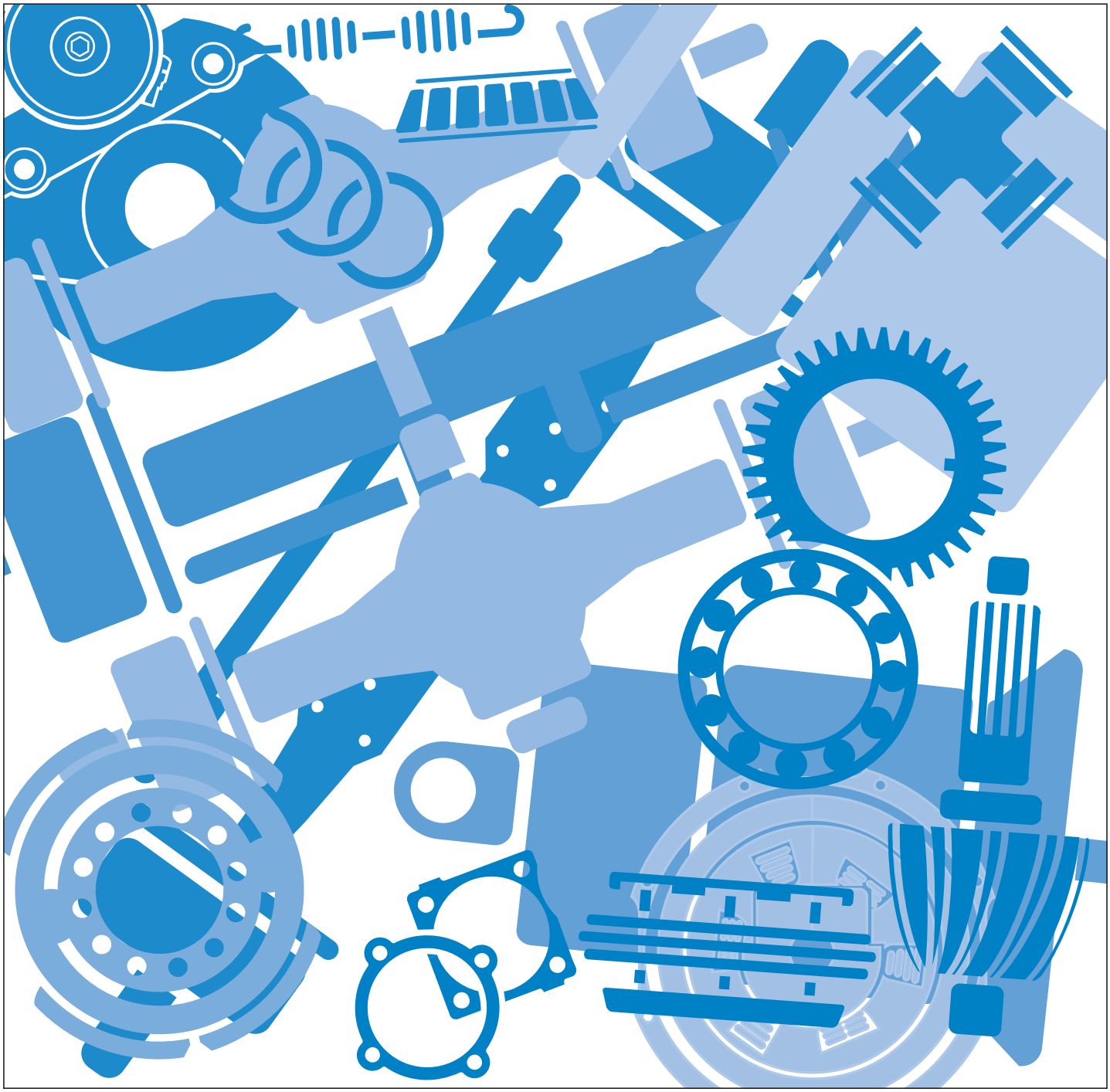
# Roadranger®

## Dana® Spicer® Brakes

Brake Systems

One Great Drivetrain from Two Great Companies

**Troubleshooting Guide BRTS-0300 November 1994**



For the most current information, visit the Roadranger web site at www.roadranger.com

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# Foreword

## Purpose

This Eaton manual is intended as a diagnostics guide for technicians involved in the servicing of Eaton EB and ES Model Brakes.

## How to Use this Manual

This manual outlines the steps necessary to pinpoint the source of problems and concerns related to braking systems. It does not describe service procedures, but instead refers the technician to service manual sections whenever possible. Therefore, this manual should be used as a "checklist" in conjunction with Eaton service manuals and other procedural guides.

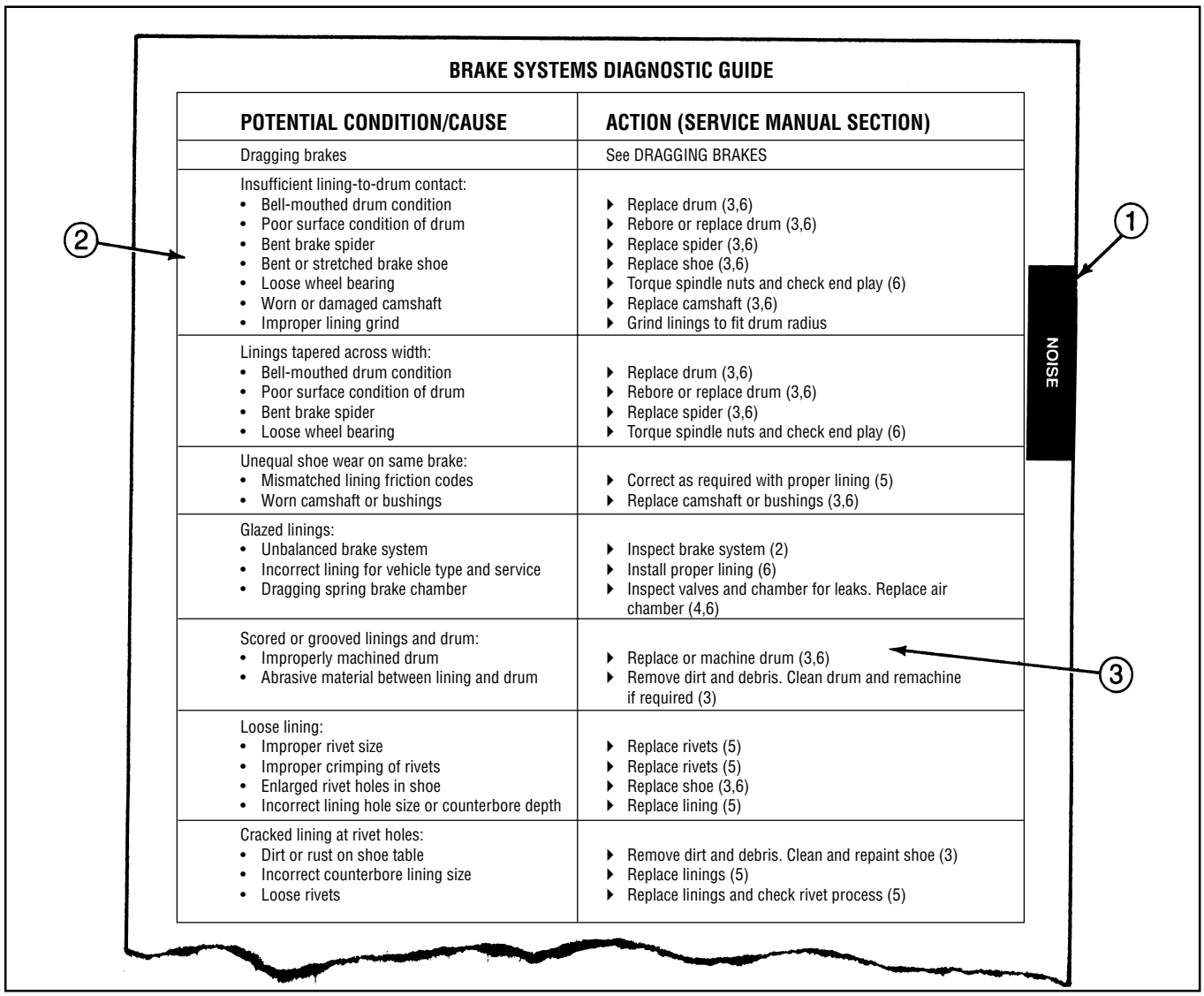
To isolate the source of a problem or concern, follow the steps below:

1. Identify the symptom(s) exhibited by the braking system. Locate the related section in this manual. (For example, if the brakes are making unusual sounds, turn to the page labeled "Noise".)
2. Use the left-hand column as a checklist. Check each item on the list. If an item is found to be defective, perform the corresponding action prescribed in the right-hand column. (For example, noise may be caused by a bent brake spider. The recommended action is to replace the spider.)
3. Refer to the appropriate service manual section for information on specific procedures. Related service manual sections are shown in parenthesis, whenever possible.(Service Manual BRSM-0033)

**Note:** Included in the General Information section are assembly diagrams to assist in troubleshooting.

⚠ Work through all potential conditions or causes related to the symptom encountered before making a final conclusion. It is possible that several problems exist, each with the same symptom. Therefore, checking each item on the list will help to ensure that all problem sources are eliminated or corrected.

