Appendix R

TRANSPORTATION, DISTRIBUTION AND LOGISTICS YOUTH APPRENTICESHIP

AUTO TECHNICIAN PATHWAY SUSPENSION & STEERING (UNIT 10)

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

1. Assist to diagnose common suspension & steering problems

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

- Consult with worksite professional to determine appropriate inspections and test(s) to perform based on customer concern
- Retrieve shop manuals and/or electronic retrieval systems
- Research applicable vehicle and service information, normal system operation specifications, vehicle service history, service precautions, and applicable technical service bulletins
- Assist worksite professional to complete diagnostic tests necessary to identify cause of customer concern

Learning Objectives

- Define characteristics of liquids
- Identify the fundamental laws of hydraulics
- Explain how hydraulics laws apply to power steering pump operation
- Identify the major parts of a steering system
- Describe the basic function of each steering system component
- Explain the operating principles of steering systems
- Identify the role of between steering systems and handling or tire wear
- Identify types of body-chassis design
- Identify the major parts of a suspension system
- Compare types of suspension systems
- Describe the basic function of each suspension system component
- Identify the role of suspension in tire wear, ride, handling, braking & acceleration force control
- Cite the safety rules that should be followed when servicing steering & suspension systems
- Discuss common problems relating to a suspension system
- Describe special issues related to electronically-controlled suspension systems
- Discuss common problems due to short and long arm suspension systems, body sway, and uneven ride height
- Explain common causes for steering column noises, looseness, & binding concerns
- Explain common problems that cause wheel/tire vibration, shimmy, and noise
- Describe common causes of vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns
- Discuss power steering fluid leakage and effects on steering
- Discuss the function of electronically controlled steering systems (including sensors, switches, and actuators)

- Identify hybrid vehicle power steering system electrical circuits, service and safety precautions

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

2. Disable, enable supplemental restraint system (SRS)

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Turn the steering wheel so the wheels are straight
- Turn ignition to OFF & remove key
- Disable
- Locate fuse center
- Remove SIR fuse
- Remove the insulator panel
- Remove the connector position assurance (CPA) from the steering wheel module coil connector
- Disconnect the steering wheel module coil connector from the vehicle harness connector
- Install the insulator panel
- Enable
- Turn the steering wheel so the wheels are straight
- Turn ignition to OFF & remove key
- Connect the steering wheel module coil connector to the vehicle harness connector
- Install the CPA to the steering wheel module coil connector
- Remove the insulator panel
- Install the SIR fuse into the body control module fuse center
- Install the insulator panel
- Turn ignition to ON

Learning Objectives

- Explain how vehicle body and frame construction works with restraint systems to protect a vehicle's occupants
- Identify and locate the most important parts of vehicle restraint systems
- Describe the purpose for restraint systems
- Describe restraint system design variations
- Summarize the operation of restraint system sensors, inflator modules, and electronic control modules
- Explain Enabling zones
- Describe different air bag systems

Comments:

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Suspension & Steering

Competency

3. Determine proper power steering fluid type; inspect fluid level & condition

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Warm up vehicle so power steering is at normal operating temperatures
- Turn engine off
- Locate power steering reservoir
- Remove cap
- Check fluid level with dipstick or by looking at the reservoir
- Inspect fluid for contamination
- Top fluid only to correct mark
- After servicing, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Identify the function of the components of a power steering system
- Identify components of electrically controlled power steering systems
- Compare types of power steering fluid
- Discuss the dangers of adding the wrong power steering fluid
- Discuss signs of low power steering fluid
- Describe how to determine if fluid is contaminated
- Explain the meaning of milky or metal contaminants in power steering fluid
- Describe why low power steering fluid indicates a leak

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

4. Flush, fill, bleed power steering system

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures

FLUSH

- Position vehicle
- Place large container under fluid return hose
- Remove fluid return hose at the power steering pump
- Run engine at idle while another tech maintains the fluid level at FULL COLD in the reservoirs using fresh power steering fluid
- Turn off engine
- Turn wheel fully to the left and right
- Remove pump reservoir inlet connection plug
- Install fluid return hose to pump reservoir
- Maintain fluid level at FULL COLD and operate engine at idle for 15 minutes
- Repeat & inspect fluid for contamination
- If contaminated repeat flush again

