

Recreation Vehicle Industry Association

Recreation Vehicle RV Pre-delivery Inspection

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RV Pre-delivery Inspection - 4th edition

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Chapter

2-1 Introduction to Pre-delivery Inspection

- Define scope of a pre-delivery inspection (inspection and documentation).
- Review the information on a Pre-delivery Inspection Sheet.
- Review the information on a Customer Acceptance Sheet.
- Record and report defects.

2-1.1 Introduction

This book is designed to acquaint students with recommended procedures that should be followed or adapted to complete the pre-delivery inspection that should be conducted on all new and used RVs. These procedures have been compiled from a variety of original equipment manufacturer (OEM) guidelines, checklists, and industry standards. The technician should adapt these procedures to the type of RV being inspected, the requirements of the OEM, and local operating procedures. Unless otherwise noted, the procedures contained herein are generic. However, they are technically sound and industry-acceptable procedures. The pre-delivery inspection should be conducted and all deficiencies corrected prior to the customer walk-through and issuance of the keys to the new owner.

Pre-delivery constitutes a vital facet of the retail sale of a recreation vehicle. A thorough pre-delivery inspection can ensure owner satisfaction by precluding or minimizing problems, thus enhancing the reputation of the dealer and manufacturer. Because of in-transit conditions, prolonged storage, and other unforeseen factors, it is impractical for any manufacturer to completely condition a new vehicle before it is delivered to the dealer. Used RVs should be thoroughly inspected and repaired prior to resale.

This pre-delivery inspection textbook has been prepared to facilitate and improve pre-delivery inspection procedures. This textbook describes the tests and inspections that should be performed and, in some cases, explains how to perform them. In other cases, the required information to perform a test or procedure will be contained in OEM guidance, supplier service and installation manuals, or training documentation.

Who should conduct the pre-delivery inspection is a matter of much discussion within the industry. A certified technician should perform the pre-delivery tests, inspections, and adjustments described herein. The Pre-delivery Inspection Checklist—included in every new vehicle received by the dealership—should be completed by the technician when conducting the pre-delivery inspection. A locally developed form should be used for the pre-delivery inspection on all used RVs. A Pre-delivery Inspection Checklist must be completed and returned to the manufacturer for each new vehicle sold. In cases where the Pre-delivery Inspection Checklist does not provide sufficient space, the technician should use standard repair order forms or other appropriate record-keeping forms to record the recommended information to be noted. A copy of these forms should then be attached to the checklist. Ensure that all attached forms contain the serial numbers and other technical data itemized on the primary checklist form. It is also recommended that the dealership retain a complete copy of all documentation pertaining to conducting of the pre-delivery inspection and actions taken as a result of the inspection for both new and used RVs.

Some dealerships also have the technician fill out the warranty registration forms during the pre-delivery inspection since model numbers, serial numbers, and like data are being recorded as part of the inspection, anyway.

2-1.2 Pre-delivery Inspection Checklists

The following is a detailed form that can be used or adapted for completing a pre-delivery inspection (see Figure 2-1 and Figure 2-2). This form contains information for the full spectrum of RVs being manufactured. It

2-1 Introduction to Pre-delivery Inspection

is recommended that categories that do not pertain to a specific RV be notated with an "N/A" for *not applicable*. Leaving entries blank could give the impression of an oversight.

1. Type or print the unit's serial number.
2. Type or print the model name.
3. Type or print the model year.
4. Type or print the unit's length.
5. If pre-delivering a motorized unit, type or print the name of the chassis manufacturer.
6. If pre-delivering a motorized unit, type or print the unit's chassis serial number.
7. The technician should initial each individual test as it is completed.
8. Record the component specifications clearly, as requested in the manual.
9. Record the results of all tests conducted including the name of the test, the results of the test, the time duration of the test, any corrective action taken, and any other pertinent information. See sample notation below.
10. When pre-delivery is finished, the technician who performed the tests and inspections should sign and date the checklist.
11. At the time of owner delivery, the dealer or dealer representative should sign and date the checklist.

The following sample is provided as a guide for notating the type of information that should be recorded during the pre-delivery inspection.

TEST: Timed Pressure Drop Test

DATE: June 2, 2010

TEST METHOD: Manometer affixed to a range burner orifice

TIME TEST STARTED: 10:50 a.m. CST

PROCEDURES: Followed procedures outlined in Chapter 4, *RV Propane Systems* textbook.

RESULTS: Pressure dropped to 7 in. water column (WC) within 1 min. Conducted a leak test. Discovered a loose propane connection at the regulator. Tightened the connection. Reconducted the timed pressure drop test. Pressure held at 7-3/4 in. WC for 3 min (11:01-11:04 a.m. CST). Disconnected manometer. Replaced range burner.

TIME TEST ENDED: 11:07 a.m. CST

Sign (Not Initial) Here

Figure 2-1 Pre-delivery Inspection Checklist Page 1 Example

PRE-DELIVERY INSPECTION CHECKLIST

MANUFACTURER _____	DATE OF MANUFACTURE _____
VEHICLE SERIAL NUMBER _____	CHASSIS NUMBER _____
BRAND/MODEL/COLOR _____	YEAR _____ LENGTH _____

