




# Installation Instructions

Spring Deflection (Load) Sensor  
Installation for Spring Suspensions

## Required Components

KEY NO.	DESCRIPTION	QTY
<b>Components included in the sensor kit</b>		
1.	Load Sensor [Includes Lever Rod, Lever Rod Clamp, Clamp Screws]	1
3.	Rubber Link and Rod	1
6.	Fine-Adjustment Linkage with Rubber Link	1
7.	Vertical Linkage Rod	1
(not shown)	Locking Pin (Installation Aid - Not Required)	1
<b>Additional Components (not included in the sensor kit, but available from Bendix)</b>		
-	Warning Label - Order BW9848 	1
(not shown)	Auxiliary Harness - Order	1
<b>Additional Components (not included in the sensor kit, and NOT available from Bendix)</b>		
2.	Mounting Bolts (5/16 Grade 5)	2
4.	Axle Strap	1
5.	Axle Attachment Bracket. Use a minimum 1 3/4" square stock.	1

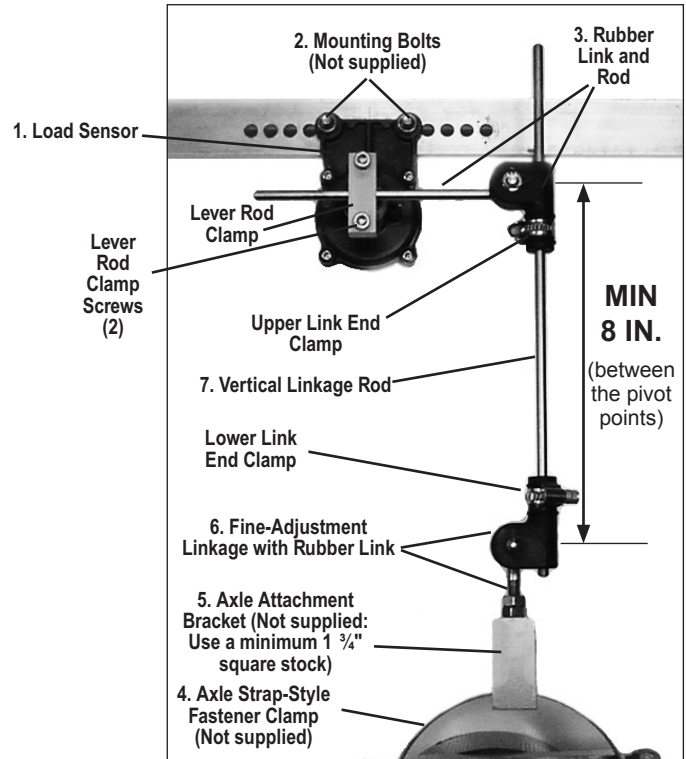


FIGURE 1 - KIT COMPONENTS AND TYPICAL INSTALLATION

## SPRING DEFLECTION VALUE

The value for the trailer's spring deflection must be known before beginning the installation. The spring deflection ("D") of a trailer may be supplied by the suspension manufacturer or determined by (a) first measuring the distance between the top of the trailer axle and the bottom of the frame when the trailer is empty (See Figure 2); then (b) subtracting the distance between them when the trailer is fully loaded. See Table 1 on page 3.

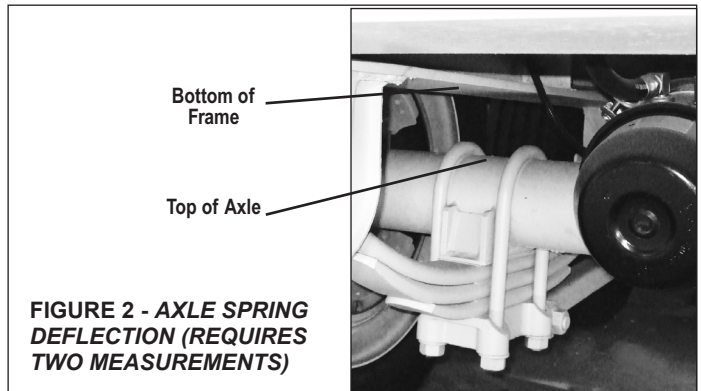


FIGURE 2 - AXLE SPRING DEFLECTION (REQUIRES TWO MEASUREMENTS)

### WARNING

Suspension jounce can result in the trailer axle dropping below the normally empty position resulting in a negative spring deflection. The sensor lever needs to be long enough to accommodate this additional travel. The maximum deflection does not necessarily occur when the trailer is lifted horizontally; rather, the geometry must be inspected for all possible motions and the maximum deflection identified.



