

PRACTICE EXAM 5: T5 SIMULATION

(50 QUESTIONS)

1. A heavy-duty truck pulls strongly to the right under power steering assist but tracks straight when the engine is off and the truck is being towed by another vehicle. The driver also reports increased steering wheel return effort after a turn. Which steering gear condition would best explain both symptoms simultaneously?

- A. Worm shaft thrust bearing preload has loosened beyond the service specification limit
- B. Pitman shaft seal is leaking allowing external oil weep around the output shaft area
- C. Spool valve in the integral gear is shifted off center toward the right turn position
- D. Sector shaft over-center adjustment has been backed off resulting in excessive lash

2. A truck steering gear shows a small external oil weep at the input shaft seal area. Tech A says the most likely cause is a damaged input shaft seal allowing fluid to escape around the rotating shaft. Tech B says input shaft weep is normally caused by a cracked spool valve sleeve and the entire steering gear must be replaced as an assembly. Who is correct?

- A. Tech A only
- B. Tech B only
- C. Both Tech A and Tech B
- D. Neither Tech A nor Tech B

3. The drag link on a tractor exhibits 3/16 inch of vertical play when checked with a pry bar at the pitman-arm-to-drag-link connection. The connection uses a tapered stud and castellated nut secured with a cotter pin. According to TMC Recommended Practice for heavy-duty steering linkage service, this finding indicates which corrective action?

- A. Adjust the pitman arm position on the sector shaft splines to recenter the drag link geometry
- B. Replace the drag link end socket because vertical play in a sealed end exceeds service limits
- C. Tighten the castellated nut to specification and install a new cotter pin to remove the play
- D. Lubricate the connection with chassis grease through the zerk fitting until movement stops

4. Which condition would LEAST likely cause excessive steering wheel free play on a Class 8 conventional tractor?

- A. Worn drag link socket at the pitman arm connection point
- B. Loose worm shaft adjuster on the integral steering gear assembly
- C. Worn cross tube tie rod ends on the steering axle linkage
- D. Restricted return line from the steering gear to the fluid reservoir

5. A power steering pump on a heavy truck is producing pressure of 1,950 psi at relief while the manufacturer specification calls for 2,150 psi maximum relief pressure. The truck shows hard steering at low speed and heavy lift conditions. The technician confirms fluid level is correct and the belt is tight with no slippage. What is the most likely cause of the low relief pressure reading?

- A. Pump internal wear or a sticking flow control valve inside the pump body
- B. Air leak on the suction side drawing air into the pumping chambers
- C. External steering gear leak reducing system pressure during the relief test
- D. Restricted high-pressure hose limiting pump output during the test sequence

6. A heavy-duty steering column features an intermediate shaft with two universal joints and a slip yoke. Tech A says the slip yoke allows for movement between the steering column and the steering gear during cab-to-chassis flex on the truck mounts. Tech B says the two universal joints must be phased so that the joint forks at each end of the intermediate shaft are aligned in the same plane. Who is correct?

- A. Tech A only
- B. Tech B only
- C. Both Tech A and Tech B
- D. Neither Tech A nor Tech B

7. A driver complains that the steering wheel will not return to center after completing a right-hand turn at low speed but returns normally after left-hand turns. Steering effort during turns feels normal in both directions. Which condition best explains this one-sided return failure?

- A. Spool valve dead-band centering spring has weakened in the integral steering gear
- B. Pump output pressure is below specification under steering load on both sides
- C. Right-side wheel-end bearing preload is excessive causing rolling resistance during return
- D. Over-center adjustment on the steering gear has been tightened beyond service limits

8. A technician inspects the front steering axle kingpins on a heavy-duty truck and finds 0.012 inch of vertical play measured at the kingpin bushing area. The OEM service limit for kingpin vertical end play is 0.010 inch maximum, with new components specified at 0.001 to 0.005 inch. Which corrective action is required?

- A. The wear is within the new-component specification range and no service is required
- B. Replace the kingpins, bushings, and thrust bearings as a complete service kit
- C. Add a thicker thrust shim between the steering knuckle and axle beam to compensate
- D. Lubricate the kingpin assembly with chassis grease through the upper and lower fittings

9. On a TRW TAS-65 integral hydraulic steering gear, the poppet relief valves perform which specific function?

- A. Limit pump output pressure to prevent damage to the high-pressure hose during relief
- B. Prevent cavitation in the gear during cold-start operation by allowing air to bleed
- C. Maintain centered spool valve position when the steering wheel is held at center
- D. Limit gear internal pressure at full lock by relieving fluid back to return circuit

10. An over-the-road truck is brought in with a complaint of steering wander and the driver reports that the truck "hunts" between lanes on smooth highway. Front tire wear shows feathering on the inside edge of both front tires. Which adjustment would be checked FIRST in the diagnostic sequence?

