

# SERVICE MANUAL

**Guardian™ SP.295F / Guardian™ SP.300F**

**Guardian™ SP.345F / Guardian™ SP.400F**

**Tier 4B (final)**

**Sprayer**

*PIN YFYM00001 and above*

**Part number 47691240**

1<sup>st</sup> edition English

February 2015





# **SERVICE MANUAL**

**SP.295F**

**SP.300F**

**SP.345F**

**SP.400F**

# Contents

---

## INTRODUCTION

Engine.....	10
[10.001] Engine and crankcase .....	10.1
[10.114] Pump drives .....	10.2
[10.216] Fuel tanks .....	10.3
[10.206] Fuel filters .....	10.4
[10.202] Air cleaners and lines .....	10.5
[10.500] Selective Catalytic Reduction (SCR) exhaust treatment .....	10.6
[10.400] Engine cooling system .....	10.7
[10.414] Fan and drive .....	10.8
Front axle system .....	25
[25.100] Powered front axle .....	25.1
Hydrostatic drive.....	29
[29.218] Pump and motor components.....	29.1
Brakes and controls .....	33
[33.202] Hydraulic service brakes .....	33.1
Hydraulic systems.....	35
[35.000] Hydraulic systems.....	35.1
[35.300] Reservoir, cooler, and filters.....	35.2
[35.220] Auxiliary hydraulic pump and lines .....	35.3
[35.752] Hydraulic fan drive cooling system.....	35.4
[35.610] Machine leveling control system .....	35.5
Pneumatic system .....	36
[36.100] Pneumatic system.....	36.1
[36.908] Pneumatic suspension .....	36.2
Steering.....	41

**<https://www.ebooklibonline.com>**

Hello dear friend!

Thank you very much for reading.

Enter the link into your browser.

The full manual is available for immediate download.

**<https://www.ebooklibonline.com>**

[41.101] Steering control .....	41.1
[41.216] Cylinders .....	41.2
<b>Wheels .....</b>	<b>44</b>
[44.511] Front wheels.....	44.1
[44.520] Rear wheels .....	44.2
<b>Cab climate control .....</b>	<b>50</b>
[50.100] Heating .....	50.1
[50.104] Ventilation .....	50.2
[50.200] Air conditioning.....	50.3
<b>Electrical systems .....</b>	<b>55</b>
[55.000] Electrical system .....	55.1
[55.100] Harnesses and connectors.....	55.2
[55.015] Engine control system.....	55.3
[55.201] Engine starting system .....	55.4
[55.301] Alternator.....	55.5
[55.302] Battery.....	55.6
[55.640] Electronic modules .....	55.7
[55.050] Heating, Ventilation, and Air-Conditioning (HVAC) control system.....	55.8
[55.047] Steering control system .....	55.9
<b>Spraying .....</b>	<b>78</b>
[78.110] Chemical spraying.....	78.1
[78.111] Spraying pump .....	78.2
[78.120] Foam marking system.....	78.3
<b>Platform, cab, bodywork, and decals .....</b>	<b>90</b>
[90.151] Cab interior.....	90.1
[90.120] Mechanically-adjusted operator seat.....	90.2
[90.100] Engine hood and panels .....	90.3

[90.116] Fenders and guards ..... 90.4



# INTRODUCTION

## Safety rules


### Personal safety





This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible death or injury.

Throughout this manual you will find the signal words DANGER, WARNING, and CAUTION followed by special instructions. These precautions are intended for the personal safety of you and those working with you.

Read and understand all the safety messages in this manual before you operate or service the machine.

 DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.

 WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.

 CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

**FAILURE TO FOLLOW DANGER, WARNING, AND CAUTION MESSAGES COULD RESULT IN DEATH OR SERIOUS INJURY.**

### Machine safety

**NOTICE:** Notice indicates a situation that, if not avoided, could result in machine or property damage.

Throughout this manual you will find the signal word Notice followed by special instructions to prevent machine or property damage. The word Notice is used to address practices not related to personal safety.

### Information

**NOTE:** Note indicates additional information that clarifies steps, procedures, or other information in this manual.

Throughout this manual you will find the word Note followed by additional information about a step, procedure, or other information in the manual. The word Note is not intended to address personal safety or property damage.

