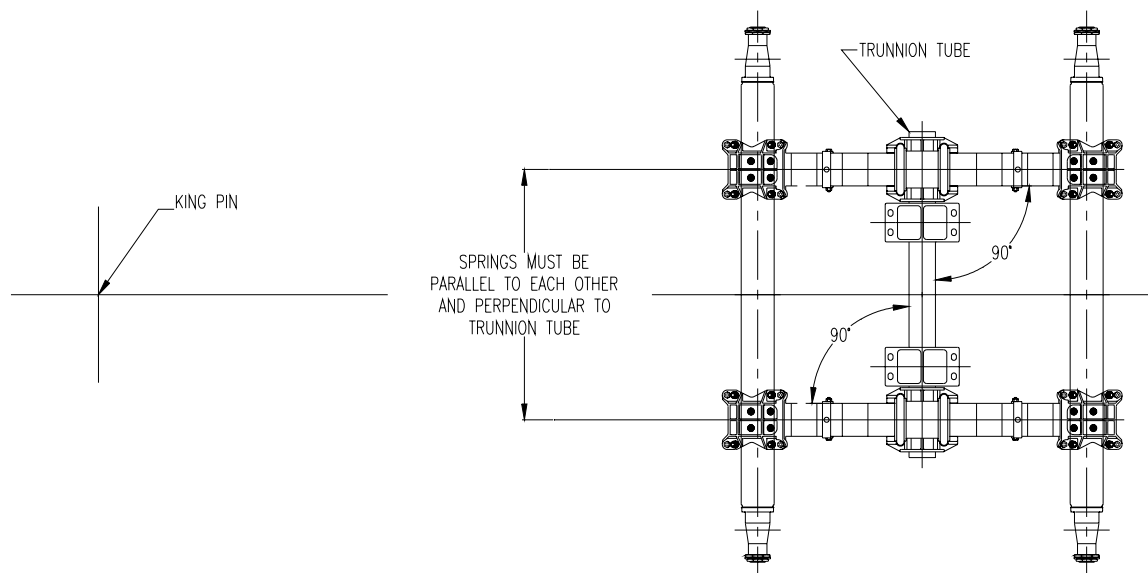
Important

Any deviation from the installation instructions must be approved in writing by Watson & Chalin.

Prior to Installing the SP-Series Suspension

Check parallel relationship of springs to each other and also perpendicularity of springs to the trunnion tube. **See figure 10.** Adjust as necessary. Ensure nuts on the trunnion cap U-bolts are tightened to the specified torque requirements. **See table on page 26**

Figure 10:



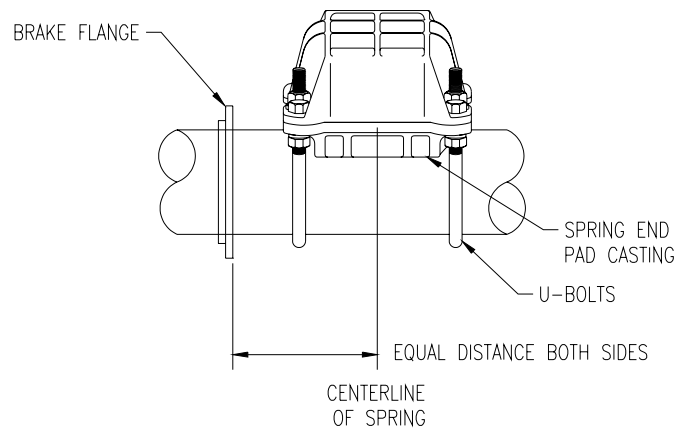
Installing the Axles

1. Install axles and temporarily secure in place with u-bolts, washers and nuts. Leave u-bolts loose enough for axle adjusting.
2. With the axles in place, check the following:

SP Series

- Axle camber, if applicable, is located on top and perpendicular to flat of Spring End Pad Casting or 1/4" to the outside of vertical centerline of axle.
- Axles are centered laterally on suspension. Measure from brake flange to centerline of spring, ensuring equal distance both sides. **See figure 11**
- Axle brake cam rotation is in the same direction as the forward rotation of the wheels.
- It is important that the axle spacing is exactly the same at both ends of axles.

Figure 11:



Note

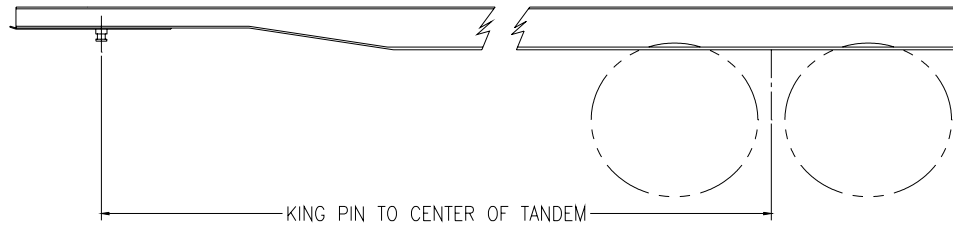
The spring end pad castings are designed so axles may be shifted 3/16" in either direction. Place wedges between axle and spring end pad castings to hold axle in position.

3. Tighten U-bolts securely, then recheck Step 2.
4. Check tire clearance with suspension.

Preparing the Trailer Frame

1. To determine the centerline of tandem, measure from king-pin and scribe a vertical line on outside of both frame members. **See figure 12**

Figure 12:



2. Prepare the frame for installation of the suspension in one of the following ways:
 - Use of optional Watson & Chalin mounting brackets - SP-0287-XX (2 required per tandem suspension). See exploded views for pedestal type suspensions.

Note

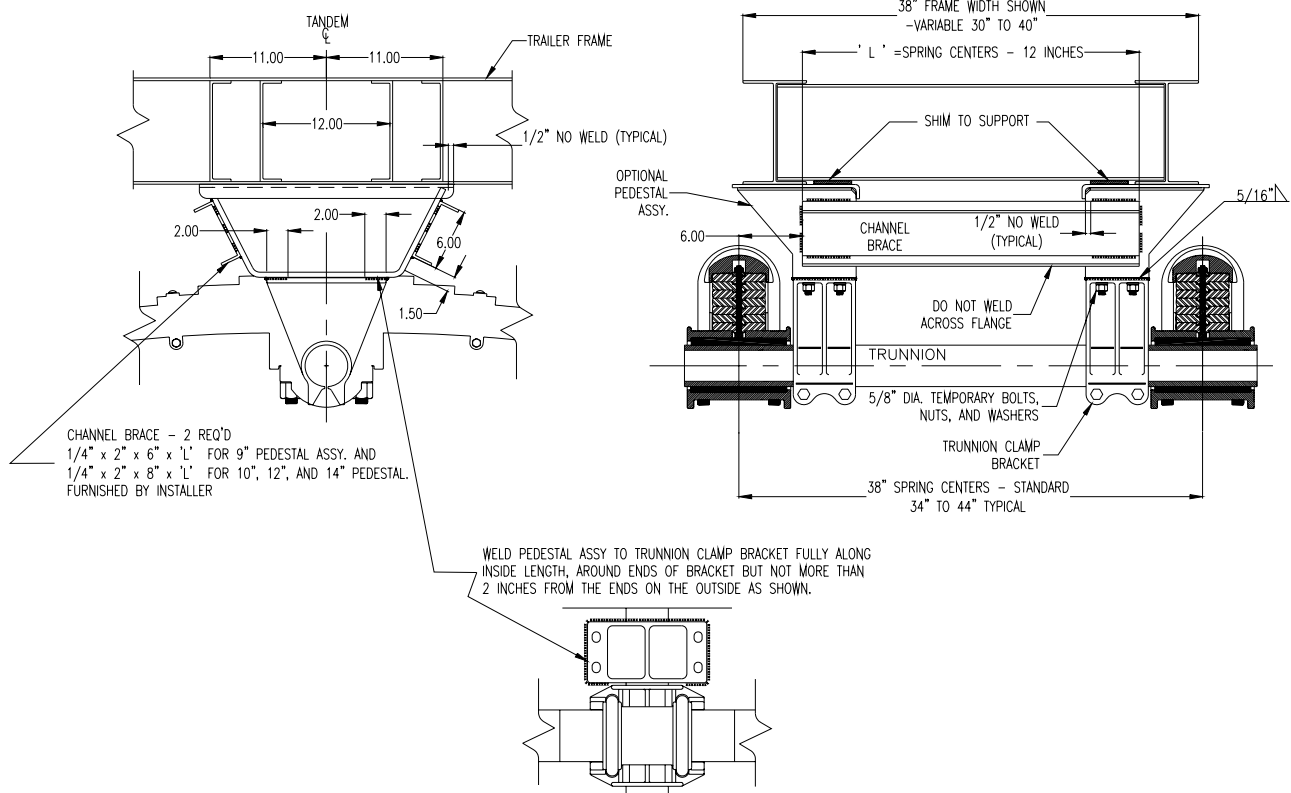
Additional customer furnished bracing is required to connect mounting brackets to each other. **See figure 13**

- Customer furnished fabricated mounting brackets.
 - Fastening directly to frame.
3. Install crossmembers and gussets as shown in **See figure 13**. Use welding rod AWS-Spec. E-70xx or equivalent.

Note

The trailer structure shown in **figure 13** is intended to be a generic representation of a typical installation, and is not intended to be a detailed recommendation for a fabrication of trailer subframe. The welds attaching the mounting bracket to the subframe will be determined by the configuration of the structure, and are the responsibility of the installer.

Figure 13:



Assembling Tandem To Trailer

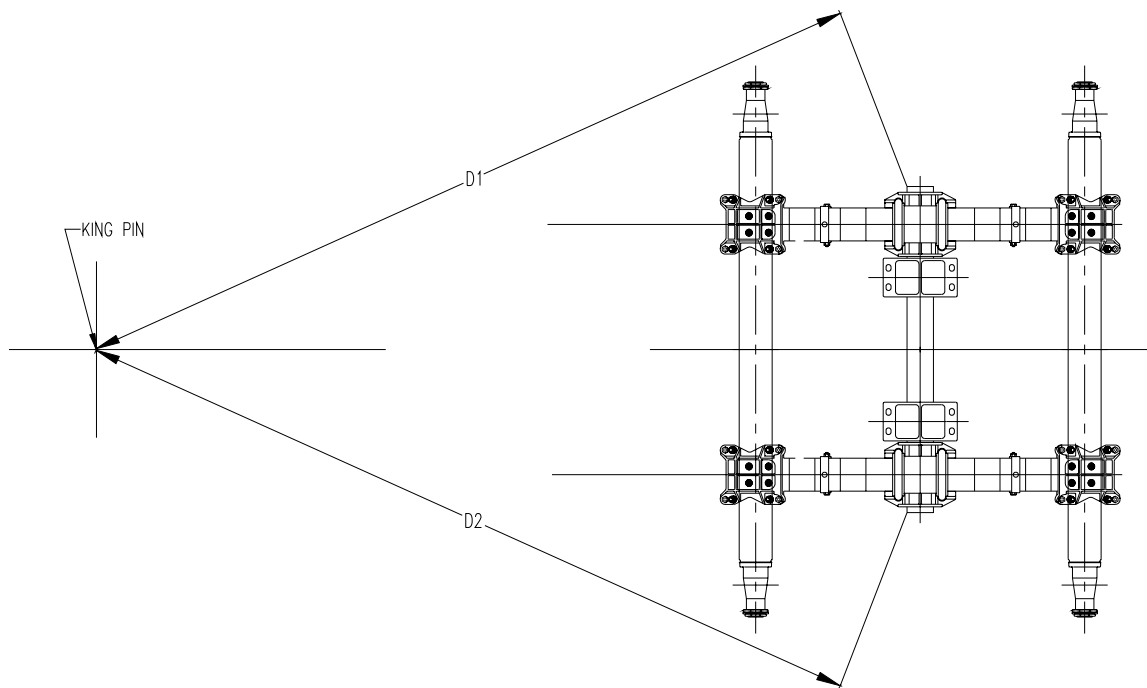
1. Install inside tires on suspension and roll unit under frame to proper centerline location.

Note

Installation of tires is not necessary at this time if a suitable dolly is used, or on trailer production lines where trailers are sometimes bottom side up.

2. Center suspension on trailer frame tandem Frame Bracket.
3. Assemble to Trunnion Clamp Castings, with 5/8" bolts, nuts and washers, leaving loose enough for adjustment.
4. Check alignment of trunnion tube axle to king-pin and shift entire suspension, if necessary, until distances D1 and D2 are equal. **See figure 14**
5. Tighten 5/8" bolts to specification, and re-check the alignment from the trunnion tube to king-pin. **See figure 14**
6. Weld securely between tandem frame brackets (pedestals), and trunnion clamp castings. **See figure 13**
7. Tighten the trunnion clamp bracket fasteners to specification.
8. Install channel braces as shown in **figure 13**.

Figure 14:

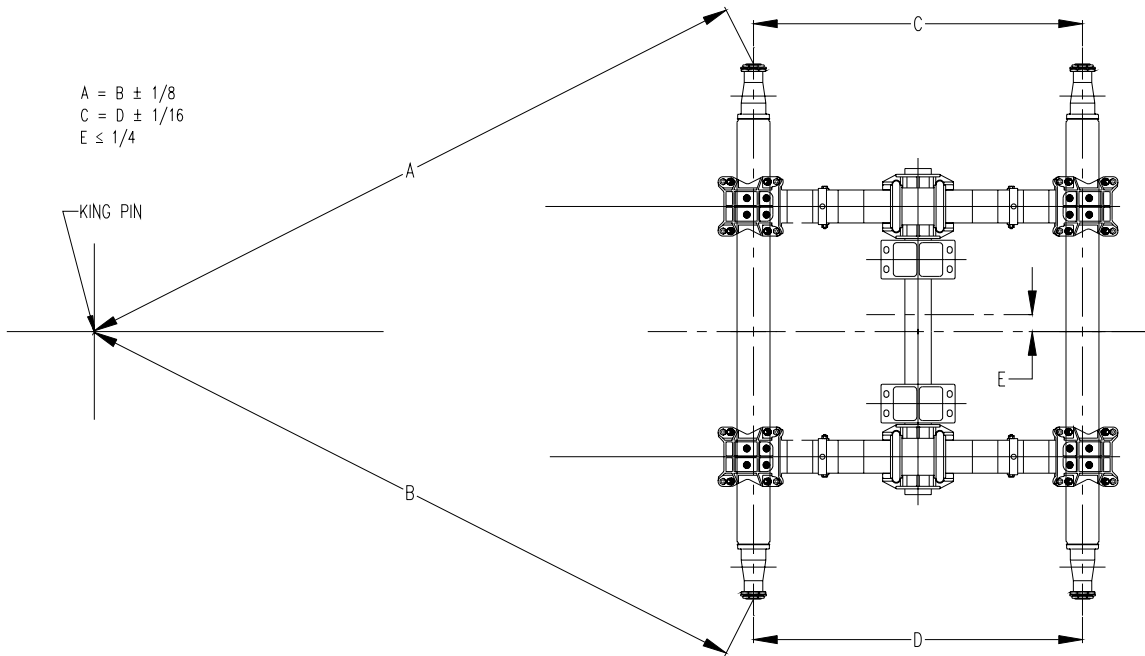


Axle Alignment

After suspension installation, the axles must be aligned in relation to the trailer kingpin.

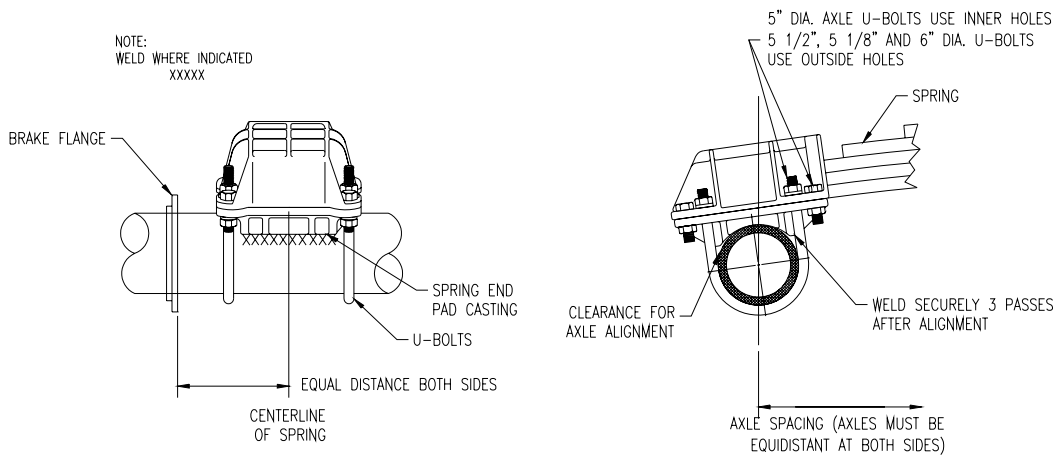
- Measure the distance from the kingpin to the centerline of the front axle spindles. **See figure 15** Dimensions A and B must be equal to each other within 1/8".
- If dimensions A and B meet the specification, tighten the U-bolts and end cap bolts to specification on the front axle only.
- Next, measure the distance from the front axle to the rear axle at the center of spindles. **See figure 15**. Dimensions C and D must be equal to each other within 1/16".
- If dimensions C and D meet the specification, tighten the U-bolts and end cap bolts to specification on the rear axle.
- Measure dimension E (lateral relationship of the axles to the trailer frame) **See figure 15**. Dimension E must not exceed 1/4". If adjustment is necessary, recheck dimensions A, B, C, and D.
- When all dimension meet specification, tighten all U-bolts and nuts to specified values. **See table on page 26 and table on page 26**

Figure 15:



- Weld axles securely to Spring End Pad Castings, following the axle manufacturer's welding recommendations, using 3/8" fillet welds on the front and rear of the axle seats. Use welding rod AWS-Spec. E-70xx or equivalent. **See figure 16**

Figure 16:



Final Checking

- Check all welding to ensure proper welds at all locations indicated on drawings.
- Check all nuts and bolts for proper tightness. (Make sure that all parts are tightened metal to metal.)
- Install tires. Unit is ready to run.

Torque Requirements

Torque specifications listed below are applied to a nut, not the capscrew. A tolerance of + or - 5% is acceptable. All torque requirements are for lubricated threads only. A lubricated thread is defined as a bolted connection that has some form of friction modifier or lubricant applied to the thread surfaces which provides a lower torque requirement. Torque values do not apply to low grade fasteners.

Capscrew/Bolt (Grade 8 UNF) Torque Requirements

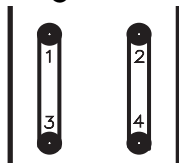
Capscrew/Bolt Size	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
Torque minimum ft./lbs.	25	50	150	300	500	700	900
Torque maximum ft./lbs.	35	75	200	350	550	800	1000

U-bolt Torque Instructions

To retorque u-bolts:

1. Partially tighten bolts #1 and #4 according to figure 17.

Figure 17: U-Bolt Torque Pattern



2. Partially tighten bolts #2 and #3.
3. Using the same sequence, torque to the proper torque as specified below.

U-Bolt (Non-Plated Clean Lubricated Thread) Torque Requirements

UNF Grade 8 Size	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
U-bolt minimum ft./lbs.	15	40	120	200	400	650	800
U-bolt maximum ft./lbs.	20	60	150	250	450	750	900

Re-Torquing Guidelines

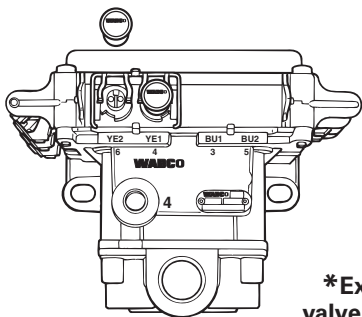
All fasteners have been previously torqued, but should be re-torqued according to the following schedule.

- after 5 days
- after 30 days
- after 60 days
- every 6 months thereafter

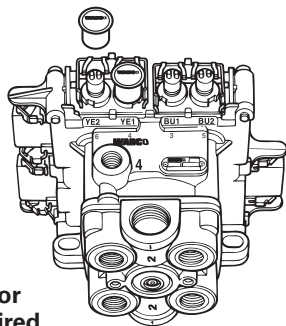
MERITOR WABCO

Easy-Stop™ and Enhanced Easy-Stop with PLC Trailer ABS Blink Code Diagnostic Guide

**Easy-Stop™
2S/1M Basic
ECU/Modulator Valve Assembly**



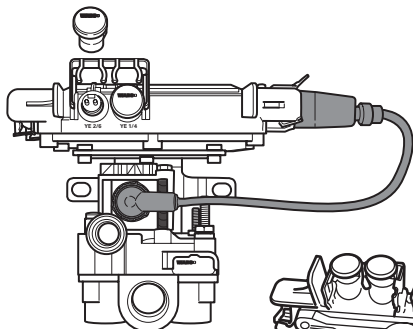
**Easy-Stop™ 2S/1M,
2S/2M*, 4S/2M*, 4S/3M*
ECU/Modulator Valve Assembly**



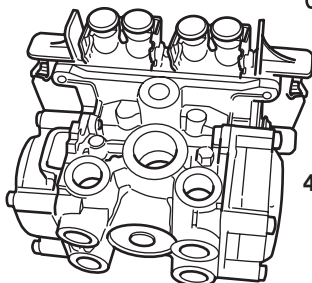
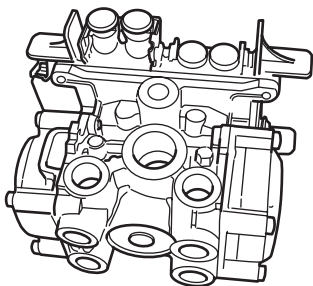
***External modulator
valve and cable required.**

Enhanced Easy-Stop™ with PLC

**2S/1M Basic ECU/Single
Modulator Valve Assembly**



**2S/2M Standard ECU/Dual
Modulator Valve Assembly**



**2S/2M, 4S/2M,
4S/3M* Premium ECU/Dual
Modulator Valve Assembly**

***External modulator valve and cable required.**

This publication covers all Enhanced Easy-Stop™ ECU/Valve Assemblies and Easy-Stop™ ECU/Valve Assemblies with serial numbers 3080002746 and higher. For Easy-Stop™ ECU/Valve Assemblies with serial numbers 3080002745 or lower, please call 1-800-535-5560 for assistance. Serial numbers are located on the bar-coded label on the side of the ECU/Valve Assembly.

Meritor WABCO Trailer ABS Quick Reference Guide

Refer to Catalog PB-96133 for Additional Details

Enhanced Easy-Stop™ Trailer ABS: Production Dates of March 2001 to Present

ECU/Valve Assembly	Description	Service ECU	Service Valve	Bracket
S400 500 101 0	2S/1M Trailers	S446 108 201 0	S472 195 033 0	S478 407 058 4
S400 500 104 0	2S/1M Dollies	S446 108 204 0	S472 195 033 0	S478 407 058 4
S400 500 102 0	2S/2M	S400 850 600 0	S400 850 602 0	
S400 500 103 0	2S/2M, 4S/2M, 4S/3M	S400 850 601 0	S400 850 602 0	
S400 500 105 0 (with InfoLink capability)	2S/2M, 4S/2M, 4S/3M		S400 850 602 0	

Easy-Stop™ Trailer ABS: Production Dates of March 1997 to February 2001

ECU/Valve Assembly	Description	Service Kit with Power Adapter	Service Kit with Power/Diagnostic Cable
S472 500 021 0	2S/1M Trailers	R955344	R955345
S472 500 011 0	2S/1M Dollies	R955322	R955323
S472 500 012 0	2S/1M, 2S/2M, 4S/2M	R955320	R955321
S472 500 013 0	4S/3M	R955346	R955347

Sensors and Extension Cables

Length	Sensor Kit	Sensor	Sensor Extension Cable
1.0 ft (0.3 m)	R955335	441 032 808 0	
3.0 ft (0.9 m)	R955336	441 032 809 0	
4.2 ft (1.3 m)			S449 713 013 0
4.6 ft (1.5 m)	R955365	441 032 817 0	
5.6 ft (1.7 m)	R955328	441 032 103 0	
5.8 ft (1.8 m)	R955341	441 032 813 0	S449 713 018 0
6.6 ft (2.0 m)	R955342	441 032 814 0	
10.0 ft (3.0 m)			S449 713 030 0
16.0 ft (5.0 m)			S449 713 050 0
39.0 ft (12.0 m)			S449 713 120 0
56.0 ft (17.0 m)			S449 713 170 0

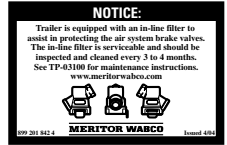
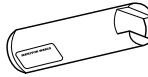
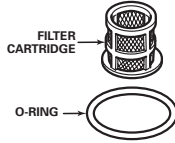
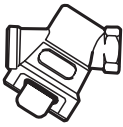
Power Cables

Length	Easy-Stop™ with Weather Pack Connector	Easy-Stop™ Blunt Cut Style	Easy-Stop™ Diagnostic Cable	Enhanced Easy-Stop™ with Weather Pack Connector	Enhanced Easy-Stop™ Blunt Cut Style	Enhanced Easy-Stop™ Y-Style Power/Diagnostics
1.5 ft (0.5 m)	S894 606 037 0			S449 326 005 4		S449 364 142 0
3.0 ft (1.0 m)	S894 604 944 0	S449 315 010 0		S449 326 010 0	S449 328 010 0	S449 364 143 0
10.0 ft (3.0 m)	S894 606 051 0	S449 315 030 0	SA1-3237-K-1103	S449 326 030 0	S449 328 030 0	
13.0 ft (4.0 m)	S894 604 945 0					
14.0 ft (4.7 m)	S894 606 038 0			S449 326 047 0		
20.0 ft (6.0 m)	S894 606 050 0			S449 326 060 0		S449 364 153 0
36.0 ft (11.0 m)		S449 315 110 0			S449 328 110 0	
49.0 ft (15.0 m)		S449 315 150 0				
66.0 ft (20.0 m)		S449 315 200 0				

SEE BACK OF CARD FOR BLINK CODES

In-Line Filter

- Function: Prevents contamination of the trailer's air system.
- Requires regular cleaning, but equipped with a bypass if needed.



Part Number

S432 500 005 0

Comments

- In-line filter (complete valve)
- Mounted at the Gladhand
- Highly recommended for control line

Part Number

R955366

Comments

- In-line filter cartridge service kit (cartridge and O-ring)

Part Number

S100 100 002 4

Comments

- In-line filter tool (to clean and replace cartridge)

Part Number

S899 201 842 4

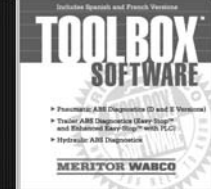
Comments

- In-line filter label

Diagnostic and Test Equipment

TOOLBOX™ Software — Easy-Stop™ and Enhanced Easy-Stop™

NOTE: TOOLBOX™ Software and support equipment is not available from Meritor WABCO. Contact SPX at 1-800-328-6657 to order.

	Comments
	<ul style="list-style-type: none"> • TOOLBOX™ Software is a pc-based diagnostics program that can display wheel speed data, test individual components, verify installation wiring and more. • Version 5.0 (or higher) supports Enhanced Easy-Stop™ with PLC and runs in Windows® 95, 98, NT, 2000, Millennium and XP. • Software part number is TOOLBOX. • An RS232 to J1708 converter box is required. Part number is J-45537-MRR.

Sensor Orientation

Easy-Stop™ Trailer ABS

— For typical Easy-Stop™ Trailer ABS installations, YE1 and YE2 are curbside, BU1 and BU2 are roadside.

Enhanced Easy-Stop™ Trailer ABS

— Look at the sensor connectors on the ECU/dual modulator valve assembly. Make sure the connectors are routed to the correct wheel end location, as follows:

Sensor Connectors on ECU/Modulator Valve Assembly Facing Front of Trailer

- 2S/2M
 - Connect curbside sensor at YE1.
 - Connect roadside sensor at BU1.
- 4S/2M*
 - Connect curbside front sensor at YE1.
 - Connect curbside rear sensor at YE2.
 - Connect roadside front sensor at BU1.
 - Connect roadside rear sensor at BU2.
- 4S/3M* — Sensor locations vary by type of installation.
 - Connect curbside sensor at YE1.
 - Connect curbside sensor at YE2.
 - Connect roadside sensor at BU1.
 - Connect roadside sensor at BU2.

Sensor Connectors on ECU/Modulator Valve Assembly Facing Rear of Trailer

- 2S/2M
 - Connect curbside sensor at BU1.
 - Connect roadside sensor at YE1.
- 4S/2M*
 - Connect curbside front sensor at BU1.
 - Connect curbside rear sensor at BU2.
 - Connect roadside front sensor at YE1.
 - Connect roadside rear sensor at YE2.
- 4S/3M* — Sensor locations vary by type of installation.
 - Connect curbside sensor at BU1.
 - Connect curbside sensor at BU2.
 - Connect roadside sensor at YE1.
 - Connect roadside sensor at YE2.

* If the lift axle is sensed in 4S/2M and 4S/3M installations: Sensors YE2 and BU2 must always be used on the lift axle to avoid an unwanted ABS indicator lamp illumination.

Troubleshooting and Repair

BLINK CODE	CAUSE OF FAULT	ACTION REQUIRED
0	No faults.	System O.K. No action needed.
3	Sensor BU1: Cable break, short circuit or out of adjustment.	Check sensor, sensor cable and cable connection; adjust sensor; or check for excessive hub runout, a sensor gap that is too wide or damage to the tooth wheels.
4	Sensor YE1: Cable break, short circuit or out of adjustment.	Check sensor, sensor cable and cable connection; adjust sensor; or check for excessive hub runout, a sensor gap that is too wide or damage to the tooth wheels.
5	Sensor BU2: Cable break, short circuit or out of adjustment.	Check sensor, sensor cable and cable connection; adjust sensor; or check for excessive hub runout, a sensor gap that is too wide or damage to the tooth wheels.
6	Sensor YE2: Cable break, short circuit or out of adjustment.	Check sensor, sensor cable and cable connection; adjust sensor; or check for excessive hub runout, a sensor gap that is too wide or damage to the tooth wheels.
7	Ext. Modulator (RD): Short to power, cable break or open, short to ground or cable damaged, or ECU/Valve Assembly Failure.	Check ABS valve and cable. Replace as required.
9	Easy-Stop™: External Modulator (BU) Enhanced Easy-Stop™: Internal Modulator Failure, Inlet Valve #2: Short to power, cable break or open, short to ground or cable damaged, or ECU/Valve Assembly Failure.	Easy-Stop™: Check ABS valve and cable. Replace as required. Enhanced Easy-Stop™: Verify correct installation. If code continues, contact Meritor WABCO for assistance.
10	Easy-Stop™: ECU/Valve Assembly Modulator (YE) Enhanced Easy-Stop™: Internal Modulator Failure, Inlet Valve #1: Short to power, cable break or open, short to ground or cable damaged, or ECU/Valve Assembly Failure.	Easy-Stop™: Check ABS valve and cable. Replace as required. Enhanced Easy-Stop™: Verify correct installation. If code continues, contact Meritor WABCO for assistance.
11	Internal Modulator Failure, Outlet Valve. Enhanced Easy-Stop™ Only.	Verify correct installation. If code continues, contact Meritor WABCO for assistance.
14	Power Supply: Over or under voltage, current low, or internal failure.	Repair vehicle power supply, check vehicle voltage output and connector; check ECU's configuration.
15	ECU — Internal Failure Internal failure.	Internal failure, contact Meritor WABCO.
16	SAE J1708 Failure	Internal failure, contact Meritor WABCO.
17	Generic SAE J2497 (PLC) Failure	Internal failure, contact Meritor WABCO.
18	Generic I/O Failure	Verify correct electrical installation. Check power supply. Make necessary corrections.

Note: (Easy-Stop™ only) If the blink code indicates there are no faults, but the trailer ABS indicator lamp continues to come on and stay on when you apply the brakes to the moving vehicle, there is an intermittent fault that must be repaired. Refer to Maintenance Manual No. 33, Expert Mode Diagnostics.

For further information on blink code diagnostics, refer to Maintenance Manual No. 33 (Easy-Stop™), Maintenance Manual MM-0180 (Enhanced Easy-Stop™) or call: **800-535-5560**.

These manuals are posted on our website at meritorwabco.com.

MERITOR WABCO

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Axle Wheel Bearing Installation Specifications



Conventional Wheel-End Systems					
	Initial Adjusting Nut Torque ①	Final Adjusting Nut Torque ④	Nut Size/Design	Jam Nut Torque Specification	Acceptable End Play Range ④
Drive axles without lock washers	200 lb-ft (272 N•m) Back off 1 turn	50 lb-ft (68 N•m) Back off 1/4 turn	Less Than 2-5/8" (66.67 mm) 2-5/8" (66.67 mm) and Over	200-300 lb-ft (272-408 N•m) 300-400 lb-ft (408-544 N•m)	0.001"-0.005" (0.025-0.127 mm)
Drive axles with bendable lock washers	200 lb-ft (272 N•m) Back off 1 turn	50 lb-ft (68 N•m) Back off 1/4 turn	Less Than 2-5/8" (66.67 mm) 2-5/8" (66.67 mm) and Over	100-150 lb-ft (136-204 N•m) 100-200 lb-ft (136-272 N•m)	0.001"-0.005" (0.025-0.127 mm)
Front non-drive steer axles	200 lb-ft (272 N•m) Back off 1 turn	50 lb-ft (68 N•m) Back off 1/2 turn	1-1/8" (28.6 mm) MFS-06, MFS-07, MFS-08 Over 1-1/8" (28.6 mm), Less Than 2-5/8" (66.67 mm) 2-5/8" (66.67 mm) and Over	150-225 lb-ft (203-305 N•m) 200-300 lb-ft (272-408 N•m) 250-400 lb-ft (339-542 N•m)	0.001"-0.005" (0.025-0.127 mm)
Trailer axles	200 lb-ft (272 N•m) Back off 1 turn	50 lb-ft (68 N•m) Back off 1/4 turn	Less Than 2-5/8" (66.67 mm)	200-300 lb-ft (272-408 N•m)	0.001"-0.005" (0.025-0.127 mm)

Long-Life Wheel-End Systems				
	Inner Nut Torque Specification ①	Outer Nut Torque Specification	Out-of-Service End Play Criteria ②	
Front non-drive steer (Easy Steer Plus™)	500-700 lb-ft (680-952 N•m)	200-300 lb-ft (272-408 N•m)	0.006" (0.1524 mm) or more	
	Inner Nut Torque ①	Outer Nut Torque	Out-of-Service End Play Criteria ②	
Trailer (TB Series)	700-750 lb-ft (952-1020 N•m)	250-300 lb-ft (340-408 N•m)	0.006" (0.1524 mm) or more	
	Initial Adjusting Nut Torque/Back off until loose, then retighten to 25 lb-ft (34 N•m) ①	Retainer Nut Torque	Final Adjusting Nut Torque ⑤	Acceptable End Play Range ③
Trailer (TRIAD™ wheel-end system)	150-200 lb-ft (204-272 N•m)	25 lb-ft (34 N•m)	200-275 lb-ft (272-374 N•m)	0.000" to 0.005" (0.127 mm)
	Adjusting Nut Torque ①	Out-of-Service End Play Criteria ②		
Trailer (TL Series)	525-550 lb-ft (714-748 N•m)	0.006" (0.1524 mm) or more		
	Inner Spindle Nut Torque ①	Outer Nut Torque	Out-of-Service End Play Criteria	
Trailer (PreSet® by ArvinMeritor)	300 lb-ft (408 N•m)	200 lb-ft (272 N•m)	0.006" (0.1524 mm) or more, service the PreSet hub assembly	

- ① Rotate the hub a minimum of five complete turns while tightening the nut.
- ② After the retightening procedure is complete.
- ③ When you correctly adjust the TRIAD™ wheel-end system using the TRIAD™ adjustment procedure, you will obtain a 0.001-inch (0.025 mm) preload on the wheel bearings, which is not measurable in the field. However, you also can adjust the TRIAD™ wheel-end system using the wheel bearing adjustment procedure for trailer axles with conventional wheel ends, above, which will result in an acceptable end play of 0.001-0.005-inch (0.025-0.127 mm).
- ④ The nut may need to be slightly tightened or loosened to meet the required end play.
- ⑤ Rotated counterclockwise against the retainer nut.



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MERITOR WABCO

INSTALLATION GUIDE

Easy-Stop™ Trailer ABS with External Diagnostics Capability 2S/1M, 2S/2M, and 4S/2M Installation Instructions

- For 2S/1M units without external diagnostics, see TP-97145
- For 4S/3M units with external diagnostics, see TP-97153

This publication replaces Installation Guide No. 31 – Revised 9/96 (2S/1M configuration) and Installation Guide No. 32 – Revised 9/96 (2S/2M and 4S/2M configurations).



WARNINGS

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

The Anti-lock Braking System (ABS) is an electrical system. When you work on the ABS, take the same precautions that you must take with any electrical system to avoid serious personal injury. As with any electrical system, the danger of electrical shock or sparks exists that can ignite flammable substances. You must always disconnect the battery ground cable before working on the electrical system.

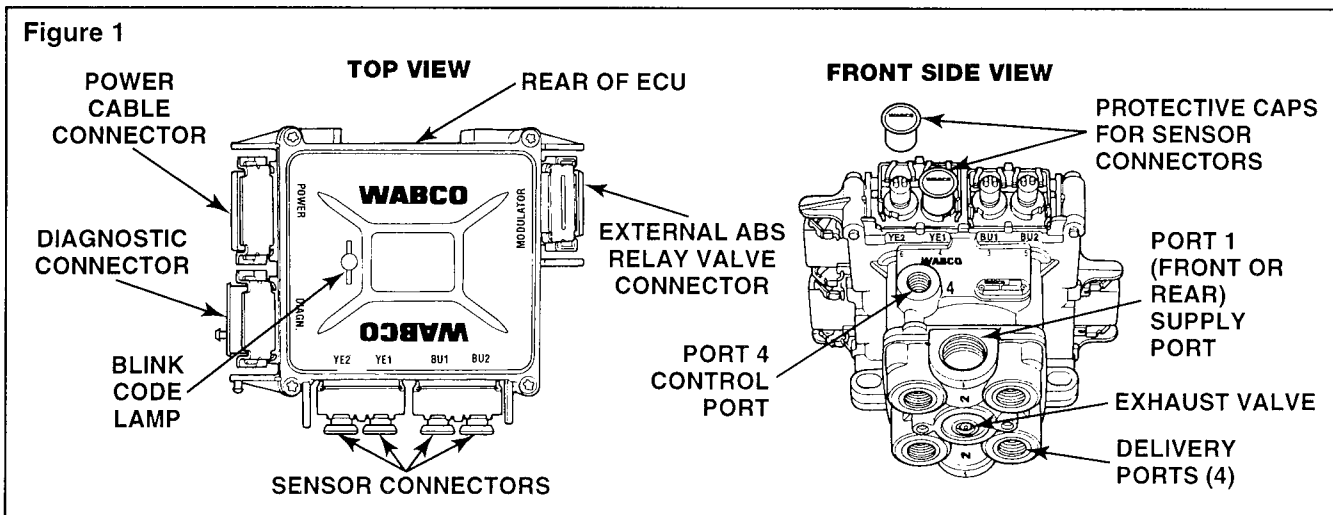
Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip or fall over and cause serious personal injury. Support the vehicle with safety stands. Block the wheels to prevent vehicle from moving.

Preparation

1. Have installation material available:
 - * ECU/valve assembly (use mounting bracket provided if mounting to vehicle frame)
 - * ABS relay valve (for 2M systems)
 - * Power and Warning Lamp Cable (1 pc.)
 - * Sensor Cables (2 pcs., 2S/1M or 2S/2M; 4 pcs., 4S/2M)
 - * Diagnostic cable and tool
 - * ABS Warning Label (TP-95172)

5/8-inch O.D. nylon tubing for supply
Pipe plug (3/4-inch NPT)
Schedule 80 pipe nipple (3/4-inch NPT) for air tank mounts or two Grade 8 bolts (3/8-inch) and prevailing torque nuts for frame mounts
SAE-standard, DOT-approved thread sealant
ABS Warning lamp (DOT-approved)

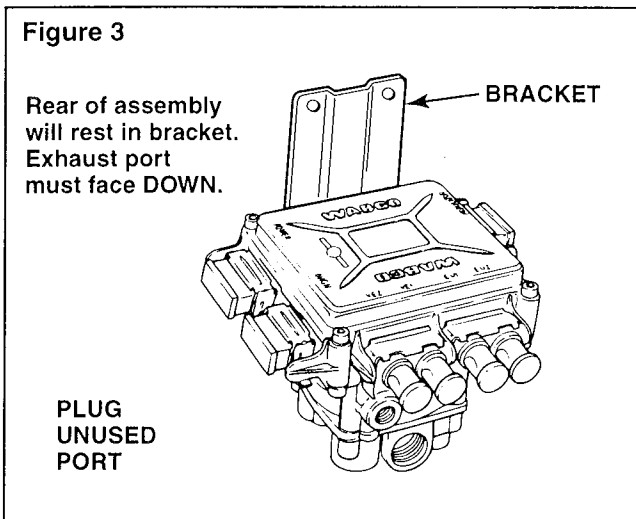
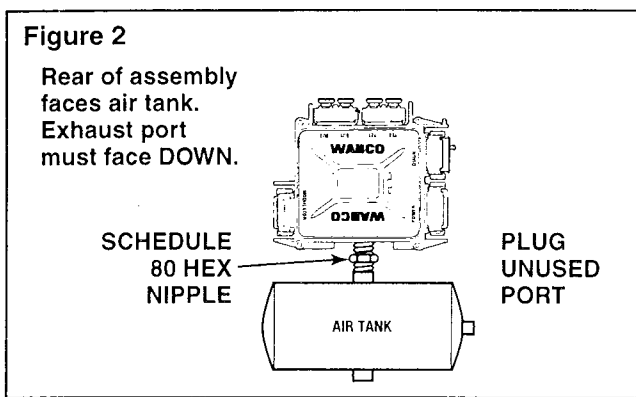
 - * Meritor WABCO components
2. Study the ECU/valve assembly. Note location of various ports and electrical connections, as well as the blink code lamp at top of ECU. Remove protective tape from the blink code lamp after painting or before releasing the trailer. **Figure 1.**



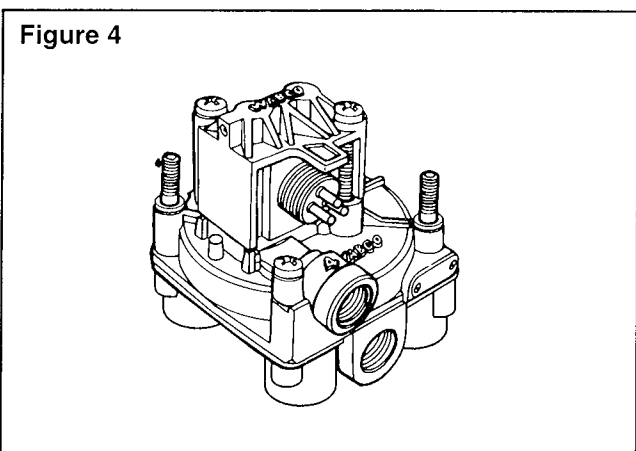
Installation

I. Attach the ECU/valve assembly.

Assembly may be mounted on the air tank (Figure 2) or on the frame of the vehicle. Figure 3.



II. Attach the ABS Relay Valve (2M Installations).



Tank-Mounted



WARNING

You must use a Schedule 80 hex nipple (3/4-inch NPT) to mount the ECU/valve assembly securely to the air tank to avoid possible serious personal injury and damage to the component.

1. Use a 3/4-inch Schedule 80 hex nipple to attach ECU/valve assembly to a reinforced air tank.
2. Use a 3/4-inch pipe plug to plug unused supply port (Port 1). Apply SAE-standard, DOT-approved thread sealant to all pipe threads.

Bracket-Mounted to Frame of Vehicle

1. Attach mounting bracket to vehicle support member between the side rails, close to the brake chambers the valve serves. Use mounting bracket supplied with ECU/valve assembly.
2. Use two 3/8-inch Grade 8 bolts with prevailing torque nuts to attach assembly to mounting bracket. Tighten bolts to 18 lb-ft (24 N•m).
3. Install a 3/4-inch NPT fitting in supply port (Port 1). Use a 3/4-inch pipe plug to plug unused supply port (Port 1).
 - Apply SAE-standard, DOT-approved thread sealant to all pipe plugs.



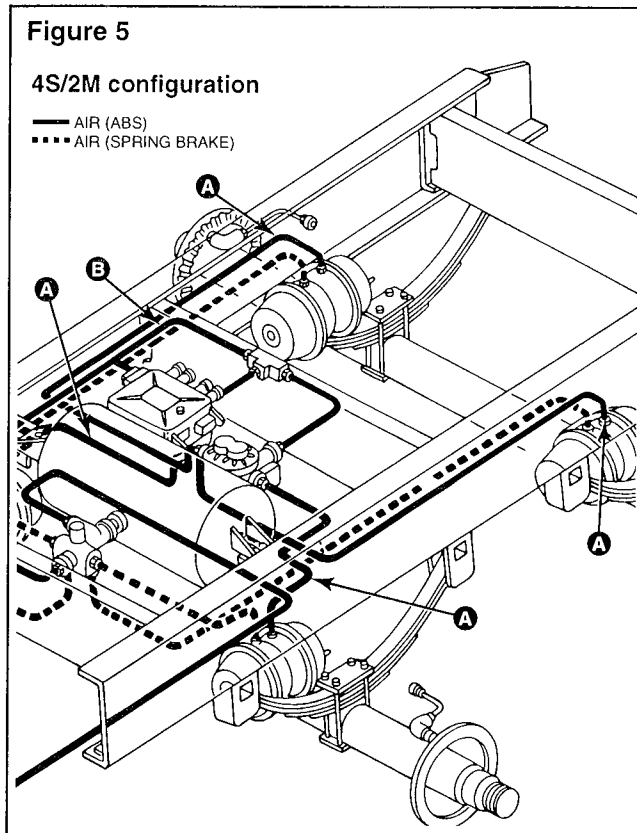
CAUTION

You must use Schedule 80 pipe nipple (3/4-inch NPT) to nipple-mount the ABS relay valve securely to the air tank to avoid possible serious personal injury and damage to components.

For frame mounting, you will need a mounting bracket. Install the valve with two lock nuts as required. If tank mounting, nipple-mount the valve directly to the air tank with Schedule 80 pipe nipple (3/4-inch NPT). Tighten the fasteners to a torque of 18 lb-ft (24 N•m).

III. Connect the air lines.

Air lines for either a 2S/2M or a 4S/2M configuration are illustrated in **Figure 5**.



1. Connect the air supply line from the supply tank to ECU/valve assembly supply port #1 (3/4-inch NPT). For 2M configurations connect the air line to supply port #1 on the external valve. **Figure 5**. Use 5/8-inch o.d. (minimum) nylon tubing or heavy-walled Schedule 80 pipe nipple (3/4-inch NPT) if the ECU/valve assembly is mounted directly to supply tank.
2. Connect the air delivery lines to the ECU/valve assembly and to external valve port #2 (3/8-inch NPT). **A**
3. Connect the air delivery lines to the appropriate brake chambers. The ECU/valve assembly services curbside chambers (3/8-inch NPT). The external valve services roadside chambers (3/8-inch NPT).
4. Connect the brake service (control) line to the ECU/valve assembly port #4 (1/4-inch NPT) and external valve control port #4 (3/8-inch NPT). **B**
5. Plug all unused ports.

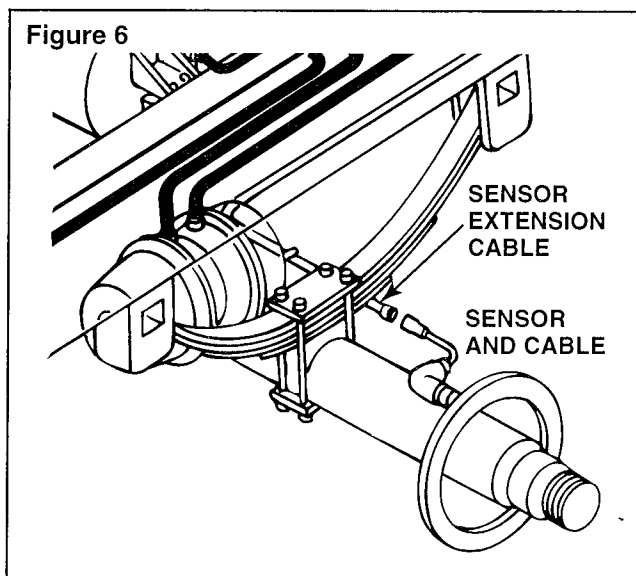
NOTE

Plumb the spring brake relay or emergency relay valve into system as usual.

IV. Install the sensor extension cables. Figure 6.

NOTE

Cables are available in several lengths. Let your supervisor know if the cable is too long (more than two feet excess).



NOTE

For non-ABS-prepped axle installations follow the sensor installation instructions on page 11.

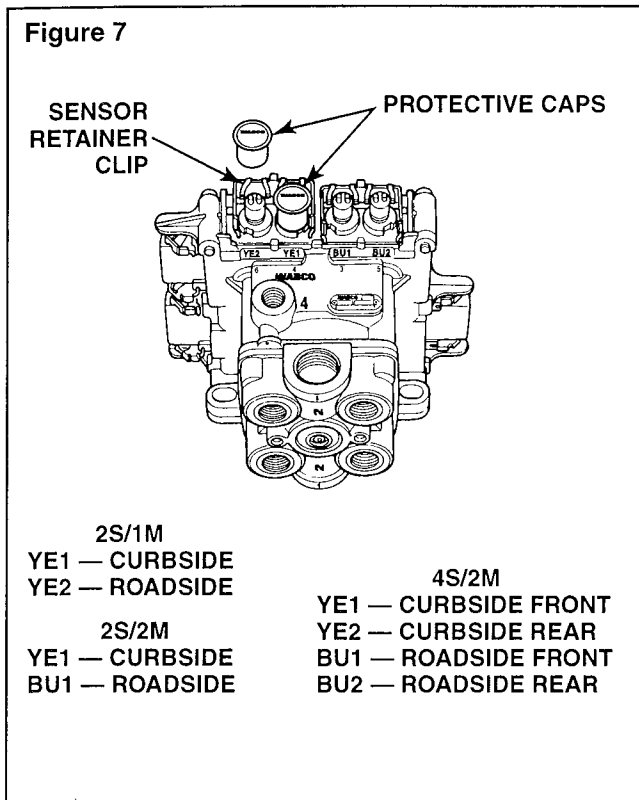
1. Visually inspect the tooth wheel and sensor to ensure there was no damage during shipping. Make necessary repairs.
2. Connect sensor and cables on the prepped axles to the sensor extension cables.
Make sure each connection is secure.
3. Route sensor cable **along back side of the trailer axle** to the ECU/valve assembly. Route with brake hose.

NOTE

Do not overtighten tie wraps on a cable. Overtightening can damage the cable. Do not tie wrap the molded sensor plug. Sensor extension cable must follow brake hose to ECU/valve assembly to allow for axle jounce and rebound.

4. Secure every eight inches with tie wrap.

IV. Install the sensor extension cables, cont'd.



5. Push sensor retainer clip on ECU/valve assembly UP.
6. Remove protective caps from the sensor connectors you are using. **Figure 7.**
7. Plug sensor extension cable into ECU/valve assembly. To secure connection, push sensor retainer clip DOWN. Retainer clips must fit in groove of sensor connectors to ensure proper connection.

2S/1M:

- Connect curbside sensor at YE1.
- Connect roadside sensor at YE2.

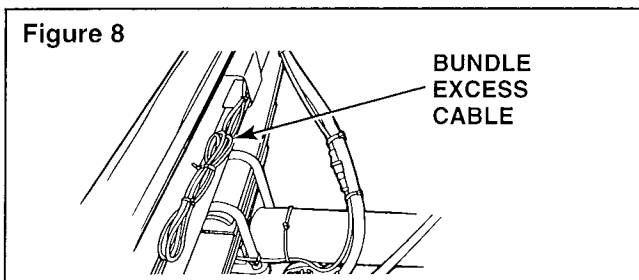
2S/2M:

- Connect curbside sensor at YE1.
- Connect roadside sensor at BU1.

4S/2M*:

- Connect curbside front sensor at YE1.
- Connect curbside rear sensor at YE2.
- Connect roadside front sensor at BU1.
- Connect roadside rear sensor at BU2.

*For lift axle sensor wiring, see MM33 or contact Meritor Customer Service.



8. Bundle any excess cable in loop (bow tie) as illustrated. **Figure 8.**
9. Secure excess cable in sub-frame of vehicle. Excess cable should not exceed two feet.

V. Install the Power/Warning Lamp Cable.

NOTE

Cables are available in several lengths. Let your supervisor know if the cable is too long (more than two feet excess).

1. Identify the type of power/warning lamp cable:
 - ABS trailer industry-standard pigtail connector cable. See **Figure 9.**
 - Full-length power cable
2. For industry-standard connector cables, route cable from harness connector to ECU/valve assembly and secure to prevent damage.

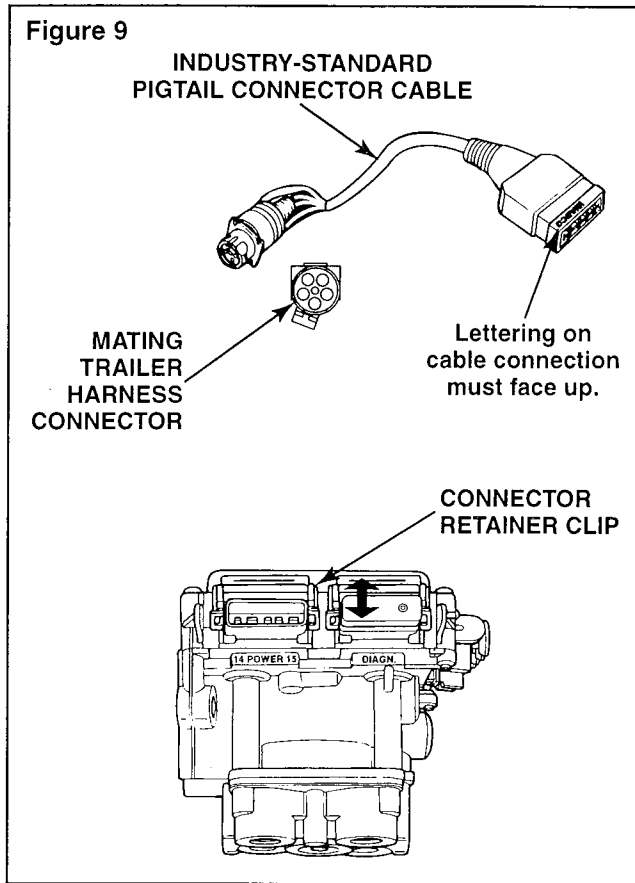
For the full-length power cable, route the cable from the ECU/valve assembly to the 7-way connector at the front of the trailer.

NOTE

Leave enough slack in cable to compensate for flexing of trailer and sub-frame.

3. Bundle any excess cable in loop (bow tie) and secure in sub-frame of trailer body to prevent cable damage. Excess cable should not exceed two feet.

V. Install the Power/Warning Lamp Cable, cont'd.



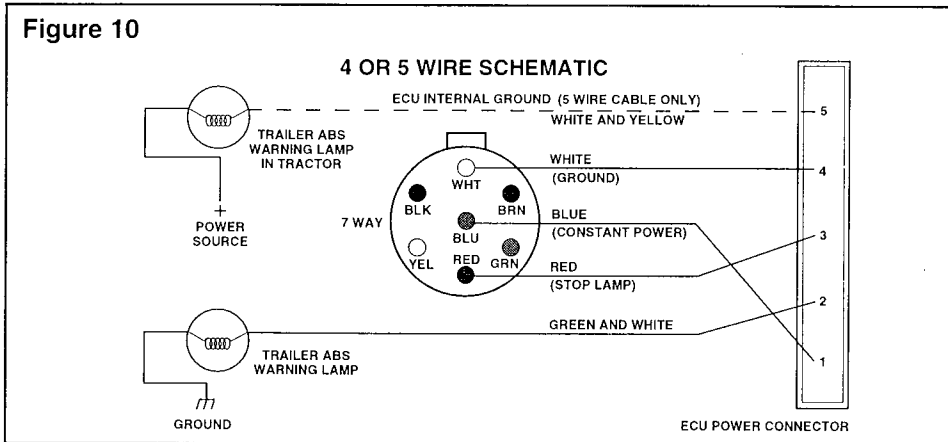
4. Remove the protective cap and push power connector retainer clip on ECU/valve assembly UP. **Figure 9.**
5. Plug the power cable into the ECU/valve assembly. Lettering on cable connection must face up.
6. Push power connector retainer clip on ECU/valve assembly DOWN to secure connection.
7. Install the ABS warning lamp on the trailer. Refer to the vehicle specification sheet for exact location of warning lamp. Use a DOT-approved lamp with ABS etched on the lens (available from major trailer lamp and lens suppliers).

NOTE

If you are using the industry-standard connector cable and do not have access to the mating trailer harness, mask the open connector on the ECU to protect it from paint or grease.

8. Connect power. Use the harness supplier's industry-standard connector cable or a full-length power cable.

Industry-standard connector cable: Attach power/warning lamp cable to harness on trailer. See **Figure 9.**



Optional full-length power cable: Wire the cable and ABS warning lamp to the seven-way connector on the trailer per the following diagram. **Figure 10.**

VI. Install the Diagnostic Cable and Bracket (If Equipped).

1. Install the diagnostic cable bracket so that the diagnostic plug is accessible. Normal location is on the right front corner of the sub-frame, but will vary depending on the type of trailer.
2. Route the diagnostic cable from the ECU/valve assembly to the diagnostic cable bracket.
3. Properly secure the cable in the sub-frame to prevent cable damage.

NOTE

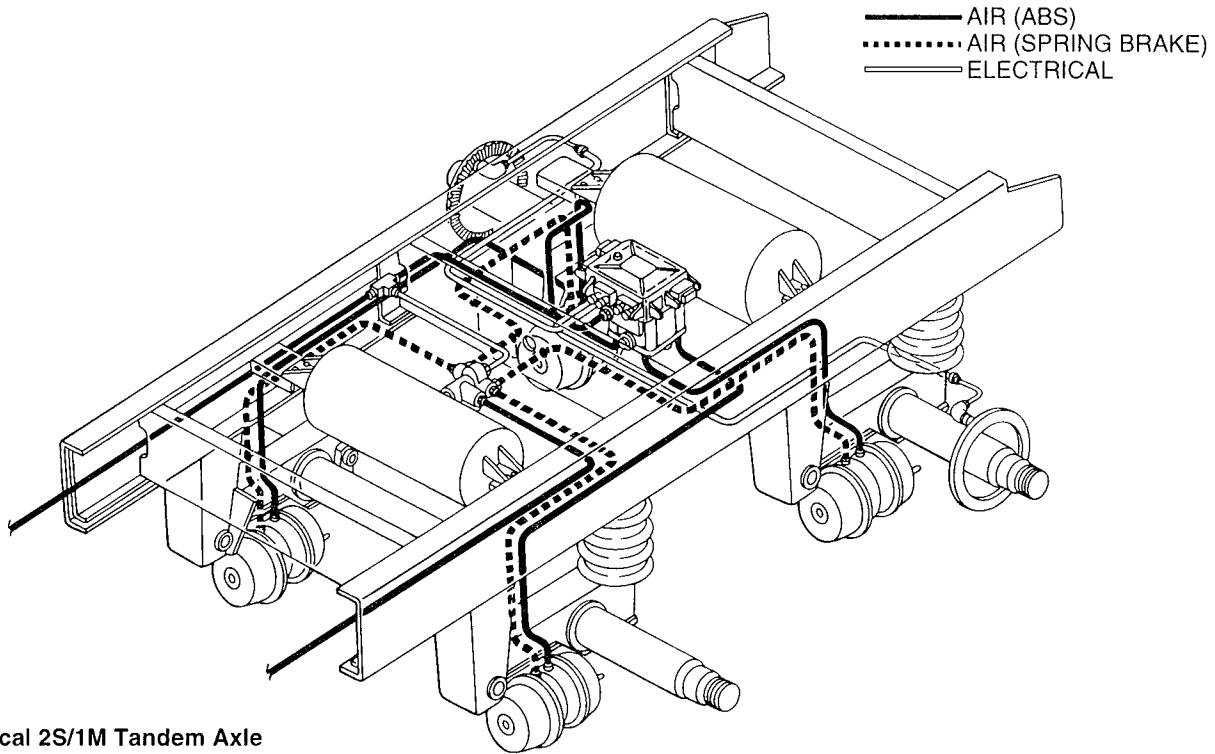
Leave enough slack in the cable to compensate for flexing of the trailer and sub-frame.

4. Bundle excess cable and secure the cable in the sub-frame.
5. Plug the diagnostic cable connector into the ECU/valve assembly. Strain relieve the cable to prevent the contacts from loosening. Push the connector retainer clip **DOWN**.

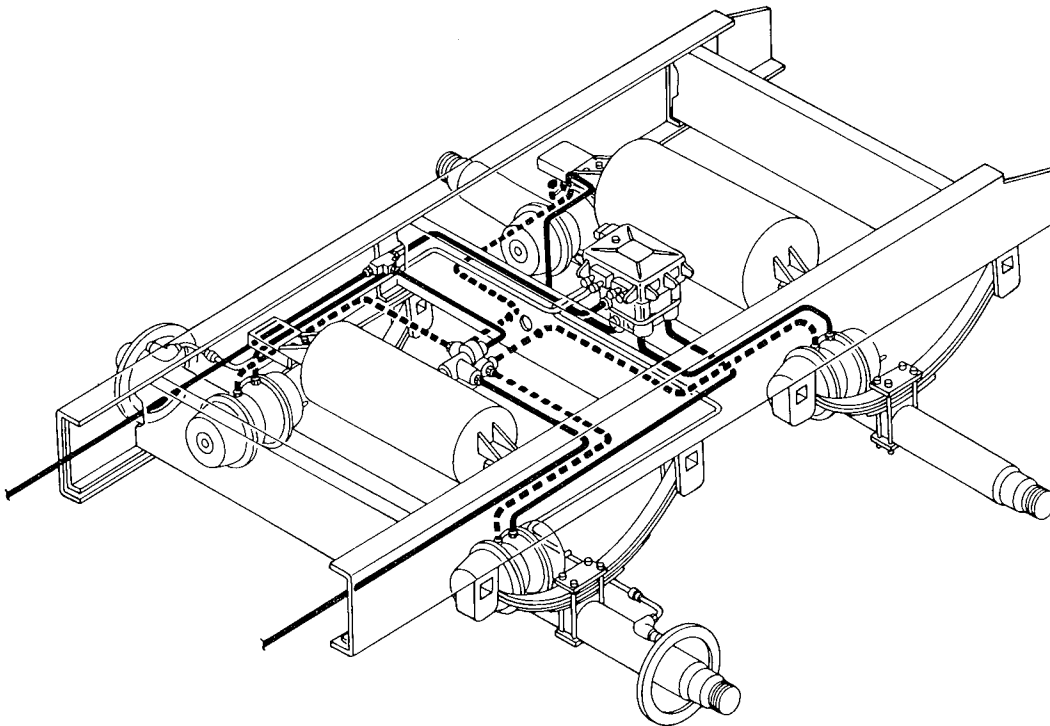
VI. Install the Diagnostic Cable and Bracket (If Equipped), cont'd.

Typical Easy-Stop Trailer ABS installations are illustrated in Figures 11, 12 and 13.

Figure 11



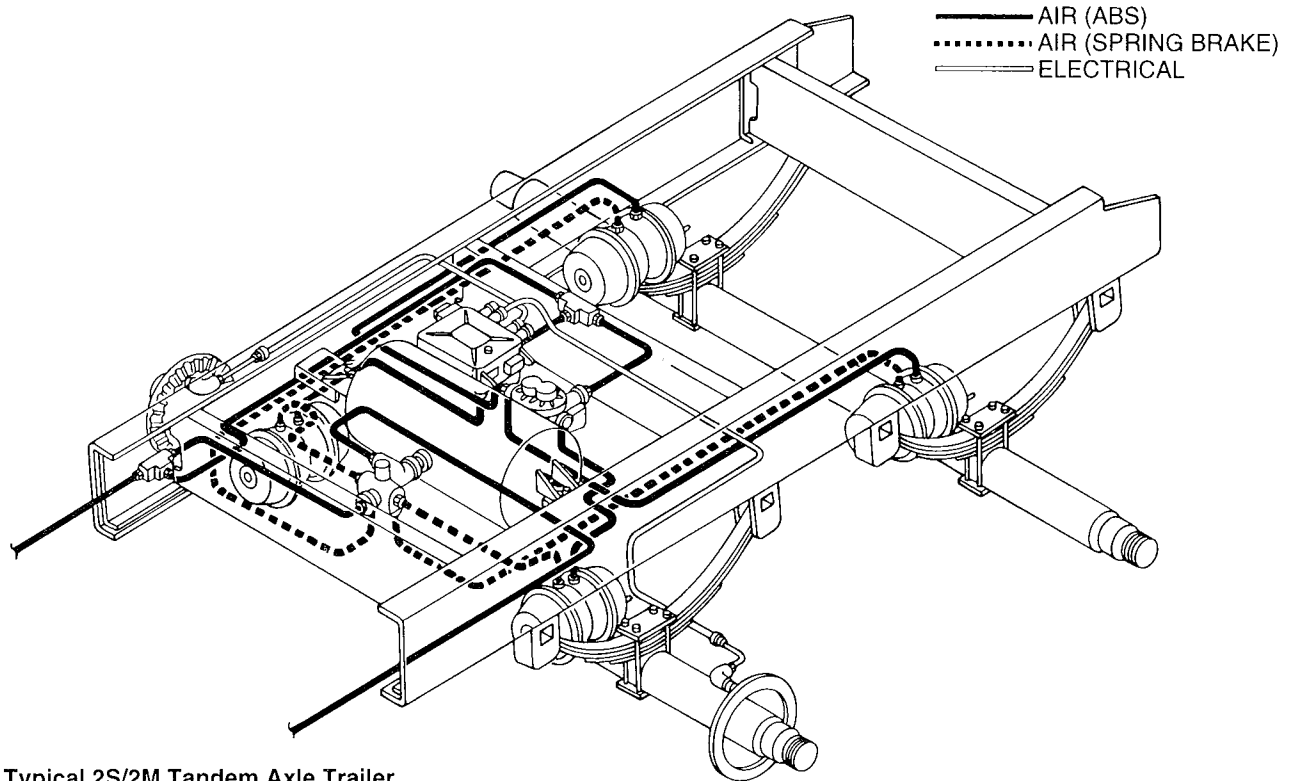
Typical 2S/1M Tandem Axle
Trailer Air Suspension Installation
with Sensors on Rear Axles.



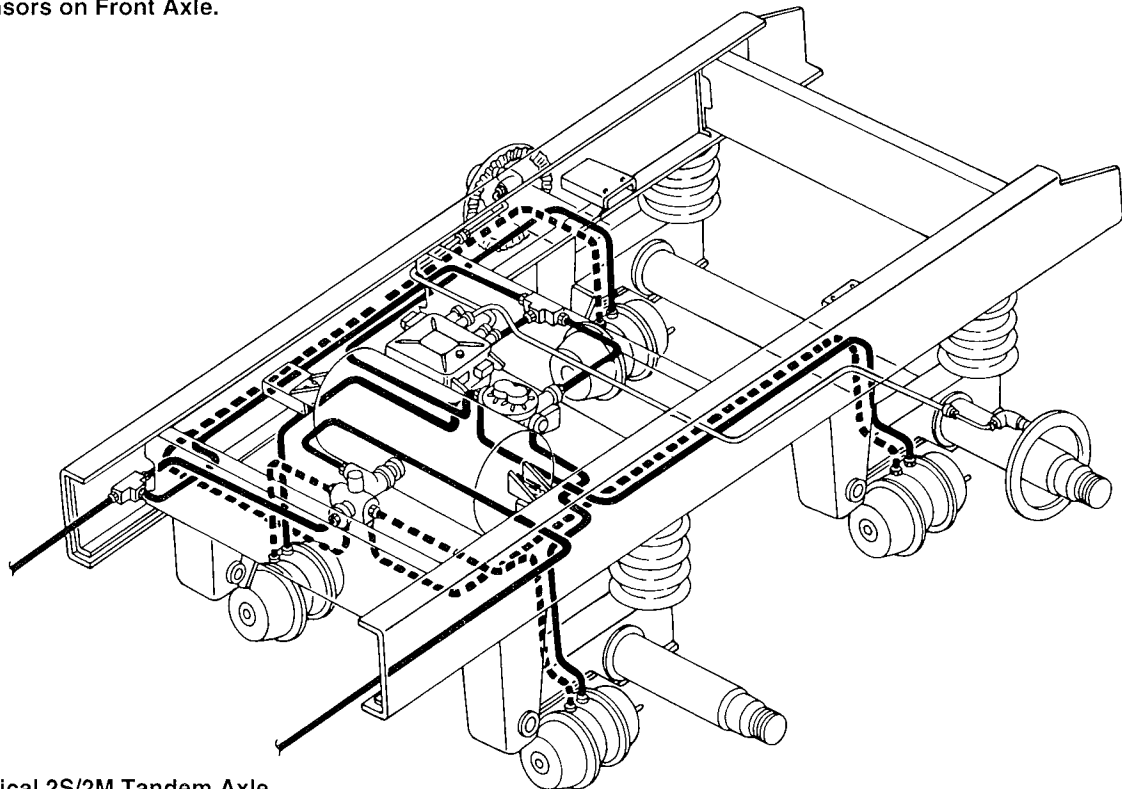
Typical 2S/1M Tandem Axle
Trailer Spring Suspension
with Sensors on Front Axles.

VI. Install the Diagnostic Cable and Bracket (If Equipped), cont'd.

Figure 12



Typical 2S/2M Tandem Axle Trailer Spring Suspension with Sensors on Front Axle.

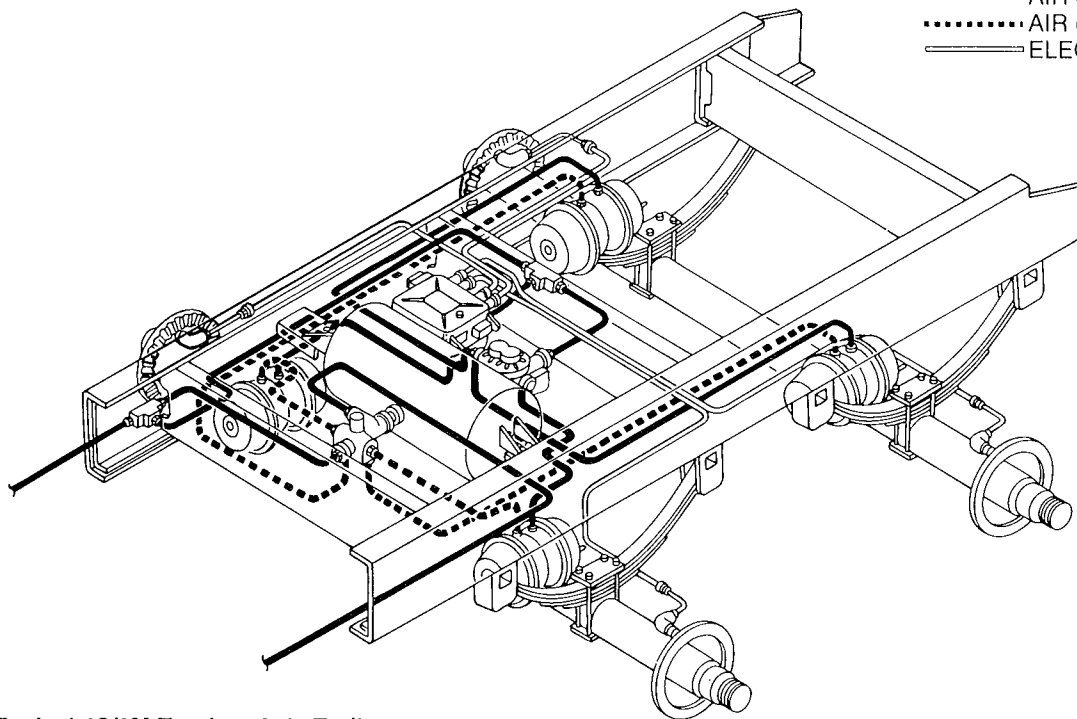


Typical 2S/2M Tandem Axle Trailer Air Suspension with Sensors on Rear Axle.

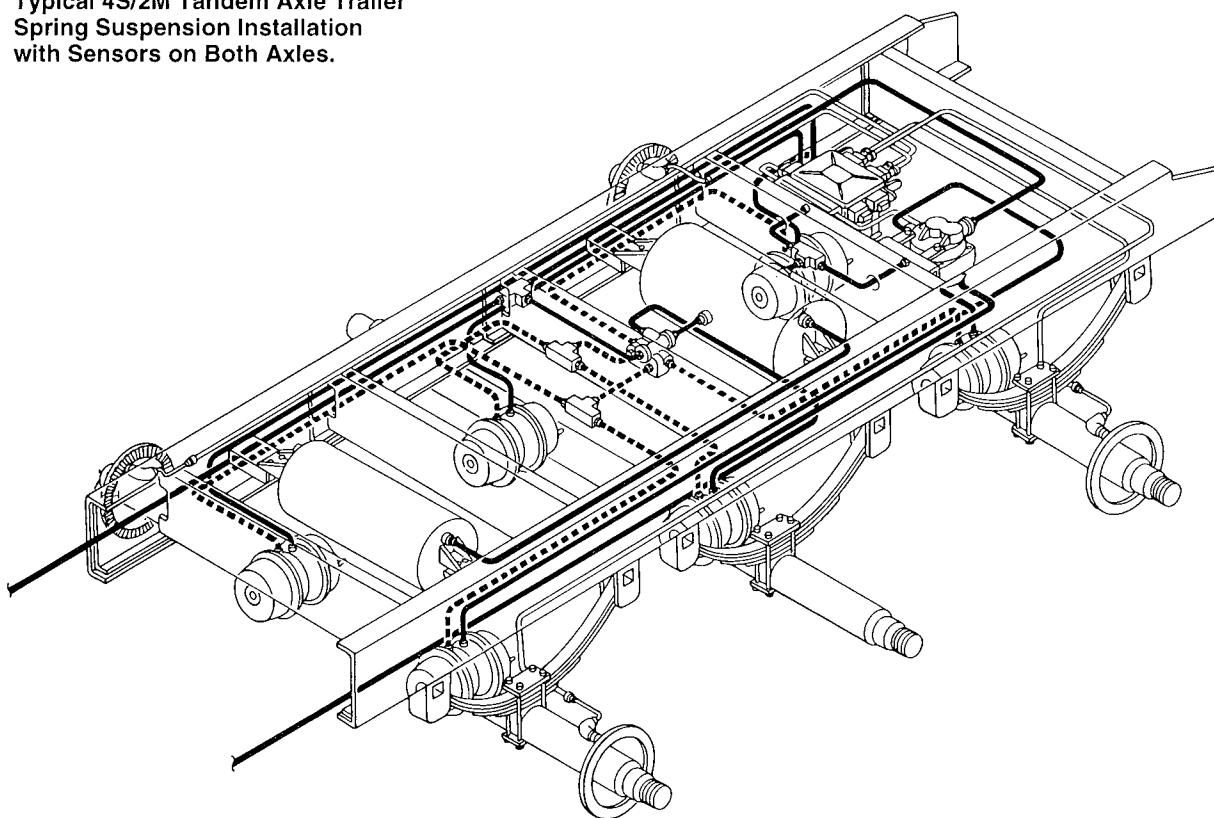
VI. Install the Diagnostic Cable and Bracket (If Equipped), cont'd.

Figure 13

— AIR (ABS)
- - - AIR (SPRING BRAKE)
— ELECTRICAL



Typical 4S/2M Tandem Axle Trailer
Spring Suspension Installation
with Sensors on Both Axles.



Typical 4S/2M Tri-Axle Trailer Spring Suspension with
Sensors on Axles 1 and 3. For Air Suspension Installations,
Sensors also on Axles 1 and 3.

VII. Test Procedure

Part 1 – Hardware Check

1. Provide 12 volts DC (9.5 to 14 volts is acceptable range) to the ECU/valve assembly. Suggested power source: 12 volt battery.
2. Observe the ABS warning lamp and the blink code lamp on the ECU. Check the results on the following chart:

IF	STATUS	ACTION																		
ABS warning lamp does not light.	Minimum power requirement not met.	Check electrical connections and power source. Make necessary repairs.																		
ABS warning lamp comes on, AND Blink code lamp on ECU continues to blink.	Hardware fault code	Identify fault location. Make necessary repairs to the installation: <table> <thead> <tr> <th># Blinks</th> <th>Location</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>Sensor BU1</td> </tr> <tr> <td>4</td> <td>Sensor YE1</td> </tr> <tr> <td>5</td> <td>Sensor BU2</td> </tr> <tr> <td>6</td> <td>Sensor YE2</td> </tr> <tr> <td>9</td> <td>Ext. Modulator (BU)</td> </tr> <tr> <td>10</td> <td>ECU Modulator (YE)</td> </tr> <tr> <td>14</td> <td>System configuration or power supply</td> </tr> <tr> <td>15</td> <td>ECU (contact Meritor WABCO)</td> </tr> </tbody> </table>	# Blinks	Location	3	Sensor BU1	4	Sensor YE1	5	Sensor BU2	6	Sensor YE2	9	Ext. Modulator (BU)	10	ECU Modulator (YE)	14	System configuration or power supply	15	ECU (contact Meritor WABCO)
# Blinks	Location																			
3	Sensor BU1																			
4	Sensor YE1																			
5	Sensor BU2																			
6	Sensor YE2																			
9	Ext. Modulator (BU)																			
10	ECU Modulator (YE)																			
14	System configuration or power supply																			
15	ECU (contact Meritor WABCO)																			
ABS warning lamp comes on, AND Relay valves click, AND Blink code lamp on ECU comes on briefly, then goes off.	Good hardware installation	Go to System End of Line Test.																		

Part 2 – End of Line Test

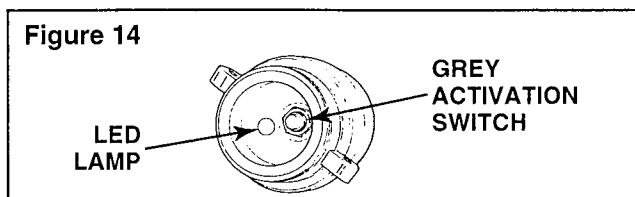
Purpose of Test: To verify proper sensor gap, sensor hook-up to the ECU, ABS valve operation, and pneumatic plumbing connections of the Meritor WABCO Easy-Stop ABS on a new trailer.

1. Remove power from the ABS.
2. Raise sensed wheels so that they may be rotated.
3. Go to the diagnostic tool. Reapply power to the ABS.

If there is no diagnostic tool on the bogey, temporarily install one for this test. You must use a diagnostic tool to complete the End of Line Test.

4. Check the diagnostic tool to verify the status of the yellow LED. **Figure 14.**

If LED comes on and stays on, go to Step 5.



If LED does not light, verify adequate power is applied to the system. Make the necessary repairs.

5. Press and release the grey activation switch three times for End of Line Test Mode, one second each time, separated by a release time of one second.

The LED should display eight rapid flashes. This indicates the End of Line Test Mode.

Then, the LED will continuously display the system configuration code:

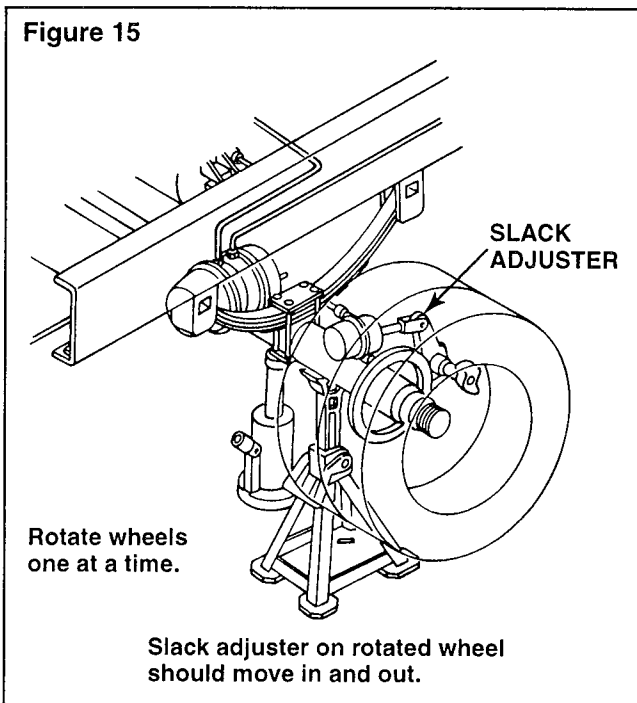
- 3 Flashes 4S/2M system configuration
- 4 Flashes 2S/2M system configuration
- 5 Flashes 2S/1M system configuration

If this does not occur, repeat Step 4.

Attach the emergency and control air lines to the trailer. Fill air tanks to release the spring brakes.

End of Line Test, cont'd.

6. Rotate each sensed wheel – one at a time – at a rate of 1/2 revolution per second. Apply control pressure to activate the brakes. (*This rate roughly equals wheel speed of 4 mph/7 kph, the wheel speed needed to activate the ABS Test Mode*). **Figure 15.**



7. Observe the slack adjuster on the rotated wheel. It should move in and out as the valve cycles. This indicates a proper installation.

If the slack adjuster on the rotated wheel does not move – but the slack adjuster on the opposite wheel does move – the sensor leads are reversed or the air line is plumbed wrong. Correct the installation.

If the slack adjuster on the rotated wheel does not move, there could be a sensor gap problem.

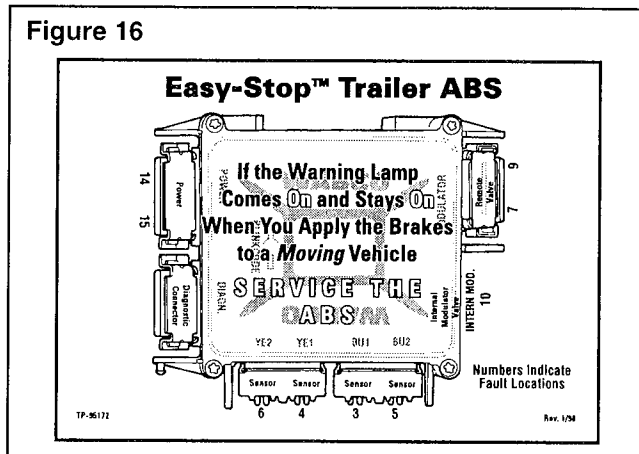
8. Repeat Steps 6 and 7 on the remaining sensed wheels.

NOTE

If you installed a diagnostic blink code tool for this test, remove it. Replace the protective cap over the connector.

VIII. Trailer Identification

After ensuring the Easy-Stop Trailer ABS has been properly installed, attach the ABS warning label included with the ECU/valve assembly to the trailer. Generally, this will be applied near the ABS trailer warning lamp. **Figure 16.** Refer to the vehicle specification sheet for the proper location.



NOTE

If this label is not included with the assembly, let your supervisor know. Labels are available from Meritor WABCO. Ask for part number TP-95172.

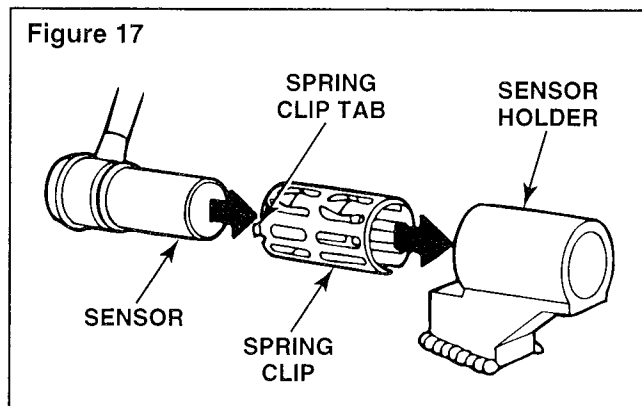
For additional assistance, contact Meritor WABCO at 1-800-535-5560.

IX. Installing Sensors On Non-ABS-Prepped Axles

NOTE

Sensor locations vary due to suspension type. Typically, a spring suspension has sensors on the forward axle and an air suspension has sensors on the rear axle.

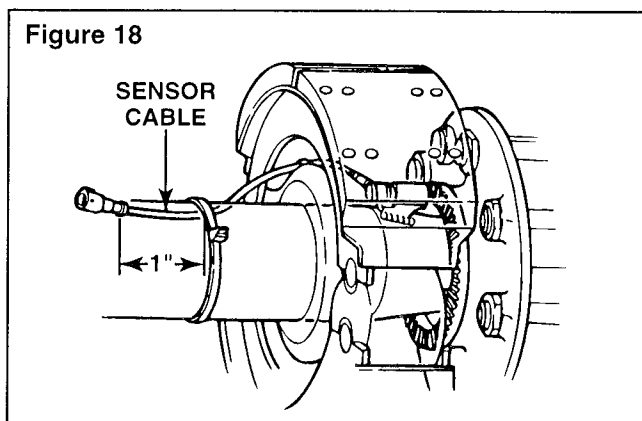
1. Apply Mobil HP, Valvoline EP633, Penzoil 707L or equivalent grease to the sensor and spring clip.
2. Push the spring clip into the sensor holder from the inboard side until the spring clip tabs are against the sensor holder. Push the sensor into the spring clip as far as possible. **Figure 17.**



3. Route the sensor cable toward the brake chamber, over the brake spider, on the back side of the axle. Secure the cable to the axle between the brake spider and the suspension brackets. Continue to route the sensor cable behind the spring seats. Secure the cable to the axle one inch from the molded sensor plug. **Figure 18.**

NOTE

Do not overtighten tie wraps on a cable. Overtightening can damage the cable. Do not tie wrap the molded sensor plug. Sensor extension cable must follow brake hose to ECU/valve assembly to allow for axle jounce and rebound.



4. Install the wheel hub carefully so that the tooth wheel pushes against the sensor as the wheel bearings are adjusted. There should be no gap between the sensor and the tooth wheel.
5. Sensor Output Voltage Test: Use a Volt/Ohm meter to check the output voltage of the sensors while rotating the wheel at approximately one-half revolution per second. Minimum output must be 0.5 volts AC. If minimum output is less than 0.5 volts AC, push the sensor toward the tooth wheel. Recheck sensor output.

MERITOR WABCO

Meritor WABCO
Vehicle Control Systems
2135 West Maple Road
Troy, MI 48084 U.S.A.
800-535-5560
www.meritorauto.com

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16579/24240



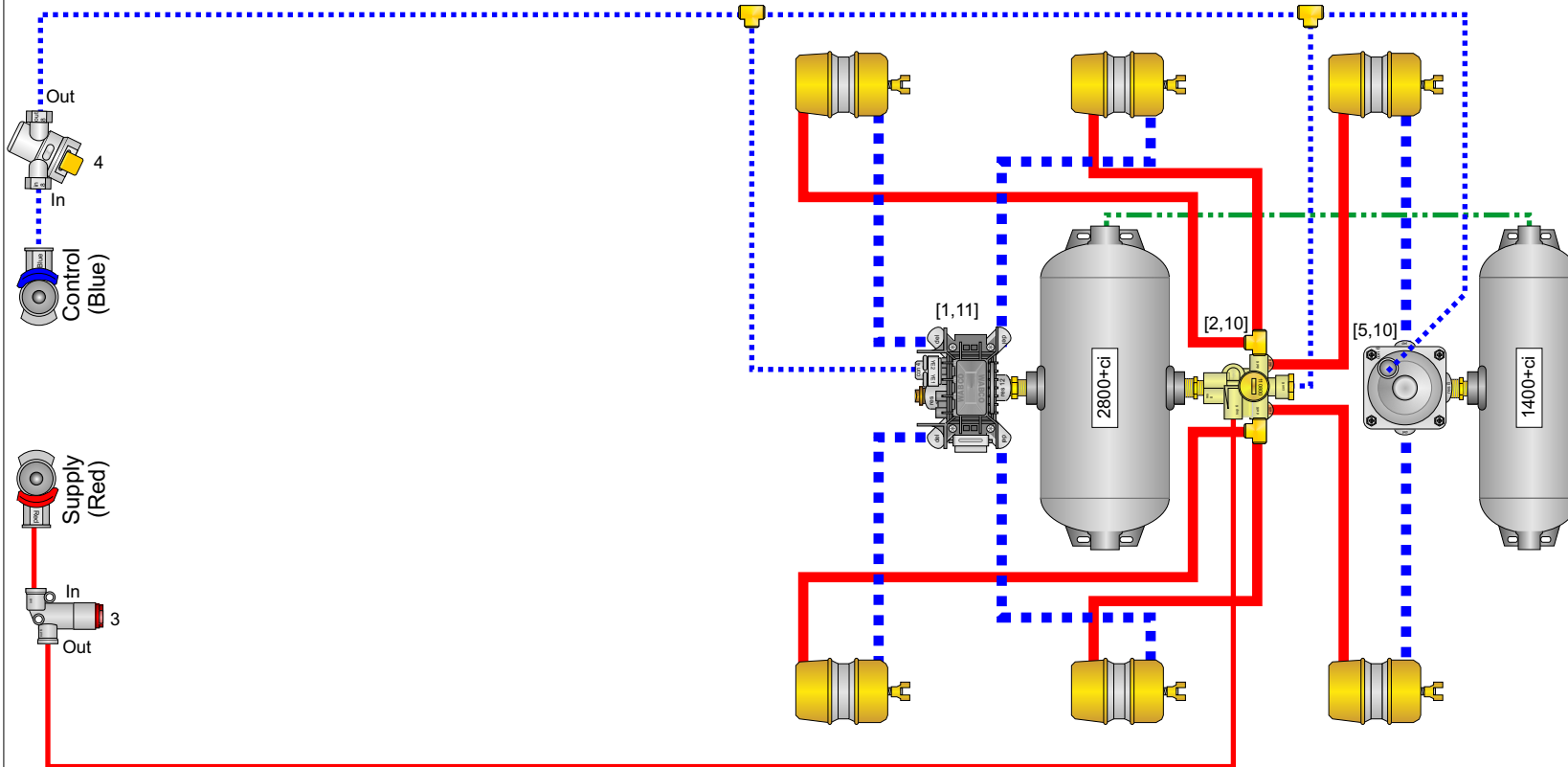
Sealco Commercial Vehicle Products



215 East Watkins Street Phoenix, Arizona 85004 602/253-1007 Fax 800/222-2334

Control Tube	Service Hose	Other	3/8" Diameter	1/2" Diameter	5/8" Diameter
Supply Tube	Spring Hose				

No.	Description	No.	Description
1	400 500 1010 2s1m ABS ECU Service Valve	10	#616 1/2" x 3/4" Nipple Or #6002 1/2" x 1/2" Nipple
2	110800 Spring Brake Valve	11	#616 1/2" x 3/4" Nipple Or #6006 3/4" x 3/4" Nipple
3	2550 Supply Filter (Optional)		
4	432 500 005 0 Control Line Filter (Optional)		
5	110410 Service Relay Valve		



Unless otherwise noted all hose is 3/8", supply line tube 1/2" & control line tube 3/8".

This design may not comply with performance requirements such as timing, grade holding or application. Compliance with these and all other applicable regulations are the responsibility of the vehicle manufacturer.

Air System Requested By

...

2s1m Three Axle Semi

DR:	CH:	Date	Drawing Number
DH	ZY	Mar. 16, 2010	P-6854



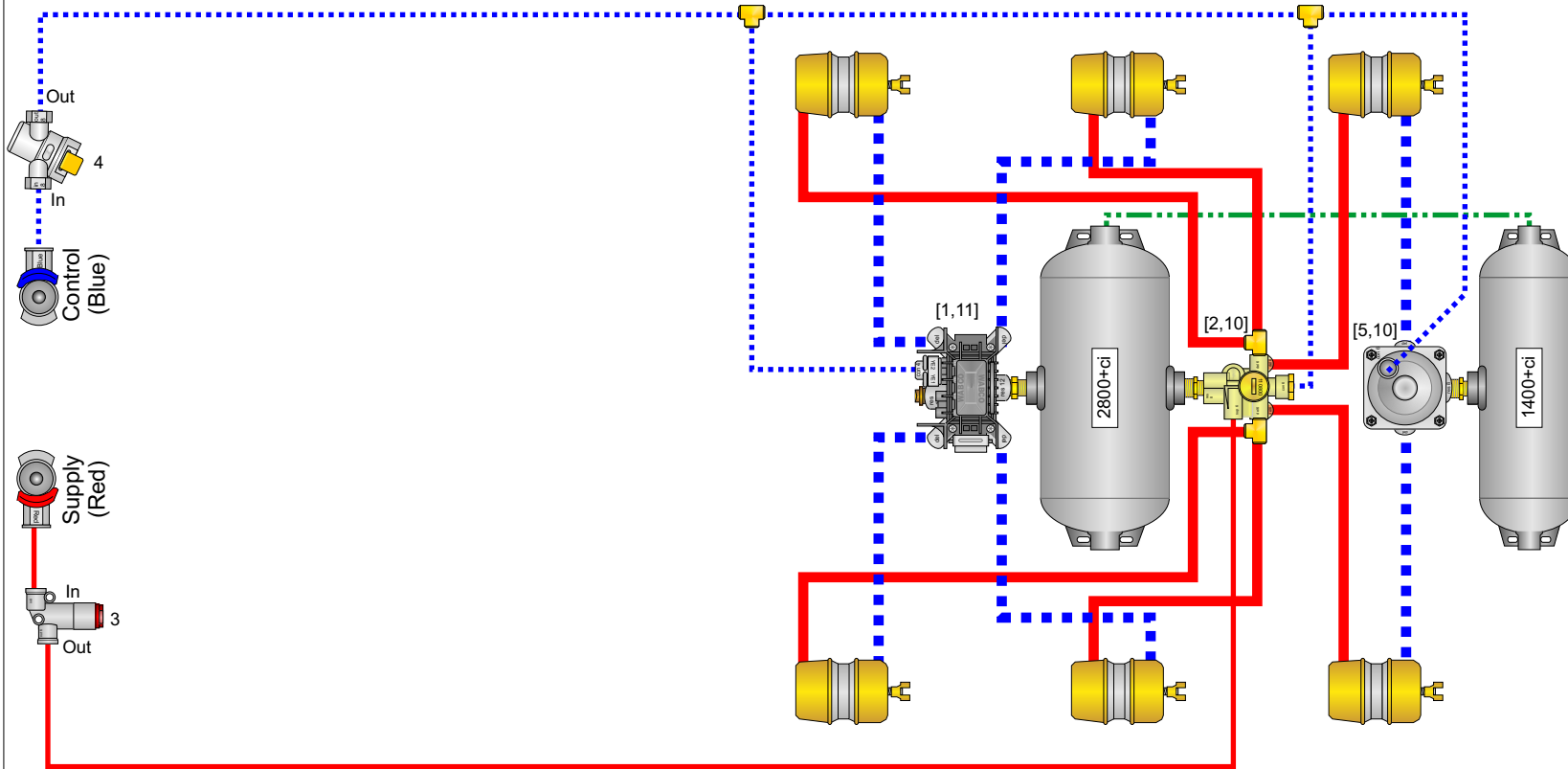
Sealco Commercial Vehicle Products



215 East Watkins Street Phoenix, Arizona 85004 602/253-1007 Fax 800/222-2334

Control Tube	Service Hose	Other	3/8" Diameter	1/2" Diameter	5/8" Diameter
Supply Tube	Spring Hose				

No.	Description	No.	Description
1	400 500 1010 2s1m ABS ECU Service Valve	10	#616 1/2" x 3/4" Nipple Or #6002 1/2" x 1/2" Nipple
2	110800 Spring Brake Valve	11	#616 1/2" x 3/4" Nipple Or #6006 3/4" x 3/4" Nipple
3	2550 Supply Filter (Optional)		
4	432 500 005 0 Control Line Filter (Optional)		
5	110487 Service Relay Valve		



Unless otherwise noted all hose is 3/8", supply line tube 1/2" & control line tube 3/8".

This design may not comply with performance requirements such as timing, grade holding or application. Compliance with these and all other applicable regulations are the responsibility of the vehicle manufacturer.

Air System Requested By

...

2s1m Three Axle Semi

DR:	CH:	Date	Drawing Number
DH	ZY	Mar. 16, 2010	P-6854-1



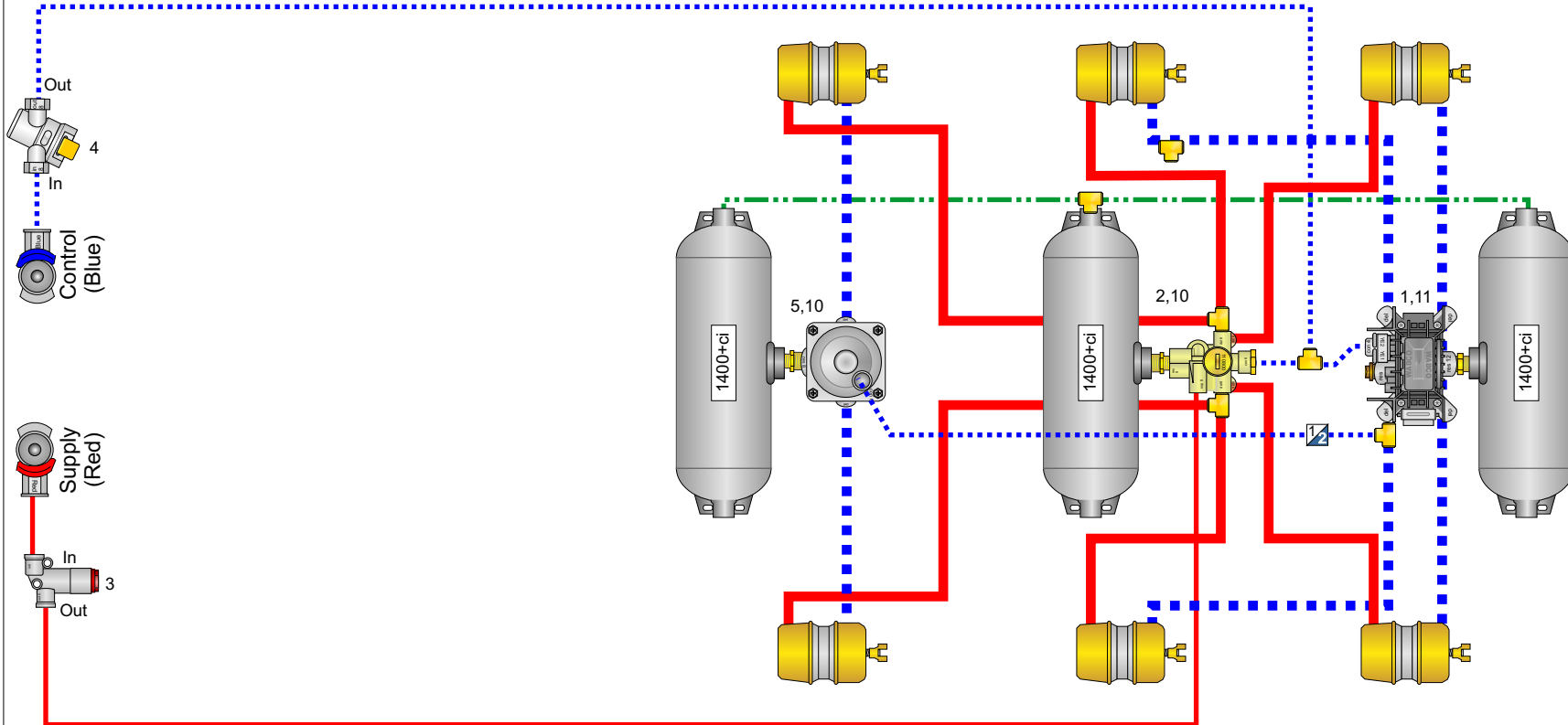
Sealco Commercial Vehicle Products



215 East Watkins Street Phoenix, Arizona 85004 602/253-1007 Fax 800/222-2334

Control Tube	Service Hose	Other	3/8" Diameter	1/2" Diameter	5/8" Diameter
Supply Tube	Spring Hose				

No.	Description	No.	Description
1	400 500 1010 2s1m ABS ECU	10	#616 1/2" x 3/4" Nipple Or #6002 1/2" x 1/2" Nipple
2	110800 Spring Brake Valve	11	#616 1/2" x 3/4" Nipple Or #6006 3/4" x 3/4" Nipple
3	2550 Supply Filter (Optional)		
4	432 500 005 0 Control Line Filter (Optional)		
5	110410 Service Relay Valve		



Unless otherwise noted all hose is 3/8", supply line tube 1/2" & control line tube 3/8".

This design may not comply with performance requirements such as timing, grade holding or application. Compliance with these and all other applicable regulations are the responsibility of the vehicle manufacturer.

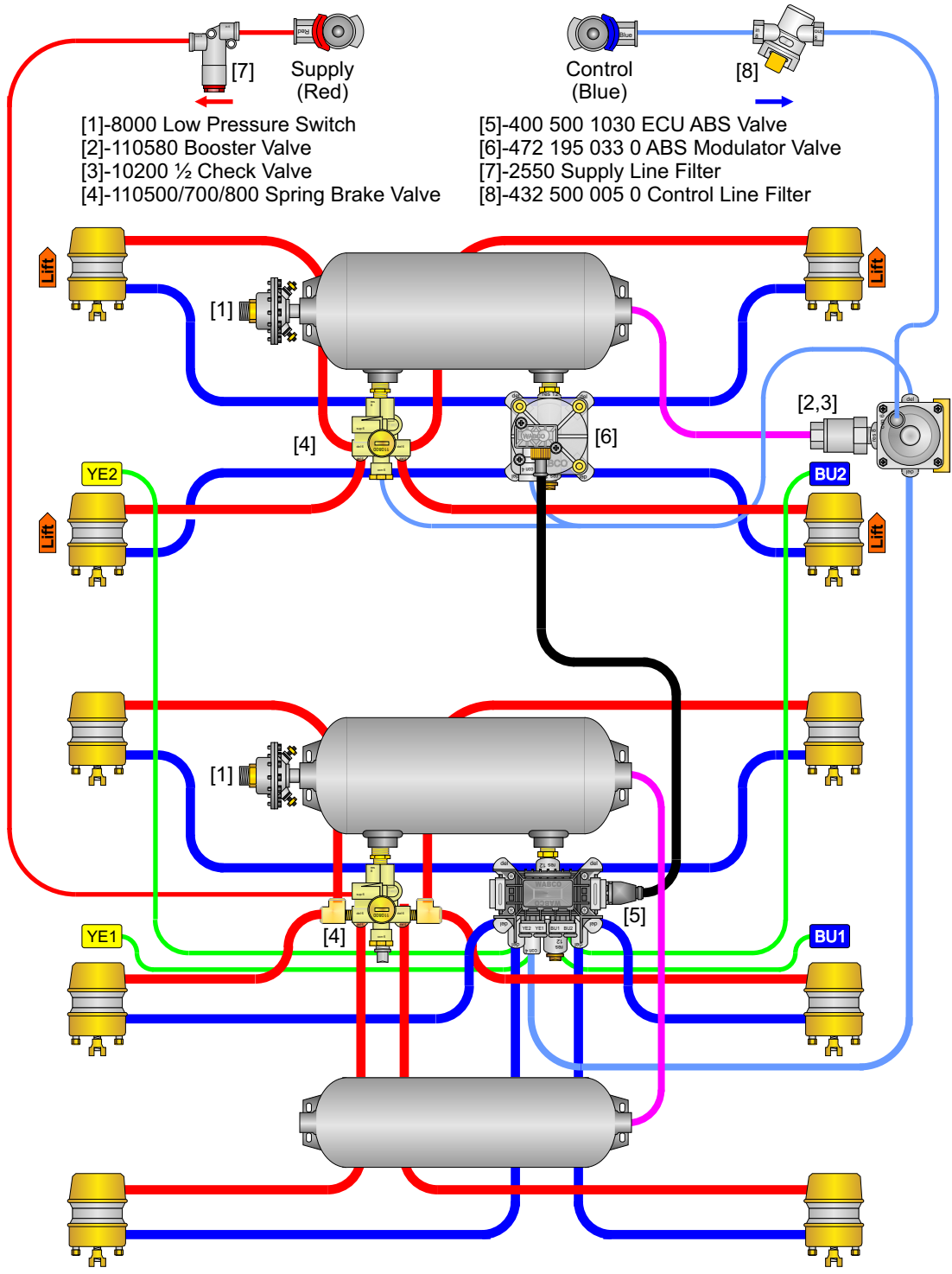
Air System Requested By

...

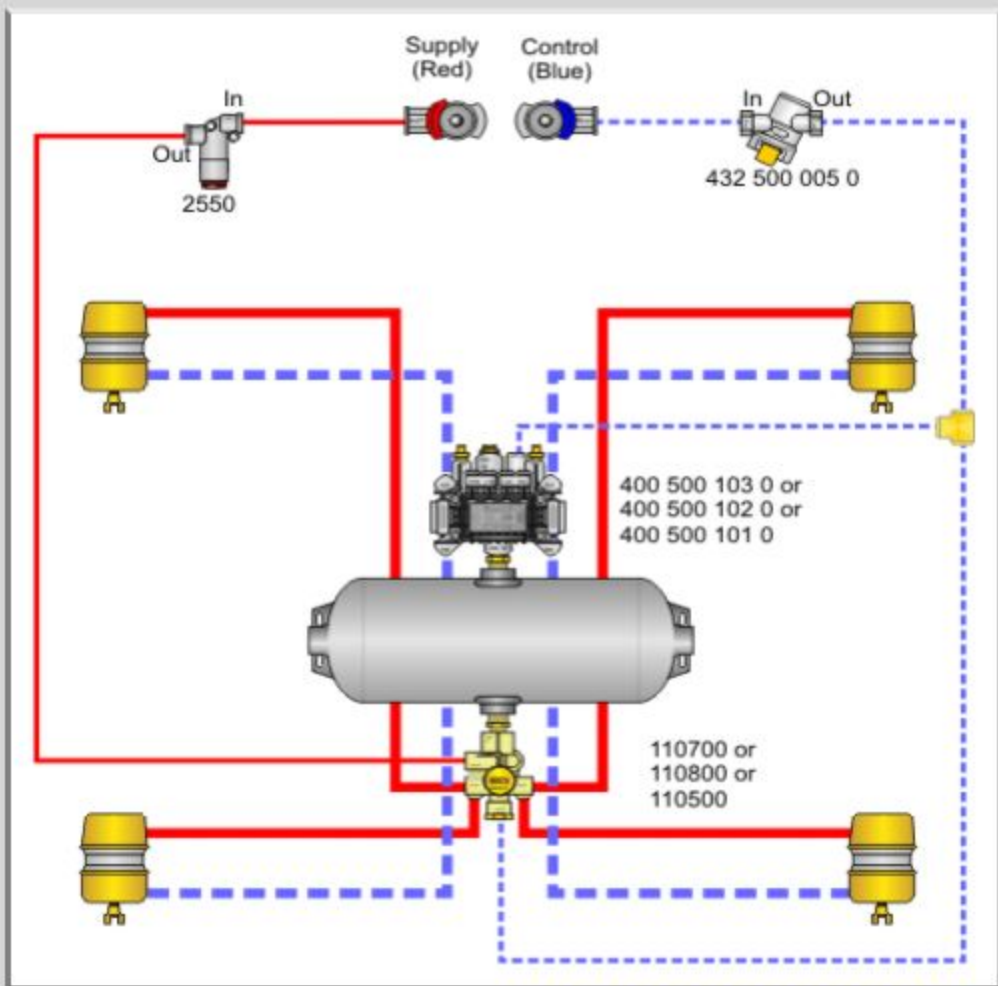
2s1m Tridem Semi

DR:	CH:	Date	Drawing Number
DH	ZY	Apr. 7, 2010	P-6808

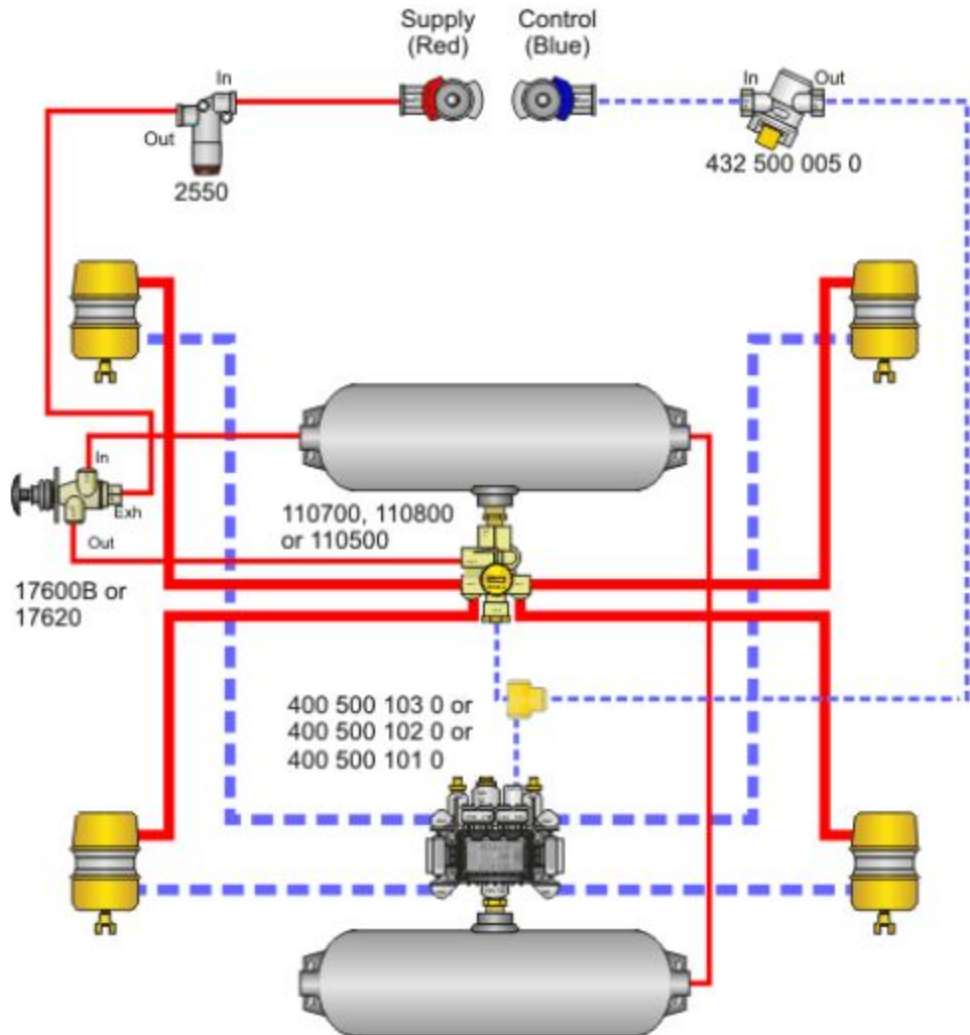
Description 5 Axle (23) SPIF with 4s3m ABS	Drawing Number P-6551
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Tandem Axle Semi Trailer With One Reservoir



Tandem Axle Semi Trailer With Two Reservoirs And A Brake Release (Hostler)

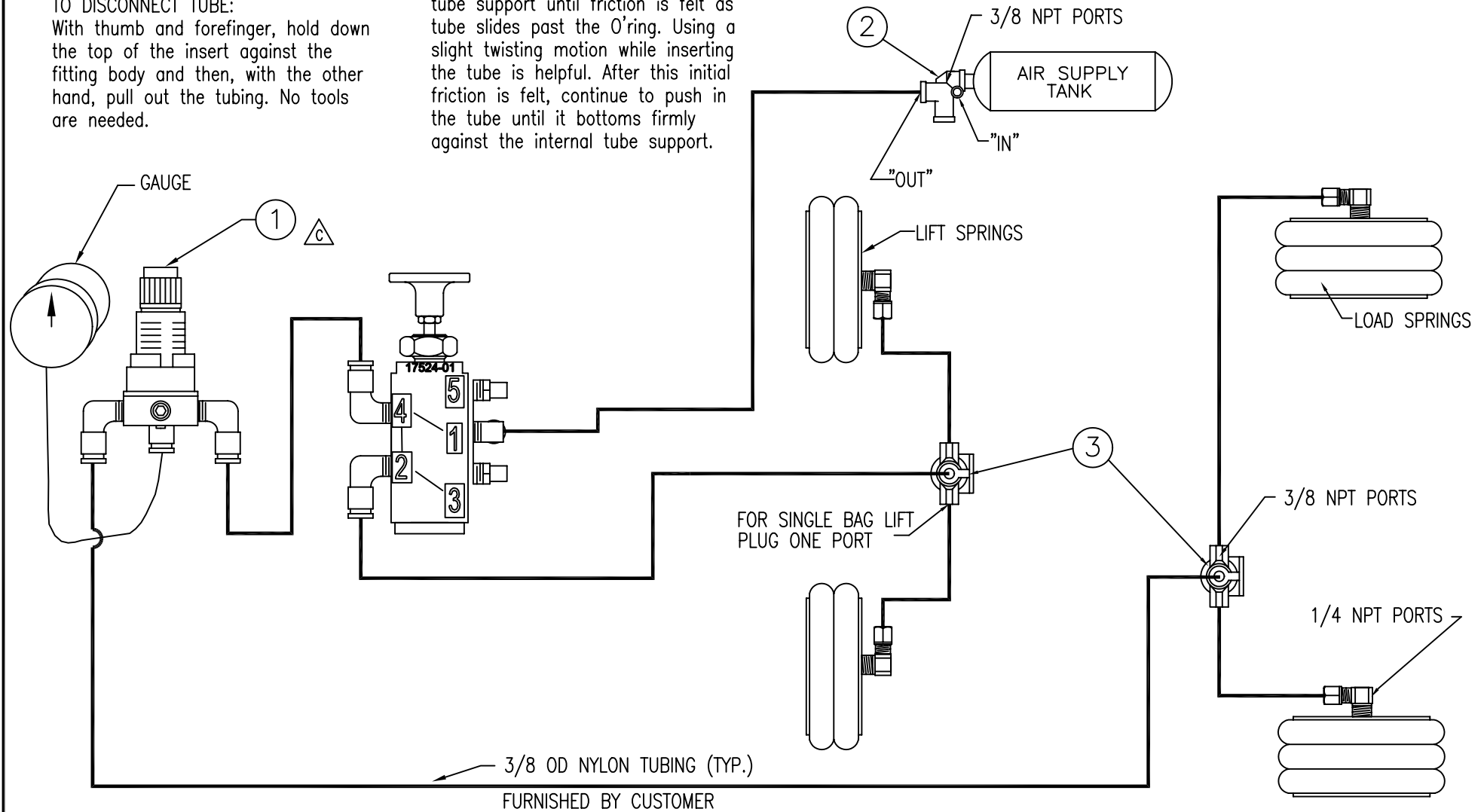


LEVEL	REVISION DESCRIPTION	ECN	DATE	BY
	ADD CONNECTION INSTR.	-	1/16/96	KDH
B	SCALE CONTROL DETAIL	-	2/19/96	KDH
C	UPDATED ITEM # 1	3044	12/03/03	JFF
D	ITEM 3 WAS 10099	7067	06/02/09	GWE

TO CONNECT TUBE:
 Cut plastic tube as squarely as possible. Insert tube end into fitting, slide the I.D. of the tube over the tube support until friction is felt as tube slides past the O'ring. Using a slight twisting motion while inserting the tube is helpful. After this initial friction is felt, continue to push in the tube until it bottoms firmly against the internal tube support.

TO DISCONNECT TUBE:
 With thumb and forefinger, hold down the top of the insert against the fitting body and then, with the other hand, pull out the tubing. No tools are needed.

ITEM	PART NO.	QTY.	DESCRIPTION
1	990021	1	CONTROL PANEL ASSEMBLY
2	10100	1	BRAKE PROTECTION VALVE
3	10099-02	2	QUICK RELEASE VALVE



REF: ACK05 REPLACEMENT

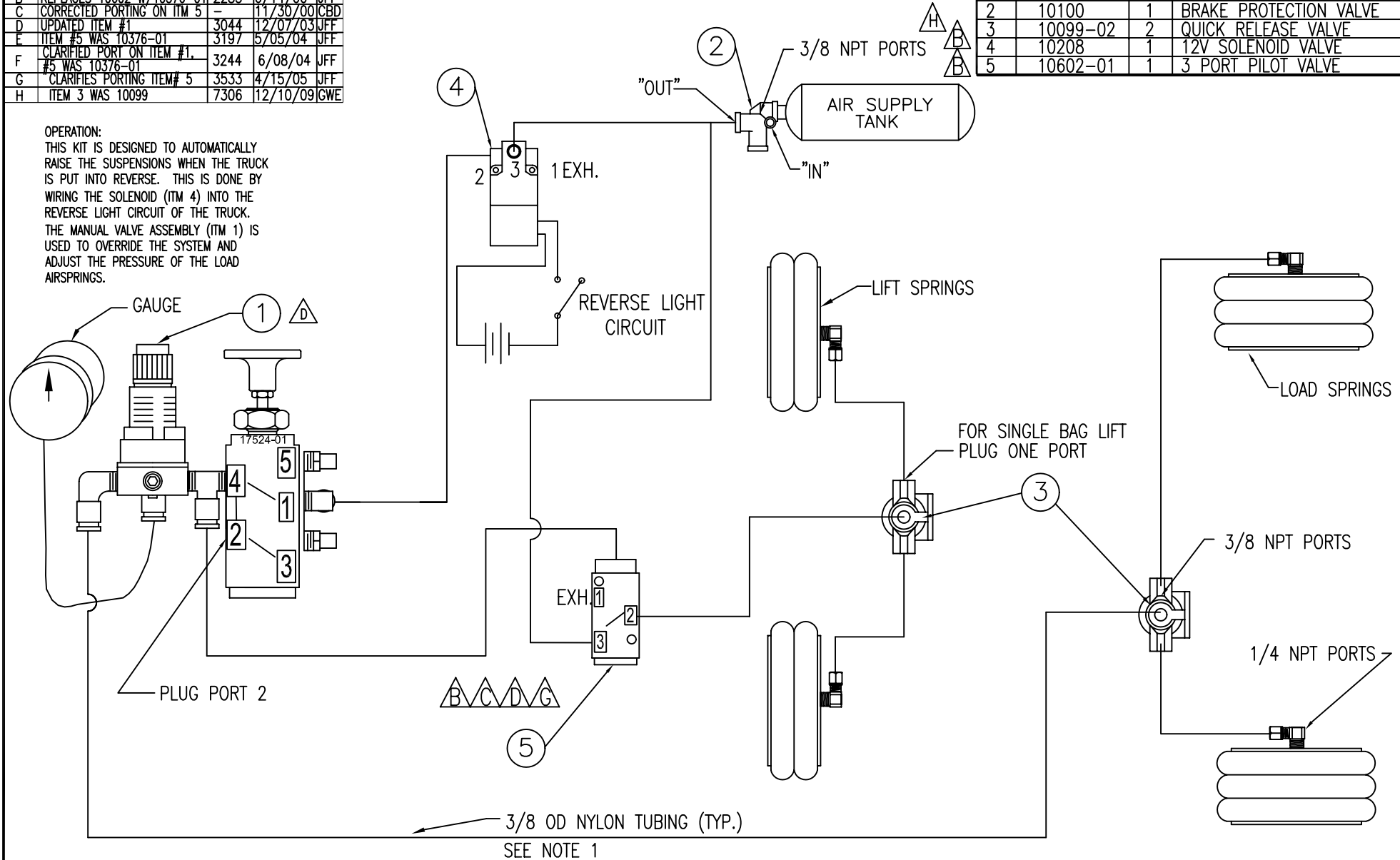
PART PROPERTIES		TOLERANCES (EXCEPT AS NOTED)		DESCRIPTION			
AREA	-	DECIMAL	±	MANUAL ACK W/ AIR RIDE			
CUT LENGTH	-	FRACTIONAL	±	SUSPENSION MODEL	SCALE	PREVIOUS ASSEMBLY	
WEIGHT	-	ANGULAR	±	DATE	CHKD BY	DRAWN BY	SIZE
				12/7/95	-	KDH	A
							DRAWING NO.
							ACK55

WATSON & CHALIN MFG., INC.

LEVEL	REVISION DESCRIPTION	ECN	DATE	BY
A	CH PORTS ON SOLENOID	N/A	6/25/96	CBD
B	REPLACES 10602 W/10376-01	2285	6/14/00	JFF
C	CORRECTED PORTING ON ITEM 5	-	11/30/00	CBD
D	UPDATED ITEM #1	3044	12/07/03	JFF
E	ITEM #5 WAS 10376-01	3197	5/05/04	JFF
F	CLARIFIED PORT ON ITEM #1, #5 WAS 10376-01	3244	6/08/04	JFF
G	CLARIFIES PORTING ITEM# 5	3533	4/15/05	JFF
H	ITEM 3 WAS 10099	7306	12/10/09	GWE

ITEM	PART NO.	QTY.	DESCRIPTION
1	990028	1	CONTROL PANEL ASSEMBLY
2	10100	1	BRAKE PROTECTION VALVE
3	10099-02	2	QUICK RELEASE VALVE
4	10208	1	12V SOLENOID VALVE
5	10602-01	1	3 PORT PILOT VALVE

OPERATION:
THIS KIT IS DESIGNED TO AUTOMATICALLY RAISE THE SUSPENSIONS WHEN THE TRUCK IS PUT INTO REVERSE. THIS IS DONE BY WIRING THE SOLENOID (ITEM 4) INTO THE REVERSE LIGHT CIRCUIT OF THE TRUCK. THE MANUAL VALVE ASSEMBLY (ITEM 1) IS USED TO OVERRIDE THE SYSTEM AND ADJUST THE PRESSURE OF THE LOAD AIRSPRINGS.



3/8 OD NYLON TUBING (TYP.)
SEE NOTE 1

NOTE:

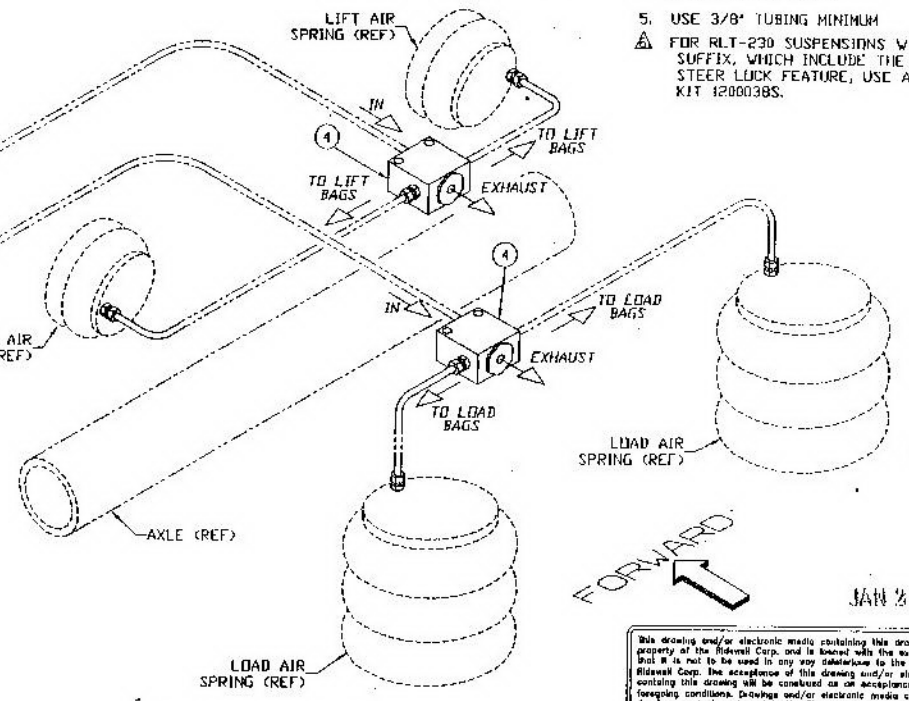
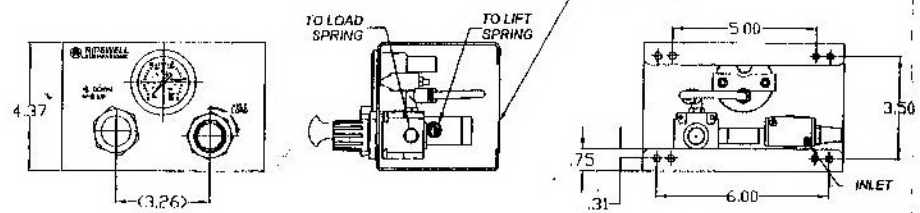
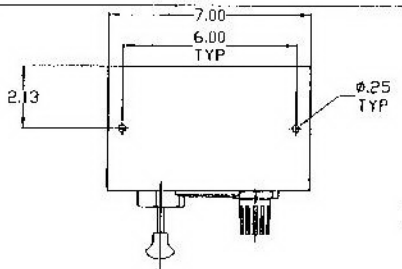
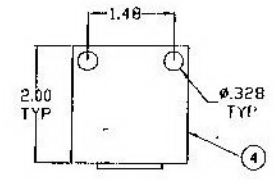
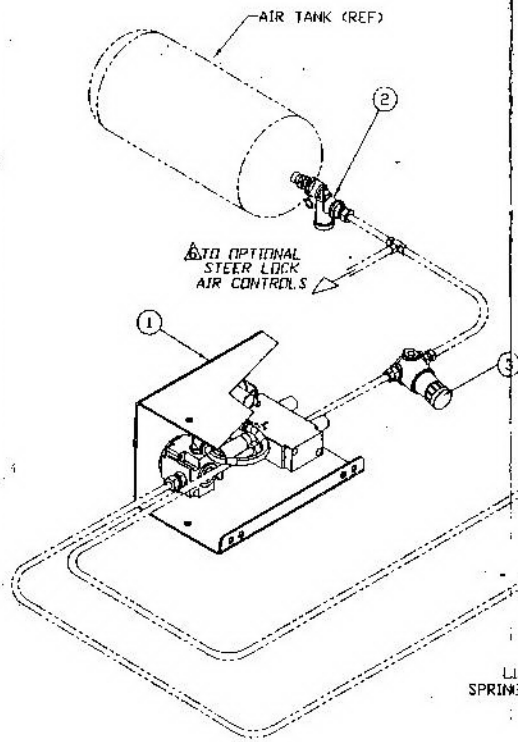
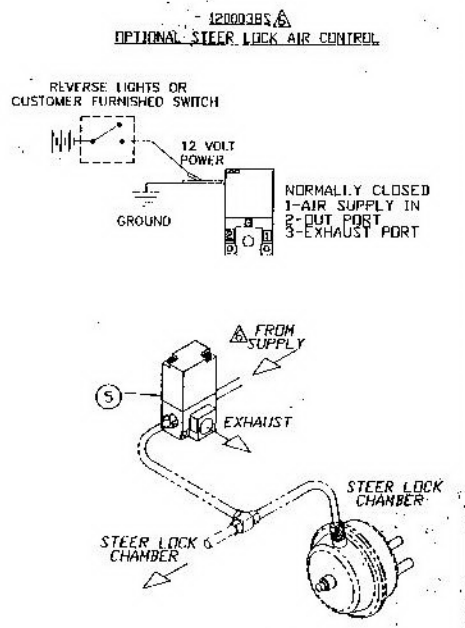
- ALL NYLON TUBING AND FITTINGS FURNISHED BY CUSTOMER. (EXCEPT FOR CONTROL PANEL)

DEPARTMENT AFFECTED	TOLERANCES (EXCEPT AS NOTED)	WATSON & CHALIN MFG., INC.			
20	DECIMAL ± .06	DESCRIPTION AUTOMATIC UP/DOWN			
-	FRACTIONAL ± 1/16	SUSPENSION MODEL	SCALE NTS	PREVIOUS ASSEMBLY -	
-	ANGULAR ± 1°	DATE 12/7/95	CHKD BY -	DRAWN BY KDH	SIZE A
		DRAWING NO. ACK-51			

PARTS FOR 120003BS (FOR STEER LOCK SUSP.)				
PARTS FOR 120003B				
ITEM No.	PART No.	PART DESCRIPTION	No. REQ'D	No. REC'D
1	1230119	ACK PANEL, AUX AXLE CNTRL	1	1
2	1230060	VALVE, PRESS. PROT. V/ CHECK	1	1
3	1230047	PRESET PRESS. REG. VALVE	1	1
4	1230079	QUICK RELEASE VALVE	2	2
5	1237652B000	SEL. VLV 3-WAY 120C MAC	-	1

NOTES:

- AIR GAUGE SHOWS PRESSURE ONLY WHEN AXLE IS IN THE "DOWN" POSITION. AXLE LIFT PRESSURE DOES NOT REGISTER ON GAUGE
 - AIR BRAKE PRESSURE PROTECTION VALVE (ITEM 2) TO OPEN AT 70psi
 - PRESET PRESSURE REGULATOR (ITEM 3) SET TO 110psi
 - ALL TUBING AND FITTINGS CUSTOMER FURNISHED
 - USE 3/8" TUBING MINIMUM
- ▲ FOR RL1-230 SUSPENSIONS WITH AN "S" SUFFIX, WHICH INCLUDE THE RIDEWELL STEER LOCK FEATURE, USE AIR CONTROL KIT 120003BS.



CONTROL PANEL ASSEMBLY

COVERED UNDER U.S. & FOREIGN PATENTS EXISTING & APPLIED FOR

DESIGNER: DK	2-12-02
CHECKED: MDJ	3-27-02
APPROVED: DK	3-27-02
PROJECT NO: 01168	SCALE: NTS
	D-SIZE: -
SEE BOM	INCHES: -
TOLERANCES UNLESS OTHERWISE SPECIFIED:	
DECIMALS: .X .XX .XXX	FRACTIONS: 1/16 1/8 1/4 3/8 1/2

RIDEWELL CORPORATION
PO BOX 4586 SPRINGFIELD, MISSOURI 65808

REV	PROJECT	REVISION DESCRIPTION	DATE	BY	CHK	APPD
F	07100	ITEM 1 P/N WAS 12300B2	1/22/08	JBS	MDJ	DK
E	06100	UPDATED HOSE LOCATIONS IN ITEM 1 BRACKET	4/4/06	GH	MDJ	DK
D	05100	ITEM 1 TO REV C	04/27/05	GH	BB	DK
C	05100	NOTE 3 HAS PRESET PRESSURE 100psi	02/02/05	GH	MDJ	DK
B	03149	ADDED ITEM 5 FOR STEER LOCK SUSPENSIONS	01/26/04	GH	MDJ	DK

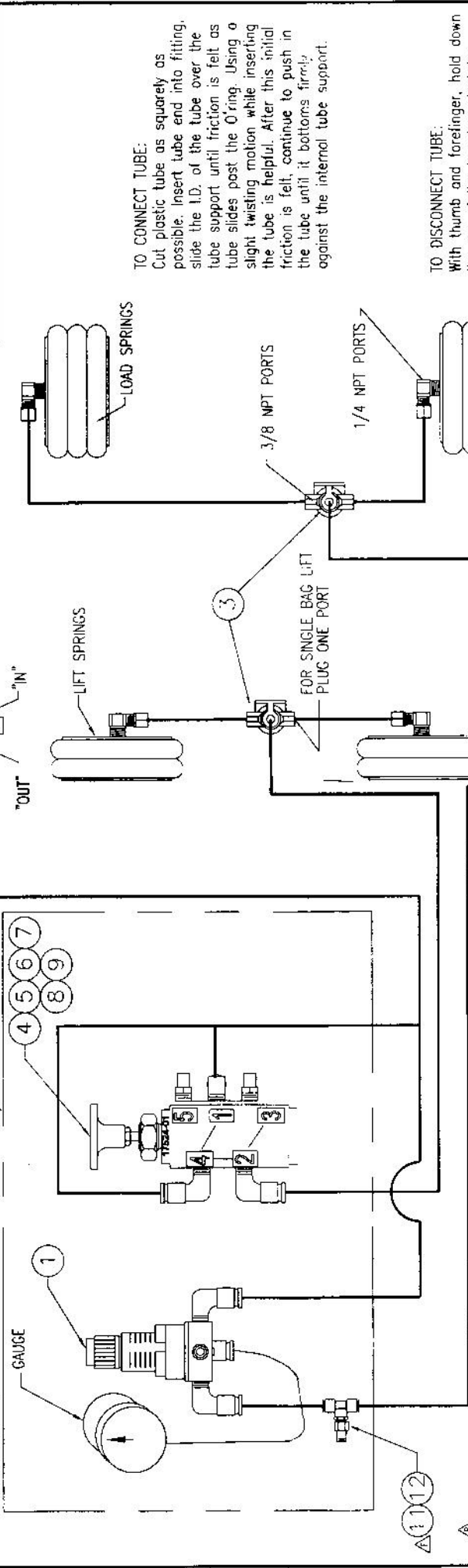
TITLE: LIFT AXLE AIR CONTROL KIT STANDARD

LEVEL	REVISION DESCRIPTION	ECN	DATE	BY
A	NEW DRAWING	3694	1-/11/05 JFF	
B	ADDED -01 OPTION	3926	4/14/06 JUB	
C	ADDED DETAIL A			
D	CHANGED ITEM #3, ADD NOTE 3	C4973	10/25/07 JFF	
E	ADDED -02 TABULATION	C6321	3/17/09 JFF	
F	ADDED -03 TABULATION	7002	05/05/09 GWE	

ITEM	PART NO.	QTY.	DESCRIPTION
1	990098	1	CONTROL PANEL ASSEMBLY
2	10100	1	BRAKE PROTECTION VALVE
3	10099-02	2	QUICK RELEASE VALVE
4	17524-01	1	5 PORT PUSH/PULL
5	90950	2	VALVE MOUNTING BRACKET
6	10340	2	CAP SCREW .25 X 1.00 UN
7	16027	2	FLY NUT .25 UNC
8	10176	4	FLAT WASHER .25
9	10619	2	LOCK WASHER .25
10	15532	2	CHAM
11	15532	2	CHAM
12	15532	2	CHAM

SEE DETAIL "A" FOR BOX DIMS

ACK-55WB-01
PUSH/PULL NOT INCLUDED IN WB

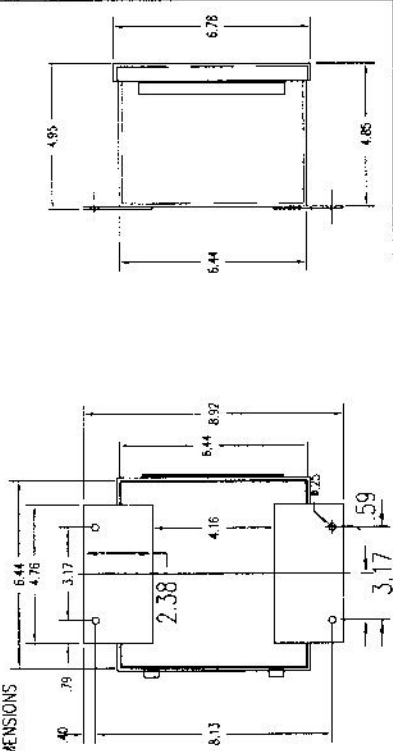


TO CONNECT TUBE:
Cut plastic tube as squarely as possible. Insert tube end into fitting, slide the I.D. of the tube over the tube support until friction is felt as tube slides past the O'ring. Using a slight twisting motion while inserting the tube is helpful. After this initial friction is felt, continue to push in the tube until it bottoms firmly against the internal tube support.

TO DISCONNECT TUBE:
With thumb and forefinger, hold down the top of the insert against the fitting body and then, with the other hand, pull out the tubing. No tools are needed.

- NOTE:**
1. ALL NYLON TUBING AND FITTINGS FURNISHED BY CUSTOMER. (EXCEPT FOR CONTROL PANEL)
 2. MANUAL OVERRIDE TO BE SET TO 0 (OFF) FOR SOLENOID TO OPERATE
 3. ACK55WB-01 ITEM #4 NOT INSTALLED IN WEATHER BOX, SHIPPED LOOSE

WEATHER BOX DIMENSIONS




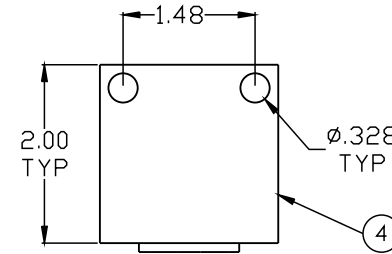
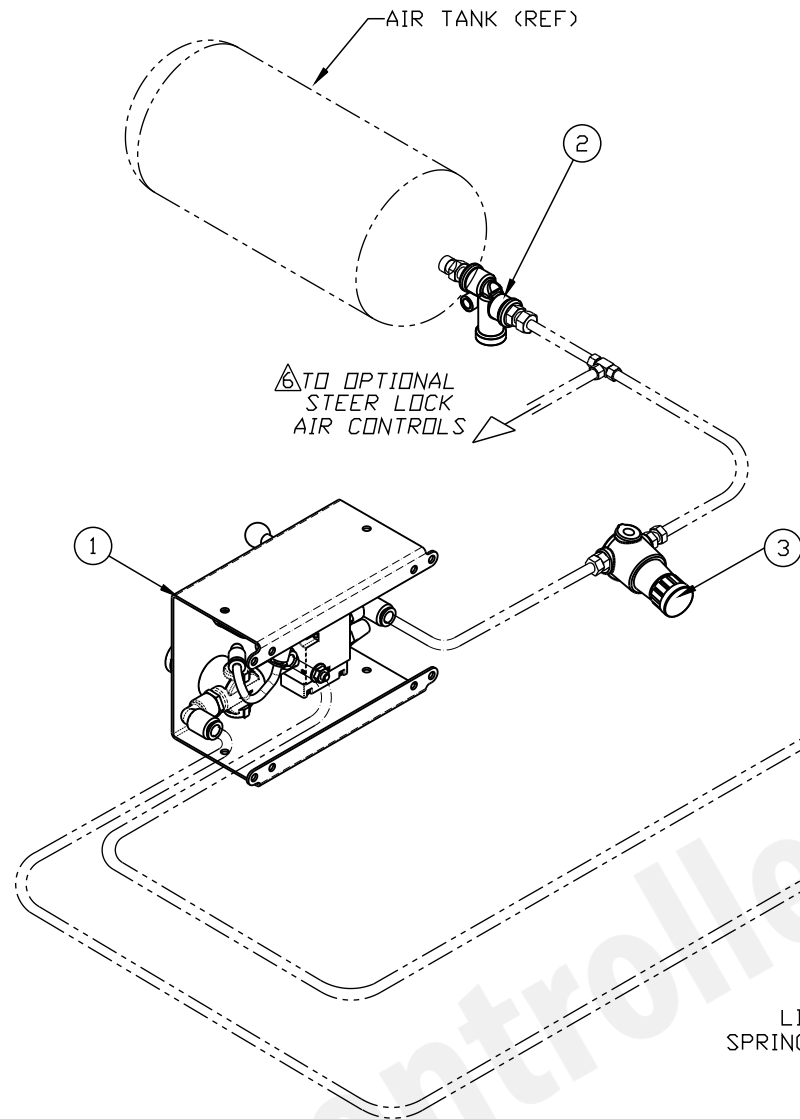
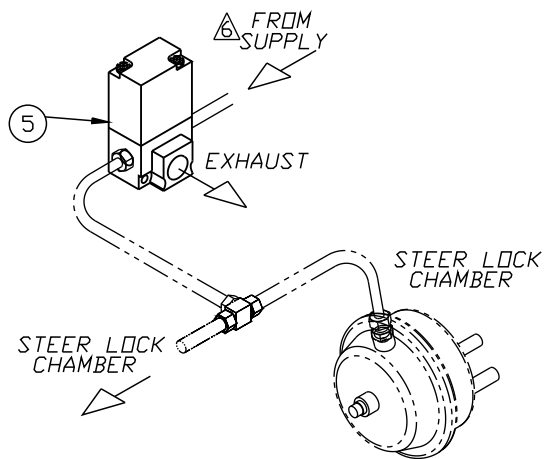
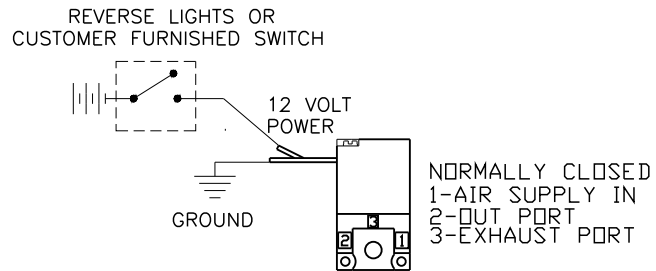
REF: ACK-05 REPLACEMENT
WATSON & CHALIN MFG. INC.