- A. Front toe setting at the cross tube using a string-and-tape or laser alignment tool
- B. Caster angle on both kingpins using a turntable-mounted electronic alignment instrument
- C. Camber angle measured from the wheel face to vertical with the truck on level pavement
- D. Steering axle thrust angle relative to the rear drive axle centerline using laser equipment

11. A heavy truck steering gear input shaft will not rotate when steering effort is applied but the steering wheel can be moved freely in both directions for approximately 30 degrees before resistance is felt. The intermediate shaft U-joints are tight and undamaged. Which component failure best matches this description?

- A. The pitman arm has loosened on the sector shaft master spline allowing rotation
- B. The intermediate shaft slip yoke splines have stripped or sheared at the upper coupling
- C. The steering gear sector shaft has fractured below the housing seal at the spline
- D. The power steering pump drive belt has slipped reducing assist pressure to the gear

12. Which of the following will cause a power steering system to make a moaning or whining noise EXCEPT?

- A. Low fluid level in the reservoir allowing air to be drawn into the pump suction
- B. A loose suction-side hose clamp permitting air to enter ahead of the pump inlet
- C. Internal pump wear reducing volumetric efficiency and causing fluid cavitation
- D. A sticking pressure relief valve in the gear releasing fluid at low system pressure

13. A 2024 model year heavy-duty tractor with electronic stability control receives steering wheel position data through which type of sensor mounted on the steering column?

- A. A potentiometer providing analog voltage signal proportional to wheel rotation angle
- B. A magnetic pickup providing pulse signals to indicate steering wheel rotation rate only
- C. A multi-track optical or magnetic encoder providing digital position and rotational direction
- D. A linear variable differential transformer indicating displacement of the intermediate shaft

14. During a steering gear swap, a technician installs the new gear and discovers that the steering wheel is approximately 30 degrees clockwise from straight ahead when the front wheels point straight. What is the correct procedure to address this condition?

- A. Remove the pitman arm, center the gear sector to its on-center position, and reinstall the pitman arm at the proper master spline alignment
- B. Loosen the steering wheel retaining nut and rotate the steering wheel on the column shaft splines to align it with straight-ahead vehicle direction
- C. Adjust the drag link length by rotating the threaded socket adjustment until the steering wheel returns to centered position during normal driving operation
- D. Reposition the intermediate shaft slip yoke splines on the upper steering column to bring the steering wheel back to its proper centered position

15. A truck driver complains of intermittent hard steering only during cold-weather start-up that disappears after the truck has been driven for several minutes. Tech A says this is normal for a high-viscosity power steering fluid that thickens at low temperature. Tech B says the issue is internal pump wear that becomes apparent only when fluid viscosity drops with warming. Who is correct?

- A. Tech A only
- B. Tech B only
- C. Both Tech A and Tech B
- D. Neither Tech A nor Tech B

16. The most common cause of a hard turning condition that is more pronounced at low engine speed but improves at highway speeds is:

- A. Internal gear wear where the spool valve dead band has expanded beyond service limit
- B. A power steering pump with worn vanes or weak springs reducing flow at low engine RPM
- C. A restricted return line from the gear creating back pressure that interferes with assist
- D. A misaligned intermediate shaft increasing rolling friction through the steering column

17. A technician performs a power steering system pressure test with a gauge tee-fitted into the high-pressure line. At idle with the wheel held at full right lock, pressure reads 2,150 psi. With engine RPM raised to 1,500 and the wheel still at full lock, pressure rises to 2,180 psi. The OEM specification calls for relief opening at 2,200 psi maximum. What does this test confirm?

- A. The pump is functioning correctly and the spool valve is centering properly at neutral
- B. The high-pressure hose is restricted and creating an artificial pressure rise at the gauge
- C. The pump is functioning correctly and the relief valve is opening within the proper range
- D. The gear's poppet relief valves are not opening which prevents over-pressure protection

18. The recommended interval for power steering fluid replacement on a Class 8 commercial tractor in normal service is best described as:

- A. As specified by the OEM, typically based on miles, hours, or measured fluid condition
- B. Every 100,000 miles or two years of service whichever comes first under all conditions
- C. Power steering fluid is sealed in the system and should never be changed unless contaminated
- D. At every chassis lubrication interval set by the fleet preventive maintenance program

19. A heavy-duty truck with multi-leaf rear spring suspension shows fractured center bolts on both rear axles. Tech A says center bolt fractures are usually caused by an overweight load applied repeatedly to the suspension. Tech B says center bolt fractures most commonly result from loose U-bolts allowing the spring stack to shift on the axle saddle. Who is correct?

- A. Tech A only
- B. Tech B only
- C. Both Tech A and Tech B
- D. Neither Tech A nor Tech B

20. A truck with air suspension on the rear drive axles will not raise to ride height after a parking brake release and starting sequence. The dash air pressure shows 120 psi system air available. The height control valves on both sides are inspected and the linkage from the chassis to the valve appears intact. Which test should be performed FIRST to isolate the cause?