BLEED

- Start the engine
- Turn the steering wheel fully from side to side
- Check the fluid level often
- Add fluid as needed
- If excessive buzzing noise is apparent repeat the bleed procedure
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain basic steering column repair operations
- Describe service and repair procedures for a rack-and-pinion steering gear
- Explain how to complete basic power steering tests

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

5. Remove, inspect, replace, adjust power steering pump belt

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Loosen the bolts holding the pump to its brackets
- Push inward on the pump to release tension
- Remove old belt
- Obtain correct belt & install in reverse order of removal
- Adjust belt tension to specifications
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe how to pry to tighten a power steering belt
- Explain how to test the power steering belt tension

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

6. Inspect, replace, adjust tie rod ends (sockets), tie rod sleeves, & clamps

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures

REMOVE

- Separate the tie rod end form the steering knuckle or center link using a fork or puller
- Measure or mark tie rod end length
- Loosen the adjustment sleeve
- Unscrew the tie rod end
- Inspect for wear & damage

REPLACE

- Turn the new tie rod end into the sleeve until it is the exact length of the old tie rod
- Install the tie rod ball stud in the center link or steering knuckle
- Tighten the fasteners to specification
- Install new cotter pins & bend correctly
- Tighten the adjustment sleeve
- Check steering action
- Check toe for proper adjustment
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain why it is important to mark the tie rod end length
- Compare the differences between a linkage steering and a rack-and-pinion steering system
- Describe the operation of hydraulic and electric-assist power steering systems
- Explain the operation of four-wheel steering systems

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

7. Remove, inspect, install upper & lower control ball joints

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect the ball joint wear indicator or measure play in the joint by physically moving the control arm & joint
- Position the vehicle
- Remove the shock absorber
- Install a spring compressor on the coil spring
- Remove the nut securing the ball joint to the steering knuckle
- Separate the knuckle & the joint
- Press, screw or drill out the worn ball joint
- Clean the threads in the control arm if applicable
- Install new ball joints into the control arm
- Torque the ball joint properly
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Compare compression versus tension ball joints
- Discuss removal methods for removing worn pressed, bolted or screwed ball joints

Comments:

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Suspension & Steering

Competency

8. Remove, inspect, install strut cartridge or assembly, strut coil spring, insulators (silencers), & upper strut bearing mount

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Unbolt the steering knuckle or bearing support, the brake lines and upper strut assembly- to- body fasteners
- Mark the cam bolt for later camber re-adjustment
- Remove the strut assembly (coil spring & chock) as a single unit
- Inspect for wear & damage
- Install in reverse order
- Adjust camber & toe when replacing
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain the operation of the four common types of springs
- Compare the various types of suspension systems

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

9. Inspect, remove, replace shock absorbers

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove the strut cartridge or assembly
- Apply a strut spring compressor to the strut coil spring
- Remove the upper damper assembly after the coil spring has been squeezed together
- Release spring tension
- Lift spring off strut
- Inspect parts for wear & damage
- Remove shock cartridge
- Replace with new shock cartridge into strut assembly
- Compress the coil spring
- Install the upper spring seat and related components
- Release the spring compressor
- Install strut cartridge back onto vehicle
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain automatic suspension leveling systems
- Describe common signs of wear & tear on shock absorbers
- Explain the importance of properly functioning shock absoprbers

Comments:

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Suspension & Steering

Competency

10. Perform pre-alignment inspection & measure vehicle ride height

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect all steering & suspension related parts are in good working condition
- Check for loose wheel bearings, wheel or tire runout, worn tires, and tires of varied types & sizes, proper tire inflation
- Measure curb height & weight
- Check cradle alignment

Learning Objectives

- Explain the principles of wheel alignment
- List the purpose of each wheel alignment setting
- Describe the use of different types of wheel alignment equipment

Comments:

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Suspension & Steering

Competency

11. Perform four wheel alignment by checking and adjusting front & rear wheel caster, camber, and toe as required

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect & correct tire, steering & suspension problems first