CUSTOMER NAME (LAST, FIRST, MIDDLE) _____	RETAIL DELIVERY DATE/MILEAGE _____
---	------------------------------------

ADDRESS _____	CITY, STATE, ZIP _____	TELEPHONE _____
---------------	------------------------	-----------------

PROPANE SYSTEM <input type="checkbox"/> CONTAINER(S) PURGED AND FILLED <input type="checkbox"/> UN1075 DECAL APPLIED <input type="checkbox"/> CYLINDER DATE(S) _____ <input type="checkbox"/> CONTAINER(S) CONDITION OK <input type="checkbox"/> CONTAINER(S) SECURED AND VENTED <input type="checkbox"/> HOSE CONDITION OK <input type="checkbox"/> PIPING AND TUBING OK <input type="checkbox"/> SIGHT GAUGE OK <input type="checkbox"/> REGULATOR <input type="checkbox"/> SECURELY MOUNTED & COVERED <input type="checkbox"/> PROPER VENT POSITION <input type="checkbox"/> OPERATING PRESSURE TEST ____ W.C. <input type="checkbox"/> LOCK-UP PRESSURE TEST ____ W.C. START TIME ____ STOP TIME ____ <input type="checkbox"/> TIMED PRESSURE DROP TEST ____ W.C. START TIME ____ STOP TIME ____ 120 VAC ELECTRICAL <input type="checkbox"/> SHORE CABLE CONDITION OK <input type="checkbox"/> HOT SKIN TEST OK <input type="checkbox"/> CIRCUIT BREAKERS OPERATIONAL <input type="checkbox"/> INTERIOR RECEPTACLE(S) POLARITY OK <input type="checkbox"/> EXTERIOR RECEPTACLE(S) POLARITY OK <input type="checkbox"/> GFCI RECEPTACLE(S)/CIRCUIT(S) OK <input type="checkbox"/> INTERIOR LIGHTS/FANS <input type="checkbox"/> CONVERTER OPERATION OK <input type="checkbox"/> REFRIGERATOR (120 VAC OPERATION) <input type="checkbox"/> MICROWAVE OPERATES <input type="checkbox"/> FRONT TELEVISION OPERATION OK <input type="checkbox"/> REAR TELEVISION OPERATION OK <input type="checkbox"/> STEREO/HOME THEATER OPERATION OK <input type="checkbox"/> OTHER ELECTRICAL APPLIANCES _____ OK _____ OK _____ OK FRESH WATER SYSTEM <input type="checkbox"/> GRAVITY/CITY FILL OK <input type="checkbox"/> FULL WATER TANK OK <input type="checkbox"/> WATER PUMP FUNCTIONS OK <input type="checkbox"/> CITY WATER CONNECTION OK <input type="checkbox"/> SYSTEM FUNCTIONS ON PUMP AND CITY HOOK-UP <input type="checkbox"/> TOILET FUNCTIONS OK <input type="checkbox"/> ALL FAUCETS FUNCTION OK <input type="checkbox"/> OUTSIDE SHOWER FUNCTIONS OK <input type="checkbox"/> COMPLETE WATER SYSTEM LEAK TEST OK <input type="checkbox"/> WATER FILTER OK <input type="checkbox"/> ACCUMULATOR TANK OK <input type="checkbox"/> ICEMAKER LINES & VALVES OK <input type="checkbox"/> WASHING MACHINE LINES OK <input type="checkbox"/> ALL LOW POINT DRAINS OK <input type="checkbox"/> WINTERIZED (WHERE APPLICABLE) WASTE WATER SYSTEM <input type="checkbox"/> FLOOD TEST ALL FIXTURES <input type="checkbox"/> FLOW TEST ALL FIXTURES <input type="checkbox"/> ALL DRAINS FUNCTION OK <input type="checkbox"/> ALL ACCESSIBLE FITTINGS OK <input type="checkbox"/> FLOOD TEST BLACK TANK <input type="checkbox"/> FLOOD TEST GRAY TANK <input type="checkbox"/> HOLDING TANKS CHECKED <input type="checkbox"/> TERMINATION VALVES FUNCTION OK	12 VDC ELECTRICAL <input type="checkbox"/> BATTERY <input type="checkbox"/> SECURED AND VENTED <input type="checkbox"/> ELECTROLYTE LEVEL OK <input type="checkbox"/> TEMP. COMPENSATED HYDROMETER <input type="checkbox"/> READING(S) OK - ALL BATTERIES <input type="checkbox"/> TERMINAL CONNECTIONS OK <input type="checkbox"/> CONVERTER OUTPUT <input type="checkbox"/> UNLOADED FUSE OUTPUT ____ VDC <input type="checkbox"/> LOADED FUSE OUTPUT ____ VDC <input type="checkbox"/> BATTERY CHARGE OUTPUT ____ VDC <input type="checkbox"/> SOLAR PANEL CHARGE OK <input type="checkbox"/> INTERIOR LIGHTS OK <input type="checkbox"/> RUNNING/MARKER LIGHTS OK <input type="checkbox"/> STOP LIGHTS OK <input type="checkbox"/> RIGHT/LEFT TURN SIGNALS OK <input type="checkbox"/> BACKUP LIGHTS OK <input type="checkbox"/> PORCH/SECURITY LIGHTS OK <input type="checkbox"/> RANGE HOOD FAN & LIGHT OK <input type="checkbox"/> VENT FANS (ALL FUNCTIONS) OK <input type="checkbox"/> REFRIGERATOR (12 VDC OPERATION) <input type="checkbox"/> MONITOR PANEL <input type="checkbox"/> BLACK WATER TANK(S) OK <input type="checkbox"/> GRAY WATER TANK(S) OK <input type="checkbox"/> FRESH WATER TANK OK <input type="checkbox"/> PROPANE OK <input type="checkbox"/> BATTERY CONDITION OK <input type="checkbox"/> OTHER OPTIONS _____ OK _____ OK <input type="checkbox"/> INVERTER OUTPUT VOLTAGE <input type="checkbox"/> UNLOADED ____ VAC LOADED ____ VAC FURNACE(S) <input type="checkbox"/> FURNACE - 1 <input type="checkbox"/> MAKE & MODEL _____ <input type="checkbox"/> SERIAL _____ <input type="checkbox"/> FURNACE CYCLE OK <input type="checkbox"/> DUCTING AIR FLOW OK <input type="checkbox"/> RETURN AIR FLOW OK <input type="checkbox"/> EXHAUST/INTAKE VENT OK <input type="checkbox"/> FURNACE - 2 <input type="checkbox"/> MAKE & MODEL _____ <input type="checkbox"/> SERIAL _____ <input type="checkbox"/> FURNACE CYCLE OK <input type="checkbox"/> DUCTING AIR FLOW OK <input type="checkbox"/> RETURN AIR FLOW OK <input type="checkbox"/> EXHAUST/INTAKE VENT OK FIRE, LIFE & SAFETY <input type="checkbox"/> FIRE EXTINGUISHER(S) OK <input type="checkbox"/> DATE CODE OK <input type="checkbox"/> CO DETECTOR OK <input type="checkbox"/> PROPANE DETECTOR OK <input type="checkbox"/> SMOKE DETECTOR(S) OK <input type="checkbox"/> DATE CODE OK <input type="checkbox"/> EXIT WINDOWS/HATCHES/PANEL(S) OK <input type="checkbox"/> SEAT BELTS OK <input type="checkbox"/> APPLICABLE MARKINGS, LABELS <input type="checkbox"/> APPLICABLE GOVERNMENTAL INSPECTIONS	WATER HEATER <input type="checkbox"/> MAKE & MODEL _____ <input type="checkbox"/> SERIAL _____ <input type="checkbox"/> WATER HEATER PROPANE CYCLE OK <input type="checkbox"/> WATER HEATER 120 VAC CYCLE OK <input type="checkbox"/> VERIFY COMBUSTION PAN SEALS OK <input type="checkbox"/> T&P VALVE OK <input type="checkbox"/> TEMP. AT CLOSEST FAUCET <input type="checkbox"/> PROPANE ____ DEG. 120VAC ____ DEG. <input type="checkbox"/> MOTOR-AID CONNECTIONS OK OVEN/RANGE <input type="checkbox"/> MAKE & MODEL _____ <input type="checkbox"/> SERIAL _____ <input type="checkbox"/> OVEN CYCLE OK <input type="checkbox"/> OVEN THERMOSTAT/TEMPERATURE OK <input type="checkbox"/> OVEN DOOR GASKET OK <input type="checkbox"/> ALL TOP BURNERS LIGHT <input type="checkbox"/> IGNITION SYSTEM OK <input type="checkbox"/> PORTABLE COOKTOPS/BBQ GRILLS OK <input type="checkbox"/> QUICK DISCONNECTS OK REFRIGERATORS <input type="checkbox"/> MAKE & MODEL _____ <input type="checkbox"/> SERIAL _____ <input type="checkbox"/> PROPANE CYCLE OK TEMP. ____ <input type="checkbox"/> 120 VAC CYCLE OK TEMP. ____ <input type="checkbox"/> 12 VDC HEATING FUNCTION OK <input type="checkbox"/> DOOR(S) GASKET(S) OK <input type="checkbox"/> COMPARTMENT SEALED TO INTERIOR <input type="checkbox"/> VERIFY PROPER VENTING <input type="checkbox"/> ICEMAKER MAKES ICE AIR CONDITIONER(S) <input type="checkbox"/> AIR CONDITIONER - FRONT <input type="checkbox"/> MAKE & MODEL _____ <input type="checkbox"/> SERIAL _____ <input type="checkbox"/> VERIFY INSTALLATION CORRECT <input type="checkbox"/> THERMOSTAT OPERATION OK <input type="checkbox"/> HEAT MODE OK <input type="checkbox"/> TEMPERATURE IN ____ OUT ____ <input type="checkbox"/> AIR CONDITIONER - REAR <input type="checkbox"/> MAKE & MODEL _____ <input type="checkbox"/> SERIAL _____ <input type="checkbox"/> VERIFY INSTALLATION CORRECT <input type="checkbox"/> THERMOSTAT OPERATION OK <input type="checkbox"/> HEAT MODE OK <input type="checkbox"/> TEMPERATURE IN ____ OUT ____ INTERIOR <input type="checkbox"/> ALL OWNERS MANUALS/WARRANTY/SERVICE & MAINTENANCE INFORMATION <input type="checkbox"/> FLOOR COVERING OK <input type="checkbox"/> TABLES/COUNTER TOPS/SINK LIDS OK <input type="checkbox"/> CURTAINS/DRAPE/BLINDS OK <input type="checkbox"/> ALL DOORS/DRAWERS OK <input type="checkbox"/> ALL WINDOWS/SCREENS OK <input type="checkbox"/> EXIT WINDOWS/HATCHES OK <input type="checkbox"/> ALL VENTS OK <input type="checkbox"/> LOUNGES/BEDS/DINETTES/CHAIRS <input type="checkbox"/> UPHOLSTERY OK <input type="checkbox"/> OPERATION OK <input type="checkbox"/> WALL/CEILING PANELS & TRIM OK <input type="checkbox"/> TUB/SHOWER SURROUNDS OK <input type="checkbox"/> GENERAL APPEARANCE/CLEANLINESS OK
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ORIGINAL - RETURN TO MANUFACTURER

YELLOW - DEALER COPY

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Figure 2-2 Pre-delivery Inspection Checklist Page 2 Example