- A. Replace both height control valves with new units and recheck operation after installation
- B. Manually raise the height control valve linkage and observe if the air bags inflate normally
- C. Disconnect the supply line to the height control valves and check for air pressure at inlet
- D. Apply pressurized air directly to the air bag inlet ports and check for leaks at the bag

21. On a heavy-duty trailing arm air suspension, the pivot bushings at the trailing arm-to-frame connection are typically constructed as:

- A. Roller bearings packed with high-temperature grease and sealed with double-lip seals
- B. Bronze sleeve bushings requiring chassis lubrication at scheduled service intervals
- C. Plain steel sleeves running on steel bores with no lubrication required in service
- D. Bonded rubber bushings that flex during suspension travel and require no lubrication

22. A driver reports a banging noise from the rear of the trailer over highway expansion joints. The trailer has air ride suspension and the driver indicates the noise is metallic and sharp. Inspection finds that the upper shock mount on the right rear has fractured at the bracket. Which condition would have most likely caused this fracture?

- A. Worn shock absorber that has been bottoming out internally during rebound travel cycles
- B. Air bag pressure regulated above specification creating excessive ride height during operation
- C. Trailing arm bushing wear allowing axle fore-aft shift that misaligned the shock mount
- D. Overload condition during recent operation that caused single-event bracket fatigue failure

23. The function of a torque rod (also called torsion rod or radius rod) on a heavy-duty trailing arm rear suspension is to:

- A. Limit rebound travel of the suspension by stopping the trailing arm from over-extending
- B. Provide load-sharing between two drive axles in a tandem suspension by transferring force
- C. Position the axle housing fore-aft while resisting axle rotation under driving and braking
- D. Carry vertical load from the frame to the axle in parallel with the air bag

24. A heavy-duty truck tandem rear suspension uses an equalizer beam (Hendrickson walking beam) design. Which inspection finding indicates the most critical safety concern requiring immediate service?

- A. End cap bushing on the equalizer beam shows visible wear with approximately 1/16 inch of play
- B. Upper shock absorber bushing exhibits surface cracking but the shock mount is otherwise tight
- C. Bronze saddle bushing in the equalizer center bearing shows scoring on the inside diameter
- D. Center bushing in the equalizer beam pivot shows movement greater than 1/8 inch when pried

25. The primary purpose of a track bar (also called Panhard rod) on a heavy-duty rear air suspension is to:

- A. Prevent lateral movement of the axle relative to the frame during cornering events
- B. Limit fore-aft movement of the axle during acceleration and braking by tying it together
- C. Carry a portion of the vertical suspension load in parallel with the air bags
- D. Restrain axle rotation under driving torque to prevent pinion gear lift during acceleration

26. When servicing a heavy-duty leaf spring rear suspension, which component should always be replaced when the spring leaves are renewed?

- A. The U-bolt high tensile nuts can be reused if cleaned and re-torqued to specification
- B. The spring center bolt should be reused because it is matched to the existing axle saddle
- C. The U-bolts and U-bolt nuts should be replaced because they were stretched at original installation
- D. The shock absorber on the side because it will have settled into the previous geometry

27. A driver complains of harsh ride on a tractor with air ride suspension. The technician finds that air bag pressure on both rear bags is approximately 90 psi at empty rolling weight, and ride height is approximately 1 inch above specification. Which condition best explains the harsh ride symptom?

- A. Air bag internal damage causing cushion loss and direct frame-to-axle contact during travel

- B. Height control valve adjustment is biased high causing excessive bag pressure and stiff ride
- C. Shock absorbers are over-damped and require replacement with softer-rated units for empty loads
- D. Pivot bushings on the trailing arms have bound up and are no longer permitting suspension travel

28. On a Hendrickson Haulmaax rubber suspension (mechanical rubber spring), the major maintenance concern that distinguishes it from steel spring suspensions is:

- A. Higher U-bolt torque specifications that require frequent re-torquing to maintain clamping force
- B. More frequent shock absorber replacement because rubber spring rates are higher than steel
- C. Required lubrication of the rubber spring elements at every chassis service interval to prevent dryness
- D. Inspection of the rubber spring elements for cracking, set, or contamination affecting ride performance

29. When inspecting a heavy-duty truck frame for damage after a collision, which deformation pattern indicates that the frame rail has yielded and must be replaced rather than straightened?

- A. Visible bow or sag in the frame rail combined with cracking or paint flaking at high-stress points
- B. A localized dent at one frame rail web that does not extend through to the opposite flange face
- C. A bend at the front bumper mount area that occurred from light contact during low-speed parking
- D. Surface scratches and gouges on the outside of the rail web from contact with another object

30. The typical service life expectation for a Hendrickson PrimaaxEX rear air suspension under linehaul service is approximately:

- A. 250,000 miles before the trailing arm bushings require replacement at first major service
- B. 500,000 miles before any major component overhaul is required for the suspension assembly
- C. 1,000,000 miles or more for the major components when properly maintained in normal service
- D. The suspension is sealed for life and is not designed for replacement of its internal components

31. An air suspension air bag has failed and the technician is preparing to replace it. Which step must be completed BEFORE removing the failed bag?

