eM2 Maintenance Manual

Models: eM2

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1. Introduction

1.01 Foreword

Foreword

Instructions and procedures are those recommended by Freightliner Trucks, Western Star, Freightliner Custom Chassis Corporation (FCCC), Thomas Built Buses (TBB), or the component manufacturer. Maintenance schedules and additional service information are included in the product Maintenance Manual.

IMPORTANT: Descriptions and specifications in this manual were in effect at the time of printing. Daimler Truck North America LLC reserves the right to discontinue models and to change specifications or design at any time without notice and without incurring obligation. Descriptions and specifications contained in this publication provide no warranty, expressed or implied, and are subject to revision and editions without notice.

Refer to https://northamerica.daimlertruck.com/ for more information, or contact Daimler Truck North America LLC at the address below.

Environmental Concerns and Recommendations

Whenever you see instructions in this manual to discard materials, you should attempt to reclaim and recycle them. To preserve our environment, follow appropriate environmental rules and regulations when disposing of materials.



NOTICE:

Do not replace suspension, axle, or steering parts (such as springs, wheels, hubs, and steering gears) with used parts. Used parts may have been subjected to collisions or improper use and have undetected structural damage.

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1.02 Service Publications

Descriptions of Service Publications

Daimler Truck North America (DTNA) LLC distributes the following major service publications in paper and electronic formats. Refer to DTNA TechLit for more information.

Workshop/Service Manual

Workshop and service manuals contain service and repair information for all vehicle systems and components, except for major components such as engines, transmissions, and rear axles. Each workshop and service manual section is divided into subjects that can include general information, principles of operation, removal, disassembly, assembly, installation, and specifications. Workshop and service manuals contain service and repair information for all vehicle systems and components installed in our plants.

Maintenance Manual

Maintenance manuals contain routine maintenance procedures and intervals for vehicle components and systems. They have information such as lubrication procedures and tables, fluid replacement procedures, fluid capacities, and specifications. Maintenance manuals do not contain detailed repair or service information. Maintenance manuals should not be used for covering plant quality or quality assurance issues. The purpose of maintenance manuals is to increase the life of the component being maintained. Except for federally required maintenance items, like mufflers, these are recommendations, not requirements.

Troubleshooting Manual

Troubleshooting manuals contain diagnostic procedures for determining the root cause of fault codes and symptoms in vehicle components and systems, including multiplexed systems. In addition to fault codes and symptoms, testing procedures and ‘how to’ sections are included in troubleshooting manuals. The troubleshooting manual does not include information on the removal, inspection, or installation of components.

Technical Service Bulletins (TSBs)

TSBs provide issue notifications to the service network. They are intended for issues that can be addressed when the expected symptom or failure is present when the vehicle arrives in the shop for normal service. TSBs should not be used to bring a vehicle in for inspection, or update a vehicle before a failure has occurred. In the literature request system, they have a higher priority than Workshop, Drivers, and Maintenance Manuals. All TSBs must have a clearly defined symptom or customer complaint that is causing the customer to bring the vehicle into the dealership. If they do not, dealerships will take it as an expectation that they should be proactively checking every single vehicle when they come in. TSBs are not visible to vehicle owners and operators.

Parts Bulletin (PB) or Parts Technical Bulletin (PTB)

PBs are used to communicate information on parts. These bulletins contain lists of parts and Bills of Material (BOMs) needed to do replacement and upgrade procedures. PBs do not contain service procedures or Standard Repair Times (SRTs).

Customer Service Announcements (CSAs)

CSAs are used to communicate information to the dealer or distributor network. They remain on DTNA Portal and continue to be communicated via myComm.

Tool Letters (TLs)

TLs are used to communicate the release of both physical and electronic tools. They remain on DTNA Portal and continue to be communicated via myComm.

18SP Letters

18SPs are special procedures or instructions that are included in unique service parts kits. They are available on TechLit in the event that someone lost their kit’s original copy.

Original Equipment Manufacturer (OEM) Letters

OEM letters are other suppliers’ letters that we make available on TechLit as a courtesy.

DTNA Portal

Service and parts applications and information can be accessed on the DTNA Portal. While there is some content available to users without logging in, access to most content and applications on DTNA Portal requires authentication by registered users. Registration requirements for each user type can be found on the main landing page before logging in. In addition to accessing Aftermarket applications, DTNA Portal can be used for searching all content published within DTNA Portal pages as well as within many applications. The following applications can be accessed via DTNA Portal.

TechLit

Web-based service manuals can be accessed on the TechLit application.

PartsProX

PartsProX® is an electronic parts catalog system, showing the specified vehicle's build record.

EZWiring

EZWiring™ makes products' wiring drawings and floating pin lists available online for viewing and printing. EZWiring can also be accessed from within PartsProX.

Service Solutions

The Service Solutions application provides diagnostic assistance with Symptoms Search, by connecting to a large knowledge base gathered from technicians and service personnel. Solutions published within Service Solutions are routed through DTNA Compliance, but are not vetted through the normal reviews that service bulletins, service manuals, and campaigns go through. Content published should only be published on Service Solutions if it doesn’t meet the criteria to be published in one of the more official publication types.

Vehicle Info

Vehicle Information is a single point of entry to search for DTNA and Detroit Diesel service information. This allows you to search for information specific to a vehicle or Detroit Diesel engine. Vehicle specifications, vehicle recalls and campaigns, warranty information, and vehicle literature can all be found within Vehicle Info. It also contains the registration information for the selected vehicle.

Warranty Lit

Review important warranty information including warranty manuals, letters, recall and field service information and more.

Recall Campaigns

Recall campaigns cover situations that involve service work or replacement of parts in connection with a recall notice. These campaigns pertain to matters of vehicle safety. All recall campaigns are distributed to dealers; customers receive notices that apply to their vehicles.

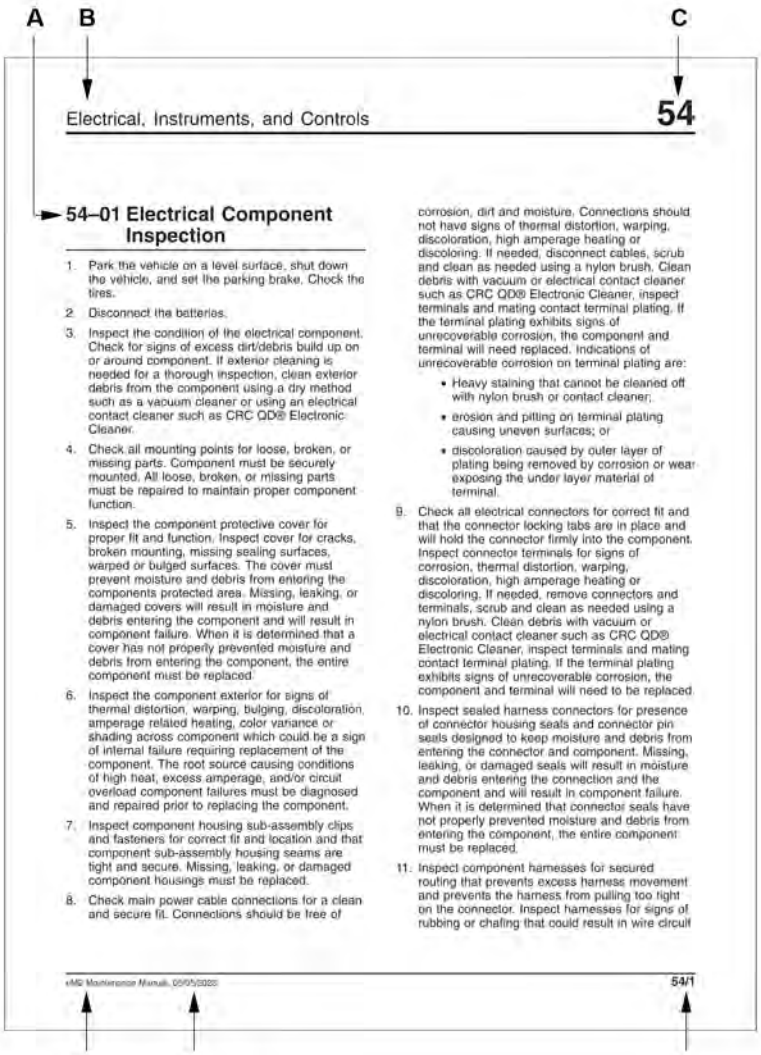
Field Service Campaigns

Field service campaigns are concerned with non-safety-related service work or replacement of parts. All field service campaigns are distributed to dealers; customers receive notices that apply to their vehicles.

Warranty Manual

This manual covers the provisions and procedures under which authorized service facilities will be reimbursed for warranty-related work on products, parts, and accessories manufactured or supplied by DTNA.

1.03 Page Description



A. Maintenance Operation Number consists of the Group Number followed by the Sequence Number
B. Group Title
C. Group Number
D. Vehicle Name
E. Release Date
F. Group Number/Page Number

Fig 1, Example of a Maintenance Manual Page

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2. General Information

2.01 Determining Scheduled Maintenance Intervals

Performing regular maintenance on your Freightliner vehicle will help ensure that your vehicle delivers safe reliable service and optimum performance for years to come. Failure to follow a regular maintenance program can result in inefficient operation and unscheduled down time.

Over-the-road vehicles operate under conditions that fall within the service schedule described below. Refer to the service schedule table or the vehicle maintenance schedule table to determine how often maintenance should be performed.

When the vehicle reaches the distance given for a maintenance interval, see the Maintenance Interval Operation Table for a list of the maintenance operations to be performed at that maintenance interval. Use the maintenance operation reference numbers to find detailed instructions in the manual on each operation.

Service Schedule

Service Schedule I: (short-haul transport) applies to vehicles that annually travel less than 60,000 miles (100 000 kilometers) and operate under normal conditions. Examples of Schedule I usage are: operation primarily in cities and densely populated areas; local transport with infrequent freeway travel; or high percentage of stop-and-go travel.

NOTE: Maintenance instructions in this manual are based on average vehicle use and normal operating conditions. Unusual vehicle operating conditions may require service at more frequent intervals.

2.02 Service Schedule Table

Service Schedule	Maintenance Interval Operation	Maintenance Interval		
		Frequency	Miles	km
Schedule I (Short-Haul Transport) vehicles that annually travel less than 60,000 miles (100 000 km)	Initial Maintenance (IM)	first	10,000	16 000
	Maintenance 1 (M1)	every	10,000	16 000
	Maintenance 2 (M2)	every	50,000	80 000
	Maintenance 3 (M3)	every	100,000	160 000
	Maintenance 4 (M4)	every	150,000	240 000

2.03 Vehicle Maintenance Schedule Table

Table 1, Maintenance for Service Schedule I

Maint. No.	Maintenance Interval	Service Date	Service Schedule I	
			Miles	km
1st	IM and M1		10,000	16 000
2nd	M1		20,000	32 000
3rd	M1		30,000	48 000
4th	M1		40,000	64 000
5th	M1 and M2		50,000	80 000

6th	M1		60,000	96 000
7th	M1		70,000	112 000
8th	M1		80,000	128 000
9th	M1		90,000	144 000
10th	M1, M2, and M3		100,000	160 000
11th	M1		110,000	176 000
12th	M1		120,000	192 000
13th	M1		130,000	208 000
14th	M1		140,000	224 000
15th	M1, M2, and M4		150,000	240 000
16th	M1		160,000	256 000
17th	M1		170,000	272 000
18th	M1		180,000	288 000
19th	M1		190,000	304 000
20th	M1, M2, and M3		200,000	320 000
21st	M1		210,000	336 000
22nd	M1		220,000	352 000
23rd	M1		230,000	368 000
24th	M1		240,000	384 000
25th	M1 and M2		250,000	400 000
26th	M1		260,000	416 000
27th	M1		270,000	432 000
28th	M1		280,000	448 000
29th	M1		290,000	464 000
30th	M1, M2, M3, and M4		300,000	480 000
31st	M1		310,000	496 000
32nd	M1		320,000	512 000
33rd	M1		330,000	528 000
34th	M1		340,000	544 000

35th	M1 and M2		350,000	560 000
36th	M1		360,000	576 000
37th	M1		370,000	592 000
38th	M1		380,000	608 000
39th	M1		390,000	624 000
40th	M1, M2, and M3		400,000	640 000
41st	M1		410,000	656 000
42nd	M1		420,000	672 000
43rd	M1		430,000	688 000
44th	M1		440,000	704 000
45th	M1, M2, and M4		450,000	720 000
46th	M1		460,000	736 000
47th	M1		470,000	752 000
48th	M1		480,000	768 000
49th	M1		490,000	784 000
50th	M1, M2, and M3		500,000	800 000
51st	M1		510,000	820 000
52nd	M1		520,000	837 000
53rd	M1		530,000	853 000
54th	M1		540,000	869 000
55th	M1 and M2		550,000	885 000
56th	M1		560,000	901 000
57th	M1		570,000	917 000
58th	M1		580,000	933 000
59th	M1		590,000	949 000
60th	M1, M2, M3, and M4		600,000	965 000
61st	M1		610,000	982 000
62nd	M1		620,000	998 000
63rd	M1		630,000	1 014 000

64th	M1		640,000	1 030 000
65th	M1 and M2		650,000	1 046 000
66th	M1		660,000	1 062 000
67th	M1		670,000	1 078 000
68th	M1		680,000	1 094 000
69th	M1		690,000	1 110 000
70th	M1, M2, and M3		700,000	1 127 000
71st	M1		710,000	1 143 000
72nd	M1		720,000	1 159 000
73rd	M1		730,000	1 175 000
74th	M1		740,000	1 191 000
75th	M1, M2, and M4		750,000	1 207 000
76th	M1		760,000	1 223 000
77th	M1		770,000	1 239 000
78th	M1		780,000	1 255 000
79th	M1		790,000	1 271 000
80th	M1, M2, and M3		800,000	1 287 000
81st	M1		810,000	1 304 000
82nd	M1		820,000	1 320 000
83rd	M1		830,000	1 340 000
84th	M1		840,000	1 352 000
85th	M1 and M2		850,000	1 370 000
86th	M1		860,000	1 384 000
87th	M1		870,000	1 400 000
88th	M1		880,000	1 416 000
89th	M1		890,000	1 432 000
90th	M1, M2, M3, and M4		900,000	1 448 000
91st	M1		910,000	1 465 000
92nd	M1		920,000	1 481 000

93rd	M1		930,000	1 500 000
94th	M1		940,000	1 513 000
95th	M1 and M2		950,000	1 530 000
96th	M1		960,000	1 550 000
97th	M1		970,000	1 561 000
98th	M1		980,000	1 577 000
99th	M1		990,000	1 593 000
100th	M1, M2, and M3		1,000,000	1 609 000

Table 1, Maintenance for Service Schedule I

2.04 Initial Maintenance (IM) Operations

The Initial Maintenance table lists all maintenance operations that are to be performed at the initial maintenance (IM) interval. Maintenance operation numbers are reference numbers used to help you find detailed instructions in this manual on the maintenance operations to be performed. All operations listed in the table, along with the operations listed in the applicable M1 maintenance interval table, must be performed to complete the initial maintenance (IM).

Table 2, Initial Maintenance (IM) Operations for Service Schedule I

Maintenance Operation Number	Initial Maintenance (IM) Operations for Service Schedule I	Check
2.05	2.05 M1 Maintenance Interval Operations	
6.02	6.02 Frame Fastener Torque Check	
7.03	7.03 Suspension U-Bolt Torque Check	
8.05.01	8.05.01 Checking the Drive Axle Alignment	

Table 2, Initial Maintenance (IM) Operations for Service Schedule I

2.05 M1 Maintenance Interval Operations

The M1 Maintenance Interval Operations tables list all maintenance operations that are to be performed at the M1 maintenance interval. Maintenance operation numbers are reference numbers used to help you find detailed instructions in this manual on the maintenance operations to be performed.

IMPORTANT: After performing all operations listed in this table, perform all daily, weekly, and monthly maintenance operations listed in the 'Pretrip and Post-Trip Inspections and Maintenance' chapter of the **eM2™ Driver's Manual**.

Table 3, M1 Maintenance Interval Operations for Service Schedules I

Maintenance Operation Number	M1 Maintenance Interval Operations for Service Schedule I	Check
4.02	4.02 Inspection of the Air Compressor	
8.06.01	8.06.01 General Information	

10.01	10.01 Wheel Nut Check
10.02	10.02 Tire Check
11.03.01	11.03.01 Parking Brake Operational Check
11.06	11.06 Operating and Leakage Tests of the Bendix Automatic Drain Valve[1]
13.02	13.02 Testing the Natural Gas Detection System Sensor[1]
14.02	14.02 Cab Shock Absorber Bracket Torque Check
14.03	14.03 Inspection of the Aerodynamic Component

1. Test the gas detection system sensor three times per year.

Table 3, M1 Maintenance Interval Operations for Service Schedules I

2.06 M2 Maintenance Interval Operations

The M2 Maintenance Interval Operations tables list all maintenance operations that are to be performed at the M2 maintenance interval. Maintenance operation numbers are reference numbers used to help you find detailed instructions in this manual on the maintenance operations to be performed. Perform all M1 maintenance interval operations at the M2 maintenance interval.