PRE-DELIVERY INSPECTION CHECKLIST CONTINUED		
MANUFACTURER		BRAND/MODEL/COLOR
VEHICLE SERIAL NUMBER		
CUSTOMER NAME (LAST, FIRST, MIDDLE)		
EXPANDABLE ROOM(S)/SLIDE-OUT(S)	TOWABLES	MOTOR HOMES
<input type="checkbox"/> MECHANICAL OPERATION OK <input type="checkbox"/> ALIGNMENT FRONT TO REAR OK <input type="checkbox"/> ALIGNMENT TOP TO BOTTOM OK <input type="checkbox"/> SWITCH OPERATION OK <input type="checkbox"/> EXTENDED SEAL(S)/SWEEPS OK <input type="checkbox"/> RETRACTED SEAL(S)/SWEEPS OK <input type="checkbox"/> EXPANDABLE ROOM AWNING(S) OK <input type="checkbox"/> 120 VAC WIRING/CONNECTIONS OK <input type="checkbox"/> 12 VDC WIRING/CONNECTIONS OK <input type="checkbox"/> PROPANE PIPING OK <input type="checkbox"/> FRESH WATER PLUMBING OK <input type="checkbox"/> WASTE WATER PLUMBING OK <input type="checkbox"/> WINDOWS OK <input type="checkbox"/> OVERALL EXTERIOR APPEARANCE OK <input type="checkbox"/> OVERALL INTERIOR APPEARANCE OK <input type="checkbox"/> ROOF INSPECTION OK <input type="checkbox"/> TRAVEL BAR/LOCKS OK	<input type="checkbox"/> HITCH AND COUPLER/PIN BOX OK <input type="checkbox"/> BOLTS TIGHT <input type="checkbox"/> SAFETY CHAIN(S) OK <input type="checkbox"/> TONGUE JACK/LANDING GEAR OK <input type="checkbox"/> STABILIZING JACKS OK <input type="checkbox"/> HUB BEARING(S) LUBRICATED <input type="checkbox"/> BRAKES ADJUSTED <input type="checkbox"/> WHEEL SPIN LOCKUP <input type="checkbox"/> BRAKE FUNCTION OK <input type="checkbox"/> % SHOES REMAINING <input type="checkbox"/> BRAKE AMPERAGE <input type="checkbox"/> BREAK-AWAY SWITCH OK <input type="checkbox"/> HYDRAULIC BRAKE ACTUATOR OK <input type="checkbox"/> TIRE CONDITION OK <input type="checkbox"/> TIRE AIR PRESSURE OK <input type="checkbox"/> TIRE DATE CODE OK <input type="checkbox"/> LUG NUTS TORQUED ____ FT/LB <input type="checkbox"/> SPARE TIRE OK <input type="checkbox"/> SPRING SUSPENSION OK <input type="checkbox"/> SHACKLES/BOLTS/BUSHINGS OK <input type="checkbox"/> U-BOLTS <input type="checkbox"/> SPRINGS <input type="checkbox"/> SHOCKS <input type="checkbox"/> OTHER SUSPENSION OK <input type="checkbox"/> SKID PLATE/WHEELS OK <input type="checkbox"/> UNDERSIDE VISUAL INSPECTION OK	<input type="checkbox"/> DRIVER CONTROLS <input type="checkbox"/> INSTRUMENTS & GAUGES OK <input type="checkbox"/> FUEL LEVEL(S) ____ <input type="checkbox"/> HORN OK <input type="checkbox"/> RADIO/STEREO OK <input type="checkbox"/> POWER/SPEAKER SELECTION OK <input type="checkbox"/> WASHER/WIPERS OK <input type="checkbox"/> PARKING BRAKE OK <input type="checkbox"/> SEAT ADJUSTMENTS OK <input type="checkbox"/> DASH A/C OK <input type="checkbox"/> DASH HEATER/DEFROST OK <input type="checkbox"/> BACKUP MONITOR OK <input type="checkbox"/> BACKUP ALARM OK <input type="checkbox"/> REAR/SIDE VIEW MIRRORS OK <input type="checkbox"/> SUNVISORS OK <input type="checkbox"/> DOCKING/FOG LIGHTS OK <input type="checkbox"/> SPOT LIGHTS OK <input type="checkbox"/> TIRE CONDITION OK <input type="checkbox"/> TIRE AIR PRESSURE OK <input type="checkbox"/> LUG NUTS TORQUED ____ FT/LB <input type="checkbox"/> SPARE TIRE OK <input type="checkbox"/> HEADLIGHTS ADJUSTED <input type="checkbox"/> ENGINE COMPARTMENT <input type="checkbox"/> ENGINE OIL OK <input type="checkbox"/> COOLANT FLUID OK <input type="checkbox"/> ____ DEG. ANTIFREEZE <input type="checkbox"/> WINDSHIELD WASHER FLUID OK <input type="checkbox"/> POWER STEERING FLUID OK <input type="checkbox"/> BRAKE FLUID OK <input type="checkbox"/> TRANSMISSION FLUID OK <input type="checkbox"/> DRIVE BELTS OK <input type="checkbox"/> CHASSIS BATTERY <input type="checkbox"/> SECURED AND VENTED <input type="checkbox"/> ELECTROLYTE LEVEL OK <input type="checkbox"/> TEMP. COMPENSATED HYDROMETER <input type="checkbox"/> READING(S) OK - ALL BATTERIES <input type="checkbox"/> TERMINAL CONNECTIONS OK <input type="checkbox"/> ALTERNATOR OUTPUT ____ VDC <input type="checkbox"/> BATTERY ISOLATOR/SOLENOID OK <input type="checkbox"/> ____ VDC TO HOUSE BATTERY <input type="checkbox"/> EXHAUST <input type="checkbox"/> CONDITION OK <input type="checkbox"/> TERMINATION OK <input type="checkbox"/> LEVELING SYSTEM(S) <input type="checkbox"/> FLUID LEVEL OK <input type="checkbox"/> OPERATION OK <input type="checkbox"/> LEVEL SENSOR ACCURATE <input type="checkbox"/> CHECK FOR HYDRAULIC LEAK <input type="checkbox"/> AIR SUSPENSION OK <input type="checkbox"/> ROAD TEST <input type="checkbox"/> CRUISE CONTROL OK <input type="checkbox"/> STEERING/BRAKES OK <input type="checkbox"/> INTERIOR COMPONENTS SECURE <input type="checkbox"/> INSTRUMENTS & GAUGES OK <input type="checkbox"/> TRANSMISSION FLUID (WARM) OK
GENERATORS	FOLDING CAMPING TRAILERS	
<input type="checkbox"/> MAKE & MODEL ____ <input type="checkbox"/> SERIAL ____ <input type="checkbox"/> MECHANICAL OPERATION OK <input type="checkbox"/> OIL OK <input type="checkbox"/> COOLANT OK <input type="checkbox"/> OIL/AIR/FUEL FILTERS OK <input type="checkbox"/> OUTPUT <input type="checkbox"/> ____ VAC ____ HERTZ - NO LOAD <input type="checkbox"/> ____ VAC ____ HERTZ ____ LOAD <input type="checkbox"/> REMOTE START/GAUGES OK <input type="checkbox"/> INSTALLATION <input type="checkbox"/> SEALED COMPARTMENT <input type="checkbox"/> CLEARANCES <input type="checkbox"/> ELECTRICAL CONNECTIONS/ROUTING <input type="checkbox"/> FUEL CONNECTIONS <input type="checkbox"/> AIR INTAKE/DISCHARGE (VENTING) <input type="checkbox"/> EXHAUST CONDITION/TERMINATION	<input type="checkbox"/> LIFT MECHANISMS OK <input type="checkbox"/> LIFT SUPPORT MECHANISMS OK <input type="checkbox"/> BED SLIDE MECHANISMS OK <input type="checkbox"/> BED SUPPORT MECHANISMS OK <input type="checkbox"/> CANVASS/VINYL <input type="checkbox"/> ZIPPERS OK <input type="checkbox"/> WINDOW FLAPS OK <input type="checkbox"/> WINDOW EXIT PANEL(S) OK <input type="checkbox"/> DOOR ATTACHMENT OK <input type="checkbox"/> CEILING POWER SAFETY SWITCH OK <input type="checkbox"/> FOLDING SCREEN DOOR/LATCH(S) OK <input type="checkbox"/> ROOF TRAVEL LATCHES OK <input type="checkbox"/> ROOF/BODY SEAL OK	
EXTERIOR	TRUCK CAMPERS	
<input type="checkbox"/> KEYS FOR ALL LOCKS <input type="checkbox"/> ALL EXTERIOR COMPARTMENT DOORS & LOCKS OK <input type="checkbox"/> ENTRY DOOR/SCREEN & LOCKS OK <input type="checkbox"/> ENTRY STEP(S) OK <input type="checkbox"/> ROOF INSPECTION OK <input type="checkbox"/> RACK AND LADDERS/STORAGE PODS OK <input type="checkbox"/> TRIM SEAL OK <input type="checkbox"/> WINDOWS SEAL OK <input type="checkbox"/> OVERALL EXTERIOR APPEARANCE OK <input type="checkbox"/> AWNING(S)/WINDOW AWNING(S) OK <input type="checkbox"/> ROCKGUARD AWNING(S) OK <input type="checkbox"/> TV ANTENNA/SATELLITE OK <input type="checkbox"/> 12 VDC OPERATION OK <input type="checkbox"/> DEALER DECALS/TIRE COVER OK <input type="checkbox"/> APPLICABLE STANDARD(S) DECALS OK	<input type="checkbox"/> JACK MECHANISMS OK <input type="checkbox"/> TRUCK/CAMPER PLUG OK <input type="checkbox"/> TIE DOWN HARDWARE OK <input type="checkbox"/> WEIGHT CAPACITY OK	
	OPTIONAL EQUIPMENT	
	<input type="checkbox"/> ____ OK <input type="checkbox"/> ____ OK <input type="checkbox"/> ____ OK <input type="checkbox"/> ____ OK <input type="checkbox"/> ____ OK	

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2-1.3 Customer Acceptance Sheet (Warranty Registration)

2-1.3.1 Introduction

Warranty registration occurs after the technician has explained the operation of a unit to its new owner. In many cases, the Warranty Registration form is used as a guide when delivering the unit, and it is an excellent tool to educate the new owner. As the technician finishes explaining and/or demonstrating each system, appliance, or component, they should check off that item on the Warranty Registration form. Again, it is recommended that a category that does not pertain be notated with an "N/A" (not applicable) rather than left blank.

Procedure for filling out Warranty Registration:

1. Record the purchase date (the first day of ownership).
2. Type or print the unit's serial number.
3. Type or print the model name.
4. Type or print the unit's model year.
5. Type or print the unit's length.
6. If registering a motorized unit, type or print the unit's chassis serial number.
7. If registering a motorized unit, type or print the chassis manufacturer.
8. Ensure that the owner's last name, first name, and middle initial are typed or printed on the form and spelled correctly.
9. Ensure that the owner's correct regular mailing address (street or P.O. box number) is typed or printed correctly on the form.
10. Ensure that the owner's city, state, and zip code are typed or printed on the form.
11. Ensure that the owner's country of residence is typed or printed on the form.
12. Ensure that the owner's telephone number (include area code) is correctly typed or printed on the form.
13. Ensure that the dealer's name and number, the dealership's address, and telephone number (include the area code) are typed or printed on the form.
14. Check all items demonstrated and/or explained to the owner during owner delivery.
15. Enter the date.
16. Obtain authorized dealer representative signature and date.
17. Obtain the owner's signature and date it.

A sample warranty registration is shown in Figure 2-3.

Figure 2-3 Sample Warranty Registration

COMPANY NAME				
WARRANTY REGISTRATION				
DATE OF PURCHASE	SERIAL NUMBER	MODEL	YEAR	LENGTH
MOTORIZED: CHASSIS SERIAL NUMBER		CHASSIS MANUFACTURER		MILEAGE
THIS PRODUCT WILL BE WARRANTED IN THE NAME OF:				
OWNER		DEALER		
OWNER'S NAME (LAST, FIRST, MIDDLE)		SELLING DEALER		DEALER NUMBER
REGULAR MAILING ADDRESS - STREET OR PO BOX		REGULAR MAILING ADDRESS - STREET OR PO BOX		
CITY	YEAR	ZIP	CITY	YEAR
COUNTRY	TELEPHONE (AREA CODE)		TELEPHONE (AREA CODE)	
TYPE OR PRINT ALL ENTRIES				
<p>At the time of retail delivery, the selling dealer representative will perform the following inspections with the new owner and complete this pre-delivery and acceptance declaration. This form must be received within 30 calendar days from the date of purchase.</p>				
<div style="display: flex; flex-wrap: wrap;"> <div style="width: 33%;"> <input type="checkbox"/> EXTERIOR INSPECTION <input type="checkbox"/> SHORELINE FUNCTION AND OPERATION <input type="checkbox"/> GENERATOR FUNCTION AND OPERATION <input type="checkbox"/> FRESH WATER SYSTEM: CITY AND GRAVITY WATER FILLS, WATER TANK, DRAINING <input type="checkbox"/> WASTE WATER SYSTEM: HOLDING TANKS, DRAINING <input type="checkbox"/> PROPANE SAFETY EXPLAINED <input type="checkbox"/> PROPANE CONTAINER(S) FILLED <input type="checkbox"/> WATER HEATER OPERATION <input type="checkbox"/> INTERIOR INSPECTION: FLOOR CARE, EMERGENCY EXITS, ROOF VENTS <input type="checkbox"/> CONVERTER FUNCTION AND OPERATION <input type="checkbox"/> RV BATTERY FUNCTION AND OPERATION <input type="checkbox"/> RV BATTERY FULLY CHARGED </div> <div style="width: 33%;"> <input type="checkbox"/> GROUND FAULT INTERRUPTER <input type="checkbox"/> CIRCUIT BREAKERS <input type="checkbox"/> INTERIOR LIGHT, SWITCHES, AND RECEPTACLES <input type="checkbox"/> REFRIGERATOR OPERATION <input type="checkbox"/> RANGE OR RANGE/OVEN OPERATION <input type="checkbox"/> OPERATION OF OTHER APPLIANCES: ROOF AIR CONDITIONER(S), MICROWAVE OVEN, FOOD CONTROL CENTER <input type="checkbox"/> MONITORING PANEL FUNCTION AND OPERATION <input type="checkbox"/> FURNACE OPERATION <input type="checkbox"/> WATER PUMP OPERATION <input type="checkbox"/> BED SETUP AND STORAGE <input type="checkbox"/> TABLE SETUP AND STORAGE </div> <div style="width: 33%;"> <input type="checkbox"/> CARE OF WINDOWS, CURTAINS, TABLES AND COUNTERTOPS <input type="checkbox"/> LAVATORY OPERATION AND CARE <input type="checkbox"/> MOTORIZED ROAD TEST: MAINTENANCE, LOADING, BACKING, OPERATION OF DASH COMPONENTS <input type="checkbox"/> NON-MOTORIZED ROAD TEST: MAINTENANCE, COUPLING/UNCOUPLING, PIGTAIL CONNECTION, LOADING, BACKING, BREAKAWAY SWITCH, BRAKE CONTROLLER <input type="checkbox"/> EXPLANATION OF WARRANTY <input type="checkbox"/> EXPLANATION OF CHASSIS WARRANTY <input type="checkbox"/> CHASSIS WARRANTY APPLIED FOR <input type="checkbox"/> EXPLANATION OF OTHER WARRANTIES <input type="checkbox"/> UNIT WAS CLEAN </div> </div>				
<p>DEALER</p> <p>I certify that the unit described above was delivered to _____ (owner's name) on this date _____. The tests and inspections listed on a Pre-Delivery Checklist, a copy of which is on file at the dealership, were performed as described in the Pre-Delivery Manual. The Propane system was tested and is free of leaks. I also certify that all applicable items listed here were explained and/or demonstrated to the owner's satisfaction. I certify that all warranties were clearly explained to the owner and that the owner was offered to be taken on a road test of the unit described above.</p> <p style="text-align: right;">Road Test was <input type="checkbox"/> accepted <input type="checkbox"/> declined</p> <p>DEALER SIGNATURE _____ DATE _____</p>				
<p>OWNER</p> <p>I certify that the unit described above was delivered to me on this date _____, and that the dealer (or an authorized representative) explained and/or demonstrated all applicable items listed here to my satisfaction. I certify that all warranties were clearly explained and that I was offered to be taken on a road test of this unit. I further certify that I have inspected this unit with the dealer or his authorized representative and that I accept the unit with complete satisfaction. Also, I have been provided with an Owner's Manual.</p> <p>OWNER SIGNATURE _____ DATE _____</p> <p style="text-align: center;">(Attach a copy of the Pre-delivery Checklist to this form.)</p>				
<p>MANUFACTURER COPY</p> <p>RETAIL COPY</p> <p>DEALER COPY</p>				