⚠ Replace only those parts that have been identified as definite problems. Doing so will save unnecessary time and expense.




**BRAKE SYSTEMS DIAGNOSTIC GUIDE**

| POTENTIAL CONDITION/CAUSE | ACTION (SERVICE MANUAL SECTION) |
|---|---|
| Dragging brakes | See DRAGGING BRAKES |
| Insufficient lining-to-drum contact:<br>• Bell-mouthed drum condition<br>• Poor surface condition of drum<br>• Bent brake spider<br>• Bent or stretched brake shoe<br>• Loose wheel bearing<br>• Worn or damaged camshaft<br>• Improper lining grind | ▸ Replace drum (3,6)<br>▸ Rebore or replace drum (3,6)<br>▸ Replace spider (3,6)<br>▸ Replace shoe (3,6)<br>▸ Torque spindle nuts and check end play (6)<br>▸ Replace camshaft (3,6)<br>▸ Grind linings to fit drum radius |
| Linings tapered across width:<br>• Bell-mouthed drum condition<br>• Poor surface condition of drum<br>• Bent brake spider<br>• Loose wheel bearing | ▸ Replace drum (3,6)<br>▸ Rebore or replace drum (3,6)<br>▸ Replace spider (3,6)<br>▸ Torque spindle nuts and check end play (6) |
| Unequal shoe wear on same brake:<br>• Mismatched lining friction codes<br>• Worn camshaft or bushings | ▸ Correct as required with proper lining (5)<br>▸ Replace camshaft or bushings (3,6) |
| Glazed linings:<br>• Unbalanced brake system<br>• Incorrect lining for vehicle type and service<br>• Dragging spring brake chamber | ▸ Inspect brake system (2)<br>▸ Install proper lining (6)<br>▸ Inspect valves and chamber for leaks. Replace air chamber (4,6) |
| Scored or grooved linings and drum:<br>• Improperly machined drum<br>• Abrasive material between lining and drum | ▸ Replace or machine drum (3,6)<br>▸ Remove dirt and debris. Clean drum and remachine if required (3) |
| Loose lining:<br>• Improper rivet size<br>• Improper crimping of rivets<br>• Enlarged rivet holes in shoe<br>• Incorrect lining hole size or counterbore depth | ▸ Replace rivets (5)<br>▸ Replace rivets (5)<br>▸ Replace shoe (3,6)<br>▸ Replace lining (5) |
| Cracked lining at rivet holes:<br>• Dirt or rust on shoe table<br>• Incorrect counterbore lining size<br>• Loose rivets | ▸ Remove dirt and debris. Clean and repaint shoe (3)<br>▸ Replace linings (5)<br>▸ Replace linings and check rivet process (5) |