- A. Remove the shock absorber on the same side to provide working clearance for bag access
- B. Exhaust the air from the bag through the supply line dump valve before further work
- C. Disconnect the height control valve linkage from the chassis bracket to allow free movement
- D. Loosen the trailing arm pivot bolt at the front bushing to allow the suspension to drop

32. Which of the following is NOT a normal function of a heavy-duty rear suspension shock absorber?

- A. Damping of vertical wheel motion to prevent excessive bouncing after a road-input event
- B. Limiting of rebound travel to prevent the suspension from over-extending during wheel drop
- C. Damping of axle rotation under braking and acceleration to reduce pinion-angle disturbance
- D. Carrying static vertical load from the chassis to the axle during normal vehicle operation

33. The caster angle on a heavy-duty tractor steer axle is typically set at:

- A. A positive value, typically 3 to 5 degrees, with the upper pivot tilted rearward
- B. A negative value, typically 1 to 2 degrees, with the upper pivot tilted forward
- C. Zero degrees on most heavy-duty trucks because positive caster causes excessive return torque
- D. A positive value, typically 8 to 12 degrees, much higher than for passenger vehicles

34. An alignment technician finds the following on a Class 8 tractor: left caster +4.5 degrees, right caster +3.0 degrees, left camber +0.25 degrees, right camber +0.25 degrees, total toe +1/16 inch toe-in. The driver complains of a steady pull to the right. What is the most likely cause of the pull condition?

- A. The cross-caster split with higher caster on the left causes a pull toward the side with less caster
- B. The total toe setting is incorrect and should be set to zero or slight toe-out for a tractor of this size

C. The camber settings are matched at +0.25 degrees and this matched camber is causing both tires to pull together

D. The right caster of +3.0 degrees is below the minimum specification and should be increased to neutral

35. The thrust angle on a heavy-duty tractor describes:

A. The angle between the steering axle centerline and the longitudinal centerline of the chassis frame

B. The vertical tilt of the steering knuckle pivots when measured against vertical at the road

C. The angle between the rear-axle direction of travel and the vehicle geometric longitudinal centerline

D. The angle between the kingpin inclination and the camber angle measured at the steering knuckle

36. A heavy-duty truck shows feathered wear (sharp inside edge) on both front tires, more severely on the right side. Which alignment condition best explains this wear pattern?

A. Equal positive camber on both front tires causing identical inside-edge wear from camber thrust

B. Excess toe-out at the front axle with possibly an additional small caster or camber asymmetry

C. Excess positive caster on the right kingpin causing increased return torque and tire scrub

D. Negative camber on both front wheels creating uneven contact patch loading at the road surface

37. The proper procedure to set toe on a heavy-duty tractor with a tie rod adjustment sleeve is:

A. Loosen the clamps at both ends and rotate the sleeve until toe reads correctly with no inspection

B. Adjust the tie rod sleeve in the direction needed and immediately reclamp without checking thread engagement

C. Center the steering wheel by feel before measurement and adjust the sleeve until toe specification is reached

D. Center the steering gear, check toe, adjust the tie rod with sleeve threads equally engaged, then reclamp

38. The included angle on a heavy-duty truck steer axle is calculated as:

- A. The sum of the front-axle caster angle and the rear-axle thrust angle measured in degrees
- B. The difference between the left-side and right-side caster angles divided by two for cross caster
- C. The sum of the kingpin inclination angle and the camber angle measured at the steering knuckle
- D. The angle between the front-wheel direction of travel and the rear-axle thrust line under load

39. A truck has been involved in a curb strike on the front-right tire and now exhibits symptoms of pull and inside-edge tire wear on the right side. Initial alignment readings show: left camber +0.2 degrees, right camber -0.8 degrees. Which conclusion best fits the data?

- A. The right side has likely sustained a bent component in the steering knuckle or axle beam
- B. The left side has lost camber and the right side is the reference, indicating that left needs adjustment
- C. The camber readings are both within typical heavy-truck specification and the pull is from a different cause
- D. The negative right-side camber is normal for the loaded condition of the truck and no service is required

40. Steering axle scrub radius on a heavy-duty truck:

- A. Has a much larger value on heavy trucks than passenger cars due to the greater track width
- B. Is determined by kingpin geometry, wheel offset, and tire dimensions as a fixed design parameter
- C. Increases in service as the kingpin bushings wear and the steering geometry shifts from design value
- D. Is measured by the alignment technician at every front-end service to verify it meets specification

41. A heavy-duty tractor pulls left after a recent steer tire replacement. Alignment readings are within specification on caster, camber, toe, and thrust angle. The previous tires had been on the truck for 200,000 miles. Which condition is most likely responsible for the new pull?