2-1.4 Pre-delivery Inspection Tools

The following list of tools will generally be needed during the pre-delivery inspection (PDI):

- Tire pressure gauge
- Tire wear gauge (for used units)
- Torque wrench (for wheel lugs)
- Floor jack
- Battery hydrometer
- Battery fill jug
- Multimeter
- Frequency meter (if equipped with a generator)
- AC ammeter
- DC ammeter
- RMS voltmeter
- 120 VAC plug tester (GFCI/polarity)
- Water distribution system test gauge
- Manometer
- Spark lighter
- Leak detector solution or electronic leak detector
- Propane system pressure test apparatus
- Basic hand tools kit (screwdriver, wrenches, etc.)
- Radiator hydrometer
- Headlight alignment tool (optional)
- Tire chucks
- Seven-way 12 VDC plug tester
- Oven thermometer
- Air conditioner thermometers
- Standard thermometer (for refrigerator run test)
- Spring scale (for alternate exit testing)
- Air speed indicator (to test airflow)
- Generator load bank (optional)
- Telephone tester
- Satellite receiver test equipment
- Portable VCR to check cables
- Short RG6 coax lead

NOTE: There is no chapter review for this chapter.

2-1-A Pre-delivery Inspection Tools

The following list of tools will generally be needed during the pre-delivery inspection (PDI):

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- Tire pressure gauge
- Tire wear gauge (for steel wheels)
- Torque wrench (for wheel nuts)
- Floor jack
- Battery hydrometer
- Battery fill jug
- Lubricant
- AC compressor
- CAI ammonia
- A/C refrigerant
- 12V A/C leak tester (D/CV probe)
- Water distribution system test gauge
- A thermometer
- Bright light
- Leak detector solution or ultrasonic leak detector
- Propane system pressure test apparatus
- Bank head tank fill (as needed, e.g., water, etc.)
- Radiator (if damaged)
- Headlight alignment tool (optional)
- Tire chocks
- Beam way 12 VDC lamp tester
- Over the top
- Air conditioner diagnostic tool
- Standard thermometer (for temperature and time)
- Spring scale (for shock absorber testing)
- Air speed indicator (to test airflow)
- Constant load brake (optional)
- Telephone base
- Small air hose and pump
- Portable VCR to check video
- Small 12VDC power lead

NOTE: There is no other review in this chapter.

Chapter

2-2 Propane Systems

- Inspect container installation, surface, and data plate.
- Measure and adjust propane regulator operating pressure
- Conduct a timed pressure drop test.
- Conduct propane regulator lock-up test
- Document all test results and sign.
- Record and report defects

2-2.1 Introduction

Adequate testing of the propane system is essential to minimizing the risk of potential accidents. Pre-delivery inspection (PDI) of the propane system includes the following:

1. Conducting a timed pressure drop test
2. Conducting an operating pressure test
3. Conducting a regulator lock-up test
4. Conducting necessary tasks such as, but not limited to, installing, inspecting, purging, and filling propane containers as prerequisites to accomplishing the three tests identified above
5. Recording test results and actions taken

2-2.2 Container Inspection, Purging, and Filling

2-2.2.1 Examining the Containers

Federal regulations and NFPA 58 (CSA B149-00) require periodic requalification of all DOT/TC propane cylinders. ASME tanks are not required to be requalified, but the guidelines provided herein should be considered to maximize safety.

2-2.2.1.1 Visually Inspecting Containers

DOT cylinders are required to be recertified by visual inspection at intervals of 12 yr after manufacture and every 5 yr thereafter. TC cylinders are required to be recertified by visual inspection at intervals of 10 yr after manufacture and every 10 yr thereafter. To recertify the cylinder, the person must be qualified by the Department of Transportation (DOT) or Transport Canada (TC) and make records of the cylinder inspection. If a cylinder has been recertified by visual inspection, the date of requalification, followed by the letter "E," will be stamped on the cylinder valve guard. The materials herein are not intended as a guide for requalification of propane cylinders. Contact the propane supplier if interested in requalification of cylinders.

1. Verify cylinder date of manufacture. No cylinder should be filled if it is due for requalification.
2. All propane containers (DOT/TC or ASME) must be visually inspected prior to filling.
3. Visually inspect the container's data plate and container surface. Ensure that the container, valve guard, and foot ring have not been subjected to physical damage such as scraping, denting, gouging, excessive rusting, or fire. See Table 5-6 on page 5-32 of the *RV Propane Systems* textbook for maximum allowable DOT/TC cylinder dent depths.

2-2 Propane Systems

4. Document date of manufacture and all measurements made. Do not fill a container that exceeds maximum allowable dent depth. Recommend replacement of the container and document the recommendation on the PDI form, repair order, or other appropriate record-keeping form.

2-2.2.1.2 Inspect/Install Mountings and Brackets

Propane containers need to be secured to the recreation vehicle so they will not become dislodged when a load equal to eight times the container's filled weight is applied to the filled container's center of gravity in any direction (NFPA 1192 paragraph 5.2.4.1 and CSA Z240 paragraph 6.3).

ASME Tanks

ASME tanks are bolted to the RV's frame or floor.

1. Be sure the brackets are securely bolted and all bolts intended to be used are tight and in place.
2. If a bolt has been removed or has fallen out, tighten all bolts and replace missing bolts with bolts of equal size and strength.
3. If washers and lock washers were used, be sure these items are also reinstalled.
4. Bolt strength is often indicated by markings on the head of the bolt. These bolt head markings can be numbers or symbols. *Figure 5-38 on page 35 of the RV Propane Systems textbook shows an example of bolts and brackets used for a propane mounting. If in doubt, contact the container manufacturer to determine the correct bolts to use.*
5. Document all actions. Recommend replacement or repair of brackets, bolts, washers, and lock washers as necessary and document the recommendation on the PDI form, repair order, or other appropriate record-keeping form. Make sure to initial and date all actions.

DOT (TC) Cylinders

DOT (TC) cylinders are usually located on the front of trailers and A-frames or in compartments that are sealed off from the RV's interior. Cylinder securing methods vary, with the most common being adjustable straps around the middle of the cylinders and "T-bars" commonly used to secure double cylinders.

1. Ensure that the cylinders are secured in such a way that they will remain in place and in their proper and intended position.
2. Ensure that the securement method is intact and the hardware used is in good working order. On double cylinder assemblies, be sure the securement plate is adequately attached to the floor or frame. *Figure 5-35 on page 31 of the RV Propane Systems textbook shows a double cylinder assembly mounting bracket.*
3. Document all actions on the PDI form, repair order, or other appropriate record-keeping form.

2-2.2.2 Purging Containers

All new containers and, in some cases, used containers (particularly those that have their service valves left open) may contain water, air, or other contaminants. It is essential that these be removed before filling the container and putting it into service. The process of removing these contaminants is called "purging."

1. Check to see if the container is filled with gas or air. If the container does not contain propane (as determined by smell, although the presence of a factory purge sticker is a clue), disconnect the regulator from the container's service valve, open it up, and let the compressed dehydrated air blow out. ASME tanks on motorhomes have an excess flow valve that may "slug" if the air volume escaping the tank exceeds the design of the valve. If that occurs, simply close the valve for about two seconds and slowly reopen the valve. Type I valves (shown in *Figure 5-20 on page 21 of the RV Propane Systems text-*

book) require an adapter (full flow Prest-O-Lite [POL]) to allow the air to escape through the service valve, although the liquid level gauge (bleed or outage) screw can be used to bleed the air through the #54 drill-sized orifice in the outage valve.

NOTE: After the air is released or emptied, keep in mind that, at sea level, there is still 14.7 psi (atmospheric pressure) in the tank.

2. Select a site for the purging operation that is more than 25 ft (7.6 m) away from any source of ignition when releasing the air/gas mixture.
3. Use a vent stack approximately 10 ft (3 m) or taller to greatly improve fire safety. Propane can be torched with a vent stack designed for the purpose and located according to code (25 ft from the dispenser).
4. If a vent stack is not available, use a #54 drill-sized orifice to restrict the volume of the released propane.
5. Wear clothes and safety gear that are designed for dispenser operation (see "Fuel Transfer Safety" on page 5-41 of the *RV Propane Systems* textbook).

2-2.2.2.1 Purge Procedures¹

1. Purge in a safe area.
2. Be sure that the container pressure has been released.
3. If free water is present or suspected to be in the container, contact the propane supplier for a determination of the cause and effect. Some cases may require mechanical or chemical drying or, in the case of internal rust, the container may need more attention or replacement.
4. Pressurize the container to approximately 15 psi with the propane vapor. Never purge with liquid. Purging with liquid will cause any moisture in the tank to condense and/or freeze and not be expelled in the purge exhaust.
5. Vent the container to a safe atmosphere.
6. Repeat steps #4 and #5 for a total of five purgings.²
7. Pressurize the container with propane vapor and perform leak tests on the container using leak detector solution and/or an electronic leak detector.
8. The container is now ready to be placed into service. Remove the factory purge sticker and install the appropriate DOT (TC) and/or OSHA decals.