Table 4, M2 Maintenance Interval Operations for Service Schedule I

Maintenance Operation Number	M2 Maintenance Interval Operations for Service Schedule I	Check
2.05	2.05 M1 Maintenance Interval Operations	
3.02	3.02 Inspection of the High Voltage Electrical Component	
3.03	3.03 High Voltage Wiring Check	
3.04	3.04 Inspection of the Cable Gland Protection	
4.03	4.03 Air Compressor Oil and Filter Change	
5.02	5.02 Surge Tank Filler Cap Check	
7.03	7.03 Suspension U-Bolt Torque Check	
8.02.01	8.02.01 Detroit™ Axles[1]	
8.03	8.03 Inspection of the Tie Rod	
8.04	8.04 Lubrication of the Tie Rod	
9.03.01	9.03.01 General Guidelines	
11.02	11.02 Inspection of the Air Brake System Valve	
11.05	11.05 Replacement of the EAPU (Electronic Air Processing Unit) Air Dryer Desiccant Cartridge	
12.02	12.02 Inspection of the Drag Link	
12.04	12.04 Lubrication of the Power Steering Gear	
12.05	12.05 Lubrication of the Drag Link	

13.01	13.01 Inspection of the Electrical Component	
14.01	14.01 Mirror Folding Check	
15.02	15.02 Inspection of the Air Conditioner	
15.03	15.03 Replacement of the Air Filter	

1. For Schedule I vehicles with Detroit axles, complete this procedure once a year or every 25,000 miles (40 000 km), whichever comes first.

Table 4, M2 Maintenance Interval Operations for Service Schedule I

2.07 M3 Maintenance Interval Operations

The M3 Maintenance Interval Operations table lists all maintenance operations that are to be performed at the M3 maintenance interval. Maintenance operation numbers are reference numbers used to help you find detailed instructions in this manual on the maintenance operations to be performed. Perform all M1 and M2 maintenance interval operations at the M3 maintenance interval.

Table 5, M3 Maintenance Interval Operations for Service Schedule I

Maintenance Operation Number	M3 Maintenance Interval Operations for Service Schedule I	Check
2.05	2.05 M1 Maintenance Interval Operations	
2.06	2.06 M2 Maintenance Interval Operations	
5.03	5.03 Radiator Pressure-Flushing and Coolant Change[1]	

1. Every 200,000 miles (321 900 km) or every two years

Table 5, M3 Maintenance Interval Operations for Service Schedule I

2.08 M4 Maintenance Interval Operations

The M4 Maintenance Interval Operations table lists all maintenance operations that are to be performed at the M4 maintenance interval. Maintenance operation numbers are reference numbers used to help you find detailed instructions in this manual on the maintenance operations to be performed. Perform all M1 and M2 maintenance interval operations at the M4 maintenance interval.

Table 6, M4 Maintenance Interval Operations for Service Schedule I

Maintenance Operation Number	M4 Maintenance Interval Operations for Service Schedule I	Check
2.05	2.05 M1 Maintenance Interval Operations	
2.06	2.06 M2 Maintenance Interval Operations	
2.07	2.07 M3 Maintenance Interval Operations	
9.02.01	9.02.01 General Guidelines	
11.04	11.04 Inspection and Lubrication of the Bendix E-6 Foot Control Valve	
12.03	12.03 Power Steering Fluid and Filter Change	

Table 6, M4 Maintenance Interval Operations for Service Schedule I

2.09 Maintenance Operation Sets Table

Table 7, Maintenance Operation Sets

Maint. No.	Operation Description	Service Schedule I				
		IM	M1	M2	M3	M4
3.02	3.02 Inspection of the High Voltage Electrical Component			•	•	•
3.03	3.03 High Voltage Wiring Check			•	•	•
3.04	3.04 Inspection of the Cable Gland Protection			•	•	•
4.02	4.02 Inspection of the Air Compressor	•	•	•	•	•
4.03	4.03 Air Compressor Oil and Filter Change			•	•	•
5.02	5.02 Surge Tank Filler Cap Check			•	•	•
5.03	5.03 Radiator Pressure-Flushing and Coolant Change[1]				•	
6.02	6.02 Frame Fastener Torque Check	•				
7.02.01	7.02.01 Front Suspension Check			•	•	•
7.03	7.03 Suspension U-Bolt Torque Check	•		•	•	•
8.02.01	8.02.01 Detroit™ Axles[2]			•	•	•
8.03	8.03 Inspection of the Tie Rod			•	•	•
8.04	8.04 Lubrication of the Tie Rod[2]			•	•	•
8.05.01	8.05.01 Checking the Drive Axle Alignment	•				
8.06.01	8.06.01 General Information		•	•	•	•
9.02.01	9.02.01 General Guidelines					•
9.03.01	9.03.01 General Guidelines			•	•	•
9.04	9.04 eCarrier Oil Filter and Fluid Change[3]					
10.01	10.01 Wheel Nut Check	•	•	•	•	•
10.02	10.02 Tire Check	•	•	•	•	•
11.02	11.02 Inspection of the Air Brake System Valve			•	•	•
11.03.01	11.03.01 Parking Brake Operational Check	•	•	•	•	•
11.04	11.04 Inspection and Lubrication of the Bendix E-6 Foot Control Valve					•
11.05	11.05 Replacement of the EAPU (Electronic Air Processing Unit) Air Dryer Desiccant Cartridge			•	•	•
11.06	11.06 Operating and Leakage Tests of the Bendix Automatic Drain Valve	•	•			

12.02	12.02 Inspection of the Drag Link			•	•	•
12.03	12.03 Power Steering Fluid and Filter Change[1]					•
12.04	12.04 Lubrication of the Power Steering Gear			•	•	•
12.05	12.05 Lubrication of the Drag Link			•	•	•
13.01	13.01 Inspection of the Electrical Component			•		
13.02	13.02 Testing the Natural Gas Detection System Sensor		•			
14.01	14.01 Mirror Folding Check			•	•	•
14.02	14.02 Cab Shock Absorber Bracket Torque Check	•	•	•	•	•
14.03	14.03 Inspection of the Aerodynamic Component	•	•	•	•	•
15.02	15.02 Inspection of the Air Conditioner			•	•	•
15.03	15.03 Replacement of the Air Filter			•	•	•

1. Complete this procedure every four years or every 200,000 miles (322 200 km), whichever comes first.
2. For Schedule I vehicles with Detroit axles, complete this procedure once a year or every 25,000 miles (40 000 km), whichever comes first.
3. The lubricant used in the eCarrier (eMotor) must meet Detroit Fluids Specification (DFS) 93K230. For more product information, see DDC-SVC-BRO-121 on the DTNAConnect Portal.

Table 7, Maintenance Operation Sets

2.10 Noise Emission Control Maintenance

Federal Law, Part 205: Transportation Equipment Noise Emission Controls

Part 205, Transportation Equipment Noise Emission Controls, requires the vehicle manufacturer to furnish, with each new vehicle, such written instructions for the proper maintenance, use, and repair of the vehicle by the ultimate purchaser to provide reasonable assurance of the elimination or minimization of noise-emission-control degradation throughout the life of the vehicle. In compliance with the law, the noise emission controls maintenance information in each applicable group of this manual, in conjunction with the vehicle workshop manual, provides these instructions to owners.

Recommendations for Replacement Parts

Replacement parts used for maintenance or repair of noise emission controls should be genuine Freightliner parts. If other than genuine Freightliner parts are used for replacement or repair of components affecting noise emission control, the owner should be sure that such parts are warranted by their manufacturer to be equivalent to genuine Freightliner parts in performance and durability.

Tampering with Noise Controls is Prohibited

Federal law prohibits the following acts or the causing thereof:

1. The removal or rendering inoperative by any person (other than for purposes of maintenance, repair, or replacement) of any device or element of design incorporated into any new vehicle for the purpose of noise control, prior to its sale or delivery to the ultimate purchaser, or while it is in use.
2. The use of the vehicle after such device or element of design has been removed or rendered inoperative by any person.

   Among those acts presumed to constitute tampering are the acts listed below:

- Removal of noise-deadening panels.
- Removal of the fan shroud.

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3. Electric Drive

3.01 Safety Precautions

Safety Precautions in this section apply to all procedures within this group.

DANGER:

Electric vehicles are equipped with a high-voltage system. Do not attempt any type of electrical work on the vehicle unless you have completed HV3 Daimler Safety Training. Failure to do so could cause severe personal injury or death.

When working on the vehicle, shut down the engine or motor, set the parking brake, and chock the tires. Before working on the vehicles, always place jack stands under the frame rails to ensure the vehicle cannot drop. For an electric vehicle, decommission the vehicle and verify the high-voltage system is shut down. Failure to follow these steps could result in serious personal injury or death.

3.02 Inspection of the High Voltage Electrical Component

DANGER:

Electric vehicles are equipped with a high-voltage system. Do not attempt any type of electrical work on the vehicle unless you have completed HV3 Daimler Safety Training. Failure to do so could cause severe personal injury or death.

1. Park the vehicle on a level surface, shut down the vehicle and set the parking brake. Chock the tires.
2. Inspect the condition of the electrical component. Check for signs of excess dirt and debris build up on or around components. If exterior cleaning is needed for a thorough inspection, clean exterior debris from the component using a dry method such as a vacuum cleaner or an electrical contact cleaner such as CRC QD® Electronic Cleaner.
3. Check all mounting points for loose, broken, or missing parts. Components must be securely mounted. All loose, broken, or missing parts must be repaired to maintain proper component function.
4. Inspect the component protective cover for proper fit and function. Inspect the cover for cracks, broken mounting, missing sealing surfaces, and warped or bulged surfaces. The cover must prevent moisture and debris from entering the components protected area. Missing, leaking, or damaged covers will result in moisture and debris entering the component and will result in component failure. When it is determined that a cover has not properly prevented moisture and debris from entering the component, the entire component must be replaced.
5. Inspect the component exterior for signs of thermal distortion, warping, bulging, discoloration, amperage related heating, color variance or shading across the component which could be a sign of internal failure requiring replacement of the component. The root source causing conditions of high heat, excess amperage, and/or circuit overload component failures must be diagnosed and repaired prior to replacing the component.
6. Inspect the component housing sub-assembly clips and fasteners for correct fit and location, and that the component sub-assembly housing seams are tight and secure. Missing, leaking, or damaged component housings must be replaced.
7. Inspect component harnesses for secured routing that prevents excess harness movement and prevents the harness from pulling too tight on the connector. Inspect harnesses for signs of rubbing or chafing that could result in wire circuit damage.

   IMPORTANT: **Do not** attempt to repair high voltage cables. If the insulation on the cable appears damaged, the harness must be replaced.

3.03 High Voltage Wiring Check

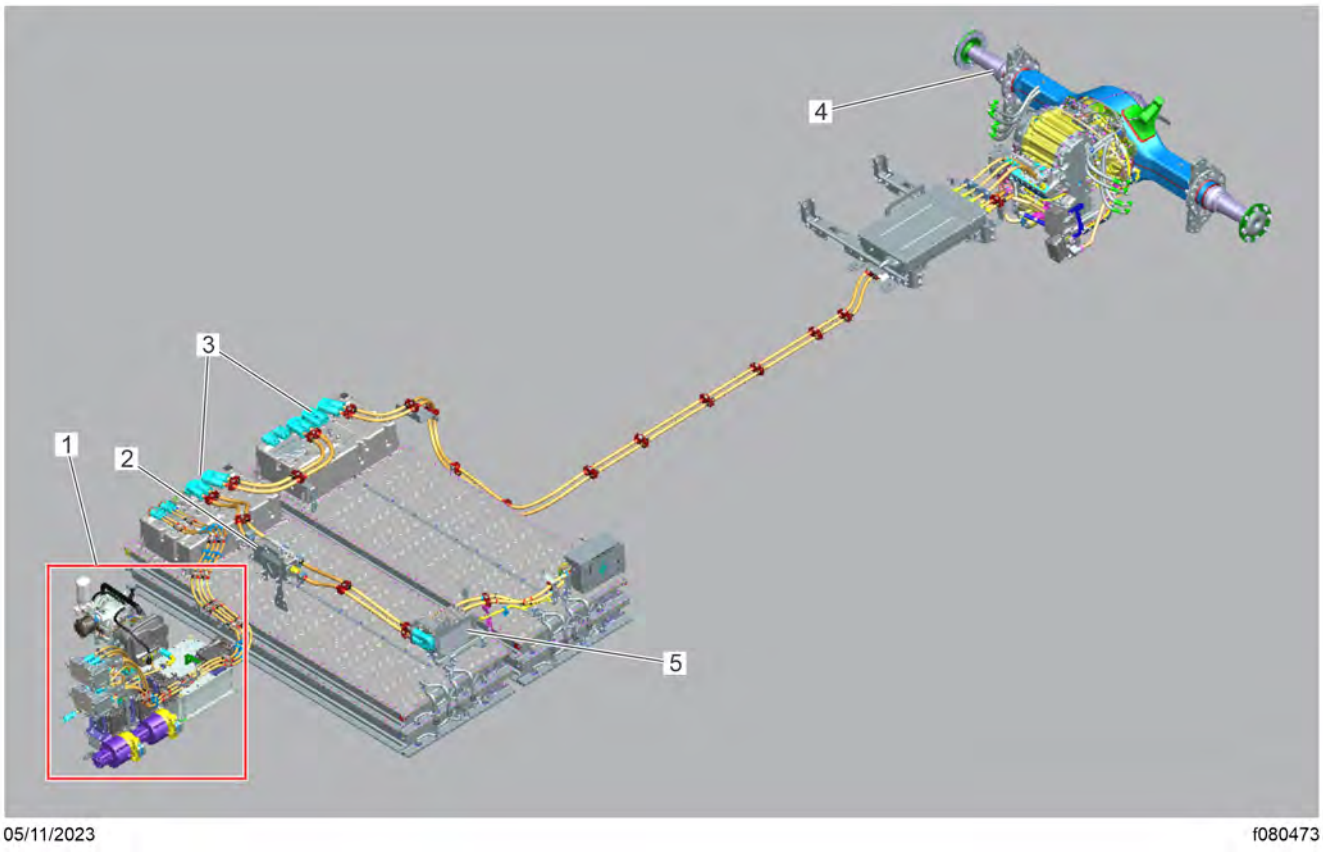
DANGER:

Electric vehicles are equipped with a high-voltage (HV) system. Do not attempt any type of electrical work on the vehicle unless you have completed HV3 Daimler Safety Training. Failure to do so could cause severe personal injury or death.

1. Park the vehicle on a level surface, shut down the vehicle, and apply the parking brake. Chock the tires.
2. Inspect the condition of the high voltage connectors. Check for signs of excess dirt and debris build up on or around the connectors. Clean exterior debris from the connectors using a dry method such as a vacuum cleaner.
3. Inspect the condition of the high voltage connectors. Check for signs of excess dirt/debris build up on or around the connectors. Clean exterior debris from the connectors using a dry method such as a vacuum cleaner.
4. Inspect high voltage harnesses for secured routing that prevents excess harness movement and prevents the harness from pulling too tight on the connector. Inspect harnesses for signs of rubbing or chafing that could result in wire circuit damage. Damaged wiring and/or damage to harness protective wrap must be replaced. All high voltage cables have specific routing that cannot be changed. When performing the harness routing check, make sure the bend diameter of the high voltage cables is within tolerance (if routed correctly, this should not be a problem). See Fig. 2,HV Cable Routing for Class 6 Vehicles, Fig. 3,HV Cable Routing for Class 7 Vehicles and Fig. 4,HV Frontbox Cable Routing.