- A. The new tires have a defective sidewall construction causing one tire to pull harder than the other

- B. The alignment specifications are incorrect and need to be re-set to compensate for the new tires
- C. The previous wear pattern on the old tires was masking an alignment issue that is now revealed
- D. Tire conicity in the new tires (steer-pull characteristic) is different between the two tires installed

42. The alignment specification known as "set-back" on a heavy-duty steer axle refers to:

- A. The amount of caster offset between left and right kingpins to compensate for road crown
- B. The rearward tilt of the upper pivot relative to the lower pivot when measured against vertical
- C. The fore-aft offset of one kingpin relative to the other when the axle is not perpendicular
- D. The horizontal distance from the chassis frame rail centerline to the kingpin centerline at each side

43. The proper torque sequence for a heavy-duty 10-stud disc wheel assembly is:

- A. Tighten studs in numerical order around the wheel from 1 through 10 in three progressive passes
- B. Tighten in a star or alternating cross pattern with multiple progressive torque passes to specification
- C. Tighten all studs by hand first, then apply final torque to one stud before moving to the next stud
- D. Apply final torque to the top stud and work clockwise around the wheel until all studs are torqued

44. A driver complains of vibration at highway speed that disappears at speeds below 45 mph. Inspection shows even tread wear and proper tire pressure on all positions. Which inspection should be performed FIRST?

- A. Check wheel-and-tire balance using a dynamic on-vehicle balancer or a bench balancer
- B. Check front-end alignment to confirm caster and camber are within manufacturer specification
- C. Replace the steer tires because high-speed vibration is typically caused by tire belt separation
- D. Check the steering gear for internal wear that may be amplifying chassis vibration at speed

45. Hub-piloted disc wheels rely on which feature to center the wheel on the hub?

- A. Stud-piloted seating cones at the inside of the wheel disc that center on the wheel studs
- B. Lug nut tapered seats which mate against matching machined seats on the wheel disc faces
- C. The hub flange face which provides axial location and also serves to center the wheel radially
- D. Machined hub pilot pads on the hub flange that engage matching pilot bores in the wheel disc

46. A wheel-end seal on a steer axle is leaking lubricant. Which inspection finding is the most common root cause that must be addressed before installing a new seal?

- A. Excessive grease level in the wheel-end cavity overflowing past the seal during operation under heat
- B. Improper seal installation depth from the previous service that allowed the seal to ride at an angle
- C. Damaged or worn seal running surface on the spindle journal or sealing wear sleeve area
- D. A failed wheel bearing producing excessive heat in the seal area causing lubricant breakdown

47. The proper bearing preload procedure for a heavy-duty steer axle wheel-end on a TMC RP 618 compliant configuration is:

- A. Tighten to seat bearings, back off, retighten to torque, back off a precise amount, install lock
- B. Tighten the inner adjusting nut to a high torque value and lock the system at that value
- C. Tighten the inner adjusting nut to seat bearings and back off until the wheel-end shows end-play
- D. Tighten the inner adjusting nut to a lower torque than passenger-vehicle specification and use it

48. A trailer tire shows a series of small "cup" or "scallop" wear patterns evenly spaced around the circumference. The trailer is a tandem-axle dry van running standard linehaul. Which condition most likely caused this wear pattern?

- A. Misalignment of the rear trailer axle relative to the lead trailer axle at the pivot

- B. Worn or weak shock absorbers allowing the tire to bounce repeatedly at a resonant speed
- C. Excessive cold inflation pressure causing reduced contact patch and uneven tread wear
- D. Incorrect axle camber from a worn trailer suspension bushing causing one-sided tread wear

49. Which condition would require IMMEDIATE removal of a heavy-duty truck tire from service per DOT regulations?

- A. Tread depth at 4/32 inch on a steer axle position with no other observable damage to the tire
- B. A small puncture in the tread area that has not penetrated to the inner liner of the tire casing
- C. Sidewall scuffing from contact with a curb that has not exposed any of the cord layers underneath
- D. A bulge in the sidewall area that indicates separation of the cord plies from the rubber casing

50. The typical air pressure specification for a Class 8 tractor steer tire (size 295/75R22.5) at full GVW loading is:

- A. 80 to 90 psi cold inflation depending on ambient temperature and road condition
- B. 95 to 100 psi cold inflation with adjustment downward of 5 psi for warm weather operation
- C. 110 to 120 psi cold inflation as specified by the tire manufacturer load and inflation table
- D. 130 to 140 psi cold inflation to maximize tire life and minimize rolling resistance

