



MAYOR & COUNCIL COMMUNICATION

DATE: March 1, 2016
CONSENT
ITEM 18
MOTION

AGENDA ITEM: Needed repairs/upgrades to Engine #2

SUBMITTED BY: Greg Malmquist, Fire Chief

THROUGH: City Administrator

REVIEWED BY: City Administrator

SUGGESTED ORDER OF BUSINESS:

- Introduction of Item City Administrator
- Report/Presentation..... Fire Chief
- Questions from Council to Staff Mayor Facilitates
- Call for Motion Mayor & City Council
- Discussion Mayor & City Council
- Action on Motion..... Mayor Facilitates

POLICY RECCOMENDER: Fire Chief

FISCAL IMPACT: \$4,653.02

SUMMARY AND ACTION REQUESTED: Determine expenditure for repairs/upgrades.

LEGISLATIVE HISTORY: This Engine, purchased in 1990, was our “First Due” from Station #1 until 2014. At that time it was swapped with Engine 2 from Station #2. This was done due to increasing maintenance issues/costs, to reduce the number of responses and increase the life of the vehicle. This vehicle has been identified in the CIP for several years for replacement, and in the current CIP is shown for replacement in 2017. It was taken “out of service” on February 11, 2016, due to DOT non-compliance, (most recent items are Jake Brake operating intermittently and front turn signals falling off of truck, see photos) safety concerns raised by Firefighters and emergency lighting concerns.

DOT compliance encompasses the proper function and operation of basic items on the vehicle such as brakes, running lights, turn signals, brake lights, tires, etc. Basic items to ensure the vehicle is road worthy and safe to operate. While we are exempt from annual DOT Inspections,

we still maintain compliance with these requirements to ensure the safety of our personnel and to protect the City from potential liability in the event of an accident. Our fleet is inspected twice a year by DOT Certified mechanics. At such time they identify items that need attention or repair. (See attached DOT inspection form and EAM checklist).

Emergency lighting requirements are determined by NFPA, (National Fire Protection Assoc.), which establishes nationally recognized standards. While this vehicle met the requirements when it was constructed in 1990, standards have changed over the last 26 years. Technology has improved with improved, brighter LED lighting. Roadways have become increasingly more dangerous for Responders, both responding to a scene and working at a scene on a roadway, due to drivers being more distracted and inattentive than ever, (cell phones and other technology). (See attached NFPA 1901, Standard for Automotive Fire Apparatus, Chapter 13, pages 36 – 43 pertain to lighting).

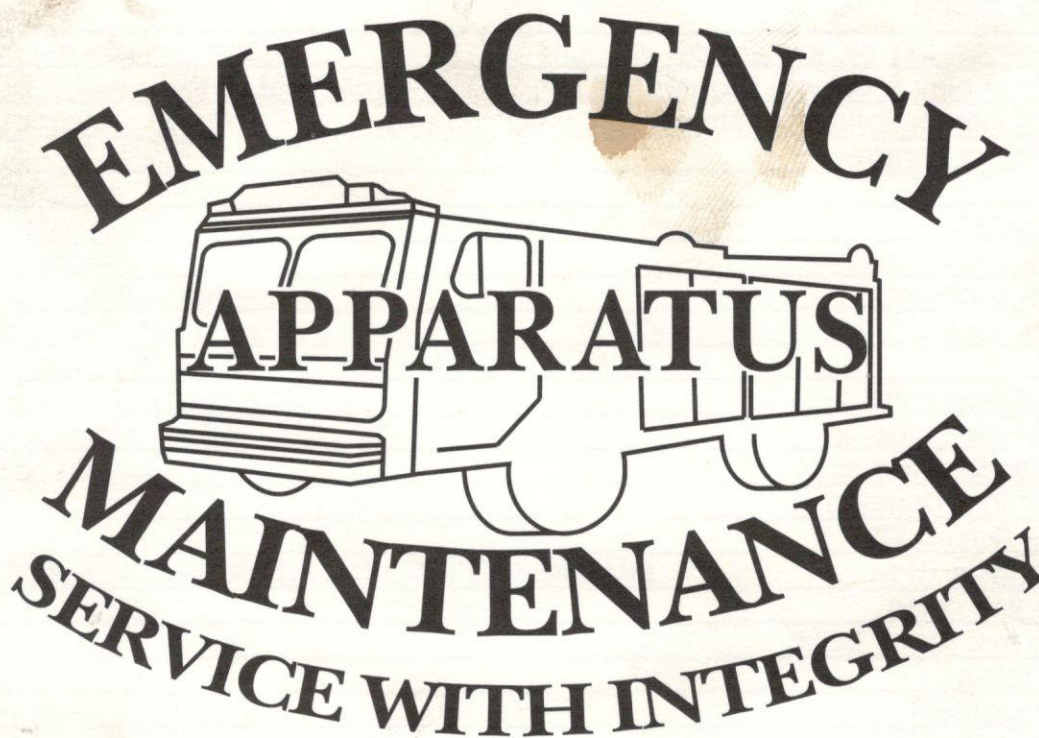
BACKGROUND INFORMATION (SWOT):

| | |
|----------------------|--|
| Strengths | If repairs/upgrades are done, vehicle will be back in service and a safer work environment will be provided for Firefighters. |
| Weaknesses | Significant investment in 26 year old apparatus with an approx.. value of \$6,000 - \$11,000. Current emergency lighting met NFPA Standards in 1990, but not today's standards. Drivers today are more distracted than ever. |
| Opportunities | Provide for the safety of Firefighters and ensure proper response with proper equipment to serve community. |
| Threats | Future additional maintenance issues due to age of vehicle. If not repaired will have response impact. When T2 goes in for scheduled repair, we will not have an Engine at Station #2 for one week. With this vehicle out of service, we have one rated Engine/Tender (T2) for response from Station #2. T2 is a larger vehicle, due to the amount of water it carries, that does not fit in many of the driveways in the Station #2 area. This will lead to crews waiting for a vehicle from Station #1 in the event of a fire. |

RECOMMENDATION: Looking for determination from Council.

ATTACHMENTS:

- EAM Repair Quote
- DOT Inspection Form
- EAM Safety Inspection Checklist
- NFPA Standard 1901
- Photos
- Last inspection report from EAM



7512 4th Avenue
Lino Lakes, MN 55014
651-786-4463 800-EAM-3911
e-mail: service@eamservice.com
website: www.eamservice.com

Emergency Vehicle Safety Inspection/Full Service Report

CUSTOMER COPY

Customer Name LAKE ELMO

Date 7-21-15

Unit No. Engine 2

Mileage 64,987

Engine Hours 3,718

☒ Vehicle deficiencies are noted on this report.

**The Reliability of Mechanical equipment is directly related
to the quality and frequency of maintenance!**

CHECK FOLLOWING ITEMS

Satisfactory Requires attn.

| | | |
|--|----|----|
| Operation of starter | BB | |
| Warning Devices, low oil, low air, low vacuum | BB | |
| Steering wheel play & column securement | BB | |
| Operation of interior lights, switches & rear vision mirrors | | BB |
| Heater-Defroster controls | BB | |
| Horn | BB | |
| Safety equipment | BB | |
| Window lifts & door latches | BB | |
| Seat belts & cushions | BB | |
| Operation of wipers & windshield condition | BB | |
| Foot brake | BB | |
| Clutch pedal free travel | NA | |
| Operation of transmission | BB | |
| Speedometer & instruments | BB | |
| Air governor for operation | BB | |
| Oil pressure @ high idle | BB | |
| Maximum engine RPM | BB | |
| Unusual engine noise | BB | |
| One minute test for air leaks | BB | |
| All exterior lights | | BB |
| Emergency Lighting | BB | |
| Parking-Brake System | BB | |
| UNDER CHASSIS - FRONT END RAISED | | |
| Front bearing & king pins for looseness | BB | |
| Steering arms & sector mounts for looseness | BB | |
| Front springs | BB | |
| Lube front axle | BB | |
| Adjust brakes (air only) - Check Pedal Height (hydraulic) | BB | |
| Drain oil | BB | |
| Replace oil & fuel filter | BB | |
| Refill crankcase | BB | |
| Crossmembers & frame for looseness, cracks | BB | |
| Lube chassis complete | BB | |
| Clutch brake adjustment | NA | |
| Transmission oil level & leaks | BB | |
| Drain air tanks, inspect brake hoses & tubing, hydraulic/air | BB | |
| U-joints for play | BB | |
| U-joint slip yoke | BB | |
| Differential pinion bearing for looseness | BB | |
| Rear springs, U-bolts, center bolts | BB | |
| Torque arms & bracket looseness & cracks | BB | |
| Rear brake drums & linings through inspection hole | BB | |
| All wheel seals for leaks | BB | |
| Differential oil level | BB | |
| Power divider oil level | NA | |
| Clean axle vents | BB | |
| Cab mounts & bolts | BB | |
| Check coolant & nitrate levels | | BB |
| Pressure test cooling system | BB | |
| Fan hub for looseness | BB | |
| Master cylinder fluid level | NA | |
| Water pump for leaks and looseness | BB | |