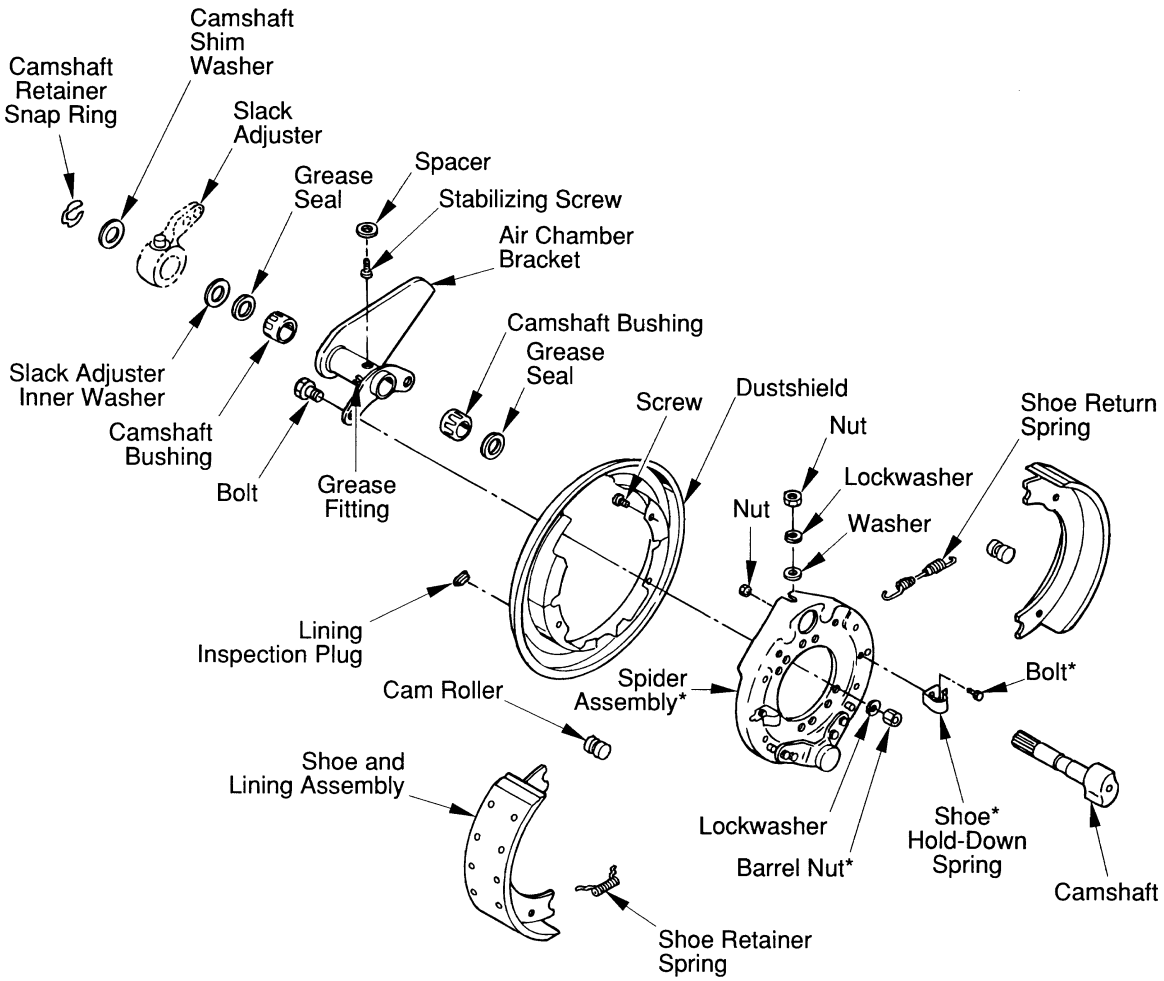
## ⚠ DANGER

## AVOID CREATING DUST
## POSSIBLE CANCER AND LUNG DISEASE HAZARD

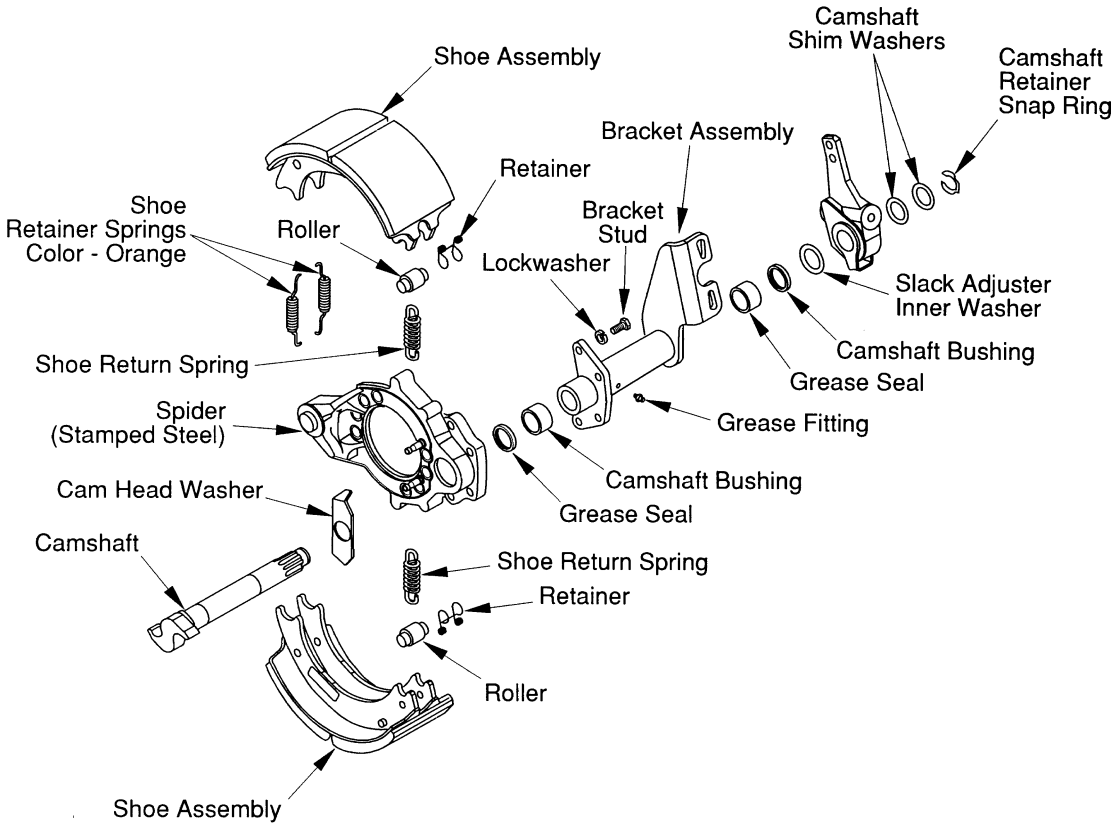
***While Eaton does not offer asbestos brake linings, the long-term effects of some non-asbestos fibers have not been determined. Current OSHA Regulations cover exposure levels to some components of non-asbestos linings but not all. The following precautions must be used when handling these materials.***

1. AVOID CREATING DUST. Compressed air or dry brushing must never be used for cleaning brake assemblies or the work area.
2. EATON RECOMMENDS THAT WORKERS DOING BRAKE WORK MUST TAKE STEPS TO MINIMIZE EXPOSURE TO AIRBORNE BRAKE LINING PARTICLES. Proper procedures to reduce exposure include working in a well ventilated area, segregation of areas where brake work is done, use of local filtered ventilation systems or use of enclosed cells with filtered vacuums. Respirators approved by the Mine Safety and Health Administration (MSHA) or National Institute for Occupational Safety and Health (NIOSH) should be worn at all times during brake servicing.
3. Workers must wash before eating, drinking or smoking; shower after working, and should not wear work clothes home. Work clothes should be vacuumed and laundered separately without shaking.
4. OSHA regulations regarding testing, disposal of waste and methods of reducing exposure for asbestos are set forth in 29 Code of Federal Regulations § 1910.001. These regulations provide valuable information which can be utilized to reduce exposure to airborne particles.
5. Material safety data sheets on this product, as required by OSHA, are available from Eaton.

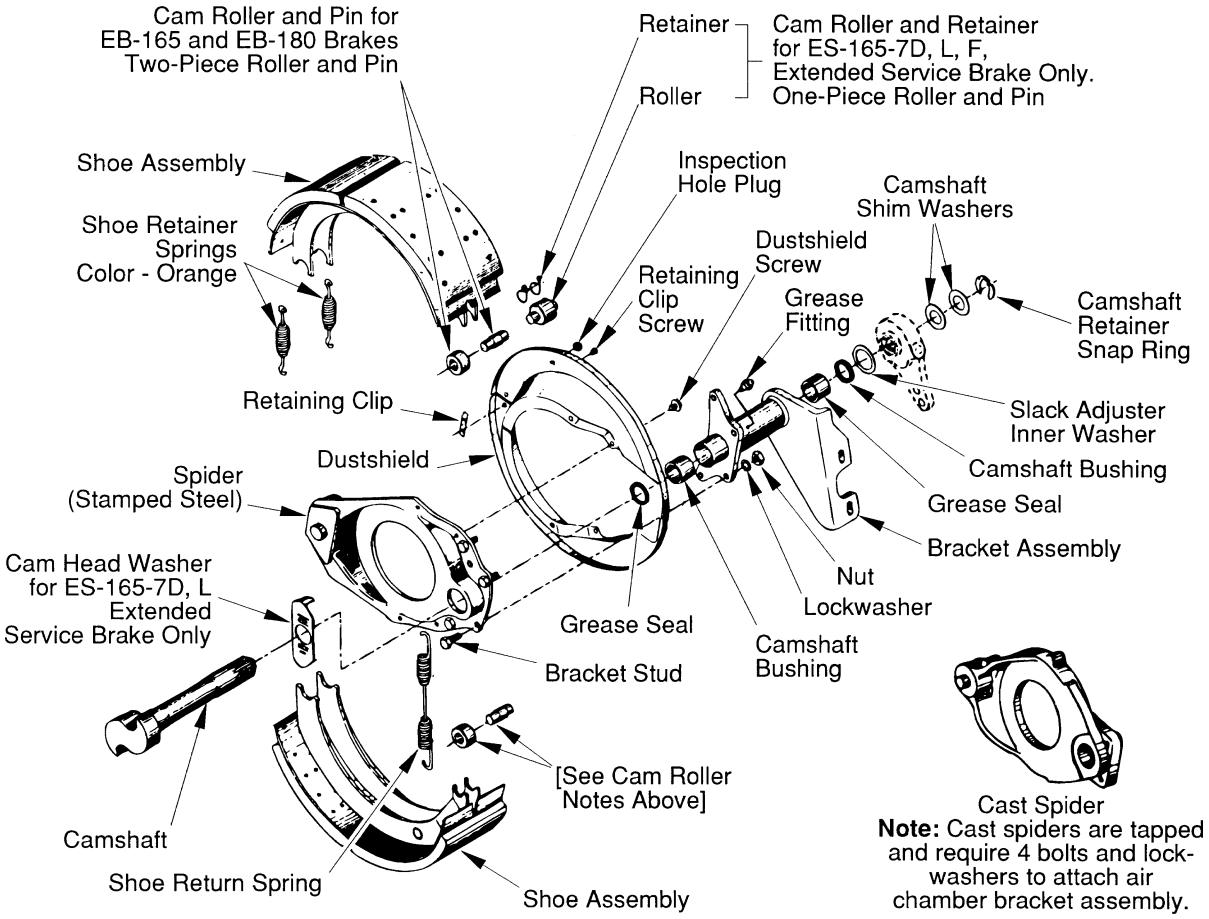
## ES/EB-150-4L


Camshaft Shim Washer
Camshaft Retainer Snap Ring
Slack Adjuster
Grease Seal
Spacer
Stabilizing Screw
Air Chamber Bracket
Camshaft Bushing
Grease Seal
Slack Adjuster Inner Washer
Camshaft Bushing
Bolt
Grease Fitting
Screw
Dustshield
Nut
Lockwasher
Washer
Nut
Shoe Return Spring
Lining Inspection Plug
Cam Roller
Spider Assembly*
Bolt*
Shoe and Lining Assembly
Lockwasher
Barrel Nut*
Shoe* Hold-Down Spring
Camshaft
Shoe Retainer Spring