CASTER

- Move the upper or lower control arm so the ball joint moves to the front or rear

CAMBER

- Move the control arm in or out without moving the ball joint
- Recheck caster

TOE

- Lengthen or shorten the tie rod
- Check rear wheels caster, camber, & toe if needed
- Check tracking if needed
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Describe the commonly adjusted wheel alignment angles
- Explain how alignment angles are changed using alignment equipment
- Explain the proper order of wheel alignment
- Describe different methods to change caster or camber settings
- Explain how moving the upper control arm forward affects caster
- Explain how moving the upper control arm rearward affects caster
- Discuss how camber is adjusted at the connection between the knuckle & the strut
- Discuss the change to toe-in or toe-out when the steering knuckle arms face forward
- Discuss the change to toe-in or toe-out when the steering knuckle arms face rearward

Comments:

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Competency

12. Center steering wheel

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Shorten or lengthen each tie rod the same amount to keep the steering wheel spokes centered
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain toe-out on turns, steering axis inclination, and tracking

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

13. Inspect tire condition & tire wear patterns; check air pressure

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Inspect the outer side wall, tread area, inner side wall
- Check tires for bulges, splits, cracks, chunking, cupping of the tread
- Check for punctures, cuts, tears and other physical injuries

AIR PRESSURE

- Remove valve stem cap
- Press tire gauge squarely over valve stem
- Read air pressure
- Compare reading to specification
- If tire pressure is low, add air
- If tire pressure is high, press on the valve core pin to release some air
- Recheck tire pressure and add or release air as needed
- Replace valve stem cap
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Define tire wear pattern
- Describe common tire wear patterns and the problems they indicate
- Identify the parts of a tire and wheel
- Describe different methods of tire construction
- Explain tire and wheel sizes
- Describe tire ratings
- Describe tire inflation and rotation procedures

Comments:

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Suspension & Steering

Competency

14. Measure wheel, tire, axle flange, & hub runout

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Place the dial indicator against the side rim and on the tire side wall
- Turn the tire by hand
- Note the indicator reading
- Place the dial indicator on the tire tread and on the inner part of the rim
- Turn the tire by hand
- Note the indicator reading
- Compare readings to specification
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Define tire runout, wheel runout, lateral runout, and radial runout
- Describe common tire, wheel, and wheel bearing problems

Comments:

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Suspension & Steering

Competency

15. Dismount, inspect, remount tire on wheel; balance wheel & tire assembly (static & dynamic)

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Remove wheels
- Dismount tires from wheel using tire changing machine
- Inspect tires for wear & tear

STATIC BALANCE

- Add wheel weights opposite the heavy area of the wheel

DYNAMIC BALANCE

- Add weights exactly where they are needed using a dynamic balancing machine
- Remount tire on the wheel
- Install tires on the vehicle
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Explain static and dynamic wheel balance
- Explain what is happening to the tire and steering when tires are imbalanced
- Summarize different methods of balancing wheels and tires
- Compare and contrast on-vehicle and off-vehicle balancing methods
- Compare different types of balancing machines
- Discuss how rear wheel drive or limited slip differential impacts on-car balancing procedures
- Explain the operation of the tire changing machine

Comments:

Unit 10: Auto Technician Pathway
Suspension & Steering

Competency

16. Inspect tire & wheel assembly for air loss; repair tire using internal patch

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

Performance will be successful when learners:

- Obtain equipment & materials needed
- Review safety & service procedures
- Fill tire with air
- Place tire in a drum of water or wet tire with hose
- Look for air bubbles
- Mark the leak
- Remove tire from the wheel
- Inspect the inside surface for the puncture
- Fill injury with recommended plug or sealant
- Select patch of correct size and material
- Scuff the area the patch will cover
- Apply adhesive to inner liner
- Place patch on inner liner
- Use stitching tool to tightly bond patch
- After servicing, verify service and make adjustments as needed, cleanup work area, return tools to proper location, complete appropriate documentation

Learning Objectives

- Discuss why tires are no longer recommended to be patched without dismounting
- Explain why areas larger than 13 mm or punctures in sidewalls should not be repaired or patched

Comments: