FIRE APPARATUS FLEET STUDY
JANUARY-FEBRUARY 2018

Specialty Fleet Consulting
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<th>A</th>
<th>INTRODUCTION and REPORT</th>
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<td>B</td>
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<td>8382</td>
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<td>O</td>
<td>Maintenance Recommendations</td>
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<tr>
<td>P</td>
<td>Air Disc Brake Manual</td>
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<tr>
<td>Q</td>
<td>Oil Sample Invoice</td>
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February 25, 2018

Fire Chief Charles Hanley
Jackson County Fire District #5
5811 S. Pacific Hwy.
Phoenix, OR 97535

Dear Chief Hanley and distinguished Fire District board members,

My name is Craig Weeks and I am the retired Chief of Fire Fleet Services for the Los Angeles County Fire Department and I now operate as Specialty Fleet Consulting, an independent consultant herein known as SFC. SFC offers over thirty years of experience in fire department fleet management including but not limited to inspection and evaluation of fire apparatus, establishing preventive maintenance programs, training for inspection and preventive maintenance and establishing a replacement plan including writing of specifications and providing assistance in competitive purchasing.

On January 25-26, 2018, at the request of Fire Chief Charles Hanley, SFC conducted a study on the Jackson County Fire District #5 fire apparatus fleet. Below is a report of my findings and recommendations based on the study.

8301: 03/2014 Pierce Saber Pumper

Apparatus is in overall good condition, however will need some repairs prioritized in the next 30-90 days. In particular, front and rear brakes, air conditioning and a significant engine oil leak which appears to come from the power steering pump mounting flange. Other repairs are minor but should be addressed at the same time.

Chassis, Cab, Body
- Air conditioning pressure tap fitting leaking (left side front frame rail below steering gear box) – A/C will likely not work properly or at all by summer

Drivetrain
- Monitor, prioritize and schedule front brakes for replacement
- Monitor, prioritize and schedule rear brakes for replacement
- Engine oil leak, appears to be power steering pump mount – Severe
- Coolant leak, upper radiator hose at thermostat housing – Clamp tightened on site
Fire Pump and Plumbing
- Pump shift override cable rubbing on intermediate driveline
- Foam leaking down right side mid frame rail – specific source unknown without unloading/disassembly of longitudinal hose bed

**Engine Oil Analysis:** The engine oil shows high levels of soot, dirt and indications of iron. Soot and iron are indicators of possible cylinder wear and blow-by and dirt is likely from work performed trying to stop oil leaks and may be contributing to cylinder wear. Current recommendation is to repair the current oil leak, change oil and filter and have filter opened and examined for debris and continue monitoring.

**Transmission Fluid Analysis:** The transmission fluid shows signs of iron which may indicate fluid pump wear. No other abnormal wear or contamination is currently present. Recommend servicing fluid and filters using Allison OEM “Gold” filters, flush transmission fluid cooler, both coolant and fluid sides prior to summer and monitor.

**8302: 03/2014 Pierce Saber Pumper**

Apparatus is in overall good condition, however needs immediate attention on the rear brakes which are wearing unevenly. This was prioritized by District staff at the time identified. Other repairs are minor in nature and can be addressed during other maintenance or repair services.

**Chassis, Cab, Body**
- Power steering return hose from steering gear box rubbing and wearing on corner of frame rail, needs to be secured and protected (marked with rag and shown to engineer)

**Drivetrain**
- Rear brakes are wearing unevenly and right side is thin. Brakes should be exposed and thoroughly inspected for the cause and components replaced as necessary as soon as possible

**Fire Pump and Plumbing**
- No deficiencies noted

**Engine Oil Analysis:** The engine oil currently indicates no abnormal wear.

**Transmission Fluid Analysis:** The transmission fluid shows signs of high particle counts and oxidation which may indicate overheating. No other abnormal wear or contamination is currently present. Recommend servicing fluid and filters using Allison OEM “Gold” filters, flush transmission fluid cooler, both coolant and fluid sides prior to summer and monitor.
8303: 05/2006 Pierce Contender Pumper

Apparatus is in overall fair condition, however is in need of significant repairs. In particular, an audible engine misfire at given loads and RPM and engine oil and coolant leaks as well as front brake lining flaking and steering leaks and linkage issues would need to be addressed with emphasis on priority and the front brake calipers need to be properly lubricated and adjusted for optimal performance. Immediate mechanical repair needs of this apparatus may likely exceed $30,000 and a complete engine failure significantly more. Additional but less critical repairs noted should also be addressed and will add significant additional costs.

Chassis, Cab, Body
- Left front outer brake pad material flaking off
  - Engineer stated the apparatus is prone to pre-mature brake wear and pulls when braking. Brake calipers may not be properly lubricated, adjusted and maintained
    - Meritor ADB brake maintenance manual PDF provided. See section 13, page 53 for approved grease and proper lubrication procedure
- Steering tie rod ends have some movement and will need to be replaced soon
- Power steering gear box pressure and return hoses leaking
- Heater hose is rubbing on power steering gear box fitting (visible with cab down)
- Rear brake slack adjusters need to be serviced and checked for proper adjustment and operation
- Driveline universal joint bolts, some have lock plates and some do not. This may not be an issue provided proper U-joint lock bolts were used. Inspect frequently for tightness

Drivetrain
- Engine sounds like it has a misfire around 900-1000 RPM with a load either while pumping or in gear
  - Future engine repairs are eminent
- Multiple engine oil leaks around cylinder head
- Significant coolant leak from radiator upper tank.

Fire Pump and Plumbing
- Pump panel engine monitoring LCD display does not properly display information due to failed diodes. Display is proprietary to the apparatus manufacturer but may be replaced with an all-in-one electronic governor control with display such as the FRC Pump Boss which is consistent with other District apparatus

**Engine Oil Analysis:** The engine oil currently indicates no abnormal wear which implies the engine misfire may be fuel delivery related such as an under fueling fuel injector.

**Transmission Fluid Analysis:** The transmission fluid shows signs of oxidation which may indicate overheating. The presence of aluminum may indicate wear of the torque converter/impeller. Recommend servicing fluid and filters using Allison OEM “Gold” filters, flush transmission fluid cooler, both coolant and fluid sides prior to summer and monitor.
Due to the current mechanical condition and that the engine is the most basic rating and underpowered for this application, it is recommended this apparatus be prioritized for replacement.

**8311: 10/1999 International Central States Pumper**

Apparatus is in overall poor condition and is in need of significant and extensive repairs. If the vehicle is to continue to remain in active service, safety items which include steering linkage and suspension items and seat belts require immediate attention. Other repairs such as fire pump, valve and plumbing issues, although not detrimental to on-highway operation do create potential liability to the District should they not perform appropriately and be deemed a contributing factor to loss associated with a failure to suppress fire. The apparatus is incapable of passing an NFPA fire pump test. Proper repairs to this apparatus will likely exceed $50,000.

**Chassis, Cab, Body**
- Steering drag link end loose and needs replacing (one-piece unit)
- Both rear and front passenger seats need reupholstered
- Front seat belts in need of replacement due to damage from being caught in closed door
- Steering gear leaks
- Front suspension leaf springs weak, losing arc, less than 1" from rebound snubbers
- Driver and right rear cab door hinges loose and need replacing
- Air conditioning compressor and clutch seized
- Ladder rack linear actuator not functioning properly

**Drivetrain**
- Engine starter cranks slow on initial start up – Check battery cables/terminals, test batteries, starter amp draw and voltage drop
- Minor engine oil leak from rear cylinder head rocker cover
- Front drive axle significant pinion and axle seal leaks
- Front drive axle driveline slip joint splines loose
- Transmission tail housing leaking
- Transmission cooler lines leaking at radiator cooler

**Fire Pump and Plumbing**
- Fire pump gear box input shaft seal oil leak
- Fire pump impeller shaft seal severe leak.
- Multiple valves leaking
- Pump driveline yoke loose at pump gear box input splines – Will likely require yoke and input shaft replacement
- Foam system inoperable – Control head display buttons missing and pump/motor appears seized. Entire system is obsolete and likely requires replacement

**Engine Oil Analysis:** The engine oil currently indicates no abnormal wear.

**Transmission Fluid Analysis:** The transmission fluid currently indicates no abnormal wear.
It is recommended this apparatus not be utilized for active service in its current condition.