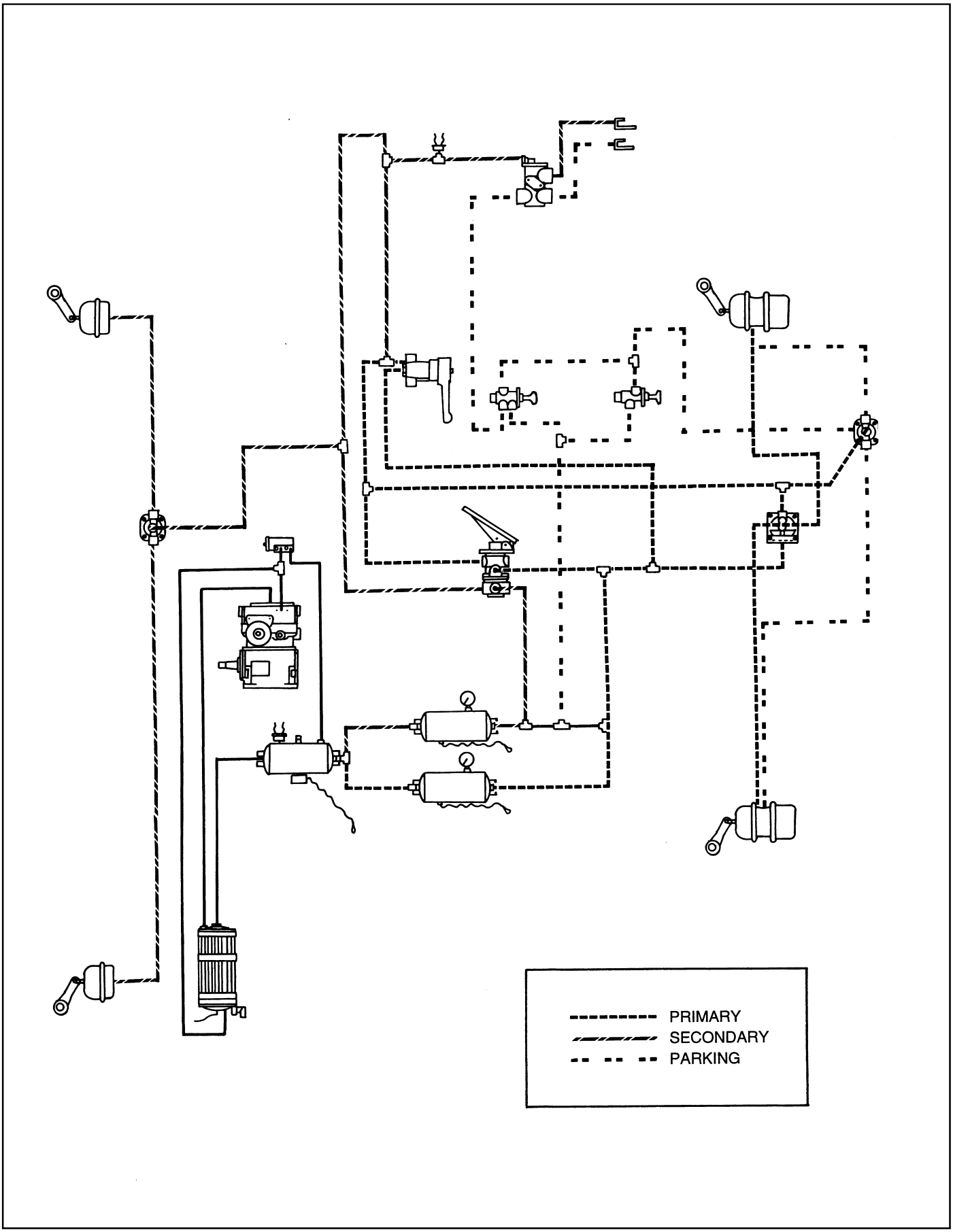
## ES-150-8D, F


Shoe Assembly
Camshaft Shim Washers
Camshaft Retainer Snap Ring
Bracket Assembly
Retainer
Shoe Retainer Springs Color - Orange
Roller
Bracket Stud
Lockwasher
Slack Adjuster Inner Washer
Shoe Return Spring
Camshaft Bushing
Grease Seal
Spider (Stamped Steel)
Grease Fitting
Camshaft Bushing
Cam Head Washer
Grease Seal
Camshaft
Shoe Return Spring
Retainer
Roller
Shoe Assembly

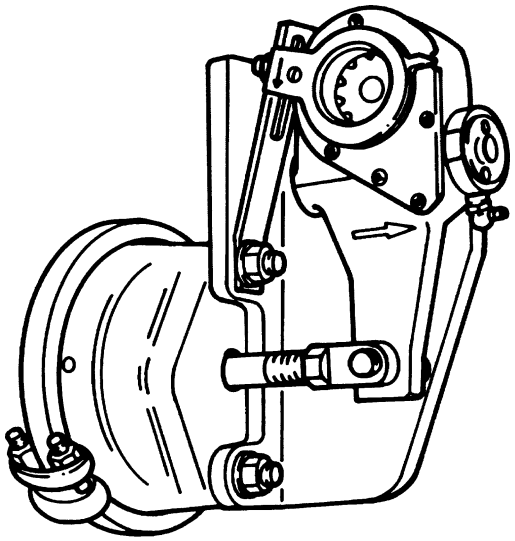
## EB/ES-165-7L,D


Cam Roller and Pin for EB-165 and EB-180 Brakes Two-Piece Roller and Pin
Retainer
Roller
Cam Roller and Retainer for ES-165-7D, L, F, Extended Service Brake Only. One-Piece Roller and Pin
Shoe Assembly
Shoe Retainer Springs Color - Orange
Inspection Hole Plug
Camshaft Shim Washers
Dustshield Screw
Retaining Clip Screw
Grease Fitting
Camshaft Retainer Snap Ring
Retaining Clip
Slack Adjuster Inner Washer
Dustshield
Camshaft Bushing
Spider (Stamped Steel)
Grease Seal
Bracket Assembly
Cam Head Washer for ES-165-7D, L Extended Service Brake Only
Nut
Lockwasher
Grease Seal
Camshaft Bushing
Bracket Stud
[See Cam Roller Notes Above]
Camshaft
Shoe Return Spring
Shoe Assembly
Cast Spider
**Note:** Cast spiders are tapped and require 4 bolts and lock-washers to attach air chamber bracket assembly.

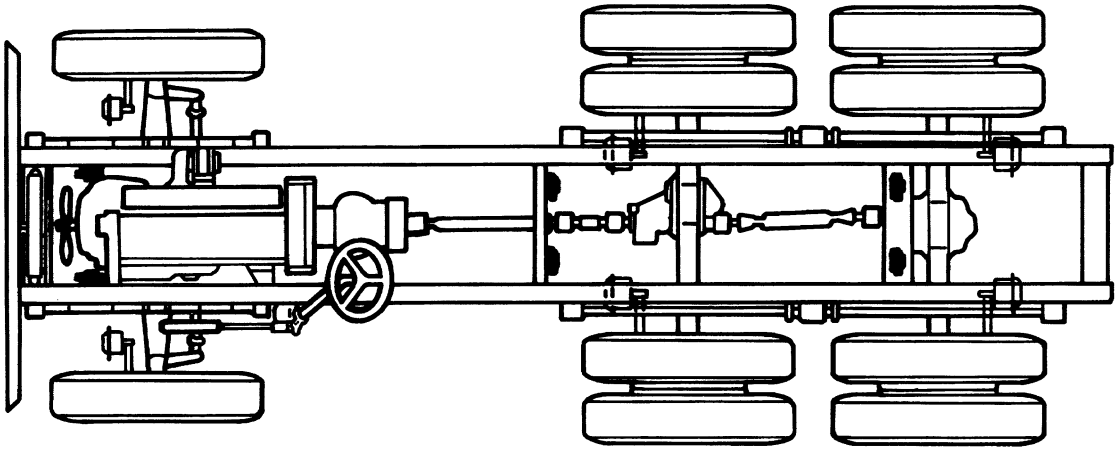
| POTENTIAL CONDITION/CAUSE | ACTION (SERVICE MANUAL SECTION) |
|---|---|
| Dragging brakes | See DRAGGING BRAKES |
| Insufficient lining-to-drum contact:<br>• Bell-mouthed drum condition<br>• Poor surface condition of drum<br>• Bent brake spider<br>• Bent or stretched brake shoe<br>• Loose wheel bearing<br>• Worn or damaged camshaft<br>• Improper lining grind | <br>◗ Replace drum (3,6)<br>◗ Rebore or replace drum (3,6)<br>◗ Replace spider (3,6)<br>◗ Replace shoe (3,6)<br>◗ Torque spindle nuts and check end play (6)<br>◗ Replace camshaft (3,6)<br>◗ Grind linings to fit drum radius |
| Linings tapered across width:<br>• Bell-mouthed drum condition<br>• Poor surface condition of drum<br>• Bent brake spider<br>• Loose wheel bearing | <br>◗ Replace drum (3,6)<br>◗ Rebore or replace drum (3,6)<br>◗ Replace spider (3,6)<br>◗ Torque spindle nuts and check end play (6) |
| Unequal shoe wear on same brake:<br>• Mismatched lining friction codes<br>• Worn camshaft or bushings | <br>◗ Correct as required with proper lining (5)<br>◗ Replace camshaft or bushings (3,6) |
| Glazed linings:<br>• Unbalanced brake system<br>• Incorrect lining for vehicle type and service<br>• Dragging spring brake chamber | <br>◗ Inspect brake system (2)<br>◗ Install proper lining (6)<br>◗ Inspect valves and chamber for leaks. Replace air chamber (4,6) |
| Scored or grooved linings and drum:<br>• Improperly machined drum<br>• Abrasive material between lining and drum | <br>◗ Replace or machine drum (3,6)<br>◗ Remove dirt and debris. Clean drum and remachine if required (3) |
| Loose lining:<br>• Improper rivet size<br>• Improper crimping of rivets<br>• Enlarged rivet holes in shoe<br>• Incorrect lining hole size or counterbore depth | <br>◗ Replace rivets (5)<br>◗ Replace rivets (5)<br>◗ Replace shoe (3,6)<br>◗ Replace lining (5) |
| Cracked lining at rivet holes:<br>• Dirt or rust on shoe table<br>• Incorrect counterbore lining size<br>• Loose rivets | <br>◗ Remove dirt and debris. Clean and repaint shoe (3)<br>◗ Replace linings (5)<br>◗ Replace linings and check rivet process (5) |

