# Section 5
# Adjustments and Alignments

## Adjusting Suspension Ride Height

The height control valve and linkage should be checked regularly for proper clearance, operation and adjustment.

**NOTE: Improperly adjusted ride height will result in incorrect alignment measurements and may result in abnormal tire wear. Check ride height prior to front suspension alignment.**

The ride height of the front suspension is the distance from the bottom of the chassis frame rail to the center of the wheel spindle. Properly adjusted ride height results in correct suspension travel and alignment. The ride height should not be adjusted to adjust chassis rake angle.

### Preparation

1. Park the vehicle on a level surface.
2. Set the parking brake and block the drive wheels to prevent vehicle movement.
3. Check that the rear suspension is adjusted to the correct ride height per the vehicle manufacturer specifications.
4. Check height control valve plumbing to ensure there are not any air leaks.
5. Make sure shock mounts are mounted securely and not bent.

### Adjustment

1. Measure the distance between the centers of the shock mounts. If the distance is not within 14.92 ± .10 inches then adjust as follows.
2. Disconnect height control valve linkage on the opposite side and allow the air spring to deflate by rotating the height control valve arm down. Do not alter length when disconnecting.
3. Loosen adjusting bolt (See Figure 15) on actuation arm.
4. Rotate the actuation arm to achieve specified ride height. Wait 30 seconds for suspension to "settle" after adjusting to verify correct adjustment.

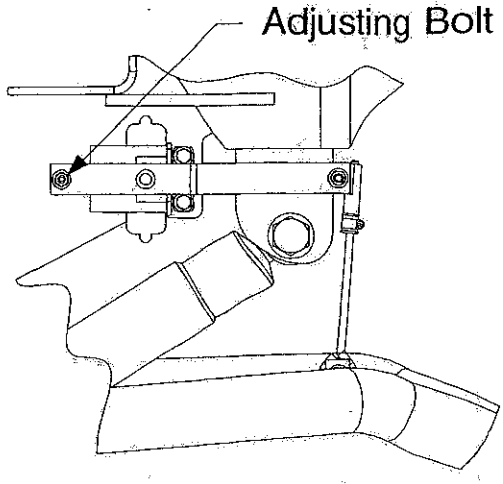


Figure 15 – Height Control Valve Adjustment.

9. Tighten the adjusting bolt on the actuation arm.
10. Reconnect the height control valve linkage on the other side and repeat steps 2-4 for the opposite side as needed.
11. Verify that the ride height is correct on both sides.

**NOTE: The height control valves must be adjusted individually.**

# Section 5
# Adjustments and Alignments

## Checking and Adjusting the Wheel Bearings

### Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

> **WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.**

3. If the tire and wheel are not removed make sure all the wheel nuts are tightened to the specified torque of **450-500 lbf•ft**. See Torque Table.
4. If the tire and wheel are removed (recommended for aluminum wheels) secure the brake drum to the hub with the wheel nuts or remove the brake drum.
5. Remove the vent plug from the hubcap.

### Adjustment

1. Seat the bearings by tightening the inner spindle nut to **180 lbf•ft** while rotating the wheel in both directions.
2. Loosen the inner spindle nut completely and then re-tighten the inner nut to **20 lbf•ft**.
3. Back off the inner spindle nut ¼ turn.
4. Install the spindle lock washer.

> **NOTE: If the dowel pin of the inner spindle nut and a hole in the locking washer are not aligned, turn the locking washer over and re-install. If required, loosen the inner spindle nut just enough for alignment.**

> **CAUTION: Never tighten the inner spindle nut to align the dowel pin with hole in locking washer. This can pre-load the bearings and cause premature bearing failure.**

5. Install the replacement spindle washer P/N 6969 and the outer spindle nut. Tighten the outer spindle nut to **200-300 lbf•ft**.
6. Attach a dial indicator with a magnetic base to the face of the hub. (See Figure 16). Note the brake drum is shown for reference only.
7. Place the tip of the dial indicator on the center of the steering knuckle spindle. Set the dial indicator on zero.

> **NOTE: Do not push/pull at the top and the bottom of the hub. Pushing or pulling at the top and the bottom will not yield a true measurement of the endplay.**

8. Measure the endplay by simultaneously pushing/pulling on each side of the hub while observing the dial indicator. The endplay is the *total* travel observed. If the endplay is not within .001-.004 inch re-adjust the wheel bearings per steps 2-5 or by re-indexing inner spindle nut. Otherwise continue to step 9.