UNDER CHASSIS - FRONT END RAISED (CON'T)

Satisfactory Requires attn.

| | | |
|---|------------------|--|
| Air compressor mounts | BB | |
| Air conditioning mounts & wires | NA | |
| Alternator load test Volts 13.8 Amps <u>84.1</u> | BB | |
| Alternator mounting brackets | BB | |
| All belts | BB | |
| Fuel lines for leaks | BB | |
| Exhaust system | BB | |
| Service air cleaner | BB BB | |
| Clean & check battery cables | BB | |
| Battery water level, hold downs & cover | BB | |
| Battery load test #1 <u>11.2</u> #2 <u>11.0</u> #3 <u>11.2</u> #4 <u>11.8</u> | BB | |
| Check all hoses, condition & leaks | BB | |
| Check & fill steering sector | BB | |
| Install service sticker | BB | |

RUN ENGINE AND CHECK FOLLOWING

| | | |
|--|----|--|
| Air cleaner restriction | BB | |
| Air filter for leaks | BB | |
| Retighten drain plug | BB | |
| Recheck oil level | BB | |
| Lube door hinges & locks, check latch timing | BB | |
| Lube seat mechanism | - | |
| Fuel tank straps, mounts, caps & crossover line protection | BB | |
| Mud flap brackets | BB | |
| Wheel bearing reservoirs for correct level | BB | |
| Visually check exposed wheel nuts, studs, lock rings & rims for cracks or looseness | BB | |
| Axle flange nuts & gaskets | BB | |
| Tread depth RF <u>14/32</u> LF <u>14/32</u> RRI <u>15/32</u> RRO <u>14/32</u> LRI <u>17/32</u> LRO <u>14/32</u> | | |
| RRRI <u>—</u> RRRO <u>—</u> LRRI <u>—</u> LRRO <u>—</u> Meets DOT requirements | | |
| Tire Pressure RF <u>100</u> LF <u>—</u> RRI <u>100</u> RRO <u>100</u> LRI <u>65</u> LRO <u>85</u> <small>Air L.R.'s to 100 PSI</small> | BB | |

| GENERATOR SERVICE | Satisfactory | Requires Attn. | HYDRAULIC GENERATOR SYSTEM |
|------------------------------------|--------------|----------------|---|
| Change oil & refill crankcase | | BB | Replace hydraulic filter & fluid |
| Replace oil filters | BB | | Check fluid level |
| Replace fuel filters | | | Inspect wiring |
| Check generator mounts | BB | | Inspect generator mounts & trays |
| Retighten drain, recheck oil level | BB | | Inspect hydraulic pump and PTO mounting |
| Check exhaust & air filter systems | BB | | Remove hydraulic pump on direct mounts & inspect/lube drive splines |
| | | | Clean cooling system |
| | | | Inspect all hydraulic hoses & fittings |

| Positive Pressure Fan | Hydraulic Rescue Tool |
|------------------------------------|--|
| Change oil and refill crankcase | Change oil and refill crankcase |
| Replace fuel filter | Replace fuel filter |
| Visually inspect fan blades | Visually inspect all hoses & couplings |
| Visually inspect all guards | Check engine mounts |
| Visually inspect drive belts | Check hydraulic fluid level |
| Check engine mounts | Check exhaust & air filter systems |
| Check stabilizer feet | |
| Check exhaust & air filter systems | |

Vehicle Deficiencies listed on Back

Inspector's Signature

Bill Boehman

Certification Number

928609

Fire Pumps and Accessories

Maintenance Report

Volume Pump

Pump Transmission

Change Oil, and Filter if applicable

Operation
Completed

BB

Outboard bearing/

Lubricate or check oil Level if applicable

BB

Transfer Valve Lubricate

BB

Shift Unit

Check Oil Level and Lubricate all Linkage

BB

Priming System

Check Pump & Motor Mounts

Oil Motor, Check Tank Oil Level & Fill

Check Motor Coupling

Lubricate Priming Valve & Linkage

BB

Discharge, Suction & Drain Valves

Operate & Lubricate

BB

Pilot Valve Clean Screen and Orifice

Flush and Insure Water Flow

Stops In Off Position

BB

Conduct Dry Vacuum Test

Max Vacuum Achieved 22

Vacuum Drop 34

Pass ✓ Fail ✗

BB

Test Run pump, Operate Relief &

Transfer Valve

Check Packing Drip Rate mech. seals

BB

Operation
Completed

High Pressure Pump

Pump Crankcase change oil

Relief Valve Lubricate & Inspect

Hose Reels Lubricate & Inspect

Nozzle Guns Lubricate & Inspect

PTO Cable Lubricate & Inspect

PTO Driveshaft & Pillow Blocks

Inspect And Lubricate

Inlet Strainer Clean & Inspect

Check Drive Belt(s)

Test Run Insure Smooth Flow

Foam Pro

Inspect Wiring, Hoses

Flowmeters & Connections

For Tightness, Corrosion, Leaks

And/or Damage

Foam Strainer screen

Remove and Clean

1600 Series

Cam Bearing Grease Fitting

Lubricate With a Manual Grease Gun

Cam Bearing

Lubricate Cam Surface

2001/2002 Series

Gear Case Drain & Refill Using

SAE30 Non-Detergent Oil

Operation
Completed

Compressed Air Foam System

Compressor

Change Oil & Filter

Use ISO 68 Hydraulic Oil

Polychain & Clutch

Visually Check

Air/Oil Separator

Change Cartridge every 24 months

Air Intake System and Filter

Check

Water Strainer

Check

Portable Pump Service

Change oil and refill crankcase

Replace oil filter

Replace fuel filter

Check engine & pump mounts

Change pump oil

Check exhaust & air filter systems

Equipment Deficiencies listed below

- 1) L1 compartment upper light out
- 2) L3 compartment lights out (bad switch)
- 3) generator " " (bad switch)
- 4) right ~~step~~ light out on tail board, 1 marker light out
- 5) B2 lower compartment light out
- 6) right pump panel lights out, 1 out left panel
- 7) coolant filter housing shut off valve frozen open
- 8) air filter should be replaced Carquest # 87491
- 9) relief valve stuck closed- water is gone
- 10) #1 discharge linkage over extends
- 11) ~~generator overfueling~~
- 12) tank to pump / tank fill leaking 3" elbow 1 1/4 gate

Invoice



Send Payment To:

Emergency Apparatus Maintenance, Inc.
7512 4th Avenue
Lino Lakes, MN 55014
TEL: 651.786.4463 • 1.800.EAM.3911
FAX: 651.786.0517
EML: service@eamservice.com

Work Order: 81919

Type: Service

WO Date: 07/20/2015

Invoiced: 07/29/2015

PO:

Reference:

Accounts Payable
Lake Elmo Fire Department
3800 Laverne Ave No.
Lake Elmo, MN 55042

Amount Due: \$1,065.00

Terms: Net 30 Days

Service Summary

Engine 2 (3173)

Miles: 64987

Hours: 3718

Request

Work Completed

- | | |
|---|---|
| 1 NFPA Pump Test. | 1.1 NFPA Pump Test Completed. Passed all phases. |
| 2 Service Pump per EAM Pump Service Report. | 2.1 Service Pump per EAM Pump Service Report - Completed. |
| 3 Full Service/Emergency Vehicle Safety Inspection. | 3.1 Service Truck - Completed. |
| 4 Service Generator. | 4.1 Service Generator - Completed. Crankcase was overfull of gas/oil mixture, creating a large mess when fill plug was removed - cleaned up. Ran generator after servicing for 1/2 hour with no issues, checked oil level - good. |

Parts Installed & Summary of Charges

| Qty | Price | Total | Part | Part Number | Summary of Charges | |
|------|--------|--------|-------------------------------------|-------------|-----------------------|------------|
| 1.0 | \$0.00 | \$0.00 | Oil Filter (1748) | 1748 | Quoted Labor | \$825.00 |
| 1.0 | \$0.00 | \$0.00 | Fuel Filter (3405) | 3405 | Total Labor | \$825.00 |
| 40.0 | \$0.00 | \$0.00 | 15W-40 Oil | 15w/40 | Quoted Parts | \$240.00 |
| 12.0 | \$0.00 | \$0.00 | Automatic Transmission Fluid, Quart | Dextron III | Total Parts | \$240.00 |
| 1.0 | \$0.00 | \$0.00 | Oil Filter (1516) | 1516 | Total Accessories | \$0.00 |
| 4.0 | \$0.00 | \$0.00 | 10/30, Oil, Quart | 10/30 | Environmental Charges | \$0.00 |
| | | | | | Pump Service | \$0.00 |
| | | | | | Pump Test | \$0.00 |
| | | | | | Subtotal: | \$1,065.00 |
| | | | | | Tax: | \$0.00 |
| | | | | | Total: | \$1,065.00 |

NOTE: The following items are awaiting customer approval before repairs are made. Please call Emergency Apparatus Maintenance.