2-2.2.2.2 Alternative Method to Vapor Purge Utilizing a Vacuum Pump

Twenty-six inches of mercury vacuum has been found to be an acceptable alternative to vapor purging in new containers only. However, the investment in equipment and training can be higher. Do not apply a vacuum to containers for purging that have or may have contained propane.

2-2.2.3 Filling Containers

Supervisors should check frequently on their personnel filling propane containers to determine if the correct procedures are being followed. National codes and some state or provincial laws require that the filling

1. Proper purging based on NPGA Safety Bulletin #133.

2. Purging with 30 psi three times or 45 psi twice will result in an acceptable propane-to-air mixture that has been measured to be approximately 93.75% pure.

personnel are properly trained and that documentation of their training is on file. Refillers are sometimes required to carry cards documenting their qualifications.

2-2.2.3.1 Calculating DOT (TC) Cylinder Fill Weight

Fill cylinders (and tanks) to the 80 percent level only. If using a scale (the weight system), DOT (TC) cylinders typically used on recreation vehicles hold 20, 30, or 40 lb of propane by weight. They are sometimes incorrectly called 5, 7, and 10 gal (18.9, 26.5, and 37.9 L) cylinders. These are convenient references only and do not allude to the actual capacity of these cylinders. The propane capacity in pounds is 0.42 times the water capacity stamped on the collar. When filling cylinders by weight, refer to the tare weight (TW) stamped on the guard (example: TW 19). The tare weight is the weight of the empty cylinder before propane is added. Add the 19 lb (8.6 kg) cylinder weight (TW) to the 20 lb (9.1 kg) propane capacity and fill the cylinder to 39 lb (17.7 kg).

2-2.2.3.2 Filling Containers by Volume

If filling tanks by volume with a liquid meter, read the water capacity stamped on the ASME tank. Determine from that water capacity the volume of propane necessary to fill the container. The tank must be filled by utilizing the fixed maximum liquid level gauge.

The water capacity of a DOT (TC) cylinder is shown in pounds on the cylinder or on the cylinder's valve guard. Therefore, to determine the gallons of propane a DOT (TC) cylinder will hold, move the decimal one place to the left (based on NFPA 58 Table 7.4.2.2). The cylinders, however, must be filled by weight (0.42 times the water capacity in weight) or by utilizing the fixed maximum liquid level gauge.

Example 1:

An empty 20 lb (9.1 kg) cylinder has a water capacity of approximately 48 lb as specified on the valve guard of the cylinder. Multiply this water weight by 0.10 or simply move the decimal point one place to the left to determine how many gallons of propane it can hold. In this case, it will be 4.8 U.S. gallons of propane.

The propane capacity of an ASME tank is determined by taking 80 percent of the water capacity in gallons shown on the tank's data plate.

Example 2:

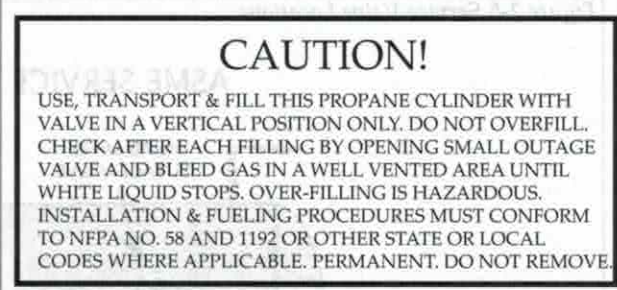
An ASME tank is stamped 28.6 U.S. gallons of water capacity. To be properly filled to the 80 percent maximum fill level, multiply the number of gallons (28.6 water capacity) times 0.8. This would equal 22.9 gal of propane.

2-2.2.3.3 Avoid Overfilling

To avoid overfilling the container, always use the fixed maximum liquid level gauge (outage valve). This means that the fixed maximum liquid level gauge must be opened during the filling process. Stop filling the container immediately when the white fog-like liquid is emitted from the fixed maximum liquid level gauge opening. Open the fixed maximum liquid level gauge in a well ventilated area and keep open. This bleeding process ensures that any liquid in the container above the 80 percent level will be emitted from the container. This is accomplished when the white liquid stops. In most containers, the dip tube is fastened to the service valve. In some cases, the dip tube is located at a separate opening of the container. But in every case, the dip tube extends to the 80 percent level of the container, and the liquid level of propane must not rise above the end of this dip tube.

Reinstall the DOT (TC) cylinder on the trailer as soon as possible. If it is not to be reinstalled, or if the refilled cylinder is loaded in the customer's automobile to be transported to a travel trailer at another location, a plastic POL plug must be inserted into the service valve opening, unless it is a Type I valve. This is a mandated safety procedure to guard against the accidental release of propane or dirt contamination. Type I valves require the use of a dust cap. The cylinder also needs to be secured for transport in an upright position. Read the manufacturer's caution label before transporting or storing cylinders. A caution label is shown in Figure 2-4.

Figure 2-4 Caution Label



2-2.2.4 Propane Compartment and Compartment Venting

1. Ensure that the propane compartment is sealed and vapor tight to the interior of the RV.
2. Ensure that venting is in compliance with *paragraph 5.2.6, NFPA 1192, Standard on Recreational Vehicles, 2011 Edition*.
3. Ensure that the propane compartment doors or panels providing access to valves are not equipped with locks or require special tools to be opened.
4. Document all actions on the PDI form, repair order, or other appropriate record-keeping form.

2-2.2.5 Hose and Piping Conditions

2-2.2.5.1 Hoses

1. Inspect POL/quick closing coupling (QCC) hoses for cracks and kinks.
2. Inspect POL/QCC fittings for damage or corrosion.
3. Inspect POL/QCC hoses for rubbing or excessive wear.
4. Inspect low-pressure hose for cracks and kinks.
5. Inspect low-pressure hose fittings for damage or corrosion.
6. Document all actions on the PDI form, repair order, or other appropriate record-keeping form.

2-2.2.5.2 Piping and Tubing

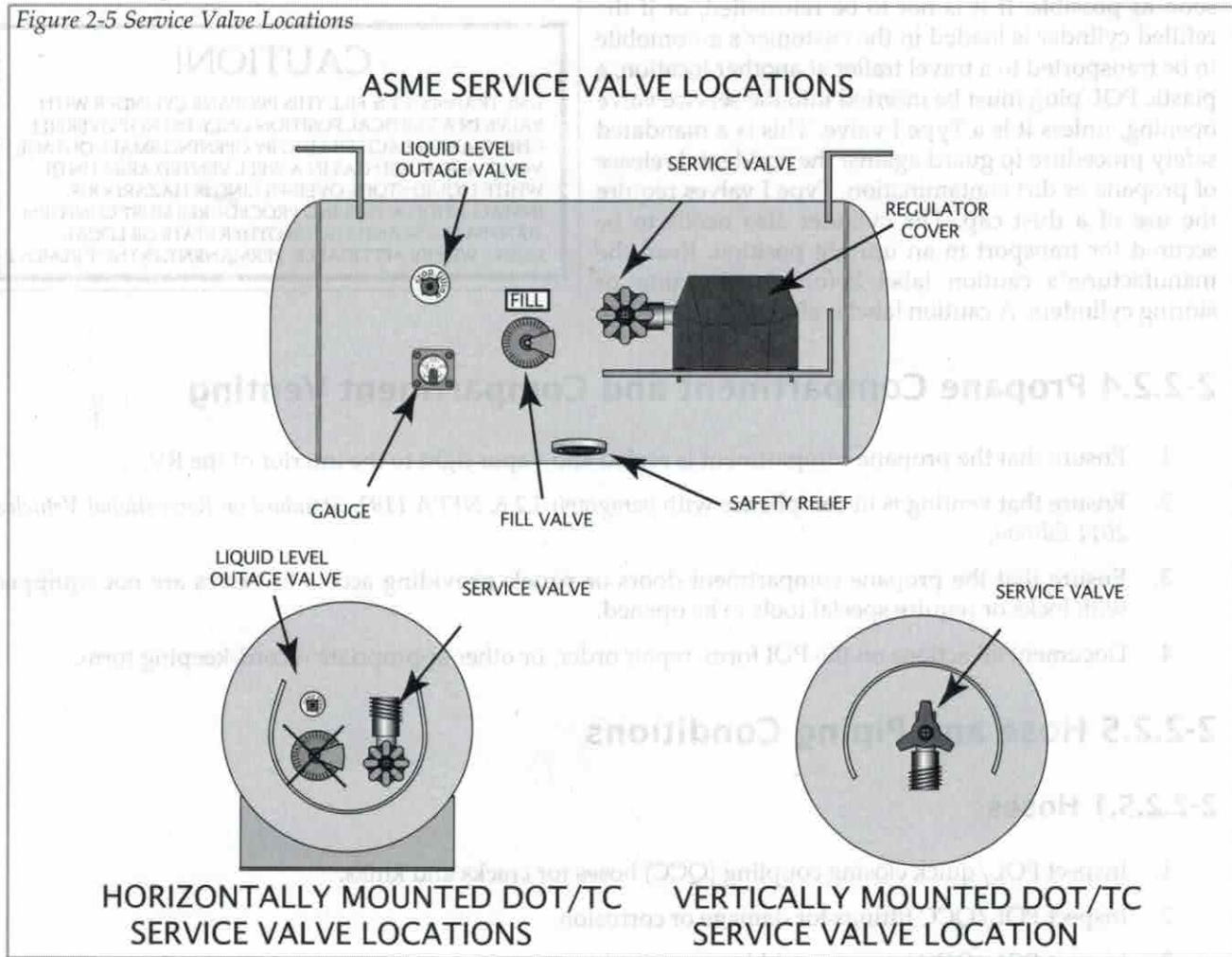
1. Inspect all underside piping and tubing for damage or corrosion.
2. Inspect all underside fittings for damage or corrosion.

2-2.2.6 Regulator

1. Ensure that the regulator is mounted securely.
2. Ensure that the regulator vent is pointing directly down to the ground or within 45° of this vertical plane.
3. Ensure that the regulator is in an enclosed compartment or covered properly.
4. Document all actions on the PDI form, repair order, or other appropriate record-keeping form.

2-2.2.7 System Tests

Figure 2-5 Service Valve Locations



2-2.2.7.1 Conducting an Operating Pressure Test

To conduct these tests effectively and efficiently, follow these guidelines:

1. Prepare documentation to record the results of the operating pressure test.
2. Ensure that the propane system is turned off at the container service valve.
3. Turn off all appliances.
4. With the propane system off, disconnect the low-pressure hose or piping from the regulator outlet using backup wrenches.
5. Connect test apparatus (see "Making a Test Apparatus" on page 5-53 of the *RV Propane Systems* textbook) to the regulator.
6. Connect the propane low-pressure hose to the test apparatus.
7. Connect manometer to the test apparatus. The system is now ready to test.