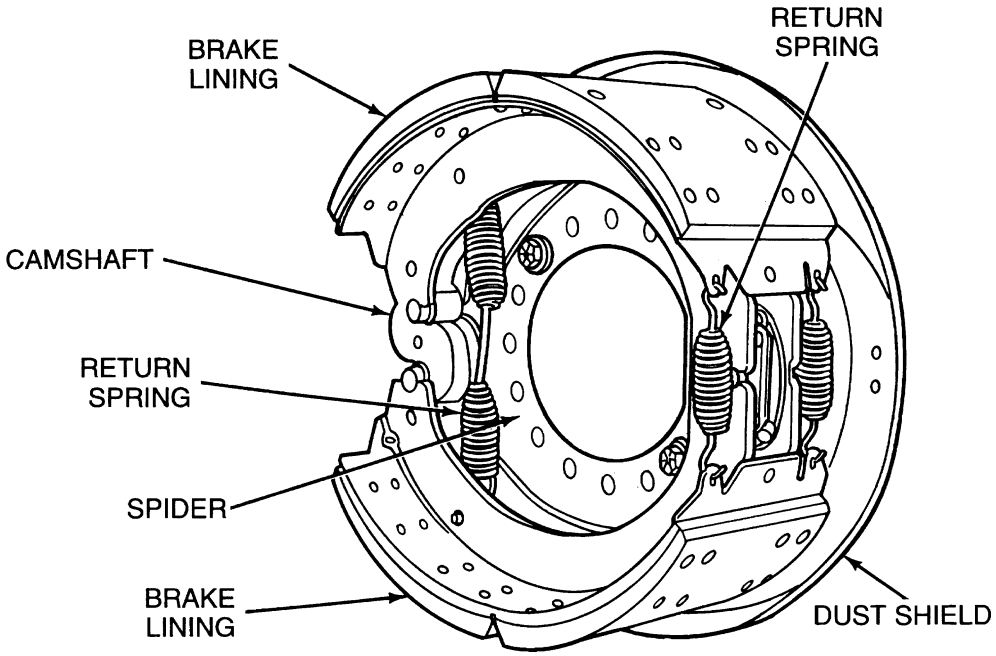

PRIMARY
SECONDARY
PARKING

| POTENTIAL CONDITION/CAUSE | ACTION (SERVICE MANUAL SECTION) |
|---|---|
| Inadequate air supply to chamber: | |
| • Old or broken lines | ◗ Replace chamber air lines (3) |
| • Pinhole leaks in air chamber line | ◗ Replace chamber air lines (3) |
| • Loose or damaged fittings | ◗ Tighten or replace fittings (3) |
| • Air line inner lining separation | ◗ Replace chamber air lines (3) |
| Separation: | |
| • Plugged lines | ◗ Remove blockage |
| • Contamination | ◗ Remove contamination |
| Valve problems: | |
| • Worn valves | ◗ Repair or replace |
| • Internal component failures | ◗ Repair or replace |
| • Seals/O-rings damaged | ◗ Replace seals/O-rings |
| • External vents blocked | ◗ Remove blockage |
| Governor failure: | |
| • Incorrect set point | ◗ Correct set point |
| • Contamination | ◗ Remove contamination |
| • Damaged valve | ◗ Repair or replace |
| Compressor failure: | |
| • Worn or leaking compressor | ◗ Repair or replace compressor |
| • Slipping/broken belts/drives | ◗ Repair or replace belts or drives |
| Contamination: | |
| • No air dryer | ◗ Install air dryer |
| • Faulty air dryer | ◗ Repair or replace air dryer |
| • Dirty/damaged filter | ◗ Replace air filter |
| • Desiccant debris | ◗ Remove debris |
| • Incompatible oils | ◗ Drain and refill oil |
| Leaking air tanks | ◗ Repair or replace |
| Improperly set air chamber: | |
| • Too much rod free-travel | ◗ Adjust brakes (2) |
| Slack adjuster improperly set: | |
| • Incorrect installation of slack adjuster | ◗ Install slack adjuster properly (3,6) |
| • Incorrect in-service adjustment | ◗ Adjust brakes using correct procedure (2,6) |
| • Incorrect setup of external reference control arms (Eaton-Haldex) | ◗ Perform correct setup procedure (3,6) |
| • Worn clevis pin | ◗ Replace clevis pin (3,6) |



| POTENTIAL CONDITION/CAUSE | ACTION (SERVICE MANUAL SECTION) |
|---|---|
| Slack adjuster not functioning properly:<br>• Bushing worn<br>• Spline damaged<br>• Worn or damaged internal parts<br>• Incorrect slack window (auto slacks) | <br>◗ Replace bushing (3,6)<br>◗ Replace slack adjuster (3,6)<br>◗ Replace slack adjuster (3,6)<br>◗ Install correct window (3,6) |
| Overadjustment/underadjustment:<br>• Contamination of internal parts (auto slacks)<br>• False feedback to slack adjuster due to degraded foundation brake components (see below)<br>• Severely glazed or worn linings | <br>◗ Replace slack adjuster (3,6)<br>◗ Replace bad foundation brake component<br><br>◗ Replace linings (5) |
| Degraded foundation brake components:<br>• Grease or oil on linings<br>• Flat spots on cam or rollers | <br>◗ Replace linings (5)<br>◗ Replace cam or roller (3,6) |
| Camshaft bushings binding:<br>• lacks lubricant<br>• Stretched shoe<br>• Other broken or bent parts<br>• Performing downgrade braking using light drag | <br>◗ Lubricate bushings<br>◗ Replace shoe (3,6)<br>◗ Replace damaged parts as required (3,6)<br>◗ Use snub method on downgrades |