---

## Personal safety

### General safety rules

Use caution when operating the machine on slopes. Raised equipment, full tanks and other loads will change the center of gravity of the machine. The machine can tip or roll over when near ditches and embankments or uneven surfaces.

Never permit anyone other than the operator to ride on the machine.

Never operate the machine under the influence of alcohol, drugs, or while otherwise impaired.

Pay attention to overhead power lines and hanging obstacles. High voltage lines may require significant clearance for safety.

Hydraulic oil or diesel fuel leaking under pressure can penetrate the skin, causing serious injury or infection.

- DO NOT use your hand to check for leaks. Use a piece of cardboard or paper.
- Stop engine, remove key and relieve the pressure before connecting or disconnecting fluid lines.
- Make sure all components are in good condition and tighten all connections before starting the engine or pressurizing the system.
- If hydraulic fluid or diesel fuel penetrates the skin, seek medical attention immediately.
- Continuous long term contact with hydraulic fluid may cause skin cancer. Avoid long term contact and wash the skin promptly with soap and water.

Keep clear of moving parts. Loose clothing, jewelry, watches, long hair, and other loose or hanging items can become entangled in moving parts.

Wear protective equipment when appropriate.

DO NOT attempt to remove material from any part of the machine while it is being operated or components are in motion.

Make sure all guards and shields are in good condition and properly installed before operating the machine. Never operate the machine with shields removed. Always close access doors or panels before operating the machine.

Dirty or slippery steps, ladders, walkways, and platforms can cause falls. Make sure these surfaces remain clean and clear of debris.

A person or pet within the operating area of a machine can be struck or crushed by the machine or its equipment. DO NOT allow anyone to enter the work area.

Raised equipment and/or loads can fall unexpectedly and crush persons underneath. Never allow anyone to enter the area underneath raised equipment during operation.

Never operate engine in enclosed spaces as harmful exhaust gases may build up.

Before starting the machine, be sure that all controls are in neutral or park lock position.

Start the engine only from the operator's seat. If the safety start switch is bypassed, the engine can start with the transmission in gear. Do not connect or short across terminals on the starter solenoid. Attach jumper cables as described in the manual. Starting in gear may cause death or serious injury.

Always keep windows, mirrors, all lighting, and Slow Moving Vehicle (SMV) emblem clean to provide the best possible visibility while operating the machine.

Operate controls only when seated in the operator's seat, except for those controls expressly intended for use from other locations.

Before leaving the machine:

1. Park machine on a firm level surface.
2. Put all controls in neutral or park lock position.
3. Engage park brake. Use wheel chocks if required.
4. Lower all hydraulic equipment — Implements, header, etc.
5. Turn off engine and remove key.

When, due to exceptional circumstances, you would decide to keep the engine running after leaving the operator's station, then the following precautions must be followed:

1. Bring the engine to low idle speed.
2. Disengage all drive systems.

3. **⚠ WARNING**

**Some components may continue to run down after disengaging drive systems.  
Make sure all drive systems are fully disengaged.  
Failure to comply could result in death or serious injury.**

W0113A

Shift the transmission into neutral.

4. Apply the parking brake.

**⚠ General maintenance safety ⚠**

Keep area used for servicing the machine clean and dry. Clean up spilled fluids.

Service machine on a firm level surface.

Install guards and shields after servicing the machine.

Close all access doors and install all panels after servicing the machine.

Do not attempt to clean, lubricate, clear obstructions or make adjustments to the machine while it is in motion or while the engine is running.

Always make sure working area is clear of tools, parts, other persons and pets before you start operating the machine.

Unsupported hydraulic cylinders can lose pressure and drop the equipment causing a crushing hazard. Do not leave equipment in a raised position while parked or during service, unless securely supported.

Incorrect towing procedures can cause accidents. Contact your dealer if towing is required.

Stop the engine, remove key and relieve pressure before disconnecting or connecting fluid lines.

Stop the engine and remove key before disconnecting or connecting electrical connections.

Scalding can result from incorrect removal of coolant caps. Cooling system operates under pressure. Hot coolant can spray out if a cap is removed while the system is hot. Allow system to cool before removing cap. When removing a cap turn it slowly to allow pressure to escape before completely removing the cap.

Replace damaged or worn tubes, hoses, electrical wiring, etc.