DESCRIPTION	SCALE	PREVIOUS ASSEMBLY
MANUAL ACK W/ AIR RIDE		
ACK	NTS	
DATE	CHKD BY	DRAWING NO.
3/17/09	JFF	B ACK55WB

PART NO.	ITEM #4	ITEM #10 QTY.	ITEM #11	ITEM #12
ACK55WB	17524-01	1	N/A	
ACK55WB-01	17524-01 SEE NOTE 3	1		
ACK55WB-02	CONTROL IN SEPARATE BOXES	2		
**ACK55WB-03	17524-01	1	17818	17761

**MAYLAND SPEC

1200038S 
 OPTIONAL STEER LOCK AIR CONTROL

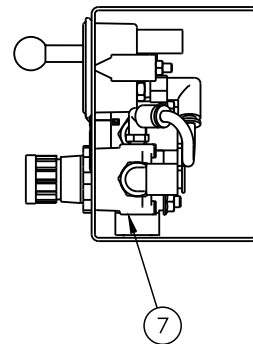
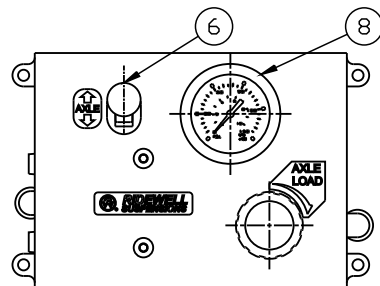
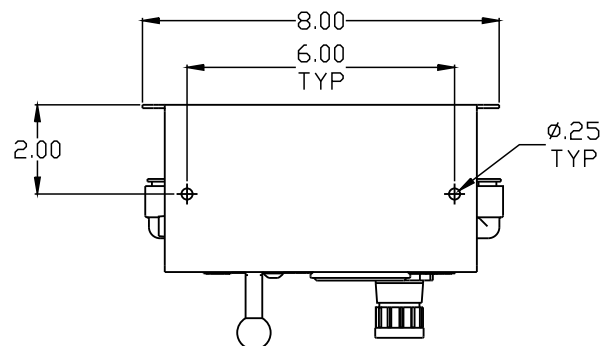


PARTS FOR 1200038S  (FOR STEER LOCK SUSP.)
 PARTS FOR 1200038

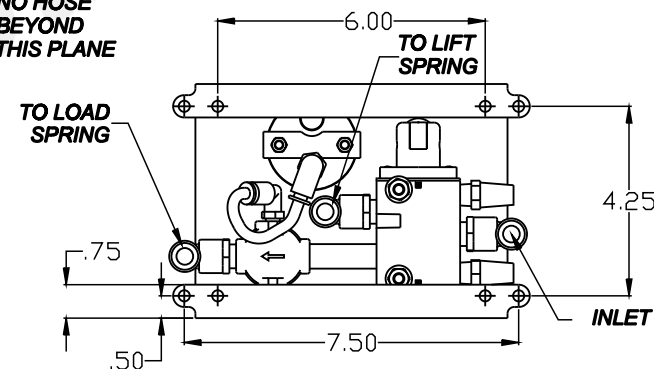
ITEM No.	PART No.	PART DESCRIPTION	No. REQD.	No. REQD.
1	1210024	ACK PANEL, AUX AXLE CNTRL	1	1
2	1230060	VALVE, PRESS. PROT. W/ CHECK	1	1
3	1230047	PRESET PRESS. REG. VALVE	1	1
4	1230078	QUICK RELEASE VALVE	2	2
5	1237652B000	SDL VLV 3-WAY 12DC MAC	-	1
6	1230156	VLV,MAN,4-WAY SPRES LEVERDOWN	-	-
7	1230141	PRESSURE REG,1/4 NPT	-	-
8	1230080	GAUGE,2"PNEL,LIGHT 0-150 PSI	-	-

NOTES:

- AIR GAUGE SHOWS PRESSURE ONLY WHEN AXLE IS IN THE "DOWN" POSITION. AXLE LIFT PRESSURE DOES NOT REGISTER ON GAUGE
- AIR BRAKE PRESSURE PROTECTION VALVE (ITEM 2) TO OPEN AT 70psi
- PRESET PRESSURE REGULATOR (ITEM 3) SET TO 110psi
- ALL TUBING AND FITTINGS CUSTOMER FURNISHED
- USE 3/8" TUBING MINIMUM
- FOR RLT-230 SUSPENSIONS WITH AN "S" SUFFIX, WHICH INCLUDE THE RIDEWELL STEER LOCK FEATURE, USE AIR CONTROL KIT 1200038S.
- ITEMS 6-8 ARE PART OF ITEM 1 AND ARE LISTED FOR REPLACEMENT REFERENCE ONLY



NO HOSE BEYOND THIS PLANE




CONTROL PANEL ASSEMBLY

G	10100	ITEM 1 P/N WAS 1230119, ADDED NOTE 7 (REPLACEMENT REF. PARTS)	3/8/10	G.H.	MDJ	DK
F	07100	ITEM 1 P/N WAS 1230062	1/22/08	JBS	MDJ	DK
E	06100	UPDATED HOLE LOCATIONS IN ITEM 1 BRACKET	4/4/06	GH	MDJ	DK
D	05100	ITEM 1 TO REV C	04/27/05	GH	BB	DK
C	05100	NOTE 3: WAS PRESET PRESSURE 100psi	02/02/05	GH	MDJ	DK
B	03149	ADDED ITEM 5 FOR STEER LOCK SUSPENSIONS	01/26/04	GH	MDJ	DK
REV	PROJECT	REVISION DESCRIPTION	DATE	BY	CHK	APPD

DRAWN BY:	DK	2-12-02
CHECKED:	MDJ	3-27-02
APPROVED:	DK	3-27-02
PROJECT NO:	01168	SCALE: B-SIZE: NTS D-SIZE: -
MATERIAL:	SEE BOM	WEIGHT: -
TOLERANCES UNLESS OTHERWISE SPECIFIED:	DECIMAL: .XX ±0.1 FRACTION: 1/16 ±1/16 XXX ±0.030 ANG: X ±1°	

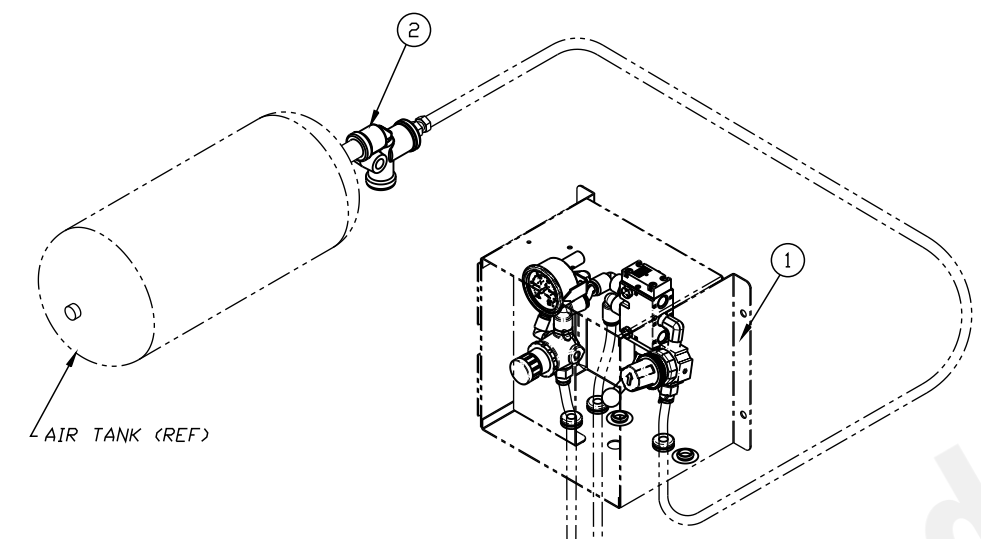
 **RIDEWELL CORPORATION**
 PO BOX 4586 SPRINGFIELD, MISSOURI 65808

TITLE: LIFT AXLE AIR CONTROL KIT STANDARD

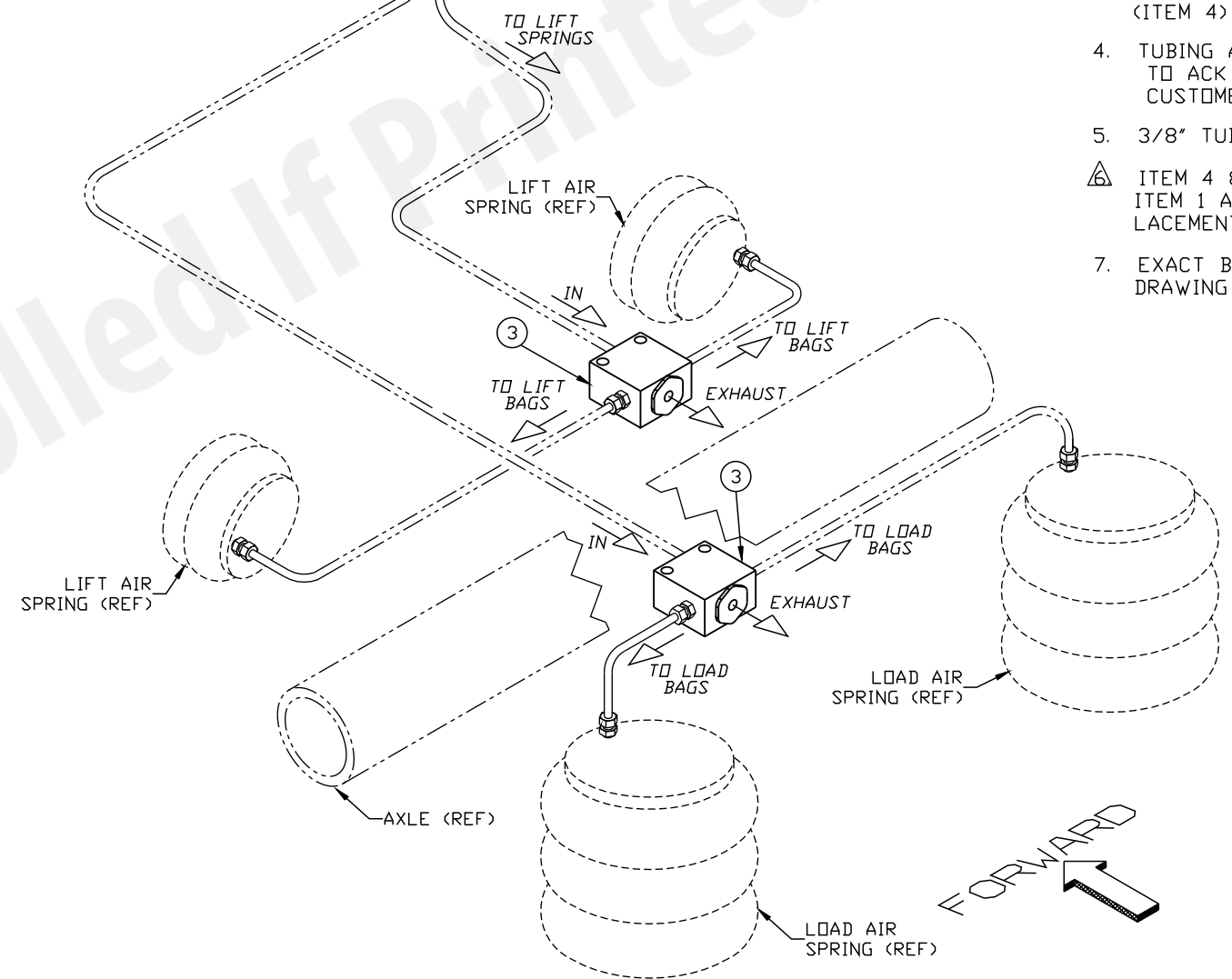
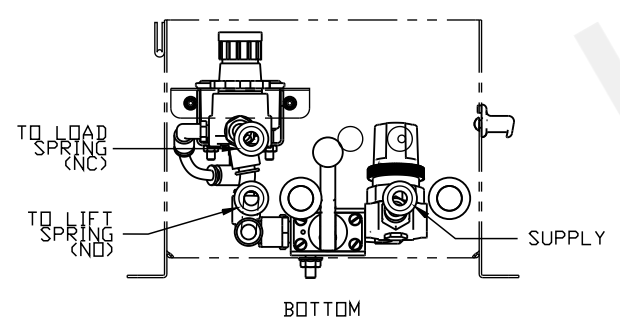
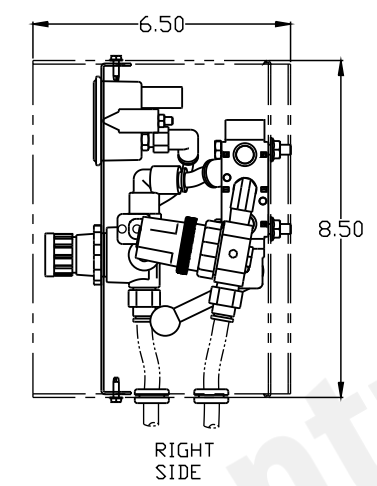
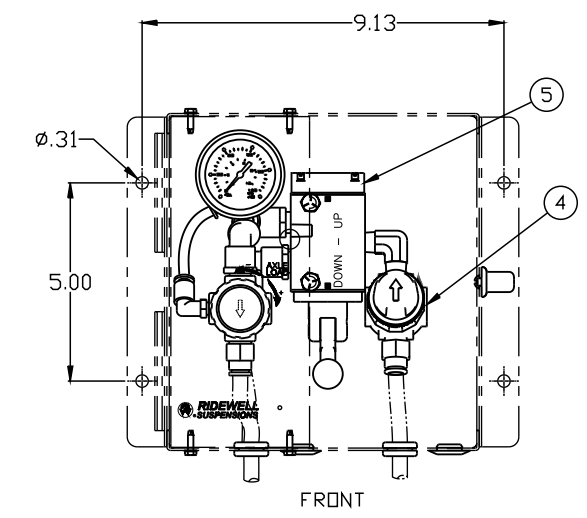
SHEET 1 OF 1 PART NO: 1200038 REV: 

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ITEM No.	PART No.	PART DESCRIPTION	No. REQD.
1	1210032	ACK BOX ASSY.	1
2	1230060	VALVE, PRESS. PROT. W/ CHECK	1
3	1230078	QUICK RELEASE VALVE	2
4	1230047	PRESET PRESS. REG. VALVE	2
5	1230116	VALVE, 4WAY, MAN, LEV, S/PRESS	2



ACK ENCLOSURE (ITEM 1)
SHOWN W/OUT LID, AND LATCH



- NOTES:
1. AIR GAUGE SHOWS PRESSURE ONLY WHEN AXLE IS IN THE "DOWN" POSITION. AXLE LIFT PRESSURE DOES NOT REGISTER ON GAUGE
 2. AIR BRAKE PRESSURE PROTECTION VALVE (ITEM 2) TO OPEN AT 70psi
 3. PRESET PRESSURE REGULATOR (ITEM 4) SET TO 110psi
 4. TUBING AND FITTINGS EXTERNAL TO ACK BOX (ITEM 1) ARE CUSTOMER FURNISHED
 5. 3/8" TUBING RECOMMENDED
 6. ITEM 4 & 5 ARE PART OF ITEM 1 AND ARE LISTED FOR REPLACEMENT REF, ONLY.
 7. EXACT BOX CONFIGURATION DRAWING AVAILABLE UPON REQUEST

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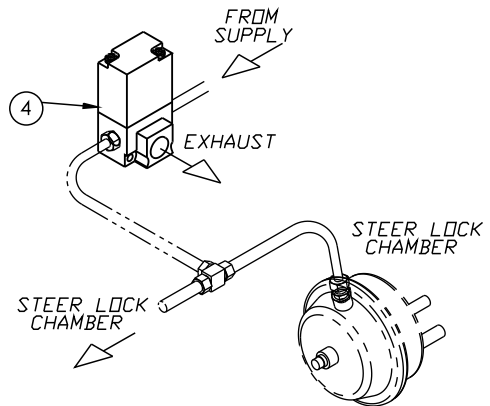
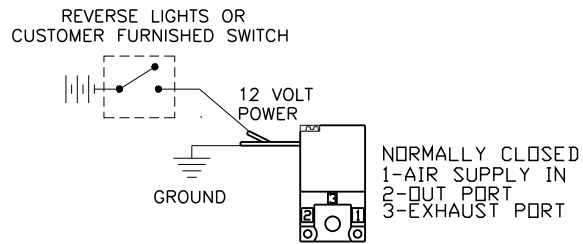
REV	PROJECT	REVISION DESCRIPTION	DATE	BY	CHK	APPD
B	15100	UPDATED ACK BOX (ITEM 1)	9/11/15	PMB	B.B.	MDJ
A	12111	REMOVED GROMMET FOR GAUGE WIRING	7/19/12	PMB	MDJ	PMB

DRAWN BY:	GH	11/01/11
CHECKED:	MDJ	11/14/11
APPROVED:	PMB	11/14/11
PROJECT NO:	11100	
SCALE:	B-SIZE: NTS	
	D-SIZE: -	
MATERIAL:	SEE BOM	WEIGHT: -
TOLERANCES UNLESS OTHERWISE SPECIFIED: DECIMAL: .XX ±0.06 FRACTION: 1/16 XXX ±0.030 ANG: X ±1'		

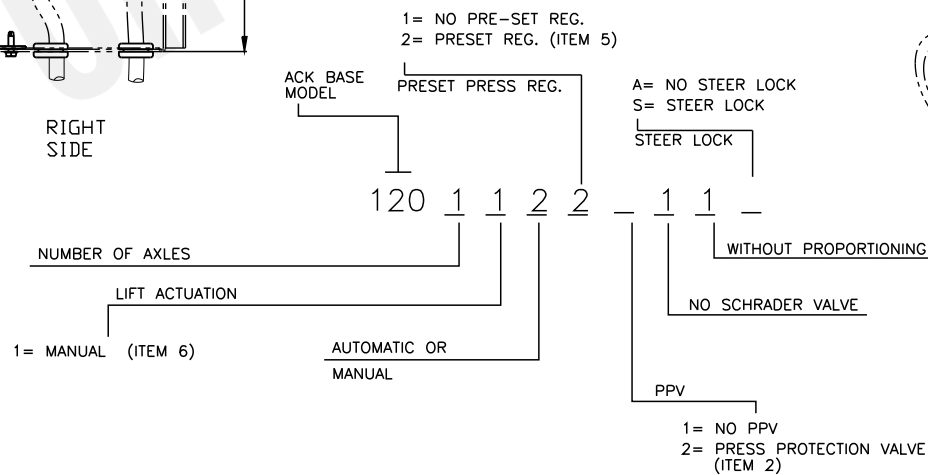
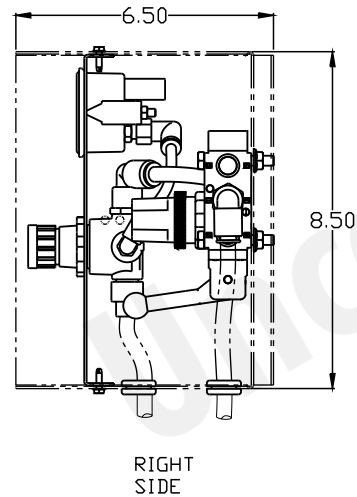
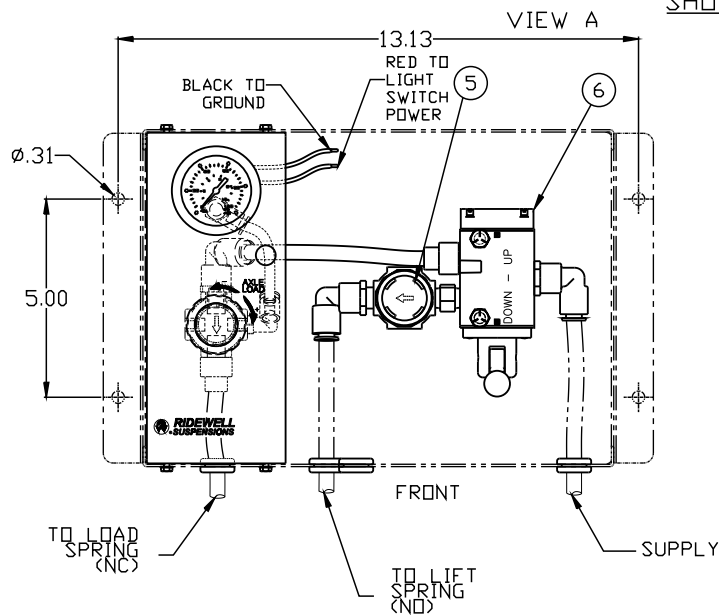


TITLE: ONE AXLE, MANUAL, SML BOX AIR CONTROL KIT FOR ADJUSTABLE PRESSURE REGULATION

OPTIONAL STEER LOCK AIR CONTROL



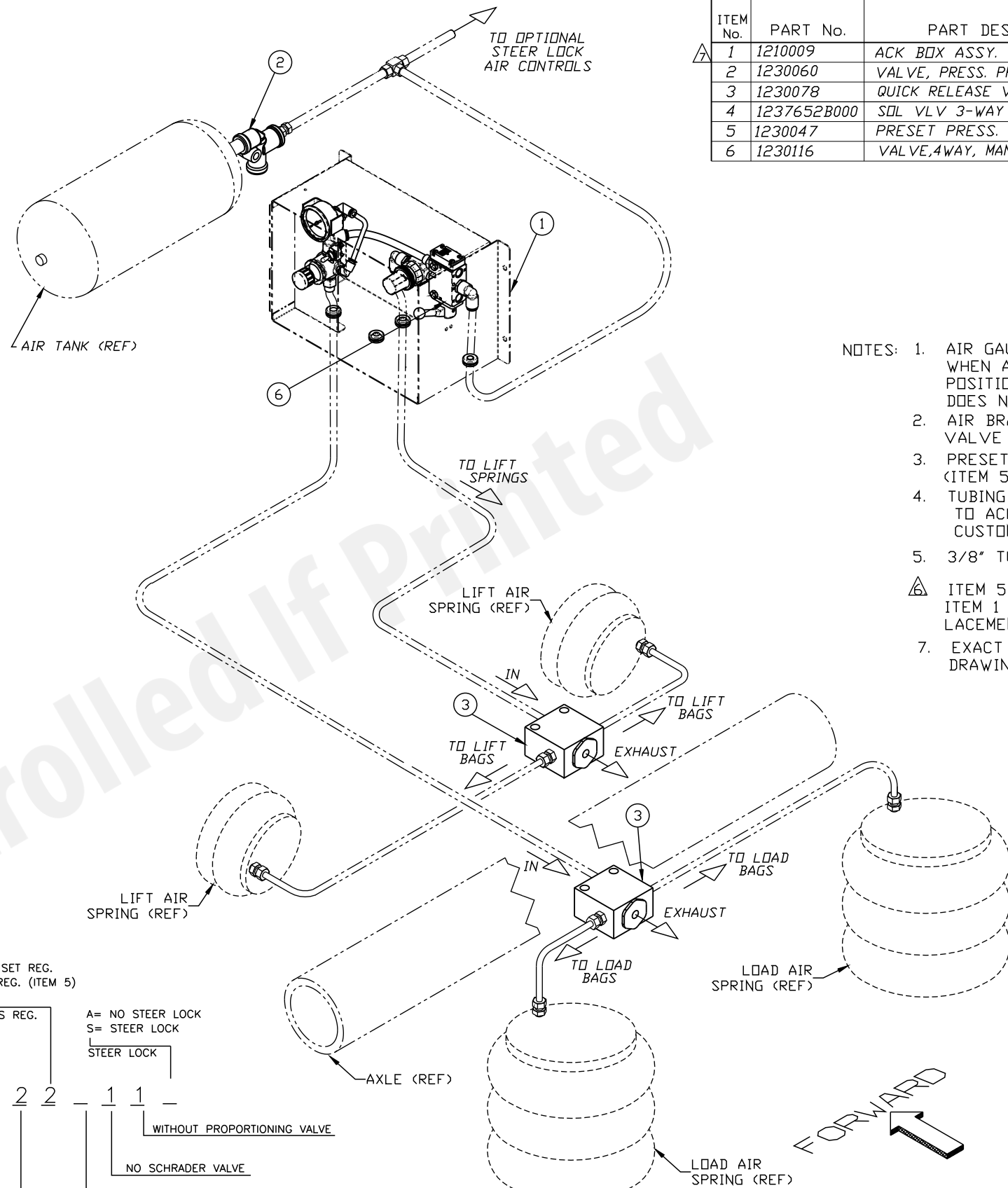
**ACK ENCLOSURE (ITEM 1)
SHOWN W/OUT LID, AND LATCH**



ITEM No.	PART No.	PART DESCRIPTION	No. REQD.	No. REQD.	No. REQD.	No. REQD.
1	1210009	ACK BOX ASSY.	1	1		
2	1230060	VALVE, PRESS. PROT. W/ CHECK	1	-		
3	1230078	QUICK RELEASE VALVE	2	2		
4	1237652B000	SOL VLV 3-WAY 12DC MAC	-	-		
5	1230047	PRESET PRESS. REG. VALVE	1	1		
6	1230116	VALVE, 4WAY, MAN, LEV, S/PRESS	1	1		

1201122211A
1201122211A

- NOTES:
- AIR GAUGE SHOWS PRESSURE ONLY WHEN AXLE IS IN THE "DOWN" POSITION. AXLE LIFT PRESSURE DOES NOT REGISTER ON GAUGE
 - AIR BRAKE PRESSURE PROTECTION VALVE (ITEM 2) TO OPEN AT 70psi
 - PRESET PRESSURE REGULATOR (ITEM 5) SET TO 110psi
 - TUBING AND FITTINGS EXTERNAL TO ACK BOX (ITEM 1) ARE CUSTOMER FURNISHED
 - 3/8" TUBING RECOMMENDED
 - ITEM 5 & 6 ARE PART OF ITEM 1 AND ARE LISTED FOR REPLACEMENT REF, ONLY.
 - EXACT BOX CONFIGURATION DRAWING AVAILABLE UPON REQUEST



DRAWN BY: GH	7/9/09
CHECKED: MDJ	7/9/09
APPROVED: DK	7/9/09
PROJECT NO: 09100	SCALE: B-SIZE: NTS D-SIZE: -
MATERIAL: SEE BOM	WEIGHT: -
TOLERANCES UNLESS OTHERWISE SPECIFIED: DECIMAL: .XX ±0.1 FRACTION: 1/16 XXX ±0.06 ANG: ±1°	

RIDEWELL CORPORATION
PO BOX 4586 SPRINGFIELD, MISSOURI 65808

TITLE: ONE AXLE, MANUAL AIR CONTROL KIT FOR ADJUSTABLE PRESSURE REGULATION

PART NO: 1201122X11X

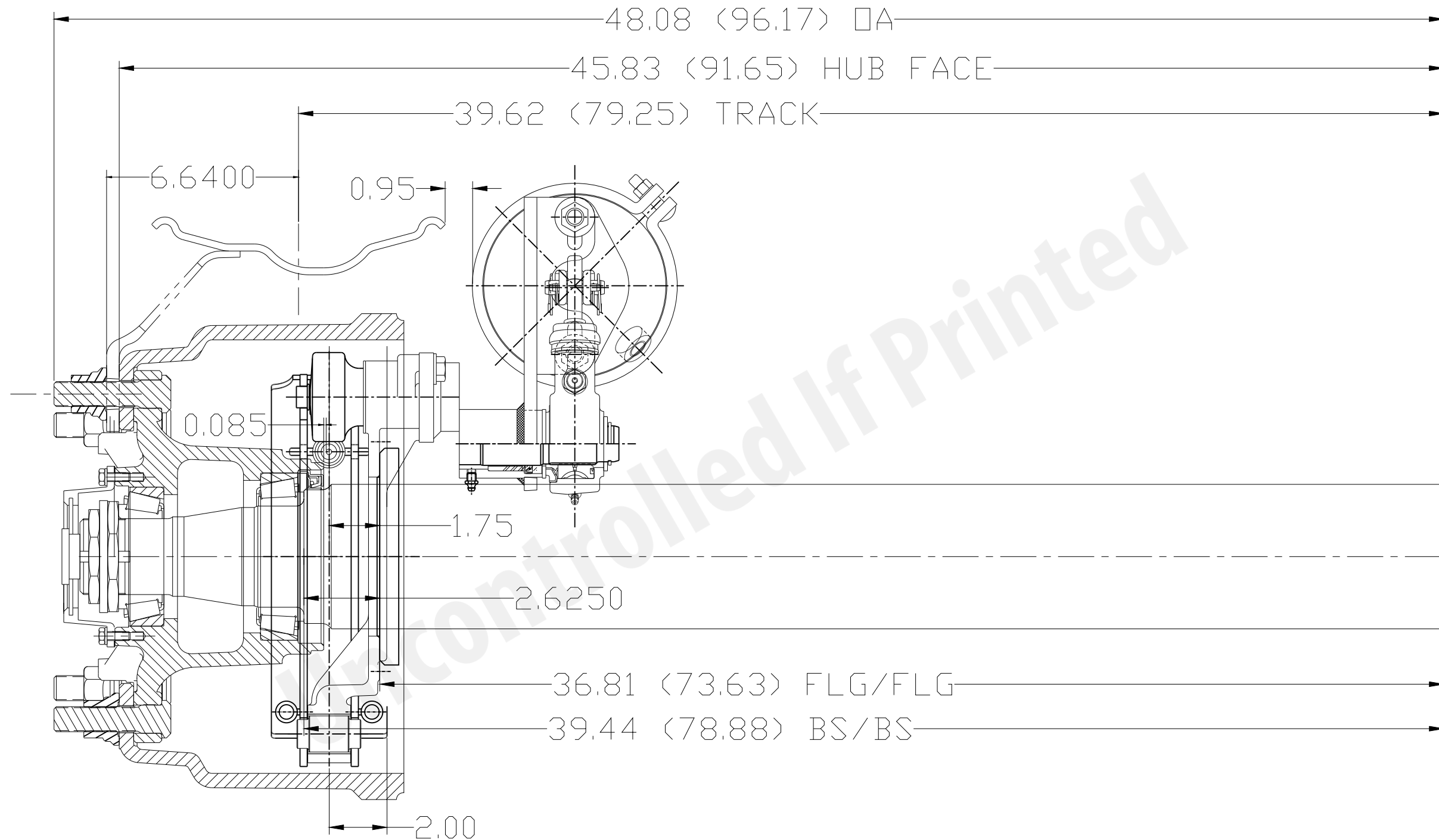
REV: -

SHEET 1 OF 1

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COVERED UNDER U.S. & FOREIGN PATENTS EXISTING & APPLIED FOR

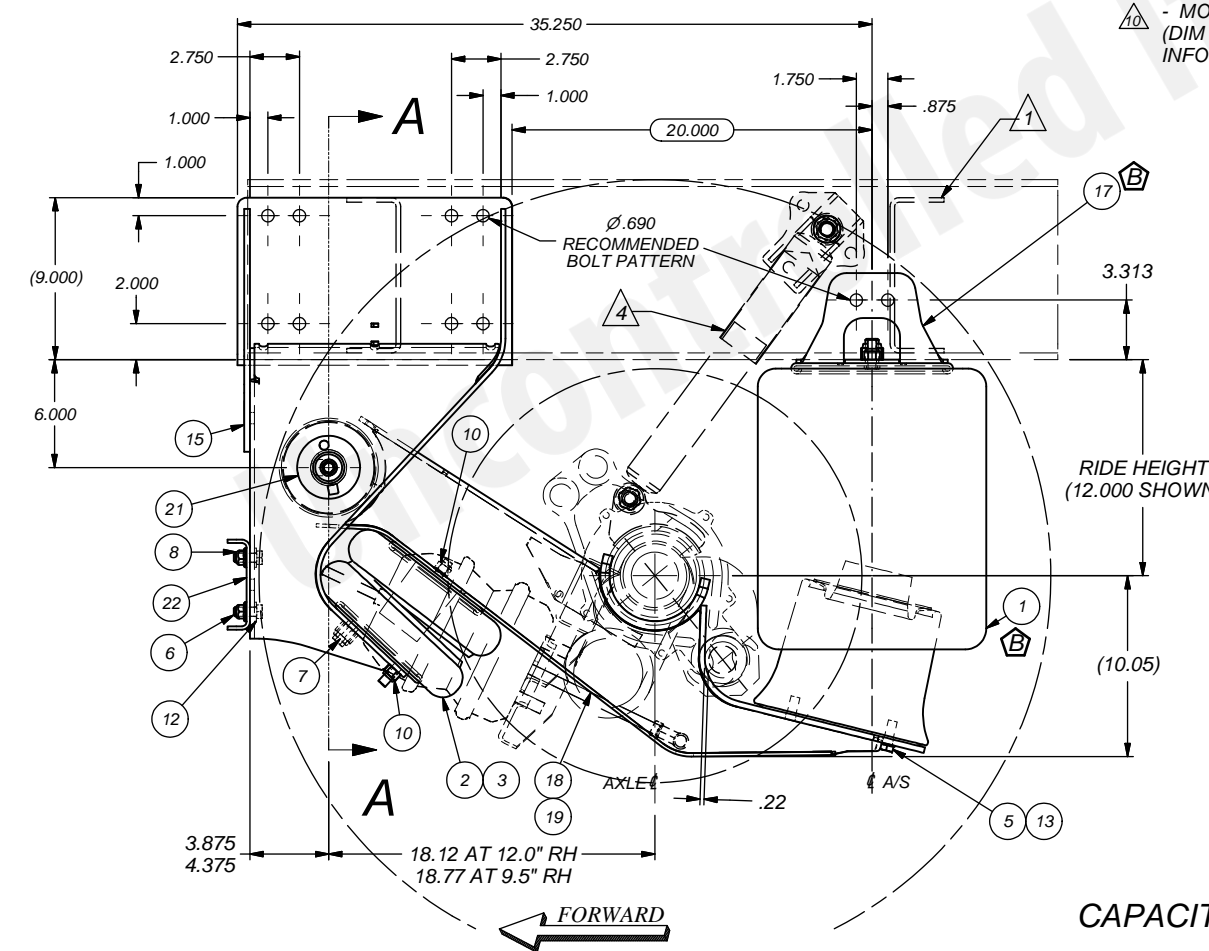
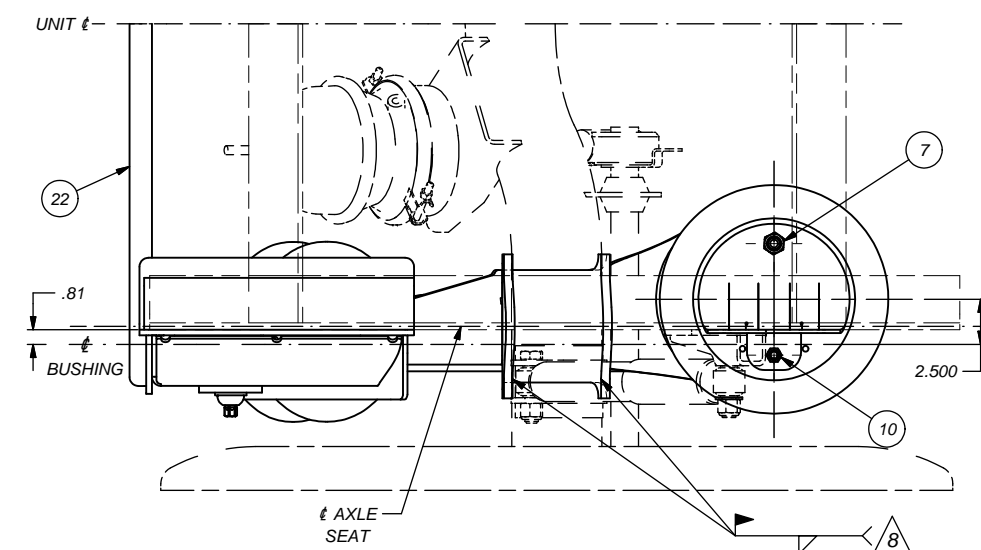
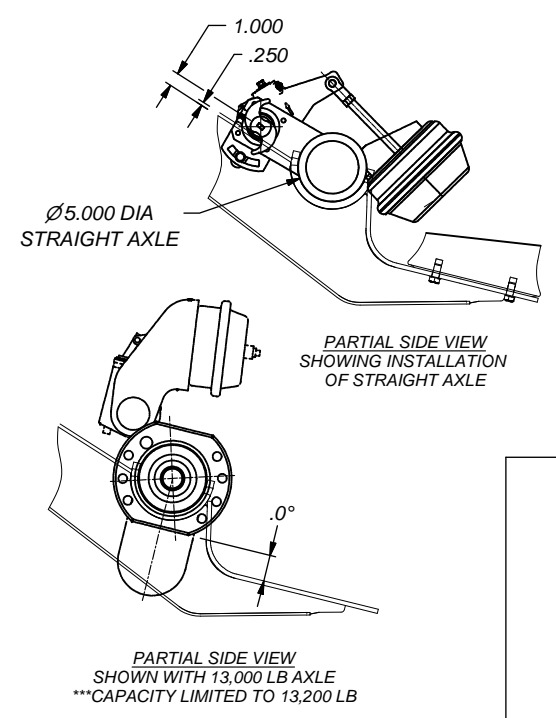
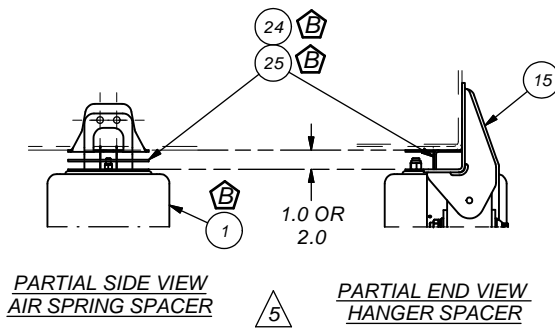
REV	PROJECT	REVISION DESCRIPTION	DATE	BY	CHK	APPD



HUB # 001-02546 } 1660264
 DRUM: 54295-0018 }
 1.75 FROM FLANGE FACE TO BRAKE CL
 2.63 FROM BEARING SHOULDER TO FLANGE

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B	ECN#	ADDED RWC TITLE BLOCK AND BRAKES	12/05/08	MDJ		
A	--	REFINED DESIGN WITH KIC HUB& DRUM	VARIOUS	MDJ	MDJ	MDJ
REV	ECN#	REVISION DESCRIPTION	DATE	BY	CHK	APPD
DRAWN BY: MDJ		12/15/06				
CHECKED:						
APPROVED:						
PROJECT NO:	SCALE:	TITLE: AXLE FN SPINDLE W/ 15 x 4 BRAKES				
-	B-SIZE: 1/4 D-SIZE: -					
MATERIAL:	WEIGHT:					
-	-					
TOLERANCES UNLESS OTHERWISE SPECIFIED:		PART NO:		REV:		
DECIMAL: ±X ±0.1	FRACTION: ±1/16	SHEET 1 OF 1		1640067		B
±XX ±0.06	ANG: X ±1'					
±XXX ±0.030	[XXX] KCC					
*WELD TOLERANCES PER ISO WD45-02						



AXLE ADJUSTMENT PROCEDURE:

- AXLE ALIGNMENT SHALL BE IN ACCORDANCE WITH SAE OR TMC RECOMMENDED STANDARDS.
- LOOSEN PIVOT NUT.
- USING 1/2" DRIVE BREAKER BAR, ROTATE ADJUSTER PLATE IN THE DIRECTION OF DESIRED AXLE MOVEMENT.
- ENSURE THAT THE ADJUSTER PLATE AND ALIGNMENT WASHER HAVE MOVED IN UNISON. IT IS IMPORTANT THAT THE BUSHING IS NOT SKEWED IN THE HANGER PRIOR TO TIGHTENING.
- SNUG PIVOT FASTENERS AND RECHECK ALIGNMENT.
- TORQUE PIVOT BOLT USING A 1" DRIVE IMPACT WRENCH AND #6100054 E-20 TORX SOCKET (OR EQUIVALENT) UNTIL THE TORX HEAD SHEARS OFF FROM THE BOLT.
- WELDING OF ADJUSTER PLATES OR ALIGNMENT WASHERS TO THE HANGER SIDEWALLS IS NOT REQUIRED OR RECOMMENDED.

NOTES:

- △ - CUSTOMER FURNISHED CROSSMEMBERS SHOWN IN RECOMMENDED LOCATIONS.
- △ - FAILURE TO OBSERVE INSTALLATION INSTRUCTIONS MAY VOID WARRANTY
- △ - BUSHING (ITEM 23) IS PART OF THE BUSHING/BEAM ASSEMBLY (ITEM 18&19) AND IS LISTED FOR REPLACEMENT REFERENCE ONLY. BUSHING REPLACEMENT KIT PART NO. 6040128/6040078. TRADITIONAL HARDWARE MUST BE TORQUED TO 500 FT-LB.
- △ - SHOCK MOUNTING KITS ARE AVAILABLE FROM RIDEWELL P/N 6030105. SEE RCA-215 INSTALLATION MANUAL FOR MOUNTING INSTRUCTIONS.
- △ - SPACER KITS ARE NOT INCLUDED WITH SUSPENSION AND ARE LISTED FOR REFERENCE ONLY. ORDER AS NEEDED FOR RIDE HEIGHT OPTIMIZATION.
- △ - RETORQUE FASTENERS AFTER 6,000 MILES.
- △ - ADJUSTMENT PLATE (ITEM 21) MUST SIT FLAT AGAINST HANGER.
- △ - WELD IN ACCORDANCE WITH RIDEWELL WELD PROCEDURE NO. 1.
- △ - BUSHING (ITEM 23) CAN BE INSTALLED USING BUSHING INSTALLATION TOOL NO. 6100044.
- △ - MOUNTING CENTER DIMS "C" & "D" VARY WITH FRAME WIDTH (DIM "B") SEE CHART B-B FOR CORRECT DIMENSION INFORMATION.

PARTS REQUIRED FOR 6001115 (CARTON OF PARTS)					
PARTS FOR 3010971 RH HANGER BEAM ASSEMBLY					
PARTS FOR 3010970 LH HANGER BEAM ASSEMBLY					
ITEM	PART NO.	DESCRIPTION	QTY	QTY	QTY
1	1001R121202	AIR SPRING 1R12-1202			2
2	1002B09611G	AIR SPRING 2B9-611 (LH)			1
3	1002B09614G	AIR SPRING 2B9-614 (RH)			1
4	1130048	PIVOT BLT RND SHEAR-TYPE 7/8" 9NC	1	1	
5	1140554B105	HHCS 1/2" 13NC 1"LG. GR 5, ZINC PLT			6
6	1145383B105	HHCS 1/2" 13NC 1-1/4" L GR 5, ZINC PLT			8
7	1150011	L'NUT 3/4"-16NF GR 2,NYL,ZINC PLa			4
8	1150012	L'NUT 1/2" 13NC FLANGED T-L GR 8 (G)			8
9	1150032	L'NUT 7/8" 9NC GR8 SECURELOK	1	1	
10	1150555B112	L'NUT 1/2" 13NC NYL, GR2, ZINC PL.			6
11	1160868B100	WASHER 7/8" A-325 FLAT ZINC PLATE	1	1	
12	1167053B100	WASHER 1/2" A-325 FLAT ZINC PLATE			8
13	1167482B000	L'WASHER 1/2 INTERNAL TOOTH			6
14	1167680B000	WEAR WASHER, UHMW-PE, BLACK	2	2	
15	3360112	HANGER ASS'Y LH - 215	1		
16	3360113	HANGER ASS'Y RH - 215		1	
17	8003809	A/SPG MTG BRKT MAIN ANGLE 215			2
18	5970354	BUSHING BEAM ASS'Y LH	1		
19	5970355	BUSHING BEAM ASS'Y RH		1	
20	7002582	ALIGNMENT WASHER 3.5"OD	1	1	
21	7002684	ADJUSTER PLATE 3.5"OD	1	1	
22	8001809	CROSSMEMBER CHANNEL			1
23	1110086	BUSHING 75 DURO .906ID X 4.125 WIDE	-	-	-
24	6040167	1" SPACER KIT (CARTON OF PARTS)	-	-	-
25	6040168	2" SPACER KIT (CARTON OF PARTS)	-	-	-
26	6040128	BUSH. REPL. KIT (SNAP OFF BOLT)	-	-	-
27	6040078	BUSH. REPL. KIT (TRADITIONAL BOLT)	-	-	-

TORQUE VALUES

ITEM	SIZE	TORQUE	
		(FT-LB)	(N-M)
5&10	1/2-13 NC	25	34
8	1/2-13 NC	45-50	61-68
7	3/4-16 NF	50	68
9	7/8-9 NC	SEE NOTES	SEE NOTES

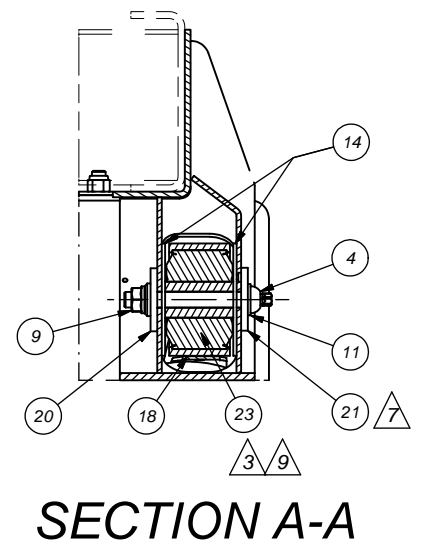
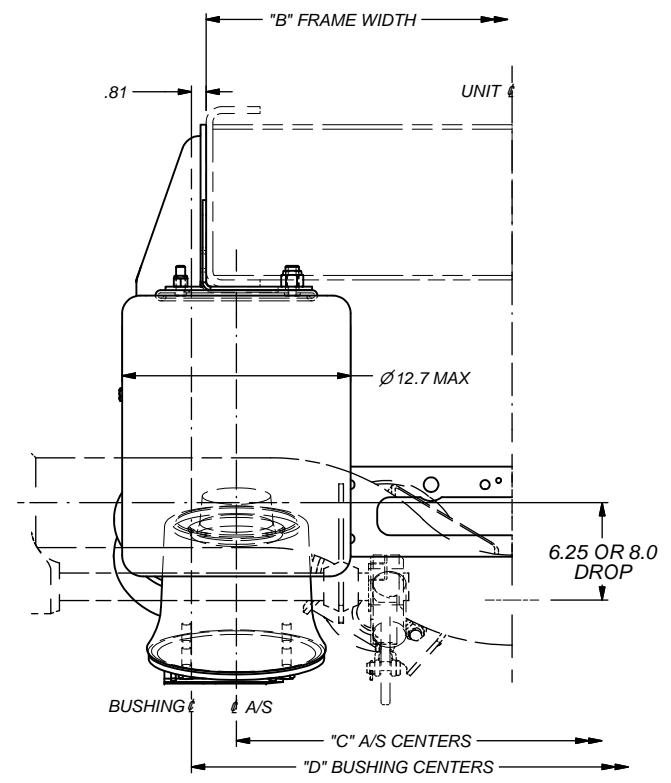
RIDE HEIGHT	TRAVEL TABLE					
	NO SPACER		1" SPACER		2" SPACER	
	UP	DOWN	UP	DOWN	UP	DOWN
9.50	4.5	5.8	-	-	-	-
10.00	5.0	5.3	-	-	-	-
10.50	5.5	4.8	4.5	5.8	-	-
11.00	6.0	4.3	5.0	5.3	-	-
11.50	6.5	3.8	5.5	4.8	4.5	5.8
12.00	7.0	3.3	6.0	4.3	5.0	5.3
12.50	-	-	6.5	3.8	5.5	4.8
13.00	-	-	7.0	3.3	6.0	4.3
13.50	-	-	-	-	6.5	3.8
14.00	-	-	-	-	7.0	3.3

CHART B-B

FRAME WIDTH	DIM "B"	DIM "C"	DIM "D"
33.5	30.13	35.125	
34.0	30.63	35.625	
34.5	31.13	36.125	
35.0	31.63	36.625	

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REV	PROJ / ECR	DESCRIPTION	DATE	BY	CHK	APPD
C	17102	CARTON OF PARTS, 6001115 WAS 6001076. 1" SPACER KIT 6040167 WAS 6040060. 2" SPACER KIT 6040168 WAS 6040061.	2/20/17	BWH	AAS	BC
B	14108	ITEM 18 AND 19 BEAM ASSY. WERE INCORRECT	10/22/14	BC	MDJ	MJK
A	14108	FIXED ITEM 10 BOM, ADDED DIMENSIONS, UPDATED TORQUE CHART	10/10/14	BC	MDJ	MJK



CAPACITY = 22,500 lbs

DRAWN BY: BC 9/30/14
 CHECKED: MDJ 10/1/2014
 APPROVED: MJK 10/6/2014
 PROJECT NO: 14108
 SCALE: B - SIZE NTS
 D - SIZE NTS
 MATERIAL: SEE BOM
 TOLERANCES UNLESS OTHERWISE SPECIFIED:
 DECIMAL: .X ± 0.1
 .XX ± 0.06
 .XXX ± 0.030
 *WELD TOLERANCES PER ISO W4542

RIDEWELL CORPORATION
 PO BOX 4586 SPRINGFIELD, MISSOURI 65808

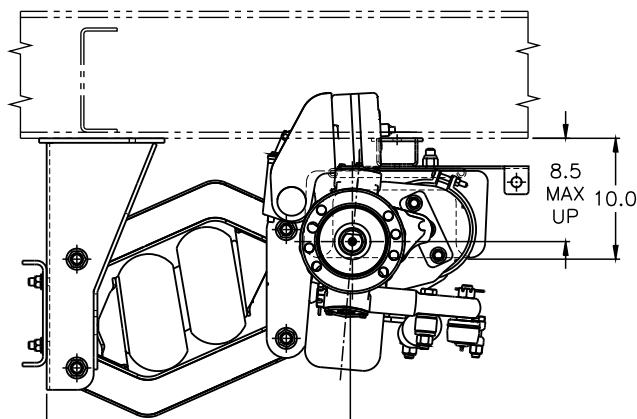
RCA-215MM-1-9.5/12.0-22.5
AIR RIDE/AIR LIFT MID MOUNT
FOR TRUCK

SHEET 1 OF 1 PART NO: 2150204 REV: C

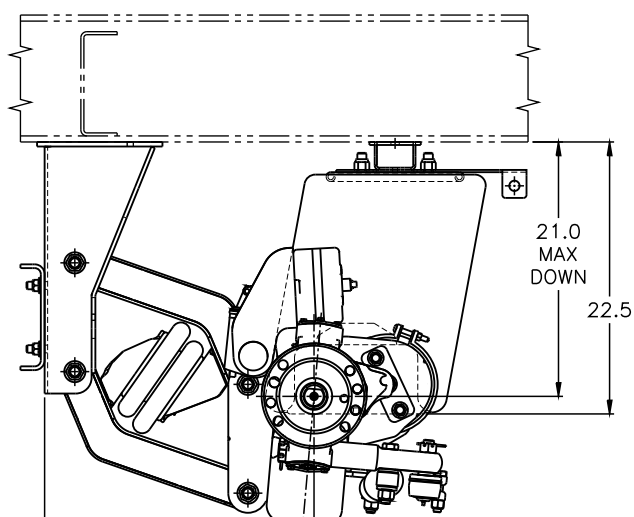
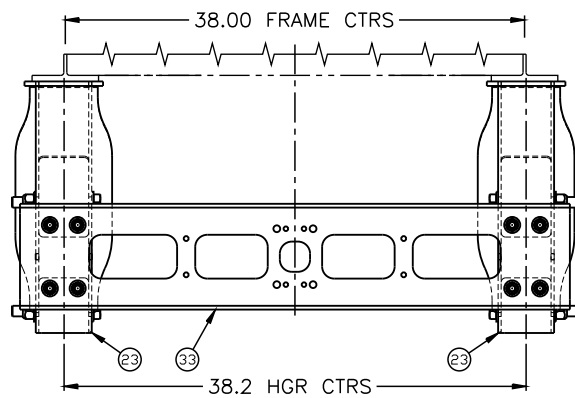
CHART "A"

TO INCLUDE NON STEER LOCK OPTIONS, THE "S" SUFFIX SHOULD BE OMITTED FROM THE SUSPENSION AND AXLE PART NUMBERS, (I.E. 2332200).

SUSP	AXLE DESCRIPTION	ITEM 22	DIM "W"	DIM "X"	DIM "Y"	DIM "Z"	ITEM 31	ITEM 33
2332200(S)	NARROW M KP	1640300(S)	34	89.0	26	65.5	3450233	8170023
2332201(S)	WIDE M KP	1640301(S)	40	95.0	32	71.5	3450234	8170029
2332202(S)	-	-	-	-	-	-	-	-
2332203(S)	-	-	-	-	-	-	-	-
2332204(S)	NARROW KAI KP	1640303(S)	34	89.0	26	65.5	3450233	8170023
2332205(S)	WIDE KAI KP	1640304(S)	40	95.0	32	71.5	3450234	8170029
2332206(S)	-	-	-	-	-	-	-	-
2332207(S)	-	-	-	-	-	-	-	-



ARTICULATION UP



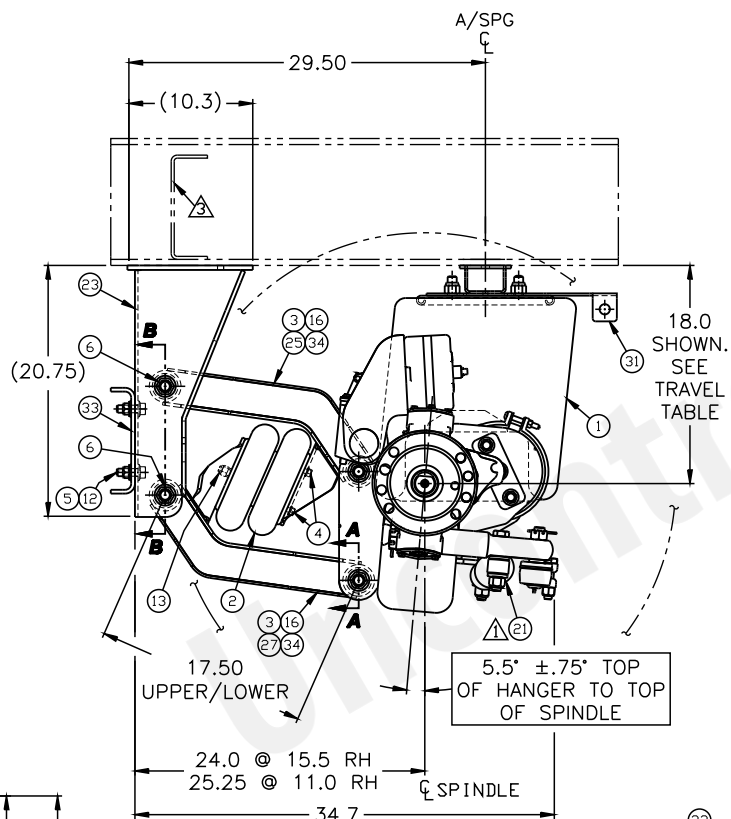
ARTICULATION DOWN

TORQUE VALUES

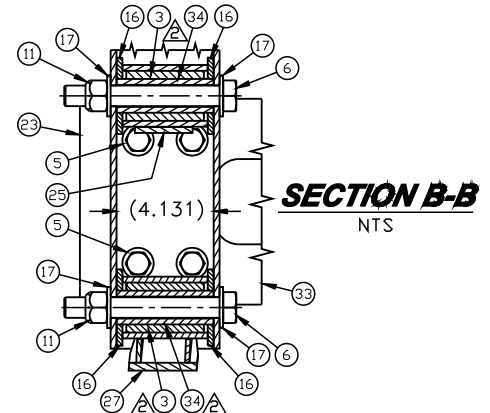
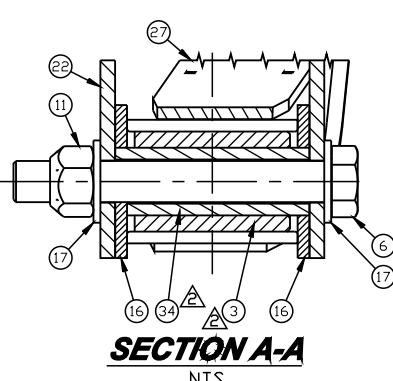
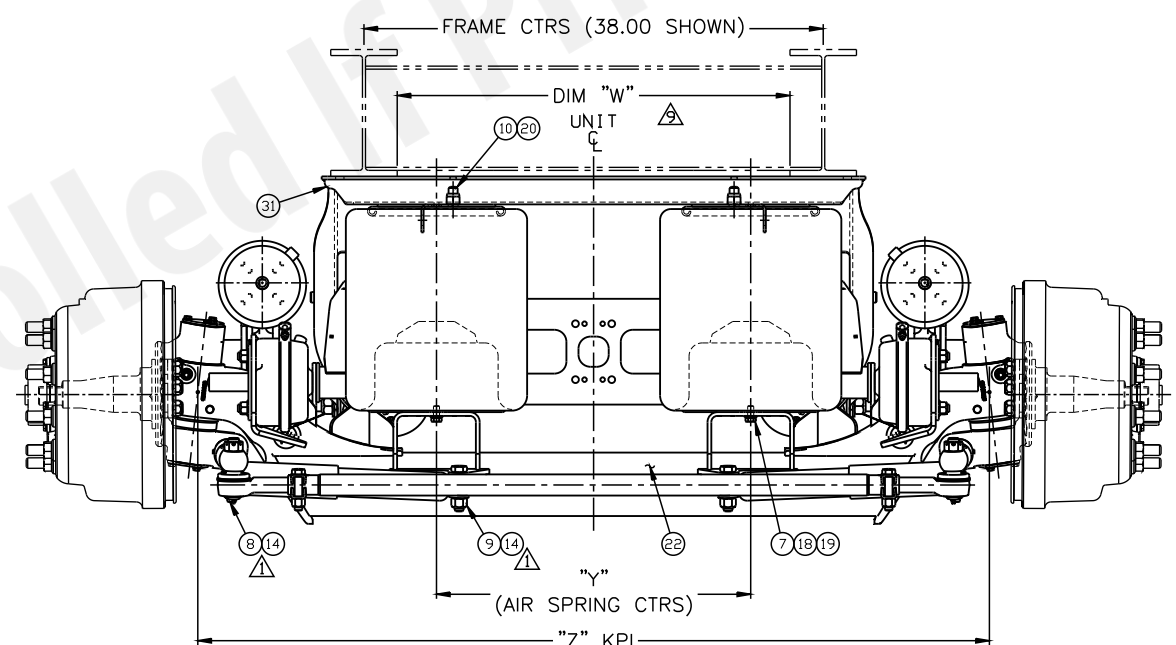
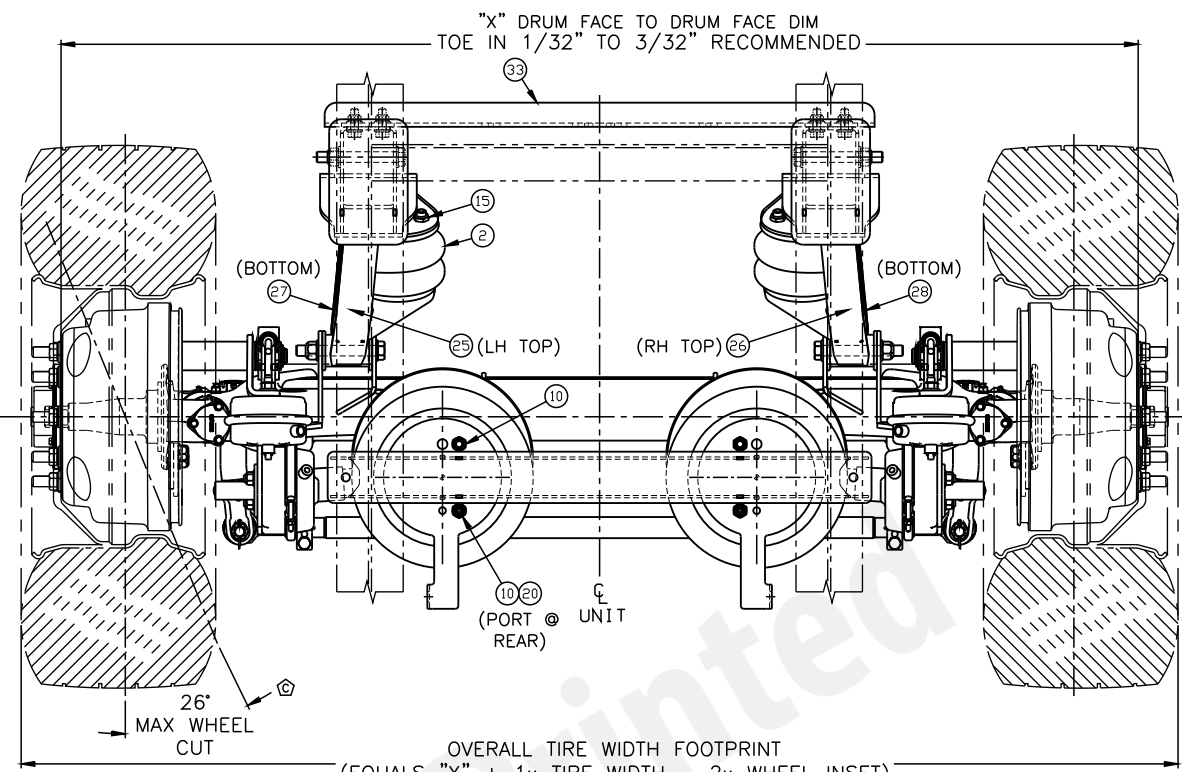
ITEM	SIZE	TORQUE	
		(FT-LB)	(N·M)
7	.50-13NC	25	34
13	.50-20NC	25	34
15	.75-16NF	25	34
12	.625-11NC	160	217
14	.75-10NC	160	217
10	.75-16NC	50	68
11	.875-14NC	350	475

TRAVEL TABLE

RIDE HEIGHT	UP TRAVEL		DOWN TRAVEL
	13.5	15.0	
13.5	5.0	7.5	14.0
14.0	5.5	7.0	14.5
14.5	6.0	6.5	15.0
15.0	6.5	6.0	15.5
15.5	7.0	5.5	16.0
16.0	7.5	5.0	16.5
16.5	8.0	4.5	17.0
17.0	8.5	4.0	17.5
17.5	9.0	3.5	18.0
18.0	9.5	3.0	-



FORWARD



ITEM No.	PART No.	PART DESCRIPTION	No. REQD.
1	1001R14296G	A/SPG 1R14-296	2
2	1003586946C	A/SPG 2B9-254 / 20F-2 #6946	2
3	1120043	BUSH 2.14x1.428x3.30LG 90A	8
4	1130051	WHIZ-LOCK FL SCR .375-16 x .75	4
5	1140018	HHCS .625-11NC x 1.75 LG FLNG	8
6	1140088	HHCS .875-14NF x 6.75 LG GR8	8
7	1140554B105	HHCS .50-13NC x 1 LG GR5 ZINC	4
8	1143076B105	HHCS .75-10NC x 4.50 LG GR5	-
9	1147698B105	HHCS .75-10NC x 3.25 LG	-
10	1150011	L' NUT .75-16NF GR2 NYL INS	4
11	1150052	L' NUT .875-14NF TOP LOCK	8
12	1150060	L' NUT .625-11NC FLNG	8
13	1150062	L' NUT .50-20NF NYL INS GR2	2
14	1150709B105	L' NUT .75-10NC OVAL .75 HI	-
15	1154700B102	L' NUT .75-16NF JAM NYL INS GR2	2
16	1160026	SHIM WASHER .25 x 3.25 x 1.50	16
17	1160868B100	WASHER .875 A-325 FLAT	16
18	1167053B100	WASHER .50 A-325 FLAT	4
19	1167482B000	L' WASHER .50 INT TDDTLCK	4
20	1230059	PLUG .25 MPT HEX SOCKET	2
21	1310002	DAMPER SELF CTRG	-
22	CHART "A"	AXLE 20K FAB	1
23	3170124	HANGER ASS'Y 233-20K MMT	2
24	-	NOT USED	-
25	5050022	T' ROD SUB-ASS'Y LH UPPER 233-20	1
26	5050023	T' ROD SUB-ASS'Y RH UPPER 233-20	1
27	5050024	T' ROD SUB-ASS'Y LH LOWER 233-20	1
28	5050025	T' ROD SUB-ASS'Y RH LOWER 233-20	1
29	6040142	BUSHING KIT 233-20K	-
30	6040145	BUSHING KIT 233-20K w/HARDWARE	-
31	CHART "A"	A/SPG MTG PLT - 233-20K MMT	1
32	-	NOT USED	-
33	CHART "A"	CROSS CHANNEL 233-20K	1
34	9090082	SLV 1.44" OD x .938" ID x 4.111" LG	8

- NOTES:**
- △ - ITEMS 8, 9, 14 & 21 ARE PART OF THE AXLE ASSEMBLY (ITEM 22) AND ARE LISTED FOR REPLACEMENT REFERENCE ONLY.
 - △ - BUSHING INSTALLATION: - INSERT BUSHING (ITEM 3) INTO TORQUE ROD (ITEMS 25-28). - APPLY ALL-PURPOSE GREASE TO BUSHING FACE AND INNER DIAMETER AND TO THE OUTER DIAMETER OF THE INNER SLEEVES (ITEM 34). - PRESS IN INNER SLEEVE.
 - △ - FRAME CROSSMEMBER REQ'D WITHIN 6" OF LEADING OR TRAILING EDGE OF HANGER (OPTIMAL LOCATION SHOWN).
 - △ - BUSHING KITS (ITEMS 29 & 30) ARE AVAILABLE AS SEPARATE ORDER ITEMS.
 - △ - RE-TORQUE FASTENERS AFTER 6,000 MILES AND 36,000 MILES THEREAFTER.
 - △ - PRODUCT IS DESIGNED FOR SINGLE WHEEL APPLICATION.
 - △ - NOTE ALL TIRE AND WHEEL COMBINATIONS MUST BE INSET.
 - △ - TIRE AND WHEEL COMBINATION MAY DICTATE GAWR. GAWR NOT TO EXCEED 20K.
 - △ - ITEM 31 MUST BE PROPERLY SUPPORTED. A MAXIMUM DIM "W" IS ALLOWED BETWEEN FRAME MEMBERS, OTHERWISE IF EXCEEDED, A FRAME CROSSMEMBER IS REQUIRED FOR SUPPORT. SEE DIM "W" IN CHART "A".

CAPACITY=20,000 lbs. (2332200(S) SHOWN)

REV	ECN#	REVISION DESCRIPTION	DATE	BY	CHK	APPD
C	15102	WHEEL CUT DIMENSION WAS INCORRECT @ 32.1	10/22/15	AAS	MDJ	MJK
B	15102	ITEM 23 WAS 3170130, 24 WAS 3170131, 31 WAS 8003618, 32 WAS 8003619, EDIT CHART A & NOTE 3	7/14/15	AAS	MDJ	MJK
		ADDED NOTE 9 AND DIM "W" IN CHART "A"				

DRAWN BY: AAS 3/30/15
 CHECKED: MDJ 4/10/2015
 APPROVED: MJK 4/10/2015
 PROJECT NO: -
 SCALE: B-SIZE: NTS
 D-SIZE: N/A
 MATERIAL: SEE BOM
 WEIGHT: -
 TOLERANCES UNLESS OTHERWISE SPECIFIED:
 DECIMAL: .1X ±0.1 FRACTION: 1/16
 .XX ±0.06 ANG: X ±1'
 .XXX ±0.030
 *WELD TOLERANCES PER ISO WD45-02

RIDEWELL CORPORATION
 PO BOX 4586 SPRINGFIELD, MISSOURI 65808

TITLE: RSS-233MMT (MID MOUNT TRAILER) SELF STEER, LIFTABLE, MID MOUNT 20,000 lb. CAP., 5" DROP W/P-FF AXLE

SHEET 1 OF 1 PART NO: **23322 (S) MMT** REV: **C**

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AXLE ADJUSTMENT PROCEDURE:

- AXLE ALIGNMENT SHALL BE IN ACCORDANCE WITH SAE OR TMC RECOMMENDED STANDARDS.
- LOOSEN 1.25 INCH NUT AT ECCENTRIC BOLT & REMOVE ANTI-TURN WASHER.
- TO MOVE AXLE: TURN ECCENTRIC BOLT HEAD IN DIRECTION AXLE IS TO BE MOVED. MAXIMUM MOVEMENT FROM 12 O'CLOCK POSITION IS TO 9 OR 3 O'CLOCK POSITION, FORWARD OR REARWARD.
- WITH ECCENTRIC BOLT AT ITS FINAL SETTING, INSTALL ANTI-TURN WASHER OVER ECCENTRIC BOLT HEAD AND WELD TO HANGER. TIGHTEN 1.25 INCH NUT TO SPECIFIED TORQUE.

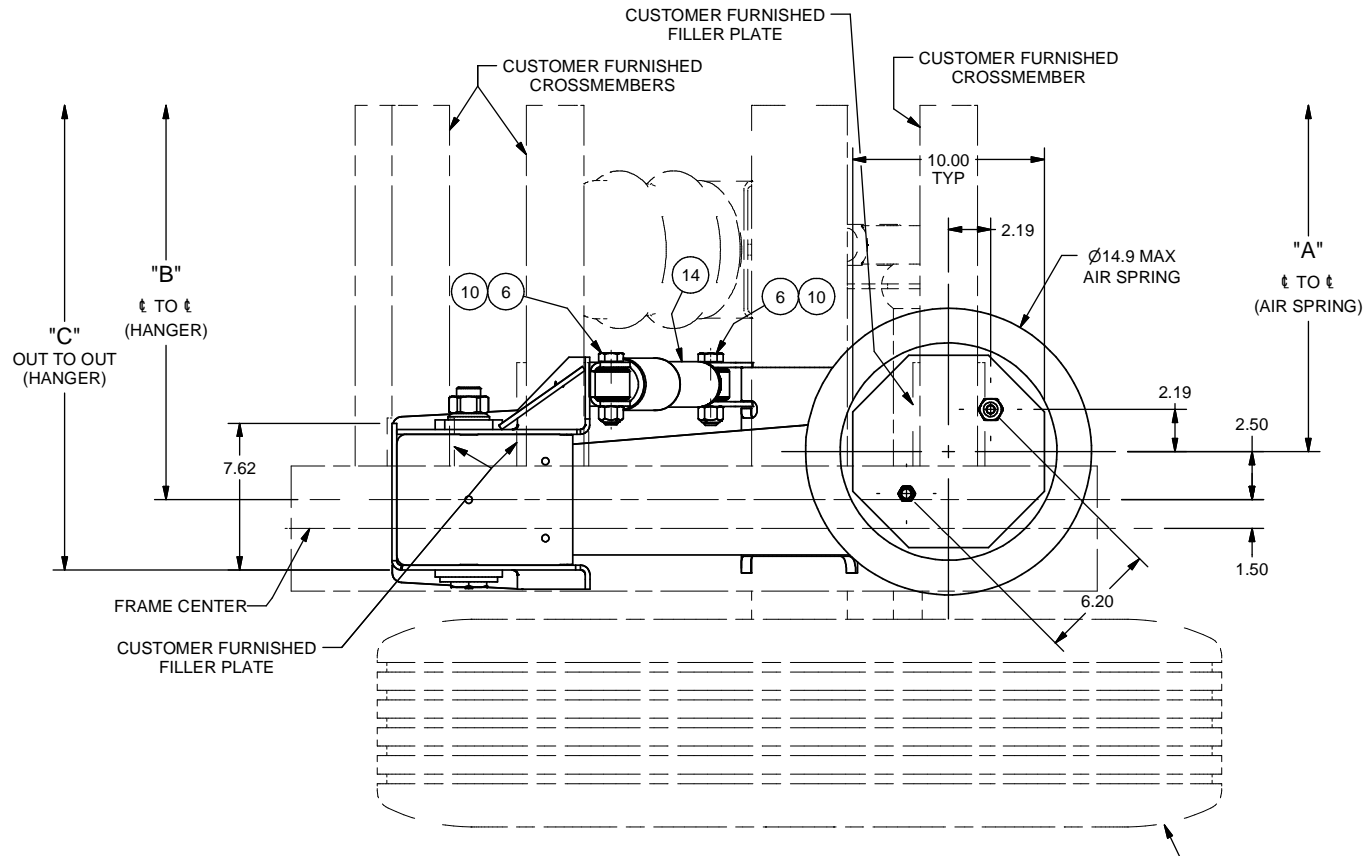
ITEM	SIZE	TORQUE	
		(FT-LB)	(N-M)
PIVOT (Ø1.25 FASTENERS)	1 1/4-7	1000	1356
SHOCK (Ø0.75 FASTENERS)	3/4-10	200	271
AIR SPRING (Ø0.75 FASTENERS)	3/4-16	50	68
AIR SPRING (Ø0.50 FASTENERS)	1/2-13	25	34

NOTES:

- MAIN PIVOT FASTENERS WILL BE SHIPPED WITH MINIMAL TORQUE APPLIED. IT IS THE INSTALLER'S RESPONSIBILITY TO TIGHTEN FASTENERS TO SPECIFIED TORQUE AFTER AXLE IS ALIGNED.
- TORQUE VALUES REFLECT LUBRICATED THREAD CONDITION (NUTS ARE PRE-LUBED).
- SUSPENSION FASTENERS TO BE RETORQUED INITIALLY AT 6,000 MILES (9,656 KM) AND 50,000 MILES (80,467 KM) INCREMENTS THEREAFTER.
- IN THE EVENT OF BUSHING REPLACEMENT, HUCK FASTENERS MAY BE REPLACED WITH 3/4-10 GRADE 8 HARDWARE TORQUED AT 280-330 FT.LB. FOR BUSHING REPLACEMENT ORDER KIT #6040028.
- FOR AXLE TO SUSPENSION WELDING SEE RIDEWELL WELD PROCESS #1.
- SUGGESTED CROSSMEMBER LOCATION AND SIZE ARE GIVEN. SIZE AND SHAPE MAY VARY WITH THE TRAILER DESIGN AND ARE THE RESPONSIBILITY OF THE TRAILER OEM.
- STATED DOWN TRAVEL REFLECTS SUSPENSION WITH SHOCK ABSORBERS AT MAXIMUM EXTENSION AND WITH UNPRESSURIZED AIR SPRINGS. STATED UP TRAVEL REFLECTS SUSPENSION WITH AIR SPRINGS AT BUMPER CONTACT.
- STATED CAPACITY RATING FOR SUSPENSION ONLY. RATING OF AXLE, BRAKES, AND WHEEL END EQUIPMENT PER MANUFACTURER.
- CONTACT RIDEWELL FOR AIR CONTROL KIT OPTIONS.
- INSTALLER MUST SET THE SUSPENSION TO THE SPECIFIED MOUNTING HEIGHT BEFORE TORQUING THE PIVOT BOLT TO PREVENT PRE-LOADING THE RUBBER IN THE BUSHING.
- FAILURE TO BRACE HANGERS FOR LATERAL LOADS VOIDS WARRANTY.

CLEARANCE SPECIFICATIONS:

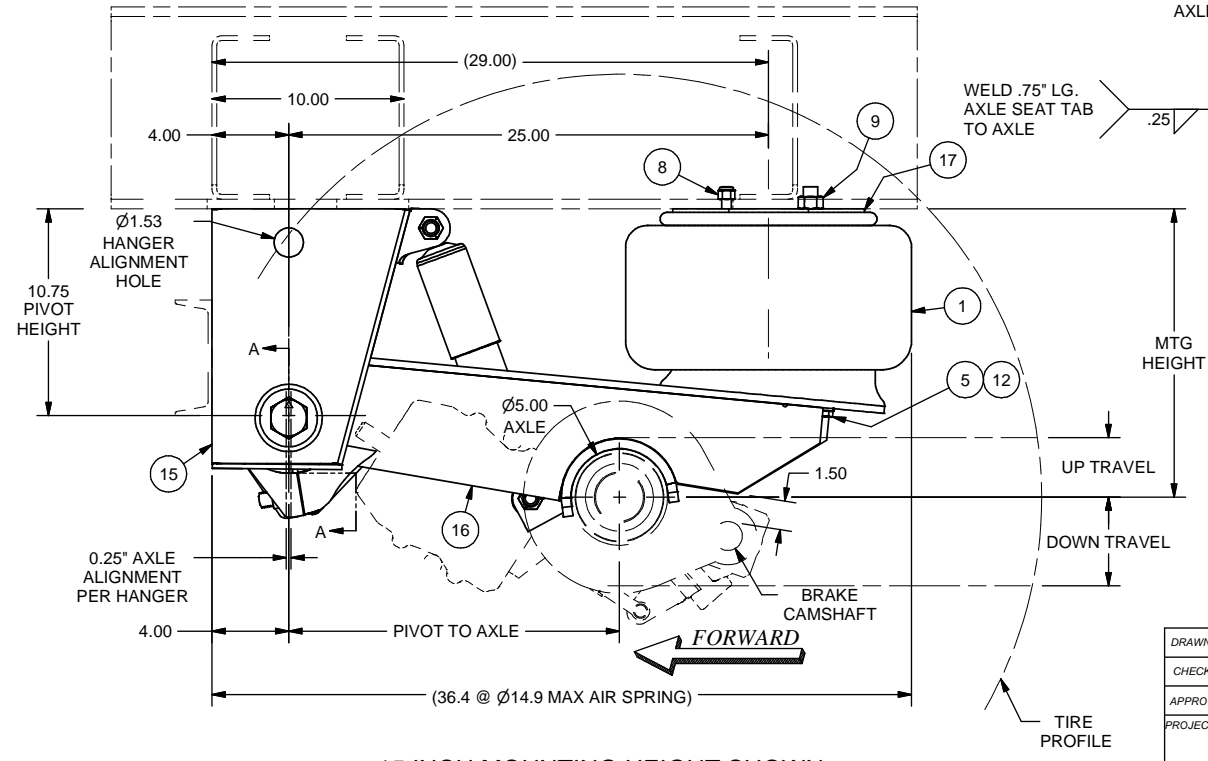
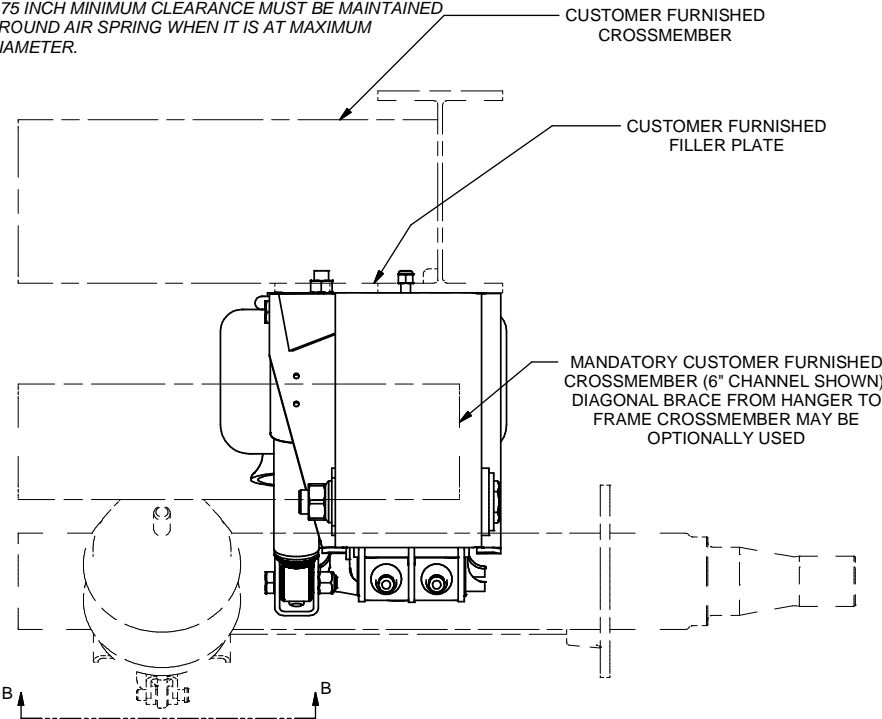
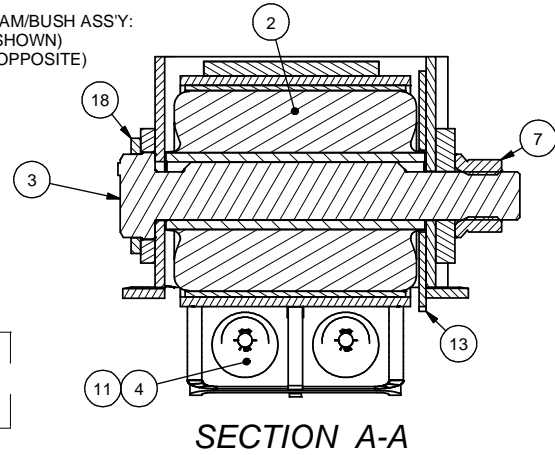
- a) 1.5 INCH MINIMUM CLEARANCE REQUIRED BETWEEN TOP OF TIRE AND BOTTOM OF TRAILER STRUCTURE WHEN AXLE IS AT BUMPER CONTACT.
- b) 2.0 INCHES MINIMUM CLEARANCE REQUIRED BETWEEN INSIDE OF TIRE AND TRAILER STRUCTURE FOR LATERAL MOVEMENT.
- c) 0.75 INCH MINIMUM CLEARANCE MUST BE MAINTAINED AROUND AIR SPRING WHEN IT IS AT MAXIMUM DIAMETER.



PARTS REQUIRED FOR 6000119 (CARTON OF PARTS)					
PARTS REQUIRED FOR 3010362 (RH HGR/LBA)					
PARTS REQUIRED FOR 3010361 (LH HGR/LBA)					
ITEM	PART NO.	DESCRIPTION	QTY	QTY	QTY
1	1000008	AIR SPRING 1R14-175			2
2	1117680B001	BUSH ASSY 70 DURO MONOPIVOT	1	1	
3	1137694B000	ECCENTRIC BOLT (FORGED) 9.5"	1	1	
4	1137738B301	HUCK BOLT 3/4X.75 HP8F-DT24-12	2	2	
** 5	1145383B105	HHCS 1/2" 13NC 1-1/4" L GRADE 5, ZINC PLATE			6
* 6	1147698B105	HHCS 3/4" 10NC 3-1/4" L GRADE 5, ZINC PLATE			4
7	1150033	L'NUT 1-1/4"-7NC GR8 SECURELOK	1	1	
** 8	1150555B112	L'NUT 1/2" 13NC NYL GR2 ZN PLT			2
** 9	1150558B102	NUT 3/4" 16NF GRD 2			2
* 10	1150709B105	L'NUT 3/4" 10NC OVAL 3/4" HI WAX			4
11	1157738B301	HUCK COLLAR 3/4" HPCF - R24U	2	2	
** 12	1160556B100	L'WASHER 1/2" S/T MED ZINC PLATE			6
13	1167680B000	WEAR WASHER, UHMW-PE, BLACK	1	1	
14	1270563B003	SHOCK ASSY 6" MONROE			2
15	3260058	HANGER ASSY - LH	1		
	3260059	HANGER ASSY - RH		1	
16	4280008	BEAM ASSY - LH	1		
	4280009	BEAM ASSY - RH		1	
17	7000675	AIR SPRING PLATE OCT 10" 6.2			2
* 18	9003092B000	ANTI-TURN WASHER			2

* ITEMS ARE INCLUDED IN PARTS BAG 1800001
 ** ITEMS ARE INCLUDED IN PARTS BAG 1800002

REFERENCE NOTE FOR ORDERING BEAM/BUSH ASSY:
 5970077 - LH BEAM/BUSH ASSEMBLY (SHOWN)
 5970078 - RH BEAM/BUSH ASSEMBLY (OPPOSITE)



TRACK WIDTH (IN)	71.50	77.50
DIMENSION "A" (IN)	30.00	36.00
DIMENSION "B" (IN)	35.00	41.00
DIMENSION "C" (IN)	42.31	48.31

MODEL NUMBER	MTG HEIGHT	UP TRAVEL	DOWN TRAVEL	PIVOT TO AXLE
RAR-240-1-15-30-OSW	15.0"	3.1"	4.6"	17.23"
	16.0"	4.1"	3.6"	16.96"
	17.0"	5.1"	2.6"	16.61"

This drawing and/or electronic media containing this drawing is the sole property of the Ridewell Corp. and is loaned with the express condition that it is not to be used in any way deleterious to the interest of the Ridewell Corp. The acceptance of this drawing and/or electronic media containing this drawing will be construed as an acceptance of the foregoing conditions. Drawings and/or electronic media containing this drawing are to be returned to the Ridewell Corp. upon request.

REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD
S	12105	ADDED VIEW B-B	9/10/12	G.H.	MDJ	CJB
R	11106	REMOVED FROM CHARTED DRAWING (240-30K O/S CHT)	10/5/11	PMB	MDJ	CJB

DRAWN BY: _____
 CHECKED: _____
 APPROVED: _____
 PROJECT NO: _____
 SCALE: B - SIZE NTS
 D - SIZE NTS
 MATERIAL: SEE B.O.M.
 TOLERANCES UNLESS OTHERWISE SPECIFIED:
 DECIMAL: .X ± 0.1 FRACTION: ± 1/16"
 .XX ± 0.06 ANG: X ± 1°
 .XXX ± 0.030 XXX KCC
 *WELD TOLERANCES PER ISO W045-02

RIDEWELL CORPORATION
 PO BOX 4586 SPRINGFIELD, MISSOURI 65808

30,000 LB. CAPACITY OVERSLUNG SUSPENSION
RAR-240-1-15-30-OSW

SHEET 1 OF 1 PART NO: **2400060** REV: **S**

AXLE ADJUSTMENT PROCEDURE:

- AXLE ALIGNMENT SHALL BE IN ACCORDANCE WITH SAE OR TRM RECOMMENDED STANDARDS.
- LOOSEN 1.25 INCH NUT AT ECCENTRIC BOLT & REMOVE ANTI-TURN WASHER.
- TO MOVE AXLE: TURN ECCENTRIC BOLT HEAD IN DIRECTION AXLE IS TO BE MOVED. MAXIMUM MOVEMENT FROM 12 O'CLOCK POSITION IS TO 9 OR 3 O'CLOCK POSITION, FORWARD OR REARWARD.
- WITH ECCENTRIC BOLT AT ITS FINAL SETTING, INSTALL ANTI-TURN WASHER OVER ECCENTRIC BOLT HEAD AND WELD TO HANGER. TIGHTEN 1.25 INCH NUT TO SPECIFIED TORQUE.

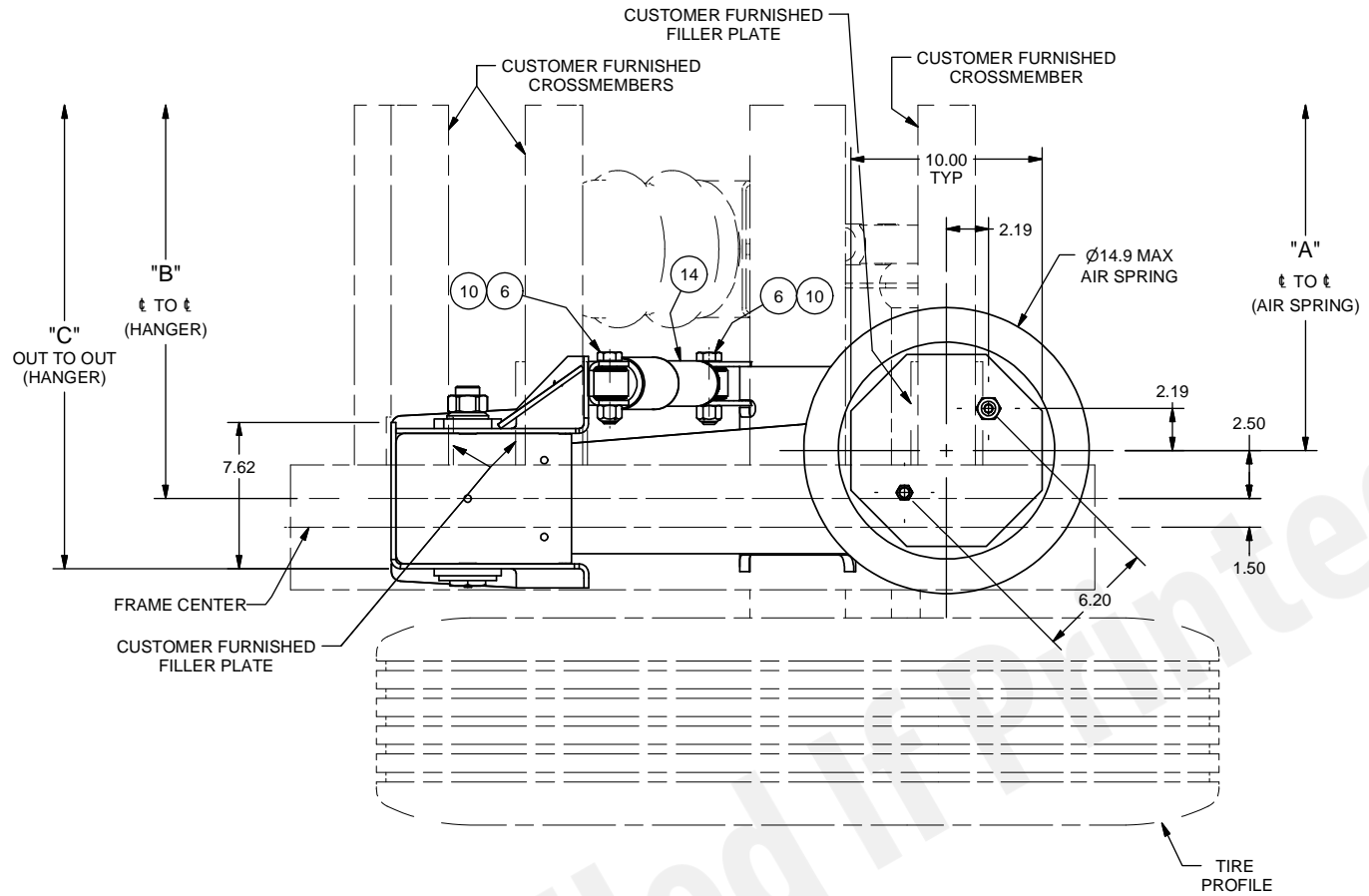
ITEM	SIZE	TORQUE	
		(FT-LB)	(N-M)
PIVOT (Ø1.25 FASTENERS)	1 1/4-7	1000	1356
SHOCK (Ø0.75 FASTENERS)	3/4-10	200	271
AIR SPRING (Ø0.75 FASTENERS)	3/4-16	50	68
AIR SPRING (Ø0.50 FASTENERS)	1/2-13	25	34

NOTES:

- MAIN PIVOT FASTENERS WILL BE SHIPPED WITH MINIMAL TORQUE APPLIED. IT IS THE INSTALLER'S RESPONSIBILITY TO TIGHTEN FASTENERS TO SPECIFIED TORQUE AFTER AXLE IS ALIGNED.
- TORQUE VALUES REFLECT LUBRICATED THREAD CONDITION (NUTS ARE PRE-LUBED).
- SUSPENSION FASTENERS TO BE RETORQUED INITIALLY AT 6,000 MILES (9,656 KM) AND 50,000 MILES (80,467 KM) INCREMENTS THEREAFTER.
- IN THE EVENT OF BUSHING REPLACEMENT, HUCK FASTENERS MAY BE REPLACED WITH 3/4-10 GRADE 8 HARDWARE TORQUED AT 280-330 FT.LB. FOR BUSHING REPLACEMENT ORDER KIT #6040028.
- FOR AXLE TO SUSPENSION WELDING SEE RIDEWELL WELD PROCESS #1.
- SUGGESTED CROSSMEMBER LOCATION AND SIZE ARE GIVEN. SIZE AND SHAPE MAY VARY WITH THE TRAILER DESIGN AND ARE THE RESPONSIBILITY OF THE TRAILER OEM.
- STATED DOWN TRAVEL REFLECTS SUSPENSION WITH SHOCK ABSORBERS AT MAXIMUM EXTENSION AND WITH UNPRESSURIZED AIR SPRINGS. STATED UP TRAVEL REFLECTS SUSPENSION WITH AIR SPRINGS AT BUMPER CONTACT.
- STATED CAPACITY RATING FOR SUSPENSION ONLY. RATING OF AXLE, BRAKES, AND WHEEL END EQUIPMENT PER MANUFACTURER.
- CONTACT RIDEWELL FOR AIR CONTROL KIT OPTIONS.
- INSTALLER MUST SET THE SUSPENSION TO THE SPECIFIED MOUNTING HEIGHT BEFORE TORQUING THE PIVOT BOLT TO PREVENT PRE-LOADING THE RUBBER IN THE BUSHING.
- FAILURE TO BRACE HANGERS FOR LATERAL LOADS VOIDS WARRANTY.

CLEARANCE SPECIFICATIONS:

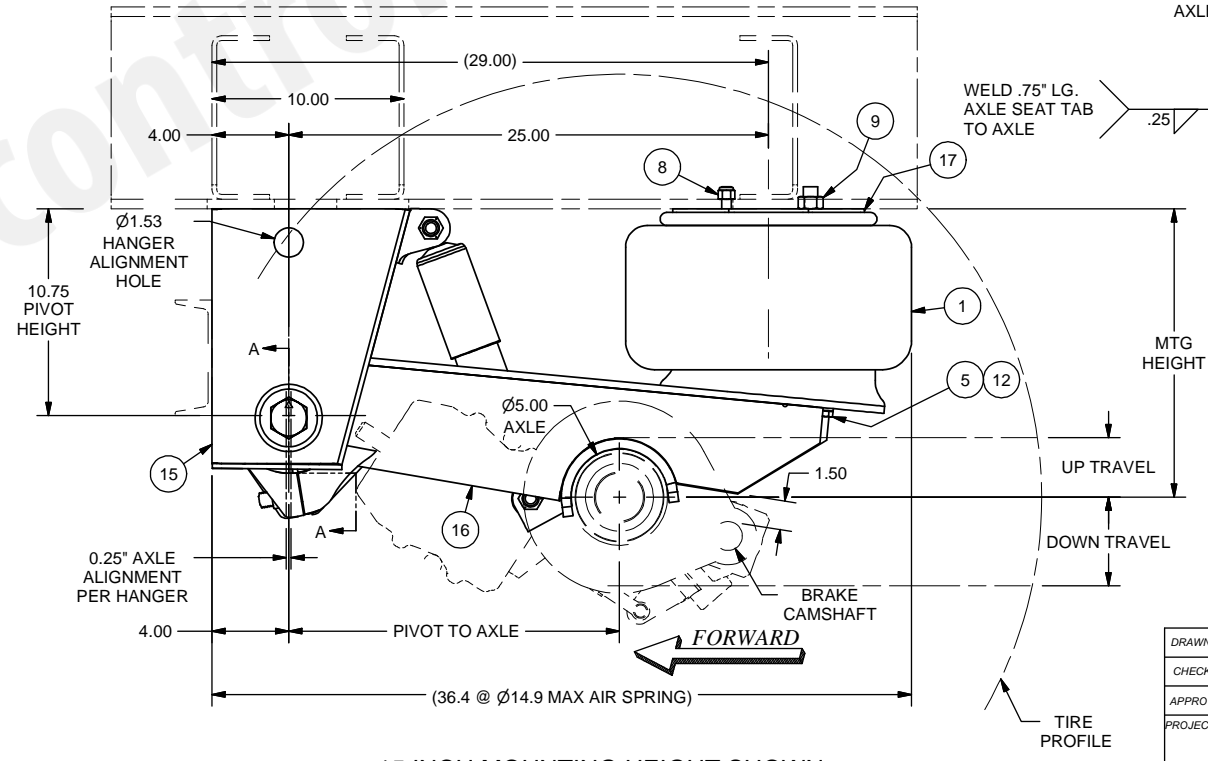
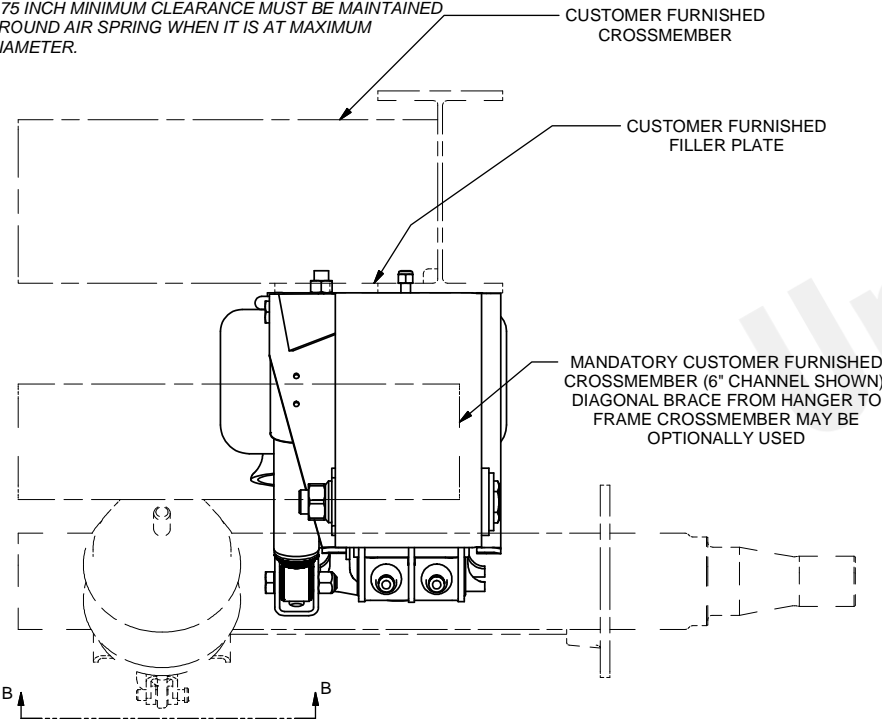
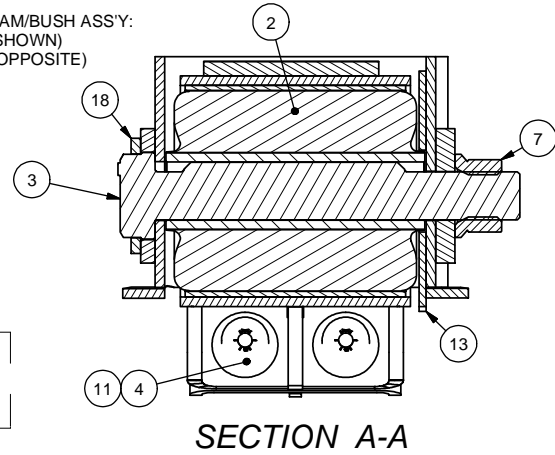
- a) 1.5 INCH MINIMUM CLEARANCE REQUIRED BETWEEN TOP OF TIRE AND BOTTOM OF TRAILER STRUCTURE WHEN AXLE IS AT BUMPER CONTACT.
- b) 2.0 INCHES MINIMUM CLEARANCE REQUIRED BETWEEN INSIDE OF TIRE AND TRAILER STRUCTURE FOR LATERAL MOVEMENT.
- c) 0.75 INCH MINIMUM CLEARANCE MUST BE MAINTAINED AROUND AIR SPRING WHEN IT IS AT MAXIMUM DIAMETER.



PARTS REQUIRED FOR 6000119 (CARTON OF PARTS)					
PARTS REQUIRED FOR 3010362 (RH HGR/LBA)					
PARTS REQUIRED FOR 3010361 (LH HGR/LBA)					
ITEM	PART NO.	DESCRIPTION	QTY	QTY	QTY
1	1000008	AIR SPRING 1R14-175			2
2	1117680B001	BUSH ASSY 70 DURO MONOPIVOT	1	1	
3	1137694B000	ECCENTRIC BOLT (FORGED) 9.5"	1	1	
4	1137738B301	HUCK BOLT 3/4X.75 HP8F-DT24-12	2	2	
** 5	1145383B105	HHCS 1/2" 13NC 1-1/4" L GRADE 5, ZINC PLATE			6
* 6	1147698B105	HHCS 3/4" 10NC 3-1/4" L GRADE 5, ZINC PLATE			4
7	1150033	L'NUT 1-1/4"-7NC GR8 SECURELOK	1	1	
** 8	1150555B112	L'NUT 1/2" 13NC NYL GR2 ZN PLT			2
** 9	1150558B102	NUT 3/4" 16NF GRD 2			2
* 10	1150709B105	L'NUT 3/4" 10NC OVAL 3/4" HI WAX			4
11	1157738B301	HUCK COLLAR 3/4" HPCF - R24U	2	2	
** 12	1160556B100	L'WASHER 1/2" S/T MED ZINC PLATE			6
13	1167680B000	WEAR WASHER, UHMW-PE, BLACK	1	1	
14	1270563B003	SHOCK ASSY 6" MONROE			2
15	3260058	HANGER ASSY - LH	1		
	3260059	HANGER ASSY - RH		1	
16	4280008	BEAM ASSY - LH	1		
	4280009	BEAM ASSY - RH		1	
17	7000675	AIR SPRING PLATE OCT 10" 6.2			2
* 18	9003092B000	ANTI-TURN WASHER			2

* ITEMS ARE INCLUDED IN PARTS BAG 1800001
 ** ITEMS ARE INCLUDED IN PARTS BAG 1800002

REFERENCE NOTE FOR ORDERING BEAM/BUSH ASSY:
 5970077 - LH BEAM/BUSH ASSEMBLY (SHOWN)
 5970078 - RH BEAM/BUSH ASSEMBLY (OPPOSITE)



15 INCH MOUNTING HEIGHT SHOWN

TRACK WIDTH (IN)	71.50	77.50
DIMENSION "A" (IN)	30.00	36.00
DIMENSION "B" (IN)	35.00	41.00
DIMENSION "C" (IN)	42.31	48.31

MODEL NUMBER	MTG HEIGHT	UP TRAVEL	DOWN TRAVEL	PIVOT TO AXLE
RAR-240-1-15-30-OSW	15.0"	3.1"	4.6"	17.23"
	16.0"	4.1"	3.6"	16.96"
	17.0"	5.1"	2.6"	16.61"

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REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD
S	12105	ADDED VIEW B-B	9/10/12	G.H.	MDJ	CJB
R	11106	REMOVED FROM CHARTED DRAWING (240-30K O/S CHT)	10/5/11	PMB	MDJ	CJB

DRAWN BY: _____
 CHECKED: _____
 APPROVED: _____
 PROJECT NO: _____
 SCALE: B - SIZE NTS
 D - SIZE NTS
 MATERIAL: SEE B.O.M.
 TOLERANCES UNLESS OTHERWISE SPECIFIED:
 DECIMAL: .X ± 0.1 FRACTION: ± 1/16
 .XX ± 0.06 ANG: X ± 1'
 .XXX ± 0.030 XXXI KCC
 *WELD TOLERANCES PER ISO W045-02

RIDEWELL CORPORATION
 PO BOX 4586 SPRINGFIELD, MISSOURI 65808

30,000 LB. CAPACITY OVERSLUNG SUSPENSION
RAR-240-1-15-30-OSW

SHEET 1 OF 1 PART NO: **2400060** REV: **S**

AXLE ADJUSTMENT PROCEDURE:

- AXLE ALIGNMENT SHALL BE IN ACCORDANCE WITH SAE OR TMC RECOMMENDED STANDARDS.
- LOOSEN 1.25 INCH NUT AT ECCENTRIC BOLT & REMOVE ANTI-TURN WASHER.
- TO MOVE AXLE: TURN ECCENTRIC BOLT HEAD IN DIRECTION AXLE IS TO BE MOVED. MAXIMUM MOVEMENT FROM 12 O'CLOCK POSITION IS TO 9 OR 3 O'CLOCK POSITION, FORWARD OR REARWARD.
- WITH ECCENTRIC BOLT AT ITS FINAL SETTING, INSTALL ANTI-TURN WASHER OVER ECCENTRIC BOLT HEAD AND WELD TO HANGER. TIGHTEN 1.25 INCH NUT TO SPECIFIED TORQUE.

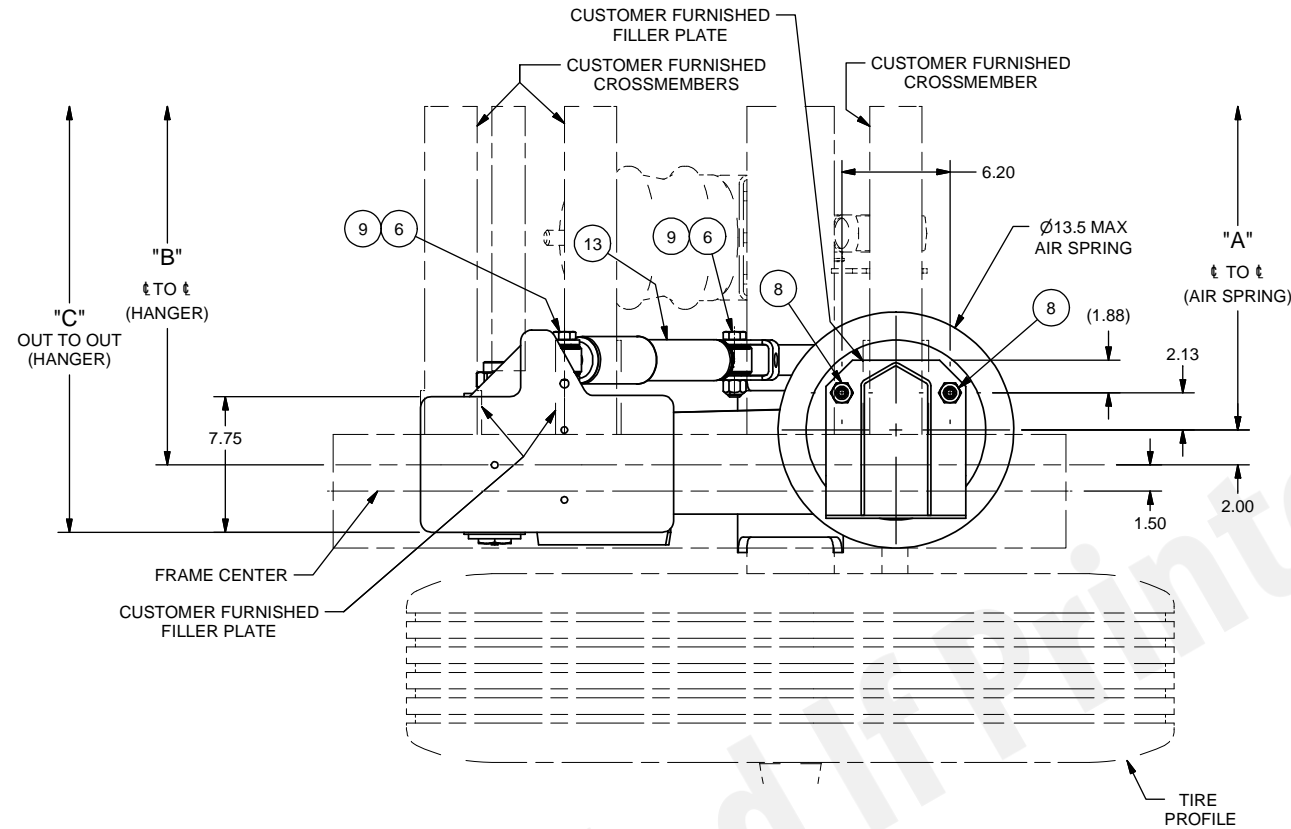
ITEM	SIZE	TORQUE	
		(FT-LB)	(N-M)
PIVOT (Ø1.25 FASTENERS)	1 1/4-7	1000	1356
SHOCK (Ø0.75 FASTENERS)	3/4-10	200	271
AIR SPRING (Ø0.75 FASTENERS)	3/4-16	50	68
AIR SPRING (Ø0.50 FASTENERS)	1/2-13	25	34

NOTES:

- MAIN PIVOT FASTENERS WILL BE SHIPPED WITH MINIMAL TORQUE APPLIED. IT IS THE INSTALLER'S RESPONSIBILITY TO TIGHTEN FASTENERS TO SPECIFIED TORQUE AFTER AXLE IS ALIGNED.
- TORQUE VALUES REFLECT LUBRICATED THREAD CONDITION (NUTS ARE PRE-LUBED).
- SUSPENSION FASTENERS TO BE RETORQUED INITIALLY AT 6,000 MILES (9,656 KM) AND 50,000 MILES (80,467 KM) INCREMENTS THEREAFTER.
- IN THE EVENT OF BUSHING REPLACEMENT, HUCK FASTENERS MAY BE REPLACED WITH 3/4-10 GRADE 8 HARDWARE TORQUED AT 280-330 FT.LB. FOR BUSHING REPLACEMENT ORDER KIT #6040029.
- FOR AXLE TO SUSPENSION WELDING SEE RIDEWELL WELD PROCESS #1.
- SUGGESTED CROSSMEMBER LOCATION AND SIZE ARE GIVEN. SIZE AND SHAPE MAY VARY WITH THE TRAILER DESIGN AND ARE THE RESPONSIBILITY OF THE TRAILER OEM.
- STATED DOWN TRAVEL REFLECTS SUSPENSION WITH SHOCK ABSORBERS AT MAXIMUM EXTENSION AND WITH UNPRESSURIZED AIR SPRINGS. STATED UP TRAVEL REFLECTS SUSPENSION WITH AIR SPRINGS AT BUMPER CONTACT.
- STATED CAPACITY RATING FOR SUSPENSION ONLY. RATING OF AXLE, BRAKES, AND WHEEL END EQUIPMENT PER MANUFACTURER.
- CONTACT RIDEWELL FOR AIR CONTROL KIT OPTIONS.
- INSTALLER MUST SET THE SUSPENSION TO THE SPECIFIED MOUNTING HEIGHT BEFORE TORQUING THE PIVOT BOLT TO PREVENT PRE-LOADING THE RUBBER IN THE BUSHING.
- FAILURE TO BRACE HANGERS FOR LATERAL LOADS VOIDS WARRANTY.

CLEARANCE SPECIFICATIONS:

- a) 1.5 INCH MINIMUM CLEARANCE REQUIRED BETWEEN TOP OF TIRE AND BOTTOM OF TRAILER STRUCTURE WHEN AXLE IS AT BUMPER CONTACT.
- b) 2.0 INCHES MINIMUM CLEARANCE REQUIRED BETWEEN INSIDE OF TIRE AND TRAILER STRUCTURE FOR LATERAL MOVEMENT.
- c) 0.75 INCH MINIMUM CLEARANCE MUST BE MAINTAINED AROUND AIR SPRING WHEN IT IS AT MAXIMUM DIAMETER.



PARTS REQUIRED FOR 6007739B024 (CARTON OF PARTS)

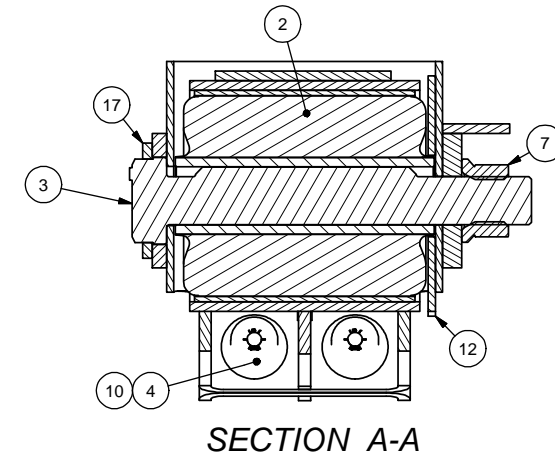
PARTS REQUIRED FOR 3017739B224 (RH HGR/LBA)

PARTS REQUIRED FOR 3017739B124 (LH HGR/LBA)

ITEM	PART NO.	DESCRIPTION	QTY	QTY	QTY
1	1001R13109G	AIR SPRING 1R13-109			2
2	1117680B075	BUSH ASSY 60 DURO MONOPIVOT	1	1	
3	1137694B000	ECCENTRIC BOLT (FORGED) 9.5"	1	1	
4	1137738B301	HUCK BOLT 3/4X.75 HP8F-DT24-12	2	2	
** 5	1145383B105	HHCS 1/2" 13NC 1-1/4"L GRADE 5, ZINC PLATE			6
* 6	1147698B105	HHCS 3/4" 10NC 3-1/4"L GRADE 5, ZINC PLATE			4
7	1150033	L'NUT 1-1/4"-7NC GR8 SECURELOK	1	1	
** 8	1150558B102	NUT 3/4" 16NF GRD 2			4
* 9	1150709B105	L'NUT 3/4" 10NC OVAL 3/4" HI WAX			4
10	1157738B301	HUCK COLLAR 3/4" HPCF - R24U	2	2	
** 11	1160556B100	L'WASHER 1/2" S/T MED ZINC PLATE			6
12	1167680B000	WEAR WASHER, UHMW-PE, BLACK	1	1	
13	1270563B003	SHOCK ASSY 6" MONROE			2
14	3260070	HANGER ASSY - LH	1		
	3260071	HANGER ASSY - RH		1	
15	34500001	TOP A/S MTG PL ASSY 7.188			2
16	4287739D102	BEAM ASSY - LH	1		
	4287739D202	BEAM ASSY - RH		1	
17	9003092B000	ANTI-TURN WASHER			2

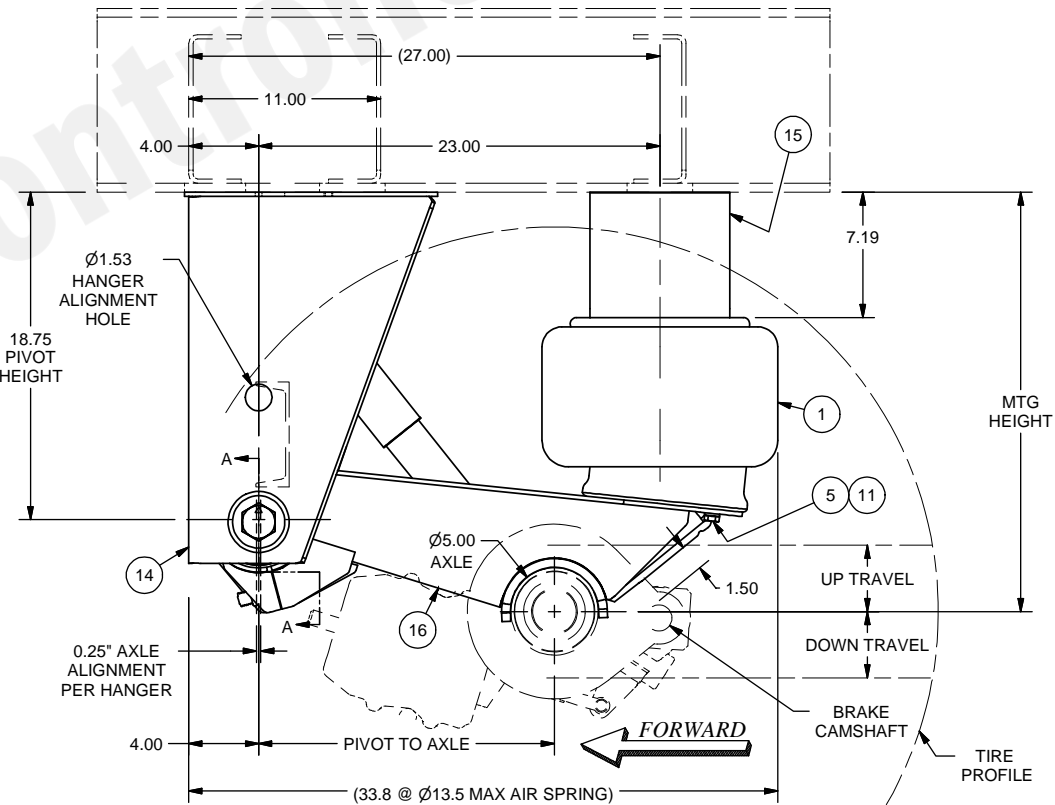
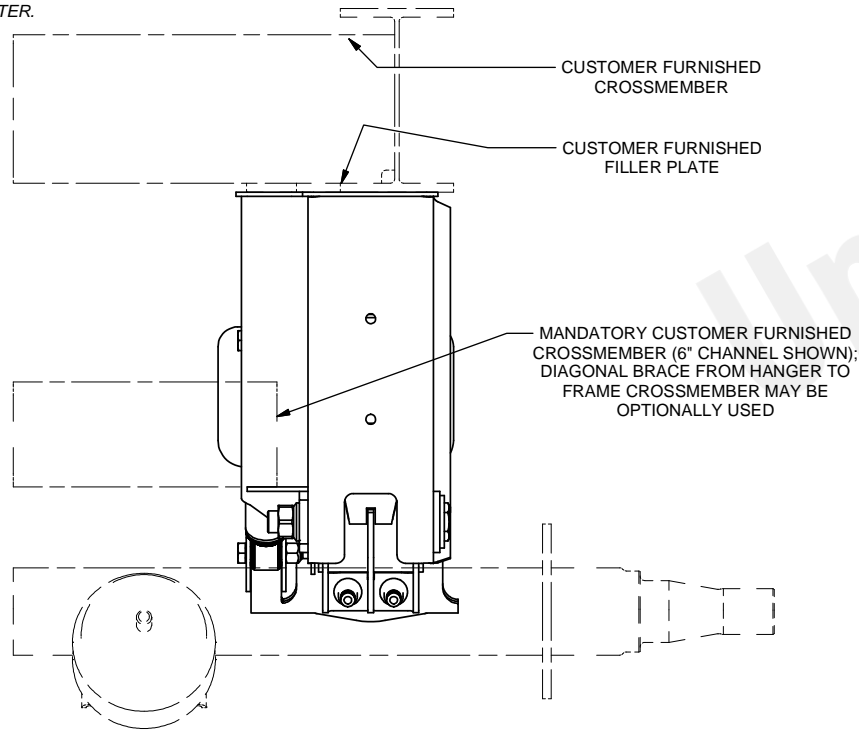
* ITEMS ARE INCLUDED IN PARTS BAG 1800001
 ** ITEMS ARE INCLUDED IN PARTS BAG 1800004

REFERENCE NOTE FOR ORDERING BEAM/BUSH ASS'Y:
 5970087 - LH BEAM/BUSH ASSEMBLY (SHOWN)
 5970088 - RH BEAM/BUSH ASSEMBLY (OPPOSITE)



TRACK WIDTH (IN)	71.50	77.50
DIMENSION "A" (IN)	31.00	37.00
DIMENSION "B" (IN)	35.00	41.00
DIMENSION "C" (IN)	42.67	48.67

MODEL NUMBER	MTG HEIGHT	UP TRAVEL	DOWN TRAVEL	PIVOT TO AXLE
RAR-240-1-23-25-OSW	23.0"	2.8"	4.8"	17.23"
	24.0"	3.8"	3.8"	16.96"
	25.0"	4.8"	2.8"	16.61"



24 INCH MOUNTING HEIGHT SHOWN

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DRAWN BY:	
CHECKED:	
APPROVED:	
PROJECT NO:	SCALE: B - SIZE NTS D - SIZE NTS
MATERIAL:	SEE B.O.M.

RIDEWELL CORPORATION
 PO BOX 4586 SPRINGFIELD, MISSOURI 65808

TITLE: 25,000 LB. CAPACITY OVERSLUNG SUSPENSION RAR-240-1-23-25-OSW

TOLERANCES UNLESS OTHERWISE SPECIFIED:
DECIMAL: .X ± 0.1 FRACTION: ± 1/16
.XX ± 0.06 ANG: X ± 1'
.XXX ± 0.030 XXX KCC
*WELD TOLERANCES PER ISO W045-02

SHEET 1 OF 1 PART NO: 2400123 REV: X

REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD
X	11106	REMOVED FROM CHARTED DRAWING (240-25K O/S CHT)	7/25/11	PMB	MDJ	CJB

AXLE ADJUSTMENT PROCEDURE:

- AXLE ALIGNMENT SHALL BE IN ACCORDANCE WITH SAE OR TMC RECOMMENDED STANDARDS.
- LOOSEN 1.25 INCH NUT AT ECCENTRIC BOLT & REMOVE ANTI-TURN WASHER.
- TO MOVE AXLE: TURN ECCENTRIC BOLT HEAD IN DIRECTION AXLE IS TO BE MOVED. MAXIMUM MOVEMENT FROM 12 O'CLOCK POSITION IS TO 9 OR 3 O'CLOCK POSITION, FORWARD OR REARWARD.
- WITH ECCENTRIC BOLT AT ITS FINAL SETTING, INSTALL ANTI-TURN WASHER OVER ECCENTRIC BOLT HEAD AND WELD TO HANGER. TIGHTEN 1.25 INCH NUT TO SPECIFIED TORQUE.

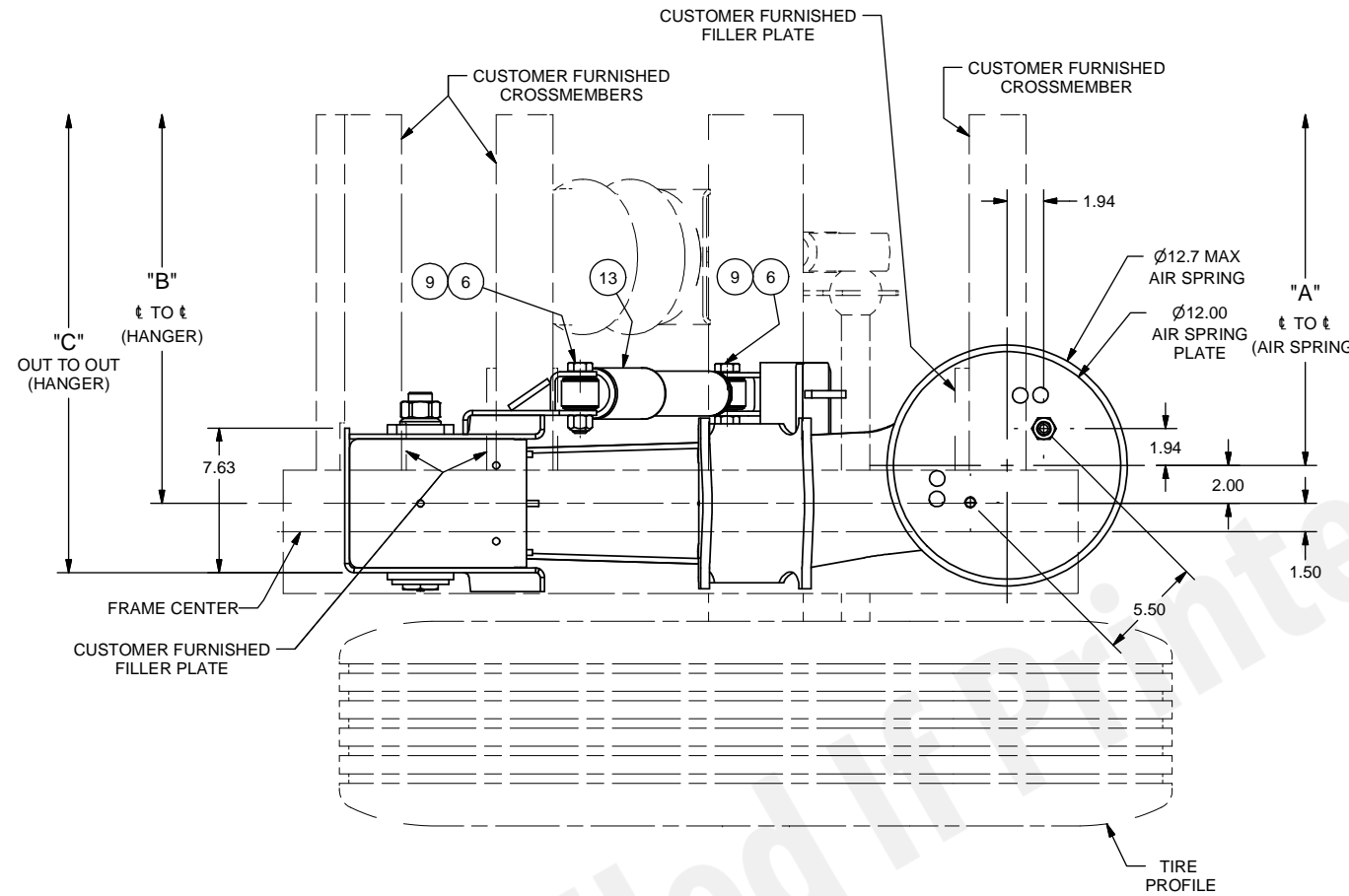
ITEM	SIZE	TORQUE	
		(FT-LB)	(N-M)
PIVOT (Ø 1.25 FASTENERS)	1 1/4-7	1000	1356
SHOCK (Ø 0.75 FASTENERS)	3/4-10	200	271
AIR SPRING (Ø 0.75 FASTENERS)	3/4-16	50	68
AIR SPRING (Ø 0.50 FASTENERS)	1/2-13	25	34

NOTES:

- MAIN PIVOT FASTENERS WILL BE SHIPPED WITH MINIMAL TORQUE APPLIED. IT IS THE INSTALLER'S RESPONSIBILITY TO TIGHTEN FASTENERS TO SPECIFIED TORQUE AFTER AXLE IS ALIGNED.
- TORQUE VALUES REFLECT LUBRICATED THREAD CONDITION (NUTS ARE PRE-LUBED).
- SUSPENSION FASTENERS TO BE RETORQUED INITIALLY AT 6,000 MILES (9,656 KM) AND 50,000 MILES (80,467 KM) INCREMENTS THEREAFTER.
- IN THE EVENT OF BUSHING REPLACEMENT, HUCK FASTENERS MAY BE REPLACED WITH 3/4-10 GRADE 8 HARDWARE TORQUED AT 280-330 FT.LB. FOR BUSHING REPLACEMENT ORDER KIT #6040029.
- FOR AXLE TO SUSPENSION WELDING SEE RIDEWELL WELD PROCESS #1.
- SUGGESTED CROSSMEMBER LOCATION AND SIZE ARE GIVEN. SIZE AND SHAPE MAY VARY WITH THE TRAILER DESIGN AND ARE THE RESPONSIBILITY OF THE TRAILER OEM.
- STATED DOWN TRAVEL REFLECTS SUSPENSION WITH SHOCK ABSORBERS AT MAXIMUM EXTENSION AND WITH UNPRESSURIZED AIR SPRINGS. STATED UP TRAVEL REFLECTS SUSPENSION WITH AIR SPRINGS AT BUMPER CONTACT.
- STATED CAPACITY RATING FOR SUSPENSION ONLY. RATING OF AXLE, BRAKES, AND WHEEL END EQUIPMENT PER MANUFACTURER.
- CONTACT RIDEWELL FOR AIR CONTROL KIT OPTIONS.
- INSTALLER MUST SET THE SUSPENSION TO THE SPECIFIED MOUNTING HEIGHT BEFORE TORQUING THE PIVOT BOLT TO PREVENT PRE-LOADING THE RUBBER IN THE BUSHING.
- FAILURE TO BRACE HANGERS FOR LATERAL LOADS VOIDS WARRANTY.

CLEARANCE SPECIFICATIONS:

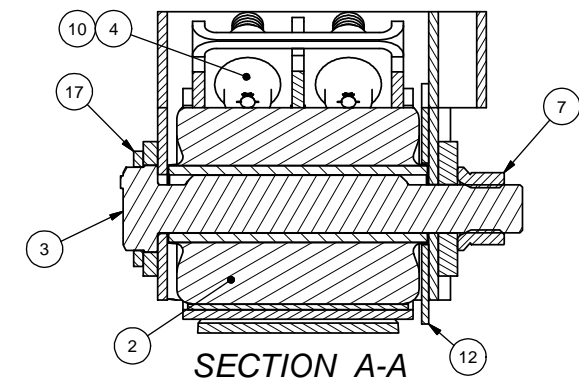
- 1.5 INCH MINIMUM CLEARANCE REQUIRED BETWEEN TOP OF TIRE AND BOTTOM OF TRAILER STRUCTURE WHEN AXLE IS AT BUMPER CONTACT.
- 2.0 INCHES MINIMUM CLEARANCE REQUIRED BETWEEN INSIDE OF TIRE AND TRAILER STRUCTURE FOR LATERAL MOVEMENT.
- 0.75 INCH MINIMUM CLEARANCE MUST BE MAINTAINED AROUND AIR SPRING WHEN IT IS AT MAXIMUM DIAMETER.



PARTS REQUIRED FOR 6000057 (CARTON OF PARTS)					
PARTS REQUIRED FOR 3010131 (RH HGR/LBA)					
PARTS REQUIRED FOR 3010130 (LH HGR/LBA)					
ITEM	PART NO.	DESCRIPTION	QTY	QTY	QTY
1	1000001	AIR SPRING 1R12-467			2
2	1117680B075	BUSH ASSY 60 DURO MONOPIVOT	1	1	
3	1137694B000	ECCENTRIC BOLT (FORGED) 9.5"	1	1	
4	1137738B301	HUCK BOLT 3/4X.75 HP8F-DT24-12	2	2	
** 5	1145383B105	HHCS 1/2" 13NC 1-1/4" L GRADE 5, ZINC PLATE			6
* 6	1147698B105	HHCS 3/4" 10NC 3-1/4" L GRADE 5, ZINC PLATE			4
7	1150033	L'NUT 1-1/4"-7NC GR8 SECURELOK	1	1	
** 8	1150558B102	NUT 3/4" 16NF GRD 2			2
* 9	1150709B105	L'NUT 3/4" 10NC OVAL 3/4" HI WAX			4
10	1157738B301	HUCK COLLAR 3/4" HPCF - R24U	2	2	
** 11	1160556B100	L'WASHER 1/2" S/T MED ZINC PLATE			6
12	1167680B000	WEAR WASHER, UHMW-PE, BLACK	1	1	
13	1270563B003	SHOCK ASSY 6" MONROE			2
14	3267744C108	HANGER ASSY - LH	1		
	3267744C208	HANGER ASSY - RH		1	
15	4280023	BEAM ASSY - LH	1		
	4280024	BEAM ASSY - RH		1	
16	7000407	AIR SPRING MOUNTING PLATE			2
17	9003092B000	ANTI-TURN WASHER			2

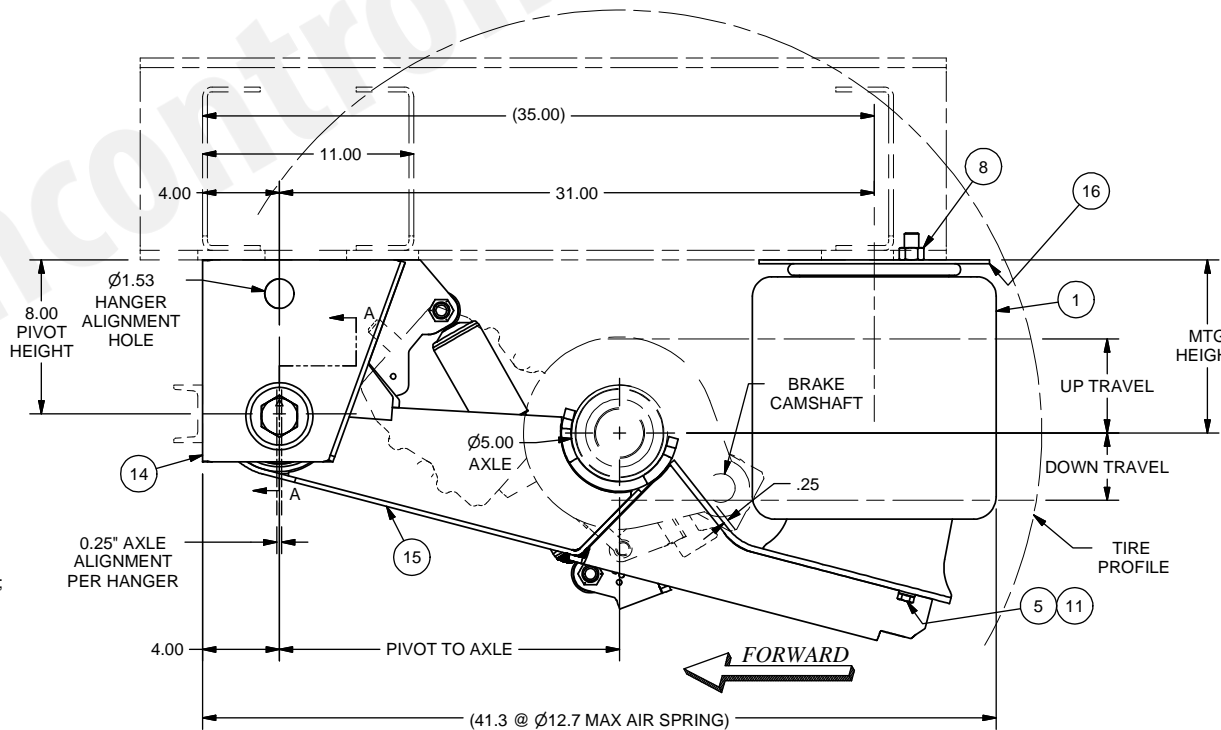
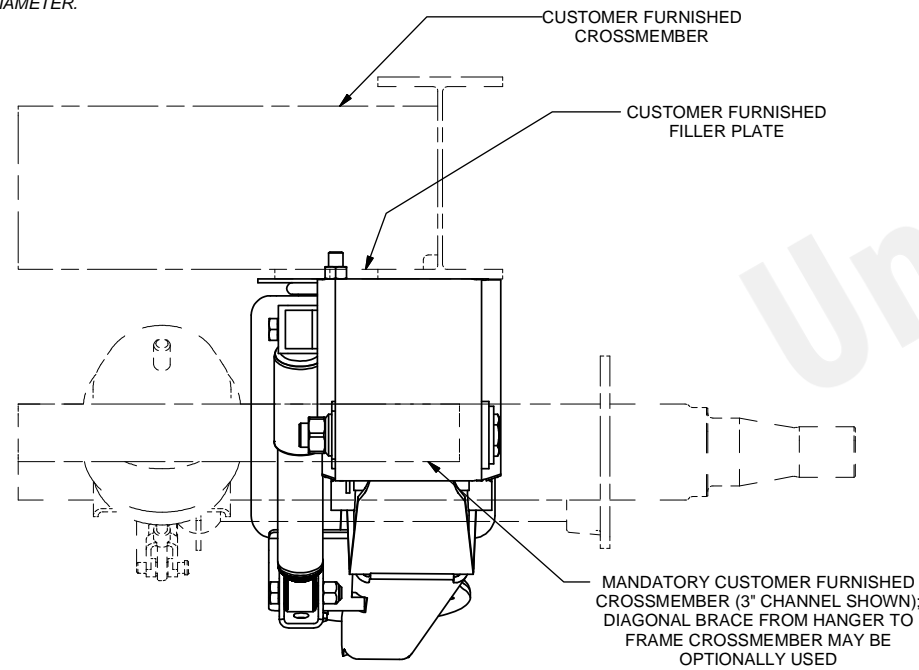
* ITEMS ARE INCLUDED IN PARTS BAG 1800001
 ** ITEMS ARE INCLUDED IN PARTS BAG 1800003

REFERENCE NOTE FOR ORDERING BEAM/BUSH ASSY:
 5970080 - LH BEAM/BUSH ASSEMBLY (SHOWN)
 5970079 - RH BEAM/BUSH ASSEMBLY (OPPOSITE)



TRACK WIDTH (IN)	71.50	77.50
DIMENSION "A" (IN)	31.00	37.00
DIMENSION "B" (IN)	35.00	41.00
DIMENSION "C" (IN)	42.31	48.31

MODEL NUMBER	MTG HEIGHT	UP TRAVEL	DOWN TRAVEL	PIVOT TO AXLE
RAR-240HT-1-9-25-USW	7.0"	2.9"	5.5"	17.72"
	7.5"	3.4"	5.0"	17.74"
	8.0"	3.9"	4.5"	17.75"
	8.5"	4.4"	4.0"	17.74"
	9.0"	4.9"	3.5"	17.72"
	9.5"	5.4"	3.0"	17.69"



9 INCH MOUNTING HEIGHT SHOWN

REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD
AC	12105	REVISED MTG HEIGHT CHART	3/6/12	G.H.	MDJ	CJB
AB	11104	UPDATED HANGER TO CURRENT REV	1/5/12	PMB	MDJ	CJB
AA	11106	REMOVED FROM CHARTED DRAWING (240-25K U/S CHT)	9/9/11	PMB	MDJ	CJB

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DRAWN BY:	
CHECKED:	
APPROVED:	
PROJECT NO:	
SCALE:	B - SIZE NTS D - SIZE NTS
MATERIAL:	SEE B.O.M
TOLERANCES UNLESS OTHERWISE SPECIFIED:	DECIMAL: .X ± 0.1 XX ± 0.06 XXX ± 0.030
	FRACTION: ± 1/16 ANG: X ± 1' XXX: X ± 1'
	Weld Tolerances per ISO W45-02

RIDEWELL CORPORATION
 PO BOX 4586 SPRINGFIELD, MISSOURI 65808

**25,000 LB. CAPACITY
 UNDERSLUNG SUSPENSION
 RAR-240HT-1-9-25-USW**

SHEET 1 OF 1 PART NO: **2400308** REV: **AC**

AXLE ADJUSTMENT PROCEDURE:

- AXLE ALIGNMENT SHALL BE IN ACCORDANCE WITH SAE OR TMC RECOMMENDED STANDARDS.
- LOOSEN 1.25 INCH NUT AT ECCENTRIC BOLT & REMOVE ANTI-TURN WASHER.
- TO MOVE AXLE: TURN ECCENTRIC BOLT HEAD IN DIRECTION AXLE IS TO BE MOVED. MAXIMUM MOVEMENT FROM 12 O'CLOCK POSITION IS TO 9 OR 3 O'CLOCK POSITION, FORWARD OR REARWARD.
- WITH ECCENTRIC BOLT AT ITS FINAL SETTING, INSTALL ANTI-TURN WASHER OVER ECCENTRIC BOLT HEAD AND WELD TO HANGER. TIGHTEN 1.25 INCH NUT TO SPECIFIED TORQUE.

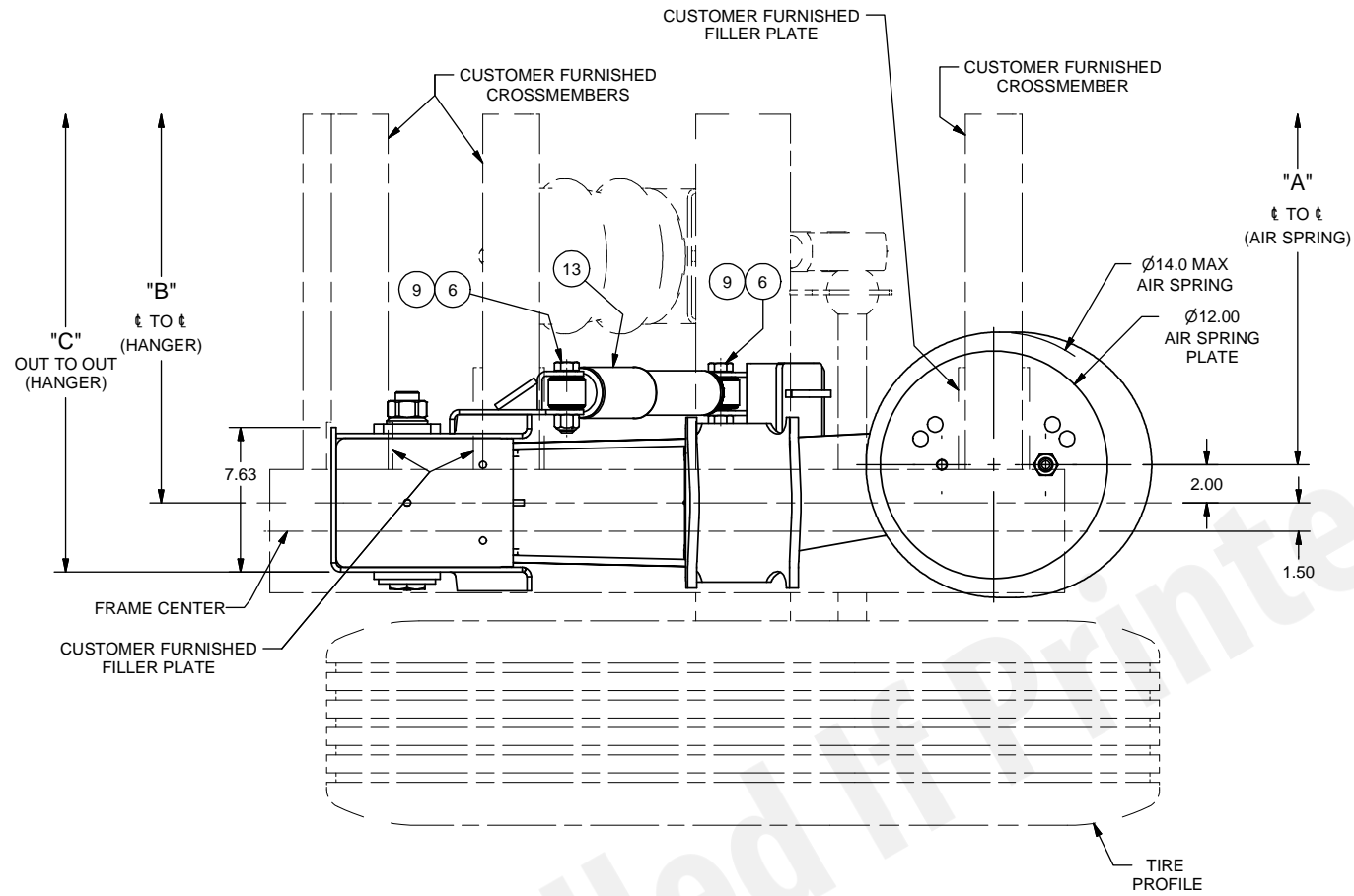
ITEM	SIZE	TORQUE	
		(FT-LB)	(N-M)
PIVOT (Ø1.25 FASTENERS)	1 1/4-7	1000	1356
SHOCK (Ø0.75 FASTENERS)	3/4-10	200	271
AIR SPRING (Ø0.75 FASTENERS)	3/4-16	50	68
AIR SPRING (Ø0.50 FASTENERS)	1/2-13	25	34

NOTES:

- MAIN PIVOT FASTENERS WILL BE SHIPPED WITH MINIMAL TORQUE APPLIED. IT IS THE INSTALLER'S RESPONSIBILITY TO TIGHTEN FASTENERS TO SPECIFIED TORQUE AFTER AXLE IS ALIGNED.
- TORQUE VALUES REFLECT LUBRICATED THREAD CONDITION (NUTS ARE PRE-LUBED).
- SUSPENSION FASTENERS TO BE RETORQUED INITIALLY AT 6,000 MILES (9,656 KM) AND 50,000 MILES (80,467 KM) INCREMENTS THEREAFTER.
- IN THE EVENT OF BUSHING REPLACEMENT, HUCK FASTENERS MAY BE REPLACED WITH 3/4-10 GRADE 8 HARDWARE TORQUED AT 280-330 FT.LB. FOR BUSHING REPLACEMENT ORDER KIT #6040028.
- FOR AXLE TO SUSPENSION WELDING SEE RIDEWELL WELD PROCESS #1.
- SUGGESTED CROSSMEMBER LOCATION AND SIZE ARE GIVEN. SIZE AND SHAPE MAY VARY WITH THE TRAILER DESIGN AND ARE THE RESPONSIBILITY OF THE TRAILER OEM.
- STATED DOWN TRAVEL REFLECTS SUSPENSION WITH SHOCK ABSORBERS AT MAXIMUM EXTENSION AND WITH UNPRESSURIZED AIR SPRINGS. STATED UP TRAVEL REFLECTS SUSPENSION WITH AIR SPRINGS AT BUMPER CONTACT.
- STATED CAPACITY RATING FOR SUSPENSION ONLY. RATING OF AXLE, BRAKES, AND WHEEL END EQUIPMENT PER MANUFACTURER.
- CONTACT RIDEWELL FOR AIR CONTROL KIT OPTIONS.
- INSTALLER MUST SET THE SUSPENSION TO THE SPECIFIED MOUNTING HEIGHT BEFORE TORQUING THE PIVOT BOLT TO PREVENT PRE-LOADING THE RUBBER IN THE BUSHING.
- FAILURE TO BRACE HANGERS FOR LATERAL LOADS VOIDS WARRANTY.

CLEARANCE SPECIFICATIONS:

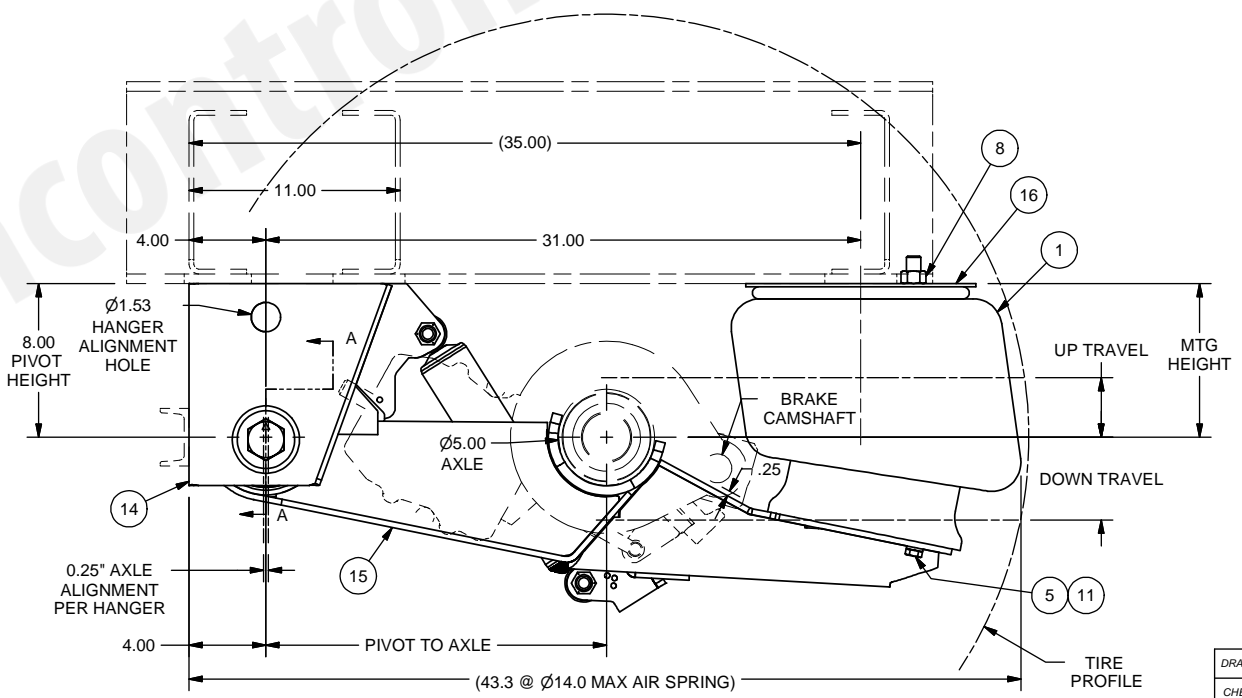
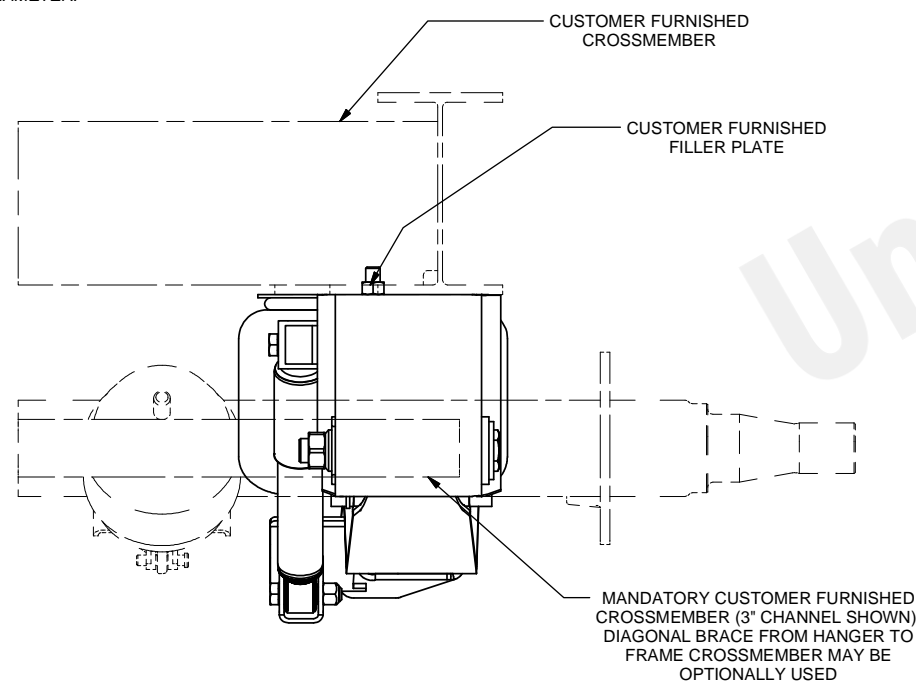
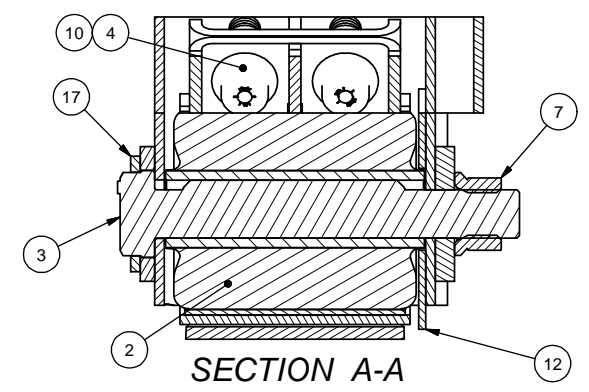
- 1.5 INCH MINIMUM CLEARANCE REQUIRED BETWEEN TOP OF TIRE AND BOTTOM OF TRAILER STRUCTURE WHEN AXLE IS AT BUMPER CONTACT.
- 2.0 INCHES MINIMUM CLEARANCE REQUIRED BETWEEN INSIDE OF TIRE AND TRAILER STRUCTURE FOR LATERAL MOVEMENT.
- 0.75 INCH MINIMUM CLEARANCE MUST BE MAINTAINED AROUND AIR SPRING WHEN IT IS AT MAXIMUM DIAMETER.



PARTS REQUIRED FOR 6007754B108 (CARTON OF PARTS)					
PARTS REQUIRED FOR 3017754B278 (RH HGR/LBA)					
PARTS REQUIRED FOR 3017754B178 (LH HGR/LBA)					
ITEM	PART NO.	DESCRIPTION	QTY	QTY	QTY
1	1003588778C	AIR SPRING 1R14-130			2
2	1117680B001	BUSH ASSY 70 DURO MONOPIVOT	1	1	
3	1137694B000	ECCENTRIC BOLT (FORGED) 9.5"	1	1	
4	1137738B301	HUCK BOLT 3/4X.75 HP8F-DT24-12	2	2	
** 5	1145383B105	HHCS 1/2" 13NC 1-1/4"L GRADE 5, ZINC PLATE			6
* 6	1147698B105	HHCS 3/4" 10NC 3-1/4"L GRADE 5, ZINC PLATE			4
7	1150033	L'NUT 1-1/4"-7NC GR8 SECURELOK	1	1	
** 8	1150558B102	NUT 3/4" 16NF GRD 2			2
* 9	1150709B105	L'NUT 3/4" 10NC OVAL 3/4" HI WAX			4
10	1157738B301	HUCK COLLAR 3/4" HPCF - R24U	2	2	
** 11	1160556B100	L'WASHER 1/2" S/T MED ZINC PLATE			6
12	1167680B000	WEAR WASHER, UHMW-PE, BLACK	1	1	
13	1270563B003	SHOCK ASSY 6" MONROE			2
14	3267744C108	HANGER ASSY - LH	1		
	3267744C208	HANGER ASSY - RH		1	
15	4287754D175	BEAM ASSY - LH	1		
	4287754D275	BEAM ASSY - RH		1	
16	7000407	AIR SPRING MOUNTING PLATE			2
17	9003092B000	ANTI-TURN WASHER			2

* ITEMS ARE INCLUDED IN PARTS BAG 1800001
 ** ITEMS ARE INCLUDED IN PARTS BAG 1800003

REFERENCE NOTE FOR ORDERING BEAM/BUSH ASS'Y:
 5970048 - LH BEAM/BUSH ASSEMBLY (SHOWN)
 5970049 - RH BEAM/BUSH ASSEMBLY (OPPOSITE)



TRACK WIDTH (IN)	71.50	77.50
DIMENSION "A" (IN)	31.00	37.00
DIMENSION "B" (IN)	35.00	41.00
DIMENSION "C" (IN)	42.31	48.31

MODEL NUMBER	MTG HEIGHT	UP TRAVEL	DOWN TRAVEL	PIVOT TO AXLE
RAR-240-1-8-30-USW	7.5"	2.6"	4.8"	17.74"
	8.0"	3.1"	4.3"	17.75"
	8.5"	3.6"	3.8"	17.74"
	9.0"	4.1"	3.3"	17.72"

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← FORWARD
 8 INCH MOUNTING HEIGHT SHOWN

DRAWN BY:	
CHECKED:	
APPROVED:	
PROJECT NO:	
SCALE:	B - SIZE NTS D - SIZE NTS
MATERIAL:	SEE B.O.M.
WEIGHT:	355#

RIDEWELL CORPORATION
 PO BOX 4586 SPRINGFIELD, MISSOURI 65808

TITLE:
 30,000 LB. CAPACITY
 UNDERSLUNG SUSPENSION
 RAR-240-1-8-30-USW

Z	11106	REMOVED FROM CHARTED DRAWING (240-30K U/S CHT)	2/13/12	G.H.	MDJ	CJB	TOLERANCES UNLESS OTHERWISE SPECIFIED: DECIMAL: .X ± 0.1 FRACTION: ± 1/16 XX ± 0.06 XXX ± 0.030	WEIGHT: 355#	REV:
REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD	*WELD TOLERANCES PER ISO W045-02		Z

AXLE ADJUSTMENT PROCEDURE:

- AXLE ALIGNMENT SHALL BE IN ACCORDANCE WITH SAE OR TMC RECOMMENDED STANDARDS.
- LOOSEN 1.25 INCH NUT AT ECCENTRIC BOLT & REMOVE ANTI-TURN WASHER.
- TO MOVE AXLE: TURN ECCENTRIC BOLT HEAD IN DIRECTION AXLE IS TO BE MOVED. MAXIMUM MOVEMENT FROM 12 O'CLOCK POSITION IS TO 9 OR 3 O'CLOCK POSITION, FORWARD OR REARWARD.
- WITH ECCENTRIC BOLT AT ITS FINAL SETTING, INSTALL ANTI-TURN WASHER OVER ECCENTRIC BOLT HEAD AND WELD TO HANGER. TIGHTEN 1.25 INCH NUT TO SPECIFIED TORQUE.