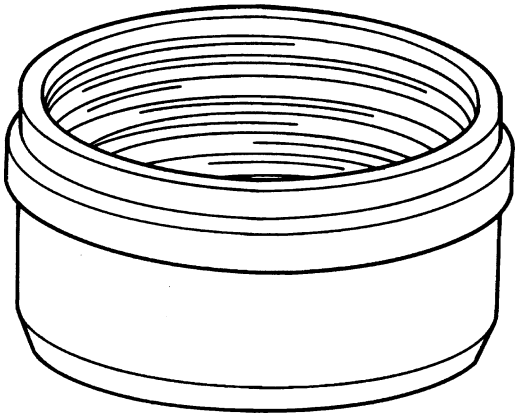




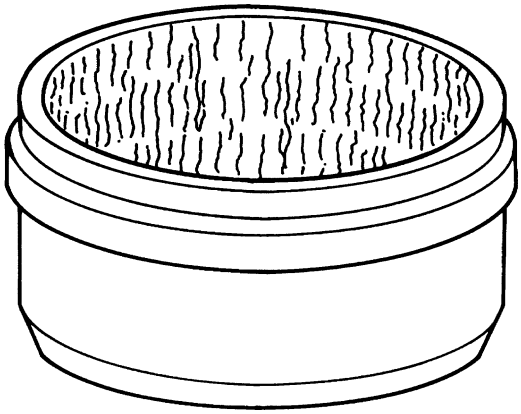

| POTENTIAL CONDITION/CAUSE | ACTION (SERVICE MANUAL SECTION) |
|---|---|
| Dragging brakes | See DRAGGING BRAKES<br>◗ Check brake adjustment |
| Grabbing or pulling brakes: | |
| • Grease, oil or dirt on linings | ◗ Replace linings (5) |
| • Glazed linings | ◗ Deglaze linings or replace (5) |
| • Cam bracket seal failure | ◗ Replace seals (5) |
| • Brake linings not a balanced set, different codes, or lining brand | ◗ Replace linings (5) |
| • Loose or broken linings | ◗ Replace linings (5) |
| • Brake drum out-of-round | ◗ Replace drum (3,6) |
| • Defective brake drum | ◗ Replace drum (3,6) |
| • Camshaft binding at one or more wheels | ◗ Clean and lubricate (2,3) |
| • Defective slack adjuster | ◗ Replace slack adjuster (3,6) |
| • Uneven brake adjustment (side-to-side) | ◗ Adjust brakes (2) |
| • Broken or bent part(s) | ◗ Replace part(s)(6) |
| • Loose spider or drum mounting bolts | ◗ Retorque bolts (6) |
| • Different air chamber size or slack adjuster length (side-to-side) | ◗ Use same size air chamber and slack adjuster length on all brakes |

# BRAKE SYSTEMS DIAGNOSTIC GUIDE

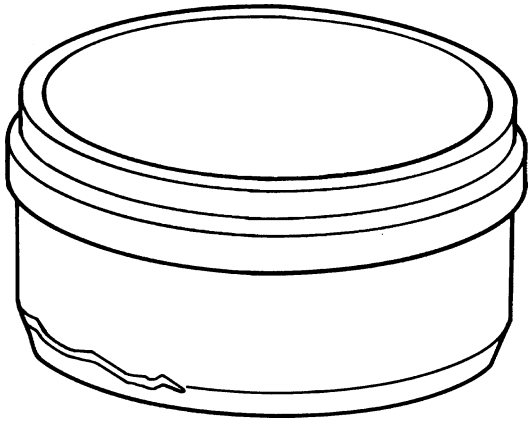
**1.) Scoring**



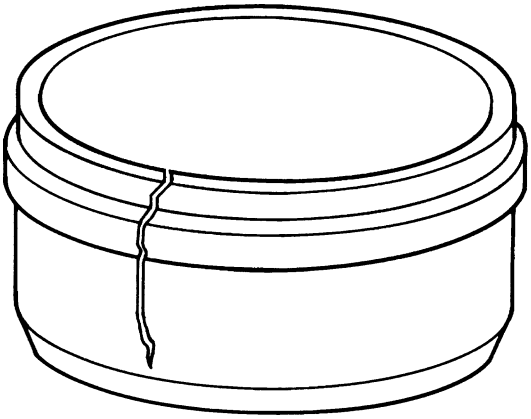
**2.) Severe Heat Checking**
**(Drum cannot be turned to eliminate heat cracks)**



**3.) Cracking Through Hat Section**

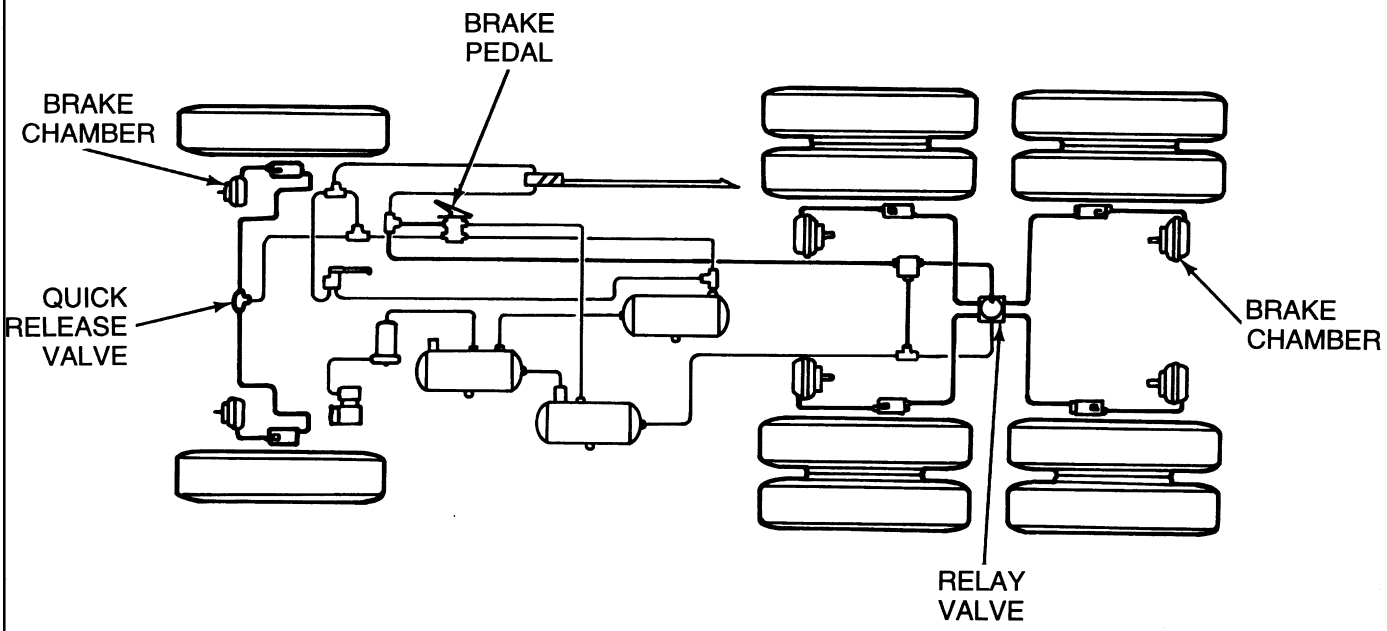


**4.) Cracking Through Side Wall**



| POTENTIAL CONDITION/CAUSE | ACTION (SERVICE MANUAL SECTION) |
|---|---|
| Dragging brake | See DRAGGING BRAKES |
| Brake drum heat checked:<br>• Out-of-round brake drum<br>• Eccentric mounting of drum<br>• Loose wheel bearing<br>• Glazed linings<br>• Improper friction materials for vehicle type and vocation<br>• Overworked brake<br>• Driver abuse<br>• Wrong drum type<br>• Defective brake lining<br>• Debris between lining and drum<br>• Performing downgrade braking using light drag | <br>◗ Replace drum (3)<br>◗ Correct as required (3)<br>◗ Correct as required<br>◗ Deglaze or replace linings (5)<br>◗ Consult dealer for proper friction levels<br>◗ Check brake balance (2)<br>◗ Correct as required<br>◗ Replace with correct drum type (3)<br>◗ Replace lining (5)<br>◗ Clean, remove dirt and debris (3)<br>◗ Use snub method on downgrades |
| Excessive scoring of drum:<br>• Soft drum | <br>◗ Replace drum (3) |
| Excessive lining wear | See PREMATURE LINING WEAR |