8313: 02/1995 International Central States Pumper

Apparatus is in overall poor condition and is in need of significant and extensive repairs. If the vehicle is to continue to remain in active service, safety items which include steering linkage and suspension items, seats and seat belts require immediate attention. Other repairs such as fire pump, valve and plumbing issues, although not detrimental to on-highway operation do create potential liability to the District should they not perform appropriately and be deemed a contributing factor to loss associated with a failure to suppress fire. The apparatus is incapable of passing an NFPA fire pump test. Air bubbles in the transmission fluid indicate a potential problem. This was being addressed by District staff at the time of notification. Provided the transmission is not in need of major repairs, proper repairs to this apparatus will likely exceed $30,000.

Chassis, Cab, Body
- Steering drag link end loose and needs replacing (one-piece unit)
- Both front seat fore and aft adjuster and track assemblies in need of immediate replacement
- Front seat belts in need of replacement due to damage from being caught in closed door
- Steering gear leaks
- Front suspension leaf springs weak, significant list to the left side

Drivetrain
- Transmission fluid aerated. Transmission should be diagnosed for air in fluid
  - First step is to have filters checked for being clogged and collapsed
- Engine oil leak, front accessory drive cover from the left side
- Right front drive axle seal leaks

Fire Pump and Plumbing
- Fire pump impeller shaft seal severe leak.
- Multiple valves leaking
- Steel plumbing rotting. Major patch repairs evident and additional leaks starting

Engine Oil Analysis: The engine oil currently indicates no abnormal wear.

Transmission Fluid Analysis: The transmission fluid was not sampled due to foaming (aeration) of the fluid which indicates a developing internal problem. The vehicle was prioritized by District staff to have the filters removed and inspected by a local vendor.

It is recommended this apparatus not be utilized for active service in its current condition, however addressing safety items would deem the vehicle to be road worthy.
Apparatus is in overall poor condition and due to the numerous repairs, many of which relate to the safe operation of this apparatus, it should be taken out of active service. Also, based on the size of the apparatus and equipment being carried, it is likely to be overweight.

**Chassis, Cab, Body**
- Left rear parking brake cable rubbing and wearing on leaf spring
- Right front body mounting U-bolt clamped over frame rivet and both sides loose
- Rear body isolating rubber between body and frame has come out and rear body mounts are not readily accessible
- All hinged compartment door latch strikers worn and are in need of replacement to ensure contents are properly secured
- Breathing apparatus (BA) brackets are not NFPA compliant and do not properly secure the breathing apparatus and allow the composite bottles to rub on bracket mounting bolts potentially causing irreparable damage to the bottles
- Spare BA bottles are not properly secured with a secondary restraint and valves are not properly protected to prevent damage and a projectile pressure discharge
- This vehicle may exceed its gross vehicle weight limit when fully loaded and should be weighed prior to operating

**Drivetrain**
- Engine fast idle circuit is not operating properly allowing engine to uncontrollably speed up to governed RPM while stationary. Should this happen while driving, the vehicle would uncontrollable
- Engine oil leak, front of engine – Possible front crank seal
- Engine oil leak, rear of engine – Possible rear crank seal
- Fuel line, lower left side of engine missing bolt in securing bracket and bracket is rubbing and wearing into aluminum front engine cover
- Power Take Off (PTO) transmission oil leak – R&R and Reseal PTO
- Front axle driveline slip joint splines loose and shaft rubbing on hydraulic hoses

**Fire Pump and Plumbing**
- Foam leak from bottom of foam tank
- Pressure relief valve does not work properly
- Uncontrollable engine speed causes high system pressures which would cause an unsafe pumping operation

**Engine Oil Analysis:** The engine oil was not sampled.

**Transmission Fluid Analysis:** The transmission fluid was not sampled.

It is recommended the apparatus be removed from service. Repairs would likely far exceed the value of the vehicle even in perfect operating condition.
8341: 07/2004 International S&S Tender

Apparatus is in overall good condition but needs rear brakes thoroughly inspected immediately for potential oil contamination. Other repairs such as the steering shaft and PTO U-joints should receive priority attention.

Chassis, Cab, Body
- Steering shaft upper U-joint loose – Replace

Drivetrain
- Minor oil leak from rear head rocker cover
- Plastic cover rubbing on front driveline yoke
- Right rear brake shoes appear to be contaminated with oil – Remove dust cover for inspection

Fire Pump and Plumbing
- Both PTO shaft U-joints loose

*Engine Oil Analysis:* The engine oil shows signs of nearly 7% fuel dilution and decreased viscosity. This may be from periods of extended idle. No other abnormal wear is indicated. Recommend changing oil and filter and continue to monitor oil level and condition. Also recommend shutting down engine when not necessary to run.

*Transmission Fluid Analysis:* The transmission fluid was not sampled.

This apparatus is a good candidate for trade-in or to sell.

8343: 2009 International Danko Tender

Apparatus is in overall good condition but needs rear brakes thoroughly inspected immediately for potential oil contamination. Other repairs such as the steering linkage and pressure governor should receive priority attention.

Chassis, Cab, Body
- Left steering tie rod end 1/8" play – Replace and realign
- Right steering tie rod end dust boot torn (unable to clean out contamination) – Replace and realign

Drivetrain
- Front engine accessory drive cover and crank seal leaking oil
- Fan belt is oil saturated and deteriorating
- Right rear brake shoes appear to be contaminated with oil

Fire Pump and Plumbing
- Pump panel throttle pressure governor does not accurately adjust for throttle/pressure control
**Engine Oil Analysis:** The engine oil currently indicates a low viscosity but no abnormal wear. It is recommended that the engine oil used is proper and approved by the engine manufacturer and change oil and filter if determined to be incorrect. The low oil viscosity may be a contributing factor to the premature oil leaks.

**Transmission Fluid Analysis:** The transmission fluid was not sampled.

This apparatus is a good candidate for trade-in or to sell.

**8361: 06/2010 Ford F-450 Brush Engine**

Apparatus is in overall good condition. However steering linkage and oil leaks should be addressed with priority. Additionally, apparatus of this type would typically be constructed on the next higher capacity F-550 chassis and should be weighed to ensure it is not overweight when loaded.

**Chassis, Cab, Body**
- Steering drag link ends loose – Replace and re-align
- Right front lower body damage

**Drivetrain**
- Engine oil leak from both cylinder head/rocker covers
- Rear axle pinion seal, minor leak

**Fire Pump and Plumbing**
- No deficiencies noted

**Engine Oil Analysis:** The engine oil was not sampled.

**Transmission Fluid Analysis:** The transmission fluid was not sampled.

This apparatus is a good candidate to repurpose.

**8362: 08/1999 Ford F-350 Pick-up/Brush Engine**

Apparatus is in overall good condition. Replacement of steering linkage and re-alignment should provide for continuous service.

**Chassis, Cab, Body**
- Steering drag link ends loose – Replace and re-align

**Drivetrain**
- No deficiencies noted

**Fire Pump and Plumbing**
• No deficiencies noted

**Engine Oil Analysis:** The engine oil was not sampled.

**Transmission Fluid Analysis:** The transmission fluid was not sampled.

This apparatus is a good candidate to repurpose.

**8363: 06/2010 Ford F-450 Brush Engine**

Apparatus is in overall good condition. However steering linkage, suspension, coolant leaks and oil leaks should be addressed with priority. Additionally, apparatus of this type would typically be constructed on the next higher capacity F-550 chassis and should be weighed to ensure it is not overweight when loaded.