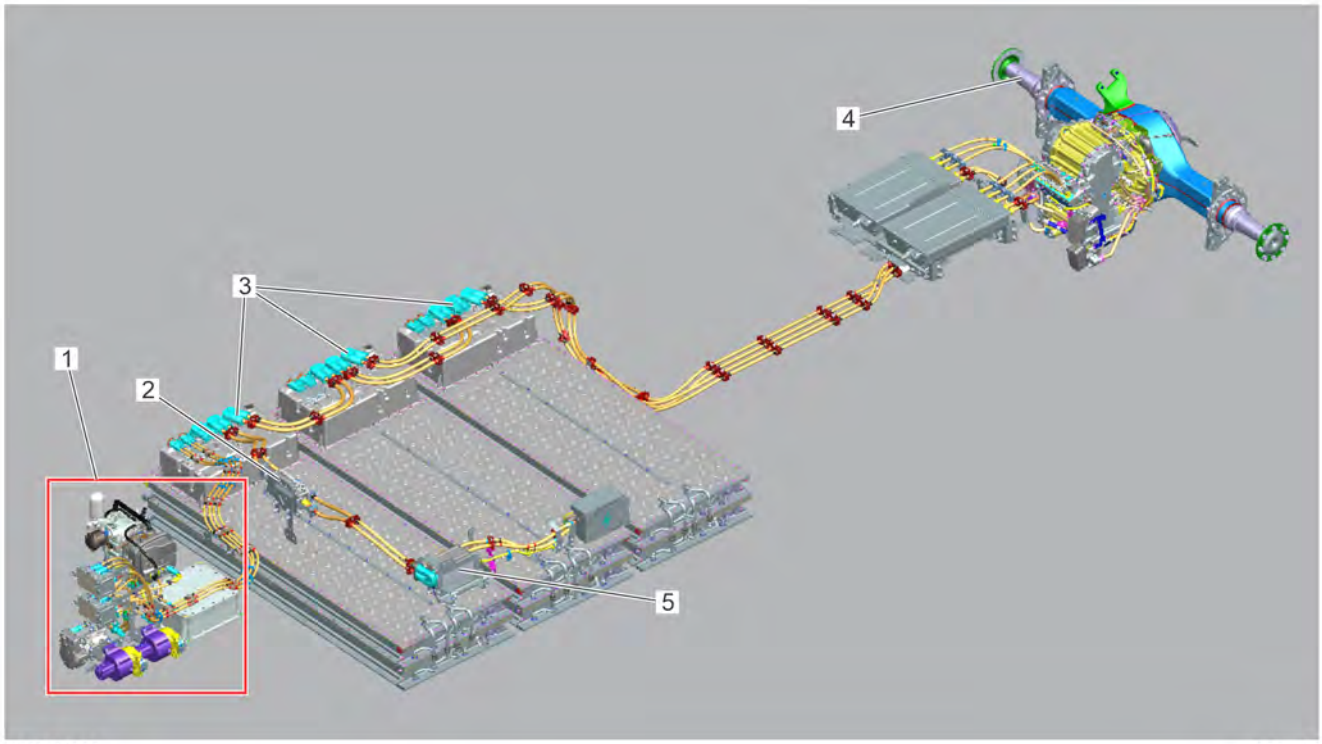
   Check for the following:

   - broken clamps or ties and worn or damaged cables where fasteners touch the cables;
   - fix cable routing, as required, by removing fasteners.



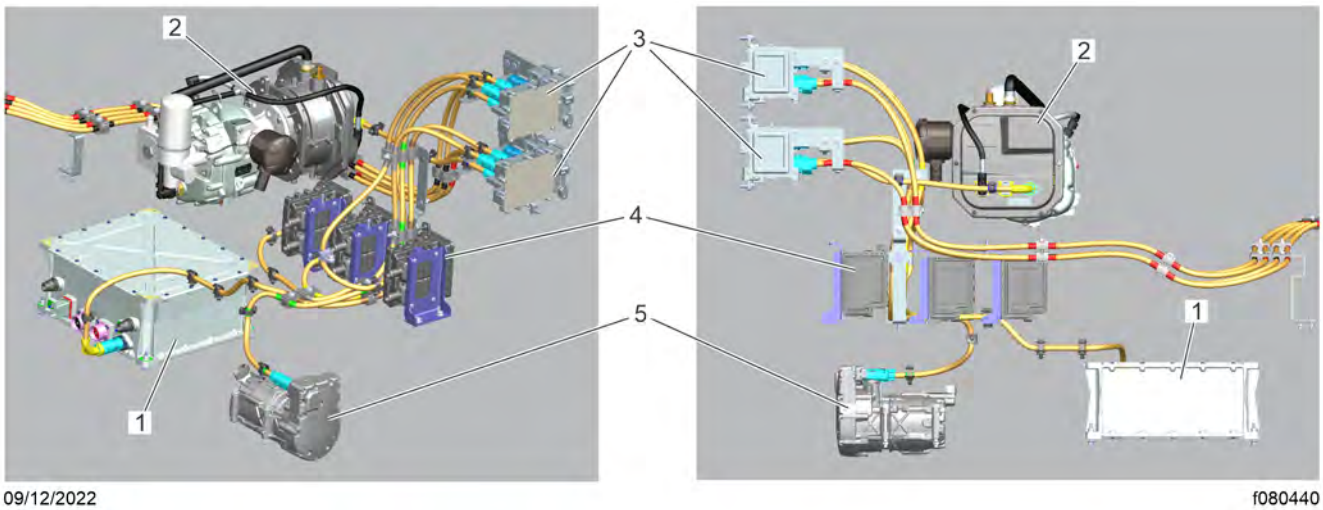
1. Frontbox
2. Charging Fuse
3. High Voltage Batteries
4. eAxles
5. DC Box

Fig 2, HV Cable Routing for Class 6 Vehicles



1. Frontbox
2. Charging Fuse
3. High Voltage Batteries
4. eAxles
5. DC Box

Fig 3, HV Cable Routing for Class 7 Vehicles



1. DC/DC Converter
2. Air Compressor
3. Auxiliary PDU
4. Positive Temperature Coefficient Heating Element
5. eRC

Fig 4, HV Frontbox Cable Routing

IMPORTANT: Do not over bend cables. Doing so may cause damage to the cables which may result in a loss of power to the vehicle.

NOTE: Removing HV connector mounting fasteners requires the vehicle to be decommissioned.

3.04 Inspection of the Cable Gland Protection

IMPORTANT: Cable gland protection provides corrosion protection to the cable gland to inverter housing located in multple areas throughout the vehicle.

1. Inspect all cable glands to make sure corrosion protection is not worn or damaged.
2. If the corrosion protection is damaged, apply anti-corrosion dielectric spray (48-25901-000) to the assembled cable gland.
   2.a Apply the spray to cover all exposed metallic surfaces of the cable gland with not more than a 10 mm skirt on the surrounding surface of the connection.

NOTE: Do not spray the anti-corrosion spray on any part of the cable or coverings and/or tape.

Fig. 5,Cable Gland Protection shows corrosion protection applied to the cable glands.

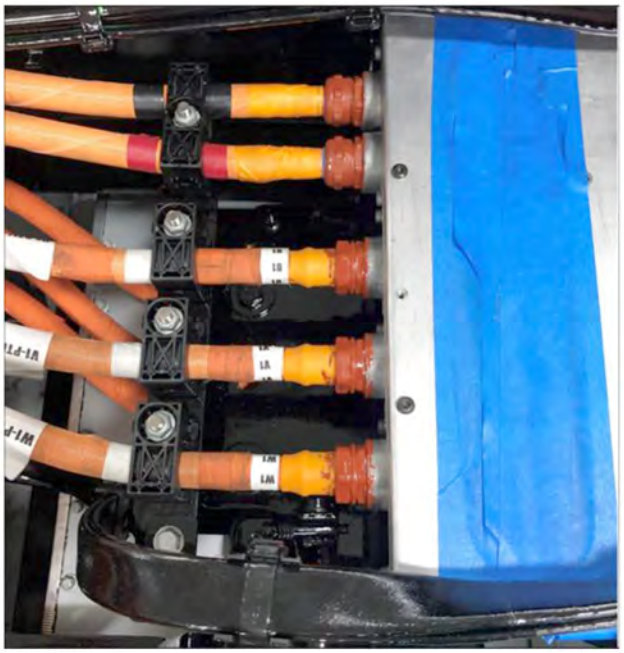


Fig 5, Cable Gland Protection

4.01 Safety Precautions 28
4.02 Inspection of the Air Compressor 28
4.03 Air Compressor Oil and Filter Change 28

4. Air Compressor

4.01 Safety Precautions

Safety Precautions in this section apply to all procedures within this group.

DANGER:

When working on the vehicle, shut down the engine or motor, set the parking brake, and chock the tires. Before working under the vehicle, always place jack stands under the frame rails to ensure the vehicle cannot drop. Failure to follow these steps could result in serious personal injury or death.

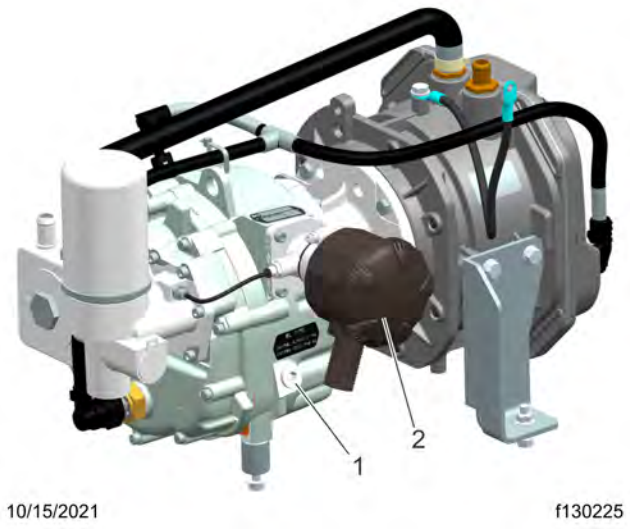
Electric vehicles are equipped with a high-voltage system. Do not attempt any type of electrical work on the vehicle unless you have completed HV3 Daimler Safety Training. Failure to do so could cause severe personal injury or death.

4.02 Inspection of the Air Compressor

1. Inspect the air compressor intake hoses and connections at the air intake at the air cleaner, the resonator, and the air compressor for physical damage or loose connections. If needed, change the hoses, and/or tighten or replace the connections.
2. Inspect the coolant supply and return lines for tight connections. Tighten the connections and replace the lines and fasteners if needed.

4.03 Air Compressor Oil and Filter Change

1. Park the vehicle on a level surface, shut down the vehicle, and apply the parking brake. Chock the tires.
2. Open the hood.
3. Remove the air compressor air filter.
4. Clean the area around the fill plug.
5. Remove the fill plug.
6. Drain the air compressor oil using one of the following methods.
   - Place a drain pan under the air compressor and remove the drain plug.
   - Use a syringe or hand pump to remove the oil from the air compressor.
7. Fill using the approved air compressor oil described in Table 8,Approved Air Compressor Oil until the oil level reaches the bottom threads of the fill plug. Fig. 6,Approved Air Compressor Oil shows the location of the oil port and air filter.



1. Oil Port
2. Air Filter

Fig 6, Approved Air Compressor Oil

Table 8, Approved Air Compressor Oil

Lubricant	Type	Refill Capacity: qt (L)
Cetus PAO 46	Synthetic	1 (1)

Table 8, Approved Air Compressor Oil

8. Tighten the fill plug to 21 to 24 lbf·ft (28 to 32 N·m).
9. Install a new filter.
10. Close the hood.

5.01 Safety Precautions 32
5.02 Surge Tank Filler Cap Check 32
5.03 Radiator Pressure-Flushing and Coolant Change 33

5. Cooling System

5.01 Safety Precautions

Safety Precautions in this section apply to all procedures within this group.

DANGER:

Electric vehicles are equipped with a high-voltage system. Do not attempt any type of electrical work on the vehicle unless you have completed HV3 Daimler Safety Training. Failure to do so could cause severe personal injury or death.

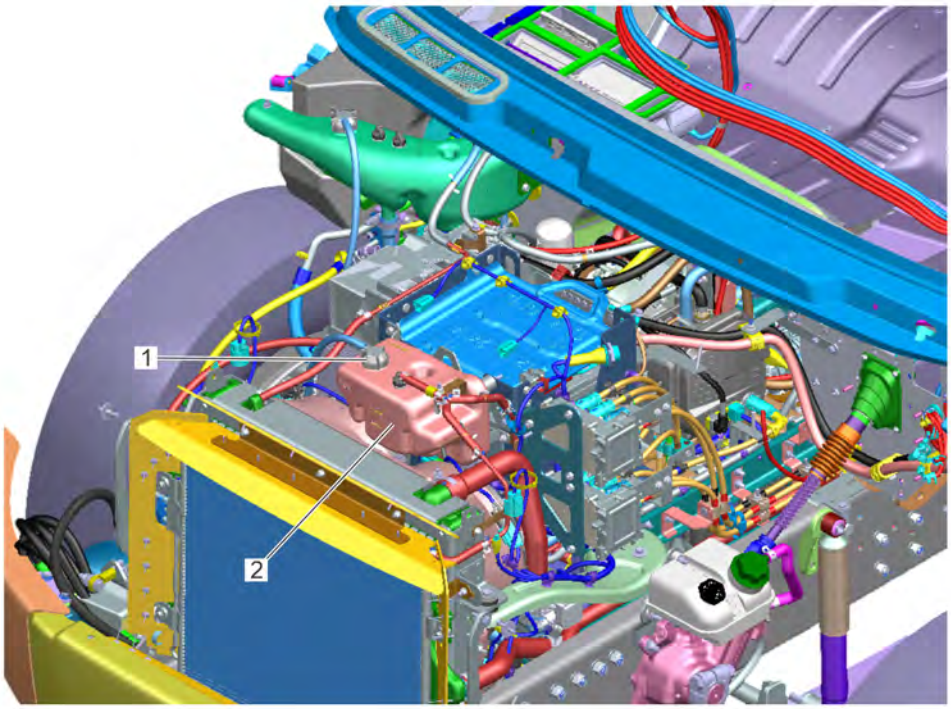
When working on the vehicle, shut down the engine or motor, set the parking brake, and chock the tires. Before working on the vehicles, always place jack stands under the frame rails to ensure the vehicle cannot drop. For an electric vehicle, decommission the vehicle and verify the high-voltage system is shut down. Failure to follow these steps could result in serious personal injury or death.

5.02 Surge Tank Filler Cap Check

WARNING:

Do not remove or loosen the surge tank cap until the cooling system has completely cooled. Use extreme care when removing the cap. A sudden release of pressure from removing the cap prior to the system cooling can result in a surge of scalding coolant that could cause serious personal injury.

1. Check the surge tank filler cap to see if it maintains pressure to within 10% of the pressure rating marked on the cap. If it does not, replace the cap. Make sure that the replacement cap is correctly rated for the cooling system of the vehicle. See Fig.7,Surge Tank.



1. Surge Tank Filler Cap
2. Surge Tank

Fig 7, Surge Tank

2. There is a valve in the filler cap that opens under vacuum. This prevents the collapse of hoses and other parts that are not internally supported when the system cools. Inspect the vacuum-relief valve to be sure it is not stuck.
3. Make sure that the filler cap seals properly on the coolant filler neck seat, and that the O-ring is not cracked or deteriorated. Replace the cap if the O-ring shows deterioration or damage.

5.03 Radiator Pressure-Flushing and Coolant Change

1. Apply the vehicle parking brakes, then chock the tires. Tilt the hood.
2. Place a suitable container under the elbow of the radiator outlet pipe and the radiator. The container should hold at least 60 quarts (59 liters) of fluid.
3. Remove the surge tank cap.
4. Remove the drain plugs from the radiator tank. Allow the coolant to drain.
5. Disconnect the radiator upper and lower hoses, and install the surge tank cap and the radiator tank drain plug. Attach the flushing gun nozzle to the radiator at the lower radiator hose opening. Run the water until the radiator is full.

CAUTION:
When flushing the radiator, do not apply more than 15 psi (100 kPa) air pressure. Excessive pressure can damage the radiator.

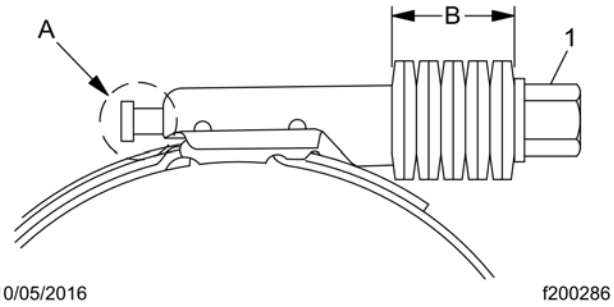
6. Gradually, apply up to 15 psi (100 kPa) air pressure to help dislodge sediment that has built up in the radiator core.

7. Shut off the air at the pressure gun nozzle and allow the radiator to refill with water.
8. Repeat the previous two steps until clean water flows from the radiator.
9. Remove the radiator drain plug and allow the radiator to drain. Install and tighten the drain plug after the radiator has been drained. Do not overtighten.
10. Connect the hoses using Breeze Constant-Torque clamps, see Fig. 8,Breeze Constant-Torque Hose Clamp Installation.

    When installing Breeze Constant-Torque hose clamps, the clamps must be tightened to the correct torque. The screw tip of the clamp must extend about 1/4 inch (6 mm) from the clamp housing, and the Belleville washer stacks must be collapsed almost flat. Use a torque wrench to install these clamps correctly. The correct installation torque is as follows:

    For Breeze Constant-Torque clamps with a 5/16-inch tightening screw hex: 55 lbf·in (620 N·cm).

    For Breeze Constant-Torque clamps with a 3/8-inch tightening screw hex: 90 lbf·in (1020 N·cm).