FIGURE 3 - WHEN THE TRAILER IS UNLOADED



## GENERAL SAFETY GUIDELINES

**WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS**

**TO AVOID PERSONAL INJURY OR DEATH:**

**When working on or around a vehicle, the following guidelines should be observed AT ALL TIMES:**

- ▲ Park the vehicle on a level surface, apply the parking brakes and always block the wheels. Always wear personal protection equipment.
- ▲ Stop the engine and remove the ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, **EXTREME CAUTION** should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically-charged components.
- ▲ Do not attempt to install, remove, disassemble or assemble a component until you have read, and thoroughly understand, the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.
- ▲ If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning ANY work on the vehicle. If the vehicle is equipped with a Bendix® AD-IS® air dryer system, a Bendix® DRM™ dryer reservoir module, or a Bendix® AD-9si® air dryer, be sure to drain the purge reservoir.
- ▲ Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
- ▲ Never exceed manufacturer's recommended pressures.
- ▲ Never connect or disconnect a hose or line containing pressure; it may whip and/or cause hazardous airborne dust and dirt particles. Wear eye protection. Slowly open connections with care, and verify that no pressure is present. Never remove a component or plug unless you are certain all system pressure has been depleted.
- ▲ Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, wiring, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.
- ▲ Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.
- ▲ Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.
- ▲ For vehicles with Automatic Traction Control (ATC), the ATC function must be disabled (ATC indicator lamp should be ON) prior to performing any vehicle maintenance where one or more wheels on a drive axle are lifted off the ground and moving.
- ▲ The power **MUST** be temporarily disconnected from the radar sensor whenever any tests **USING A DYNAMOMETER** are conducted on a vehicle equipped with a Bendix® Wingman® system.
- ▲ You should consult the vehicle manufacturer's operating and service manuals, and any related literature, in conjunction with the Guidelines above.



**WARNING**

### Prevent Load Sensor Damage When Lifting this Trailer

To prevent damage to the Bendix® Load Sensor installed on the trailer, the linkage rod must be disconnected from the sensor's rubber boot whenever the frame of the trailer is lifted, dropping the axle(s). This includes when jacking the rear bumper or when a crane is used to lift the trailer.



**WARNING**

### Operating the vehicle with a damaged/ disconnected sensor could lead to a serious accident

Bendix® Advanced Trailer ABS used on the vehicle uses sensors, including the load sensor, to assist the Trailer Roll Stability function.

## VEHICLE PREPARATION

Follow all standard industry safety precautions including those listed on page 2 of these instructions.

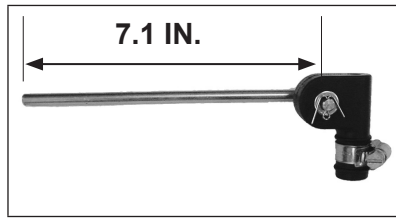
Park the vehicle on a level surface and chock the wheels and/or hold the vehicle by means other than the air brakes.

## INSTALLATION

1. Identify the ideal location for the sensor — above and behind the axle it will be connected to. It should be installed as close as possible ( $\pm 5$  inches) to the center of the axle. The sensor **MUST NOT** be installed on a lift axle. Be sure to have room for the sensor placement, vertical linkage motion, and the harness routing. Note that the sensor can be installed upward or downward, however, the load sensor's bracket mounting holes must always be horizontal. When installing on a fleet, select a location that will work for all vehicles, if possible. This will aid in troubleshooting.
2. On an unloaded trailer the angle between the horizontal and vertical linkage rods, when installed, should be 90 degrees. See *Figure 3*. The linkage rod must be sufficiently long so that when installed, the center portion — measured between the two rubber clamps — must be at least eight (8) inches (See *Figure 1*).

## LOAD SENSOR ASSEMBLY

3. Measure the lever rod as supplied in the kit. The length needed for this installation is 7.1 inches (180.3 mm) as shown in *Figure 4* (pivot point to the end of the rod).