**Chassis, Cab, Body**

- Steering drag link ends loose – Replace and re-align
- Left tie rod end loose – Replace and re-align
- Both lower ball joint dust boots torn – Replace and re-align
  - Steering and suspension repairs should be performed as soon as possible
- Body mounting U-bolts loose
- Fuel fill and vent hoses rubbing on booster leaf spring – Secure and protect
- Diesel Exhaust Fluid fill hose rubbing on frame – Secure and protect
- Replace all tires

**Drivetrain**

- Engine oil over full. Monitor oil level and if increases without adding, or a notable change in engine performance occurs, it is recommended the vehicle be removed from service pending repairs. Oil sample has been pulled for analysis to check for fuel contamination
- Significant engine oil leak from right side cylinder head/rocker cover
- Coolant leak, lower radiator hose heater hose fitting
- Coolant leak at bottom of oil cooler
- Main driveline slip joint splines loose

**Fire Pump and Plumbing**

- No deficiencies noted

**Engine Oil Analysis:** The engine oil analysis confirmed the presence of diesel fuel dilution of nearly 18%. This vehicle should not remain in active service until the source of contamination is identified and repaired or irreversible engine damage will occur.

**Transmission Fluid Analysis:** The transmission fluid was not sampled.

This apparatus is a good candidate to repurpose or due to low miles, may bring the highest resale value if repaired.
8381: 05/2006 Ford E-350 Ambulance

Apparatus is in overall fair condition, however the vehicle has been equipped with a breathing air cascade system which does not appear to be securely mounted and may become dislodged in the event of a traffic collision. In addition, the ambulance style is intended to carry the crew and a patient and based on the reverse arc of the rear suspension leaf springs and steering linkage wear, the air system and added equipment has severely overloaded the vehicle making it unsafe for use on a highway.

Chassis, Cab, Body
- Steering tie rod and drag link ends – replace and re-align
- Power steering pressure line leaking at front cross member
- Power steering suction line leaking at pump
- Incorrect wide angle side view mirrors installed
- Rear suspension leaf springs have a reverse arc indicating the vehicle is severely overloaded and unsafe to operate on a public roadway
- The air cascade system mounting does not appear to be adequate to secure the system in the event of a traffic collision

Drivetrain
- No deficiencies currently noted
- The 6.0 Power Stroke diesel is known for inherent mechanical problems

Fire Pump and Plumbing
- Not applicable

Engine Oil Analysis: The engine oil was not sampled.

Transmission Fluid Analysis: The transmission fluid was not sampled.

Based on the current condition, it is recommended this apparatus be immediately removed from active service.

8382: 10/2000 Ford Explorer

Apparatus is in overall poor condition and due to the numerous repairs, many of which relate to the safe operation of this apparatus, it is recommended the apparatus be removed from service. Repairs would likely far exceed the value of the vehicle even in perfect operating condition.

Chassis, Cab, Body
- Steering tie rod ends – replace and re-align
- Front shock absorbers - replace and re-align
- Ball joints - replace and re-align
- Hood hinges and support struts worn
- Rear hatch hinges and hardware need replacing. Hatch glass not secure
• Front grill warning light wires unprotected and rubbing on hood latch
• Headlight lenses severely deteriorated and need replacing
• Dash instrument lights inoperable

**Drivetrain**
• Coolant leak at thermostat housing
• Engine oil leak at oil filter adapter
• Engine oil leak at oil pan/rear engine main seal
• Front differential pinion seal, significant leak
• Engine idle control not working properly when cold or when air conditioning activated or transmission placed into gear – Possible idle air solenoid
• Needs front brakes soon

**Fire Pump and Plumbing**
• Not applicable

**Engine Oil Analysis:** The engine oil was not sampled.

**Transmission Fluid Analysis:** The transmission fluid was not sampled.

**SUMMARY and RECOMMENDATIONS:**
All apparatus studied are in need of varying degrees of maintenance and repair. The District should consider developing a regular inspection and maintenance program in compliance with Oregon Department of Transportation (ODOT) which refers to the Federal Motor Carrier Safety Regulations (FMCSR Part 396). In addition, vehicle operators should be trained to perform daily pre-trip safety inspections and maintain apparatus log books which should be carried within each apparatus. Apparatus inspection reports and maintenance records should also be maintained for each vehicle so records may be easily accessible if requested by a law enforcement agency and it is further recommended that repair records be separated by MAINTENANCE and BREAKDOWN to quickly identify if a given apparatus is experiencing a high rate of failure. A section for WARRANTY should also be included for new apparatus.

[Link to Oregon.gov]
[Link to ECFR]

Based on conversations with the Fire Chief as to the dynamic growth and ever changing operational requirements of the District such as the critical need for roof access for vertical ventilation, ladder storage for rescue and elevated streams and tactical wildland/urban interface firefighting apparatus, SFC is making the following recommendations in order of priority but which have obvious and significant budget obligations to the District:

1. Replace triple combination pumper 8303 with a straight chassis quintuple combination pumper apparatus with aerial device allowing for advanced rescue and elevated fire operations capabilities. The quintuple (Quint) apparatus provides the multi-function capabilities of both a pumper and an aerial ladder truck with lower gross vehicle weight, shorter wheel base, better turning radius and lower expense than a standard aerial
ladder platform truck. According to the Fire Chief, the nearest aerial ladder truck, if available, has a response time in excess of 30 minutes to existing target hazards.

2. Replace 8311, 8313, 8341 and 8343 with two (2) 1000 gallon commercial chassis all-wheel drive brush pumpers that meet Type-3, Type-4 and Tactical Tender requirements.
   a. Selling or trading in apparatus would help to offset the purchase price.
   b. The new vehicles would ensure maximum cost recovery for the District when called upon for mutual aid strike team assignments.
   c. New apparatus would still serve as ready reserve engines in place of front line apparatus and therefore not limited to seasonal use.

3. Replace 8332, 8361 and 8363 with two (2) 300 gallon crew cab Type-6 brush pumpers with storage capacity for rescue equipment.
   a. Consider repurposing 8361 as a Support/Utility/Light Rescue.
   b. Repurpose 8362 as a Support/Utility/Admin vehicle.
   c. Current brush pumpers do not meet current Type-6 personnel requirements of three (3) or have adequate compartment space for rescue equipment. Current vehicles may also be overweight when fully loaded.
   d. Replacement units would provide 600 gallons water and up to eight (8) personnel when combined and do not require special driver licensing.
   e. Selling or trading in apparatus would help offset the purchase price.
   f. The new vehicles would ensure maximum cost recovery for the District when called upon for mutual aid strike team assignments.

4. Replace 8302 with a Type-1 pumper properly specified for the District's needs and operation and place 8302 into reserve status.

5. Replace 8301 with a Type-1 pumper properly specified for the District's needs and operation. Trade-in or sell 8301.

This proposal would reduce the fleet size by five (5) while providing a high functioning and efficient fleet of rescue and fire suppression apparatus while developing revenue to the District from major campaign brush fire assignments and decreasing on-going maintenance costs.

Submitted

Craig A. Weeks

Craig A. Weeks
Specialty Fleet Consulting
208-972-7243
specialtyfleet@gmail.com
8301
03/2014 Pierce Saber, Cummins ISL-9, 450hp
1000 gallon, 1250 GPM Pumper
39,090 miles

**Chassis, Cab, Body**
- Air conditioning pressure tap fitting leaking (left side front frame rail below steering gear box) – A/C will likely not work properly or at all by summer

**Drivetrain**
- Monitor, prioritize and schedule front brakes for replacement
- Monitor, prioritize and schedule rear brakes for replacement
- Engine oil leak, appears to be power steering pump mount – Severe
- Coolant leak, upper radiator hose at thermostat housing – Clamp tightened on site

**Fire Pump and Plumbing**
- Pump shift override cable rubbing on intermediate driveline
- Foam leaking down right side mid frame rail – specific source unknown without unloading/disassembly of longitudinal hose bed
8302
03/2014 Pierce Saber, Cummins ISL-9, 450hp
1000 gallon, 1250 GPM Pumper
31,953 miles

Chassis, Cab, Body
- Power steering return hose from steering gear box rubbing and wearing on corner of frame rail, needs to be secured and protected (marked with rag and shown to engineer)

Drivetrain
- Rear brakes are wearing unevenly and right side is thin. Brakes should be exposed and thoroughly inspected for the cause and components replaced as necessary as soon as possible

Fire Pump and Plumbing
- No deficiencies noted
8303
05/2006 Pierce Contender, Cummins ISL-9, 350hp
1000 gallon, 1250 GPM Pumper
82,060 miles

Chassis, Cab, Body
- Left front outer brake pad material flaking off
  - Engineer stated the apparatus is prone to pre-mature brake wear and pulls when braking. Brake calipers may not be properly lubricated, adjusted and maintained
    - Meritor ADB brake maintenance manual PDF provided. See section 13, page 53 for approved grease and proper lubrication procedure
- Steering tie rod ends have some movement and will need to be replaced soon
- Power steering gear box pressure and return hoses leaking
- Heater hose is rubbing on power steering gear box fitting (visible with cab down)
- Rear brake slack adjusters need to be serviced and checked for proper adjustment and operation
- Driveline universal joint bolts, some have lock plates and some do not. This may not be an issue provided proper U-joint lock bolts were used. Inspect frequently for tightness

Drivetrain
- Engine sounds like it has a misfire around 900-1000 RPM with a load either while pumping or in gear
  - Future engine repairs are eminent
- Multiple engine oil leaks around cylinder head
- Significant coolant leak from radiator upper tank.

Fire Pump and Plumbing
- Pump panel engine monitoring LCD display does not properly display information due to failed diodes. Display is proprietary to the apparatus manufacturer but may be replaced with an all-in-one electronic governor control with display such as the FRC Pump Boss which is consistent with other District apparatus
**Unknown Hours on the Oil. Oxidation is elevated, possibly due to overheating or extended Oil change intervals. Aluminum is elevated and may indicate Torque Converter/Impeller wear. More sample history needed to establish a normal wear trend. Cut open filter(s) and inspect for debris. Change Oil and filter(s) and resample in 2,000 miles to monitor.**

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JACKSON COUNTY FIRE DISTRICT 5
5811 South Pacific Hwy
Phoenix, OR 97535

8311
10/1999 International 2574, 4x4, Cummins N-14
Central States 1000 gallon, 1250 GPM Pumper
75,448 miles

Chassis, Cab, Body
- Steering drag link end loose and needs replacing (one-piece unit)
- Both rear and front passenger seats need reupholstered
- Front seat belts in need of replacement due to damage from being caught in closed door
- Steering gear leaks
- Front suspension leaf springs weak, losing arc, less than 1" from rebound snubbers
- Driver and right rear cab door hinges loose and need replacing
- Air conditioning compressor and clutch seized
- Ladder rack linear actuator not functioning properly

Drivetrain
- Engine starter cranks slow on initial start up – Check battery cables/terminals, test batteries, starter amp draw and voltage drop
- Minor engine oil leak from rear cylinder head rocker cover
- Front drive axle significant pinion and axle seal leaks
- Front drive axle driveline slip joint splines loose
- Transmission tail housing leaking
- Transmission cooler lines leaking at radiator cooler

Fire Pump and Plumbing
- Fire pump gear box input shaft seal oil leak
- Fire pump impeller shaft seal severe leak.
- Multiple valves leaking
- Pump driveline yoke loose at pump gear box input splines – Will likely require yoke and input shaft replacement
- Foam system inoperable – Control head display buttons missing and pump/motor appears seized. Entire system is obsolete and likely requires replacement

This apparatus is incapable of performing a drafting pump operation or NFPA pump test due to pump and plumbing leaks. Fire pump is mounted above frame rails and completely inaccessible for regular maintenance and service
8313
02/1995 International 2574, 4x4, Cummins N-14
Central States 1000 gallon, 1250 GPM Pumper
89,339 miles

Chassis, Cab, Body
- Steering drag link end loose and needs replacing (one-piece unit)
- Both front seat fore and aft adjuster and track assemblies in need of immediate replacement
- Front seat belts in need of replacement due to damage from being caught in closed door
- Steering gear leaks
- Front suspension leaf springs weak, significant list to the left side

Drivetrain
- Transmission fluid aerated. Transmission should be diagnosed for air in fluid
  - First step is to have filters checked for being clogged and collapsed
- Engine oil leak, front accessory drive cover from the left side
- Right front drive axle seal leaks

Fire Pump and Plumbing
- Fire pump impeller shaft seal severe leak.
- Multiple valves leaking
- Steel plumbing rotting. Major patch repairs evident and additional leaks starting

This apparatus is incapable of performing a drafting pump operation or NFPA pump test due to pump and plumbing leaks. Failure of rotten plumbing during a pumping operation would be catastrophic and could cause injury to personnel (see link).
G
Chassis, Cab, Body
- Left rear parking brake cable rubbing and wearing on leaf spring
- Right front body mounting U-bolt clamped over frame rivet and both sides loose
- Rear body isolating rubber between body and frame has come out and rear body mounts are not readily accessible
- All hinged compartment door latch strikers worn and are in need of replacement to ensure contents are properly secured
- Breathing apparatus (BA) brackets are not NFPA compliant and do not properly secure the breathing apparatus and allow the composite bottles to rub on bracket mounting bolts potentially causing irreparable damage to the bottles
- Spare BA bottles are not properly secured with a secondary restraint and valves are not properly protected to prevent damage and a projectile pressure discharge
- This vehicle may exceed its gross vehicle weight limit when fully loaded and should be weighed prior to operating

Drivetrain
- Engine fast idle circuit is not operating properly allowing engine to uncontrollably speed up to governed RPM while stationary. Should this happen while driving, the vehicle would uncontrollable
- Engine oil leak, front of engine – Possible front crank seal
- Engine oil leak, rear of engine – Possible rear crank seal
- Fuel line, lower left side of engine missing bolt in securing bracket and bracket is rubbing and wearing into aluminum front engine cover
- Power Take Off (PTO) transmission oil leak – R&R and Reseal PTO
- Front axle driveline slip joint splines loose and shaft rubbing on hydraulic hoses

Fire Pump and Plumbing
- Foam leak from bottom of foam tank
- Pressure relief valve does not work properly
- Uncontrollable engine speed causes high system pressures which would cause an unsafe pumping operation

It is recommended this vehicle not be operated on a public roadway or as a pumping fire suppression unit due to its current unsafe operating condition.
JACKSON COUNTY FIRE DISTRICT 5
5811 South Pacific Hwy
Phoenix, OR 97535

8341
07/2004 International 4300, DT570
S&S 2000 gallon, 750 GPM Tender
11,693 miles

Chassis, Cab, Body
  • Steering shaft upper U-joint loose – Replace

Drivetrain
  • Minor oil leak from rear head rocker cover
  • Plastic cover rubbing on front driveline yoke
  • Right rear brake shoes appear to be contaminated with oil – Remove dust cover for inspection

Fire Pump and Plumbing
  • Both PTO shaft U-joints loose

*Address brake issue immediately*
8343
2008 International 4300, Maxxforce 9
Danko 2000 gallon, 750 GPM Tender
11,796 miles

Chassis, Cab, Body
- Left steering tie rod end 1/8" play – Replace and realign
- Right steering tie rod end dust boot torn (unable to clean out contamination) – Replace and realign

Drivetrain
- Front engine accessory drive cover and crank seal leaking oil
- Fan belt is oil saturated and deteriorating
- Right rear brake shoes appear to be contaminated with oil

Fire Pump and Plumbing
- Pump panel throttle pressure governor does not accurately adjust for throttle/pressure control

*Address brake issue immediately*

*Pump pressure governor is high priority*
8361
06/2010, Ford F-450, 4x4, Ext. Cab, 6.7 diesel
Skid Mounted Brush Pumper
45,491 miles

**Chassis, Cab, Body**
- Steering drag link ends loose – Replace and re-align
- Right front lower body damage

**Drivetrain**
- Engine oil leak from both cylinder head/rocker covers
- Rear axle pinion seal, minor leak

**Fire Pump and Plumbing**
- No deficiencies noted

*Due to worn steering components with low miles, this vehicle may exceed its Gross Vehicle Weight Rating and should be weighed when fully loaded.*
8362
08/1999 Ford F-350 SRW, 4x4, 2 door Pick-Up, 7.3 diesel
Skid Mounted Brush Pumper
98,415 miles

Chassis, Cab, Body
- Steering drag link ends loose – Replace and re-align

Drivetrain
- No deficiencies noted

Fire Pump and Plumbing
- No deficiencies noted
L
8363
06/2010, Ford F-450, 4x4, Ext. Cab, 6.7 diesel
Skid Mounted Brush Pumper
27,868 miles

Chassis, Cab, Body
- Steering drag link ends loose – Replace and re-align
- Left tie rod end loose – Replace and re-align
- Both lower ball joint dust boots torn – Replace and re-align
  - Steering and suspension repairs should be performed as soon as possible
- Body mounting U-bolts loose
- Fuel fill and vent hoses rubbing on booster leaf spring – Secure and protect
- Diesel Exhaust Fluid fill hose rubbing on frame – Secure and protect
- Replace all tires

Drivetrain
- Engine oil over full. Monitor oil level and if increases without adding, or a notable change in engine performance occurs, it is recommended the vehicle be removed from service pending repairs. Oil sample has been pulled for analysis to check for fuel contamination
- Significant engine oil leak from right side cylinder head/rocker cover
- Coolant leak, lower radiator hose heater hose fitting
- Coolant leak at bottom of oil cooler
- Main driveline slip joint splines loose

Fire Pump and Plumbing
- No deficiencies noted

Due to worn steering components with low miles, this vehicle may exceed its Gross Vehicle Weight Rating and should be weighed when fully loaded.
UNKNOWN HOURS ON THE OIL. LOW OIL VISCOSITY AND THE FUEL TEST INDICATE A HIGH LEVEL OF FUEL DILUTION. 17.81% FUEL DILUTION DETECTED BY GAS CHROMATOGRAPHY. ALUMINUM IS ELEVATED AND MAY INDICATE PISTON WEAR. SCHEDULE UNIT FOR INSPECTION AS SOON AS POSSIBLE. MORE SAMPLE HISTORY NEEDED TO ESTABLISH A NORMAL WEAR TREND. CHECK FOR SOURCE OF FUEL DILUTION AND RESAMPLE IN HALF THE NORMAL INTERVAL TO VERIFY FUEL DILUTION NO LONGER EXISTS.

<table>
<thead>
<tr>
<th>SAMPLE DATE</th>
<th>SAMPLE ID</th>
<th>METER (HR)</th>
<th>METER ON FLUID</th>
<th>Cu</th>
<th>Fe</th>
<th>Zr</th>
<th>Al</th>
<th>Pb</th>
<th>Se</th>
<th>Si</th>
<th>Na</th>
<th>K</th>
<th>Mg</th>
<th>Ni</th>
<th>Ag</th>
<th>Sb</th>
<th>Ti</th>
<th>V</th>
<th>Ca</th>
<th>P</th>
<th>Zn</th>
<th>Mg</th>
<th>Ba</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>07-Feb-18</td>
<td>H390-48039-0213</td>
<td>0.7</td>
<td>40</td>
<td>3</td>
<td>89</td>
<td>4</td>
<td>19</td>
<td>2</td>
<td>1</td>
<td>17</td>
<td>4</td>
<td>1</td>
<td>20</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2279</td>
<td>1146</td>
<td>1288</td>
<td>251</td>
<td>22</td>
<td>43</td>
</tr>
</tbody>
</table>

**OIL FORMULATION - OIL CONDITION - OIL CONTAMINATION**

<table>
<thead>
<tr>
<th>SAMPLE DATE</th>
<th>SAMPLE ID</th>
<th>METER (HR)</th>
<th>METER ON FLUID</th>
<th>FLUID TYPE</th>
<th>FLUID BRAND</th>
<th>FLUID WEIGHT</th>
<th>FLUID CHANGE</th>
<th>FILTER CHANGE</th>
<th>V100</th>
<th>ST</th>
<th>OXI</th>
<th>SUL</th>
<th>NIT</th>
<th>W</th>
<th>A</th>
<th>F</th>
<th>P</th>
<th>PRc</th>
</tr>
</thead>
<tbody>
<tr>
<td>07-Feb-18</td>
<td>H390-48039-0213</td>
<td>0.7</td>
<td>40</td>
<td>15W-40</td>
<td>N</td>
<td>11.6</td>
<td>42</td>
<td>19</td>
<td>23</td>
<td>11</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>P</td>
<td>17.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cu = Copper, Fe = Iron, Zr = Zirconium, Al = Aluminum, Pb = Lead, Si = Silicon, Na = Sodium, K = Potassium, Mg = Magnesium, Ca = Calcium, Mg = Magnesium, Mn = Manganese, Zn = Zinc, P = Phosphorus, A = Antimony, P = Fuel, W = Water, N = Nitrogen, T = Tin, E = Ethylene, S = Sulfur, O = Oxygen, So = Sulfur, ST = Sulfur, OX = Oxygen, So = Sulfur, V100 = Viscosity at 100°C.
8381
05/2006, Ford E-350 Ambulance, 6.0 Diesel
Scene Support Unit
41,458 miles

Chassis, Cab, Body
- Steering tie rod and drag link ends – replace and re-align
- Power steering pressure line leaking at front cross member
- Power steering suction line leaking at pump
- Incorrect wide angle side view mirrors installed
- Rear suspension leaf springs have a reverse arc indicating the vehicle is severely overloaded and unsafe to operate on a public roadway
- The air cascade system mounting does not appear to be adequate to secure the system in the event of a traffic collision

Drivetrain
- No deficiencies currently noted
- The 6.0 Power Stroke diesel is known for inherent mechanical problems

Fire Pump and Plumbing
- Not applicable

This vehicle is unsafe to operate on a public roadway in its current condition
N
JACKSON COUNTY FIRE DISTRICT 5
5811 South Pacific Hwy
Phoenix, OR 97535

8382
10/2000, Ford Explorer, 4x4, 4.0 V-6
Command/Admin.
121,175 miles

Chassis, Cab, Body
- Steering tie rod ends – replace and re-align
- Front shock absorbers - replace and re-align
- Ball joints - replace and re-align
- Hood hinges and support struts worn
- Rear hatch hinges and hardware need replacing. Hatch glass not secure
- Front grill warning light wires unprotected and rubbing on hood latch
- Headlight lenses severely deteriorated and need replacing
- Dash instrument lights inoperable

Drivetrain
- Coolant leak at thermostat housing
- Engine oil leak at oil filter adapter
- Engine oil leak at oil pan/rear engine main seal
- Front differential pinion seal, significant leak
- Engine idle control not working properly when cold or when air conditioning activated or transmission placed into gear – Possible idle air solenoid
- Needs front brakes soon

Fire Pump and Plumbing
- Not applicable
February 25, 2018

The following are some recommendations I am making to help with the future maintenance needs of your fleet.

1. **FIRE PUMP and VALVE MAINTENANCE:**
   a. As an initial treatment, pour two (2) cups of a powdered dishwashing detergent such as Cascade for every 500 gallons of water directly into the water tank (4 cups for the 1000 gallon pokers).
   b. Run the fire pump at approximately 100 psi circulating water back to the tank for approximately 15-20 minutes to mix thoroughly.
   c. Operate all gate valves with a cap on the outlet and the drain open. This will help break down hard water deposits and will typically allow gate valves to operate much smoother.
   d. Leave detergent in the tank as it will act as a “Wet Water” additive.
   e. Perform this approximately once per month reducing to one (1) cup detergent per 500 gallons.

2. **GATE VALVE CONTROLS:**
   a. I noticed the push/pull gate valve controls on some equipment were twisted to the 45° lock position.
   b. It takes 10-20 pounds of force to move the controls when locked and because the pump and body move independently when traveling down the road, the combined force of locked valve controls puts tremendous force on the pump panel.
   c. It is recommended that the controls be left in the unlocked position to prevent damage and stripped mounting screws.

Craig Weeks
Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

⚠️ WARNING
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Lubrication

Automatic Slack Adjuster

Use a grease gun to lubricate the automatic slack adjuster through the grease fitting until new grease flows from the pressure relief seal under the pawl assembly. Refer to Maintenance Manual 1, Preventive Maintenance and Lubrication, for the approved lithium-based greases for automatic slack adjusters. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

Anti-Seize Compound

Meritor lubricant specification 0-637, part number 2297-U-4571, is a corrosion control grease. Do not mix this grease with other greases. This compound is also available from the Southwest Petro-Chemical Division of Witco Chemical Corporation, 1400 South Harrison, Olathe, KS 66061, as “Corrosion Control”, part number SA 824946.

- Use anti-seize compound on the clevis pins of all slack adjusters.
- Also use anti-seize compound on the automatic slack adjuster and cam splines if the slack adjuster gear has no grease groove and holes around its inner diameter.

Caliper

⚠️ CAUTION
Only use Meritor specification 0-616-A or 0-645 grease inside the disc brake caliper. Do not use lithium-base grease, which can melt from high temperatures inside the caliper. Damage to components can result.

Meritor air disc brakes have been manufactured in three different designs. Note that the location of the caliper grease fitting and pressure relief valve is different in brakes manufactured before 1985, from 1985 to 1991, and after 1992. Figure 13.1, Figure 13.2 and Figure 13.3.
NOTE: Lubricate brake-actuating components inside the caliper two to four times during the life of the lining, or every six months.

1. Turn the adjusting nut on the automatic slack adjuster to move the inboard lining against the rotor. Figure 13.4.

2. Plug the pressure relief valve by holding a finger over the poppet.

NOTE: For calipers with grease fittings in the caliper and the camshaft cap, first apply grease to the caliper fitting, then apply grease to the camshaft cap fitting.

3. Apply grease through the grease fitting in the caliper until grease flows out of the seal at the camshaft cap.

⚠️ CAUTION
You must force excess grease from the caliper. Brakes can drag due to excessive grease in the caliper, which will reduce brake lining life.

4. Remove the pressure relief valve from the caliper. Turn the slack adjuster adjusting nut in the opposite direction to fully retract the caliper piston and force excess grease through the pressure relief hole.

5. Clean the excess grease from the outside of the caliper with a rag.

6. Install the pressure relief valve.

7. Adjust the brake. Refer to Section 11.

Maintenance
The maintenance schedules shown in this manual are for normal operating conditions. Refer below for other operating conditions.

- Operation under severe conditions can require shorter periods between maintenance.
- Operation over long distances with few stops can permit longer periods between maintenance.

A maintenance schedule for each vehicle can be set after the brakes are inspected several times.

Minor Inspections
Inspect and lubricate the brake and automatic slack adjuster according to one of the following schedules. Use the schedule that provides the most frequent inspection and lubrication.

- The chassis lubrication schedule used by your fleet.
- The chassis lubrication schedule recommended by the chassis manufacturer.
- A minimum of four times during the life of the linings.

Air System
- A vehicle equipped with a combination of air disc and drum brakes requires special attention to obtain maximum brake performance.
- Replace air system valves with valves of identical performance characteristics.
- A correctly maintained air system and correct air pressure to each brake can help to ensure maximum brake performance and reduced lining wear.
Automatic Slack Adjuster

NOTE: For complete maintenance instructions on the Meritor automatic slack adjuster, consult Maintenance Manual 4B, Automatic Slack Adjuster. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

![Warning Icon]

WARNING
Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury and damage to components can result.

1. Place blocks in front and behind the wheels to prevent the vehicle from moving.

![Warning Icon]

WARNING
Before you service a spring chamber, carefully follow the manufacturer's instructions to compress and lock the spring to completely release the brake. Verify that no air pressure remains in the service chamber before you proceed. Sudden release of compressed air can cause serious personal injury and damage to components.

2. If the vehicle has spring brakes, manually compress and lock the springs to release the brakes. You must check to ensure that no air pressure remains in the service halves of the air chambers.

Slack Adjusters Manufactured Before 1993

1. Remove the slack adjuster when these conditions are apparent.
   - The grease is dry or contaminated.
   - The pawl or actuator is worn.
2. Disassemble the slack adjuster.
3. Replace any worn or damaged parts.
4. Use new seals and a new boot when you assemble the unit.

Slack Adjusters Manufactured in 1993 and Later

1. Use the correct slack adjuster template to ensure that the clevis is installed in the correct position. Refer to Section 11.
2. Before you perform brake maintenance, check the free stroke and the adjusted chamber stroke as described in Section 11.
3. If the free stroke is not correct, refer to the tables in Section 14 to correct the stroke before you adjust the chamber stroke.
4. Inspect the boot for cuts or other damage. If the boot is cut or damaged, remove the pawl and inspect the grease.
5. If the grease is in good condition, replace the damaged boot with a new boot.
6. Use a grease gun to lubricate the slack adjuster through the grease fitting. If necessary, install a camshaft into the slack adjuster gear to minimize grease flow through the gear holes.
7. Lubricate until new grease purges from around the inboard camshaft splines and from the pawl assembly.
8. Measure the gap between the clevis and the collar on a "Quick Connect" clevis. Replace the clevis if the gap exceeds 0.060-inch (1.52 mm). Figure 13.5

Slide Pins and Bushings

1. Check for contamination on the slide pins. If necessary, remove and clean the slide pins and caliper bushings. Refer to Section 4.
2. Use a pin gauge, J-34064-54, to check the slide pin bushings for wear. If you can fit the gauge between the slide pin and the bushing, the bushing or slide pin is worn. Replace worn bushings and slide pins. Refer to Section 4. To obtain the pin gauge, contact SPX Kent-Moore at 800-328-6657.

Rotors
Inspect the rotor for cracks, deep scores or other damage. Replace the rotor when necessary. Refer to Section 8.
Air Chamber

Move the air chamber from side-to-side to check that the caliper moves freely on the slide pins. When the caliper does not move freely, inspect the slide pins, slide pin bushings and slide pin retainers for wear or damage. Replace components when necessary. Refer to Section 10 and Section 4.

Lining

When the linings wear, the caliper slides in along the slide pins. To check for lining wear, check the position of the caliper inboard bosses on the slide pins. Figure 13.6. If the bosses are within 1/4-inch (6.4 mm) of the ends of the pins, remove the wheels and tires and inspect the linings. If the bosses are within 1/8-inch (3.2 mm) of the ends of the pins, replace the linings. Refer to Section 10.

Major Inspections

When you reline the brakes, or at least once a year, perform the following inspection.

1. Inspect the automatic slack adjuster and brakes as previously described in the minor inspection guidelines in this section. Perform minor inspections before you do any other maintenance or reline procedures.

2. Perform all the procedures, inspections and measurements described in Section 10.

3. Lubricate the automatic slack adjuster and the caliper.

4. Adjust the brakes as described in Section 11.
# Lubrication and Maintenance

## Table G: Air Disk Brake (1540, 1560, 1760) Grease Specifications

<table>
<thead>
<tr>
<th>Component</th>
<th>Meritor Specification</th>
<th>NLGI Grade</th>
<th>Grease Description</th>
<th>Outside Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caliper</td>
<td>0-616-A</td>
<td>1</td>
<td>Clay Base</td>
<td>Down to $-40^\circ\mathrm{F} (-40^\circ\mathrm{C})$</td>
</tr>
<tr>
<td></td>
<td>0-645</td>
<td>2</td>
<td>Synthetic Oil, Clay Base</td>
<td>Down to $-65^\circ\mathrm{F} (-54^\circ\mathrm{C})$</td>
</tr>
<tr>
<td>Slide Pin Retainers</td>
<td>0-637$^2$</td>
<td>1-1/2</td>
<td>Calcium Base</td>
<td>Refer to the grease manufacturer’s specifications for the temperature service limits.</td>
</tr>
<tr>
<td>Camshaft Splines</td>
<td>Any of Above</td>
<td>See Above</td>
<td>Anti-Seize</td>
<td>See Above</td>
</tr>
<tr>
<td></td>
<td>0-641</td>
<td>See Above</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. The grease used inside the caliper must be non-melting and also allow correct brake function at cold temperatures listed.
2. Do not mix 0-637 calcium-base, corrosion-control grease with other greases.