Engine, transmission, exhaust components, and hydraulic lines may become hot during operation. Take care when servicing such components. Allow surfaces to cool before handling or disconnecting hot components. Wear protective equipment when appropriate.

When welding, remove all electrical monitors from unit to prevent damage. Always disconnect the battery before welding on the machine. Always wash your hands after handling battery components.



# **SERVICE MANUAL**

## **Engine**

**SP.295F**

**SP.300F**

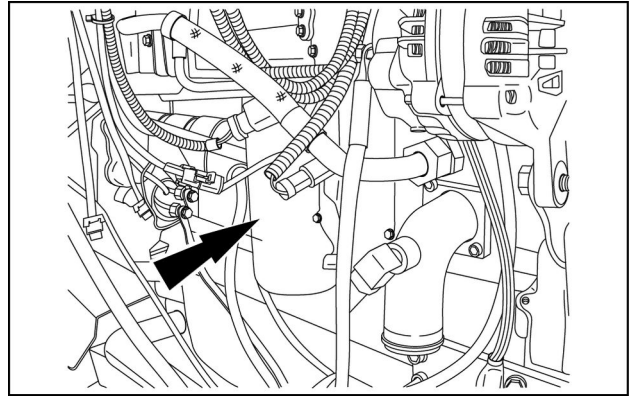
**SP.345F**

**SP.400F**

---

## Engine - Replace - Engine oil and filter

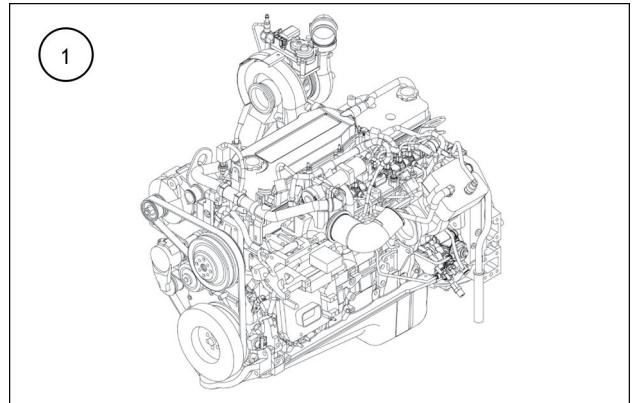
Refer to the Cummins Operation and Maintenance Manual for all engine maintenance procedures and maintenance schedules not covered in this manual. Change the engine oil and filter as described in the Cummins Operation and Maintenance Manual.



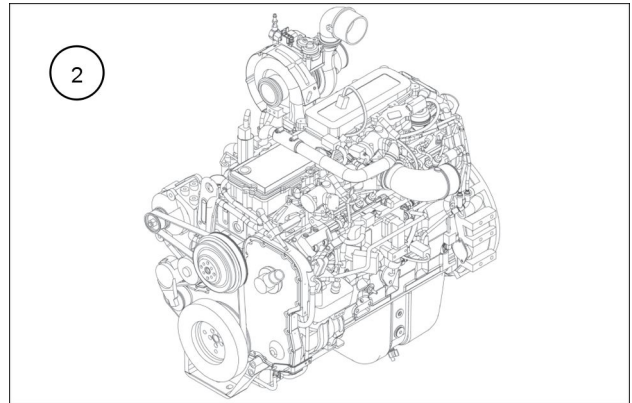
RAIL14SP00872AA 1

## Engine - Remove

1. Two different types of engine are used on Guardian sprayers.  
The sprayer model numbers SP.295F and the SP.300F use the Cummins QSB engine **(1)**.  
The sprayer model numbers SP.345F and SP.400F use the Cummins QSL engine **(2)**.
2. Move the vehicle to a hard level surface
3. Turn the ignition key to the OFF position. Remove the key from the ignition.
4. Allow the engine to cool before proceeding.
5. Access the battery disconnect switch located at the left rear of the vehicle. Turn the switch to the OFF position.