NOTE: Make sure all connections are leak free.

8. With the manometer connected, turn on the gas at the container.

9. Slowly open the gas cock on the test apparatus. The #41 drill hole provides a flow rate of approximately 75,000 Btu/hr. This is equal to the 30 ft³/hr flow and represents about 50 percent or more of the Btu/hr flow rate of the appliances. A propane regulator must have a rated capacity equal to or greater than the total Btu/hr input of all appliances.
10. Measure the operating pressure in inches of water column on the manometer. The operating pressure is now shown on the manometer. It should be 11 in. WC, nominal (± 0.5).
11. Remove the dust cover and adjust regulator if measured inches of water column is not correct. Use a screwdriver and turn the adjusting screw until the system's operating pressure is at 11 in. WC. When adjusting the regulator, remember that screwing in the adjusting screw (clockwise) increases the pressure; screwing out the adjusting screw (counterclockwise) decreases the pressure.
12. Document the operating pressure test results. As a minimum, the test documentation should include:

Make, model, and identification number of RV

The date and times of the test

Type of manometer used

Calibration date of manometer if other than a U-tube type

Initial system pressure (inches WC)

Adjustment procedures taken if applicable

Corrected pressure reading

Technician's name and signature

2-2.2.7.2 Regulator Lock-up Test

Lock-up pressure is the amount of pressure required to press against the regulator diaphragm, overcome the spring, and completely seat the lever seat assembly in the regulator so that no gas flows through the regulator.

Upon completion of the operating pressure test and regulator adjustment, conduct the following regulator lock-up test using the test apparatus identified above.

1. Close the gas cock on the test apparatus.
2. Ensure that propane is still on at the container or turn it on at the service valve on the container.
3. Monitor propane pressure on the manometer for three minutes.
4. If pressure exceeds 14 in. WC or if pressure climbs during the three minutes, replace the regulator.
5. Close the service valve of the container.
6. Remove the test apparatus.
7. Reconnect the low-pressure hose to the regulator using a primary and a backup wrench.
8. Conduct a leak test or a timed pressure drop test on any fittings that were disconnected.
9. Return the system back to proper operation.
10. Document all actions on the PDI form, repair order, or other appropriate record-keeping form.

NOTE: If a lock-up test is being conducted as a separate function, check the operating pressure first to ensure that the delivery pressure is correct. Adjust the regulator as necessary to achieve a nominal 11 in. WC.

2-2.2.8 Timed Pressure Drop Test

To leak test the propane system, perform a timed pressure drop test with a dial, digital, straight, or loop (U-tube) manometer shown in *Figure 2-6*. The timed pressure drop test is outlined by the *NFPA 1192 paragraph 5.3.20.6*. The procedure is discussed below.

NOTE: Temperature change in a piping system can cause a timed pressure drop test reading to change. The pressure will rise if the temperature rises and decrease as the piping cools. The temperature of both the air and piping need to be approximately the same, and a uniform temperature needs to be maintained throughout the test period. If a unit, left out in cold weather overnight, is brought into a warm bay for a timed pressure drop test, the piping could warm up during the test. The pressure will rise as the temperature rises. This rise in pressure could hide the existence of a leak that would remain undetected because what would be a manometer reading drop is offset by the pressure increase.

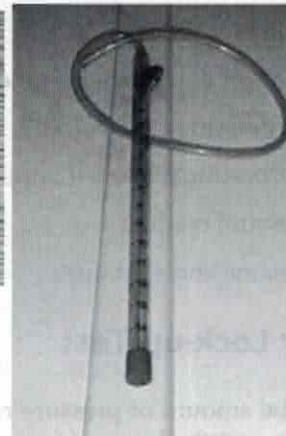
Figure 2-6 Manometer Examples



Dial



Digital



Straight



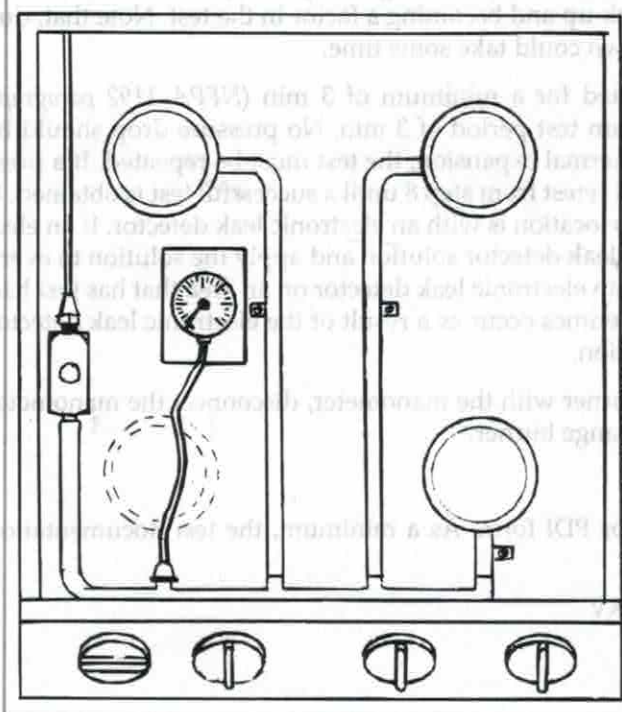
U-tube

Timed Pressure Drop Test at the Range Burner

1. Prepare documentation for recording the timed pressure drop test results.
2. Turn off the propane system at the container service valve.
3. Turn off all propane appliance valves.
4. Turn off all open pilot lights.
5. Remove a range burner and attach a manometer to the range burner orifice. See *Figure 2-7*.
6. Turn the propane system on at the container service valve to pressurize the system.
7. Listen to the regulator for sounds of escaping propane that would indicate an open line. Silence indicates the regulator has locked up. Propane passing through the regulator when the service valve is first turned on usually makes a "PFFFFT" sound until the regulator locks up. Once the regulator locks up, no sound should be heard.
8. Turn on the burner valve with the manometer attached and pressurize the propane system to 10 to 14 in. WC.
9. Turn off the propane at the container service valve.

10. Slowly open a second burner valve and reduce the operating pressure to a nominal 8 in. (± 0.5) WC. Turn the burner valve off after achieving a nominal 8 in. Reducing the system pressure to 8 in. WC ensures that the appliance regulator is not in lock-up and becoming a factor in the test. Note that, due to the very low propane flow rate, this bleed down could take some time.
11. The RV Standard requires this test be conducted for a minimum of 3 min (NFPA 1192 paragraph 5.2.30.6). Watch the manometer for this minimum test period of 3 min. No pressure drop should be detected. If there is a pressure increase due to thermal expansion, the test must be repeated. If a pressure drop is noted, locate and repair the leak and retest from step 8 until a successful test is obtained. If a leak is observed, one method of discovering its location is with an electronic leak detector. If an electronic leak detector is not available, use a liquid leak detector solution and apply the solution to every fitting in the system to find the leak. Do not use an electronic leak detector on an area that has just had leak solution applied, as false positives can sometimes occur as a result of the electronic leak detector interacting with the chemicals in the liquid solution.
12. If no leaks are determined, turn off the range burner with the manometer, disconnect the manometer from the range burner spud, and reconnect the range burner.
13. Return the propane system to full operation.
14. Document the test results on the repair order or PDI form. As a minimum, the test documentation should include:
 - Make, model, and identification number of RV
 - The date and times of the test
 - Temperature of air and piping
 - Type of manometer used
 - Calibration date of the manometer used if other than a U-tube type
 - Recorded pressures at the beginning and end of each test, repeated until a successful test is achieved
 - Corrective action taken between each test as necessary
 - Final correct pressure reading in inches of water column and beginning and ending time with technician's name and signature
 - Documentation of both the exact manometer measurement and duration when conducting the timed pressure drop test

Figure 2-7 Manometer at Range Burner with Rangetop Off



Timed Pressure Drop Test with a Test Apparatus

NOTE: Instructions for "Making a Test Apparatus" on page 5-53 of the *RV Propane Systems* textbook.

Use the following procedures to connect the propane system test apparatus. These procedures are provided as guidance but are not included in the procedures to be followed in conducting the timed pressure drop test.

With all appliances turned off and the propane supply turned off, disconnect the low-pressure hose or piping from the regulator. Connect the 3/8-in. female flare of the test apparatus flex hose to the regulator outlet fitting. Attach the low-pressure hose, previously attached to the regulator, to the half-union end of the test apparatus. Attach the manometer hose to the 5/16-in. hose barb on the test apparatus. Make sure the gas cock on the test apparatus is closed. Slowly turn the propane supply back on at the service valve. Conduct a leak test to ensure that all connections are leak free.

1. Prepare documentation to record the timed pressure drop test results.
2. Ensure that the propane system is turned off at the container service valve.
3. Turn off the burner valves on the gas range and gas valves on other appliances.
4. Turn off all open pilot lights.
5. Turn propane system on slowly at the service valve. Bleed pressure to a nominal 8 in. WC (between 7.5 and 8.5 in. WC) using the gas cock. Listen to the regulator for sounds of escaping propane that could indicate an open gas line. Propane passing through the regulator when the service valve is first turned on usually makes a sound like "PFFFFT" until the regulator locks up. Once the regulator locks up, no sound should be heard.
6. Turn propane off at the service valve.

7. Monitor the manometer for a period of at least 3 min. Locate and repair leaks and retest until a successful test (no pressure drop) is accomplished. *NEPA 1192 paragraph 5.3.20.6* requires this test to be conducted for a minimum of 3 min. If a leak is observed, one method of discovering its location is with an electronic leak detector. If an electronic leak detector is not available, use a liquid leak detector solution and apply the solution to every fitting in the system to find the leak.
8. Bleed the propane pressure from the system using the gas cock on the test apparatus.
9. Remove the test apparatus from the system and reattach the low-pressure hose or piping.
10. Turn propane system on at the service valve.
11. Leak test the low-pressure hose or piping connection.
12. Return the propane system to full operation.
13. Document test results. Document the test results on the repair order or PDI form. At a minimum, include the following information on the test documentation:
 - Make, model, and identification number of unit
 - The date and inclusive times of the test
 - Type of manometer used
 - Calibration date of manometer used if other than a U-tube type
 - The measured inches of water column pressure read at the beginning and end of each test until a successful test is achieved
 - Corrective action taken between each test as necessary
 - Final correct pressure reading in inches of water column and beginning and ending time
 - Technician's name and signature

NOTE: There is no chapter review for this chapter.