## Table H: Conventional Automatic Slack Adjuster Grease Specifications

<table>
<thead>
<tr>
<th>Component</th>
<th>Meritor Specification</th>
<th>NLGI Grade</th>
<th>Grease Type</th>
<th>Outside Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic Slack Adjuster</td>
<td>0-616-A</td>
<td>1 and 2</td>
<td>Clay Base</td>
<td>Down to $-40^\circ\mathrm{F} (-40^\circ\mathrm{C})$</td>
</tr>
<tr>
<td></td>
<td>0-692</td>
<td>2</td>
<td>Lithium Base</td>
<td>Down to $-40^\circ\mathrm{F} (-40^\circ\mathrm{C})$</td>
</tr>
<tr>
<td></td>
<td>0-645</td>
<td>See Above</td>
<td>Synthetic Oil, Clay Base</td>
<td>Down to $-65^\circ\mathrm{F} (-54^\circ\mathrm{C})$</td>
</tr>
<tr>
<td>Clevis Pins</td>
<td>Any of Above</td>
<td>1-1/2</td>
<td>Calcium Base</td>
<td>See Above</td>
</tr>
<tr>
<td></td>
<td>0-637</td>
<td></td>
<td>Anti-Seize</td>
<td>Refer to the grease manufacturer’s specifications for the temperature service limits.</td>
</tr>
<tr>
<td></td>
<td>0-641</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Table I: Automatic Slack Adjuster

### Operating Temperature

**Down to $-40^\circ\mathrm{F} (-40^\circ\mathrm{C})$**
- Clay-Base Greases
  - Meritor Spec 0-616-A (Part Number A-1779-W-283)
  - Shell Darina Number 1
  - Texaco Thermatex EP-1
  - Texaco Hyterm EP-1
  - Aralub 3837

**Down to $-65^\circ\mathrm{F} (-54^\circ\mathrm{C})$**
- Synthetic Greases
  - Meritor Spec 0-645 (Part Number 2297-X-4574)
  - Mobilgrease 28 (Military)
  - Mobiltemp SHC 32 (Industrial)
  - Tribolube-12 Grade 1
## Troubleshooting

### Table J: Air Disc Brake

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Possible Causes</th>
<th>Check For</th>
<th>Corrections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor stopping power</td>
<td>Incorrect air chamber or slack adjuster size</td>
<td>Check with vehicle manufacturer or Meritor for correct chamber and slack adjuster size.</td>
<td>Replace equipment with the recommended size.</td>
</tr>
<tr>
<td></td>
<td>Vehicle air system malfunction</td>
<td>Correct air pressure at the chamber inlet</td>
<td>Have the air system evaluated by a qualified brake system specialist.</td>
</tr>
<tr>
<td></td>
<td>Brakes out-of-adjustment</td>
<td>Stroke</td>
<td>Repair, replace parts as required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Installation with auto slack template</td>
<td>Adjust to the recommended stroke.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jam nut torque</td>
<td>Correct the set-up and check with the template.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clevis wear</td>
<td>Tighten as required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pawl wear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vehicle overload</td>
<td>Overloading — Refer to GAWR limitations on vehicle I.D. plate.</td>
<td>Observe the vehicle manufacturer's load recommendations.</td>
</tr>
<tr>
<td></td>
<td>Contamination on the linings</td>
<td>Grease, oil, etc., on the linings</td>
<td>Replace the linings.</td>
</tr>
<tr>
<td></td>
<td>Companion vehicle brakes not working correctly</td>
<td>Inspect the companion vehicle brakes and air system.</td>
<td>Adjust or repair as required.</td>
</tr>
<tr>
<td>Poor grade holding ability</td>
<td>Refer to Poor stopping power</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incorrect spring brake chamber size</td>
<td>Check with original equipment manufacturer or Meritor for the correct size.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>Spring brake power spring in the caged position</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brake not functioning</td>
<td>Refer to Poor stopping power</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internal caliper failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Movement of the load plate piston when actuating the automatic slack adjuster</td>
<td></td>
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<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of normal response</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle pulls to one side when stopping</td>
<td>Refer to Poor stopping power, Poor grade holding ability and Brake not functioning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table J: Air Disc Brake

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Possible Causes</th>
<th>Check For</th>
<th>Corrections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake drag</td>
<td>Incorrect manual adjustment</td>
<td>Automatic slack adjuster set-up</td>
<td>Correct the set-up. Adjust to the recommended stroke and running clearance. Check with the template.</td>
</tr>
<tr>
<td></td>
<td>Vehicle air system malfunction</td>
<td>Correct running clearance pad-to-disc or rotor</td>
<td>Repair or replace parts as required.</td>
</tr>
<tr>
<td></td>
<td>Spring brake not releasing</td>
<td>Correct operation of the quick release valve and relay valve</td>
<td>Find the source of the leak and repair as required.</td>
</tr>
<tr>
<td></td>
<td>Excessive grease pressure in the caliper</td>
<td>Vehicle air system leakage</td>
<td>Repair or replace spring brake chamber as required.</td>
</tr>
<tr>
<td></td>
<td>Internal corrosion of caliper assembly</td>
<td>Spring brake chamber malfunction</td>
<td>Wait for full build-up before driving.</td>
</tr>
<tr>
<td></td>
<td>Caliper seized on slide pins</td>
<td>Slow build-up of trailer emergency air pressure</td>
<td>Set the compressor or governor to the correct pressure range.</td>
</tr>
<tr>
<td></td>
<td>Misalignment of slide pins</td>
<td>Incorrect air pressure range at compressor or governor</td>
<td>Follow the lubrication recommendations.</td>
</tr>
<tr>
<td></td>
<td>Excessive paint or other foreign build-up on the caliper slide pins or bushings</td>
<td>Incorrect lubrication procedures</td>
<td>Replace the seals as required. Inspect and overhaul the caliper assembly as required.</td>
</tr>
<tr>
<td></td>
<td>Caliper should move back and forth with hand effort, 20-30 lb-ft (27-41 N·m)</td>
<td>Piston boot and caliper seals</td>
<td>Remove both pins. Clean, inspect and replace the pins and bushings as required.</td>
</tr>
<tr>
<td>Short outboard lining life</td>
<td>Remove the pads. Clean, inspect and replace the slide pins and bushings as necessary.</td>
<td>Install the caliper and slide pins without the pads. Tighten the retainer nuts. Check that the caliper slides freely on the slide pins. If the problem continues, check the axle mounting flange for nicks, burns or gouges. Repair as necessary. Install the torque plate and caliper and check again for free movement. If the flange is acceptable but the problem continues, contact your Meritor representative for information.</td>
<td></td>
</tr>
<tr>
<td>Conditions</td>
<td>Possible Causes</td>
<td>Check For</td>
<td>Corrections</td>
</tr>
<tr>
<td>------------</td>
<td>----------------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>Short lining life</td>
<td>Refer to Brake drag and Short outboard lining life</td>
<td>—</td>
<td>Refer to Brake drag and Short outboard lining life.</td>
</tr>
<tr>
<td></td>
<td>Abusive use of brake system</td>
<td>Driver technique</td>
<td>Train the drivers.</td>
</tr>
<tr>
<td></td>
<td>Vehicle overload</td>
<td>Overloading. Refer to gross axle weight ratings (GAWR) limitations on vehicle identification plate.</td>
<td>Observe the vehicle manufacturer's load recommendations.</td>
</tr>
<tr>
<td></td>
<td>Companion vehicle brakes do not work correctly</td>
<td>Inspect companion vehicle brakes and air system.</td>
<td>Adjust or repair as required.</td>
</tr>
<tr>
<td>Pad backing plate tab wear</td>
<td>Brinnelling of pad tab area</td>
<td>Signs of brinnelling and back-and-forth movement of the pad in the caliper</td>
<td>Remove and replace the pads. Check the anti-rattle clip. If wear is excessive, replace the caliper assembly.</td>
</tr>
<tr>
<td>Fractured disc or rotor</td>
<td>Refer to Brake drag, Short outboard lining life and Short lining life</td>
<td>Disc or rotor for minimum thickness</td>
<td>Replace the disc or rotor, shoes and linings as required. Review the correct maintenance procedures with personnel.</td>
</tr>
<tr>
<td></td>
<td>• Cracked or broken</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Slide pin or retainer pin assemblies hard to remove</td>
<td>Highly corrosive environment</td>
<td>Signs of corrosion</td>
<td>Inspect the slide pins and retainer pin assemblies. Replace as required. Apply an anti-seize compound to the retainer, but not to the threads. Seal the inner end of the lower slide pin retainer hole in the torque plate. Replace as required. Clean the disc or rotor as required. Inspect the pads and replace if oil-soaked.</td>
</tr>
<tr>
<td>Brake smoking</td>
<td>Leaking hub or wheel seal</td>
<td>Condition of seals</td>
<td>Replace as required. Follow the lubrication recommendation. Replace the piston boot if required.</td>
</tr>
<tr>
<td></td>
<td>Leaking caliper sealing components</td>
<td>Condition of piston boot, piston cap seal and piston or caliper seal</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Piston boot popped out of piston seating groove</td>
<td>Excessive lubrication of caliper, Inspect piston boot position.</td>
<td>Clean the slide pins and brake as required.</td>
</tr>
<tr>
<td></td>
<td>Paint on slide pins or brake</td>
<td>All painted surfaces</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>High brake temperature</td>
<td>Refer to Poor stopping power, Brake drag, Short outboard lining life and Short lining life</td>
<td>Refer to Poor stopping power, Brake drag, Short outboard lining life and Short lining life</td>
</tr>
</tbody>
</table>
### Table K: Automatic Slack Adjuster