PRACTICE EXAM 5: ANSWER KEY AND EXPLANATIONS

1. C — Spool valve shifted off-center toward the right turn position. A shifted spool valve continuously directs hydraulic assist toward right-turn assist while the steering wheel is centered, producing a power-induced right pull, and biased centering also creates the heavier return effort after a turn. This condition only manifests with the engine running because spool-valve assist is what drives the bias.
2. A — Tech A only. The input shaft seal is the dynamic seal around the rotating worm shaft and is the most common source of input-side weep, and it can be replaced as a serviceable component without replacing the entire gear. Tech B is incorrect because input shaft weep does not require replacing the steering gear assembly.
3. B — Replace the drag link end socket because vertical play exceeds service limits. TMC RP 615 and OEM specifications allow no measurable vertical play in a sealed drag link end; 3/16 inch indicates a worn ball-and-socket joint that cannot be adjusted out by retorquing. Replacement is the only acceptable corrective action because worn linkage allows steering wander and unpredictable response.
4. D — Restricted return line from the steering gear to the fluid reservoir. A restricted return line creates back pressure and can cause hard steering and noise, but it does not produce mechanical free play in the steering wheel. The other three conditions all introduce mechanical lash that the driver feels as free play before the front wheels respond.
5. A — Pump internal wear or a sticking flow control valve. Low relief pressure with adequate fluid and belt tension points to internal pump wear (worn vanes, scored cam ring) or a flow control valve that opens early, both of which prevent the pump from reaching specified relief pressure. External leaks would show fluid loss, and a restricted hose typically raises the gauge reading rather than lowering it.
6. C — Both Tech A and Tech B. The slip yoke accommodates relative motion between cab and chassis as the engine and frame flex on rubber mounts during driving. U-joint phasing is also required so the angular velocity variations at each joint cancel out, preventing torsional vibration in the steering column.
7. C — Right-side wheel-end bearing preload is excessive. Excessive bearing preload on one side increases rolling friction at that wheel, and during return from a right-hand turn the system has to

overcome that drag to recenter, while a left-hand return is unaffected by it. Spool-valve and pump issues would affect both directions equally.

8. B — Replace the kingpins, bushings, and thrust bearings as a complete service kit. The 0.012 inch reading exceeds the 0.010 inch service limit, and kingpin service is performed as a complete assembly because reusing any worn component compromises the service life of the new parts. Adding shims is not a corrective measure for worn pivot components.
9. D — Limit gear internal pressure at full lock by relieving fluid back to return circuit. Poppet relief valves in integral steering gears open at full lock to bypass fluid internally, preventing pressure spikes that would damage the gear, hoses, or pump when the operator holds the wheel against the stop. They are gear-mounted, not pump-mounted.
10. A — Front toe setting at the cross tube. Wander combined with feathering on the inside edge of both front tires is the classic signature of incorrect toe (specifically toe-out), making toe the first measurement to verify before checking other angles. Toe is also the easiest and least expensive setting to confirm and adjust.
11. B — Intermediate shaft slip yoke splines have stripped or sheared. Free wheel rotation through approximately 30 degrees followed by resistance indicates a broken connection in the rotational path, and stripped slip yoke splines allow the shaft to spin within the coupling until the failure surfaces engage. A fractured sector shaft would not produce a defined free-play angle.
12. D — A sticking pressure relief valve in the gear releasing fluid at low system pressure. Power steering moan and whine are caused by air entrainment, fluid cavitation, or pump wear — not by relief valve operation, which is silent in normal release. The other three options all introduce air or cavitation conditions that produce audible noise.
13. C — A multi-track optical or magnetic encoder providing digital position and rotational direction. Modern ESC systems require absolute steering angle and rotation direction, which a multi-track digital encoder provides directly to the J1939 network. Single-track sensors only provide rate or relative position and cannot meet ESC requirements.
14. A — Remove the pitman arm, center the gear sector, and reinstall at the proper master spline. The gear has a fixed on-center position that is established at manufacture, and the pitman arm uses a master spline to locate it correctly relative to the steering linkage geometry. Rotating the steering wheel on its column would cancel the master alignment in the column but leave the gear sector misindexed.
15. D — Neither Tech A nor Tech B. Cold-weather hard steering that improves with operation is normal and expected as fluid viscosity drops and the system reaches operating temperature, but it is not caused by high viscosity by itself nor by internal pump wear. Internal pump wear would not improve with warming temperature.