7. Apply the nitrogen for a period of at least 2 min. Inspect and repair leaks and vent until a safe oxygen level (no pressure drop) is accomplished. (Note: This procedure is not to be used for a minimum of 2 min. If a leak is observed, use method of detecting its location is with an electronic leak detector. If an electronic leak detector is available, use a liquid leak detector solution and apply the solution to every nutting in the system to find the leak.

8. Bleed the propane pressure from the system using the gas cow for the test apparatus.

9. Remove the test apparatus from the system and seal the low-pressure lines properly.

10. Turn propane system on at the service valve.

11. Leak test the low-pressure hoses using piping connection.

12. Return the propane system to full operation.

13. Document test results. Document the test results on the report or test form. At a minimum,

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* State model and identification number of coil

* The date and duration of the test

* Typical atmospheric load

* Distribution rate of nitrogen used if other than a 25-inch type

* The measured or bar or water column pressure used at the beginning and end of each test with a

successful test is achieved

* Corrective action taken between each test as necessary

* Final correct pressure reading in inches of water column and beginning and end of test

* Technician's name and signature

NOTE: There is no chapter review for this chapter.

Chapter

2-3 Electrical Systems

- Perform hot skin test.
- Verify system performance (including transfer switch, GFCI).
- Inspect battery condition.
- Verify operation of 12 VDC appliances.
- Conduct a polarity test.
- Test operation of 120 VAC appliances.
- Test interior and exterior lighting.
- Record and report defects.

2-3.1 Low Voltage System

2-3.1.1 Introduction

An improperly operating 12 VDC system may be a major inconvenience to the customer and may cause fires. A proper pre-delivery inspection of the system and repair of any faults will ensure that the system functions as intended. The PDI of the low-voltage electrical system will include:

1. Inspecting/testing the battery condition
2. Measuring engine alternator output
3. Measuring converter output
4. Verifying the monitor panel operation
 - A. Black water tank status
 - B. Gray water tank status
 - C. Freshwater tank status
 - D. Propane status
 - E. Battery status
5. Verifying the polarity of the system
6. Measuring solar panel charge
7. Verifying the operation of 12 VDC system lights and switches, including:
 - A. Interior lights
 - B. Running/marker lights
 - C. Stop lights
 - D. Turn signals
 - E. Backup lights
 - F. Porch/security lights
 - G. Range hood fan and light
 - H. Vent fans (all functions)
8. Verifying inverter output voltage
 - A. Unloaded voltage

2-3 Electrical Systems

- B. Loaded voltage
- 9. Repairing defects and recording any actions taken on PDI form, repair order form, or other appropriate record-keeping form

2-3.1.2 Battery—Charge Level, Mounting

2-3.1.2.1 RV Battery

Battery Safety

Batteries contain *sulfuric acid*. For this reason, there are numerous safety precautions to be followed when handling the acid during servicing operations. The other principal hazard with batteries occurs when they are charging and discharging. The following is a list of the safety rules that must be observed when handling or servicing batteries:

1. When working with acid, such as when filling batteries, splash-proof safety goggles must be worn. Additional protective clothing may be advisable, particularly if many batteries are handled.
2. When adding water or filling a battery with electrolyte, use nonmetallic containers and funnels.
3. Do not store acid in excessively warm locations or in direct sunlight.
4. Avoid contact with skin, eyes, and clothing. Use goggles or safety glasses to protect eyes when working with batteries to prevent against possible splashing of acid in eyes. In the case of acid contacting skin, eyes, or clothing, flush immediately with water for a minimum of 15 minutes.
5. If acid is swallowed, drink large quantities of milk or water followed by milk of magnesia, a beaten egg, or vegetable oil, and call a physician immediately.
6. Hydrogen and oxygen gases are produced during normal battery operation. This gas mixture can explode if flames or sparks are brought near the battery.
7. When charging or using a battery in an enclosed space, always provide ventilation and shield eyes.
8. Be careful to avoid letting tools or metallic objects fall across the battery terminals.
9. Never break a live circuit at the battery terminals. An arc could occur whenever charger leads or booster cable leads are disconnected. Any arc could ignite the accumulated hydrogen gas.
10. Always disconnect the ground cable first at a point away from the battery terminals. Disconnecting the ground first will eliminate the potential of the wrench grounding out a live circuit and causing a spark.
11. When removing cell caps to test or inspect a battery, ensure that they are reinstalled before charging or using jumper cables. This will prevent electrolyte from spilling and prevent explosion by ensuring that the spark arresters are in place. The battery caps contain spark arresters.
12. Use fender covers to protect the equipment finish from any possibility of acid spillage.

The following special precautions, in addition to those listed above, apply to batteries with thin-wall polypropylene containers. The electrolyte level is critical when handling a polypropylene-cased battery because of the flexibility of the container. Excessive pressure placed on the end walls could cause acid to spew through the cap vents in conventional batteries. To lift this type of battery, use a battery carrier or carry it with hands at diagonally opposite corners.

Battery Inspection

1. If the battery box is inside the RV, be sure the battery is vapor tight from the inside of the RV and is properly vented to the outside atmosphere (see ANSI/RVIA 12V paragraph 2-3).
2. Inspect the electrolyte level of the battery. Top off with distilled water or fill with electrolyte if the battery was shipped dry.
3. Charge the RV battery if necessary.
4. Connect the RV battery. Connect the positive (red) cable to the positive terminal post and the negative (black) cable to the negative terminal post. With the shoreline connected, if a "clicking" noise is heard at the converter, the polarity of the battery could be reversed. If more than one battery is installed, confirm the type of installation (series, parallel series/parallel) used.
5. Test the charge level of the RV battery with a temperature-compensated hydrometer.

NOTE: Sealed batteries, gel batteries, and oil-filled batteries do not require this step.

- A. If the specific gravity is 1.265, the battery is fully charged. Return the solution to the battery and replace the caps. A difference of 0.050 in any two cells indicates a need for a new battery

NOTE: It is important to wear appropriate protective clothing whenever working with batteries.

- B. If the specific gravity is less than 1.265, the battery should be charged then retested.

- C. Record the charge level on the Pre-delivery Checklist.

6. Conduct a battery load test on used batteries, in accordance with the battery specifications.
7. Inspect the battery mounting to ensure that all brackets and clamps are secure and that the battery and terminals are clean.
8. Record the RV battery manufacturer on the PDI form, repair order form, or other appropriate record-keeping form.
9. Measure the solar panel charge rate, if applicable.

Figure 2-8 Temperature Compensated Hydrometer



2-3.1.3 Interior 12 VDC System

2-3.1.3.1 Converter—Output, Battery Charger

NOTE: To avoid unnecessary drain on the RV battery and to check the operation of the converter, the power cord must be connected to a 120 VAC receptacle before performing the tests in this section.

NOTE: A hot skin test must be performed before plugging in converter to shore power. See Section 2-3.2.2.2.

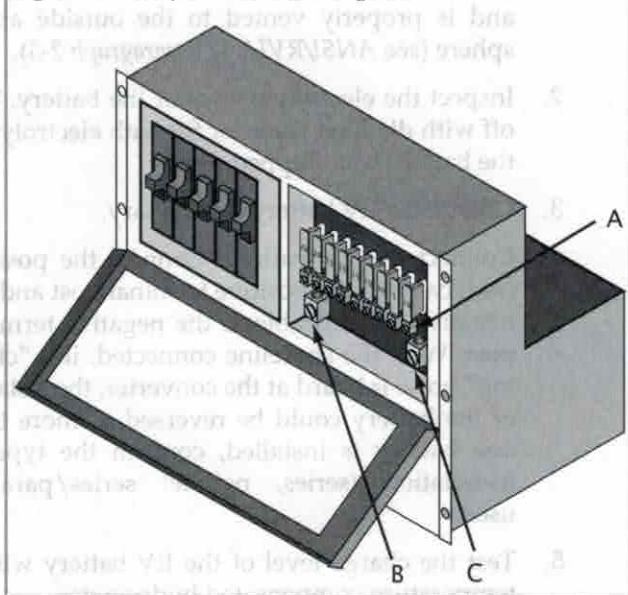
1. Test the converter output circuits.

- A. Locate the interior low-voltage fuses or circuit breakers.
- B. Visually inspect the fuses or circuit breakers. If a fuse is blown or missing, install a fuse of the correct style and size. If a circuit breaker is tripped, reset it. If the fuse or circuit breaker trips again, repair the circuit as necessary.
- C. Set a multimeter on the DC voltage scale. Connect the positive probe of the meter to the output side of circuit (A); connect the negative probe of the meter to the ground lug on the converter (B). Repeat the procedure for each circuit.
- D. If the meter reads approximately 12 VDC or more for each circuit, continue with Step 2. If the voltmeter reads less than 12 VDC, note it and repair as necessary.

2. Test the converter's battery charger.

- A. At the RV battery.
 - Turn off all 12 VDC loads.
 - Set the multimeter on the DC voltage scale.
 - Connect the positive meter probe to the battery's positive terminal post; connect the negative meter probe to the battery's negative terminal post.
 - Compare the meter readings to the manufacturer's specifications.
 - If the meter reads less than 13 VDC or more than 14.2 VDC, the converter is charging improperly and may need to be replaced.
- B. At the converter.
 - Turn off all 12 VDC loads
 - Disconnect the positive and negative battery lines at the converter.
 - Set the multimeter on the DC voltage scale. Connect the positive meter probe to the converter charge lug (C). Connect the negative meter probe to the converter ground lug (B).
 - If the multimeter reads 13 VDC to 14.2 VDC, reconnect the battery wires and continue.
 - If the multimeter reads less than 13 VDC or more than 14.2 VDC, the converter could be defective and may need to be replaced.

Figure 2-9 Sample Converter Diagram



3. Record the converter manufacturer, model number, and serial number on the PDI form, repair order form, or other appropriate record-keeping form as well as the warranty form.

2-3.1.3.2 Interior 12 VDC Receptacles

1. Set the multimeter on the DC voltage scale. Test the output voltage and polarity of each 12 VDC receptacle.
 - A. Touch the positive meter probe to the center of the receptacle; touch the negative meter probe to the case of the receptacle.
 - B. If the meter reads approximately 12 VDC, continue to the interior lights and switches checks.
 - C. If the meter reads less than 12 VDC, locate and correct the problem, then retest the receptacle.
 - D. If the meter reads negative voltage, the 12 VDC polarity is reversed. Find the source of the reverse polarity and correct it. Replace and retest the receptacle.

