BAKER COLLEGE
STUDENT LEARNING OUTCOMES

AST 1310A Brakes
4 Semester Hours

Student Learning Outcomes & Enabling Objectives

1. Demonstrate general brake systems diagnosis techniques.
    a. Identify and interpret brake system concerns; determine needed action. (P-1)
    b. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. (P-1)
    c. Describe procedure for performing a road test to check brake system operation including an anti-lock brake system (ABS). (P-1)
    d. Install wheel and torque lug nuts. (P-1)

2. Demonstrate hydraulic system diagnosis and repair techniques.
    a. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law). (P1)
    b. Measure brake pedal height, travel, and free play (as applicable); determine needed action. (P-1)
    c. Check master cylinder for internal/external leaks and proper operation; determine needed action. (P-1)
    d. Remove, bench bleed, and reinstall master cylinder. (P-1)
    e. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine needed action. (P-1)
    f. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear; and loose fittings/supports; determine needed action. (P-1)
    g. Replace brake lines, hoses, fittings, and supports. (P-2)
    h. Fabricate brake lines using proper material and flaring procedures (double flare and ISO types). (P-2)
    i. Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification. (P-1)
    j. Inspect, test, and/or replace components of brake warning light system. (P-3)
    k. Identify components of hydraulic brake warning light system. (P-2)

l. Bleed and/or flush brake system. (P-1)
m. Test brake fluid for contamination. (P-1)

3. Demonstrate drum brake diagnosis and repair techniques.
    a. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine needed action. (P-1)
    b. Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability. (P-1)
    c. Refinish brake drum and measure final drum diameter; compare with specification. (P-1)
    d. Remove, clean, inspect, and/or replace brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble. (P-1)
    e. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed. (P2)
    f. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments. (P-1)

4. Demonstrate disc brake diagnosis and repair techniques.
    a. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action. (P-1)
    b. Remove and clean caliper assembly; inspect for leaks, damage, and wear; determine needed action. (P-1)
    c. Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine needed action. (P-1)
    d. Remove, inspect, and/or replace brake pads and retaining hardware; determine needed action. (P-1)
    e. Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads; inspect for leaks. (P-1)
    f. Clean and inspect rotor and mounting surface; measure rotor thickness, thickness variation, and lateral runout; determine needed action. (P-1)
    g. Remove and reinstall/replace rotor. (P-1)
    h. Refinish rotor on vehicle; measure final rotor thickness and compare with specification. (P1)
    i. Refinish rotor off vehicle; measure final rotor thickness and compare with specification. (P1)
    j. Retract and re-adjust caliper piston on an integrated parking brake system. (P-2)
    k. Check brake pad wear indicator; determine needed action. (P-1)
    l. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer’s recommendations. (P-1)

5. Demonstrate power-assist units diagnosis and repair techniques.
    a. Check brake pedal travel with and without engine running to verify proper power booster operation. (P-2)
    b. Identify components of the brake power assist system (vacuum and hydraulic); check vacuum supply (manifold or auxiliary pump) to vacuum – type power. (P-1)
    c. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine needed action. (P-1)
    d. Inspect and test hydraulically-assisted power brake system for leaks and proper operation; determine needed action. (P-3)
    e. Measure and adjust master cylinder pushrod length. (P-3)

6. Demonstrate related systems (i.e. Wheel Bearings, Parking Brakes, Electrical) diagnosis and repair techniques.
    a. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action. (P-1)
    b. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings. (P-2)
    c. Check parking brake system and components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed. (P-1)
    d. Check parking brake operation and parking brake indicator light system operation; determine needed action. (P-1)
    e. Check operation of brake stop light system. (P-1)
    f. Replace wheel bearing and race. (P-3)
    g. Remove, reinstall, and/or replace sealed wheel bearing assembly. (P-1)
    h. Inspect and replace wheel studs. (P-1)

7. Demonstrate electronic brake control systems: Antilock Brakes (ABS), Traction Control (TCS), and Electronic Stability Control (ESC) systems diagnosis and repair techniques.
    a. Identify and inspect electronic brake control system components (ABS, TCS, ESC); determine needed action. (P-1)
    b. Describe the operation of a regenerative braking system. (P-3)
    c. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine needed action. (P-2)
    d. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine needed action. (P-2)
    e. Depressurize high-pressure components of an electronic brake control system (P-2)
    f. Bleed the electronic brake control system hydraulic circuits. (P-1)

g. Test, diagnose, and service electronic brake control system speed sensors (digital and analog), 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-2)
h. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). (P-1)

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Big Ideas

General brake systems diagnostic techniques
Hydraulic system diagnosis and repair
Drum brake diagnosis and repair
Disc brake diagnosis and repair
Power-assist diagnosis and repair
Related systems
Electronic brake control systems diagnosis and repair

Essential Questions

1. How do you perform general brake systems diagnostics?
2. How do you perform hydraulic system diagnosis and repair?
3. How do you perform drum brake diagnosis and repair?
4. How do you perform disc brake diagnosis and repair?
5. How do you perform power-assist diagnosis and repair?
6. How do you perform diagnosis and repair of related brake systems?
7. How do you perform electronic brake control systems diagnosis and repair?