16. B — A power steering pump with worn vanes or weak springs reducing flow at low engine RPM. Hard steering at low engine speed that improves at higher speed is a flow-related complaint, and worn pump vanes or weak vane springs reduce volumetric output at low RPM but recover output as speed increases. Internal gear wear and restricted return lines do not show this RPM-dependent improvement.
17. C — Pump is functioning correctly and the relief valve is opening within the proper range. Pressure rising from 2,150 to 2,180 psi without exceeding the 2,200 psi specification confirms the pump produces adequate output and the relief valve limits maximum pressure within OEM tolerance. The system is operating as designed.
18. A — As specified by the OEM, typically based on miles, hours, or measured fluid condition. Power steering fluid replacement intervals are OEM-specific and depend on fluid type, vehicle duty cycle, and condition monitoring; there is no universal interval. Treating fluid as sealed-for-life or assuming a fixed mileage applies across all chassis is incorrect.
19. B — Tech B only. Center bolt fractures in multi-leaf springs are almost always caused by loose U-bolts, which allow the leaf stack to shift on the axle saddle, transferring axle locating loads through the center bolt — a part not designed to carry those loads. Overload alone rarely shears a center bolt as long as U-bolt clamping force is maintained.
20. C — Disconnect the supply line to the height control valves and check for air pressure at inlet. Confirming supply pressure to the valves is the next logical isolation step after verifying linkage and air system pressure, because no inlet air means the problem is upstream (lines, supply solenoid, or protection valve). Replacing valves before testing is wasteful, and pressurizing the bag directly bypasses the diagnostic sequence.
21. D — Bonded rubber bushings that flex during suspension travel. Heavy-duty trailing arm pivots use bonded rubber (Sevon-type) bushings that twist in shear during suspension stroke and require no lubrication. Roller, bronze, or plain bearings would not survive the millions of small-stroke cycles a trailing arm sees in service.
22. A — Worn shock absorber bottoming internally during rebound. A shock that has lost damping or has internal damage transmits high-impact loads to its mounting brackets every time the suspension extends rapidly, and over time fatigue cracks the upper bracket. Air bag pressure and trailing arm wear can cause other failures but rarely fracture an upper shock mount in this pattern.
23. C — Position the axle housing fore-aft while resisting axle rotation under driving and braking. Torque rods (radius rods) locate the axle longitudinally and prevent the axle from rotating under driveline torque, which is critical because air bags cannot resist these loads. They do not carry vertical load or limit suspension travel.
24. D — Center bushing in the equalizer pivot shows movement greater than 1/8 inch. The center pivot is the primary load-sharing point of the equalizer beam suspension, and any significant movement

at this bushing affects load distribution and axle alignment, presenting a safety hazard. End cap and saddle wear are more tolerable in service than center pivot movement.

25. A — Prevent lateral movement of the axle relative to the frame. A track bar (Panhard rod) is mounted laterally between frame and axle and constrains side-to-side movement during cornering, which is essential because trailing arm air suspensions provide minimal lateral location otherwise. Fore-aft and rotational restraint come from torque rods, not the track bar.
26. C — U-bolts and U-bolt nuts should be replaced because they were stretched. U-bolts are torqued into the yield range to provide the high clamping force needed for axle location, and once stretched they cannot reliably reach the same clamp load on reinstallation. Reusing stretched U-bolts is a known cause of repeated center bolt failures.
27. B — Height control valve adjustment is biased high. Air bag pressure of 90 psi at empty rolling weight is excessive and indicates the height control valve is positioning the suspension above design ride height, which over-pressurizes the bags and stiffens the ride. Correct adjustment to specified ride height restores normal bag pressure and ride quality.
28. D — Inspection of the rubber spring elements for cracking, set, or contamination. Mechanical rubber suspensions like Haulmaax depend on rubber spring elements that degrade from UV exposure, ozone, oil contamination, and load-induced compression set, so visual inspection and condition assessment are the distinguishing service requirements. The springs are not lubricated.
29. A — Visible bow or sag combined with cracking or paint flaking at high-stress points. Yielding of the frame rail produces permanent deformation that cannot be straightened back to original strength, and stress-area cracking or paint flaking confirms the steel has exceeded its elastic limit. Localized dents and surface damage do not indicate yield of the structural section.
30. C — 1,000,000 miles or more for the major components when properly maintained. Heavy-duty linehaul air suspensions are engineered for million-mile service life on major components such as trailing arms, frame brackets, and pivot hardware, with normal wear items (bushings, bags, shocks) replaced at scheduled intervals. They are not sealed for life and do receive component service.
31. B — Exhaust the air from the bag through the supply line dump valve. An air bag at system pressure can release stored air with significant force when disconnected, creating a serious injury hazard, so the bag must be exhausted before any disassembly. The other steps are not required before bag removal.
32. D — Carrying static vertical load from the chassis to the axle. Shocks damp motion but do not carry vertical load — that is the function of the air bag or leaf spring. Damping vertical motion, limiting rebound travel, and reducing axle disturbance are all normal shock functions in heavy-duty suspensions.
33. A — A positive value, typically 3 to 5 degrees, with the upper pivot tilted rearward. Heavy-duty trucks use moderate positive caster to provide directional stability and steering wheel return, and

the typical specification is 3 to 5 degrees. The 8 to 12 degree range is excessive and would create heavy steering effort.