A. The screw tip must extend about 1/4 inch (6 mm).
B. Belleville washers must collapse almost flat.
1. Tightening Screw Hex

Fig 8, Breeze Constant-Torque Hose Clamp Installation

NOTE: All hose clamps will lose torque after installation due to "compression set." However, when correctly installed, Breeze Constant-Torque clamps will hold enough torque to automatically adjust and keep consistent sealing pressure. During vehicle operation and shutdown, the screw tip may adjust according to temperature and pressure changes. The torque may need to be adjusted for individual applications.

11. Refill the radiator with coolant.
12. Replace the surge tank cap(s).
13. Return the hood to the operating position.
14. Run the de-aeration procedure using DiagnosticLink.

IMPORTANT: The approved coolant for eCascadia is Extended Life Coolant (ELC) with Organic Acid Technology (OAT) per Detroit Fluid Specification (DFS) 93K217. For additional information, see DDC-SVC-BRO-0002 on the DTNA Connect Portal.

15. Shut off the vehicle, then check the coolant level in the surge tank. Add coolant if the level isn't at the MAX line on the surge tank.

6.01 Safety Precautions 38
6.02 Frame Fastener Torque Check 38

6. Frame and Frame Components

6.01 Safety Precautions

Safety Precautions in this section apply to all procedures within this group.

DANGER:

Electric vehicles are equipped with a high-voltage system. Do not attempt any type of electrical work on the vehicle unless you have completed HV3 Daimler Safety Training. Failure to do so could cause severe personal injury or death.

When working on the vehicle, shut down the engine or motor, set the parking brake, and chock the tires. Before working on the vehicle, always place jack stands under the frame rails to ensure the vehicle cannot drop. For an electric vehicle, decommission the vehicle and verify the high-voltage system is shut down. Failure to follow these steps could result in serious personal injury or death.

6.02 Frame Fastener Torque Check

Frame brackets and components secured with Huckbolt® fasteners do not require a torque check, however, they should be inspected for damage. Frame brackets and components secured with conventional bolts and nuts are to be checked at initial maintenance (IM). Check the torque of frame fasteners to offset the effects of "bedding in" (or seating). When checking torque, tighten the nut, not the bolt head whenever possible. This will give a true torque reading by eliminating bolt-body friction. When checking the torque of frame fasteners, inspect the frame for cracks and other damage. Set a click-type torque wrench to the maximum torque of the fastener you are checking. Apply pressure until the torque wrench clicks. Do not loosen the bolt to check the torque. See **Group 00** in the **eM2 Workshop Manual** for torque specifications.

NOTICE:

Ensure that fasteners are properly tightened. Continued vehicle operation with loose fasteners could result in bracket or frame damage.

Check the fasteners at the following locations:

- axle stops
- frame crossmembers and gussets
- front frame brackets
- front suspension spring brackets
- high-voltage battery mounts
- impact structure
- radius rods
- rear suspension spring brackets
- shock absorbers
- all other suspension fasteners
- all other axle fasteners
- all other frame fasteners

Any component that shows signs of cracking or other damage must be repaired or replaced. Refer to the **eM2 Workshop Manual** for repair or replacement information.

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7.02.02 Front and Rear Suspension Shock Absorber Check 40
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7. Suspension

7.01 Safety Precautions

Safety Precautions in this section apply to all procedures within this group.

DANGER:

Electric vehicles are equipped with a high-voltage system. Do not attempt any type of electrical work on the vehicle unless you have completed HV3 Daimler Safety Training. Failure to do so could cause severe personal injury or death.

When working on the vehicle, shut down the engine or motor, set the parking brake, and chock the tires. Before working on the vehicles, always place jack stands under the frame rails to ensure the vehicle cannot drop. For an electric vehicle, decommission the vehicle and verify the high-voltage system is shut down. Failure to follow these steps could result in serious personal injury or death.

7.02 Suspension Inspection

7.02.01 Front Suspension Check

WARNING:

Do not replace individual leaves of a damaged leaf spring assembly; replace the complete spring assembly. Visible damage (cracks or breaks) to one leaf causes hidden damage to other leaves. Replacement of only the visibly damaged part(s) is no assurance that the spring is safe. On front spring assemblies, if cracks or breaks exist in the two top leaves, a loss of vehicle control could occur. Failure to replace a damaged spring assembly could cause an accident resulting in property damage, serious personal injury, or death.

Inspect the front spring assemblies for cracked, broken, or abnormally bent leaves. If any of these conditions exist, replace the spring assembly; see **Group 32** of the *eM2™ Workshop Manual*.

Inspect the spring bushings for wear or other damage. If any of these conditions exist, replace the damaged bushings.

7.02.02 Front and Rear Suspension Shock Absorber Check

Make sure the shock absorber brackets are tight, and the shock absorber is not striking or rubbing the frame or some other part of the chassis. Striking or rubbing the frame is characterized by chafe marks on the shock absorber body and the frame rail; see Fig. 9,Direct-Acting Shock Absorber (front suspension shown). Check the rubber mounting bushings for cracks, cuts, swelling, dry rot, or missing pieces. If the shock absorber bushings are no longer serviceable, replace the shock absorber with a new one.

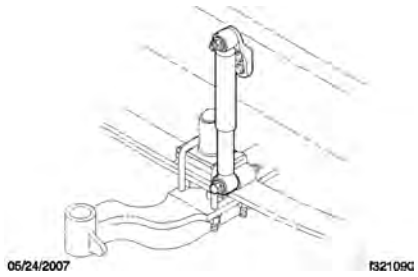


Fig 9, Direct-Acting Shock Absorber (front suspension shown)

Inspect the shock absorber for oil leakage. Some misting of the oil is normal, and does not mean the shock is leaking. If the shock absorber is damaged or leaking, replace it with a new one; see **Group 32** of the *eM2 Workshop Manual*.

7.02.03 Freightliner AirLiner Rear Suspension Check

Components Checking

Inspect the forward spring brackets for wear, cracks, and other damage. If any of these conditions exist, replace the damaged bracket(s); see **Group 32** of the *eM2 Workshop Manual*.

Inspect the spring bushings for wear or other damage. If any of these conditions exist, replace the damaged bushings.



WARNING:

Replace worn, cracked, or damaged spring brackets. Failure to do so could result in bracket breakage, possibly leading to loss of vehicle control and resulting in personal injury or property damage.

Inspect the crossmember(s) and gussets for wear, cracks, and other damage. If any of these conditions exist, replace the damaged parts; see **Group 32** of the *eM2 Workshop Manual*.

Visually check the air spring piston for cracks, chips, and broken areas. Check the air bag for rips, tears, and holes. Verify that the air spring assembly does not leak. If any of these conditions exist, replace the damaged parts; see **Group 32** of the *eM2 Workshop Manual*.

Suspension Height Checking

IMPORTANT: Before checking the AirLiner suspension height, make sure there is no load on the chassis, and the trailer is unhitched.

IMPORTANT: To prevent voiding the warranty on Barksdale height-control valves, note the following:

- Do not overtighten the bolts in the Barksdale height-control valve housing. The bolts should not be loose, and should not require tightening. Only if necessary, tighten the valve housing bolts 45 lbf·in (500 N·cm). Any damage to the valve housing will void the warranty.
- Do not attempt to disassemble the Barksdale valve body or the control lever. There are no serviceable parts in the valve, and any disassembly will void the warranty.



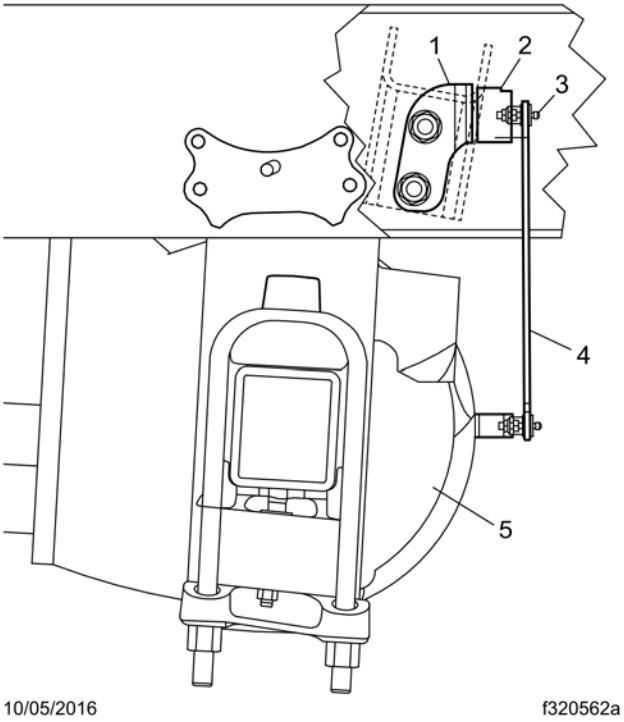
NOTICE:

When removing or loosening a Barksdale height-control valve from a mounting bracket, always hold the valve-side mounting studs in place with an Allen wrench while loosening or tightening the nuts that attach the valve to the bracket. Because the mounting studs are threaded into the valve body, loosening the nuts without holding the studs can tighten the studs, which can crush the valve body and damage the valve. Conversely, tightening the nuts without holding the studs can back the studs out, causing a separation of the two halves of the valve body, and possibly a leak.

1. Park the vehicle on a level surface, using a light application of the brakes. Do not apply the parking brakes. Shift the transmission into neutral, and build the secondary air pressure to at least 100 psi (690 kPa). Shut down the engine. Have an assistant chock the tires on one axle only.
2. Mark the location of the front and rear tires on the floor.

NOTE: The stud bolt that fastens the valve's height-control lever to the vertical linkage is oriented correctly when the linkage rod is vertical, as viewed from the side of the vehicle; see Fig. 10,, page 42. The rod may be on the forward or aft side of the lever to get it to be vertical.

3. Measure the distance between the left forwardmost axle stop and the suspension as indicated; see Table 9,Suspension Ride-Height Measurement, Single-Leaf Spring, 21k/40k, High Ride for an acceptable range of heights for each suspension.



1. Valve Mounting Bracket
2. Height-Control Valve
3. Stud Bolt
4. Linkage Rod
5. Axle

Fig 10, Barksdale Height-Control Valve Installation (side view) (typical)

IMPORTANT: **Suspensions with Single-Leaf Springs**: Measure between the top of the U-bolt **pad** and the bottom of the axle stop.

4. If the measurement is not within the acceptable range, refer to the *eM2 Workshop Manual* for adjustment instructions. If the distance is within the acceptable range, apply the parking brakes.

Table 9, Suspension Ride-Height Measurement, Single-Leaf Spring, 21k/40k, High Ride



Measure Point	Suspension Height Measurement		
	Min	Target	Max
A = Measure Here	2-3/8 inch (60 mm)	2-5/8 inch (67 mm)	2-7/8 inch (73 mm)

Table 9, Suspension Ride-Height Measurement, Single-Leaf Spring, 21k/40k, High Ride

7.03 Suspension U-Bolt Torque Check

NOTICE:
Failure to retorque the U-bolt nuts could result in spring breakage and abnormal tire wear.

Check the U-bolt torque of both the front and rear axles where applicable.

1. Park the vehicle on a level surface and apply the parking brakes. Chock the tires.
2. Check the U-bolt torque. See Table 10,Spring U-Bolt High Nut Torque Values for U-bolt torque specifications. Tighten in a diagonal pattern as shown in Fig. 11,Tightening Pattern for U-Bolt High Nuts. Set a click-type torque wrench to the mid-point torque value for the fastener being checked. Turn the wrench in a clockwise motion (looking up) until the torque wrench clicks, then release pressure on the torque wrench, and turn the wrench again until it clicks. If the nut turns on the second application, the bolt is stretching and must be replaced. See **Group 32** of the *eM2™ Workshop Manual* for bolt replacement procedures.

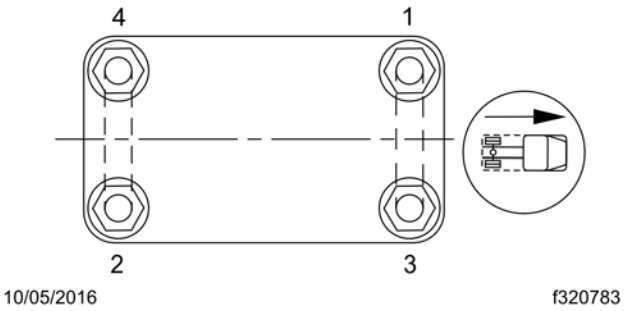


Fig 11, Tightening Pattern for U-Bolt High Nuts

Table 10, Spring U-Bolt High Nut Torque Values

Size	Torque: lbf·ft (N·m)
5/8–18	180–230 (245–313)
3/4–16	270–330 (367–449)
7/8–14	420–500 (571–680)
1–14	520–600 (707–816)
M20	216–274 (292–372)
M20 (Airtek)	330–370 (447–502)

Table 10, Spring U-Bolt High Nut Torque Values

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8. Front Axle

8.01 Safety Precautions

Safety Precautions in this section apply to all procedures within this group.

DANGER:

Electric vehicles are equipped with a high-voltage system. Do not attempt any type of electrical work on the vehicle unless you have completed HV3 Daimler Safety Training. Failure to do so could cause severe personal injury or death.

When working on the vehicle, shut down the engine or motor, set the parking brake, and chock the tires. Before working on the vehicle, always place jack stands under the frame rails to ensure the vehicle cannot drop. For an electric vehicle, decommission the vehicle and verify the high-voltage system is shut down. Failure to follow these steps could result in serious personal injury or death.

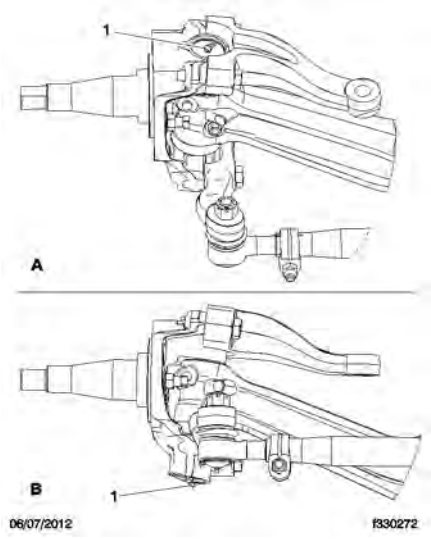
8.02 Lubrication of the Knuckle Pin

8.02.01 Detroit™ Axles

NOTICE:

Use regulated pressure when lubricating the knuckle assemblies, otherwise damage could result to the knuckle caps.

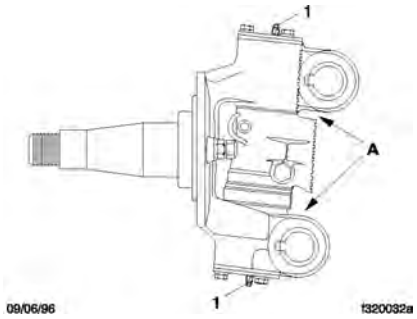
1. Park the vehicle on a level surface, shut down the engine, and set the parking brake. Chock the tires. When lubricating upper and lower knuckle assemblies, do not raise the front axle.
2. Wipe the fittings clean.
3. Apply multipurpose chassis grease, NLGI Grade 1 (6% 12-hydroxy lithium stearate grease) or NLGI Grade 2 (8% 12-hydroxy lithium stearate grease), until new grease is seen at the junctions of the axle beam and knuckles. For locations of grease fittings, see Fig. 12,Grease Fittings, Detroit Axles; for grease exit points, see Fig. 13,Knuckle Pin Lubrication.



A. Upper View, LH Side.
B. Lower View, LH Side.

1. Grease Fitting

Fig 12, Grease Fittings, Detroit Axles



A. Grease Exit.

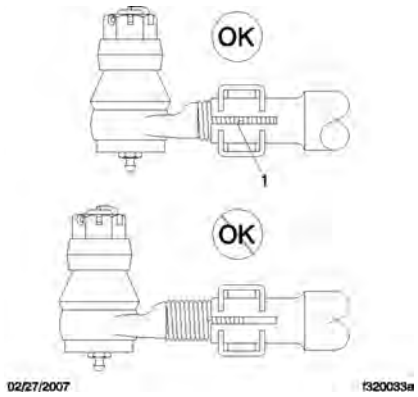
1. Grease Fitting

Fig 13, Knuckle Pin Lubrication

8.03 Inspection of the Tie Rod

Inspect the tie-rod ends as follows:

1. Shake the cross-tube. A loose fit, or movement between the tapered shaft of the ball and the cross-tube socket members indicates that the tie-rod end assembly must be replaced.
2. The threaded portion of the tie-rod end assembly must be inserted all the way into the cross-tube split for adequate clamping. See Fig. 14,Tie-Rod End Adjustment. Replace the components if this cannot be done. See **Group 33** of the *eM2™ Workshop Manual*.