- L-1 Compartment upper light out.
- L-3 Compartment lights out, bad switch.

Entered 12/18/15

Invoice

**Send Payment To:**

Emergency Apparatus Maintenance, Inc.
7512 4th Avenue
Lino Lakes, MN 55014
TEL: 651.786.4463 · 1.800.EAM.3911
FAX: 651.786.0517
EML: service@eamservice.com

Work Order: 81919
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PO:
Reference:

Accounts Payable
Lake Elmo Fire Department
3800 Laverne Ave No.
Lake Elmo, MN 55042

Amount Due: \$1,065.00

Terms: Net 30 Days

NOTE: The following items are awaiting customer approval before repairs are made. Please call Emergency Apparatus Maintenance.

- 3 Generator compartment lights out, bad switch.
- 4 Right step light out on tailboard, 1 marker light out.
- 5 R-2 Lower compartment light out.
- 6 Right pump panel lights out, 1 out left panel.
- 7 Coolant filter housing shut off valve frozen open.
- 8 Air filter should be replaced - Carquest #87491.
- 9 #1 Discharge linkage over extends.
- 10 Generator overfueling.
- 11 Tank to pump/tank fill leaking - 3" Elkhart, 1-1/2" gate.

Pump Test Certification Results



Department: Lake Elmo Fire Department

Vehicle: Engine 2 (3173)

Make: Navistar

Year: 1990

Model: 2674

Miles: 64987

Engine:

Governed Speed: 2425

Pump Make: Waterous

Pump Capacity: 1250

Pump Model: CMYBX

Pump S/N: 21139W

Test Time: 11:16:00

Test Date: 07/22/2015

Ambient Temperature (°F): 80

Water Temperature (°F): 87

Barometer (mmHg): 30.01

PASSED

Cumulative Test Data

| | Capacity | 200 PSI | 250 PSI | |
|---------------------|----------|---------|---------|---------------------------------------|
| Gallons Per Minute: | 1250 | 875 | 625 | |
| R.P.M. Calibrated: | 1659 | 1802 | 1586 | |
| R.P.M. Engine: | 1600 | 1800 | 1550 | |
| R.P.M. Panel: | 1100 | 1300 | 1100 | |
| Net Pump Pressure: | 150 | 200 | 250 | |
| Correction Factor: | 4 | 3 | 2 | 1250 GPM @ 150 PSI @ 1659 RPM Volume |
| Pump Pressure: | 146 | 197 | 248 | 875 GPM @ 200 PSI @ 1802 RPM Volume |
| Pump Suction: | 7 | 3 | 2 | 625 GPM @ 250 PSI @ 1586 RPM Pressure |

Relief Valve/Pressure Governor Test

| Pressure | Operates Properly | PSI Increase |
|----------|-------------------|--------------|
| 150 PSI | YES | 13 |
| 90 PSI | YES | 10 |
| 250 PSI | YES | 8 |

Dry Vacuum Test

| | |
|-------------------------|----|
| Pump Packing Drip Rate: | 0 |
| Vacuum Achieved: | 22 |
| Vacuum Drop: | 2 |

Priming Test

| | |
|-------------------|----|
| Suction Diameter: | 6 |
| Suction Length: | 20 |
| Suction Lift: | 2 |
| Time: | 7 |

Capacity Test Raw Data

| Tip | Mode | CF |
|--------------------|----------|-------|
| 2 1/4" | Volume | 4 |
| Tachometer | | |
| Cab | Panel | |
| 1659 | 1100 | |
| Pump Gauges | | |
| Pressure | Compound | |
| 145 | 6 | |
| Test Gauges | | |
| Pressure | Vacuum | |
| 146 | 7 | |
| Calibrated | | |
| Time | RPM | PITOT |
| 11:16:00 | 1658 | 69 |
| 11:21:00 | 1662 | 69 |
| 11:26:00 | 1654 | 69 |
| 11:31:00 | 1662 | 69 |
| 11:36:00 | 1660 | 69 |

200 PSI Test Raw Data

| Tip | Mode | CF |
|--------------------|----------|-------|
| 2" | Volume | 3 |
| Tachometer | | |
| Cab | Panel | |
| 1802 | 1300 | |
| Pump Gauges | | |
| Pressure | Compound | |
| 195 | 5 | |
| Test Gauges | | |
| Pressure | Vacuum | |
| 197 | 3 | |
| Calibrated | | |
| Time | RPM | PITOT |
| 11:41:00 | 1800 | 55 |
| 11:46:00 | 1804 | 55 |
| 11:51:00 | 1802 | 55 |

250 PSI Test Raw Data

| Tip | Mode | CF |
|--------------------|----------|-------|
| 1 1/2" | Pressure | 2 |
| Tachometer | | |
| Cab | Panel | |
| 1586 | 1100 | |
| Pump Gauges | | |
| Pressure | Compound | |
| 249 | 5 | |
| Test Gauges | | |
| Pressure | Vacuum | |
| 248 | 2 | |
| Calibrated | | |
| Time | RPM | PITOT |
| 11:56:00 | 1588 | 88 |
| 12:01:00 | 1588 | 88 |
| 12:06:00 | 1584 | 88 |

Technician: Bill Bothman

Work Order: 81919

Printed: 7/29/2015

PERIODIC VEHICLE INSPECTION REPORT

| | | | | | | | | | | | | | |
|------------------------------|--|-----------------------------|--|--------------------------|--|-----------|--|----------------------|--|------------|--|-----------------|--|
| 1. Date MM/DD/YYYY | | 2. Insp. Location (Address) | | 3. Time (AM / PM) | | 4. DECAL# | | 5. Veh Make | | 6. Mod. Yr | | 7. Unit# | |
| 8. Odometer Reading (C or H) | | | | 9. VIN# | | | | 10. Lic# | | | | 11. State | |
| 12. Owner Name | | | | 13. Owner Str. Address | | | | 14. City, State, ZIP | | | | | |
| 15. Carrier Name | | | | 16. Carrier Str. Address | | | | 17. City, State, ZIP | | | | | |
| 18. Owner USDOT# | | | | 19. Carrier USDOT# | | | | 20. Inspector Name | | | | 21. Inspector # | |