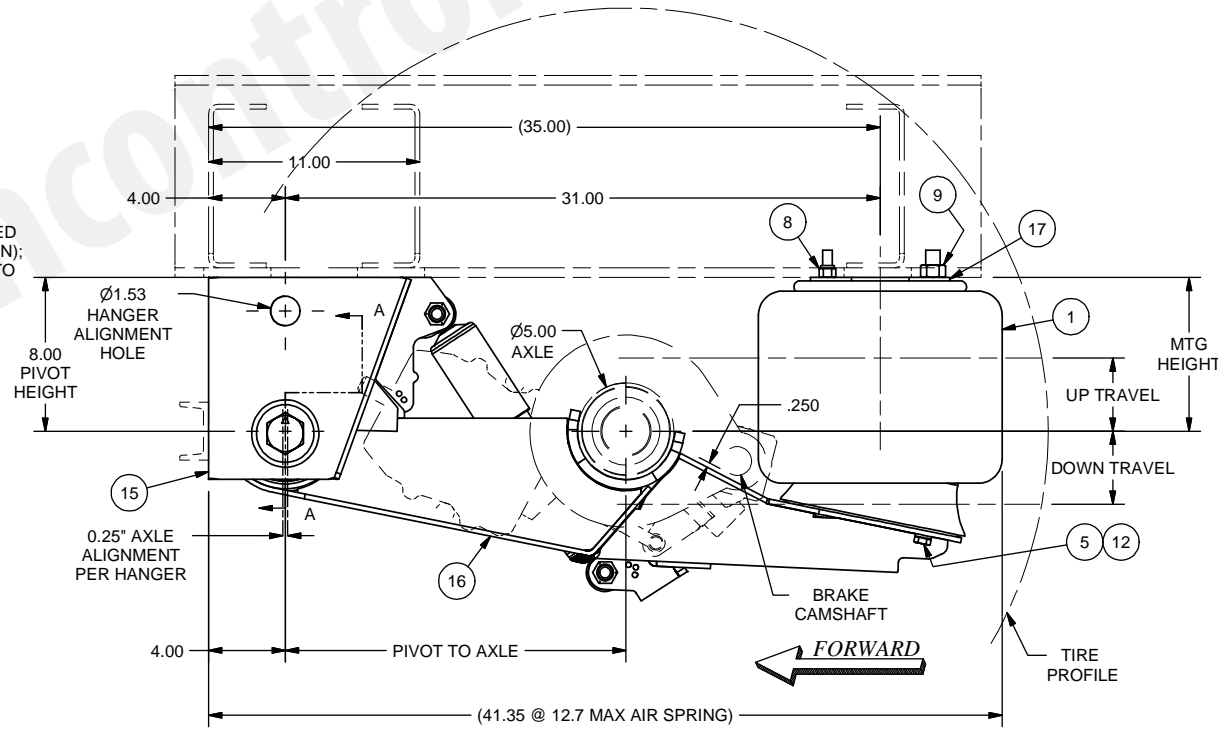
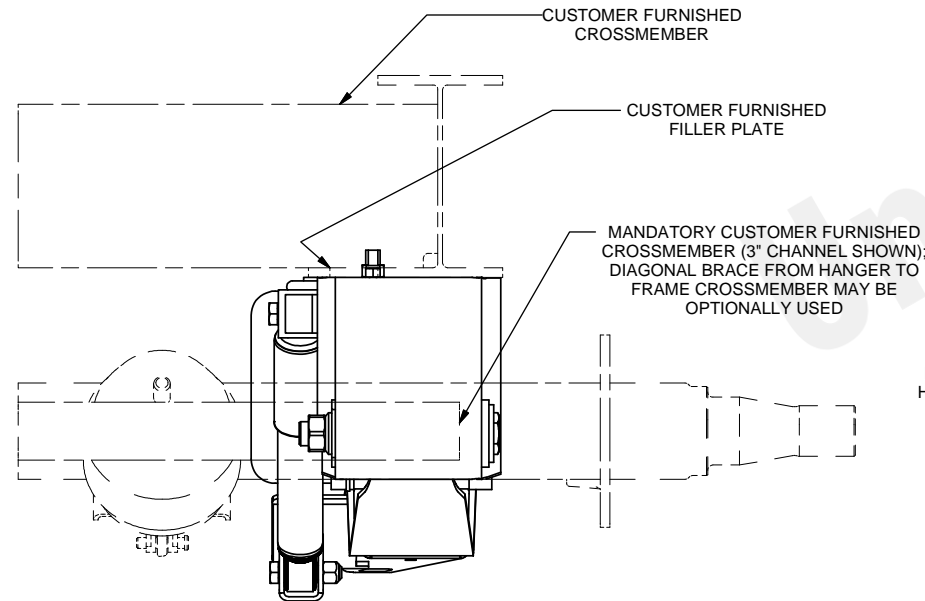
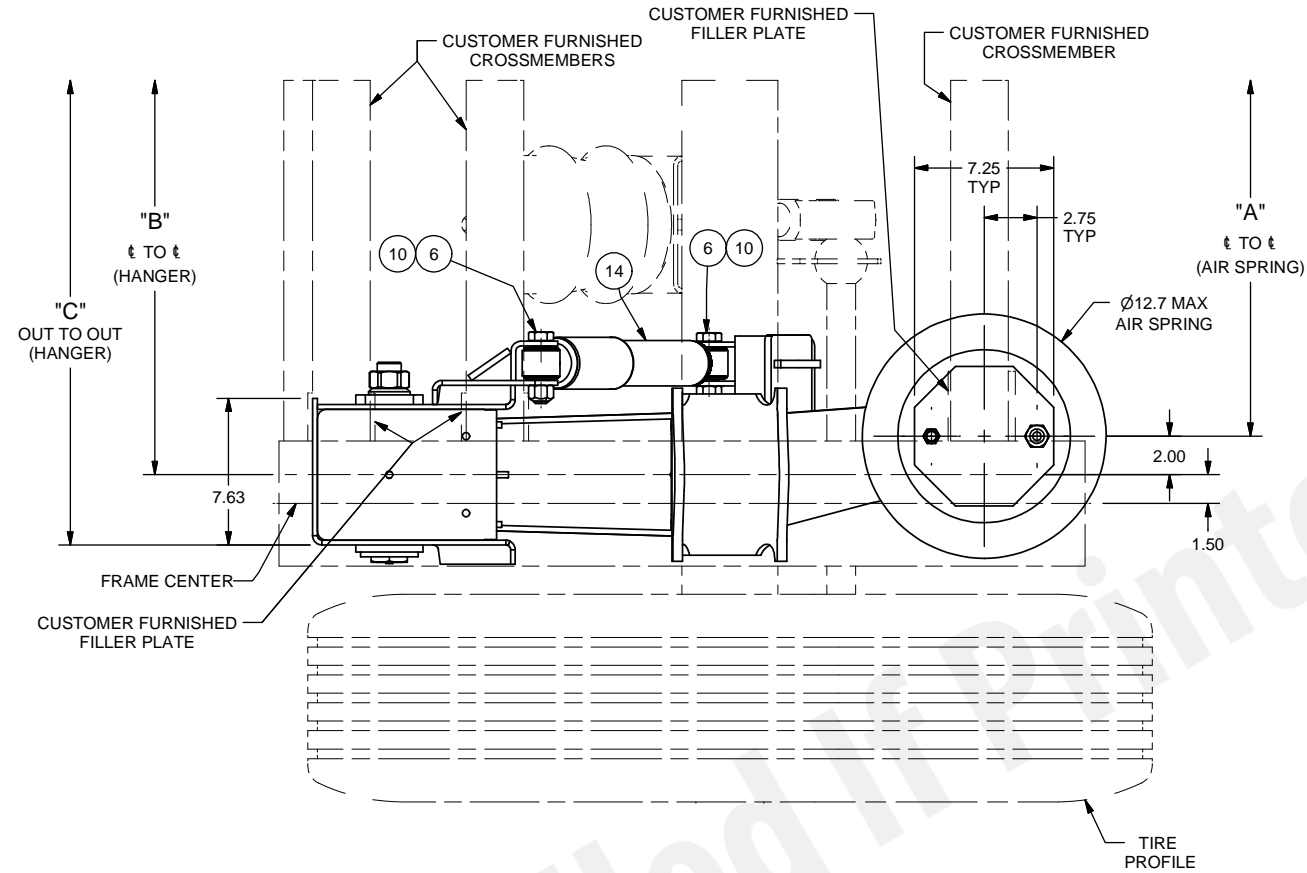
ITEM	SIZE	TORQUE	
		(FT-LB)	(N-M)
PIVOT (Ø1.25 FASTENERS)	1 1/4-7	1000	1356
SHOCK (Ø0.75 FASTENERS)	3/4-10	200	271
AIR SPRING (Ø0.75 FASTENERS)	3/4-16	50	68
AIR SPRING (Ø0.50 FASTENERS)	1/2-13	25	34

NOTES:

- MAIN PIVOT FASTENERS WILL BE SHIPPED WITH MINIMAL TORQUE APPLIED. IT IS THE INSTALLER'S RESPONSIBILITY TO TIGHTEN FASTENERS TO SPECIFIED TORQUE AFTER AXLE IS ALIGNED.
- TORQUE VALUES REFLECT LUBRICATED THREAD CONDITION (NUTS ARE PRE-LUBED).
- SUSPENSION FASTENERS TO BE RETORQUED INITIALLY AT 6,000 MILES (9,656 KM) AND 50,000 MILES (80,467 KM) INCREMENTS THEREAFTER.
- IN THE EVENT OF BUSHING REPLACEMENT, HUCK FASTENERS MAY BE REPLACED WITH 3/4-10 GRADE 8 HARDWARE TORQUED AT 280-330 FT.LB. FOR BUSHING REPLACEMENT ORDER KIT #6040029.
- FOR AXLE TO SUSPENSION WELDING SEE RIDEWELL WELD PROCESS #1.
- SUGGESTED CROSSMEMBER LOCATION AND SIZE ARE GIVEN. SIZE AND SHAPE MAY VARY WITH THE TRAILER DESIGN AND ARE THE RESPONSIBILITY OF THE TRAILER OEM.
- STATED DOWN TRAVEL REFLECTS SUSPENSION WITH SHOCK ABSORBERS AT MAXIMUM EXTENSION AND WITH UNPRESSURIZED AIR SPRINGS. STATED UP TRAVEL REFLECTS SUSPENSION WITH AIR SPRINGS AT BUMPER CONTACT.
- STATED CAPACITY RATING FOR SUSPENSION ONLY. RATING OF AXLE, BRAKES, AND WHEEL END EQUIPMENT PER MANUFACTURER.
- CONTACT RIDEWELL FOR AIR CONTROL KIT OPTIONS.
- INSTALLER MUST SET THE SUSPENSION TO THE SPECIFIED MOUNTING HEIGHT BEFORE TORQUING THE PIVOT BOLT TO PREVENT PRE-LOADING THE RUBBER IN THE BUSHING.
- FAILURE TO BRACE HANGERS FOR LATERAL LOADS VOIDS WARRANTY.

CLEARANCE SPECIFICATIONS:

- a) 1.5 INCH MINIMUM CLEARANCE REQUIRED BETWEEN TOP OF TIRE AND BOTTOM OF TRAILER STRUCTURE WHEN AXLE IS AT BUMPER CONTACT.
- b) 2.0 INCHES MINIMUM CLEARANCE REQUIRED BETWEEN INSIDE OF TIRE AND TRAILER STRUCTURE FOR LATERAL MOVEMENT.
- c) 0.75 INCH MINIMUM CLEARANCE MUST BE MAINTAINED AROUND AIR SPRING WHEN IT IS AT MAXIMUM DIAMETER.



8 INCH MOUNTING HEIGHT SHOWN

REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD
AB	12105	REVISED MTG HEIGHT CHART	3/6/12	G.H.	MDJ	CJB
AA	11106	REMOVED FROM CHARTED DRAWING (240-25K U/S CHT)	6/1/11	PMB	MDJ	CJB

PARTS REQUIRED FOR 6007744B107 (CARTON OF PARTS)

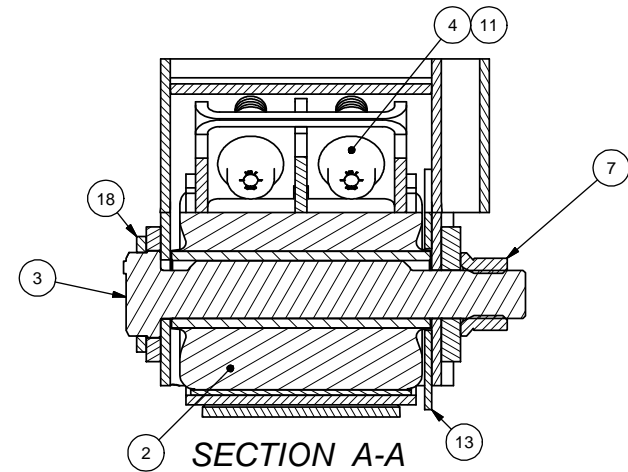
PARTS REQUIRED FOR 3017744B200 (RH HGR/LBA)

PARTS REQUIRED FOR 3017744B100 (LH HGR/LBA)

ITEM	PART NO.	DESCRIPTION	QTY	QTY	QTY
1	1003589010C	AIR SPRING 1R12-421			2
2	1117680B075	BUSH ASSY 60 DURO MONOPIVOT	1	1	
3	1137694B000	ECCENTRIC BOLT (FORGED) 9.5"	1	1	
4	1137738B301	HUCK BOLT 3/4X.75 HP8F-DT24-12	2	2	
** 5	1145383B105	HHCS 1/2" 13NC 1-1/4"L GRADE 5, ZINC PLATE			6
* 6	1147698B105	HHCS 3/4" 10NC 3-1/4"L GRADE 5, ZINC PLATE			4
7	1150033	L'NUT 1-1/4"-7NC GR8 SECURELOK	1	1	
** 8	1150555B112	L'NUT 1/2" 13NC NYLON GR 2, ZINC PLATE			2
** 9	1150558B102	NUT 3/4" 16NF GRD 2			2
* 10	1150709B105	L'NUT 3/4" 10NC OVAL 3/4" HI WAX			4
11	1157738B301	HUCK COLLAR 3/4" HPCF - R24U	2	2	
** 12	1160556B100	L'WASHER 1/2" S/T MED ZINC PLATE			6
13	1167680B000	WEAR WASHER, UHMW-PE, BLACK	1	1	
14	1270563B003	SHOCK ASSY 6" MONROE			2
15	3267744C107	HANGER ASSY - LH	1		
	3267744C207	HANGER ASSY - RH		1	
16	4287744D100	BEAM ASSY - LH	1		
	4287744D200	BEAM ASSY - RH		1	
17	7001723B000	A/SPG PLATE 7-1/4" OCTAGON			2
* 18	9003092B000	ANTI-TURN WASHER			2

* ITEMS ARE INCLUDED IN PARTS BAG 1800001
 ** ITEMS ARE INCLUDED IN PARTS BAG 1800002

REFERENCE NOTE FOR ORDERING BEAM/BUSH ASS'Y:
 5970003 - LH BEAM/BUSH ASSEMBLY (SHOWN)
 5970004 - RH BEAM/BUSH ASSEMBLY (OPPOSITE)



TRACK WIDTH (IN)	71.50	77.50
DIMENSION "A" (IN)	31.00	37.00
DIMENSION "B" (IN)	35.00	41.00
DIMENSION "C" (IN)	42.31	48.31

MODEL NUMBER	MTG HEIGHT	UP TRAVEL	DOWN TRAVEL	PIVOT TO AXLE
RAR-240-1-7.5-25-USW	7.5"	2.6"	3.5"	17.74"
	8.0"	3.1"	3.0"	17.75"

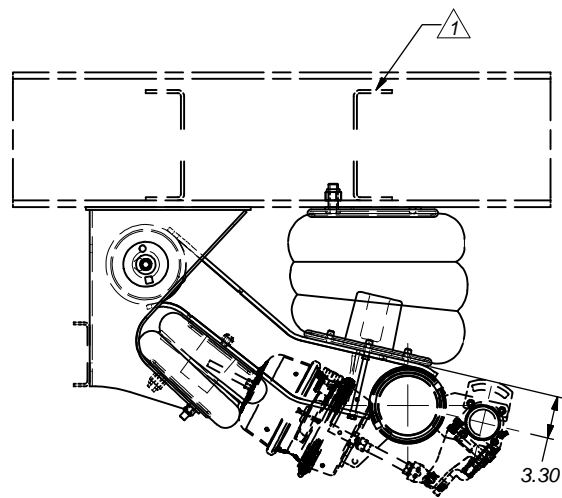
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DRAWN BY:	
CHECKED:	
APPROVED:	
PROJECT NO:	
SCALE:	B - SIZE NTS D - SIZE NTS
MATERIAL:	SEE B.O.M.
TOLERANCES UNLESS OTHERWISE SPECIFIED:	DECIMAL: .XX ± 0.01 FRACTION: ± 1/16 XXX ± 0.030 ANG: X ± 1' KCC *WELD TOLERANCES PER ISO W045-02

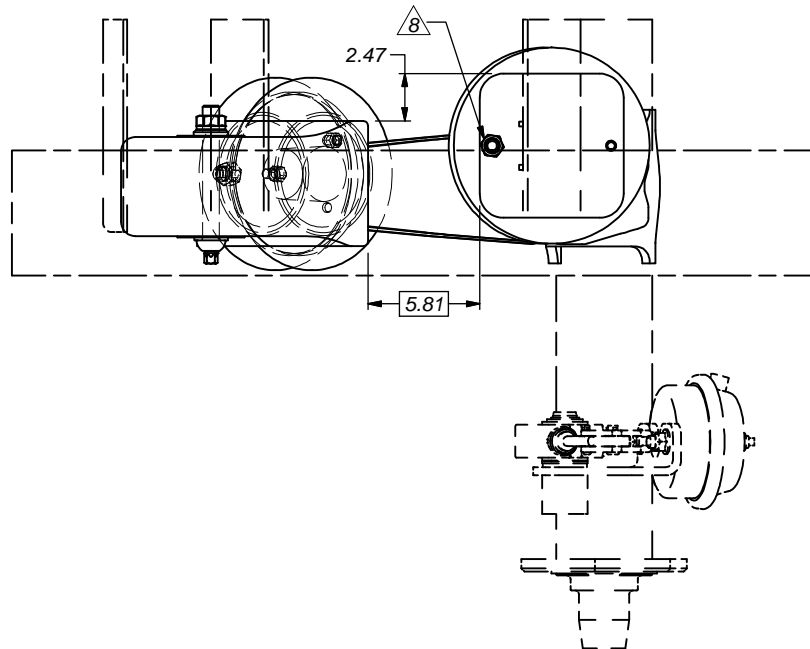
RIDEWELL CORPORATION
 PO BOX 4586 SPRINGFIELD, MISSOURI 65808

TITLE:
 25,000 LB. CAPACITY
 UNDERSLUNG SUSPENSION
 RAR-240-1-7.5-25-USW

SHEET 1 OF 1 PART NO: **2404107** REV: **AB**



CLOCKING FOR LONG CAM AXLES



AXLE ADJUSTMENT PROCEDURE:

- AXLE ALIGNMENT SHALL BE IN ACCORDANCE WITH SAE OR TMC RECOMMENDED STANDARDS.
- LOOSEN PIVOT NUT.
- USING 1/2" DRIVE BREAKER BAR, ROTATE ADJUSTER PLATE IN THE DIRECTION OF DESIRED AXLE MOVEMENT.
- ENSURE THAT THE ADJUSTER PLATE AND ALIGNMENT WASHER HAVE MOVED IN UNISON. IT IS IMPORTANT THAT THE BUSHING IS NOT SKEWED IN THE HANGER PRIOR TO TIGHTENING.
- SNUG PIVOT FASTENERS AND RECHECK ALIGNMENT.
- TORQUE PIVOT BOLT USING A 1" DRIVE IMPACT WRENCH AND #610054 E-20 TORX SOCKET (OR EQUIVALENT) UNTIL THE TORX HEAD SHEARS OFF FROM THE BOLT.
- WELDING OF ADJUSTER PLATES OR ALIGNMENT WASHERS TO THE HANGER SIDEWALLS IS NOT REQUIRED OR RECOMMENDED.

NOTES:

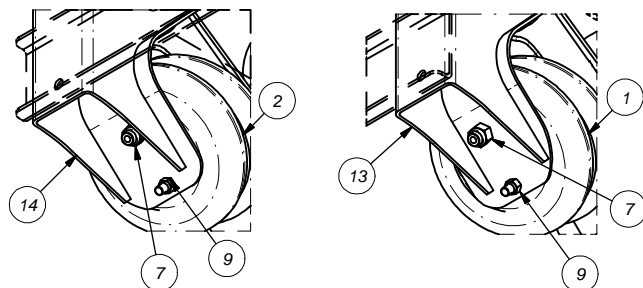
- 1 - CUSTOMER FURNISHED CROSSMEMBERS SHOWN IN RECOMMENDED LOCATIONS.
- 2 - FAILURE TO OBSERVE INSTALLATION INSTRUCTIONS MAY VOID WARRANTY
- 3 - BUSHING (ITEM 20) IS PART OF THE BUSHING/BEAM ASSEMBLY (ITEM 15&16) AND IS LISTED FOR REPLACEMENT REFERENCE ONLY. BUSHING REPLACEMENT KIT PART NO. 6040128/6040078. TRADITIONAL HARDWARE MUST BE TORQUED TO 500 FT-LB.
- 4 - RETORQUE FASTENERS AFTER 6,000 MILES AND EVERY 30,000 MILES AFTER.
- 5 - ADJUSTMENT PLATE AND ALIGNMENT WASHER (ITEMS 18 AND 19) MUST SIT FLAT AGAINST HANGER.
- 6 - WELD IN ACCORDANCE WITH RIDEWELL WELD PROCEDURE NO. 1.
- 7 - BUSHING (ITEM 20) CAN BE INSTALLED USING BUSHING INSTALLATION TOOL NO. 6100044.
- 8 - A/SPNGS CAN BE ROTATED IN INCREMENTS OF 90 DEGREES FOR OPTIMAL PORT LOCATION
- 9 - BEAM CENTER DIM "B" VARIES WITH FRAME WIDTH (DIM "A") SEE CHART B-B FOR CORRECT DIMENSION INFORMATION
- 10 - RIDEWELL DOES NOT RECOMMEND DISHED OUT WHEELS DUE TO SEVERE BEARING OVERLOAD.
- 11 - CUSTOMER FURNISHED SPACER PLATE REQ. AT HANGER AND A/S CROSSMEMBERS.

PARTS REQUIRED FOR 6001033 (CARTON OF PARTS)

PARTS FOR 3010997 RH HANGER BEAM ASSEMBLY

PARTS FOR 3010996 LH HANGER BEAM ASSEMBLY

ITEM	PART NO.	DESCRIPTION	QTY	QTY	QTY
1	1002B09611G	A/SPG 2B9-611			1
2	1002B09614G	A/SPG 2B9-614			1
3	1003B12339G	A/SPG 3B12-339			2
4	1130048	PIVOT BLT RD HD SHR-TYPE 7/8" 9NC	1	1	
5	1140025	HHCS 3/8" 16NC 5-3/4" LG GR5 ZN PLT			2
6	1140674B105	HHCS 3/8" 16NC 1" LG. GR5, ZN PLT			2
7	1150011	L'NUT 3/4"-16NF GRADE 2 NYL ZN PLT			4
8	1150032	L'NUT 7/8" 9NC GR8 SECURELOK	1	1	
9	1150555B112	L'NUT 1/2" 13NC NYLON GR2 ZN PLT			4
10	1160011	L'WASHER 3/8" INTERNAL TOOTH			4
11	1160868B100	WASHER 7/8" A-325 FLAT ZINC PLATE	1	1	
12	1167680B000	WEAR WASHER, UHMW-PE, BLACK	2	2	
13	3360130	HANGER ASS'Y LH	1		
14	3360131	HANGER ASS'Y RH		1	
15	5970428	BEAM / BUSHING ASY - LH	1		
	4150036	BEAM ASSEMBLY LH	-	-	-
16	5970429	BEAM / BUSHING ASS'Y - RH		1	
	4150037	BEAM ASSEMBLY RH	-	-	-
17	7002347	A/SPG MTG PLATE			2
18	7002582	ALIGNMENT WASHER 3.5"OD	1	1	
19	7002684	ADJUSTER PLATE 3.5"OD	1	1	
20	1110086	BUSHING 75 DURO .906ID X 4.125 WIDE	-	-	-
21	6040128	BUSH. REPL. KIT (SNAP OFF BOLT)	-	-	-
22	6040078	BUSH. REPL. KIT (TRADITIONAL BOLT)	-	-	-



LIFT SPRING MOUNTING DETAILS

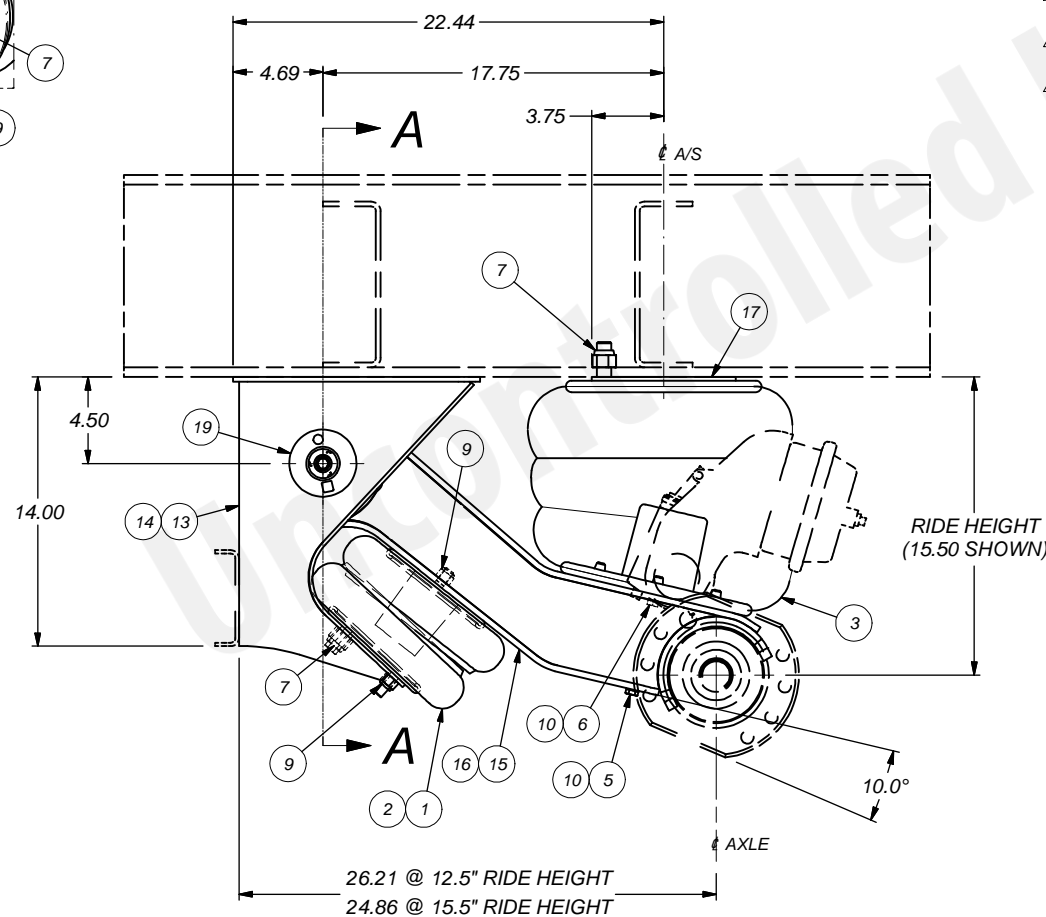
RIDE HEIGHT	TRAVEL	
	UP	DOWN
12.5	5.0	6.0
13.0	5.5	5.5
13.5	6.0	5.0
14.0	6.5	4.5
14.5	7.0	4.0
15.0	7.5	3.5
15.5	8.0	3.0

TORQUE VALUES 4

ITEM	SIZE	TORQUE	
		(FT-LB)	(N M)
5&6	3/8-16 NC	25	34
9	1/2-13 NC	25	34
7	3/4-16 NF	50	68
4	7/8-9 NC	SEE AXLE ADJ. PROCEDURE	

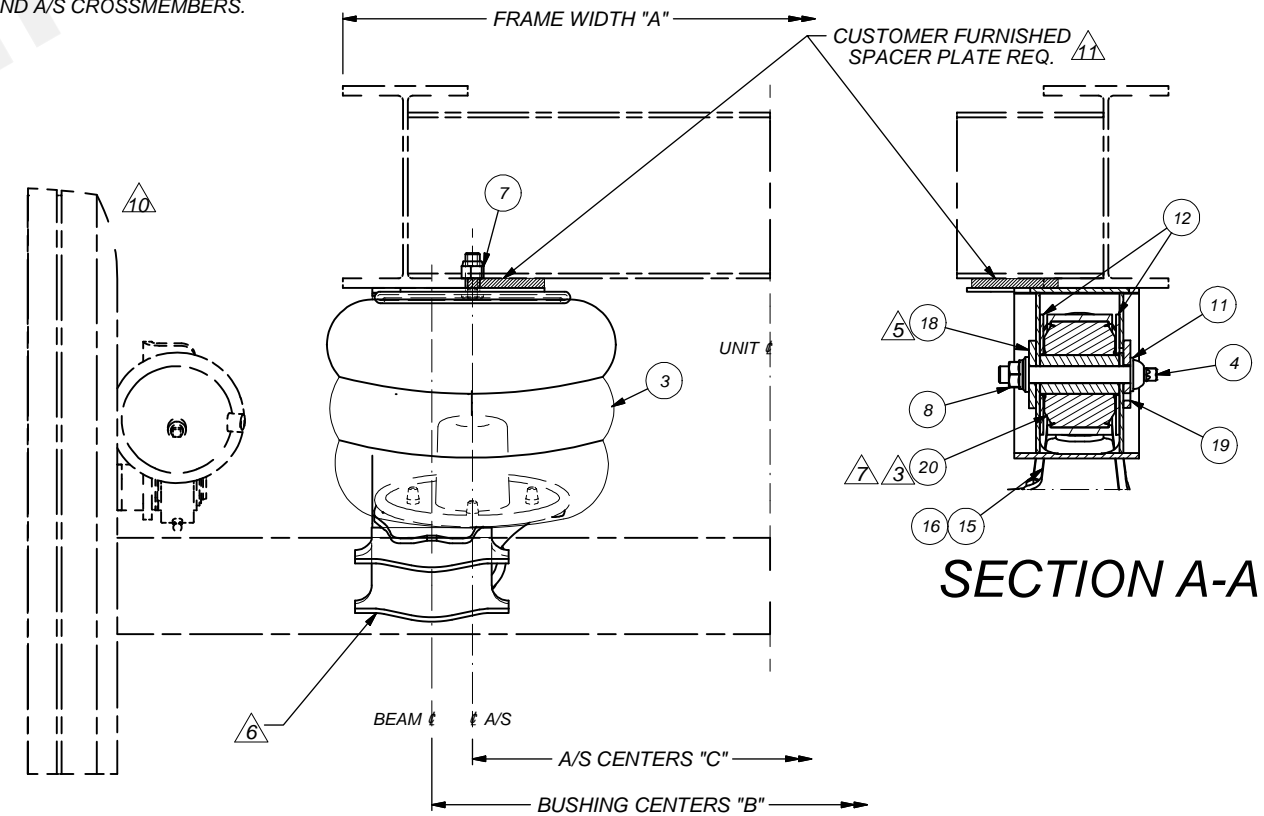
CHART B-B 9

AXLE TRACK	FRAME WIDTH "A"	BEAM CENTERS "B"	A/S CENTERS "C"
71.5 OR 79.38	43.5	35.25	31.00
77.5 OR 79.38	49.5	41.25	37.00



FORWARD

CAPACITY = 13,200 lbs



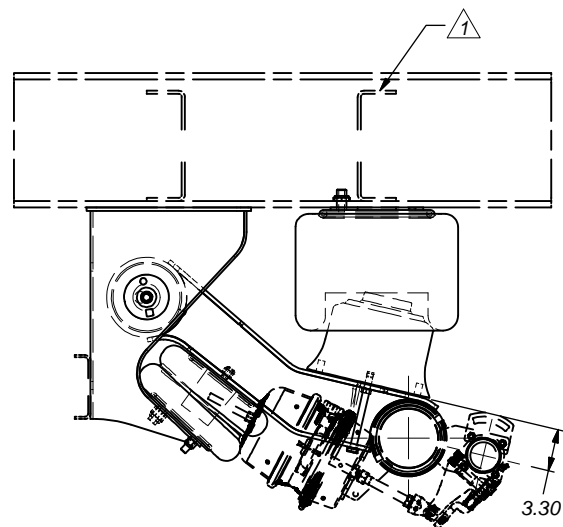
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DRAWN BY: BC	11/13/14
CHECKED: MDJ	3/2/2015
APPROVED: MJK	3/5/2015
PROJECT NO: 14109	SCALE: B-SIZE NTS, D-SIZE NTS
MATERIAL: SEE BOM	Weight: N/A
TOLERANCES UNLESS OTHERWISE SPECIFIED: DECIMAL: .X ± 0.1 FRACTION: ± 1/16 .XX ± 0.06 ANG: X ± 1' .XXX ± 0.030 [XXX] KCC *WELD TOLERANCES PER ISO W045-02	

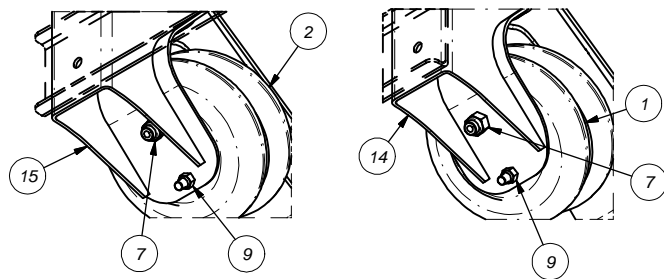
RIDEWELL CORPORATION
 PO BOX 4586 SPRINGFIELD, MISSOURI 65808
RUL-245 LMT 12.5 / 15.5 13k
WELD-ON, TRAILER
13,200 LB CAPACITY

SHEET 1 OF 1	PART NO: 2450401	REV: -
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REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD



CLOCKING FOR LONG CAM AXLES



LIFT SPRING MOUNTING DETAILS

RIDE HEIGHT	TRAVEL	
	UP	DOWN
15.0	5.0	6.0
15.5	5.5	5.5
16.0	6.0	5.0
16.5	6.5	4.5
17.0	7.0	4.0
17.5	7.5	3.5
18.0	8.0	3.0

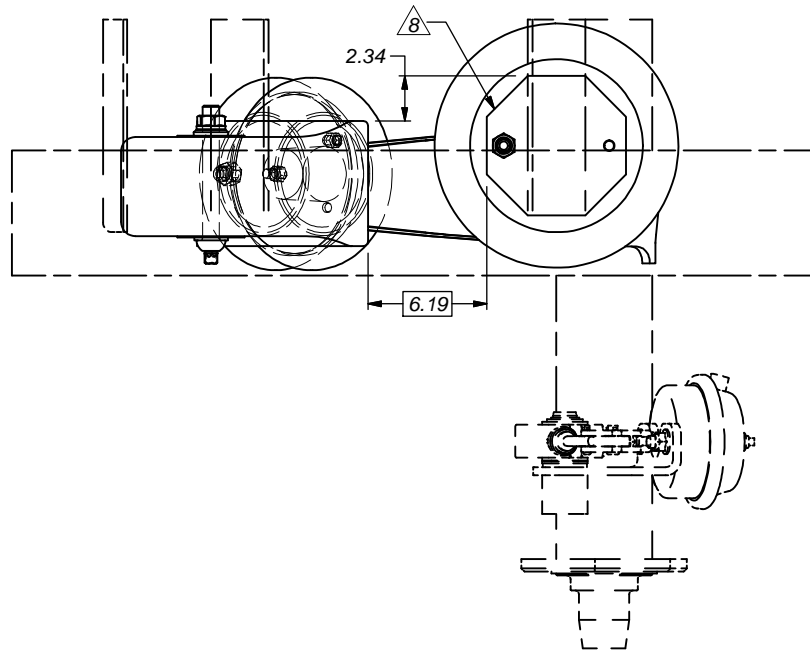
TORQUE VALUES ⁴

ITEM	SIZE	TORQUE	
		(FT-LB)	(N M)
-	3/8-16 NC	25	34
5, 6, 9	1/2-13 NC	25	34
7&10	3/4-16 NF	50	68
4	7/8-9 NC	SEE AXLE ADJ. PROCEDURE	

CHART B-B ⁹

AXLE TRACK	FRAME WIDTH "A"	BEAM CENTERS "B"	A/S CENTERS "C"
71.5 OR 79.38	43.5	35.25	31.00
77.5 OR 79.38	49.5	41.25	37.00

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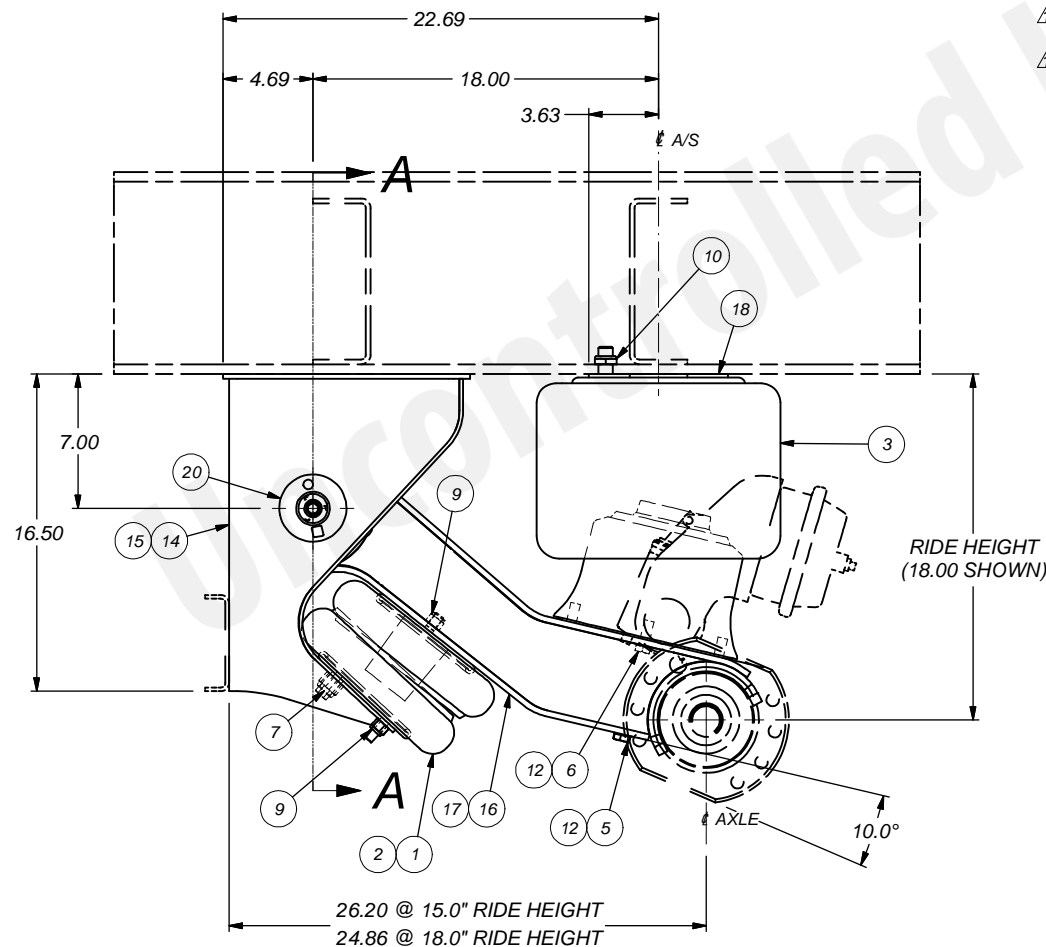


AXLE ADJUSTMENT PROCEDURE:

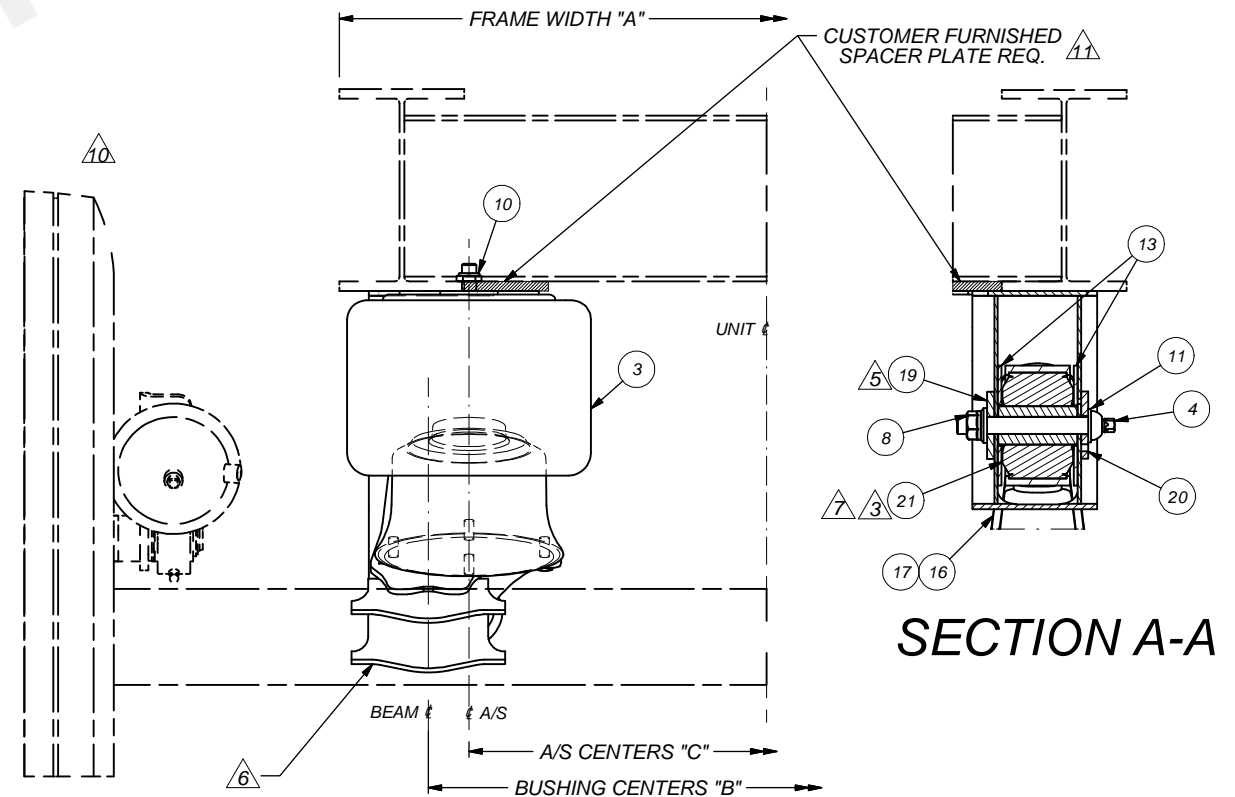
- AXLE ALIGNMENT SHALL BE IN ACCORDANCE WITH SAE OR TMC RECOMMENDED STANDARDS.
- LOOSEN PIVOT NUT.
- USING 1/2" DRIVE BREAKER BAR, ROTATE ADJUSTER PLATE IN THE DIRECTION OF DESIRED AXLE MOVEMENT.
- ENSURE THAT THE ADJUSTER PLATE AND ALIGNMENT WASHER HAVE MOVED IN UNISON. IT IS IMPORTANT THAT THE BUSHING IS NOT SKEWED IN THE HANGER PRIOR TO TIGHTENING.
- SNUG PIVOT FASTENERS AND RECHECK ALIGNMENT.
- TORQUE PIVOT BOLT USING A 1" DRIVE IMPACT WRENCH AND #6100054 E-20 TORX SOCKET (OR EQUIVALENT) UNTIL THE TORX HEAD SHEARS OFF FROM THE BOLT.
- WELDING OF ADJUSTER PLATES OR ALIGNMENT WASHERS TO THE HANGER SIDEWALLS IS NOT REQUIRED OR RECOMMENDED.

NOTES:

- ¹ - CUSTOMER FURNISHED CROSSMEMBERS SHOWN IN RECOMMENDED LOCATIONS.
- ² - FAILURE TO OBSERVE INSTALLATION INSTRUCTIONS MAY VOID WARRANTY
- ³ - BUSHING (ITEM 20) IS PART OF THE BUSHING/BEAM ASSEMBLY (ITEM 15&16) AND IS LISTED FOR REPLACEMENT REFERENCE ONLY. BUSHING REPLACEMENT KIT PART NO. 6040128/6040078. TRADITIONAL HARDWARE MUST BE TORQUED TO 500 FT-LB.
- ⁴ - RETORQUE FASTENERS AFTER 6,000 MILES AND EVERY 30,000 MILES AFTER.
- ⁵ - ADJUSTMENT PLATE AND ALIGNMENT WASHER (ITEMS 18 AND 19) MUST SIT FLAT AGAINST HANGER.
- ⁶ - WELD IN ACCORDANCE WITH RIDEWELL WELD PROCEDURE NO. 1.
- ⁷ - BUSHING (ITEM 20) CAN BE INSTALLED USING BUSHING INSTALLATION TOOL NO. 6100044.
- ⁸ - A/SPNGS CAN BE ROTATED IN INCREMENTS OF 90 DEGREES FOR OPTIMAL PORT LOCATION
- ⁹ - BEAM CENTER DIM "B" VARIES WITH FRAME WIDTH (DIM "A") SEE CHART B-B FOR CORRECT DIMENSION INFORMATION.
- ¹⁰ - RIDEWELL DOES NOT RECOMMEND DISHED OUT WHEELS DUE TO SEVERE BEARING OVERLOAD.
- ¹¹ - CUSTOMER FURNISHED SPACER PLATE REQ. AT HANGER AND A/S CROSSMEMBERS.



FORWARD
CAPACITY = 13,200 lbs



PARTS REQUIRED FOR 6001035 (CARTON OF PARTS)					
PARTS FOR 3011001 RH HANGER BEAM ASSEMBLY					
PARTS FOR 3011000 LH HANGER BEAM ASSEMBLY					
ITEM	PART NO.	DESCRIPTION	QTY	QTY	QTY
1	1002B09611G	A/SPG 2B9-611			1
2	1002B09614G	A/SPG 2B9-614			1
3	1001R12584G	A/SPG 1R12-584			2
4	1130048	PIVOT BLT RD HD SHR-TYPE 7/8" 9NC	1	1	
5	1140077	HHCS 1/2" 13NC 6.0"L GR5 ZN			2
6	1140554B105	HHCS 1/2" 13NC 1"L.G. GR5, ZN PLT			2
7	1150011	L'NUT 3/4"-16NF GRADE 2 NYL ZN PLT			2
8	1150032	L'NUT 7/8" 9NC GR8 SECURELOK	1	1	
9	1150555B112	L'NUT 1/2" 13NC NYLON GR2 ZN PLT			4
10	1154700B102	L'NUT 3/4" 16NF JAM NYL INS GR2			2
11	1160868B100	WASHER 7/8" A-325 FLAT ZINC PLATE	1	1	
12	1167482B000	L'WASHER 1/2 INTERNAL TOOTH			4
13	1167680B000	WEAR WASHER, UHMW-PE, BLACK	2	2	
14	3360132	HGR ASS'Y LH	1		
15	3360133	HGR ASS'Y RH		1	
16	5970428	BEAM / BUSHING ASY - LH	1		
	4150036	BEAM ASSEMBLY LH	-	-	-
17	5970429	BEAM / BUSHING ASSY - RH		1	
	4150037	BEAM ASSEMBLY RH	-	-	-
18	7001723B000	A/SPG PLATE 7-1/4" OCTAGON			2
19	7002582	ALIGNMENT WASHER 3.5"OD	1	1	
20	7002684	ADJUSTER PLATE 3.5"OD	1	1	
21	1110086	BUSHING 75 DURO .906ID X 4.125 WIDE	-	-	-
22	6040128	BUSH. REPL. KIT (SNAP OFF BOLT)	-	-	-
23	6040078	BUSH. REPL. KIT (TRADITIONAL BOLT)	-	-	-

DRAWN BY: BC	11/13/14
CHECKED: MDJ	3/2/2015
APPROVED: MJK	3/5/2015
PROJECT NO: 14109	SCALE: B - SIZE NTS, D - SIZE NTS
MATERIAL: SEE BOM	Weight: N/A

RIDEWELL CORPORATION
PO BOX 4586 SPRINGFIELD, MISSOURI 65808

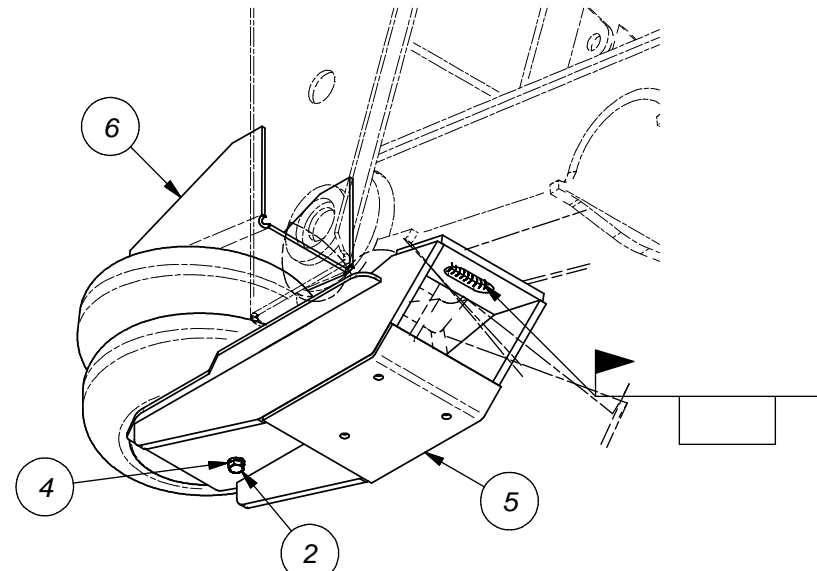
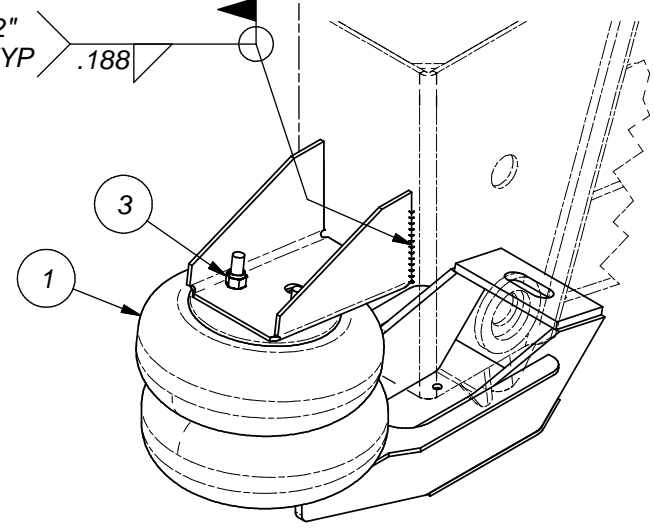
TITLE: **RUL-245 MMT 15.0/18.0 13k WELD-ON, TRAILER 13,200 LB CAPACITY**

TOLERANCES UNLESS OTHERWISE SPECIFIED:
DECIMAL: .X ± 0.1, .XX ± 0.06, .XXX ± 0.030
FRACTION: ± 1/16, ANG: X ± 1', [XXX] KCC
*WELD TOLERANCES PER ISO W045-02

SHEET 1 OF 1
PART NO: **2450411**
REV: -

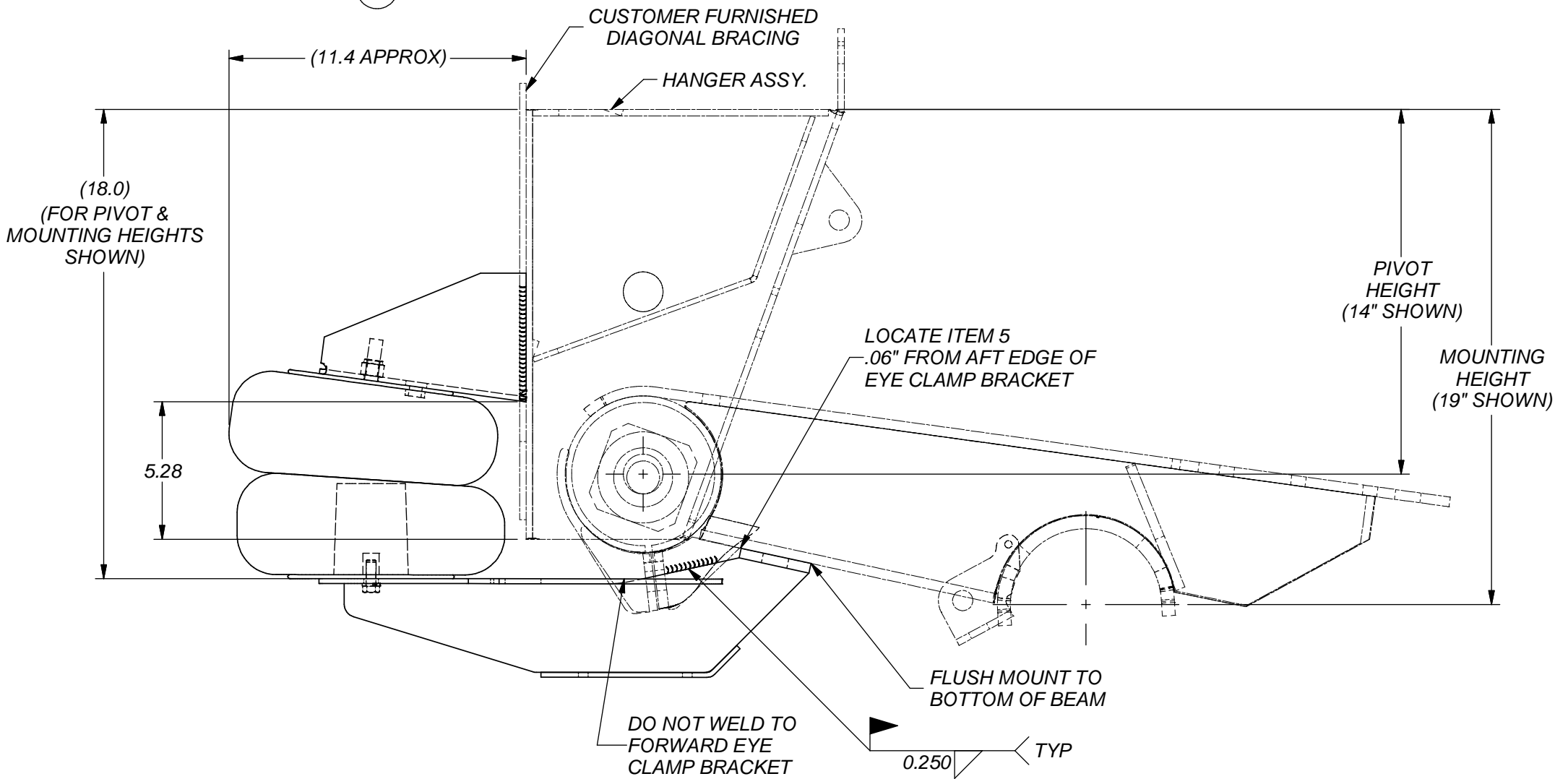
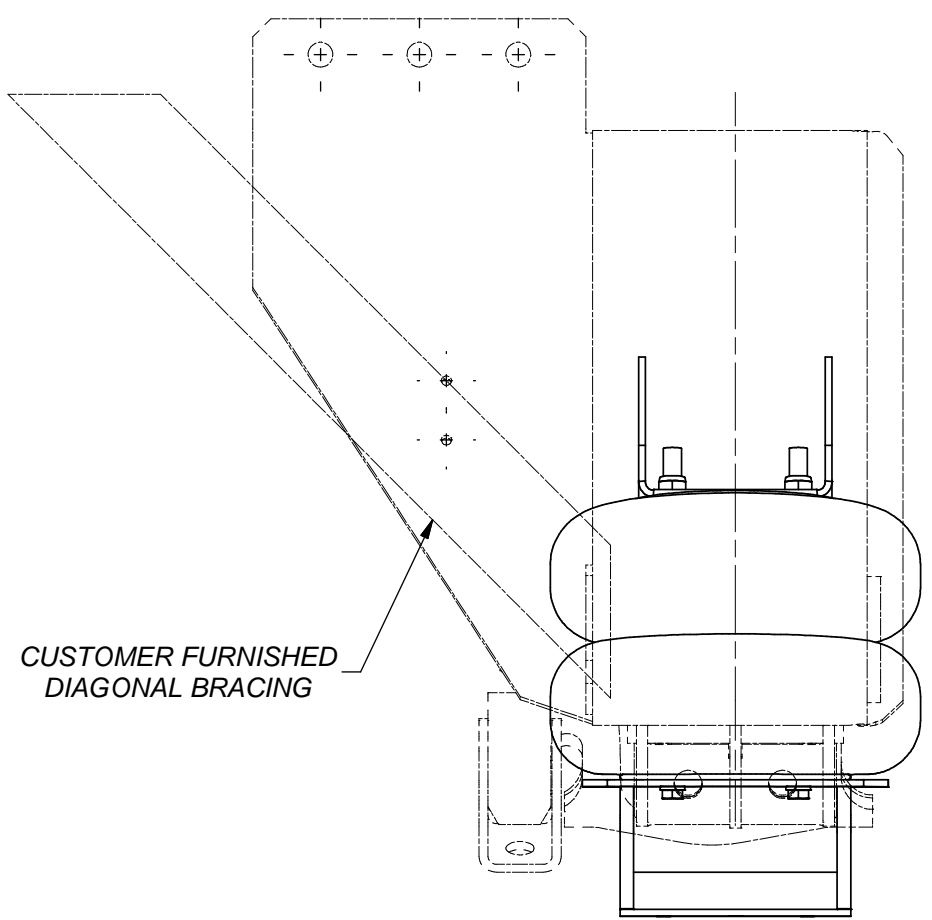
REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD

STOP WELD 1/2" FROM EDGE, TYP .188



Parts List			
ITEM	PART NO.	DESCRIPTION	QTY
1	1003586948C	AIR SPRING 2B9-251/20F-2 #6948	2
2	1140674B105	HHCS 3/8" 16NC 1"LG. GRADE 5	4
3	1150555B112	L'NUT 1/2" 13NC NYLON INSERT GRADE 2	4
4	1160675B100	L'WASHER 3/8" S/T MED ZINC PLATED	4
5	5970329	LIFT ARM ASSEMBLY, 240 30K O/S	2
6	8001834	SUPPORT CHANNEL, AIR SPRING	2

NOTES:
1. TORQUE ALL FASTENERS TO 25 FT-LBS.



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REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD
C	12105	ADDED TOOLING HOLES TO ITEM 5	7/31/12	G.H.	MDJ	CJB
B	12105	ADDED CUSTOMER FURNISHED DIAGONAL BRACING	5/9/12	G.H.	MDJ	CJB
A	06102	CHANGED CONSTRUCTION OF 5970329	11/15/06	MLH	MDJ	CJB

DRAWN BY:	JMB	7/26/2005
CHECKED:	MDJ	12/12/2005
APPROVED:	CJB	12/12/2005
PROJECT NO:	03145	SCALE: B - SIZE 3/16 D - SIZE
MATERIAL:	SEE BOM	Weight 63.7#
TOLERANCES UNLESS OTHERWISE SPECIFIED: DECIMAL: .X ± 0.1 FRACTION: ± 1/16 .XX ± 0.06 ANG: X ± 1' .XXX ± 0.030 [XXX] KCC *WELD TOLERANCES PER ISO W045-02		

RIDEWELL CORPORATION
PO BOX 4586 SPRINGFIELD, MISSOURI 65808

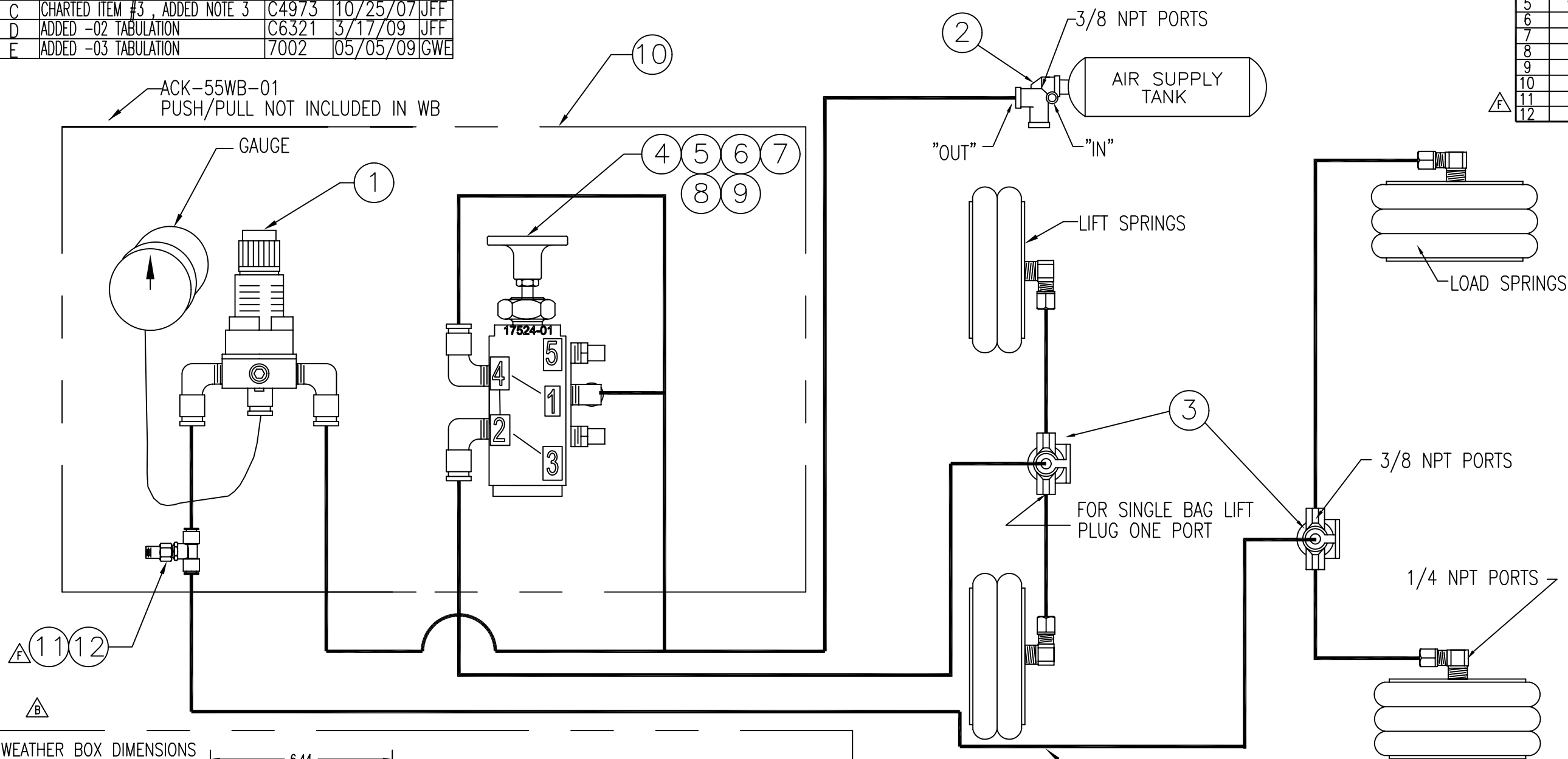
TITLE: **LIFT KIT ASSEMBLY, 240 30K O/S**

SHEET 1 OF 1 PART NO: **2990101** REV: **C**

LEVEL	REVISION DESCRIPTION	ECN	DATE	BY
A	NEW DRAWING	3694	11/11/05	JFF
B	ADDED -01 OPTION ADDED DETAIL A	3926	4/14/06	JJB
C	CHARTED ITEM #3, ADDED NOTE 3	C4973	10/25/07	JFF
D	ADDED -02 TABULATION	C6321	3/17/09	JFF
E	ADDED -03 TABULATION	7002	05/05/09	GWE

ITEM	PART NO.	QTY.	DESCRIPTION
1	990099	1	CONTROL PANEL ASSEMBLY
2	10100	1	BRAKE PROTECTION VALVE
3	10099-02	2	QUICK RELEASE VALVE
4	17524-01	1	5 PORT PUSH/PULL
5	90990	1	VALVE MOUNTING BRACKET
6	10040	2	CAP SCREW .25 X 1.00 UN
7	10027	2	HEX NUT .25 UNC.
8	10176	4	FLAT WASHER
9	10639	2	LOCK WASHER .25
10	17532	1	CHART WEATHERBOX
11	CHART	1	.38T X .25NPT BRANCH TEE
12	CHART	1	VALVE STEM .25FNPT

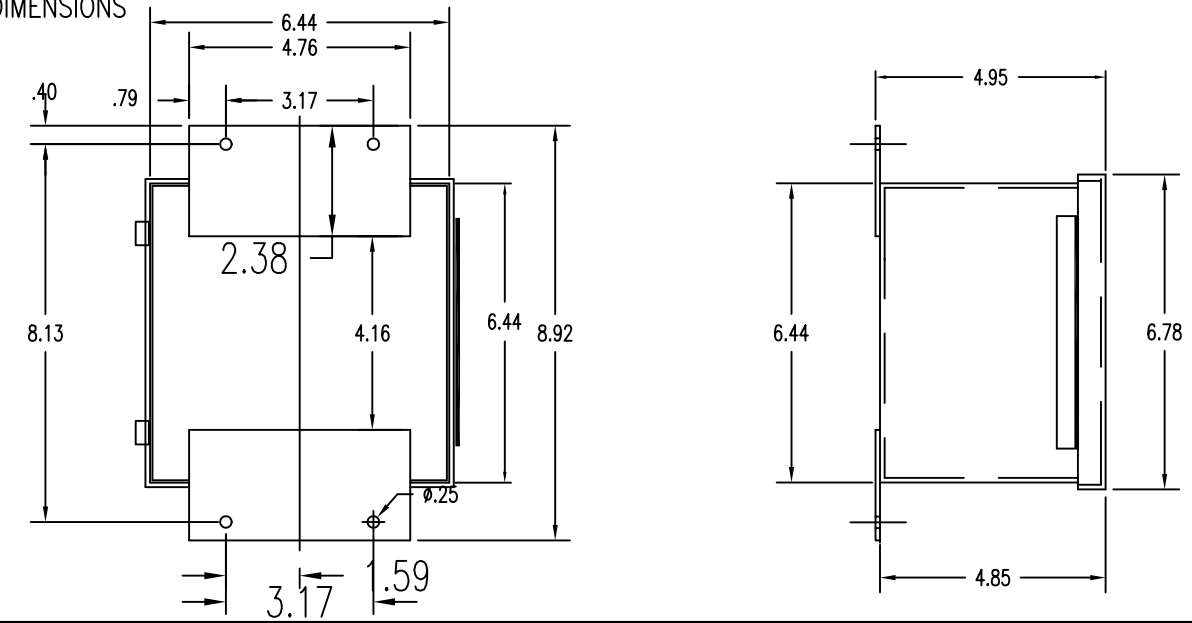
SEE DETAIL "A" FOR BOX DIMS



TO CONNECT TUBE:
Cut plastic tube as squarely as possible. Insert tube end into fitting, slide the I.D. of the tube over the tube support until friction is felt as tube slides past the O'ring. Using a slight twisting motion while inserting the tube is helpful. After this initial friction is felt, continue to push in the tube until it bottoms firmly against the internal tube support.

TO DISCONNECT TUBE:
With thumb and forefinger, hold down the top of the insert against the fitting body and then, with the other hand, pull out the tubing. No tools are needed.

WEATHER BOX DIMENSIONS



- NOTE:
- ALL NYLON TUBING AND FITTINGS FURNISHED BY CUSTOMER. (EXCEPT FOR CONTROL PANEL)
 - MANUAL OVERRIDE TO BE SET TO 0 (OFF) FOR SOLENOID TO OPERATE
 - ACK55WB-01 ITEM #4 NOT INSTALLED IN WEATHER BOX, SHIPPED LOOSE

**MARYLAND SPEC

PART NO.	ITEM #4	ITEM #10 QTY.	ITEM #11	ITEM #12
ACK55WB	17524-01	1		
ACK55WB-01	17524-01 SEE NOTE 3	1	N/A	N/A
ACK55WB-02	CONTROL IN SEPERATE BOXES	2		
**ACK55WB-03	17524-01	1	17818	17761

REF: ACK-05 REPLACEMENT

WATSON & CHALIN MFG., INC.

DESCRIPTION				
MANUAL ACK W/ AIR RIDE				
SUSPENSION MODEL		SCALE		PREVIOUS ASSEMBLY
ACK		NTS		
DATE	CHKD BY	DRAWN BY	SIZE	DRAWING NO.
3/17/09		JFF	B	ACK55WB

Table of Contents

Pgs. 1-2	Application, Capacity, Standard Features, Options	Pg. 9	Pre-Installation, Axle Installation
Pg. 3	How To Order	Pg. 10	Axle Installation (cont.), Preparing Trailer Frame For Mounting Tandem Assembly
Pg. 4	Axle Specifications and Mounting Heights Charts	Pg. 11	Installation Using Hutchens Mounting Brackets
Pg. 5	900 - 36 thru 70,000 lbs. Bill of Materials, Spring Identification Chart D	Pg. 12	Mounting Tandem Assembly To Trailer
Pgs. 6-7	900 Illustrated - 3 Leaf Shown	Pg. 13	Bump-Outs, Axle Alignment, Adjustment Plate Welding
Pg. 8	Trunnion Hanger Chart A, Trunnion Tube Chart B, Trunnion U-Bolt Chart C, Spring End Cap Chart E, Spring Seat Chart F, Axle U-Bolt Chart G	Pg. 14	Numerical Listing Of Parts, Important: Decal Note

Preface

In the mid-1950's Hutchens' engineers realized an urgent need for a heavier, more rugged, single point tandem that would allow more oscillation without wear and have an adjustable alignment feature. After thorough research and severe road testing, Hutchens introduced the Hutch 800 model suspension in weight capacities of 36,000, 42,000, 50,000 and 60,000 lbs.

The 800 single point suspension remained virtually unchanged until the very early 1970's. At that time a split trunnion casting, which permits easy maintenance and replacement of trunnion bushings should it become necessary, replaced the solid one-piece casting that had been used previously. This model was known as the 800A.

Still in the early 1970's Hutchens introduced the 800B. The 800B had inverted trunnion U-bolts that allowed easier maintenance since the trunnion U-bolt nuts were now on the underside of the suspension. Underslung axle configurations were added as well.

In the mid-1970's Hutchens began offering the 900 model single point suspension. The 900 offers many improvements over earlier single points offered to the market. Greater versatility of axle spacing and spring selection is provided through the use of a wide selection of springs specifically designed for different load carrying capacities. The 900 offered spring box ends for square axles as well as round axles.

In the late 1980's Hutchens introduced a lighter-weight, three-leaf spring, single point suspension in weight capacities of 44,000 and 50,000 lbs. Taking advantage of advances in leaf spring engineering and manufacturing technology, the three-leaf 903 redefined lightweight suspension performance in heavy-duty applications. The addition of this innovative spring to the rugged 900 series further broadened an already versatile suspension line.

In this booklet we define the 900 Series' Applications, Capacities, Features and Options. We also describe what information is required to order your 900 Series suspension. Isometric drawings and Bills of Materials are presented for easier identification of parts. An installation section is included as well. This 900 publication supersedes all previously issued materials relating to the 900 Series suspension, its installation and its usage. Usage of outdated materials can result in improper installation of the suspension. The last page of this booklet contains a Numerical Listing Of Parts found within this publication. Parts are listed in numerical order, and are followed by a parts description and page numbers on which they can be found.

Before beginning any installation procedures, the customer should read all installation instructions thoroughly. Should you have any questions concerning the 900 Series or any of its predecessors, please contact Hutchens for assistance.

Application

The 900 Series suspensions are designed for heavy-duty and/or off-road applications. The 900 is a single point suspension connected to the trailer frame by a trunnion located at the center of the suspension. This makes it ideal for logging, heavy load hauling and dump operations.

Capacity

The 900 Series suspensions are available in Gross Tandem Weight Ratings (G.T.W.R.) of 36,000, 42,000, 44,000, 50,000, 60,000 and 70,000 lbs.

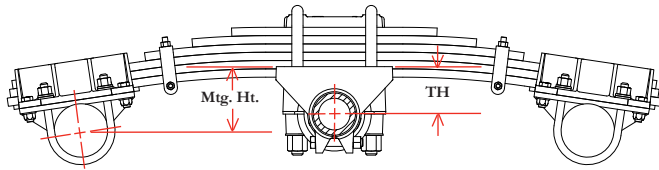
Features

- ▶ Cast steel parts, wheelabrated and prime painted.
- ▶ Extra heavy-duty 5" wide leaf springs.
- ▶ Accurate spring alignment preserved by the use of rugged spring guides on the trunnion casting.
- ▶ A split trunnion casting permits easy maintenance and replacement of trunnion bushings.
- ▶ Axle alignment and realignment made possible by adjustable plates within the spring-end boxes. One adjustment plate on each axle is welded at the factory. After axle alignment is completed, the installer welds the other adjustment plate to ensure sustained axle alignment.
- ▶ For increased life and flexibility, thick rubber pads are used above the spring leaves in the axle boxes. This construction permits greater twist freedom in the spring box...a standard flexibility feature that reduces wear and promotes better ride characteristics.

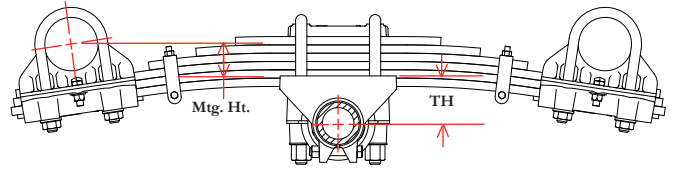
Options

Standard 900 Series suspensions are available in capacities of 36,000, 42,000, 50,000, 60,000 and 70,000 lbs. Additionally, lightweight two-leaf and three-leaf units are available in capacities of 36,000, 44,000 and 50,000 lbs.

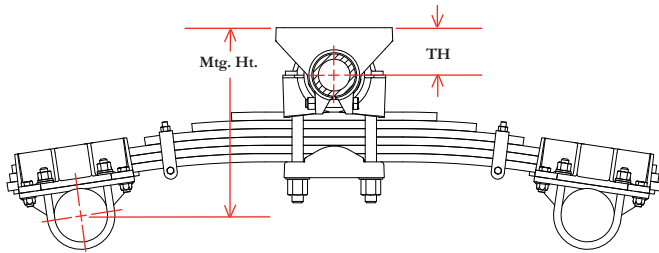
Numerous mounting heights (Mtg./ht. = the vertical distance from the center line of the axle to the top of the trunnion hanger), axle and trunnion combinations are possible. These include overslung (OS, springs over axles) and underslung (US, springs under axles) axle units as well as overslung (springs over trunnion) and underslung (springs under trunnion) trunnion configurations.



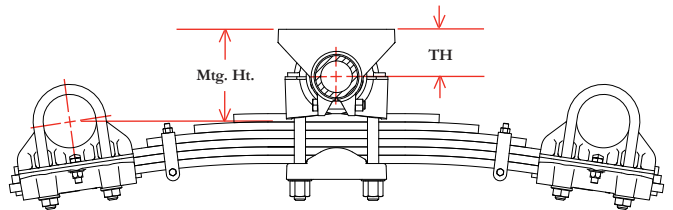
Overslung Axles – Overslung Trunnion



Underslung Axles – Overslung Trunnion



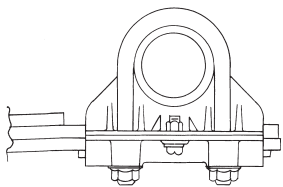
Overslung Axles – Underslung Trunnion



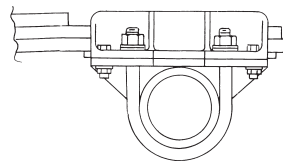
Underslung Axles – Underslung Trunnion

Note: The above drawings are views of the suspension as seen from the centerline of the trailer.

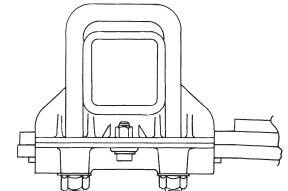
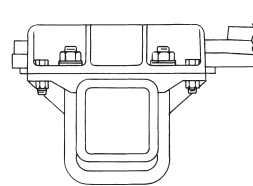
Axle seats to accommodate 5", 5 3/4" and 6" round axles or 5" x 5" square axles are available.



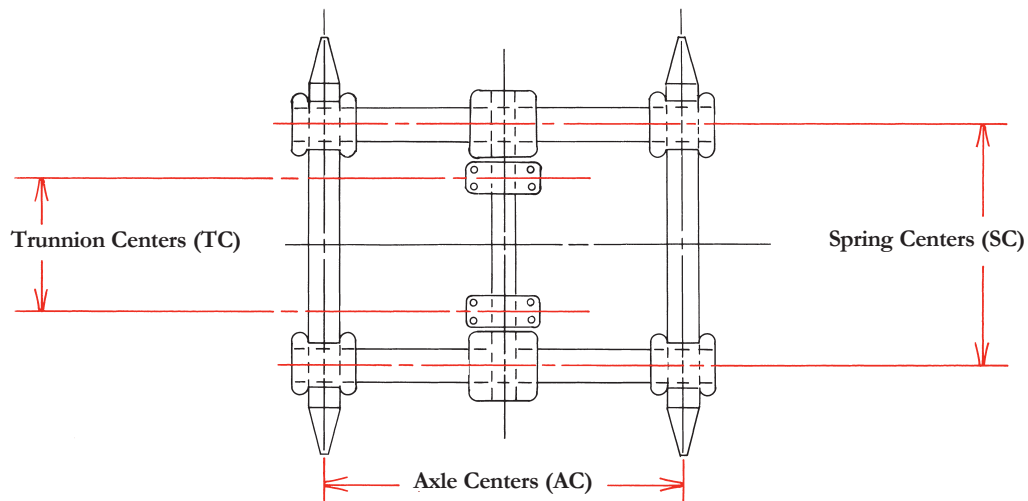
Axle Seat for Round Axle



Axle Seat for Square Axle

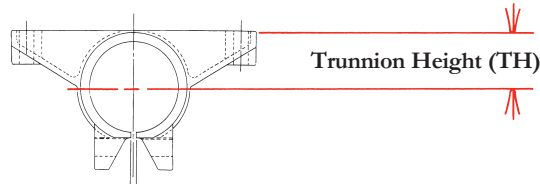


Several different axle centers (AC) are available. See Axle Specifications And Mounting Heights Charts on Page 4.



Standard spring centers (SC) for the 900 Series suspensions are 38". Other spring centers can be furnished upon request.

Trunnion hanger heights (TH) of 2 1/2", 4 1/2", 6 1/2" and 8 1/2" are available.



Standard trunnion hanger centers (TC) are 22 1/8" (for 38" spring centers). Trunnion centers of 20 1/8" can be specified while maintaining 38" spring centers.

Trunnion bushings of either rubber or Polyurethane ("free oscillating") are available. Unless otherwise specified, trunnion bushings are assumed to be rubber.

When installing your 900 Series suspension, adequate vertical clearance must be provided for the tires, springs and U-bolts. This is usually accomplished through the use of a mounting bracket or pedestal.

For a more integrated installation solution consider the Straddle Mount trunnion hanger option.

How To Order Your 900 Series Single Point Suspension System

With so many options available on the 900 Series suspensions, each unit must be ordered by a description of the unit desired. Any abbreviations listed are defined in the Options section of this booklet. Such abbreviations are commonly found in Hutchens suspension notation.

1. Determine which 900 Series suspension will meet your weight requirements - 36,000#, 42,000#, 44,000#, 50,000#, 60,000# or 70,000# GTWR.
2. Select a mounting height (Mtg./ht.) that corresponds to your particular situation. See Axle Specifications And Mounting Heights Charts on Page 4.

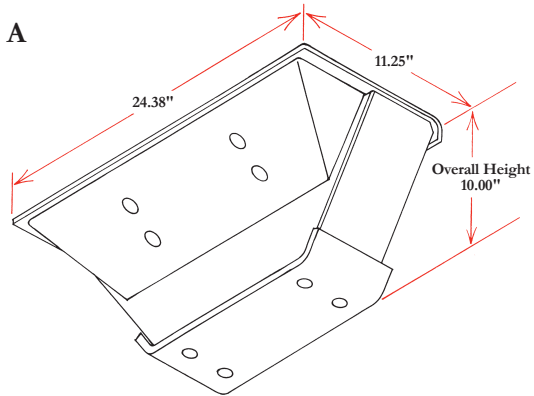
From this chart please note that mounting height is dependent upon:

3. Axle configuration - Overslung or Underslung.
4. Axle size - 5", 5 3/4", 6" Round or 5" x 5" Square (Hutchens does not manufacture or sell axles).
5. Trunnion configuration - Overslung or Underslung.
6. Trunnion Hanger Height (TH) - 2 1/2", 4 1/2", 6 1/2" or 8 1/2". In many instances more than one combination will result in the same mounting height.

Therefore, all the aforementioned factors should be taken into consideration when ordering as well as the following:

7. Axle Centers (AC) - See Axle Specifications And Mounting Heights Charts on Page 4.
8. Spring Centers (SC)
9. Trunnion Centers (TC)
10. To help ease the installation of your 900 Series suspension you may wish to order a pair of Hutch mounting brackets (Part #16793-01). See Fig. A below.

Fig. A



Example: A 900 Series suspension with a GTWR of 42,000 lbs., a mounting height of 4" for overslung (OS) 5" round axles, an overslung (OS) trunnion configuration with a trunnion hanger height (TH) of 2 1/2", axle centers (AC) of 50 1/2", spring centers (SC) of 38", and trunnion centers (TC) of 22 1/8" would be ordered as follows:

Quantity	Suspension Model	Axle Config.	Trunnion Config.	Axle Size	Trunnion Height	Axle Centers	Spring Centers	Trunnion Centers
1 ea.	900-42	OS (axles)	OS (trun.)	5" Rd.	2 1/2 TH	50 1/2 AC	38 SC	22 1/8 TC

Example: A 900 Series suspension with a GTWR of 50,000 lbs., a mounting height of 9 1/2" for underslung (US) 5" x 5" square axles, an underslung (US) trunnion configuration with a trunnion hanger height (TH) of 6 1/2", axle centers (AC) of 53", spring centers (SC) of 36", trunnion centers (TC) of 20 1/8" utilizing a three-leaf spring* and free oscillating trunnion bushings** would be ordered as follows:

Quantity	Suspension Model	Axle Config.	Trunnion Config.	Axle Size	Trunnion Height	Axle Centers	Spring Centers	Trunnion Centers	Spring * Type
1 ea.	900-50	US (axles)	US (trun.)	5" x 5" Sq.	6 1/2 TH	53 AC	36 SC	20 1/8 TC	3 leaf w/ free oscillating bushing**

* Three-leaf springs are available for 44,000 and 50,000 lb. units only and must be specified.

** Must be specified.

Overslung Axle Specifications And Mounting Heights For Models:

900-36 through 900-44 with 2.5 Trunnion Ht., 5" Rd. & 5" x 5" Sq. Axles

900-50 through 900-70 with 4.5 Trunnion Ht., 5" Rd. & 5" x 5" Sq. Axles

Model Description	Gross Tandem Weight Rating (GTWR)	Spring Number	Number of Spring Leaves	Nominal Axle Spacing		Mounting Height			
				Unloaded	Loaded	Overslung Trunnion		Underslung Trunnion	
						Unloaded	Loaded	Unloaded	Loaded
900-36	36,000	10054-00	5	48.00	48.75	4.00	3.00	15.00	14.00
900-36	36,000	11151-00	5	50.50	51.50	4.00	2.50	15.00	13.50
900-36	36,000	16258-01	Tapered 2	50.50	51.50	4.00	2.50	13.35	11.85
900-42	42,000	9997-00	6	48.00	48.75	4.00	3.00	15.75	14.75
900-42	42,000	9998-00	6	50.50	51.50	4.00	2.75	15.75	14.62
900-44	44,000	12258-01	Tapered 3	50.50	51.50	4.00	2.87	14.50	13.37
900-50	50,000	10055-00	7	48.00	48.75	6.00	5.00	18.50	17.12
900-50	50,000	9999-00	7	50.50	51.50	6.00	4.62	18.50	17.50
900-50	50,000	12258-01	Tapered 3	50.50	51.50	6.00	4.62	16.50	15.12
900-50	50,000	10000-00	8	54.00	55.25	6.50	5.00	19.75	18.25
900-60	60,000	10001-00	9	54.00	55.25	6.50	4.75	20.50	18.75
900-70	70,000	24967-01	10	54.00	55.25	6.50	4.75	21.38	19.63
With 4.5 Trunnion Height Add (900-36 thru 44)/(900-50 thru 70)						2.00/0.00	2.00/0.00	2.00/0.00	2.00/0.00
With 6.5 Trunnion Height Add (900-36 thru 44)/(900-50 thru 70)						4.00/2.00	4.00/2.00	4.00/2.00	4.00/2.00
With 8.5 Trunnion Height Add (900-36 thru 44)/(900-50 thru 70)						6.00/4.00	6.00/4.00	6.00/4.00	6.00/4.00
When 5.75" or 6" Rd. Axles Are Used Add						.50	.50	.50	.50

Mounting heights shown for models 900-50 thru 70 are based on a 4.50 high trunnion bracket. Do not use the 2.50 high bracket on models with 50,000 lbs. GTWR or greater.

Underslung Axle Specifications And Mounting Heights For Models:

900-36 through 900-44 with 2.5 Trunnion Ht., 5" Rd. & 5" x 5" Sq. Axles

900-50 through 900-70 with 4.5 Trunnion Ht., 5" Rd. & 5" x 5" Sq. Axles

Model Description	Gross Tandem Weight Rating (GTWR)	Spring Number	Number of Spring Leaves	Nominal Axle Spacing		Mounting Height			
				Unloaded	Loaded	Overslung Trunnion		Underslung Trunnion	
						Unloaded	Loaded	Unloaded	Loaded
900-36	36,000	10054-00	5	50.50	50.00	-4.25	-5.25	6.75	5.75
900-36	36,000	11151-00	5	53.00	52.25	-4.25	-5.75	6.75	5.25
900-36	36,000	16258-01	Tapered 2	53.00	52.25	-4.25	-5.75	5.10	3.60
900-42	42,000	9997-00	6	50.62	50.00	-5.00	-6.00	6.75	5.75
900-42	42,000	9998-00	6	53.00	52.25	-5.00	-6.25	6.75	5.50
900-44	44,000	12258-01	Tapered 3	53.00	52.25	-5.00	-6.12	5.50	4.37
900-50	50,000	10055-00	7	50.62	50.00	-3.00	-4.00	9.50	8.50
900-50	50,000	9999-00	7	53.00	52.25	-3.00	-4.37	9.50	8.12
900-50	50,000	12258-01	Tapered 3	53.00	52.25	-3.00	-4.37	7.50	6.12
900-50	50,000	10000-00	8	57.00	56.00	-2.50	-4.00	10.75	9.25
900-60	60,000	10001-00	9	57.00	56.00	-2.50	-4.25	11.50	9.75
900-70	70,000	24967-01	10	57.00	56.00	-2.50	-4.25	12.38	10.63
With 4.5 Trunnion Height Add (900-36 thru 44)/(900-50 thru 70)						2.00/0.00	2.00/0.00	2.00/0.00	2.00/0.00
With 6.5 Trunnion Height Add (900-36 thru 44)/(900-50 thru 70)						4.00/2.00	4.00/2.00	4.00/2.00	4.00/2.00
With 8.5 Trunnion Height Add (900-36 thru 44)/(900-50 thru 70)						6.00/4.00	6.00/4.00	6.00/4.00	6.00/4.00
When 5.75" or 6" Rd. Axles Are Used Subtract						-.50	-.50	-.50	-.50

Mounting heights shown for models 900-50 thru 70 are based on a 4.50 high trunnion bracket. Do not use the 2.50 high bracket on models with 50,000 lbs. GTWR or greater.

900 Tapered Leaf (shown) and Multi-Leaf - 36 thru 70,000

Bill of Materials

Item	Part No.	Quantity				Description
		Overslung Trunnion		Underslung Trunnion		
		Overslung Axle	Underslung Axle	Overslung Axle	Underslung Axle	
1	See Chart A, Page 8	2	2	2	2	Trunnion Hanger
2	10376-00	4	4	4	4	Hex Bolt 3/4" - 16 UNF x 4 1/2", GR5
3	20936-01	2	2	2	2	Washer, .173 x 5.75 OD x 4.03 ID, Flat Edge - 2 1/2" Trunnion Ht.
	895-00	2	2	2	2	Washer, 7GA x 4.03 ID x 5.75 OD - 4 1/2", 6 1/2", 8 1/2" Trunnion Ht.
4	See Chart B, Page 8	1	1	1	1	Trunnion Tube
5	See Chart C, Page 8	4	4	4	4	U-Bolt, Trunnion
6	9640-00	2	2	0	0	Top Plate - Cast, Square U-Bolt
7	See Chart D, Below	2	2	2	2	Spring
8	See Chart E, Page 8	4	4	4	4	Spring End Cap
9	841-00	20	4	20	4	Hex Nut, Self Locking, 3/4" - 16 UNF
10	9293-00	16	8	16	8	Hex Bolt, 5/8" - 18 UNF x 2", GR5
11	817-00	32	0	32	0	Washer, 1/8" x 13/16 ID x 1 1/2 OD
12	814-00	8	8	8	8	Rubber Pad - Plain
13	10608-00	4	4	4	4	Adjustment Plate
14	See Chart F, Page 8	4	4	4	4	Spring Seat
15	10273-00	16	8	16	8	Washer, 1/8" x 21/32 ID x 1 15/16 OD
16	11513-03	16	8	16	8	Hex Locknut, 5/8" - 18 UNF
17	See Chart G, Page 8	8	8	8	8	U-Bolt - Axle
18	12919-01 [‡]	2	2	2	2	Galvanized Liner - .040 x 4.75 x 10.00
19	891-00	2	2	2	2	Trunnion Hub - Upper Half
20	890-00	2	2	2	2	Rubber Bushing - Trunnion Hub
	23276-01	2	2	2	2	Free Oscillating Trunnion Bushing*
21	898-00	2	2	—	—	Trunnion Hub - Lower Half
	892-00	—	—	2	2	Trunnion Hub - Lower Half
22	837-00	8	8	8	8	Washer, 1/8" x 1 1/4 ID x 2 1/4 OD
23	836-00	8	8	8	8	Hex Nut, 1 1/8" - 12 UNF x 1 1/2 HI
24	10562-00	0	16	0	16	Flange Locknut - 1-14 UNS, GRF
25	820-00	0	0	2	2	Spring Clamp Plate
26	10488-00	4	4	4	4	Pressure Plate, 5" x 5" Axle Only

Chart D - Spring Identification ** (Item #7)

Unit Weight Capacity (lbs.)	36,000	36,000	36,000	42,000	42,000	44/50,000	50,000	50,000	50,000	60,000	70,000
Number of Leaves	Tapered 2 [‡]	5	5	6	6	Tapered 3 [‡]	7	7	8	9	10
Spring Part No.	16258-01	10054-00	11151-00	9997-00	9998-00	12258-01	10055-00	9999-00	10000-00	10001-00	24967-01

* Available upon request, must be specified.

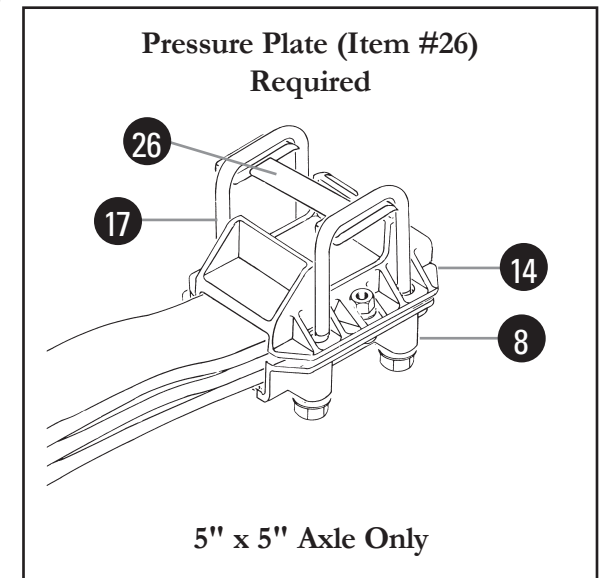
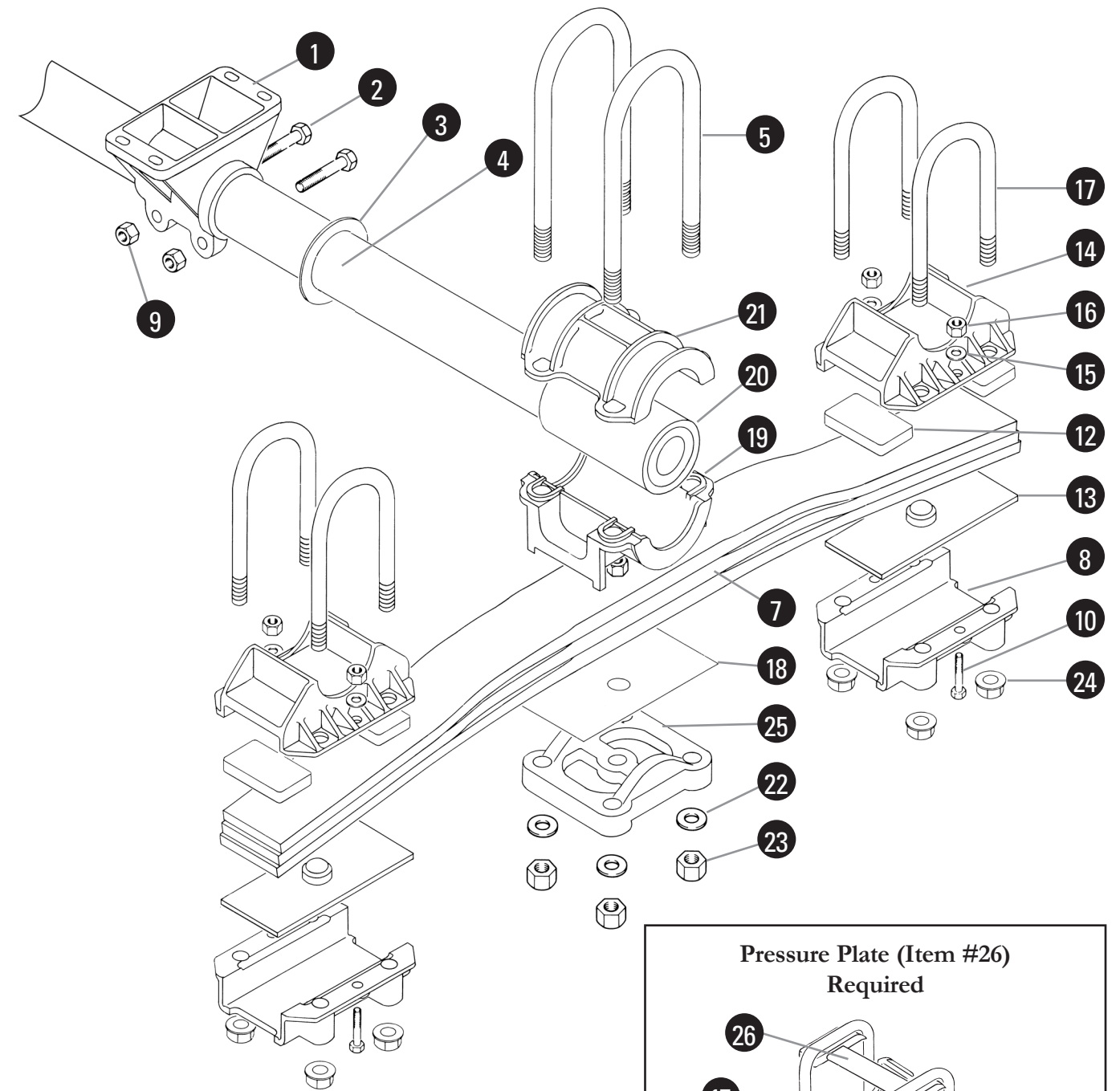
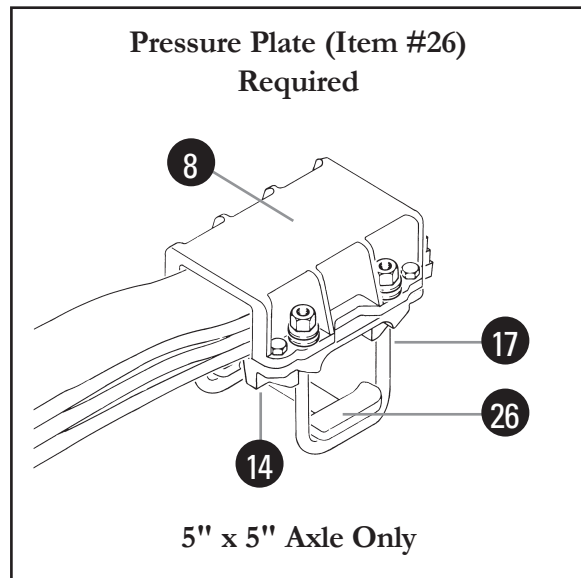
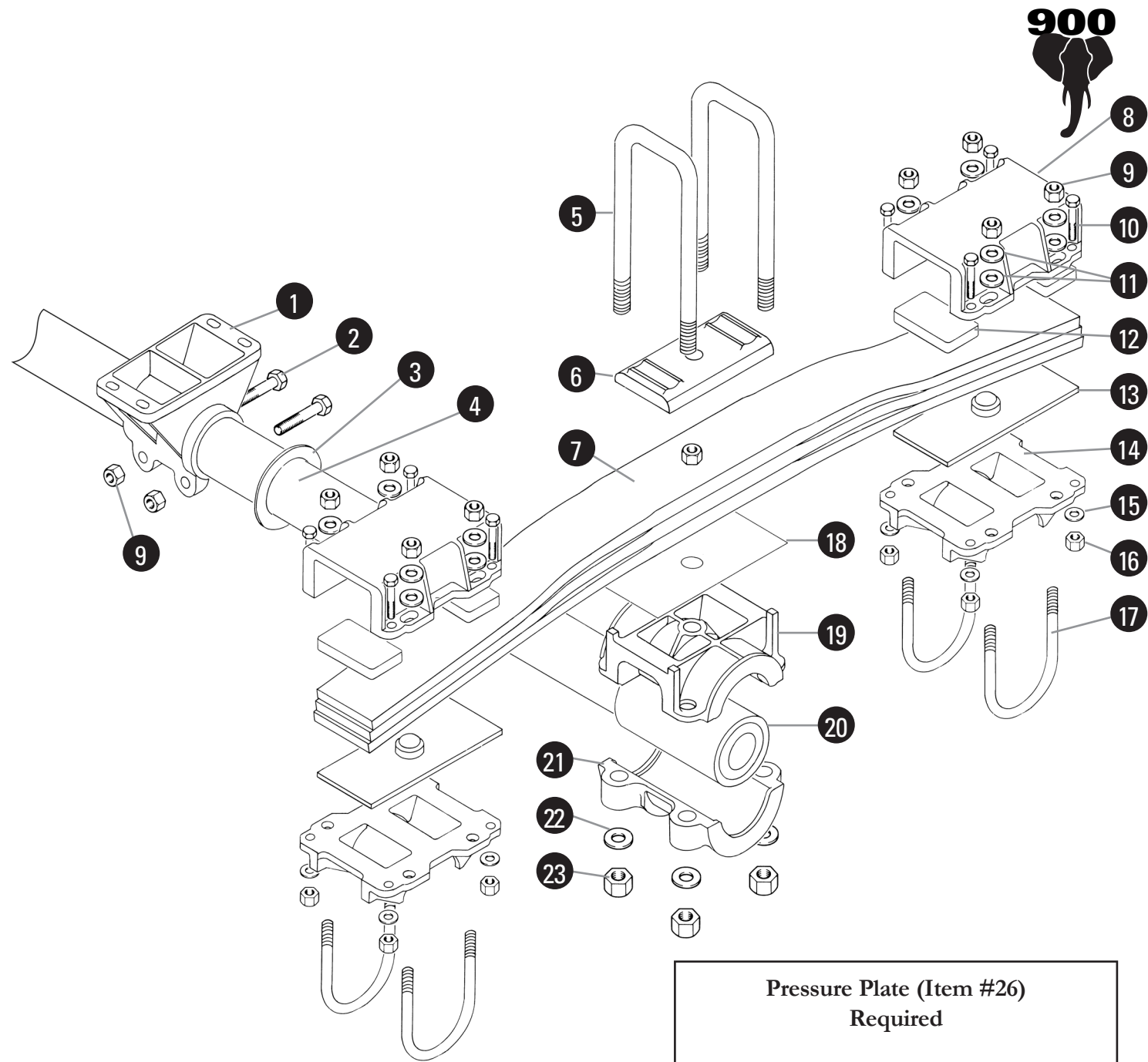
** For a detailed description of axle spacings, mounting heights, etc. obtained when utilizing the above springs, see the Axle Specifications And Mounting Heights Charts on Page 4.

‡ A galvanized liner is required on the tension surface (bottom side) of the spring when taper leaf (2 and 3 leaf) springs are utilized. Liners are not required on flat plate (5, 6, 7, 8, 9 and 10 leaf) springs.

Over-slung Trunnion – Over-slung Axle



Under-slung Trunnion – Under-slung Axle



900 – 36, 42, 44, 50, 60 and 70,000

Chart A – Trunnion Hanger (Item #1)

	Trunnion Hanger Height			
	2 1/2"	4 1/2"	6 1/2"	8 1/2"
Part No.	850-01	10476-03	849-01	897-01

Chart B – Trunnion Tube (Item #4)

Unit Weight Capacity (lbs.)/ Wall Thickness	Spring Centers/Trunnion Hanger Centers/Overall Length					
	38"/22.12"/48"	36"/20.12"/46"	44"/28.12"/54"	42"/26.12"/52"	41"/25.12"/51"	
36,000 - 44,000 / 1/2"	893-01	893-04	893-07	893-09	893-11	
50,000 - 70,000 / 3/4"	893-02	893-05	893-08	893-10	893-12	

Chart C – Trunnion U-Bolt (Item #5)

Unit Weight Capacity (lbs.)/ Spring Part No.	Trunnion Configuration					
	Overslung	Lgth.	Dia.	Underslung	Lgth.	Dia.
36,000/10054-00	9639-01	12 5/16"	1 1/8"	835-02	13 3/4"	1 1/8"
36,000/11151-00	9639-01	12 5/16"	1 1/8"	835-02	13 3/4"	1 1/8"
36,000/16258-01	9639-10	11"	1 1/8"	835-01	12 3/8"	1 1/8"
42,000/9997-00	9639-02	13 1/8"	1 1/8"	835-03	14 5/8"	1 1/8"
42,000/9998-00	9639-02	13 1/8"	1 1/8"	835-03	14 5/8"	1 1/8"
44,000/12258-01	9639-01	12 5/16"	1 1/8"	835-02	13 3/4"	1 1/8"
50,000/10055-00	9639-03	13 15/16"	1 1/8"	835-04	15 3/8"	1 1/8"
50,000/9999-00	9639-03	13 15/16"	1 1/8"	835-04	15 3/8"	1 1/8"
50,000/12258-01	9639-01	12 5/16"	1 1/8"	835-02	13 3/4"	1 1/8"
50,000/10000-00	9639-04	14 11/16"	1 1/8"	835-06	16 1/8"	1 1/8"
60,000/10001-00	9639-05	15 1/2"	1 1/8"	835-05	17"	1 1/8"
70,000/24967-01	9639-06	16 1/4"	1 1/8"	835-08	18"	1 1/8"

Chart E – Spring End Cap (Item #8)

Axle Size	Unit Weight Capacity (lbs.)	Axle Configuration	
		Overslung	Underslung
5" Rd. – 5" x 5" Sq.	36,000	10049-00	10050-02
	42-70,000	9937-00	9941-02
5 3/4" Rd. – 6" Rd.	36,000	10049-00	—
	42-70,000	9937-00	9942-02

Chart F – Spring Seat (Item #14)

Axle Size	Axle Configuration	
	Overslung	Underslung
5" Rd.	9934-02	9938-00
5" x 5" Sq.	9935-02	9939-00
5 3/4" Rd.	9936-03	9940-00
6" Rd.	9936-04	9940-01

Chart G – Axle U-Bolt (Item #17)

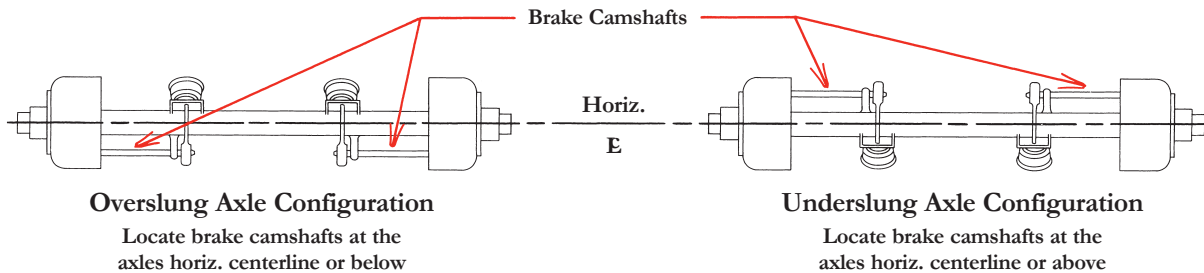
Axle Size	Unit Weight Capacity (lbs.)	Axle Configuration					
		Overslung	Lgth.	Dia.	Underslung	Lgth.	Dia.
5" Rd.	36,000	10060-01	7"	3/4"	10064-01	9 3/4"	1"
	42-70,000	10060-01	7"	3/4"	10064-02	10 1/2"	1"
5" x 5" Sq.	36,000	10063-02	7 7/8"	3/4"	10067-02	10 1/2"	1"
	42-70,000	10063-02	7 7/8"	3/4"	10067-03	11 1/8"	1"
5 3/4" Rd.	36,000	10061-01	8"	3/4"	10065-01	11 1/2"	1"
	42-70,000	10061-01	8"	3/4"	10065-01	11 1/2"	1"
6" Rd.	36,000	10062-01	8"	3/4"	10066-01	11 1/2"	1"
	42-70,000	10062-01	8"	3/4"	10066-01	11 1/2"	1"

Pre-Installation

The 900 single point suspension is shipped assembled - except for the axle U-bolts, nuts and washers which are packaged separately. On each axle there is one adjustment plate factory welded, and one that is welded by the installer following axle alignment. Refer to the preceding pages for detailed component information, unit capacity, and mounting heights. Before beginning any installation procedures, the customer should read all installation instructions thoroughly.

Prior to installation check for interference between brake camshafts and suspension components. Recommended camshaft locations are as follows:

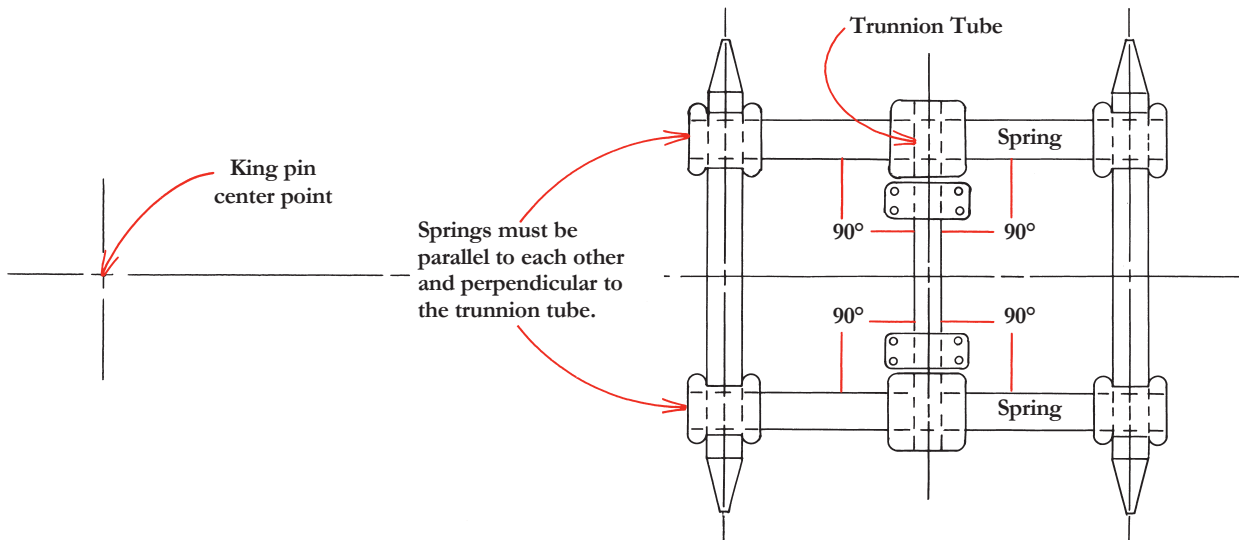
Fig. 1



Inspect the suspension assembly to be certain that spring alignment has not been destroyed during shipment.

Set the suspension on the axles. Check to see that the springs are parallel to each other and perpendicular to the trunnion tube. See Fig. 2. Be sure the nuts on the trunnion hub U-bolts are torqued to specification.

Fig. 2



Axle Installation

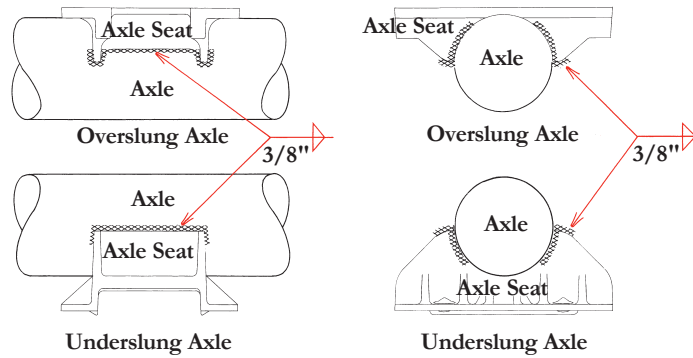
1. With the axle camber up, locate the center of both axles by measuring between the brake flanges and marking the center.
2. Place the suspension on the axles, making certain that the axle seats are an equal distance from the center of the axle. All axle seats should measure the same distance from the brake flanges.
3. Align the camber marks on the top of the axle with the centerline of the axle seats. Be certain that all axle seats fit

the axle properly. If necessary, grind the axle seats to ensure that they fit properly, and are horizontal and parallel.

4. Tack-weld seats in place and recheck to make certain they are still level, parallel, and in the proper location and alignment.

Important: On underslung models, axle seats must be located beneath axles. See Fig. 3. Be certain that the camber marks are on top of the axle.

Fig. 3

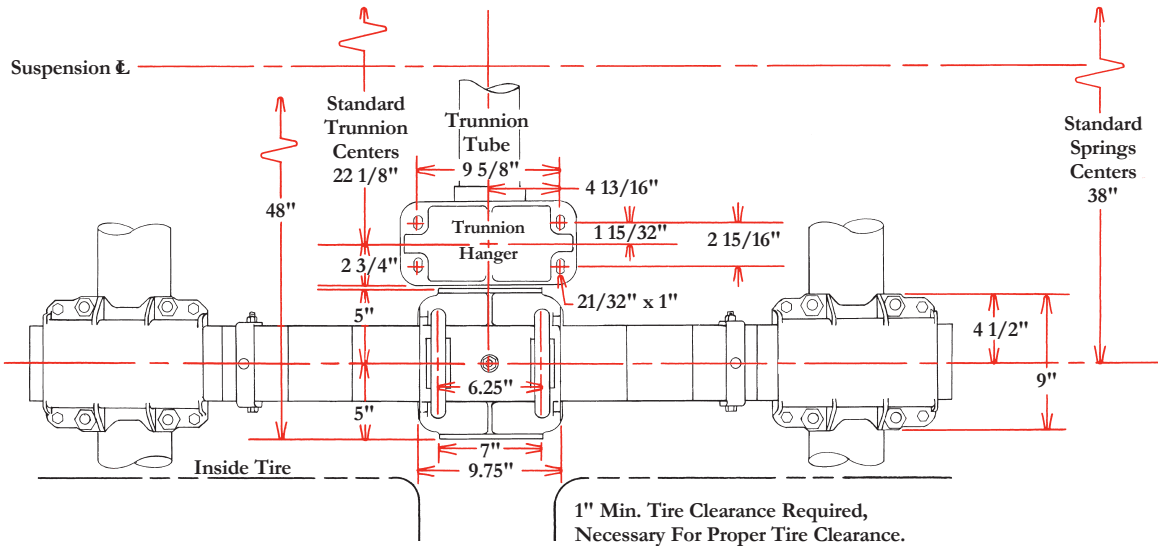


5. Check tire clearance with the suspension at this time. See Fig. 4.
6. Following the axle manufacturer's welding recommendations, weld the axle seats to the axle using 3/8" fillet welds on front and rear of the axle seats. See Fig. 3.

Caution: Do not attach welding ground clamps to U-bolts, springs or axles except to designated weld points. These parts should be protected from weld splatter.

7. Assemble axle U-bolts to spring end boxes, but do not tighten.

Fig. 4



Preparing Trailer Frame For Mounting Tandem Assembly

Determine suspension location on the trailer frame by measuring from the king pin to outside of the frame at desired location and marking each side at the suspension's centerline. The frame should now be prepared for mounting of the suspension in one of the following three ways:

1. Use of the optional Hutch mounting brackets (Part #16793-01). Two each are required. See Fig. A on Page 3.

Note: Additional bracing (furnished by the installer) connecting one mounting bracket with the other is recommended. See Fig. 5 on Page 11.

2. Fabrication of your own mounting bracket.
3. Bolting directly to the frame.

Note: When any of the aforementioned methods of mounting the suspension are utilized, a "minimum dimension" must be maintained between the trunnion tube centerline and the top of the suspension components. See Fig. 5. This minimum dimension is tabulated in Chart H.

Chart H

Model	Number of Spring Leaves	Minimum Dimension	
		Overslung Trunnion	Underslung Trunnion
900-36	2	9"	4 1/2"
900-36	5	10 1/2"	4 1/2"
900-42	6	11 1/4"	4 1/2"
900-44	3	10"	4 1/2"

Model	Number of Spring Leaves	Minimum Dimension	
		Overslung Trunnion	Underslung Trunnion
900-50	3	10"	4 1/2"
900-50	7	12"	4 1/2"
900-50	8	12 3/4"	4 1/2"
900-60	9	13 1/2"	4 1/2"
900-70	10	14 1/4"	4 1/2"

Installation Using Hutchens Mounting Brackets (Part #16793-01)

Fig. 5

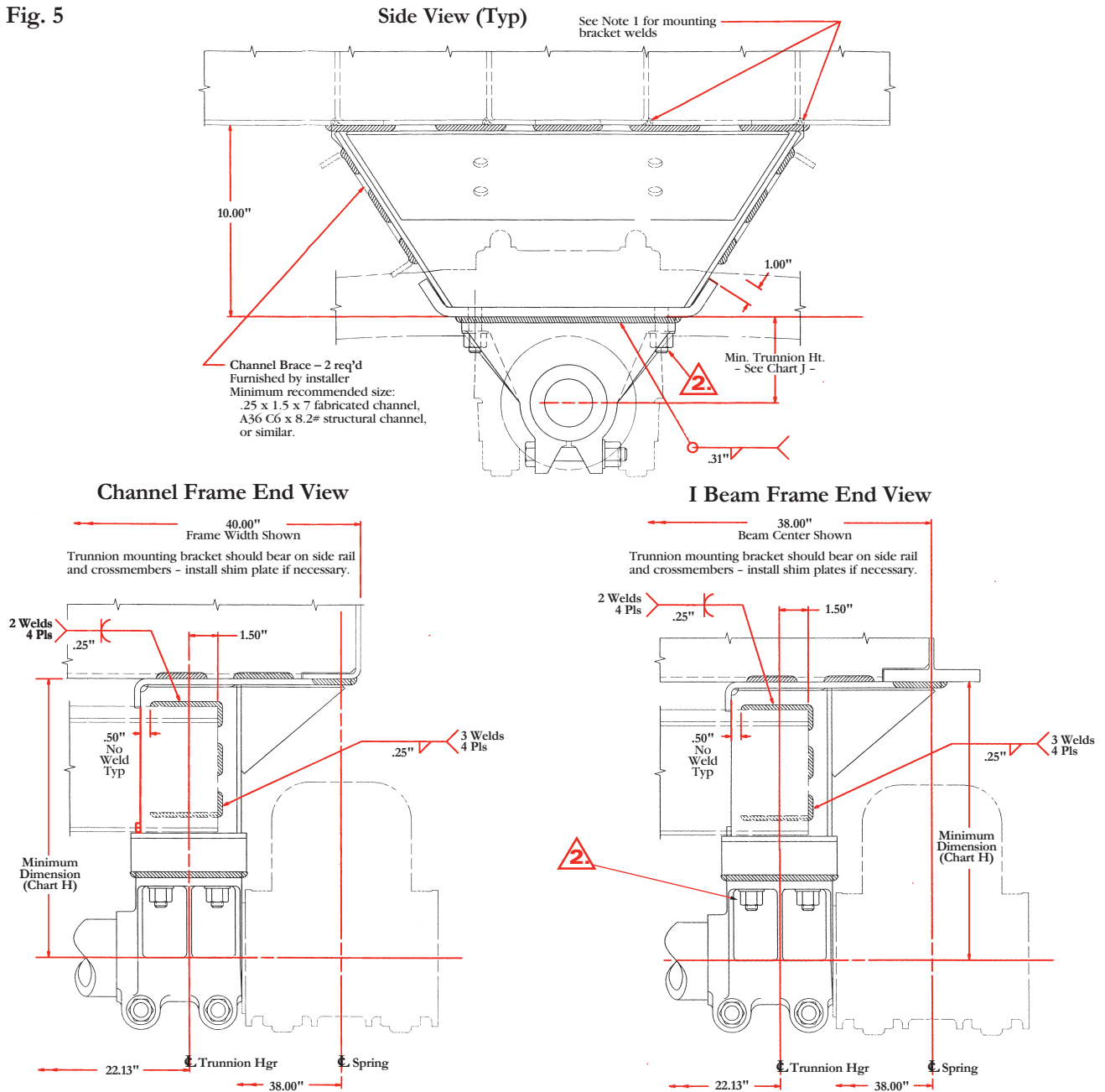


Chart J

Number of Spring Leaves	2	3	5	6	7	8	9	10
Min. Trunnion Hanger Ht.	2.50	4.50	4.50	4.50	6.50	6.50	6.50	8.50

Note:

1. a) The upper trailer structure shown is intended to be a generic representation of a typical installation, and is not intended to be a detailed recommendation for a fabrication of a trailer subframe.
- b) The welds attaching the mounting bracket to the subframe will be determined by the configuration of the structure, and are the responsibility of the trailer manufacturer.

c) As a general recommendation, the frame bracket should be welded to the trailer structure with either a solid weld or skip welds that cover at least 60% of the mounting bracket perimeter. Do not weld within 1/2" of any raw edges of the trailer main rails or crossmembers. Welding should be in accordance with AWS E70XX procedures or equivalent.

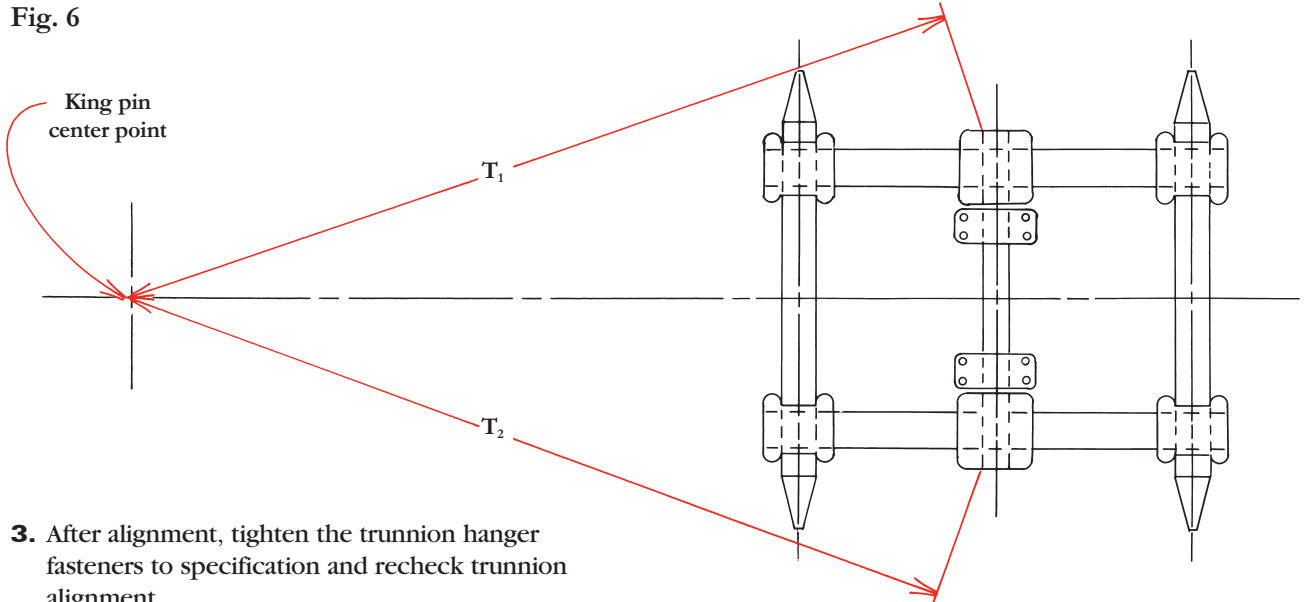
2. Mounting bracket bolts are to be furnished by installer. For one piece trunnion hangers use 5/8" Grade 5 or better bolts and Grade B or better nuts. For two piece trunnion hangers use 3/4" Grade 8 bolts and Grade C nuts.

Mounting Tandem Assembly To Trailer

1. Attach trunnion hanger to mounting bracket or trailer frame. Do not tighten bolts.

2. Align the trunnion tube with the king pin. Dimensions T_1 and T_2 must be equal. See Fig. 6.

Fig. 6



3. After alignment, tighten the trunnion hanger fasteners to specification and recheck trunnion alignment.

4. When the trunnion tube has been aligned and the trunnion hanger bolts have been torqued, weld the

trunnion hanger all around to the mounting bracket or trailer frame and frame member. See Fig. 7.

Fig. 7

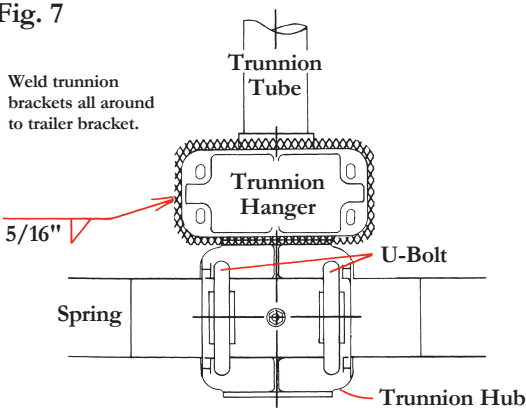
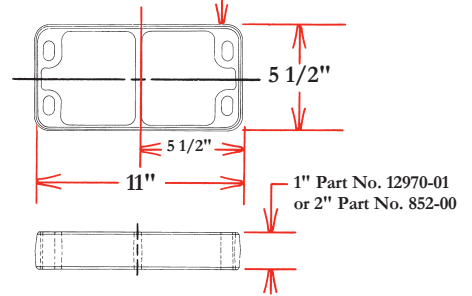


Fig. 8

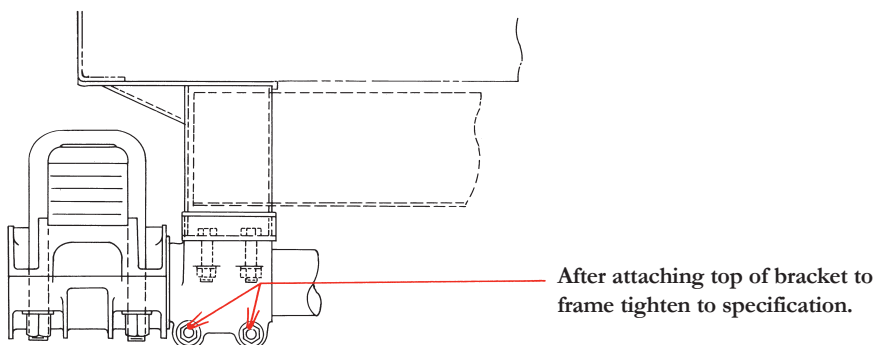
When using the 852-00 or 12970-01 spacer, insert spacer between hanger casting and extension bracket and weld solidly top and bottom. Do not stack spacers.



Note: To achieve non-standard trunnion hanger heights, a spacer is sometimes used atop the trunnion hanger. See Fig. 8. When using a spacer, it must be solidly welded to both the trunnion hanger and mounting bracket or frame. Do not stack spacers.

5. After the trunnion hangers have been attached to the trailer frame, tighten the 3/4" clamp fasteners to specification. See Fig. 9.

Fig. 9

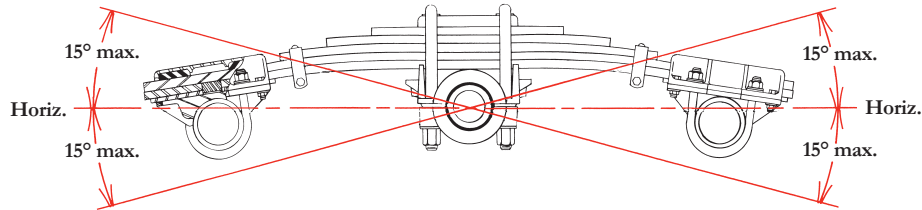


Bump-Outs

When rubber bushings are utilized in the trunnion connection, the maximum oscillation at the trunnion hub should not exceed 15° above or below horizontal. See Fig. 10.

Spring end boxes are designed to accept bump-outs or stops, which the installer should provide to assure tire clearance or to limit oscillation - whichever becomes critical first.

Fig. 10

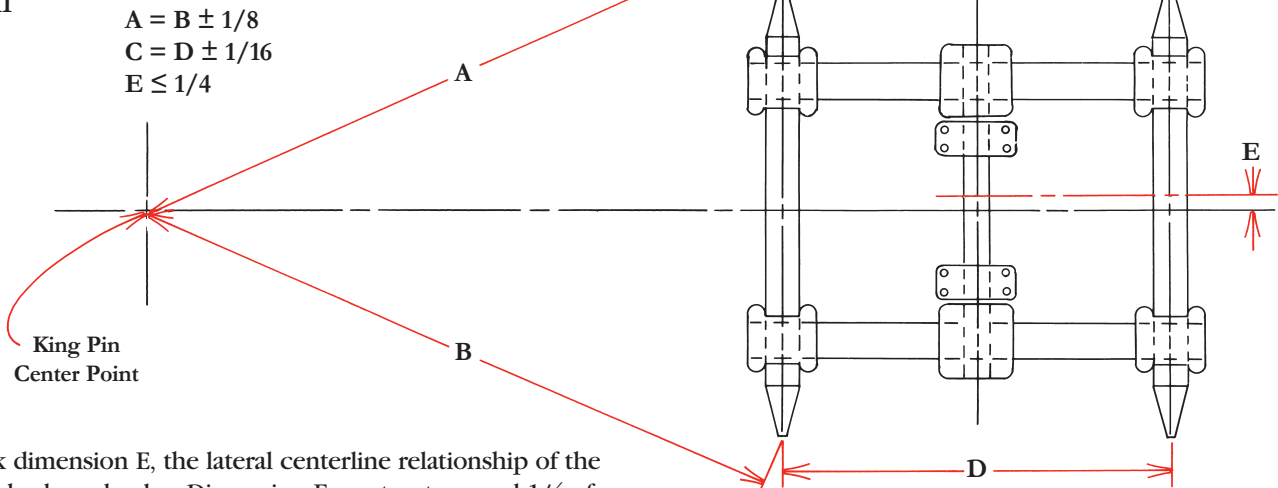


Axle Alignment

After the suspension has been installed under the trailer, the axles should be properly aligned in relation to the trailer king pin in the following manner: Measure the distance from the king pin to the centerline of the spindles on the front axle. As noted in Fig. 11, dimensions A and B must be equal within 1/8 of an inch. After aligning the front axle, tighten the U-bolts and end clamp bolts to specification on that axle only. Next, align

the rear axle with the front axle. As noted in Fig. 11, dimensions C and D must be equal within 1/16 of an inch. After aligning the rear axle with the front axle, tighten the U-bolts and end clamp bolts on the rear axle. Refer to TTMA RP No. 71-05 (Trailer Axle Alignment) for more detail.

Fig. 11



Check dimension E, the lateral centerline relationship of the trailer body and axles. Dimension E must not exceed 1/4 of an inch. At this time, recheck the alignment of the front axle with the king pin, and the rear axle with the front axle. After

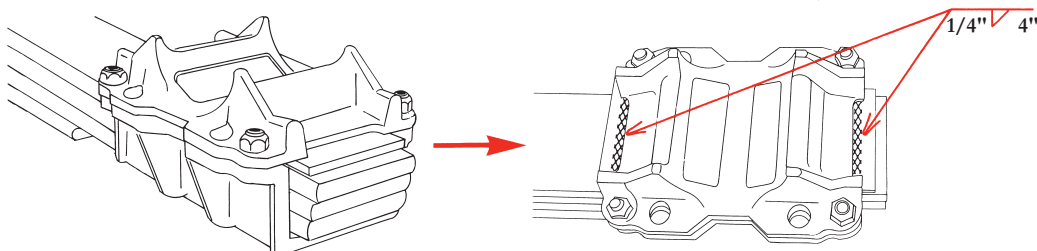
alignment has been accomplished, tighten the U-bolts and nuts to specification.

Adjustment Plate Welding

On each axle there is one adjustment plate that is welded at the factory and one that is not.

After alignment has been completed, weld the unwelded alignment plate exactly like the one that has been welded at the factory. See Fig. 12.

Fig. 12



CAUTION – These adjustment plates **MUST BE WELDED BEFORE** operating the trailer.

Check all fasteners (U-bolts, end cap, trunnion hub, etc.) to make sure they are torqued to specification. Torque for all fasteners should be checked after an initial break-in period, and periodically thereafter. See Decal Note on Page 14.

Numerical Listing of Parts

Part No.	Description	Pg. #	Part No.	Description	Pg. #
814-00	Rubber Pad - Plain	5	9936-04	Spring Seat - Adj., 6 RD, OS	8
817-00	Washer - 1/8 x 13/16 ID x 1 1/2 OD	5	9937-00	Spring End Cap - OS	8
820-00	Spring Clamp Plate	5	9938-00	Spring Seat - 5 RD, US	8
835-01	U-Bolt - 1 1/8 DIA, 5 7/8 RD x 12 3/8	8	9939-00	Spring Seat - 5 SQ, US	8
835-02	U-Bolt - 1 1/8 DIA, 5 7/8 RD x 13 3/4	8	9940-00	Spring Seat - 5 3/4 RD, US	8
835-03	U-Bolt - 1 1/8 DIA, 5 7/8 RD x 14 5/8	8	9940-01	Spring Seat - 6 RD, US	8
835-04	U-Bolt - 1 1/8 DIA, 5 7/8 RD x 15 3/8	8	9941-02	Spring End Cap - Adj., 5 RD & 5 SQ, US	8
835-05	U-Bolt - 1 1/8 DIA, 5 7/8 RD x 17	8	9942-02	Spring End Cap - Adj., 5 3/4 RD & 6 RD, US	8
835-06	U-Bolt - 1 1/8 DIA, 5 7/8 RD 16 1/8	8	9997-00	Spring Assembly - 6 Leaf, 42,000 LB, 48 AC	4, 5, 8
835-08	U-Bolt - 1 1/8 DIA, 5 7/8 RD x 18	8	9998-00	Spring Assembly - 6 Leaf, 42,000 LB, 50.5 AC	4, 5, 8
836-00	Hex Nut - 1 1/8 - 12 UNF, 1 1/2 HI	5	9999-00	Spring Assembly - 7 Leaf, 50,000 LB, 50.5 AC	4, 5, 8
837-00	Washer - 1/8 x 1 1/4 ID x 2 1/4 OD	5	10000-00	Spring Assembly - 8 Leaf, 50,000 LB, 54 AC	4, 5, 8
841-00	Hex Nut - Self Locking, 3/4 - 16 UNF	5	10001-00	Spring Assembly - 9 Leaf, 60,000 LB, 54 AC	4, 5, 8
849-01	Trunnion Hgr. - Cast, 6 1/2 HI, 11 LG	8	10049-00	Spring End Cap - OS, 36,000 LB	8
850-01	Trunnion Hgr. - Cast, 2 1/2 HI, 11 LG	8	10050-02	Spring End Cap - Adj., US, 36,000 LB	8
852-00	Spacer - Trunn Hgr, 2 High, 11 LG	12	10054-00	Spring Assembly - 5 Leaf, 36,000 LB, 48 AC	4, 5, 8
890-00	Rubber Bushing - Trunnion Hub	5	10055-00	Spring Assembly - 7 Leaf, 50,000 LB, US	4, 5, 8
891-00	Trunnion Hub - Upper Half, Cast	5	10060-01	U-Bolt - 3/4 DIA, 5 RD x 7	8
892-00	Trunnion Hub - Lower Half, Cast	5	10061-01	U-Bolt - 3/4 DIA, 5 3/4 RD x 8	8
893-01	Trunnion Tube - 1/2 Wall, 48 LG	8	10062-01	U-Bolt - 3/4 DIA, 6 RD x 8	8
893-02	Trunnion Tube - 3/4 Wall, 48 LG	8	10063-02	U-Bolt - 3/4 DIA, 5 SQ x 7 7/8	8
893-04	Trunnion Tube - 1/2 Wall, 46 LG	8	10064-01	U-Bolt - 1 DIA, 5 RD x 9 3/4	8
893-05	Trunnion Tube - 3/4 Wall, 46 LG	8	10064-02	U-Bolt - 1 DIA, 5 RD x 10 1/2	8
893-07	Trunnion Tube - 1/2 Wall, 54 LG	8	10065-01	U-Bolt - 1 DIA, 5 3/4 RD x 11 1/2	8
893-08	Trunnion Tube - 3/4 Wall, 54 LG	8	10066-01	U-Bolt - 1 DIA, 6 RD x 11 1/2	8
893-09	Trunnion Tube - 1/2 Wall, 52 LG	8	10067-02	U-Bolt - 1 DIA, 5 SQ x 10 1/2	8
893-10	Trunnion Tube - 3/4 Wall, 52 LG	8	10067-03	U-Bolt - 1 DIA, 5 SQ x 11 1/8	8
893-11	Trunnion Tube - 1/2 Wall, 51 LG	8	10273-00	Washer - 1/8 x 21/32 ID x 1 5/16 OD	5
893-12	Trunnion Tube - 3/4 Wall, 51 LG	8	10376-00	Hex Bolt - 3/4 - 16 UNF x 4 1/2 LG, GR 5	5
895-00	Washer - 7 GA x 4 1/32 ID x 5 3/4 OD	5	10476-03	Trunnion Hgr. - Cast, 4 1/2 HI	8
897-01	Trunnion Hgr. - Cast 8 1/2 HI, 11 LG	8	10488-00	Pressure Plate - Cast, 5 SQ	5
898-00	Trunnion Hub - Lower Half, Cast	5	10562-00	Flange Locknut - 1-14 UNS, GRF, Phos & Oil	5
9293-00	Hex Bolt - 5/8 - 18 UNF x 2, GR 5	5	10608-00	Plate - Adj.	5
9639-01	U-Bolt - 1 1/8 DIA, 5 1/8 SQ, 12 5/16	8	11151-00	Spring Assembly - 5 Leaf, 36,000 LB, 50.5 AC	4, 5, 8
9639-02	U-Bolt - 1 1/8 DIA, 5 1/8 SQ, 13 1/8	8	11513-03	Hex Locknut - 5/8 - 18 UNF, 28, GRC	5
9639-03	U-Bolt - 1 1/8 DIA, 5 1/8 SQ, 13 15/16	8	12258-01	Spring Assembly - 3 Leaf	4, 5, 8
9639-04	U-Bolt - 1 1/8 DIA, 5 1/8 SQ, 14 11/16	8	12919-01	Galvanized Liner - .040 x 4.75 x 10.00	5
9639-05	U-Bolt - 1 1/8 DIA, 5 1/8 SQ, 15 1/2	8	12970-01	Spacer - Trunn Hgr, 1 High, 11 LG	12
9639-06	U-Bolt - 1 1/8 DIA, 5 1/8 SQ, 16 1/4	8	16087-01	Decal - 900 Series	14
9639-10	U-Bolt - 1 1/8 DIA, 5 1/8 SQ, 11	8	16258-01	Spring Assembly - 2 Leaf	4, 5, 8
9640-00	Top Plate - Cast, SQ U-Bolt	5	16793-01	Mounting Bracket - H900, 10.00 HI	3, 11
9934-02	Spring Seat - Adj., 5 RD, OS	8	20936-01	Washer - .173 x 5.75 OD x 4.03 ID SPCL FLAT EDGE	5
9935-02	Spring Seat - Adj., 5 SQ, OS	8	23276-01	Trunnion Bushing - Free Oscillating,	5
9936-03	Spring Seat - Adj., 5 3/4 RD, OS	8		5% Oil Filled PUR, 9.00 LG	
			24967-01	Spring Assembly - 10 Leaf, 70,000 LB, 54 AC	4, 5, 8

Important: Warning Decal Note

When the installation of your "Hutch" single point suspension is complete and the trailer has been painted, a torque requirement decal (Part No. 16087-01) must be installed in plain view on the road side of the trailer immediately above the suspension. It is essential that the correct decal is in plain view on each trailer. Decals are shipped with the suspension. If decals are not received, or if for any reason additional decals are wanted, contact our Customer Service Department at (800) 654-8824 or fax (417) 862-2317 and decals will be shipped promptly at no charge.

WARNING

SAFETY ALERT! (1) FOLLOW ALL TORQUE REQUIREMENTS. (2) DO NOT USE ANY COMPONENT WITH VISIBLY WORN OR DAMAGED THREADS. FAILURE TO FOLLOW THESE SAFETY ALERTS CAN LEAD TO LOSS OF VEHICLE CONTROL, PROPERTY DAMAGE, SERIOUS PERSONAL INJURY OR DEATH.

Hutchens Suspension Torque Requirements – 900/440 Series (Decal Part Number 16087-01 Rev. E)

After an initial break in period, approximately 1000 miles, and at least every 4 months periodically thereafter, ALL bolts and nuts should be checked to insure that recommended torque values are being maintained.

Oil torque values listed are for new fasteners with lubricated threads. It is recommended that new installations be performed with oiled fasteners. For dry threads which have been in service, use the higher torque values which are noted below.

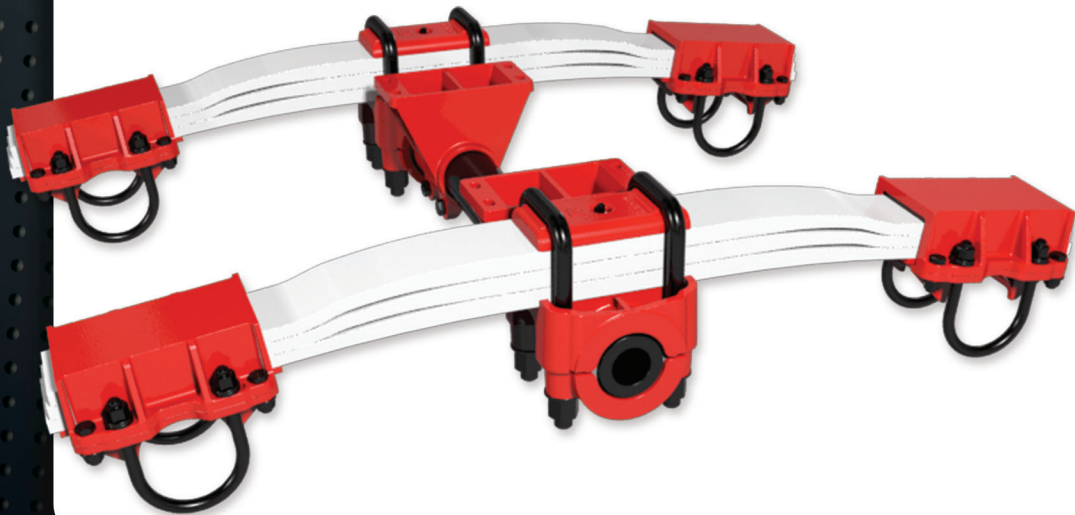
	OILED	DRY
1 1/8-12 UNF	670 lb-ft	880 lb-ft
1-14 UNF	540 lb-ft	730 lb-ft
7/8-14 UNF	500 lb-ft	670 lb-ft
3/4-16 UNF	220 lb-ft	300 lb-ft
5/8-18 UNF	130 lb-ft	180 lb-ft

Hutchens Industries, Inc., P.O. Box 1427, Springfield, Missouri 65801-1427 Toll Free 1 (800) 654-8824

The Hutch 900 Single Point Suspension offers the superior durability, reliability and performance that your fleet deserves – and it is backed by Hutchens' on-time delivery, warranty, and commitment to after-sale support and service.

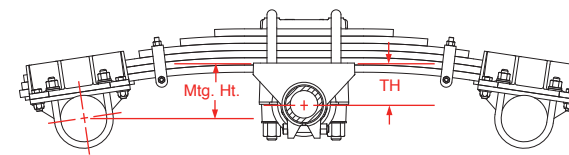
Designed for heavy-duty, on and off-road applications, the Hutch 900 is a single point suspension that attaches to the trailer frame at a single location – which makes it ideal for logging, heavy load hauling and dump operations.

- Features extra heavy-duty 5" wide leaf springs and cast steel parts.
- Accurate spring alignment preserved by the use of rugged spring guides on the trunnion casting.
- A split trunnion casting permits easy maintenance and replacement of trunnion bushings.
- Axle alignment and realignment made possible by adjustable plates within the spring-end boxes. One adjustment plate on each axle is welded at the factory. After axle alignment is completed, the installer welds the other adjustment plate to ensure sustained axle alignment.
- For increased life and flexibility, thick rubber pads are used above the spring leaves in the axle boxes which permit greater twist freedom...a standard flexibility feature that reduces wear and promotes better ride characteristics.
- Weight capacity ratings of 36,000, 42,000, 44,000, 50,000, 60,000 and 70,000 lbs., with weight-saving two and three leaf units also available.

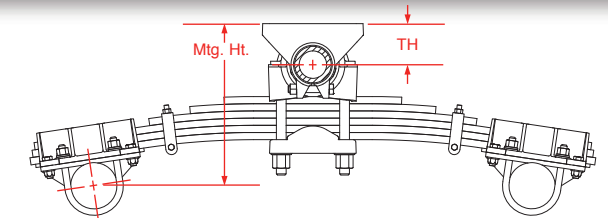


900 SERIES

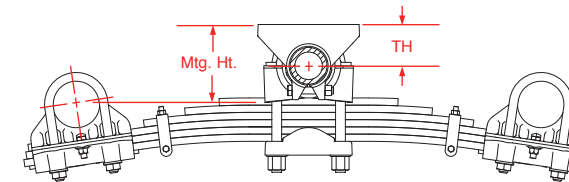
TRAILER SUSPENSION SYSTEMS



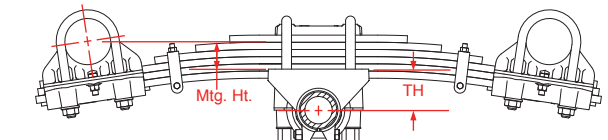
Overslung Axles - Overslung Trunnion



Overslung Axles – Underslung Trunnion



Underslung Axles – Underslung Trunnion



Underslung Axles – Overslung Trunnion

Note: The above drawings are views of the suspension as seen from the centerline of the trailer.

Numerous mounting heights, axle and trunnion combinations are possible. These include overslung (springs over axles) and underslung (springs under axles) axle units as well as overslung (springs over trunnion) and underslung (springs under trunnion) trunnion configurations. As shown above, Mounting Height (Mtg. Ht.) is the vertical distance from the center line of the axle to the top of the trunnion hanger while Trunnion Height (TH) is the vertical distance from the centerline of the trunnion tube to the top of the trunnion hanger. Trunnion hangers are available in heights of 2 1/2", 4 1/2", 6 1/2" and 8 1/2". Axle seats are available to accommodate 5", 5 3/4" and 6" round axles or 5" x 5" square axles.

Options

16793-01 Mounting Bracket

To help ease the installation of your 900 Series suspension you may wish to order a pair of Hutch mounting brackets (Part #16793-01).


Straddle Mount

For a more integrated installation solution consider the Straddle Mount trunnion hanger option.



Important: Warning Decal Note

When the installation of your “Hutch” suspension is complete and the trailer and/or subframe has been painted, a torque requirement decal (Part No. 16086-01) must be installed in plain view on the road side of the trailer immediately above the suspension. It is essential that the correct decal is in plain view on each trailer. Decals are shipped with the suspension. If decals are not received, or if for any reason additional decals are wanted, contact our Customer Service Department at (800) 654-8824 or fax (417) 862-2317 and decals will be shipped promptly at no charge.


WARNING


SAFETY ALERT! (1) FOLLOW ALL TORQUE REQUIREMENTS. (2) DO NOT USE ANY COMPONENT WITH VISIBLY WORN OR DAMAGED THREADS. FAILURE TO FOLLOW THESE SAFETY ALERTS CAN LEAD TO LOSS OF VEHICLE CONTROL, PROPERTY DAMAGE, SERIOUS PERSONAL INJURY OR DEATH.