RAIL15SP00248FA 1



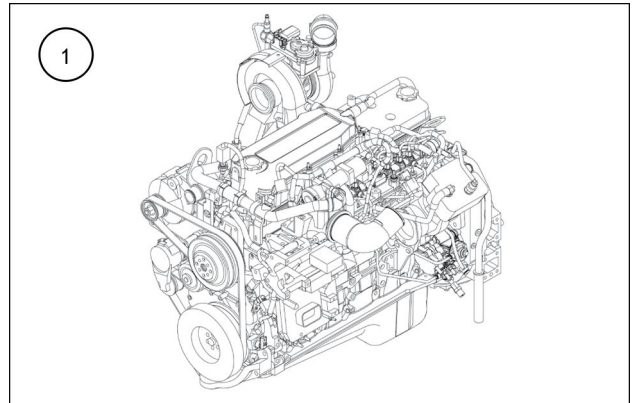
RAIL15SP00249FA 2

6. Drain the hydraulic reservoir. Refer to **Reservoir, cooler, and filters - Remove (35.300)**
7. Drain the engine coolant from the cooling package. Refer to **Engine cooling system - Remove (10.400)**
8. Remove the engine enclosure panels. Refer to **Engine hood and panels - Remove (90.100)**
9. Disconnect and remove the deaeration tank, which is attached to the SCR mounting enclosure.
10. Remove the SCR system and the mounting enclosure. Refer to **Selective Catalytic Reduction (SCR) muffler and catalyst - Remove (10.500)**
11. Remove the air cleaner and the mounting frame. Refer to **Air cleaners and lines - Remove (10.202)**
12. Remove the Auxiliary pump from the hydrostatic tandem pump assembly. Refer to **Auxiliary hydraulic pump - Remove (35.220)**
13. Remove the hydrostatic tandem pump assembly from the engine.  
Refer to **Pump - Remove (29.218)** for QSB engines.  
Refer to **Pump - Remove (29.218)** for QSL engines.
14. Disconnect the fuel line attached to the engine. Plug the fuel line and mark the connection point for reattachment.
15. Disconnect any lines connected to the SCR system from the engine. Plug the lines and mark the connection points for reattachment.

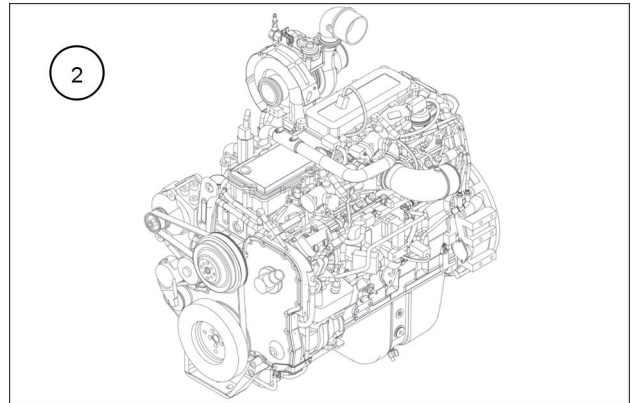
16. Disconnect any hydraulic oil lines attached to the engine. This will include the line connected to the cooling fan motor. Plug the lines and mark the connection points for reattachment.
17. Disconnect any engine coolant lines attached to the engine. Plug the lines and mark the connection points for reattachment.
18. Disconnect any air intake lines attached to the engine. This will include air line attached to the turbocharger, and lines attached to the pneumatic system. Plug the lines and mark the connection points for reattachment.
19. Remove the air conditioner compressor from the engine by removing the mounting bolts. Do not evacuate the air conditioning system. Move the air conditioner compressor, with lines attached, to the side.
20. Disconnect all electrical connections to the engine. This will include ground wires, ECM harness, sensor connections, and system power wires. Tag and mark the wires and connectors for reattachment.
21. Verify that all attachments and connections to the engine have been removed.
22. Attach a suitable lifting device to the engine lift points. Support the engine.
23. Access the engine mounting bolts located on the underside of the engine. Two mounting bolts are located at the right hand side to the engine, and one mounting bolt is located at the left side of the engine.
24. Loosen the bolts but do not remove completely.
25. Lift the engine slightly and verify full support of the engine with the lifting device.
26. Remove the engine mounting bolts from the engine. Lift the engine from its mounting points.

## Engine - Install

1. Two different types of engine are used on Guardian sprayers.  
The sprayer model numbers SP.295F and the SP.300F use the Cummins QSB engine **(1)**.  
The sprayer model numbers SP.345F and SP.400F use the Cummins QSL engine **(2)**.



