### 4 A. General Suspension and Steering Systems Diagnosis

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.  
2. Identify and interpret suspension and steering concern; determine necessary action.  
3. Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins.  
4. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals).

### 4 B. Steering Systems Diagnosis and Repair

1. Disable and enable supplemental restraint system (SRS).
2. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).
3. Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action.
4. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, noise, and fluid leakage concerns; determine necessary action.
5. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, noise, and fluid leakage concerns; determine necessary action.
6. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action.
7. Adjust manual or power non-rack and pinion worm bearing preload and sector lash.
8. Remove and replace manual or power rack and pinion steering gear; inspect mounting bushings and brackets.
9. Inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.
10. Determine proper power steering fluid type; inspect fluid level and condition.
11. Flush, fill, and bleed power steering system.
12. Diagnose power steering fluid leakage; determine necessary action.
13. Remove, inspect, replace, and adjust power steering pump belt.
14. Remove and reinstall power steering pump.
15. Remove and reinstall power steering pump pulley; check pulley and belt alignment.
16. Inspect and replace power steering hoses and fittings.
17. Inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper.
18. Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps.
19. Test and diagnose components of electronically controlled steering systems using a scan tool; determine necessary action.
20. Inspect and test non-hydraulic electric power assist steering.
21. Identify hybrid vehicle power steering system electrical circuits, service and safety precautions.

### 4 C. Suspension Systems Diagnosis and Repair

#### 4 C 1. Front Suspension

1. Diagnose short and long arm suspension system noises, body sway, and uneven riding height concerns; determine necessary action.
2. Diagnose strut suspension system noises, body sway, and uneven riding height concerns; determine necessary action.
3. Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers.
4. Remove, inspect and install strut rods (compression/tension) and bushings.
5. Remove, inspect, and install upper and/or lower ball joints.

6. Remove, inspect, and install steering knuckle assemblies.

7. Remove, inspect, and install short and long arm suspension system coil springs and spring insulators.

8. Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts.

9. Remove, inspect, and install stabilizer bar bushings, brackets, and links.

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

11. Lubricate suspension and steering systems.

4 C 2. Rear Suspension
1. Remove, inspect, and install coil springs and spring insulators.

2. Remove, inspect, and install transverse links, control arms, bushings, and mounts.

3. Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts.

4. Remove, inspect, and install strut cartridge or assembly, strut coil spring, and insulators (silencers).

4 C 3. Miscellaneous Service
1. Inspect, remove, and replace shock absorbers.

2. Remove, inspect, and service or replace front and rear wheel bearings.

3. Test and diagnose components of electronically controlled suspension systems using a scan tool; determine necessary action.

4 D. Wheel Alignment Diagnosis, Adjustment, and Repair
1. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action.

2. Perform prealignment inspection; perform necessary action.

3. Measure vehicle riding height; determine necessary action.

4. Check and adjust front and rear wheel camber; perform necessary action.

5. Check and adjust caster; perform necessary action.

6. Check and adjust front wheel toe and center steering wheel.

7. Check toe-out-on-turns (turning radius); determine necessary action.

8. Check SAI (steering axis inclination) and included angle; determine necessary action.

9. Check and adjust rear wheel toe.

10. Check rear wheel thrust angle; determine necessary action.

11. Check for front wheel setback; determine necessary action.

12. Check front cradle (subframe) alignment; determine necessary action.

4 E. Wheel and Tire Diagnosis and Repair
1. Diagnose tire wear patterns; determine necessary action.

2. Inspect tires; check and adjust air pressure.

3. Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action.

4. Rotate tires according to manufacturer’s recommendations.

5. Measure wheel, tire, axle, and hub runout; determine necessary action.

6. Diagnose tire pull (lead) problem; determine necessary action.

7. Balance wheel and tire assembly (static and dynamic).

8. Dismount, inspect, and remount tire on wheel.

9. Dismount, inspect, and remount tire on wheel equipped with tire pressure sensor.

10. Reinstall wheel; torque lug nuts.

11. Inspect tire and wheel assembly for air loss; perform necessary action.

12. Repair tire using internal patch.

13. Inspect, diagnose, and calibrate tire pressure monitoring system.
## 5 BRAKES - NATEF

### 5 A. General Brake Systems Diagnosis
1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1
2. Identify and interpret brake system concern; determine necessary action. P-1
3. Research applicable vehicle and service information, such as brake system operation, vehicle service history, service precautions, and technical service bulletins. P-1
4. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals). P-1