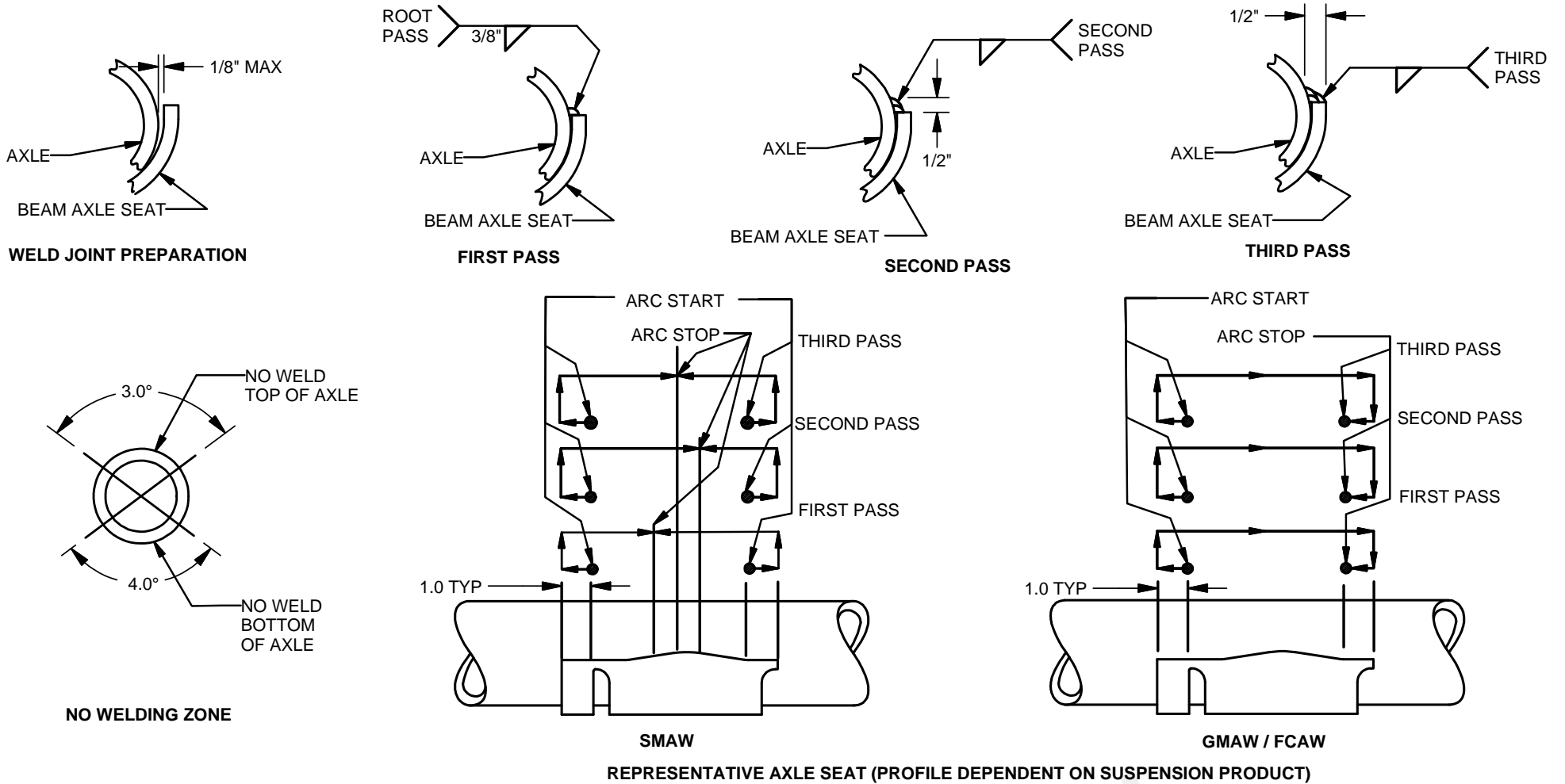
Hutchens Suspension Torque Requirements
9600-9700 Series (Decal Part Number 16086-01 Rev. J)

After an initial break in period, approximately 1000 miles, and at least every 4 months periodically thereafter, ALL bolts and nuts should be checked to insure that recommended torque values are being maintained.

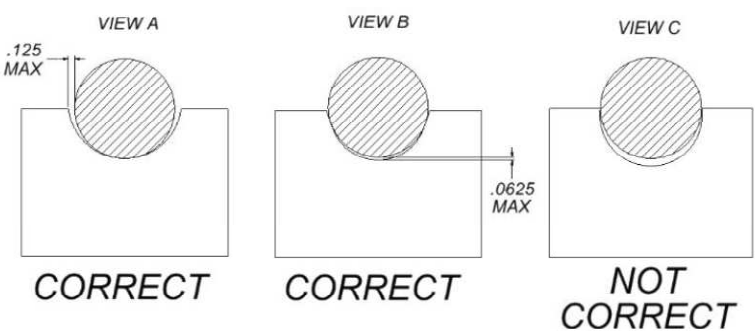
Oiled torque values listed are for new fasteners with lubricated threads. It is recommended that new installations be performed with oiled fasteners. For dry threads which have been in service, use the higher torque values which are noted below.


	OILED	DRY
1 1/8-7 (9600 / 9700 Rocker Bolt)	590 lb-ft	790 lb-ft
1-14 or 1-8 (9700 Radius Rod Bolt)	540 lb-ft	720 lb-ft
7/8-14 (Axle U-Bolts & 9600 Radius Rod Bolt)	350 lb-ft	470 lb-ft
3/4-16 (Axle U-Bolts)	310 lb-ft	420 lb-ft
5/8-18 (Radius Rod Clamp Bolt)	130 lb-ft	170 lb-ft
5/8-18 (Spring Retainer Bolt)	35 lb-ft	50 lb-ft


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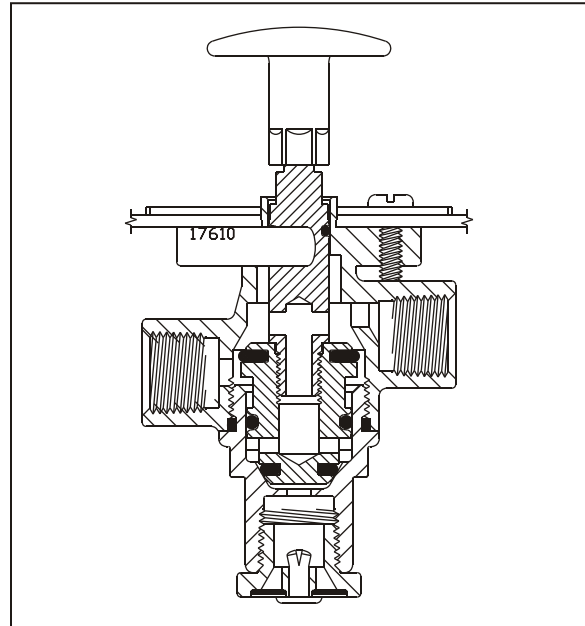
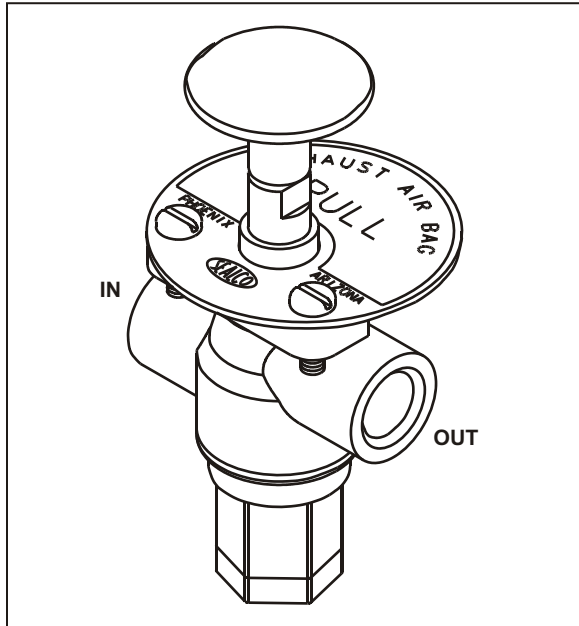
- 1 - CAUTION: All welds must be kept away from the top and bottom of the axle where maximum stresses occur (see "NO WELDING ZONE" illustration above). Do not test-weld the arc on any part of the axle tube.
- 2 - All welders and welding operators should be certified as per the requirements of the American Welding Society (AWS) or equivalent. All electrodes used should meet the AWS specifications and classifications for welding carbon and low-alloy steels.
- 3 - Recommended Welding Methods: Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW) or Flux Cored Arc Welding (FCAW). The welding method used and the electrode selected must develop a minimum weld tensile strength of 70,000 psi per AWS specifications. The best fusion and mechanical properties will be obtained by using the voltage, current, and shielding medium recommended by the electrode manufacturer. If the SMAW method is used, the stick electrodes must be new, dry, free of contaminants and stored per AWS specifications.
- 4 - Weld Joint Preparation: The joint to be welded should be positioned in the flat or horizontal position. All grease, dirt, paint, slag or other contaminants must be removed from the weld joint without gouging the axle tube. CAUTION: Never weld when the axle is cold. The axle and beam assemblies to be welded should be at a temperature of at least 60°F (15°C). Pre-heat the weld zone to the axle manufacturer's recommended pre-heat temperature, if required. This will reduce the chance of an area of brittle material forming adjacent to the weld.
- 5 - The axle should fit into the beam assembly with a maximum root gap of 1/8-inch between the axle and the beam axle seat (see "WELD JOINT PREPARATION" illustration above).
- 6 - NOTE: Clamp the axle to the beam axle seat with a C-clamp prior to welding to make sure that proper contact occurs (see "CORRECT" illustration below).
- 7 - Ground the axle to one of the attached axle parts such as the brake chamber brackets, cam brackets or brake spider. Never ground the axle to a wheel or a hub as the spindle bearing may sustain damage.
- 8 - Multiple pass welding should be used on the beam/axle connection using the following guidelines: 8.1-Total fillet weld size should be 1/2-inch. 8.2-Weld pass starts and stops should be performed as illustrated above. 8.3-Never start or stop welds at the end of the weld joint. 8.4-Each pass must be accomplished in one or two segments. 8.5-Start welds at least 1-inch from the end and backweld over the start. Backstep fill all craters. 8.6-If process is not GMAW all slag must be removed between passes. 8.7-Welds must go to within 1/8-inch +/- 1/16-inch of the ends of the axle seat and must not go beyond or around the ends of the axle seat. 8.8-Post-weld peening is recommended, but not required: Needle peen the entire toe of the second pass, including around the ends of the axle seat. Hold the needles perpendicular to the axle. A uniform dimpled pattern will appear when properly peened.



F	16101	ADDED MAXIMUM TO 5, ADDED GMAW NOTE TO 8.6 UPDATED CORRECT VIEWS	2/10/2016	G.H.	B.B.	CJB
E	15101	REVISED TEXT. REMOVED LIST OF MODELS.	6/30/15	G.H.	MDJ	CJB
REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD
DRAWN BY: CBC		2/1/2016		 RIDEWELL CORPORATION PO BOX 4586 SPRINGFIELD, MISSOURI 65808		
CHECKED: MDJ		2/21/2003				
APPROVED: CJB		2/21/2003				
PROJECT NO: 03103		SCALE: A-SIZE: NTS		TITLE: RIDEWELL WELD PROCESS #1, 5" DIA. AXLE, 3 PASS WELD		
MATERIAL: -		WEIGHT: -		PART NO: WELD PROCESS #1		REV: F
SHEET 1 OF 1						

SUSPENSION CONTROL VALVES

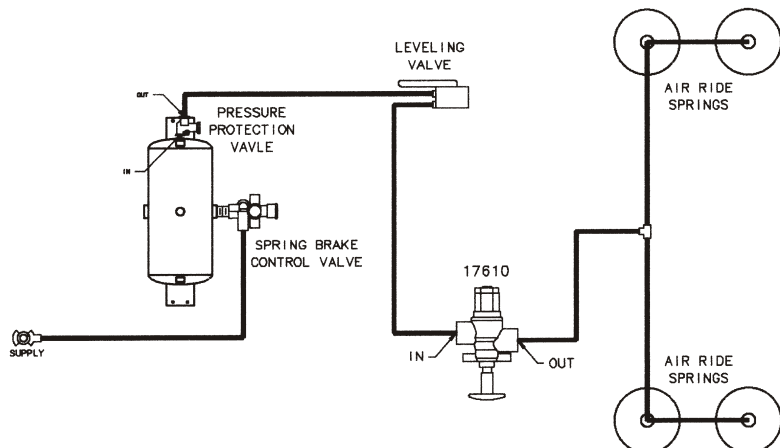
Air Bag Control Valve – Manual Operation



INFORMATION:

- Commonly used to control the inflation & deflation of air suspension bags
- Allows for movement of trailer back to dock without re-inflating air bags
- Operates with all air suspension systems
- Pull to manually exhaust air from air bags

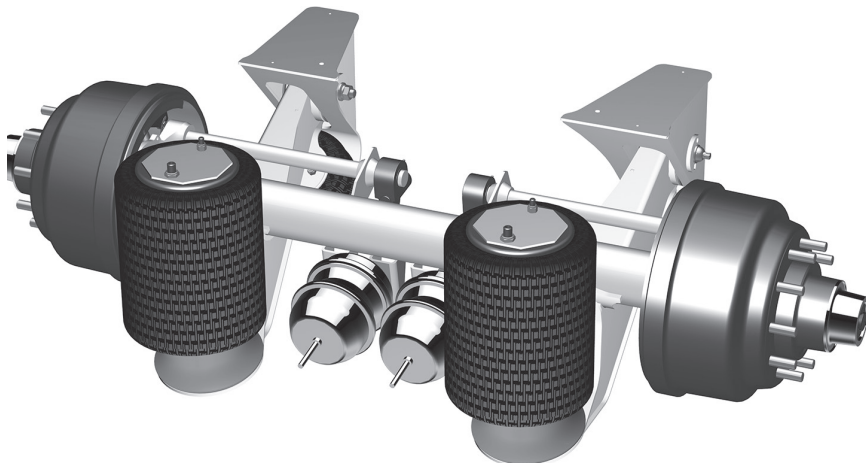
Push to refill air bags from reservoir



PART NUMBER	PORT SIZES (NPT)	
	Inlet	Outlet
17610	3/8"	3/8"

RCA-215T - Trailer

Nonsteerable – Auxiliary Axle Suspension



Installation and Service Manual

Suspension Identification 2

Suspension System Serial Tag

Installation 3

Prior to Installation

Axle Integration

Axle Weld Standards

Suspension Mounting

Air Control Kit - Troubleshooting

Maintenance 9

Recommended Service Intervals

Parts Illustration

215T Trailer Suspension

Bushing Replacement Kit

Bushing Replacement Procedure

Appendix 14

Torque Specifications

Axle Alignment

Warranty 16



Part No.: 9710113

Doc.: 215T-Trailer-ISM-RevB-09-18-17

SUSPENSION IDENTIFICATION

Introduction

It's important that the proper suspension model be chosen for the application in which it is to be used. The Ridewell Compact Air Ride (RCA) 215T Trailer Suspension is available for a wide range of applications. The suspension can be purchased with or without an integrated axle.

Refer to the engineering drawing for detailed information on the suspension system components and operating parameters.

Read through the entire Installation and Service Manual (ISM) before performing any installation or maintenance procedures.

Serial Identification Tag

Ridewell suspension systems and axles can be identified by the Part and Serial Number listed on the serial identification tags.

Suspension Serial Tag

The Suspension Serial Tag provides information on the suspension model (Figure 1).

The **Part Number (215xxxx)** refers to the individual suspension system.

The nine-digit **Serial Number (1xxxxxxx)** refers to the date and order of manufacture of the suspension.

Please refer to both the part number and serial number when contacting Ridewell for customer service, replacement parts and warranty information.

Axle Body - Serial Tag

Ridewell-branded axles will have a tag attached to the axle tube listing the **Part Number (165xxxx)** and **Serial Number** of the axle body (Figure 2).

Notes and Cautions

All work should be performed by a properly trained technician using the proper/special tools and safe work procedures.

The ISM uses two types of service notes to provide important safety guidelines, prevent equipment damage and make sure that the suspension system operates correctly. The service notes are defined as:

“NOTE”: Provides additional instructions or procedures to complete tasks and make sure that the suspension functions properly.


 **CAUTION** Indicates a hazardous situation or unsafe practice that, if not avoided, could result in equipment damage and serious injury.



Figure 1. The Suspension Serial Tag is located on the left-hand (driver's side) suspension hanger.

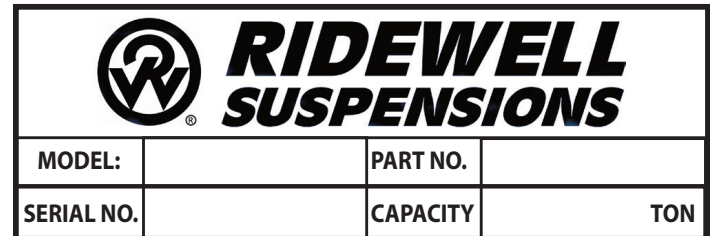


Figure 2. Ridewell axles have a serial identification tag listing the Part Number (165xxxx) and serial number of the axle body.

Prior to Installation

Refer to the engineering drawing to confirm dimensional requirements and the range of ride heights available.

The suspension is designed to fit up onto standard I-beam trailer frames at beam centers that correspond to standard axle track widths (Figure 3).

Installation at wider beam centers will reduce suspension clearances. Installation at narrower beam centers will de-rate the axle beam capacity.

NOTE: For non-standard beam centers, frames, frame centers, axle track widths and wheel-end equipment, the installer is responsible for verifying clearances, axle capacity, proper fit-up, and any additional required support structure.

Installations can vary and procedures should be adapted for different vehicles, as needed.

- The Gross Axle Weight Rating (GAWR) is determined by the system component with the lowest load rating. Please consult with tire, wheel, axle and brake manufacturers before installation to determine the GAWR.
- If vehicle chassis modifications are required, consult with the vehicle manufacturer to ensure that such changes are permitted.
- Welding or altering suspension components is not permitted without the express written permission of Ridewell Suspensions.

Installer Responsibilities

The installer of the suspension has the sole responsibility for proper attachment of the suspension system to the vehicle chassis.

- The installer is responsible for locating the suspension system on the vehicle to provide the proper load distribution.
- The installer must verify that vehicle crossmembers are positioned to support the suspension at the installing location.
- It is the installer’s responsibility to determine that axle spacing conforms to any applicable federal and local bridge laws.
- The installer must verify that air reservoir volume requirements are met after suspension installation. Consult the vehicle manufacturer or Federal Motor Vehicle Safety Standards (FMVSS) 121 for more information.
- The installer must verify there is sufficient clearance for proper functioning of the auxiliary suspension, air springs, brake chambers, steering components, axle (including axle to driveline clearance) and tires.

Figure 3. Standard Trailer Dimensions

Trailer Width	Axle Track Width	Frame Center	Beam Center	Air Spring Center
96"	71.5"	38"	35"	31"
102"	77.5"	44"	41"	37"

Axle Integration

Suspension systems are available with and without a factory integrated axle. Customer-supplied axle assemblies must be positioned and oriented (rotated) properly before welding the axle.

Use the top-center mark on the axle, if available, to identify the center of the axle and orient the axle assembly on the suspension. The axle assembly should be installed so that the camshafts, when activated, rotate in the same direction as the wheels.

CAUTION Failure to follow procedures and design specifications could result in injury, damage to the axle or suspension and void the warranty.

Weld Preparation

The joint to be welded should be positioned in the flat or horizontal position. All grease, dirt, paint, slag or other contaminants must be removed from the weld joint.

The axle and suspension components should be at a minimum temperature of 60°F (15.5°C). Pre-heat the weld zone to the axle manufacturer's recommended pre-heat temperature, if required.

Weld Procedure

- Center the axle assembly on the beams (Figure 4).
- Check the engineering drawing for the brake component orientation (rotation) before clamping into place and making the final welds.
 - Drum brake camshafts are spaced off the tail of the trailing arm beam. Make sure the brake chamber brackets are oriented properly and clamp the axle assembly into place.
 - Disc brake assemblies have a right- and left-hand caliper assembly. Make sure the callipers are located on the correct side and rotated to the proper position before clamping the axle assembly into place.
- Check the gap between the axle and the axle seats before welding (Figure 5). Side gaps should be no greater than 1/8". The gap at the bottom of the axle seat should be no greater than 1/16".
- Weld the axle to the seat according to Ridewell Weld Process #1 (Page 5).

NOTE: Mounted air springs should be covered to protect them from welding spatter.

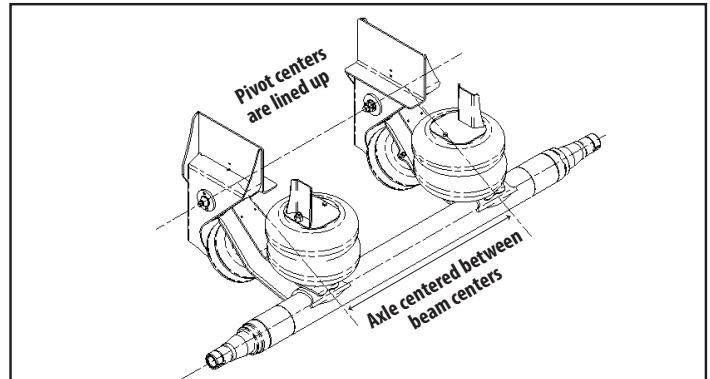


Figure 4.
Axle should be centered between beams.

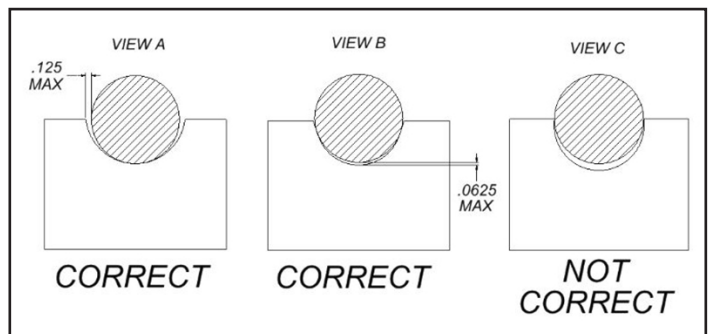
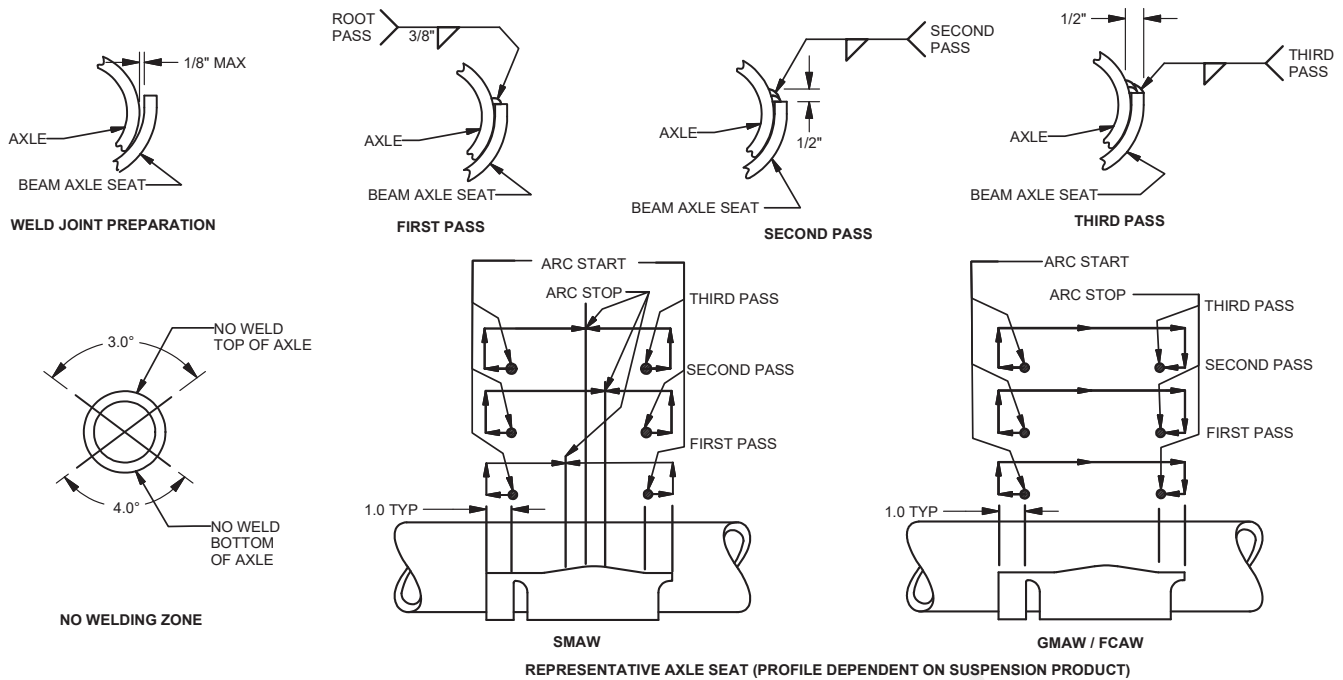
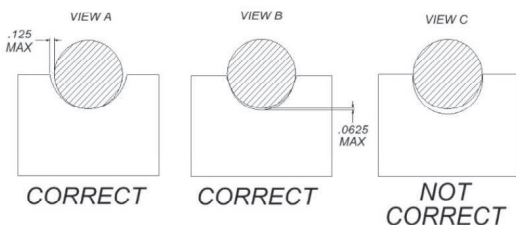



Figure 5. Correct axle seating for welding.



- CAUTION:** All welds must be kept away from the top and bottom of the axle where maximum stresses occur (see "NO WELDING ZONE" illustration above). Do not test-weld the arc on any part of the axle tube.
- All welders and welding operators should be certified as per the requirements of the American Welding Society (AWS) or equivalent. All electrodes used should meet the AWS specifications and classifications for welding carbon and low-alloy steels.
- Recommended Welding Methods:** Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW) or Flux Cored Arc Welding (FCAW). The welding method used and the electrode selected must develop a minimum weld tensile strength of 70,000 psi per AWS specifications. The best fusion and mechanical properties will be obtained by using the voltage, current, and shielding medium recommended by the electrode manufacturer. If the SMAW method is used, the stick electrodes must be new, dry, free of contaminants and stored per AWS specifications.
- Weld Joint Preparation:** The joint to be welded should be positioned in the flat or horizontal position. All grease, dirt, paint, slag or other contaminants must be removed from the weld joint without gouging the axle tube. **CAUTION:** Never weld when the axle is cold. The axle and beam assemblies to be welded should be at a temperature of at least 60°F (15°C). Pre-heat the weld zone to the axle manufacturer's recommended pre-heat temperature, if required. This will reduce the chance of an area of brittle material forming adjacent to the weld.
- The axle should fit into the beam assembly with a maximum root gap of 1/8-inch between the axle and the beam axle seat (see "WELD JOINT PREPARATION" illustration above).
- NOTE:** Clamp the axle to the beam axle seat with a C-clamp prior to welding to make sure that proper contact occurs (see "CORRECT" illustration below).
- Ground the axle to one of the attached axle parts such as the brake chamber brackets, cam brackets or brake spider. Never ground the axle to a wheel or a hub as the spindle bearing may sustain damage.
- Multiple pass welding should be used on the beam/axle connection using the following guidelines: 8.1-Total fillet weld size should be 1/2-inch. 8.2-Weld pass starts and stops should be performed as illustrated above. 8.3-Never start or stop welds at the end of the weld joint. 8.4-Each pass must be accomplished in one or two segments. 8.5-Start welds at least 1-inch from the end and backweld over the start. Backstep fill all craters. 8.6-If process is not GMAW all slag must be removed between passes. 8.7-Welds must go to within 1/8-inch +/- 1/16-inch of the ends of the axle seat and must not go beyond or around the ends of the axle seat. 8.8-Post-weld peening is recommended, but not required: Needle peen the entire toe of the second pass, including around the ends of the axle seat. Hold the needles perpendicular to the axle. A uniform dimpled pattern will appear when properly peened.



F	16101	ADDED MAXIMUM TO 5, ADDED GMAW NOTE TO 8.6 UPDATED CORRECT VIEWS	2/10/2016	G.H.	B.B.	CJB
E	15101	REVISED TEXT. REMOVED LIST OF MODELS.	6/30/15	G.H.	MDJ	CJB
REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD
DRAWN BY: CBC		2/1/2016		 RIDEWELL CORPORATION PO BOX 4586 SPRINGFIELD, MISSOURI 65808		
CHECKED: MDJ		2/21/2003				
APPROVED: CJB		2/21/2003				
PROJECT NO: 03103		SCALE: A-SIZE: NTS		TITLE: RIDEWELL WELD PROCESS #1, 5" DIA. AXLE, 3 PASS WELD		
MATERIAL: -		WEIGHT: -		SHEET 1 OF 1		PART NO: WELD PROCESS #1
						REV: F

Mounting the suspension to the frame

Refer to the engineering drawing for the range of ride heights available and clearance requirements .

The suspension installer has the final responsibility of attaching the suspension to the vehicle frame.

Weld-On Installation Procedure

Recommended locations of customer-furnished filler plates and supporting crossmembers for the hangers and air spring mounting plates are shown on the engineering drawing.

CAUTION Welding method must use a minimum weld tensile strength of 70,000 psi, per AWS specifications.

1. Mark desired location of the hangers and filler plates on the frame. Hangers must be installed parallel to each other for proper axle alignment.
2. Mark the desired location of the air spring mounting plates and filler plates on the frame. NOTE: Protect other chassis components from weld spatter during installation, if necessary.
3. Install filler plates for the hangers and air spring mounting plates on the frame. Weld filler plates to crossmembers with 1/4" fillet welds down the length of the crossmember.
4. Weld the hangers to the frame/filler plates with 1/4" fillet welds completely around the hangers. Stop the welds 1/2" from the corners and edges.
5. Weld the air spring mounting plates to the frame/filler plates with 3/16" fillet welds.
6. Attach a crossmember or diagonal brace to the front of the hangers with 1/4" fillet welds.

Bolt-On Installation

Before installation, check to make sure that wires, hoses or other components will not be affected by drilling into the frame rail.

- Bolts/nuts for attaching the suspension to the vehicle are supplied by the installer. Grade 8 bolts and flanged lock nuts or lock nuts with hardened washers are recommended.
- Bolt holes are not provided in the air spring mounting plates. Clamp mounting plates and filler plates, if used, in place and drill (minimum) two bolt holes in each mounting plate for installation onto the chassis.

Shock Absorber Kit (Optional)

The shock absorber can be installed after the suspension has been assembled and mounted on the vehicle.

Installation Procedure

Refer to the shock kit engineering drawing for the correct mounting locations and installation angles for the upper and lower mounting brackets on individual RCA-215 suspension models.

CAUTION Welding method for lower mounting bracket must use a minimum weld tensile strength of 70,000 psi, per AWS specifications.

1. Disconnect and remove the load springs from the suspension assembly. Protect the lift springs from welding spatter.
2. Remove the upper air spring mounting brackets.
3. Weld replacement upper air spring mounting brackets provided in shock absorber kit to frame crossmember with 3/16" fillet weld.
4. Measure the shock absorber to axle (lower) mounting bracket location from the edge of the axle seat, not from the axle weld. Clamp the bracket into place. Use a 5/16" fillet weld to weld the lower mounting bracket to the axle at the forward and rear edge only. Do not weld perpendicular to the axle centerline.
5. Attach the shock absorbers to mounting brackets, with supplied HHCS and lock nut. Torque lock nut to 160-200 ft-lb (217-271 N-m).
6. Install load springs. Torque to specifications (Appendix). Connect load springs to air system.
7. Raise and lower suspension to make sure that shock absorbers clear air spring mounting plates and that shock absorbers do not overextend.

CAUTION Failure to torque bolts/nuts of suspension components to specifications can result in failure of the suspension and void the warranty.

Final Assembly and Inspection

1. Verify welds of frame hangers and air spring mounting plates.
2. Inspect for any loose or missing fasteners on the suspension assembly. Verify that all suspension component bolts/nuts are torqued to proper values (Appendix).
3. Install wheels and tires.
CAUTION When lowering an auxiliary axle on an unloaded vehicle, pressure to the load air springs must be reduced to below 10 psi. Failure to reduce the air pressure could cause the vehicle's drive axles to rise from the ground and the vehicle could roll in an unsafe manner.
4. Check that tires are inflated to recommended pressure. Check wheel hubs for proper level of lubricant recommended by the manufacturer.
5. Lift the axle to the raised position. Check the air system tubing and connections for leaks.
6. Check that wheels can rotate freely and that brakes and slack adjusters are properly adjusted.
7. Raise and lower the suspension assembly (wheels and tires installed) through the entire range of travel. Make sure that sufficient clearances for air springs, brake chambers and other components has been provided.

CAUTION Do not lower the auxiliary axle while the vehicle is moving above 10 mph.

Regulate load with air spring pressure

The load capacity of the auxiliary axle is adjusted by increasing or decreasing the pressure to the air springs. By applying more air, the lift axle takes on a greater percentage of the load's weight. The load capacity is decreased as the air pressure decreases.

Accurate readings of the load capacity can be obtained by parking a loaded vehicle over a calibrated scale and lowering the axle onto the scale. The air pressure to the air springs is manually adjusted up or down to obtain the axle load weight at various air pressures.

CAUTION Do not exceed the rated load capacity of the suspension system or other components. Exceeding the capacity can cause component failure and void the warranty.

Install air system components

Connect the load and lift air springs and an air control kit to the air system (Figure 6).

The air control kit (ACK) consists of a pressure regulator with a gauge connected to an air valve controlled by an electric switch or manual knob. The ACK allows the operator to control the air spring pressure so that the auxiliary axle can support different loads.

Ridewell has a number of manual/electric ACK configurations available. Installation will vary by the type of configuration.

CAUTION The installer is responsible for making sure that air system requirements comply with the appropriate Federal Motor Vehicle Safety Standards.

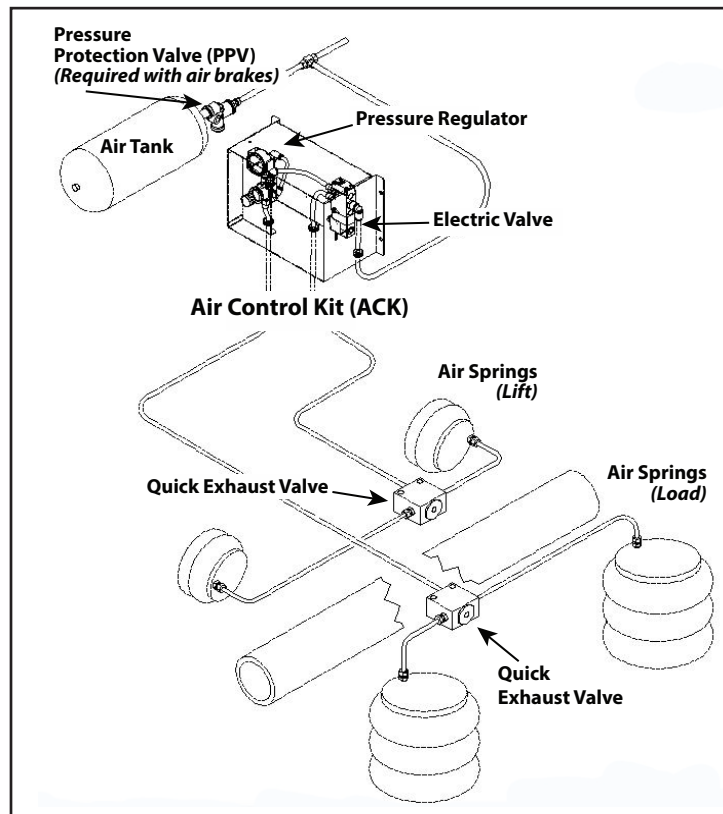


Figure 6.
Example of Air Control Kit (ACK) installation

Troubleshooting – Air System Installation

Problem	Possible Cause	Solution
Air springs fill but do not exhaust.	<ul style="list-style-type: none"> – Obstructed air line. – Faulty controls wiring. – Manual override pushed in 	<ul style="list-style-type: none"> – Check for pinched/blocked lines. – Check wiring with voltmeter and correct wiring/installation. – Release manual override.
Air system leaks down after a short period of time.	<ul style="list-style-type: none"> – Leak in air system beyond accepted standards. 	<ul style="list-style-type: none"> – Pressurize system and spray soap water solution onto the tubing, valves and fittings. Check for bubbles (leaks). Note: Some valves will leak at an acceptable rate. – Check that tubing cuts are straight and smooth. Re-cut and reassemble fitting joints, if necessary.
Auxiliary unit will not stay up	<ul style="list-style-type: none"> – Loose Air Fittings. – Damaged Air Lines. – Air lines to lift and load air springs are reversed. – Damaged or Worn Air Springs. 	<ul style="list-style-type: none"> – Check and retighten fittings. Repair or replace component, as necessary. – Check installation. Air line from regulator goes to (load) air springs. – Replace if worn or damaged.
Auxiliary unit not getting the correct lift	<ul style="list-style-type: none"> – Air lines to lift and load air springs are reversed. – Lift air springs do not have proper air pressure. – Interference with driveline or other chassis components. – Air control system not installed correctly. 	<ul style="list-style-type: none"> – Check installation. Air line from regulator goes to (load) air springs. – Check for loose fittings or worn/damaged lines. Verify air tank pressure with gauge. – Visually inspect unit operation for proper clearance. Check for loose fasteners and retighten. – Check installation; refer to OEM installation procedures.

A visual inspection of the suspension structure should be performed during each pre-trip/safety inspection. Ridewell Suspensions recommends the following minimum service intervals for standard duty, on-highway usage applications. More frequent intervals are recommended for heavier duty applications.

Daily/Pre-Trip Inspections

- Check tires for proper inflation, damage or excessive wear.
- Check wheel-ends for obvious signs of lubricant leakage. Check for missing components.
- Check axle assemblies for damage/loose components.
- Visually inspect suspension structure for signs of damage or excessive wear.
- Check for loose or missing bolts/nuts. Check for irregular movement in suspension components.
- Make sure air controls are operating properly. Drain all moisture from air reservoirs.

First 6,000 miles of use

- Torque all suspension bolts/nuts to specifications (see torque values chart in Appendix).
- Verify that the suspension is operating at the designed ride height.

Refer to the following Technology & Maintenance Council (TMC) publications for additional maintenance information:

TMC RP 609	Self-Adjusting and Manual Brake Adjuster Removal, Installation and Maintenance
TMC RP 618	Wheel Bearing Adjustment Procedure
TMC RP 619	Air System Inspection Procedure
TMC RP 622	Wheel Seal and Bearing Removal, Installation, and Maintenance
TMC RP 631	Recommendations for Wheel End Lubrication
TMC RP 643	Air Ride Suspension Maintenance Guidelines
TMC RP 728	Trailer Axle Maintenance

Every 12,000 miles of use

- Inspect air springs for any damage or excessive wear. Torque air spring bolts/nuts to specifications (see torque values chart in Appendix).
- Check air lines and connections for leaks.
- Lubricate Brake Cams and Slack Adjusters.

First 50,000 miles of use

- Torque all suspension component bolts/nuts to specifications (see Appendix).
- Check wheel ends for excessive play.

Annually/100,000 miles of use

- Inspect pivot connections for worn pivot bushings and replace, if necessary. Torque pivot hardware and component bolts/nuts to specifications (Appendix).
- Check suspension hanger and air spring mounting plate connections to frame.
- Check lubrication level in wheel ends:
 - 1) Oil-Filled Wheel Ends: Refill/Replace lubricant as needed (Refer to TMC RP 631 “100K/Annual Inspection”).
 - 2) Semi-Fluid Grease: Pull outer bearing and visually inspect lubrication level. Refill/Replace as needed (Refer to TMC RP 631 “Level 3 Lubrication Level Inspection” and TMC RP 618 “Wheel Bearing Adjustment Procedure”).
- Check air system for leaks.
- Test air system pressure protection valve (if equipped).
- Check brake chambers and brakes for damage and proper function.

CAUTION Failure to torque bolts/nuts of suspension components to specifications can result in failure of the suspension and void the warranty.

Pivot Bushing Inspection Procedure

Park the unloaded trailer on a level surface. Set the brakes and chock the tires so vehicle cannot move during inspection.

Insert the flat end of a pry-bar between one side of the hanger sidewall and the wear washers. Move the pry-bar back-and-forth and look for excessive movement of the beam (NOTE: A small amount of beam

movement because of the rubber flexing is normal). Inspect the wear washers for excessive wear/damage.

Repeat the pry-bar process and wear washer inspection on the other side of the hanger. If any large/easy movement or damaged wear washers is observed, drop the beams for further inspection. Replace components as necessary.

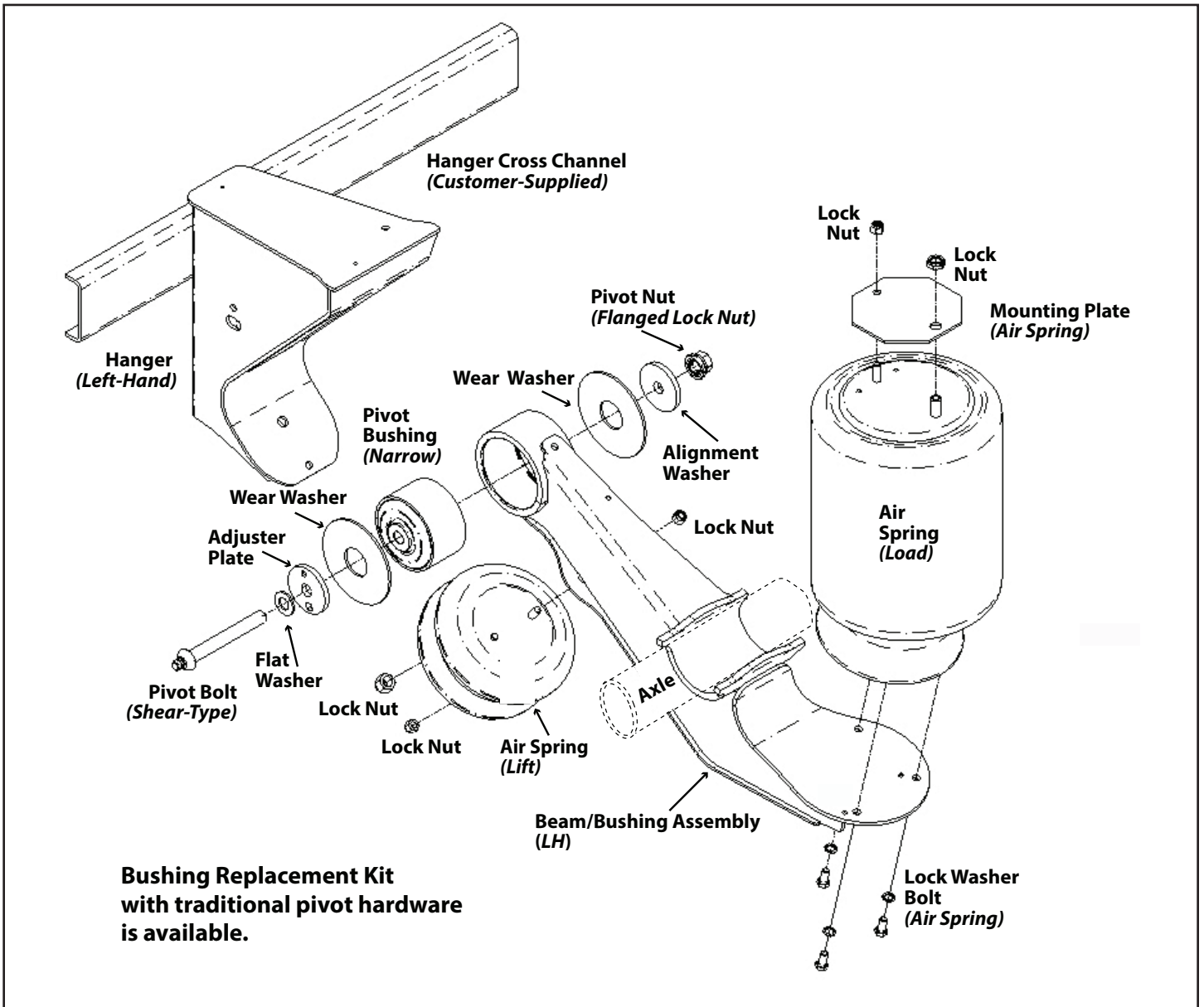


Figure 7.
RCA-215T Trailer Suspension
 Refer to the engineering drawing for the individual component part number.

RCA 215T Trailer Suspension – Bushing Replacement Kit

Suspension Type	Bushing Rplcmnt Kit Part No.	Bushing Rplcmnt Tool Part No.	Pivot Hardware	Torque Specification	
				foot-pound	Newton-meter
All Models	6040078	6100044	Traditional - Hex Head Cap Screw-HHCS/Lock Nut	500 ft-lb	678 N-m
All Models	6040128	6100044	Shear-Type	Use a 1" drive impact wrench to tighten pivot bolt until the Torx® head is sheared off.	

CAUTION Failure to install and maintain suspension component fasteners at torque specifications could result in suspension failure and void the warranty. Refer to the engineering drawing for torque values.

Bushing Replacement Procedure

Park the vehicle on a level surface. Chock wheels to keep vehicle from moving. Raise vehicle to height that removes load from suspension and support with jack stands. Disconnect the linkage from the height control valve(s), if equipped. Exhaust all air from the air system.

CAUTION Failure to properly chock wheels, exhaust the air system and safely support the vehicle could allow vehicle/suspension movement that could result in serious injury.

Disassemble suspension

Remove wheels and tires, if necessary. Remove pivot hardware and alignment plate. Inspect the alignment plate and repair/replace, as needed. Discard pivot hardware (new hardware and wear washers are included in the bushing replacement kit).

Rotate trailing arm beams down and out of the hangers. Inspect the pivot bolt holes and the hanger surfaces for unusual wear or damage. Repair or replace components, as needed.

Bushing Removal

Bushing Replacement Tool-6100044

- Lubricate the threads of the hex nut-threaded rod assembly, the inside threads of the plunger, and the end cap bearing with grease.
- Assemble the bushing replacement tool and place on the eye of the beam (Figure 8).
NOTE: Cone is tapered inside to a smaller opening on one end.
 - Place the end cap on the hex nut-threaded rod assembly. The end cap should be seated on the flange of the hex nut. Place the larger opening of the cone against the end cap.
 - Insert the threaded rod through the bushing sleeve and center the tapered end of the cone on the beam eye.
 - Thread the plunger onto the threaded rod. Rotate the plunger until the plate is seated snugly against the bushing.
- Use a 3/4" drive impact wrench on the hex nut to rotate the threaded rod and press the bushing out of the beam eye into the cone.

NOTE: A small amount of heat may be required to break the bond between the bushing and the beam eye. Do not overheat. Allow beam to cool before installing the new bushing.

- Disassemble the bushing replacement tool. Remove old bushing from the cone and discard.

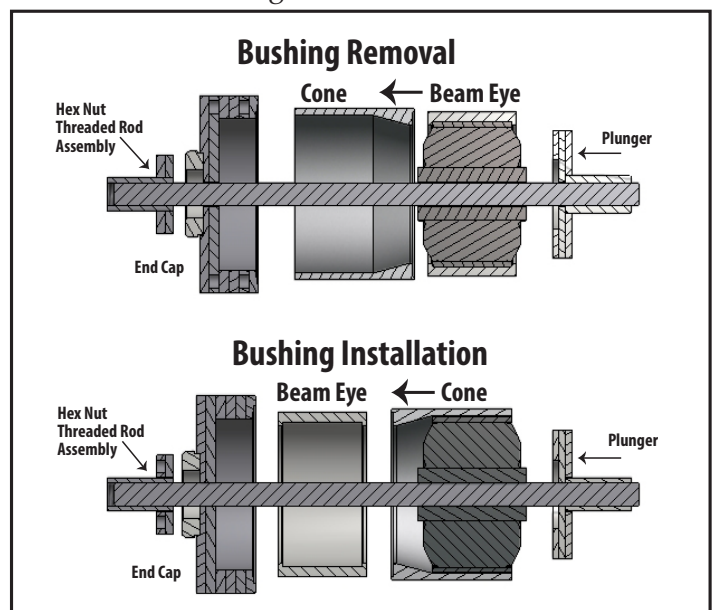


Figure 8.
The tapered end of cone allows bushing to expand during removal.

New Bushing Installation

1. Clean foreign debris/corrosion out of beam eye.
2. Liberally apply P80[®] lubricant or soap solution to the inside of the beam eye, the outside of the bushing and the inside of the cone.
3. Cone is tapered inside to a smaller opening on one end. Insert new bushing into the larger opening.
4. Assemble the bushing replacement tool and place on the eye of the beam (Figure 9).
 - 4.1 Place the end cap on the hex nut-threaded rod assembly. The end cap should rest on the flange of the hex nut.
 - 4.2 Insert the threaded rod/end cap assembly through the beam eye. Place the tapered end of the cone onto the threaded rod and center the cone on the beam eye.
 - 4.3 Thread the plunger onto the threaded rod. Rotate the plunger until the plate is seated snugly against the bushing.
5. Use 3/4" drive impact wrench on the hex nut to rotate threaded rod and press bushing into the beam eye. NOTE: Hold the plunger with an open end wrench to prevent the cone from rotating.
6. Disassemble and remove the bushing replacement tool. Check the placement of the bushing to make sure it is centered in the beam eye.

Reassemble suspension

Rotate trailing arm beams into hangers. Install pivot connection hardware – alignment washers, adjuster plates, wear washers, shear-type pivot bolt, flat washer and flanged lock nut.

NOTE: Tighten flanged lock nut until adjuster plate pin is engaged and pivot hardware is snug against hanger. Do not apply final torque until axle alignment has been checked.

Connect height control valve linkage, if necessary. Inflate air springs. Install wheels and tires (if removed). Raise vehicle and remove support stands. Lower vehicle to ground.

Check axle alignment and realign, if necessary. Tighten pivot bolt with a 1" drive impact wrench and E-20 Torx[®] socket (Ridewell tool 6100054) until the Torx[®] head is sheared off.

NOTE: If traditional pivot hardware is used, torque to 500 ft-lb (678 N-m).

⚠ CAUTION Failure to torque pivot hardware to specifications can result in suspension failure and void the warranty.

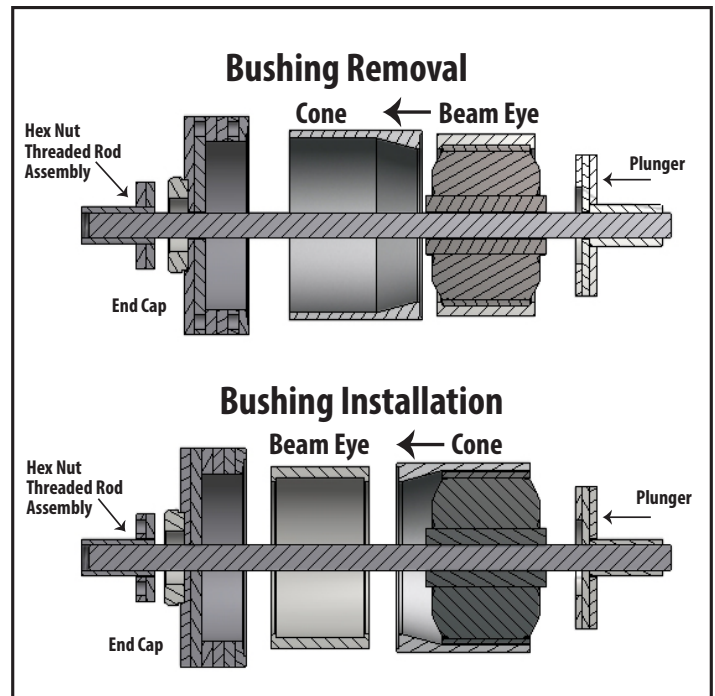


Figure 9.
Bushing Replacement Tool-6100044.
The tapered end of cone compresses the bushing for installation.

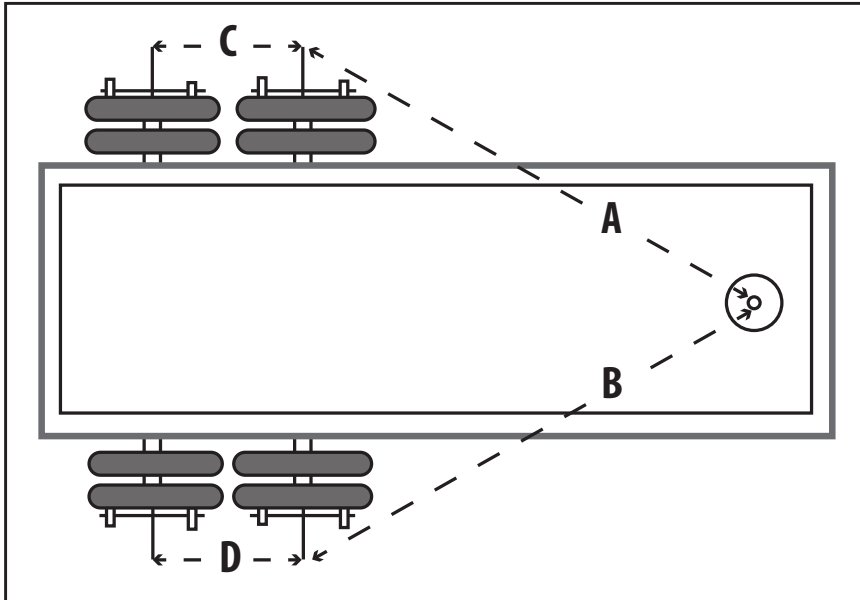
RCA-215T Trailer Suspension – Torque Specifications

Fastener Type	Size	Torque Specifications	
		foot-pound	Newton-meter
Pivot Bolt - (Shear-Type) Pivot Nut - (Lock Nut) <i>Requires E-20 Torx® socket (RW #6100054)</i>	7/8" - 9NC	Use a 1" drive impact wrench to tighten pivot bolt until Torx head is sheared off.	
Pivot Bolt - Hex Head Cap Screw (HHCS) Pivot Nut - (Lock Nut)	7/8" - 9NC	500 ft-lb	678 N-m
Lock Nut - (Air Spring)	1/2" - 13NC	25 ft-lb	34 N-m
Lock Nut - (Air Spring)	3/4" - 16NF	50 ft-lb	68 N-m
Bolt (HHCS) Lock Nut - (Shock Absorber-Optional)	3/4" - 10NC	160-200 ft-lb	217-271 N-m
<p><i>Torque values reflect a lubricated thread condition (Nuts are pre-lubed). Do not overtorque.</i></p> <p>⚠CAUTION <i>Suspension is shipped with minimal torque applied to fasteners. It is the installer's responsibility to apply the proper torque values. All fasteners, except shear-type pivot bolt, MUST be re-torqued after the first 6,000 miles of operation. Failure to install and maintain fasteners at torque specifications could result in suspension failure and void the warranty. Refer to the engineering drawing for torque specifications.</i></p>			

Axle Alignment

Alignment should be performed on a level surface with the suspension at the desired ride height. Refer to the engineering drawing for the designed ride heights of the suspension model.

Align the suspension per TMC or SAE recommended standards. On a multiple-axle vehicle, the forward axle is moved into the proper alignment, then the remaining axles are positioned so that they are parallel to the forward axle. A maximum tolerance of 1/8-inch difference from side-to-side of the forward axle and 1/16-inch difference from side-to-side for the aft axles is acceptable (Figure 10).



Check the forward axle alignment by measuring from the kingpin to both ends of the axle centers.

If the difference between the "A" measurement and the "B" measurement is greater than 1/8-inch, the forward axle needs to be aligned.

If the difference between the "C" measurement and the "D" measurement is greater than 1/16-inch, the aft axle should be adjusted into alignment.

Figure 10.
Kingpin measurement for alignment.

Speed Set™ Alignment

The RCA-215 Auxiliary Axle Trailer Suspension is equipped with the Ridewell Speed Set® alignment feature for simple, manual alignment of the axles.

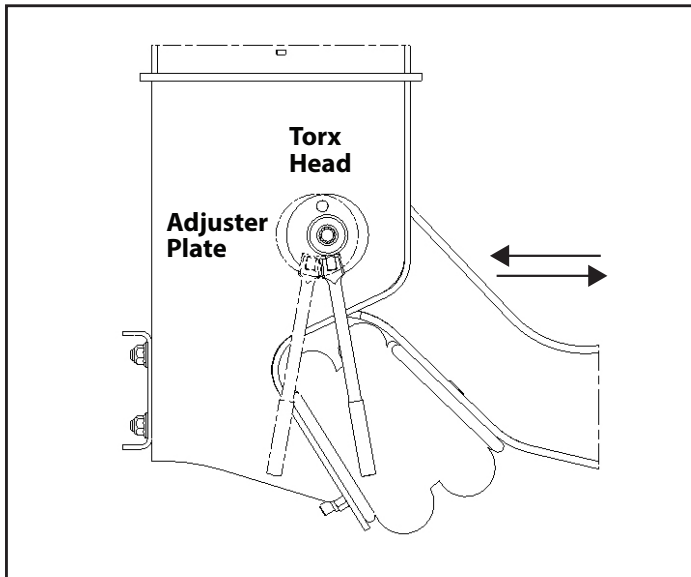


Figure 11.
Move beam back-and-forth using adjuster plate and breaker bar until axle is aligned.

Axle alignment procedure

1. Loosen the pivot nut enough for beam to move within hanger. Position beam so that pivot bolt is centered within alignment slot on the hanger.
2. Locate the adjuster plate at the pivot connection. Insert a 1/2"-shank breaker bar into the square hole of the adjuster plate. Push on the breaker bar to move the beam forward or backward until the axle reaches the alignment measurements (Figure 11).

NOTE: Check to make sure that the pivot bushing is not wedged sideways during beam movement. The adjuster plate and alignment washer should move in unison with the beam.

3. Tighten the pivot nut so that the beam can no longer move. Re-check alignment measurements and adjust, if necessary.

NOTE: Check to make sure that both the adjuster plate and alignment washer are flat against the beam before final torque is applied.

4. Use a 1" drive impact wrench with an E-20 Torx® socket to tighten the pivot bolt until the Torx head shearoff.

CAUTION Failure to properly torque pivot hardware could result in catastrophic suspension failure and void the warranty (See Torque Chart in Appendix).

WARRANTY

Terms and coverage in this warranty apply only to the United States and Canada.

Ridewell Suspensions warrants the suspension systems manufactured by it to be free of defects in material and workmanship. Warranty coverage applies only to suspensions that have been properly installed, maintained and operated within the rated capacity and recommended application of the suspension. The responsibility for warranty coverage is limited to the repair/replacement of suspension parts. The liability for coverage of purchased components is limited to the original warranty coverage extended by the manufacturer of the purchased part.

All work under warranty must have prior written approval from the Ridewell warranty department. Ridewell has the sole discretion and authority to approve or deny a claim and authorize the repair or replacement of suspension parts. All parts must be held until the warranty claim is closed.

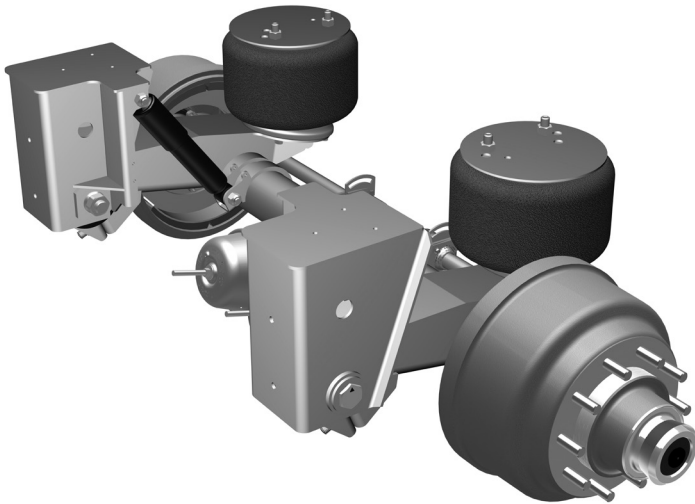
Parts that need to be returned for warranty evaluation will be issued a Returned Materials Authorization (RMA). Parts must be returned to Ridewell with the transportation charges prepaid. The transportation charges will be reimbursed if the warranty claim is approved.

This non-transferable warranty is in lieu of all other expressed or implied warranties or representations, including any implied warranties of merchantability or fitness or any obligations on the part of Ridewell. Ridewell will not be liable for any business interruptions, loss of profits, personal injury, any costs of travel delays or for any other special, indirect, incidental or consequential losses, costs or damages caused by Ridewell.

Contact the Ridewell Warranty Dept. at 417.833.4565 - Ext. 135, for complete warranty information.

RAR-240

Trailer Air-Ride Suspension



Installation and Service Manual

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Warranty 16



Part No.: 9710105

Doc.: 240-Trailer-ISM-RevB-04-04-17

SUSPENSION IDENTIFICATION

Introduction

It's important that the proper suspension model be chosen for the application in which it is to be used. The Ridewell Air Ride (RAR) 240 Trailer Suspension is available in an overslung, underslung or yoke mount configuration for use in a range of applications. The suspension can be purchased with or without an integrated axle.

Refer to the engineering drawing for detailed information on the suspension system components and operating parameters.

Read through the entire Installation and Service Manual (ISM) before performing any installation or maintenance procedures.

Serial Identification Tag

Ridewell suspension systems and axles can be identified by the Part and Serial Number listed on the serial identification tags.

Suspension Serial Tag

The Suspension Serial Tag provides information on the suspension model (Figure 1).

The **Part Number (240xxxx)** refers to the individual suspension system.

The nine-digit **Serial Number (1xxxxxxx)** refers to the date and order of manufacture of the suspension.

Please refer to both the part number and serial number when contacting Ridewell for customer service, replacement parts and warranty information.

Axle Body - Serial Tag

Ridewell-branded axles will have a tag attached to the axle tube listing the **Part Number (165xxxx)** and **Serial Number** of the axle body (Figure 2).

Notes and Cautions

All work should be performed by a properly trained technician using the proper/special tools and safe work procedures.

The ISM uses two types of service notes to provide important safety guidelines, prevent equipment damage and make sure that the suspension system operates correctly. The service notes are defined as:

“NOTE”: Provides additional instructions or procedures to complete tasks and make sure that the suspension functions properly.

CAUTION Indicates a hazardous situation or unsafe practice that, if not avoided, could result in equipment damage and serious injury.

 RIDEWELL SUSPENSIONS	
PART NO:	
SERIAL NO:	
GROSS AXLE WEIGHT RATING CERTIFICATION IS PER THE FINAL STAGE MANUFACTURER OR ALTERER.	
THIS PRODUCT MAY BE COVERED UNDER ONE OR MORE PATENTS. ADDITIONAL PATENTS MAY BE PENDING.	
FOR MORE INFORMATION ON PATENT OR SUSPENSION/AXLE CAPACITY RATING CONTACT RIDEWELL CORPORATION.	
www.ridewellcorp.com	(800) 641-4122

Figure 1. The Suspension Serial Tag is located on the left-hand (driver's side) suspension hanger.


 RIDEWELL SUSPENSIONS			
MODEL:		PART NO.	
SERIAL NO.		CAPACITY	TON

Figure 2. Ridewell axles have a serial identification tag listing the Part Number (165xxxx) and Serial Number of the axle body.

Prior to Installation

Refer to the engineering drawing to confirm dimensional requirements and the range of ride heights available.

The suspension is designed to fit up onto standard I-beam trailer frames at beam centers that correspond to standard axle track widths (Figure 3).

Installation at wider beam centers will reduce suspension clearances. Installation at narrower beam centers will de-rate the axle beam capacity.

For non-standard beam centers, frames, frame centers, axle track widths and wheel-end equipment, the installer is responsible for verifying clearances, axle capacity, proper fit-up, and any additional required support structure.

Installations can vary and procedures should be adapted for different vehicles, as needed.

- The Gross Axle Weight Rating (GAWR) is determined by the system component with the lowest load rating. Please consult with tire, wheel, axle and brake manufacturers before installation to determine the GAWR.
- If vehicle chassis modifications are required, consult with the vehicle manufacturer to ensure that such changes are permitted.
- Welding or altering suspension components is not permitted without the express written permission of Ridewell Suspensions.

Installer Responsibilities

The installer of the suspension has the sole responsibility for proper attachment of the suspension system to the vehicle chassis.

- The installer is responsible for locating the suspension system on the vehicle to provide the proper load distribution.
- The installer must verify that vehicle crossmembers are positioned to support the suspension at the installing location.
- It is the installer’s responsibility to determine that axle spacing conforms to any applicable federal and local bridge laws.
- The installer must verify that air reservoir volume requirements are met after suspension installation. Consult the vehicle manufacturer or Federal Motor Vehicle Safety Standards (FMVSS) 121 for more information.
- The installer must verify there is sufficient clearance for proper functioning of the suspension, air springs, brake chambers, axle and tires.

Figure 3. Standard Trailer Dimensions

Trailer Width	Axle Track Width	Frame Center	Beam Center	Air Spring Center
96"	71.5"	38"	35"	31"
102"	77.5"	44"	41"	37"

Axle Integration

Suspension systems are available with and without a factory integrated axle. Customer-supplied axle assemblies must be positioned and oriented (rotated) properly before welding the axle.

Use the top-center mark on the axle, if available, to identify the center of the axle and orient the axle assembly on the suspension. The axle assembly should be installed so that the camshafts, when activated, rotate in the same direction as the wheels.

CAUTION Failure to follow procedures and design specifications could result in injury, damage to the axle or suspension and void the warranty.

Weld Preparation

The joint to be welded should be positioned in the flat or horizontal position. All grease, dirt, paint, slag or other contaminants must be removed from the weld joint.

The axle and suspension components should be at a minimum temperature of 60°F (15.5°C). Pre-heat the weld zone to the axle manufacturer's recommended pre-heat temperature, if required.

Weld Procedure

Ridewell recommends supporting the axle and suspension with a weld fixture during axle integration. Contact Ridewell Customer Service for the correct weld fixture for your suspension model.

1. Center the axle assembly between the beam centers (Figure 4).
2. Check the engineering drawing for the brake component orientation (rotation) before clamping into place and making the final welds.
 - 2.1 Drum brake camshafts are spaced off the tail of the trailing arm beam. Make sure the brake chamber brackets are oriented properly and clamp the axle assembly into place.
 - 2.2 Disc brake assemblies have a right- and left-hand caliper assembly. Make sure the callipers are located on the correct side and rotated to the proper position before clamping the axle assembly into place.
3. Check the gap between the axle and the axle seats before welding (Figure 5). Side gaps should be no greater than 1/8". The gap at the bottom of the axle seat should be no greater than 1/16".
4. Weld the axle to the seat according to Ridewell Weld Process #1 (Page 5).

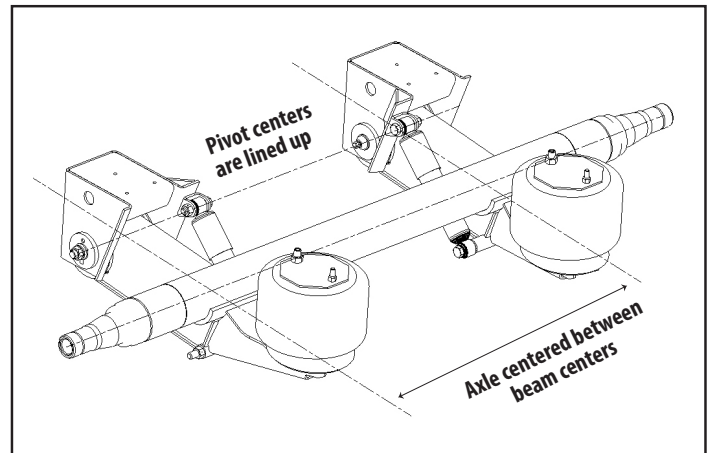


Figure 4. Axle should be centered between beam centers. Beams and axle should be perpendicular. Refer to the engineering drawing for measurements.

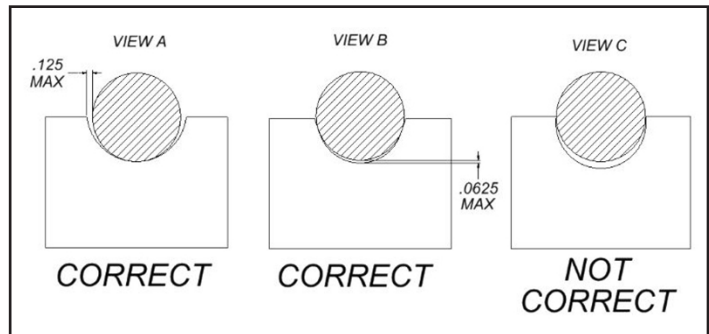
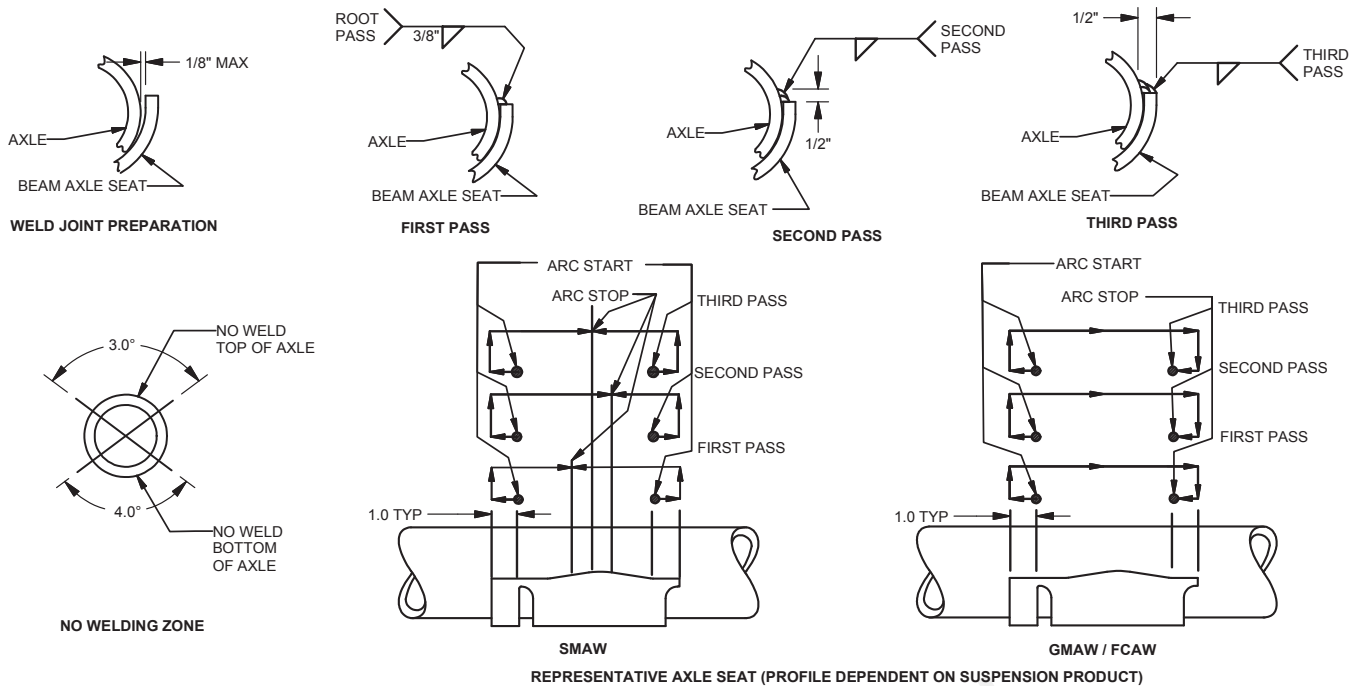
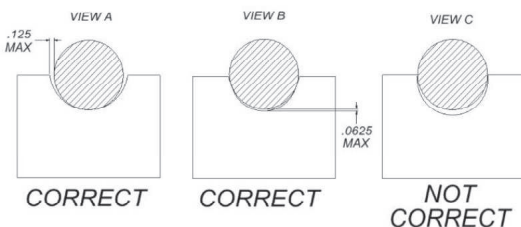


Figure 5. Correct axle tube seating for welding.



- 1 - CAUTION: All welds must be kept away from the top and bottom of the axle where maximum stresses occur (see "NO WELDING ZONE" illustration above). Do not test-weld the arc on any part of the axle tube.
- 2 - All welders and welding operators should be certified as per the requirements of the American Welding Society (AWS) or equivalent. All electrodes used should meet the AWS specifications and classifications for welding carbon and low-alloy steels.
- 3 - Recommended Welding Methods: Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW) or Flux Cored Arc Welding (FCAW). The welding method used and the electrode selected must develop a minimum weld tensile strength of 70,000 psi per AWS specifications. The best fusion and mechanical properties will be obtained by using the voltage, current, and shielding medium recommended by the electrode manufacturer. If the SMAW method is used, the stick electrodes must be new, dry, free of contaminants and stored per AWS specifications.
- 4 - Weld Joint Preparation: The joint to be welded should be positioned in the flat or horizontal position. All grease, dirt, paint, slag or other contaminants must be removed from the weld joint without gouging the axle tube. CAUTION: Never weld when the axle is cold. The axle and beam assemblies to be welded should be at a temperature of at least 60F (15°C). Pre-heat the weld zone to the axle manufacturer's recommended pre-heat temperature, if required. This will reduce the chance of an area of brittle material forming adjacent to the weld.
- 5 - The axle should fit into the beam assembly with a maximum root gap of 1/8-inch between the axle and the beam axle seat (see "WELD JOINT PREPARATION" illustration above).
- 6 - NOTE: Clamp the axle to the beam axle seat with a C-clamp prior to welding to make sure that proper contact occurs (see "CORRECT" illustration below).
- 7 - Ground the axle to one of the attached axle parts such as the brake chamber brackets, cam brackets or brake spider. Never ground the axle to a wheel or a hub as the spindle bearing may sustain damage.
- 8 - Multiple pass welding should be used on the beam/axle connection using the following guidelines: 8.1-Total fillet weld size should be 1/2-inch. 8.2-Weld pass starts and stops should be performed as illustrated above. 8.3-Never start or stop welds at the end of the weld joint. 8.4-Each pass must be accomplished in one or two segments. 8.5-Start welds at least 1-inch from the end and backweld over the start. Backstep fill all craters. 8.6-If process is not GMAW all slag must be removed between passes. 8.7-Welds must go to within 1/8-inch +/- 1/16-inch of the ends of the axle seat and must not go beyond or around the ends of the axle seat. 8.8-Post-weld peening is recommended, but not required: Needle peen the entire toe of the second pass, including around the ends of the axle seat. Hold the needles perpendicular to the axle. A uniform dimpled pattern will appear when properly peened.



F	16101	ADDED MAXIMUM TO 5, ADDED GMAW NOTE TO 8.6 UPDATED CORRECT VIEWS	2/10/2016	G.H.	B.B.	CJB
E	15101	REVISED TEXT. REMOVED LIST OF MODELS.	6/30/15	G.H.	MDJ	CJB
REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD
DRAWN BY: CBC		2/1/2016		RIDEWELL CORPORATION PO BOX 4586 SPRINGFIELD, MISSOURI 65808		
CHECKED: MDJ		2/21/2003				
APPROVED: CJB		2/21/2003				
PROJECT NO: 03103		SCALE: A-SIZE: NTS		TITLE: RIDEWELL WELD PROCESS #1, 5" DIA. AXLE, 3 PASS WELD		
MATERIAL: -		WEIGHT: -		SHEET 1 OF 1		REV: F
				PART NO: WELD PROCESS #1		

Mounting the suspension to the frame

Refer to the engineering drawing for the range of ride heights available, torque values, spacing and clearance requirements of the suspension.

Recommended locations of customer-furnished filler plates and supporting crossmembers for the suspension hangers and air spring mounting plates are shown on the engineering drawing.

The suspension installer has the final responsibility of attaching the suspension to the vehicle frame.

Weld-On Installation Procedure

CAUTION Welding method must use a minimum weld tensile strength of 70,000 psi, per AWS specifications.

1. Mark the desired location of the hangers and filler plates on the vehicle frame. Hangers must be installed parallel to each other for proper axle alignment.
2. Mark the desired location of the air spring mounting plates and filler plates on the frame.
3. Install filler plates for the hangers and air spring mounting plates on the frame. Weld filler plates to crossmembers with ¼" fillet welds down the length of the crossmember.
4. Weld the hangers to the frame/filler plates with 1/4" fillet welds completely around the hangers. Stop the welds 1/2" from the corners and edges.
 - 4.1 For hangers with wing gussets, the wing gussets must be welded to a crossmember or other supporting structure.
 - 4.2 A length of 1 1/2"-diameter pipe can be placed through the holes in the two hangers to help with stabilization and alignment.
5. Weld the air spring mounting plates to the frame/filler plates with 3/16" fillet welds.
6. Attach a crossmember or diagonal brace to the front of the hangers with 1/4" fillet welds.

Bolt-On Installation

Before installation, check to make sure that wires, hoses or other components will not be affected by drilling into the frame rail.

- Bolts/nuts for attaching the suspension to the vehicle are supplied by the installer. Grade 8 bolts and flanged lock nuts or lock nuts with hardened washers are recommended.
- Bolt holes are not provided in the air spring mounting plates. Clamp mounting plates and filler plates (if necessary) in place before drilling.

Final Assembly and Inspection

- Verify the welds of the hanger and air spring mounting plates.
- Check the location for sufficient clearances of suspension components.
- Attach beam and axle assemblies to hangers. Note: Do not fully torque pivot hardware until axle alignment is completed.
- Complete assembly and installation of air springs as shown on the engineering drawing. Torque to specifications (See Appendix).
- Install shock absorbers. NOTE: If the suspension is painted after shocks are installed, make sure paint overspray does not get under the shock absorber dust covers.
- Install/connect the height control valve (HCV), if applicable (Page 7). Check the air system tubing and fittings after installation for leaks.
- Verify the suspension ride height is adjusted within the range shown on the engineering drawing and complete axle alignment procedure (Appendix).

CAUTION Failure to torque bolts/nuts of suspension components to specifications can result in failure of the suspension and void the warranty.

Install the height control valve

The Ridewell Extreme Air® Height Control Kit (HCK) automatically adds and exhausts air from the air suspension to maintain the vehicle ride height as loads increase and decrease. The (HCK) assembly consists of a lever arm connected to the height control valve (HCV) and a vertical rod arm (vertical linkage) connected to the suspension/axle (Figure 6).

Refer to the Extreme Air® installation guide for installation procedures. Be sure to check the air system after installation for leakage. **CAUTION** The installer is responsible for making sure that air system requirements comply with the appropriate Federal Motor Vehicle Safety Standards.

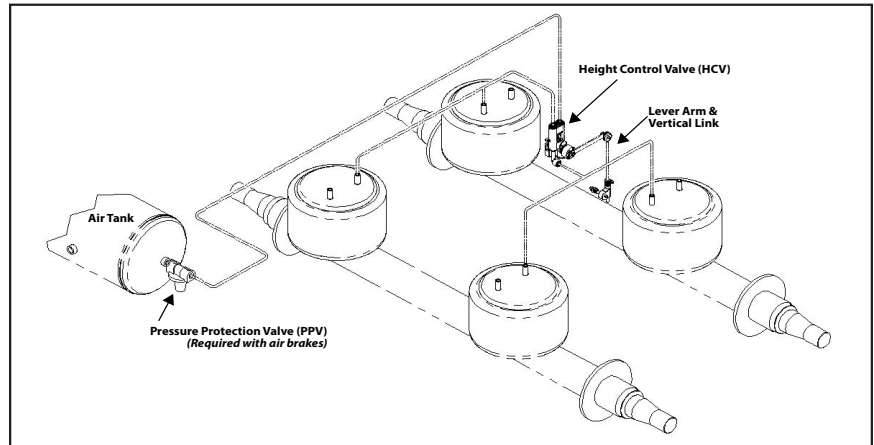
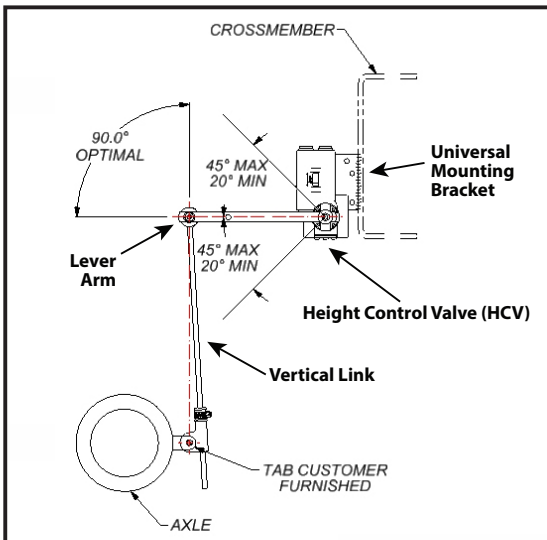


Figure 6.
Example of single Height Control Valve (HCV) installation on vehicle frame with linkage attached to the axle.

Troubleshooting – Height Control Valve Installation

Problem	Possible Cause	Corrective Action
HCV is not receiving air/ HCV is not delivering air to the air springs.	<ul style="list-style-type: none"> Blocked air supply line. Air tank is not filling/reaching set pressure. Pressure Protection Valve (PPV) not working correctly. Pilot port is not plumbed or is plumbed incorrectly. 	<ul style="list-style-type: none"> Verify air lines are pressurized by removing supply line at HCV. Check for pinched lines. Verify air tank pressure with manual/in-line pressure gauge. Check PPV operation by making sure that valve opens when system reaches the desired pressure set-point (<i>usually greater than 70 psi</i>). Check HCV configuration – Non-Dump; Pressure-Dump (Normally Open); Zero-Pressure Dump (Normally Closed). Reinstall, if necessary.
Air springs fill but do not exhaust.	<ul style="list-style-type: none"> Obstructed air line. HCV installed backwards. Supply line installed in suspension port 	<ul style="list-style-type: none"> Disconnect linkage and rotate actuating lever to down position (exhaust). If springs remain inflated, check for pinched/blocked lines. Check installation. Reinstall, if necessary. Move air supply line to HCV supply port.
Air system leaks down in a short period of time.	<ul style="list-style-type: none"> HCV installed backwards. Leak in air system beyond accepted standards. 	<ul style="list-style-type: none"> Disconnect HCV linkage and rotate actuating lever to the up position (fill). If air springs do not inflate, reinstall HCV. To find leak in the HCV area, pressurize system and spray soapy water solution onto the valve and lines. Check for bubbles (leaks): No leak found – Do not remove valve, check the rest of the system for leaks. Check that tubing cuts are straight and smooth. Re-cut and reassemble if necessary.

MAINTENANCE

A visual inspection of the suspension structure should be performed during each pre-trip/safety inspection. Ridewell Suspensions recommends the following minimum service intervals for standard duty, on-highway usage applications. More frequent intervals are recommended for heavier duty applications.

Daily/Pre-Trip Inspections

- ___ Check tires for proper inflation, damage or excessive wear.
- ___ Check wheel-ends for obvious signs of lubricant leakage. Check for missing components.
- ___ Check axle assemblies for damage or loose components.
- ___ Visually inspect suspension structure for signs of damage or excessive wear.
- ___ Check for loose or missing bolts/nuts. Check for irregular movement in suspension components.
- ___ Make sure air controls are operating properly. Drain all moisture from air reservoirs.

First 6,000 miles of use

- ___ Torque all suspension component bolts/nuts to specifications (Appendix/Engineering drawing).
- ___ Verify that the suspension is operating at the installed ride height.

Refer to the following Technology & Maintenance Council (TMC) publications for additional maintenance information:

TMC RP 609	Self-Adjusting and Manual Brake Adjuster Removal, Installation and Maintenance
TMC RP 618	Wheel Bearing Adjustment Procedure
TMC RP 619	Air System Inspection Procedure
TMC RP 622	Wheel Seal and Bearing Removal, Installation, and Maintenance
TMC RP 631	Recommendations for Wheel End Lubrication
TMC RP 643	Air Ride Suspension Maintenance Guidelines
TMC RP 728	Trailer Axle Maintenance

Every 12,000 miles of use

- ___ Inspect air springs for any damage or excessive wear. Torque air spring bolts/nuts to specifications (Appendix/Engineering drawing).
- ___ Check air lines and connections for leaks.

Every 50,000 miles of use

- ___ Torque all suspension component bolts/nuts to specifications (Appendix/Engineering drawing).

Annually/100,000 miles of use

- ___ Inspect pivot connection for worn pivot bushing and wear washers. Replace components, if necessary. Torque suspension component bolts/nuts to specifications (Appendix/Engineering drawing).
- ___ Check arm beam-to-axle connection welds.
- ___ Check lubrication level in wheel ends:
 - 1) Oil-Filled Wheel Ends:
Refill/Replace lubricant as needed (Refer to TMC RP 631 "100K/Annual Inspection").
 - 2) Semi-Fluid Grease:
Pull outer bearing and visually inspect lubrication level. Refill/Replace as needed (Refer to TMC RP 631 "Level 3 Lubrication Level Inspection" and TMC RP 618 "Wheel Bearing Adjustment Procedure").
- ___ Check air lines and connections for leaks.
- ___ Test air control system pressure protection valve (PPV), if equipped.
- ___ Check height control valve (HCV) adjustment.
- ___ Verify that the suspension is operating at the installed ride height.

CAUTION Failure to torque the bolts/nuts of suspension components to specifications can result in failure of the suspension and voiding of the warranty.

Pivot Bushing Inspection Procedure

Park the unloaded trailer on a level surface. Set the brakes and chock the tires so vehicle cannot move during inspection.

Insert the flat end of a pry-bar between one side of the hanger sidewall and the wear washers. Move the pry-bar back-and-forth and look for excessive movement of the beam (NOTE: A small amount of beam

movement because of the rubber flexing is normal). Inspect the wear washers for excessive wear/damage.

Repeat the pry-bar process and wear washer inspection on the other side of the hanger. If any large/easy movement or damaged wear washers is observed, drop the beams for further inspection. Replace components as necessary.

Figure 7.
RAR-240 -
25K Trailer
Suspension -
Overslung.

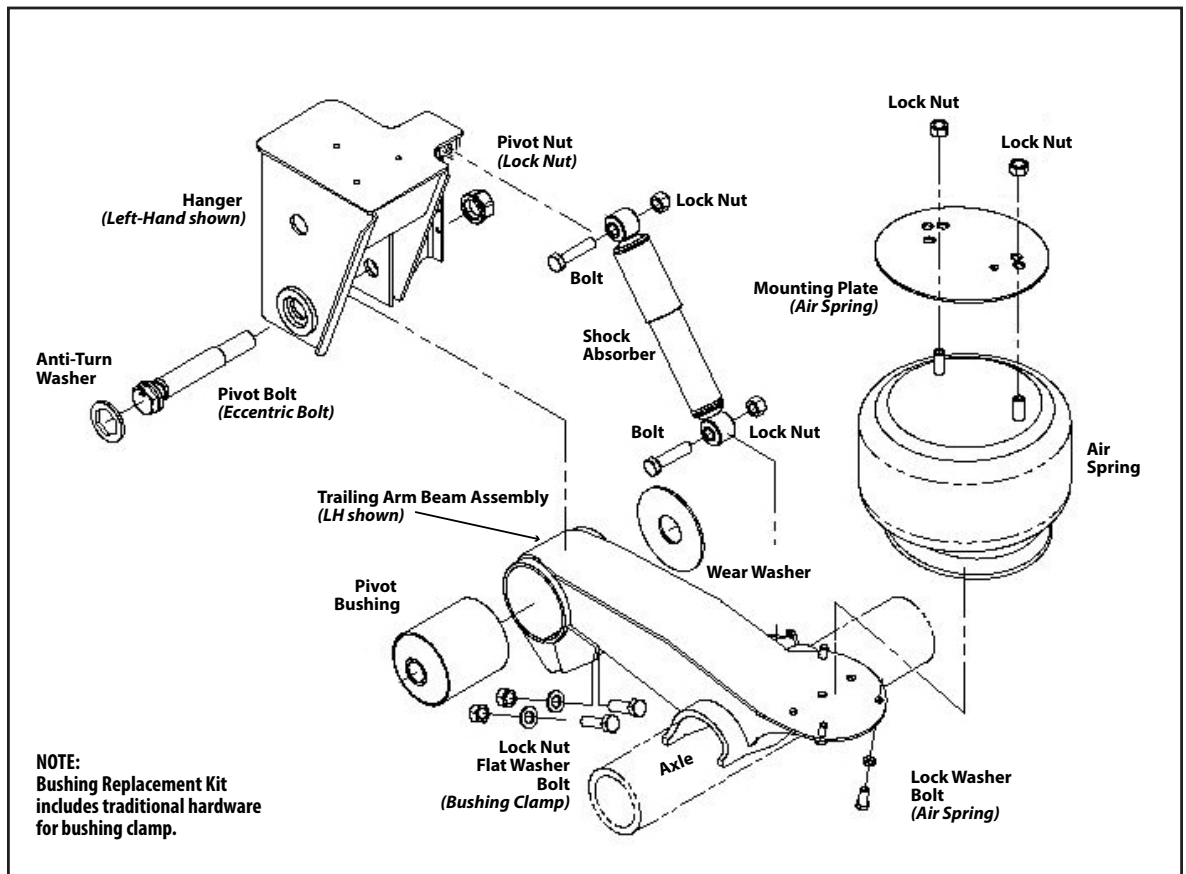
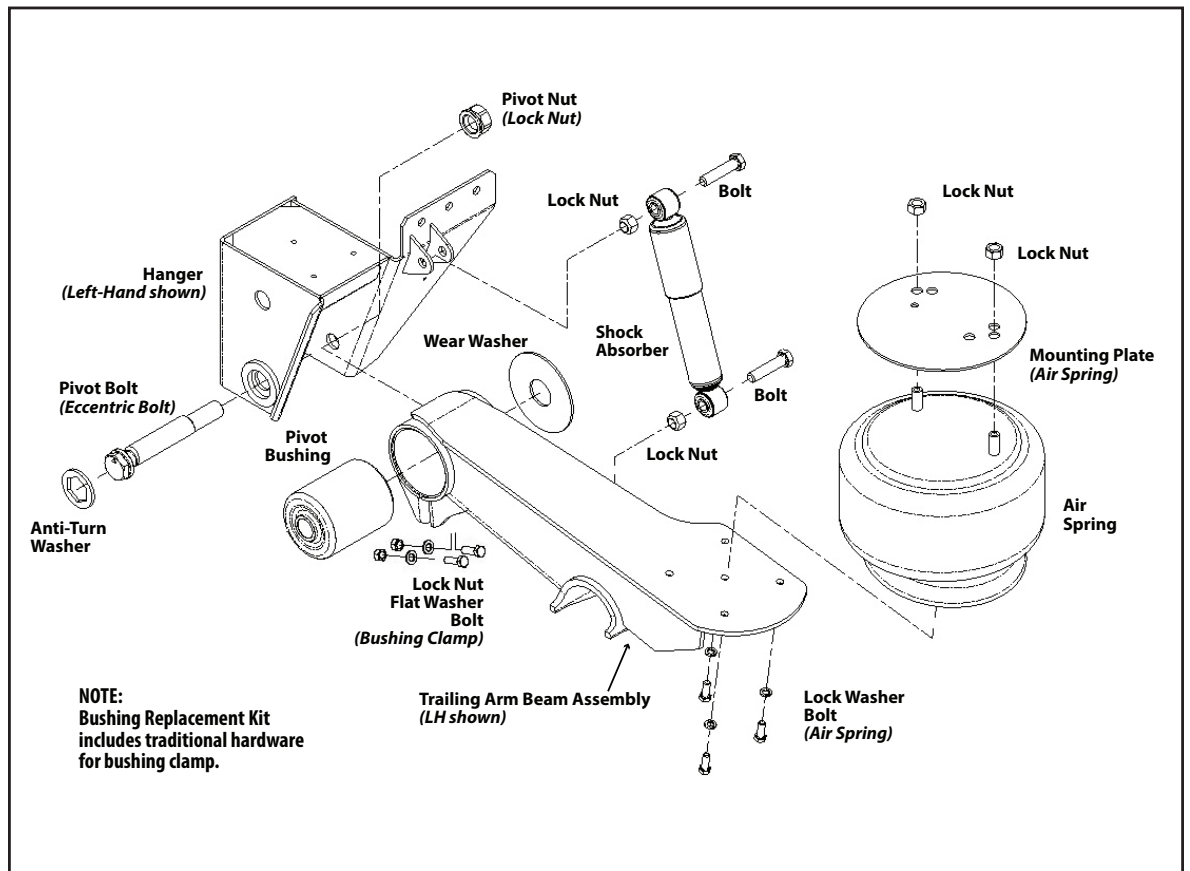


Figure 8.
RAR-240 -
30K Trailer
Suspension -
Overslung.

Refer to the engi-
 neering drawing
 for the individual
 component part
 number.



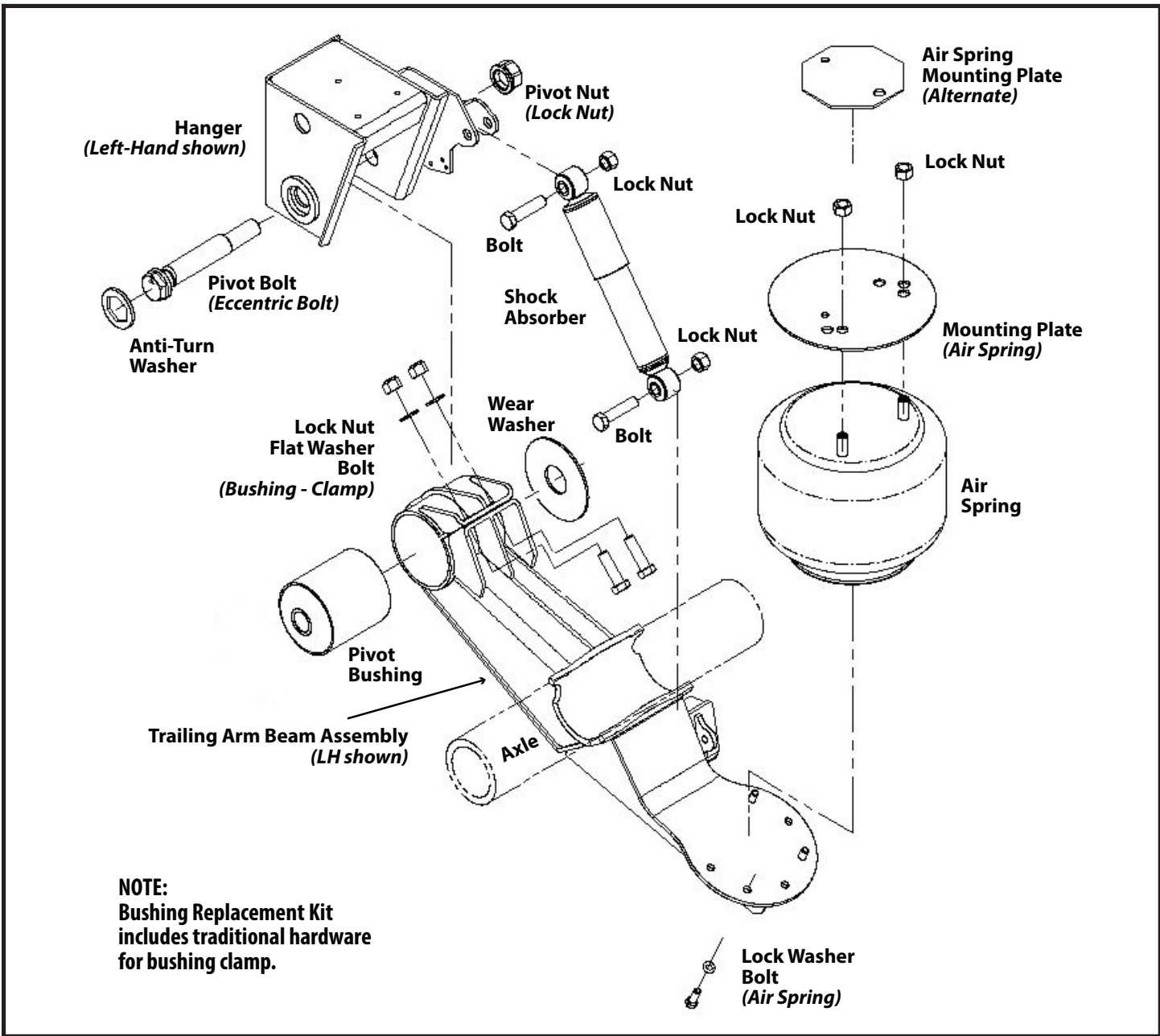


Figure 9.
RAR-240 - 25/30K Trailer Suspension – Underslung.
 Refer to the engineering drawing for the individual component part number.

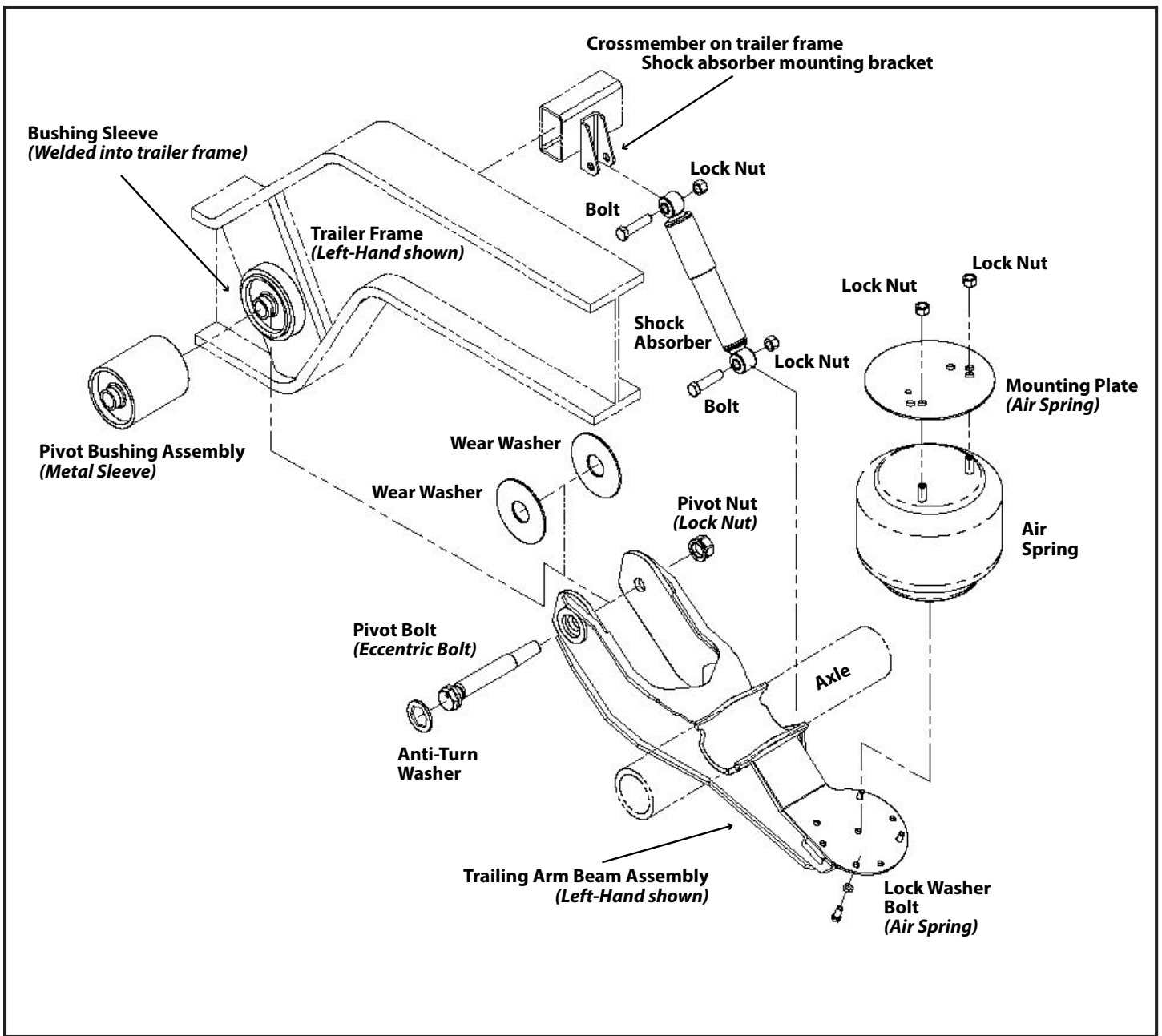


Figure 10.
RAR-240 Trailer Suspension – 25/30K Yoke Mount.
 Refer to the engineering drawing for the individual component part number.

RAR-240 Trailer Suspension – Bushing Replacement Kit

Suspension Type	Replacement Kit Part No.	Pivot Hardware	Torque Specifications	
			foot-pound	Newton-meter
15K - Underslung (u/s) (2400080)	6040029	Eccentric Bolt	1,000 ft-lb	1,350 N-m
25K - Standard underslung (u/s) or overslung (o/s)	6040029	Eccentric Bolt	1,000 ft-lb	1,350 N-m
30K - Standard u/s or o/s	6040028	Eccentric Bolt	1,000 ft-lb	1,350 N-m
25K - Tanker special - o/s	6040071	Eccentric Bolt	1,000 ft-lb	1,350 N-m
30K - Tanker special - o/s	6040091	Eccentric Bolt	1,000 ft-lb	1,350 N-m
25K/30K - Yoke Mount	6040011	Eccentric Bolt	1,000 ft-lb	1,350 N-m
Pre-1995 - 25K/30K; o/s or u/s	6047680B060	Eccentric Bolt	1,000 ft-lb	1,350 N-m

CAUTION Failure to install and maintain pivot hardware at torque specification could result in suspension failure and void the warranty. Refer to the engineering drawing for torque values.

Bushing Replacement Procedure – Overslung/Underslung Suspension

Park the vehicle on a level surface. Chock wheels to keep vehicle from moving. Raise vehicle to height that removes load from suspension and support with jack stands. Disconnect the linkage from the height control valve(s), if necessary, and exhaust all air from the air springs. **CAUTION** Failure to properly chock wheels, exhaust air system and raise and safely support the vehicle could allow movement resulting in serious injury.

Disassemble Suspension

1. Remove pivot nut. Remove the anti-turn washer from the eccentric bolt head by grinding away the welds. Locate arrow on bolt head. Turn bolt head until arrow points straight up. Remove bolt.
2. Rotate arm beams down and out of hanger. Inspect pivot bolt hole and hanger surfaces for wear or damage. Repair or replace components, if needed.

Bushing Removal

Remove Huck® fasteners from bushing clamp (Figure 11). Separate bushing clamp and remove pivot bushing assembly. NOTE: Bushing replacement kit includes traditional bolts, washers and nuts to replace the Huck® fasteners.

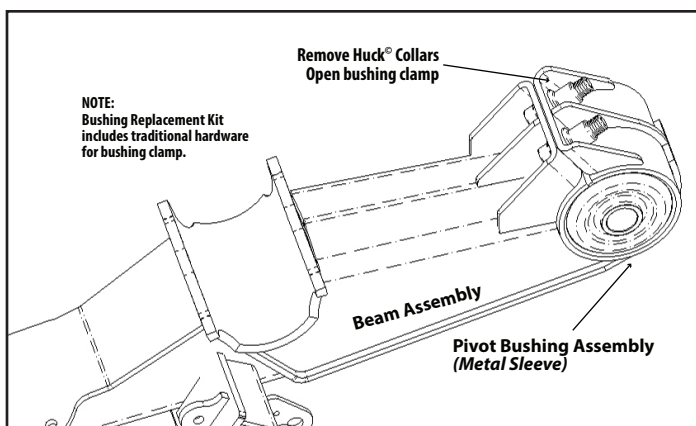


Figure 11.
Cut collars and remove bolts from bushing clamp.

New Bushing Installation

1. Insert new bushing assembly into bushing clamp. Install replacement bolts, washers and nuts.
2. Center bushing assembly on bushing clamp. Torque nuts on clamp to 190 ft-lb. Make sure bushing clamp surfaces are closed “metal-to-metal” and torque nuts to 280 ft-lb (380 N-m).

Reassemble Suspension

1. Rotate arm beams into hangers. Install new wear washer on inboard side of the beams. **CAUTION** Tanker Special/Yoke Mount suspension requires two (2) wear washers - one on the inboard and one on the outboard sides of the beams.
2. Coat the large diameter shank of the eccentric bolt with anti-seize compound, locate arrow on bolt head and install bolt with arrow pointing straight up.
3. Align the axle, if necessary (Appendix). Weld anti-turn washers over the eccentric bolt head with 1/4” fillet welds at the top and bottom of bolt head. With the suspension at ride height, torque pivot nut to 1,000 ft-lb (1,350 N-m).
4. Install shock absorbers.
5. Install wheels and tires (if removed). Raise the vehicle and remove support stands. Lower vehicle to the ground.
6. Connect height control valve linkage, if necessary, and adjust ride height.

Bushing Replacement Procedure – Yoke Mount Suspension

Park the vehicle on a level surface. Chock wheels to keep vehicle from moving. Raise vehicle to height that removes load from suspension and support with jack stands. Disconnect the linkage from the height control valve(s), if necessary. Exhaust all air from the air springs. Remove the wheels and tires, if necessary.

CAUTION Failure to properly chock wheels, exhaust the air system and support the vehicle could allow vehicle movement that could result in serious injury.

Disassemble Suspension

1. Remove pivot nuts. Remove the anti-turn washers from the eccentric bolt (pivot bolt) heads by grinding away the welds.
2. Locate arrow on eccentric bolt head, turn bolt head until arrow points straight up and remove bolt.
3. Rotate beams down and away from frame. Inspect the trailing arm pivot bolt holes and wear washers for unusual wear or damage. Repair or replace components as needed.

Bushing Removal and Installation

1. Remove the pivot bushing assembly from the bushing sleeve welded to the frame by grinding away the four (4) welds on each side of the sleeve.
2. Position (center) new bushing assembly into the bushing sleeve welded to the frame. Rotate (clock) the seam in the bushing assembly to -45° (Figure 12).

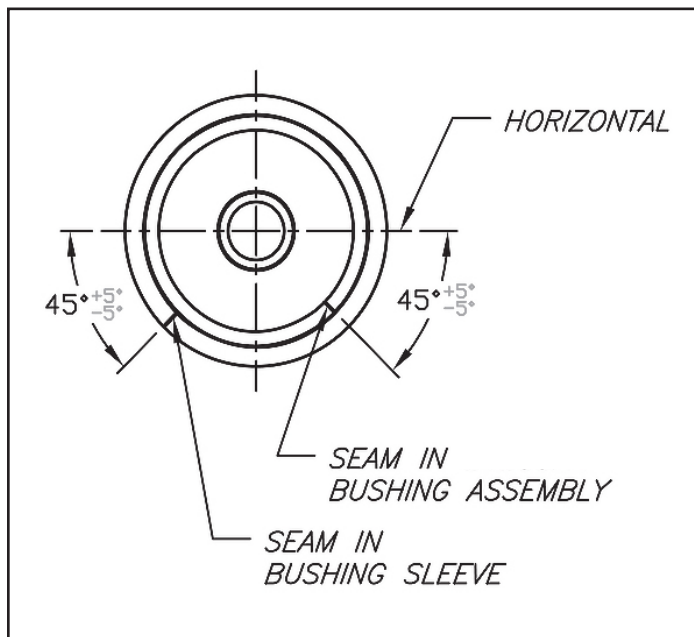


Figure 12.
RAR-240 Yoke Mount - Pivot bushing orientation.
Line up the seam of the bushing assembly to the seam of bushing sleeve in the frame at -45° .

3. Attach bushing assembly with four (4) one-inch welds on each side.

3.1 Welds should be staggered and the steel allowed to cool between welds.

3.2 Weld the top of the bushing sleeve at the outboard side of frame, then the bottom of the sleeve at the inboard side of frame and move the welds around the sleeve in 90° increments.

CAUTION Excessive heat and distortion can damage the bond between the rubber bushing and steel sleeve of the bushing assembly.

Reassemble suspension

1. Rotate trailing arm beams onto the frame. Install new wear washers on both the inboard and outboard side of the bushing assembly.
2. Coat the large diameter shank of the eccentric bolts with anti-seize compound, locate arrow on bolts and install bolts with the arrows pointing straight up.
3. Align the axle, if necessary (Appendix).
4. Weld anti-turn washers over eccentric bolt heads with 1/4" fillet welds at top and bottom of bolt head. With the suspension at ride height, torque pivot nut to 1,000 ft-lb (1,350 N-m).
5. Install shock absorbers.
6. Install wheels and tires (if removed). Raise vehicle and remove support stands. Lower vehicle to ground.
7. Connect height control valve linkage, if necessary, and adjust ride height.

CAUTION Failure to properly torque pivot hardware could result in catastrophic suspension failure and void the warranty

APPENDIX

RAR-240 Trailer Suspension - Torque Specifications

Fastener Type	Size	Torque Specifications	
		foot-pound	Newton-meter
Pivot Bolt (Eccentric Bolt) Pivot Nut (Lock Nut)	1 1/4"-7NC	1,000 ft-lb	1,350 N-m
Bolt/Lock Nut (Shock Absorber)	3/4"-10NC	200 ft-lb	270 N-m
Bolt/Lock Nut (Air Spring)	1/2"-13NC	25 ft-lb	35 N-m
Bolt/Lock Nut (Air Spring)	3/4"-16NF	50 ft-lb	70 N-m

Torque values reflect a lubricated thread condition (Nuts are pre-lubed). Do not overtorque.

⚠CAUTION Suspension is shipped with minimal torque applied to fasteners. It is the installer's responsibility to apply the proper torque values. All fasteners must be re-torqued after the first 6,000 miles of operation. Failure to install and maintain suspension component fasteners at torque specifications could result in suspension failure and void the warranty.

Axle Alignment

Alignment should be performed on a level surface with the suspension at the desired ride height. Refer to the engineering drawing for the designed ride heights of the suspension model.

Align the suspension per TMC or SAE recommended standards. On a multiple-axle vehicle, the forward axle is moved into the proper alignment, then the remaining axles are positioned so that they are parallel to the forward axle.

A maximum tolerance of 1/8-inch difference from side-to-side of the forward axle and 1/16-inch difference from side-to-side for the aft axles is acceptable (Figure 13).

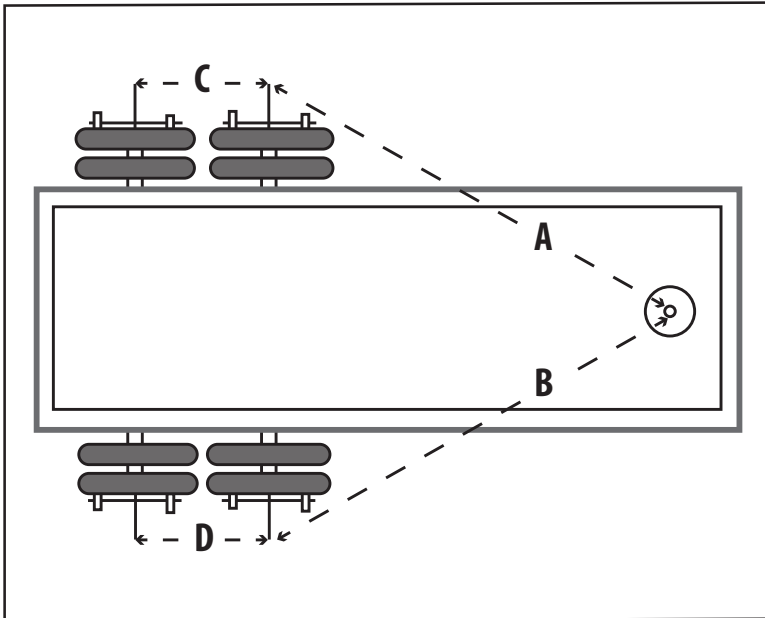


Figure 13.
Kingpin measurement for axle alignment.

Check the forward axle alignment by measuring from the kingpin to both ends of the axle centers. If the difference between the “A” measurement and the “B” measurement is greater than 1/8-inch, the forward axle needs to be aligned.

If the difference between the “C” measurement and the “D” measurement is greater than 1/16-inch, the aft axle needs adjustment.

Axle Alignment Procedure

1. Loosen the pivot nut enough for the beam to move. NOTE: If installed, remove the anti-turn washer by grinding away the welds.
2. Turn bolt head until arrow on bolt head points straight up (12 o’clock position).
3. Turn eccentric bolt to move beam forward or backward until axle reaches alignment.
CAUTION Do not turn arrow past the 9 o’clock or 3 o’clock position (horizontal).

4. Weld anti-turn washer over bolt head with 1/4” fillet welds at top and bottom (Figure 14).
5. Torque pivot nut to 1,000 ft-lb (1,350 N-m).

CAUTION Failure to properly torque pivot hardware could result in catastrophic suspension failure and void the warranty

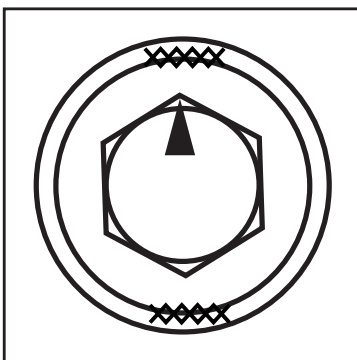


Figure 14.
Secure anti-turn washer with 1/4” fillet welds before applying final torque to pivot nut.

WARRANTY

Terms and coverage in this warranty apply only to the United States and Canada.

Ridewell Suspensions warrants the suspension systems manufactured by it to be free of defects in material and workmanship. Warranty coverage applies only to suspensions that have been properly installed, maintained and operated within the rated capacity and recommended application of the suspension. The responsibility for warranty coverage is limited to the repair/replacement of suspension parts. The liability for coverage of purchased components is limited to the original warranty coverage extended by the manufacturer of the purchased part.

All work under warranty must have prior written approval from the Ridewell warranty department. Ridewell has the sole discretion and authority to approve or deny a claim and authorize the repair or replacement of suspension parts. All parts must be held until the warranty claim is closed.

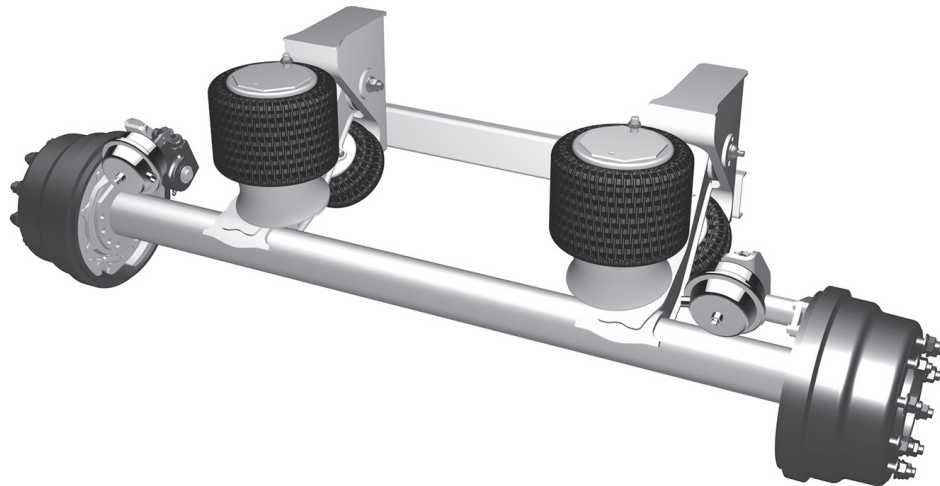
Parts that need to be returned for warranty evaluation will be issued a Returned Materials Authorization (RMA). Parts must be returned to Ridewell with the transportation charges prepaid. The transportation charges will be reimbursed if the warranty claim is approved.

This non-transferable warranty is in lieu of all other expressed or implied warranties or representations, including any implied warranties of merchantability or fitness or any obligations on the part of Ridewell. Ridewell will not be liable for any business interruptions, loss of profits, personal injury, any costs of travel delays or for any other special, indirect, incidental or consequential losses, costs or damages caused by Ridewell.

Contact the Ridewell Warranty Dept. at 417.833.4565 - Ext. 135, for complete warranty information.

RUL-245T - Trailer

NonSteerable - Auxiliary Axle Suspension



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Part No.: 9710110

Doc: 245T-Trailer-RevA-03-27-17

SUSPENSION IDENTIFICATION

Introduction

It's important that the proper suspension model be chosen for the application in which it is to be used. The Ridewell Universal Lift (RUL) - 245T Trailer Suspension is available for use in a range of applications. The suspension can be purchased with or without an integrated axle.

Refer to the engineering drawing for detailed information on the suspension system components and operating parameters.

Read through the entire Installation and Service Manual (ISM) before performing any installation or maintenance procedures.

Identification Tag

Ridewell suspension systems and axles can be identified by the Part and Serial Number listed on the serial identification tags.

Suspension Serial Tag

The Suspension Serial Tag provides information on the suspension model (Figure 1).

The **Part Number (245xxxx)** refers to the individual model of the suspension system.

The nine-digit **Serial Number (1xxxxxxx)** refers to the date and order of manufacture of the suspension.

Please refer to both the part number and serial number when contacting Ridewell for customer service, replacement parts and warranty information.

Axle Body - Serial Tag

Ridewell-branded axles will have a tag attached to the axle tube listing the **Part Number (165xxxx)** and **Serial Number** of the axle body (Figure 2).

Notes and Cautions

All work should be performed by a properly trained technician using the proper/special tools and safe work procedures.

The ISM uses two types of service notes to provide important safety guidelines, prevent equipment damage and make sure that the suspension system operates correctly. The service notes are defined as:

“NOTE”: Provides additional instructions or procedures to complete tasks and make sure that the suspension functions properly.

CAUTION Indicates a hazardous situation or unsafe practice that, if not avoided, could result in equipment damage and serious injury.

 RIDEWELL SUSPENSIONS	
PART NO:	
SERIAL NO:	
GROSS AXLE WEIGHT RATING CERTIFICATION IS PER THE FINAL STAGE MANUFACTURER OR ALTERER.	
THIS PRODUCT MAY BE COVERED UNDER ONE OR MORE PATENTS. ADDITIONAL PATENTS MAY BE PENDING.	
FOR MORE INFORMATION ON PATENT OR SUSPENSION/AXLE CAPACITY RATING CONTACT RIDEWELL CORPORATION.	
www.ridewellcorp.com	(800) 641-4122

Figure 1. The Suspension Serial Tag is located on the left-hand (driver's side) suspension hanger.


 RIDEWELL SUSPENSIONS			
MODEL:		PART NO.	
SERIAL NO.		CAPACITY	TON

Figure 2. Ridewell axles have a serial identification tag listing the Part Number (165xxxx) and serial number of the axle body.

Prior to Installation

Refer to the engineering drawing to confirm dimensional requirements and the range of ride heights available.

The suspension is designed to fit up onto standard I-beam trailer frames at beam centers that correspond to standard axle track widths (Figure 3).

Installation at wider beam centers will reduce suspension clearances. Installation at narrower beam centers will de-rate the axle beam capacity.

NOTE: For non-standard beam centers, frames, frame centers, axle track widths and wheel-end equipment, the installer is responsible for verifying clearances, axle capacity, proper fit-up, and any additional required support structure.

Installations can vary and procedures should be adapted for different vehicles, as needed.

- The Gross Axle Weight Rating (GAWR) is determined by the system component with the lowest load rating. Please consult with tire, wheel, axle and brake manufacturers before installation to determine the GAWR.
- If vehicle chassis modifications are required, consult with the vehicle manufacturer to ensure that such changes are permitted.
- Welding or altering suspension components is not permitted without the express written permission of Ridewell Suspensions.

Installer Responsibilities

The installer of the suspension has the sole responsibility for proper attachment of the suspension system to the vehicle chassis.

- The installer is responsible for locating the suspension system on the vehicle to provide the proper load distribution.
- The installer must verify that vehicle crossmembers are positioned to support the suspension at the installing location.
- It is the installer’s responsibility to determine that axle spacing conforms to any applicable federal and local bridge laws.
- The installer must verify that air reservoir volume requirements are met after suspension installation. Consult the vehicle manufacturer or Federal Motor Vehicle Safety Standards (FMVSS) 121 for more information.
- The installer must verify there is sufficient clearance for proper functioning of the auxiliary suspension, air springs, brake chambers, steering components, axle (including axle to driveline clearance) and tires.

Figure 3. Standard Trailer Dimensions

Trailer Width	Axle Track Width	Frame Center	Beam Center	Air Spring Center
96"	71.5"	38"	35"	31"
102"	77.5"	44"	41"	37"

Axle Integration

Suspension systems are available with and without a factory integrated axle. Customer-supplied axle assemblies must be positioned and oriented (rotated) properly before welding the axle to the axle seats.

The axle assembly should be installed so that the camshafts, when activated, rotate in the same direction as the wheels.

CAUTION Failure to follow procedures and design specifications could result in injury, damage to the axle or suspension and void the warranty.

Weld Preparation

The joint to be welded should be positioned in the flat or horizontal position. All grease, dirt, paint, slag or other contaminants must be removed from the weld joint.

The axle and suspension components should be at a minimum temperature of 60°F (15.5°C). Pre-heat the weld zone to the axle manufacturer's recommended pre-heat temperature, if required.

Weld Procedure

1. Center the axle assembly on the beam centers (Figure 4).
2. Check the engineering drawing for the brake component orientation (rotation) before clamping into place and making the final welds.
 - 2.1 Drum brake camshafts are spaced off the tail of the trailing arm beam. Make sure the brake chamber brackets are oriented properly and clamp the axle assembly into place.
 - 2.2 Disc brake assemblies have a right- and left-hand caliper assembly. Make sure the callipers are located on the correct side and rotated to the proper position before clamping the axle assembly into place.
3. Check the gap between the axle and the axle seats before welding (Figure 5). Side gaps should be no greater than 1/8". The gap at the bottom of the axle seat should be no greater than 1/16".
4. Weld the axle to the seat according to Ridewell Weld Process #1 (Page 5).

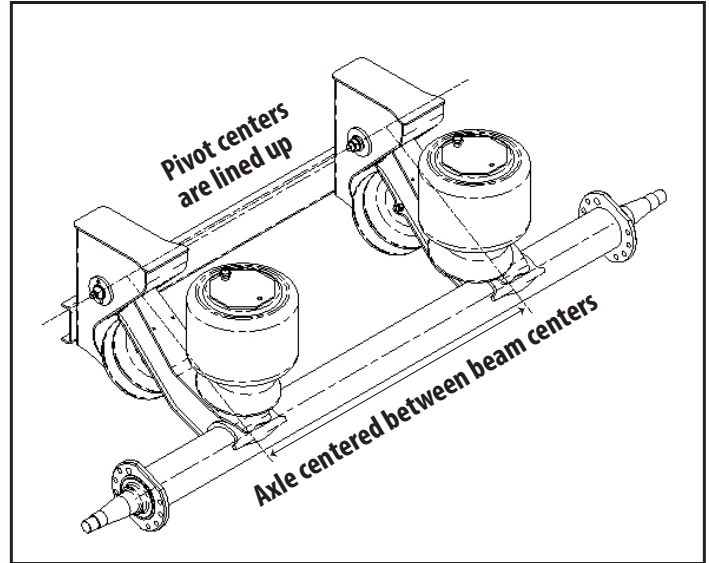


Figure 4. Axle should be centered between the beams with beams and axle perpendicular to each other. Refer to the engineering drawing for measurements.

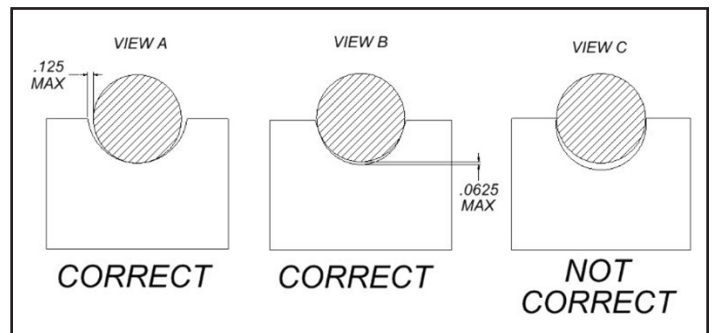
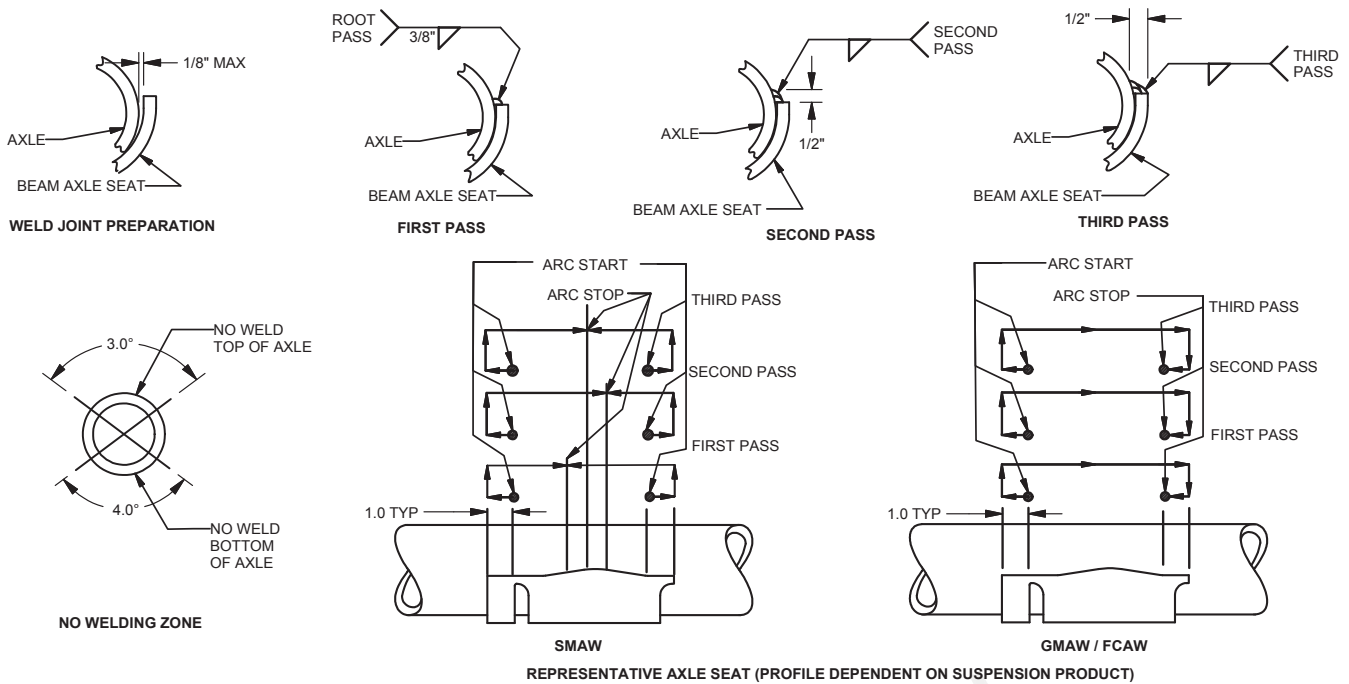
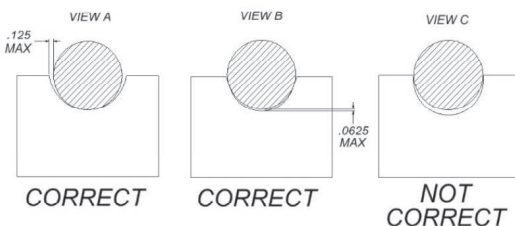



Figure 5. Correct axle tube seating for welding.



- 1 - CAUTION: All welds must be kept away from the top and bottom of the axle where maximum stresses occur (see "NO WELDING ZONE" illustration above). Do not test-weld the arc on any part of the axle tube.
- 2 - All welders and welding operators should be certified as per the requirements of the American Welding Society (AWS) or equivalent. All electrodes used should meet the AWS specifications and classifications for welding carbon and low-alloy steels.
- 3 - Recommended Welding Methods: Shielded Metal Arc Welding (SMAW), Gas Metal Arc Welding (GMAW) or Flux Cored Arc Welding (FCAW). The welding method used and the electrode selected must develop a minimum weld tensile strength of 70,000 psi per AWS specifications. The best fusion and mechanical properties will be obtained by using the voltage, current, and shielding medium recommended by the electrode manufacturer. If the SMAW method is used, the stick electrodes must be new, dry, free of contaminants and stored per AWS specifications.
- 4 - Weld Joint Preparation: The joint to be welded should be positioned in the flat or horizontal position. All grease, dirt, paint, slag or other contaminants must be removed from the weld joint without gouging the axle tube. CAUTION: Never weld when the axle is cold. The axle and beam assemblies to be welded should be at a temperature of at least 60°F (15°C). Pre-heat the weld zone to the axle manufacturer's recommended pre-heat temperature, if required. This will reduce the chance of an area of brittle material forming adjacent to the weld.
- 5 - The axle should fit into the beam assembly with a maximum root gap of 1/8-inch between the axle and the beam axle seat (see "WELD JOINT PREPARATION" illustration above).
- 6 - NOTE: Clamp the axle to the beam axle seat with a C-clamp prior to welding to make sure that proper contact occurs (see "CORRECT" illustration below).
- 7 - Ground the axle to one of the attached axle parts such as the brake chamber brackets, cam brackets or brake spider. Never ground the axle to a wheel or a hub as the spindle bearing may sustain damage.
- 8 - Multiple pass welding should be used on the beam/axle connection using the following guidelines: 8.1-Total fillet weld size should be 1/2-inch. 8.2-Weld pass starts and stops should be performed as illustrated above. 8.3-Never start or stop welds at the end of the weld joint. 8.4-Each pass must be accomplished in one or two segments. 8.5-Start welds at least 1-inch from the end and backweld over the start. Backstep fill all craters. 8.6-If process is not GMAW all slag must be removed between passes. 8.7-Welds must go to within 1/8-inch +/- 1/16-inch of the ends of the axle seat and must not go beyond or around the ends of the axle seat. 8.8-Post-weld peening is recommended, but not required: Needle peen the entire toe of the second pass, including around the ends of the axle seat. Hold the needles perpendicular to the axle. A uniform dimpled pattern will appear when properly peened.



F	16101	ADDED MAXIMUM TO 5, ADDED GMAW NOTE TO 8.6 UPDATED CORRECT VIEWS	2/10/2016	G.H.	B.B.	CJB
E	15101	REVISED TEXT. REMOVED LIST OF MODELS.	6/30/15	G.H.	MDJ	CJB
REV	PROJECT	DESCRIPTION	DATE	BY	CHK	APPD
DRAWN BY:	CBC	2/1/2016	 RIDEWELL CORPORATION PO BOX 4586 SPRINGFIELD, MISSOURI 65808			
CHECKED:	MDJ	2/21/2003				
APPROVED:	CJB	2/21/2003				
PROJECT NO:	03103	SCALE:	A-SIZE:	TITLE:		
MATERIAL:	-	WEIGHT:	-	RIDEWELL WELD PROCESS #1, 5" DIA. AXLE, 3 PASS WELD		
SHEET 1 OF 1			PART NO:	WELD PROCESS #1		REV: F

Mounting the suspension to the frame

Refer to the engineering drawing for the range of ride heights available and clearance requirements .

The suspension installer has the final responsibility of attaching the suspension to the vehicle frame.

Weld-On Installation Procedure

Recommended locations of customer-furnished filler plates and supporting crossmembers for the hangers and air spring mounting plates are shown on the engineering drawing.

CAUTION Welding method must use a minimum weld tensile strength of 70,000 psi, per AWS specifications.

1. Mark desired location of the hangers and filler plates on the frame. Hangers must be installed parallel to each other for proper axle alignment.
2. Mark the desired location of the air spring mounting plates and filler plates on the frame. NOTE: Protect other chassis components from weld spatter during installation, if necessary.
3. Install filler plates for the hangers and air spring mounting plates on the frame. Weld filler plates to crossmembers with 1/4" fillet welds down the length of the crossmember.
4. Weld the hangers to the frame/filler plates with 1/4" fillet welds completely around the hangers. Stop the welds 1/2" from the corners and edges.
5. Weld the air spring mounting plates to the frame/filler plates with 3/16" fillet welds.
6. Attach a crossmember or diagonal brace to the front of the hangers with 1/4" fillet welds.

Bolt-On Installation

Before installation, check to make sure that wires, hoses or other components will not be affected by drilling into the frame rail.

- Bolts/nuts for attaching the suspension to the vehicle are supplied by the installer. Grade 8 bolts and flanged lock nuts or lock nuts with hardened washers are recommended.
- Bolt holes are not provided in the air spring mounting plates. Clamp mounting plates and filler plates, if used, in place and drill (minimum) two bolt holes in each mounting plate for installation onto the chassis.

Final Assembly and Inspection

- Verify the welds of the hanger and air spring mounting plates.
 - Check the location for sufficient clearances of suspension components.
 - Attach beam and axle assemblies to hangers. Note: Do not fully torque pivot hardware until axle alignment is completed.
 - Complete assembly and installation of air springs as shown on the engineering drawing. Torque to specifications (Appendix).
7. Install/connect the air control kit (ACK) to the suspension (Page 8). Check the air system after installation for leaks and proper operation of controls.
 8. Perform final assembly and inspection and align the suspension per TMC or SAE recommended standards (Appendix). Alignment should be performed with suspension at installed ride height.

CAUTION Failure to torque bolts/nuts of suspension components to specifications can result in failure of the suspension and void the warranty.

Installation and Operation Check

1. Check attachment of frame hangers and air spring mounting plates.
2. Inspect for any loose or missing fasteners on the suspension assembly. Verify that all suspension component bolts/nuts are torqued to proper values (Appendix).
3. Lift the axle to the raised position. Check the air system tubing and connections for leaks.
4. Check that tires are inflated to recommended pressure. Check wheel hubs for proper level of lubricant recommended by the manufacturer.
5. Verify that wheel lug nuts are tightened and that wheels can rotate freely.
6. Check that brakes and slack adjusters are properly adjusted.
7. Raise and lower the suspension assembly (wheels and tires installed) through the entire range of travel. Make sure that sufficient clearances for air springs, brake chambers and other components has been provided.

⚠CAUTION When lowering an auxiliary axle on an unloaded vehicle, pressure to the load air springs must be reduced to below 10 psi. Failure to do so could cause the vehicle's drive axles to rise from the ground and the vehicle could roll in an unsafe manner.

⚠CAUTION Do not lower lift-axle while vehicle is moving in forward or reverse travel above 10 mph. Lowering the axle above the recommended speed can cause component damage and premature wear.

Air springs pressure regulates axle load

The load capacity of the auxiliary axle is adjusted by increasing or decreasing the pressure to the air springs. By applying more air, the lift axle takes on a greater percentage of the load's weight. The load capacity is decreased as the air pressure decreases.

Accurate readings of the load capacity can be obtained by parking a loaded vehicle over a calibrated scale and lowering the axle onto the scale. The air pressure to the air springs is manually adjusted up or down to obtain the axle load weight at various air pressures.

⚠CAUTION Do not exceed the rated load capacity of the suspension system or other components. Exceeding the capacity can cause component failure and void the warranty.

Install air system components

Connect the load and lift air springs and an air control kit to the air system (Figure 6).

The air control kit (ACK) consists of a pressure regulator with a gauge connected to an air valve controlled by an electric switch or manual knob. The ACK allows the operator to control the air spring pressure so that the auxiliary axle can support different loads.

Ridewell has a number of manual/electric ACK configurations available. Installation will vary by the type of configuration.

CAUTION The installer is responsible for making sure that air system requirements comply with the appropriate Federal Motor Vehicle Safety Standards.

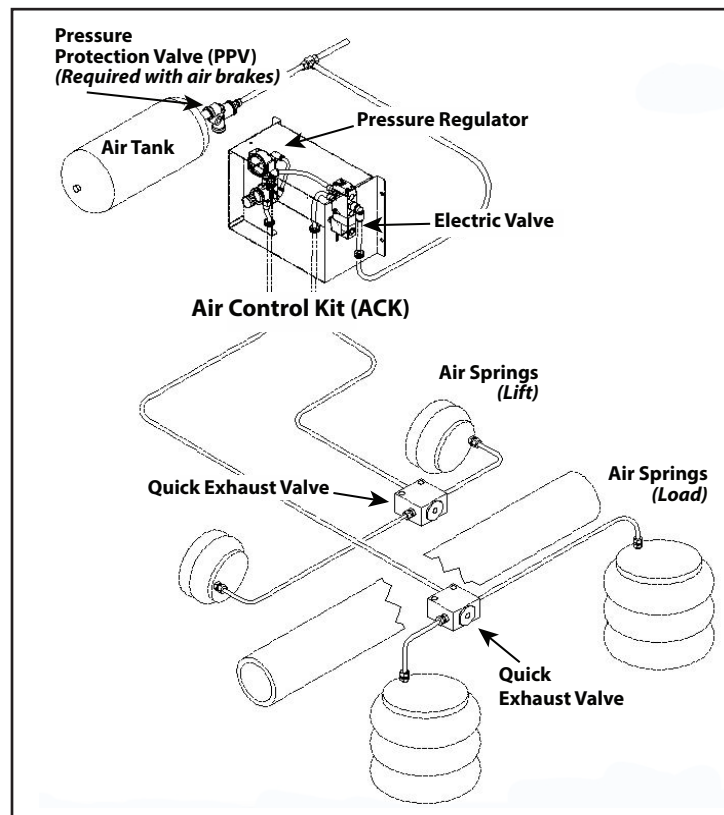


Figure 6.
Example of Air Control Kit (ACK) installation

Troubleshooting – Air System Installation

Problem	Possible Cause	Solution
Air springs fill but do not exhaust.	<ul style="list-style-type: none"> – Obstructed air line. – Faulty controls wiring. – Manual override pushed in 	<ul style="list-style-type: none"> – Check for pinched/blocked lines. – Check wiring with voltmeter and correct wiring/installation. – Release manual override.
Air system leaks down after a short period of time.	<ul style="list-style-type: none"> – Leak in air system beyond accepted standards. 	<ul style="list-style-type: none"> – Pressurize system and spray soap water solution onto the tubing, valves and fittings. Check for bubbles (leaks). Note: Some valves will leak at an acceptable rate. – Check that tubing cuts are straight and smooth. Re-cut and reassemble fitting joints, if necessary.
Auxiliary unit will not stay up	<ul style="list-style-type: none"> – Loose Air Fittings. – Damaged Air Lines. – Air lines to lift and load air springs are reversed. – Damaged or Worn Air Springs. 	<ul style="list-style-type: none"> – Check and retighten fittings. Repair or replace component, as necessary. – Check installation. Air line from regulator goes to (load) air springs. – Replace if worn or damaged.
Auxiliary unit not getting the correct lift	<ul style="list-style-type: none"> – Air lines to lift and load air springs are reversed. – Lift air springs do not have proper air pressure. – Interference with driveline or other chassis components. – Air control system not installed correctly. 	<ul style="list-style-type: none"> – Check installation. Air line from regulator goes to (load) air springs. – Check for loose fittings or worn/damaged lines. Verify air tank pressure with gauge. – Visually inspect unit operation for proper clearance. Check for loose fasteners and retighten. – Check installation; refer to OEM installation procedures.

A visual inspection of the suspension structure should be performed during each pre-trip/safety inspection. Ridewell Suspensions recommends the following minimum service intervals for standard duty, on-highway usage applications. More frequent intervals are recommended for heavier duty applications.

- Daily/Pre-Trip Inspections**
- Check tires for proper inflation, damage or excessive wear.
 - Check wheel-ends for obvious signs of lubricant leakage. Check for missing components.
 - Check axle assemblies for damage/ loose components.
 - Visually inspect suspension structure for signs of damage or excessive wear.
 - Check for loose or missing bolts/nuts. Check for irregular movement in suspension components.
 - Make sure air controls are operating properly. Drain all moisture from air reservoirs.

- First 6,000 miles of use**
- Torque all suspension bolts/nuts to specifications (see torque values chart in Appendix).
 - Verify that the suspension is operating at the designed ride height.

Refer to the following Technology & Maintenance Council (TMC) publications for additional maintenance information:	
TMC RP 609	Self-Adjusting and Manual Brake Adjuster Removal, Installation and Maintenance
TMC RP 618	Wheel Bearing Adjustment Procedure
TMC RP 619	Air System Inspection Procedure
TMC RP 622	Wheel Seal and Bearing Removal, Installation, and Maintenance
TMC RP 631	Recommendations for Wheel End Lubrication
TMC RP 643	Air Ride Suspension Maintenance Guidelines
TMC RP 728	Trailer Axle Maintenance

- Every 12,000 miles of use**
- Inspect air springs for any damage or excessive wear. Torque air spring bolts/nuts to specifications (see torque values chart in Appendix).
 - Check air lines and connections for leaks.
 - Lubricate Brake Cams and Slack Adjusters.

- First 50,000 miles of use**
- Torque all suspension component bolts/nuts to specifications (see Appendix).
 - Check wheel ends for excessive play.

- Annually/100,000 miles of use**
- Inspect pivot connections for worn pivot bushings and replace, if necessary. Torque pivot hardware and component bolts/nuts to specifications (Appendix).
 - Check suspension hanger and air spring mounting plate connections to frame.
 - Check lubrication level in wheel ends:
 - 1) Oil-Filled Wheel Ends: Refill/Replace lubricant as needed (Refer to TMC RP 631 “100K/Annual Inspection”).
 - 2) Semi-Fluid Grease: Pull outer bearing and visually inspect lubrication level. Refill/Replace as needed (Refer to TMC RP 631 “Level 3 Lubrication Level Inspection” and TMC RP 618 “Wheel Bearing Adjustment Procedure”).
 - Check air system for leaks.
 - Test air system pressure protection valve (if equipped).
 - Check brake chambers and brakes for damage and proper function.

CAUTION Failure to torque bolts/nuts of suspension components to specifications can result in failure of the suspension and void the warranty.

Pivot Bushing Inspection Procedure

Park the unloaded trailer on a level surface. Set the brakes and chock the tires so vehicle cannot move during inspection.

Insert the flat end of a pry-bar between one side of the hanger sidewall and the wear washers. Move the pry-bar back-and-forth and look for excessive movement of the beam (NOTE: A small amount of beam

movement because of the rubber flexing is normal). Inspect the wear washers for excessive wear/damage.

Repeat the pry-bar process and wear washer inspection on the other side of the hanger. If any large/easy movement or damaged wear washers is observed, drop the beams for further inspection. Replace components as necessary.

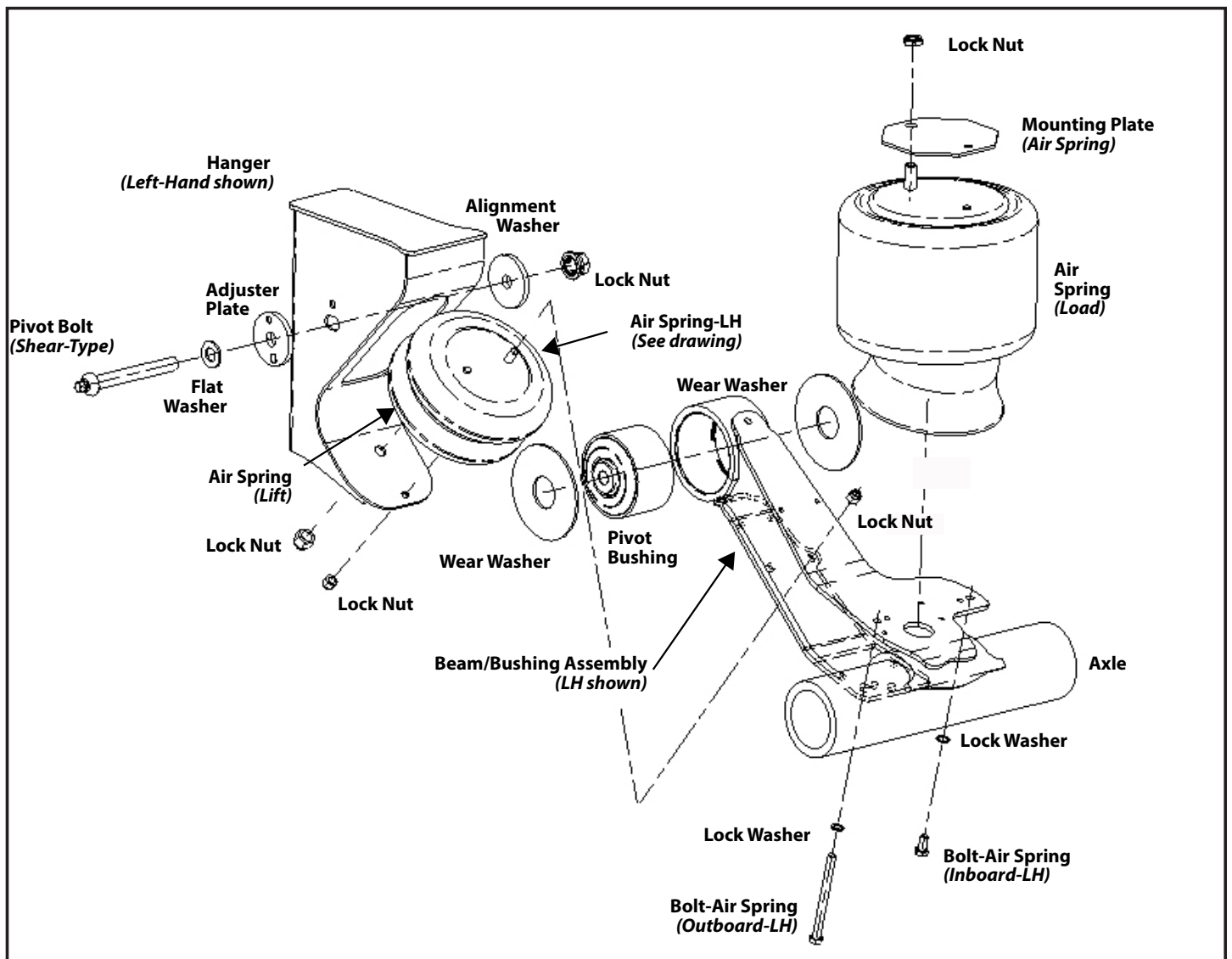


Figure 7.
RUL-245T Trailer Suspension.
 Refer to the engineering drawing for the individual component part number.

RUL-245T - Trailer Suspension – Bushing Replacement Kit

Suspension Type	Bushing Rplcmnt Kit Part No.	Bushing Rplcmnt Tool Part No.	Pivot Hardware	Torque Specification	
				foot-pound	Newton-meter
All Models	6040078	6100044	Traditional - Hex Head Cap Screw-HHCS/Lock Nut	500 ft-lb	678 N-m
All Models	6040128	6100044	Shear-Type	Use a 1" drive impact wrench to tighten pivot bolt until the Torx® head is sheared off.	

CAUTION Failure to install and maintain pivot hardware at torque specification could result in suspension failure and void the warranty. Refer to the engineering drawing for torque values.

Bushing Replacement Procedure

Park the vehicle on a level surface. Chock wheels to keep vehicle from moving. Raise vehicle to height that removes load from suspension and support with jack stands. Disconnect the linkage from the height control valve(s), if equipped. Exhaust all air from the air system.

CAUTION Failure to properly chock wheels, exhaust the air system and safely support the vehicle could allow vehicle/suspension movement that could result in serious injury.

Disassemble suspension

Remove wheels and tires, if necessary. Disassemble the pivot connections. Remove and inspect adjuster plate and alignment washer(s). Replace, if necessary.

Discard pivot hardware (new pivot hardware and wear washers included in bushing replacement kit).

Rotate trailing arm beams down and out of the hangers. Inspect the pivot bolt holes and the hanger surfaces for unusual wear or damage. Repair or replace components, as needed.

Bushing Removal

1. Lubricate the threads of the hex nut-threaded rod assembly, the inside threads of the plunger, and the end cap bearing with grease.
2. Assemble the bushing replacement tool and place on the eye of the beam (Figure 8). NOTE: Cone is tapered inside to a smaller opening on one end.
 - 2.1 Place the end cap on the hex nut-threaded rod assembly. The end cap should be seated on the flange of the hex nut. Place the larger opening of the cone against the end cap.
 - 2.2 Insert the threaded rod through the bushing sleeve and center the tapered end of the cone on the beam eye.
 - 2.3 Thread the plunger onto the threaded rod. Rotate the plunger until the plate is seated snugly against the bushing.

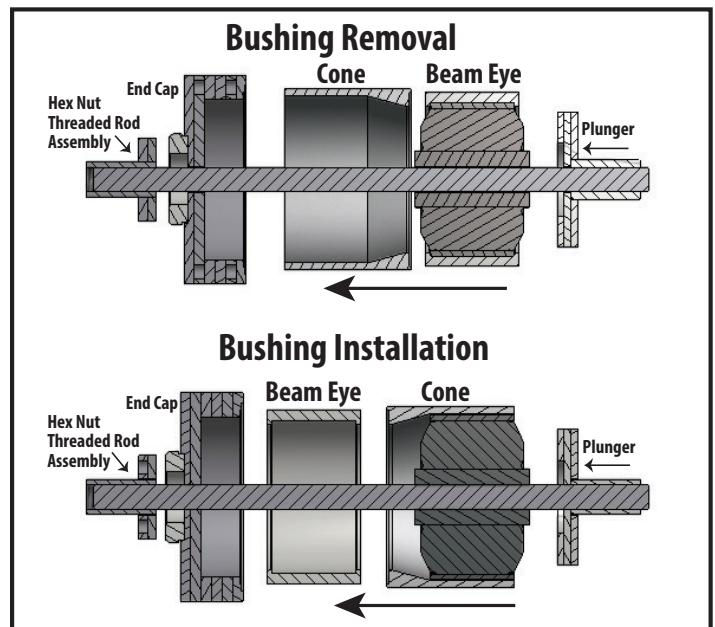


Figure 8.
The tapered end of the tool cone is placed against the beam eye for removal/installation.

3. Use a 3/4" drive impact wrench on the hex nut to rotate the threaded rod and press the bushing out of the beam eye into the cone.
NOTE: A small amount of heat may be required to break the bond between the bushing and the beam eye. Do not overheat. Allow beam to cool before installing the new bushing.
4. Disassemble the bushing replacement tool. Remove old bushing from the cone and discard.

Continued on next page

Replacement w/ 6100044 (continued)

New Bushing Installation

1. Use a wire brush to clean any foreign debris and any corrosion out of the beam eye.
2. Liberally apply P80[®] lubricant or soap solution to the inside of the beam eye, the outside of the bushing and the inside of the cone.
3. The cone is tapered inside to a smaller opening on one end. Insert the new bushing into the larger opening of the cone.
4. Assemble the bushing replacement tool and place on the eye of the beam (Figure 8).
 - 4.1 Place the end cap on the hex nut-threaded rod assembly. The end cap should rest on the flange of the hex nut.
 - 4.2 Insert the threaded rod/end cap assembly through the beam eye. Place the tapered end of the cone onto the threaded rod and center the cone on the beam eye.
 - 4.3 Thread the plunger onto the threaded rod. Rotate the plunger until the plate is seated snugly against the bushing.
5. Use a 3/4" drive impact wrench on the hex nut to rotate the threaded rod and press the bushing into the beam eye.

NOTE: Hold the plunger with an open end wrench to prevent the cone from rotating.
6. Disassemble and remove the bushing replacement tool. Check the placement of the bushing to make sure it is centered in the beam eye.

Reassemble suspension

Rotate trailing arm beams into hangers. Install adjuster plates and alignment washers. Install new wear washers and pivot hardware (do not reuse shear-type pivot bolt). NOTE: Do not apply final torque.

Connect air system (if disconnected). Install wheels and tires (if removed). Inflate air springs. Raise vehicle and remove support stands. Lower vehicle to ground.

Check axle alignment and realign (Appendix). Tighten pivot bolt with a 1" drive impact wrench and E-20 Torx[®] socket (Ridewell tool 6100054) until the Torx[®] head is sheared off.

CAUTION Failure to properly torque pivot hardware can result in suspension failure and void warranty.

Replacement:

Factory Bonded Wide Bushing (6 3/4") in RUL-245 Suspensions Manufactured Before 2009:

Park the vehicle on a level surface. Chock wheels to keep vehicle from moving. Exhaust all air from the air system. Disassemble suspension, if necessary, to reach pivot connections.

Bushing Replacement Procedure

Refer to the engineering drawing for additional component part numbers and torque values.

Service Parts Needed:

1987625B000 - Epoxy - Fusor320 50ML (tube)
1117625C060 - Bushing - Monopivot 62Duro

1. Remove old bushing from load beam or sleeve. Apply heat to the outside of the sleeve with an oxyacetylene torch to destroy any remaining bonding element and make bushing removal easier.
2. Use a wire brush to remove any remaining bonding residue, rubber, dirt, rust, etc, from the sleeve bore.
3. Wash the bore of the bushing sleeve with paint thinner. Wash the surface of the replacement bushing with paint thinner.

CAUTION Epoxy adhesive and paint thinner are flammable materials that are irritating to the eyes, respiratory system and skin. Thoroughly read all label instructions before use.
4. Remove cap from Epoxy Adhesive 50ml tube kit. Squeeze out entire contents of adhesive. Thoroughly mix the two-parts of the adhesive
NOTE: Adhesive must be used within 20 minutes after mixing.
5. Spread mixed adhesive on the entire surface of the replacement bushing. Apply adhesive to the inside of the sleeve bore.
6. Press replacement bushing into the bore of the sleeve until bushing is centered.
7. Wipe the excess adhesive from the ends of installed bushing with paint thinner.
8. Adhesive can be handled after four hours and will totally cure after 24 hours.

CAUTION Adhesive must be totally cured before returning vehicle to service.

Reassemble the suspension, if necessary. Torque to specifications.

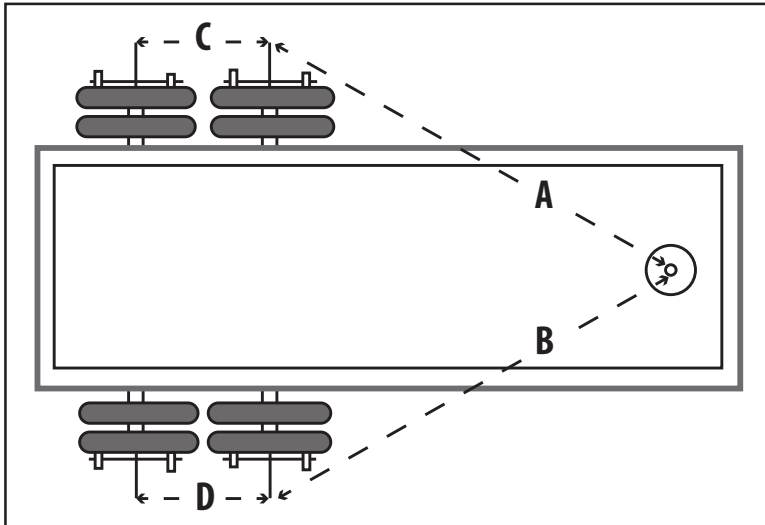
RUL-245T - Trailer Suspension – Torque Specifications

Fastener Type	Size	Torque Specifications	
		foot-pound	Newton-meter
Pivot Bolt - (Shear-Type) Pivot Nut - (Lock Nut) <i>Requires E-20 Torx® socket (RW #6100054)</i>	7/8" - 9NC	Use a 1" drive impact wrench to tighten pivot bolt until Torx head is sheared off.	
Pivot Bolt - (Hex Head Cap Screw (HHCS)) Pivot Nut - (Lock Nut)	7/8" - 9NC	500 ft-lb	678 N-m
Lock Nut - (Air Spring)	1/2" - 13NC	25 ft-lb	35 N-m
Lock Nut - (Air Spring)	3/8" - 16NC	25 ft-lb	35 N-m
Combo Port - (Air Spring Fastener)	3/4" - 16NF	45-50 ft-lb	45-50 ft-lb
Bolt - (Air Spring)	3/8" - 16NC	25 ft-lb	35 N-m
<p><i>Torque values reflect a lubricated thread condition (Nuts are pre-lubed). Do not overtorque.</i></p> <p>⚠CAUTION <i>Suspension is shipped with minimal torque applied to fasteners. It is the installer's responsibility to apply the proper torque values. All fasteners, except shear-type pivot bolt, MUST be re-torqued after the first 6,000 miles of operation. Failure to install and maintain suspension component fasteners at torque specifications could result in suspension failure and void the warranty.</i></p>			

Axle Alignment

Alignment should be performed on a level surface with the suspension at the desired ride height.

Align the suspension per TMC or SAE recommended standards. On a multiple-axle vehicle, the forward axle is moved into the proper alignment, then the remaining axles are positioned so that they are parallel to the forward axle. A maximum tolerance of 1/8-inch difference from side-to-side of the forward axle and 1/16-inch difference from side-to-side for the aft axles is acceptable (Figure 9).



Check the forward axle alignment by measuring from the kingpin to both ends of the axle centers.

If the difference between the "A" measurement and the "B" measurement is greater than 1/8-inch, the forward axle needs to be aligned.

If the difference between the "C" measurement and the "D" measurement is greater than 1/16-inch, the aft axle needs adjustment.

Figure 9.
Kingpin measurement for axle alignment.

Speed Set™ Alignment

The RUL-245T Auxiliary Axle Trailer Suspension is equipped with the Ridewell Speed Set® alignment feature for simple, manual alignment of the axles.

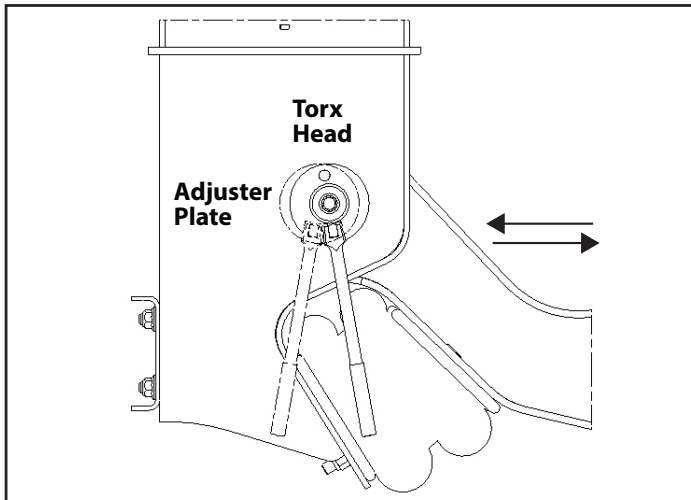


Figure 10.
Move beam back-and-forth with adjuster plate until axle is aligned.

Axle alignment procedure

1. Loosen the pivot nut enough for beam to move.
2. Locate the adjuster plate at the pivot connection. Insert a 1/2" -shank breaker bar into the square hole of the adjuster plate. Move the arm beam forward or backward until the axle reaches alignment (Figure 10).
NOTE: Check to make sure that the pivot bushing is not wedged sideways during beam movement. The adjuster plate and alignment washer on the two sides of the hanger should move in unison with the beam.
3. Tighten the pivot nut so that beam can no longer move. Re-check alignment measurements and adjust, if necessary.
NOTE: Check to make sure that both the adjuster plate and alignment washer are flat against the hanger before final torque is applied.
4. Use a 1" drive impact wrench with an E-20 Torx® socket to tighten the pivot bolt until the Torx head is sheared off.

CAUTION Failure to properly torque pivot hardware could result in catastrophic suspension failure and void the warranty (Appendix).

WARRANTY

Terms and coverage in this warranty apply only to the United States and Canada.

Ridewell Suspensions warrants the suspension systems manufactured by it to be free of defects in material and workmanship. Warranty coverage applies only to suspensions that have been properly installed, maintained and operated within the rated capacity and recommended application of the suspension. The responsibility for warranty coverage is limited to the repair/replacement of suspension parts. The liability for coverage of purchased components is limited to the original warranty coverage extended by the manufacturer of the purchased part.

All work under warranty must have prior written approval from the Ridewell warranty department. Ridewell has the sole discretion and authority to approve or deny a claim and authorize the repair or replacement of suspension parts. All parts must be held until the warranty claim is closed.

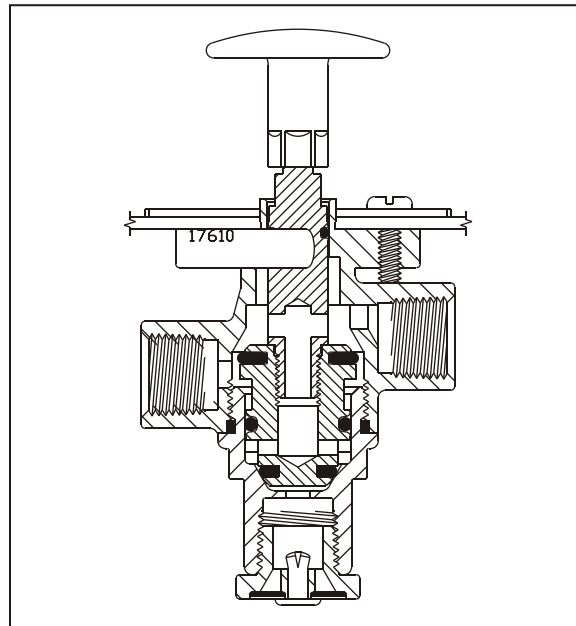
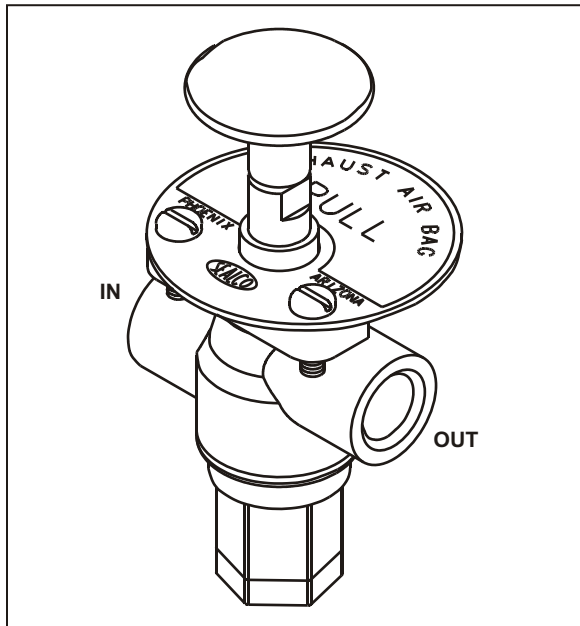
Parts that need to be returned for warranty evaluation will be issued a Returned Materials Authorization (RMA). Parts must be returned to Ridewell with the transportation charges prepaid. The transportation charges will be reimbursed if the warranty claim is approved.

This non-transferable warranty is in lieu of all other expressed or implied warranties or representations, including any implied warranties of merchantability or fitness or any obligations on the part of Ridewell. Ridewell will not be liable for any business interruptions, loss of profits, personal injury, any costs of travel delays or for any other special, indirect, incidental or consequential losses, costs or damages caused by Ridewell.

Contact the Ridewell Warranty Dept. at 417.833.4565 - Ext. 135, for complete warranty information.

SUSPENSION CONTROL VALVES

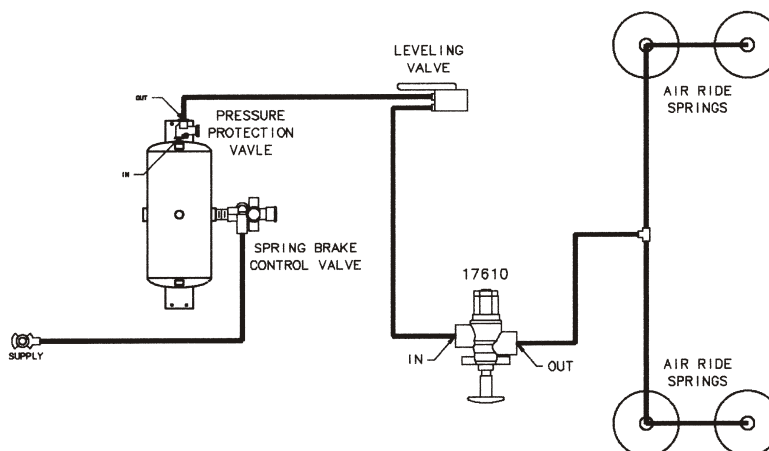
Air Bag Control Valve – Manual Operation



INFORMATION:

- Commonly used to control the inflation & deflation of air suspension bags
- Allows for movement of trailer back to dock without re-inflating air bags
- Operates with all air suspension systems
- Pull to manually exhaust air from air bags

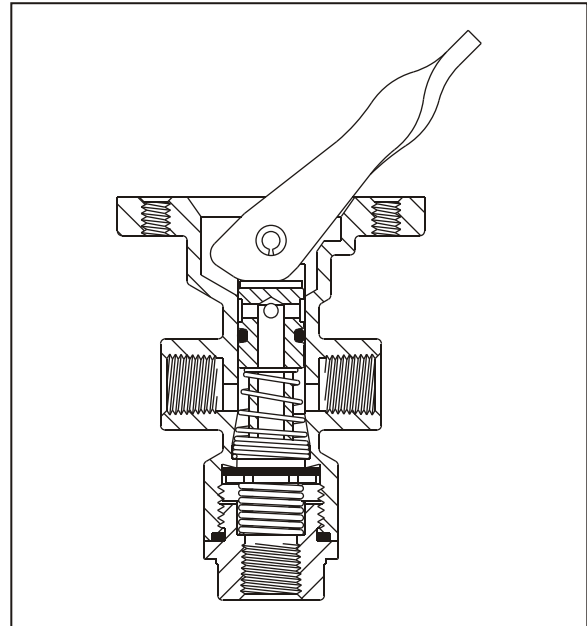
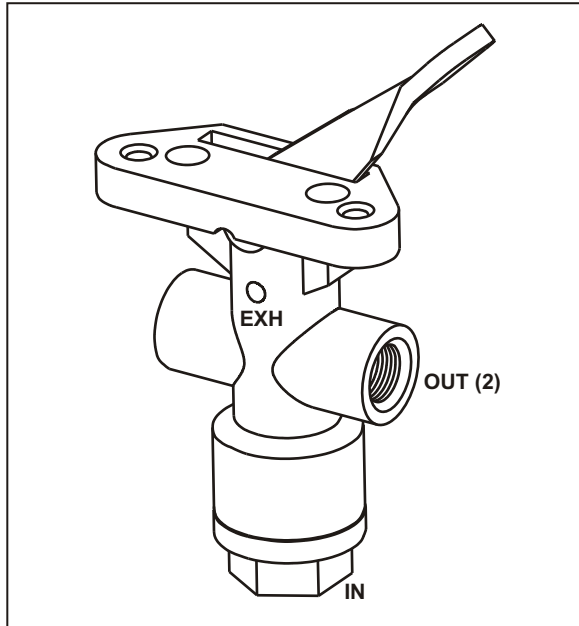
Push to refill air bags from reservoir



PART NUMBER	PORT SIZES (NPT)	
	Inlet	Outlet
17610	3/8"	3/8"

HAND CONTROL VALVES

Lever Control Valves



INFORMATION:

- Used for a variety of applications
- Manual operation
- **REPAIR KIT 110242**

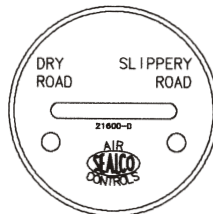


PLATE 812

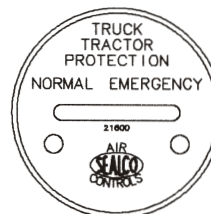


PLATE 821



PLATE 8022

PART NUMBER	NAME PLATE	PORT SIZES (NPT)	
		Inlet	Outlet (2)
21600	821	1/8"	1/8"
21600D	812	1/8"	1/8"
21600-2	None	1/8"	1/8"
110167	None	1/8"	1/8"
110300	8097	1/8"	1/8"
110301	8098	1/8"	1/8"
110413	8116	1/8"	1/8"
216050	8023	1/8"	1/8"
216100	8007	1/8"	1/8"
216200	8022	1/8"	1/8"

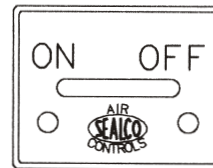


PLATE 8023

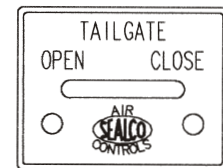


PLATE 8097

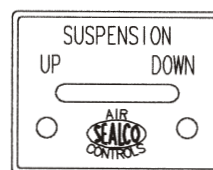


PLATE 8098

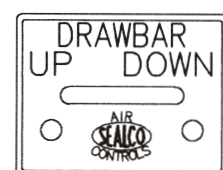
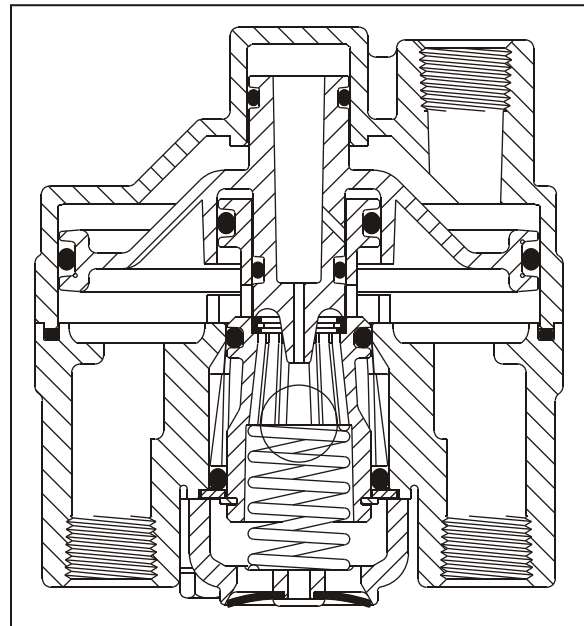
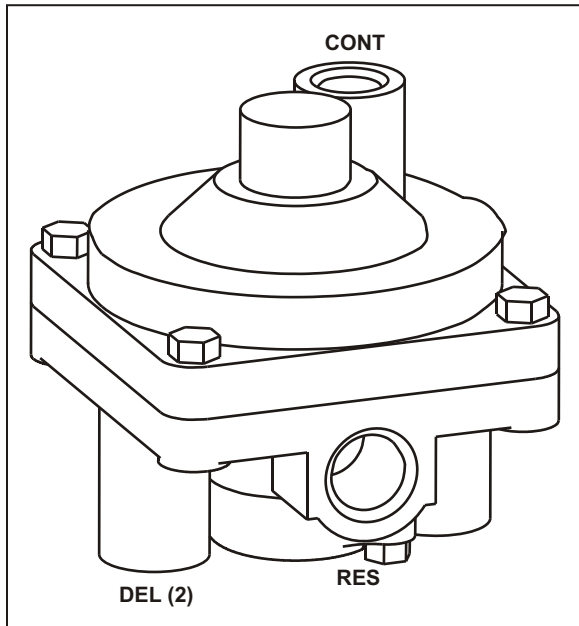


PLATE 8116

SERVICE RELAY VALVES

Service Relay Valves (2 Delivery Ports)



INFORMATION:

- Nipple mounted 110360 & 110410 are used primarily for single axle trailer service brakes or tandem axle by axle trailer brake designs
- 110365 may be used as a frame mounted version of 110360 or as a Control Line Valve to replace 110463 or 110464
- 110412 & 110487 may be used as a tractor, straight truck or trailer Service Relay Valve
- Mounting Hardware on pages 61 & 62
- Piping examples on page 74
- No Plug Units or Repair Kits available

PART NUMBER	PORT SIZES (NPT)			NOMINAL CRACK PRESSURE	MOUNTING INFORMATION
	Control	Reservoir	Delivery		
110360	3/8"	1/2"	3/8"	1.5 psi	Use 6002 or 6003 nipple
110365	3/8"	1/2"	3/8"	1.5 psi	Frame Bracket Kit 110485 included
110410	3/8"	1/2"	3/8"	4.0 psi	Use 6002 or 6003 nipple
110412	3/8"	1/2"	3/8"	4.0 psi	Frame Bracket Kit 110485 included
110487	3/8"	1/2"	3/8"	5.5 psi	Use 6002 or 6003 nipple

MERITOR WABCO

Installation Guide

Enhanced Easy-Stop™ Trailer ABS 2S/1M Basic with PLC Installation Instructions

Hazard Alert Messages

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

How to Obtain Additional Maintenance and Service Information

Refer to Maintenance Manual MM-0180, Enhanced Easy-Stop™ Trailer ABS with PLC, and Maintenance Manual 33, Easy-Stop™ Trailer ABS. To obtain these publications, call ArvinMeritor's Customer Service Center at 800-535-5560, or visit the Tech Library on our website at meritorwabco.com.

Important Information

This bulletin contains instructions for mounting the ECU/single modulator valve assembly as one unit. If you are mounting the ECU and valve separately, please contact Meritor WABCO at 800-535-5560 for specific installation requirements and instructions.

Differences Between Easy-Stop™ and Enhanced Easy-Stop™

There are some changes to Enhanced Easy-Stop™ that you need to be aware of before you begin the installation.

- Enhanced Easy-Stop™ includes Power Line Communication (PLC) function.
- The ECU/single modulator valve assembly may be mounted as one unit or the ECU and the valve may be mounted or serviced separately.
- The assembly is shipped with the valve cable between the ECU and valve disconnected from the ECU.
- The LED on top of the ECU has been eliminated.
- The blink code tool LED does not operate simultaneously with the ABS lamp on the trailer.
- The control port on the Enhanced Easy-Stop™ single modulator valve is 3/8-inch — on previous versions it was 1/4-inch.

Preparation

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

The Anti-lock Braking System (ABS) is an electrical system. When you work on the ABS, take the same precautions that you must take with any electrical system to avoid serious personal injury. As with any electrical system, the danger of electrical shock or sparks exists that can ignite flammable substances. You must always disconnect the battery ground cable before working on the electrical system.

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.

End of line testing must be done after all installations. Meritor WABCO recommends using TOOLBOX™ Software to perform this testing. If you do not have TOOLBOX™ Software, this bulletin also includes instructions for testing without the software.

1. Before beginning the installation procedure, inspect the ECU/single modulator valve assembly for damage that may have occurred during shipping or storage.
 - Look for crushed or bent connectors.
 - Verify that the retainer clips have not been bent or otherwise damaged.
 - Attach the ABS relay valve cable to the ECU with the WABCO ID face down. Ensure the cable is free from cuts or breaks.
 - Do not install a damaged ECU/single modulator valve assembly. Notify your supervisor, or contact Meritor WABCO if there is any apparent damage.

2. Have the following installation material available.

- * ECU/single modulator valve assembly
- * Power cable or power/diagnostic cable
- * Sensor extension cables (two pieces)
- * Sensors (two) for non-ABS-prepped axles
- * ABS Indicator Label (TP-95172)

5/8-inch O.D. nylon tubing for supply (frame mounts)

Pipe plug (3/4-inch NPTF)

Schedule 80 hex pipe nipple (3/4-inch NPTF) for air tank mounts or two Grade 8 bolts (3/8-inch) and prevailing torque nuts for frame mounts

SAE-standard, DOT-approved thread sealant

To ensure correct lamp operation, use an incandescent-type DOT-approved lamp, or an LED with integral load resistor.

* Meritor WABCO components

3. Study the ECU/single modulator valve assembly. Note the location of the various ports and electrical connections on the ECU. Figure 1.

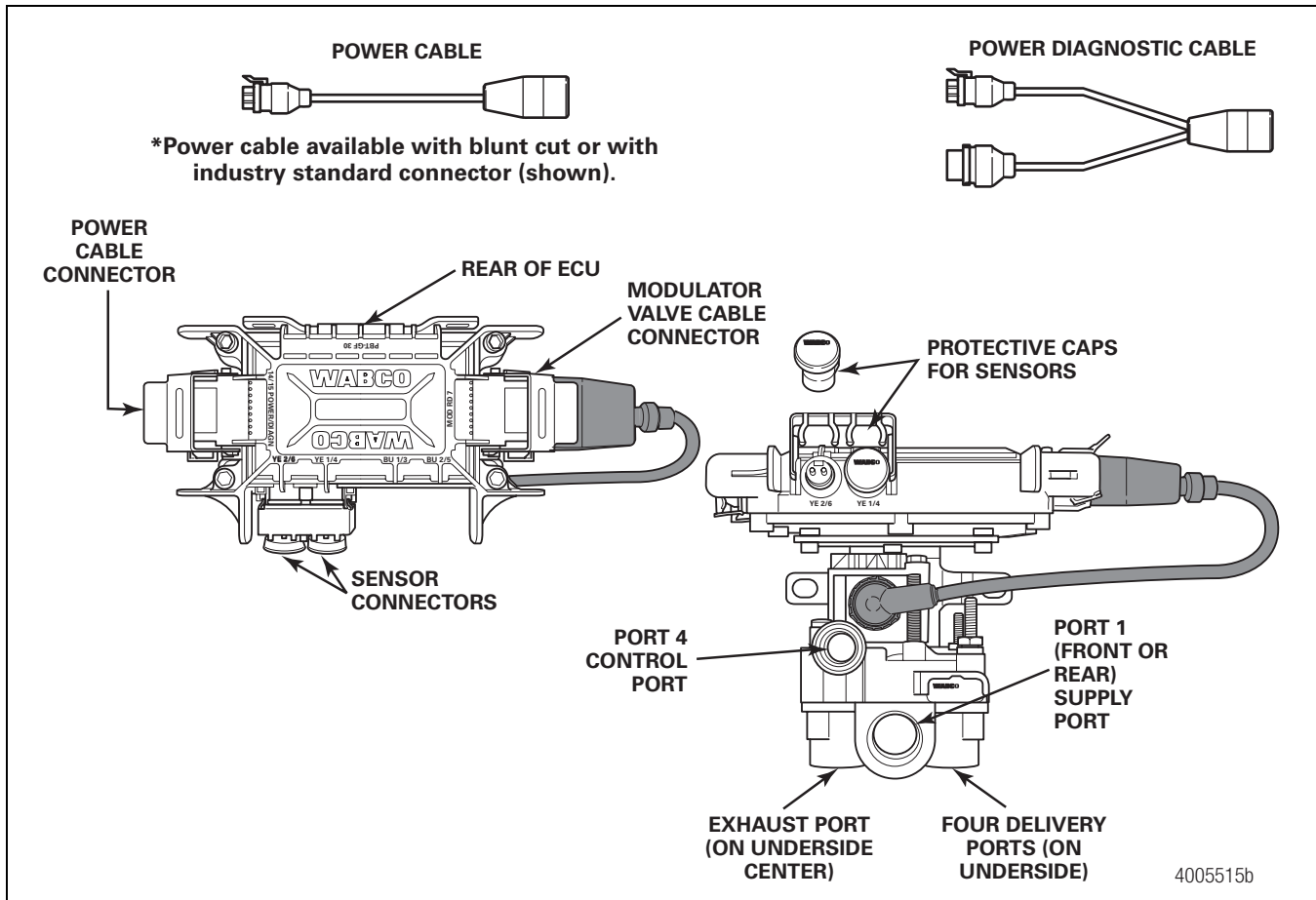


Figure 1

Installation

I. Install the ECU/single modulator valve assembly.

The assembly may be mounted on the air tank or on the cross member of the vehicle.

Tank-Mounted

⚠ WARNING

You must use a Schedule 80 hex nipple (3/4-inch NPTF) to mount the ECU/single modulator valve assembly securely to the air tank to avoid possible serious personal injury and damage to the component.

1. Use a 3/4-inch NPTF Schedule 80 hex nipple to attach the ECU/single modulator valve assembly to a reinforced air tank. Do not overtighten.

Meritor WABCO does not recommend the use of a vise when installing the hex nipple. Use of a vise may cause overclamping. Overclamping may damage the internal components of the ECU/single modulator valve assembly.

2. Use a 3/4-inch NPTF pipe plug to plug the unused supply port (Port 1). Apply SAE-standard, DOT-approved Teflon tape or paste-type thread sealant to all pipe threads beyond the first two threads. Pipes with pre-applied thread sealant may also be used.
3. Rotate and tighten the ECU/single modulator valve assembly until the exhaust port faces DOWN and the connection is secure. Use a torque wrench or ratchet with an extension at the 3/4-inch pipe plug installed on the front supply port (Port 1). Figure 2.

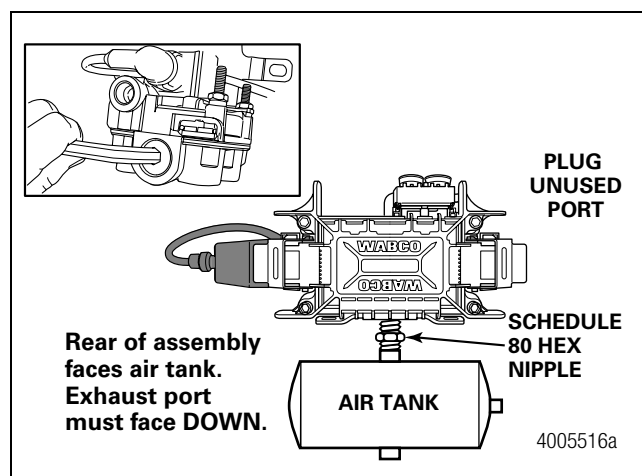


Figure 2

Bracket-Mounted to Cross Member of Vehicle

1. Install a 3/4-inch NPTF fitting in the supply port (Port 1).
 - Use a 3/4-inch NPTF pipe plug to plug the unused supply port (Port 1). Apply SAE-standard, DOT-approved Teflon tape or paste-type thread sealant to all pipe threads beyond the first two threads. Pipes with pre-applied thread sealant may also be used.
2. Mark the location of two mounting holes on the vehicle cross member. Mounting holes must be 4-3/4 inches apart. Figure 3.

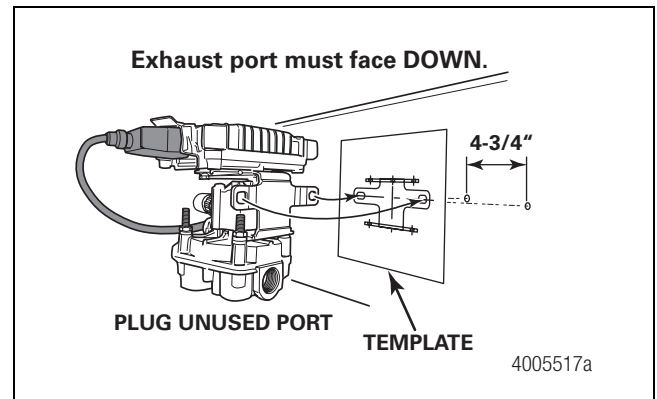


Figure 3

3. Drill two 3/8-inch holes into the center of the vehicle cross member.
4. Attach the mounting bracket to the vehicle cross member midway between the side rails, close to the brake chambers the valve serves.
5. Use two 3/8-inch Grade 8 bolts with prevailing torque nuts and washers to attach the assembly to the vehicle cross member. Tighten the bolts to 18 lb-ft (24 N•m). **ⓘ**

II. Connect the air lines.

Plumb the spring brake relay or emergency relay valve into the system as usual.

1. For bracket mounts, connect the air supply line from the supply tank to ECU/single modulator valve assembly supply Port 1.

Use 5/8-inch O.D. min. nylon tubing for frame mounts.

- Connect the air delivery lines from the service chambers to the ECU/single modulator valve assembly Port 2 (3/8-inch NPTF). Figure 4.
 - Attach the opposite ends of the air delivery lines to the appropriate brake chambers (3/8-inch NPTF).

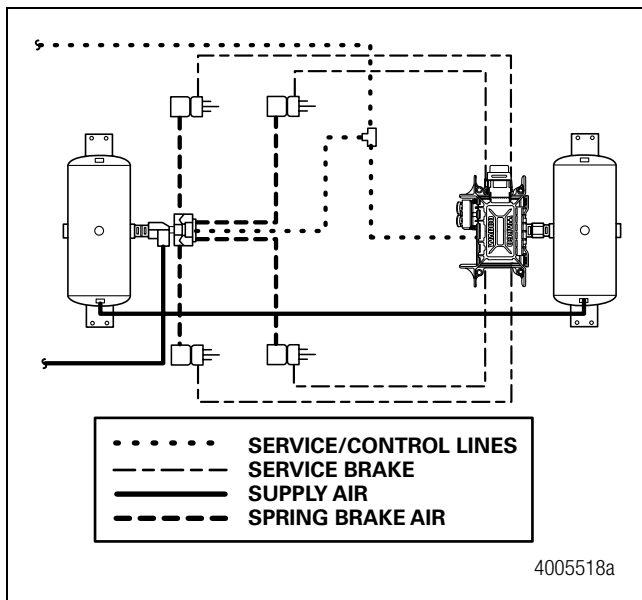


Figure 4

- Connect the brake service control line to the ECU/single modulator valve assembly Port 4 (3/8-inch NPTF). Figure 4.
- Plug any unused delivery ports. Apply SAE-standard, DOT-approved Teflon tape or paste-type thread sealant to all pipe threads beyond the first two threads. Pipes with pre-applied thread sealant may also be used.

III. Install the two sensor extension cables (ABS-Prepped Axles).

Instructions for installing sensors on non-ABS-prepped axles are included in the Appendix.

Meritor WABCO recommends placing sensors on the axle that will provide the most braking performance. The suspension manufacturer can provide this information.

- Visually inspect the tooth wheel and sensor to ensure no damage occurred during shipping. Perform any necessary repairs.
- Connect the sensor and cables on the prepped axles to the sensor extension cables. Figure 5.

Ensure that each connection is secure.

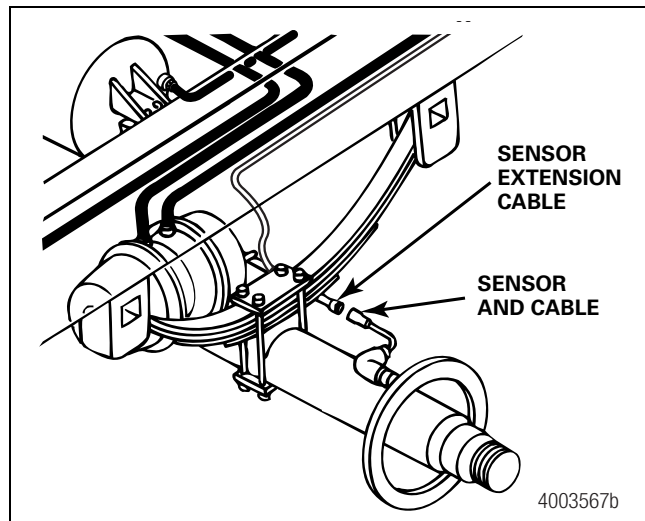


Figure 5

- Route the sensor cable along the back side of the trailer axle to the ECU/single modulator valve assembly. Route the cable with the brake hose. Figure 5.

Do not overtighten the tie wraps on a cable. Overtightening can damage the cable. Do not tie wrap the molded sensor plug. The sensor extension cable must follow the brake hose to the ECU/single modulator valve assembly to allow for axle jounce and rebound.

- Secure the cables every eight inches (203 mm) with tie wraps or cable clips.
- Push the sensor retainer clip on the ECU/single modulator valve assembly UP.
- Remove the protective caps from the YE2 and YE1 sensor connectors. Figure 6.

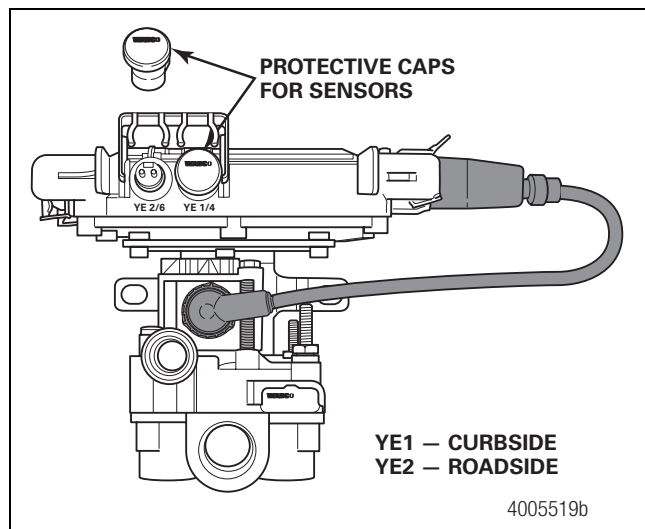


Figure 6

7. Plug the sensor extension cable into the ECU/single modulator valve assembly. To secure the connection, push the sensor retainer clip **DOWN**. Retainer clips must fit in the groove of the sensor connectors to ensure correct connection.
 - Connect the curbside sensor at YE1.
 - Connect the roadside sensor at YE2.
8. Create a strain relief to protect the sensor extension connector terminals. Without the strain relief, normal trailer jounce and vibration will cause the terminals to spread and loosen. Use a tie wrap or clip to secure the cable to the air hose as close to the fitting as possible. Figure 7.

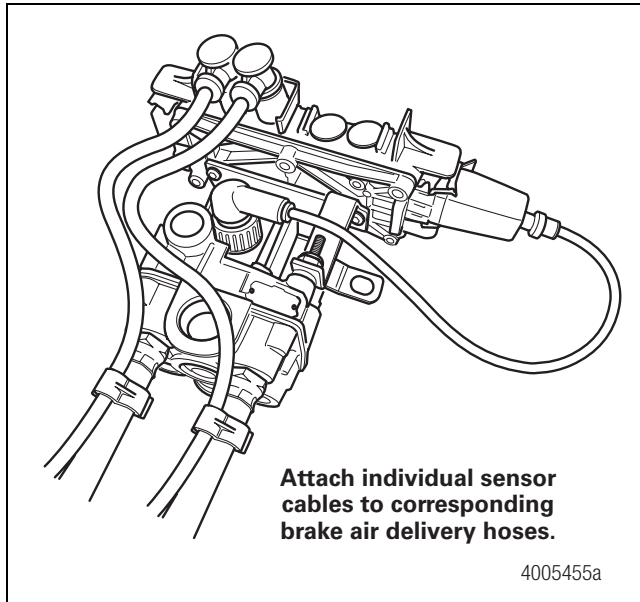


Figure 7

9. Bundle any excess cable in a loop (bow tie). Figure 8.

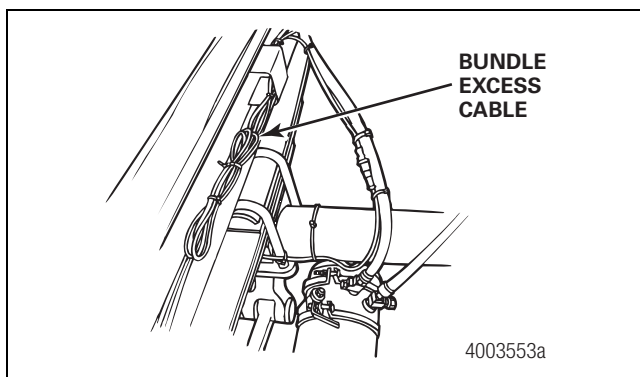


Figure 8

10. Secure excess cable in the sub-frame of the vehicle or along the air hoses as appropriate. Excess cable should not exceed two feet (0.61 meter).

IV. Install the power or power/diagnostic cable.

1. Identify the type of cable to be installed.
 - ABS trailer industry-standard pigtail connector cable
 - Blunt-cut power cable
2. For industry-standard pigtail connector cables, route the cable from the harness connector to the ECU/single modulator valve assembly and secure it to prevent damage.

For a blunt-cut power cable, route the cable from the ECU/single modulator valve assembly to a junction box which interfaces with the seven-way connector at the front of the trailer.

Leave enough slack in the cable to compensate for flexing of the trailer and sub-frame.
3. Bundle any excess cable in a loop (bow tie) and secure it in the sub-frame of the trailer body to prevent cable damage.
4. Push the hinged power connector retaining clip **UP** and remove the protective cap from the ECU/single modulator valve assembly. Figure 9.

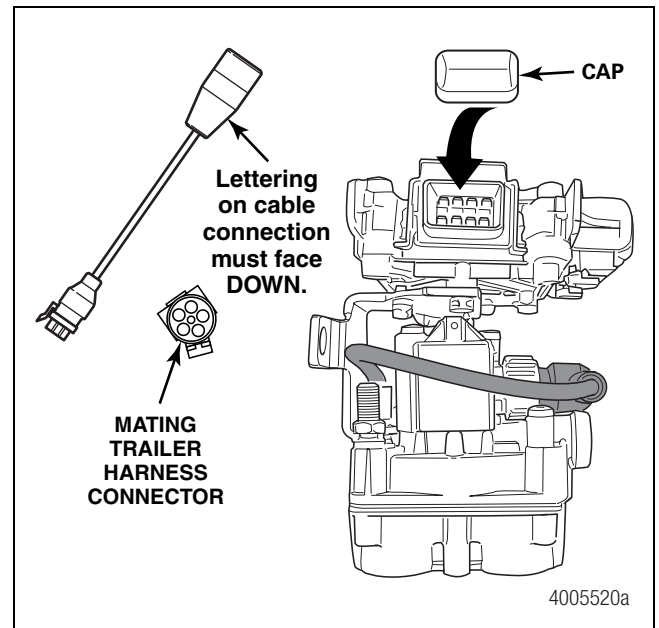


Figure 9

5. Plug the power 8-pin connector on the power or power cable into the ECU/single modulator valve assembly. WABCO identification on the cable connection must face **DOWN**.

6. Pull the hinged power connector retaining clip on the ECU/single modulator valve assembly DOWN to secure the connection.
7. If you are installing the power cable only, go to Step 9.
8. If you are installing the power/diagnostic “Y” cable:
 - A. Install the diagnostic cable bracket so that the diagnostic plug is accessible. The normal location is on the right front corner of the sub-frame, but will vary depending on the type of trailer.
 - B. Route the diagnostic cable from the ECU/single modulator valve assembly to the diagnostic cable bracket.
 - C. Correctly secure the cable in the sub-frame to prevent cable damage.
Leave enough slack in the cable to compensate for flexing of the trailer and sub-frame.
 - D. Bundle any excess cable in a loop (bow tie) and secure the cable in the sub-frame.
9. Install the ABS indicator lamp on the trailer. Refer to the vehicle specification sheet for the exact location of the indicator lamp. Use a DOT-approved lamp with ABS etched on the lens (available from major trailer parts suppliers).
If you are using the industry-standard connector cable and do not have access to the mating trailer harness, mask the open connector to protect it from paint or grease.
10. Connect the power. Use the industry-standard connector cable or a blunt-cut power cable.
 - **For industry-standard connector cables:** Attach the power cable to the harness on the trailer. Figure 10.
 - **For an optional blunt-cut power cable:** Wire the cable and ABS indicator lamp to the seven-way connector on the trailer according to the following diagram. Figure 10.

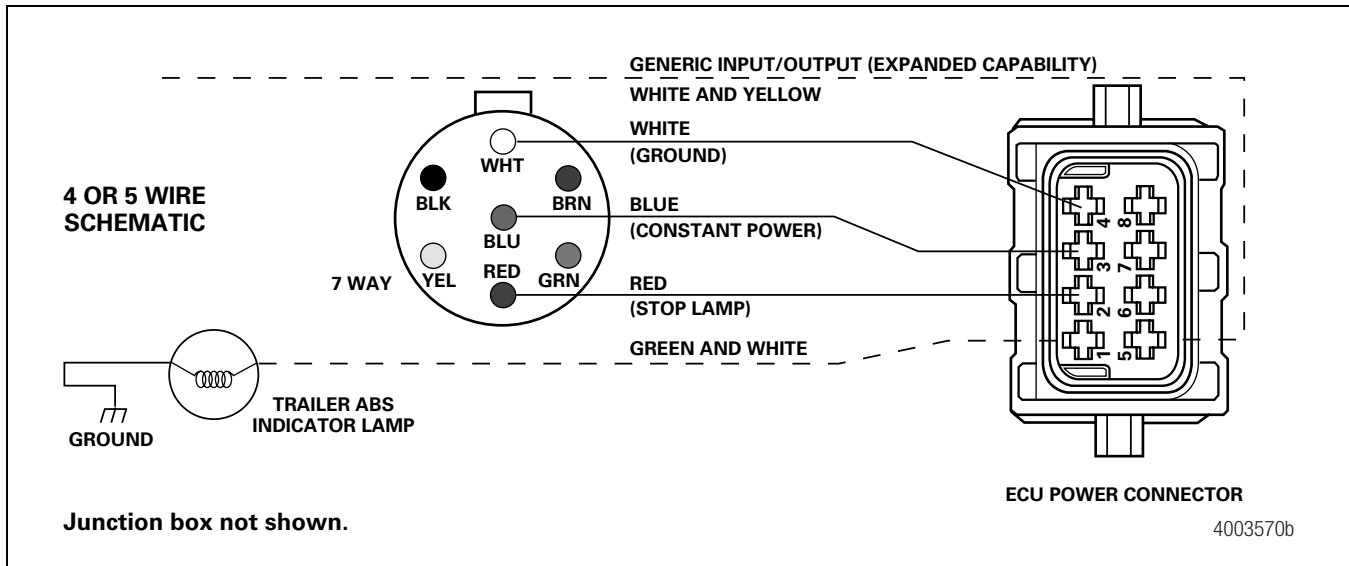


Figure 10

Typical Easy-Stop™ Trailer ABS Installations

Refer to Figure 11 for typical Easy-Stop™ trailer ABS installations.

Meritor WABCO recommends placing sensors on the axle that will provide the most braking performance. The suspension manufacturer can provide this information.

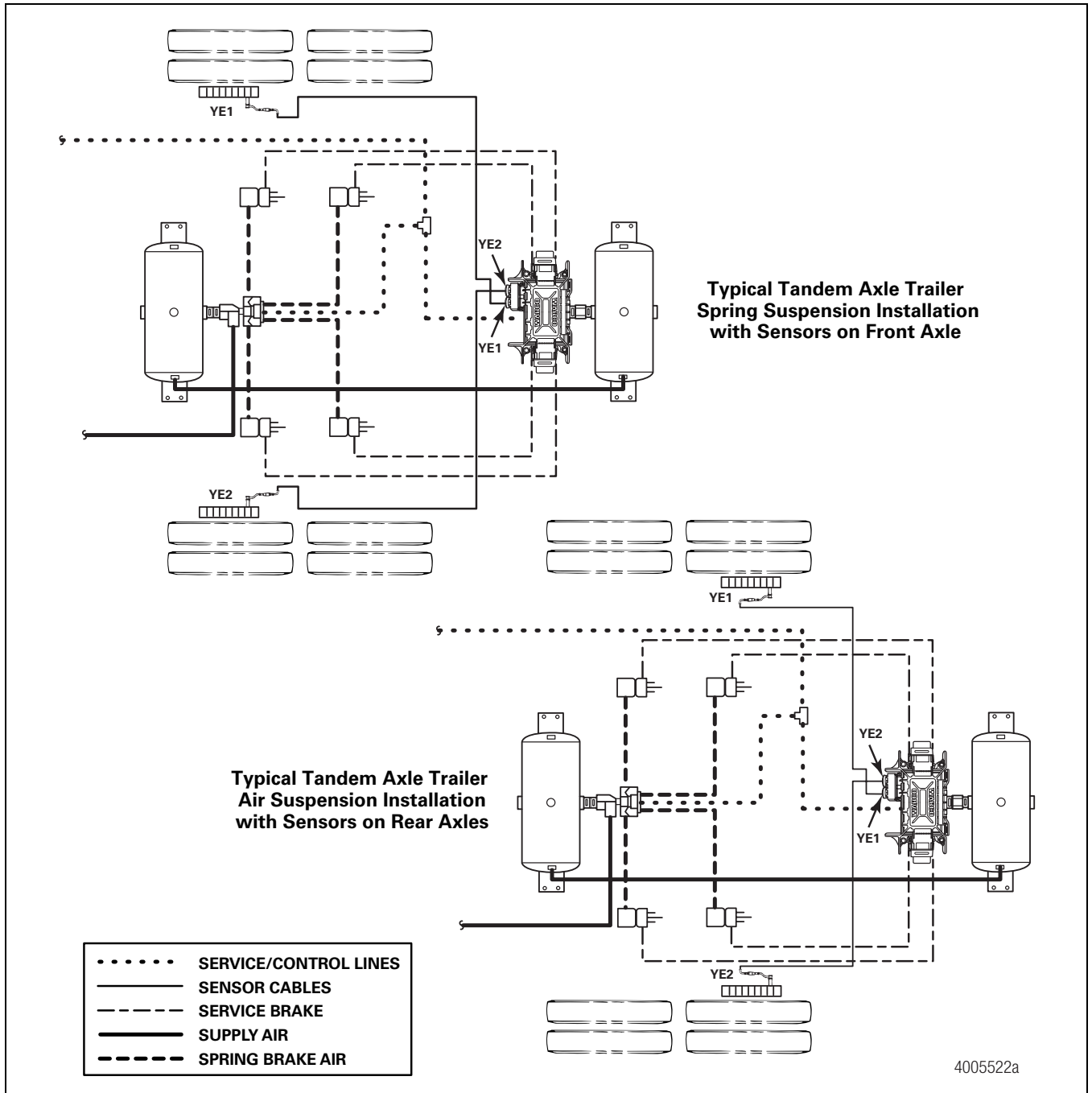


Figure 11

End of Line Testing

End of line testing is required on all Enhanced Easy-Stop™ installations. To run these tests, Meritor WABCO recommends you use TOOLBOX™ Software.

TOOLBOX™ Software and general test procedures are included in this bulletin. If you are using a Pro-Link, refer to the operating manual for test instructions.

Enhanced Easy-Stop™ 2S/1M Basic Installation — End of Line Testing Procedure Using TOOLBOX™ Software

If you are testing an installation that has a power only cable, temporarily install a Meritor WABCO combination power/diagnostics “Y” style cable.

1. Connect the diagnostic connector on the cable to the PC serial port/SAE diagnostic interface (J1587/J1708 to RS232 interface).

Refer to the Software Owner’s Manual, TP-99102, for instructions for running TOOLBOX™ Software.

2. Display the **Trailer ABS Main Screen**.
3. Verify the power supply.
 - Apply 12 volts DC to the blue wire (constant). Check the screen for the correct voltage (9.4 to 14 volts). Constant power voltage is displayed in the PRIMARY field. Figure 12.
 - Apply 12 volts DC to the red wire (stoplight power). Check the screen for the correct voltage (9.4 to 14 volts). Stoplight power voltage is displayed in the SECONDARY field. Figure 13.

The internal field is not applicable to this test.

4. Check the Faults field on the Main Screen.

NONE = No faults present, proceed with end of line test.

YES = Faults present, double-click on “YES” to bring up the fault information screen.

Use the information in the **Repair Instructions** field to perform the necessary repairs.

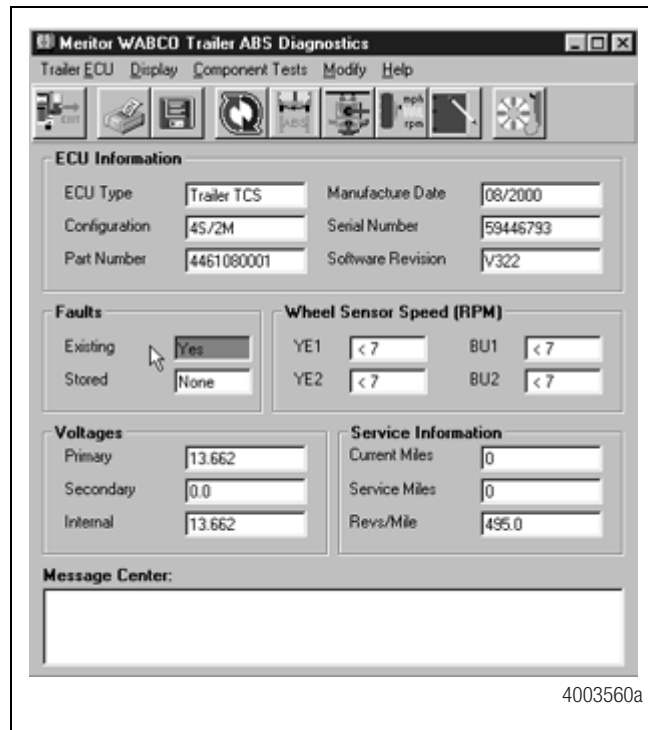


Figure 12

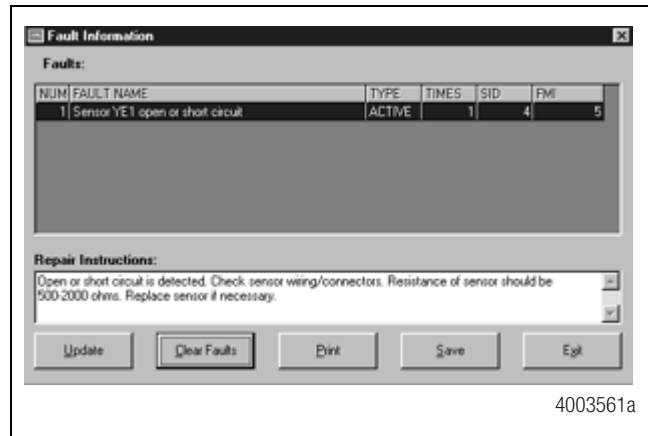


Figure 13

End of Line Test with TOOLBOX™ Software

Verify Correct Valve and Lamp Installation

To verify valve and lamp installations with TOOLBOX™ Software:

1. At the **Trailer Main Screen**, click on **Component Test**, then select **Valves/Lamp** to display the **Valve Activation Screen**. Figure 14.



Figure 14

2. The Red valve indicator will be selected. Click on the **Activate** button and listen for the valve to click, indicating a good installation. The **Test Status** box at the bottom of the menu will also display the status of this test.
3. Click on the **Test** button to activate the ABS indicator lamp — this is the lamp that is mounted on the side of the trailer. The lamp will flash eight times, indicating lamp installation is OK. The **Test Status** box at the bottom of the menu will also display the status of this test.
4. Click on **Close** to exit.

Sensor Orientation Test

The sensor orientation test must be performed as part of the end of line testing procedure.

Sensor Orientation Test Screen

Before beginning this test, look at the ECU to see if the wheel end sensors face the front or rear of the trailer. TOOLBOX™ will ask for this information to start the test (Step 5). To perform the sensor orientation test:

1. Raise the sensed wheel ends off the ground.
2. Apply air to the emergency line to fill the air tanks and release the spring brakes so that the wheels can be rotated.
3. Apply 12 volts DC to the ABS.
4. At the **Trailer Main Menu**, click on **Component Test**, then select **Sensor Orientation Test** to display the **Sensor Orientation Test** screen. Figure 15.

When the **Sensor Orientation Test** screen first appears, the **Sensors Facing** field will display the default — **Front**. This will occur regardless of the actual sensor orientation of the installation being tested.

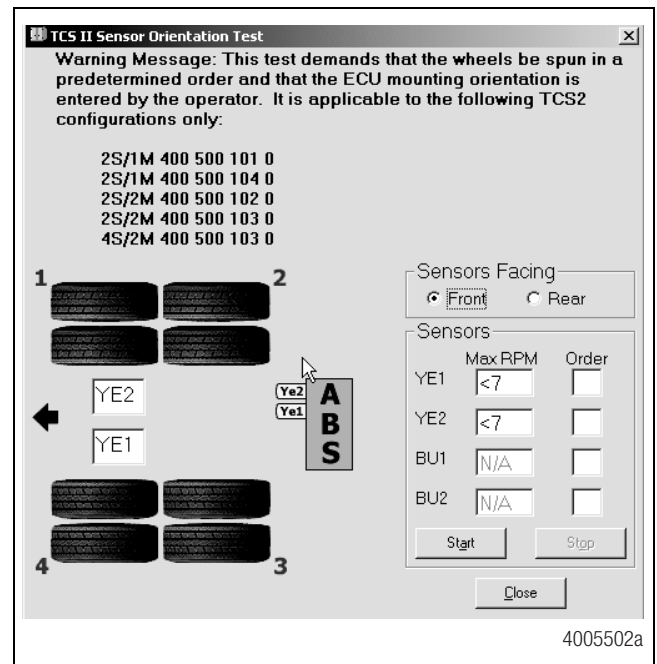


Figure 15

- Click on **Front** or **Rear** in the **Sensors Facing** field to select the mounting orientation of the ECU/single modulator valve assembly.

Refer to Figure 15 and Figure 16 for illustrations of the ECU mounted with sensors facing forward and rear. The correct mounting orientation must be selected prior to starting the test.

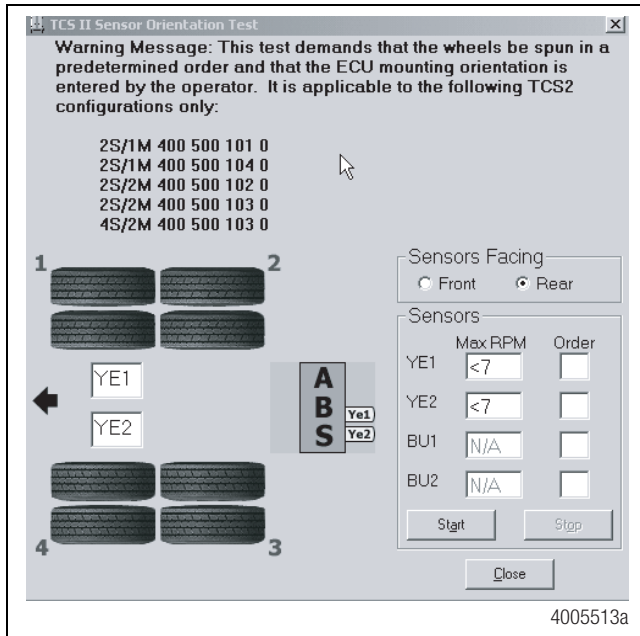


Figure 16

- Click on **Start** to begin the test. Figure 17.

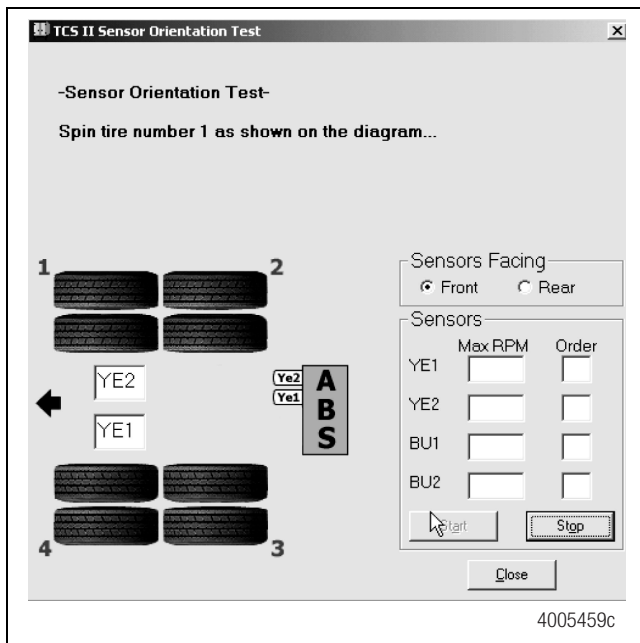


Figure 17

- Follow the screen prompts, starting with 1, to rotate each sensed wheel end at a rate of 1/2 revolution per second. This rate equals a wheel speed of approximately 4 mph (7 kph). As each sensed wheel is rotated, check the color of the sensor identification block on the screen for results. Sensor identification boxes are located in the bottom left portion of the **Sensor Orientation Test** screen. Figure 16.

Green background: Correct sensor location. Spin the next sensed wheel as indicated by the screen prompt.

Red background: Incorrect sensor location. If you get a red background, you must stop the test (click on **Stop**), make the necessary corrections and repeat Steps 3 through 6.

- To finish the Sensor Orientation Test, click on **Stop**, then on **Close**.
- Verify there is sensor output. If there is no sensor output, verify that a tone ring has been installed and that the sensor is pushed all the way in against the tone ring. Perform the necessary repairs and repeat the test. If the problem persists, contact Meritor WABCO (800-535-5560). Sensor output appears in the Sensors field located in the bottom right portion of the **Sensor Orientation Test** screen. Figure 16.

End of Line Testing without TOOLBOX™ Software

- Apply 12 volts DC power to the ABS.
- The ECU/single modulator valve assembly should click two times.
- If the indicator lamp **comes on** for three seconds and **goes out**:

This indicates a correct installation. The end of line test is complete.

If the ABS indicator lamp **comes on** and **stays on**, check the sensor installation:

- Remove the power from the ABS and raise the sensed wheels so they may be rotated.
- Repeat Step 1 and Step 2.
- Rotate each sensed wheel — one at a time — at a rate of 1/2 revolution per second. This rate equals a wheel speed of approximately 4 mph (7 kph).

The ABS indicator lamp should now go out and stay out indicating a correct installation. The end of line test is complete.

- If the ABS lamp does not go out, there is a sensor gap problem or hardware fault. Adjust the sensor and, if necessary, perform a fault code check.

Sensor Gap Adjustment

Push the sensor into its holder until it contacts the tooth wheel. At installation, there must be no gap between the sensor and the tooth wheel.

Measure the AC voltage output. The value should be 0.2 volt AC when the wheel is rotated at a rate of 1/2 revolution per second.

Perform any necessary repairs.

Repeat the sensor installation check. If the trailer lamp still does not go out, a system fault exists. Perform a fault code check.

Fault Code Check

Use constant power activation to perform the following fault code check.

1. Apply constant power to the ECU/single modulator valve assembly for more than one, but less than five seconds.
2. Remove the power.
3. Reapply the power.
4. Check the trailer ABS indicator lamp on the side of the trailer. The fault code will be displayed three times.
5. Find the fault on the chart and perform the necessary repairs.
6. After performing the necessary repairs, repeat the end of line test to verify correct sensor installation.

Blink Code Chart		
Blink Code	Problem Area	Action
4	Sensor YE1 (curbside sensor)	Check sensor installation. Perform necessary repairs.
6	Sensor YE2 (roadside sensor)	Check sensor installation. Perform necessary repairs.
7	ECU/single modulator valve assembly	Verify correct installation. If code continues, contact Meritor WABCO for assistance.
14	Power Supply	Verify correct electrical installation. Check power supply. Perform necessary repairs.
15	ECU Failure	Verify correct installation. If code continues, contact Meritor WABCO for assistance.
16	SAE J1708 Failure	Internal failure, contact Meritor WABCO.
17	SAE J2497 Failure	Internal failure, contact Meritor WABCO.
18	Generic I/O Failure	Verify correct electrical installation. Check power supply. Perform necessary repairs.

Trailer Identification

After ensuring the Enhanced Easy-Stop™ trailer ABS has been correctly installed, attach the ABS indicator label included with the ECU/single modulator valve assembly to the trailer. Generally, this will be applied near the ABS trailer indicator lamp. Figure 18. Refer to the vehicle specification sheet for the correct location.

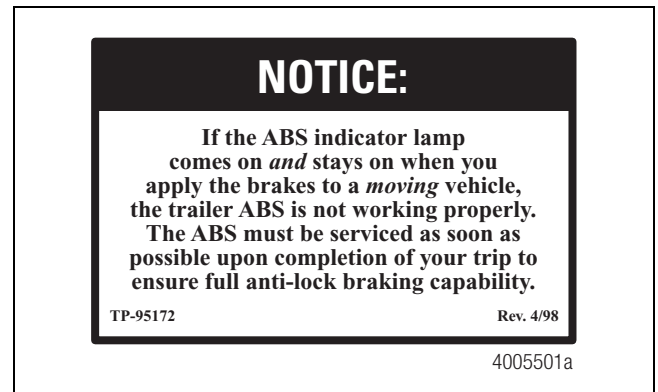


Figure 18

If this label is not included with the assembly, let your supervisor know. Labels are available from Meritor WABCO. Ask for part number TP-95172.

For additional assistance, contact Meritor WABCO at 800-535-5560.

Appendix

Installing Sensors on Non-ABS-Prepped Axles

Sensor locations vary due to suspension type. Meritor WABCO recommends placing the sensor on the axle that will provide the most braking performance. Contact your suspension manufacturer for further information.

1. Apply a mineral oil-based grease that contains molydisulfide to the sensor spring clip, the body of the sensor and the bore of the sensor block. The grease must be anti-corrosive and contain adhesive properties that will continuously endure temperatures from -40° to 300°F (-40° to 150°C).

2. Push the spring clip into the sensor holder from the inboard side, until the spring clip tabs are against the sensor holder. Push the sensor into the spring clip as far as possible.

Use Meritor WABCO spring clips to ensure a correct fit.

3. Push the spring clip into the sensor holder from the inboard side until the spring clip tabs are against the sensor holder. Push the sensor into the spring clip as far as possible.

Figure A-1.

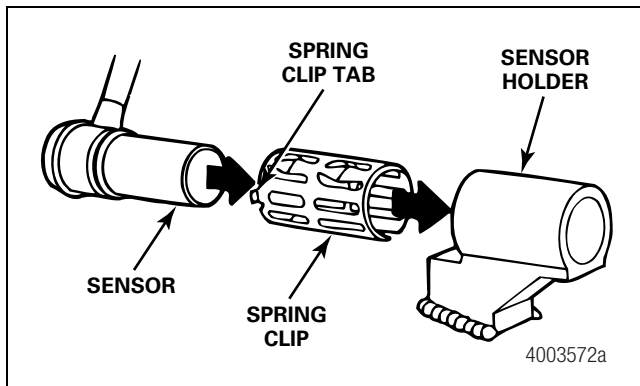


Figure A-1

4. Route the sensor cable toward the brake chamber, over the brake spider or through the pre-stamped hole dedicated to ABS sensors. Route to the back side of the axle. Secure the cable to the axle between the brake spider and the suspension brackets. Continue to route the sensor cable behind the spring seats. Secure the cable to the axle one inch from the molded sensor plug. Figure A-2.

Do not overtighten tie wraps on a cable. Overtightening can damage the cable. Do not tie wrap the molded sensor plug. The sensor extension cable must follow the brake hose to the ECU/valve assembly to allow for axle jounce and rebound.

Brake hose clips with a provision for the sensor extension cable are recommended as opposed to tie wraps. Meritor WABCO does not supply this part.

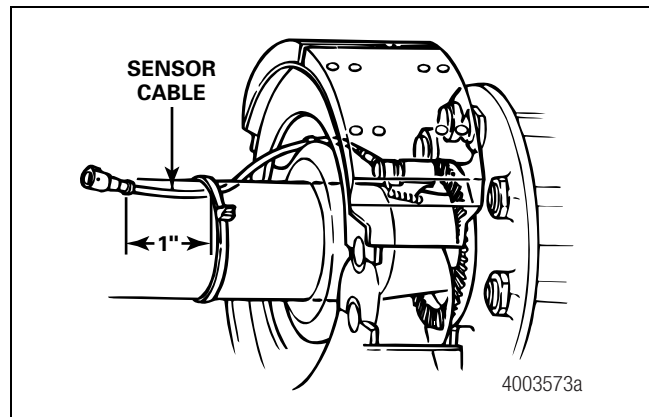


Figure A-2

5. Install the wheel hub carefully so that the tooth wheel pushes against the sensor as the wheel bearings are adjusted. There should be no gap between the sensor and the tooth wheel.

6. Test the sensor output voltage. Use a volt/ohm meter to check the output voltage of the sensors while rotating the wheel at approximately 1/2 revolution per second. Minimum output must be 0.2 volt AC. If minimum output is less than 0.2 volt AC, push the sensor toward the tooth wheel. Recheck the sensor output.

MERITOR WABCO

Meritor WABCO Vehicle Control Systems
2135 West Maple Road
Troy, MI 48084-7121 USA
800-535-5560
meritorwabco.com



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Revised 08-05
(16579/24240)



Spring Brake & Emergency Valves Quick Reference



View the full Sealco product line on the web at www.sealcocvp.com

Spring Brake Valves

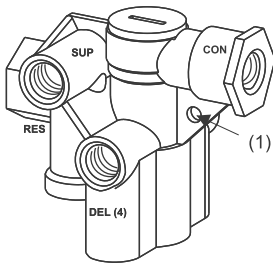
Spring brake valves are primarily designed to release the springs on dual air chamber brakes and fill the reservoir. All include supply line protection, anti-compounding support, and a delivery pressure holding feature. Each have four 3/8" delivery ports, a 3/8" supply port, a 3/8" control port and at least one 1/2" reservoir port.

Fill Priority indicates how the valve directs flow when the reservoir is empty. 'Spring' means the spring chambers get 100% of the flow up to about 80 psi. 'Service' means the reservoir shares the flow with the spring chambers.

Relay Fill feature uses reservoir pressure to dramatically reduce the brake's release time.

Premium Four Port Spring Brake Valves

These small body premium valves include the Relay Fill feature.



Part Number	Fill Priority
110800	Spring
110700	Service

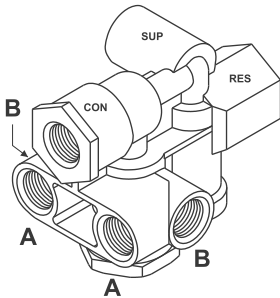
Service Assemblies

110515 Pressure Protection
110705 Movable Seat.

(1) Hole indicates the valve is a 110800

Value Priced Four Port Spring Brake Valves

These are small body spring brake priority valves.



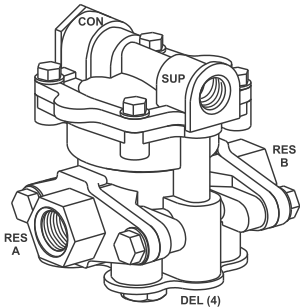
Part Number	Plugged Ports
110500	None
110505	Delivery Ports B
110510	Delivery Ports A

Service Assemblies

110515 Pressure Protection
110520 Movable Seat.

Protected Reservoir Four Port Spring Brake Valves

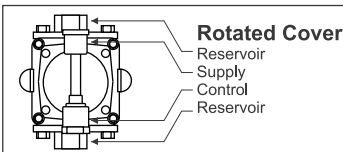
These large body valves have two reservoir ports and include the Relay Fill feature.



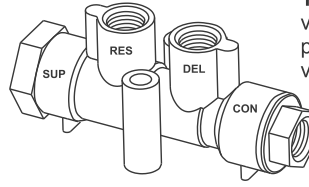
Part Number	Reservoir		Rotated Cover
	A	B	
110170	1/2"	1/2"	No
110171	1/2"	3/8"	Yes
110191	3/8"	1/2"	Yes
110310	3/8"	1/2"	No
110315	1/2"	3/8"	No

Service Assemblies

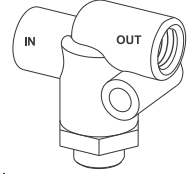
110175 Plug Unit (PRE 10/92)
110609 Plug Unit (Post 9/92)
110185 Major Repair Kit
110195 Minor Repair Kit



Emergency Control Valves



110376 is a 3/8" ported emergency control valve. It is often used to add emergency & park brake features to relay valves on vehicles that do not use spring brakes.

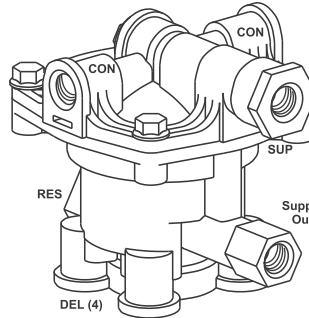


Always aim vent downward

110257 is a specialized 3/8" ported, emergency pressure protection valve. It provides supply line protection when coupled with the 110376 or the 110338 valve. It should not replace or be replaced with conventional pressure protection valves.

Relay Emergency Valves

Relay emergency valves are used in brake systems with single chamber brake actuators. Each valve features a 3/4" reservoir port, four 3/8" delivery ports, two control and one supply port. Ratio valves produce a momentary pressure surge during harder than normal braking.



Non-Charging Style

Part Number	Con/Sup Ports	Ratio Valve	Supply Out
110338	3/8"	No	Yes

110359 Non-Charging Valve Repair Kit

Charging Style

Part Number	Con/Sup Ports	Ratio Valve	Supply Out
110200	1/4"	*Yes	No
110205	3/8"	*Yes	No
110460	1/4"	No	No
110470	3/8"	No	No
110475	3/8"	No	Yes

110201 Charging Valve Repair Kit

Service Assemblies/Kits

110143 Plug Unit Assembly
110162 Spool Assembly
110166 Minor Spool Kit

*Ratio valves should not be used on dollies, steerable axles, & lift axles.

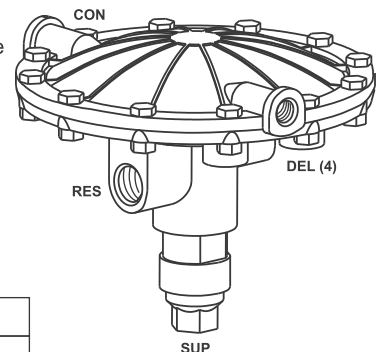
Relay Emergency Valves (Pre FMVSS 121 Regulations)

A charging style relay emergency valve used for single chamber brake actuators on US air brake systems prior to implementation of FMVSS 121. It features a 1.5 psi crack pressure, 1/2" reservoir port and 1/4" delivery, control, and supply ports.

A1000S Relay Emergency Valve



1000-5A



Service Assemblies

1000-5A Replacement Cartridge
10-5 Repair Kit.



Service Brake Valves Quick Reference



View the full Sealco product line on the web at www.sealcovp.com

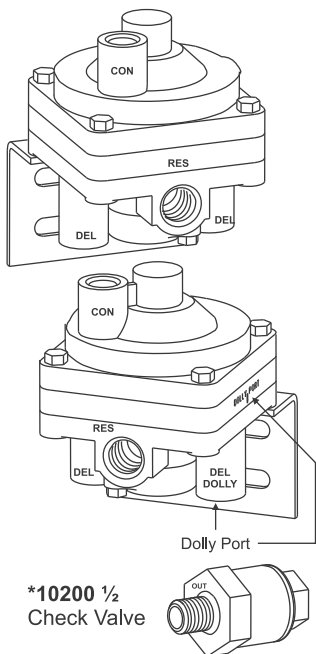
Two & Four Delivery Port Piston Style Valves

Piston style service relay valves with 3/8" delivery and control ports. Suitable for reservoir or frame mounting. No service parts are available.

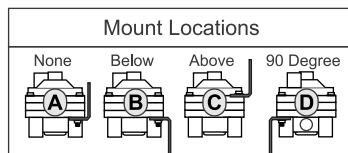
4 Delivery Port Valves			2 Delivery Port Valves		
3/4" Reservoir Port			1/2" Reservoir Port		
Part Number	Crack Pressure	Mounting	Part Number	Crack Pressure	Mounting
110380	1.5 psi	Nipple	110360	1.5 psi	Nipple
110385	1.5 psi	Frame	110365	1.5 psi	Frame
110415	4.0 psi	Nipple	110410	4.0 psi	Nipple
110416	4.0 psi	Frame	110412	4.0 psi	Frame
110488	5.5 psi	Nipple	110487	5.5 psi	Nipple
110615	4.0 psi	*2030	*Use four #2030 screws for mounting		

Control Line Booster Valves

These "speed up" valves are primarily used on dollies, lead semi, and long trailers to accelerate the apply and release of the control line signal. They have two 3/8" delivery ports, one 1/2" reservoir port, a 3/8" control port and feature a zero pound crack pressure. Some are equipped with a reduced flow delivery port marked "Dolly" which improves brake balance on trailer trains.



Part Number	Dolly Port	Mount	Check Valve
110570	Yes	(B)	None
110571	Yes	(A)	None
110580	No	(B)	None
110582	No	(C)	None
110588	No	(D)	None
110605	No	(B)	10200 1/2"
110606	Yes	None	10200 1/2"
110690	Yes	None	None
110790	No	None	None

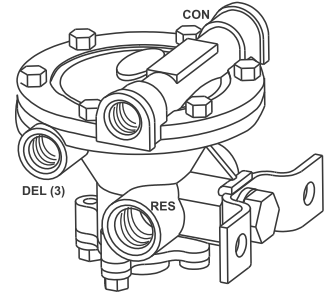


*Most applications require the 10200 1/2" to be installed in the reservoir port.

Three Delivery Port Diaphragm Style Valves

These frame mounted valves are commonly used on tractor, trucks, or lift axles. They feature a 5.5 psi crack pressure, two 3/8" delivery ports, one 1/2" delivery ports, two 1/2" reservoir ports, two control ports and a mounting kit.

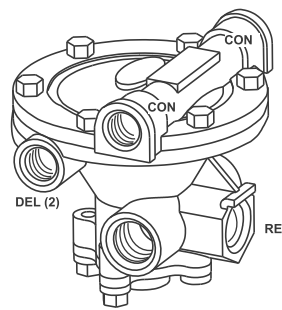
Part Number	Control Port	Mounting Kit
9125	1/4"	110237
110207	3/8"	110237
110228	3/8"	110156



9125-5 Plug Unit Assembly
912-5 Repair Kit

Two Delivery Port Diaphragm Style Valves

These rugged diaphragm valves are primarily used for single axle vehicle or lift axle applications. They are configured with a 1/2" reservoir port, two 3/8" control and two 3/8" delivery ports.



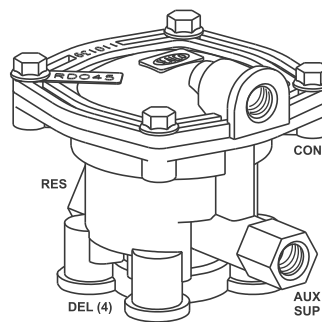
Part Number	Crack Pressure	Mounting
110197	4.0 psi	Nipple
110198	4.0 psi	Nipple (1)
110199	4.0 psi	Nipple (2)
110275	4.0 psi	Frame (3)
110507	6.0 psi	Tank

(1) 6002 (1/2") nipple included
(2) 6003 (3/4") nipple included
(3) 110237 frame kit included

110227 Plug Unit Assembly For All But The 110507
912-5 Repair Kit

Four Port Service Relay

Service relay valves with four 3/8" delivery ports, a 3/4" reservoir port and 3/8" auxiliary supply port (unless otherwise noted). Ratio valves produce a momentary pressure surge during harder than normal braking.



*Ratio Valves		
Part Number	Aux. Supply	Plug Unit (Crack Pressure)
110139	Yes	110143 (4.5)
110584	Yes	110583 (5.5)
110600	No	110143 (4.5)
Non-Ratio Valve		
Part Number	Aux. Supply	Plug Unit (Crack Pressure)
110450	Yes	110143 (4.5)

110673 Auxiliary Supply Port Repair Kit

*Ratio valves should not be used on dollies, steerable axles, & lift axles.



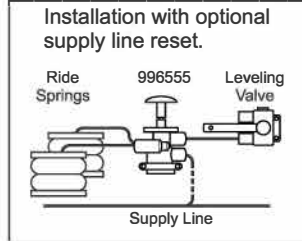
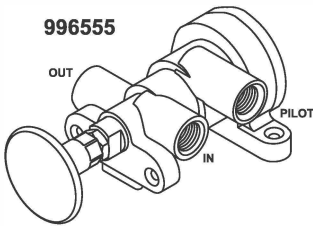
Control Valves Quick Reference

View the full Sealco product line on the web at www.sealcovp.com



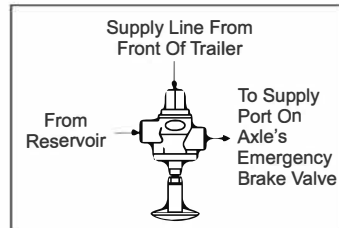
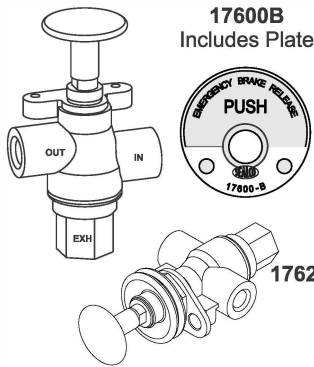
Suspension Exhaust Valve With Reset Pilot Port

Commonly used to exhaust air suspensions.



Park Brake Release Valves

Use to release parking brakes on trailers or dollies

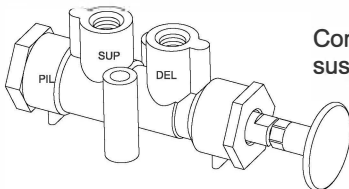


Single Hole Mounting With Weather Boot (No Plate)

176-5 Repair Kit

Normally Closed Pilot Reset Hand Valve

Used in systems where delivery vents when the vehicle's park brakes are released.



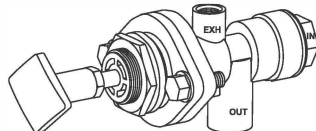
Commonly used for slider suspension locks.

110589WC

Momentary (Deadman) Hand Valve

Delivers when knob is depressed and held in. Commonly used for locking mechanisms such as sliding fifth wheel plates.

110770

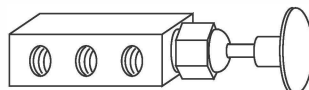


17620-2 Mounting Kit (Optional)
Includes Weather Boot & Retainer Nut

Five Port & Suspension Valves

These valves are commonly used to raise and lower lift axles.

152000 Manual Valve
Includes extra pilot reset port. Can be mounted through panel or body mounted.

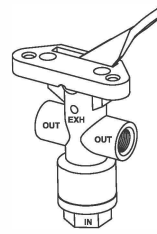


138000 LSAS MR

Automatically lowers lifted axles when a load is sensed.

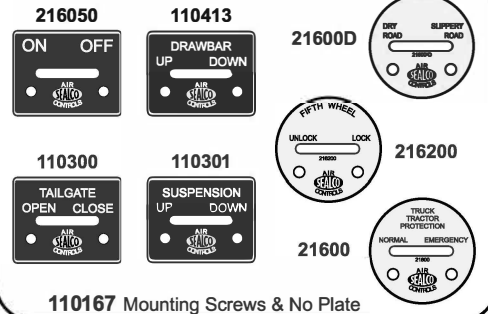
Lever Hand Control Valves

A versatile manually operated lever valve used in a wide variety of applications. Toggles side to side to open or close.



21600-2 Basic Valve

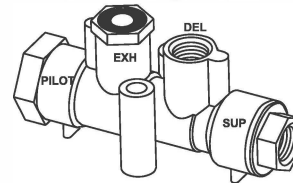
Valves With Plates & Mounting Screws



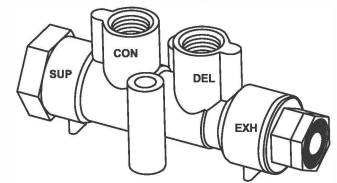
Pilot Control Valves

Pilot operated control valves with exhaust breather.

110587 Normally Closed



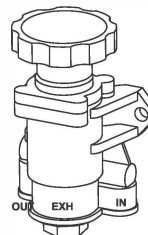
110591 Normally Open



Pressure Control Valves

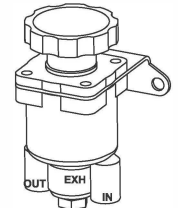
Robust pressure regulators suitable for outdoor use. Each has a 1/4" inlet, a 1/4" outlet, and a 1/8" exhaust port.

5400



9400 & 940000

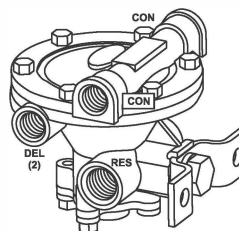
Part Number	Minimum Delivery	Maximum Delivery
5400	Zero PSI	Inlet PSI
9400	5 PSI	85 PSI
940000	Zero PSI	Inlet PSI



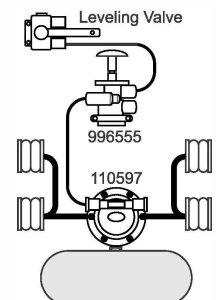
Fast Fill Suspension Valves

Provides fast filling of air suspension up to 40 psi then returns control to the leveling valve. Each has a minimum of two 3/8" control ports, two 3/8" delivery ports and a 1/2" reservoir port.

110595 Frame Mounted Version
Includes an extra 1/2" reservoir and delivery port.



110597 Nipple Mounted Version





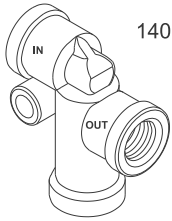
Auxiliary System Valves Quick Reference



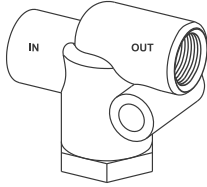
View the full Sealco product line on the web at www.sealcovp.com

Set Pressure Protection Valves

These valves can be nipple or body mounted. The 140 series include an internal check valve.



140 Series



110 Series

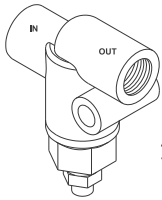
Always aim vents downward

Part Number	In/Out Ports	Close *PSI	Repair Kit
140200	3/8"	50	140201
140270	3/8"	60	140271
140280	3/8"	70	140281
140290	3/8"	80	140291
140300	1/4"	50	140201
140370	1/4"	60	140271
140380	1/4"	70	140281
140390	1/4"	80	140291
110258	3/8"	90	None
110657	3/8"	70	None

*Nominal Closing Pressure

Adjustable Pressure Protection Valves

These PPVs feature an adjustable closing pressure.



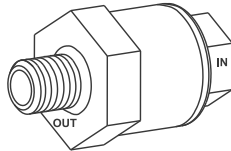
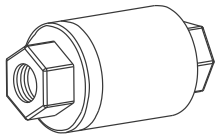
Always aim vent downward

Part Number	In/Out Ports	Factory *Set	Adjust Range
1300	3/8"	60	20-70
1300-45	3/8"	45	20-70
1300-80	3/8"	80	20-85

*Nominal Opening Pressure

Check Valves

Rugged all metal body check valves



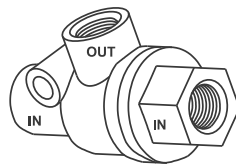
Single Check All Female		
Part Number	Inlet Port	Outlet Port
2200 1/4	1/4"	1/4"
2200 1/2	1/2"	1/2"
2200 3/4	3/4"	3/4"

Single Check Female/Male		
Part Number	Inlet Port	Outlet Port
10200 3/8	3/8"	3/8"
10200 1/2	1/2"	1/2"
10200 3/4	3/4"	3/4"
102001	3/4"	1/2"
102002	1/2"	3/4"

*Bypass Check All Female		
Part Number	Ports Size	Orifice Size
110183	1/4"	.028"
220000	3/4"	.030
220100	1/4"	.062

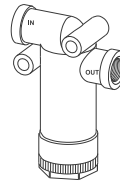
*Bypass check valves deliver full flow in one direction and metered flow (based upon orifice size) in the other.

These should not be used in place of standard check valves.



Two Way Check All Female		
Part Number	Inlet Port	Outlet Ports
320100	3/8"	3/8"

System Filter

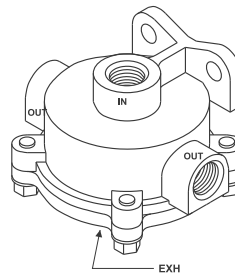


This supply line filter provides extra protection from contamination introduced through the gladhand.

2550 Supply Line Filter With 3/8" NPT Ports

Quick Release Valves

Heavy duty brake and suspension system quick release valves

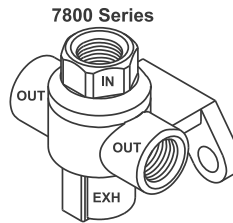


*Exhaust Port Threaded 1/2" NPT

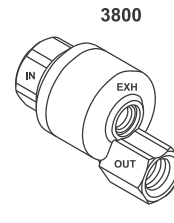
Part Number	Inlet Port	Outlet Ports	Crack PSI	Repair Kit
2000B 3/8	3/8"	1/4"	4-5	20-5
2000B 1/2	1/2"	3/8"	4-5	20-5
2000C 3/8	3/8"	1/4"	8-10	20-5
2000C 1/2	1/2"	3/8"	8-10	20-5
2000D 3/8	3/8"	1/4"	0-1	20D-5
2000D 1/2	1/2"	3/8"	0-1	20D-5
200000	1/4"	1/4"	0-1	20D-5
*200001	3/8"	3/8"	0-1	20D-5
*200002	1/2"	3/8"	0-1	20D-5
*200003	3/8"	1/4"	0-1	20D-5
*200004	3/8"	3/8"	0-1	200135
*200006	1/4"	1/4"	0-1	20D-5

Quick Release & Holding Valves

These valves will deliver and retain pressure until the supply pressure drops to less than half that of the delivery.



7800 Series



3800

Part Number	Port Size
3800	1/4"
7800	1/4"
780210	3/8"
*780219	3/8"

*Includes Exhaust Seal

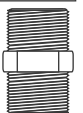
Mounting Nipples And Tees

These parts are NPT threaded fittings for use in air systems. The plated steel schedule 80 nipples are suitable for mounting air brake valves to reservoirs.

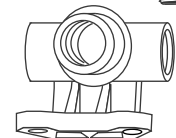
Number	Threads	Notes
6002	1/2"x1/2"	...
6003	1/2"x3/4"	...
6006	3/4"x3/4"	[W]
6010	1/2"x3/4"	[S]
6011	1/2"x1/2"	[S]
6012	3/4"x3/4"	[S] [W]

Number	Threads	Notes
616	1/2"x3/4"	[W]
617	1/2"x3/4"	[W] [F]

[F]=3/4" Thread Is Female
[S]=Pre-installed Sealant
[W]=Wrench Pad



780212	3/8 NPT Tee With Mount
780212P	Plated 3/8 NPT Tee With Mount
780214	3/8 & 1/4(2) NPT Tee With Mount



General Valve Assembly Information

The Basics

Every valve has the following elements:

- Inlet
- Main relief
- Work sections
- Outlet
- Section seals
- Stud kit to hold the assembly in place

The valve inlet is connected directly to the outlet coming from the hydraulic pump, and the valve outlet is connected directly to the tank.

The main relief valve is generally installed in the inlet and controls maximum system pressure.

The valve work sections connect the cylinders, motors, spreader valves or other auxiliary valves.



Work Section Types

Sections can be the following types:

- Single Acting (one work port)
- Double Acting (two work ports)

Actuators

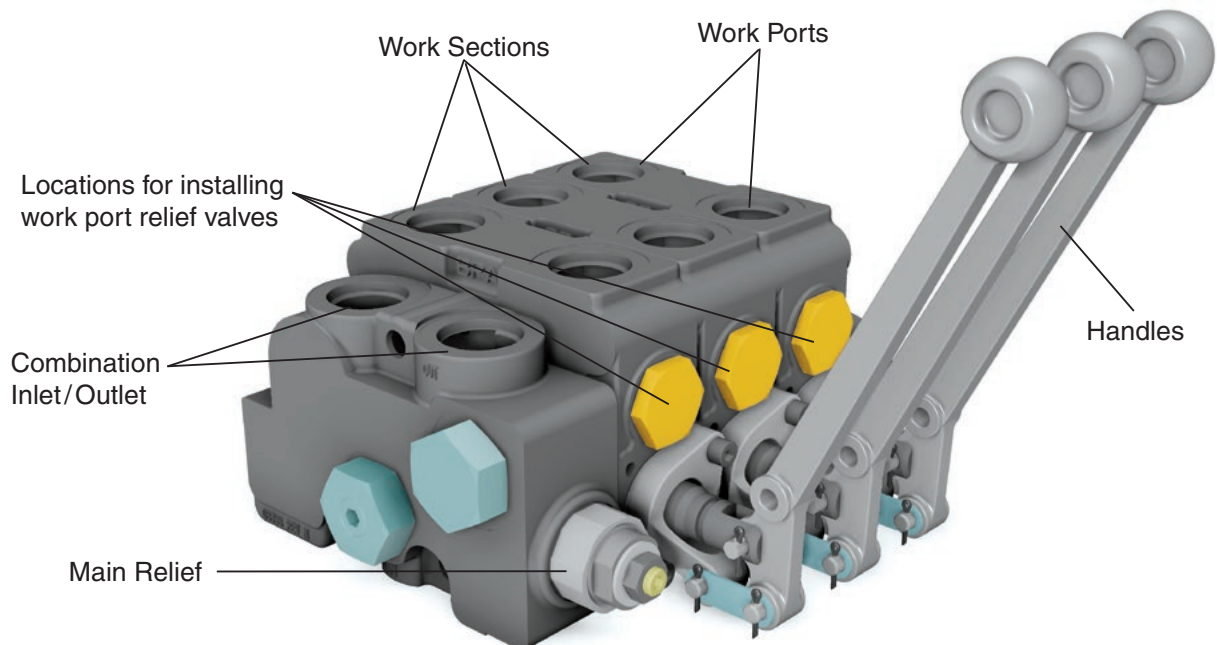
Work sections can be actuated by four means:

- Manual Handles
- Electric Solenoids
- Air Actuators
- Hydraulic Pilot

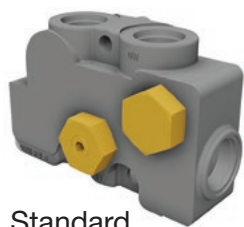
Work Port Relief Valves

Individual work section can have work port relief valves screwed into the sides of the work sections and can control:

- Control pressure
- Reduce cavitation
- Work port relief valves can be adjustable or fixed depending to the style.



V20 Inlets



Standard



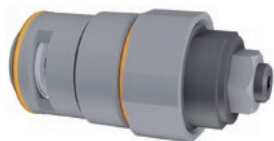
Mid Inlets

Specifications

Nominal Flow	Up to 95 LPM (25 GPM)
Operating Pressure	Up to 240 Bar (3500 PSI)

Part Number	Model Number	Description	Porting
08650029	20-LC-12	Standard Inlet	SAE 12
08650004	20-12-SF	Split Flow Mid Inlet	SAE 12
08650003	20-12-CF	Combined Flow Mid Inlet	SAE 12

V20 Main Relief Valves

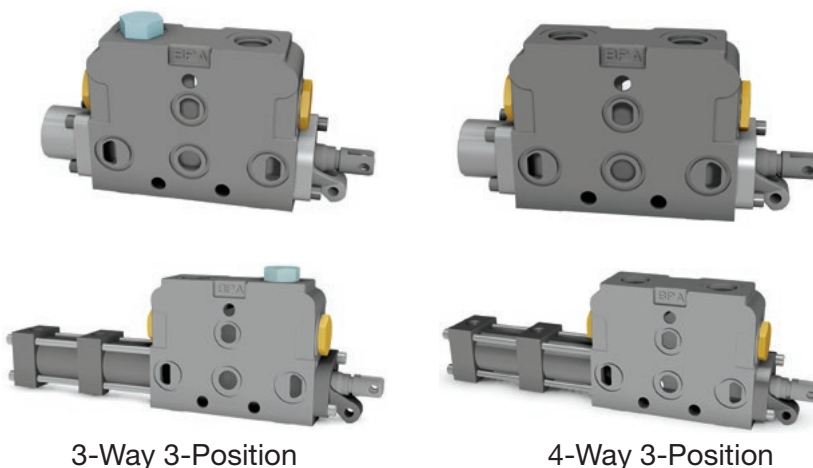


Part Number	Model Number	Description
RP51A-3000	RP51A-3000	Main Relief Valve
08650419	WH-1950	Fixed Main Relief Valve 134 Bar (1950 PSI)
08650420	WH-2550	Fixed Main Relief Valve 176 Bar (2550 PSI)



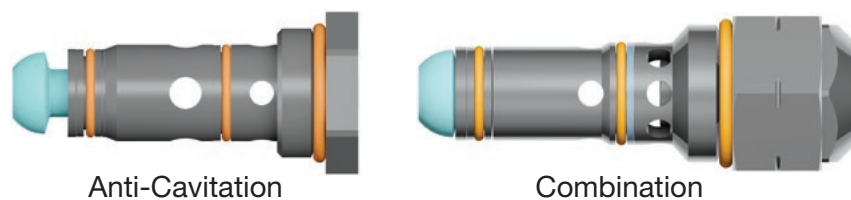
V20 Work Sections

Model V20 double-acting cylinder sections versus V20 motor spools cannot be visually determined simply by looking at the valves. It is important to keep the valves properly marked during the assembly process. It is recommended that a permanent M be marked on the motor spool so the installer will know the difference.



Part Number	Model Number	Description	Porting
08650016	20-10-03	Single-Acting Cylinder Spool	SAE 10
08650020	20-10-04	Double-Acting Cylinder Spool	SAE 10
08650018	20-10-F4	Double-Acting Motor Spool	SAE 10
13650963	20-10-03-PA1	Single-Acting Cylinder Spool Pneumatic	SAE 10
13650964	20-10-04-PA1	Double-Acting Cylinder Spool Pneumatic	SAE 10

V20 Work Port Reliefs

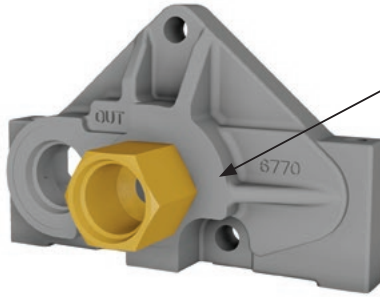


Part Number	Model Number	Description
08650380	K-20-AC	Anti-Cavitation Check
08650387	CRA-1200	Combination PR/AC 83 Bar (1200 PSI)
08650388	CRA-1700	Combination PR/AC 117 Bar (1700 PSI)
08650389	CRA-1950	Combination PR/AC 134 Bar (1950 PSI)
08650390	CRA-2500	Combination PR/AC 176 Bar (2550 PSI)

V20 Outlets



Standard Outlet



Power Beyond Outlet

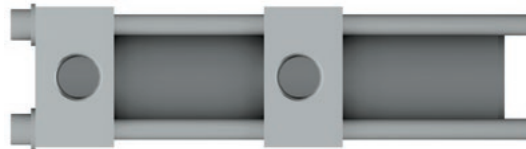
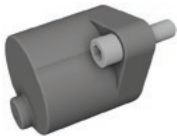
The Power Beyond Sleeve must be ordered separately and does not come installed.



Power Beyond Sleeve

Part Number	Model Number	Description	Porting
13650146	20-RC-12-E	Standard Outlet	SAE 12
08650024	20-RC-12-E-MY	Power Beyond Outlet	SAE 12
08650103	K-20-10-Y	Power Beyond Sleeve	SAE 10
08650100	K-20-X	Conversion Plug	SAE 12

Action Kits



Part Number	Model Number	Description
08650105	K-20-D	3-Position Detent
08650630	K-20-PA1	Pneumatic Positioner

Handles and Accessories

Part Number	Model Number	Description
08650151	K-20-VH-B	Vertical Handle Black
08650156	K-20-HH-B	Horizontal Handle Black
08650107	K-20-RET	Standard Seal Retainer Plate
08650097	Wiper	Spool Wiper
08650113	K-20-HBO-C1	Complete Bracket
08650112	K-20-Boot	Spool Boot Assembly



Stud Kits

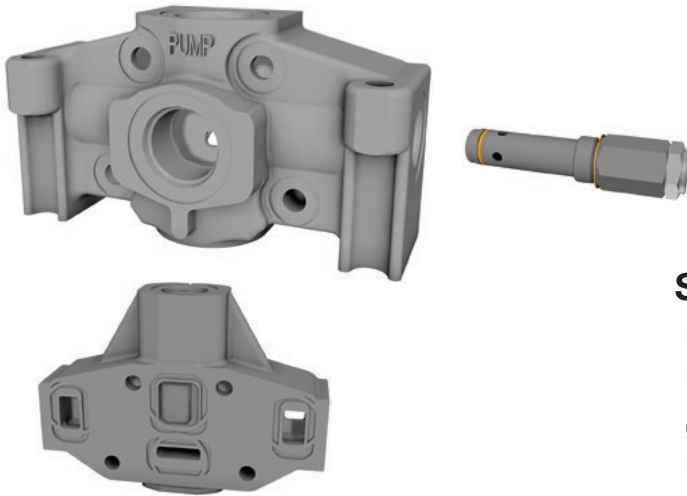
Mid Inlets and Utility Sections count as a work section when selecting stud kits.



Part Number	Model Number	Description
08650087	K-20-1	1 Work Section
08650088	K-20-2	2 Work Sections
08650089	K-20-3	3 Work Sections
08650090	K-20-4	4 Work Sections
08650091	K-20-5	5 Work Sections
08650092	K-20-6	6 Work Sections
08650093	K-20-7	7 Work Sections
08650094	K-20-8	8 Work Sections
08650095	K-20-9	9 Work Sections
08650096	K-20-10	10 Work Sections



VA20 and VG20 Inlets / Main Relief Valves



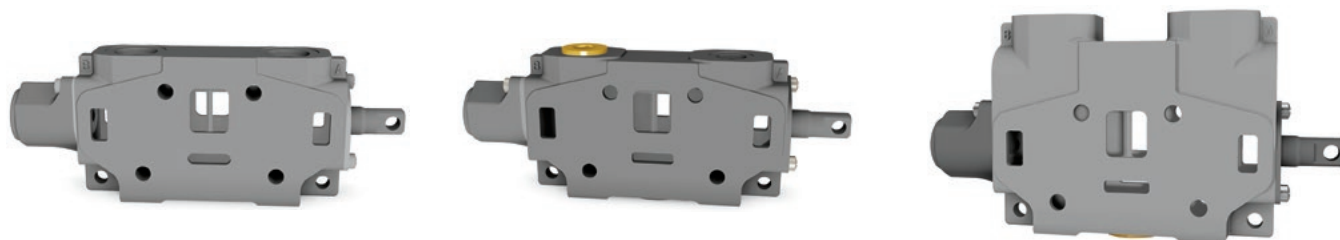
Specifications

Nominal Flow	Up to 170 LPM (45 GPM)
Operating Pressure	VA20 Up to 172 Bar (2500 PSI) VG20 Up to 241 Bar (3500 PSI)

Part Number	Model Number	Description	Porting
347-9175-002	DVA20-A880	Inlet	SAE 16 Porting
347-9174-004	DVA20-CFA70	Combined Flow Mid Inlet	SAE 12 Porting
347-9174-002	DVA20-SFA70	Split Flow Mid Inlet	SAE 12 Porting
391-1873-001	DVA20-MRV	Adjustable Main Relief	N/A
391-1873-002	DV20-MRVP	Main Relief Plug	N/A
347-9175-010	DVG20-A880	Inlet	SAE 16 Porting
347-9174-006	DVG20-CFA70	Combined Flow Mid Inlet	SAE 12 Porting
347-9174-005	DVG20-SFA70	Split Flow Mid Inlet	SAE 12 Porting
391-1873-128	DVG20-HMRV	Adjustable Main Relief	N/A



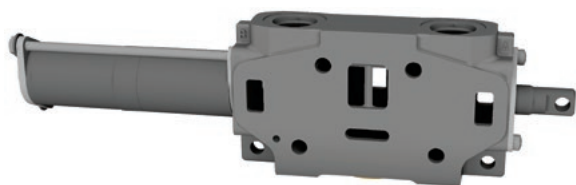
VA20 and VG20 Work Sections



Spring Return

Part Number	Model Number	Description	Porting
347-9172-003	DVA20-DA7	Low Boy Double-Acting Cylinder Spool	SAE 12
347-9172-006	DVA20-MA7	Low Boy Double-Acting Motor Spool	SAE 12
347-9171-003	DVA20-SA7	Low Boy Single-Acting Cylinder Spool	SAE 12
347-9172-009	DVA20-HA755	High Boy Double-Acting Cylinder Spool	SAE 12
347-9172-012	DVA20-LA755	High Boy Double-Acting Motor Spool	SAE 12
347-9171-006	DVA20-JA705	High Boy Single-Acting Cylinder Spool	SAE 12
347-9172-052	DVG20-DA7	Low Boy Double-Acting Cylinder Spool	SAE 12
347-9172-053	DVG20-MA7	Low Boy Double-Acting Motor Spool	SAE 12
347-9172-056	DVG20-HA755	High Boy Double-Acting Cylinder Spool	SAE 12
347-9172-057	DVG20-LA755	High Boy Double-Acting Motor Spool	SAE 12
347-9171-007	DVG20-JA705	High Boy Single-Acting Cylinder Spool	SAE 12

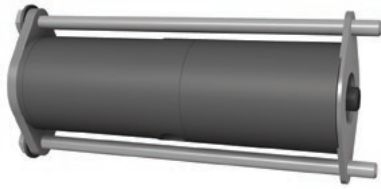
* Hi boy port accessories come standard unplugged and must use either a port option or port plug for operation.



Pneumatic

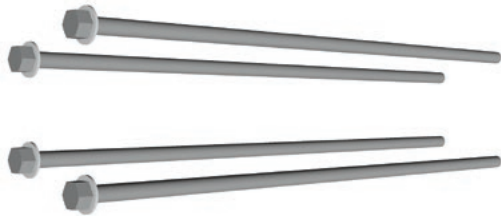
Part Number	Model Number	Description	Porting
347-9172-034	DVA20-DV7	Low Boy Double-Acting Cylinder Spool	SAE 12
347-9171-018	DVA20-SV7	Low Boy Single-Acting Cylinder Spool	SAE 12

VA20 and VG20 Positioner Kits



Part Number	Model Number	Description
391-1873-206	DV20-K-113	Pneumatic Shifter
391-1873-020	DV20-K-101	3-Position Detent
391-1873-019	DV20-K-100	Spring Center

VA20 and VG20 Stud Kits

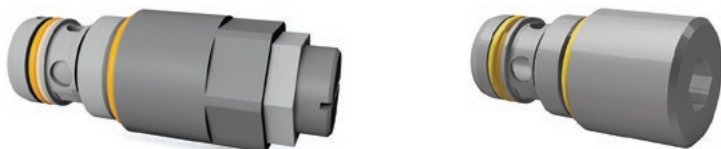


Part Number	Model Number	Description
391-1873-045	DVA20-SK1	1 Work Section
391-1873-046	DVA20-SK2	2 Work Sections
391-1873-047	DVA20-SK3	3 Work Sections
391-1873-048	DVA20-SK4	4 Work Sections
391-1873-049	DVA20-SK5	5 Work Sections
391-1873-050	DVA20-SK6	6 Work Sections
391-1873-051	DVA20-SK7	7 Work Sections
391-1873-052	DVA20-SK8	8 Work Sections
391-1873-129	DVG20-TSK1	1 Work Section
391-1873-130	DVG20-TSK2	2 Work Sections
391-1873-131	DVG20-TSK3	3 Work Sections
391-1873-132	DVG20-TSK4	4 Work Sections
391-1873-133	DVG20-TSK5	5 Work Sections
391-1873-134	DVG20-TSK6	6 Work Sections
391-1873-135	DVG20-TSK7	7 Work Sections
391-1873-136	DVG20-TSK8	8 Work Sections

TSK have studs and nuts



VA and VG Work Port Relief



Part Number	Model Number	Description
391-1873-006	DV-PRVAC	Screw Adjustable Work Port Relief
391-1873-010	DV-AC	Anti-Cavitation Check Valve
391-1873-007	DV-PRV-1	Work Port Relief 34 - 69 Bar (500 - 1000 PSI)
391-1873-008	DV-PRV-2	Work Port Relief 69 - 172 Bar (1000 - 2500 PSI)
391-1873-009	DV-PRV-3	Work Port Relief 172 - 241 Bar (2500 - 3500 PSI)
391-1873-011	DV-PRVP	Work Port Relief Plug

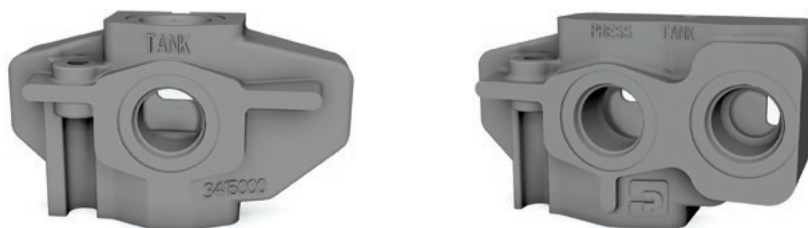
*PRV Accesories are shim adjustable.

VA and VG20 Handle Assemblies

Part Number	Model Number	Description
391-1873-094	DV20-H4	Standard 6" Handle
391-1873-062	DV20-H8	Standard 8" Handle



VA20 and VG20 Outlets



Part Number	Model Number	Description	Porting
347-9176-002	DVA20-TR88	Tank Return	SAE 16
347-9176-004	DVA20-PB80	Power Beyond End Porting	SAE 16
347-9176-005	DVA20-PB08	Power Beyond Top Porting	SAE 16
347-9176-007	DVG20-TTR88	Tank Return	SAE 16
347-9176-008	DVG20-TTB80	Power Beyond Porting	SAE 16

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2. Price; Payment. Prices stated on Seller's Quote are valid for thirty (30) days, except as explicitly otherwise stated therein, and do not include any sales, use, or other taxes or duties unless specifically stated. Seller reserves the right to modify prices to adjust for any raw material price fluctuations. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and payment for all purchases is due thirty (30) days from the date of invoice (or such date as may be specified by Seller's Credit Department). Unpaid invoices beyond the specified payment date incur interest at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. Shipment; Delivery; Title and Risk of Loss. All delivery dates are approximate. Seller is not responsible for damages resulting from any delay. Regardless of the manner of shipment, delivery occurs and title and risk of loss or damage pass to Buyer, upon placement of the Products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions.

4. Warranty. Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of eighteen (18) months from the date of delivery. All prices are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY IS THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon receipt. No claims for shortages will be allowed unless reported to the Seller within ten (10) days of delivery. No other claims against Seller will be allowed unless asserted in writing within thirty (30) days after delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the defect is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

6. LIMITATION OF LIABILITY. IN THE EVENT OF A BREACH OF WARRANTY, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE WITHIN A REASONABLE PERIOD OF TIME. IN NO EVENT IS SELLER LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, WHETHER BASED IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

7. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

8. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, will be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer ordering the items manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller has the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

10. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller retains a security interest in all Products delivered to Buyer and this agreement is deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest.

11. Improper Use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney fees and defense costs), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought

by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, application, design, specification or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Products; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

12. Cancellations and Changes. Buyer may not cancel or modify or cancel any order for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change Product features, specifications, designs and availability.

13. Limitation on Assignment. Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

14. Force Majeure. Seller does not assume the risk and is not liable for delay or failure to perform any of Seller's obligations by reason of events or circumstances beyond its reasonable control (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

15. Waiver and Severability. Failure to enforce any provision of this agreement will not invalidate that provision; nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days prior written notice. Seller may immediately terminate this agreement, in writing, if Buyer: (a) breaches any provision of this agreement (b) appoints a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or one if filed by a third party (d) makes an assignment for the benefit of creditors; or (e) dissolves its business or liquidates all or a majority of its assets.

17. Governing Law. This agreement and the sale and delivery of all Products are deemed to have taken place in, and shall be governed and construed in accordance with, the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement.

18. Indemnity for Infringement of Intellectual Property Rights. Seller is not liable for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and refund the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller is not liable for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

19. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged. The terms contained herein may not be modified unless in writing and signed by an authorized representative of Seller.

20. Compliance with Laws. Buyer agrees to comply with all applicable laws, regulations, and industry and professional standards of care, including those of the United Kingdom, the United States of America, and the country or countries in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act ("Anti-Kickback Act") and the U.S. Food Drug and Cosmetic Act ("FDCA"), each as currently amended, and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that it is familiar with the provisions of the U. K. Bribery Act, the FCPA, the FDA, and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer will not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller.



Parker Safety Guide for Selecting and Using Hydraulic Valves and Related Accessories

WARNING: Failure or improper selection or improper use of Parker Hydraulic Valve Division (HVD) Valves or related accessories (“Products”) can cause death, personal injury and property damage. Possible consequences of failure or improper use of these Products include but are not limited to:

- Valves or parts thereof thrown off at high speed
- High velocity fluid discharge
- Explosion or burning of the conveyed fluid
- Contact with suddenly moving or falling objects controlled by the Valve
- Injections by high-pressure fluid discharge
- Contact with fluid that may be hot, cold, toxic or otherwise injurious
- Injuries resulting from injection, inhalation or exposure to fluids
- Injury from handling a heavy item (dropped, awkward lift)
- Electric shock from improper handling of solenoid connections
- Injury from slip or fall on spilled or leaked fluid

Before selecting or using any of these Products, it is important that you read and follow the instructions below. In general, the Products are not approved for in-flight aerospace applications. Consult the factory for the few that are FAA approved.

1.0 GENERAL INSTRUCTIONS

- 1.1 **Scope:** This safety guide provides instructions for selecting and using (including assembling, installing and maintaining) these Products. For convenience all items in this guide are called “Valves”. This safety guide is a supplement to and is to be used in conjunction with the specific Parker catalogs for the specific Valves and/or accessories being considered for use. See item 1.6 below for obtaining those catalogs.
- 1.2 **Fail-Safe:** Valves can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of the Valve or Valve Assembly will not endanger persons or property.
- 1.3 **Safety Devices:** Never disconnect, override, circumvent or otherwise disable any safety lockout on any system whether powered by HVD Valves or any motion control system of any manufacturer. (e.g. Automatic shut-off on a riding lawn mower should the operator get out of the seat).
- 1.4 **Distribution:** Provide a copy of this safety guide to each person that is responsible for selecting or using HVD Valve Products. Do not select HVD Valves without thoroughly reading and understanding this safety guide as well as the specific Parker catalogs for the Products considered or selected.
- 1.5 **User Responsibility:** Due the wide variety of operating conditions and applications for Valves, HVD and its distributors do not represent or warrant that any particular Valve is suitable for any specific system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing is solely responsible for:
 - Making the final selection of the Valve
 - Assuring that the user’s requirements are met and that the application presents no health or safety hazards.
 - Providing all appropriate health and safety warnings on the equipment on which the Valves are used.
 - Assuring compliance with all applicable government and industry standards.
- 1.6 **Additional Questions:** Call the appropriate Parker technical service department if you have any questions or require any additional information. See the Parker publication for the product being considered or used, or call 1-800-CPARKER, or go to www.parker.com, for the telephone numbers of the appropriate technical service department. For additional copies of this or any other Parker Safety Guide go to www.parker.com and click on the safety button on the opening page. Catalogs and/or catalog numbers for the various HVD Valve Products can be obtained by calling HVD at 440-366-5100. Phone numbers and catalog information is also available on the Parker website, www.parker.com.

2.0 VALVE SELECTION INSTRUCTIONS

- 2.1 **Pressure:** Valve selection must be made so that the maximum working pressure of the Valve is equal to or greater than the maximum system pressure. Surge, impulse or peak transient pressures in the system must be below the maximum working pressure of the Valve. Surge, impulse and peak pressures can usually be determined by sensitive electrical instrumentation that measures and indicates pressures at millisecond intervals. Mechanical pressure gauges indicate only average pressure and cannot be used to determine surge, impulse or peak transient pressures. Burst pressure ratings if given or known are for manufacturing purposes only and are not an indication that the Product can be used in applications at the burst pressure or otherwise above the maximum working pressure.
- 2.2 **Temperature:** The fluid temperature must be regulated or controlled so that the operating viscosity of the fluid is maintained at a level specified for the particular Valve product. Such ranges are given in the product catalogs or can be obtained from the appropriate customer service department for the particular Valve product.
- 2.3 **Fluid Compatibility:** The fluid conveyed in Valves has direct implications on the Valve selection. The fluid must be chemically compatible with the Valve component materials. Elastomer seals, brass, cast iron, aluminum for example all are potentially affected by certain fluids. Additionally, fluid selection affects the performance of various Valves. Considerations relative to fluid selection are outlined in the specific HVD Valve product catalog. Of particular importance is that the fluid be for hydraulic use, contain the proper additives and wear inhibitors. See 1.6 “Additional Questions” above for information to obtain such HVD catalogs.
- 2.4 **Changing Fluids:** If a system requires a different fluid, it should be done with the guidance in number 2.3 above. Additionally, it may be necessary to flush the system (including the Valves) to remove any of the previous fluid. Consult the Parker Valve Division for guidance.
- 2.5 **Size:** Transmission of power by means of pressurized fluid varies with pressure and rate of flow. The size of the components must be adequate to keep pressure losses to a minimum and avoid damage due to heat generation or excessive fluid velocity.
- 2.6 **Placement:** Installation of Valves must take into account the orientation of the Valve and the proximity of the Valve to other parts of the system. This includes but is not limited to closeness to hot and cold areas, access for servicing and operation as well as orientation for proper connectors.
- 2.7 **Ports:** Connection of Valves in systems can be by threaded ports, sub-base surfaces, flanges and manifolds. In all cases, the proper fitting, surface or mounting hardware must be selected to properly seal and contain the system fluid so as to avoid the adverse conditions listed in the initial warning box above. Specifically, if using threaded ports, the designer must make sure that the mating fitting is of the compatible thread. Also, the instructions provided by the connector hardware supplier must be read and understood so as to properly assemble the connector. The Parker Safety Guide for using Hose, Tubing and Fittings and Related Accessories is but one reference to this end.
- 2.8 **Environment:** Care must be taken to insure that the Valve and Valve Assemblies are either compatible with or protected from the environment (that is, surrounding conditions) to which they are exposed. Environmental conditions including but not limited to ultraviolet radiation, sunlight, heat, ozone, moisture, water, salt water, chemicals and air pollutants can cause degradation and premature failure.
- 2.9 **Electric Power:** For Valves requiring electric power for control, it is imperative that the electricity be delivered at the proper voltage, current and wattage requirements. To obtain the proper control requirements please refer to the respective Parker product catalog for the specific Valve that is intended for use. If further guidance is required, call the appropriate technical service department identified in the respective Parker product catalog.
- 2.10 **Specifications and Standards:** When selecting Valves, government, industry and Parker specifications and recommendations must be reviewed and followed as applicable.
- 2.11 **Accessories:** All accessories used in conjunction with any Parker Valve product must be rated to the same requirements of the Valve including but not limited to pressure, flow, material compatibility, power requirements. All of these items must be examined as stated in the “VALVE INSTALLATION INSTRUCTIONS” paragraph 3.0.

(continued on next page)

3.0 VALVE INSTALLATION INSTRUCTIONS

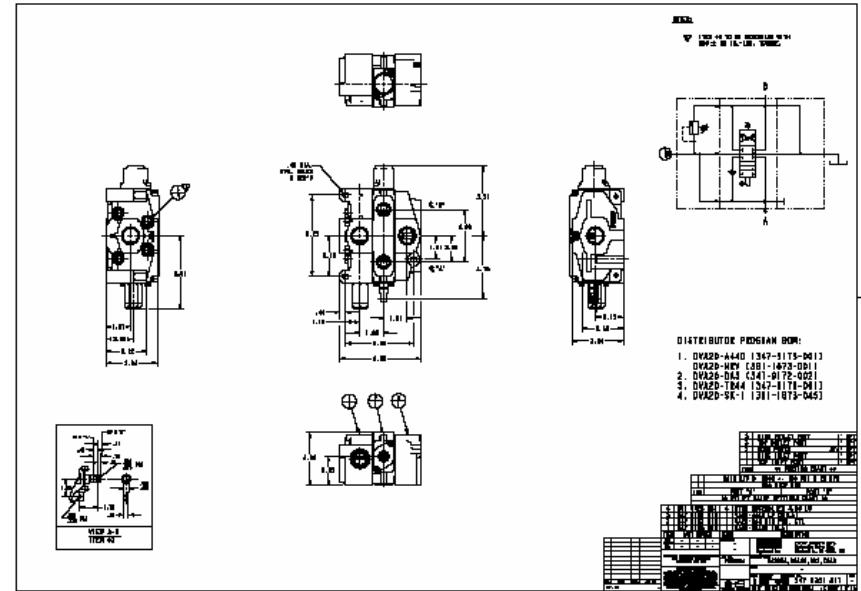
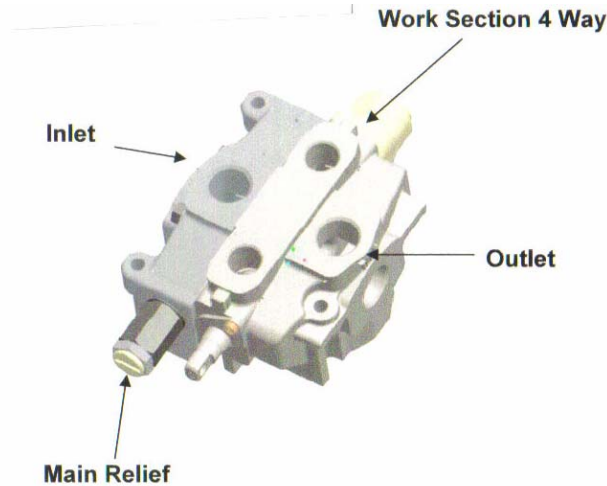
- 3.1 **Component Inspection:** Prior to use, a careful examination of the Valve(s) must be performed. The Valve intended for use must be checked for correct style, size, catalog number and external condition. The Valve must be examined for cleanliness, absence of external defects or gouges, cracked or otherwise deformed parts or missing items. The mounting surface or port connections must be protected and free of burrs, scratches, corrosion or other imperfections. Do NOT use any item that displays any signs of nonconformance. In addition, any accessory including but not limited to fittings, bolt kits, hoses, sub bases, manifolds, and electrical connectors must be subjected to the same examination.
- 3.2 **Handling Valves:** Many Valves whether HVD Valves or of another manufacturer can be large, bulky or otherwise difficult to handle. Care must be taken to use proper lifting techniques, tools, braces, lifting belts or other aids so as not to cause injury to the user, any other person or to property.
- 3.3 **Filtration:** Fluid cleanliness is a necessity in any hydraulic system. Fluid filters must be installed and maintained in the system to provide the required level of fluid cleanliness. Filters can be placed in the inlets, pressure lines and return lines. The level of cleanliness required is specified in the HVD product catalog for the specific Valve(s) selected or intended for use. For additional information on Filter selection contact Parker Filter Division at 800-253-1258 or 419-644-4311.
- 3.4 **Servo Valves:** Application of Servo Valves in general requires knowledge and awareness of “closed loop control theory” and the use of electronic controls for successful and safe operation. Individuals who do not have such experience or knowledge must gain training before use of such Products. Parker offers both classroom training as well as manuals to assist in gaining this knowledge. These aids can be obtained by contacting Hydraulic Valve Division at 440-366-5100, calling the general Parker help line 800-CPARKER or go ing to the Parker web site at www.parker.com.
- 3.5 **Accessory Ratings:** All accessories used in combination with the selected or intended Valve product must be rated and compatible with the selected Valve. Specifically, the items must be of equal or greater rating including but not limited to pressure, flow, power, size, port style, thread connectors and material.
- 3.6 **Connection Styles:** It is the responsibility of the user of the Parker product to properly select connectors and accessories that match the connections on the sub plate, Valve, flange or threaded connection or manifold. It is also the responsibility of the installer to possess adequate skill and knowledge including but not limited to thread preparation, torque technique, hose assembly and inspection, tube preparation and assembly, and fitting installation. Parker Tube Fitting Division (www.parker.com/ffd) catalog 4300 and Parker Hose Products (www.parkerhose.com) catalog 4400 describe some basic technical information relative to proper fitting assembly.
- 3.7 **Electrical Connections:** All electrical connections must be made to the applicable codes and local safety requirements.
- 3.8 **Gauges and Sensors:** The user must install sufficient gauges and sensors in the system so as to be able to determine the condition of the system. This includes but is not limited to pressure gauges, flow meters, temperature sensors and site gauges. These are of utmost importance should removal or disassembly of a Valve, portion of a Valve or portion of the system become necessary. Refer to “VALVE MAINTENANCE AND REPLACEMENT INSTRUCTIONS” for details and especially item 4.8.
- 3.9 **System Checkout:** Once installed, the Valve installation must be tested to insure proper operation and that no external leakage exists. All safety equipment must be in place including but not limited to safety glasses, helmets, ear protection, splash guards, gloves, coveralls and any shields on the equipment. All air entrapment must be eliminated and the system pressurized to the maximum system pressure (at or below the Valve maximum working pressure) and checked for proper function and freedom from leaks. Personnel must stay out of potentially hazardous areas while testing and using.

4.0 VALVE MAINTENANCE AND REPLACEMENT INSTRUCTIONS

- 4.1 **Maintenance Program:** Even with proper installation, Valves and Valve System life may be significantly reduced without a continuing maintenance program. The severity of the application and risk potential must determine the frequency of the inspection and the replacement of the Products so that Products are replaced before any failure occurs. A maintenance program must be established and followed by the user and, at a minimum, must include instructions 4.2 through 4.10. An FMEA (Failure Mode and Effects Analysis) is recommended in determining maintenance requirements.
- 4.2 **Visual Inspection-Valves:** Any of the following conditions require immediate shut down and replacement of the Valve.
- Evidence that the Valve is in partial dis-assembly.
 - Visible crack or suspicion of a crack in the Valve housing or bent, cracked or otherwise damaged solenoid.
 - Missing or partially extending drive pin on a flow control knob.
 - Missing, loose components, obstructions or other condition impeding the motion or function of the manual knob, lever, foot pedal or other mechanical operator of a hydraulic Valve.
 - Any evidence of burning or heat induced discoloration.
 - Blistered, soft, degraded or loose cover of any kind.
 - Loose wire or electrical connector.
- 4.3 **Visual Inspection-Other:** The following conditions must be tightened, repaired, corrected or replaced as required.
1. Fluid on the ground must be cleaned immediately. Also, the source of the fluid must be determined prior to running the equipment again.
 2. Leaking port or excessive external dirt build-up.
 3. System fluid level is too low or air is entrapped or visible in the reservoir.
 4. Equipment controlled by the Valve or Valve assembly has been losing power, speed, efficiency
- 4.4 **Filter Maintenance:** System filters must be maintained and kept in proper working order. The main service requirement is periodic replacement of the filter element or screen. Contact Parker Filter Division at 800-253-1258 or 419-644-4311 for further filter maintenance details.
- 4.5 **Functional Test:** See “System Checkout” number 3.9 above in “VALVE INSTALLATION INSTRUCTIONS”.
- 4.6 **Replacement Intervals:** Valves and Valve Systems will eventually age and require replacement. Seals especially should be inspected and replaced at specific replacement intervals based on previous experience, government or industry recommendations, or when failures could result in unacceptable downtime, damage or injury risk. At a minimum seals must be replaced whenever service is rendered to a Valve product.
- 4.7 **Adjustments, Control Knobs, and Other Manual Controls:** System Pressure and Flow are typically adjusted by knobs and/or handles. A set-screw or lock-nut secures the adjustment device so as to maintain the desired setting. This set-screw or lock-nut must first be loosened prior to making any adjustments and re-tightened after adjustment on the HVD Valve. All adjustments must be made in conjunction with pressure gauges and/or flow meters (or by watching the speed of the actuator in the case of setting flow only). See paragraph “Gauges and Sensors” above in the section “VALVE INSTALLATION INSTRUCTIONS”. Under no circumstances should any control knob, adjustment stem, handle, foot pedal or other actuating device be forced beyond the mechanical stop(s) on the Valve. For example, the Parker Safety Notice Bulletin **HY14-3310-B1/US** for HVD Colorflow Valves specifically restricts the adjustment torque to “hand adjust” or “less than 10 ft/lbs” if it cannot be adjusted by hand. Failure to adhere to this may force the knob beyond the stop point allowing it to be ejected at high speed resulting in death, personal injury and property damage. For complete safety instructions on HVD Colorflow Valves, copies of Safety Notice **Bulletin HY14-3310-B1/US** can be obtained directly from the Hydraulic Valve Division at 440-366-5100 or from the Parker web site at www.parker.com by selecting the “Safety” button. Parker help line 800-CPARKER is on call 24/7 as well should there be any question about the use of a HVD Valve. Additionally, when making adjustments, always adjust the Valve with all parts of your body to the side of the Valve (that is, the knob is not pointing toward you or anyone else).
- 4.8 **High pressure Warning:** Hydraulic power is transmitted by high-pressure fluids through hoses, fittings and valves, pumps and actuators. This condition can be dangerous and potentially lethal and, therefore, extreme caution must be exercised when working with fluids under pressure. From time to time, hoses, Valves, tubes or fittings fail if they are not replaced at proper time intervals. Typically these failures are the result of some form of misapplication, abuse, wear, or failure to perform proper maintenance. When such failure occurs, generally the high pressure fluid inside escapes in a stream which may or may not be visible to the user. Under no circumstances should the user attempt to locate the leak by “feeling” with their hands or any other part of their body. High-pressure fluids can and will penetrate the skin and cause severe tissue damage and possible loss of limb or life. Even seemingly minor hydraulic fluid injection injuries must be treated immediately by a physician with knowledge of the tissue damaging properties of hydraulic fluid. If a hose, tube, fitting or Valve failure occurs, immediately shut down the equipment and leave the area until pressure has been completely released from the system. Simply shutting down the pump may or may not eliminate the pressure in the system. It may take several minutes or even hours for the pressure to be relieved so that the leak area can be examined safely. Once the pressure has been reduced to zero, the suspected leaking item can be taken off the equipment and examined. It must always be replaced if a failure has occurred. Never attempt to patch or repair a connector (especially a hose) or Valve that has failed. Consult the nearest Parker distributor or the appropriate Parker division for component replacement information. Never touch or examine a failed hydraulic component unless it is obvious that the item no longer contains fluid under pressure.



347-9201-817 VA20 NPT Ports 4 Way 3 Position Manual



Inlet
Relief Valve
Work Section
Outlet
Stud Kit

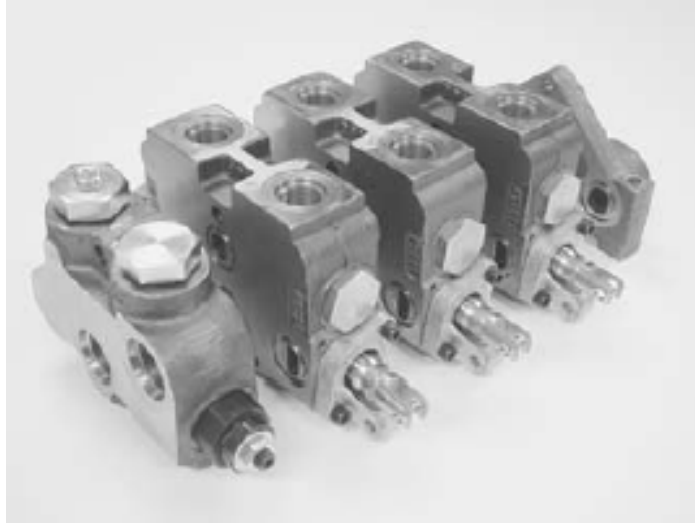
DVA20-A440
DVA20-MRV
DVA20-DA3
DVA20-TR44
DVA20-SK-1

347-9175-001
391-1873-001
346-9172-002
347-9176-001
391-1873-045





HVD Valve Components Open Center V20 VA20 VA35

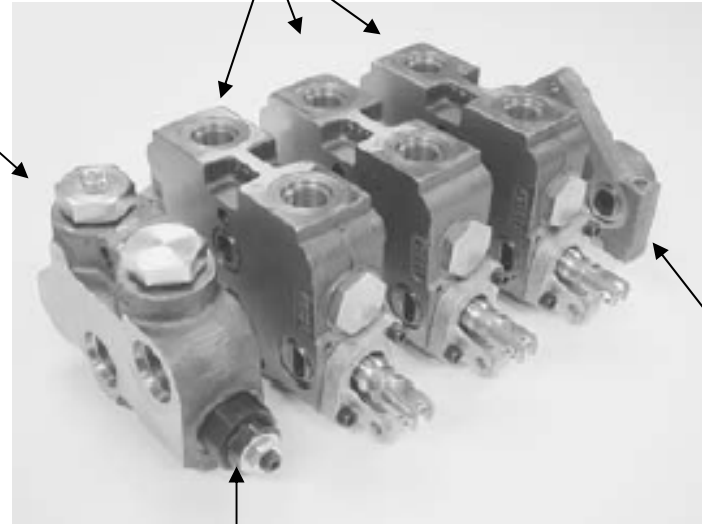




Basic Construction

Work Section

Inlet



Outlet

Main Relief

**All Valves Have
And Inlet – Outlet
And Work Sections**

**Work Port Plugs
This is Where Work
Port Reliefs are Installed**

Torque for Valves

**Gresen V20 Series
Commercial DVA20 Series
Commercial DVA35 Series**

Studs

384 In. lbs

350 In. lbs

400 In. lbs

**Main
Relief**

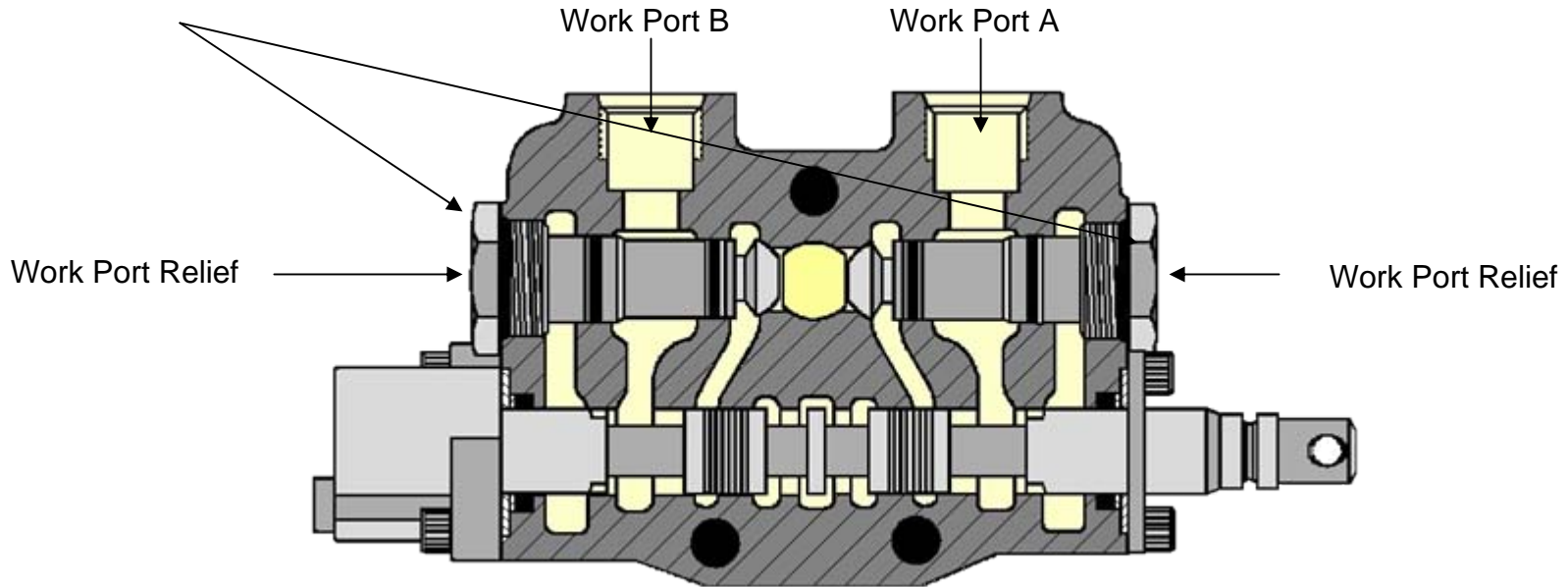
75 ft. lbs

90 ft. lbs



Basic Work Section

All Work Sections Have Plugged Accessory Ports



Note: Commercial Low Boy Work Sections do not Provide for Work Port Relief Ports



V20 Flow and Pressure Rating



Flow Rating 25 GPM

Pressure Rating 3500 PSI

Inlets & Outlets

NPT 3/4"

SAE 12

Work Ports

NPT 1/2"

SAE 10





V20 NPT Pipe Thread

NPT (Pipe Thread)

V20 Inlet

	Gresen #
20-LC-75	08650030
RP51A-3000	08650421
WH-1700	08650418
WH-1950	08650419
WH-2550	08650420
20-75-CF	08650001

Description

V 20 Inlet ¾ NPT Add Relief
Main Relief Adjustable
Main Relief Non Adjustable
Main Relief Non Adjustable
Main Relief Non Adjustable
Combined Flow Mid-Inlet

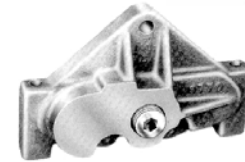


8398 Left Cover

V20 OUTLET

20-RC-75-E	13650147
20-RC-75-E-MY	08650027
K-20-50-7	08650101

Standard Outlet
Power Beyond Outlet
½" NPT Power Beyond Sleeve



8398 Right Cover

V20 WORK SECTIONS

20-50-04	08650021	V20 D/A Cylinder ½" NPT
20-50-03	08650017	V20 S/A Cylinder ½" NPT
20-50-K4	08650015	V20 D/A Motor Spool

FOR SINGLE ACTING FLOAT USE 20-50-03 AND K-20-R



Model V20P
(8072 Section)

V20 SPOOL ACTION KITS

K-20-D	08650105	V20 Detent Kit (3 Position)
K-20-R	08650106	V20 Spool In Detent (S/A Float)
K-20-PA1	08650630	Air Shift
K-20-VH-B	08650151	Handle Kit Complete





V20 SAE Straight Thread O-Ring

V20 INLET

20-LC-12
 RP51A-3000
 WH-1700
 WH-1950
 WH-2550
 20-12-CF

Gresen# DESCRIPTION

08650029 V20 Inlet SAE 12 Plugged Relief
 Same Main Relief Adjustable 3000 PSI
 08650418 Main Relief Non Adjustable
 08650419 Main Relief Non Adjustable
 08650420 Main Relief Non Adjustable
 08650003 Combined Flow Mid-Inlet



8398 Left Cover

V20 OUTLETS

20-RC-12-E
 20-RC-12-E-MY
 K-20-10-Y

13650146 Standard Outlet
 08650024 Power Beyond Outlet
 08650103 SAE 10 Power Beyond Sleeve



SAE 10 Power Beyond Sleeve

V20 Work Sections

20-10-04 08650020 V20 D/A Cylinder SAE 10
 20-10-03 08650016 V20 S/A Cylinder SAE 10
 20-10-K4 08650015 D/A FLOAT
 20-10-F4 08650019 V20 D/A Motor Spool

For Single Acting Float use 20-10-03 and K-20-R



Model V20P
(8072 Section)

All Work Sections are Ported for Work Port Relief's and Plugged "Add Port Options"





V20 Work Port Accessories

Model Number	Part Number	Relief Valve	Combination Relief & Anti-Cav Check	Anti-Cavitation Check Assembly	Pressure Range and Setting				
					500-1249 Set @ 1200 PSI c/p	1250-1749 Set @ 1700 PSI c/p	1750-1999 Set @ 1950 PSI c/p	2000-2599 Set @ 2550 PSI c/p	500-3500 Set @ 2500 PSI c/p
RC-1200	8650394	•			•				
RC-1700	8650395	•				•			
RC-1950	8650396	•					•		
RC-2550	8650397	•						•	
RP20A-2500	8650975	•							•
CRA-1200	8650387		•		•				
CRA-1700	8650388		•			•			
CRA-1950	8650389		•				•		
CRA-2550	8650390		•					•	
K-20-AC	8650380			•					



Model RC
Work Port Relief Valve



CRA Combination
Relief Anti-Cavitation
Check Valve



Anti-Cavitation
Check Valve





V20 Handle and Stud Kits

V20 Handle End Options

Handle Kits Contain Necessary Links and Pins.

Item No.	Model Number	Part Number	Description
1	K-20-VH-B	8650151	Vertical Handle (Black)
2	K-20-VH-P	8650153	Vertical Handle (Plain)
3	K-20-HH-B	8650154	Horizontal Handle (Black)
4	K-20-HH-P	8650156	Horizontal Handle (Plain)
5	K-20-RET	8650107	Standard Seal Retainer Plate
6	K-20-RET-HD	8650108	Heavy Duty Seal Retainer
7	K-20-WIPER	8650097	Sec. Spool Wiper
8	K-20-HBO-CI	8650113	Complete Bracket (Cast Iron) less Handle and Links
9	K-20-BOOT	8650112	Spool Boot Assembly



Vertical Handle Assemblies

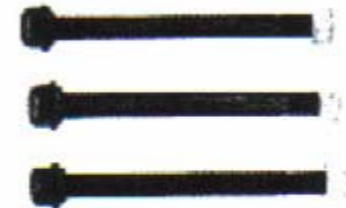


Horizontal Handle Assemblies

V20 Standard Section Stud Assembly Kits

Includes Section Seals and Nuts. (Stud Kits Do Not include 21866-001 Load Sensing and Solenoid Pilot Passage Section Seals. These seals must be purchased separately if required.)

Item No.	Model Number	Part Number	Description
1	K-20-1	8650087	One Section
2	K-20-2	8650088	Two Section
3	K-20-3	8650089	Three Section
4	K-20-4	8650090	Four Section
5	K-20-5	8650091	Five Section
6	K-20-6	8650092	Six Section
7	K-20-7	8650093	Seven Section
8	K-20-8	8650094	Eight Section
9	K-20-9	8650095	Nine Section
10	K-20-10	8650096	Ten Section
11	K-20-SECT-SEAL ♦	13850405	Section seal for load sensing and/or solenoid pilot passages.



Stud Assembly Kit

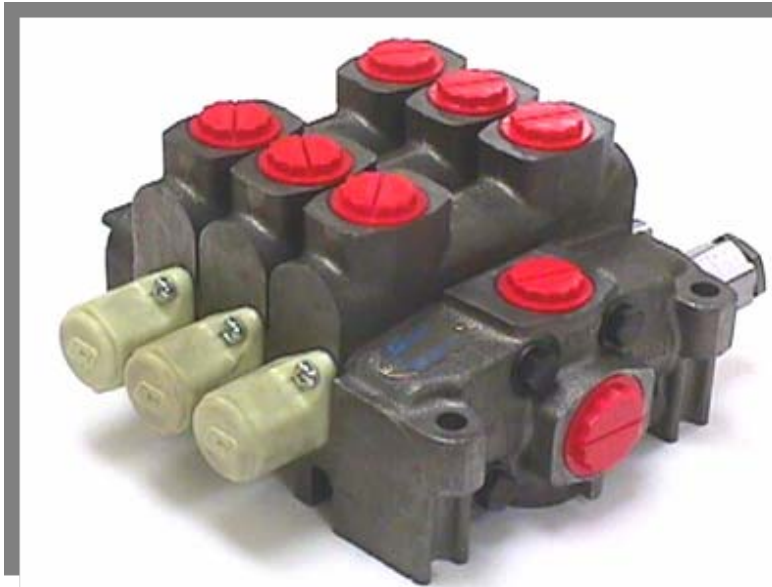
When using an 8644 Right End Cover add one section to assure proper stud length.

♦ Kit includes 25 pieces of seal number 21866001.





DVA DVG 20 Flow and Pressure Rating



Flow Rating **40 GPM**

Pressure

DVA **2500 PSI**

DVG **3500 PSI**

Inlets & Outlets

NPT **1"**

SAE **16**

Work Ports

NPT **3/4"**

SAE **12**





DVA20 NPT Pipe Thread

DVA Inlets

DVA20-A440

10 Digit

347-9175-001

Description

Inlet 1" Pipe (Need to Add Relief)



DVA20 MRV & MRV Plugs

DVA20-MRV

391-1873-001

DVA20-MRVP

391-1873-002

500 TO 2000 PSI Relief
Main Relief Plug



DVA20 Outlets

DVA20-TR44

347-9176-001

DVA20-PB44

347-9176-003

Standard Outlet 1" Ports
Power Beyond Outlet 1" Ports



DVA Work Sections

DVA20-DA3

347-9172-002

DVA20-SA3

346-9171-002

DVA20-MA3

347-9172-005

DVA20-FC3

347-9172-037

DVA20-DV3

347-9172-033

Single Acting Float – Use DVA20-SA3 and DVA20-K-114 Kit

Low-Boy

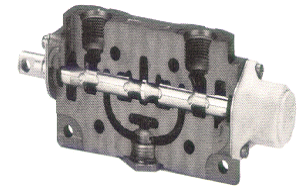
D/A 3/4" Work Ports

SA 3/4" Work Ports

Motor Spool 3/4" Work Ports

D/A Float 3/4" Work Ports

D/A With Air Shift



DVA20 Work Sections

DVA20-HA355

347-9172-008

DVA20-JA305

347-9171-005

High-Boy (Must use WPR or Plugs)

D/A 3/4" Work Ports

S/A 3/4" Work Ports





DVA20 SAE Straight Thread O-Ring

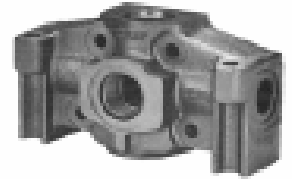
DVA20 Inlets

DVA20-A880

10 Digit Code

347-9175-002

Inlet SAE 16(Need to add Relief Valve)



DVA20 MRV & MRV Plugs

DVA20-MRV

391-1873-001

500-2500 PSI Relief

DVA20-MRVP

391-1873-002

Main Relief Plug



DVA20 Outlets

DVA20-PB08

347-9176-005

Power Beyond Outlet/ Top Porting

DVA20-TR88

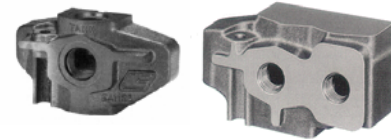
347-9176-002

Standard Outlet

DVA20-PB80

347-9176-004

Power Beyond Outlet/End Porting



DVA20 Work Sections

DVA20-DA7

347-9172-003

Low Boy

D/A

DVA20-SA7*

347-9171-003

S/A

DVA20-SC7

347-9171-014

Single Acting With Float

DVA20-MA7

347-0172-006

Motor Spool

DVA20-DV7

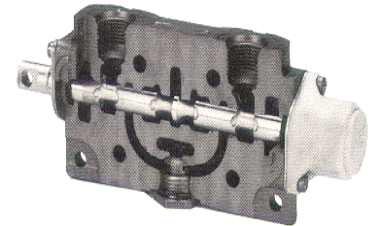
347-9172-034

D/A With Air Shift

DVA20-SV7

347-9171-018

S/A With Air Shift



*Single Acting Float - USE DVA20-SA7 and DVA20-K-114

DVA20 Work Sections

DVA20-HA755

347-9172-009

High Boy

D/A W/ Work Ports

DVA20-JA705

347-9171-006

S/A W/ Work Ports





DVG20 SAE Straight Thread O-Ring

DVG20 Inlets

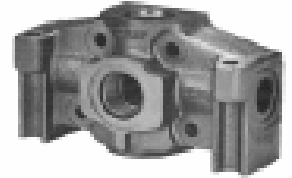
DVG20-A880

10 Digit

347-9175-010

Description

Inlet SAE 16



DVG20 Main Relief Valve

DVG20-HMRV

391-1873-128

Main Relief 2500 to 3500 PSI

DVG20-MRVP

391-1873-002

Main Relief Valve Plug



DVG20 Outlets

DVG20-TTR88

347-9176-007

Standard Outlet SAE 16

DVG20-TPB80

347-9175-010

Outlet Power Beyond SAE 16



DVG20 Work Sections

DVG20-DA7

347-9172-052

D/A Cylinder SAE 12

DVG20-DV7

347-9172-067

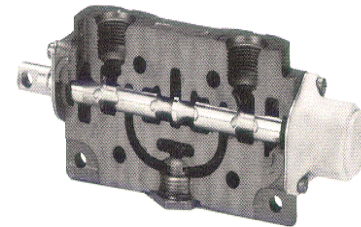
D/A Cylinder Air Shift

DVG20-MA7

347-9172-053

D/A Motor Float in Neutral SAE 12

Low Boy



DVG20 Work Sections

DVG20-JA705

347-9171-007

S/A Cylinder SAE 12

DVG20-HA755

347-9172-056

D/A Cylinder SAE 12

DVG20-LA755

347-9172-057

D/A Motor Float in Neutral SAE 12

High Boy





DVA DVG 20 Accessories

Stud Kits

DVA20-SK-1	391-1873-045
DVA20-SK-2	391-1873-046
DVA20-SK-3	391-1873-047
DVA20-SK-4	391-1873-048
DVA20-SK-5	391-1873-049
DVA20-SK-6	391-1873-050
DVA20-SK-7	391-1873-051
DVA20-SK-8	391-1873-052
DVG20-TSK-1	391-1873-129
DVG20-TSK-2	391-1873-130
DVG20-TSK-3	391-1873-131
DVG20-TSK-4	391-1873-132
DVG20-TSK-5	391-1873-133
DVG20-TSK-6	391-1873-134
DVG20-TSK-7	391-1873-135
DVG20-TSK-8	391-1873-136

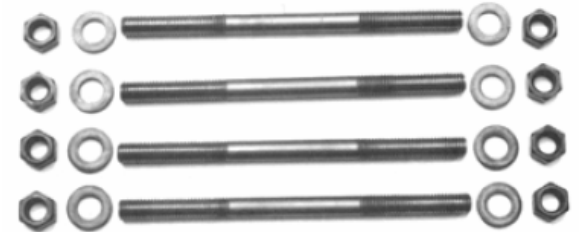
Work Port Accessories

DV-PRAVC	391-1873-006
DV-PRVS-1	391-1873-344
DV-PRVS-2	391-1873-345
DV-PRV-1	391-1873-007
DV-PRV-2	391-1873-008
DV-PRV-3	391-1873-009
DV-PRL-12	391-1873-016
DV-PRV-SK	391-1873-080
DV-PRT-12	391-1873-234

10 Digit

Work Sections

- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight
- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight



- Screw Adj. Relief 2500 PSI
- Adj. Relief 500-1000 PSI
- Adj. Relief 1000-2500 PSI
- WPR Shim Adj. 500-1000 PSI
- WPR Shim Adj. 1000-2500 PSI
- WPR Shim Adj. 2500-3000 PSI
- Work Port Plug
- Shim Kit
- Work Port Restrictor





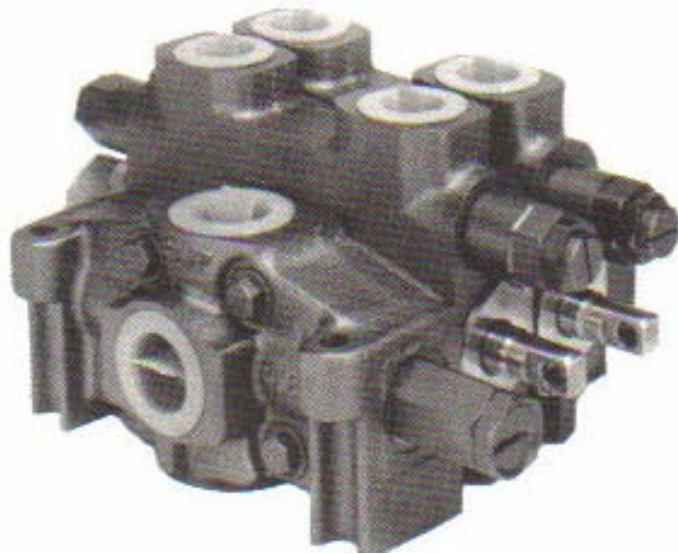
DVA DVG 20 Accessories

Handle Assemblies	10 Digit #	Description
DV20-H-3	391-1873-093	6" Std Handle
DV20-H-4	391-1873-098	8" Std Handle
DV20-H-6	391-1873-061	6" Handle for High Boy
DV20-H-8	391-1873-062	8" Handle for High Boy
Seal Kits		
DV20-K-1	391-1873-035	Work Section Assembly
DV20-K-2	391-1873-036	Work Section , Spool, Check Seals
Spool Action Kits		
DV20-K-100	391-1873-019	Spring Center Kit
DV20-K-101	391-1873-020	3 Position Detent
DV20-K-113	391-1873-206	Air Shift
DV20-K-114	391-1873-206	Detent In , Single Acting Float





DVA DVG 35 Flow and Pressure Ratings



Flow Rating **70 GPM**

Pressure Rating

DVA **2500 PSI**

DVG **3500 PSI**

Inlet and Outlets

NPT **1 1/4"**

SAE **20**

Work Ports

NPT **1"**

SAE **16**





DVA35 NPT Pipe Thread

DVA35 Inlet
DVA35-A440

10 Digit #
348-9175-001

Description
Inlet 1" Pipe (Add Relief)



DVA35 Main Relief Valve

DVA35-MRV-1 391-1873-003
DVA35-MRV-2 391-1873-004

800-2000 PSI
2000-2500 PSI



Outlet

DVA35-TR55 348-9176-001
DVA35-PB55 348-9176-003

Standard Outlet
Power Beyond



Work Sections

DVA35-SA4 348-9171-002
DVA35-DA4 348-9172-002
DVA35-MA4 348-9172-005
DVA35-SV4 348-9171-018

Low Boy

S/A Cylinder 1" Work Ports
D/A Cylinder 1" Work Ports
D/A Motor Float In Neutral
S/A Cylinder Air Shift



Work Sections

DVA35-JA405 348-9171-005
DVA35-HA455 348-9172-008
DVA35-LA455 348-9172-011
DVA35-GC455 348-9172-031

High Boy

S/A Cylinder
D/A Cylinder
D/A Motor Float In Neutral
D/A Detent Float In Neutral





DVA35 SAE Straight Thread O-Ring

DVA35 Inlet

DVA35-A880
DVA35-A980

10 Digit

348-9175-005
348-9175-002

Description

Inlet SAE 16 Need To Add Relief
Inlet SAE 20 Need To Add Relief



Main Relief

DVA35-MRV-1
DVA35-MRV-2

391-1873-003
391-1873-004

800-2000 PSI
2000-2500 PSI



Outlet

DVA35-TR99
DVA35-PB90

348-9176-002
348-9176-004

Standard Outlet
Power Beyond



Work Sections

DVA35-SA8
DVA35-DA8
DVA35-MA8
DVA35-SV8
DVA35-DV8

348-9171-003
348-9172-003
348-9171-016
348-9171-016
348-9172-030

Low Boy

S/A Cylinder SAE 16
D/A Cylinder SAE 16
D/A Motor Float In Neutral
S/A Cylinder Air Shift
D/A Cylinder Air Shift



Work Sections

DVA35-JA805
DVA35-HA855
DVA35-GC855

348-9171-006
348-9172-009
348-9172-032

High Boy

S/A Cylinder
D/A Cylinder
D/A Detent Float In Neutral





DVG35 SAE Straight Thread O-Ring

DVG35 Inlets

DVG35-A880
DVG35-A980

10 Digit

348-9175-008
348-9175-004

Description

Standard Inlet SAE 16
Inlet SAE 20



DVG35 Main Relief

DVG35-HMRV 391-1873-137
DVG35-MRVP 391-1873-005

2800 to 3500 PSI
Main Relief Plug



DVG35 Outlets

DVG35-TTR99 348-9176-007
DVG35-TPB99 348-9176-008

Standard Outlet SAE 20
Power Beyond Outlet SAE 20



DVG35 Work Sections

DVG35-DA8 347-9172-048
DVG35-MA8 348-9172-049

Low Boy

D/A Cylinder SAE 16
D/A Motor Float in Neutral



DVG35 Work Sections

DVG35-JA805 348-9171-001
DVG35-HA855 348-9172-065
DVG35-GC855 348-9172-099

High Boy

S/A Cylinder SAE 16
D/A Cylinder SAE 16
D/A Detent Float In Neutral





DVA DVG 35 Valve Accessories

DVA/DVG Stud

DVA35-SK-1	391-1873-053
DVA35-SK-2	391-1873-054
DVA35-SK-3	391-1873-055
DVA35-SK-4	391-1873-056
DVA35-SK-5	391-1873-057
DVA35-SK-6	391-1873-058
DVA35-SK-7	391-1873-059
DVA35-SK-8	391-1873-060

DVG35-TSK-1	391-1873-138
DVG35-TSK-2	391-1873-139
DVG35-TSK-3	391-1873-140
DVG35-TSK-4	391-1873-141
DVG35-TSK-5	391-1873-142
DVG35-TSK-6	391-1873-143
DVG35-TSK-7	391-1873-144
DVG35-TSK-8	392-1873-145

DVG35 Work Port Accessories

DV-PRAVC	391-1873-006
DV-PRVS-1	391-1873-344
DV-PRVS-2	391-1873-345
DV-PRV-1	391-1873-007
DV-PRV-2	391-1873-008
DV-PRV-3	391-1873-009
DV-DPL-16	391-1873-017
DV-PRV-SK	391-1873-080

Work Sections

- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight



- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight



- Screw Adj. Relief 2500 PSI
- Adj. Relief 500-1000 PSI
- Adj. Relief 1000-2500 PSI
- WPR Shim Adj. 500-1000 PSI
- WPR Shim Adj. 1000-2500 PSI
- WPR Shim Adj. 2500-3000 PSI
- Work Port Plug
- Shim Kit





DVA DVG 35 Valve Accessories

Handle Assembly

DV35-H-3	391-1873-096	6" Standard Handle
DV35-H-4	391-1873-097	8" Standard handle
DV35-H-6	391-1873-064	6" Handle For High Boy
DV35-H-8	391-1873-065	8" Handle For High Boy

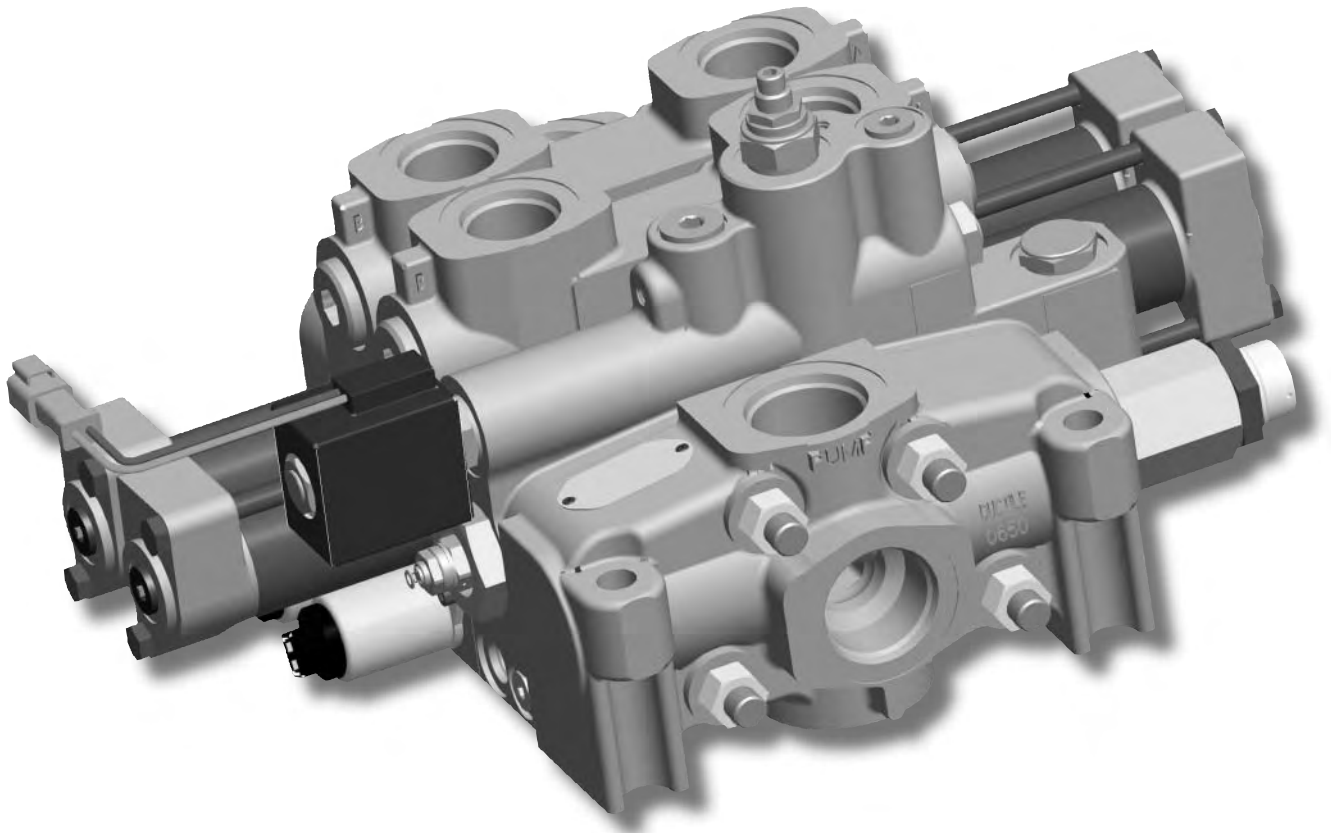
Seal Kits

DV35-K11	391-1873-040	Work Section Assembly Seals
DV35-K12	391-1873-041	Work Section, Spool, Check Seals

Spool Action Kits

DV35-K-200	391-1873-026	Spring Return
DV35-K-201	391-1873-027	3 Position Detent
DV35-K-213	391-1873-203	Air Shift





VG35EH Open-Center Directional Control Valve

Build Program with Pricing
Bulletin HY14-2007-B1/US

Addendum to PL HY14-2000/US
Effective: January 1, 2008

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



ENGINEERING YOUR SUCCESS.

Technical Information

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Pilot Generating/Regulating Section 4

Work Sections 4

Offer of Sale II

Safety Guide II



WARNING – USER RESPONSIBILITY

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

- This document and other information from Parker-Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.
- The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.
- To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

OFFER OF SALE

The items described in this document are hereby offered for sale by Parker-Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated in the detailed "Offer of Sale" elsewhere in this document or available at www.parker.com/hydraulicvalve.

SAFETY GUIDE

For safety information, see Safety Guide SG HY14-1000 at www.parker.com/safety or call 1-800-CParker.

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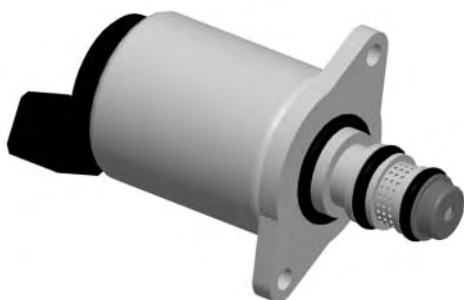


General Description

The VG35 has been a strong and reliable player in the 170-246 LPM (45-65 GPM) open-center, directional control valve market for many years. Now it has a new, electrohydraulic package designed for open-center systems and for those customers wanting to take machine control to the next level.

The offering consists of the following:

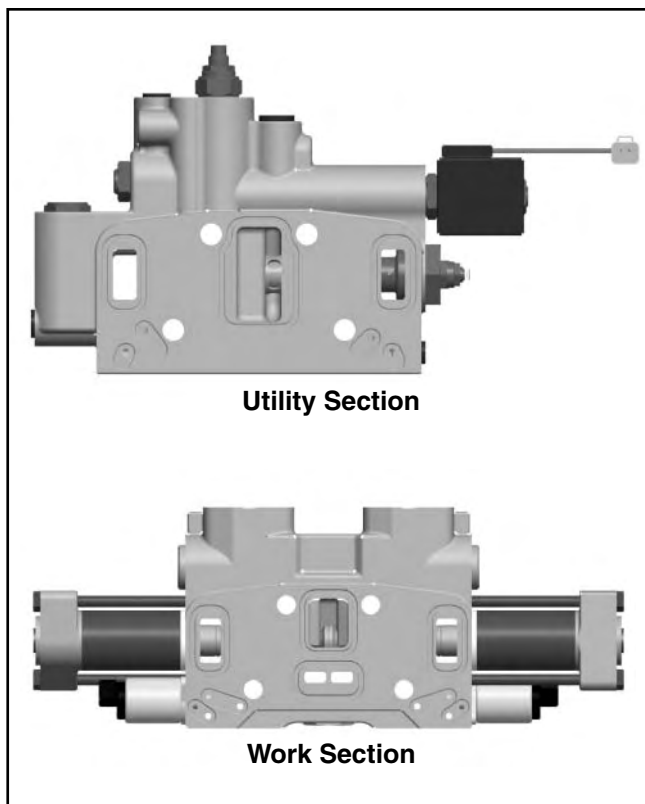
- A global solenoid (pwm) that can be used for proportional or on/off control. The connector options are Amp Jr., Deutsch and Weather Pak.
- Work sections rated to 275 Bar (4000 PSI): 4-way, 3-position; and 3-way, 3-position.
- A pilot generating/regulating section that is referred to as a “utility section”. The purpose of this section is to generate and regulate pilot pressure in an open-center circuit. This section is positioned adjacent to the inlet.
- An outlet that can accept an external regulated signal. This is an option, when a pilot generating/regulating or “utility” section is not required.



Solenoid



Outlet



Operation

Open-center valves that are operated by either hydraulic-remote or electrohydraulic require a way to generate and regulate the pilot pressure. For hydraulic-remote operation, the regulated pilot pressure is needed for the pilot controllers. For electrohydraulic operation, the regulated pilot pressure is required for the work section solenoids. Generation and regulation of the pilot signal can be accomplished externally with an in-line solution, however, this approach requires extra plumbing.

The VG35 has an integrated section that selectively generates and regulates the pilot pressure to be sent to the hydraulic-remote controllers, or the solenoids installed in the work section.

When an operator selects a spool, a signal is sent to a normally open solenoid in the “utility” section. Pressure will then build until it reaches the setting of relief valve. This is sufficient pressure to move the main spool, so that it can be connected to the load pressure. At that point, the inlet of the valve will see system pressure, and the pressure-reducing valve in the “utility section” will regulate the pilot pressure to the hydraulic-remote controllers or the work section solenoids.

For electrohydraulic operation, optimizing machine control is achieved by having a dedicated drain for the work section solenoids. Therefore, the VG35EH package isolates the solenoid within the control valve, and the solenoid drain port is located in the “utility section”.

Specifications

Pressures	Pump Inlet Ports: 275 Bar (4000 PSI) Service Ports: 45 Bar (5000 PSI) Pilot: 35 Bar (508 PSI) (input or internal supply) Tank Return Ports: 15 Bar (220 PSI) Solenoid Drain: 2 Bar (29 PSI)
Flow Rates (maximum recommended)	246 LPM (65 GPM)
Leakage Performance	With mineral oil, 100 SUS@ 49°C (120° F) at 75.9 Bar (1100 PSI) differential Workport w/Steel Plug of no accessory: 30cc/min max. Workport w/RV or RV+AC: 35cc/min max.
Hydraulic Fluid	Mineral Base oil For other fluids consult factory Viscosity, working range: 15-380mm ² /s (15-380 cSt)
Hydraulic Oil Temperature	Recommended Operating Range without Solenoid Operation: -30° to 90°C (-22 to 194°F) Recommended Operating Range with Solenoid Operation: -20° to 80°C (-4 to 176°F)
Filtration (ISO4406)	20/18/14 in Main Flow Paths 18/16/13 Pilot Supply

Weights

Inlet with relief	7.2 kg (15.8 lbs)
Work section – manual spring return	8.4 kg (18.4 lbs)
Work section – hydraulic remote	10.4 kg (22.8 lbs)
Work section – solenoid operated	10.8 kg (23.8 lbs)
Work section – pilot generation	9.6 kg (21.1 lbs)
Add for port relief	0.3 kg (0.65 lbs)
Outlet	4.8 kg (10.6 lbs)

Solenoid Specifications

Voltage	12 or 24 VDC
Frequency	100 ±10 Hz
Pilot	35 Bar (508 PSI) 15-23 LPM (4-6 GPM)
Current Input (I)	1.5A for 12 VDC 0.75A for 24 VDC
Current (mA) for Spool Shift	12V 24V
Start Shift	550 225
Full Shift	150 575
Insulation Material	Class H
Duty Cycle	100%
R20 Ohm	5.3 (±5%) for 12 VDC 21.2 (±5%) for 24 VDC
Fluid Cleanliness	17/14 per ISO 4406
Ambient Temperature	-30° to 80°C (-22 to 176°F)
Fluid Temperature	-20° to 80°C (-4 to 194°F)

Connections

O-ring boss ports SAE-J1926-1
 BSPP ports ISO 1179-1

Description	SAE#	Thread Size	
		O-ring boss	BSPP
Inlet port, Top or Side	16	1-5/16"-12 UNF	1"-11
Inlet port, Top or Side	20	1-5/8"-12 UNF	1-1/4"-11
Outlet port, Top or Side	16	1-5/16"-12 UNF	1"-11
Outlet port, Top or Side	20	1-5/8"-12 UNF	1-1/4"-11
Work Ports	16	1-5/16"-12 UNF	1"-11
Work Ports	12	1-1/16"-12 UNF	3/4"-14



VG35EH Inlet Covers

Product Code	Part Number	List Price	SAE-16 Top	SAE-16 Side	SAE-20 Top	SAE-20 Side	Blocked Pilots
DVG35-A990	348 9175 009	\$192.44			X	X	
DVG35-A880	348 9175 008	\$192.44	X	X			
VG35-A990-BP	348 9195 098	\$225.50			X	X	X

NOTE: VG35-A990-BP is required when a pilot generation utility section is NOT used. This inlet has face machining that terminates the internal pilot and drain galleries.



VG35EH Main Relief Options

Product Code	Part Number	List Price	800-2000 PSI	2000-2500 PSI	2500-3500 PSI	No R/V Option
DVA35-MRV-1	391 1873 003	\$102.40	X			
DVA35-MRV-2	391 1873 004	\$102.40		X		
DVG35-HMRV	391 1873 137	\$127.12			X	
DV-MRVP	391 1873 005	\$27.41				X



VG35EH Outlet Covers

Product Code	Part Number	List Price	SAE-20 Side	SAE-20 Top	SAE-24 Side	No Machined Ports	Ext Pilot & Drain SAE-6
VG35-ZT99000	348 9106 285	\$194.80	X	X			
VG35-ZT99022	348 9106 287	\$270.38	X	X			X
VG35-ZT100000	348 9106 304	\$194.80			X		
VG35-ZT100022	348 9106 305	\$270.38			X		X
VG35-ZT00000	348 9106 306	\$194.80				X	

NOTE: External pilot and drain ports are required to bring an outside pilot supply into the valve stack. The external pilot and drain ports are NOT required when using a pilot generation utility section.



VG35EH Power Beyond Outlet Covers

Product Code	Part Number	List Price	SAE-20 Top	SAE-20 Side	Non Ported
DVG35-TPB99	348 9176 008	\$194.84	X	X	
DVG35-TPB00	348 9176 011	\$194.84			X

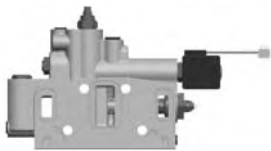
NOTE: Power Beyond Outlets have application limitations. An outside pilot supply cannot be fed into them. Additionally, a last in-line work section is required. Consult factory for these special part numbers.



VG35EH Stud Assembly Kits

Product Code	Part Number	List Price	No of Sections
DVG35-TSK-1	391 1873 138	\$62.50	1
DVG35-TSK-2	391 1873 139	\$69.75	2
DVG35-TSK-3	391 1873 140	\$80.59	3
DVG35-TSK-4	391 1873 141	\$89.64	4
DVG35-TSK-5	39 11873 142	\$98.68	5
DVG35-TSK-6	391 1873 143	\$104.12	6
DVG35-TSK-7	391 1873 144	\$154.52	7
DVG35-TSK-8	391 1873 145	\$114.96	8

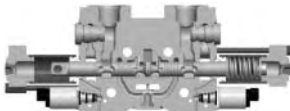
NOTE: Remember to count pilot generating section as one section when ordering studs.



VG35EH Pilot Generating Utility Sections

Product Code	Part Number	List Price	12V	24V	Deutsch
VG35EH-PGP2DA	348 9159 001	\$776.56	X		X
SOL-12V-DUMP	DSL103AD012LWD6R	\$123.33	X		X
SOL-24V-CONVT	S10LWD6RD024	\$78.00		X	X

NOTES: 1. SOL-12V-DUMP can be added to the Utility section. This allows for selective operation of VG35 work sections.
 2. SOL-24V-CONVT coil will convert the Utility section from 12 volt to 24 volt.
 3. Solenoids have 6" leadwires terminated with Deutsch DT04-2P receptacle with pin terminals.



VG35EH Work Sections

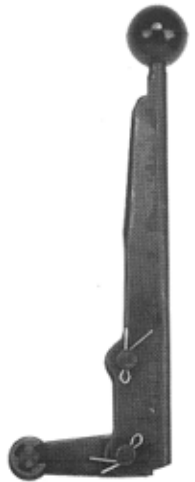
Product Code	Part Number	List Price	12 Volt 4-Way 3-Pos Hold in Neutral	12 Volt 4-Way 3-Pos Float in Neutral	12 Volt 3-Way 3-Pos Hold in Neutral	24 Volt 4-Way 3-Pos Hold in Neutral	24 Volt 4-Way 3-Pos Float in Neutral	24 Volt 3-Way 3-Pos Hold in Neutral	Solenoid Push Pin Override
VG35-HP2AS899	348 9152 161	\$882.97	X						
VG35-LP2AS899	348 9152 162	\$887.50		X					
VG35-JP2AS809	348 9151 020	\$864.11			X				
VG35-HP4AS899	348 9152 163	\$882.97				X			
VG35-LP4AS899	348 9152 164	\$887.50					X		
VG35-JP4AS809	348 9151 021	\$864.11						X	
VG35-HP2AOS899	348 9152 033	\$894.33	X						X
VG35-LP2AOS899	348 9152 062	\$899.62		X					X
VG35-JP2AOS809	348 9151 012	\$876.23			X				X
VG35-HP4AOS899	348 9152 127	\$894.33				X			X
VG35-LP4AOS899	348 9152 128	\$899.62					X		X
VG35-JP4AOS809	348 9151 022	\$876.23						X	X

NOTES: 1. Port Accessories are same as DVA/DVG from Distributor Valve Program Bulletin HY14-2000/US.
 2. Work sections listed have SAE-16 workports.
 3. Work sections listed use "AMP Junior Power Timer" connectors.
 4. Use adapter kit 391 1823 417 to convert from AMP Jr. to Packard.
 5. Series circuit work sections are not available at this time.

Handle Assembly

For DVA20/35 and DVG20/35

A=Old Style Handle W/ VA Linkage
VA=New Style Handle W/ VA Linkage



Lever Length	6"		8"		10"		Linkage Kits Handle to Valve			
	A	VA	A	VA	A	VA	A to VA	VA to A	VA to VA	A to A
Code										
DV20-	H-3	H-6	H-4	H-8	H-5	H-10	HK-1	HK-2	HK-5	HK-7
DV35-	H-3	H-6	H-4	H-8	H-5	H-10	HK-3	HK-4	HK-6	HK-8

Work Section -- Spool Actuation Kits

For DVA20/35 and DVG20/35

Code	Spring Return	3-Position Detent	Rotary Control	Air Shift	Metering Hydraulic Remote Control	On / Off Pilot Operated	Single-Ended D. A. Solenoid 12 VDC	Double-Ended D.A. Solenoid 12VDC	Detent IN Spring Ret'n OUT	Detent OUT Spring Ret' IN	Single Ended DA Solenoid 24 v
DV20-	K-100	K-101	K-102	K-113	K-109	K-110	K-106	K-111	K-107	K-108	K112
DV35-	K-200	K-201	K-202	K-213	K-209	K-210	K-206	K-211	N/A	N/A	K212



These kits are for LH assemblies ONLY. RH kits are NOT AVAILABLE

Seal Kits

For DVA20/35 and DVG20/35

Code	Work Section Assembly Kit	Work Section Repair Kit	Port R/V Without A/C Seal Kit	Port R/V With A/C Seal Kit	Main R/V Repair Kit	Main R/V Seal Kit
DV20-	K-1	K-2	K-3	K-3-1	K-4	K-5
DV35-	K-11	K-12	K-3	K-3-1	K-14	K-15
Kit Contains	Section Seals	Section, Spool and Check Seals	All Replaceable Seals	All Replaceable Seals	All Replaceable Seals & Cartridge Body	All Replaceable Seals

Brief Circuit Descriptions

Series Circuit

Available in DVA20 sections only.

If a machine's work cycle requires simultaneous as well as separate operation of individual hydraulic work functions, a series circuit is right for the job.

As with the other circuits, the oil flows through the open center when all spools are in neutral. There is no parallel passage in standard series sections because they feed directly from the open center passage. If more than one spool is operated, pump flow goes first to the section closest to the inlet. Return flow from the first section is fed back into the open center for use by downstream sections.

Downstream sections can be series, parallel or tandem and will operate in series with the upstream section.

In series circuits, operating pressure is cumulative. Therefore, the sum of the pressures in the circuits can not exceed the circuit or main relief valve setting.

Parallel Circuits

Parallel circuits are the most common on mobile equipment because more than one function can be operated simultaneously and at random. If two or more functions are fully operated at the same time, the one with the lightest load will assert priority because the fluid will take the path of least resistance. However, the operator can divide the flow between functions by metering the spools.

Movement of the spool meters or shuts off the flow of oil thru the open center passage and pressurizes the parallel passage. Oil is then available, at the operator's discretion, to all work ports connected to the parallel passage.

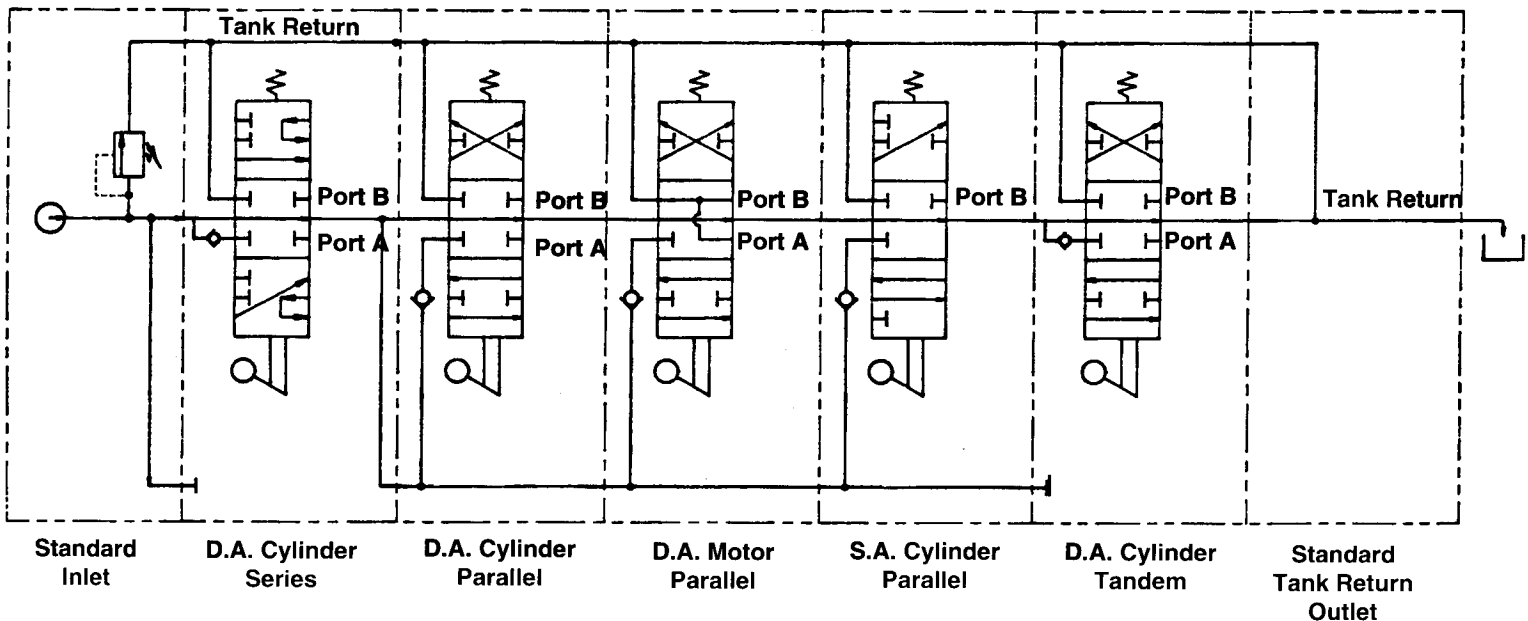
Tandem Circuits

(Not available in the program)

Tandem circuits are sometimes called priority or standard circuits by other manufacturers. Tandem sections feed from the open center passage like series sections but the return flow is directed to the tank return passage and is not available downstream.

If a tandem section is followed by a series or tandem section, operating the tandem section nearest the inlet will assert priority and downstream sections will not function.

Typical Work Section Schematics



INTRODUCTION

This manual has been prepared to assist you in the proper maintenance of the VA20™/VA35™ and VG20™/VG35™/VG80™ directional control valves. Before any work is done, we suggest that you read the assembly and disassembly instructions completely.

The first rule of good maintenance is cleanliness, which includes a clean environment. **MAKE SURE YOU DISASSEMBLE AND ASSEMBLE YOUR HYDRAULIC EQUIPMENT IN A CLEAN AREA.** Dirt is the natural enemy of any hydraulic system.

GENERAL INFORMATION

The VA and VG model valves are updated versions of our proven A20™ and A35™ units. The VG models are cast from compacted graphite, a high strength iron alloy, which allows the valve to be rated to 3500 psi. VA models are cast from gray iron and are rated at 2500 psi. These open-center, directional-control valves are available in parallel, tandem, and series circuitry. As needed, the sectional, stack-type construction provides flexibility for the addition or subtraction of work sections to an existing valve bank. This design also permits the combination of parallel, tandem, and series circuitry in a single bank. The internal coring of each valve section determines its circuitry and the number of gasket seals required.

All sections with optional features, such as port relief valves, crossover relief valves, and anti-cavitation checks, are dimensionally larger when measured from the top of the port to the bottom of the housing. These are referred to as “hi-boy” sections. Those without work-port options can use the low-profile castings, which are called “lo-boy” sections.

REPLACEMENT PARTS

The illustrations and instructions in this manual apply only to the VA/VG series assemblies, subassemblies, and components. All valve components, except for spools and housings, are available as replacement parts or subassemblies. Spools are hone-fitted to their individual housings, so damage to either of these components means the entire section must be replaced.

We recommend that you use only genuine VA/VG series replacement parts in your service program. Manufactured to the same exacting tolerances and quality controls as the original equipment, genuine VA/VG replacement parts may help prevent premature, component failure and costly downtime. Service parts and assemblies are available through your original equipment dealer or any authorized distributor.

MAINTENANCE

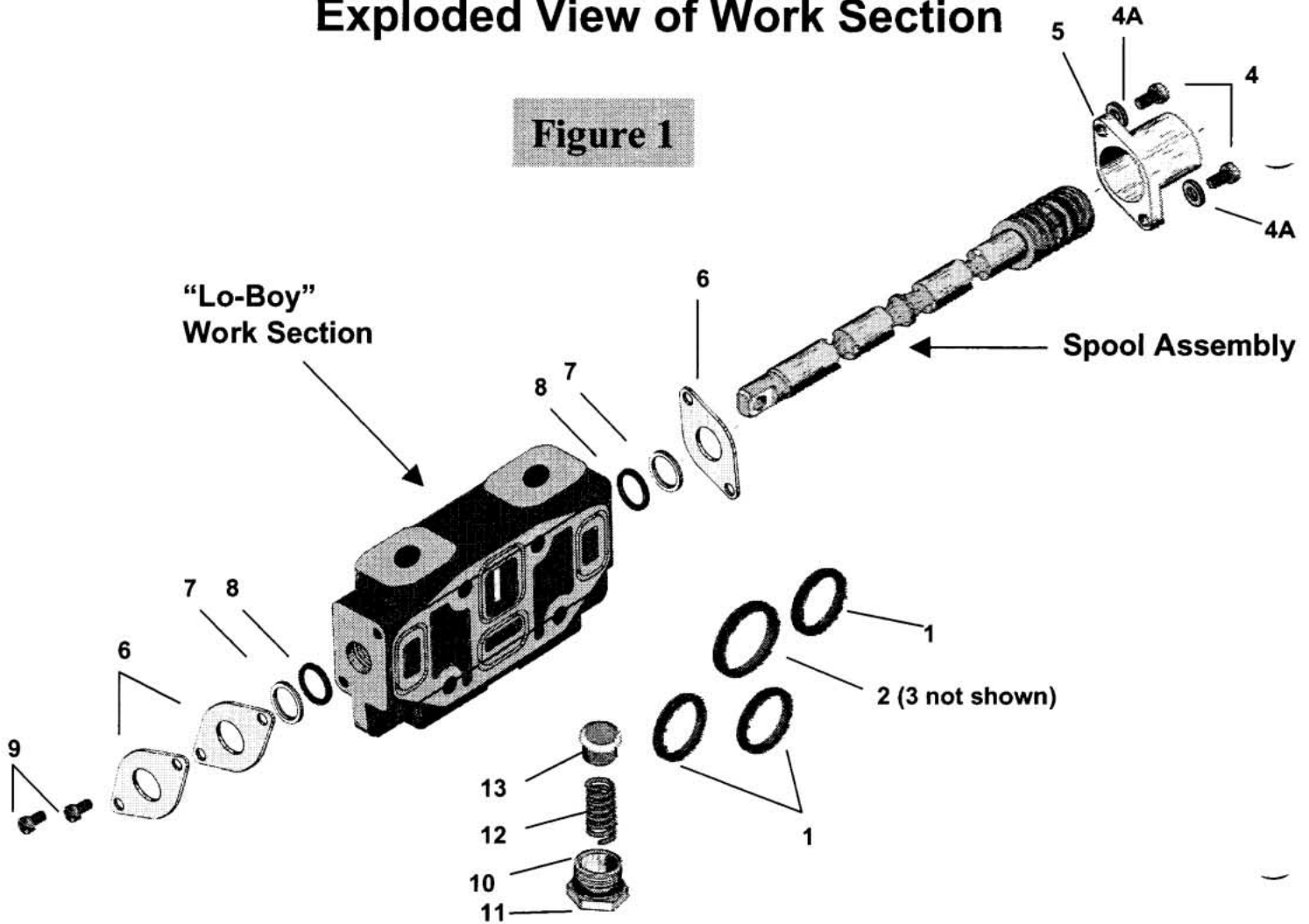
Valves are often used in hazardous environments. Inspect them frequently for damage due to improper use, corrosion or normal wear. If needed, repairs should be made immediately.

Always refer to the machine manual for the proper procedure to remove the valve from the machine.

Remove the valve bank from the equipment, disconnecting all hoses, fittings, control handles and linkage connectors that might be attached to the valve. Plug all ports and thoroughly clean the exterior of the valve bank, then the port plugs can be removed.

Exploded View of Work Section

Figure 1



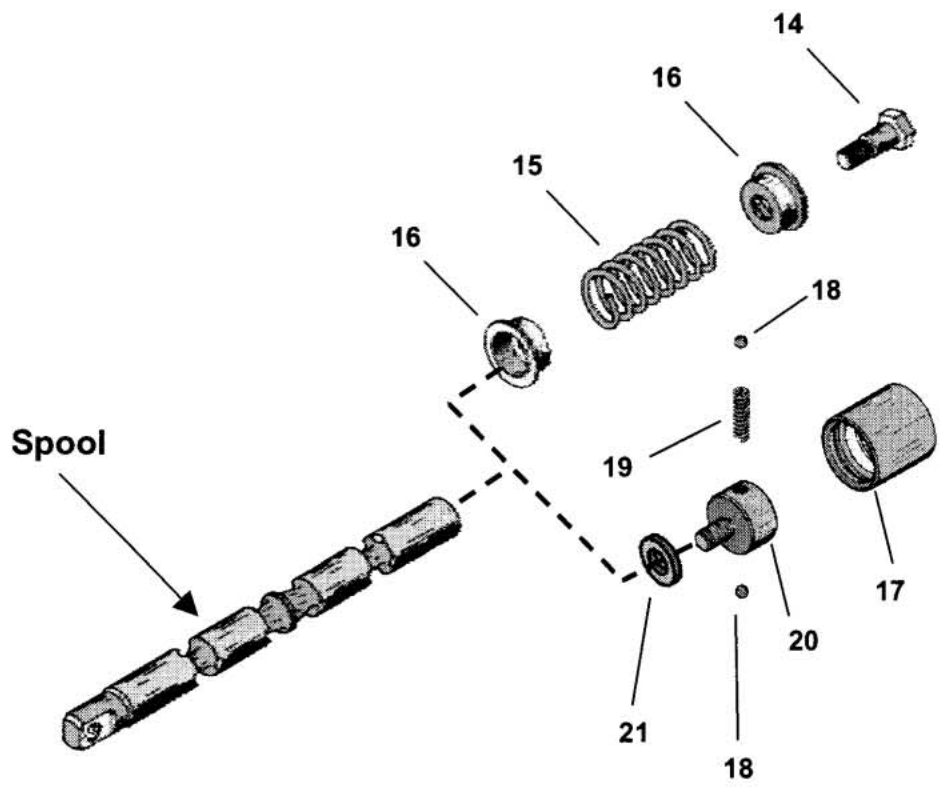
Parts List For Work Section

Item	Description	Qty.	VA/VG20 Part No.	VA/VG35 Part No.	VG80 Part No.
Parallel Section Seals* See Figure 1					
1.	Square Seals	3	391-2881-206	391-2881-200	391-2881-433
2.	Square Seal	1	391-2881-200	391-2881-403	391-2881-670
Series Section Seals					
1.	Square Seals	2	391-2881-206	391-2881-200	.....
3.	Square Seal	1	391-2881-627	391-2881-628	.....
Parallel and Series Section Component Parts. See Figure 1					
4.	Back Cap Screws	2	391-1433-020	391-1433-009	(4) 391-1402-068
4A.	Lock washers	8	.....	.....	391-3783-039
5.	Back Cap	1	341-6000-100	342-6000-100	341-0585-099
6.	Retainer Plates	3	391-2183-001	391-2183-005	391-2183-157
7.	Back up Rings	2	391-2681-378	391-2681-426	391-2681-285
8.	Spool Seals	2	391-1985-014	391-2887-212	391-2881-096
9.	Retainer Plate Screws	2	391-1433-015	391-1433-002	(4) 391-1402-015
10.	Check Valve Cap	1	391-0581-044	391-0581-044	391-0585-099
	Or Valve Cap (F.I.N.)	1	391-2281-015	391-2281-015	.....
11.	O Ring Seal **	1	391-2881-204	391-2881-204	391-2881-249
12.	Check Spring **	1	391-3581-713	391-3581-713	391-3581-778
13.	Check Valve Poppet **	1	391-2481-069	391-2481-069	391-2383-091

*Parallel Sealing Face includes inlets and mid-inlets.

**Not required in Float-in-neutral Sections.

Figure 2



Spring Centered and Detent Spool Operators. See Figure 2

14.Stripper Bolt	1	391-1432-022	391-1432-021	391-1402-452
15.Centering Spring	1	391-3581-608	391-3581-633	391-3581-330
16.Spring Guides	2	391-1642-045	391-1642-013	391-1642-161
17.Detent Sleeve	1	391-3283-015	391-3283-008	391-3384-310
18.Detent Balls	2	391-0282-010	391-0282-009	391-0282-011
19.Detent Spring	1	391-3581-130	391-3581-015	391-3581-316
20.Detent Poppet Retainer	1	391-2583-008	391-2583-006	391-3384-311
21.Detent Spacer	1	.....	.....	391-3782-208

Valve Disassembly Instructions

Reference exploded view and parts list on page 2 and 3 for work section detail.

Step 1 - Valve Bank

This step is the most critical in the disassembly procedure. It should be followed closely to ensure that the valve bank is properly reassembled after repairs have been made.

With a waterproof, quick-drying marker, mark each casting with a sequential number. Start by marking the inlet casting with the #1 and finish by marking the outlet with the highest number.

Next, mark the port boss closest to the back cap on each work section with a "B" (for back cap end).

Then, mark the port boss closest to the spool clevis on each work section with a "C" (for clevis end).

Finally, if relief valves are removed from the valve bank they must be marked with the corresponding number of the casting and port location (B or C) from which they were removed. Inlet and mid-inlet relief valves are marked with a casting number only.

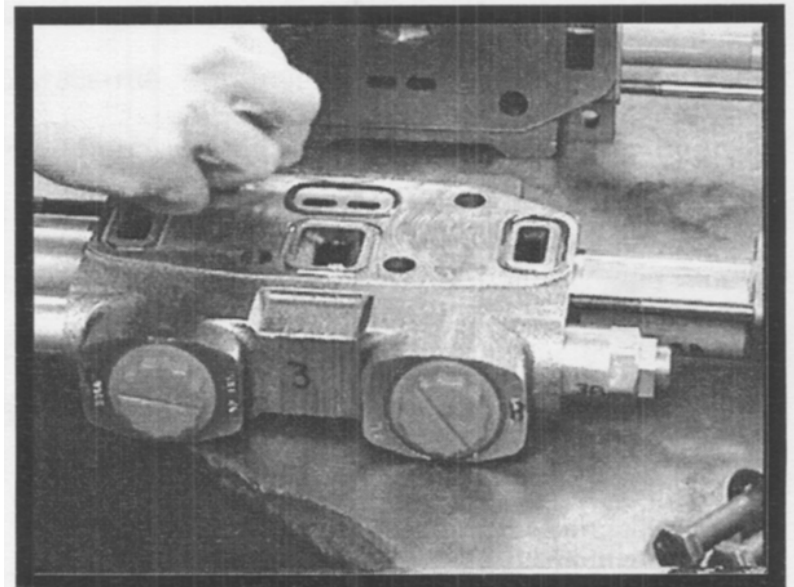
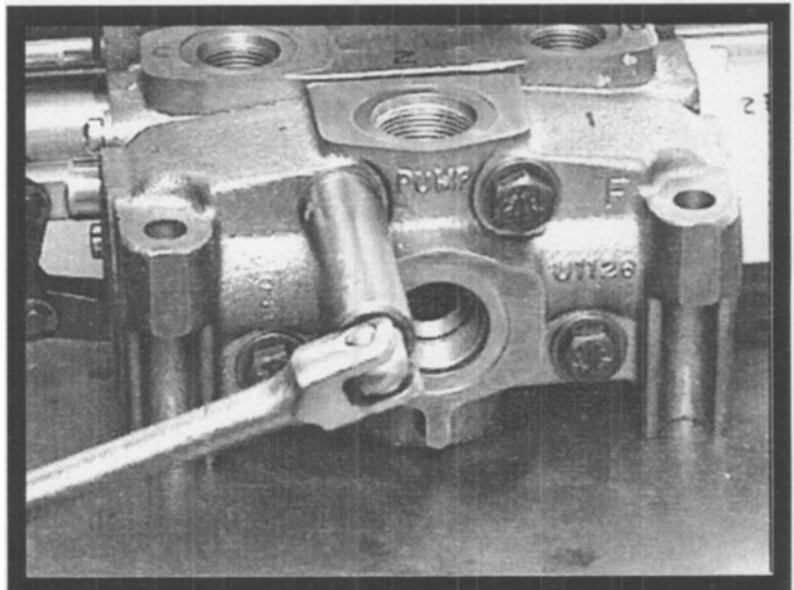
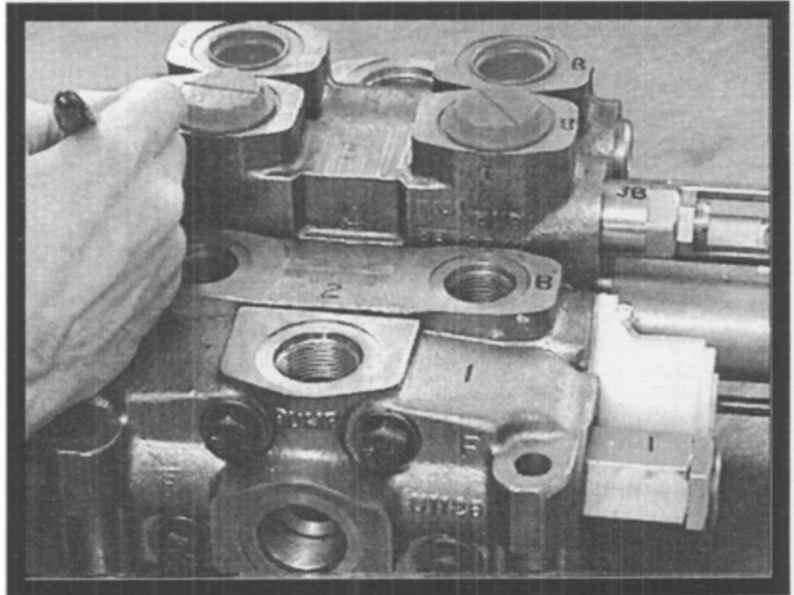
Step 2 - Tie Bolts

Remove the four, tie bolts that hold the bank together and separate the sections.

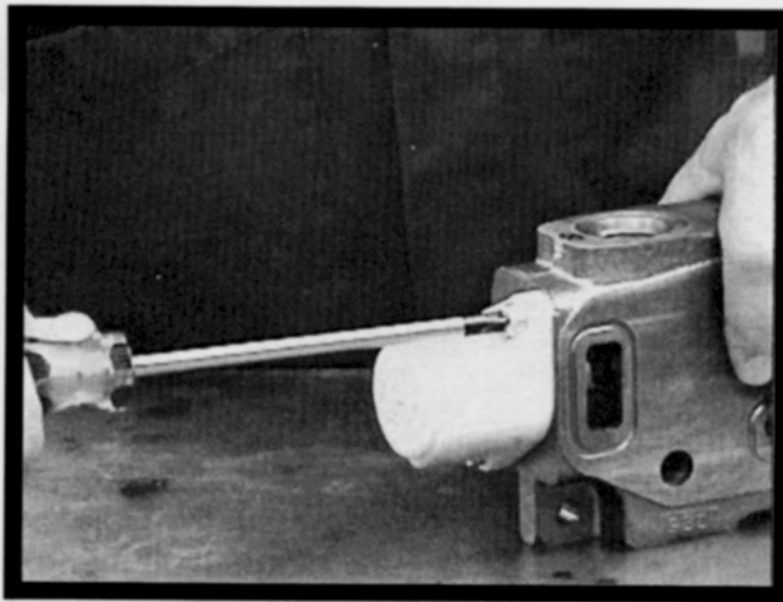
NOTE: VA valve tie bolts thread into the outlet casting. VG valve tie bolts pass through the entire bank, requiring washers and hex nuts to be fastened at both ends of the bolt.

Step 3 - Section Seals

The inlet, mid-inlet and each parallel work section have four, section seals, (Fig. 1, items 1 & 2) on the downstream, mating face. Series work sections and the VA/VG35 split flow mid inlets have three section seals on the downstream mating face, (Fig. 1, items 1 & 3.) These section seals should be removed and discarded.

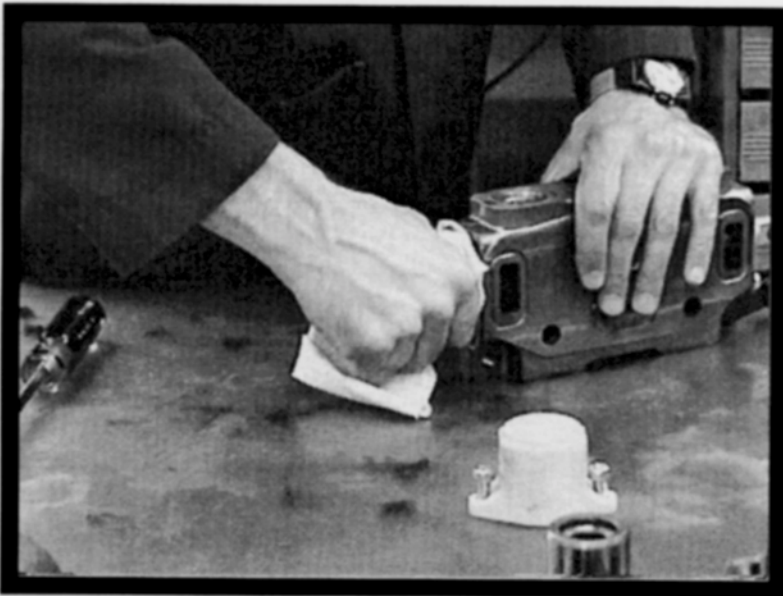


REMINDER: ALL WORK MUST BE PERFORMED IN A CLEAN AREA.



Step 4 - Valve Back Cap

Using a large, Phillips-head screwdriver, remove the two, cap screws (Fig. 1, item 4) which fasten the back cap to the work section. Lightly tap the end of the screwdriver handle with a hammer to break adhesive. Remove the back cap (Fig. 1, item 5).

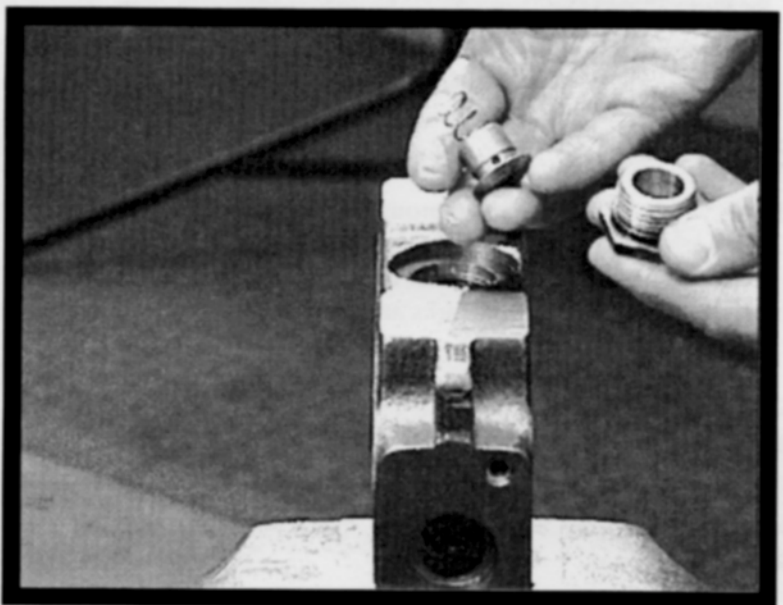


Step 5 - Control Spool and Seals

Grasp the spring end of the spool with a clean, lint-free cloth and pull the spool out of the housing using a twisting motion. Generally, the rear, retainer plate (Fig. 1, item 6) back-up ring (Fig. 1, item 7) and spool seal (Fig. 1, item 8) will come out with the spool.

CAUTION: For detented spool models, be careful not to remove the detent poppet sleeve (Fig. 2, item 17) unless it is to be serviced.

Using a large, Phillips-head screwdriver, remove the two, retainer-plate screws (Fig. 1, item 9) from the spool clevis end of the work section. Lightly tap the end of the screwdriver handle with a hammer to break the adhesive. Remove the two, retainer plates (Fig. 1, item 6) the back-up ring (Fig. 1, item 7) and the spool seal (Fig. 1, item 8). Tag or mark with the appropriate, work section identification number. (See Step 1.) Spool seals (Fig. 1, item 8) and back-up rings (Fig. 1, item 7) should be discarded.



Step 6 - Transition Check

The transition check is located in the bottom center of the work section housing. Carefully clamp the work section in a vise with ports down. Do not clamp on the machined surface. Remove the check-valve cap (Fig. 1, item 10) and its O-ring seal (Fig. 1, item 11). Discard the seal. Remove the check spring (Fig. 1, item 12,) and the check-valve poppet (Fig. 1, item 13).

NOTE: Only cylinder work sections (ports blocked in neutral) have a transition check. Motor sections have only a cap plug.

Valve Disassembly Instructions

Spool Disassembly Spring Centered Spool

The spring assembly should not be removed from the spool unless these parts need to be replaced. Once the spool is free of the work section housing, it must be handled carefully to avoid damage. Place the spool vertically in a soft-jawed vise, clamping on the flat, spool clevis, and remove the stripper bolt (Fig. 1, item 14) with a wrench.

Lightly tap the stripper bolt with a hammer and a punch to help break the adhesive. Cautious application of heat may be required to free the stripper bolt, since an anaerobic thread adhesive was used during its assembly.

CAUTION: Too much heat may distort the spool.

As the stripper-bolt threads disengage, the spring (Fig. 2, item 15) and spring guides (Fig. 2, item 16) will release abruptly from the spool.

Detent Spool

The detent assembly should not be removed from the spool unless these parts need to be replaced. Wrap the detent sleeve (Fig. 2, item 17) with a clean, lint-free cloth. Grip the cloth-covered sleeve and pull firmly. As the sleeve moves backwards, the detent balls (Fig. 2, item 18) and the detent spring (Fig. 2, item 19) will release abruptly. The cloth should capture these parts and prevent their loss.

Next, clamp the spool in a soft-jawed vise and remove the detent poppet retainer (Fig. 2, item 20). Place an undersized bar through the detent ball bore to serve as a wrench. Lightly tap the detent poppet retainer with a hammer and a punch to help break the adhesive. Cautious application of heat may be required again, since an anaerobic adhesive was also used in the detent retainer assembly.

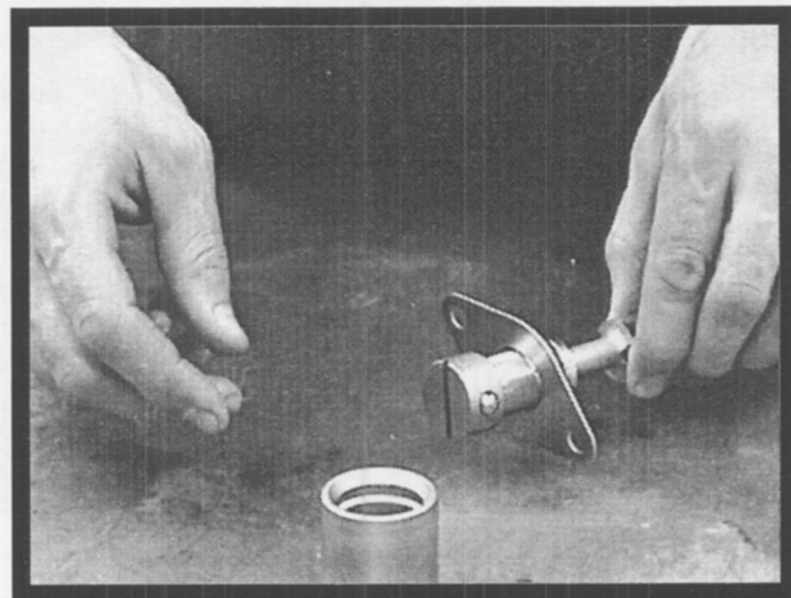
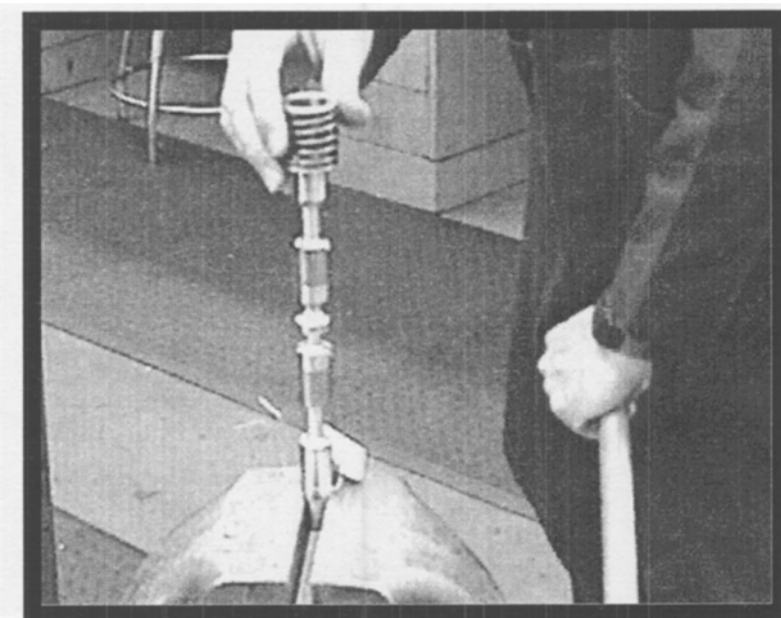
CAUTION: Too much heat may distort the spool!

CLEANING, INSPECTION, AND REPAIR

1. Inspect the spool bore, transition check seat and spool from each section for deep scratches, gouges or excessive wear. If any of these conditions exist, replace the section. Minor, surface damage on the control spool and check poppet can be carefully polished away with a very fine, crocus cloth.

2. Examine the machined surfaces of the valve housing for nicks and burrs that could cause leakage between sections. Lightly stone these surfaces to remove any rough spots.

CAUTION: A shallow-milled relief area extends across the O-ring face of the valve housing. This should not be stoned or ground off!



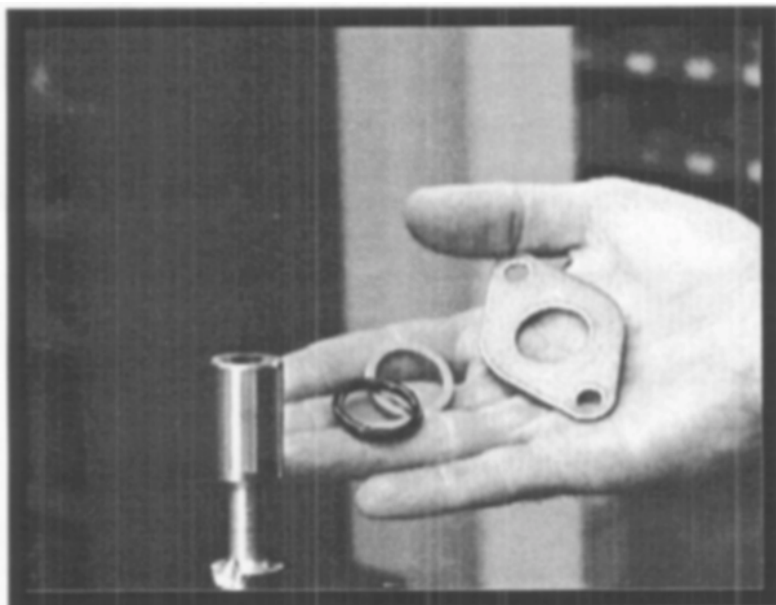
3. Wash all parts thoroughly in a cleaning solvent and blow dry before beginning reassembly. Pay special attention to the number and letters marked on the parts in Step 1. If any marks are removed during cleaning, re-mark immediately.

4. Clean adhesive from threads of spool, stripper bolt, housing, cap screws and hex nut with Loctite™ Chisel Gasket Remover.

Preparation of Parts

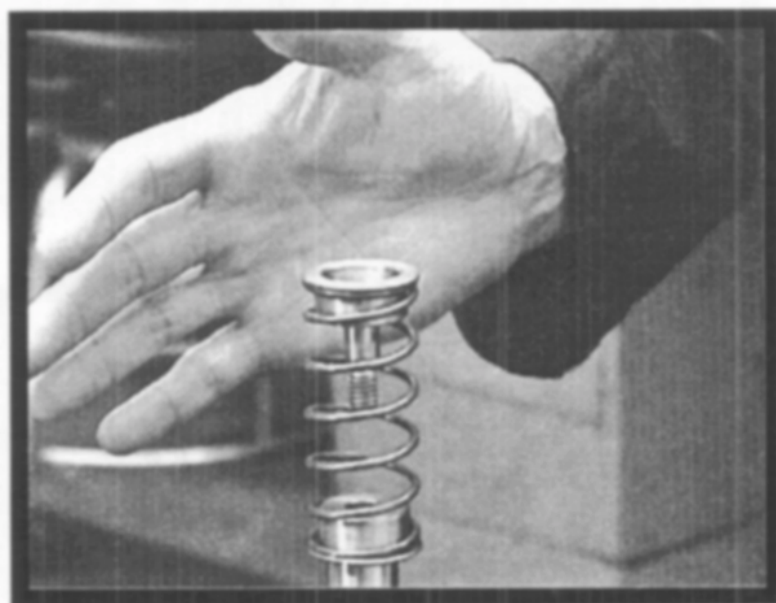
Spray the threads of the new stripper bolt (Fig. 2, item 14) tapped-threaded spool end, all screws and screw holes on both ends of the housing with LOCQUIC Primer Grade NF™ and let dry.

Spring Center Spool Assembly



Step 1 - Spool Assembly-Spring Centered

Clamp the flat, clevis end of the control spool in a soft jawed vise. Apply Parker Super-O-Lube™ to the spool seal (Fig. 1, item 8) and slide it onto the end of the spool away from the clevis. Slide on the back-up ring (Fig. 1, item 7) and retainer plate (Fig. 1, item 6). Position these items onto the spool, so that they do not interfere with the spool operator mechanism during assembly. Do not allow the O-ring to come in contact with the sharp edge of the spool notches.



Step 2 - Attach Spring Guides and Spring

Apply 2 - 3 drops of Loctite 262™ or equivalent anaerobic adhesive near the middle of the female threads in the spool. Assemble the spring guides (Fig. 2, item 16) centering spring (Fig. 2, item 15) and stripper bolt (Fig. 2, item 14,) onto the spool (Reverse of Step 7). Torque the stripper bolt to 175 in. lbs. +/-4 in. lbs.

CAUTION: Care must be taken to ensure that the spring retainer is not pinched under the shoulder bolt during assembly. This can result in burrs that may cause spool binding. Check for binding by compressing the spring and guides or by rotating the spring guide nearest the housing.

CAUTION: Follow the adhesive manufacturer's instructions for proper cleaning and curing. Failure to clean and prepare parts properly may result in assembly failure!

Lightly coat the centering spring with high- temperature grease to prevent rusting. Set the spool assembly aside and let it cure for a minimum of 1 hour. After curing, test the stripper bolt to make certain it can withstand 125 in. lbs. of breakaway torque.

Detent Spool Assembly

Step 1 - Spool Assembly-Detent

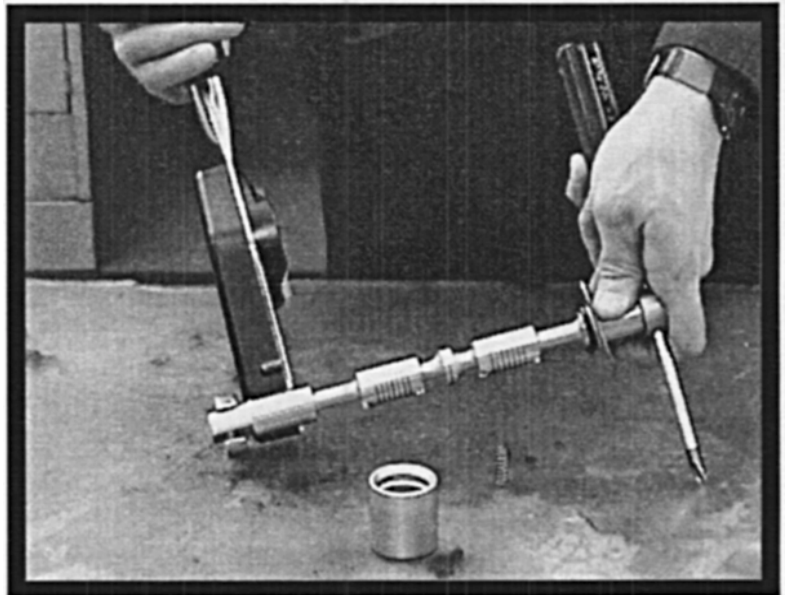
Apply Parker Super-O-Lube™ to the spool seal (Fig. 1, item 8) and slide it onto the spool. Slide the back-up ring (Fig. 1, item 7) and one, retainer plate (Fig. 1 item 6) onto the spool. Position these items onto the spool, so that they do not interfere with the spool operator mechanism during assembly. Do not allow the O-ring to come in contact with the sharp edge of the spool notches. Apply 2 - 3 drops of Loctite 262™ or an equivalent, anaerobic adhesive near the middle of the female threads in the spool.

CAUTION: Follow the adhesive manufacturer's instructions for proper cleaning and curing. Failure to clean and prepare parts properly may result in assembly failure.



Step 2 - Spool Assembly-Detent

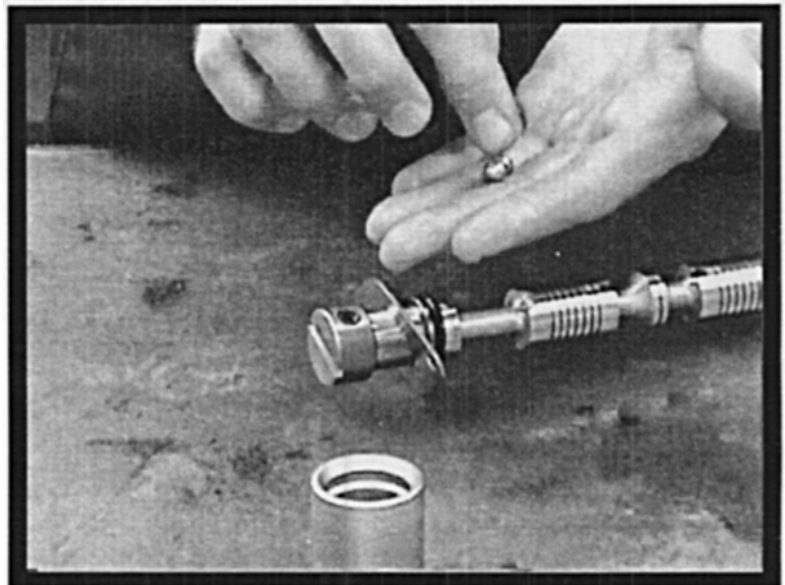
Thread the detent ball retainer (Fig. 2, item 20) into the spool end. Torque the detent ball retainer to 175 in. lbs. +/-4 in. lbs.. This can be accomplished by using a crows-foot socket on the flats of the clevis, and holding the spool by inserting a round, steel rod or screwdriver through the hole in the ball retainer.

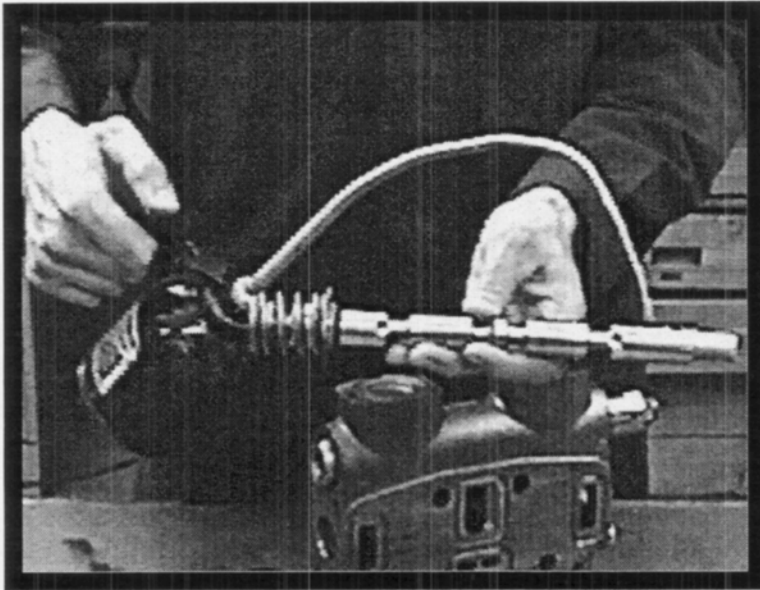


Step 3 - Detent Balls and Spring

Next, lightly coat the detent balls (Fig. 2, item 18) detent spring (Fig. 2, item 19) and entire inside diameter of the detent sleeve (Fig. 2, item 17) with high-temperature grease.

Insert the detent spring into the through hole in the detent ball retainer. Place the steel balls on the ends of the spring. Compress the balls and spring, then slip on the detent sleeve. (Note: The detent sleeve is not symmetrical; one end of the sleeve has a lead-in chamfer. This chamfer must face the spool clevis when assembled.) Move the detent sleeve to the neutral or middle position to prevent the subassembly from separating during subsequent steps.

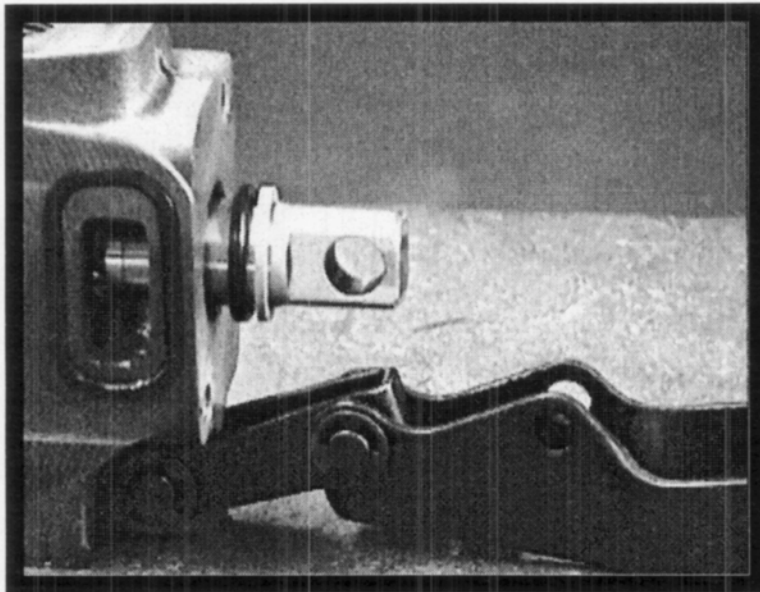




Step 1 - Spool Subassembly

Apply 2 - 3 drops of Loctite 262™ or equivalent to the fillister screw holes on both ends of the housing.

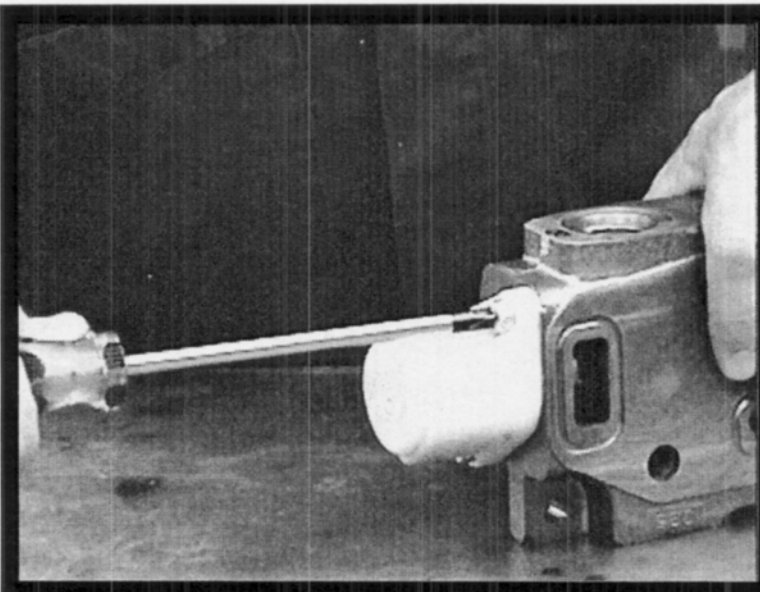
Apply a light coating of clean, hydraulic oil to the valve spool. Carefully insert the spool assembly into the housing. Use caution to avoid causing burrs. Be careful not to pinch, roll or damage the seals. Make sure that the spool and housing are in the proper orientation (see Step 1, page 6 disassembly).



Step 2 - Spool Seal and Back up

Apply Parker Super-O-Lube™ to the spool seal (Fig. 1, item 8) and slide it onto the spool. Slide on the back-up ring (Fig. 1, item 7). Push both items into the counter-bore until they bottom out.

Assemble the two, front, retainer plates (Fig. 1, item 6) using the two short, fillister screws (Fig. 1, item 9). Check retainer plates for proper alignment. Tighten to a final torque of 34 in. lbs. +/- 2 in. lbs..



Step 3 - Back cap

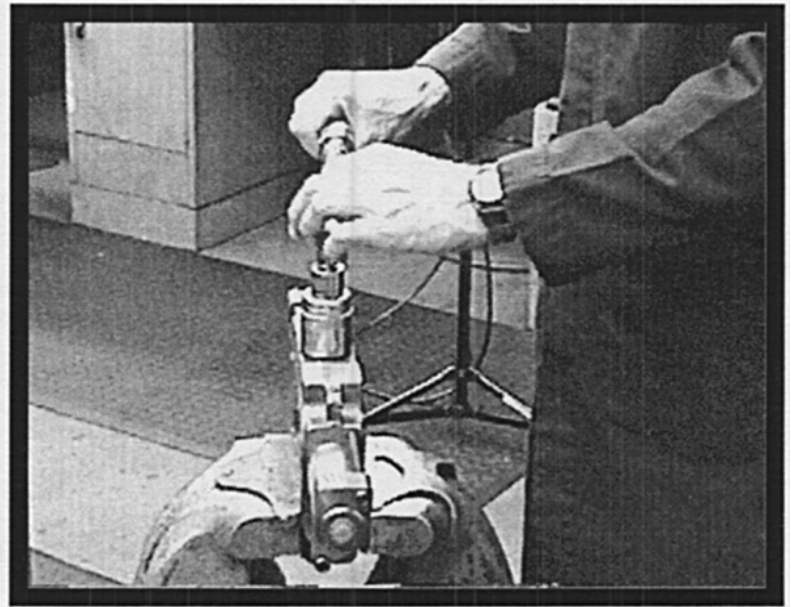
Install the back cap using the two, long, fillister screws (Fig. 1, item 4). Tighten to a final torque of 34 in. lbs. +/- 2 in. lbs.

Caution: Excessive torque will damage the back cap ears!

Valve Assembly Instructions

Step 4 - Install Transition Check

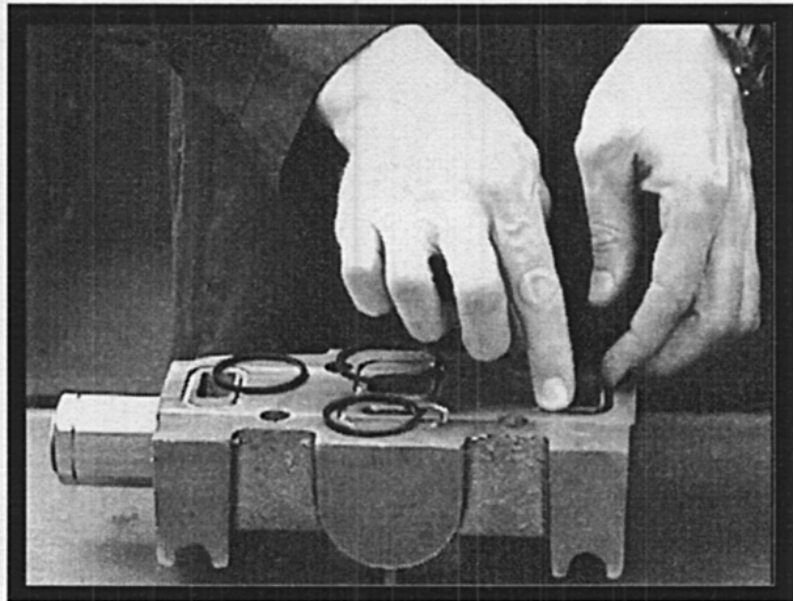
Inspect transition check components for cleanliness. Install check poppet (Fig. 1, item 13) into the transition check cavity. Align the check spring (Fig. 1, item 12) square to the poppet, then carefully place the check cap (Fig. 1, item 11) over the poppet and spring. Turning by hand, engage several threads. Tighten to a final torque of 75 ft. lbs. +/-4ft. lbs..



Step 5 - Relief Valves

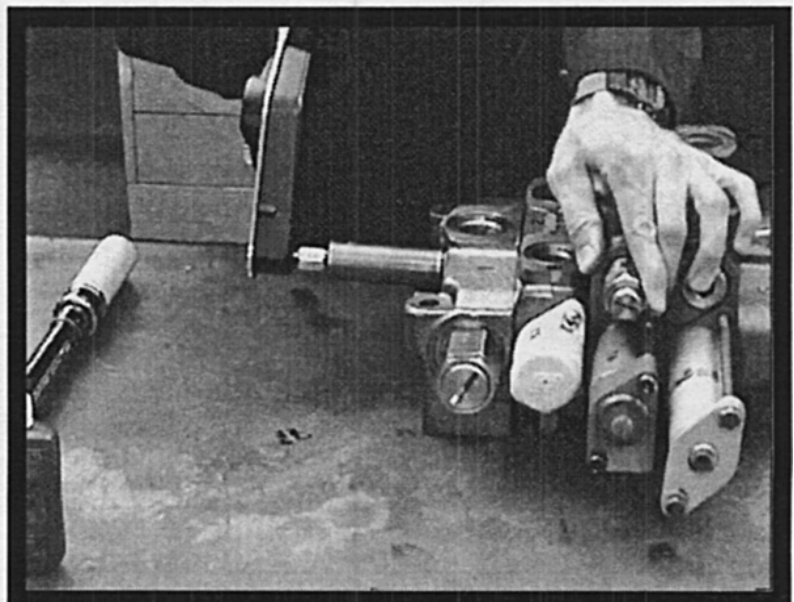
Return all relief valves to their proper positions and torque to 75 ft. lbs.

Install new, section seals. Place section seals (Fig. 1, items 1 & 2, or items 1 & 3) in the proper grooves. Make certain seals stay in their grooves during assembly.



Step 6 - Install Tie Bolts

Slide the tie bolts through the inlet casting. If cap screws are used, place a washer on the cap screw prior to installation. Place the valve sections on the tie bolts in their proper sequence (see Step 1, page 4). Turning by hand, engage several threads in the outlet. If it is a VG series assembly, assemble nut and washer to either end of the stud and follow above instructions. Torque the tie bolts in a cross-corner pattern.



Tie Bolt Torque Values

VA20 - 29 ft. lbs. (348 in. lbs.)

VG20 - 42 ft. lbs. (504 in. lbs.)

VA35 - 34 ft. lbs. (408 in. lbs.)

VG35 - 75 ft. lbs. (900 in. lbs.)

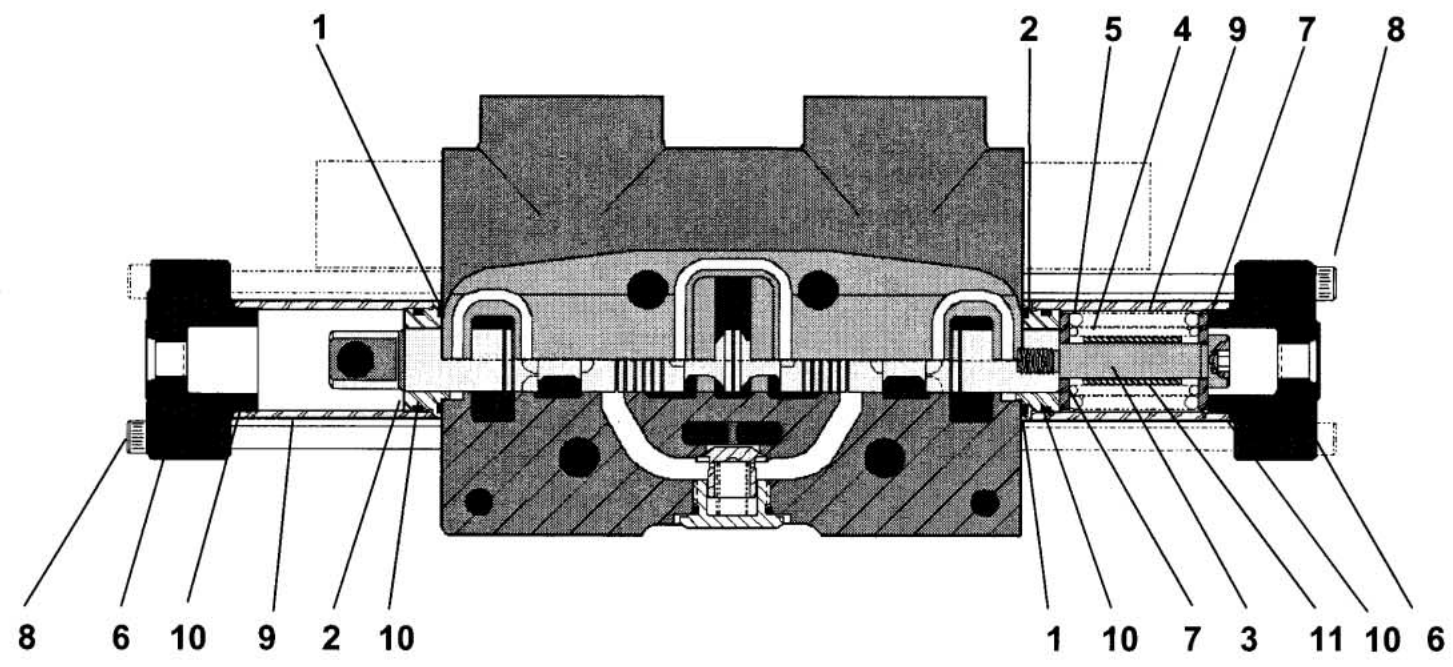
VG80 - 150 ft. lbs. (1800 in. lbs.)

Read these instructions carefully. Failure to follow these procedures can result in poor performance or product

malfunction. Make sure all work is done in a clean area.

REMOTE CAP COMPONENTS - Figure 3

- | | | | |
|-----------------------|-------------------------|-------------------------|-----------------|
| 1. O-rings (2) | 4. Return spring, inner | 7. Spring retainers (2) | 10. O-rings (4) |
| 2. Seal retainers (2) | 5. Return spring, outer | 8. Cap screws (4) (8*) | 11. Stop tube |
| 3. Shoulder bolt | 6. Valve caps (2) | 9. End tubes (2) | |
- * Required for VG80



Hydraulic Remote Control
Figure 3

REMOTE ENDCAP SEAL PARTS LIST

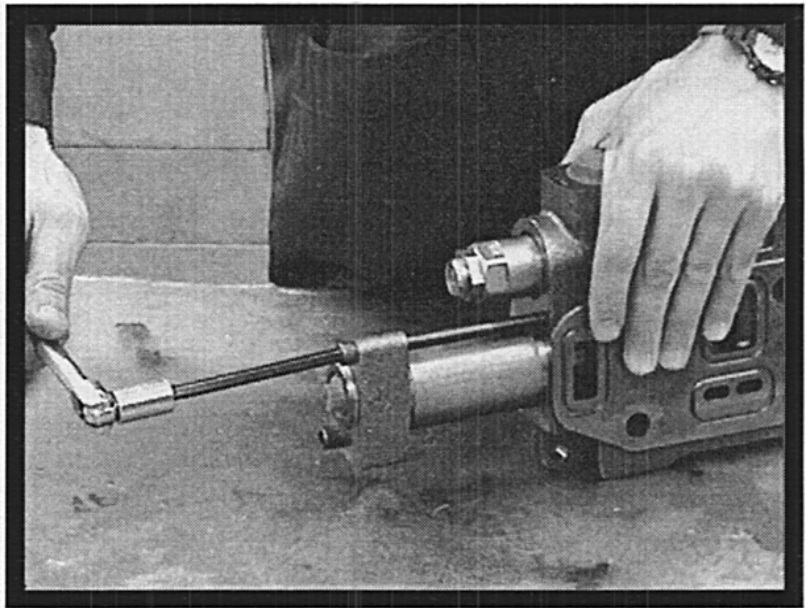
Item	Description	Qty.	VA/VG20	VA/VG35	VG80
1.	O-rings	2	391 2881 625	391 2881 625	391 2881 124
10.	O-rings	4	391 2881 242	391 2881 242	391 2881 106

Remote-Control Operator Disassembly

Step 1 - Remote endcaps

Using an allen wrench, remove cap screws (Fig. 3 item 8) from both ends of the valve section. Lightly tap the wrench with a hammer to help break the bond of the anaerobic adhesive.

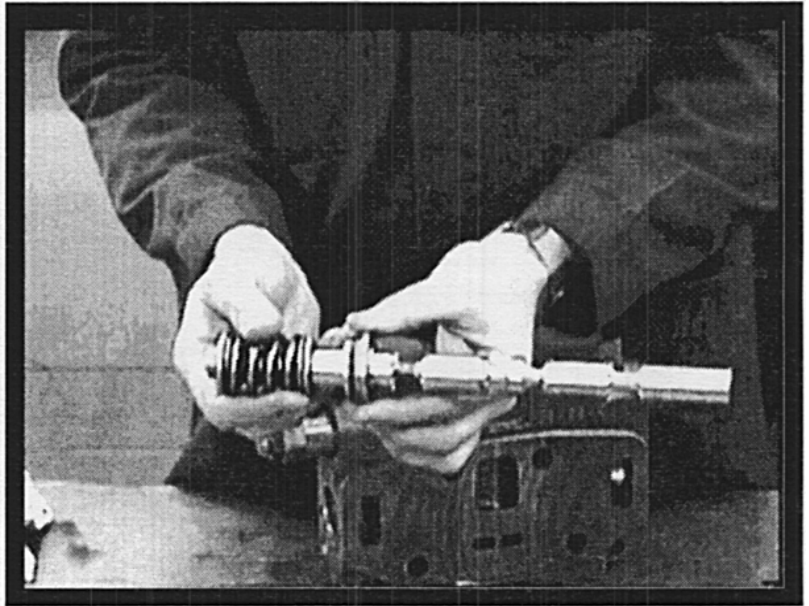
Remove valve caps (Fig. 3, item 6) O-ring seals (Fig. 3, item 10) and end tubes (Fig. 3, item 9) from each end of the valve housing. Discard the O-ring seals.



Step 2 - Spool Subassembly

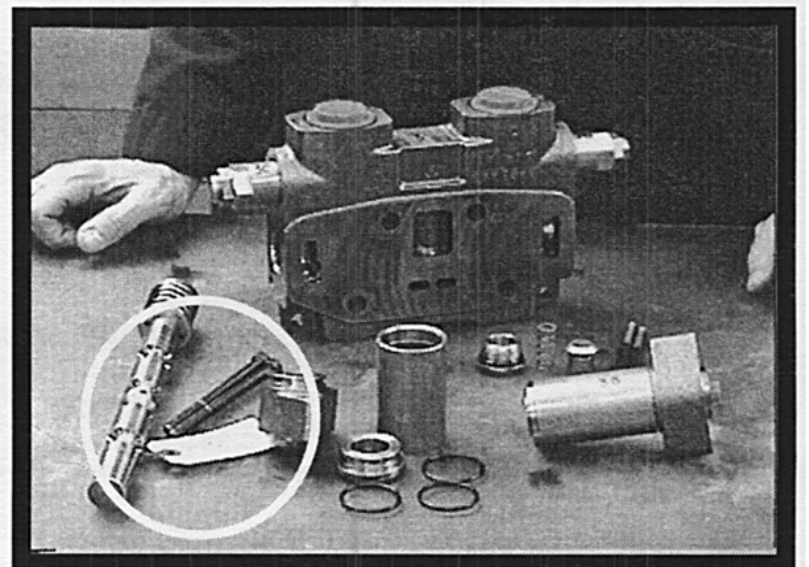
Slide the seal retainer (Fig. 3, item 2) from the clevis end of the spool assembly. Grasp the spool assembly by the spring end and slide it out of the housing. Remove the remaining seal retainer by sliding it over the spool.

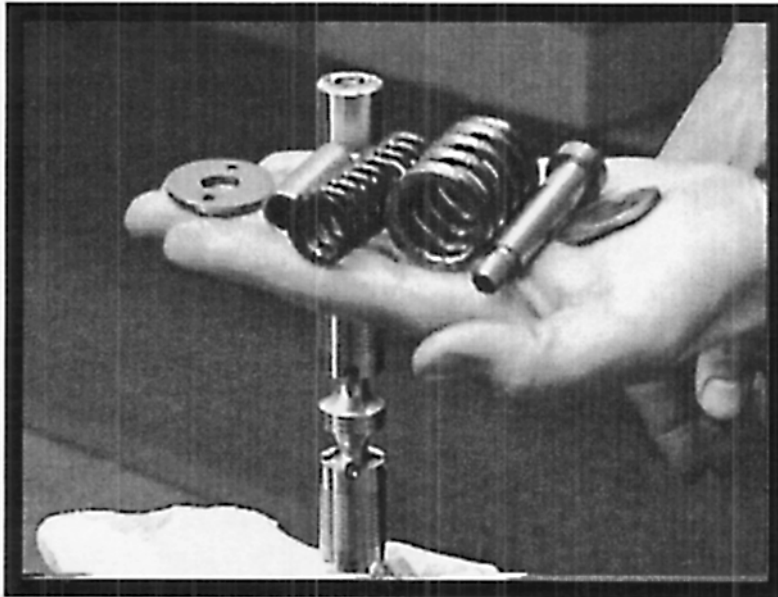
Now, remove the O-ring seals (Fig. 3, items 1 & 10) from both seal retainers and discard the seals.



Step 3 - Spool Identification

The spool should now be tagged or marked with the appropriate work section identification number (see Step 1, page 4).





Step 4 - Spring Pack

The spring assembly should not be removed from the spool unless it needs to be replaced. Insert the clevis end of the spool in a soft-jawed vice. It may be necessary to apply heat to the stripper bolt to loosen the anaerobic adhesive.

Use heat carefully to avoid warping the spool.

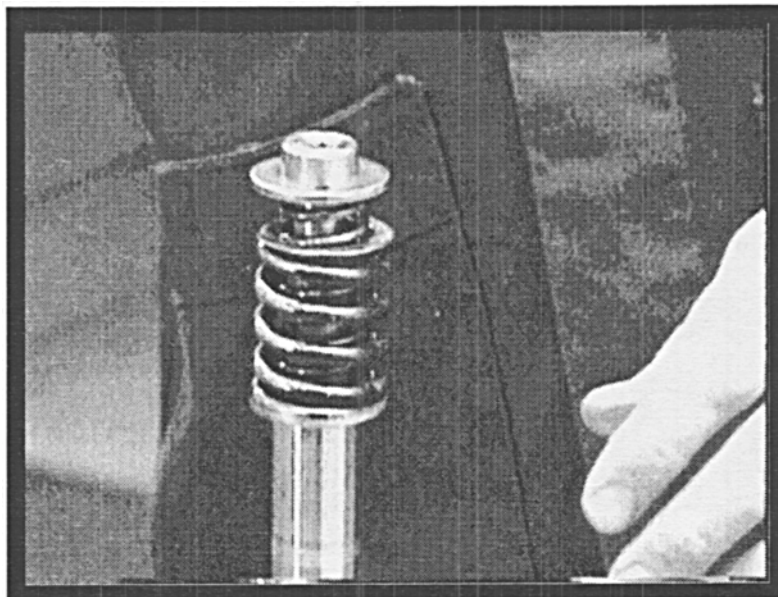
Always Work In A Clean Environment

Remote Control Operator Assembly

Step 1 - Spring Pack

If the shoulder bolt and spring assembly were disassembled, place the spool in a soft-jawed vise with the tapped and threaded end up. Carefully clamp on the flat, spool clevis. Apply 2 - 3 drops of Loctite 262™ or equivalent to the middle of the female threads in the spool end. Assembled joints should be allowed to cure for a minimum of one hour before being subjected to hydraulic testing.

Slide a spring retainer (Fig. 3, item 7) onto the shoulder bolt (Fig. 3, item 3) followed by the stop tube (Fig. 3, item 11). Next, slide springs (Fig. 3, items 4 & 5) onto the shoulder bolt. Place the remaining spring retainer on the end of the spool and thread the shoulder bolt into the hole by hand. Torque the shoulder bolt to 175 in. lbs. using a torque wrench.

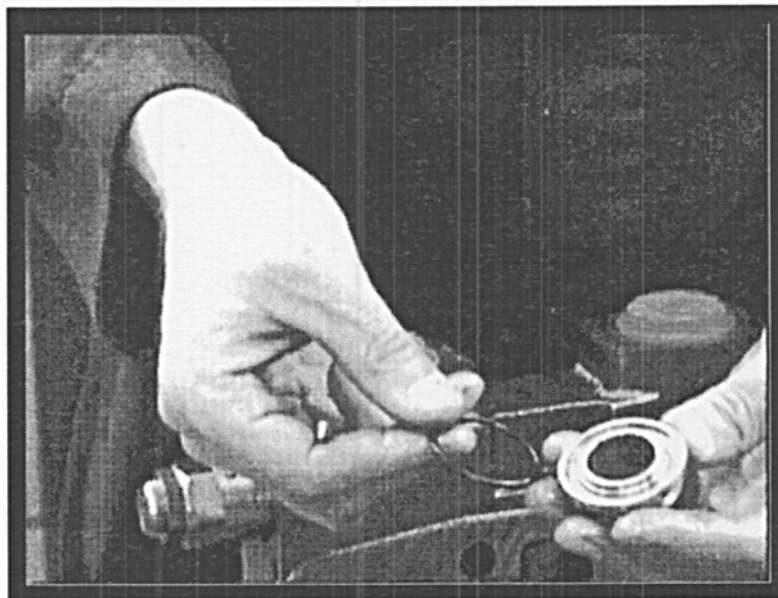


CAUTION: Care must be taken to ensure that the spring retainer is not pinched under the shoulder bolt during assembly. This can result in burrs that may cause spool binding.

Step 2 - Seal Retainers

Install the two, O-ring seals (Fig. 3, items 1 & 10) on both seal retainers (Fig. 3, item 2). Apply Parker Super-O-Lube™ to the O-ring seals.

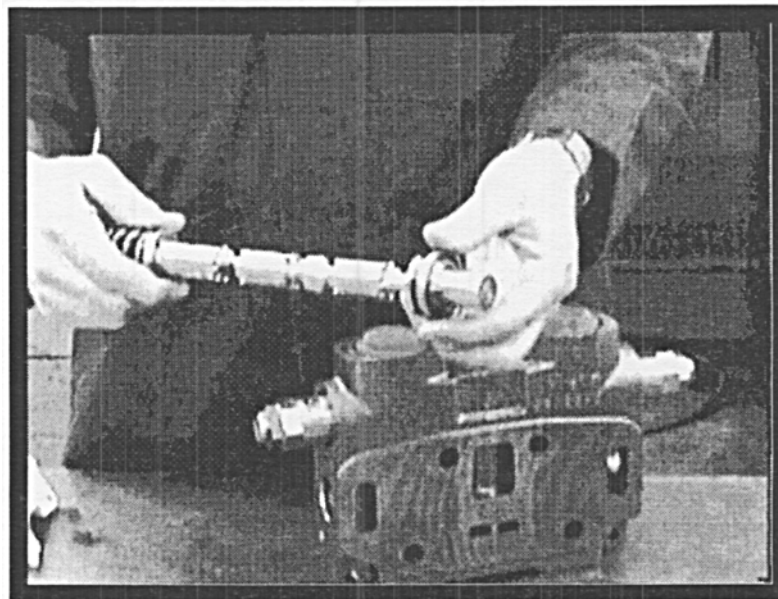
CAUTION: The O-ring seals are similar in size. Be sure to insert O-ring seals 1 & 10 in their proper position. They are not interchangeable!

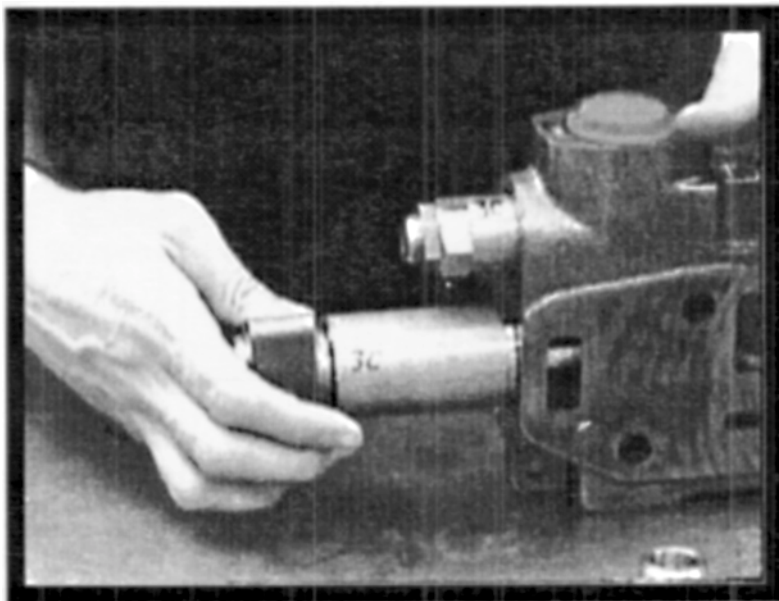


Step 3 - Spool Installation

Apply 2 - 3 drops of Loctite 262™ or equivalent to the cap screw holes on both ends of the housing.

Slide one seal retainer over the spool, resting against the spring retainer. Make sure the O-ring (Fig. 3, item 1) is facing the section casting. Apply a light coating of clean, hydraulic oil to the valve spool. Carefully insert the spool into the housing. Use caution to avoid causing burrs.





Step 4 - Assemble Endcaps

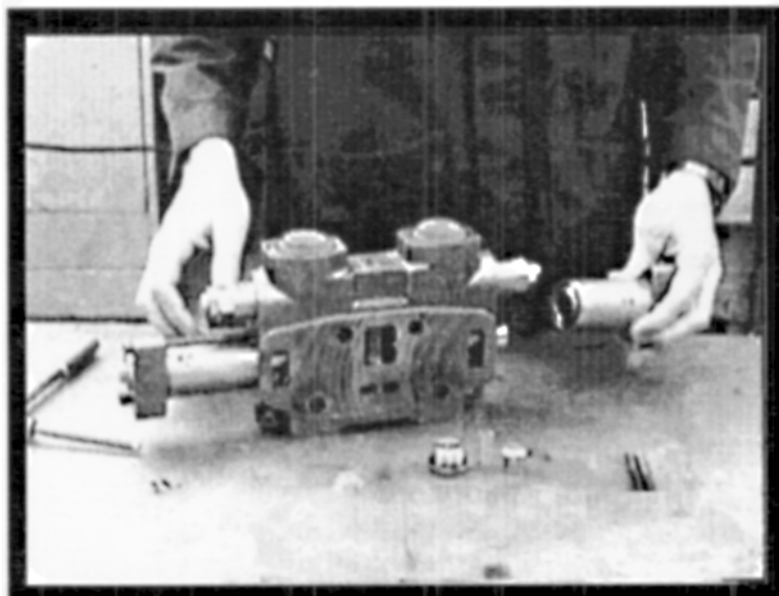
Apply a light coat of grease to the valve-cap O-rings (Fig. 3, item 10). Assemble the O-rings onto both of the cast-iron valve caps (Fig. 3, item 6). Slide the end tube (Fig. 3, item 9) over the spring end of the spool. Position the cast-iron valve cap, as shown, on the end tube and push into place. Be careful not to shear the valve-cap seal during installation.

Install two, cap screws (Fig. 3, item 8) tighten evenly and torque to the final specification.

VA20™/VG20™ to 100 in. lbs.

VA35™/VG35™ to 175 in. lbs.

VG80™ to 175 in. lbs.



Step 5 - Complete Endcap Assembly

Install seal retainer (Fig. 3, item 2) with seals on the clevis end of the spool. Install the end-cap tube (Fig. 3, item 9) the valve cap (Fig. 3, item 6) and the cap screws (Fig. 3, item 8) as previously explained.

Step 6 - Assemble Transition Check

Inspect the transition-check components for cleanliness. Install a new O-ring seal (Fig. 1, item 11) on the check-valve cap. Place the check poppet (Fig. 1, item 13) into the housing. Align the check spring (Fig. 1, item 12) square to the poppet, then carefully place the check cap (Fig. 1, item 10) over the check poppet. Turning by hand, engage several threads. Tighten to final torque of 75 ft. lbs. +/- 4 ft. lbs.

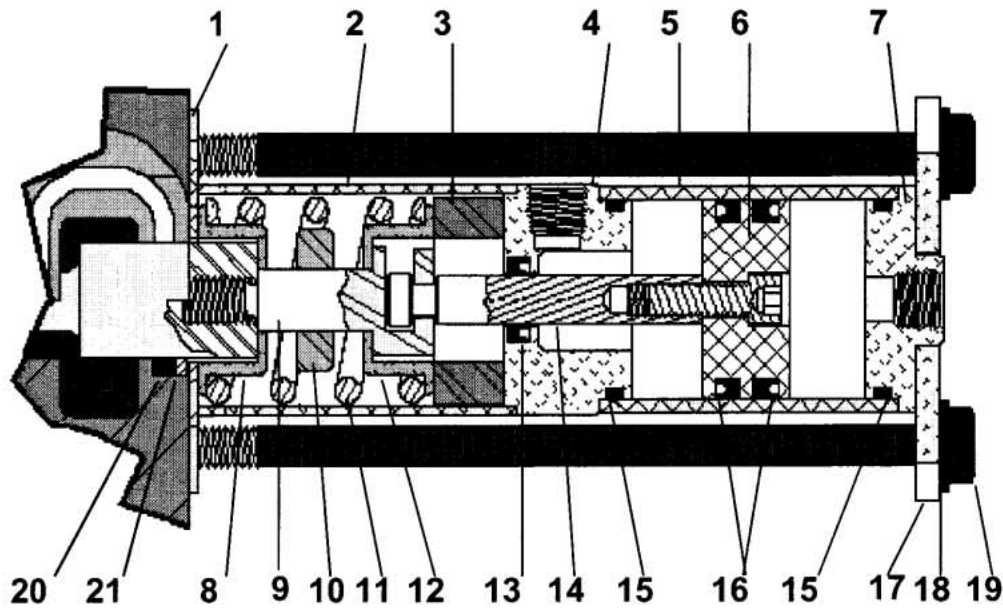
CAUTION: Failure to follow these recommended assembly instructions can result in poor performance or product malfunction. Product should be thoroughly tested to ensure proper operation before the valve is put back into service.

USE ONLY ORIGINAL VA/VG™ SERIES REPLACEMENT PARTS

PNEUMATIC CAP COMPONENTS VA/VG20 AND VA/VG35 - Figure 4

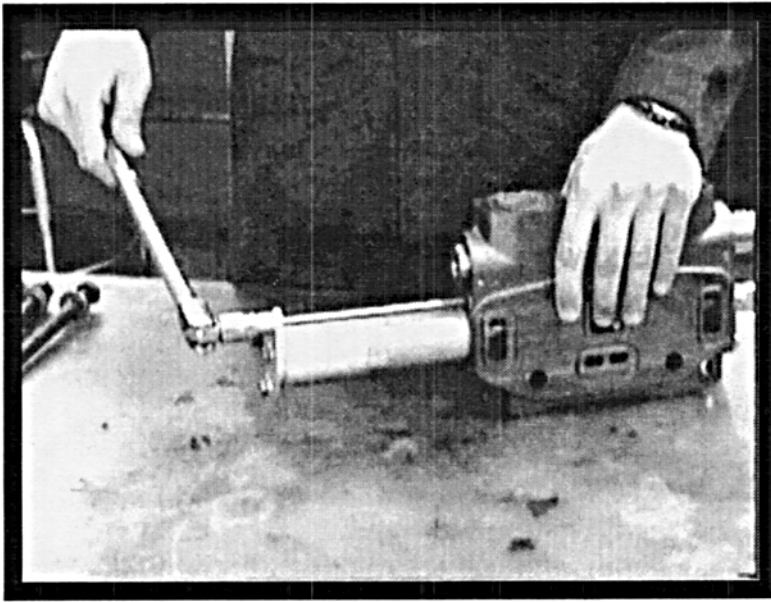
- | | | | |
|--------------------|---------------------|---------------------|-----------------------|
| 1. Retaining plate | 7. Seal retainer | 13. Wiper seal | 19. Cap screws (2) |
| 2. Spacer tube | 8. Spring retainer | 14. Piston rod | 20. Spool Seals (2) |
| 3. Spacer | 9. Stripper bolt | 15. O-rings (2) | 21. Back up rings (2) |
| 4. Flange | 10. Stop tube | 16. Wiper seals (2) | |
| 5. Pressure tube | 11. Spring | 17. Retainer plate | |
| 6. Piston | 12. Spring retainer | 18. Washers (2) | |

Single-Ended Pneumatic Cap Figure 4



SEAL PARTS LIST - Figure 4

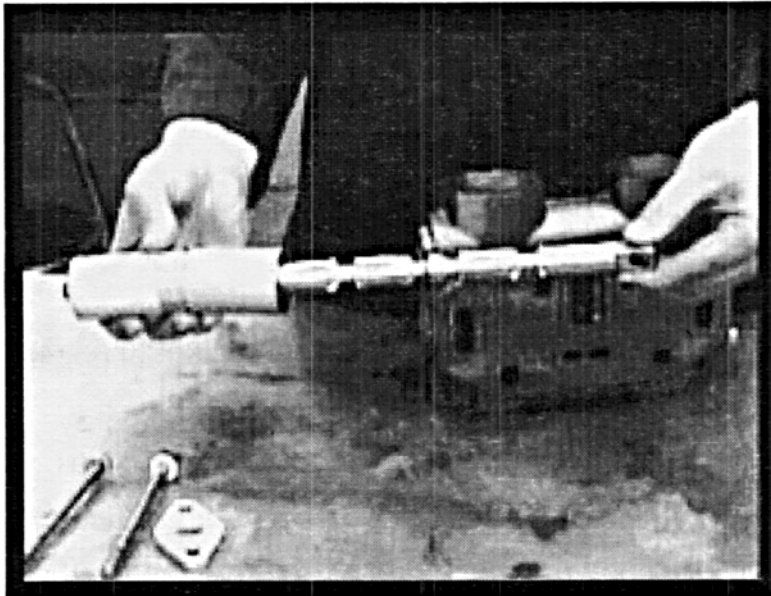
Item	Description	Qty.	VA/VG20™	VA/VG35™
13.	Wiper seal	1	391 2883 165	391 2883 165
15.	O-rings	2	391 2881 625	391 2881 625
16.	Wiper seals	2	391 2883 164	391 2883 164



Step 1 - Pneumatic Endcap

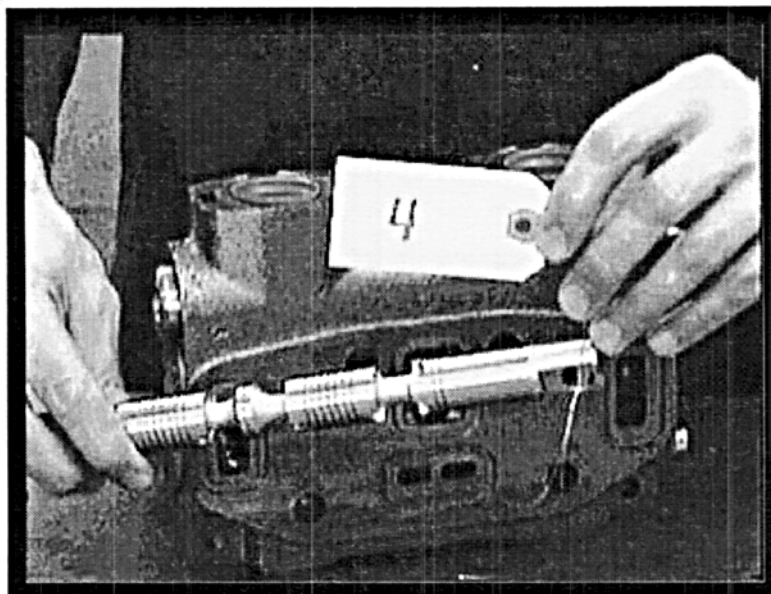
Remove the two, hex-head cap screws (Fig. 4, item 19) and retainer plate (Fig. 4, item 17). Since Loctite™ was used to hold fasteners, slide the Endcap and spool out of the valve body as one assembly.

Remove the two, retainer screws (not shown) from the clevis end of the spool, lightly tapping the end of the screwdriver handle with a hammer to break adhesive. Remove the two, retainer plates, back-up ring and spool seal. Discard the spool seals and back-up rings from both ends of the work section.



Step 2 - Spacer Tube

Next, slide the spacer tube (Fig. 4, item 2) off of the spool to expose the spring (Fig. 4, item 11) and spring retainers (Fig. 4, items 8 and 12). Disconnect the piston rod (Fig. 4, item 14) from the stripper bolt (Fig. 4, item 9). Slide the spacer (Fig. 4, item 3,) and flange (Fig. 4, item 4) off the piston rod. Remove the wiper seal (Fig. 4, item 13) and O-ring (Fig. 4, item 15) from the flange and discard.



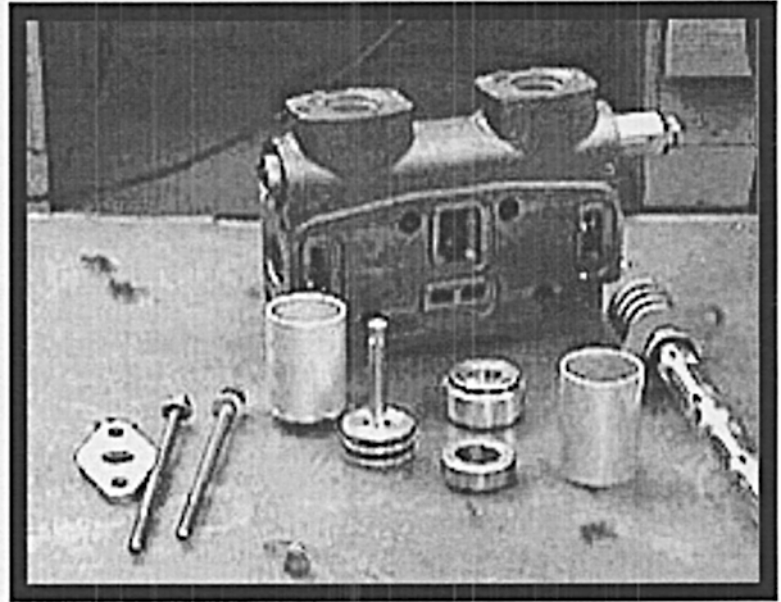
Step 3 - Spool Identification

The spool should now be tagged or marked with the respective, work-section identification number (see Step 1, page 6).

Pneumatic Section Disassembly

Step 4 - Pneumatic Endcap

Slide piston (Fig. 4, item 6) and piston rod assembly out of the pressure tube, exposing the two, wiper seals (Fig. 4, item 16). Remove the wiper seals and discard. Insert a screwdriver handle into the pressure tube and dislodge the seal retainer (Fig. 4, item 7). Remove the O-ring (Fig. 4, item 15) and discard.



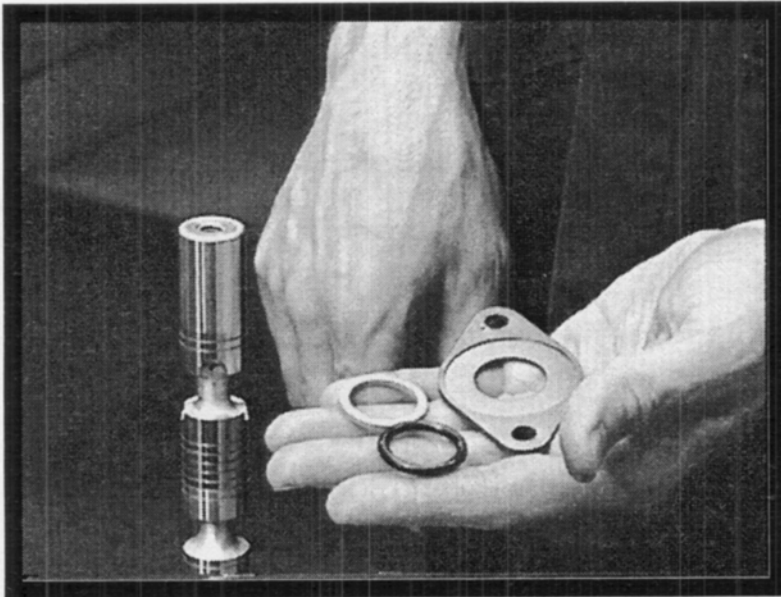
Step 5 - Stripper Bolt

The spring assembly should not be removed from the spool unless these parts are being replaced. Carefully place the spool clevis in a soft-jawed vise. Lightly tap the stripper bolt with a hammer and punch to break the adhesive. If it does not release, cautiously apply heat.

Caution: Too much heat may distort the spool.

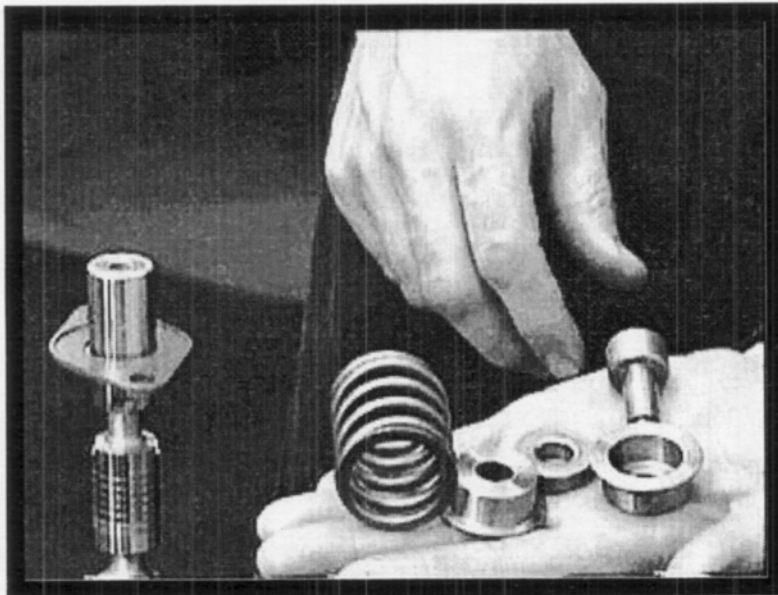
As the stripper-bolt threads disengage, the spring (Fig. 4, item 11) and spring retainers (Fig. 4, items 8 and 12) will release abruptly.





Step 1 - Spool Assembly

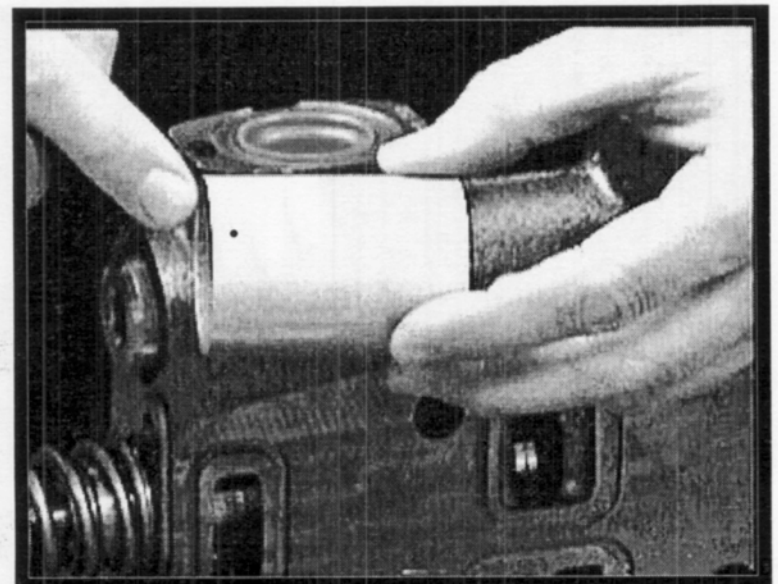
Clamp the flat, clevis end of the control spool in a soft-jawed vise. Apply Parker Super-O-Lube™ to the spool seal (Fig. 4, item 20) and slide it onto the end of the spool, away from the clevis. Slide on the back up ring (Fig. 4, item 21) and retainer plate (Fig. 4, item 6). Position these items onto the spool so that they do not interfere with the spool operator mechanism during assembly. Do not allow the O-ring to come in contact with the sharp edge of the spool notches.



Step 2 - Spring Assembly

Apply 2 - 3 drops of Loctite RC680™ or equivalent, anaerobic adhesive near the middle of the female threads in the spool. Place the spring retainer (Fig. 4, item 8) over the end of the spool followed by the centering spring (Fig 4, item 11). Place the stop tube (Fig. 4, item 10) in the spring and cap with the other spring retainer (Fig. 4, item 12). Insert the stripper bolt (Fig. 4, item 9) and torque to 180 in. lbs..

Apply a light coating of clean, hydraulic oil to the valve spool. Carefully insert the spool into the housing. Use caution to avoid causing burrs. Be careful not to pinch, roll or damage seals. Be certain the spool and the housing are in their original orientation.

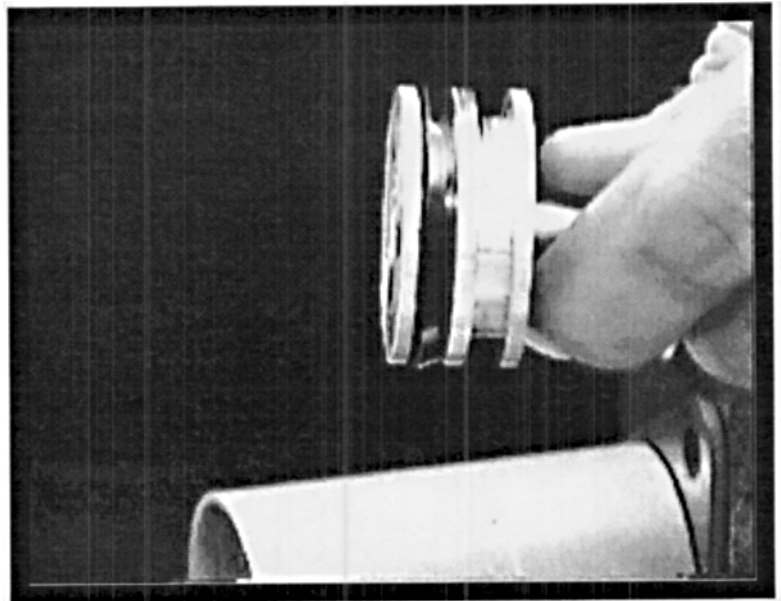


Step 3 - Spacer Tube

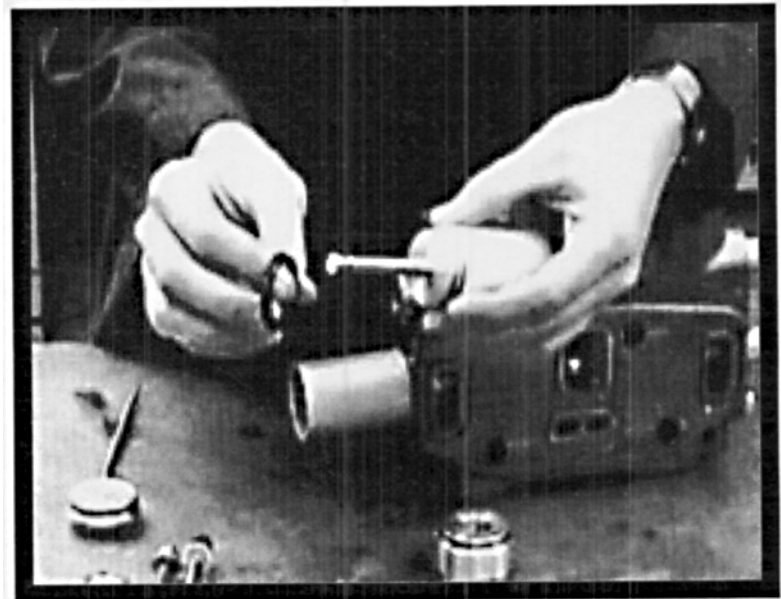
Install the spacer tube (Fig. 4, item 2) over the spring with the vent hole positioned away from the section casting.

Step 4 - Air Piston Assembly

Apply Parker Super-O-Lube™ to the wiper seals (Fig. 4, item 16) and install one seal in the groove farthest from the piston rod (Fig. 4, item 6). The wiper seal has a cup design that must be installed with the open cup facing the end of the piston. Slide the piston, rod-end first, into the pressure tube (Fig. 4, item 5).

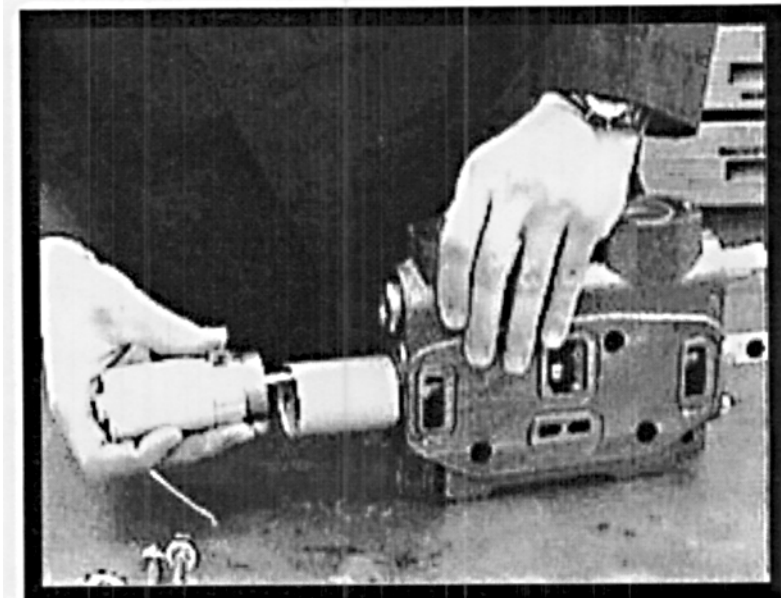


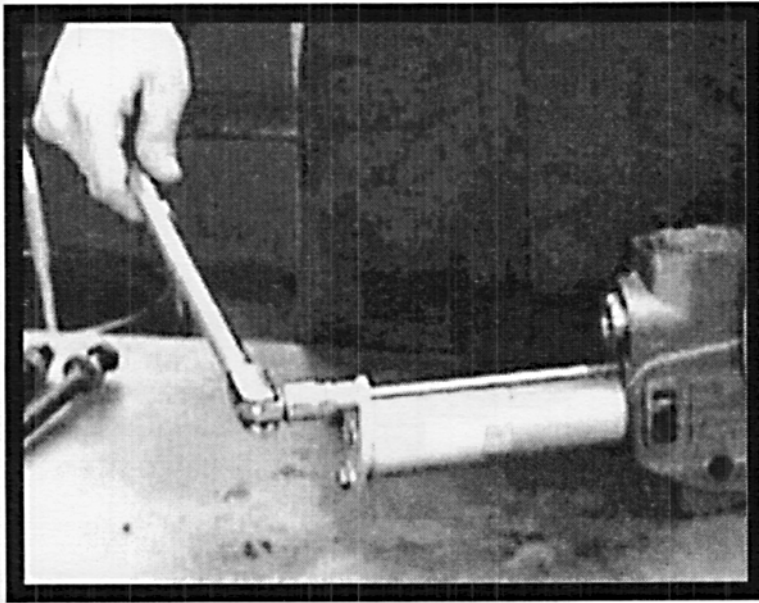
Push the piston through the pressure tube and expose the wiper seal groove closest to the rod. Install the second wiper seal with open cup facing the piston rod. Slide the piston into the pressure tube and leave the piston rod extended beyond the pressure tube.



Step 5 - Piston Subassembly

Apply Parker Super-O-Lube™ to the wiper seal (Fig. 4, item 13) and O-rings (Fig. 4, item 15). Facing the open cup inward, squeeze the wiper seal and insert it into the flange's seal groove (Fig. 4, item 4). Install one O-ring (Fig. 4, item 15) on the flange. Carefully slide the flange onto the piston rod. Pull the piston rod through the flange until the piston bottoms on the flange. Slide the spacer (Fig. 4, item 3) over the piston rod. Insert the end of the piston rod into the slot in the stripper bolt.





Step 6 - Endcap Assembly

Place the remaining O-ring (Fig. 4, item 15) on the seal retainer (Fig. 4, item 7). Install the retainer plate (Fig. 4, item 17) over the seal retainer (Fig. 4, item 7). Apply 2 to 3 drops of Loctite 262™ inside the tapped holes in the housing. Place the washers (Fig. 4, item 18) on the 6 1/4" cap screws (Fig. 4, item 19). Push the cap screws through the retainer plate and screw them into the valve housing. Make sure all parts are properly aligned and seated. Torque the cap screws to 25 - 30 in. lbs.

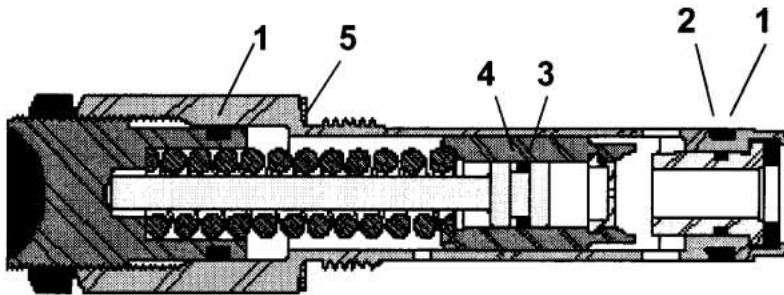
CAUTION: Failure to follow the recommended assembly instructions can result in poor performance or product malfunction. The product should be thoroughly tested to ensure proper operation before the valve is placed back into service.

Cutaways for Main Relief Valves

Main System Relief Valve

The main, relief valve protects the hydraulic system against overload pressures. It is typically located in the inlet casting and the mid-inlet sections used in the valve bank. Figure 6 illustrates the arrangement of the parts and serviceable seals for the differential-area main relief valve. Figure 7 illustrates the serviceable components found in the pilot-operated main relief. These cartridge-type relief valves are removed from the valve bank as a subassembly and replaced or serviced.

Figure 6



SERVICE PARTS LIST - Figure 6

Item	Description	Qty	VA/VG20™	VA/VG35™
1.	O-rings	2	391-2881-332	391-2881-336
2.	Back up Ring	1	391-2681-373	.....
3.	O-ring	1	391-2881-156	391-2881-137
4.	Back up Ring	1	391-2681-163	391-2681-165
5.	Gasket Washer	1	391-1583-013	391-1583-012

*All seals in the relief cartridge are not serviceable.

VA20/VG20™, VA35/VG35™

Main Differential Area Relief Valve Part Numbers:

355-9107-035

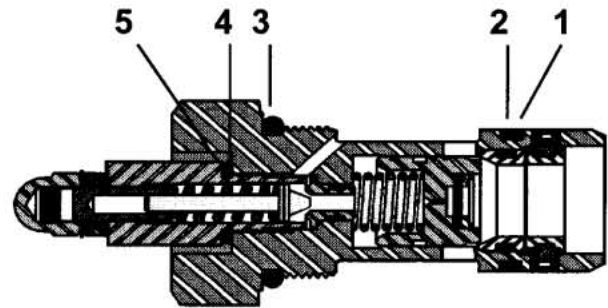
355-9107-061

355-9107-013

355-9001-082

355-9107-385

Figure 7



SERVICE PARTS LIST - Figure 7

Item	Description	Qty	VG80™
1.	O-ring	1	391-2881-342
2.	Back up Ring	1	391-2681-303
3.	O-ring	1	391-2881-344
4.	O-ring	1	391-2881-208
5.	Gasket Washer	1	391-1581-001

*All seals in the relief cartridge are not serviceable.

VG80™ Main Pilot Operated Relief Valve Part Numbers:

355-9001-008

355-9001-031

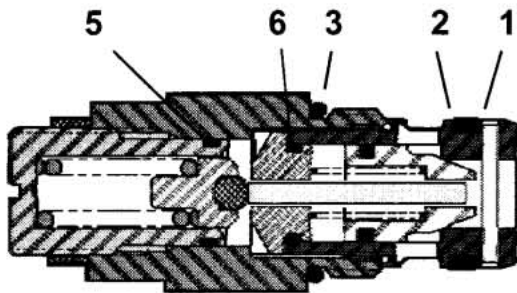
NOTE: When installing relief valve, torque to 75 ft. lbs.

Work Port Relief Valve Options

The full-flow work port relief valve normally functions when the valve spool is in the neutral position. During over pressurization, fluid is discharged from the work-port passage into the tank-return passage of the valve work section. The pressure setting is normally higher than that of the main, relief valve.

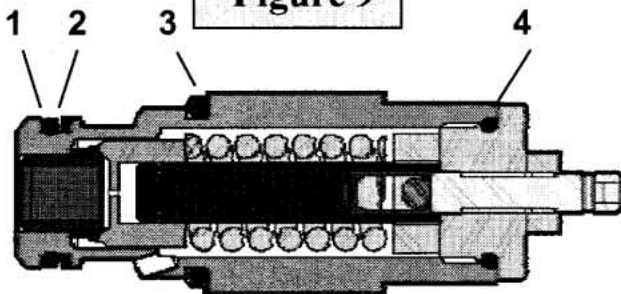
Avoid setting the main and port relief valves at the same pressure setting. If these relief-valve settings are set too close, interaction will occur causing chatter and possible instability of the load.

Figure 8



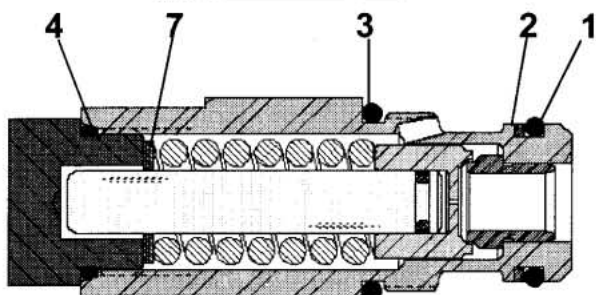
Pilot operated with anti-cavitation
355-9001-115

Figure 9



Differential area - screw adjusted
355-900X-308

Figure 10



Differential area - shim adjusted
355-900X-143

SERVICE PARTS LIST FOR FIG. 8-10

Item	Description	Qty.	Part No.
1.	O-ring	1	391-2881-333
2.	Back up Ring	1	391-2681-510
3.	O-ring	1	391-2881-204
4.	O-ring	1	391-2881-246
5.	O-ring	1	391-2881-801
6.	O-ring	1	391-2881-363
7.	Shims	...	see chart above

* All seals in the relief cartridge are not serviceable

NOTE: When installing relief valve, torque to 75 ft. lbs.

The pilot-operated, port relief (Fig. 8) with the anti-cavitation check can be used in all hi-boy work sections in the VA20/VG20™, VA/VG35™ and VG80™ series. The differential-area, work-port, relief valve (Fig. 9) can be used in VA20/VG20™, VA/VG35™ hi-boy sections if the section has the appropriate machining.

SHIMS FOR FIG. 10

Part No.	Pressure
391-3782-103	502 psi
391-3782-104	122 psi
391-3782-105	40 psi

Screw-Adjustable, Relief-Valve Pressure Ranges and Adjustments

<u>R/V #</u>	<u>Valve Series</u>	<u>Pressure Range - PSI</u>	<u>1/4 turns Part Equals PSI *</u>
355-9107-035	VA/VG20	800 - 2500	165
355-9001-061	VA/VG20	2501 - 3800	160
355-9107-013	VA/VG35	800 - 2000	80
355-9107-082	VA/VG35	2001 - 2500	121
355-9107-385	VA/VG35	2501 - 3500	249
355-9001-008	VG80	1000 - 2500	196
355-9001-031	VG80	2500 - 3500	290
355-9001-115	VA/VG20, 35, 80	500 - 5000	446
355-9001-308	VA/VG20, 35, 80	500 - 1250	95
355-9002-308	VA/VG20, 35, 80	1251 - 2650	138
355-9003-308	VA/VG20, 35, 80	2651 - 4200	188

*Adjustment pressures are approximate.

Guidelines for Setting Hydraulic, Relief-Valve Pressure :

- Release hydraulic pressure before connecting or disconnecting any gauge.
- Install an accurate pressure gauge as close to the pump as possible.
- Back-out the relief-valve adjustment screw without removing it.
- Warm the hydraulic oil by idling the engine with the power take-off and hydraulic pump engaged.
- As applicable, fully engage the control valve for the circuit being tested. Allow the cylinder to reach full extension.
- Raise the engine RPM to operating speed.
- If adjustment is necessary, do not bring the pressure to a higher setting then lower it to the desired setting. Obtain each final pressure by bringing the pressure gradually up to the proper setting.
- Tighten the lock nut and apply a sealant to avoid tampering.



Warning

Relief-valve pressures should be set according to the original, equipment manufacturer's specifications. Exceeding the specifications could cause a failure in the hydraulic system or with the mechanical structure of the equipment. These failures could cause serious personal injury or death.

DVA20 - DVG20 - VA20 - VG20 - VALVE SEAL KITS

NOTE: PART NUMBERS IN BOLD ARE DISTRIBUTOR PROGRAM ITEMS

PART NUMBER	KIT DESCRIPTION	APPLICATION / WHERE USED
391 1873 035 391 1803 055	SECTION SEAL KIT (BETWEEN SECTIONS)	INLET SECTIONS PARALLEL AND TANDEM WORKSECTIONS MIDSECTION INLET
391 1873 083	SECTION SEAL KIT (BETWEEN SECTIONS)	SERIES WORKSECTIONS
391 1873 036 391 1803 457	WORK SECTION REPAIR KIT (ALL SEALS)	MANUAL, PARALLEL, AND TANDEM WORKSECTIONS
391 1803 846	SPOOL SEAL KIT	STANDARD MANUAL WORKSECTIONS
391 1873 039 391 1803 469	MAIN-RELIEF SEAL KIT (ALL SERVICEABLE SEALS)	391 1873 001, 391 1873 128 355 9107 035, 355 9001 061
391 1803 674	MAIN-RELIEF, PLUG SEAL KIT CONVERTIBLE-OUTLET, PLUG SEAL KIT	391 1873 002
391 1873 042 391 1803 737	SCREW ADJUSTED, PILOT-OPERATED, PORT RELIEF VALVE WITH ANTI-CAVITATION SEAL KIT (ALL SERVICEABLE SEALS)	391 1873 006, 355 9001 115
391 1823 038	PORT-ACCESSORY SEAL KIT (EXTERNAL SEALS ONLY)	391 1873 006 , 355 9001 115 391 1873 007, 008, 009 355 900X 143 391 1873 010 , 355 9001 164 391 1873 011 , 391 2283 075
391 1873 037 391 1823 122	SLUG-ADJUSTED, RELIEF VALVE KIT (ALL SERVICEABLE SEALS)	391 1873 007, 008, 009 355 900X 143
391 1873 207 391 1803 387	PNEUMATIC, ENDCAP SEAL KIT (NEW COMMERCIAL INTERTECH DESIGN)	391 1873 206 , 391 1803 553
391 1803 694	PNEUMATIC, ENDCAP SEAL KIT (OLD RMH DESIGN)	391 1873 022 , 391 1803 606 391 1803 767

DVA35 - DVG35 - VA35 - VG35 - VALVE SEAL KITS**NOTE: PART NUMBERS IN BOLD ARE DISTRIBUTOR PROGRAM ITEMS**

PART NUMBER	KIT DESCRIPTION	APPLICATION / WHERE USED
391 1873 040 391 1803 093	SECTION SEAL KIT (BETWEEN SECTIONS)	INLET SECTIONS PARALLEL AND TANDEM WORK SECTIONS COMBINED-FLOW, MIDSECTION INLETS MIDSECTION SELECTORS
391 1803 150	SECTION SEAL KIT (BETWEEN SECTIONS)	SERIES WORK SECTIONS SPLIT-FLOW, MIDSECTION INLETS
391 1873 041 391 1803 722	WORK SECTION REPAIR KIT (ALL SEALS)	MANUAL, PARALLEL, AND TANDEM WORK SECTIONS
391 1823 121	WORK SECTION REPAIR KIT (ALL SEALS)	MANUAL, SERIES WORK SECTIONS
391 1823 146	WORK SECTION REPAIR KIT (ALL SEALS) AND TANDEM WORKSECTIONS	REMOTE, PARALLEL,
391 1873 044 391 1803 272	MAIN RELIEF-VALVE SEAL KIT (ALL SERVICEABLE SEALS)	391 1873 003 , 355 9107 013 391 1873 004 , 355 9107 085 391 1873 137 , 355 9107 385
391 1803 682	MAIN RELIEF-VALVE PLUG SEAL KIT CONVERTIBLE-OUTLET, PLUG SEAL KIT	391 1873 005
391 1873 042 391 1803 737	SCREW ADJUSTED, PILOT-OPERATED, PORT RELIEF VALVE WITH ANTI-CAVITATION SEAL KIT (ALL SERVICEABLE SEALS)	391 1873 006 , 355 9001 115
391 1823 038	PORT-ACCESSORY SEAL KIT (EXTERNAL SEALS ONLY)	391 1873 006 , 355 9001 115 391 1873 007, 008, 009 355 900X 143 391 1873 010 , 355 9001 164 391 1873 011 , 391 2283 075
391 1873 037 391 1823 122	SLUG-ADJUSTED, RELIEF VALVE KIT (ALL SERVICEABLE SEALS)	391 1873 007, 008, 009 355 900X 143
391 1873 207 391 1803 387	PNEUMATIC ENDCAP SEAL KIT (NEW COMMERCIAL INTERTECH DESIGN)	391 1873 203 , 391 1803 554
391 1803 695	PNEUMATIC ENDCAP SEAL KIT (OLD RMH DESIGN)	391 1873 203 , 391 1803 591
391 1823 121	WORK SECTION REPAIR KIT (ALL SEALS)	SERIES WORK SECTIONS

DVG80 - VG80 VALVE SEAL KITS

NOTE: PART NUMBERS IN BOLD ARE DISTRIBUTOR PROGRAM ITEMS

PART NUMBER	KIT DESCRIPTION	APPLICATION / WHERE USED
391 1873 160 391 1803 484	SECTION SEAL KIT (BETWEEN SECTIONS)	INLET SECTIONS ALL WORK SECTIONS
391 1873 161 391 1803 594	WORK SECTION REPAIR KIT (ALL SEALS)	MANUAL WORK SECTIONS
391 1823 101	MAIN, RELIEF-VALVE SEAL KIT (ALL SERVICEABLE SEALS)	355 9001 008, 031
391 1803 041	MAIN, RELIEF-VALVE SEAL KIT (EXTERNAL SEALS)	355 9001 008, 031
391 1803 054	MAIN, RELIEF-VALVE AND PLUG SEAL KIT (EXTERNAL SEALS)	391 1873 146, 391 1873 147 355 9001 103
391 1803 770	MAIN, RELIEF-VALVE SEAL KIT (ALL SERVICEABLE SEALS)	391 1873 146 , 355 9001 103
391 1873 042 391 1803 737	SCREW-ADJUSTED, PILOT-OPERATED, PORT RELIEF VALVE WITH ANTI-CAVITATION SEAL KIT (ALL SERVICEABLE SEALS)	391 1873 006 , 355 9001 115
391 1823 038	PORT ACCESSORY SEAL KIT (EXTERNAL SEALS ONLY)	391 1873 006 , 355 9001 115 391 1873 011 , 391 2283 075 391 1873 010 , 355 9001 164
391 1823 175	WORK SECTION REPAIR KIT (ALL SEALS)	HYDRAULIC-REMOTE OPERATED

Troubleshooting

TROUBLE

PROBABLE CAUSE

REMEDY

TROUBLE	PROBABLE CAUSE	REMEDY
Oil leaks between sections	Pinched, blown or missing section seal	Replace section seal
	Stud fasteners not correctly torqued	Replace section seals and re-torque
	Mounting plate not level	Loosen mounting bolts and shim as required
	Contamination/burrs on seal	Clean seal groove, replace section seal
Oil leaks at either end of spool	Over-pressurized tank core	Correct high, back-pressure condition
	Worn or damaged spool seals	Replace seals and seal retainers
Spring - centered spools do not return to neutral	Broken centering spring	Replace centering spring
	Misalignment of operating linkage	Check linkage for mechanical binding
	Foreign particles in system	Clean valve and system
Load will not hold	Cylinder leaking or worn	Check cylinder - repair
	Port relief valve not holding	Remove and clean or replace
	Spool or housing scored or worn excessively	Replace section
Load drops when spool moved from neutral	Dirt or foreign particles lodged between check-valve poppet and seat	Disassemble, clean & reassemble
	Scored or sticking check-valve poppet	Replace poppet
No motion, slow, or erratic system operation	Worn pump	Check flow & pressure
	Defective cylinder or motor	Repair or replace
	Low-reservoir oil level	Add oil to specifications
	Clogged suction strainer	Clean or replace
	Suction line restricted	Check lines
	Relief valve not properly set	Check pressure setting
	Relief valve poppet or seat scored & sticking open	Replace relief valve
	Valve spool not shifted to full stroke	Check spool linkage travel

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2. Payment: Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

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7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges

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9. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. Patents, U.S. Trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights. If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

11. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

12. Entire Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

9/91-P

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X-Series

Directional Control Valve DX-6

Formerly the RSM290 Series



Key valve features

DX-6 is a sectional valve designed for max. operating pressures up to 5000 psi (350 bar) and max. pump flows up to 180 l/min with "Q-inlet". For standard inlets without flow regulator the recommended max. pump flows is 37 gpm (140 Lpm). The valve is available with 1 to 10 working sections per valve assembly.

DX-6 includes as standard a variety of sections, spools, spool controls and additional parts in a modular design. That makes the valve very flexible.

The valve is, as standard, setup for both manual and remote control. The manual controlled sections can either be with open spool ends or encapsulated. The encapsulation decreases in a significant way the risk for external leakage and makes the valve well adapted for applications in demanding environment. The spool controls for remote control are generally designed as complete modules for assembling on one of the valve sides.

DX-6 is in first place designed as an open center valve for fixed displacement pumps but can also be configured for variable displacement pumps. It is available with manual, hydraulic or electro hydraulic proportional remote control.

DX-6 can be fully adapted for marine applications. The valve offers excellent operating characteristics, and good controllability on a wide range of machinery due to the specially designed spools. Low and uniform spool forces are the result of careful balancing of the flow forces.

Q-inlet

The Q-inlet is designed with a flow control (Q-function) that by-passes the major part of the pump flow to tank when the system is idling, still giving access to full pump flow when the working sections are operated. Besides greatly reducing heat generation this also provides improved operating characteristics.

Applications

The DX-6 is ideal for applications where you need excellent control characteristics such as cranes, sky-lifts, garbage

Technical data

Pressures / Flows

Max. operating pressure set per port:

P1, P2, PM:	5000 psi	350 bar
A, B:	5800 psi	400 bar
T1, T2, T3:	300 psi	20 bar
Pp:	450 psi	30 bar
Tp:	75 psi	5 bar
X, Y:	360 psi	25 bar

Typical Nominal Inlet Flow:

Inlet without flow control function	37 gpm	140 Lpm
Inlet with flow control function	48 gpm	180 Lpm
Fluid temperature range	5°F up to +176°F	-15°C up to +80°C

Further data

Spool stroke nominal:	±0.27 in	±7 mm
Spool control force spool control 9M1:		
Neutral position:	20 b.	90 N
Max. spool stroke:	24 b.	105 N

Permissible contamination level:

Spool control M: Equal or better than 20/18/14 as per ISO 4406

Spool control H, EH: Equal or better than 20/17/13 as per ISO 4406

Viscosity range: 10 – 400 mm²/s (cSt); Higher viscosity allowed at start up.

Leakage at 1450 psi, 32 cSt, 100° F ≤ 12 cc/min (100 bar, 32 cSt and 40°C)

Pressure fluid: Mineral oil and synthetic oil based on mineral oil HL, HLP according to DIN 51524.

Higher values are possible, depending on application. For applications with demands that exceed stated data above, please contact us for consideration.

MTTFd value after consultation with HYDAC.

trucks, demountable bodies, excavators, telescopic load handlers, skid-loaders, wheel loaders etc.

Remote control

As remote controlled the valve offers compact design with internal pilot oil supply, solenoids in a compact assembly on one side of the valve and integrated hand levers for manual override/manual operation. The integrated pilot supply system for the electro hydraulic remote control makes the valve easy to install and gives a reliable remote control function. It is also possible to

supply the pilot system externally.

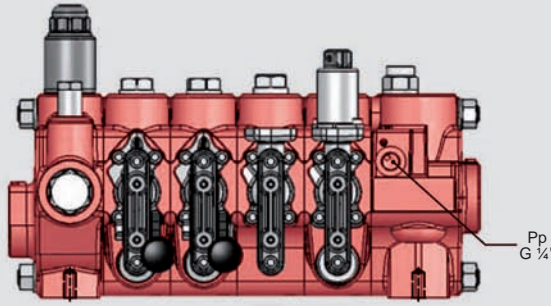
The hydraulic remote control can also be configured both for internal and external pilot supply.

Accessories

- A wide choice of spools and spool controls for different flow combinations and for several applications and systems
- A full range of service port valves
- Possibility of high pressure carry-over
- Inlet with electrical unloading valve
- Manual versions easily convertible to remote control

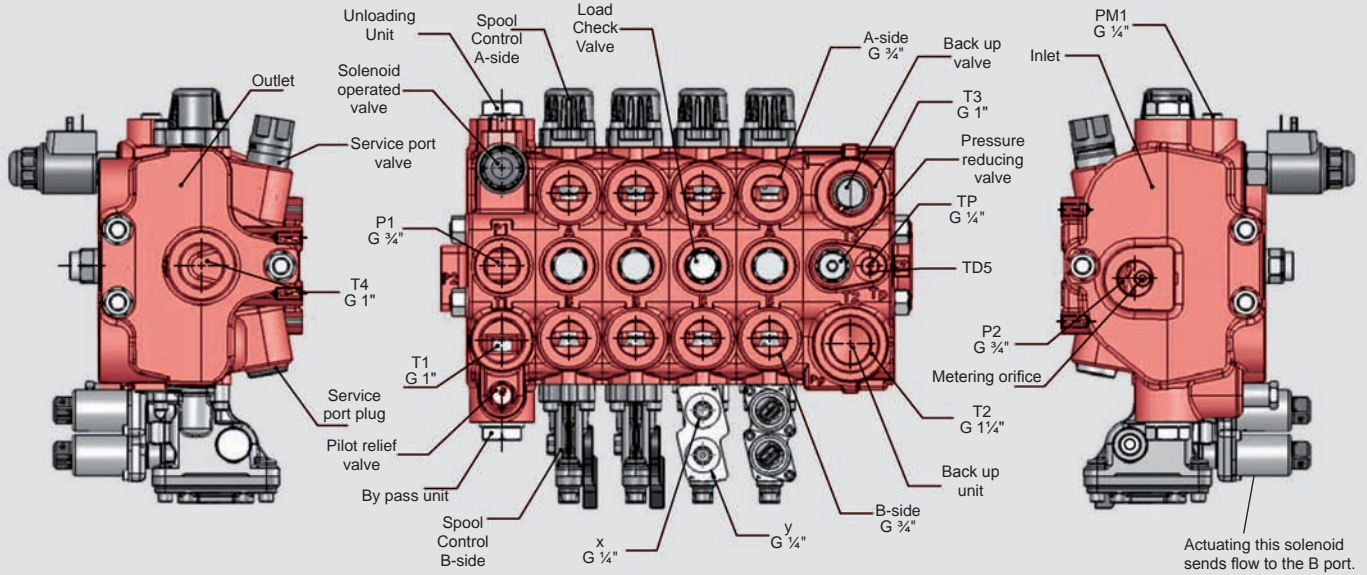
General overview

The drawing shows a 4-sectional valve with inlet and outlet. The sections are with various types of spool controls. SAE ports are shown in the table.

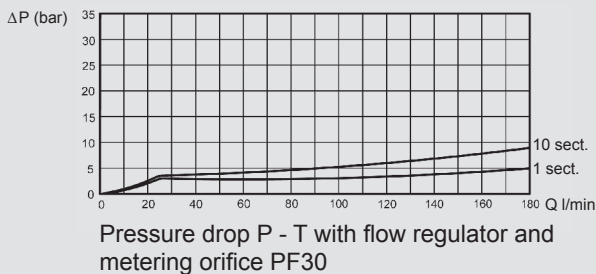
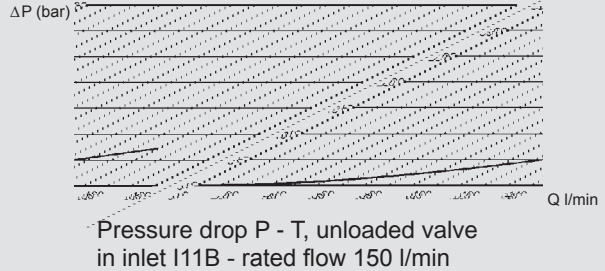
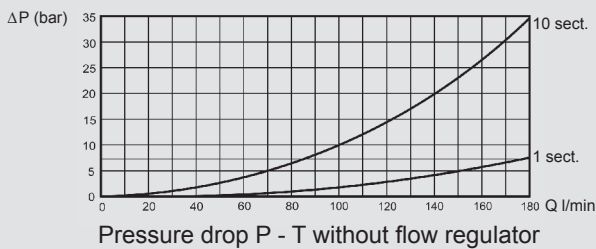
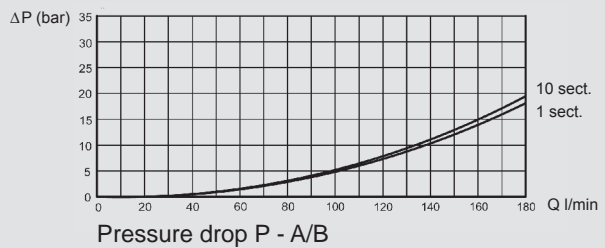
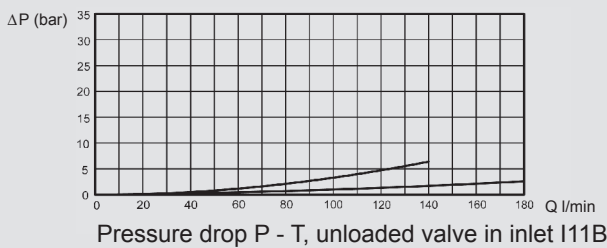
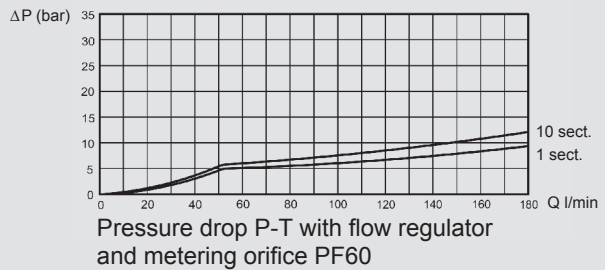
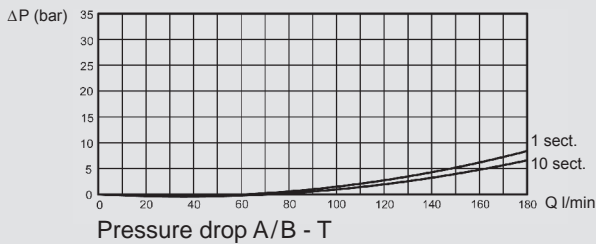


Port Sizes for US Models

P1	SAE12	P2	SAE12
T1	SAE16	T2	SAE20
T3	SAE16	T4	SAE16
A&B	SAE12		
X	SAE04	Y	SAE04
Pp	SAE06	Tp	SAE06
PM1	SAE04		



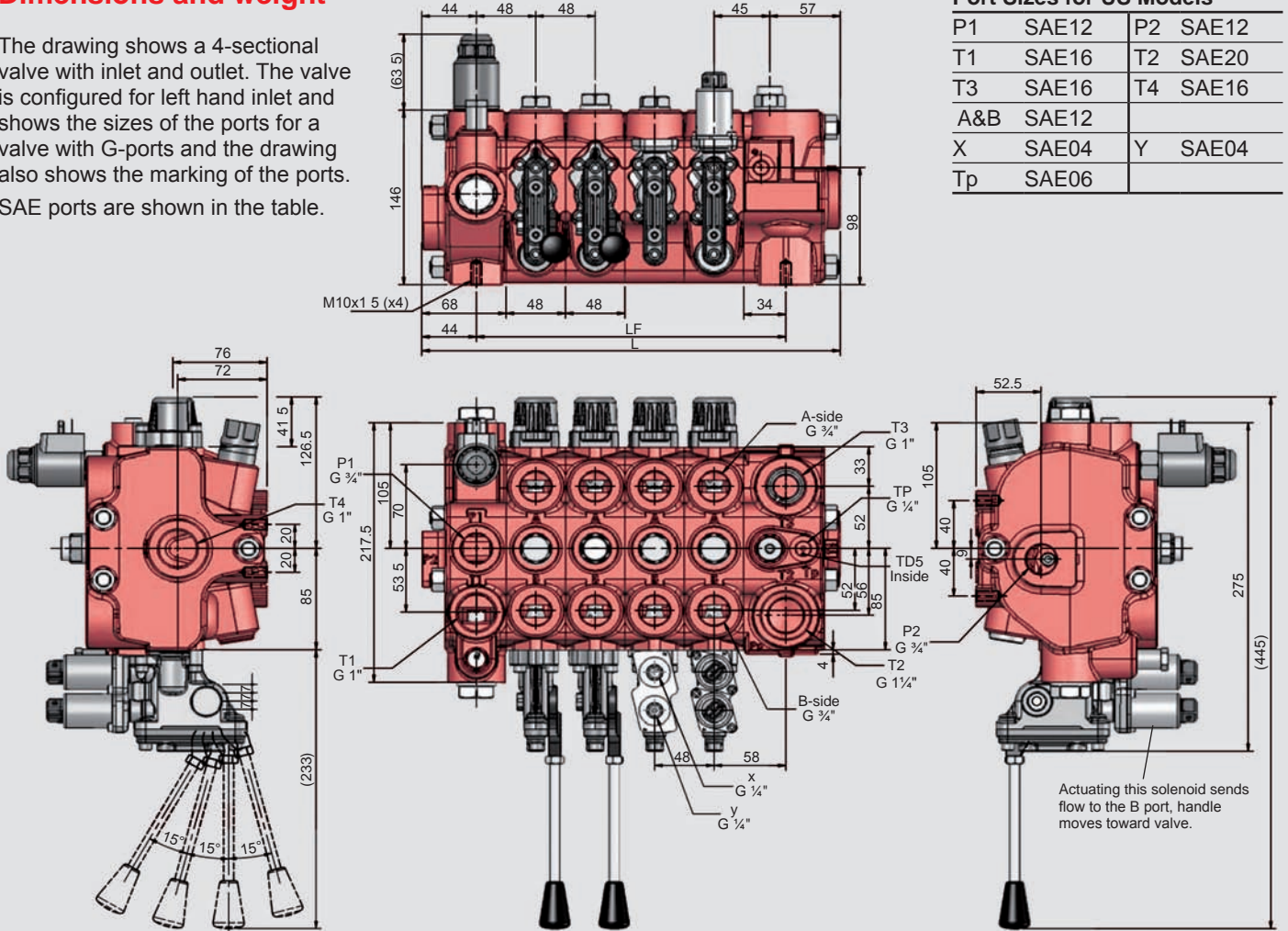
Pressure drop Oil temperature/viscosity for all graphs: +40°C / 32 cSt



Note: The pressure drop curves are valid for sections equipped with spools that are fully open at maximum spool travel.

Dimensions and weight

The drawing shows a 4-sectional valve with inlet and outlet. The valve is configured for left hand inlet and shows the sizes of the ports for a valve with G-ports and the drawing also shows the marking of the ports. SAE ports are shown in the table.



Port Sizes for US Models

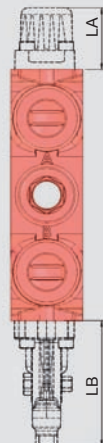
P1	SAE12	P2	SAE12
T1	SAE16	T2	SAE20
T3	SAE16	T4	SAE16
A&B	SAE12		
X	SAE04	Y	SAE04
TP	SAE06		

Weight

Inlet section I13B	14.3 lbs	6.5 kg
Inlet section I123B	12.1 lbs	5.5 kg
Working section	12.1 lbs	5.5 kg
Outlet section	15.4 lbs	7.0 kg
Outlet & working section US	14.3 lbs	6.5 kg
Mid outlet section	15.4 lbs	7.0 kg

No. of working sections	L(in)	L(mm)	LF(in)	LF(mm)
1	7.6	194	4.2	106
2	9.5	242	6.1	154
3	11.4	290	8.0	202
4	13.3	338	9.8	250
5	15.2	386	11.7	298
6	17.1	434	13.6	346
7	19.0	482	15.5	394
8	20.9	530	17.4	442
9	22.8	578	19.3	490
10	24.6	626	21.2	538

Measurements spool controls



Type	LA (in)	LA (mm)	Type	LB (in)	LB (mm)
9M1	1.7	42	M1	3.3	85
9MO1	1.7	42	MO3	2.1	53
9R1	1.7	42	MO3F	2.1	53
11M1	2.9	74	H1	3.3	85
11MO1	2.9	74	H1F	3.3	85
11R1	3.7	95	EHM112	3.3	85
SM11	3.5	90	EHM124	3.3	85
SM21	4.3	109	EHM112F	3.3	85
SMO11	3.5	90	EHM124F	3.3	85
SMO21	4.3	109			
SR11	3.5	90			
SR21	4.3	109			

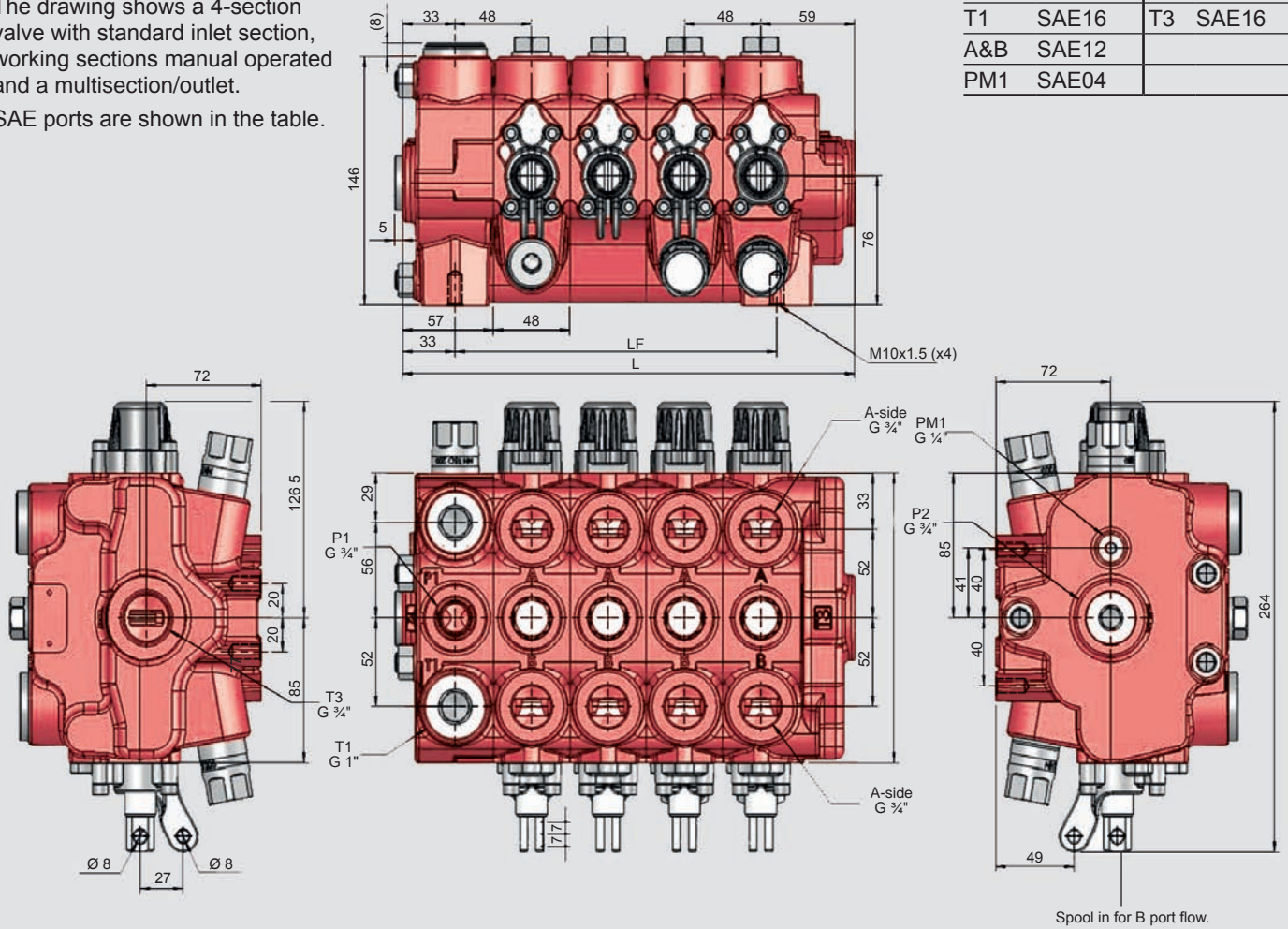
Dimensions and weight

The drawing shows a 4-section valve with standard inlet section, working sections manual operated and a multisection/outlet.

SAE ports are shown in the table.

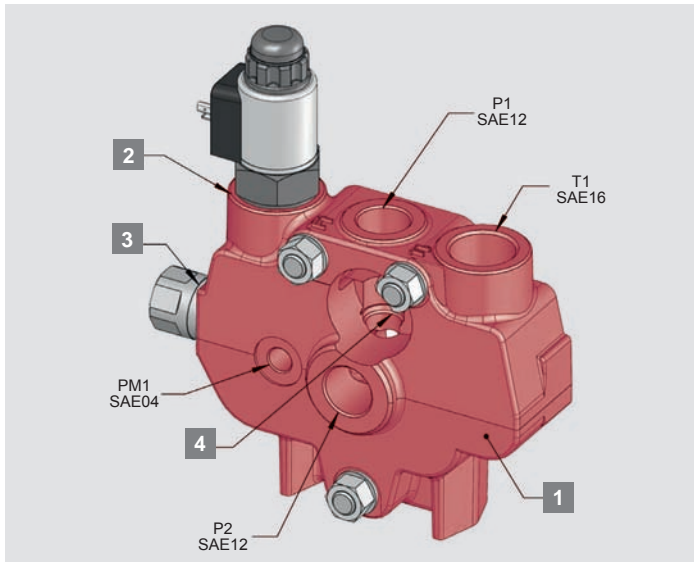
Port Sizes for US Models

P1	SAE12	P2	SAE12
T1	SAE16	T3	SAE16
A&B	SAE12		
PM1	SAE04		



No. of working sections	L (in)	L (mm)	LF (in)	LF (mm)
1	5.5	140	2.3	58
2	7.4	188	4.2	106
3	9.3	236	6.1	154
4	11.2	284	8.0	202
5	13.1	332	9.8	250
6	15.0	380	11.7	298
7	16.9	428	13.6	346
8	18.7	476	15.5	394
9	20.6	524	17.4	442
10	22.5	572	19.3	490

Inlet Section I23B



The standard inlet section I23B has two pump connections P1 and P2, a gauge port PM1 to monitor system pressure and a tank connection T1. Direct acting main relief valve (TBD201), and an unloading function via 2/2 solenoid valve (EU) for emergency dump of pump flow. The cavity (4) can be used to separate the parallel gallery from the center gallery to accomplish systems with parallel connection downstream of another valve or to control a variable pump.

Main relief function

TBD201 is adjustable and sealable for setting range 580 - 4,500 psi (40 - 300 bar) with setting step 100 psi (7 bar).

Unloading valve EU12 and EU24

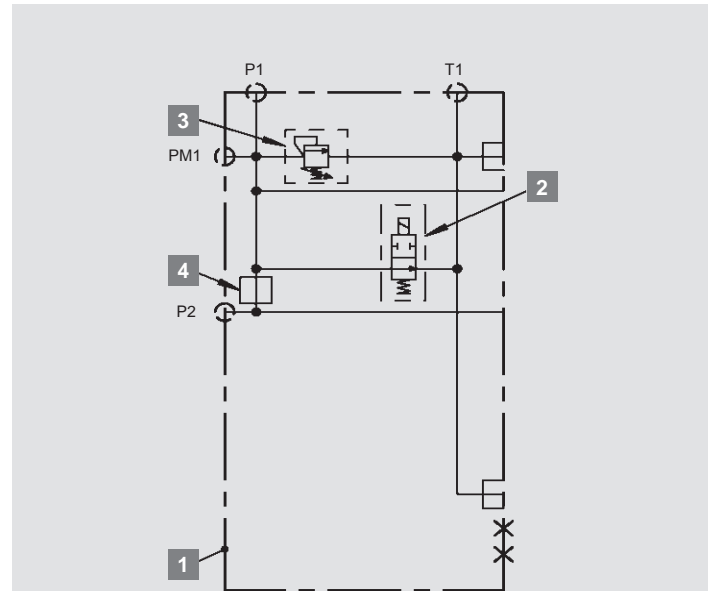
EU12 and EU24 are 2-way, normally open, solenoid type cartridge valves. It is an option in all inlet sections.

It is intended for emergency stop and for pressure drop/heat generation reduction.

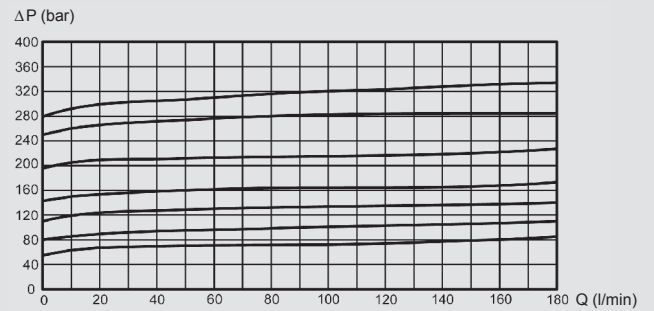
Rated flow:	40 gpm, 4,000 psi (150 Lpm, 280 bar)
Rated flow:	27 gpm, 5,000 psi (100 Lpm, 350 bar)
Power consumption:	18 W
Rated voltage EU12:	12 V
Rated voltage EU24:	24 V
Max voltage variation:	+/-15%
Duty factor*:	100%
Connection:	EN 175301-803 form A
Protection class:	IP65

* Sufficient cooling must be secured.

The unloading valve has manual override, with twist pin operation. PE21 is the plug for the cavity.

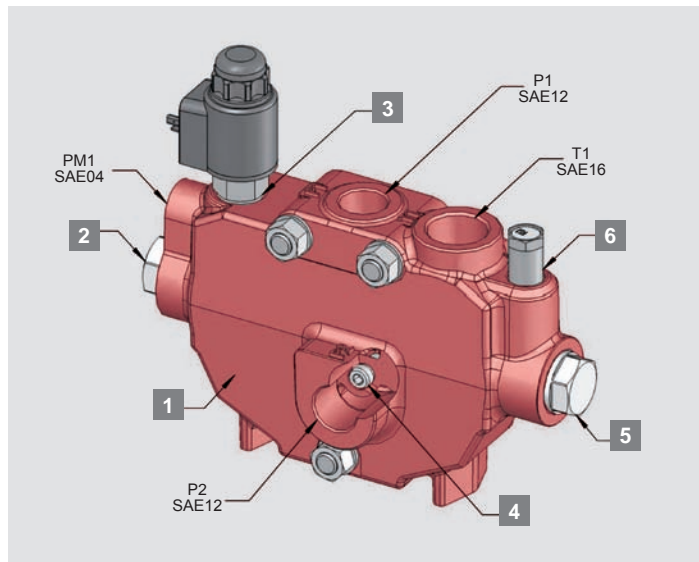


1	Inlet	I23B
2	Unloading valve	EU24
3	Relief valve	TBD201
4	Cavity for plug PM02	N/A



Characteristic main relief function (TBD201)

Inlet section I13B



Flow control function

The inlet section I13B with its integral Q-function provides by-pass of pump flow to tank in idling condition, thereby reducing pressure drop and heat generation. It also reduces flow forces and makes the control response to large extent unaffected by varying pump flows. This contributes to the excellent operating characteristics achievable with DX-6.

The regulated flow into the centre passage is set by an exchangeable metering orifice (4).

In case the I13B inlet section is configured with metering orifice PF60, this orifice determines the high pressure carry over flow to downstream arrangements.

Unloading function

An unloading spool along with an electrical operated pilot valve forms the unloading function. The unloading spool both unloads the pump flow to tank and as well disconnects the valve's parallel passage from the pump.

Together with a load holding valve, DX-6 achieves a very safe emergency dump of pump flow to tank.

EU912 and EU926 are 2-way, normally open, solenoid type cartridge valves. It is an option in all inlet sections. It is intended for emergency stop and for pressure drop/heat generation reduction.

Rated flow:	11 gpm (40 Lpm)
Power consumption:	18 W
Rated voltage EU12:	12 V
Rated voltage EU24:	24 V
Max voltage variation:	+/-15%
Duty factor*:	100%
Connection:	EN 175301-803 form A
Protection class:	IP65

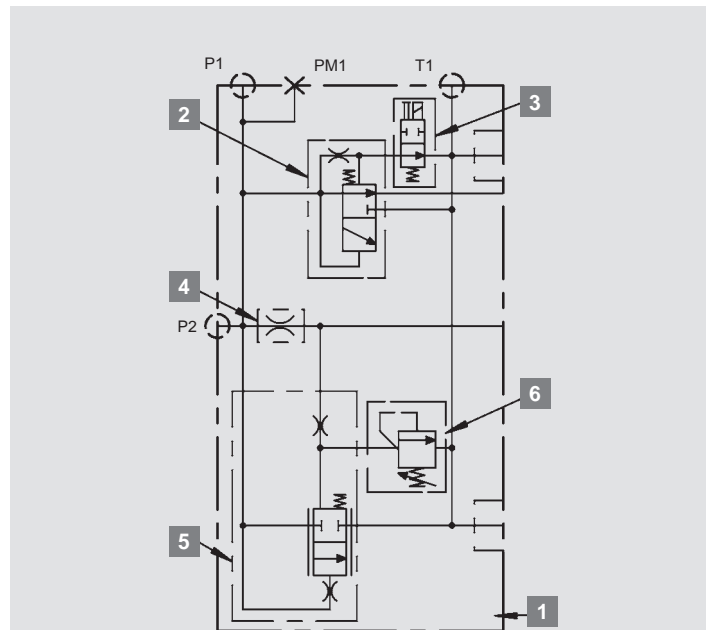
* Sufficient cooling must be secured.

The unloading valve has manual override, with twist pin operation. PE20 is the plug for the cavity.

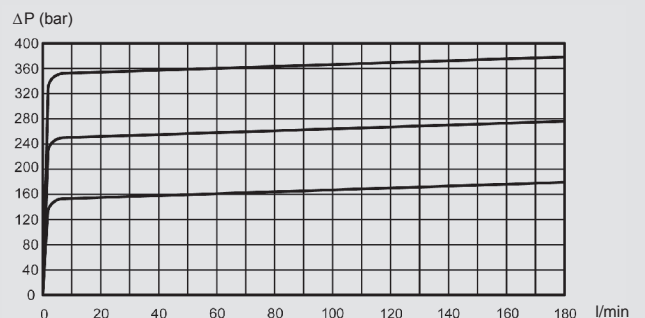
Main relief function

The by pass unit FK29 in combination with the relief valve TB 12 form the pilot operated relief valve function.

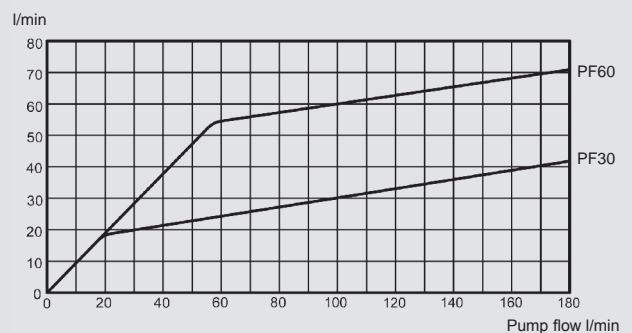
TB12 is adjustable and sealable for setting range 200-5000 psi (40 – 350 bar) with setting step 100 psi (7 bar).



1	Inlet section	I13B
2	Unloading unit	FU29
3	Solenoid operated valve	E926
4	Metering orifice for centre channel flow	PF60
5	By-pass flow control unit	FK29
6	Pilot relief valve	TB12



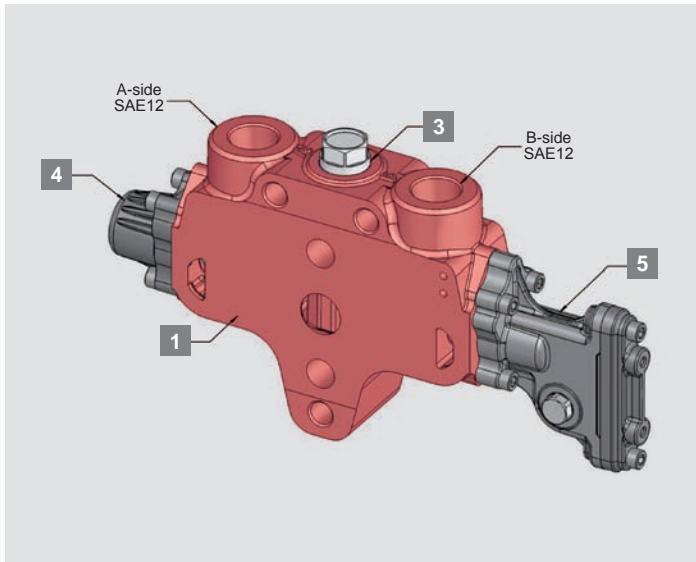
Characteristics main relief function



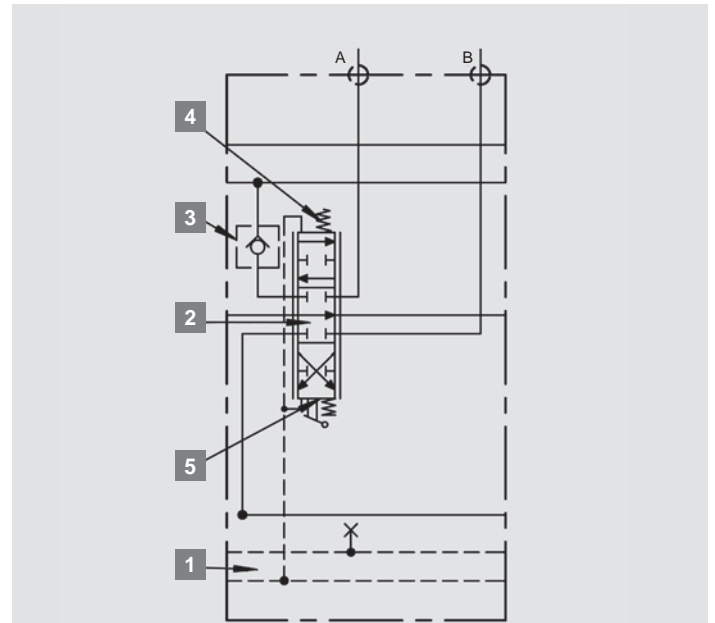
Characteristics regulated flow

Oil temperature / viscosity for all graphs: 104°F (+40°C)

Working section S14L

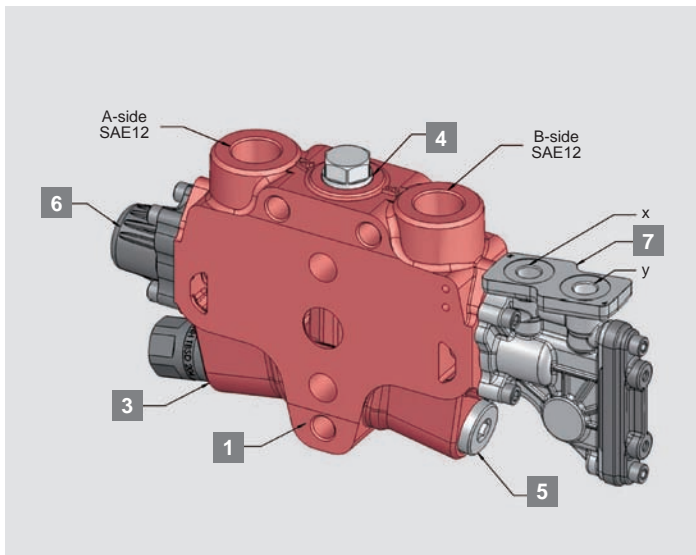


Working section S14L for both manual and remote operation. The example shows a section configured for manual operation with the spring centering spool control on A-side and encapsulated lever mechanism on B-side spool actuator. The section S14L includes a loadcheck valve.

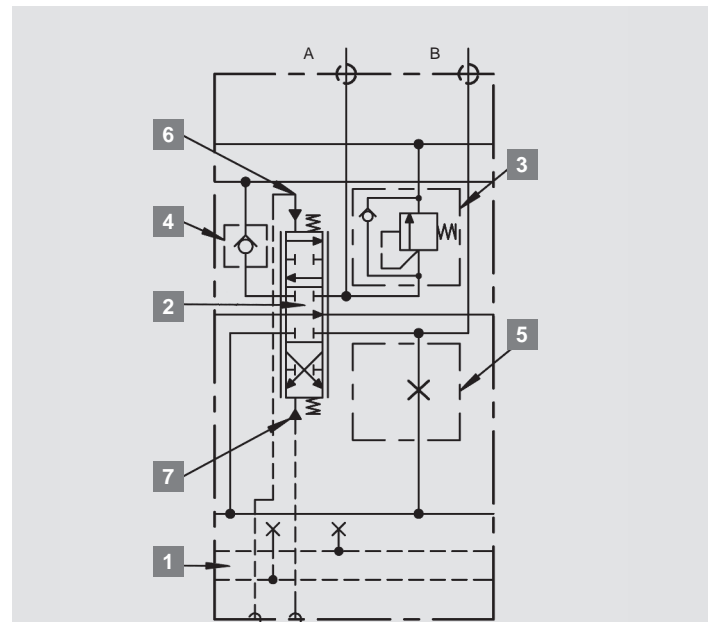


1	Working section	S14L
2	Spool	1XY
3	Load check valve	MF29
4	Spool control, A-side	9M1
5	Spool actuator, B-side	M1

Working section S24L

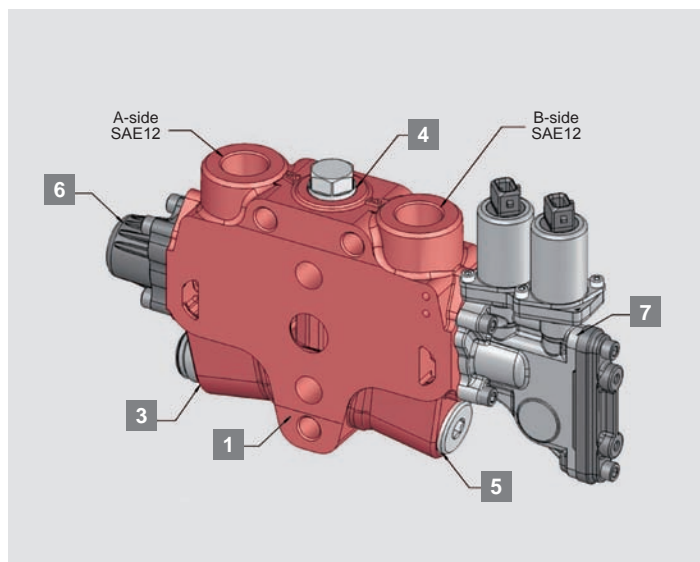


Working section S24L for both manual and remote operation. The example shows a section configured for hydraulic remote control with the spring centering spool control on A-side and the ports for control pressure on the B-side spool actuator. The section S24L includes loadcheck valve and cavities for service port valves of type TBD/TBSD205.



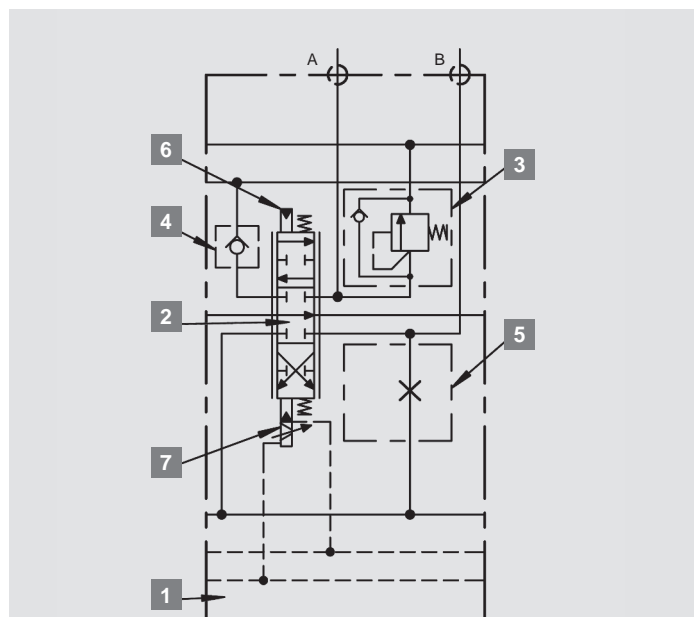
1	Section	S24L
2	Spool	1XY
3	Service port valve	TSBD205
4	Load check valve	MB29
5	Service port plug	P204
6	Spool control, A-side	9R1
7	Spool actuator, B-side	H1

Work section S34L



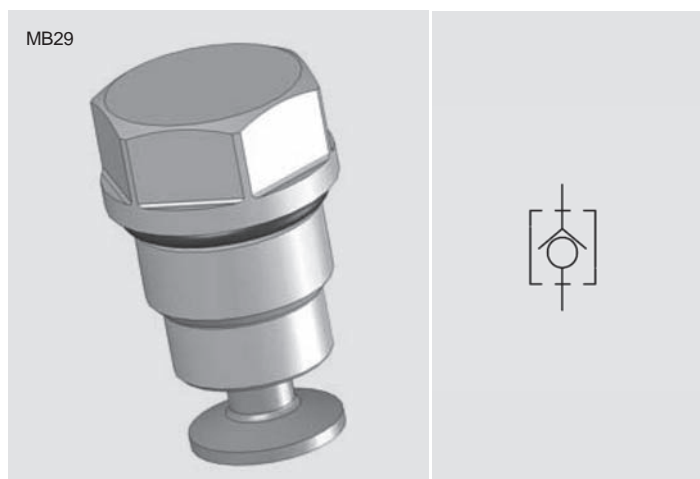
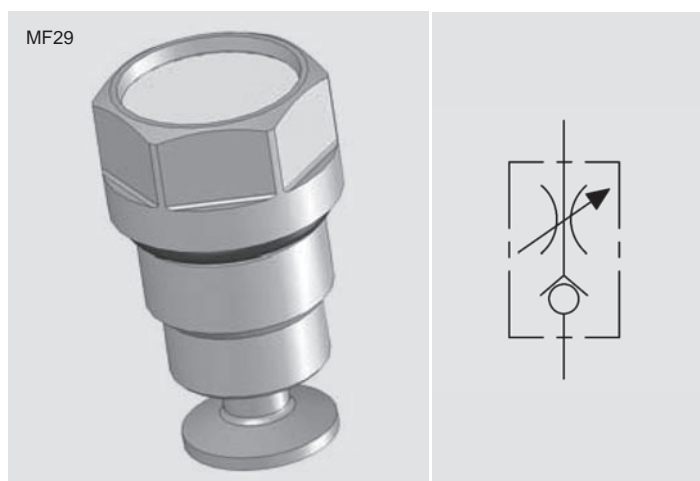
Working section S34L for both manual and remote operation. The example shows a section configured for electro hydraulic remote control with the spring centering spool control on A-side and the proportional solenoids on the B-side.

The section S34L includes loadcheck valve and cavities for service port valves of type TBSD280.



1	Section	S34L
2	Spool	1XY
3	Service port valve	TBSD280
4	Load check valve	MB29
5	Service port plug	P280
6	Spool control, A-side	9R1
7	Spool control, B-side	EH1XX

Load check valve

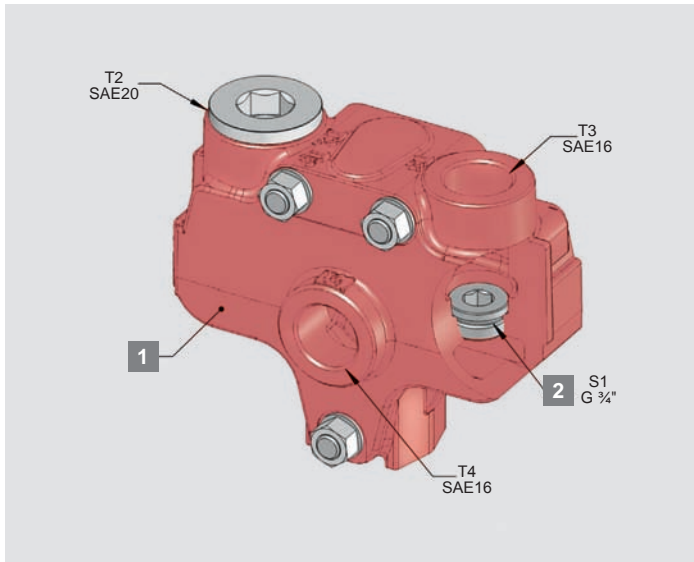


The main function of the load check valve is to prevent the load from moving backwards if the load pressure is higher than pump pressure when operating.

MB29
Load check valve.

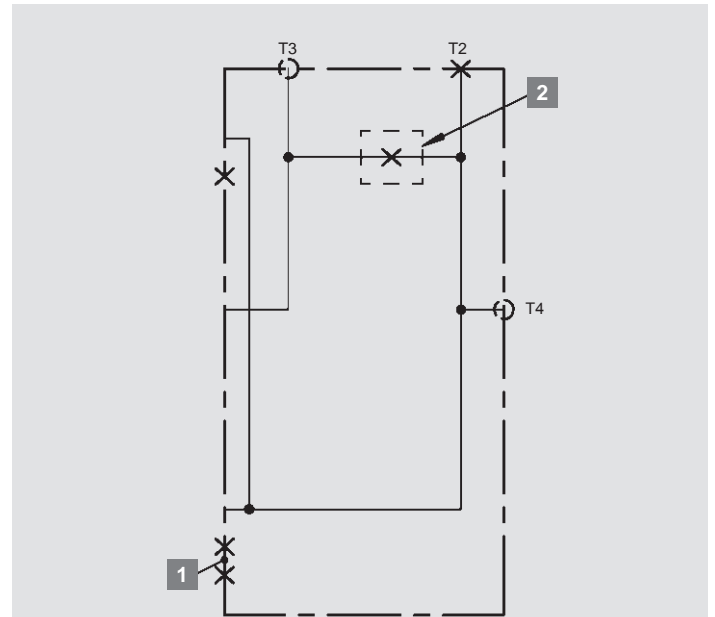
MF29
Load check valve with adjustable flow limitation. MF29 restricts the flow out from a section. Typical application is a slewing function.

Outlet section U13B



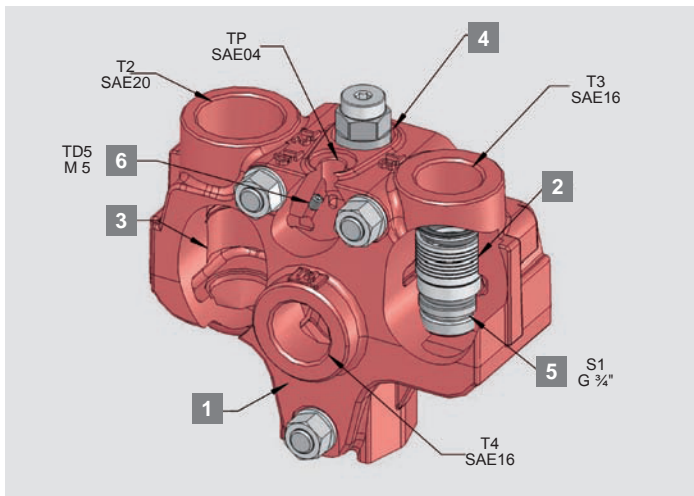
The standard outlet section U13B has three tank connection ports T2, T3 and T4.

Port T3 is used for high pressure carry over function (HPCO) when plug S29 is installed in the S1 cavity (see example).



1	Outlet selection	U13B
2	S1 Carry over plug	S29

Outlet section U13L



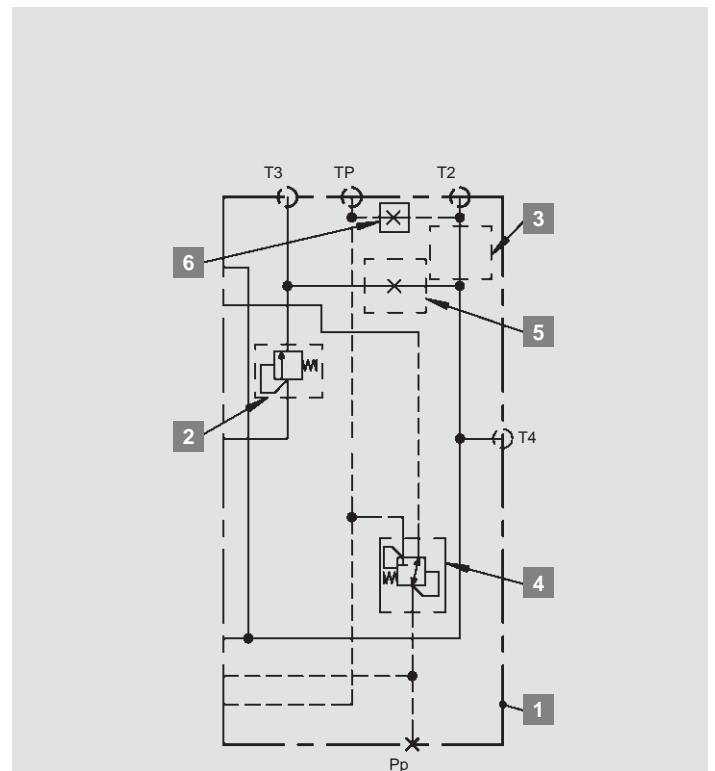
The outlet section U13L with integrated pilot pressure supply for a valve with electro-hydraulic remote controlled working sections. Same configuration can be used for pilot pressure supply, via port Pp, to a hydraulic controller for use with hydraulic remote controlled working sections.

To ensure sufficient pressure for the pilot circuit a start up pressure is generated by the back-up cartridge BUP14 installed in cavity 2. The back-up cartridge can be used in combination with HPCO plug S29. A pressure reducing valve TRA63 limits the pressure in the pilot circuit.

Because the pilot pressure is supplied from the parallel gallery an emergency stop will also unload the pilot pressure.

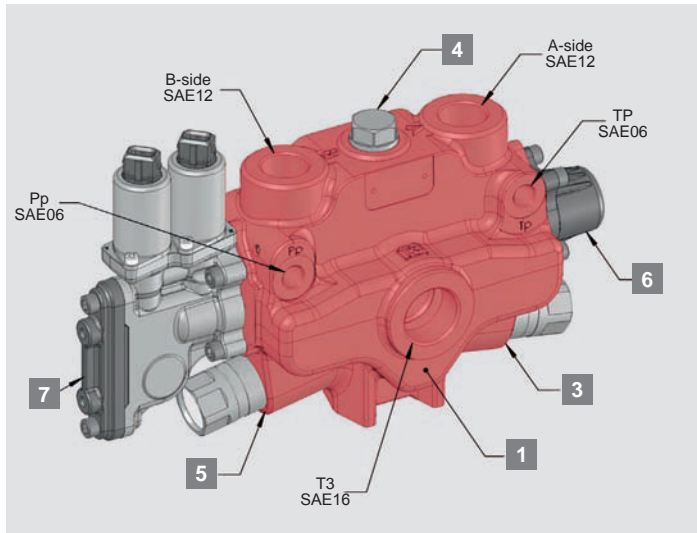
It is recommended to drain the return flow in the pilot circuit via port Tp direct to tank in separate piping. This is accomplished by PMS5 installed in cavity 6. Note: The port Tp must not be plugged when PMS5 is installed.

The outlet section U13L can be configured with a back-up cartridge (BUP14 installed in cavity 3) for an increased pressure in the return passage to prevent cavitation in severe conditions. This is accomplished without compromising the pressure drop P - T at idling.

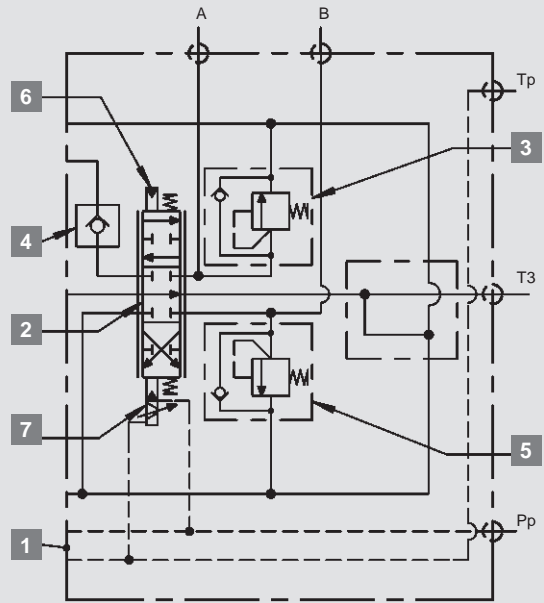


1	Outlet selection	U13L
2	Back up valve	BUP14
3	Pilot pressure valve	BUP14
4	Pressure reducing valve or plug	TRA63/P63
5	Carry over plug	S29
6	Plug for pilot drain	PMS5

Outlet with working section US24L

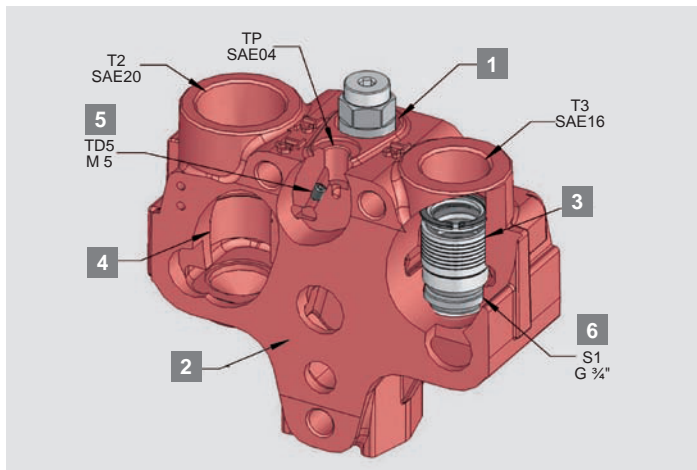


The US24L is an outlet section with integrated spool section, T3 port for tank connection for both manual operation and remote control with external pilot pressure supply. High pressure carry over function is achieved with SU31 installed in port T3. Pp – supplied pilot pressure, Tp – pilot drain.



1	Outlet and working section	US24L
2	Spool	1XY
3	Service port valve	TBSD205
4	Load check valve	MB29
5	Service port plug	TBSD205
6	Spool control A-side	9R1
7	Spool actuator B-side	EH1XX

Mid outlet N13B

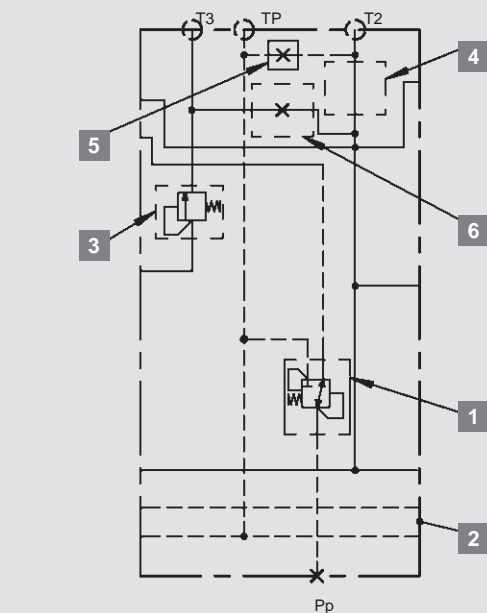


The mid-outlet section N13B with integrated pilot pressure supply for a valve with electro-hydraulic remote controlled working sections. Same configuration can be used for pilot pressure supply, via port Pp, to a hydraulic controller for use with hydraulic remote controlled working sections.

To ensure sufficient pressure for the pilot circuit a start up pressure is generated upstream of the mid-outlet by the back-up cartridge BUP14 installed in cavity 3. The back-up cartridge can be used in combination with HPCO plug S29. A pressure reducing valve TRA63 limits the pressure in the pilot circuit.

Because the pilot pressure is supplied from the parallel gallery an emergency stop will also unload the pilot pressure.

It is recommended to drain the return flow in the pilot circuit via port Tp direct to tank in separate piping. This is accomplished by PMS5 installed in cavity 5. Note: The port Tp must not be plugged when PMS5 is installed.

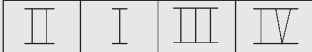

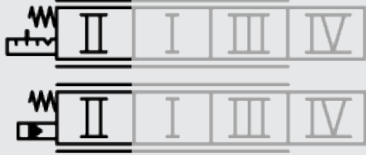
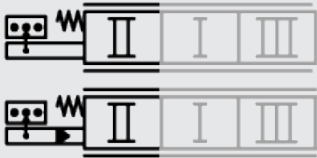


1	Pressure reducing valve	TRA63
2	Mid outlet section	N13B
3	Back up valve	BUP14
4	Pilot pressure valve	BUP14
5	Plug for pilot drain	PMS5
6	Carry over plug	S29

The mid-outlet section N13B can be configured with a back-up cartridge (BUP14 installed in cavity 4) for an increased pressure in the return passage to prevent cavitation in severe conditions. This is accomplished without compromising the pressure drop P – T at idling.



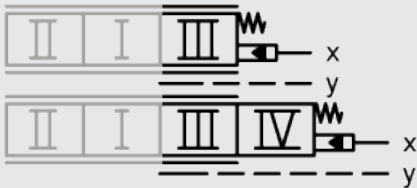
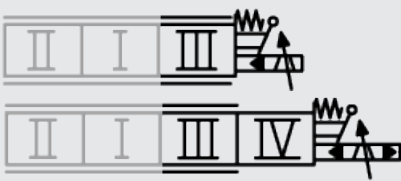
Spool controls A-side

The spool controls are designed in a modular system for a high degree of flexibility. The sections are basically symmetric but as standard machined either for left or right hand inlet with spool actuator on B-side and spool control on A-side.

	
Spool control 9 9M1 Manual spring centered 3 pos. encapsulated. 9MO1 Manual spring centered 3 pos. open spool ends. 9R1 Remote spring centered 3 pos.	
Spool control 11 11M1 Manual spring centered 4 pos. encapsulated. 11MO1 Manual spring centered 4 pos. open spool ends. 11R1 Remote spring centered 4 pos.	
Spool control S* SM11 Manual spring centered 3 pos. spool position indicator. SMO11 Manual spring centered 3 pos. open spool ends spool position indicator. SR11 Remote spring centered 3 pos. spool position indicator.	

Spool controls B-side

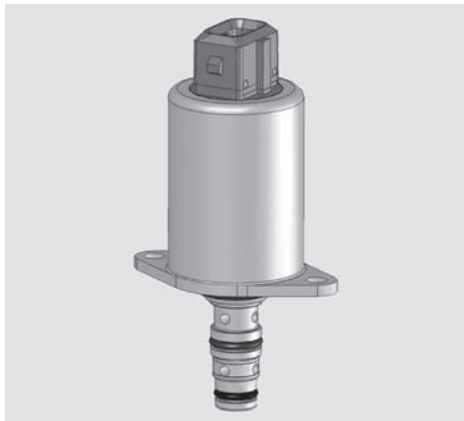
Remote spool actuators can be with or without manual override. The valve is, as standard setup for both manual and remote control.

	
Spool actuator/bracket M M1 for manual lever 3 pos. MO3 for manual lever 3 pos. open spool ends. MO3F for manual lever 4 pos. open spool ends.	
Spool actuator H H1 Hydraulically 3 pos. manual override available as option (H1M1). H1F Hydraulically 4 pos. Manual override available as option (H1M1F).	
Spool actuator EHM EHM1** Electro hydraulically manual override 3 pos. Without manual override as option (EH1**). EHM**F Electro hydraulically manual override 4 pos. without manual override as option (EH1**F).	

* standard connector M12x1, also available in Deutsch connector.

** 12 or 24 V DC.

Solenoid valve for EHP – ER12 / 24



The solenoid valves are 3/2-way electrically operated pressure reducing valves used to provide controlled pilot pressure to operate valve spools.

Functional principle:	PWM (Pulse Width Modulation)
Duty factor:	100 %
Connection:	DEUTSCH DT04*
Recommended PMW frequency:	100 Hz
Protection class:	IP 65
Ambient temperature:	-30 °C up to +80 °C

ER12

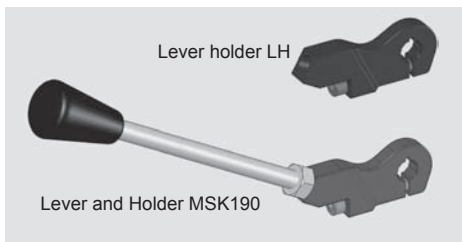
Rated voltage:	12 V DC
Starting current:	600 mA
Fully shifted:	1,500 mA
Coil resistance +20 °C:	4.72 Ohm

ER24

Rated voltage:	24 V DC
Starting current:	300 mA
Fully shifted:	750 mA
Coil resistance +20 °C:	20.8 Ohm

*Also available with AMP Junior-Power-Timer

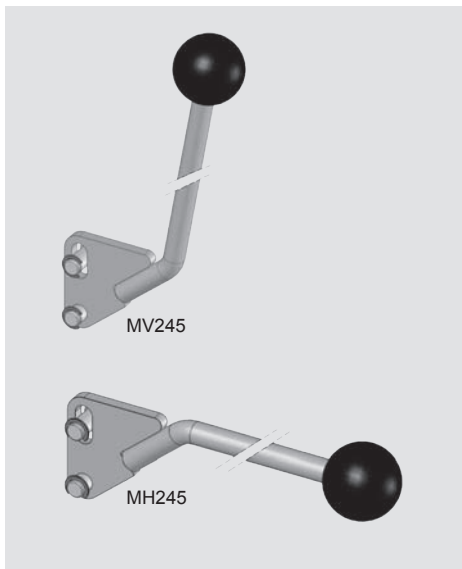
Levers



Lever and Holder MSK190

The lever holder (LH) is for use together with spool actuator of type M1/EHM.

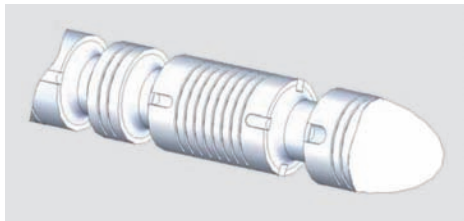
The lever holder is delivered in combination with a lever as MSK190.



Lever MV/MH

Lever for use in combination with open spool ends and a bracket M03/M03F. When mounted on a valve, the lever MH stands in a horizontal position and MV stands in a vertical position. Lever length 145 or 245 mm.

Spools – main design parameters



Generally the spools are divided in 3 different flow ranges.
 The position indicating **regulated** flow ranges is replaced by X.
 The position indicating **pump** flow is replaced by Y.
 The last three positions in the code are design parameters.
 In the table only the accessibility of different functions are shown.

Pos. 1 – Functionality

Diagram	Function	Code
	Spools for general use	
	Double acting	1XY
	Single acting	2XY
	Double acting, 4th pos. for float	3XY
	Motor spool A – T	4XY
	Regenerative	8XY

Pos. 2 – Regulated center flow – X in the code above

0 = Full pump flow i. e. no regulated flow

3 = 7.5 gpm (30 Lpm) regulated flow (use with inlet section I13B)

6 = 15 gpm (60 Lpm) regulated flow (use with inlet section I13B)

Pos. 3 – Pump flow supplied – Y in the code above

3 = 20 gpm ± 2.5 gpm (80 Lpm ± 10 Lpm)

4 = 30 gpm ± 5 gpm (110 Lpm ± 20 Lpm)

6 = 160 l/min +/- w30 l/min

Example:

Spool 136xxx – double acting spool with 7.5 gpm regulated flow and 40 gpm pump flow, xxx in the code are design parameter.

The DX-6 spools are available in a variety of flows and styles to accommodate most design requirements. Since the development of spools is a continuous process and all available spools are not described in this data sheet, contact HYDAC for advice on choosing spools in order to optimize your valve configuration.

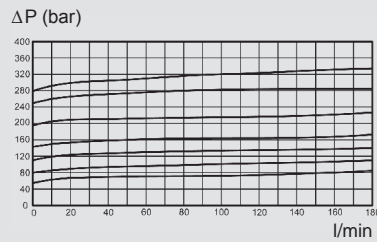
Service port valves

Port relief valve TBD205

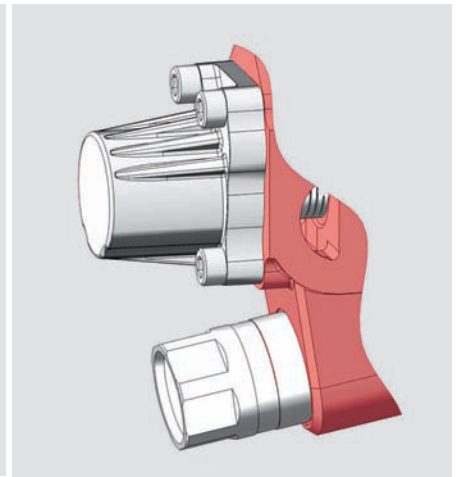
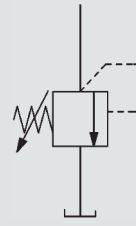
TBD205 is a differential area, direct acting relief valve, for the secondary circuit. It is adjustable and sealable.

Setting range for TBD205:

- 600-4,350 psi (40-300 bar)
- Setting range step: 100 psi (7 bar)



Relief characteristics TBD205

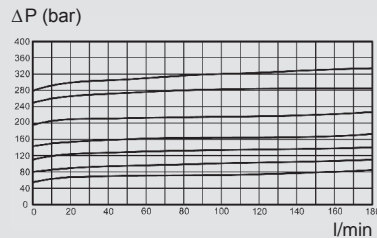


Port relief valve TBSD205

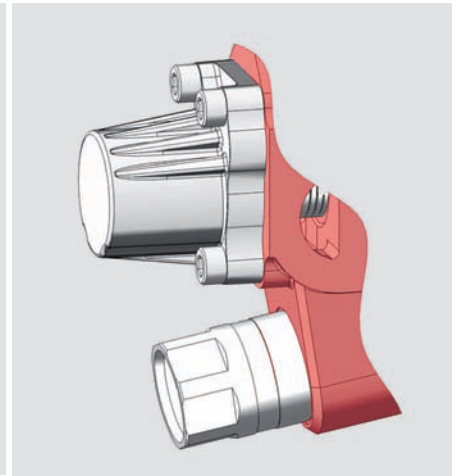
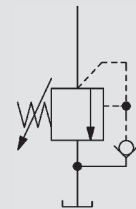
TBSD205 is a differential area, direct acting relief and anticavitation valve, for the secondary circuit. It is adjustable and sealable.

Setting ranges for TBSD205:

- 600-4,350 psi (40-300 bar)
- Setting range step: 100 psi (7 bar)



Relief characteristics TBSD205

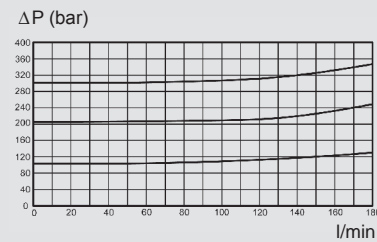


Port relief and anticavitation valve TBSD280

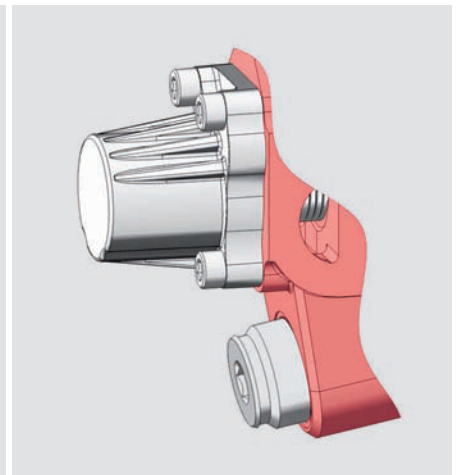
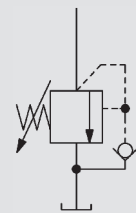
TBSD280 is a direct acting relief and anticavitation valve, for the secondary circuit. It is fixed and sealable.

Setting ranges for TBSD280:

- 1,300-5,800 psi (90-400 bar)
- Setting range step: 100 psi (7 bar)

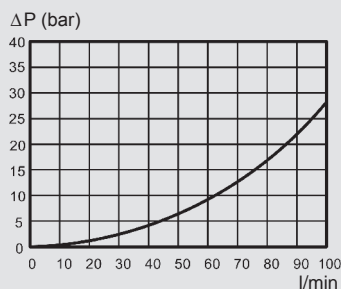


Relief characteristics TBSD280

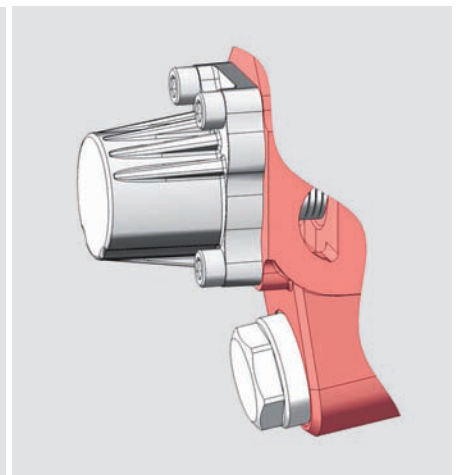


Anticavitation valve SB204

The anticavitation valve service to ensure that, in the event of a lower pressure in the cylinder port than in the tank, oil can be drawn from the system oil tank to the consumer.



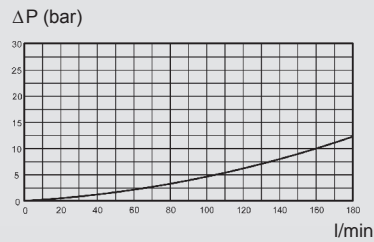
Anticavitation characteristics
TBSD205 and SB204



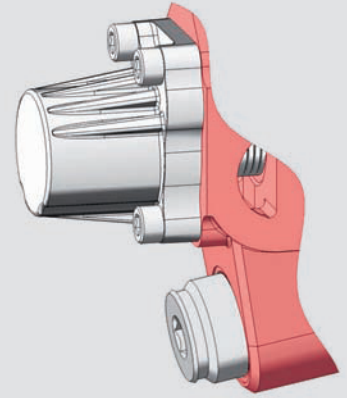
Service port valves

Anticavitation valve SB280

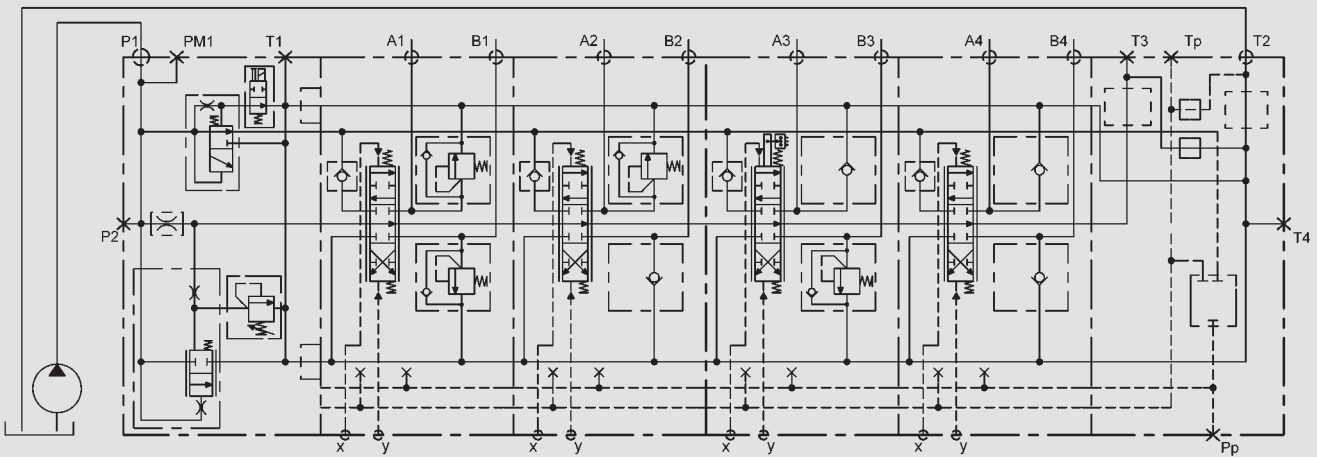
The anticavitation valve service to ensure that, in the event of a lower pressure in the cylinder port than in the tank, oil can be drawn from the system oil tank to the consumer.



Anticavitation characteristics
TBSD280 and SB280

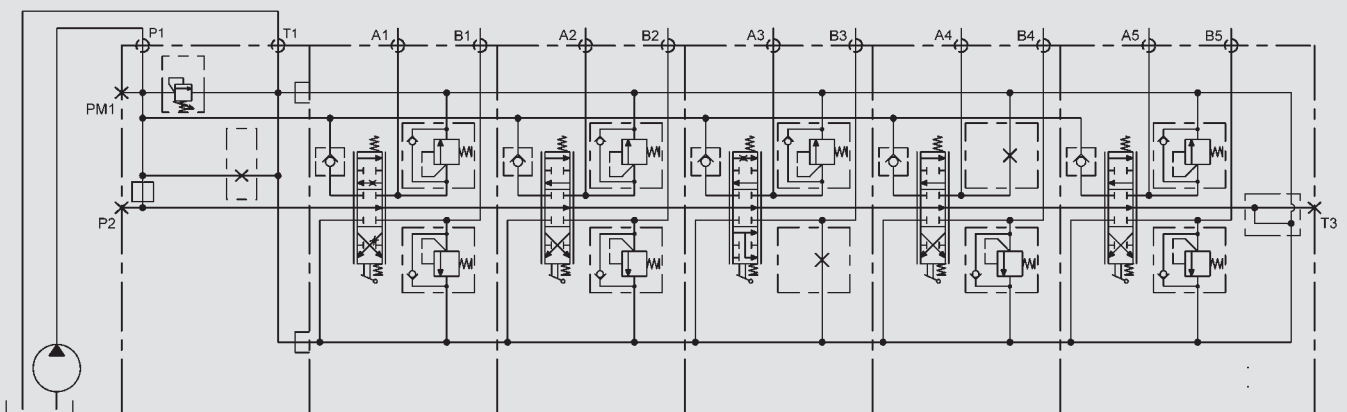


Typical hydraulic circuit diagrams



This example shows a DX-6 with parallel circuitry.

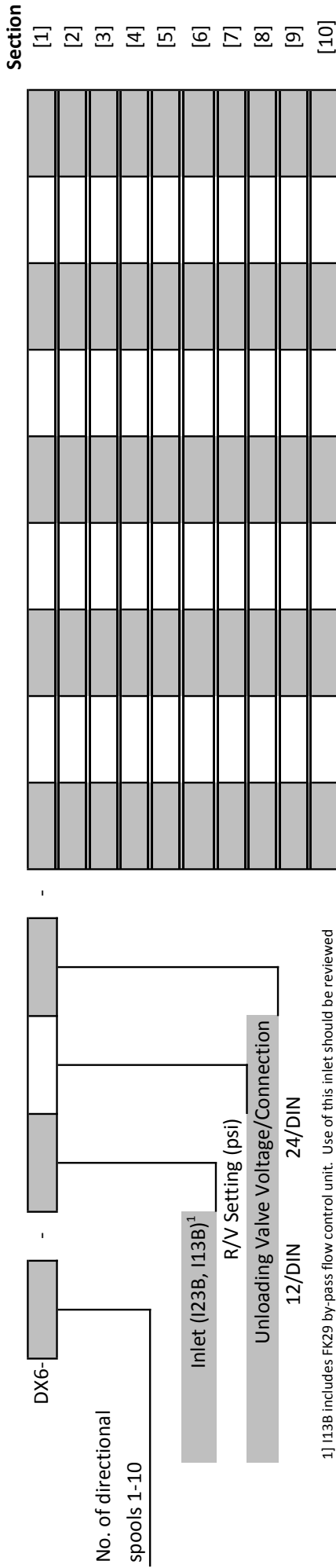
The inlet section with flow control function and electrical unloading. A metering orifice determines the center passage flow. A pilot operated relief valve in combination with the flow control performs the main relief valve function. Four working sections all with double acting cylinder spools hydraulically actuated. Section 3 with a spool position indicator. Outlet section machined for pilot pressure supply, back-up pressure and high pressure carry-over (HPCO) but in the example configured with cavity plugs.



This example shows a DX-6 with parallel circuitry.

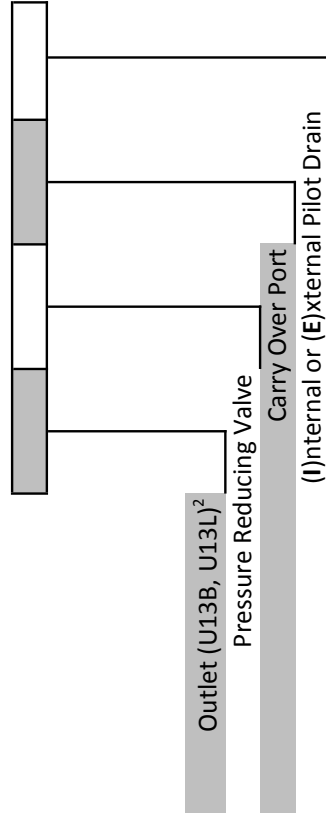
The inlet section of standard type with a direct acting main relief valve. Five working sections all manual operated. Section 3 with 3-position regenerative spool. The outlet section with integrated working section with option for HPCO.

Ordering Details DX6 Sectional Control Valve



1] I13B includes FK29 by-pass flow control unit. Use of this inlet should be reviewed with your HYDAC applications consultant.

Repeat for Number of Sections



2] Leave blank if US24L is used as last section body

Application Information

OEM: _____
 Machine Type: _____
 Pump Type: _____
 Pump Flow: _____
 System Pressure: _____
 EAU: _____
 Other Information: _____


	Valve Series	Coordinate ID
	DX-6	

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Spare parts list

Valve Series

Coordinate ID

DX-6

Typical valve build specification

Valve specification number

Date printed

Inlet assembly* 2900254	Inlet [AA00]	I13B 029001139	P1	Shipping Plug Push	T1	Plug SAE-16 2700732	PM1	Plug SAE-4 2702086	El. Contr. Valve [AA08]	PE20 6900002241
	Main Relief Valve [BN00]	TB12-2500 6900002224	P2	Plug SAE-12 2058344	Unloading Unit [AA04]	FU29 02900140	Metering Orifice [AA12]	PF60 02900141	Control Unit [AA16]	FK29 02900142
Outlet assembly 2900258	Outlet [AF00]	U13L 2900143	T2	Shipping Plug Push	T3	Plug SAE-16 2700732	T4	Plug SAE-16 2700732	Pp	Plug SAE Push
General	Tie rod kit [AL00]	R490 02900247			Pilot Backup [AF04]	BUP14 02900111	Anticav. Backup [AF06]	OPEN	Tp w/ External Drain	Shipping Plug Push
	Seal Kit [AV]	SSK (x5) 02900138			Press. Reducing Valve [AA28]	TRA63 6900000064	Power Beyond [FR05]	OPEN		OPEN

		1	2	3	4					
AQ	Section	S24L 3784021	S24L 3784021	S24L 3784021	S24L 3784021					
BH	Spool	164HB 3780667	164HB 3780667	164HB 3780667	164HB 3780667					
CE	A-side Relief cavity	P204 6900002245	P204 6900002245	P204 6900002245	P204 6900002245					
	B-side Relief cavity	P204 6900002245	P204 6900002245	P204 6900002245	P204 6900002245					
CK	Check valve	MB29 02900148	MB29 02900148	MB29 02900148	MB29 02900148					
DB	Spool control A-port side	9R1 02900252	9R1 02900252	9R1 02900252	9R1 02900252					
DM	Spool control B-port side	EHM100 02900115	EHM100 02900115	EHM100 02900115	EHM100 02900115					
DR	Solenoids	PPCD04 12V DT 02095313	PPCD04 12V DT 02095313	PPCD04 12V DT 02095313	PPCD04 12V DT 02095313					
DY	Work Port A	Shipping Plug Push	Shipping Plug Push	Shipping Plug Push	Shipping Plug Push					
EJ	Work Port B	Shipping Plug Push	Shipping Plug Push	Shipping Plug Push	Shipping Plug Push					
SA	Section Assembly**									

TA	Tag Fields	P/N 1234567	MOD RSM290	P 4350	DATE	T 290
AD	Additional Assembly Procedures	Specification				
TE	Test Procedures	Specification				
PA	Packaging Procedures	Specification				

HANDLES	P/N 3550295	MOD MSK190	QTY 4
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Revisions		
Rev.	Date	ECN No.

Indicates service item

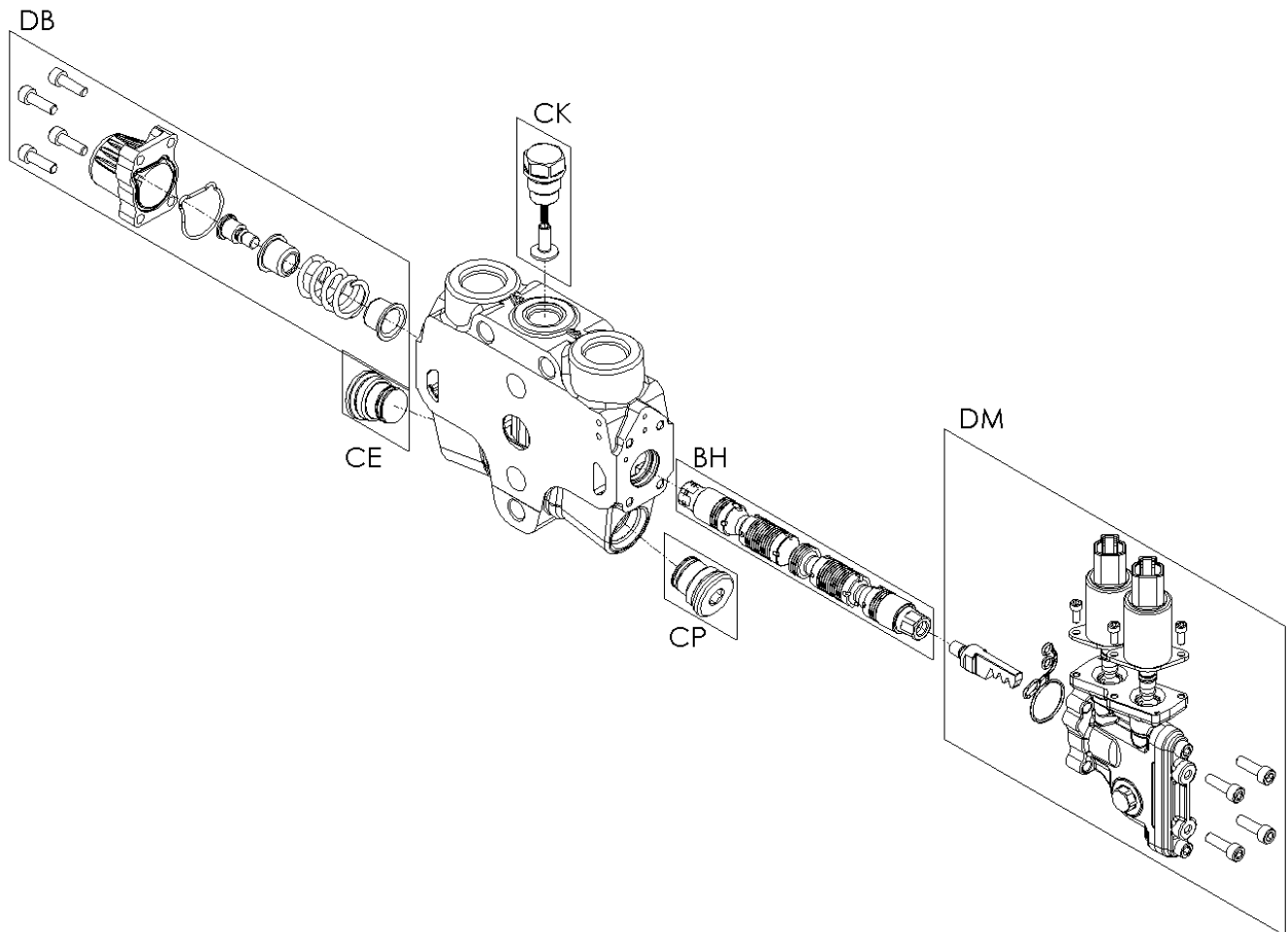
* Order main relief separately, not included with inlet assembly

**Order section seal kit separately, not included with section assembly

	Valve Series	Coordinate ID
	DX-6	SA

Section Assembly Coordinate IDs

*See specific Coordinate IDs in this document for service details.



HYDAC Spare parts list

Valve Series

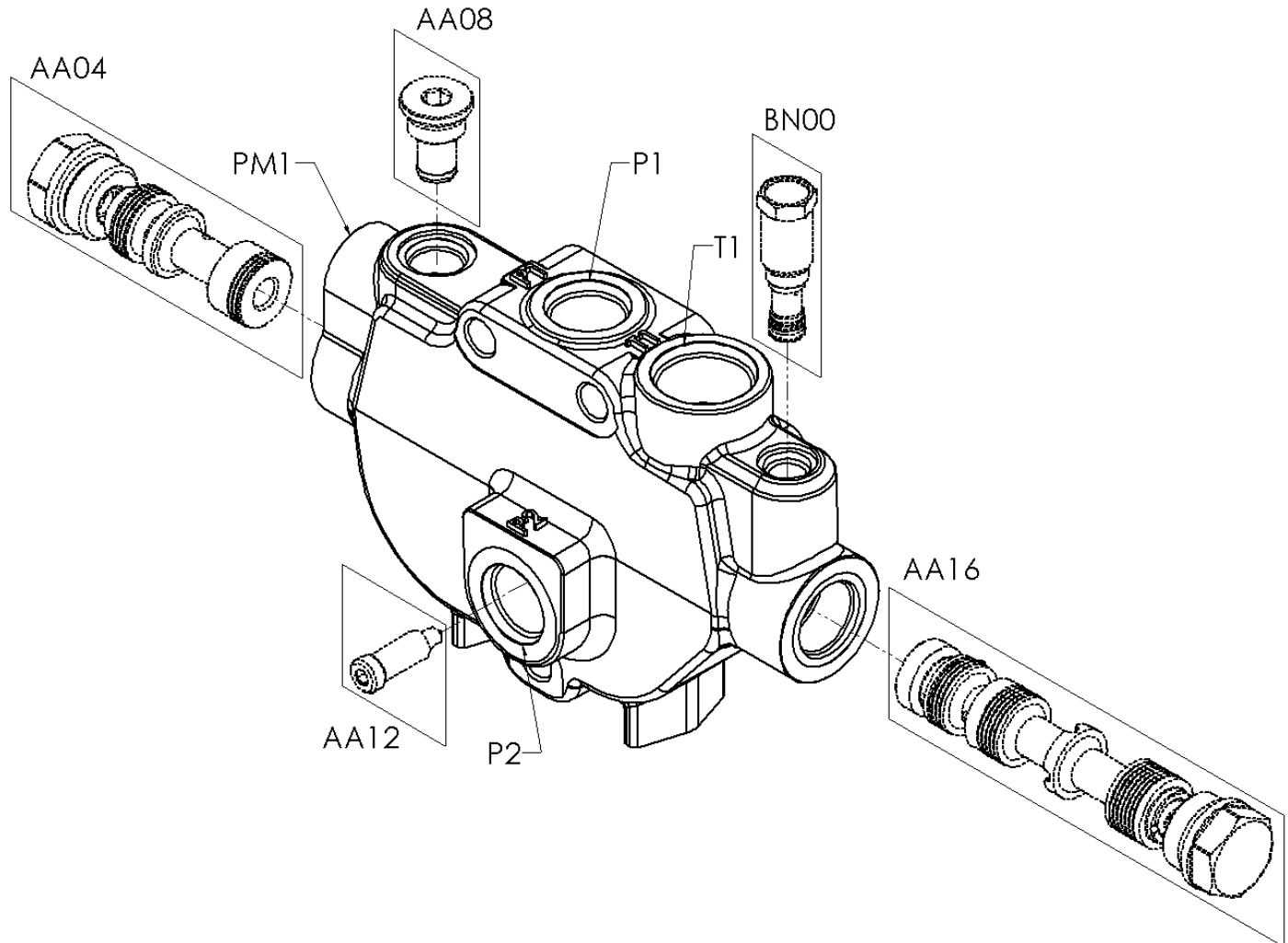
Coordinate ID

DX-6

AA00

I13B

*Relief valve not included, order separately



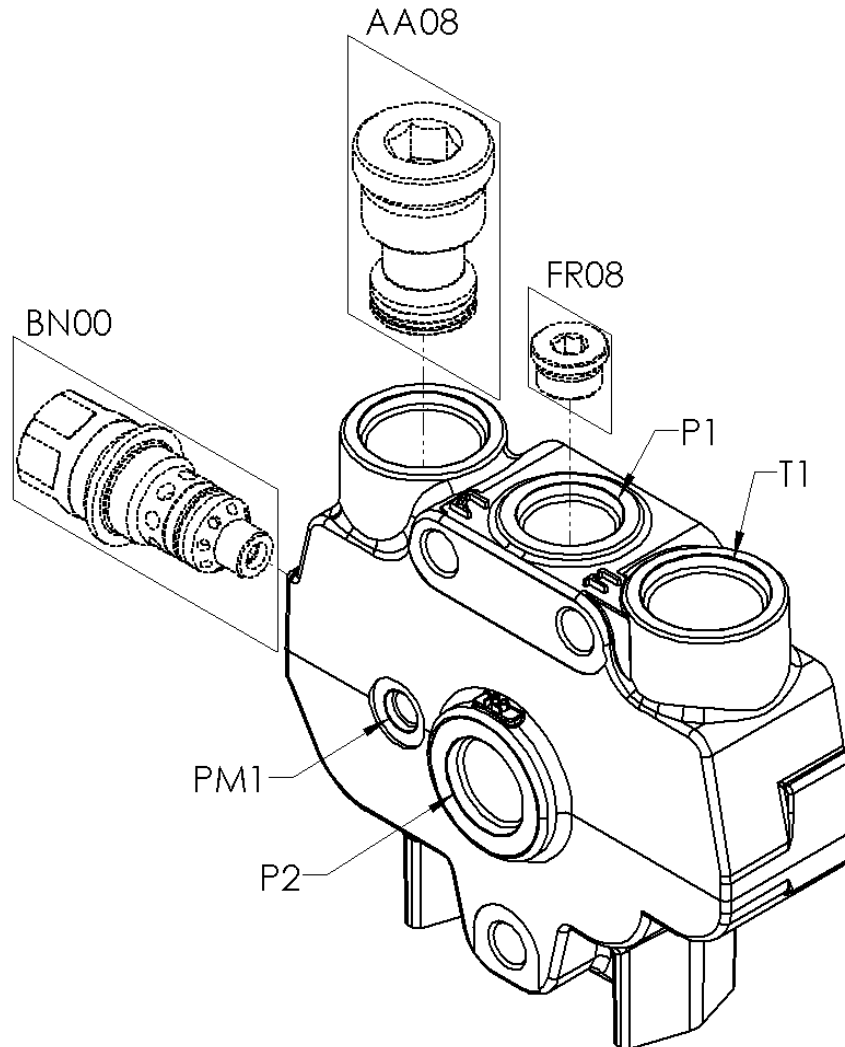
Part No.	Model Code	Description
2900254	DX-6/I13B/FU29/PE20/PF30/FK29	Inlet, flow control with center channel 8 GPM; without unloading function
2901896	DX-6/I13B/FU29/PE20/PF50/FK29	Inlet, flow control with center channel 13 GPM; without unloading function
2901897	DX-6/I13B/FU29/PE20/PF60/FK29	Inlet, flow control with center channel 16 GPM; without unloading function
2901898	DX-6/I13B/FU29/WS08Y-12/PF30/FK29	Inlet, flow control with center channel 8 GPM; with 12VDC unloading function
2901899	DX-6/I13B/FU29/WS08Y-12/PF50/FK29	Inlet, flow control with center channel 13 GPM; with 12VDC unloading function
2901900	DX-6/I13B/FU29/WS08Y-12/PF60/FK29	Inlet, flow control with center channel 16 GPM; with 12VDC unloading function
2901901	DX-6/I13B/FU29/WS08Y-24/PF30/FK29	Inlet, flow control with center channel 8 GPM; with 24VDC unloading function
2901902	DX-6/I13B/FU29/WS08Y-24/PF50/FK29	Inlet, flow control with center channel 13 GPM; with 24VDC unloading function
2901903	DX-6/I13B/FU29/WS08Y-24/PF60/FK29	Inlet, flow control with center channel 16 GPM; with 24VDC unloading function

*Port sizes; P1 & P2 SAE-12, T1 SAE-16, PM SAE-4

**For non-standard cases, check valve specification sheet for inlet assembly part number

I23B

*Relief valve not included, order separately

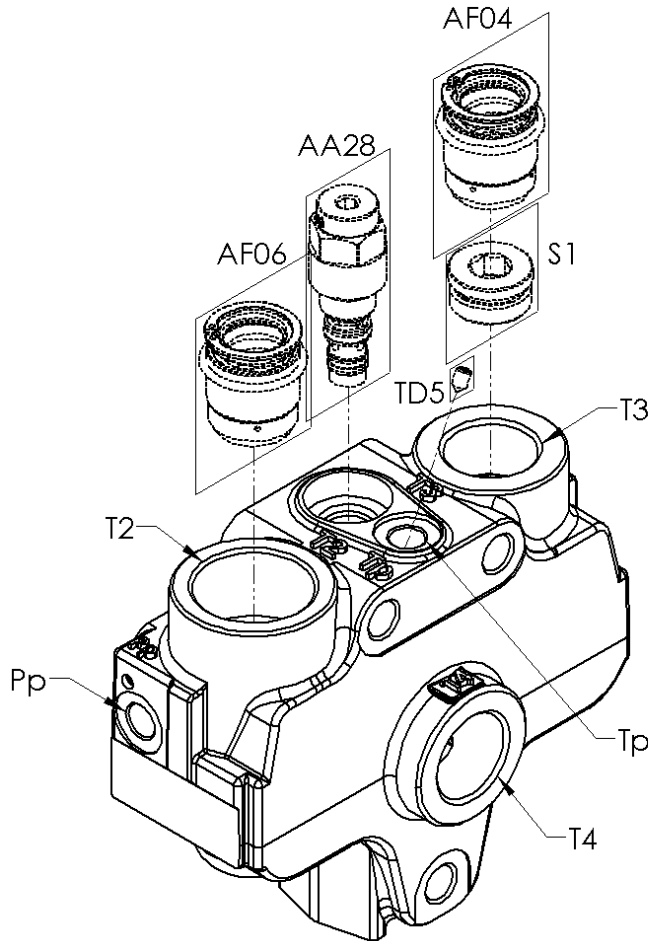


Part No.	Model Code	Description
2901572	DX-6/I23B/PE21	Inlet, without unloading function
2901908	DX-6/I23B/EU12	Inlet, with 12VDC unloading function
2901909	DX-6/I23B/EU24	Inlet, with 24VDC unloading function

*Port sizes; P1 & P2 SAE-12, T1 SAE-16, PM SAE-4

**For non-standard cases, check valve specification sheet for inlet assembly part number

U13L



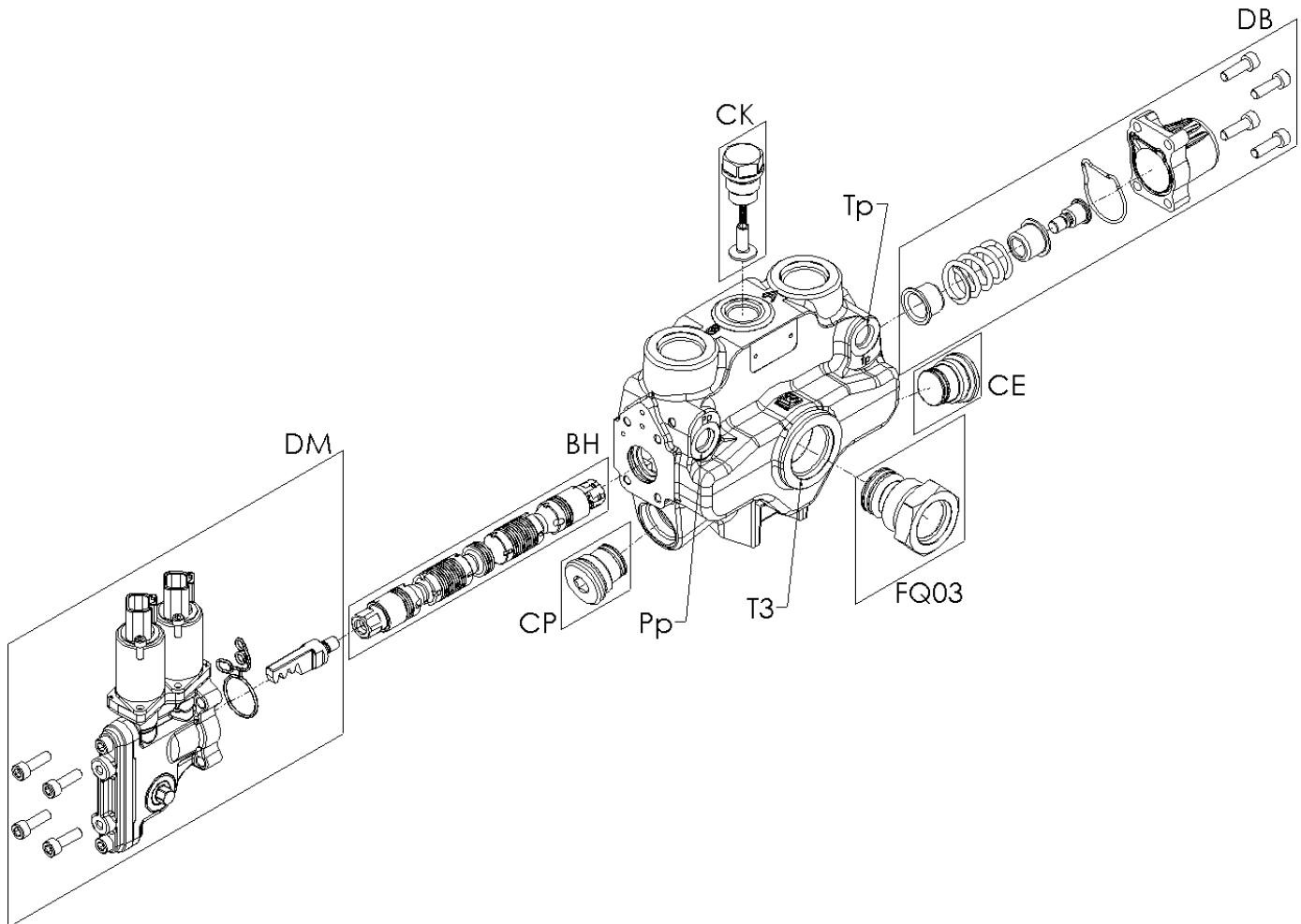
Part No.	Model Code	Description
2901910	DX-6/U13L/P63/MANUAL	Outlet, for manual operation
2901911	DX-6/U13L/P63/MANUAL/CC	Outlet, for manual operation, closed center flow
2901912	DX-6/U13L/P63/MANUAL/PB	Outlet, for manual operation, high pressure carryover flow
2901913	DX-6/U13L/TRA63/INT-PLT/INT-DR	Outlet, for electro-hydraulic operation, internal pilot, internal drain
2900258	DX-6/U13L/TRA63/INT-PLT/EXT-DR	Outlet, for electro-hydraulic operation, internal pilot, external drain
2900416	DX-6/U13L/P63/EXT-PLT/EXT-DR	Outlet, for electro-hydraulic operation, external pilot, external drain
2901914	DX-6/U13L/P63/EXT-PLT/INT-DR	Outlet, for electro-hydraulic operation, external pilot, internal drain
2901915	DX-6/U13L/TRA63/INT-PLT/INT-DR/CC	Outlet, for electro-hydraulic operation, internal pilot, internal drain, closed center flow
2900849	DX-6/U13L/TRA63/INT-PLT/EXT-DR/CC	Outlet, for electro-hydraulic operation, internal pilot, external drain, closed center flow
2901916	DX-6/U13L/P63/EXT-PLT/EXT-DR/CC	Outlet, for electro-hydraulic operation, external pilot, external drain, closed center flow
2901917	DX-6/U13L/P63/EXT-PLT/INT-DR/CC	Outlet, for electro-hydraulic operation, external pilot, internal drain, closed center flow
2901918	DX-6/U13L/TRA63/INT-PLT/INT-DR/PB	Outlet, for electro-hydraulic operation, internal pilot, internal drain, high pressure carryover flow
2901919	DX-6/U13L/TRA63/INT-PLT/EXT-DR/PB	Outlet, for electro-hydraulic operation, internal pilot, external drain, high pressure carryover flow
2901920	DX-6/U13L/P63/EXT-PLT/EXT-DR/PB	Outlet, for electro-hydraulic operation, external pilot, external drain, high pressure carryover flow
2901921	DX-6/U13L/P63/EXT-PLT/INT-DR/PB	Outlet, for electro-hydraulic operation, external pilot, internal drain, high pressure carryover flow

*Port sizes; T2 SAE-20, T3 & T4 SAE-16, Pp & Tp SAE-4

**For non-standard cases, check valve specification sheet for outlet assembly part number

US24L

*Accessories not included, order separately



Part No

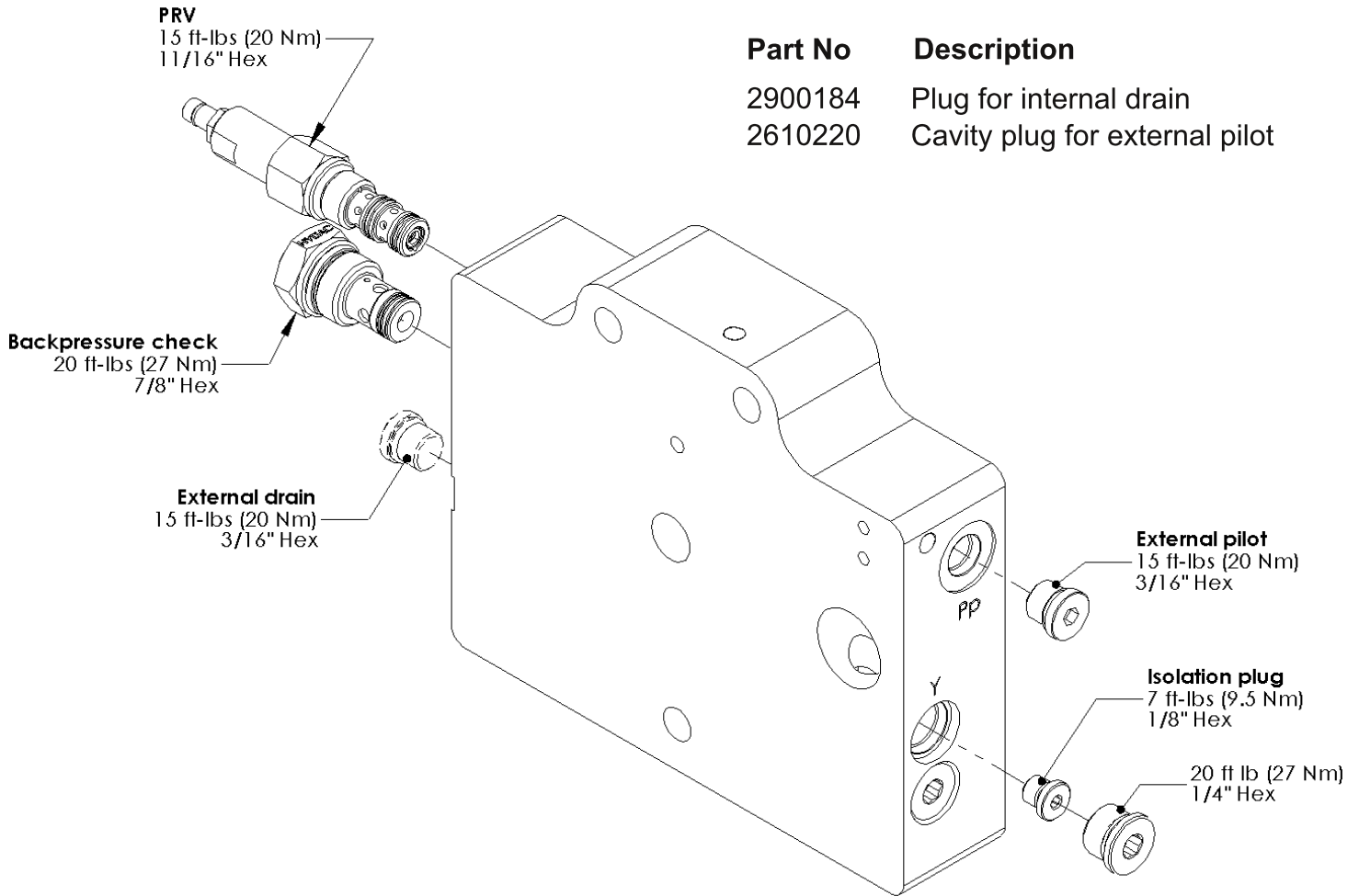
6900014203

Description

Outlet and working section, With cavity for high pressure carryover nipple. T3 SAE-16, Pp&Tp SAE-6.

Transition Block


*Supplied as internal pilot, external drain configuration



-To convert to internal drain, remove plug "Y" and remove isolation plug inside port, replace "Y" plug in port; add plug to "DR" and tighten to recommended torque.

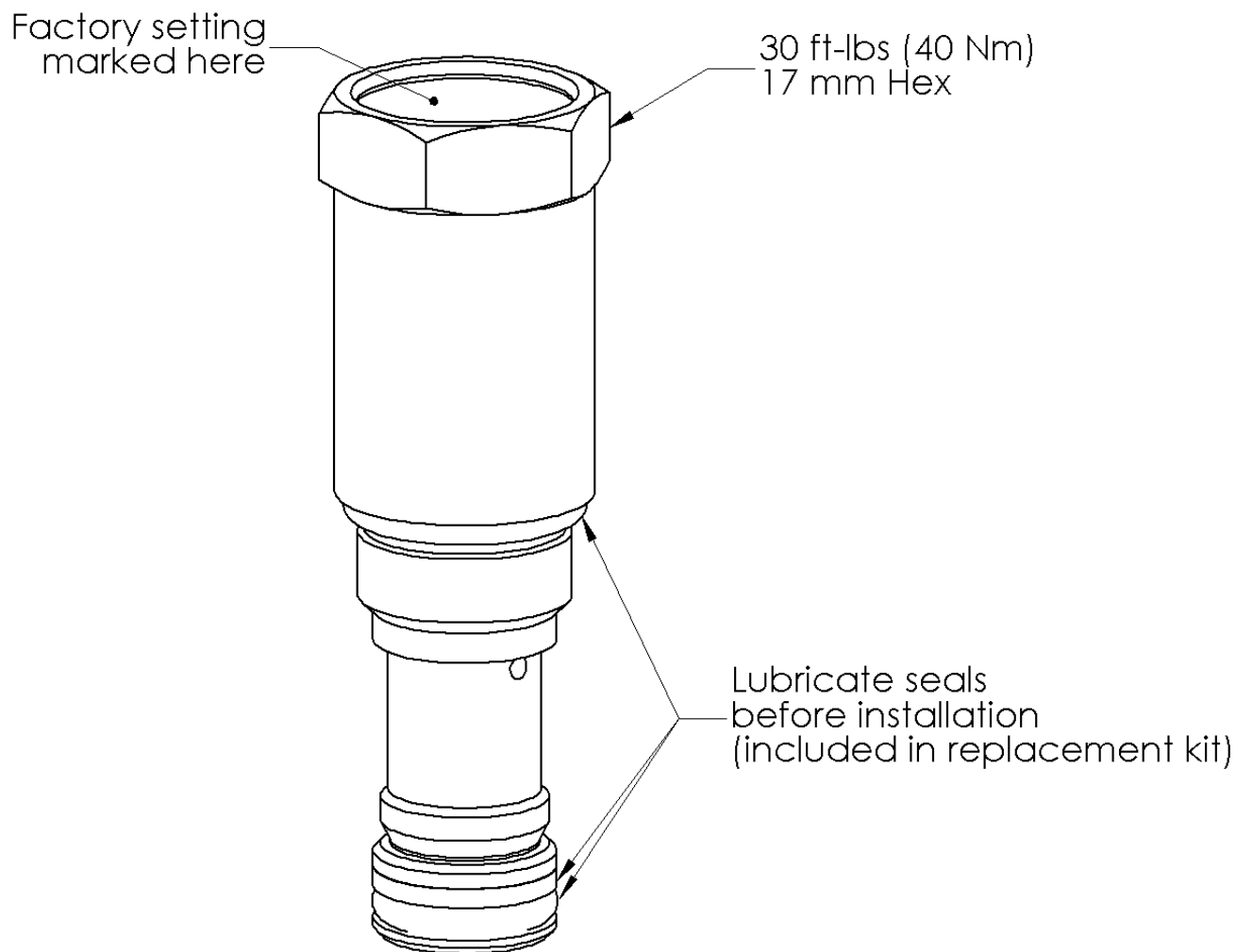
-To convert to external pilot, remove plug from "Pp" and connect regulated pilot line (350 PSI); replace PRV with cavity plug.

Part No	Description
2900185	Transition block from DX-6 to RS160, SAE ports. For electro-hydraulic proportional control. Provisions for internal and external pilot and drain connections; Pp SAE-4, DR SAE-4
2902203	Transition block from DX-6 to RS160, SAE ports. For manual spool control.

	Valve Series	Coordinate ID
	DX-6	BN00

TB12

*For use with I13B (2900139) inlet



*Order relief valve by model code: **TB12-S-XXXX**

where XXXX is the desired pressure setting from 0500 to 5000 PSI, set in 50 PSI increments.

-This is an adjustable pilot relief valve with optional factory setting

Part No

6900000745

Description

Replacement seal kit for TB12

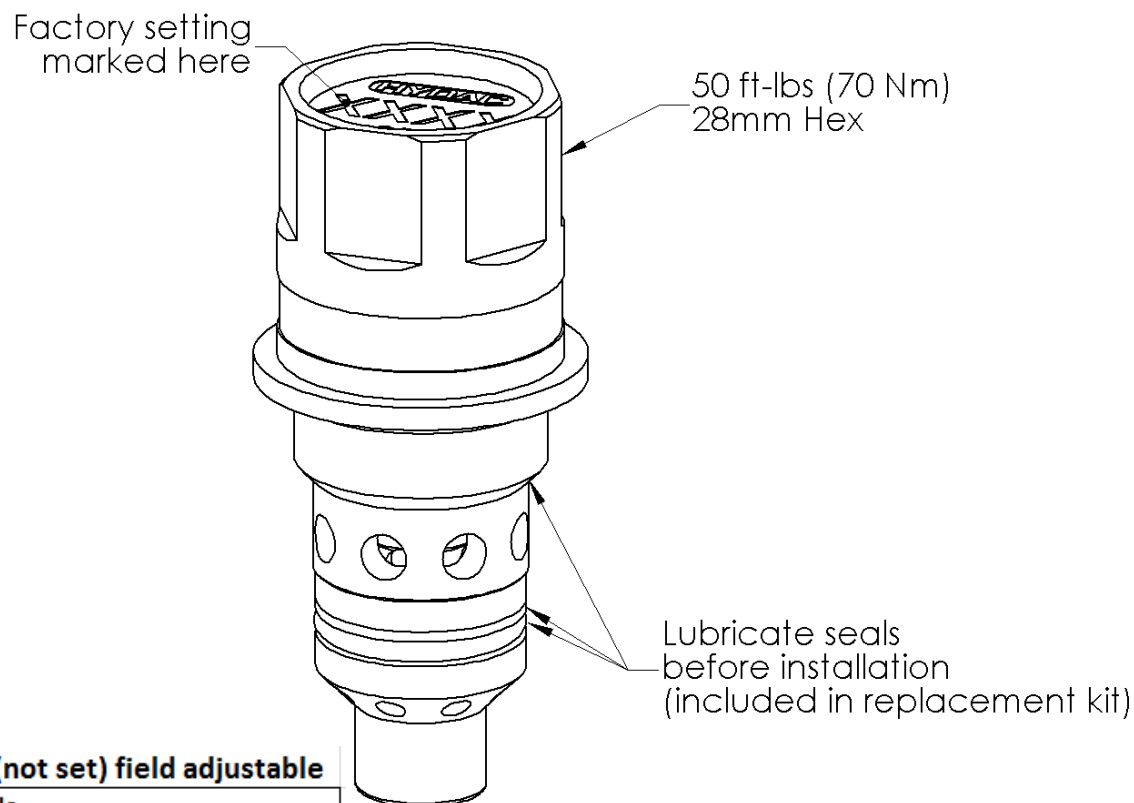
6900002224

Fully adjustable from 0500 to 5000 psi, not set

	Valve Series	Coordinate ID
	DX-6	BN00

TBD201

*For use with I23B (2900686) inlet



Factory shipped (not set) field adjustable

Part No.	Model Code
2900375	TBD201-A-0500-0950 (ADJ, NOT SET)
2900376	TBD201-A-1000-1300 (ADJ, NOT SET)
6900002197	TBD201-A-1350-1800 (ADJ, NOT SET)
2900377	TBD201-A-1850-2250 (ADJ, NOT SET)
2900378	TBD201-A-2300-3050 (ADJ, NOT SET)
2900379	TBD201-A-3100-3900 (ADJ, NOT SET)
2900380	TBD201-A-3950-4350 (ADJ, NOT SET)

*Order relief valve by model code: **TBD201-S-XXXX**

where XXXX is the desired pressure setting from 0500 to 5000 PSI, set in 50 PSI increments.

-See table above to determine full adjustability range of factory set valve.

Part No

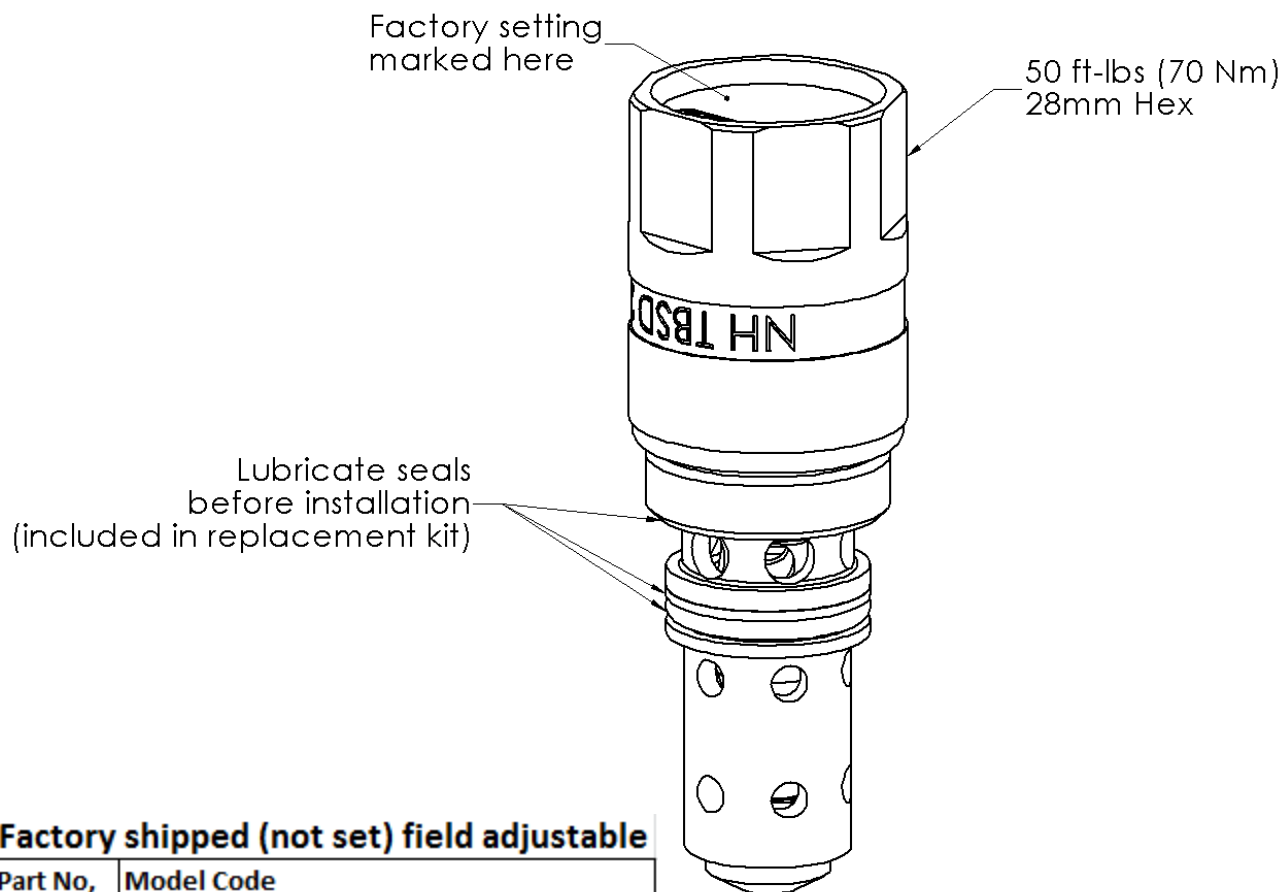
3465707

Description

Replacement seal kit for TBD201

	Valve Series	Coordinate ID
	DX-6	CE,CP

TBSD205



Factory shipped (not set) field adjustable

Part No.	Model Code
2900169	TBSD205-A-0500-0950 (ADJ, NOT SET)
2900170	TBSD205-A-1000-1300 (ADJ, NOT SET)
2900171	TBSD205-A-1350-1800 (ADJ, NOT SET)
2900172	TBSD205-A-1850-2250 (ADJ, NOT SET)
2900173	TBSD205-A-2300-3050 (ADJ, NOT SET)
2900174	TBSD205-A-3100-3900 (ADJ, NOT SET)
2900175	TBSD205-A-3950-4350 (ADJ, NOT SET)


*Order relief valve by model code: **TBSD205-S-XXXX**

where XXXX is the desired pressure setting from 0500 to 5000 PSI, set in 50 PSI increments.

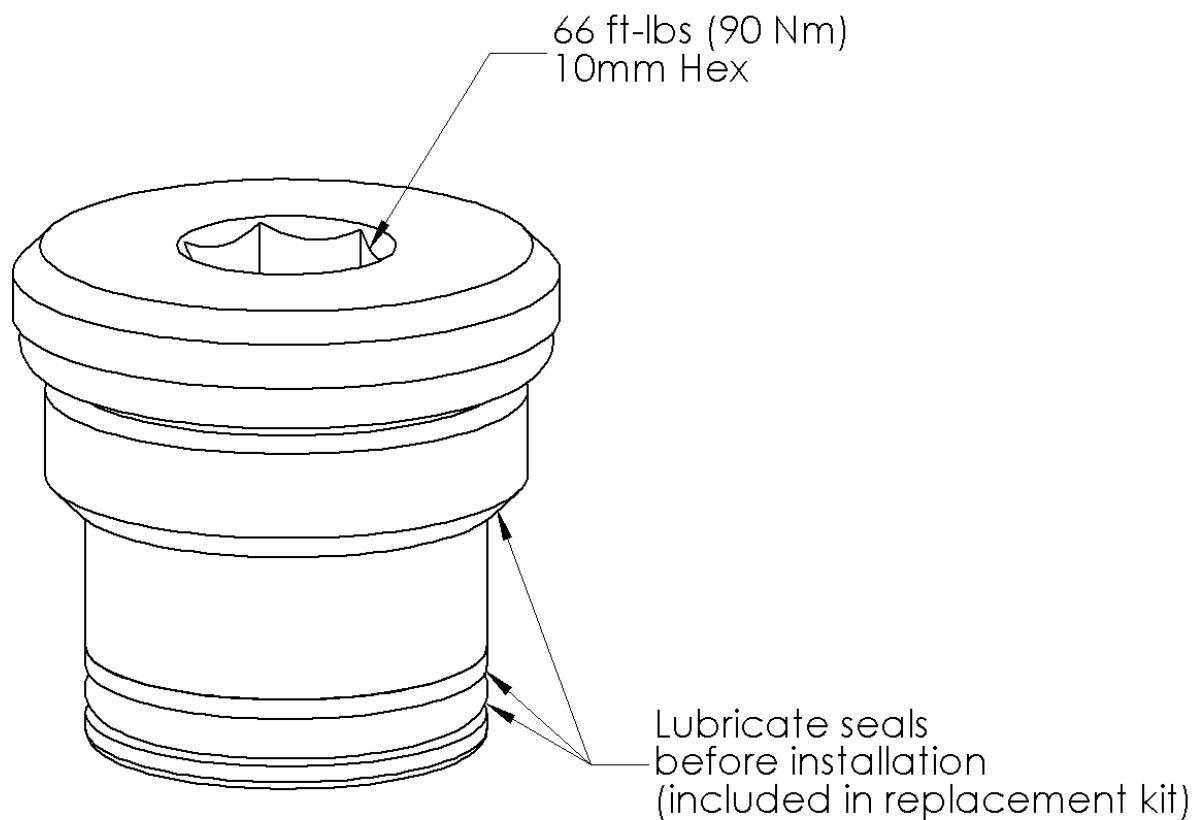
-See table above to determine full adjustability range of factory set valve.

Part No
3515233

Description
Replacement seal kit for TBSD205/P204

	Valve Series	Coordinate ID
	DX-6	CE,CP

P204



Part No

6900002245

Description

Plug replacing TBSD205

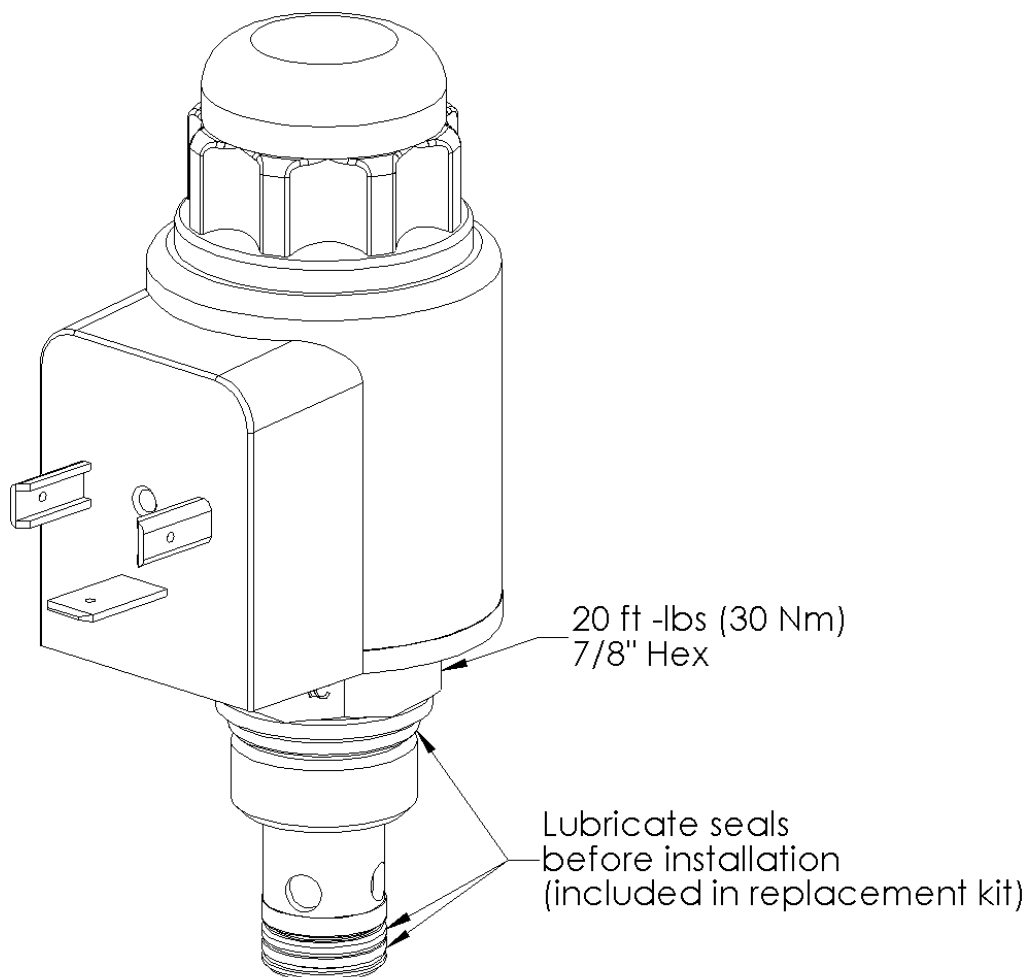
3515233

Replacement seal kit for TBSD205/P204


	Valve Series	Coordinate ID
	DX-6	AA08

WS08Y-01M

*For use with I13B (2900139) inlet



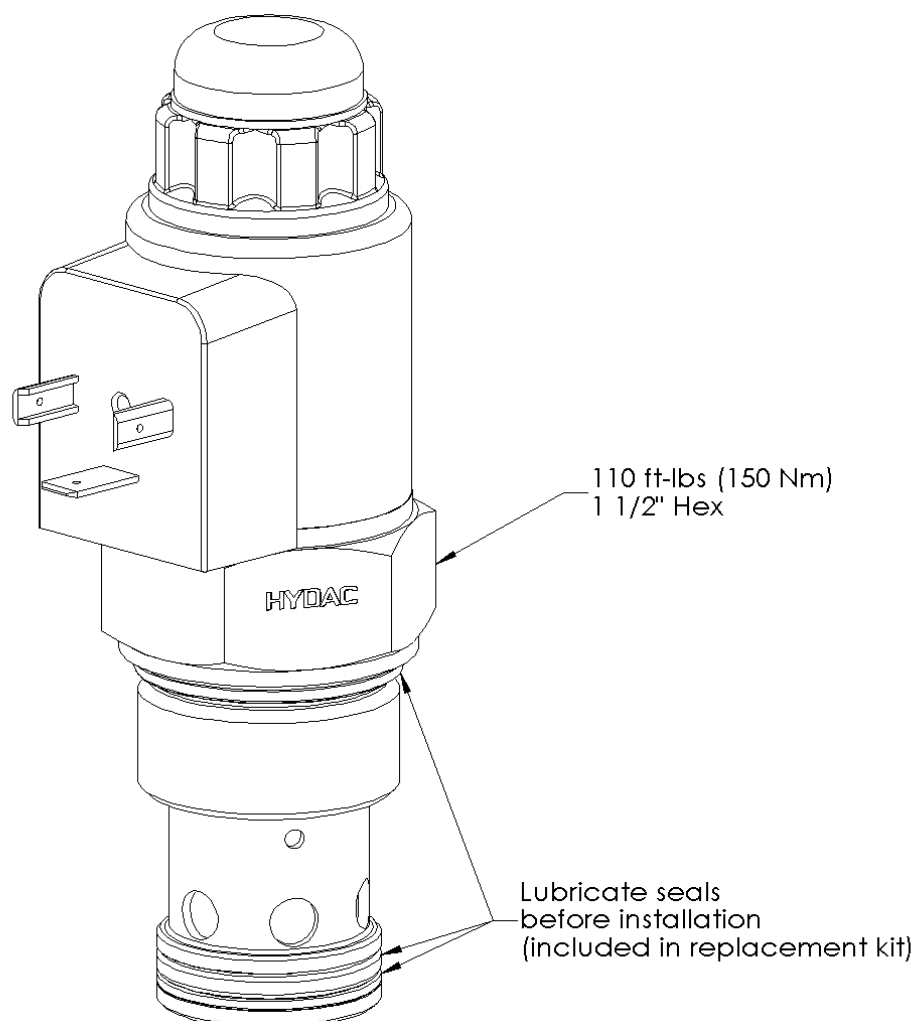
Model Code	Part No	Description
WS08Y-01M-12DG	3019408	2-way, normally open, solenoid type cartridge valve. intended for emergency stop and for pressure/heat reduction. Rated 12VDC, connection EN 175301-803-A
WS08Y-01M-24DG	561989	2-way, normally open, solenoid type cartridge valve. intended for emergency stop and for pressure/heat reduction. Rated 24VDC, connection EN 175301-803-A
	3033920	Replacement seal kit for WS08Y-01M

	Valve Series	Coordinate ID
	DX-6	AA08

EU12, EU24

*For use with I23B (2900686) inlet

*Available in 12VDC or 24VDC



Part No

6900014015

Description


2-way, normally open, solenoid type cartridge valve, for unloading function. Rated 12VDC

6900014016

2-way, normally open, solenoid type cartridge valve, for unloading function. Rated 24VDC

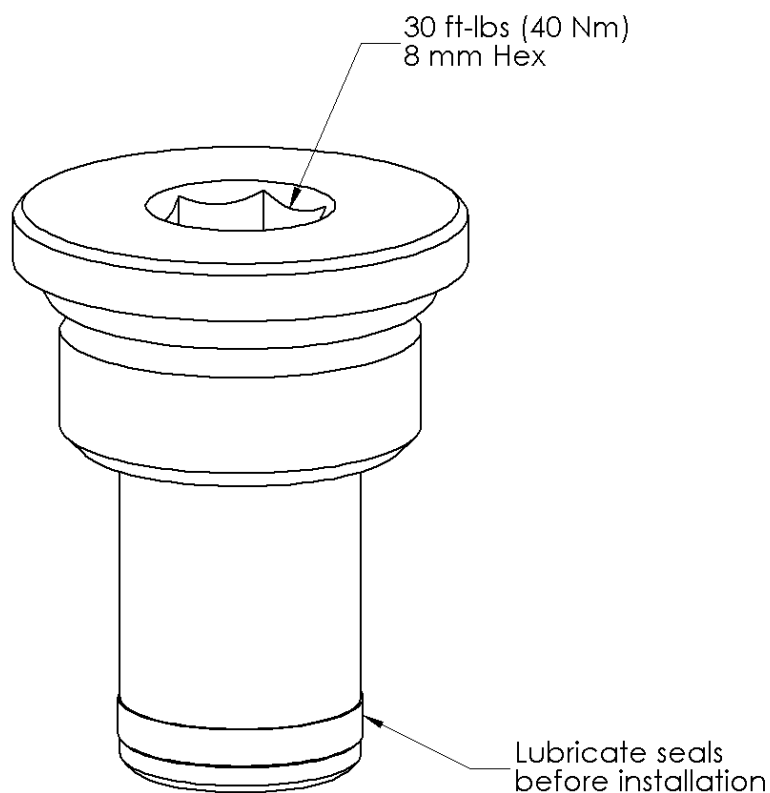
3052427

Replacement seal kit for EU12/EU24/PE21

	Valve Series	Coordinate ID
	DX-6	AA08

PE20

*For use with I13B (2900139) inlet




Part No

6900002241

Description

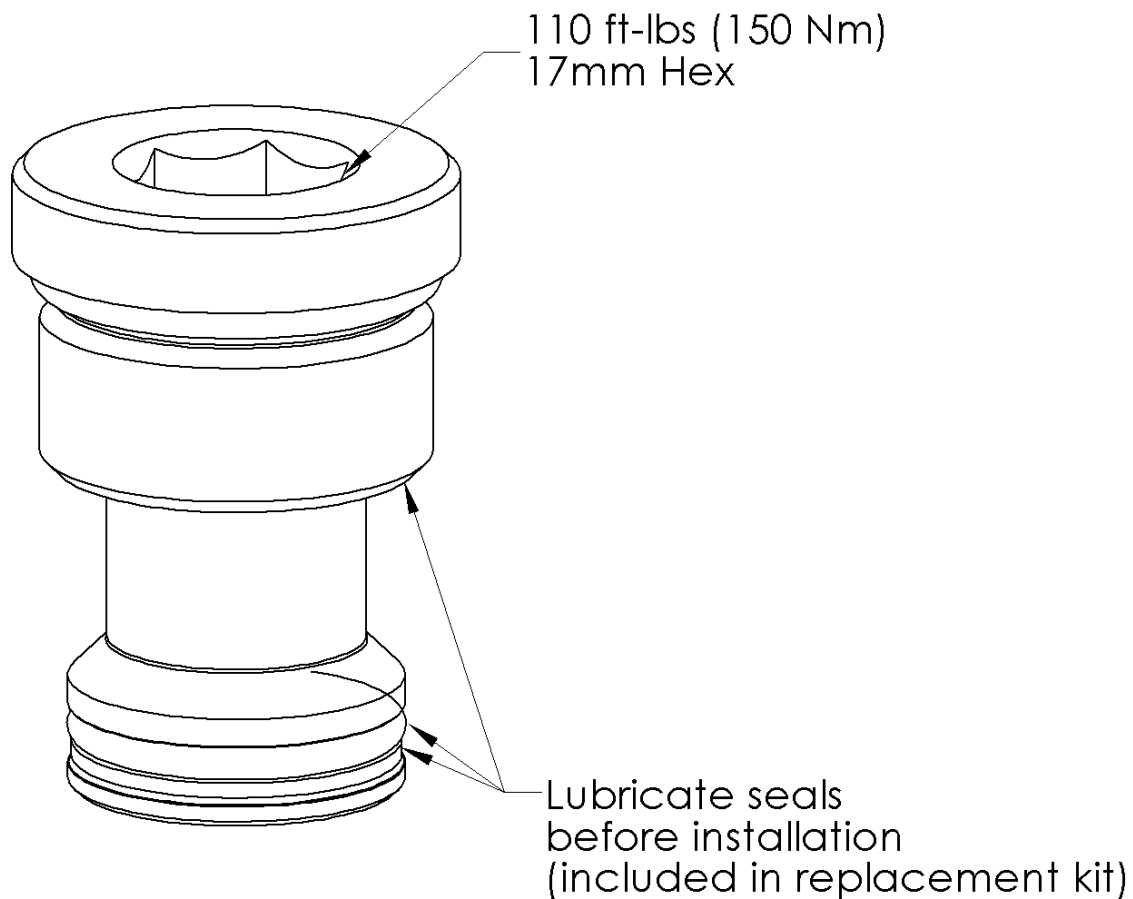
Plug replacing electric control solenoid valve

*No seal kit available for this plug

	Valve Series	Coordinate ID
	DX-6	AA08

PE21

*For use with I23B (2900686) inlet



Part No

6900012644

Description

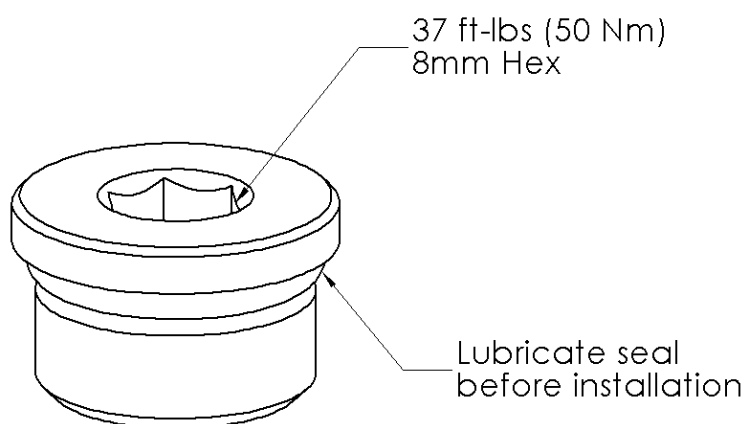
Plug replacing electric control solenoid valve

3052427

Replacement seal kit for EU12/PE21

	Valve Series	Coordinate ID
	DX-6	FR05

PM02



Part No


6900002256

Description

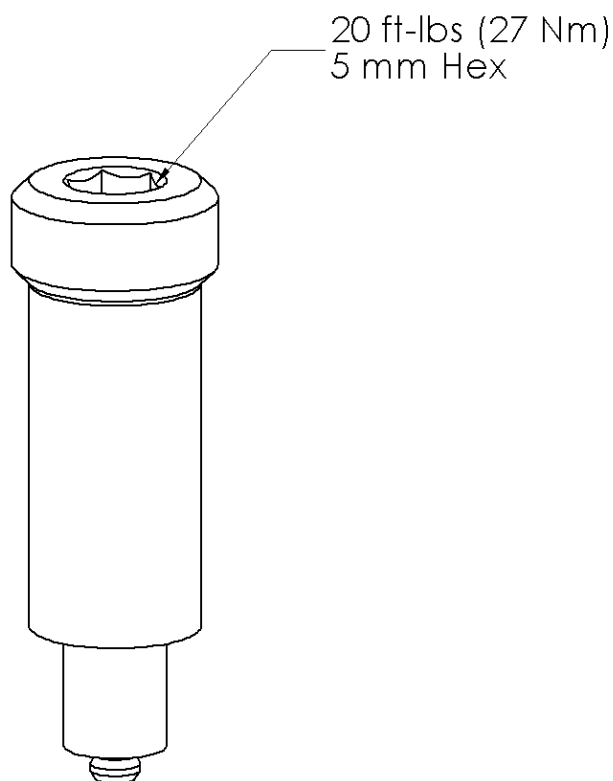
Plug disconnecting parallel passage pump flow passage.

6900005871

Replacement seal for PM02

	Valve Series	Coordinate ID
	DX-6	AA12

Metering orifice



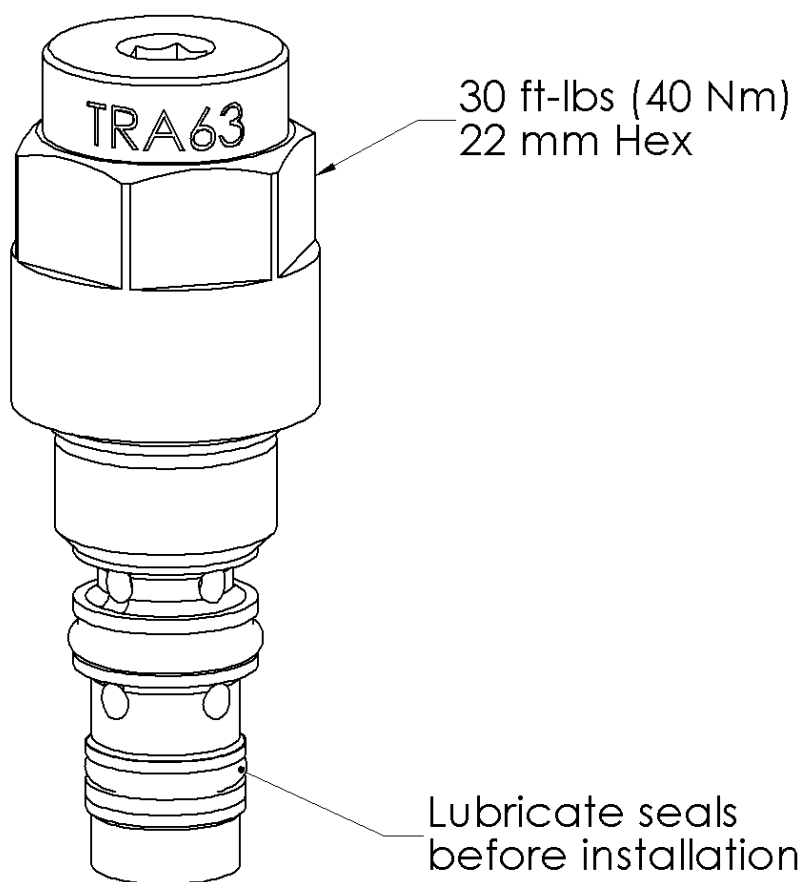
Model Code	Part No	Description
PF08	2900476	Metering orifice for center channel flow, 2 gpm, in combination with FK29 and pump flow 25 gpm; green.
PF16	2900475	Metering orifice for center channel flow, 4 gpm, in combination with FK29 and pump flow 25 gpm; orange.
PF30	2900119	Metering orifice for center channel flow, 8 gpm, in combination with FK29 and pump flow 25 gpm; red.
PF50	6900010858	Metering orifice for center channel flow, 13 gpm, in combination with FK29 and pump flow 25 gpm; yellow.
PF60	2900141	Metering orifice for center channel flow, 16 gpm, in combination with FK29 and pump flow 25 gpm; blue.

	Valve Series	Coordinate ID
	DX-6	AA28

TRA63

Replacement seal kit includes:

- x1 pc 8.3x2.4
- x1 pc 10.3x2.4
- x1 pc 15.4x2.1
- x1 pc 11.0x15.0x1.0 backup



Part No


6900000064

2901893

Description

Pressure reducing valve, pilot pressure 350 psi

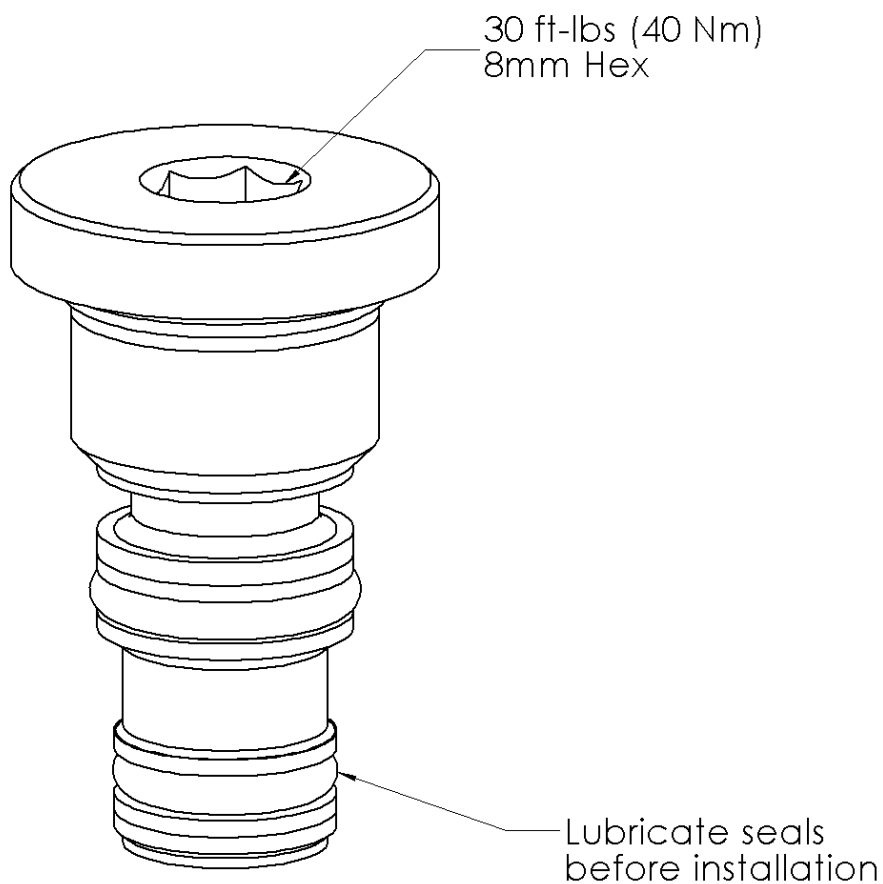
Replacement seal kit for TRA63/P63

	Valve Series	Coordinate ID
	DX-6	AA28

P63

Replacement seal kit includes:

- x1 pc 8.3x2.4
- x1 pc 10.3x2.4
- x1 pc 15.4x2.1



Part No

3522640

Description

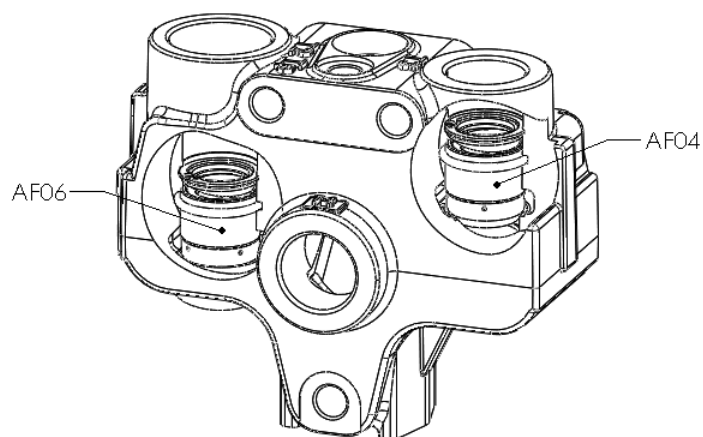
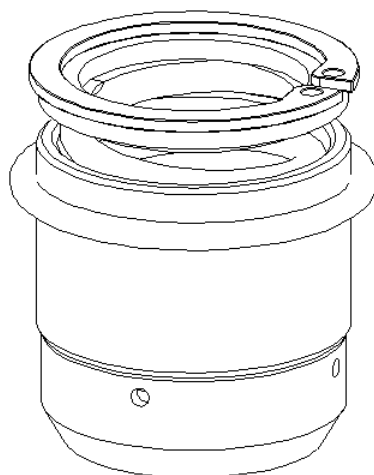
Plug replacing pressure reducing valve.