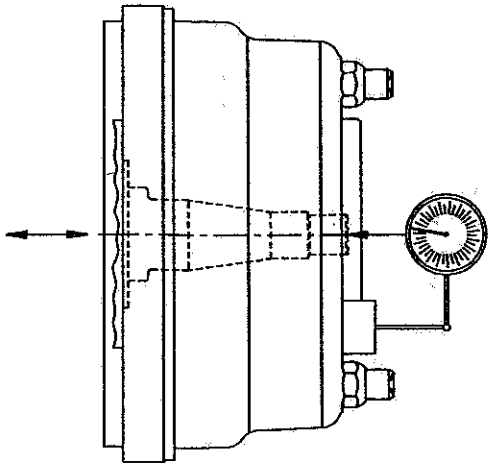

Figure 16 - Wheel Endplay Measurement

9. Bend the spindle washer over one wrench flat of the outer nut.
10. Install the hubcap gasket and hubcap. Tighten the capscrews to **20-30 lbf•ft**. See Torque Table for sequence.

## Adjusting the Maximum Turn Angle

**CAUTION: Do not adjust maximum turn angle greater than 50°. Mis-adjustment of the turn angle can cause damage to steering system components.**

Check the turn angle if the front tires rub against the frame, suspension, body, or if the steering gear has been serviced. Use an alignment machine to check the angle. See the procedure of the alignment machine manufacturer.

The steering stop bolt on the suspension subframe controls the maximum turn angle. If the stop bolt is missing, bent, or broken; replace the stop bolt(s) or jam nut(s) and follow the procedure below for adjustment. Inspect other suspension components for damage.

In the course of adjusting the steering stop(s), the steering gear poppet valves may require readjustment. Refer to TRW's TAS Steering Gear Service Manual for readjusting the poppets.

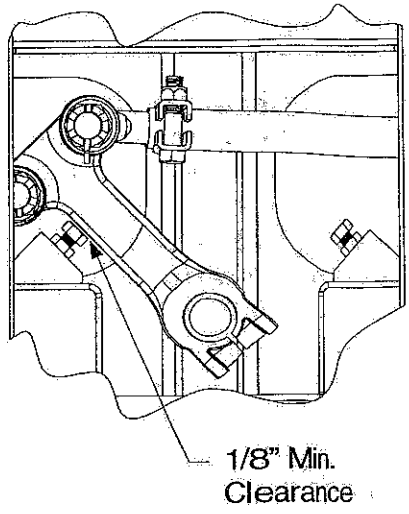


Figure 17 - Steering Arm Stop Bolt

**CAUTION: In power steering systems, the hydraulic pressure should relieve or "drop off" when the steered wheels approach the steering stops in either direction. If the pressure does not relieve, the components of the front suspension may be damaged.**

# Section 5
# Adjustments and Alignments

## Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Place the front tires on a suitable device that allows the front wheels to turn and measures the wheel turn angle.
3. Check that the steering gear is centered and the tires are steered straight ahead with equal toe-in side to side. If either of these two conditions is not met, then adjust toe-in first before centering the steering gear. See Adjusting the Toe-In Section and refer to Spartan chassis service guidelines for centering the steering gear.

**NOTE: Unequal toe-in side to side or an out-of-center steering gear can result in unequal turn angles and steering pull while steering straight ahead. The drag link length may be adjusted to attain steering gear on center condition while maintaining equal toe-in side to side.**

4. Check that the lengths of the tie rods are equal to each other within 1/16" inch. If not, adjust lengths according to the Adjusting the Toe-In Section before adjusting the steering stops.

**NOTE: Do not adjust the length of the tie rods to center the steering wheel. This can cause the steering gear to become off center.**

## Adjustment

1. Turn the steering wheel until the steering arm contacts the stop bolt or the steering wheel stops turning (See Figure 17). Measure the turn angle of the wheel on the same side as the turn (i.e. inside wheel).
2. If the wheel turn angle differs from Spartan chassis guidelines then adjust as follows.
3. Loosen the jam nut on the stop bolt.
4. Turn the stop bolt until the specified wheel turn angle is achieved and the bolt head contacts the steering arm.
5. Tighten the jam nut to **90-110 lbf•ft**. See Torque Table.