### 5 B. Hydraulic System Diagnosis and Repair
1. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal’s Law). P-1
2. Measure brake pedal height; determine necessary action. P-2
3. Check master cylinder for internal and external leaks and proper operation; determine necessary action. P-2
4. Remove, bench bleed, and reinstall master cylinder. P-1
5. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action. P-1
6. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action. P-2
7. Fabricate and/or install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed. P-2
8. Select, handle, store, and fill brake fluids to proper level. P-1
9. Inspect, test, and/or replace metering (hold-off), proportioning (balance), pressure differential, and combination valves. P-2
10. Inspect, test, and adjust height (load) sensing proportioning valve. P-3
11. Inspect, test, and/or replace components of brake warning light system. P-3
12. Bleed (manual, pressure, vacuum or surge) brake system. P-1
13. Flush hydraulic system. P-3

### 5 C. Drum Brake Diagnosis and Repair
1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action. P-1
2. Remove, clean (using proper safety procedures), inspect, and measure brake drums; determine necessary action. P-1
3. Refinish brake drum. P-1
4. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble. P-1
5. Remove, inspect, and install wheel cylinders. P-2
6. Pre-adjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings. P-1
7. Install wheel, torque lug nuts, and make final checks and adjustments. P-1

### 5 D. Disc Brake Diagnosis and Repair
1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action. P-1
2. Remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing; determine necessary action. P-1
3. Clean and inspect caliper mounting and slides for wear and damage; determine necessary action. P-1
4. Remove, clean, and inspect pads and retaining hardware; determine necessary action. P-1
5. Disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts. P-2

6. Reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks. P-1

7. Clean, inspect, and measure rotor with a dial indicator and a micrometer; follow manufacturer’s recommendations in determining need to machine or replace. P-1

8. Remove and reinstall rotor. P-1

9. Refinish rotor on vehicle. P-1

10. Refinish rotor off vehicle. P-1

11. Adjust calipers equipped with an integrated parking brake system. P-3

12. Install wheel, torque lug nuts, and make final checks and adjustments. P-1

**5 E. Power Assist Units Diagnosis and Repair**

1. Test pedal free travel with and without engine running; check power assist operation. P-2

2. Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster. P-2

3. Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; determine necessary action. P-2

4. Inspect and test hydraulically assisted power brake system for leaks and proper operation; determine necessary action. P-3

5. Measure and adjust master cylinder pushrod length. P-3

**5 F. Miscellaneous (Wheel Bearings, Parking Brakes, Electrical, Etc.) Diagnosis and Repair**

1. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action. P-1

2. Remove, clean, inspect, repack, and install wheel bearings and replace seals; install hub and adjust wheel bearings. P-1

3. Check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, or replace as needed. P-2

4. Check parking brake operation; determine necessary action. P-1

5. Check operation of parking brake indicator light system. P-3

6. Check operation of brake stop light system; determine necessary action. P-1

7. Replace wheel bearing and race. P-1

8. Inspect and replace wheel studs. P-1

9. Remove and reinstall sealed wheel bearing assembly. P-2

**5 G. Antilock Brake and Traction Control Systems**

1. Identify and inspect antilock brake system (ABS) components; determine necessary action. P-1

2. Diagnose poor stopping, wheel lock-up, abnormal pedal feel or pulsation, and noise concerns caused by the antilock brake system (ABS); determine necessary action. P-2

3. Diagnose antilock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine necessary action. P-1

4. Depressurize high-pressure components of the antilock brake system (ABS). P-3

5. Bleed the antilock brake system’s (ABS) front and rear hydraulic circuits. P-2

6. Remove and install antilock brake system (ABS) electrical/electronic and hydraulic components. P-3

7. Test, diagnose and service ABS speed sensors, toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data). P-1

8. Diagnose antilock brake system (ABS) braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). P-3

9. Identify traction control/vehicle stability control system components. P-3