2901893

Replacement seal kit for TRA63/P63

	Valve Series	Coordinate ID
	DX-6	AF04,AF06


BUP14



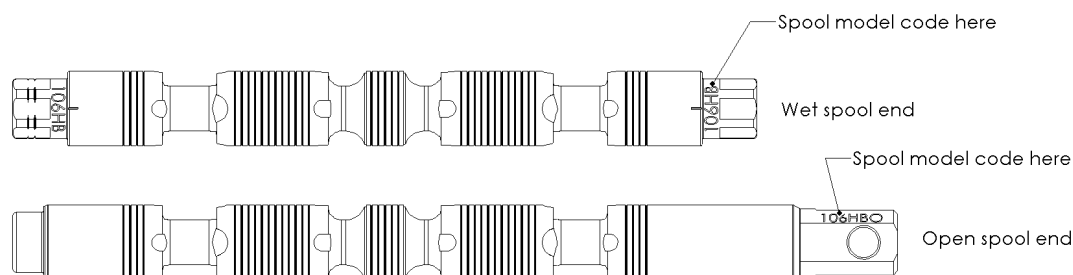
Part No
3522640

Description


Back-up unit. Opening pressure 145 psi; designed for 0-50 gpm. In coordinate AF04 back-up pressure for pilot supply. In coordinate AF06 back-up pressure for anticavitation function.

 Spare parts list	Valve Series	Coordinate ID
	DX-6	BH

Spools

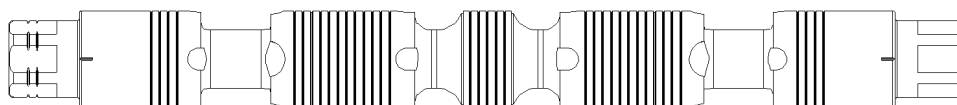


Model Code	Part No	Description
106HB	3807660	Spool, 3-positional double acting. Pump flow 140 l/min. Port flow 140 l/min at pump pressure 250 bar. Wet spool ends
106HBO	3778309	Spool, 3-positional double acting. Pump flow 140 l/min. Port flow 140 l/min at pump pressure 250 bar. Open spool ends
136HB	3800603	Spool, 3-positional double acting. Pump flow 180 l/min. Center flow 30 l/min. Wet spool ends
156HC	3800471	Spool, 3-positional double acting. Pump flow 180 l/min. Center flow 60 l/min. Wet spool ends
164HB	3780667	Spool, 3-positional double acting. Center flow 60-69 l/min at pump flow 100 l/min. Port flow 100 l/min at pump pressure 250 bar. Wet spool ends
406HB	3807996	Motor spool, 3-positional double acting. Pump flow 140 l/min. Port flow 140 l/min at pump pressure 250 bar. Wet spool ends
406HBO	3778438	Motor spool, 3-positional double acting. Pump flow 140 l/min. Port flow 140 l/min at pump pressure 250 bar. Open spool ends
436HB	3800716	Motor spool, 3-positional double acting. Pump flow 180 l/min. Center flow 30 l/min. Wet spool ends
465HB	3781335	Motor spool, 3-positional double acting. Center flow 60-69 l/min at pump flow 100 l/min. Port flow 120 l/min at pump pressure 250 bar. Wet spool ends
706HB	3809339	Series spool, 3-positional double acting. Pump flow 140 l/min. Return flow goes A/B to ceter via parallel passage. Wet spool ends
706HBO	3778606	Series spool, 3-positional double acting. Pump flow 140 l/min. Return flow goes A/B to ceter via parallel passage. Open spool ends
864BB	3781416	Regenerative spool, 3-positional double acting. Center flow 60-69 l/min at pump flow 100 l/min. Port flow 100 l/min at pump pressure 250 bar. Wet spool ends


	Valve Series	Coordinate ID
	DX-6	BH

Obsolete Spools

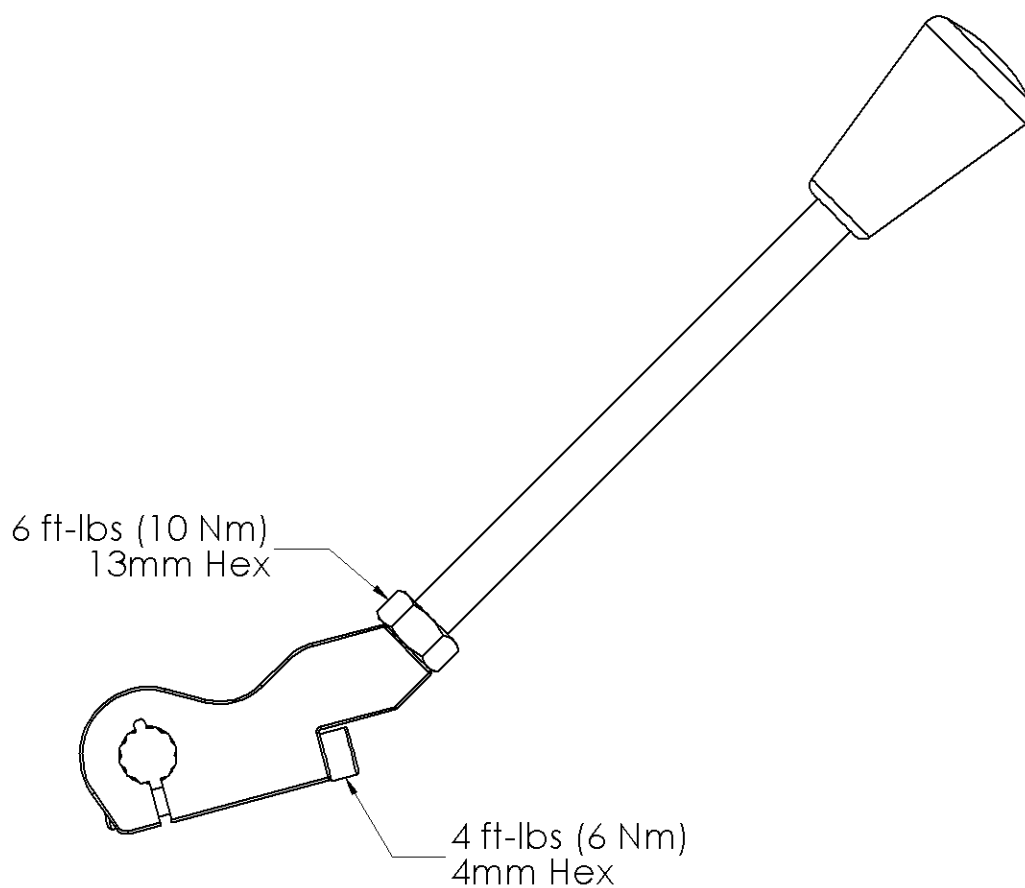
*Previously used in S23L (2900144) body



164HA	2900146	Spool, 3-positional double acting. Center flow 60-69 l/min at pump flow 100 l/min. Port flow 100 l/min at pump pressure 250 bar. Wet spool ends. (Replaced by 164HB)
464SA	2900251	Motor spool, 3-positional double acting. Center flow 60-69 l/min at pump flow 100 l/min. Port flow 100 l/min at pump pressure 250 bar. Wet spool ends. (Replaced by 464SB)
465HA	2900147	Motor spool, 3-positional double acting. Center flow 60-69 l/min at pump flow 100 l/min. Port flow 120 l/min at pump pressure 250 bar. Wet spool ends. (Replaced by 465HB)
864BA	6900010269	Regenerative spool, 3-positional double acting. Center flow 60-69 l/min at pump flow 100 l/min. Port flow 100 l/min at pump pressure 250 bar. Wet spool ends. (Replaced by 864BB)

	Valve Series	Coordinate ID
	DX-6	LEVER

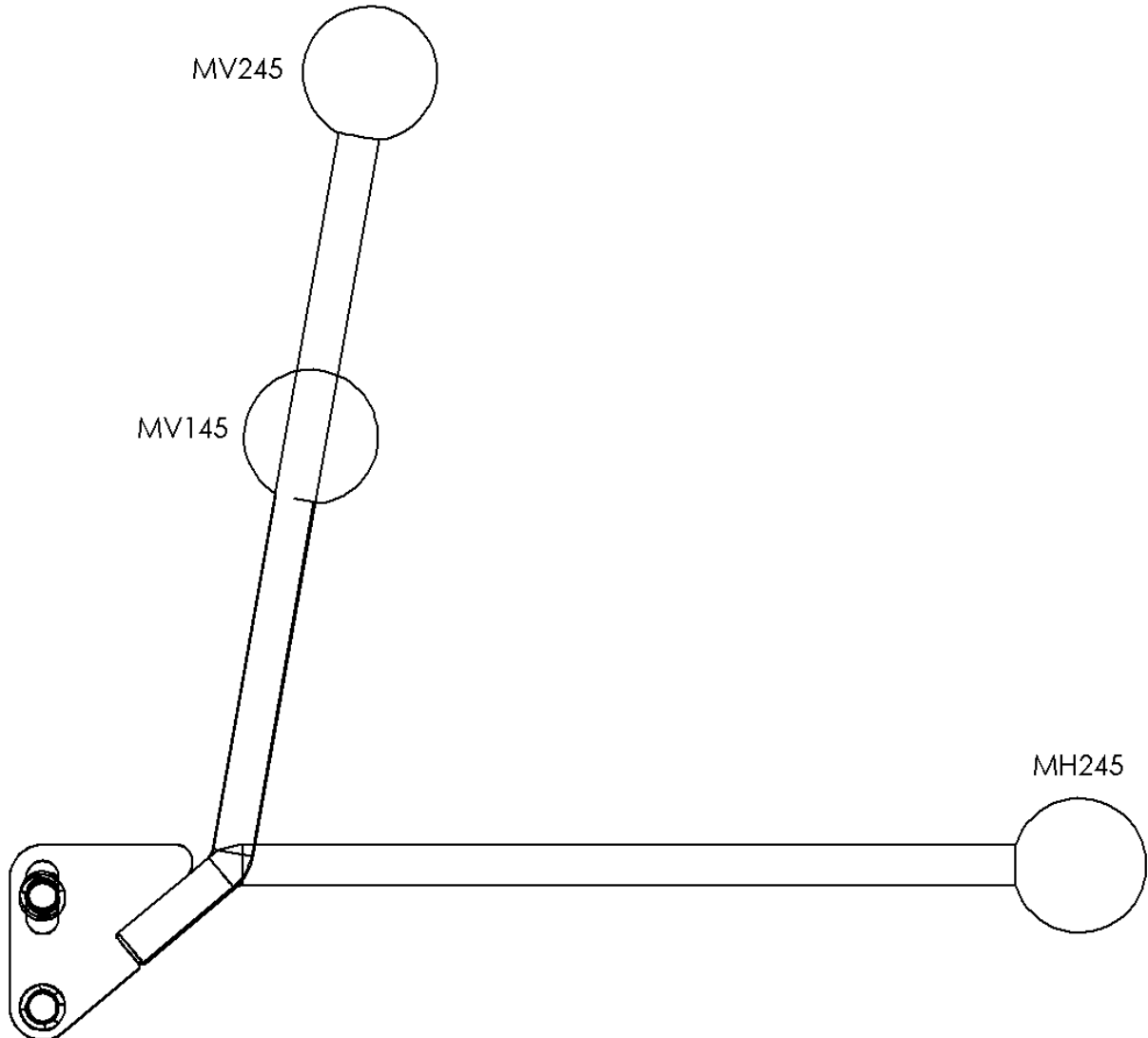
MSK190



Part No
3550295

Description
Complete hand lever for hexagon shaft on
M1, H2M1 and EHM100 spool controls.

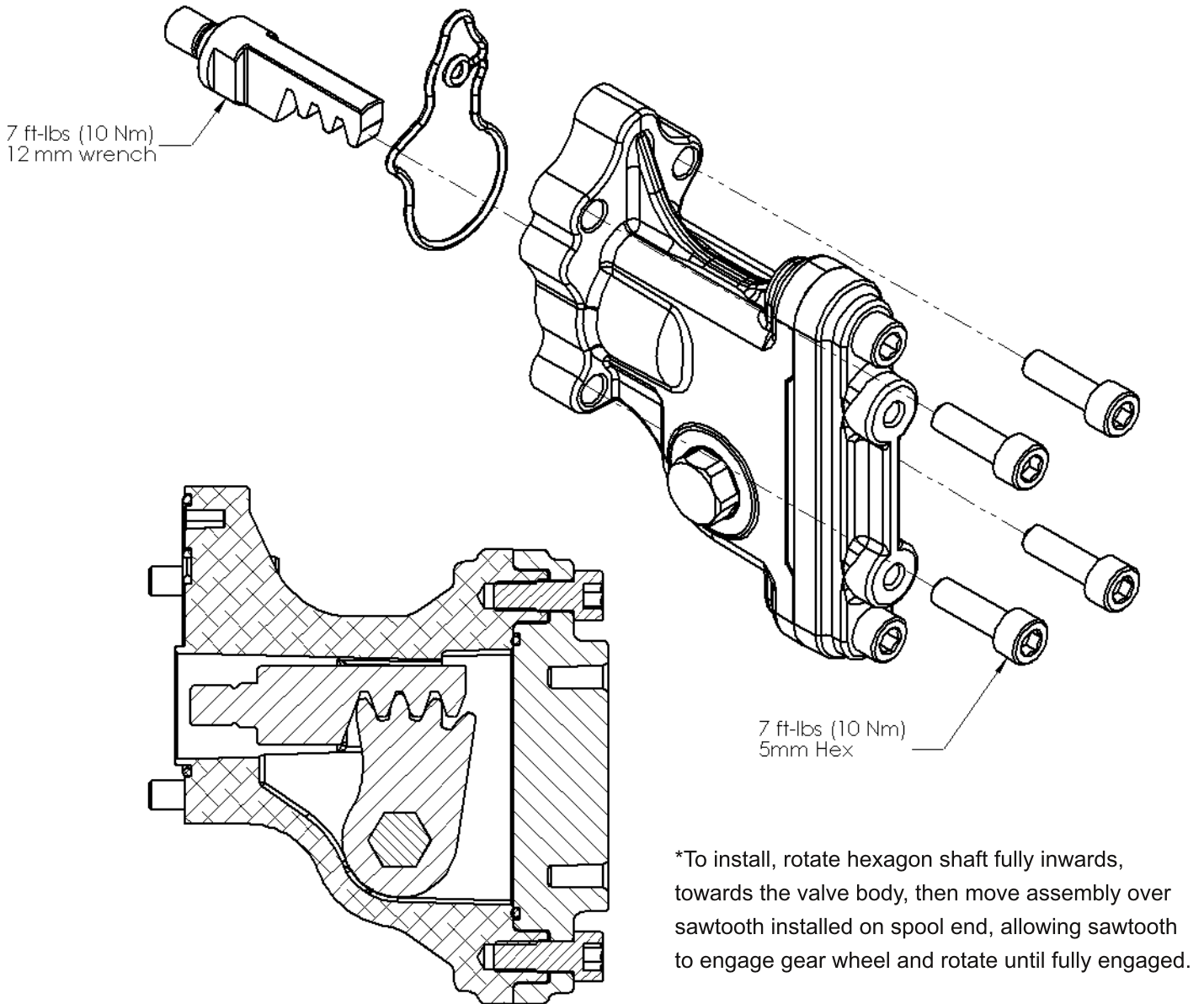
MV245, MH245, MV145



Part No	Description
2092029	Lever for use in combination with bracket M03; includes 1 lever, 1 ball knob, 2 pins and 4 e-clips; lever is vertical and 9.5"
2092591	Lever for use in combination with bracket M03; includes 1 lever, 1 ball knob, 2 pins and 4 e-clips; lever is horizontal and 9.5"
2093753	Lever for use in combination with bracket M03; includes 1 lever, 1 ball knob, 2 pins and 4 e-clips; lever is vertical and 5.5"

M1

*Hand lever sold separately



Part No

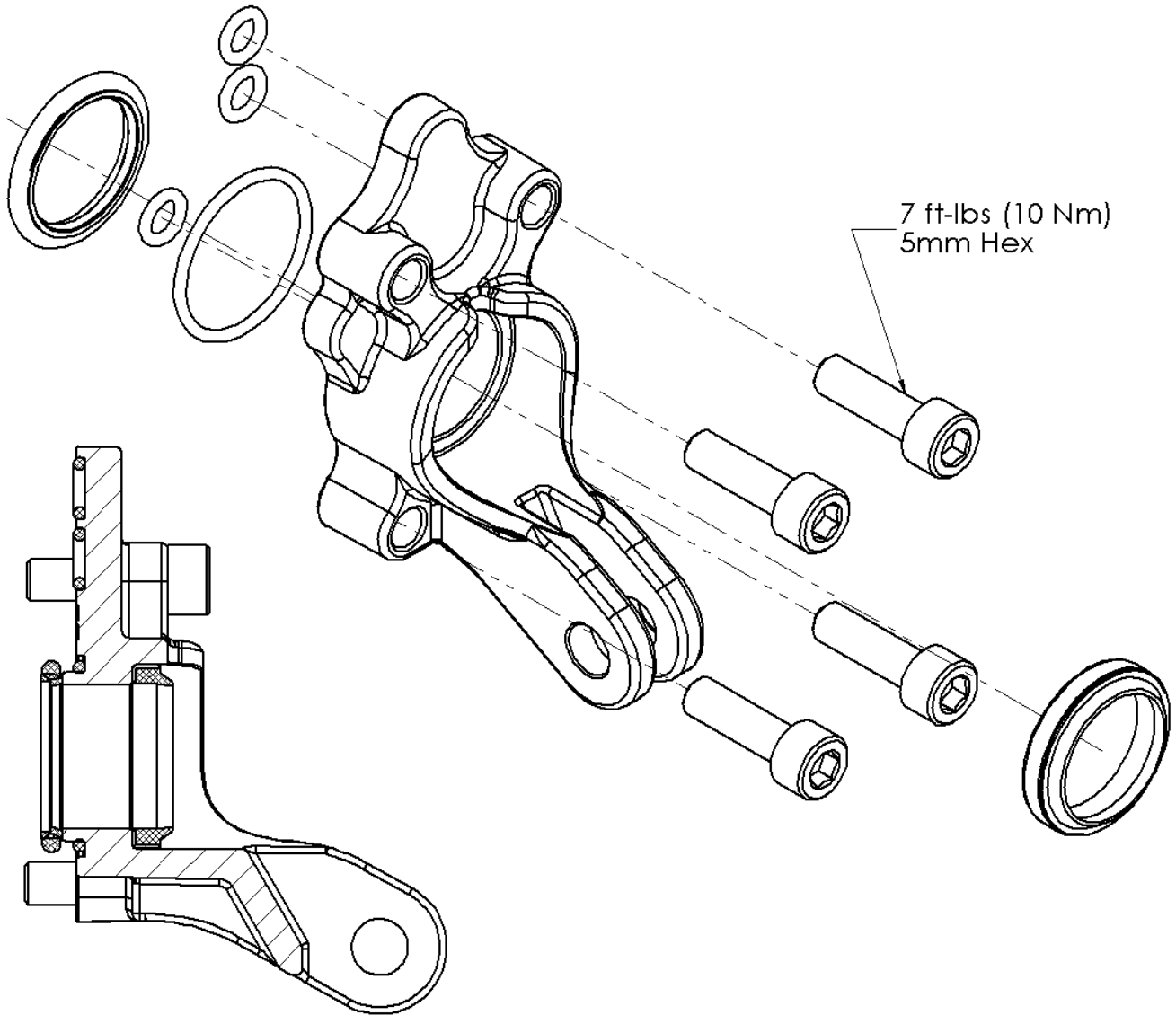
2900150

Description

Manual control for level, for 3-positional spools; wet spool end to be used with 9M1

M03

*Hand lever sold separately



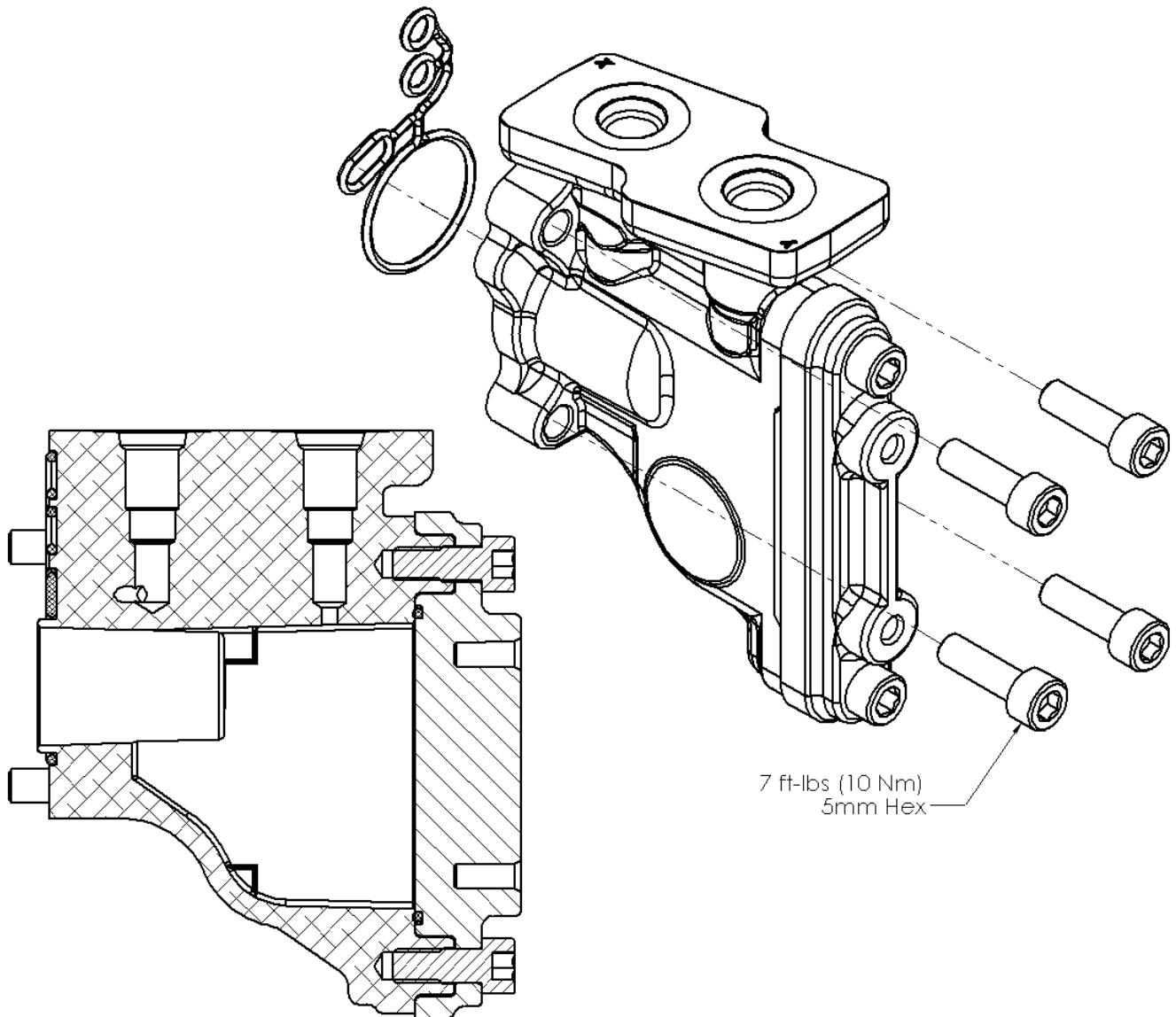
Part No

6900012776

Description

Manual actuator for spools with open ends. To be used with 3-position spools, to be used with 9M01; lever to be order as separate item.

H2



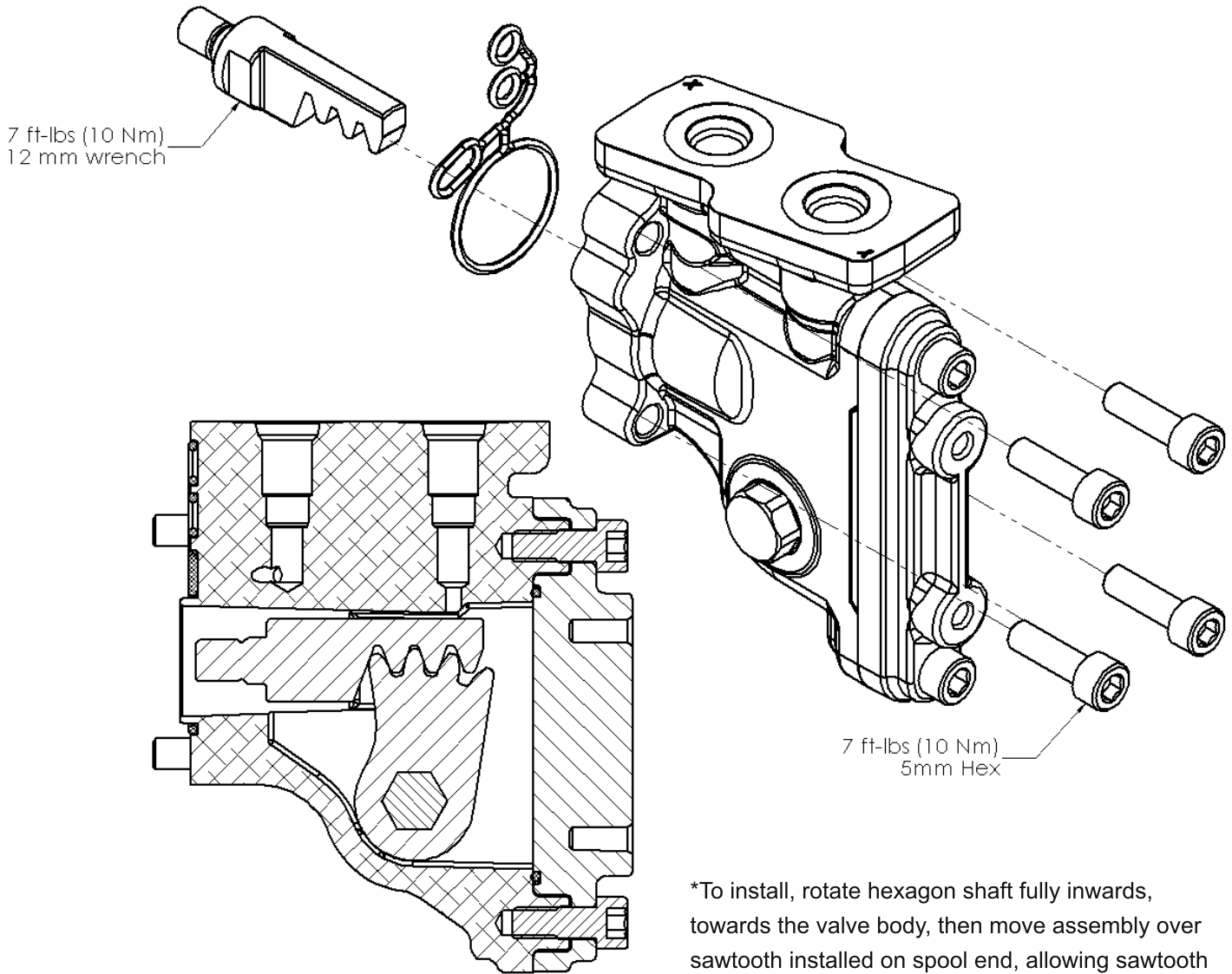
Part No
2900123

Description

Hydraulically operated spool actuator for 3-positional spools; Ports marked "x" and "y" are SAE-4, pressure in "x" moves spool position II (out) and pressure in "y" moves spool position III (in). Control pressure 80-250 psi; max 725 psi. To be used with 9R1.

H2M1

*Hand lever sold separately



*To install, rotate hexagon shaft fully inwards, towards the valve body, then move assembly over sawtooth installed on spool end, allowing sawtooth to engage gear wheel and rotate until fully engaged.

Part No

2900124

Description

Hydraulically operated spool actuator for 3-positional spools with manual override; Ports marked "x" and "y" are SAE-4, pressure in "x" moves spool position II (out) and pressure in "y" moves spool position III (in). Control pressure 80-250 psi; max 725 psi. To be used with 9R1.



Spare parts list

Valve Series

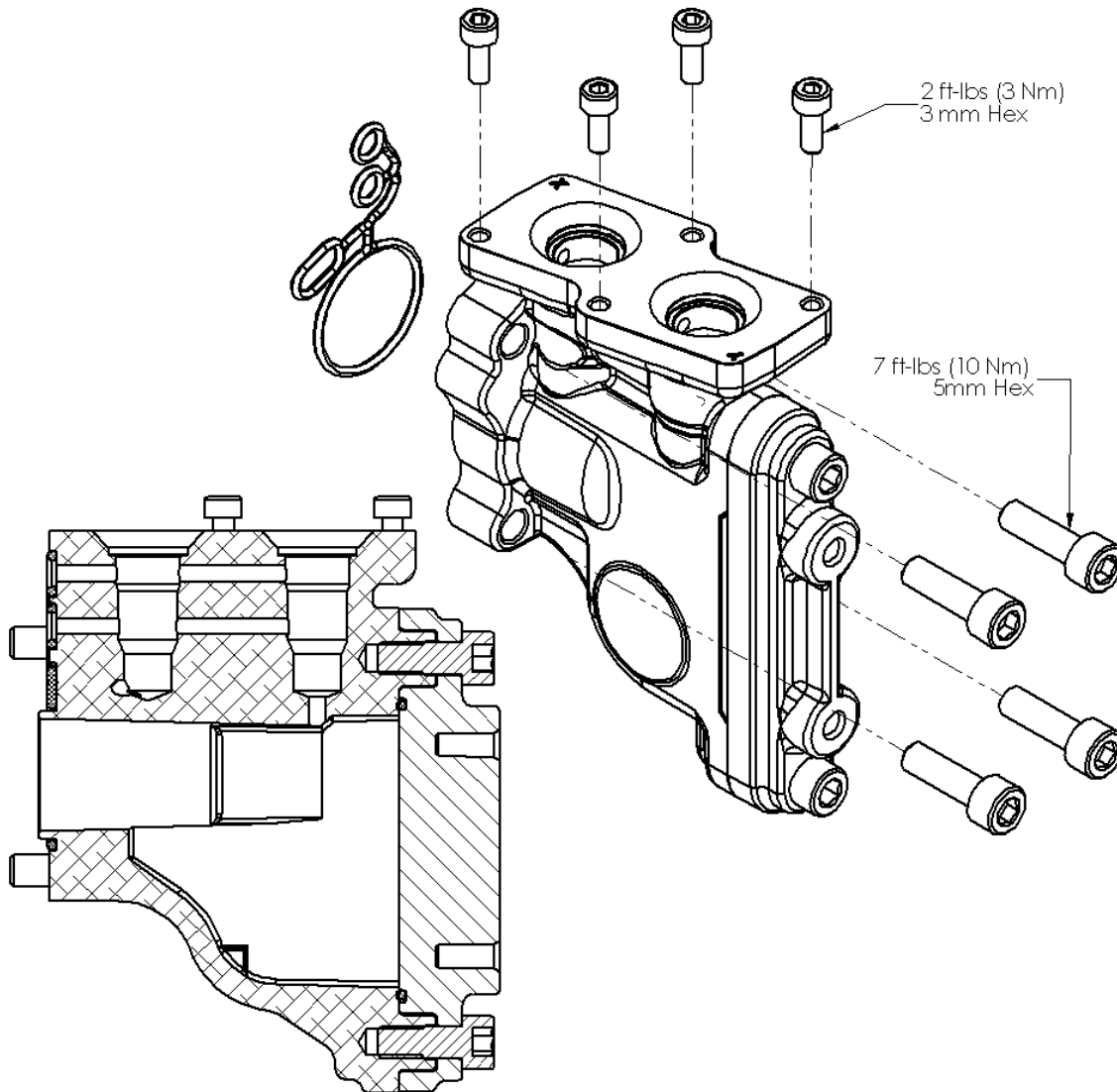
Coordinate ID

DX-6

DM

EH100

*Solenoids sold separately



Part No

2900116

Description

Electro-hydraulic spool control for 3-position spool. Ports marked "x" and "y" are solenoid cavities, pressure in "x" moves spool position II (out) and pressure in "y" moves spool position III (in). To be used with 9R1.



Spare parts list

Valve Series

Coordinate ID

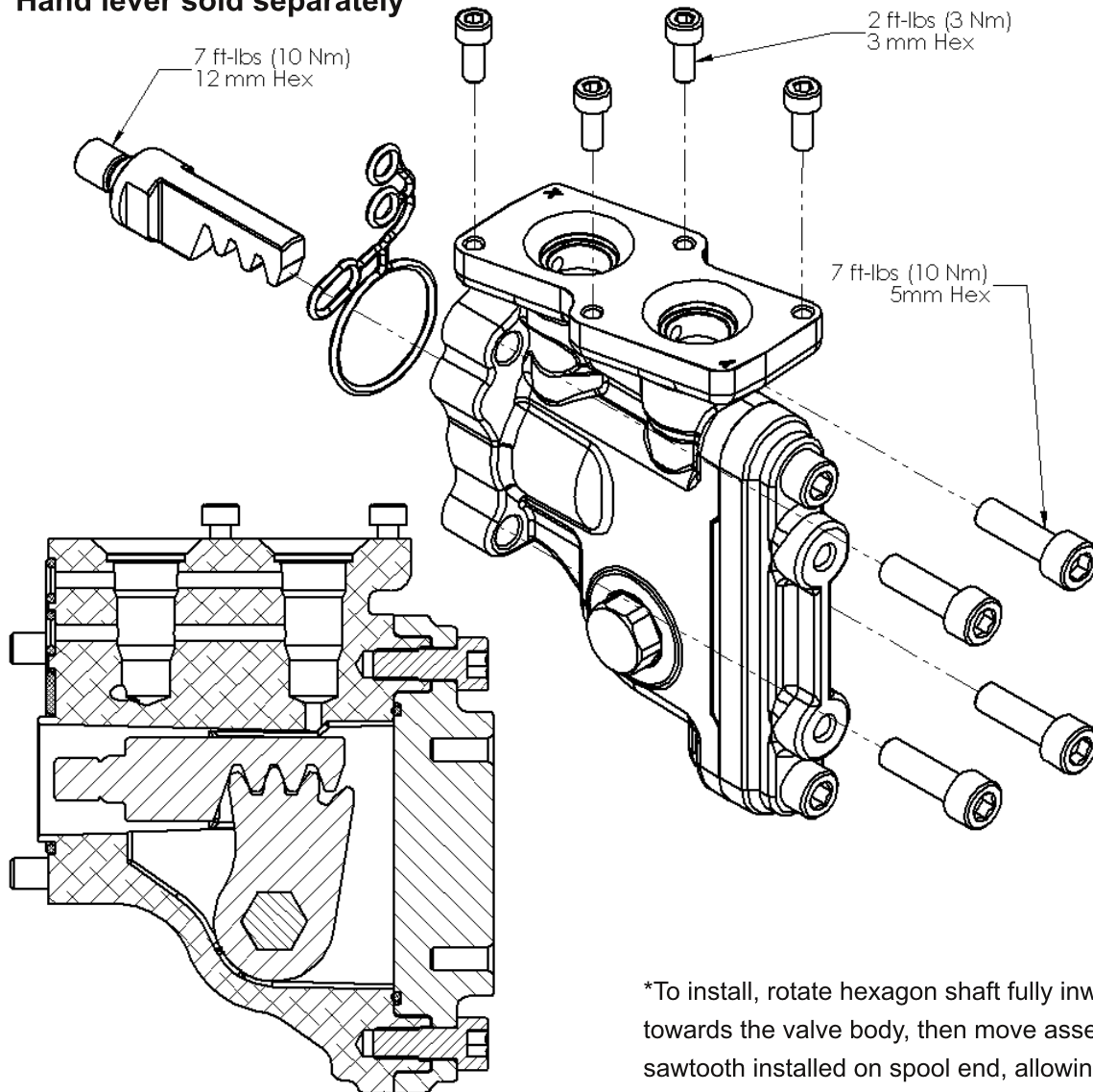
DX-6

DM

EHM100

*Solenoids sold separately

*Hand lever sold separately



*To install, rotate hexagon shaft fully inwards, towards the valve body, then move assembly over sawtooth installed on spool end, allowing sawtooth to engage gear wheel and rotate until fully engaged.

Part No

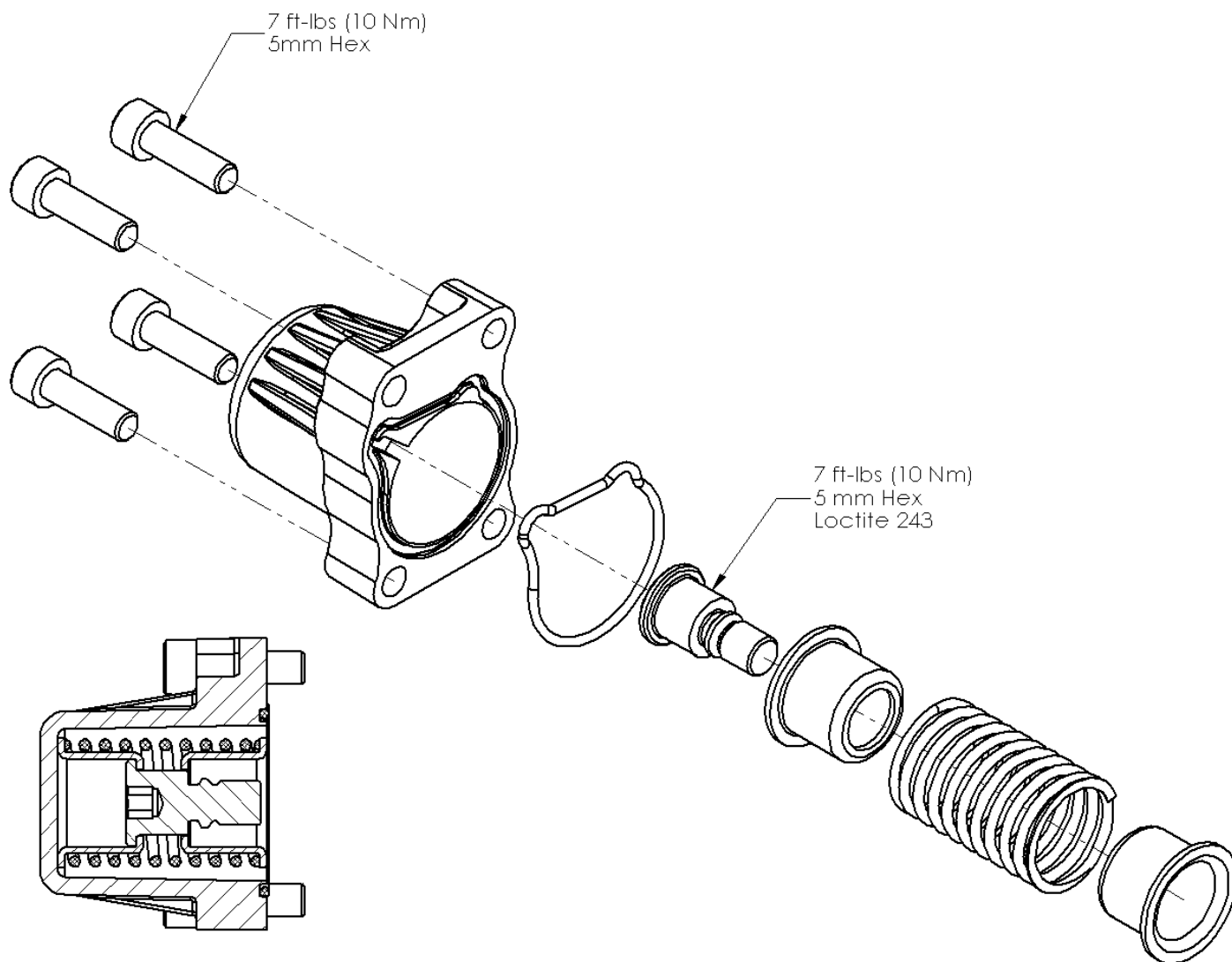
2900115

Description

Electro-hydraulic spool control for 3-position spool with manual override. Ports marked "x" and "y" are solenoid cavities, pressure in "x" moves spool position II (out) and pressure in "y" moves spool position III (in). To be used with 9R1.

 Spare parts list	Valve Series	Coordinate ID
	DX-6	DB

9M1

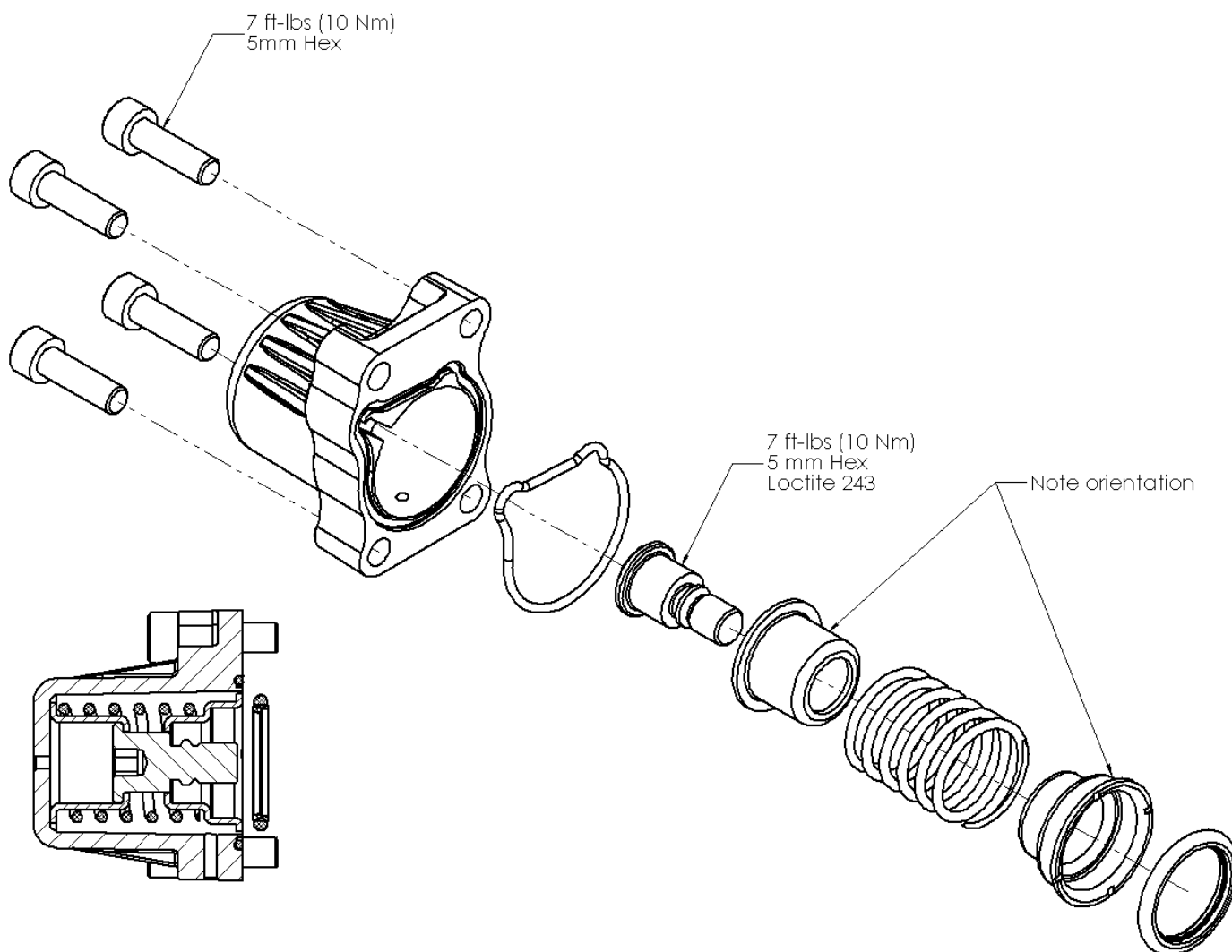


Part No
2900149

Description
Spool control, manual for 3-position spools. Closed cap for wet spool ends, to be used with M1.

	Valve Series	Coordinate ID
	DX-6	DB

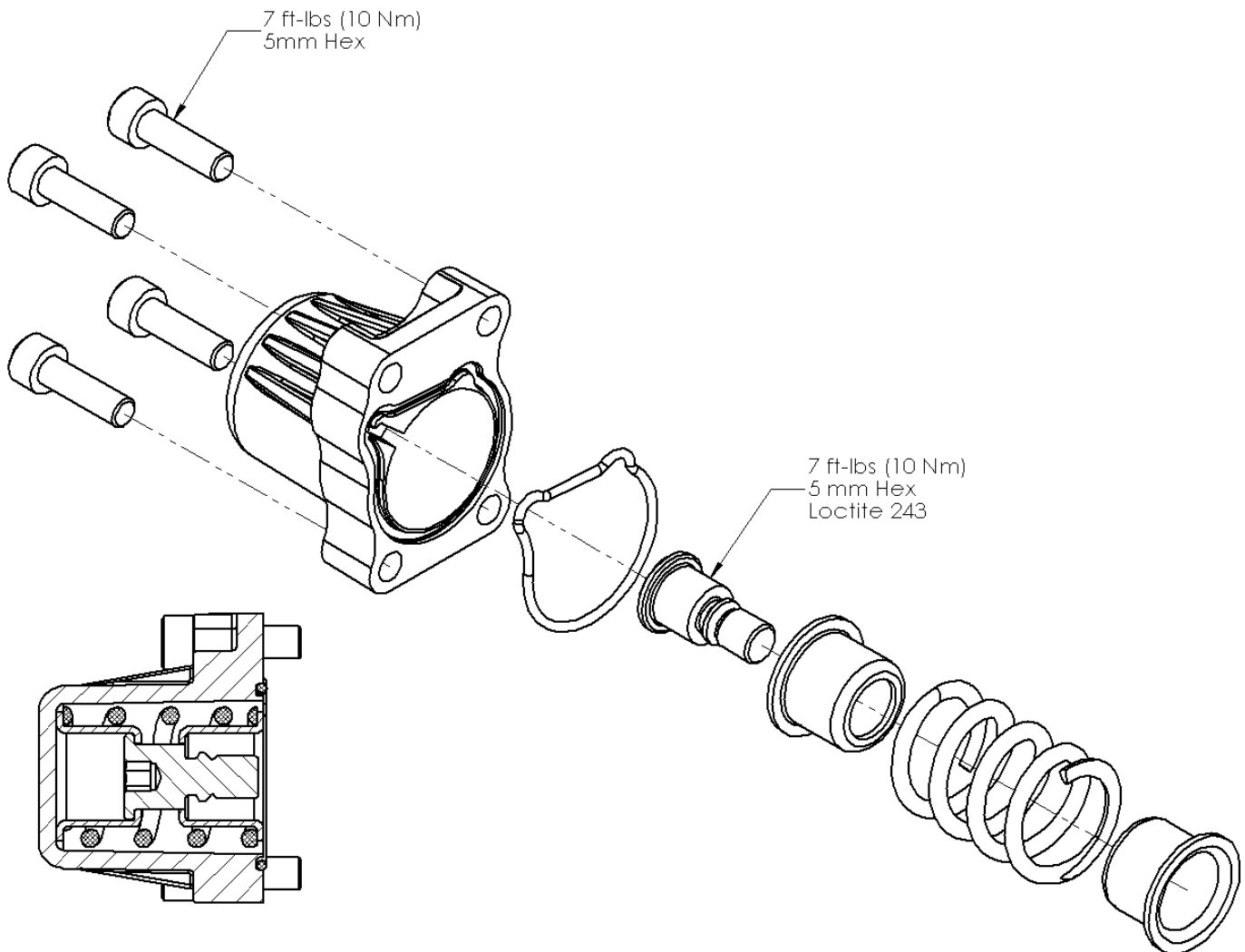
9M01



Part No
3677614

Description
Spool control, manual for 3-position spools with open ends. To be used with M09.

9R1




Part No

2900252

Description

Spool control, 3-position, for proportional pressure control. Control pressure 80 - 250 psi; max supplied pressure 725 psi. To be used with H2, H2M1, EH100 and EHM100

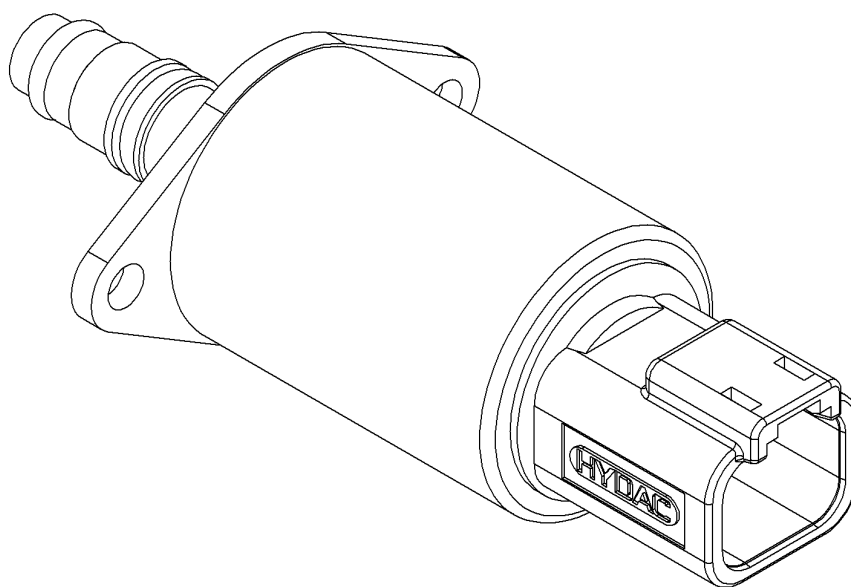
	Valve Series	Coordinate ID
	DX-6	

Replacement seal kit includes:

x1 pc 14.1x2.4

x1 pc 6.5x1.5

x1 pc 8.5x1.5



Part No

2900563

2900564

2900661


Description

Replacement solenoid 12VDC, deutsch connector*

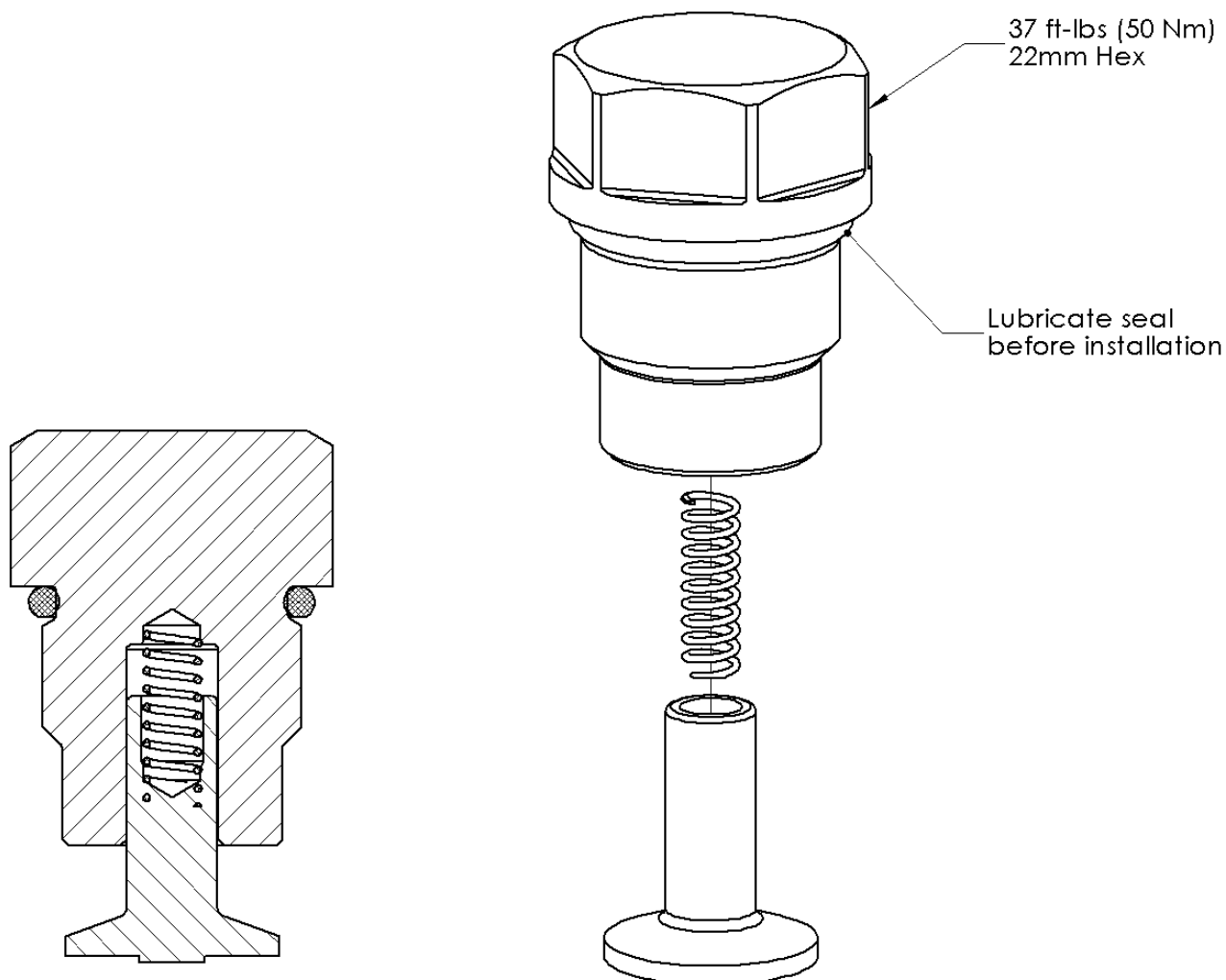
Replacement solenoid 24 VDC, deutsch connector*

Replacement seal kit for solenoids

*includes mounting screws

	Valve Series	Coordinate ID
	DX-6	CU

MB29



Part No

2900148

6900002416

Description

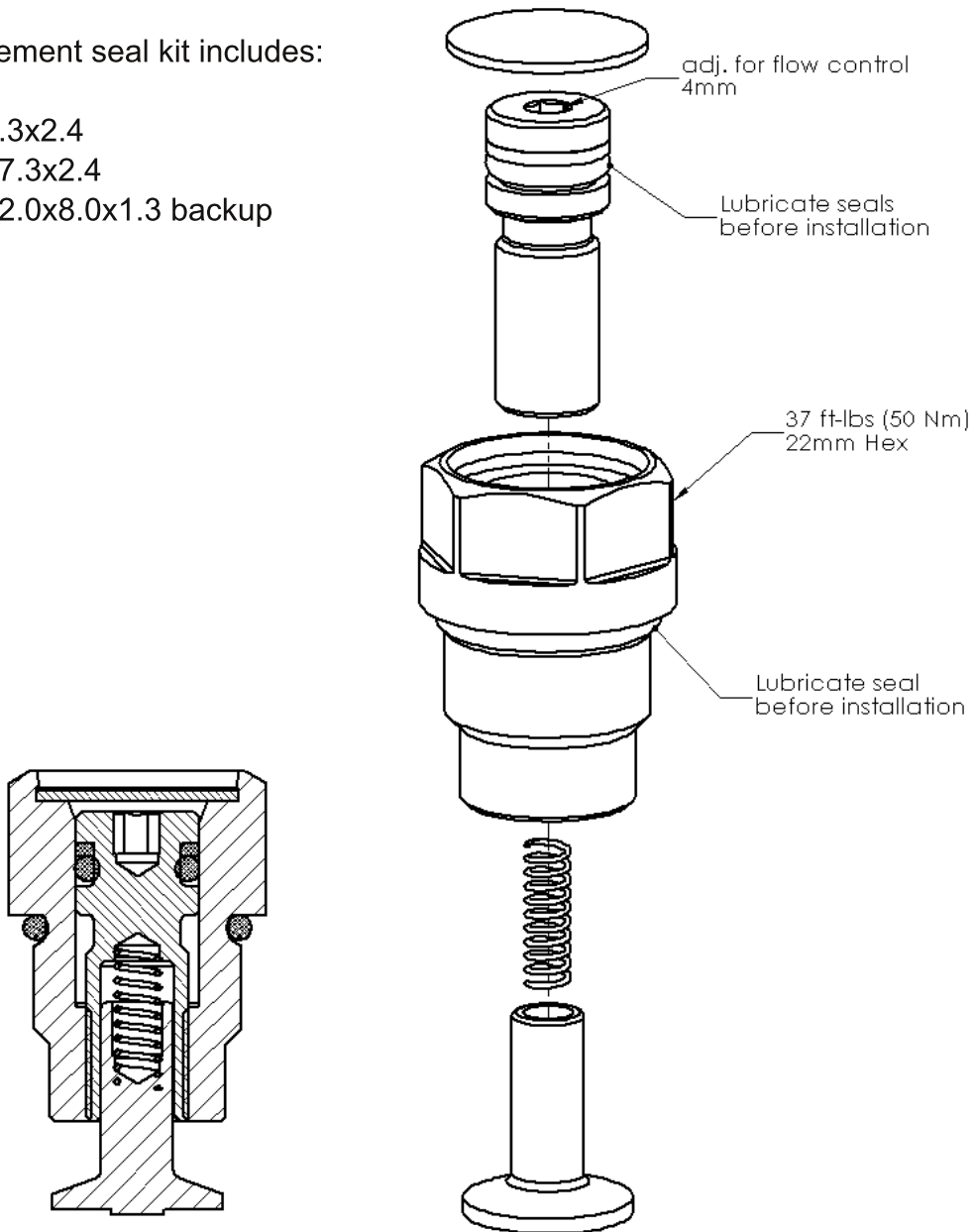
Load check valve

Replacement seal for MB29 load check

MF29

Replacement seal kit includes:

- x1 pc 7.3x2.4
- x1 pc 17.3x2.4
- x1 pc 12.0x8.0x1.3 backup



Part No

2900114

Description

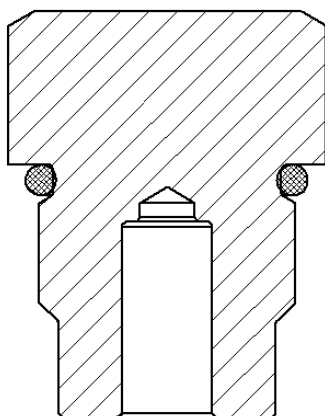
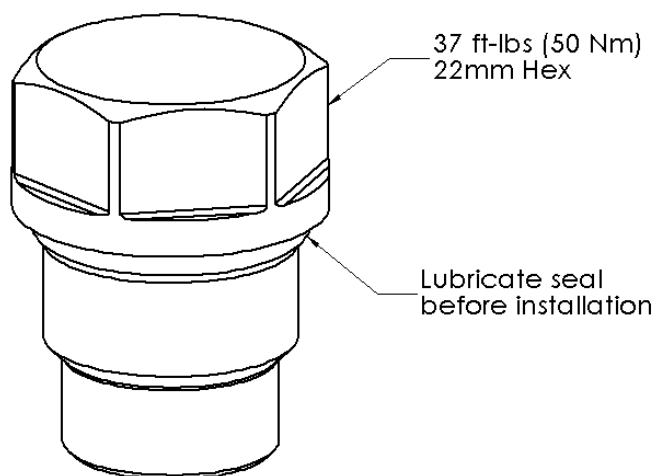
Load check valve with adjustable flow limitation

2901894

Replacement seal kit for MF29 load check

	Valve Series	Coordinate ID
	DX-6	CU

MP29



Part No

2900148

6900002416

Description

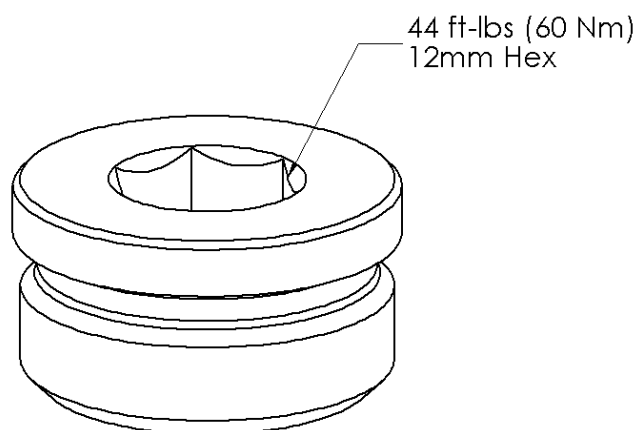
Cavity plug when load check function is not needed

Replacement seal for MP29 plug

	Valve Series	Coordinate ID
	DX-6	FR05

PS29

*For use with U13L (2900143) outlet



Part No
2900117

Description
Carry over plug

	Valve Series	Coordinate ID
	DX-6	FR05

SU31

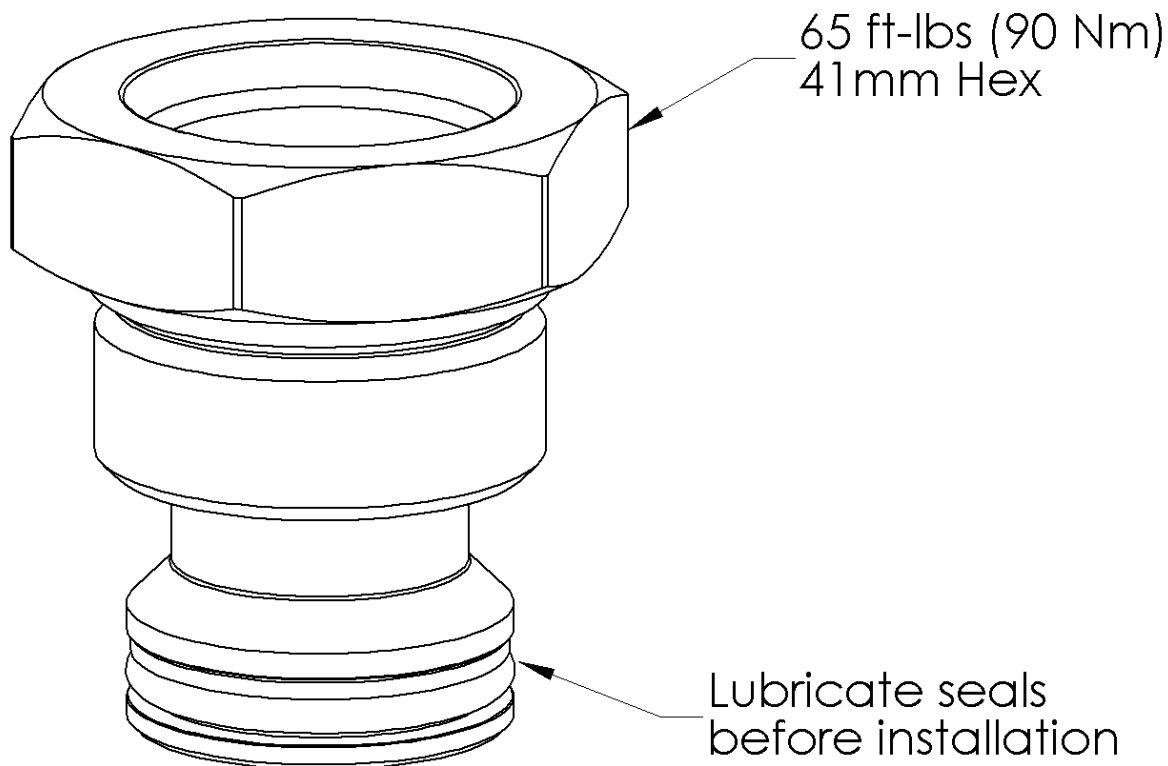
*For use with US24L (6900014203) outlet

Replacement seal kit includes:

x1 pc 29.3x2.3

x1 pc 23.47x2.62

x1 pc 23.8x28.0x1.3 backup



Part No


6900014205

Description

Carry over plug, inner thread SAE-12

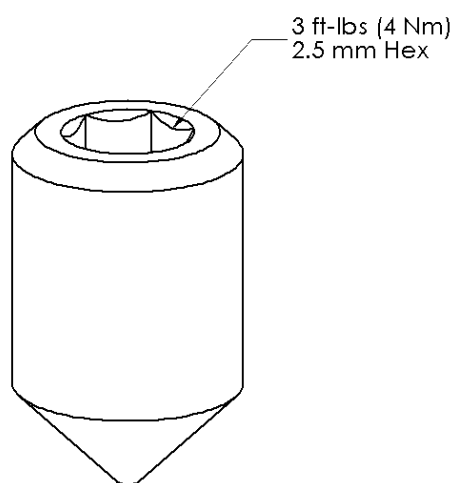
2901895

Replacement seal kit for SU31

	Valve Series	Coordinate ID
	DX-6	TD5

PMS6

*For use with U13L (2900143) outlet



Part No
2900253

Description
Set screw, isolates pilot and main return oil flow.

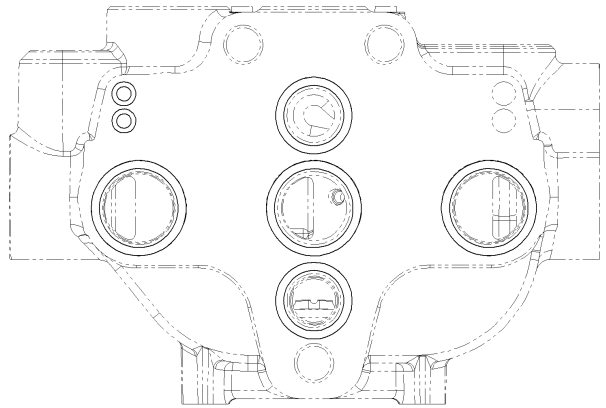
SSK

- Seal interface on inlet body includes (4) blanks for 5.28x1.78 seals; install (2x) seals per notation
- Note: seals align with corresponding pilot holes on the adjacent section

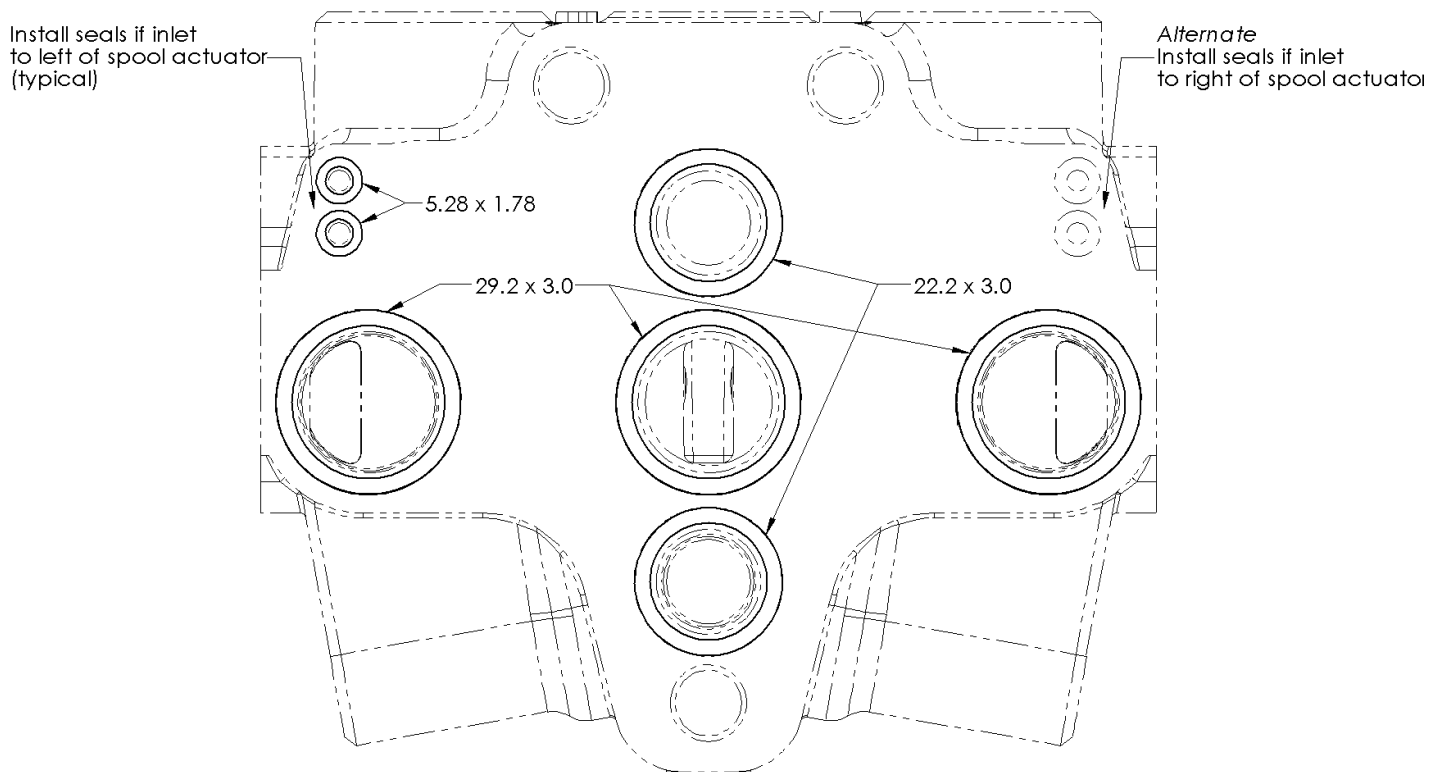
Kit includes:

- x3 pc 29.2x3.0
- x2 pc 22.2x3.0
- x2 pc 5.28x1.78

Inlet Interface



Section Interface

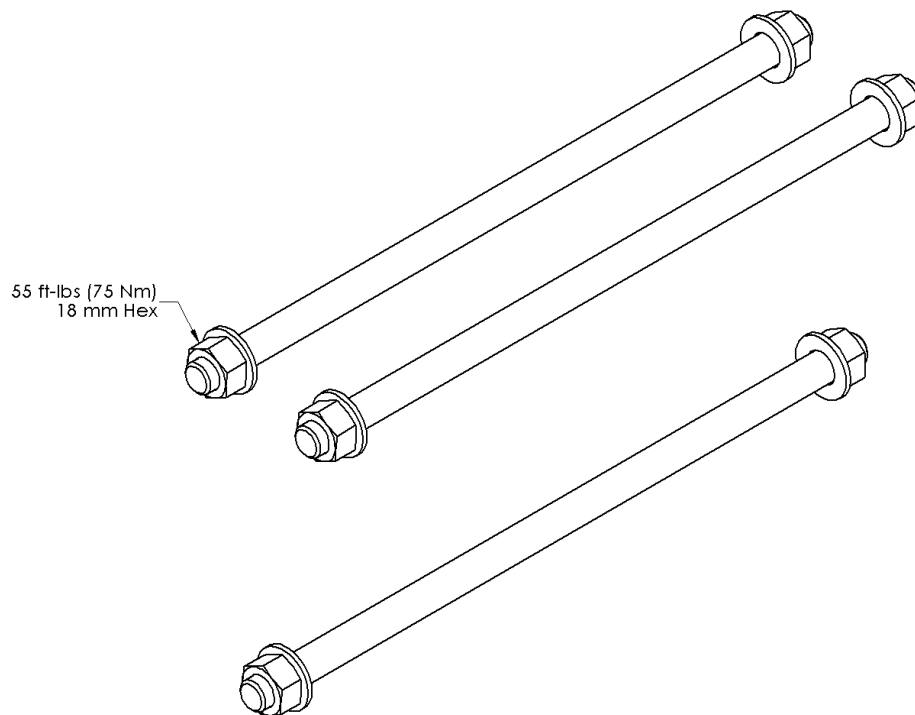


Part No
2900138

Description
Section face seal kit

	Valve Series	Coordinate ID
	DX-6	AL00

Tie Rod Kits



Part No.	Model Code	Description	Length mm [in]
2900292	R190	Tie rod kit, for one section. Contains 3 rods, 6 washers and 6 nuts	191 [7.52]
2900293	R290	Tie rod kit, for two sections. Contains 3 rods, 6 washers and 6 nuts	239 [9.41]
2900246	R390	Tie rod kit, for three sections. Contains 3 rods, 6 washers and 6 nuts	287 [11.30]
2900247	R490	Tie rod kit, for four sections. Contains 3 rods, 6 washers and 6 nuts	335 [13.19]
2900248	R590	Tie rod kit, for five sections. Contains 3 rods, 6 washers and 6 nuts	383 [15.08]
2900249	R690	Tie rod kit, for six sections. Contains 3 rods, 6 washers and 6 nuts	431 [16.97]
2900294	R790	Tie rod kit, for seven sections. Contains 3 rods, 6 washers and 6 nuts	479 [18.86]
2900295	R890	Tie rod kit, for eight sections. Contains 3 rods, 6 washers and 6 nuts	527 [20.75]
2900296	R990	Tie rod kit, for nine sections. Contains 3 rods, 6 washers and 6 nuts	575 [22.64]
2900297	R1090	Tie rod kit, for ten sections. Contains 3 rods, 6 washers and 6 nuts	623 [24.53]
2900417	R1190	Tie rod kit, for eleven sections. Contains 3 rods, 6 washers and 6 nuts	671 [26.42]

Part No.	Model Code	Description	Length mm [in]
6900014187	R19	Tie rod kit, for one section. Contains 3 rods, 3 washers and 3 nuts; for use with combination outlet US24L	95[3.74]
6900014188	R29	Tie rod kit, for two sections. Contains 3 rods, 3 washers and 3 nuts; for use with combination outlet US24L	143[5.63]
6900014189	R39	Tie rod kit, for three sections. Contains 3 rods, 3 washers and 3 nuts; for use with combination outlet US24L	191[7.52]
6900014190	R49	Tie rod kit, for four sections. Contains 3 rods, 3 washers and 3 nuts; for use with combination outlet US24L	239[9.41]
6900014191	R59	Tie rod kit, for five sections. Contains 3 rods, 3 washers and 3 nuts; for use with combination outlet US24L	287[11.30]
6900014192	R69	Tie rod kit, for six sections. Contains 3 rods, 3 washers and 3 nuts; for use with combination outlet US24L	335[13.19]
6900014193	R79	Tie rod kit, for seven sections. Contains 3 rods, 3 washers and 3 nuts; for use with combination outlet US24L	383[15.08]
6900014194	R89	Tie rod kit, for eight sections. Contains 3 rods, 3 washers and 3 nuts; for use with combination outlet US24L	431[16.97]
6900014195	R99	Tie rod kit, for nine sections. Contains 3 rods, 3 washers and 3 nuts; for use with combination outlet US24L	479[18.86]
6900014196	R109	Tie rod kit, for ten sections. Contains 3 rods, 3 washers and 3 nuts; for use with combination outlet US24L	527[20.75]
6900014197	R119	Tie rod kit, for eleven sections. Contains 3 rods, 3 washers and 3 nuts; for use with combination outlet US24L	575[22.64]



Spare parts list

Valve Series

Coordinate ID

DX-6

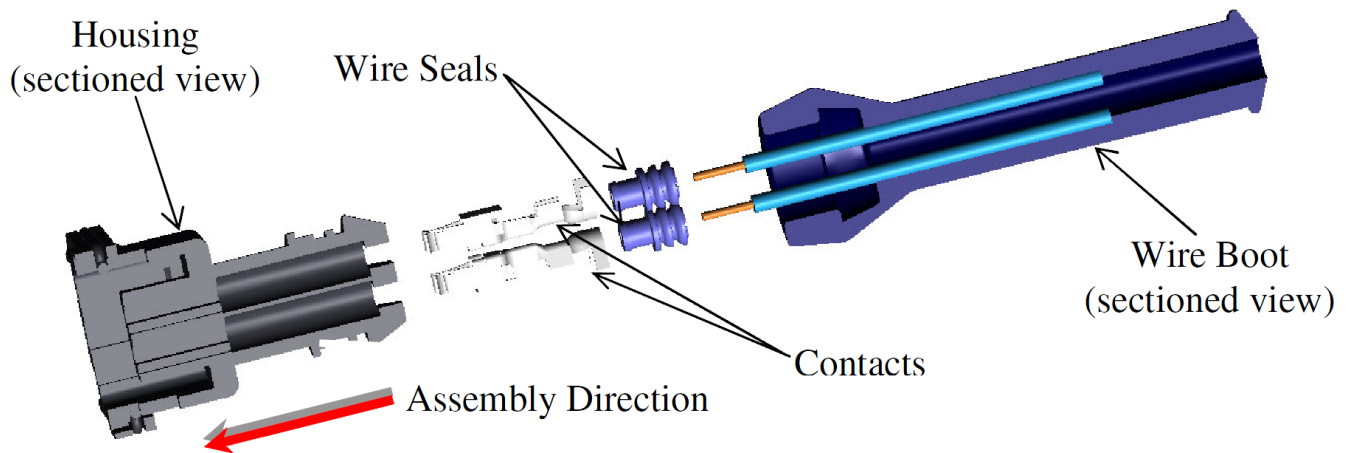
Solenoid Connectors

Part No
2095209

Kit includes:
x1 pc Housing
x2 pc Contacts
x2 pc Wire seals
x1 pc Wire boot

Description

Replacement connector kit for AMP Junior Timer style solenoids, use 16 AWG TFFN wire
*see MHD-700003 for full assembly instructions



Part No

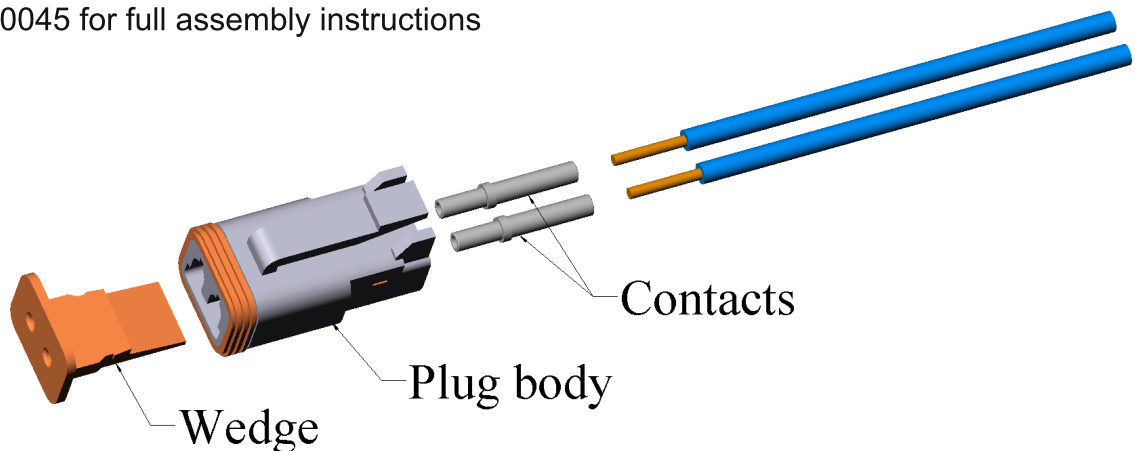
2900883

Kit includes:

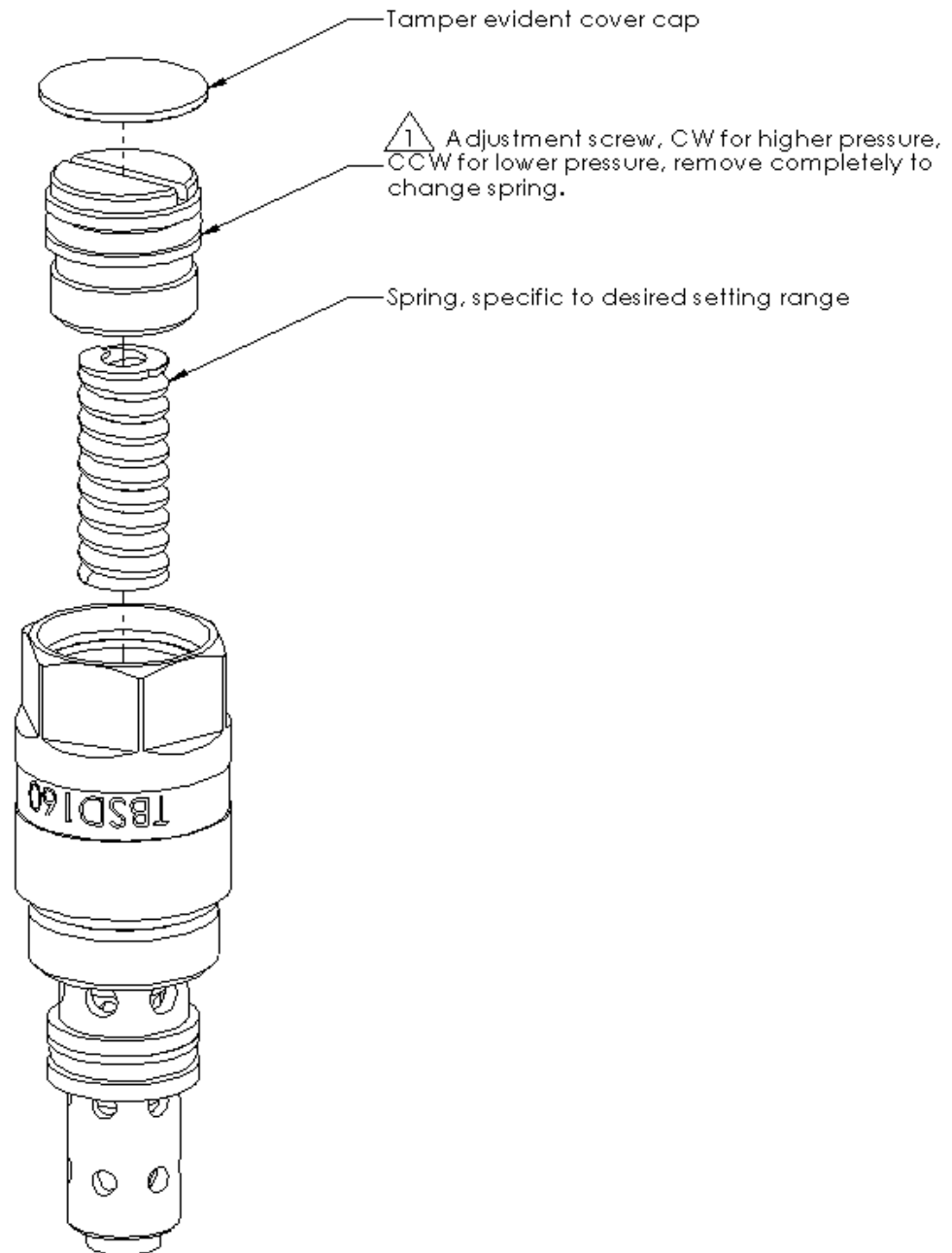
x1 pc Plug body
x1 pc Wedge
x2 pc Contacts

Description


Replacement connector kit for Deutsch DT06 style solenoids, use 16 AWG TFFN wire
*see MHD-700045 for full assembly instructions



Relief Valve Field Service Guide



1 Use extreme caution when lowering pressure, there is no hard stop for adjustment screw and can be removed completely while valve is pressurized. This will result in the adjustment screw being ejected from relief valve body at high velocity. Never attempt to set pressure lower than recommended range of installed spring.


	Valve Series	Coordinate ID
	DX-6	

General Troubleshooting Guide

<i>No Flow to the Valve</i>	
Possible Causes	Remedy
Pump suction side not receiving fluid	Replace dirty filters, clean clogged inlet line, clean or replace reservoir breather vent; fill reservoir to proper level
Pump motor not operating	Repair or replace
Pump drive motor turning in wrong direction	Reverse rotation
Directional control set in wrong position	Check position of manually operated controls; check electrical circuit on solenoid operated controls; repair or replace pilot pressure pump
Entire flow passing over relief valve or unloading valve active	Adjust or correct
Damaged Pump	Repair or replace
Improperly assembled pump or plumbing	Verify plumbing, repair, or replace

<i>Incorrect Flow to the Valve</i>	
Possible Causes	Remedy
Flow control set too low or too high	Adjust
Relief or unloading valve set too low or too high	Adjust
External leak in system	Tighten leaking connections
RPM of pump drive motor incorrect	Replace with correct unit
Worn pump, valve, motor, cylinder or other component	Repair or replace

<i>Low or No Pressure through Valve</i>	
Possible Causes	Remedy
No Power	Check electrical supply to motor, check fuses and breakers, check wire connections, check PLC outputs & Solenoids, reset Emergency stop switches
Incorrect voltage or no voltage to the valve	Verify valve voltage supply required and correct
No or Low Hydraulic Fluid in Reservoir	Check level and add as required
Pump or motor shaft is stripped or broken	Repair or replace
Pressure Relief Valve stuck open	Repair and replace
Pump Outlet flow bypassing directly to tank	Check for faulty valving or circuit error, ruptured lines, or large leaks
Low valve pilot pressure	Check pilot supply pressure, clean, or replace pilot control valve as necessary

	Valve Series	Coordinate ID
	DX-6	

General Troubleshooting Guide

<i>Low Pressure Output</i>	
Possible Causes	Remedy
Pressure relief path exists	Replace dirty filters, clean clogged inlet line, clean or replace reservoir breather vent; fill reservoir to proper level, tighten leaking connections
Pressure reducing valve set too low or damaged	Adjust or replace
Damaged pump, motor or cylinder	Repair or replace

<i>Erratic Pressure Output</i>	
Possible Causes	Remedy
Worn Pump, motor, or cylinder	Repair or replace
Contamination in fluid	Replace dirty filters and system fluid
Air in fluid	Replace dirty filters and system fluid
Worn Relief Valve	Repair or replace

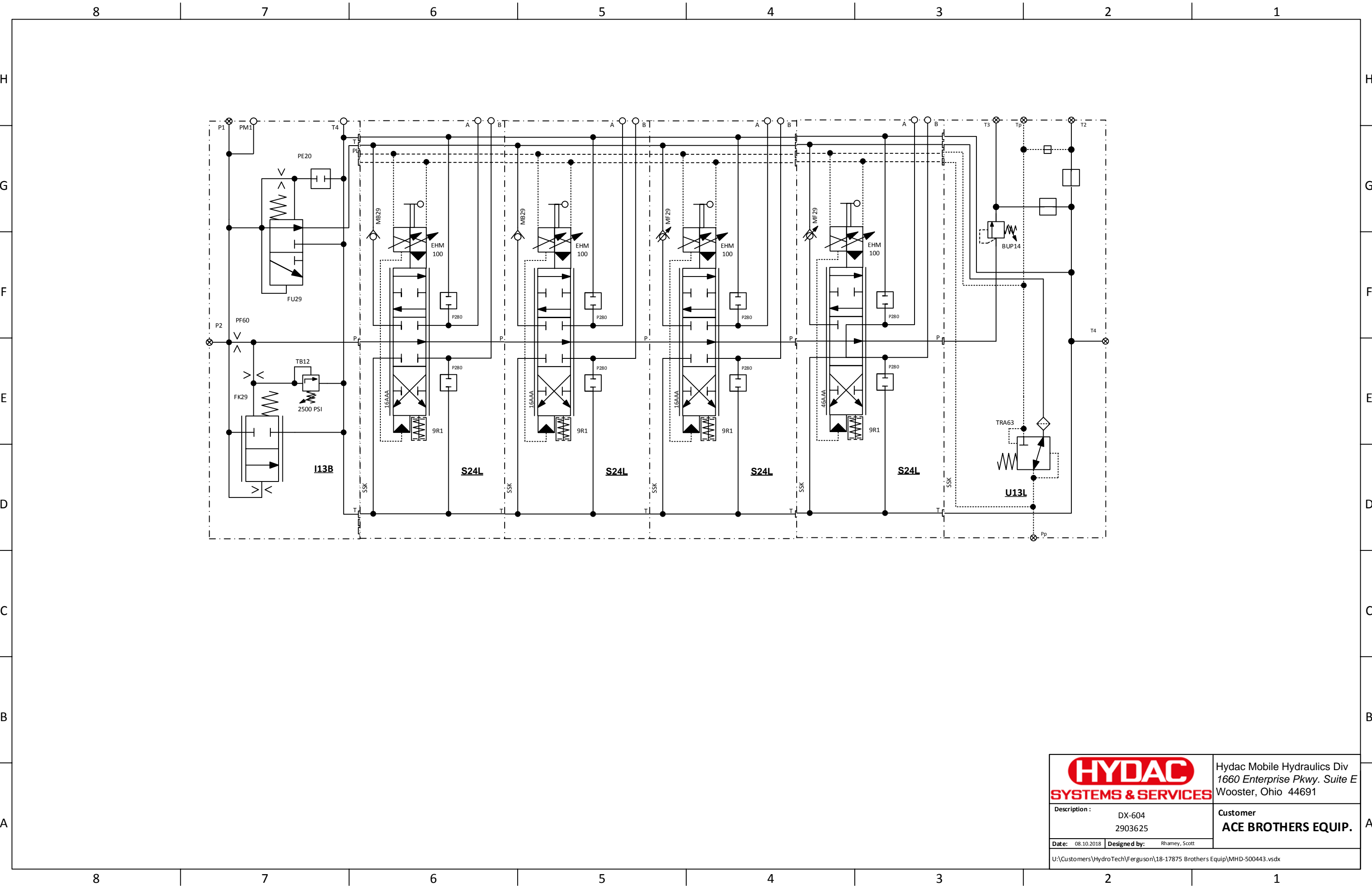
<i>External Leakage between Valve Sections</i>	
Possible Causes	Remedy
Worn, missing, or blown O-ring	Replace with new O-ring, see service literature for section seal kits
Tie Rods not tight enough	Torque to HYDAC specifications
Valve mounting surface not level	Relevel mounting plate or shim as needed
<i>External Leakage at spool ends</i>	
Possible Causes	Remedy
Missing, worn, or damaged spool seals	Replace spool seals, see HYDAC valve series service literature
Excessive pressure in return line	Correct over pressure situation in the hydraulic system

 Spare parts list	Valve Series	Coordinate ID
	DX-6	

General Troubleshooting Guide

<i>Erratic Behavior during valve shift, not centering or not shifting on electrical operators</i>	
Possible Causes	Remedy
Fluctuations in return line on internally drained electrical operators	Convert to external drain
Dirt, chip, or burrs are holding valve partially open	Clear blockage, check for damaged components, replace as needed
Pilot control valves are worn or damaged	Repair or replace
Orifice is blocked	Clear blockage
Incorrect or worn out centering spring	Replace
Centering spring operator misaligned causing spring to bind	Disassemble, correct
Over tightened Tie rods	Check and torque to specification
Possible Causes	Remedy
Worn spool or bore	Replace body and spool
Worn, stuck, or damaged load check	Replace

<i>Recommended Valve Maintenance</i>	
Action	Frequency
Visual inspection for external leakage	Weekly
Visual inspection of valve for damage parts, handles, or electrical connectors	Weekly
Inspect for loose screws, pilot valve, spool operators, etc.	Monthly



HYDAC SYSTEMS & SERVICES		Hydac Mobile Hydraulics Div 1660 Enterprise Pkwy. Suite E Wooster, Ohio 44691
Description :	DX-604 2903625	Customer ACE BROTHERS EQUIP.
Date: 08.10.2018	Designed by: Rhamey, Scott	
U:\Customers\HydroTech\Ferguson\18-17875 Brothers Equip\MHD-500443.vsd		

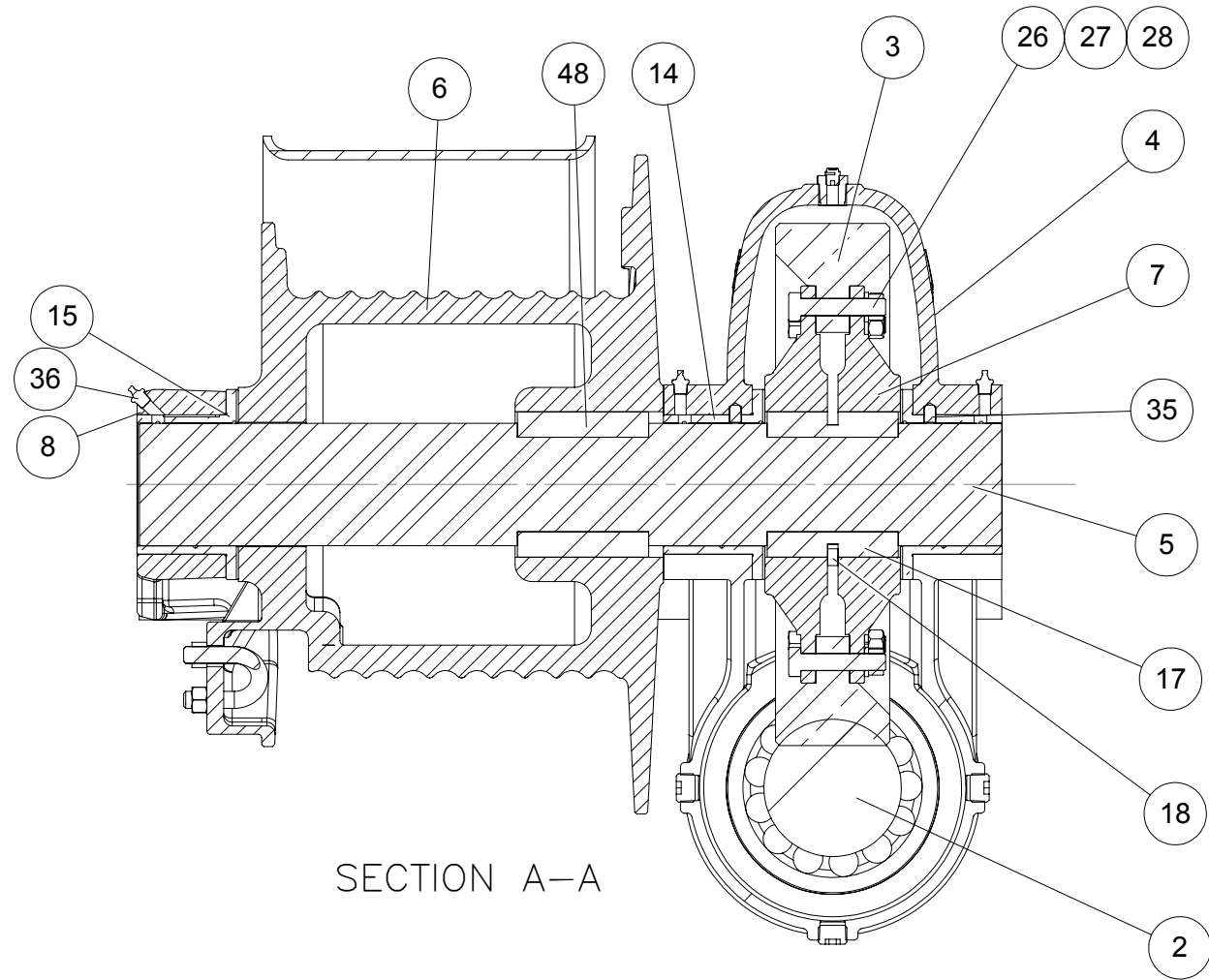
Bill of Material Report
TULSA WINCH, INC.
Single Level

Lvl	Type	Find Num	Seq Part Number	Revision	Alt	Description	Qty/Parent	Required Qty
			80897		6	H75-SLRFDXD, W/CABLE PACKER		1.00 EA
1	Asm	1	10 40309	4		HOUSING, GEAR, M75	1.00 PC	1.00 PC
1	Asm	2	20 40414	5		WORM, SL, H75	1.00 PC	1.00 PC
1	Asm	3	30 20770	3		GEAR, SL, RN65W	1.00 PC	1.00 PC
1	Asm	4	40 44034	0		COVER, HOUSING, RN65W	1.00 PC	1.00 PC
1	Asm	5	50 40417	3-A		SHAFT, H75	1.00 PC	1.00 PC
1	Asm	6	60 40779	3		DRUM, CABLE, GROOVED, M75	1.00 PC	1.00 PC
1	Mtl	7	70 22453	10		CARRIER, RN65W	2.00 PC	2.00 PC
1	Asm	8	80 40419	3		BRACKET, END, H75	1.00 PC	1.00 PC
1	Mtl	9	90 40420	3		FRAME, LH, H75	1.00 PC	1.00 PC
1	Mtl	10	100 41292	1		FRAME,R.H.,F/CABLE PACKER,	1.00 PC	1.00 PC
1	Asm	11	110 40422	3		CAP, END, H75	1.00 PC	1.00 PC
1	Asm	12	120 40423-TW	3		ADAPTER, HYDRAULIC, MODEL	1.00 PC	1.00 PC
1	Mtl	13	130 20620	2		BEARING - RA - ANG - 02.559	2.00 PC	2.00 PC
1	Asm	14	140 20162	8		BUSHING, GEARBOX, RN65W	2.00 PC	2.00 PC
1	Asm	15	150 21142	4		BUSHING, CABLE DRUM, RN65W	1.00 PC	1.00 PC
1	Mtl	16	160 21163	4		Bolt-U - 0.50-13 x 03.00	1.00 PC	1.00 PC
1	Mtl	17	170 20575	6		KEY	2.00 PC	2.00 PC
1	Mtl	18	180 20569	8		SPACER	1.00 PC	1.00 PC
1	Mtl	19	190 164056	A		Pin-Spring - 0.25 x 00.75	2.00 PC	2.00 PC
1	Mtl	20	200 20886	A		Capscrew-Hex - 0.75-16 x 02.75	4.00 PC	4.00 PC
1	Mtl	21	210 20274	A		Nut-Hex - 0.75-16	4.00 PC	4.00 PC
1	Mtl	22	220 20520	A		Washer-Lock - 0.75	4.00 PC	4.00 PC
1	Mtl	23	230 20276	A		Capscrew-Hex - 0.38-24 x 02.00	4.00 PC	4.00 PC
1	Mtl	24	240 20271	A		Nut-Hex - 0.38-24	4.00 PC	4.00 PC
1	Mtl	25	250 20526	A		Washer-Lock - 0.38	4.00 PC	4.00 PC
1	Mtl	26	260 23884	A		Capscrew-Hex - 0.50-20 x 02.50	14.00 PC	14.00 PC
1	Mtl	27	270 20267	A		Nut-Hex - 0.50-20	14.00 PC	14.00 PC
1	Mtl	28	280 20518	A		Washer-Lock - 0.50	14.00 PC	14.00 PC
1	Mtl	29	290 40709	A		Capscrew-Hex - 0.88-14 x 02.75	4.00 PC	4.00 PC
1	Mtl	30	300 20318	A		Nut-Hex - 0.88-14	4.00 PC	4.00 PC
1	Mtl	31	310 20559	A		Washer-Lock - 0.88	4.00 PC	4.00 PC
1	Mtl	32	320 29792	A		Capscrew-Hex - 0.50-20 x 01.50	8.00 PC	8.00 PC
1	Mtl	33	330 33212	A		Capscrew-Socket - 0.50-20 x 01	8.00 PC	8.00 PC
1	Mtl	34	340 20521	0		Nut-Hex - 0.50-13	2.00 PC	2.00 PC
1	Mtl	35	350 20517	3		PIN	3.00 PC	3.00 PC
1	Mtl	36	360 21128	3		FITTING, GREASE ZERK,	3.00 PC	3.00 PC
1	Mtl	37	370 40397	2		PLUG	1.00 PC	1.00 PC
1	Mtl	38	380 20286	A		PLUG, PIPE	3.00 PC	3.00 PC
1	Mtl	39	390 20323	3		Gasket - OT - 07.12 - 00.031	2.00 PC	2.00 PC
1	Mtl	40	400 20315	5		Gasket - 8B - 06.31 - 00.015	2.00 PC	2.00 PC

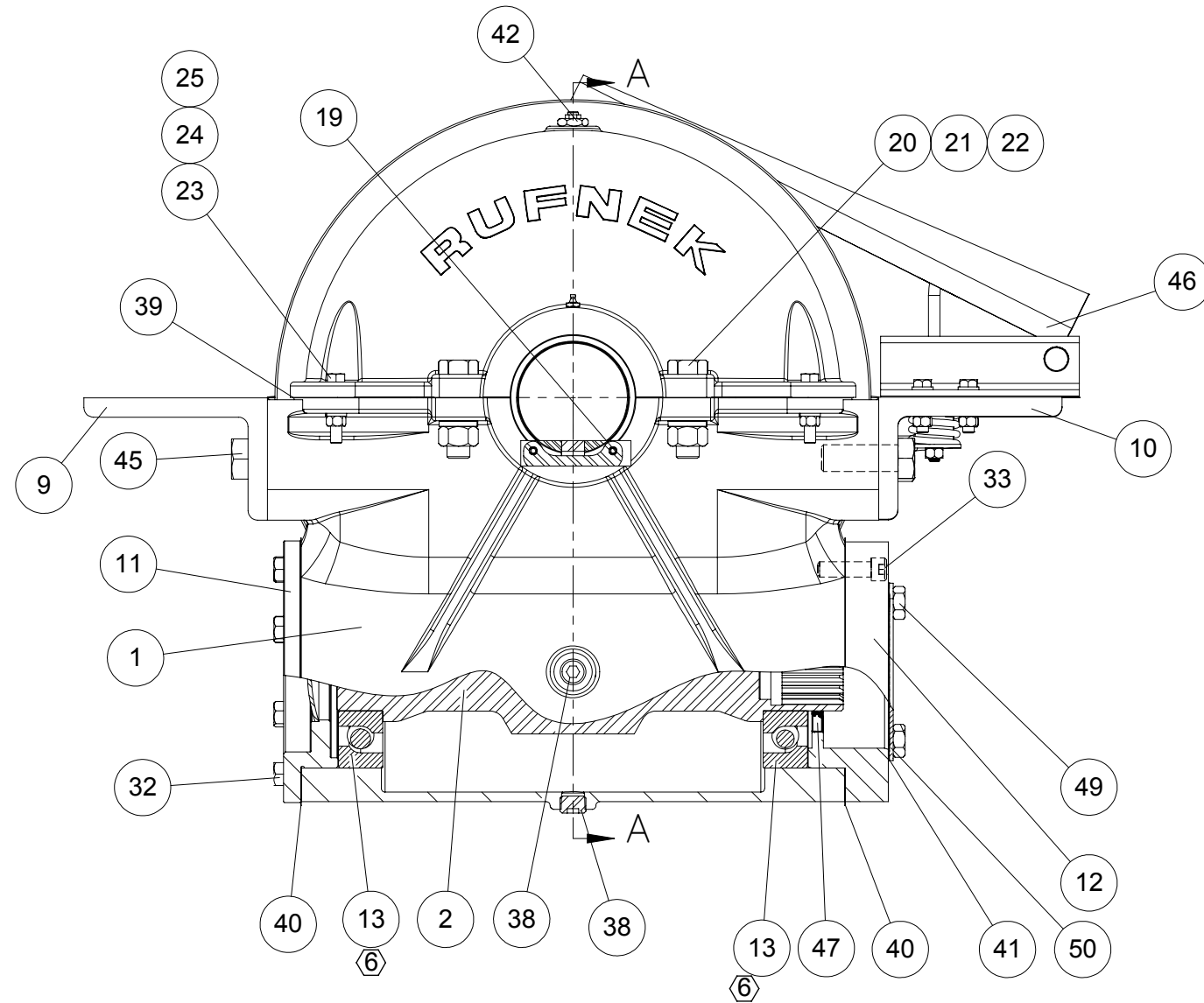
Bill of Material Report
TULSA WINCH, INC.
Single Level

Lvl	Type	Find Num	Seq Part Number	Revision	Alt	Description	Qty/Parent	Required Qty
1	Mtl	41	410 40424	0		Gasket - C4 - 05.81 - 00.031	1.00 PC	1.00 PC
1	Asm	42	420 4102-TW	0		BUSHING & BREATHER KIT, 1/2	1.00 PC	1.00 PC
1	Mtl	45	450 30203	A		Capscrew-Hex - 0.88-14 x 02.50	4.00 PC	4.00 PC
1	Asm	46	460 4073-TW	0		KIT, CABLE PACKER, R.H., H75	1.00 PC	1.00 PC
1	Mtl	47	470 41285	A		Seal - DL - 02.55 - 00.375	1.00 PC	1.00 PC
1	Mtl	48	480 41667	A		KEY, H75	2.00 PC	2.00 PC
1	Mtl	49	490 11234-TW	A		Capscrew-Hex - 0.63-11 x 01.00	4.00 PC	4.00 PC
1	Mtl	50	500 40664	1		PROTECTOR, H64, H75	1.00 PC	1.00 PC

REV.	DESCRIPTION	DATE	DRAWN	APPD.	ER NO.
6	CONVERTED TO SOLIDWORKS AND ITEM#13 BALL BEARING (20319) CHANGED TO ANGULAR CONTACT BEARING (20620)	04/17/2019	VD	LB	17-1182

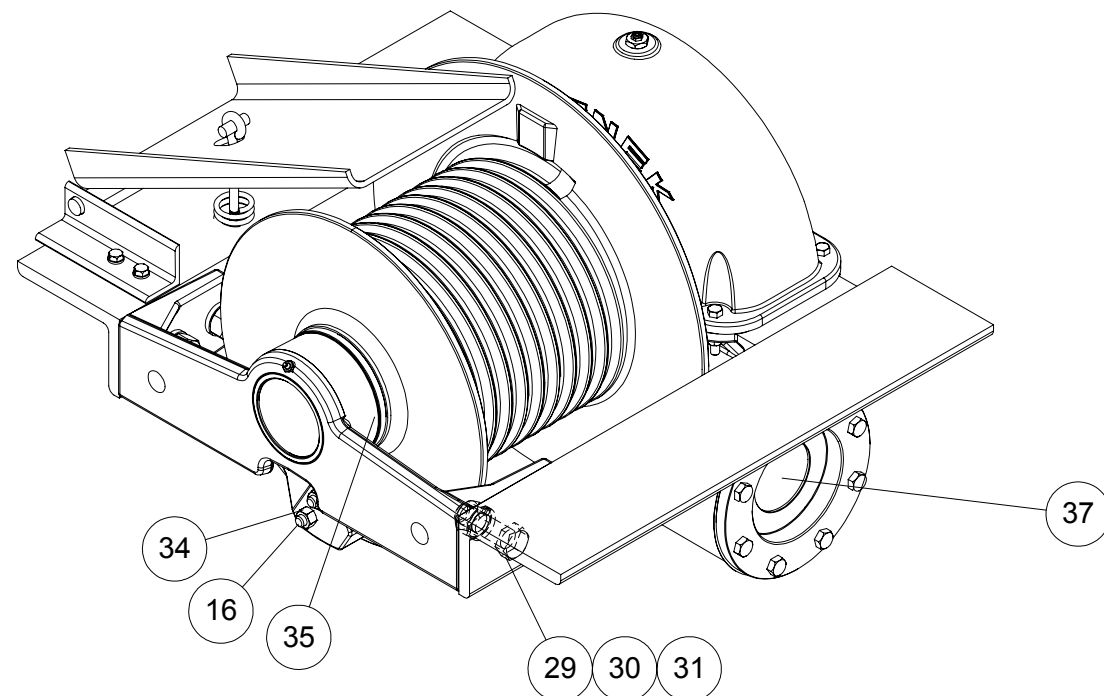




SECTION A-A



NOTES:

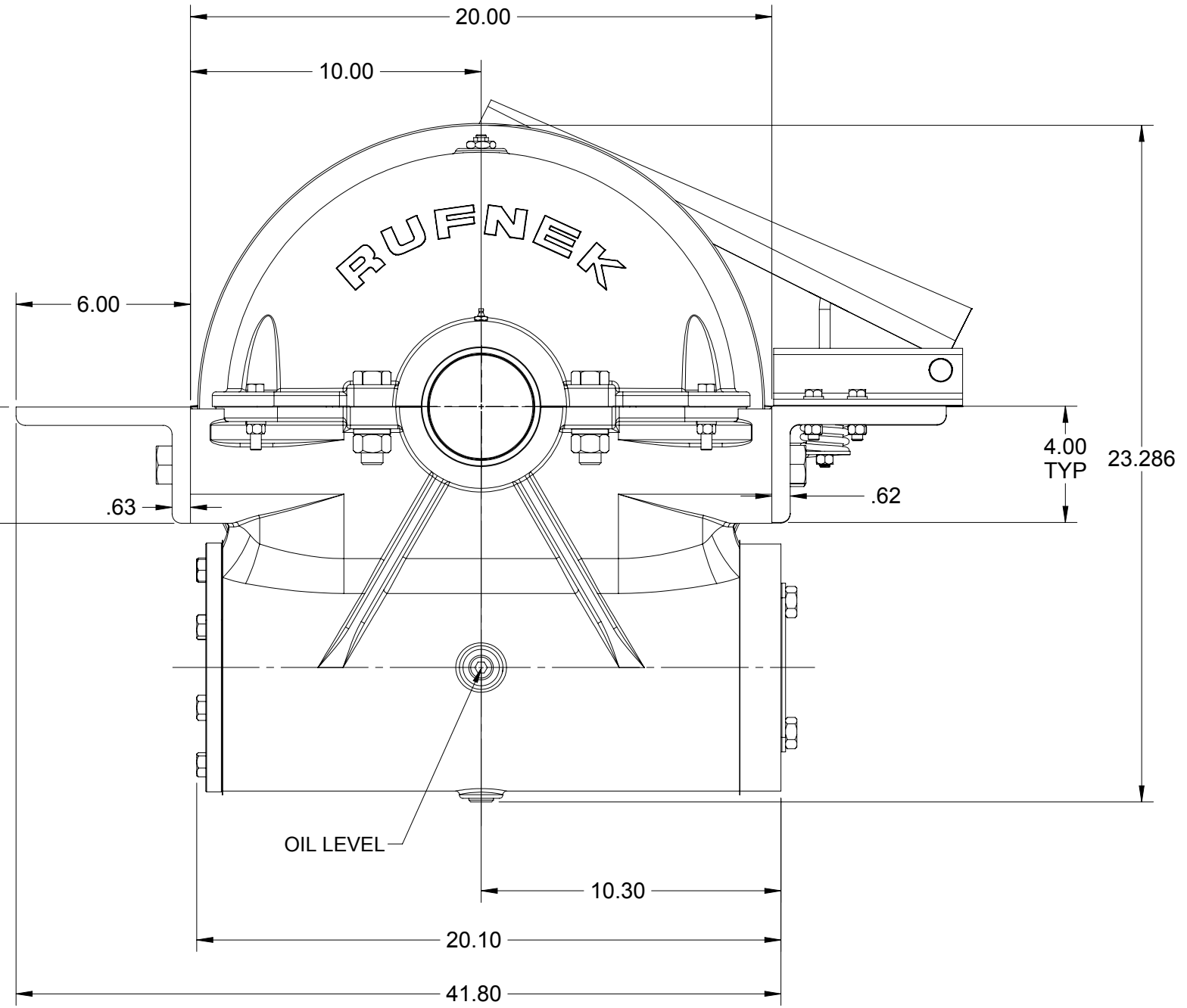
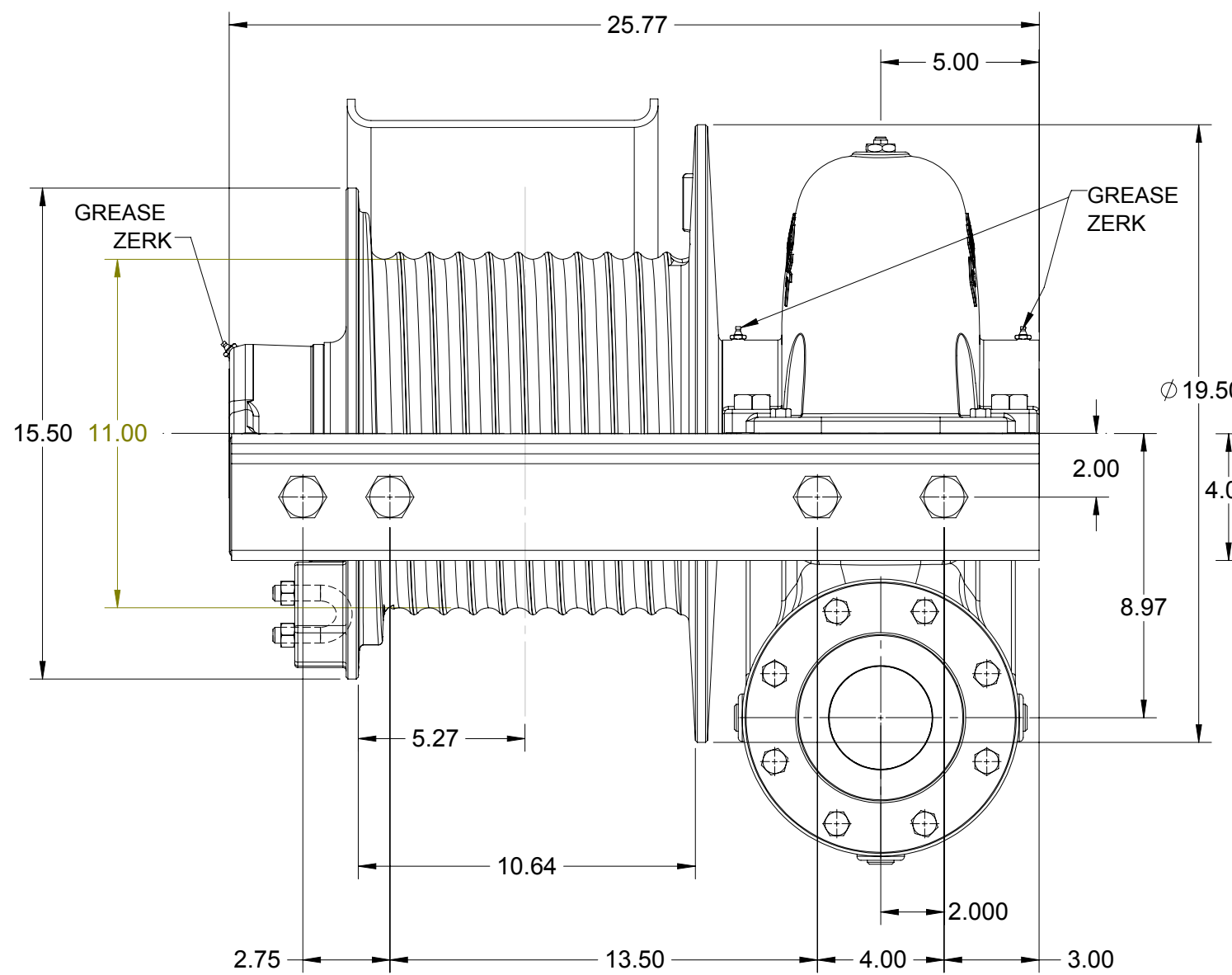
1. FILL WITH EP-140 OIL.(5 QTS)
2. PRIME WITH TWI PRIME SPEC 709171 (BLACK PRIMER)



Unless Otherwise Specified							
Imperial (in)		Do Not Scale				WORM GEAR WINCH H75-SLRFXDX, W/CABLE PACKER	
Tolerances Fractions: $\pm 1/32$ X.X: ± 0.100 X.XX: ± 0.030 X.XXX: ± 0.010 X.XXXX: ± 0.0005							
Roughness $125 \sqrt{\text{in}}$	Chamfers 0.03 @ 45°	Radii R0.03	Angles $\pm 2^\circ$	Designed	Approved	Project: -	Size: B
Break All Sharp Edges				-	-	Weight: 690 lb	Sheet: 1 of 1
Printed documents are uncontrolled and are subject to change. Verify correct revision level prior to use.				80897			

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REV.	DESCRIPTION	DATE	DRAWN	APPD.	ER NO.
6	CONVERTED TO SOLIDWORKS AND BALL BEARING (20319) CHANGED TO ANGULAR CONTACT BEARING (20620)	04/17/2019	VD	LB	17-1182



PERFORMANCE DATA

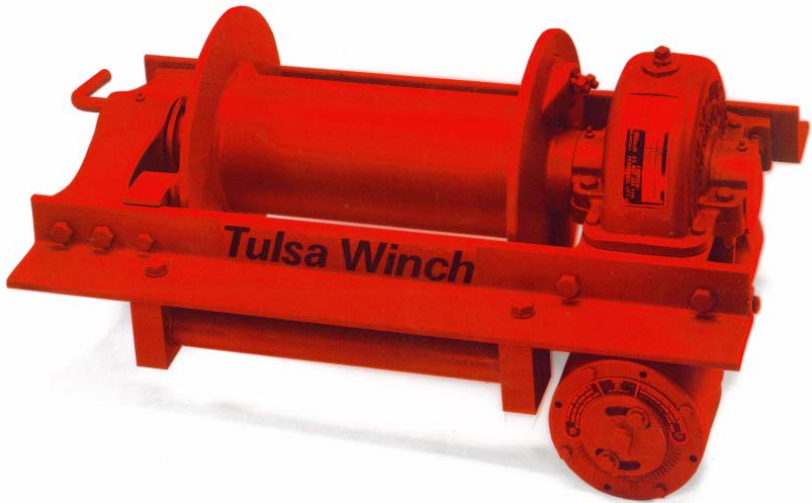
MAXIMUM CONTAINER WT.(LBS @45 ANGLE)	70,000
FIRST LAYER LINEPULL(LBS)	50,000
OUTPUT TORQUE(FT-LBS)	24,000
PRESSURE(PSI@RATED LINEPULL)	2,000
FIRST LAYER LINE SPEED (FPM)	19
REQUIRED FLOW(GPM @ RATED LINE SPEED)	50
OPTIONAL TWO -SPEED MOTOR	
FIRST LAYER LINESPEED (FPM IN LO)	19
FIRST LAYER LINE SPEED (FPM IN HI)	38
WEIGHT(LBS)	960
CABLE DIA (IN)	.875
CABLE CAPACITY(FEET)	
FIRST LAYER	42
SECOND LAYER	95

NOTES:

Unless Otherwise Specified				TWG Jenks																			
Imperial (in)		Do Not Scale		WORM GEAR WINCH				H75-SLRFDX, W/CABLE PACKER															
Tolerances																							
Fractions: ± 1/32				<table border="0" style="width: 100%;"> <tr> <td>Designed</td> <td>Approved</td> <td>Project:</td> <td>Size:</td> </tr> <tr> <td></td> <td></td> <td></td> <td>B</td> </tr> <tr> <td colspan="2">Break All Sharp Edges</td> <td>Weight:</td> <td>Sheet:</td> </tr> <tr> <td colspan="2">Printed documents are uncontrolled and are subject to change. Verify correct revision level prior to use.</td> <td>690 lb</td> <td>1 of 1</td> </tr> </table>				Designed	Approved	Project:	Size:				B	Break All Sharp Edges		Weight:	Sheet:	Printed documents are uncontrolled and are subject to change. Verify correct revision level prior to use.		690 lb	1 of 1
Designed	Approved							Project:	Size:														
									B														
Break All Sharp Edges								Weight:	Sheet:														
Printed documents are uncontrolled and are subject to change. Verify correct revision level prior to use.		690 lb	1 of 1																				
Roughness		Angles		180897																			
125/√		± 2°																					
Chamfers		Radii		<p style="font-size: small;">This drawing is the property of TWG Jenks. Reproduction or divulging of data hereon is not permitted without specific approval of TWG Jenks.</p>																			
0.03 @ 45°		R0.03																					



RUFNEK®



**Installation, Operating &
Maintenance Manual**

Worm Gear Winch



This manual **MUST** be kept with the winch at all times. New winch operators **MUST** read and understand the contents fully.

WARNING

FAILURE TO HEED THE FOLLOWING WARNINGS MAY RESULT IN SERIOUS INJURY OR DEATH!

- Do not use to lift or move people. If your task involves moving or lifting people, you must use the proper equipment, not this winch.
- Winch operators must be trained in the proper, safe operation of the winch.
- Cable anchors on Tulsa Winches are not designed to hold the rated load of the winch. You must keep at least five (5) wraps of cable on the drum to insure that the cable doesn't come loose.
- Stay clear of suspended loads and of cable under tension. A broken cable or dropped load can cause serious injury or death.
- Make sure that all equipment, including the winch and cable, is maintained properly. Pay especially close attention to the clutch, making sure that it fully engages when shifted. Do not attempt to disengage the clutch when a load is on the winch.
- Winches not equipped with automatic worm brakes should never be used to lift loads.
- Avoid shock loads. This type of load imposes a strain on the winch many times the actual weight of the load and can cause failure of the cable or of the winch.

INTRODUCTION

Thank you for purchasing a new Tulsa Winch. We are proud of our products and are certain that they will perform your winch tasks properly. However, we do ask that you take a few minutes to read and thoroughly understand this booklet. Also, if you have new operators assigned to the winch, make sure that they read and understand it. Because of the large number of models we manufacture, we are unable to show parts lists for every model in this booklet. If you want or need parts lists, please write Tulsa Winch, 11135 S. James, Jenks, OK 74037. Or call (918) 298-8300 or fax us at (918) 298-8367. You may also go to our Web site at www.team-twg.com.

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GENERAL OPERATIONS

1. Be sure to read all safety instructions thoroughly. It is important that each operator is aware of the consequences of misuse or poor operating practices of this winch.
2. Tulsa Winch products are not to be used to lift, hoist, or move people. If your application requires moving persons, you must use the proper equipment for the task.
3. Cable anchors on Tulsa Winch products are not designed to hold the rated load of the winch. You must keep at least five (5) wraps of cable on the drum to insure that the cable does not come loose.
4. Personnel must stay clear of a suspended load or any line under load. A distance of 1-1/2 times the length of the cable should be maintained while the cable is under tension. Failure to heed this warning may result in serious injury or death.
5. Make sure that all equipment is maintained properly and regular systems checks are performed to insure your winch is working safely. Refer to the maintenance section of this manual for details on these procedures.
6. Avoid shock loads. This type of load imposes a strain on the winch many times the actual weight of the load and can cause failure of the cable or of the winch.
7. Always inspect cable before beginning job. Never allow cable to slide through hands while maintaining tension, use hand-over-hand method to keep cable tension while spooling. Always use leather gloves when handling cable.

WINCH BREAK IN

Winches, like any other kind of machinery, require a "break-in" to perform well and to maximize their life. The following guidelines should be used in the break-in of Tulsa Winches.

Use extreme care when first spooling cable onto the winch. DO NOT run the winch at high speeds when performing this operation. Make sure that the cable is unrolled in a line (to prevent kinks) and SLOWLY inhaul the winch to install the cable.

DO NOT exceed one half rated load or one half rated linespeed for the first thirty minutes of operation. This will insure that the worm and gear have an opportunity to wear in properly. Periodically, check the gearbox for temperature rises and allow the winch to cool down between pulls. Worm gear winches are designed and intended for intermittent duty application only; using them in extremely long pulls may generate excessive heat and shorten the life of the winch.

WINCH OPERATION

To familiarize yourself with the winch, run it for a few minutes to understand the controls and the “feel” of the winch. Pay particular attention to the controls and how they operate. If the winch has air controls on the brake or clutch, or both, operate them to see how they work and the direction of activation of the controls. If the winch is hydraulically powered, make sure you understand which way the winch will rotate when the control lever is moved.

Always make sure that all people are clear of the load and of the cable area before beginning a winching operation. A broken cable can fly in any direction.

If you are using a mechanically powered winch, learn to pay close attention to the truck engine to sense possible overload

The typical winch operating cycle consists of the following steps:

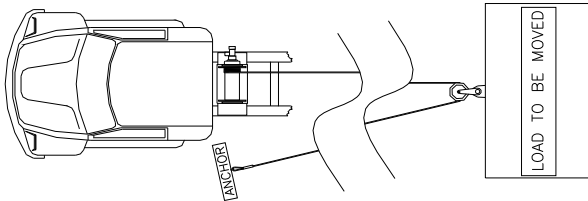
1. Disengaging the winch drum clutch and pulling off enough cable to allow hooking the load. If the winch is equipped with a manually operated drum rake, use it to keep the cable from “birds nesting” while being pulled off. DO NOT get into the habit of powering off cable; all this does is shorten the life of the winch, especially the winch brake.

Note: The drum brake is for free-spooling cable only. It is not intended to be a load-holding brake and must not be used as such

2. After hooking to the load, engage the drum clutch and release the drum brake, if the winch is so equipped. Make sure the clutch is fully engaged.
3. Begin winching the load slowly, watching carefully to insure that the load is moving normally and that no one is in the immediate area of the load or of the cable.
4. When the load is positioned where you want it, stop the winch. If the load is suspended, the automatic worm brake will hold it until you are ready to lower it.

USING A SNATCH BLOCK

By using a snatch block you have effectively cut the load on the winch in half. A snatch block should be used any time you have a concern about the ability of the winch or cable to move a load. The following illustration shows one way to rig such a block



CABLE CONSIDERATIONS

As the number of layers of cable on a winch increases, the rated capacity of the winch goes down. If you are operating at near the top of the drum flanges, the effective rating of the winch is about half of what it is on the first layer. You should therefore, only keep as much cable on the winch as you need for your job.

Never use larger or smaller cable on your winch than is recommended for it. The use of larger cable will not allow you to pull larger loads and may, in fact, break easier than the proper size cable. The use of smaller cable may overheat the winch due to increased running time with more cable.

The following chart shows the recommended cable sizes for Tulsa Winches:

CABLE CONSIDERATIONS (Continued)

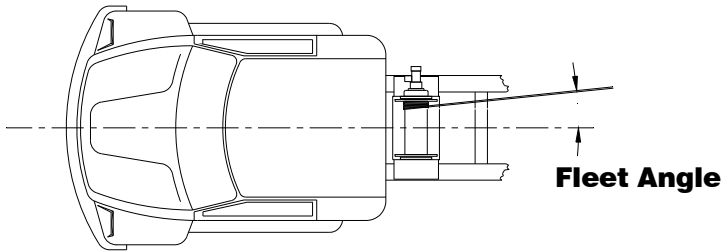
Winch Model	Cable Size
938	7/16"
1138 or RN10W	7/16"
1000	7/16"
1200	1/2"
10 or RN15W	1/2"
12	1/2"
18	5/8"
18G	5/8"
19	5/8"
23 or RN20W	5/8"
24	3/4"
34 or RN30W	3/4"
64 or RN45W	7/8"
70 or RN65W	1"
75	1"
80 or RN100W	1"

Consult your local cable supplier for recommendation on the best type of cable and hardware to use in your specific application.

WARNING: CABLE ANCHORS ON TULSA WINCHES ARE NOT DESIGNED TO HOLD THE RATED LOAD OF THE WINCH. YOU MUST KEEP AT LEAST 5 WRAPS OF CABLE ON THE DRUM TO INSURE THAT THE CABLE DOES NOT COME LOOSE.

THE IMPORTANCE OF A PROPER FLEET ANGLE

Maintaining the proper fleet angle is important to the success of your winching operation, the life of your winch and the life of the cable you are using. The fleet angle can best be described by the following illustration.

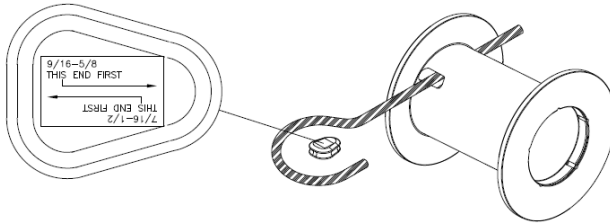


The fleet angle should be kept as small as possible to insure proper spooling and to maximize cable and winch life. To promote even cable spooling, keep the fleet angle below three degrees. Whenever possible, spool through a block at the back of the truck body. Never pull directly against the flange of the winch cable drum as this may cause the cable or the winch to break.

If you are using a front mounted winch for vehicle recovery, use a snatch block to avoid pulling sideways on the winch. If your winch is equipped with a four way roller and you absolutely must pull against a side roller, do so only for as long as is necessary and carefully watch the cable on the drum. It will pile up on one side of the drum and you must insure that it doesn't jump over the drum flange. When you are finished using the winch in a manner where the cable does not spool evenly, disengage the clutch and pay out the uneven cable. Then slowly re-spool the cable, making sure that it lays evenly.

CABLE INSTALLATION

To install the cable wedge anchor, first consult the wire rope manufacturer for recommendations on how to prepare the end of the wire rope. Thread the prepared end of wire rope through the smaller side of the opening of the cable drum wedge pocket. Pull through enough cable to loop it back around and insert the end back into the wedge pocket to about 3/4 depth of the pocket. Install the wedge in the loop then pull the slack out of the loop with the working line. The wedge will slip into the pocket and secure the wire rope into the drum.



To install the u-bolt clamp style of anchor, first prepare the end of the cable as recommended by the wire rope manufacturer. Pass the wire rope through the u-bolt so that the end extends approximately 2x the diameter of the cable. Tighten the clamp evenly until the wire rope begins to deform slightly under the u-bolt and the cable is held securely.

When using the ferrule wedge anchor the cable must be 6 strand. First, make sure the cable end is cut clean and square. Insert the cable through the ferrule and spread the strands to insert the wedge halves over the core of the wire rope. Position individual strands into proper grooves around the wedge halves and tap the wedges until they are flush with the strand ends. Slide the ferrule back over the wedge and drive the wedge into the ferrule with a hammer and short pipe which fits inside the strands and over the core.

WARNING: CABLE ANCHORS ON TULSA WINCHES ARE NOT DESIGNED TO HOLD THE RATED LOAD OF THE WINCH. YOU MUST KEEP AT LEAST 5 WRAPS OF CABLE ON THE DRUM TO INSURE THAT THE CABLE DOES NOT COME LOOSE.

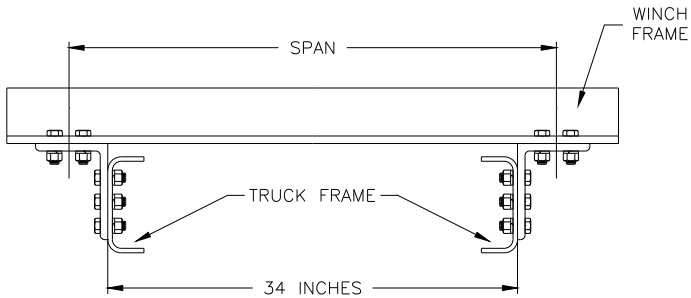
WINCH MOUNTING

You must make sure that your winch is securely mounted in order for it to function properly and to insure safe operation. The mount must be flat to insure proper alignment between the gearbox side, the drum, and the clutch

A rule of thumb to use when selecting capscrews to mount the winch is to use the same size and number of capscrews to fasten the winch to its mount as we use to fasten the gearbox and end bracket to the winch frames. Winches must never be fastened directly to the frame of a truck; mounting brackets as shown below should be used. The mounting span of the winch is very important; you should make sure that the mounting span is as close to the values shown in the chart below as possible.

All capscrews used to mount the winch should be Grade 8 or better and should be carefully tightened to the proper torque value for their size. All moving parts used to drive mechanical winches should be secure and guards used, if they are in accessible locations. If the winch being mounted is hydraulically driven, make sure the system is clean and that all components function properly, especially the relief valve.

WINCH MOUNTING (Continued)



Model	Max. Span (Inches)	No. of Capscrews	Size Capscrews
938	22	8	1/2"
1138 or RN10W	27	8	1/2"
1000	25	8	1/2"
1200	25	8	1/2"
10 or RN15W	26	8	3/4"
12	27	8	3/4"
18	34	8	3/4"
18G	32	8	3/4"
19	31	8	3/4"
23 or RN20W	31	8	3/4"
24	30	8	1"
34 or RN30W	35	8	1"
64 or RN45W	40	8 or 12	1 1/8" - 1"
70 or RN65W	34	8 or 16	1 3/8" - 1"
80 or RN100W	44	8 or 16	1 3/4" - 1 1/4"

WINCH MAINTENANCE

A winch, like any other type of machinery, needs to have regular maintenance if it is to perform properly, give lasting value, and provide safe winching. Good maintenance consists of two parts, a daily inspection and a periodic servicing.

Daily

Each day, or after one hour of winch use, the following items should be inspected and adjusted, if necessary:

1. If the winch is mechanically driven, check all drive components for alignment and tight mounting. If it is hydraulically driven, check for leaks and the proper fluid level in the hydraulic reservoir.
2. Check the cable for excessive wear, for broken strands, and lubrication
3. Check the automatic worm brake for proper adjustment and adjust it if necessary.
4. Check the drum clutch to make sure it is fully engaging when shifted in. Make adjustments if necessary.

Weekly

Once a week, or every 10 hours of operation, the following tasks should be performed for proper maintenance of your winch.

1. Lube all bushings which are equipped with grease zerks with a good quality lithium-based chassis lube.
2. Inspect the oil level in the winch gearbox and add lubricant if necessary.
3. Lubricate the cable based on your wire rope supplier's recommendations.
4. If the winch is equipped with a shoe-type brake, inspect the shoes and drum for wear and replace if necessary.

WINCH MAINTENANCE (Continued)

Bi-Annually

Every six months, the gearbox should be drained and filled with new, clean gear lubricant. All Tulsa worm gear winches are filled at the factory with EP140 gear lube, which is ideal for most working conditions. If the ambient temperatures where your winch will be working will not exceed 30 degrees F., you can use EP90; likewise, if the temperature will always be over 100 degrees F., you probably should use EP250.

The following chart shows the oil capacities for Tulsa Winches:

Winch Model	Oil Capacities (pints)
938	1 1/2
1138 or RN10W	1 1/2
1000	2
1200	2
10 or RN15W	3
12	3
18	6
18G	6
19	6
23 or RN20W	6
24	6
34 or RN30W	6
64 or RN45W	10
70 or RN65W	10
75	10
80 or RN100W	15

Some Tulsa winches may have been modified to be mounted in other than the normal attitude, which is with the worm horizontal and below the level of the output shaft. If your winch is mounted in another attitude, there may be a special plug which determined the oil level required in your winch. If you have any questions, please contact the factory.

AUTOMATIC WORM BRAKES

Most Tulsa winches are equipped with an automatic worm brake to hold suspended loads. If your winch is not equipped with one, it is intended for pulling loads only. If you wish to lift and suspend loads with your winch, it can be retrofitted with an automatic worm brake. Please consult the factory for details.

The worm brake is an important safety feature of your winch and must be maintained properly. There are two types of worm brakes used on Tulsa Winches:

1. Automotive-style shoe brakes.
2. Multiple-disc wet brakes.

Each of these worm brakes is designed to operate in the same manner. As a load is hauled in, the brake is released and the load is moved or raised. As the load is stopped, the brake engages and prevents it from falling. When the operator begins to pay out cable to lower the load, he must overcome the drag of the brake to lower the load.

In order for the brake to operate properly, it must be set to engage in the payout mode. To check this, run the winch for one minute under no load in both directions at low speeds. If there is evidence of heat build-up in the payout direction, the brake is installed properly. If the heat rise occurs in the inhaul direction, the brake is installed backward and must be changed.

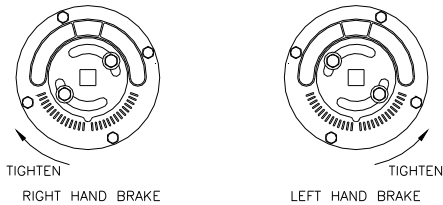
Most winches are set up to spool over the drum to the load. You can check your model code to determine this. If the winch is set up in this manner and you decide to spool the cable under the drum, you must reverse the direction of brake engagement.

The most common brake for Tulsa winches is the automotive-style shoe brake. This brake uses two shoes in a brake drum to hold winch loads. Models 10 through 34 with shoe brakes have a reversible cam; the 64, 70, and 80 require installation of a new cam to change the direction of braking.

AUTOMATIC WORM BRAKES (Continued)

The following illustration shows the end cover of the typical shoe brake and how to adjust it

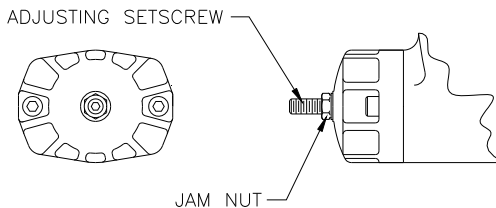
Adjustable Shoe Brake



To tighten the brake, loosen the two capscrews in the slotted holes and rotate the brake in the direction shown. If the brake on a Model 10 through 34 needs to be reversed, remove those same two capscrews, rotate the cam 60 degrees in the loosening direction, and reinstall the capscrews in the new set of holes which have just been revealed. After adjustment, be sure to re-tighten the cam capscrews securely.

The Models 938, 1138, 1060, 1242, RN10W and 1754 are equipped with an adjustable, multiple disc oil brake.

Adjustable Multiple Disk Oil Brake



This brake is adjusted by loosening the jam nut and turning the setscrew inward.

Some versions of the Models 10 through 80 are equipped with a non-adjustable multiple disc oil brake. These winches can be identified by the warning on the cover

Non-Adjustable Multi Disk Oil Brake

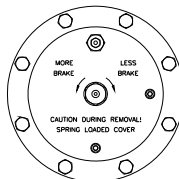


Caution During Removal! Spring Loaded Cover

These brakes require no regular adjustment. The direction of braking for all multiple disc brakes can be changed by removing the cam clutch, turning it over, and re-installing it. For detailed service instructions, contact your Tulsa Winch distributor or the factory

Some versions of the Models 10 through 80 are equipped with an adjustable multiple disc oil brake. These winches can be identified by the hex adjuster located in the center of cover.

Adjustable Multi Disk Oil Brake



This style of brake can be adjusted by turning hex adjuster counter-clockwise to increase brake and clockwise to decrease brake. The direction of braking for all multiple disc brakes can be changed by removing the cam clutch, turning it over, and re-installing it. For detailed service instructions, contact your Tulsa Winch distributor or the factory.

BRAKE ADJUSTMENT

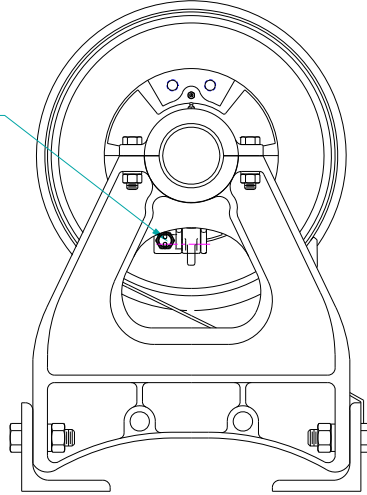
In general, worm brakes on Tulsa winches should only be adjusted enough to hold the load you are currently working with. Over adjustment will result in excessive heat generation and brake wear. The most positive way to insure proper brake adjustment is to lift a test load just barely off the ground, jog the winch out, and see if the brake holds. If it doesn't, tighten the brake slightly and try it again. If the brake is tightened completely and the load still drifts, the brake must be serviced. DO NOT use the winch to lift loads with a worn brake.

If the input to the winch is accessible and a torque wrench can be put on it, the brake can set with this torque wrench. The following table shows the torque values for all models based on rated linepull.

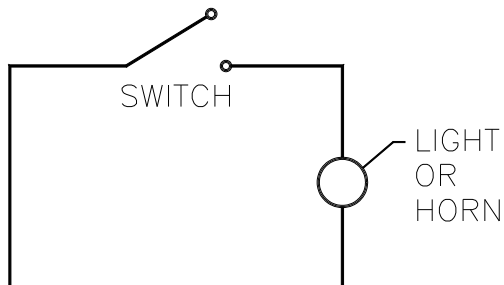
Winch Model	Brake Torque (Lb/Ft)
938	3
1138 or RN10W	3
1000	3
1200	4
10 or RN15W	32
12	32
18	50
18G	50
19	50
23 or RN20W	50
24	70
34	70
64	120
70	140
75	140
80	185

DRUM CLUTCH POSITION INDICATOR

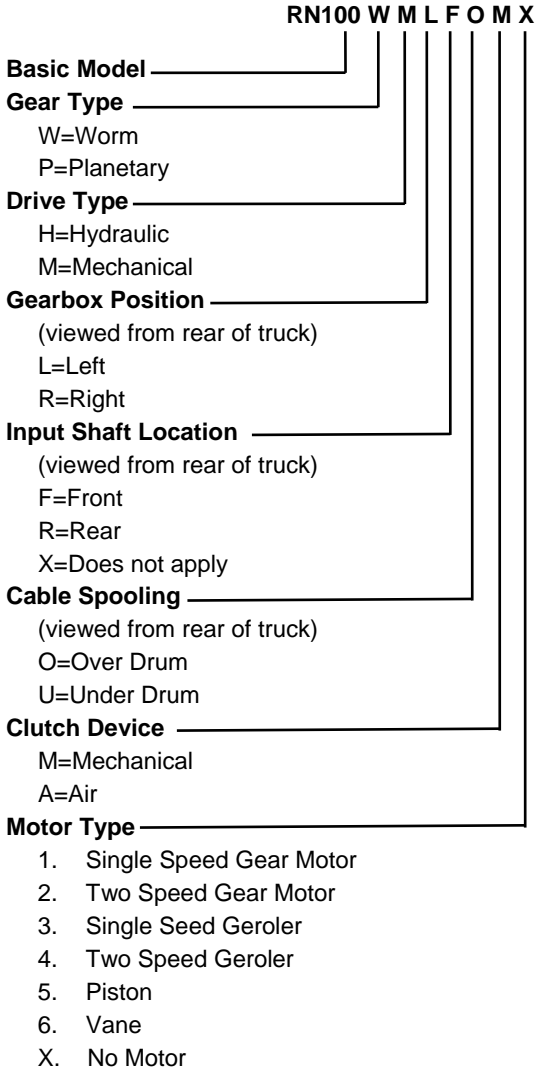
CLUTCH INDICATOR
SWITCH,
12V DC 35 AMPS,
24V DC 20 AMPS,



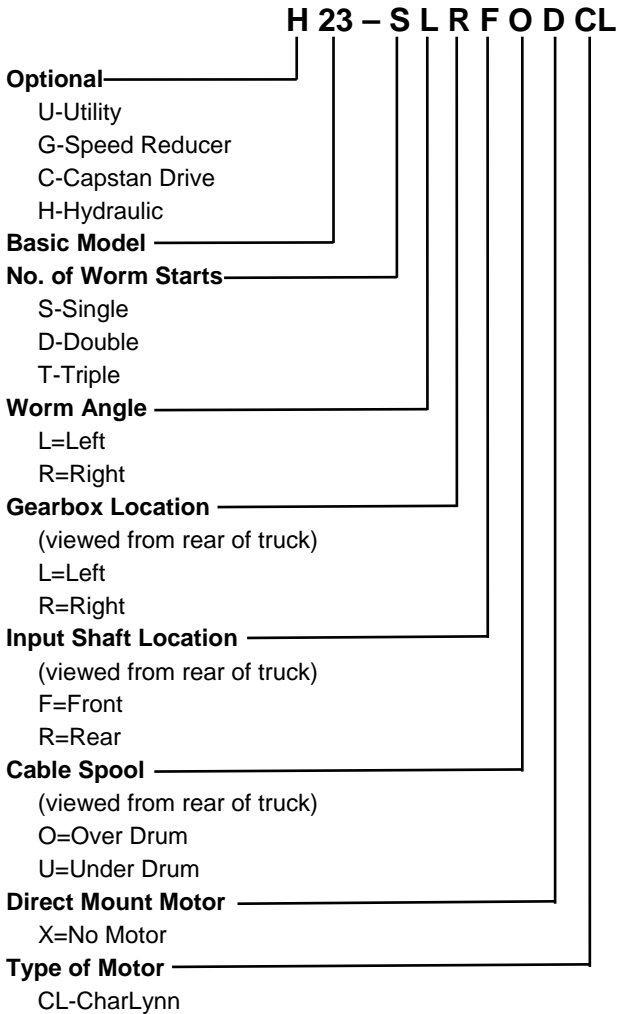
The clutch position indicator operates in a normally open position. When properly installed, as pictured in the circuit a warning light or horn will indicate when the drum clutch is disengaged



WINCH MODEL CODES




WINCH MODEL CODES

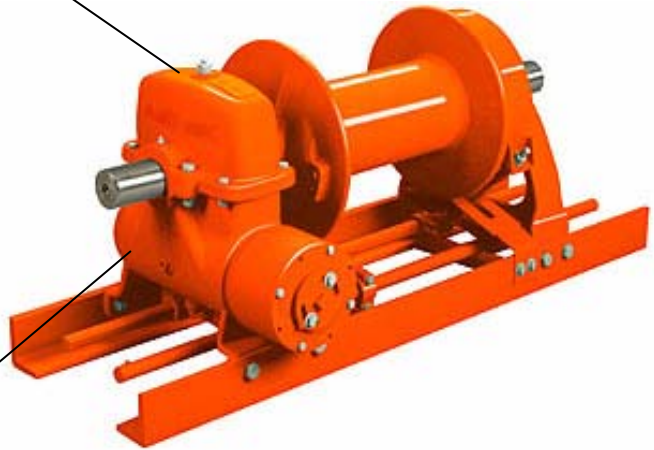


ALL Tulsa Winches have the serial number, and assembly number stamped both on the identification tag and on the housing. Please take a few minutes to record these numbers for future use. The assembly number will be required when ordering parts.

MODEL:	_____
SERIAL NO:	_____
ASSEMBLY NO:	_____

RUFNEK®	
MODEL NO.	FIRST LAYER WORKING CAPACITY
ASSY. NO.	FULL LAYER WORKING CAPACITY
SERIAL NO.	CABLE SIZE
	
CONTACT THE FACTORY FOR CONTINUOUS DUTY RATING	

Stamped
Serial Number



TULSA WINCH LIMITED WARRANTY

Effective 1/1/2005
Supersedes All Prior Warranties

Seller warrants that each article sold under this order shall at the time of shipment (i) conform to applicable specifications, and (ii) be free from defects in material and workmanship during normal and ordinary use and service (the "Warranty").

Buyer's exclusive remedy and Seller's sole obligation under this Warranty shall be, at Seller's option, to repair or replace any article or part thereof which has proven to be defective, or to refund the purchase price of such article or part thereof.

This Warranty shall expire one (1) year from the date the article is first shipped by Seller. Notice of claimed breach of this Warranty must be given by Buyer to Seller within the applicable period. Such notice shall include an explanation of the claimed warranty defect and proof of date of purchase of the article or part thereof for which warranty coverage is sought. No allowances shall be made by Seller for any transportation, labor charges, parts, "in and out" costs, adjustments or repairs, or any other work, unless such items are authorized in writing and in advance by Seller. Nor shall Seller have any obligation to repair or replace items which by their nature are expendable.

If an article is claimed to be defective in material or workmanship, or not to conform to the applicable specifications, Seller will either examine the article at Buyer's site or issue shipping instructions for return to Seller. This Warranty shall not extend to any articles or parts thereof which have been installed, used, or serviced otherwise than in conformity with Seller's applicable specifications, manuals, bulletins, or instructions, or which shall have been subjected to improper installation, operation, or usage, misapplication, neglect, overloading, or employment for other than normal and ordinary use and service.

This Warranty shall not apply to any articles or parts thereof furnished by Seller to Buyer's specifications and/or furnished by Buyer or acquired from others at Buyer's request.

SELLER MAKES NO EXPRESS WARRANTIES AND NO IMPLIED WARRANTIES OF ANY KIND, OTHER THAN THE WARRANTY EXPRESSLY SET FORTH ABOVE. SUCH WARRANTY IS EXCLUSIVE AND IS MADE AND ACCEPTED IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

The remedies for this Warranty shall be only those expressly set forth above, to the exclusion of any and all other remedies of whatsoever kind. The limited remedies set forth above shall be deemed exclusive, even though they may fail their essential purpose. No agreement varying or extending the foregoing Warranty, remedies, exclusions, or limitations shall be effective unless in a writing signed by an executive officer of Seller and Buyer. This Warranty is non transferable.

Under no circumstances shall Seller be liable (i) for any damage or loss to any property other than the warranted article or part thereof, or (ii) for any special, indirect, incidental, or consequential damage or loss, even though such expenses, damages, or losses may be foreseeable.

The foregoing limitations on Seller's liability in the event of breach of warranty shall also be the absolute limit of Seller's liability in the event of Seller's negligence in manufacture, installation, or otherwise, with regard to the articles covered by this Warranty, and at the expiration of the Warranty period as above stated, all such liabilities shall terminate.



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