**FIGURE 4 - REQUIRED TRIMMED ROD LENGTH**

This will accommodate up to a two (2) inch spring deflection. Shorten the rod, if necessary, to prevent excess rod-length from interfering with other trailer components. Assemble the load sensor according to the desired mounting location (See *Figure 7, all views*). Be sure that the load sensor mounting location permits the full range of motion of the load sensor assembly during use.

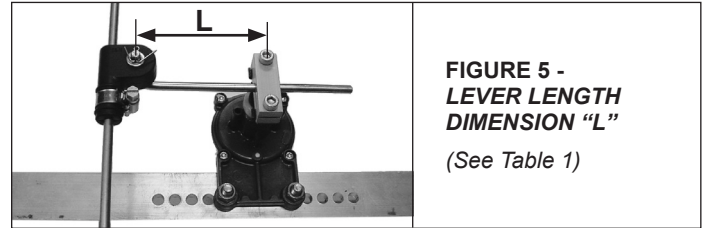
**TABLE 1:** Use the Spring Deflection value “D” to look up the Lever Length “L” required for the specific installation:

Spring Deflection “D”		Lever Length “L” (See Fig. 5)	
Inches	mm	Inches	mm
.591	15	1.985	50.41
.630	16	2.117	53.77
.669	17	2.249	57.13
.709	18	2.381	60.49
.748	19	2.396	60.85
.787	20	2.646	67.21
.827	21	2.778	70.57
.866	22	2.911	73.94
.906	23	3.043	77.30
.945	24	3.176	80.66
.984	25	3.308	84.02
1.024	26	3.440	87.38
1.063	27	3.572	90.74
1.102	28	3.705	94.10
1.142	29	3.837	97.46
1.181	30	3.969	100.82
1.220	31	4.126	104.81
1.260	32	4.234	107.54
1.299	33	4.366	110.90
1.339	34	4.498	114.26
1.378	35	4.631	117.62
1.417	36	4.763	120.99
1.457	37	4.896	124.35
1.496	38	5.028	127.71
1.535	39	5.160	131.07
1.575	40	5.293	134.43
1.614	41	5.422	137.73
1.654	42	5.557	141.15
1.693	43	5.689	144.51
1.732	44	5.822	147.87
1.772	45	5.954	151.23
1.811	46	6.086	154.59
1.850	47	6.219	157.95
1.890	48	6.351	161.31
1.929	49	6.483	164.67
1.969	50	6.616	168.04
2.008	51	6.748	171.40

**TABLE 1 - SPRING DEFLECTION “D” TO LEVER LENGTH “L”**

## LEVER LENGTH ADJUSTMENT:

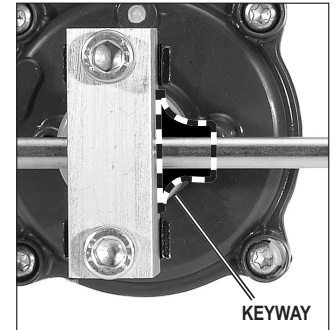
4. See *Figure 5*. Lever length “L” is the distance from the sensor to the mounting point of the axle. This will help the installer determine the length of the bracket.



**FIGURE 5 - LEVER LENGTH DIMENSION “L”**

(See Table 1)

5. See *Figure 6*. The dashed line shows the “Keyway” bracket on the sensor. See *Figure 7* for how to align the keyway for the installation. There is a channel in the sensor that aligns with the slot in the keyway at the horizontal position. Locking pins use the slot to hold the lever rod level during adjustment.

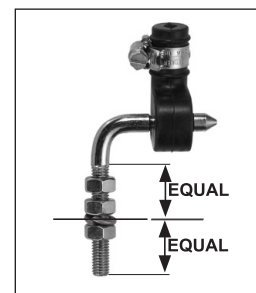


**FIGURE 6 - LOAD SENSOR “KEYWAY” BRACKET**

6. In all cases, insert the lever rod through the hole in the lever rod clamp block and adjust the lever length “L” (See *Figure 5*) to the value shown in Table 1. Tighten the lever rod clamp screws to 62 in-lbs (7 N-m).

## LINKING TO THE AXLE:

7. Attach the threaded end of the adjustable linkage to the mounting bracket — with an equal number of threads on each side of the bracket. Since the position will be adjusted, the nuts should only be finger tight at first. See *Figures 7 and 8*.