**CAUTION: After readjusting the steering stop(s) check that the steering poppets are reset properly and that the front tires do not contact the frame, suspension, or body. Also check for 1/2" minimum clearance between the air spring and brake dust cover.**

6. Repeat checking and adjustment for turning the opposite direction.

# Inspection Before Alignment

Check the following before conducting front wheel alignment measurements.

## Inspection

See "General Inspection" in Section 3.

## Wheels and Tires

1. Check that the front tires are inflated to the appropriate pressure based on the wheel loading.

2. Check that the front tires are the same size and type.
3. Check that all the wheel nuts are tightened to the specified torque of **450-500 lbf•ft.** See Torque Table.
4. Check that the wheels are balanced.

### Front Suspension

1. Check that all fasteners are tightened to the specified torque.
2. Check the suspension ride height and adjust as needed to the specified height.
3. Check for worn ball joints, tie rod ends, control arm bushings, and damaged suspension components. Replace worn components as needed.
4. Check for loose ball joint and tie rod end tapered connections, tie rod end jam nuts, and chassis steering system components. Inspect connections for wear and replace as needed. Tighten connections as needed.
5. Check the wheel bearing adjustment and adjust as needed.
6. Inspect the shock absorbers for wear and damage.

### Rear Axle and Suspension

Front tire wear and incorrect steering can be caused by the rear axle and/or suspension.

1. Check that all fasteners are tightened to the specified torque.
2. Check the suspension ride height and adjust as needed to specified height.
3. Check that all connection joints between the suspension and axle are secure.
4. Check for worn suspension bushings or damaged suspension components.
5. Check that the rear axle is correctly aligned.
6. Check that the frame is not bent.
7. Refer to any additional recommendations and specifications from the manufacturer of the chassis on rear axles and suspensions.

**NOTE: Total vehicle alignment is recommended when aligning the front suspension.**

## Front Wheel Alignment

### Equipment

ReycoGranning® recommends that suitable alignment equipment be used to measure the wheel alignment characteristics: camber, caster, and toe-in. The alignment equipment must be properly calibrated for accurate measurements. Only qualified personnel should conduct the wheel alignment measurements.

### General

The overall toe-in of the front wheels should be checked every 24,000 miles or 2 years. When the vehicle does not steer correctly or the front tires develop an abnormal tire wear pattern, the camber, caster, and toe-in should be measured and adjusted as needed. Toe-in typically has the largest effect on tire wear.

The maximum wheel turn angle should be checked and adjusted as needed.

# Section 5
# Adjustments and Alignments

Eccentric adapters have been installed at all control arm bushing mounts. The purpose of the adapters is to provide additional adjustment of camber and caster to minimize vehicle drifts or pulls to one side of the road.

## Preparation

1. Follow the manufacturer's procedures for preparing the vehicle for front and rear wheel alignment measurements.
2. Set the parking brake to prevent vehicle movement.

**NOTE: An out-of-center steering gear can result in unequal turn angles. The steering gear should remain centered during toe-in adjustment.**

**NOTE: Do not adjust the length of the tie rods to center the steering wheel. This can cause the steering gear to become off center.**

3. Check that the steering gear is centered when the tires are steered straight ahead (i.e. equal toe-in side to side). Center the steering gear according to Spartan's guidelines.
4. Measure and record the individual wheel camber, caster, and toe-in of the front suspension. Also measure and record the cross camber, cross caster, and overall toe-in.
5. If adjustment to camber and caster is required then follow the steps below. Otherwise, go to the "Adjusting the Toe-In" section to adjust the toe-in as needed.
6. Raise the vehicle until the front wheels are off the ground. Support the raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

**WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.**

## Adjusting the Camber Angle

**CAUTION: ReycoGranning® does not recommend adjusting the ride height or altering components to adjust the suspension camber. Alteration of components may cause a vehicle accident and serious personal injury.**

Camber is the angle of the tire with respect to the ground. Camber is positive when the distance between the top of the wheels is greater than the distance at the ground. A small amount of positive camber is built into the suspension because camber changes with load and chassis roll.