RAIL15SP00248FA 1



RAIL15SP00249FA 2

2. Attach the engine to a suitable lifting device. Lift the engine onto the vehicle and position the engine at its mounting point on the vehicle frame.
3. Insert the engine mounting blots with flat washers through the engine mounts and into the engine mounting holes. Do not fully tighten the mounting bolts.
4. Ensure that the engine is fully positioned and secure on the engine mounts. Tighten the bolts securely.
5. Remove the lifting device from the engine.
6. Connect all electrical connections to the engine. This will include ground wires, ECM harness, sensor connections, and system power wires.
7. Attach the air conditioner compressor and belt to the engine using the mounting bolts. Position the compressor and ensure belt tightness. Tighten the bolt securely.
8. Connect all air intake lines to the engine. This will include air line attached to the turbocharger, and lines attached to the pneumatic system. Tighten all clamps securely.
9. Connect all engine coolant lines to the engine. Tighten all clamps securely.
10. Connect all hydraulic oil lines attached to the engine. This will include the line connected to the cooling fan motor. Tighten all clamps securely.
11. Connect any lines connected to the SCR system to the engine. Tighten all clamps securely.

12. Connect the fuel line attached to the engine. Tighten all clamps securely.
13. Attach the hydrostatic tandem pump assembly to the engine.  
Refer to **Pump - Install (29.218)** for QSB engines.  
Refer to **Pump - Install (29.218)** for QSL engines.
14. Attach the auxiliary pump to the hydrostatic tandem pump assembly. Refer to **Auxiliary hydraulic pump - Install (35.220)**
15. Install the air cleaner and the mounting frame. Refer to **Air cleaners and lines - Install (10.202)**
16. Install the SCR system and the mounting enclosure. Refer to **Selective Catalytic Reduction (SCR) muffler and catalyst - Install (10.500)**
17. Attach the deaeration tank to the SCR mounting enclosure. Connect any coolant lines to the engine.
18. Attach the engine enclosure panels to the engine enclosure frame. Refer to **Engine hood and panels - Install (90.100)**
19. Fill the cooling system with proper coolant to the proper level.
20. Fill the hydraulic reservoir with proper hydraulic oil and to the proper level.
21. Inspect and ensure that all connections to the engine are made and secure.
22. Turn the battery disconnect switch to the ON position.
23. Ensure that the fuel tank, and that the Diesel Exhaust Fluid (DEF) tank are filled to the proper levels
24. Start the vehicle engine and inspect for any leaks or loose connections. Ensure proper operation of the engine and all connected components.

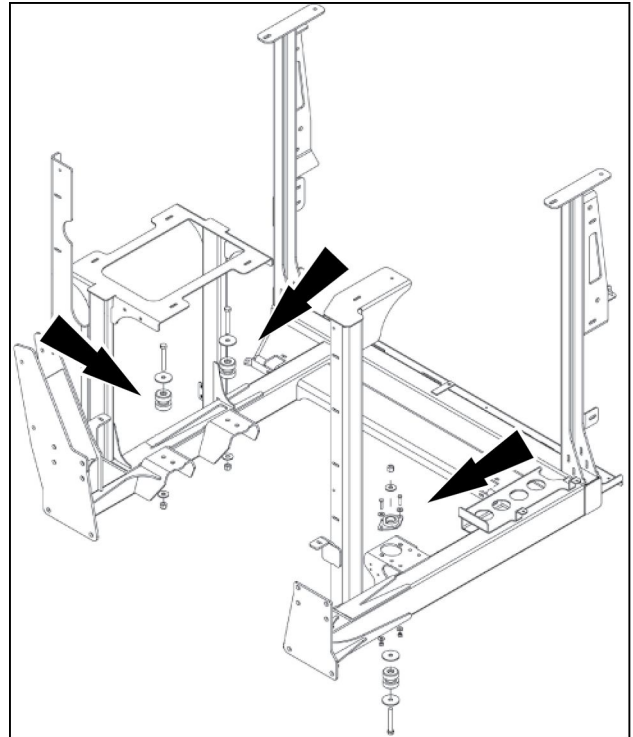
## Engine support and mounts - Remove - Engine mounts

### Prior operation:

Remove compartment engine panels and doors. Refer to **Engine hood and panels - Remove (90.100)**

**NOTE:** The applicable end of engine should be lifted slightly to remove/install some hardware in the following procedures.