**FIGURE 7 - INITIAL BRACKET LOCATION ON THE ADJUSTABLE LINKAGE**



**FIGURE 8 - THE VERTICAL LINKAGE ROD ATTACHES TO THE AXLE USING THE FINE-ADJUSTMENT LINKAGE.**

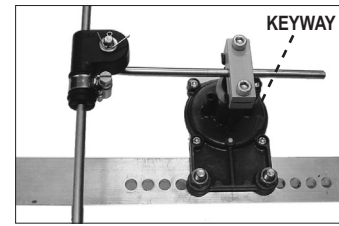
Use a minimum 1¼” square stock.

In the case of square or rectangular cross-section axles, Bendix recommends that the square stock be welded to the axle.

←← ARROWS INDICATE THE DIRECTION OF THE FRONT OF THE VEHICLE ←←

### ASSEMBLY FOR SENSORS: UPWARD MOUNT BEHIND THE AXLE

- See Figure 9A. With the lever rod removed, rotate the sensor spindle so that the keyway is towards the **REAR** of the trailer.

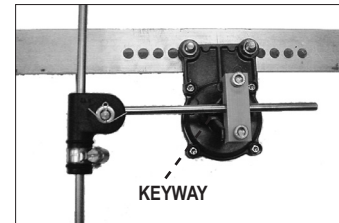


↓ VERTICAL LINKAGE RODS MUST BE LOCATED DIRECTLY ABOVE THE AXLE

FIGURE 9A - EXAMPLE OF SENSOR INSTALLATION

### ASSEMBLY FOR SENSORS: DOWNWARD MOUNT BEHIND THE AXLE

- See Figure 9B. With the lever rod removed, rotate the sensor spindle so that the keyway is towards the **FRONT** of the trailer.



↓ VERTICAL LINKAGE RODS MUST BE LOCATED DIRECTLY ABOVE THE AXLE

FIGURE 9B - EXAMPLE OF SENSOR INSTALLATION

- Using a strap-style fastener, affix the axle attachment bracket with the adjustable linkage to the axle. Take care not to tighten the strap all the way until adjustment of the vertical linkage is completed. See Figures 9A and 9B.
- After the sensor is assembled and mounted, use a level — or use an optional 5 mm locking pin — to temporarily hold the lever rod in the horizontal (unladen) position while the vertical linkage rod is adjusted and attached to the adjustable linkage on the axle. (The trailer must be unladen during calibration.)
- Remove the lower link end clamp from the adjustable linkage. Loosen the hose clamp and insert the vertical linkage rod into the link end until the end of the rod is flush with the end of the link. Hand tighten the hose clamp.
- Loosen the hose clamp on the upper link clamp and insert other end of the vertical linkage rod into the upper link end. Adjust the rod's position until the hole in the lower link is aligned with the horizontal shaft of the adjustable linkage. **To avoid slippage of the linkage, do not use lubricant on rubber link ends.**
- Remove the locking pin (if used). Check that the linkage and lever arm move freely up and down. The linkage must be free from any side-to-side forces which could cause the linkage to bind or bend.
- Push the lower rubber link end onto the shaft of the adjustable linkage. Secure the hose clamp hand-tight. Temporarily loosen the lock nuts if necessary. Tighten the axle fastener to the manufacturer's specifications.
- Connect auxiliary harness to both the Electronic Control Unit (ECU) and the sensor.
- Set the trailer on a level surface.
- Set the landing gear such that the trailer is the correct fifth-wheel height for the tractor that will pull the trailer.

### INSTALL A WARNING LABEL

It is recommended to install a warning label BW2824 (not included in the kit). See Figure 15.

### CONFIGURE FOR AN EXTERNAL LOAD SENSOR USING BENDIX® ACOM® DIAGNOSTICS

See Figure 10. In cases where the trailer is not already configured for an external load sensor, configure for an external load sensor on External Sensor #1, by selecting "Load" from the drop-down list. Next, set the empty and loaded voltage readings to 2.5 and 3.5 volts respectively.