NOTE: Shown without pinch bolt to provide clarity.

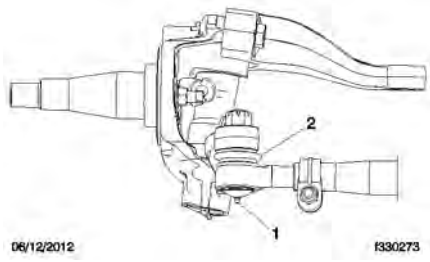
1. Cross-Tube Split

Fig 14, Tie-Rod End Adjustment

8.04 Lubrication of the Tie Rod

Detroit Axles

For any Detroit or Meritor axle that requires lubrication of the tie-rod ends, wipe the grease fittings clean, then pump multi-purpose chassis grease, NLGI Grade 1 (6% 12-hydroxy lithium stearate grease) or NLGI Grade 2 (8% 12-hydroxy lithium stearate grease), into the tie-rod ends until all used grease is forced out and fresh grease is seen at the ball stud neck. See Fig. 15,Grease Fitting and Boot (Detroit axle shown).



NOTE: No grease should emit from the tie-rod boot. If grease emits from the tie-rod boot, the boot is damaged.

1. Grease Fitting
2. Boot

Fig 15, Grease Fitting and Boot (Detroit axle shown)

8.05 All-Axle Alignment Check

8.05.01 Checking the Drive Axle Alignment

Check the axle alignment, parallelism, and thrust angle measurements for the rear drive axles. Use the applicable procedure and specifications in **Group 35** of the *eM2 Workshop Manual*.

8.05.02 Toe-In Inspection

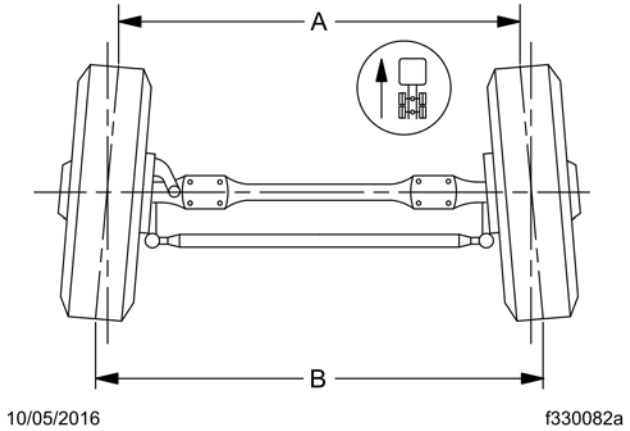
For vehicle alignment to be accurate, the shop floor must be level in every direction. The turn plates for the front wheels must rotate freely without friction, and the alignment equipment must be calibrated every three months by a qualified technician from the equipment manufacturer. Freightliner dealers must have proof of this calibration history

1. Apply the parking brakes and chock the rear tires.

2. Raise the front of the vehicle until the tires clear the ground. Place safety stands under the axle.
3. Using spray paint or a piece of chalk, mark the entire center rib of each front tire.
4. Place a scribe or pointed instrument against the marked center rib of each tire, and turn the tires. The scribe must be held firmly in place so that a single straight line is scribed all the way around each front tire.
5. Place a turn-plate or turntable under both front tires. Remove the safety stands and lower the vehicle. Remove the lock-pins from the gauges; make sure the tires are exactly straight ahead.

   NOTE: If turn-plates or turntables are not available, lower the vehicle. Remove the chocks from the rear tires and release the parking brakes. Move the vehicle backward, then forward about six feet (two meters).

6. Place a trammel bar at the rear of the front tires; locate the trammel pointers at spindle height, and adjust the pointers to line up with the scribe lines on the center ribs of the front tires. See Fig. 16,Wheel Toe-In (overhead view). Lock in place. Check that the scale is set on zero.



NOTE: B minus A equals toe-in.

Fig 16, Wheel Toe-In (overhead view)

7. Place the trammel bar at the front of the tires (see Fig. 17,Trammel Bar Positioning) and adjust the scale end so that the pointers line up with the scribe lines. See Fig. 18, Setting Trammel Bar Pointers.

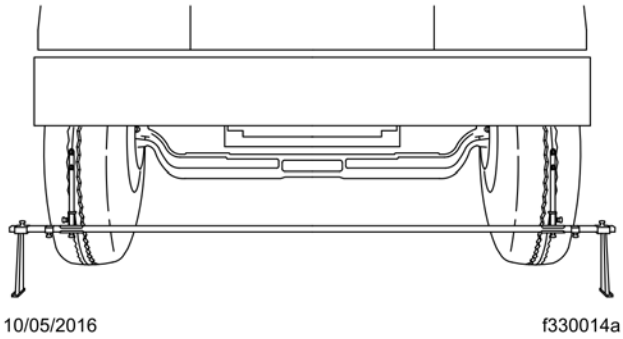


Fig 17, Trammel Bar Positioning

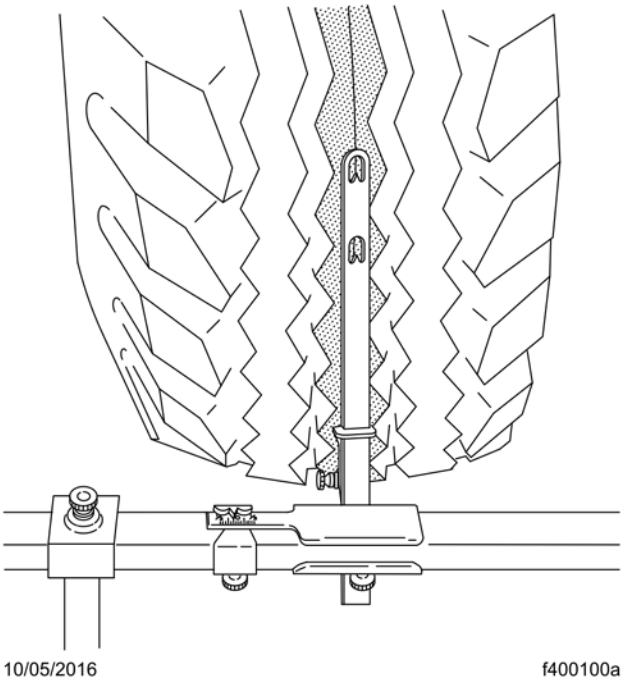


Fig 18, Setting Trammel Bar Pointers

8. Read the toe-in from the scale, and compare it to the toe-in specification in **Group 33** of the *eM2 Workshop Manual*. If corrections are needed, see **Group 33** of the *eM2 Workshop Manual* for instructions on adjusting the toe-in.

8.06 Inspection of the Steer Axle Hub Cap Vent Plug

8.06.01 General Information

As a function of their design, hubcap vent plugs will on occasion exhibit signs of hub oil on their exterior surface. Depending on environmental conditions and/or age of the plug, the amount of oil present can vary. This is a normal result of the venting process due to pressure increase within the hub cavity. For an example of normal vent plug appearance, see Fig. 19,Normal Oil Venting.



Fig 19, Normal Oil Venting

A vent plug can wear or be damaged and cause excessive leakage, or allow water to enter the hub and contaminate the oil. For examples of a leaking vent plug, see Fig. 20,Excessive Leakage and Fig. 21,Water in Oil. Evidence of a leaking vent plug may appear as;

- Oil splatter around the wheel.
- Gooey/gummy oil around the vent plug purge point.
- Hub/plug area is dirty, and water contaminated oil in the hub.
- Hub/plug area is clean, but there is water contaminated oil in the hub. (pressure washing is the most likely cause)

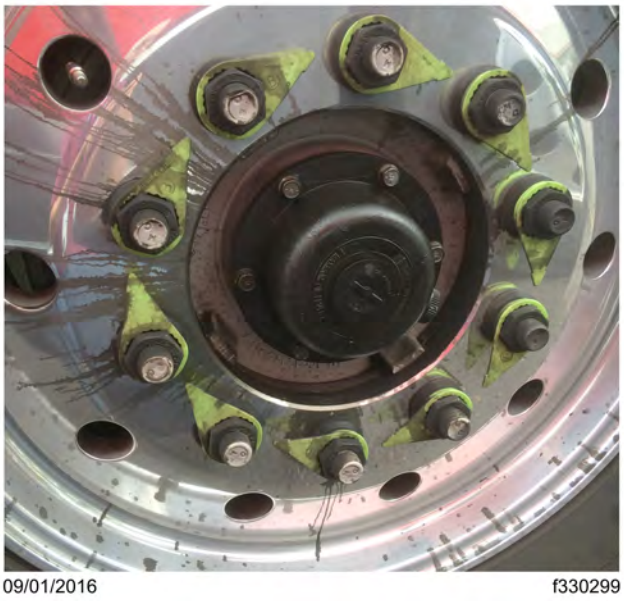


Fig 20, Excessive Leakage

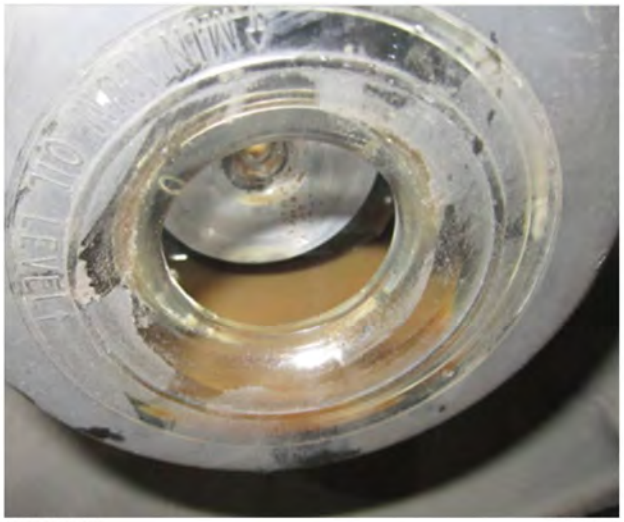


Fig 21, Water in Oil

8.06.02 Inspection of the Steer Axle Hub Cap Vent Plug

NOTICE:

Only remove vent plugs by hand. They can be damaged if a tool is used. Wipe the hub/plug area clean before checking the oil. Do not use a pressure washer to clean the hub/plug area. The plug has a vent and this can contaminate the oil with water.

1. Park the vehicle on a level surface, shut down the engine and set the parking brakes. Chock the tires.
2. Inspect the axle hub cap and vent plug for evidence of excessive leakage.
3. Wipe the hub cap and vent plug clean with a rag.
4. Remove the vent plug and check the oil for evidence of water contamination.

   If there is evidence of water contaminated oil in the hub, disassemble the effected axle end, clean, inspect, and reassemble the axle end. See **Group 33** of the *eM2 Workshop Manual* for instructions.

   If there is evidence of excessive leakage, remove the damaged part and replace it with a new part.
5. Check the oil level in the hub, and fill the hub with new approved oil as needed.

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9. Rear axle

9.01 Safety Precautions

Safety Precautions in this section apply to all procedures within this group.

DANGER:

When working on the vehicle, shut down the engine or motor, set the parking brake, and chock the tires. Before working under the vehicle, always place jack stands under the frame rails to ensure the vehicle cannot drop. Failure to follow these steps could result in serious personal injury or death.

9.02 Axle Lubricant and Filter Change, and Cleaning the Magnetic Strainer

9.02.01 General Guidelines

NOTICE:

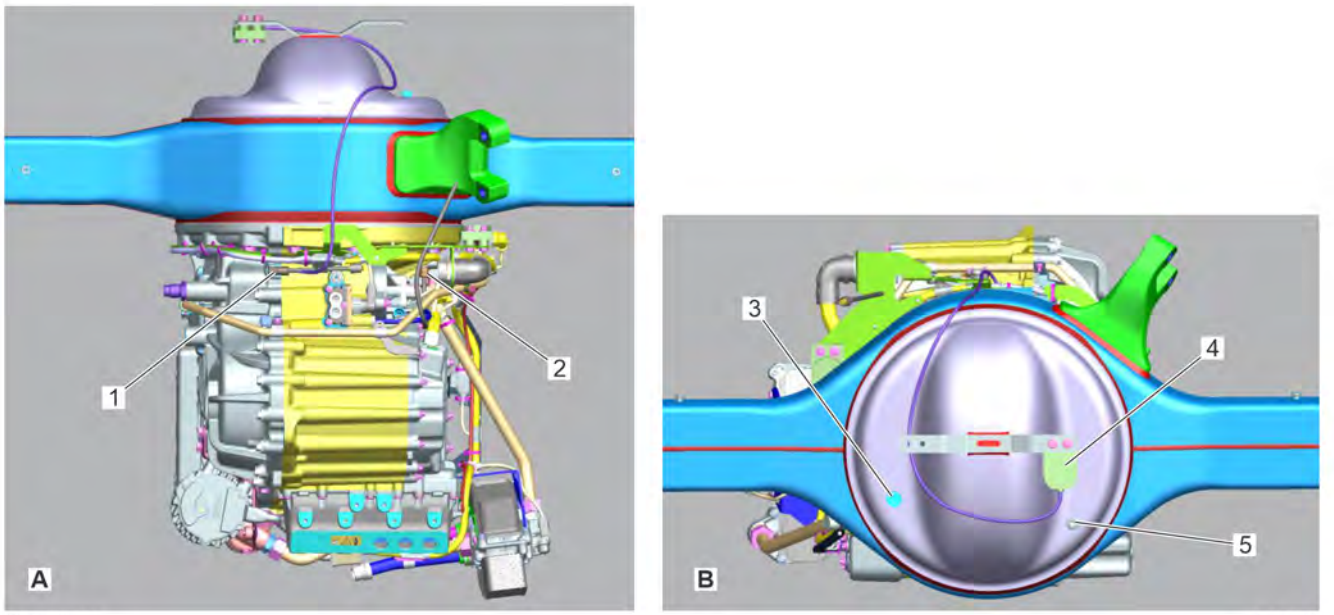
When operating under adverse conditions, it may be necessary to change the axle lubricant at more frequent intervals than listed in the scheduled maintenance tables. Failure to do so could result in axle damage.

For all axles, including tandem drive axles and two-speed axles, perform the applicable procedures under 'All Axle Models.'

9.02.02 All Axle models

Detroit® eAxle

1. Park the vehicle on a level surface, shut down the engine, and set the parking brake. Chock the tires.
2. Clean the fill plug and the area around it. In the axle housing rear cover, remove the plug from the oil fill hole. See Fig. 22,Detroit eAxle Tandem Axle (forward axle shown).



A. Top View
B. Rear View
1. eCarrier Breather Hose
2. Axle Housing Breather Hose
3. Axle Housing Fill Plug
4. eCarrier Breather
5. Temperature Sensor Port

Fig 22, Detroit eAxle Tandem Axle (forward axle shown)

CAUTION:
Be careful when draining the axle oil. It may be very hot, and could cause personal injury if it contacts the skin.

3. Place a drain pan under the rear axle drain plug. Drain the oil when it is warm. At this temperature, the oil will run more freely and ensure that the axle is flushed.
4. Clean the fill and drain plugs. Change them if necessary.
   - 4.a For magnetic plugs, use a piece of key stock or any other convenient steel slug to short the two magnetic poles and divert the magnetic field.
   - 4.b Clean away the collected material deposited on each pole. Magnets will rapidly lose their effectiveness as collected material bridges the gap between the two poles.
   - 4.c After the first oil is changed, inspect the drain plug each time for large quantities of metal particles.
   - 4.d After cleaning, install the drain plug(s) and tighten to 30 lbf·ft (41 N·m).
5. Fill the axle with the recommended lubricant. See Table 11,Detroit Rear Axle Lubricant Capacity, eAxle (Hubs Full) for lubricant capacities.

NOTE: Some Detroit axles have a small tapped and plugged hole near and below the housing oil fill hole. This smaller hole is for a lubricant temperature indicator only, and should not be used as a fill or level hole.

IMPORTANT: Lubricant used in Detroit rear axles must meet Mercedes-Benz specification MB 235.31/Detroit Fluids Specification (DFS) 93K219.03. For more product information, see DDC-SVC-BRO-0119 on the DTNA Connect Portal.

5.a Fill the axle through the oil fill hole. Lubricant should be level with the bottom of the oil fill hole. To check fluid level, see Fig. 23,Axle Lubricant Level Inspection.

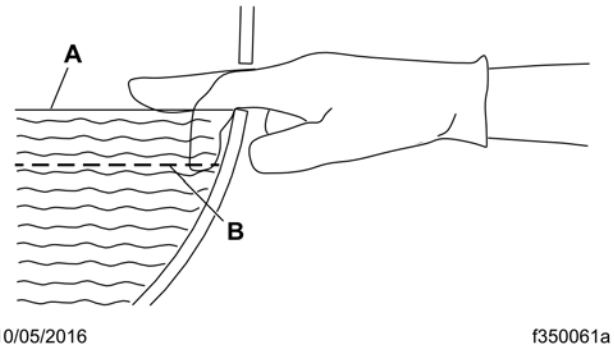
5.b Install and tighten the fill plug 30 lbf·ft (41 N·m).