34. A — Cross-caster split with higher caster on the left causes a pull toward the side with less caster. Cross-caster differences cause directional pull toward the side with the lower caster, and the 1.5-degree split here exceeds the typical 0.5-degree maximum, producing the right pull. Toe and matched camber would not produce a one-sided pull.
35. C — Angle between the rear-axle direction of travel and the vehicle geometric centerline. Thrust angle describes how the rear axle is pointed relative to the chassis, and a non-zero thrust angle causes dog-tracking and forces the steering to compensate, which can affect tire wear and handling. The other definitions describe different alignment angles.
36. B — Excess toe-out at the front axle with possibly small caster or camber asymmetry. Inside-edge feathering on both front tires is the classic toe-out wear pattern, and worse wear on the right side indicates an additional asymmetric condition such as cross-caster or cross-camber. Equal positive camber would wear outside edges, not inside.
37. D — Center the steering gear, check toe, adjust the tie rod with sleeve threads equally engaged, then reclamp. Proper toe procedure starts with a centered steering gear (not a steering wheel centered by feel), uses balanced thread engagement on both ends of the sleeve to maintain strength, and ends with reclamping. Skipping these steps risks loss of adjustment or failure of the linkage.
38. C — Sum of kingpin inclination angle and camber angle at the steering knuckle. Included angle is defined as KPI plus camber and is used to detect bent steering knuckles or axle beams when the individual angles appear normal. The other definitions describe unrelated alignment values.
39. A — Right side has likely sustained a bent component in the steering knuckle or axle beam. A 1.0-degree camber split following a curb strike on the affected side strongly indicates physical damage rather than wear, since worn pivots typically affect both sides over time and produce smaller asymmetry. Bent components must be replaced rather than aligned.
40. B — Determined by kingpin geometry, wheel offset, and tire dimensions as a fixed design parameter. Scrub radius is set by chassis design — kingpin inclination, kingpin axis intersection point, wheel offset, and tire section width all combine to define it — and it is not a measured or adjusted alignment value in service. It does not change with normal kingpin wear.
41. D — Tire conicity in the new tires is different between the two tires installed. Conicity is a manufacturing characteristic of radial tires that creates a side-pulling force, and mismatched conicity between left and right steer tires produces a pull even when alignment is correct. Swapping the steer tires side-to-side is the standard diagnostic for confirming conicity pull.
42. C — Fore-aft offset of one kingpin relative to the other when the axle is not perpendicular. Set-back describes a non-perpendicular steer axle where one kingpin is rearward of the other, often

resulting from collision damage or a bent axle, and it directly affects vehicle tracking and tire wear. The other definitions describe unrelated angles or dimensions.

43. B — Star or alternating cross pattern with multiple progressive torque passes. The cross pattern distributes clamp load evenly around the wheel disc to prevent warping, and progressive passes (typically 50%, 75%, 100% of final torque) seat the wheel squarely against the hub face. Sequential or single-pass tightening produces uneven clamping and risks wheel-off events.
44. A — Check wheel-and-tire balance using a dynamic balancer. Speed-dependent vibration that disappears below 45 mph is the signature of wheel-and-tire balance problems, since imbalance forces increase with the square of rotational speed. Balance check is the fastest and least invasive diagnostic step before pursuing alignment or tire replacement.
45. D — Machined hub pilot pads on the hub flange engage matching pilot bores in the wheel disc. Hub-piloted systems center the wheel through a precise machined fit between hub pilot pads and the wheel's pilot bore, which is the defining feature distinguishing them from stud-piloted designs. The lug nuts only provide clamping force, not centering.
46. C — Damaged or worn seal running surface on the spindle journal or sealing wear sleeve. The most common root cause of repeat wheel-end seal failures is a worn or grooved sealing surface on the spindle, and installing a new seal on a damaged surface guarantees another failure. A wear sleeve must be installed or the spindle reconditioned before fitting the new seal.
47. A — Tighten to seat, back off, retighten to torque, back off precise amount, install lock. TMC RP 618 specifies a multi-step procedure that seats the bearings, then sets a precise running clearance through controlled back-off, achieving consistent preload across vehicles and technicians. High torque or end-play methods do not produce the controlled preload required for long bearing life.
48. B — Worn or weak shock absorbers allowing tire bounce at resonant speed. Cupped or scalloped wear in regular intervals around the tire is the classic shock absorber wear signature, where reduced damping allows the suspension to oscillate and the tire to repeatedly load and unload at a resonant frequency. Misalignment and inflation issues produce different wear patterns.
49. D — Bulge in the sidewall indicating separation of the cord plies. A sidewall bulge indicates structural failure inside the casing where cord plies have separated, and the tire is at imminent risk of catastrophic failure under load — DOT regulations require immediate removal from service. The other conditions allow continued service with monitoring or routine repair.
50. C — 110 to 120 psi cold inflation as specified by the load and inflation table. Class 8 steer tires of 295/75R22.5 size at full GVW typically require 110 to 120 psi cold per the tire manufacturer's load and inflation chart, with exact pressure determined by actual axle load. Lower pressures cause overheating; higher pressures reduce contact patch and accelerate center wear.