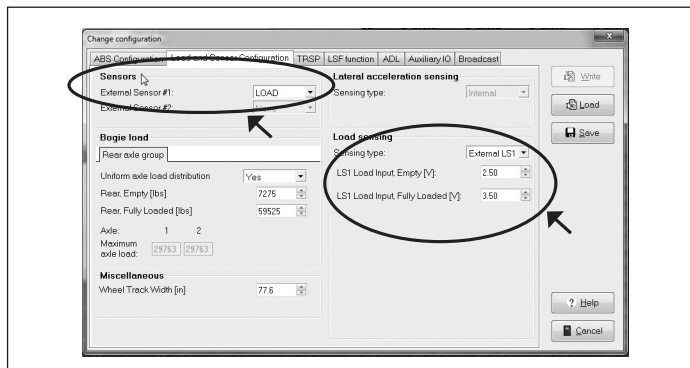
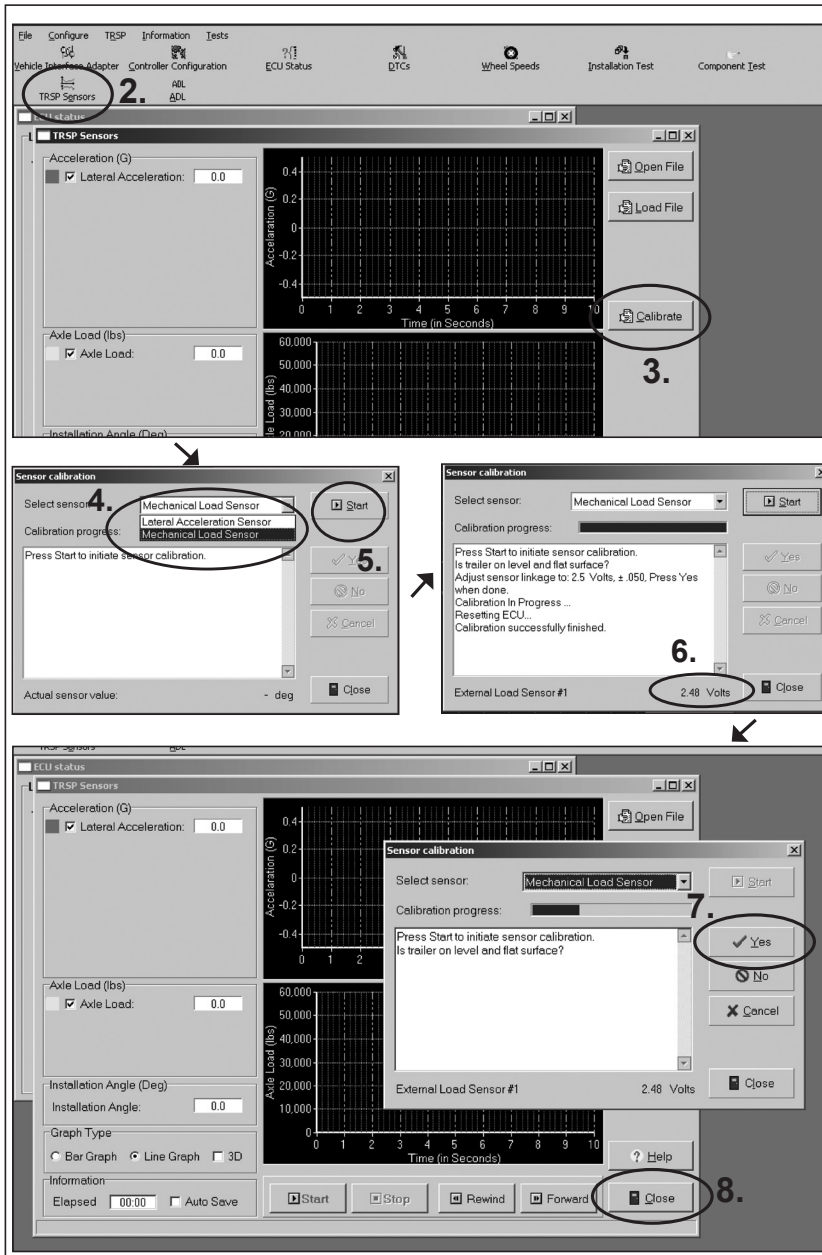


FIGURE 10 - LOAD SENSING CALIBRATION

## ADJUSTMENT AND CALIBRATION OF LOAD SENSOR USING BENDIX® ACOM® DIAGNOSTICS



1. Start the Bendix® ACom® Diagnostic software.
2. Select the “TRSP” Sensors button.
3. Select the “Calibrate” button.
4. Select the “Mechanical Load Sensor” from the “Select Sensor” drop-down menu and select “Yes.”
5. Press the “Start” button.
6. Using the fine adjustment linkage rod, adjust the sensor output voltage (displayed on bottom of screen - see Figure 11) to  $2.5 \pm 0.050$  volts. Lock the top two nuts together on the top side of the bracket then tighten the nut (with a lock washer) on the bottom side of the bracket. Check that the voltage is still between 2.45 and 2.55 volts. If necessary, repeat the adjustment until the voltage is within this range.
7. When the voltage is within the correct range, press the “Yes” button and wait for the setting to update.
8. After the successful calibration, press the “Close” button and wait until the setting is written to the Electronic Control Unit (ECU). Check that all fasteners are secured.