| PASS | FAIL | N/A | | PASS | FAIL | N/A | |
|------|------|-----|--|------|------|-----|--|
| | | | 1. BRAKE SYSTEM | | | | |
| | | | a. Service Brakes | | | | c. Brake lamps |
| | | | 1.) Adjustment | | | | d. Turn Signals |
| | | | 2.) Pads | | | | e. Marker/ID/Clearance Lamps |
| | | | b. Parking Brake System | | | | f. Conspicuity Tape/Reflectors |
| | | | c. Brake Drum or Rotors | | | | 6. LOAD SECUREMENT |
| | | | d. Brake Hose | | | | 7. STEERING MECHANISM |
| | | | e. Brake Tubing | | | | a. Steering Wheel Free Play(Lash) |
| | | | f. Low Pressure/Vacuum and/or Low Air Warning Device | | | | b. Steering Column |
| | | | g. Tractor Protection Valve | | | | c. Front Axle Beam & All Components Other Than Steering |
| | | | h. Air Compressor | | | | d. Steering Gear Box Column |
| | | | i. Electric Brakes | | | | e. Pitman Arm |
| | | | j. Hydraulic Brakes (including Power assist over Hydraulic & Engine Drive Hydraulic Booster) | | | | f. Power Steering |
| | | | k. Vacuum Systems | | | | g. Ball & Socket Joints |
| | | | l. Brake Away Brakes on Trailer | | | | h. Tie Rods & Drag Link |
| | | | 2. COUPLING DEVICES | | | | i. Nuts |
| | | | a. 5 th Wheel & Mounting/King Pin | | | | j. Steering System |
| | | | b. Pintle Hooks & Mounting Ball hitch | | | | 8. SUSPENSION |
| | | | c. Drawbar /Towbar Eye | | | | a. U-Bolts |
| | | | d. Drawbar/Towbar Tongue | | | | b. Spring Assembly |
| | | | e. Safety Devices (chains, cables, hooks) | | | | c. Torque, Radius, or Tracking Components |
| | | | f. Saddle Mounts | | | | 9. FRAME/INCLUDING CROSS FRAMES |
| | | | g. Locking Devices | | | | a. Frame Members |
| | | | 3. EXHAUST SYSTEM | | | | b. Tire & Wheel Clearance |
| | | | 4. FUEL SYSTEM | | | | c. Adjustable Axle Assemblies(sliding subframes) & Locking Devices |
| | | | a. Visible Leak | | | | 10. TIRES |
| | | | b. Fuel Cap | | | | 11. WHEELS & RIMS |
| | | | c. Securement of Tank | | | | a. Lock or Slide Ring |
| | | | 5. LIGHTING DEVICES | | | | b. Wheels & Rims |
| | | | a. Headlamps | | | | c. Fasteners (lugs) |
| | | | b. Tail Lamps | | | | d. Welds |
| | | | | | | | 12. WINDSHIELDS/Glazing |
| | | | | | | | 13. WIPERS/WASHER & DEFROSTERS |
| | | | 14. REAR VISION MIRRORS | | | | |
| | | | 15. HORN | | | | 18. REAR END PROTECTION |
| | | | 16. FIRE EXTINGUISHER | | | | 19. HOOD, FRONT BUMPER, BODY PARTS |
| | | | 17. EMERGENCY WARNING DEVICES | | | | 20. WHEEL FLAPS |
| | | | | | | | 21. DRIVELINE/DRIVESHAFT |

THIS VEHICLE IS IN COMPLIANCE WITH 49 CFR 396.17 APPENDIX G

I hereby certify that the above information is true and accurate.

Inspector Signature _____

PERIODIC VEHICLE INSPECTION INFORMATION FORM

DATE: _____ TIME: _____ VEH. LIC. #: _____ DECAL#: _____ INSPECTOR NAME: _____

BRAKE ADJUSTMENT

| | | | | | | | |
|------------------------------|---|---|---|---|---|---|---|
| RIGHT CHAMBER SIZE & TYPE | | | | | | | |
| PUSHROD STROKE | | | | | | | |
| AXLE # | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| PUSHROD STROKE | | | | | | | |
| LEFT CHAMBER SIZE & TYPE | | | | | | | |

TIRE CHART

| | | | | | | | | | |
|----------------------------|--|--|--|--|--|--|--|--|--|
| RIGHT - TIRE SIZE | | | | | | | | | |
| OUTSIDE - MIN TREAD/PSI | | | | | | | | | |
| INSIDE - MIN TREAD/PSI | | | | | | | | | |
| AXLE # | | | | | | | | | |
| INSIDE - MIN TREAD/PSI | | | | | | | | | |
| OUTSIDE - MIN TREAD/PSI | | | | | | | | | |
| LEFT - TIRE SIZE | | | | | | | | | |

STEERING WHEEL

DIAMETER: _____ INCHES STEERING WHEEL FREE PLAY: _____ INCHES

5TH WHEEL PLAY: PIVOT PIN/BACKET _____ SLIDER/BASE _____ UPPER/LOWER HALVES _____

TRACTOR/TRAILER USED FOR TEST: LICENSE # _____ LIC. STATE _____

TRACTOR PROTECTION VALVE: ACTIVATES AT: _____ PSI

TYPE OF SAFETY DEVICES: CHAINS or CABLES SIZE OF DEVICES: _____ GRADE: _____

BRAKES: TOW VEHICLE LIC #: _____ GVWR: _____ TRAILER LIC #: _____ GVWR: _____

☐ SURGE
☐ ELECTRIC

MAKE/MODEL OF CONTROLLER: _____

BUS/MOTOR COACH INSPECTIONS:

EMERGENCY EXITS AND PUSH-OUT WINDOWS CHECKED? ☐ PASS ☐ FAIL ☐ N/A

MISCELLANEOUS NOTES:

I hereby certify the information contained herein is true and accurate.

INSPECTOR SIGNATURE: _____

12.3.6.4 A label shall be provided in a location in which it is visible to an operator making trailer connections. The label shall state the maximum GVWR and tongue weight of the trailer that can be safely towed with the hitch system.

12.3.6.5 Two safety chain attachment points shall be provided near the hitch point for hitches designed to use safety chains, each designed with an ultimate strength of not less than the maximum GVWR specified on the label required in 12.3.6.4.

Chapter 13 Low Voltage Electrical Systems and Warning Devices

13.1* General. Any low voltage electrical systems or warning devices installed on the fire apparatus shall be appropriate for the mounting location and intended electrical load and shall meet the specific requirements of Chapter 13.

13.2 Wiring. All electrical circuit feeder wiring supplied and installed by the fire apparatus manufacturer shall meet the requirements of 13.2.1 through 13.2.8.

13.2.1* The circuit feeder wire shall be stranded copper or copper alloy conductors of a gauge rated to carry 125 percent of the maximum current for which the circuit is protected.

13.2.1.1 Voltage drops in all wiring from the power source to the using device shall not exceed 10 percent.

13.2.1.2 The use of star washers for circuit ground connections shall not be permitted.

13.2.1.3 All circuits shall otherwise be wired in conformance with SAE J2202, *Heavy-Duty Wiring Systems for On-Highway Trucks*, or for trailer wiring, SAE J2174, *Heavy-Duty Wiring Systems for Trailers 2032 mm or More in Width*.

13.2.2 Wiring and Wire Harness Construction.

13.2.2.1 All insulated wire and cable shall conform to SAE J1127, *Low Voltage Battery Cable*, or SAE J1128, *Low Voltage Primary Cable*, type SXL, GXL, or TXL.

13.2.2.1.1 All conductors shall be constructed in accordance with SAE J1127 or SAE J1128, except where good engineering practice dictates special strand construction.

13.2.2.1.2 Conductor materials and stranding, other than copper, shall be permitted if all applicable requirements for physical, electrical, and environmental conditions are met as dictated by the end application.

13.2.2.1.3 Physical and dimensional values of conductor insulation shall be in conformance with the requirements of SAE J1127 or SAE J1128, except where good engineering practice dictates special conductor insulation.

13.2.2.2 The overall covering of conductors shall be moisture-resistant loom or braid that has a minimum continuous rating of 194°F (90°C) except where good engineering practice dictates special consideration for loom installations exposed to higher temperatures.

13.2.3 The overall covering of jacketed cables shall be moisture resistant and have a minimum continuous temperature rating of 194°F (90°C), except where good engineering practice dictates special consideration for cable installations exposed to higher temperatures.

13.2.4 All wiring connections and terminations shall use a method that provides a positive mechanical and electrical connection.

13.2.4.1 The wiring connections and terminations shall be installed in accordance with the device manufacturer's instructions.

13.2.4.2* All ungrounded electrical terminals shall have protective covers, enclosures, or a means to protect from accidental shorting.

13.2.4.3 Wire nut, insulation displacement, and insulation piercing connections shall not be used.

13.2.5 Wiring shall be restrained to prevent damage caused by chafing or ice buildup and protected against heat, liquid contaminants, or other environmental factors.

13.2.6* Wiring shall be uniquely identified at least every 2 ft (0.6 m) by color coding or permanent marking with a circuit function code. The identification shall reference a wiring diagram. [See 4.20.2.3(6).]

13.2.7 Circuits shall be provided with properly rated low voltage overcurrent protective devices.

13.2.7.1 Such devices shall be readily accessible and protected against heat in excess of the overcurrent device's design range, mechanical damage, and water spray.

13.2.7.2 Circuit protection shall be accomplished by utilizing fuses, circuit breakers, fusible links, or solid state equivalent devices.

13.2.7.3 If a mechanical-type device is used, it shall conform to one of the following SAE standards:

- (1) SAE J156, *Fusible Links*
- (2) SAE J553, *Circuit Breakers*
- (3) SAE J554, *Electric Fuses (Cartridge Type)*
- (4) SAE J1888, *High Current Time Lag Electric Fuses*
- (5) SAE J2077, *Miniature Blade Type Electrical Fuses*

13.2.8 Switches, relays, terminals, and connectors shall have a direct current (dc) rating of 125 percent of maximum current for which the circuit is protected.

13.3 Power Supply.

13.3.1 A 12 V or greater electrical alternator shall be provided.

13.3.2* The alternator shall have a minimum output at idle to meet the minimum continuous electrical load of the fire apparatus as defined in 13.3.3, at 200°F (93°C) ambient temperature within the engine compartment, and shall be provided with full automatic regulation.

13.3.3 Minimum Continuous Electrical Load.

13.3.3.1 The minimum continuous electrical load shall consist of the total amperage required to simultaneously operate the following in a stationary mode during emergency operations:

- (1) The propulsion engine and transmission
- (2) All legally required clearance and marker lights, headlights, and other electrical devices except windshield wipers and four-way hazard flashers
- (3) The radio(s) at a duty cycle of 10 percent transmit and 90 percent receive (for calculation and testing purposes, a default value of 5 A continuous)

- (4) The lighting necessary to produce 2 fc (20 lx) of illumination on all walking surfaces on the apparatus and on the ground at all egress points onto and off the apparatus, 5 fc (50 lx) of illumination on all control and instrument panels, and 50 percent of the total compartment lighting loads
- (5) The minimum optical warning system required in Section 13.8, where the apparatus is blocking the right-of-way
- (6) The continuous electrical current required to simultaneously operate any fire pumps, aerial devices, and hydraulic pumps
- (7)* Other warning devices and electrical loads defined by the purchaser as critical to the mission of the apparatus

13.3.3.2 If the apparatus is equipped to tow a trailer, an additional 45 A shall be added to the minimum continuous electrical load to provide electrical power for the federally required clearance and marker lighting and the optical warning devices mounted on the trailer.

13.3.4* The condition of the low voltage electrical system shall be monitored by a warning system that provides both an audible and a visual signal to persons on, in, or near the apparatus of an impending electrical system failure caused by the excessive discharge of the battery set.

13.3.4.1 The charge status of the battery shall be determined either by direct measurement of the battery charge or indirectly by monitoring the electrical system voltage.

13.3.4.2 If electrical system voltage is monitored, the alarm shall sound if the system voltage at the battery or at the master load disconnect switch drops below 11.8 V for 12 V nominal systems, 23.6 V for 24 V nominal systems, or 35.4 V for 42 V nominal systems for more than 120 seconds.

13.3.5 A voltmeter shall be mounted on the driver's instrument panel to allow direct observation of the system voltage.

13.3.6 Load Management.

13.3.6.1* If the total continuous electrical load exceeds the minimum continuous electrical output rating of the installed alternator(s) operating under the conditions specified in 13.3.2, an automatic electrical load management system shall be required.

13.3.6.2 The minimum continuous electrical loads defined in 13.3.3 shall not be subject to automatic load management.

13.4* Batteries.

13.4.1 Batteries shall be of the high-cycle type.

13.4.2 With the engine off, the battery system shall be able to provide the minimum continuous electrical load for 10 minutes without discharging more than 50 percent of the reserve capacity and then to restart the engine.

13.4.3 The battery system cold cranking amps (CCA) rating shall meet or exceed the minimum CCA recommendations of the engine manufacturer.

13.4.4 The batteries shall be mounted to prevent movement during fire apparatus operation and shall be protected against accumulations of road spray, snow, and road debris.

13.4.4.1 The batteries shall be readily accessible for examination, testing, and maintenance.

13.4.4.2 A means shall be provided for jump-starting the engine if the batteries are not accessible without lifting the cab of a tilt-cab apparatus.

13.4.4.3 Where an enclosed battery compartment is provided, it shall be ventilated to the exterior to prevent the buildup of heat and explosive fumes.

13.4.4.4* The batteries shall be protected against vibration and temperatures that exceed the battery manufacturer's recommendation.

13.4.5* An onboard battery conditioner or charger or a polarized inlet shall be provided for charging all batteries. Where an onboard conditioner or charger is supplied, the associated line voltage electrical power system shall be installed in accordance with Chapter 22.

13.4.6* One of the following master disconnect switches shall be provided:

- (1) A master body disconnect switch that disconnects all electrical loads not provided by the chassis manufacturer
- (2) A master load disconnect switch that disconnects all electrical loads on the apparatus except the starter

13.4.6.1 The starter solenoids shall be connected directly to the batteries.

13.4.6.2 Electronic control systems and similar devices shall be permitted to be otherwise connected if so specified by their manufacturer.

13.4.6.3 The alternator shall be wired directly to the batteries through the ammeter shunt(s), if one is provided, and not through the master disconnect switch.

13.4.6.4* A green "master disconnect on" indicator light that is visible from the driver's position shall be provided.

13.4.6.5 Rechargeable hand lights, radios, and other similar devices shall be permitted to be connected to the electrical system ahead of the master disconnect switch.

13.4.7* A sequential switching device shall be permitted to energize the optical warning devices required in 13.3.3 and other high current devices, provided the switching device shall first energize the electrical devices required in 13.3.3 within 5 seconds.

13.5 Starting Device.

13.5.1 An electrical starting device shall be provided for the engine.

13.5.2 When the electrical starting device is operating under maximum load, the voltage drop of the conductors between the battery and the starting device shall be in accordance with SAE J541, *Voltage Drop for Starting Motor Circuits*.

13.6 Temperature Exposure. Any alternator, electrical starting device, ignition wiring, distributor, or ignition coil shall be moisture resistant and protected such that it is not exposed to a temperature that exceeds the component manufacturer's recommendations.

13.7* Electromagnetic Interference. Electromagnetic interference suppression shall be provided, as required, to satisfy the radiation limits specified in SAE J551/1, *Performance Levels and Methods of Measurement of Electromagnetic Compatibility of Vehicles, Boats (up to 15 m), and Machines (16.6 Hz to 18 GHz)*.

13.8 Optical Warning Devices. Each apparatus shall have a system of optical warning devices that meets or exceeds the requirements of this section.

13.8.1* The optical warning system shall consist of an upper and a lower warning level.

13.8.2 The requirements for each level shall be met by the warning devices in that particular level without consideration of the warning devices in the other level.

13.8.3 For the purposes of defining and measuring the required optical performance, the upper and lower warning levels shall be divided into four warning zones.

13.8.3.1 The four zones shall be determined by lines drawn through the geometric center of the apparatus at 45 degrees to a line drawn lengthwise through the geometric center of the apparatus.

13.8.3.2 The four zones shall be designated A, B, C, and D in a clockwise direction, with zone A to the front of the apparatus. (See Figure 13.8.3.2.)

13.8.4 Each optical warning device shall be installed on the apparatus and connected to the apparatus's electrical system in accordance with the requirements of this standard and the requirements of the manufacturer of the device.

13.8.5 A master optical warning system switch that energizes all the optical warning devices shall be provided.

13.8.6 The optical warning system on the fire apparatus shall be capable of two separate signaling modes during emergency operations.

13.8.6.1 One mode shall signal to drivers and pedestrians that the apparatus is responding to an emergency and is calling for the right-of-way.

13.8.6.2 One mode shall signal that the apparatus is stopped and is blocking the right-of-way.

13.8.6.3 The use of some or all of the same warning lights shall be permitted for both modes provided the other requirements of this chapter are met.

13.8.7 A switching system shall be provided that senses the position of the parking brake or the park position of an automatic transmission.

13.8.7.1 When the master optical warning system switch is on and the parking brake is released or the automatic transmission is not in park, the warning devices signaling the call for the right-of-way shall be energized.

13.8.7.2 When the master optical warning system switch is on and the parking brake is on or the automatic transmission is in park, the warning devices signaling the blockage of the right-of-way shall be energized.

13.8.7.3* The system shall be permitted to have a method of modifying the two signaling modes.

13.8.8 The optical warning devices shall be constructed or arranged so as to avoid the projection of light, either directly or through mirrors, into any driving or crew compartment(s).

13.8.9 The front optical warning devices shall be placed so as to maintain the maximum possible separation from the headlights.

13.8.10* The optical sources on each level shall be of sufficient number and arranged so that failure of a single optical source does not create a measurement point in any zone on the same level as the failed optical source without a warning signal at a distance of 100 ft (30 m) from the geometric center of the apparatus.

13.8.11 Flash Rate.

13.8.11.1 The minimum flash rate of any optical source shall be 75 flashes per minute, and the minimum number of flashes at any measurement point shall be 150 flashes per minute.

13.8.11.1.1 Steadily burning, nonflashing optical sources shall be permitted to be used.

13.8.11.1.2 The optical energy provided by nonflashing optical sources shall not be included in the calculations of the zone's total optical power.

13.8.11.2 The flasher of any current-interrupted flashing device shall otherwise meet the requirements of SAE J1690, *Flashers*.

13.8.12* Color of Warning Lights.

13.8.12.1 Permissible colors or combinations of colors in each zone, within the constraints imposed by applicable laws and regulations, shall be as shown in Table 13.8.12.1.

13.8.12.2 All colors shall be as specified in SAE J578, *Color Specification*, for red, blue, yellow, or white.

13.8.13* Requirements for Large Apparatus.

13.8.13.1 If the apparatus has a bumper-to-bumper length of 25 ft (7.6 m) or more or has an optical center on any optical warning device greater than 8 ft (2.4 m) above level ground, the requirements of 13.8.13.2 through 13.8.13.6 shall apply.

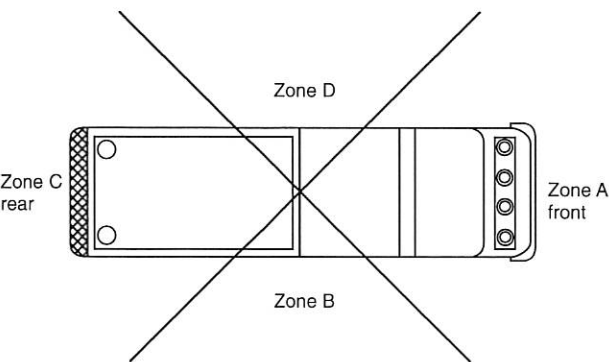


FIGURE 13.8.3.2 Warning Zones for Optical Warning Devices.

Table 13.8.12.1 Zone Colors

| Color | Calling for Right-of-Way | Blocking Right-of-Way |
|--------|--------------------------|-----------------------|
| Red | Any zone | Any zone |
| Blue | Any zone | Any zone |
| Yellow | Any zone except A | Any zone |
| White | Any zone except C | Not permitted |

13.8.13.2 Upper-Level Optical Warning Devices.

13.8.13.2.1 The upper-level optical warning devices shall be mounted as high and as close to the corner points of the apparatus as is practical to define the clearance lines of the apparatus.

13.8.13.2.2 The upper-level optical warning devices shall not be mounted above the maximum height, specified by the device manufacturer, that gives an intensity value at 4 ft (1.2 m) above level ground and at 100 ft (30.5 m) from the optical warning device of less than 50 percent of that required at the optical center.

13.8.13.3 Lower-Level Optical Warning Devices.

13.8.13.3.1 To define the clearance lines of the apparatus, the optical center of the lower-level optical warning devices in the front of the vehicle shall be mounted on or forward of the front axle centerline and as close to the front corner points of the apparatus as is practical.

13.8.13.3.2 The optical center of the lower-level optical warning devices at the rear of the vehicle shall be mounted on or behind the rear axle centerline and as close to the rear corners of the apparatus as is practical.

13.8.13.3.3 The optical center of any lower-level device shall be between 18 in. and 62 in. (460 mm and 1600 mm) above level ground.

13.8.13.4 Midship Optical Warning Devices.

13.8.13.4.1 A midship optical warning device shall be mounted on both the right and the left sides of the apparatus if the distance between the front and rear lower-level optical devices exceeds 25 ft (7.6 m) at the optical center.

13.8.13.4.2 Additional midship optical warning devices shall be required, where necessary, to maintain a horizontal distance between the centers of adjacent lower-level optical warning devices of 25 ft (7.6 m) or less.

13.8.13.4.3 The optical center of any midship mounted optical warning device shall be between 18 in. and 62 in. (460 mm and 1600 mm) above level ground.

13.8.13.5* For each operating mode, the combined optical power of all the optical sources shall meet or exceed the zone total optical power requirements shown in Table 13.8.13.5.

13.8.13.6 No individual measurement point shall be less than that shown in Table 13.8.13.5.

13.8.14* Requirements for Small Apparatus.

13.8.14.1 If the apparatus has a bumper-to-bumper length of less than 25 ft (7.6 m) and has the optical center of all optical warning devices at 8 ft (2.4 m) or less above level ground, the requirements of 13.8.14.2 through 13.8.14.5 shall apply.

13.8.14.2 Upper-Level Optical Warning Devices.

13.8.14.2.1 The upper-level optical warning devices shall be mounted as high as practical, but not over 8 ft (2.4 m), at the optical center.

13.8.14.2.2 The upper-level optical warning devices shall be permitted to be combined in one or more enclosures and shall be permitted to be mounted on the cab roof or any other convenient point.

13.8.14.3 Lower-Level Optical Warning Devices.

13.8.14.3.1 One or more lower-level optical warning devices shall be visible from the front and the side of the apparatus.

13.8.14.3.2 The optical center of the lower-level optical warning devices in the front of the vehicle shall be mounted on or forward of the front wheel centerline and as close to the front corner points of the apparatus as is practical.

13.8.14.3.3 The optical center of the device(s) shall be between 18 in. and 48 in. (460 mm and 1220 mm) above level ground.

13.8.14.3.4* It shall be permitted for red zone C lower flashing lights to switch to steady-on lights when the service brakes are

Table 13.8.13.5 Minimum Optical Power Requirements for Large Apparatus

| | | Mode of Operation | | | | | |
|------|-------|--------------------------|----------------|--|-----------------------|----------------|--|
| | | Calling for Right-of-Way | | | Blocking Right-of-Way | | |
| Zone | Level | H Total | At Any H Point | At Any Point 5 Degrees Up or 5 Degrees Down from H | H Total | At Any H Point | At Any Point 5 Degrees Up or 5 Degrees Down from H |
| A | Upper | 1,000,000 | 10,000 | 3,500 | 400,000 | 10,000 | 3,500 |
| B | Upper | 400,000 | 10,000 | 3,500 | 400,000 | 10,000 | 3,500 |
| C | Upper | 400,000 | 10,000 | 3,500 | 800,000 | 10,000 | 3,500 |
| D | Upper | 400,000 | 10,000 | 3,500 | 400,000 | 10,000 | 3,500 |
| A | Lower | 150,000 | 3,750 | 1,300 | 150,000 | 3,750 | 1,300 |
| B | Lower | 150,000 | 3,750 | 1,300 | 150,000 | 3,750 | 1,300 |
| C | Lower | 150,000 | 3,750 | 1,300 | 150,000 | 3,750 | 1,300 |
| D | Lower | 150,000 | 3,750 | 1,300 | 150,000 | 3,750 | 1,300 |

Notes:

1. All values are in candela-seconds/minute.

2. H = Horizontal plane passing through the optical center.

3. The values in the H Total columns are the total of 19 data point values for each light, with data points on the boundary between zones counted in both zones.

applied and the optical warning light system is on in the "Clearing Right-of-Way" mode.

13.8.14.4 For each operating mode, the combined optical power of all the optical sources mounted on both the upper and lower levels shall meet or exceed the zone's total optical power requirements shown in Table 13.8.14.4.

13.8.14.5 No individual measurement point shall be less than that shown in Table 13.8.14.4.

13.8.15 Tests of Optical Warning Devices.

13.8.15.1 Mechanical and Environmental Test.

13.8.15.1.1 All optical warning devices shall be tested to the requirements of SAE J595, *Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles*; SAE J845, *Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles*; or SAE J1889, *L.E.D. Signal and Marking Lighting Devices*.

13.8.15.1.2 Optical devices and components designed for mounting only in weatherproof, interior spaces shall be tested in conformance with the applicable SAE standard listed in 13.8.15.1.1 and shall comply with the vibration test and the warpage test for plastic components.

13.8.15.1.3 Optical devices and components designed for mounting on the exterior of the apparatus or in nonweatherproof interior spaces shall be tested in conformance with SAE J845 and shall comply with the following performance requirements of that standard:

- (1) Vibration
- (2) Moisture
- (3) Dust
- (4) Corrosion
- (5) High temperature
- (6) Low temperature
- (7) Durability
- (8) Warpage

13.8.15.2 Photometric Test Procedures for Optical Devices.

13.8.15.2.1 Testing shall be performed by, or on behalf of, the device manufacturer to ensure compliance with the requirements of 13.8.15.2.2 through 13.8.15.2.5.2.

13.8.15.2.1.1 The results of the testing shall be used to determine compliance with this standard, and all required photometric data shall be available, upon request, from the optical warning device manufacturer.

13.8.15.2.1.2 The goniometer, integrating photometer, and other equipment used to take the test measurements shall meet the requirements of SAE J1330, *Photometry Laboratory Accuracy Guidelines*.

13.8.15.2.2 The optical source shall be mounted in a goniometer and operated as it would be in a normal system application.

13.8.15.2.2.1 The minimum distance between the light-emitting surface of the source being tested and the front face of the photometer detector shall be 59 ft (18 m).

13.8.15.2.2.2 The goniometer shall be oriented and the integrating photometer shall be set to integrate light pulses from the source for 20 seconds.

13.8.15.2.3 For all tests performed with the power applied, the lighting system, or component thereof, shall be operated at 12.8 V ± 0.1 V for 12 V nominal equipment, 25.6 V ± 0.2 V for 24 V nominal equipment, and 38.4 V ± 0.3 V for 42 V nominal equipment.

13.8.15.2.3.1 If the equipment is rated for operation on multiple voltages, the tests shall be performed at each of the rated voltages used by the equipment.

13.8.15.2.3.2 Voltage shall be measured at a point 12 in. ± 1 in. (300 mm ± 25 mm) from the entry into the component.

13.8.15.2.4 The technique described in 13.8.15.2.2 through 13.8.15.2.2.2 shall be performed along the horizontal plane that passes through the optical center, beginning at the optical center and repeated at 5-degree intervals to the left and to the right of the optical center throughout the active horizontal angle of light emission of the optical source.

13.8.15.2.5 Measurements shall be repeated at 5 degrees up and 5 degrees down from the horizontal plane that passes through the optical center, beginning at a point on the vertical plane passing through the optical center.

13.8.15.2.5.1 The measurements shall be repeated at 5 degree intervals to the left and to the right of this vertical plane

Table 13.8.14.4 Minimum Optical Power Requirements for Small Apparatus

| Zone | Mode of Operation | | | | | |
|------|--------------------------|-----------------------|---|-----------------------|-----------------------|---|
| | Calling for Right-of-Way | | | Blocking Right-of-Way | | |
| | <i>H</i> Total | At Any <i>H</i> Point | At Any Point 5 Degrees Up or 5 Degrees Down from <i>H</i> | <i>H</i> Total | At Any <i>H</i> Point | At Any Point 5 Degrees Up or 5 Degrees Down from <i>H</i> |
| A | 1,000,000 | 10,000 | 3,500 | 400,000 | 10,000 | 3,500 |
| B | 200,000 | 8,000 | 3,500 | 200,000 | 8,000 | 3,500 |
| C | 400,000 | 10,000 | 3,500 | 800,000 | 10,000 | 3,500 |
| D | 200,000 | 8,000 | 3,500 | 200,000 | 8,000 | 3,500 |

Notes:

1. All values are in candela-seconds/minute.

2. *H* = Horizontal plane passing through the optical center.

3. The values in the *H* Total columns are the total of 19 data point values for each light, with data points on the boundary between zones counted in both zones.

throughout the active horizontal angle of light emission of the optical source.

13.8.15.2.5.2 If the optical warning device contains more than one optical source, the test shall be repeated for each optical source.

13.8.16* Compliance Documentation. The apparatus manufacturer shall demonstrate compliance of the warning system by one of the following methods:

- (1) Certification that the system was installed within the geometric parameters specified by the manufacturer of the system referencing the optical source test reports provided by the manufacturer of the system
- (2) Certification that a mathematical calculation based on test reports for individual optical sources provided by the manufacturer of the devices and performed by a qualified person demonstrates that the combination of individual devices as installed meets the requirements of this standard
- (3) Actual measurement of the lighting system after installation on the apparatus

13.9 Audible Warning Devices.

13.9.1 Audible warning equipment in the form of at least one automotive traffic horn and one electric or electronic siren shall be provided.

13.9.1.1 The siren manufacturer shall certify the siren as meeting the requirements of SAE J1849, *Emergency Vehicle Sirens*.

13.9.1.2* A means shall be provided to allow the activation of the siren within convenient reach of the driver.

13.9.2 Where furnished, air horns, electric siren(s), and electronic siren speaker(s) shall be mounted as low and as far forward on the apparatus as is practical.

13.9.3 Audible warning equipment shall not be mounted on the roof of the apparatus.

13.10 Work Lighting. All light level measurements shall be made with a light meter with a hemispherical light sensor held against the surface, facing perpendicular to the surface, and not deliberately pointed toward the light source.

13.10.1 Ground Lighting.

13.10.1.1* Rear Work Area.

13.10.1.1.1 The work area immediately behind the vehicle shall be illuminated to an average level of at least 3 fc (30 lx), measured at 25 equally spaced points on a 2.5 ft (750 mm) grid within a 10 ft × 10 ft (3 m × 3 m) square to the rear of the vehicle.

13.10.1.1.2 At least 80 percent of the 25 measurements shall meet or exceed 3 fc (30 lx).

13.10.1.1.3 If the apparatus includes an aerial platform stowed over the rear work area, the measurements shall be made with the aerial raised.

13.10.1.2 The fire apparatus shall be equipped with lighting that is capable of providing illumination at a minimum level of 2 fc (20 lx) on ground areas within 30 in. (800 mm) of the edge of the apparatus in areas designed for personnel to climb onto the apparatus or descend from the apparatus to the ground level.

13.10.1.3 Lighting designed to provide illumination on areas under the driver and crew riding area exits shall be switchable but activated automatically when the exit doors are opened.

13.10.1.4 All other ground area lighting shall be switchable.

13.10.2* Hose Bed Lighting.

13.10.2.1 If a hose bed is provided, lighting on the hose bed floor shall be at an average level of 3 fc (30 lx) or higher measured at 30 in. equally spaced intervals along the center of the hose bed floor with all dividers and covers removed.

13.10.2.2 Lateral hose beds (crosslays) that are permanently covered shall not be required to be illuminated.

13.10.3* Surface Lighting. The apparatus shall have sufficient lighting to provide a minimum level of 2 fc (20 lx) on all work surfaces, steps, and walkways.

13.10.4* Interior Lighting. The apparatus shall have sufficient lighting to provide an average level of 2 fc (20 lx) at each seating surface when measured at the center and at each corner of the seat cushion in the driving and crew compartments.

13.10.5 Compartment Lighting.

13.10.5.1 Each engine compartment and pump compartment shall have a light of at least 20 candlepower (250 lumens).

13.10.5.2 The priming lubricant reservoir, if applicable, shall be illuminated.

13.10.5.3 Each enclosed tool and equipment compartment greater than 4 ft³ (0.1 m³) in volume and having an opening greater than 144 in.² (92,900 mm²) shall have sufficient compartment lighting to provide a minimum of 2 fc (20 lx) at any location on the floor of the compartment without any shelves, dividers, or equipment in the compartment.

13.10.5.4 Compartments such as ladder tunnels, pikepole storage tubes, or underbody compartments designed around the volumetric requirements of specific equipment that can be removed without the use of article illumination shall not be required to have compartment lighting.

13.10.6 Switching. Switches for all work lighting shall be readily accessible.

13.10.7 Protection. The lights shall be arranged or protected to minimize accidental breakage.

13.10.8 Testing. All work lights mounted in wet locations shall be tested in conformance with SAE J575, *Test Methods and Equipment for Lighting Devices and Components for Use on Vehicles Less Than 2032 mm in Overall Width*, and shall comply with the following performance requirements of that standard:

- (1) Vibration
- (2) Moisture
- (3) Dust
- (4) Corrosion
- (5) High temperature
- (6) Low temperature
- (7) Durability
- (8) Warpage

13.11 Hazard Light.

13.11.1 A red flashing or rotating light, located in the driving compartment, shall be illuminated automatically whenever the

apparatus's parking brake is not fully engaged and any of the following conditions exist:

- (1) Any driver, passenger, or equipment compartment door is not closed.
- (2) Any ladder or equipment rack is not in the stowed position.
- (3) Stabilizer system is not in its stowed position.
- (4) Powered light tower is not stowed.
- (5) Any other device permanently attached to the apparatus is open, extended, or deployed in a manner that is likely to cause damage to the apparatus if the apparatus is moved.

13.11.2 Compartments meeting all of the following conditions shall be permitted to be exempt from the requirements of 13.11.1.

- (1) The volume is less than or equal to 4 ft³ (0.1 m³).
- (2) The compartment has an opening less than or equal to 144 in.² (92,900 mm²).
- (3) The open door does not extend sideways beyond the mirrors or up above the top of the fire apparatus.
- (4) All equipment in the compartment is restrained so that nothing can fall out if the door is open while the apparatus is moving.

13.11.3* Paragraph 13.11.1 shall not apply to manually raised pole lights with an extension of less than 5 ft (1.5 m).