1. Secure engine to suitable lifting device. Lift engine slightly to enable removal of the front engine mounts as follows.
2. There are three mounting points for the engine.



RAIL14SP01913AA 1

### 3. **⚠ WARNING**

#### Heavy objects!

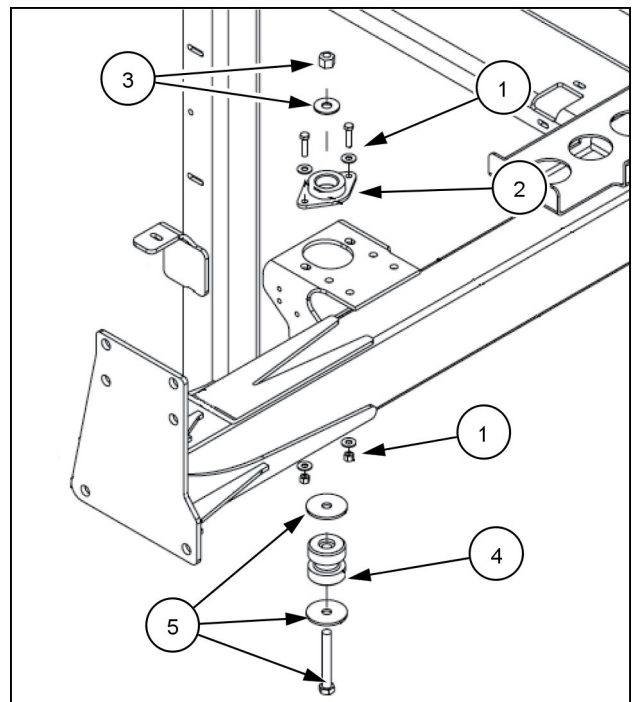
Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders.

Failure to comply could result in death or serious injury.

W0398A

Remove hex bolts, washers, and nuts (1) attaching the motor mount (2) to the frame.

4. Remove the nut and washer (3) attaching the motor mount (4) to the frame.
5. Remove the motor mount from the frame by removing the hex bolt and snubbing washers (5).
6. Secure engine to suitable lifting device. Lift engine slightly to enable removal of the rear engine mounts as follows.



RAIL14SP01914AA 2

**NOTE:** There are two rear engine mounts, both configured the same.



**Suggest:**

**If the above button click is invalid.**

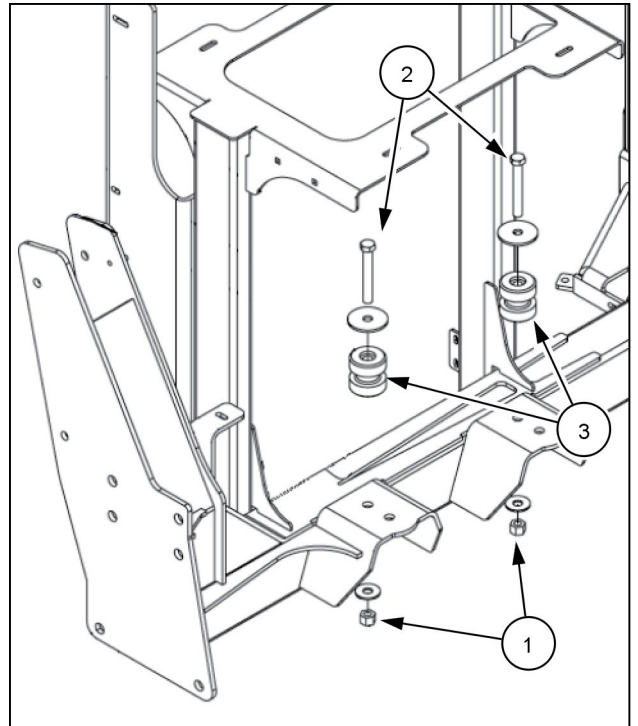
**Please download this document**

**first, and then click the above link**

**to download the complete manual.**

**Thank you so much for reading**

7. Remove nuts and washers **(1)**, and the hex bolts and washers **(2)** attaching the motor mount **(3)** to the frame. Remove the motor mounts from the vehicle.



RAIL14SP01915AA 3

**<https://www.ebooklibonline.com>**

Hello dear friend!

Thank you very much for reading.

Enter the link into your browser.

The full manual is available for immediate download.

**<https://www.ebooklibonline.com>**