# BRAKE SYSTEMS DIAGNOSTIC GUIDE



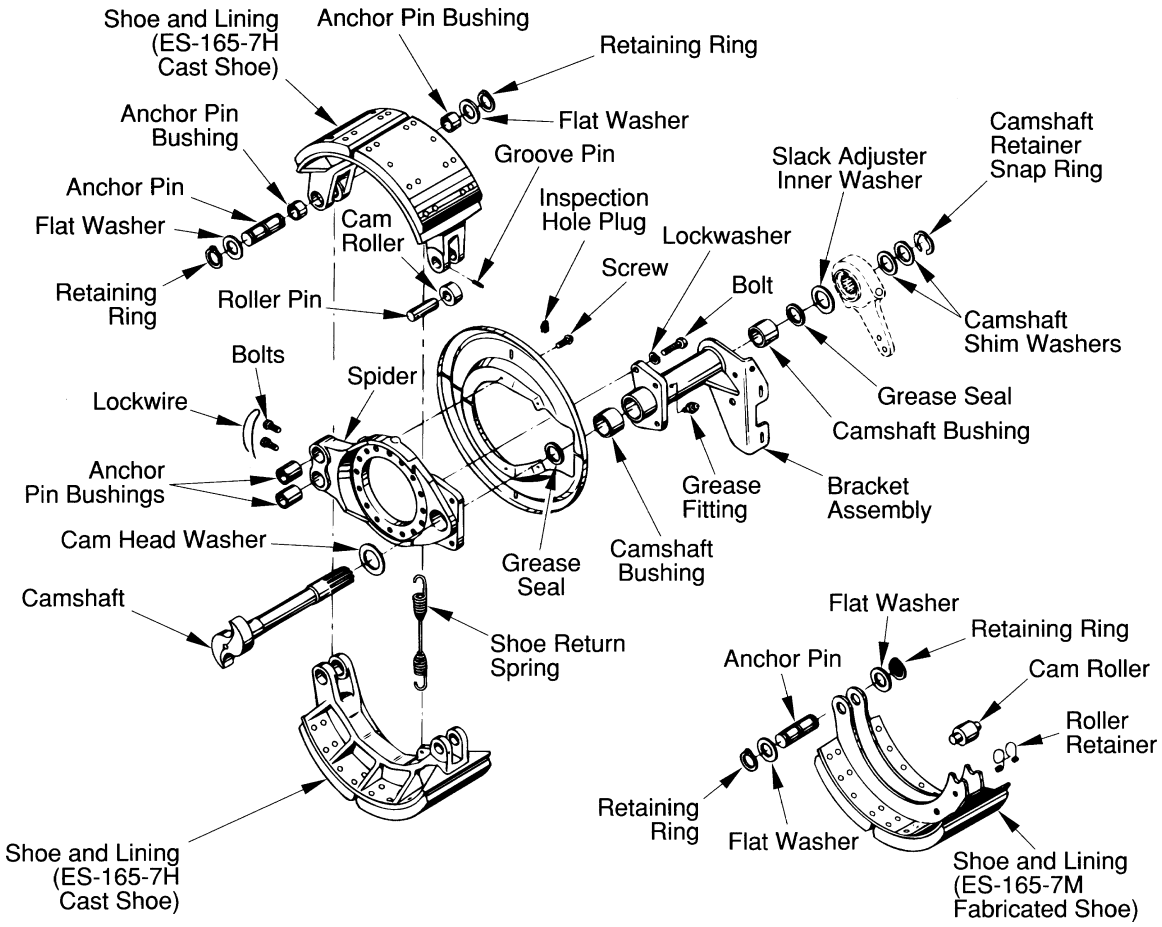

| POTENTIAL CONDITION/CAUSE | ACTION (SERVICE MANUAL SECTION) |
|---|---|
| Blockage in air lines preventing air chamber from exhausting:<br>• Air line inner lining separation<br>• Plugged lines<br>• Contamination<br>• Damaged fittings | <br>◗ Replace line<br>◗ Remove blockage<br>◗ Remove contamination<br>◗ Replace fittings |
| Air valves sticking:<br>• Seals/O-rings damaged<br>• External vents blocked<br>• Contamination<br>• Worn valves/internal component failures | <br>◗ Replace seals/O-rings<br>◗ Remove blockage<br>◗ Remove contamination<br>◗ Repair or replace as required |
| Spring brake not functioning:<br>• Power spring failure | <br>◗ Replace spring brake chamber |
| Air chamber not set properly:<br>• Too much rod free-travel<br>• Air chamber in wrong position in bracket slot<br>• Pushrod length too long | <br>◗ Adjust brakes (2)<br>◗ Reposition air chamber or bracket (3<br>◗ Adjust clevis or shorten pushrod (2) |
| Slack adjuster not set properly:<br>• Incorrect installation of slack adjuster<br>• Incorrect in-service adjustment<br>• Incorrect setup of external reference control arms (Eaton-Haldex)<br>• Broken or bent parts | <br>◗ Install slack adjuster properly (3,6)<br>◗ Check and correct adjustment procedure (2)<br>◗ Perform correct setup procedure (2)<br>◗ Replace damaged parts as required (3,6) |
| No force at shoes:<br>• Grease, oil or dirt on linings | <br>◗ Replace linings (5) |
| Lack of friction:<br>• Glazed linings<br>• Worn/damaged drums<br>• New linings, not burnished | <br>◗ Deglaze or replace linings (5)<br>◗ Replace drums (3)<br>◗ Burnish linings |

# BRAKE SYSTEMS DIAGNOSTIC GUIDE

| POTENTIAL CONDITION/CAUSE | ACTION (SERVICE MANUAL SECTION) |
|---|---|
| Incomplete release of air chamber after service application: | |
| • Incorrect clevis position | ◗ Reposition clevis (6) |
| • Incorrect bracket slot | ◗ Reposition on correct bracket slot (6) |
| • Damaged pushrod | ◗ Replace air chamber (3,6) |
| • Air chamber return spring failure | ◗ Replace air chamber (3,6) |
| • Road debris damage | ◗ Repair damage (5) |
| • Blockage in other upstream air system parts | ◗ Remove blockage (5) |
| Incomplete release of parking brake after application of pressure to air chamber: | |
| • Internal cup/cone hang-up | ◗ Repair or replace cup/cone |
| • Damaged pushrod | ◗ Replace pushrod (3,6) |
| • Diaphragm leak in parking chamber | ◗ Replace diaphragm or air chamber (3,6) |
| • Cocked power spring | ◗ Repair power spring |
| • Pushrod seal leak | ◗ Replace seal (5) |
| • Blockage in other upstream air system parts | ◗ Remove blockage |
| Air leaks in parking system: | |
| • Old or broken lines | ◗ Replace lines |
| • Pinhole leaks in air line | ◗ Replace line |
| • Loose or damaged fittings | ◗ Tighten or replace fittings |
| • Damaged or contaminated valve | ◗ Repair or replace valve |
| Blockages in service system air lines: | |
| • Inner lining separation | ◗ Replace chamber air lines |
| • Plugged lines | ◗ Remove blockage |
| • Contamination | ◗ Remove contamination |
| Air valves sticking: | |
| • Seals/O-rings damaged | ◗ Replace seals/O-rings |
| • External vents blocked | ◗ Remove blockage |
| • Low air pressure to valve (see below) | ◗ Check for blockage |
| | ◗ Check compressor |
| Low air pressure supplied to system: | |
| • Governor failure - | |
| — Incorrect set point | ◗ Adjust set point |
| — Contamination | ◗ Remove contamination |
| — Damaged valve | ◗ Repair or replace valve |
| • Compressor Failure - | |
| — Worn or leaking components | ◗ Repair or replace |
| — Damaged components | ◗ Repair or replace |
| — Slipping or broken belts or drives | ◗ Repair or replace |

| POTENTIAL CONDITION/CAUSE | ACTION (SERVICE MANUAL SECTION) |
|---|---|
| Contamination - | |
| —No air dryer | ◗ Install air dryer |
| —Faulty air dryer | ◗ Repair or replace |
| —Dirty or damaged filter | ◗ Replace filter |
| —Desiccant debris | ◗ Clean desiccant |
| —Incompatible oils | ◗ Drain and refill with proper oil |
| —Leaking air tanks | ◗ Repair or replace tank |
| —Mis-adjusted brakes | ◗ Readjust brakes |
| Insufficient pushrod free travel: | |
| • Pushrod length too long | ◗ Shorten pushrod to proper length |
| • Incorrect installation of slack adjuster | ◗ Perform correct installation procedure (6) |
| Overadjusted slack adjuster: | |
| • Incorrect in-service adjustment (manual) | ◗ Readjust using proper procedure |
| • Incorrect setup of external reference control arms (Eaton-Haldex) | ◗ Perform correct setup procedure |
| • Incorrect slack window (auto slacks) | ◗ Replace with proper slack window (6) |
| • Contamination of internal parts (auto) | ◗ Replace slack adjuster (6) |
| • False feedback to slack adjuster (review all foundation brake and wheel end problems) | ◗ Check lining clearances and hub/drum run-out (4) |
| • Auto slack installed and/or adjusted with spring brake partially applied (low reservoir pressure) | ◗ Readjust with spring brake fully retracted |
| • Performing downgrade braking using light drag | ◗ Use snub method on downgrades |
| Cam flip over: | |
| • Worn linings/drums | ◗ Replace linings/drums (3,5,6) |
| • Worn shoes/rollers | ◗ Replace as necessary (3,6) |
| • Worn cam | ◗ Replace cam (3,6) |
| Binding of camshaft in bushings: | |
| • Corrosion | ◗ Replace bushings and lubricate (5) |
| • Lack of lubricant | ◗ Lubricate with proper lubricant (2) |
| • Damaged bushings/journals | ◗ Replace bushings/journals (5) |
| Drum out-of-round: | |
| • Worn-out drum | ◗ Replace drum (3,6) |
| • Overloading of vehicle | ◗ Don't exceed legal weight rating of vehicle |
| • Over-aggressive linings | ◗ Change lining friction rating |
| • Driver abuse | ◗ Correct as required |
| • Incorrect turning of drum | ◗ Perform correct drum turning operation (2) |
| • Performing downgrade braking using light drag | ◗ Use snub method on downgrades |