The camber of the suspension is affected by the ride height of the suspension. If the ride height is set too high then the camber measurement will be more positive. See the "Checking and Adjusting Suspension Ride Height" sections before measuring camber. The table below lists the recommended camber angles.

| Nominal Camber Values-Degrees | | |
|---|---|---|
| | Unloaded | Loaded |
| Left | +1/4°(±1/4°) | +1/4°(±1/4°) |
| Right | +1/4°(±1/4°) | +1/4°(±1/4°) |

The set screw in the eccentric adapter denotes the orientation of the eccentricity of the adapter. When the set screw is in the 6 o'clock or 12 o'clock position, then the adapter is in the "neutral" position. There are two adapters at each control arm mount and they must be oriented the same.

When the set screws in both control arm mounts are oriented closer to the frame rail, the wheel camber becomes more positive. When the set screws in both control arm mounts are oriented farther from the frame rail, the wheel camber becomes more negative. The eccentric adapters at both control arm mounts must be oriented the same to affect only camber.

**NOTE: Eccentrics have been installed at all control arm mount locations. ReycoGranning® recommends that the upper control arm eccentrics be used for caster adjustment and the lower control arm eccentrics be used for camber adjustment. A combination of upper and lower adjustment can be used to provide additional adjustment.**

1. Turn the wheel to provide access to the upper control arm mount.
2. Loosen either both upper control arm mounting bolts or both lower control arm mounting bolts at the eccentric adapters. Do not remove the bolts because the adapters must remain engaged in control arm mounting plate for adjustment.
3. Loosen the set screws.
4. Rotate each eccentric adapter to the same orientation as needed based on measured wheel camber. The eccentric adapters at each control arm mount must have the same orientation.
5. Tighten the adapter locknuts to **460-490 lbf•ft**. See Torque Table.
6. Tighten the set screws to **30-40 lbf•in**. See Torque Table.
7. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
8. Re-measure the camber and readjust as needed.

## Adjusting the Caster Angle

**CAUTION: ReycoGranning® does not recommend adjusting the ride height or altering components to adjust the suspension caster. Alteration of components may cause a vehicle accident and serious personal injury.**

The caster angle is the angle from the vertical position to the axis defined by the ball joints when seen from the side of the vehicle. When the top of ball joint axis is toward the rear of the vehicle, then the caster is positive. Positive caster creates a self-aligning moment to stabilize the vehicle when driving straight ahead.

# Section 5
# Adjustments and Alignments

The caster is indirectly measured from the change in wheel camber as the wheel is turned through a prescribed arc. Therefore, the calculated caster of the wheel is affected by the ride height of the suspension. See the "Checking and Adjusting Suspension Ride Height" sections before measuring caster. The table below lists the recommended caster angles.

| Nominal Caster Values-Degrees | | |
|---|---|---|
| | Unloaded | Loaded |
| Left | +2-1/4°(±1/2°) | +2-1/4°(±1/2°) |
| Right | +2-1/4°(±1/2°) | +2-1/4°(±1/2°) |

The set screw in the eccentric adapter denotes the orientation of the eccentricity of the adapter. When the set screw is in the 6 o'clock or 12 o'clock position, then the adapter is in the "neutral" position. There are two adapters at each control arm mount and they must be oriented the same.

When the set screws in the forward control arm mount are oriented closer to the frame rail and the set screws in the rearward control arm mount are oriented farther from the frame rail, the wheel caster becomes more positive. When the set screws in the forward control arm mount are oriented farther from the frame rail and the set screws in the rearward control arm mount are oriented closer to the frame rail, the wheel caster becomes more negative. The eccentric adapters at both upper control arm mounts must be oriented opposite each other to affect caster.

**NOTE: Eccentrics have been installed at all control arm mount locations. ReycoGranning® recommends that the upper control arm eccentrics be used for caster adjustment and the lower control arm eccentrics be used for camber adjustment. A combination of upper and lower adjustment can be used to provide additional adjustment.**

1. Turn the wheel to provide access to the control arm mount.
2. Loosen both control arm mounting bolts at the eccentric adapters. Do not remove the bolts because the adapters must remain engaged in control arm mounting plate for adjustment.
3. Loosen the set screws.
4. Rotate the eccentric adapters at the forward and rearward control arm mounts opposite one another as needed based on measured wheel caster. The eccentric adapters at each control arm mount must have the same orientation.
5. Tighten the adapter locknuts to **460-490 lbf•ft**. See Torque Table.
6. Tighten the set screws to **30-40 lbf•in**. See Torque Table.
7. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
8. Re-measure caster and readjust as needed.