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Possible Causes</th>
<th>Corrections</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adjusted stroke is too long</strong></td>
<td><strong>No adjustment</strong></td>
<td>** Corrections**</td>
</tr>
<tr>
<td></td>
<td>Incorrect slack adjuster part number</td>
<td>Check with the warehouse distributor or original equipment manufacturer.</td>
</tr>
<tr>
<td></td>
<td>Clevis installed at the incorrect angle</td>
<td>Use the correct template or BSAP setting to install the clevis correctly.</td>
</tr>
<tr>
<td></td>
<td>Excessive wear between the clevis and collar, more than 0.060-inch (1.52 mm)</td>
<td>Replace with a threaded clevis.</td>
</tr>
<tr>
<td></td>
<td>Loose jam nut at clevis</td>
<td>Tighten to specification.</td>
</tr>
<tr>
<td></td>
<td>Worn clevis pin bushing in slack arm, inside diameter larger than 0.53-inch (13.46 mm)</td>
<td>Replace the bushing.</td>
</tr>
<tr>
<td></td>
<td>Weak or broken return spring in air chamber, spring force must be at least 32 lb (142.4 N) at first push rod movement</td>
<td>Replace the return spring or air chamber.</td>
</tr>
<tr>
<td></td>
<td>Spring brake does not retract fully</td>
<td>Repair or replace the spring brake.</td>
</tr>
<tr>
<td></td>
<td>Worn or stripped teeth on pawl or actuator</td>
<td>Replace the pawl or actuator.</td>
</tr>
<tr>
<td></td>
<td>High torque is required to rotate the worm when slack is removed from vehicle</td>
<td>Rebuild or replace the slack adjuster.</td>
</tr>
<tr>
<td></td>
<td>• In service slack, maximum worm torque: 45 lb-in (5.09 N(\cdot)m)</td>
<td>Replace the camshaft, gear or automatic slack adjuster as needed.</td>
</tr>
<tr>
<td></td>
<td>• New or rebuilt slack, maximum worm torque: 25 lb-in (2.83 N(\cdot)m)</td>
<td>Replace the components.</td>
</tr>
<tr>
<td></td>
<td>Excessive looseness between camshaft splines and automatic slack adjuster gear</td>
<td>Use Meritor-approved linings.</td>
</tr>
<tr>
<td></td>
<td>Worn components, cam bushing, for example, in the foundation brake</td>
<td>** Corrections**</td>
</tr>
<tr>
<td><strong>Adjusted stroke is too short</strong></td>
<td><strong>Linings drag</strong></td>
<td>Check with the warehouse distributor or original equipment manufacturer.</td>
</tr>
<tr>
<td></td>
<td>Non-original equipment manufacturer replacement linings with excessive swell or growth</td>
<td>Use the correct template to install the clevis correctly.</td>
</tr>
<tr>
<td></td>
<td>Incorrect slack adjuster part number</td>
<td>Tighten to specification.</td>
</tr>
<tr>
<td></td>
<td>Clevis installed at incorrect angle</td>
<td>Repair or replace the spring brake.</td>
</tr>
<tr>
<td></td>
<td>Loose jam nut at clevis</td>
<td>Adjust the brake.</td>
</tr>
<tr>
<td></td>
<td>Spring brake does not retract fully</td>
<td>Repair or replace the drums or linings.</td>
</tr>
<tr>
<td></td>
<td>Wrong manual adjustment</td>
<td>Correct the brake balance.</td>
</tr>
<tr>
<td></td>
<td>Poor contact between linings and drum, or drum is out-of-round</td>
<td>** Corrections**</td>
</tr>
<tr>
<td></td>
<td>Brake temperature imbalance</td>
<td>** Corrections**</td>
</tr>
</tbody>
</table>
Torque Specifications

DISC (ROTOR) TO CAST SPOKED WHEEL NUT AND BOLT
3/4" — 16 (S.A.E. GRADE 8)
275 — 325 LB-FT (373-441 Nm)
NOTE: Assemble bolt and one washer from disc side and nut with one washer from wheel side. Tighten in a crisscross pattern.

DISC (ROTOR) TO HUB STUD NUTS
3/4" — 16 (S.A.E. GRADE 8)
100 LB-FT (136 Nm) To seat the inner stud nuts against the disc.
Refer to the Disc (Rotor) section for more information.
NOTE: Assemble nut and one washer onto stud from disc side. Tighten in a crisscross pattern.

AIR CHAMBER BRACKET AND CAMSHAFT CAP TO CALIPER CAPSCREW
9/16" — 12 (S.A.E. GRADE 8)
135 — 170 LB-FT (183-230 Nm)

GREASE FITTING
1/4" — 18 PIPE THREAD
15 LB-FT MINIMUM (20 Nm MIN.)

GREASE PRESSURE RELIEF FITTING
1/8" — 27 PIPE THREAD
10 LB-FT MINIMUM (13.5 Nm MIN.)

GREASE FITTING
1/4" — 18 PIPE THREAD
15 LB-FT MINIMUM (20 Nm MIN.)
For chamber mounting stud nuts, refer to the specification table in the Adjust the Brakes section.

For clevis collar jam nut, refer to the specification table in the Adjust the Brakes section.

SLACK ADJUSTER PRESSURE RELIEF CAPSCREW
15-20 LB-FT (20-27 Nm)

TORQUE PLATE TO AXLE OR KNUCKLE FLANGE NUT AND BOLT
1/2" — 20 (S.A.E. GRADE 8) 95-115 LB-FT (115-156 Nm)
9/16" — 18 (S.A.E. GRADE 8) 130-165 LB-FT (176-224 Nm)
5/8" — 16 (S.A.E. GRADE 8) 180-240 LB-FT (244-325 Nm)
NOTE: Assemble bolt and one washer from axle or knuckle flange side and nut with one washer from torque plate side. Tighten in a crisscross pattern.

CALIPER SLIDE PIN RETAINER NUT
60-80 LB-FT (108-149 Nm)
USD SELL TOTAL 189.00

OUR MISSION: HELP OUR CUSTOMERS SUCCEED.

** PAYMENT REQUIRED **
EST. TOTAL GROSS WEIGHT OF SHIPPED ITEMS: 0.0
12-PACK W/TUBING RCL302 OSK
1 QTY. 0 0 189.00

PARTS SALES PERSON: THOMAS MEZA • BI
NO. ORDER SHIP B/O DESCRIPTION GROSS

ITEM  QTY. MAKE-UP MODEL
1 1

2/07/18 14:39:59 PM

SPECIALTY FLEET.COM CUSTOMER SHOPLIST

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AS* 81188473

CUSTOMER SHOPLIST

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SALE 09-21-18

CDM 7/23/2018

QUINN CAT