Table 11, Detroit Rear Axle Lubricant Capacity, eAxle (Hubs Full)

Axle	Oil Capacity: Quarts (liters)
Forward-Rear	10.8 (10.2)[1]
Single and Rearmost Tandem	10.8 (10.2)[1]

1. These values assume the wheel ends are properly lubricated. Actual oil capacity might vary slightly depending on gear ratio.

Table 11, Detroit Rear Axle Lubricant Capacity, eAxle (Hubs Full)



A. Correct (lube level at bottom of fill hole)

B. Incorrect (lube level below fill hole)

Fig 23, Axle Lubricant Level Inspection

9.03 Inspection of the Axle Breather and Axle Lubricant Level

9.03.01 General Guidelines

For all axles, including tandem drive axles and two-speed axles, perform the applicable procedures under 'All Axle Models.'

9.03.02 All Axle models

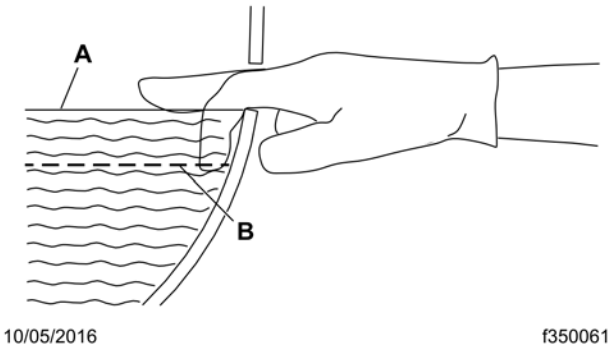
Detroit® eAxle

NOTICE:
Failure to keep the rear axle filled to the proper level with the recommended lubricant can result in rear axle damage.

1. Park the vehicle on a level surface, shut down the engine, and set the parking brake. Chock the tires.
2. If the vehicle has just been driven, allow a few minutes for the lubricant to settle.
3. Clean the fill plug and the area surrounding the fill plug on the side of the axle carrier. Remove the plug. Check lubricant level when the axle is cold, or near room temperature.

   NOTE: Some Detroit axles have a small tapped and plugged hole near and below the housing oil fill hole. This smaller hole is for a lubricant temperature indicator only, and should not be used as a fill or level hole.

4. Check that the lubricant is level with the bottom of the fill hole. See Fig. 24,Axle Lubricant Level Inspection. If low, check for oil leaks, and correct as needed. Add oil to the level of the fill plug, using the lubricant recommended in Table 12,Detroit Rear Axle Lubricant Capacity, eAxle (Hubs Full) .



A. Correct (lube level at bottom of fill hole)
B. Incorrect (lube level below fill hole)

Fig 24, Axle Lubricant Level Inspection

Table 12, Detroit Rear Axle Lubricant Capacity, eAxle (Hubs Full)

Axle	Oil Capacity: Quarts (liters)
Forward-Rear	10.8 (10.2)[1]
Single and Rearmost Tandem	10.8 (10.2)[1]

1. These values assume the wheel ends are properly lubricated. Actual oil capacity might vary slightly depending on gear ratio.

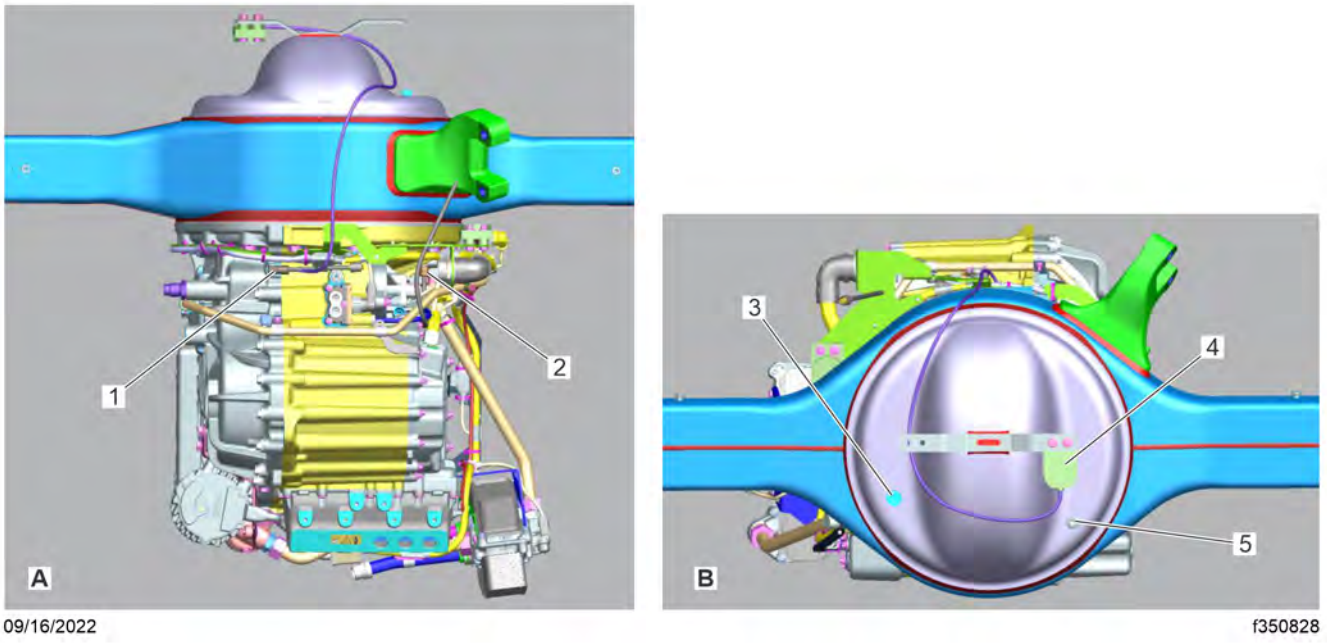
Table 12, Detroit Rear Axle Lubricant Capacity, eAxle (Hubs Full)

IMPORTANT: A lubricant level close enough to be seen or touched is not sufficient. It must be level with the bottom of the fill hole.

5. Install and tighten the fill plug 30 lbf·ft (41 N·m).

IMPORTANT: Always check the axle breather whenever checking the lubricant level. Check the breather more frequently under adverse operating conditions.

6. Check the axle housing breather (see Fig. 25,Detroit eAxle Tandem Axle (forward axle shown)). Make sure that it is open and unclogged. If the breather is plugged or damaged, clean or replace it as needed.



A. Top View
B. Rear View
1. eCarrier Breather Hose
2. Axle Housing Breather Hose
3. Axle Housing Fill Plug
4. eCarrier Breather
5. Temperature Sensor Port

Fig 25, Detroit eAxle Tandem Axle (forward axle shown)

9.04 eCarrier Oil Filter and Fluid Change

1. Park the vehicle on a level surface, shut down the vehicle, and set the parking brakes. Chock the tires.
2. Place a drain pan under the drain plug of the eCarrier.
3. Remove the drain plug and oil filter shown in Fig. 26,Drain Plug and Oil Filter.

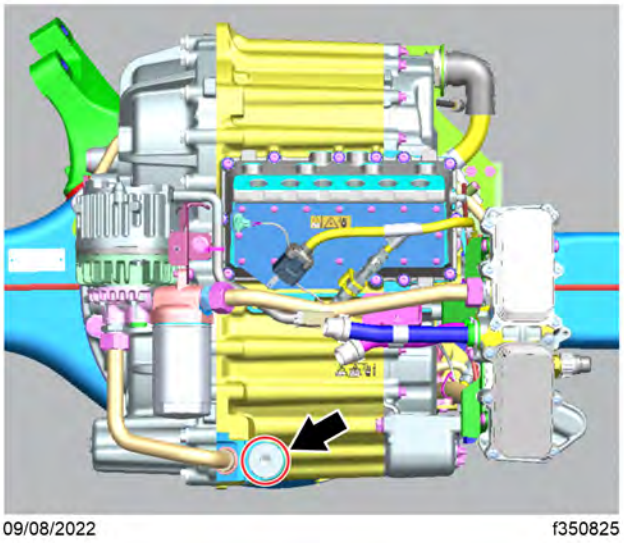


Fig 26, Drain Plug and Oil Filter

NOTE: There is a spring behind the drain plug. Catch the drain plug as it releases from the eCarrier.

4. Let the oil drain out of the eCarrier.

NOTE: Ensure the pump is only activated for a couple of seconds to prevent damage.

5. Using DiagnosticLink®, turn the eCarrier oil pump on to force the remaining fluid out. See 27,eTransmission Oil Pump Controls, Start and 28,eTransmission Oil Pump Controls, Stop. Follow the steps below to control the pump;
   - Open DiagnosticLink, and go to Actions
   - Choose ePowertrain
   - Select eTransmission oil pump controls

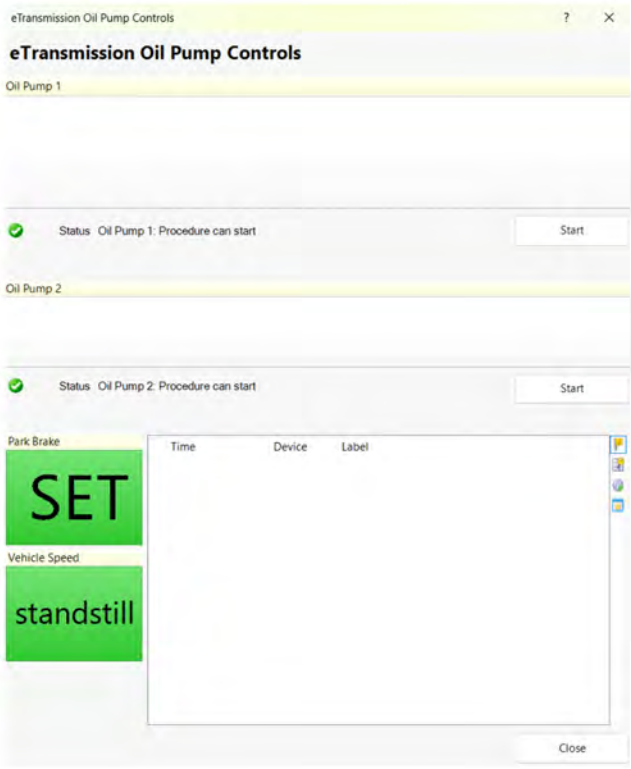


Fig 27, eTransmission Oil Pump Controls, Start

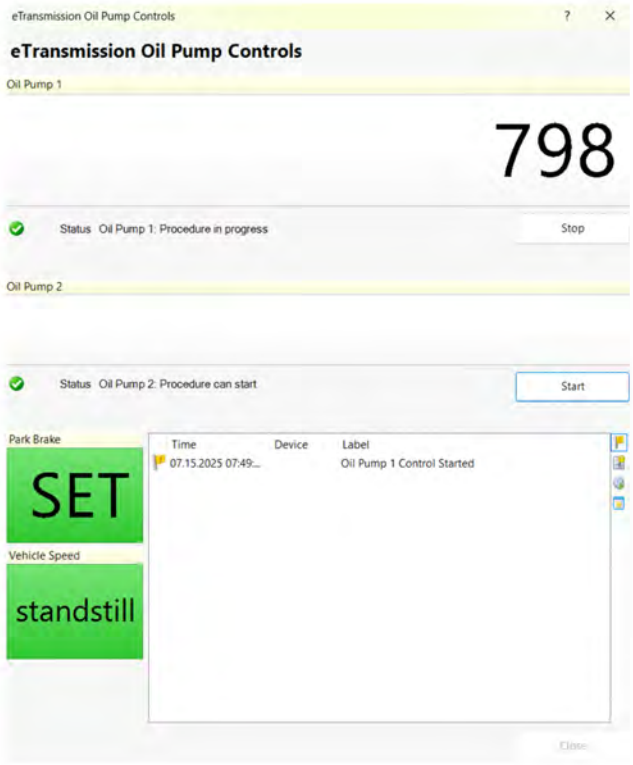


Fig 28, eTransmission Oil Pump Controls, Stop

6. Remove oil filter from the eCarrier oil pump.
7. Clean any debris out of the mesh filter shown in Fig. 29,Oil Mesh Filter.

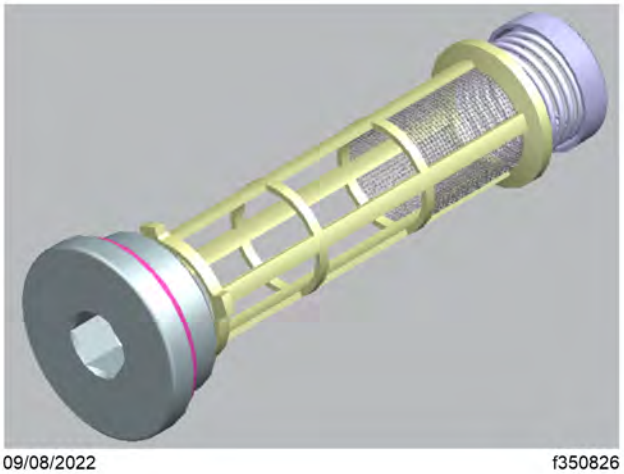


Fig 29, Oil Mesh Filter

8. Install a new oil filter onto the eCarrier oil pump.

9. Install the drain plug and filter. Tighten the drain plug 111 lbf·ft (150 N·m).
10. Remove the fill plug shown in Fig. 30,eCarrier Fluid Fill Plug.

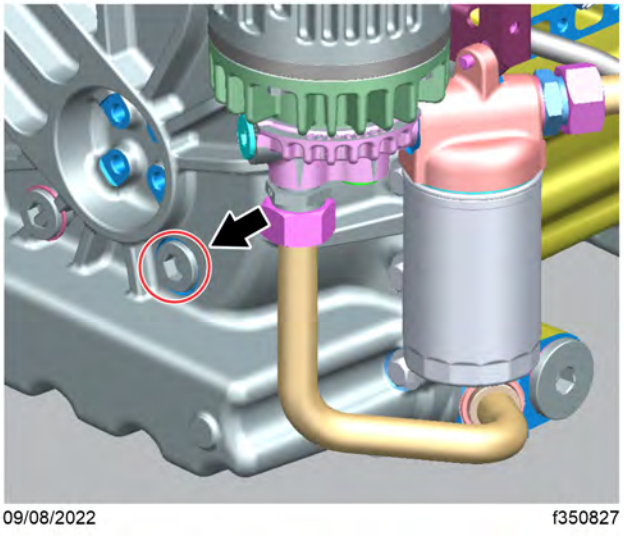


Fig 30, eCarrier Fluid Fill Plug

11. Fill the eCarrier with oil until the oil level reaches the fill plug threads. See Table 13,eCarrier Lubricant Capacity.
12. Install the oil fill plug, run the oil pump through DiagnosticLink for a few seconds to circulate the oil, then remove the fill plug and top off the oil. See 27,eTransmission Oil Pump Controls, Start and 28,eTransmission Oil Pump Controls, Stop.

    IMPORTANT: The lubricant used in eCarrier (eMotor) must meet Detroit Fluids Specification (DFS) 93K230. For more product information, see **DDC-SVC-BRO-121** on the DTNA Connect Portal.

13. Install the oil fill plug. Tighten the fill plug 85 lbf·ft (115 N·m).

Table 13, eCarrier Lubricant Capacity

Axle	Oil Capacity: Quarts (liters)
Front-Rear and Single	6.7 (7.1)
Rearmost Tandem	10.4 (11.0)

Table 13, eCarrier Lubricant Capacity

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10.02 Tire Check 64

10. Wheels and Tires

10.01 Wheel Nut Check

IMPORTANT: After a wheel has been installed, the wheel nut torque must be rechecked after 50 to 100 miles (80 to 160 km) of operation.

Check the torque on all wheel nuts. See Table 14,Disc Wheel Fastener Torque for torque specifications, and see Fig. 31,Wheel Nut Tightening Sequence for the wheel nut tightening sequence.

NOTE: Torque values are given for lubricated threads. Apply 2 drops of SAE 30W oil to a point between the nuts and flanges.

NOTICE:

Insufficient wheel nut torque can cause wheel shimmy, resulting in wheel damage, stud breakage, and extreme tire tread wear. Excessive wheel nut torque can break studs, damage threads, and crack discs in the stud hole area. Use the recommended torque values, and follow the tightening sequence shown in Fig. 31,, page 64.

Table 14, Disc Wheel Fastener Torque

Nut Size	Torque: lbf·ft (N·m) Oiled
M22 x 1.5	450–500 (610–678)

Table 14, Disc Wheel Fastener Torque

NOTE: If using specialty fasteners, consult the manufacturer for recommended torque levels.

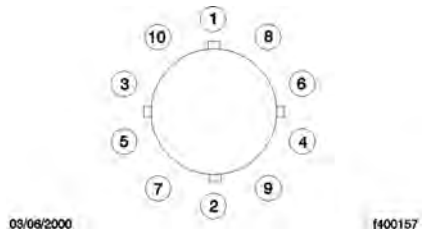


Fig 31, Wheel Nut Tightening Sequence

10.02 Tire Check

Tires should be inspected closely during the first 3000 to 10,000 miles (5000 to 16 000 km) for abnormal wear.

Maintain the proper pressures for carried loads, per the tire manufacturers' recommendations, or the tire pressure label on the driver's door.

Have the wheel alignment checked after the first 10,000 miles (16 000 km), then every 40,000 miles (60 000 km) thereafter.

Do not continue to drive the vehicle if tires develop any of the following:

- blisters;
- cuts or punctures that reach to the cord;
- a nail, screw, rock, or other puncturing object;
- flat spots or irregular wear;
- tread worn to a minimum depth;
- inability to maintain proper tire pressure.

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11.04 Inspection and Lubrication of the Bendix E-6 Foot Control Valve 70
11.05 Replacement of the EAPU (Electronic Air Processing Unit) Air Dryer Desiccant Cartridge 71
11.06 Operating and Leakage Tests of the Bendix Automatic Drain Valve 73

11. Brakes

11.01 Safety Precautions

Safety Precautions in this section apply to all procedures within this group.

DANGER:

When working on the vehicle, shut down the engine or motor, set the parking brake, and chock the tires. Before working under the vehicle, always place jack stands under the frame rails to ensure the vehicle cannot drop. Failure to follow these steps could result in serious personal injury or death.

11.02 Inspection of the Air Brake System Valve

NOTE: There is no scheduled air valve maintenance on vehicles equipped with Bendix air valves and a Bendix air dryer if the air dryer desiccant is replaced at 350,000 miles (563 000 km). If the desiccant is not changed at 350,000 miles (563 000 km), or if the vehicle is equipped with another air dryer, maintenance will have to be performed to the air brake valves. See **Group 42** of the *eM2™ Workshop Manual* for procedures.

IMPORTANT: For vehicles equipped with an oil-coalescing air dryer desiccant cartridge, replace the cartridge once a year, regardless of mileage.

11.03 Inspection of the Brake

11.03.01 Parking Brake Operational Check

CAUTION:

Perform the following check in a clear safe area. If the parking brakes fail to hold the vehicle, personal injury or property damage may result.

IMPORTANT: This procedure should be performed prior to lubrication of the brake components.

1. With the engine running, and air pressure at cut-out pressure, set the parking brake.
2. Put the vehicle in the lowest gear and gently attempt to move it forward. The vehicle should not move. If the vehicle moves, the parking brakes are not operating correctly and must be repaired before the vehicle is returned to service. See **Group 42** of the *eCascadia Workshop Manual*.

11.03.02 Inspection of the Brake Component

Air Disc Brakes

IMPORTANT: The following step to inspect the caliper mounting bolts should only be performed at the initial maintenance (IM) interval.Vehicles may have both **axial and radial** mounted calipers. Follow the instructions based on the type of calipers installed on the vehicle.

Axial Mounted Brakes

IMPORTANT: The following information applies to all types of axial mounted brake applications.

1. Park the vehicle on a level surface, shut down the engine, and set the parking brake. Chock the tires.
2. Raise the vehicle and support it on jack stands.
3. Remove all of the wheel assemblies. See **Group 40** of the *eM2 Workshop Manual* for instructions.

NOTE: In all steps that require a torque wrench, use a Snap On torque wrench ATECH4RS600, or an equivalent, with a center to handle length of 47 inches (119 cm).

4. Set a torque wrench to 350 lbf·ft (475 N·m) and tighten the caliper mounting bolts following the tightening pattern shown in Fig. 32,Axial Bolt Tightening Pattern. If they do not turn, no further work is needed. If they turn, take the vehicle to an authorized Freightliner dealer to have all of the caliper bolts on that wheel end replaced. Due to limited caliper bolt access, it may be necessary to use tool DDC DSNCHA018005 referenced in tool letter 18TL18. If the tool is needed, use tool DDC DSNCHA018005 only and no other tools. See Fig. 33,DDC DSNCHA018005 30mm Air Disc Brake Caliper Brake Bolt Torque Adaptor. If the tool is needed, see Table 15,Torque Check with 47 Inch (119 cm) Torque Wrench and Tool DDC DSNCHA018005 for torque specifications for a 47 in (119 cm) long wrench.



Fig 32, Axial Bolt Tightening Pattern



Fig 33, DDC DSNCHA018005 30mm Air Disc Brake Caliper Brake Bolt Torque Adaptor

Table 15, Torque Check with 47 Inch (119 cm) Torque Wrench and Tool DDC DSNCHA018005

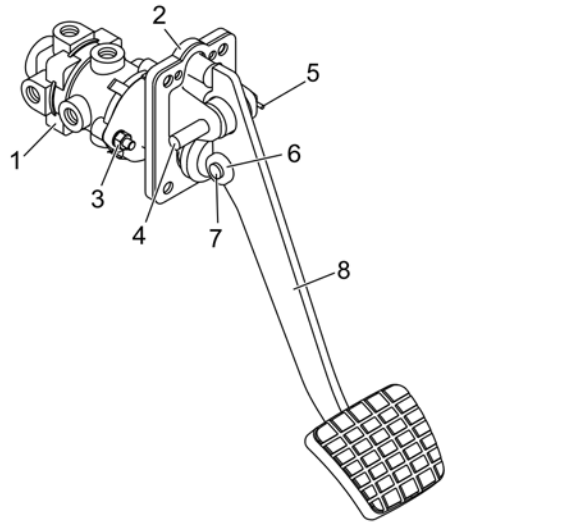
Angle View	Extension Angle (degrees)	Target Torque ~~*~lbf·ft (N·m)]	Tool Setting ~~*~lbf·ft (N·m)]
	0	350 (475)	296 (401)
	45		310 (420)
	60		320 (434)
	90		350 (475)
	120		386 (523)
	135		402 (545)

Table 15, Torque Check with 47 Inch (119 cm) Torque Wrench and Tool DDC DSNCHA018005

5. Install the wheel assemblies. For instructions, see **Group 40** of the *eM2 Workshop Manual*.
6. Remove the jack stands and lower the vehicle.

11.04 Inspection and Lubrication of the Bendix E-6 Foot Control Valve

1. Remove the brake valve from the vehicle. See **Group 42** of the *eM2 Workshop Manual*.
2. Remove the roll pin from the brake pedal pivot pin. See Fig. 34,Brake Pedal and Valve Assembly.



1. E-6 Foot Control Valve
2. Mounting Plate
3. Nut and Washer
4. Pivot Pin
5. Roll Pin
6. Roller
7. Roller Pin
8. Pedal

Fig 34, Brake Pedal and Valve Assembly

3. Remove the brake pedal pivot pin.
4. Remove the brake pedal.
5. Check the brake pedal mounting plate adapter for signs of wear or cracks at the bosses (the area from which the pivot pin was removed). Replace it if necessary.
6. Check the brake pedal rollers for signs of wear or cracks. Replace the rollers as needed.
7. If the rollers are replaced, replace the roller pin, install a new cotter pin, bend it to 90 degrees and apply Torque Seal (OPG F900 White) to the cotter pin.
8. Remove the plunger from the valve. Using alcohol, clean the existing grease from the plunger. Check the plunger for signs of wear or cracks. Replace it if necessary.
9. Lubricate the plunger with barium grease (BW 246671).
10. Insert the plunger in the valve.
11. Install the brake pedal with the pivot pin.
12. Install a new roll pin and apply Torque Seal (OPG F900 White) to the roll pin.
13. Install the brake valve assembly. See **Group 42** of the *eM2 Workshop Manual*.
14. Test the brakes before returning the vehicle to service.

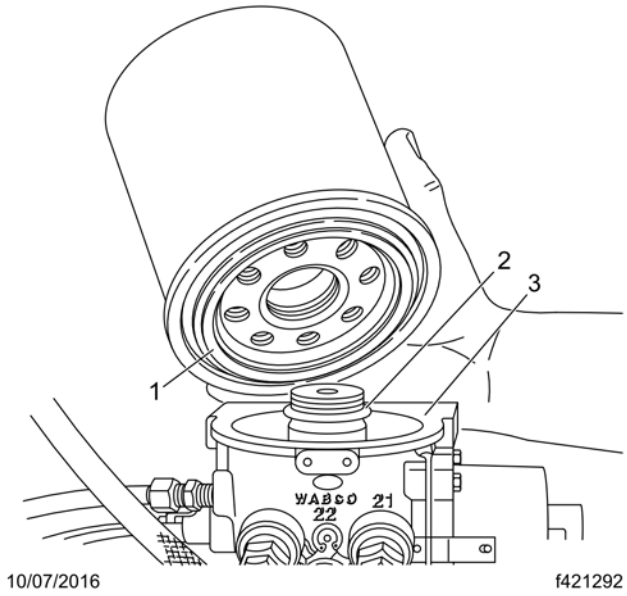
11.05 Replacement of the EAPU (Electronic Air Processing Unit) Air Dryer Desiccant Cartridge

NOTE: The following instructions apply to the 1200, 1200 Plus, and Twin air dryers.

NOTICE:

The EAPU air dryers can use either a standard or oil coalescing desiccant cartridge. When replacing the desiccant cartridge, it is very important to use the same type of cartridge that was originally installed on the dryer. Oil coalescing cartridges can be used in any application, but require more frequent service intervals (every 1 to 2 years instead of every 2 to 3 years for a standard cartridge). Do not replace an oil coalescing cartridge with a standard cartridge, as this may result in contamination and malfunctioning of downstream air system components.

See Fig. 35,Desiccant Cartridge Replacement for cartridge replacement.



1. Seal
2. O-Ring
3. Air Dryer Base

Fig 35, Desiccant Cartridge Replacement

1. Drain the air system.
2. Using a strap wrench, turn the desiccant cartridge counterclockwise and remove it.
3. Remove and discard the O-ring.
4. Clean the top surface of the dryer base with a commercial cleaning solvent.

IMPORTANT: If the air dryer base is damaged, preventing a tight seal, replace the air dryer.

5. Using a multipurpose, high-temperature grease that resists water, steam, and alkali, lightly coat the surfaces of the new O-ring and the dryer base. Install the O-ring.
6. Thread the desiccant cartridge onto the dryer base (turn clockwise). When the seal contacts the base, tighten the cartridge one complete turn more. Do not overtighten.

11.06 Operating and Leakage Tests of the Bendix Automatic Drain Valve

Operating Test

Perform the following test after repairing or replacing the DV-2 valve, to ensure that the valve is functioning properly.

With the system charged, apply the brakes several times. Each time the brakes are applied, an exhaust of air should occur from the exhaust port of the drain valve. If no air comes out, push the wire stem located inside the exhaust port. If no air comes out after pushing the wire stem, there may be a plugged filter in the adapter which should be replaced.

If the drain valve does not function properly, repair or replace it. See **Section 42.14** of the *eM2 Workshop Manual*.

Leakage Test

Perform the following test after repairing or replacing the DV-2 valve, to ensure that the valve is functioning properly.

With the system charged and pressure stabilized in the system, there should be no leaks at the drain valve exhaust port. A constant slight exhaust of air at the drain valve exhaust port could be caused by excessive leakage in the air brake system.

If the drain valve is leaking excessively, repair or replace it. See **Section 42.14** of the *eM2 Workshop Manual*.

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12. Steering

12.01 Safety Precautions

Safety Precautions in this section apply to all procedures within this group.

DANGER:

Electric vehicles are equipped with a high-voltage system. Do not attempt any type of electrical work on the vehicle unless you have completed HV3 Daimler Safety Training. Failure to do so could cause severe personal injury or death.

When working on the vehicle, shut down the engine or motor, set the parking brake, and chock the tires. Before working on the vehicle, always place jack stands under the frame rails to ensure the vehicle cannot drop. For an electric vehicle, decommission the vehicle and verify the high-voltage system is shut down. Failure to follow these steps could result in serious personal injury or death.

12.02 Inspection of the Drag Link

WARNING:

All steering system components are critical for safe operation of the vehicle. Failure to maintain the steering system as specified may result in loss of steering control, which could lead to personal injury and property damage.

1. Park the vehicle on a level surface, shut down the engine, and set the parking brake. Chock the tires.
2. Have someone turn the steering wheel from left to right. Check for movement between the ball stud end and the pitman arm, and between the ball stud end and the steering arm.

   If the ball stud end is loose, replace the drag link.
3. Check the ball stud castle nut for looseness.

   If the castle nut is loose, replace it and the cotter pin. Tighten the new castle nut as follows:

   - 3/4–16: 90 to 180 lbf·ft (122 to 230 N·m)
   - 7/8–14: 160 to 300 lbf·ft (217 to 407 N·m)
4. Inspect the boot of the drag link at both the pitman arm and the steering arm end for cracks, splits, or other damage. Replace the boot if needed.
5. Grasp the drag link near the pitman arm end, then push and pull laterally to check for axial movement in the ball stud end. If it is loose, replace the drag link. See **Group 46** of the *eM2 Workshop Manual* for replacement instructions. If there is 1/8-inch (3-mm) movement or more, do not drive the vehicle until the drag link is replaced.

12.03 Power Steering Fluid and Filter Change

WARNING:
Fill only with approved clean fluid. Failure to use the proper fluid could cause seal deterioration and leaks. Fluid leaks could eventually cause loss of power steering assist. This could lead to an accident resulting in personal injury or property damage. Wear eye protection when changing the fluid and filter.

1. Set the parking brake and chock the rear tires.
2. Raise the front of the vehicle and support it with jack stands.
3. Put the vehicle in neutral.
4. Open the hood.
5. Wipe down the area around the steering gear and related hydraulic lines.
6. Place a drain pan under the steering gear and power steering reservoir.
7. Remove the pressure line and return hose (see Fig. 36,Power Steering Reservoir) from the steering gear and allow the oil to drain.
8. Remove the filter cap from the reservoir, then remove and discard the filter.
   - Filter caps with a separate retaining ring have a threaded connection with the filter. Unscrew the filter and discard it.
   - One-piece filter caps do not have a threaded fit with the filter. Pull off the filter and discard it.
9. Turn the steering wheel from full left to full right three times to purge oil from the gear.
10. Connect the pressure line and return hose to the steering gear.
11. Fill the reservoir with an approved power steering fluid to the line between the MIN COLD and MAX HOT lines. See Fig. 36,Power Steering Reservoir. See Table 16,Approved Power Steering Fluids for approved power steering fluids.



1. Reservoir
2. Filter Cap

Fig 36, Power Steering Reservoir

Table 16, Approved Power Steering Fluids

Fluid Type	Approved Fluid
Automatic Transmission Fluid	Dexron® III
	Super ATF
	TES-389

Table 16, Approved Power Steering Fluids

12. Apply a thin film of power steering fluid on the gasket of the new filter, then attach the filter to the filter cap and install the cap on the reservoir.
    - For filter caps with a separate retaining ring, hand-tighten the filter, then turn it an additional 1/4 turn.
    - For one-piece filter caps, the filter is not threaded.
13. With the engine off, turn the steering wheel from full left to full right three times. Add more power steering fluid as needed.
14. Start the engine and operate the engine at idle. Check that the power steering fluid level is between the MIN COLD and MAX HOT lines. Add more power steering fluid if needed.
15. Turn the steering wheel from full left to full right several times. Add fluid to the reservoir as needed to maintain the fluid level between the MIN COLD and MAX HOT lines.
16. Shut down the engine.
17. Raise the vehicle, remove the jack stands, and lower the vehicle.

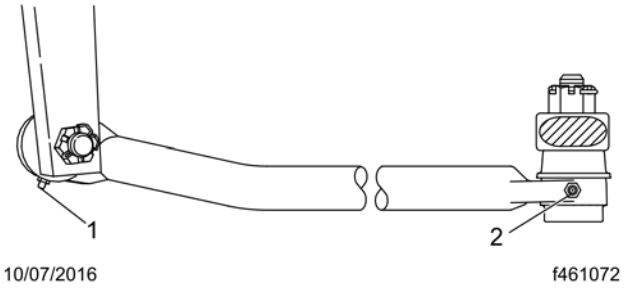
12.04 Lubrication of the Power Steering Gear

NOTICE:
Apply grease to the sector shaft with a hand-type grease gun only. Use of a high-pressure power grease gun will supply grease too quickly and could affect the high pressure seal, contaminating the hydraulic fluid.

Using a hand-type grease gun, apply NLGI Grade 2 or 3 multipurpose chassis grease until it starts to come out past the sector shaft seal.

12.05 Lubrication of the Drag Link

1. Park the vehicle on a level surface, shut down the engine, and set the parking brake. Chock the tires.
2. Using a clean rag, wipe all dirt from the drag link grease fittings. See Fig. 37,Drag Link.



1. Grease Fitting at Pitman Arm
2. Grease Fitting at Axle Steering Arm

Fig 37, Drag Link

3. Using a pressure gun and NLGI Grade 2 (8% 12-hydroxy lithium stearate grease) or NLGI Grade 1 (6% 12-hydroxy lithium stearate grease) chassis grease, apply clean grease at the grease fittings until old grease is forced out of the socket.

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13. Electrical, Instruments, and Controls

13.01 Inspection of the Electrical Component



CAUTION:

The magnetic switch studs have battery voltage. Use care when connecting the battery cables, to avoid injury from electrical shock. Failure to do so could result in personal injury.

1. Park the vehicle on a level surface, shut down the vehicle, and set the parking brake. Chock the tires.
2. Disconnect the batteries.
3. Inspect the condition of the electrical component. Check for signs of excess dirt/debris build up on or around component. If exterior cleaning is needed for a thorough inspection, clean exterior debris from the component using a dry method such as a vacuum cleaner or using an electrical contact cleaner such as CRC QD® Electronic Cleaner.
4. Check all mounting points for loose, broken, or missing parts. Component must be securely mounted. All loose, broken, or missing parts must be repaired to maintain proper component function.
5. Inspect the component protective cover for proper fit and function. Inspect cover for cracks, broken mounting, missing sealing surfaces, warped or bulged surfaces. The cover must prevent moisture and debris from entering the components protected area. Missing, leaking, or damaged covers will result in moisture and debris entering the component and will result in component failure. When it is determined that a cover has not properly prevented moisture and debris from entering the component, the entire component must be replaced.
6. Inspect the component exterior for signs of thermal distortion, warping, bulging, discoloration, amperage related heating, color variance or shading across component which could be a sign of internal failure requiring replacement of the component. The root source causing conditions of high heat, excess amperage, and/or circuit overload component failures must be diagnosed and repaired prior to replacing the component.
7. Inspect component housing sub-assembly clips and fasteners for correct fit and location and that component sub-assembly housing seams are tight and secure. Missing, leaking, or damaged component housings must be replaced.
8. Check main power cable connections for a clean and secure fit. Connections should be free of corrosion, dirt and moisture. Connections should not have signs of thermal distortion, warping, discoloration, high amperage heating or discoloring. If needed, disconnect cables, scrub and clean as needed using a nylon brush. Clean debris with vacuum or electrical contact cleaner such as CRC QD® Electronic Cleaner, inspect terminals and mating contact terminal plating. If the terminal plating exhibits signs of unrecoverable corrosion, the component and terminal will need replaced. Indications of unrecoverable corrosion on terminal plating are:
    - Heavy staining that cannot be cleaned off with nylon brush or contact cleaner;
    - erosion and pitting on terminal plating causing uneven surfaces; or
    - discoloration caused by outer layer of plating being removed by corrosion or wear exposing the under layer material of terminal.
9. Check all electrical connectors for correct fit and that the connector locking tabs are in place and will hold the connector firmly into the component. Inspect connector terminals for signs of corrosion, thermal distortion, warping, discoloration, high amperage heating or discoloring. If needed, remove connectors and terminals, scrub and clean as needed using a nylon brush. Clean debris with vacuum or electrical contact cleaner such as CRC QD® Electronic Cleaner, inspect terminals and mating contact terminal plating. If the terminal plating exhibits signs of unrecoverable corrosion, the component and terminal will need to be replaced.

10. Inspect sealed harness connectors for presence of connector housing seals and connector pin seals designed to keep moisture and debris from entering the connector and component. Missing, leaking, or damaged seals will result in moisture and debris entering the connection and the component and will result in component failure. When it is determined that connector seals have not properly prevented moisture and debris from entering the component, the entire component must be replaced.
11. Inspect component harnesses for secured routing that prevents excess harness movement and prevents the harness from pulling too tight on the connector. Inspect harnesses for signs of rubbing or chafing that could result in wire circuit damage. Damaged wiring and/or damage to harness protective wrap must be repaired and harness must be wrapped and secured to prevent further damage. When possible, harness should be routed with drip loop.
12. Inspect fuses and relays for correct fit, and that the terminals hold the fuses and relays firmly in place. Inspect fuses and relays for signs of corrosion, thermal distortion, warping, discoloration, and high amperage heating or discoloring. If loose or corroded, remove, inspect, clean, and replace as needed.
13. Connect the batteries.

13.02 Testing the Natural Gas Detection System Sensor

Daimler Truck strongly recommends that all operators follow California Code of Regulations (CCR) inspection requirements, regardless of where the vehicle is operated. Per Title 13 CCR § 935 (2), gas detection systems should be tested three times per year at equal intervals. The testing procedure should simulate the same operating environment in which the vehicle is used. Test results validating the performance of the gas detection system within the parameters established by the component manufacturer and NFPA 52 should be maintained as a permanent part of the vehicle service records. Use of alcohol, propane, and other harsh liquids or gases are not acceptable methods of testing.

Test the sensors three times per year, after any system component has been replaced, or if the vehicles was involved in an accident or fire. The gas detection system sensors must be tested regularly by a trained technician using certified test equipment that satisfies CCR § 935 (2) or NFPA 52 regulations (Xintex Methane testing kit model: MTK-20-50 or similar).

Daimler Truck recommends the highest level of safety validation if there are multiple validation requirements in the state or locally where the vehicle is operated or parked.

NOTE: Use only approved test gas cylinders for conducting sensor validation. Although the methane concentration of these cylinders is not at a flammable level, proper safety procedures must be maintained, as with any compressed gas cylinder. Make sure that the shut-off valves are fully closed when not in use. When the system is functioning normally, the control panel should display a green System Normal LED that is turned on, with no system faults.

1. Energize the methane detection system by supplying low-voltage (LV) power to the cab, and allow the system to warm up for one minute. See Fig. 38,Alarm Panel Configuration and Fig. 39,System Normal.

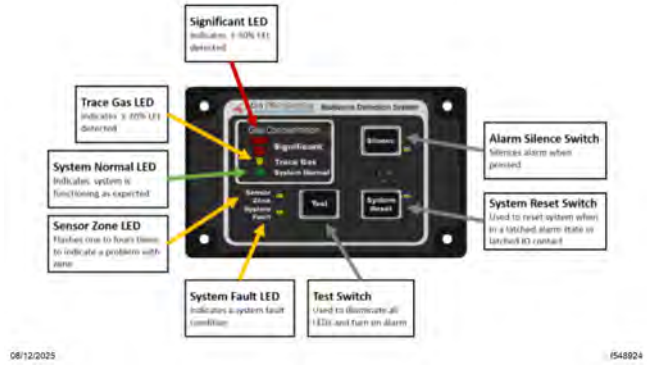


Fig 38, Alarm Panel Configuration



Fig 39, System Normal

2. Press and hold the ‘Test’ button for one minute. The system will perform a self-diagnostic test, which will include the illumination of the ‘Trace Gas’ and ‘Significant’ Gas Concentration lights, as well as the sensor Fault lights. See Fig. 40,Expected Reaction to Depressed Test Button.



Fig 40, Expected Reaction to Depressed Test Button

3. To test for sensor detection, disconnect the sensor harness and observe the control panel for the following changes:
   - Green: System Normal - LED will turn off.
   - Amber: System Fault - LED will turn on.
   - System Reset - LED will turn on.
   - Amber: Sensor Zone - LED will begin to flash, indicating the sensor zone that does not have a sensor connected (e.g., Sensor Zone 1 = one flash, Sensor Zone 2 = two flashes, etc.).

If these indications do not occur within 30 seconds, the system is faulty and must be replaced. See Fig. 41,Expected Reaction to Missing Sensor.



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Fig 41, Expected Reaction to Missing Sensor

4. Reconnect the sensor harness. The control panel should return to the System Normal state

   NOTE: Do not test with 20% LEL gas for more than 30 seconds.

5. Connect the regulator, hose, and adapter to the 20% LEL gas cylinder securely.
6. To test for trace gas detection, open the gas regulator and place the adapter over the sensor, ensuring the sensor is completely covered; observe and record any condition changes on the control panel. See Fig. 42,Fully Covered Gas Sensor and 43,Expected Reaction to Trace Gas Detected.
   - Green: System Normal - LED will turn off.
   - Amber: Trace Gas - LED will begin to flash.
   - System Reset - LED will turn on.
   - Amber: Sensor Zone - LED will flash to indicate the sensor zone that is detecting gas.

   If these indications do not occur within 30 seconds, the sensor is faulty and must be replaced.



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Fig 42, Fully Covered Gas Sensor



Fig 43, Expected Reaction to Trace Gas Detected

7. Remove the test gas and allow the sensor to air out. Once the gas has cleared, the control panel should return to the System Normal state, which may take up to 30 seconds.
8. Connect the regulator, hose, and adapter to the 50% LEL gas cylinder.
9. To test for significant gas detection, open the regulator and place the adapter onto the sensor. Observe and note any condition changes on the control panel. See Fig. 44,Expected Reaction When Latching.
   - Green System Normal LED will turn off.
   - Amber Trace Gas LED will begin to flash.
   - Red Significant LED will turn on.
   - System Reset LED will turn on.
   - Alarm will begin sounding.
   - Amber Sensor Zone LED will flash to indicate which sensor zone is detecting gas.

   If this sequence does not occur within 60 seconds, the sensor is faulty and must be replaced.



Fig 44, Expected Reaction When Latching

10. Remove the test gas and allow the sensor to air out. Once the gas has cleared, the control panel should return to the **System Normal** state, which may take up to 60 seconds.
11. To test for latching functionality, open the regulator and place the adapter onto the sensor. Observe and note any condition changes on the control panel.
    - Green: System Normal - LED will turn off.
    - Amber: Trace Gas - LED will begin to flash.
    - Red: Significant - LED will turn on.
    - System Reset - LED will turn on.
    - Alarm will begin sounding.
    - Amber: Sensor Zone - LED will flash to indicate which sensor zone is detecting gas.

    If this sequence does not occur within 60 seconds, the sensor is faulty and must be replaced.

    NOTE: For testing purposes, the silence switch was used.

12. Once significant gas has been detected, keep the adapter on the sensor for an additional 60 seconds to activate the control panel's latching functionality. Observe and note the condition changes after one minute. See Fig. 45,Expected Reaction When Latching and 46,Latched Configuration After Gas has Cleared.
    - The top red LED will turn on.

    If this does not occur within 60 seconds, the system is faulty and must be replaced.



Fig 45, Expected Reaction When Latching



Fig 46, Latched Configuration After Gas has Cleared

13. Once the gas has cleared, the control panel will remain in the latched state. To return to the System Normal state, press the ‘Reset’ button.
14. Repeat steps 3–13 for all sensor zones. Replace any sensors that fail their tests.

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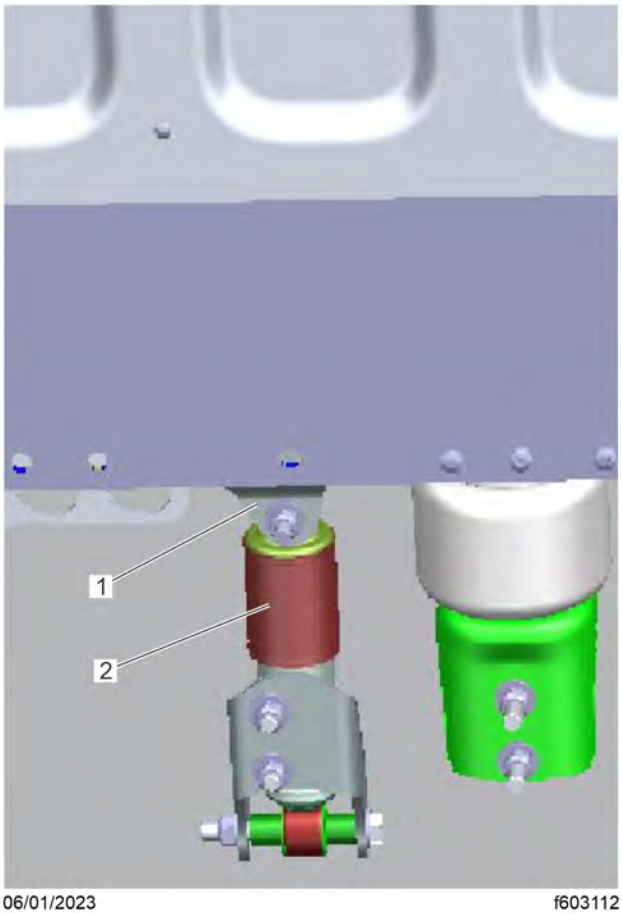
14. Cab

14.01 Mirror Folding Check

For vehicles with folding main mirrors, make sure that the mirrors fold freely on the pivot points. Pivot each mirror fully forward and backward two times to break loose any debris that may affect the fold-away feature of the mirror.

14.02 Cab Shock Absorber Bracket Torque Check

1. Apply the parking brake and chock the tires.
2. Check the torque on the upper bolt that attaches the shock absorber upper bracket to the cab. If loose, tighten the bolt 34 lbf·ft (46 N·m). See Fig. 47,Cab Shock Absorber and Upper Bracket.



1. Upper Bracket
2. Shock Absorber

Fig 47, Cab Shock Absorber and Upper Bracket

3. From behind the cab skin, check the torque of each of the two lower nuts that attach shock absorber upper bracket to the cab, while holding the bolt in place with a box wrench. If loose, tighten the nuts 34 lbf·ft (46 N·m).

14.03 Inspection of the Aerodynamic Component

Inspect aerodynamic components, if equipped, for structural damage, cracks, or wear. These may include:cab side extenders

- rubber trim on bottom of side-impact panels
- roof fairing/deflector
- bumper
- hood

Replace or repair damaged or missing components as needed.

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15. Heater and Air Conditioner

15.01 Safety Precautions

Safety Precautions in this section apply to all procedures within this group.

DANGER:

Electric vehicles are equipped with a high-voltage system. Do not attempt any type of electrical work on the vehicle unless you have completed HV3 Daimler Safety Training. Failure to do so could cause severe personal injury or death.

When working on the vehicle, shut down the engine or motor, set the parking brake, and chock the tires. Before working on the vehicles, always place jack stands under the frame rails to ensure the vehicle cannot drop. For an electric vehicle, decommission the vehicle and verify the high-voltage system is shut down. Failure to follow these steps could result in serious personal injury or death.

15.02 Inspection of the Air Conditioner

DANGER:

Electric vehicles are equipped with a high-voltage system. Do not attempt any type of electrical work on the vehicle unless you have completed HV3 Daimler Safety Training. Failure to do so could cause severe personal injury or death.

WARNING:

Wear eye protection, gloves, and protective clothing when working on the air conditioning system. Leaking refrigerant from a damaged hose or line could cause blindness or serious skin burns.

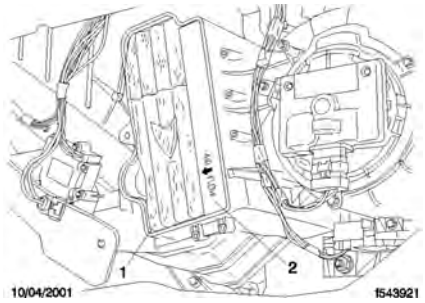
1. Park the vehicle on a level surface, shut down the vehicle, and set the parking brake. Chock the tires.
2. Check the tightness of the compressor mounting fasteners. For instructions and torque values, see **Group 01** of the *eM2™ Workshop Manual*.
3. Check for a buildup of road debris on the condenser fins. For cleaning instructions, see **Group 83** of the *eM2Workshop Manual*.

15.03 Replacement of the Air Filter

The HVAC air filter must be replaced every six months or 60,000 miles (97 000 km) to permit proper operation of the HVAC system.

1. Park the vehicle on a level surface, shut down the vehicle, and set the parking brake. Chock the tires.
2. Remove the lower HVAC cover in the cab. For instructions, see **Group 60** of the *eM2 Workshop Manual*.
3. Disconnect the wiring harness from the evaporator probe.
4. Remove the capscrews that attach the evaporator service cover to the HVAC assembly. Remove the evaporator service cover.
5. Pull the filter out of the HVAC assembly.

6. Install a new filter in the HVAC assembly. Be sure that the arrow on the filter is pointing toward the evaporator. See Fig.48,HVAC Assembly Filter.



1. Evaporator
2. Filter

Fig 48, HVAC Assembly Filter

7. Remove the condensate seal from the evaporator service cover and install a new condensate seal on the cover.
8. Using capscrews, attach the evaporator service cover to the HVAC assembly.
9. Connect the wiring harness to the evaporator probe.
10. Attach the lower HVAC cover to the dash panel. For instructions, see **Group 60** of the *eM2 Workshop Manual*.

CONTACT INFORMATION

For questions, please create a Service Technical Request using the DTTS Application on the DTNA Portal.

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