13.11.4 The hazard light shall be marked with a sign that reads "Do Not Move Apparatus When Light Is On."

13.12* Backup Alarm. An electric or electronic backup alarm shall be provided that meets the Type D (87 dBA) requirements of SAE J994, *Alarm — Backup — Electric, Laboratory Performance Testing*.

13.13 Stop, Tail, and Directional Lights.

13.13.1 The apparatus shall be equipped with all legally required stop, tail, and directional lights.

13.13.2 Directional lights shall be visible from the front, sides, and rear of the apparatus.

13.13.3 On apparatus 30 ft (10 m) or longer in length, a turn signal shall be mounted approximately midway along the apparatus at approximately running board height.

13.13.4 Equipment shall not be mounted in a manner that obscures the stop, tail, or directional lights.

13.14 Electrical System Performance Tests.

13.14.1* The fire apparatus low voltage electrical system shall be tested as required by Section 13.14 and its subsections.

13.14.1.1 The test results shall be certified by the apparatus manufacturer.

13.14.1.2 The certification shall be delivered with the apparatus.

13.14.2 Tests shall be performed when the air temperature is between 0°F and 110°F (−18°C and 43°C).

13.14.3 Test Sequence.

13.14.3.1 The three tests defined in 13.14.3.2 through 13.14.3.4.4 shall be performed in the order in which they appear.

13.14.3.1.1 Before each test, the batteries shall be fully charged until the voltage stabilizes at the voltage regulator set point and the lowest charge current is maintained for 10 minutes.

13.14.3.1.2 Failure of any of these tests shall require a repeat of the sequence.

13.14.3.2 Reserve Capacity Test.

13.14.3.2.1 The engine shall be started and kept running until the engine and engine compartment temperatures are stabilized at normal operating temperatures and the battery system is fully charged.

13.14.3.2.2 The engine shall be shut off, and the minimum continuous electrical load shall be activated for 10 minutes.

13.14.3.2.3 All electrical loads shall be turned off prior to attempting to restart the engine.

13.14.3.2.4 The battery system shall then be capable of restarting the engine.

13.14.3.2.5 Failure to restart the engine shall be considered a test failure of the battery system.

13.14.3.3 Alternator Performance Test at Idle.

13.14.3.3.1 The minimum continuous electrical load shall be activated with the engine running at idle speed.

13.14.3.3.2 The engine temperature shall be stabilized at normal operating temperature.

13.14.3.3.3 The battery system shall be tested to detect the presence of battery discharge current.

13.14.3.3.4 The detection of battery discharge current shall be considered a test failure.

13.14.3.4* Alternator Performance Test at Full Load.

13.14.3.4.1 The total continuous electrical load shall be activated with the engine running up to the engine manufacturer's governed speed.

13.14.3.4.2 The test duration shall be a minimum of 2 hours.

13.14.3.4.3 Activation of the load management system shall be permitted during this test.

13.14.3.4.4 An alarm sounded by excessive battery discharge, as detected by the warning system required in 13.3.4, or a system voltage of less than 11.8 V dc for a 12 V nominal system, 23.6 V dc for a 24 V nominal system, or 35.4 V dc for a 42 V nominal system for more than 120 seconds shall be considered a test failure.

13.14.4 Low Voltage Alarm Test.

13.14.4.1 The following test shall be started with the engine off and the battery voltage at or above 12 V for a 12 V nominal system, 24 V for a 24 V nominal system, or 36 V for a 42 V nominal system.

13.14.4.2 With the engine shut off, the total continuous electrical load shall be activated and shall continue to be applied until the excessive battery discharge alarm activates.

13.14.4.3 The battery voltage shall be measured at the battery terminals.

13.14.4.4 The test shall be considered a failure if the alarm does not sound in less than 140 seconds after the voltage drops to 11.70 V for a 12 V nominal system, 23.4 V dc for a 24 V nominal system, or 35.1 V for a 42 V nominal system.

13.14.4.5 The battery system shall then be able to restart the engine.

13.14.4.6 Failure to restart the engine shall be considered a test failure.

13.15 Documentation. The manufacturer shall deliver the following with the fire apparatus:

- (1) Documentation of the electrical system performance tests
- (2) A written electrical load analysis, including the following:
 - (a) The nameplate rating of the alternator
 - (b) The alternator rating under the conditions specified in 13.3.2
 - (c) Each of the component loads specified in 13.3.3 that make up the minimum continuous electrical load
 - (d) Additional electrical loads that, when added to the minimum continuous electrical load, determine the total continuous electrical load
 - (e) Each individual intermittent electrical load

Chapter 14 Driving and Crew Areas

14.1 General.

14.1.1 Each crew riding position shall be within a fully enclosed personnel area.

14.1.2 A label that states the number of personnel the vehicle is designed to carry shall be located in an area visible to the driver.

14.1.3* Each crew riding position shall be provided with a seat and an approved seat belt designed to accommodate a person with and without heavy clothing.

14.1.3.1* The effective seat belt web length for a Type 1 lap belt for pelvic restraint shall be a minimum of 60 in. (1525 mm) with the seat adjusted all the way back and down when measured using the following procedure:

- (1) Locate an imaginary line where the plane of the center of the seat back surface intersects the plane of the center of the seat cushion surface (line 1 in Figure 14.1.3.1). For seats with an SCBA seat back, use a plane that simulates the position of an SCBA back pad installed in the SCBA holder.
- (2) Locate point A on line 1 at the outside of the seat on the retractor side of the seat.
- (3) Locate point C on line 1 at the outside of the seat on the buckle side of the seat.
- (4) Locate point D at the tip of the buckle.
- (5) Pull the seat belt webbing entirely out of the retractor and measure along the webbing between point A and the seat belt latch plate (tongue). Record this length as AD.
- (6) Measure from point C to point D and record this length as CD.
- (7) The effective seat belt web length equals AD + CD.

14.1.3.2* A Type 2 seat belt shall have either a single retractor or dual retractors. A single retractor, Type 2 pelvic and upper torso restraint-style seat belt assembly shall have a minimum

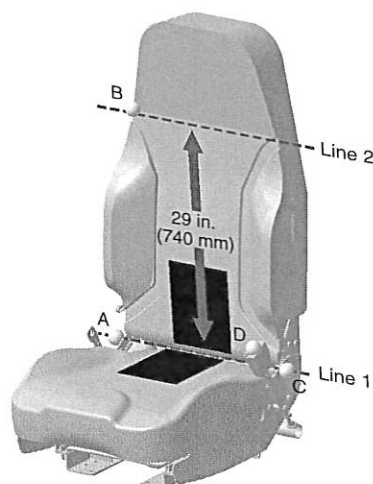


FIGURE 14.1.3.1 Dimension Lines for Measuring Seat Belt Effective Length.

effective seat belt web length of 110 in. (2800 mm) with the seat adjusted all the way back and down and when measured in accordance with 14.1.3.2.1. A dual retractor Type 2 pelvic and upper torso restraint-style seat belt assembly shall have a minimum effective shoulder belt web length of 50 in. (1270 mm) and a minimum effective lap belt web length of 60 in. (1530 mm) with the seat all the way back and down and as measured in 14.1.3.2.2.

14.1.3.2.1 Effective seat belt web length for a single retractor Type 2 seat belt shall be measured according to the following procedure:

- (1) Locate an imaginary line where the plane of the center of the seat back surface intersects the plane of the center of the seat cushion surface (line 1 in Figure 14.1.3.1). For seats with an SCBA seat back, use a plane that simulates the position of an SCBA back pad installed in the SCBA holder.
- (2) Locate an imaginary line parallel with line 1 and lying on the center of the seat back surface 29 in. (740 mm) from line 1 (line 2 in Figure 14.1.3.1).
- (3) Locate point A on line 1 at the outside of the seat on the retractor side of the seat.
- (4) Locate point B on line 2 at the shoulder strap edge of the seat back.
- (5) Locate point C on line 1 at the outside of the seat on the buckle side of the seat.
- (6) Locate point D at the tip of the buckle.
- (7) Pull the seat belt webbing entirely out of the retractor and measure along the webbing between points A and B. Record this length as AB.
- (8) Measure from point C to Point D and record this length as CD.
- (9) The effective lap belt web length equals AB + 2CD.

14.1.3.2.2 Effective seat belt web length for a dual retractor Type 2 seat belt shall be measured according to the following procedure:

- (1) Locate an imaginary line where the plane of the center of the seat back surface intersects the plane of the center of the seat cushion surface (line 1 in Figure 14.1.3.1).