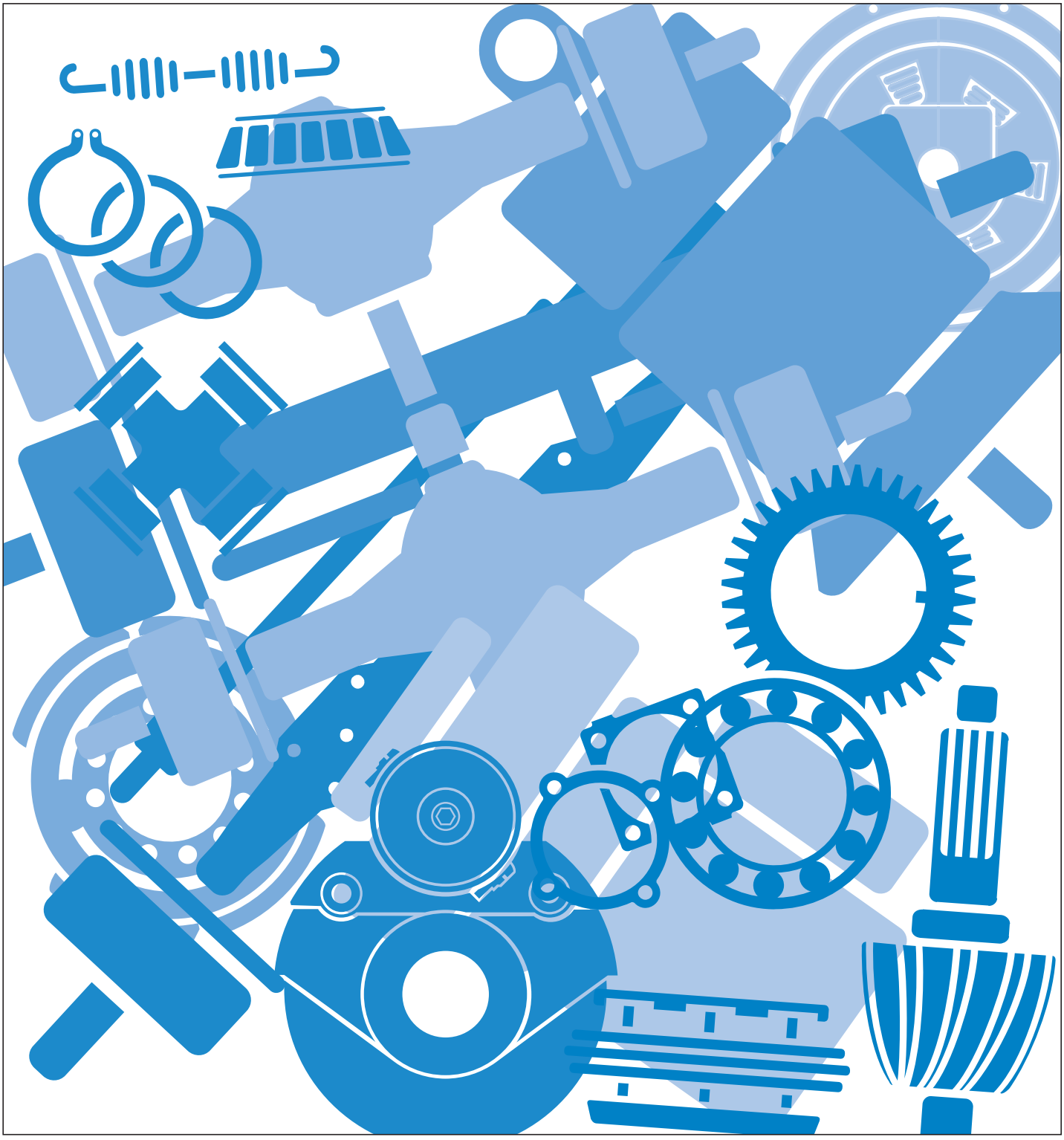
## ES-165-7H, M


Shoe and Lining (ES-165-7H Cast Shoe)
Anchor Pin Bushing
Retaining Ring
Flat Washer
Anchor Pin Bushing
Groove Pin
Anchor Pin
Flat Washer
Cam Roller
Inspection Hole Plug
Lockwasher
Screw
Retaining Ring
Roller Pin
Bolt
Bolts
Spider
Lockwire
Grease Seal
Camshaft Bushing
Anchor Pin Bushings
Grease Fitting
Bracket Assembly
Cam Head Washer
Grease Seal
Camshaft Bushing
Camshaft
Shoe Return Spring
Shoe and Lining (ES-165-7H Cast Shoe)
Slack Adjuster Inner Washer
Camshaft Retainer Snap Ring
Camshaft Shim Washers
Flat Washer
Retaining Ring
Anchor Pin
Cam Roller
Roller Retainer
Retaining Ring
Flat Washer
Shoe and Lining (ES-165-7M Fabricated Shoe)

# BRAKE SYSTEMS DIAGNOSTIC GUIDE

| POTENTIAL CONDITION/CAUSE | ACTION (SERVICE MANUAL SECTION) |
|---|---|
| Dragging brakes | See DRAGGING BRAKES |
| Poor lining-to-drum contact. Linings are tapered across width:<br>• Bell-mouthed drum<br>• Bent brake spider<br>• Bent or stretched brake shoe<br>• Loose wheel bearing<br>• Worn or damaged cam | <br><br>◗ Replace drum (3)<br>◗ Replace spider (3,6)<br>◗ Replace shoe (3,6)<br>◗ Torque spindle nuts and check end play (6)<br>◗ Replace cam (3,6) |
| Shoe-to-shoe variation:<br>• Mismatched lining friction codes<br>• Stretched shoe | <br>◗ Replace lining(s) with proper friction code (5)<br>◗ Replace shoe (3,6) |
| Brake components:<br>• Flat spots on cam or roller<br>• Worn anchor pin<br>• Worn camshaft or bushings | <br>◗ Replace cam or roller (3,6)<br>◗ Replace anchor pin (3,6)<br>◗ Replace camshaft and bushings (5) |
| Unequal wear on side-to-side brakes for same axle:<br>• Mismatched lining friction codes<br>• Seized or binding camshaft<br>• Brake drum surface in poor condition<br>• Loose wheel bearing<br>• Performing downgrade braking using light drag | <br>◗ Replace lining(s) with proper friction code (5)<br>◗ Clean and lubricate camshaft (2)<br>◗ Replace drum (3)<br>◗ Torque spindle nuts and check end play (6)<br>◗ Use snub method on downgrades |
| Slack adjuster not set properly:<br>• Incorrect installation of slack adjuster<br>• Incorrect in-service adjustment<br>• Incorrect setup of external reference control arms (Eaton-Haldex)<br>• Broken or bent parts | <br>◗ Install slack adjuster properly (3,6)<br>◗ Check and correct adjustment procedure (2)<br>◗ Perform correct setup procedure (2)<br><br>◗ Replace damaged parts as required (3,6) |
| Wear on edge of lining:<br>• Wrong lining width<br>• Wrong drum<br>• Loose bearing adjustment. Bearing spacer missing or too thin | <br>◗ Replace lining (5)<br>◗ Replace drum (3)<br>◗ Replace spacer and torque spindle nuts. Check end play (6) |

## NOTES:





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