FIGURE 11 - CALIBRATION STEPS

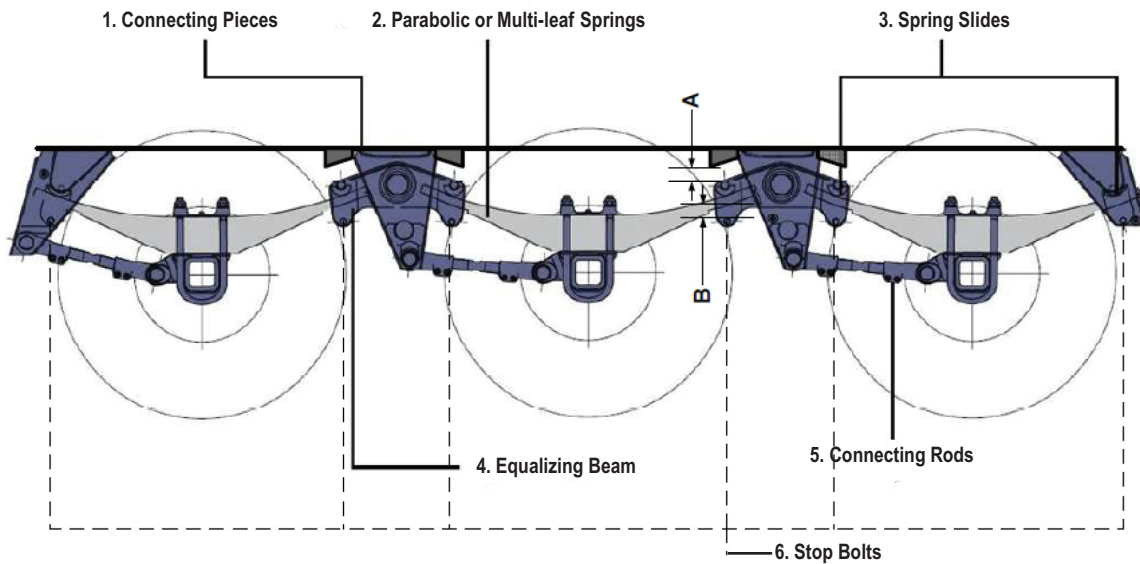


FIGURE 12 - SPRING SUSPENSION TRIDEM ON LEVEL GROUND

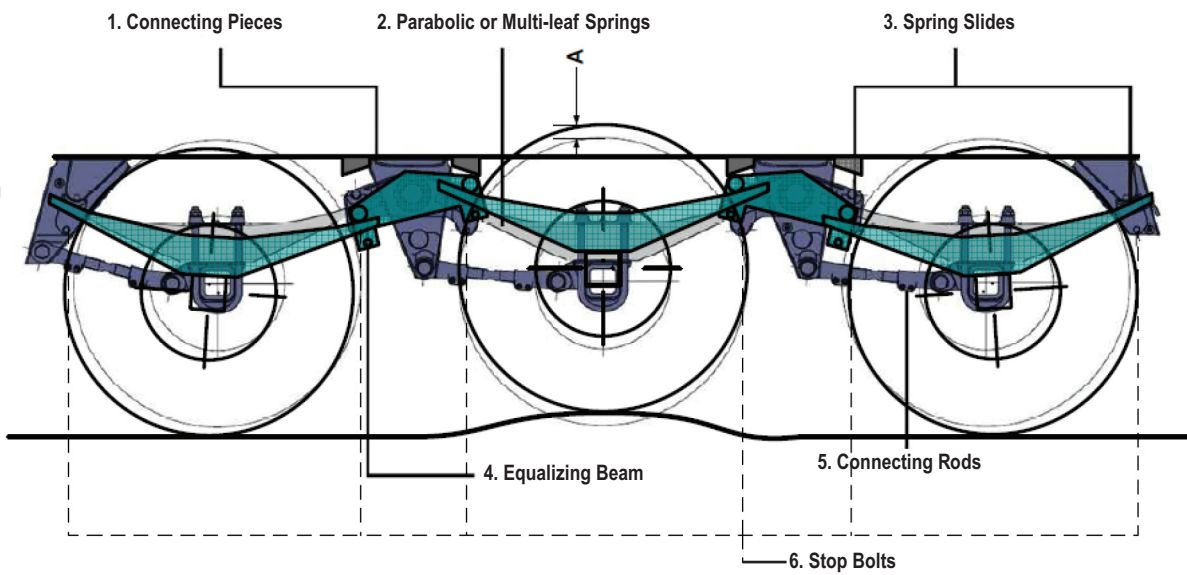


FIGURE 13: SPRING SUSPENSION TRIDEM ON CONVEX SURFACE (BUMP)

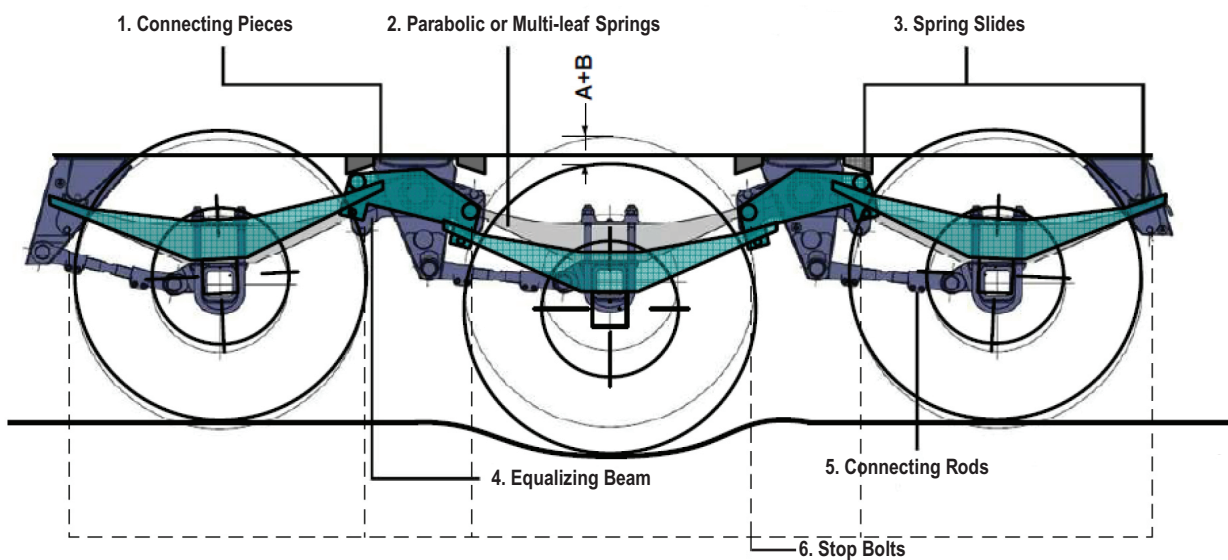


FIGURE 14 - SPRING SUSPENSION TRIDEM ON CONCAVE SURFACE (DEPRESSION)

**! WARNING**

Suspension jounce can result in the trailer axle dropping below the normally empty position resulting in a negative spring deflection. The sensor lever needs to be long enough to accommodate this additional travel. The maximum deflection does not necessarily occur when the trailer is lifted horizontally; rather, the geometry must be inspected for all possible motions and the maximum deflection identified.

Movement of a spring suspended axle with respect to a fixed point on the chassis can occur due to these multiple conditions:

- Spring deflection, under ideal conditions, may amount to just the static compression and recovery of the springs as load is added or removed respectively. This is the case when the wheels are all on a level surface. See *Figure 12*.
- Static negative deflection of the axle may occur when the trailer is lifted off of the ground (level surface) such as when it is lifted using a crane in intermodal applications, or when the trailer is being jacked up by the chassis for service. In this case the springs are allowed to move distance B (*in Figure 12*) to rest on the stop bolts.

There are additional movements that can occur outside of these static cases. The suspension has built-in tolerances that allow for additional upward and downward movement of the axle. *Figure 12* demonstrates where all wheels are on a level surface. Distance A is the available movement in the upward direction. Distance B is the available movement in the downward direction.

During driving, these dynamic movements can occur due to uneven road surfaces (pot holes and bumps), upward and downward road surface (hills and ramps), and winding road surface differences (left to right due to banking and crowns). As surface differences are encountered the equalizing beams will pivot, so the springs can move up on one side of the equalizing beam by distance A and down on the other by distance A as seen in *Figure 13*.

Additionally, when the axle's wheels are in a depression the equalizing beams will again pivot - potentially moving by distance A downward - while the springs may drop to the stop bolts (distance B). See *Figure 14*. Distances A and B must be accommodated for, in the installation of the spring deflection sensor. The linkage between the sensor and axle cannot be stretched or allowed to go completely vertical so that it would return in the opposite direction.

The distances A and B can be determined by jacking up the trailer until the wheels on the axle that has the sensor attached are off the ground. Additionally, prior to jacking or lifting the trailer, it is recommended that the vertical rod is detached from the fine adjust linkage, but must be reattached before putting the trailer back into service. See warning label BW9848 shown in *Figure 15*. If for some reason there is more jounce in the suspension than can be accommodated for by the lever length, contact your Bendix representative.

**! CAUTION**

The geometry of the suspension must be inspected for all possible motions and the maximum deflection identified.

**! CAUTION**

Not all trailers are suitable candidates for Trailer Roll Stability Program (TRSP). Consult with Bendix Engineering as needed.

**! CAUTION**

Be aware that the fifth wheel height of the tractor may affect the calibration of the spring deflection sensor. To minimize this effect, install the sensor on the rear-most axle. The calibration process may need to be rerun with the tractor that will be used attached.

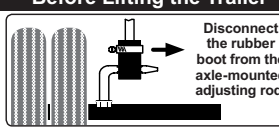
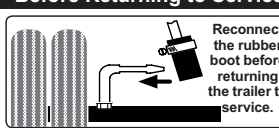
<p><b>! WARNING! Prevent Load Sensor Damage When Lifting this Trailer</b> To prevent damage to the Bendix® Load Sensor installed on this trailer, the linkage rod must be disconnected from the sensor's rubber boot whenever the frame of the trailer is lifted, dropping the axle(s). This includes when jacking the rear bumper or when a crane is used to lift the trailer.</p> <p><b>! WARNING! Operating the vehicle with a damaged/disconnected sensor could lead to a serious accident</b> The Bendix® Advanced Trailer ABS used on this vehicle uses sensors, including the load sensor, to assist the Trailer Roll Stability function.</p> <p>For more service information go to <a href="http://www.bendix.com">www.bendix.com</a>, or call the Bendix Tech Team at: 1-800-AIR-BRAKE (1-800-247-2725).</p> <p><b>Bendix</b></p> <p><small>BW2848 ©2011 Bendix Commercial Vehicle Systems LLC. All Rights Reserved. 06/11 K059149</small></p>	<p><b>Before Lifting the Trailer</b></p>  <p>Disconnect the rubber boot from the axle-mounted adjusting rod.</p> <p><b>Before Returning to Service</b></p>  <p>Reconnect the rubber boot before returning the trailer to service.</p> <p><small>Follow all standard industry safety practices, including wearing safety glasses. When working on or around this trailer, park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Disconnect the electrical connector from the ABS Controller when welding on the trailer.</small></p>
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FIGURE 15 - WARNING LABEL (RECOMMENDED) ORDER BW2848.

**Bendix Technical Assistance Team**

For direct telephone technical support, call the Bendix Tech Team at: 1-800-AIR-BRAKE (1-800-247-2725).

Or, if you prefer, e-mail us at: [techteam@bendix.com](mailto:techteam@bendix.com). Please have the following information ready when you contact the Bendix Tech Team: Bendix product model number; part number and configuration; vehicle make and model; and vehicle configuration (number of axles, tire size, etc.).

**Reference:**

The full range of Service Data sheets for Bendix® brand products are available for download on [www.bendix.com](http://www.bendix.com). You can also order copies from the Literature Center at the website.

For the Bendix® TABS-6™ Advanced Service Data sheet, download SD-13-47671. For the Advanced Multi-Channel Service Data sheet, download SD-13-47672.

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