2-3.1.3.3 Interior 12 VDC Switches and Lights

1. Test the following switches; any problems must be identified and repaired.
 - A. Porch light. Turn the porch light ON. Remove the light cover, if necessary, to verify that the bulb lights.
 - B. Water pump. Locate and turn the water pump switch ON. Listen for the pump motor operation. Turn the switch OFF.
 - C. TV antenna. Test with the TV installed for reception at all cable outlets. Reception should vary as the switch is cycled on and off. Turn the RV antenna power supply switch ON. The power indicator light should come on. Test the TV antenna control, raising and rotating mechanism. Turn the switch OFF. If the antenna is a power antenna, make certain there is 12 VDC power to the antenna head. This will also check for a good antenna power connection.
 - D. Range hood. Turn the fan and light switches ON. Check the flow of air from the vent; correct if necessary. Be certain both operate properly. Ensure that the damper operates correctly. Turn the switches OFF.
 - E. Monitoring panel. Depress the water and holding tank selectors. The panel should light. Indicators should read E (empty). Depress the battery selector and check the RV battery reading. Check the propane reading.
 - F. Power vents. Turn all power vents ON and check for proper airflow operation. Turn the vents OFF.
 - G. Turn all interior 12 VDC lights ON and OFF to check for proper operation. Repair as necessary. When the inspection is completed, all switches and lights should be OFF.
2. Record all checks made and actions taken on the PDI form, repair order form, or other appropriate record-keeping form.

2-3.2 120 VAC Electrical System

2-3.2.1 Introduction

Proper testing and identification of problems in an RV's 120 VAC system is essential to preventing serious injury to the customer and the technician. Safety is the key and, by following proper procedures, it can be ver-

2-3 Electrical Systems

ified that the system is functioning as it was designed to operate. The PDI of the 120 VAC electrical system will include the following:

1. Inspecting the shore line cable
2. Conducting a hot skin test
3. Inspecting circuit breakers
4. Verifying the polarity of the system components
5. Testing/measuring GFCI circuits, circuit breakers, and outlets
6. Verifying the operation of all lights and switches
7. Testing the converter operation
8. Operating 120 VAC appliances
 - A. Microwave
 - B. Televisions
 - C. Air conditioners
 - D. Stereo/home theatre
 - E. Washer/dryers
9. Repairing defects and recording any actions taken

2-3.2.2 120 VAC Tests

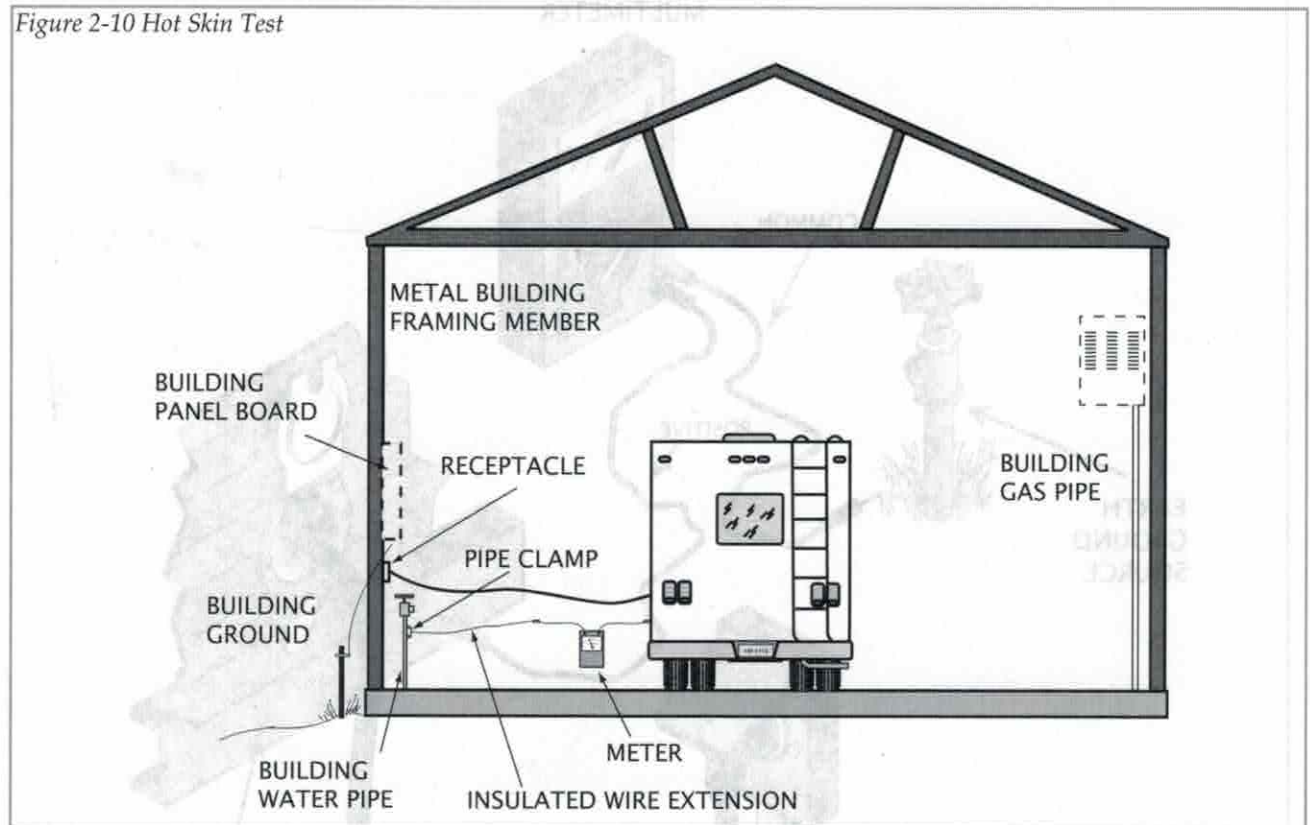
2-3.2.2.1 Measuring AC Current

The steps for measuring current on an analog or digital meter are as following:

1. Place the meter in a safe position.
2. Select the AC current mode.
3. Switch to the highest current range.
4. Ensure that the meter capacity is greater than the expected amperage.
5. Turn off the power to the circuit.
6. Disconnect the circuit at the point where the current is to be measured (fixture leads of light, switch, or similar).
7. Connect the meter between the disconnected leads created in #6 above (in series) to the meter (observe polarity in the AC mode).
8. Turn on the power to the circuit.
9. Switch to the lowest safe range.
10. Read the indicated value.
11. Turn off the power to the circuit.
12. Return the circuit to its original condition.

2-3.2.2.2 Hot Skin Test

Figure 2-10 Hot Skin Test

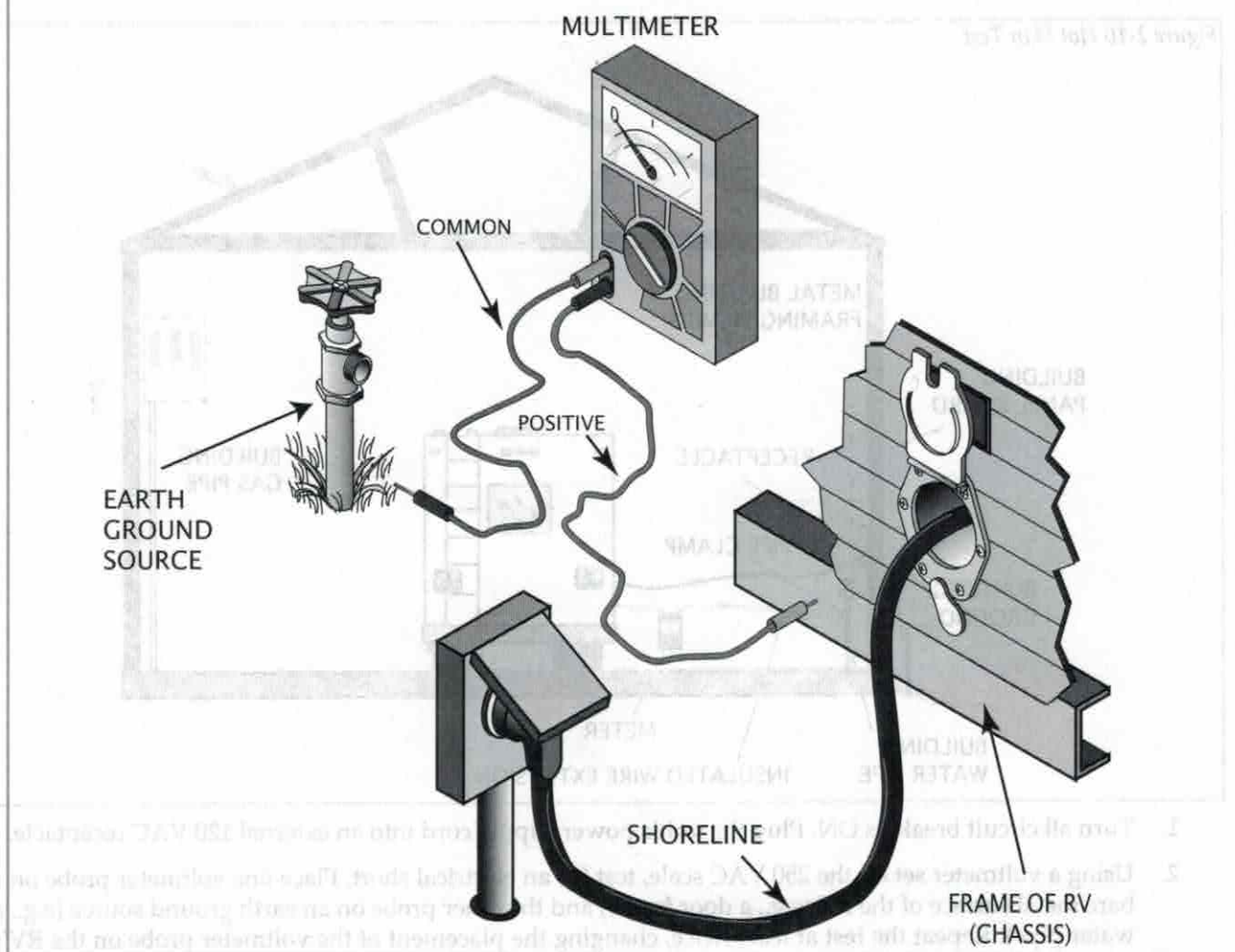


1. Turn all circuit breakers ON. Plug the unit's power supply cord into an external 120 VAC receptacle.
2. Using a voltmeter set on the 250 VAC scale, test for an electrical short. Place one voltmeter probe on a bare metal surface of the RV (e.g., a door frame) and the other probe on an earth ground source (e.g., a water pipe). Repeat the test at least twice, changing the placement of the voltmeter probe on the RV's bare metal surface (e.g., window frame or door step).
 - A. If there is a "0" reading on the voltmeter, the skin of the unit is not hot. Proceed with the AC voltage test.
 - B. If the skin of the unit is hot, there will be a reading on the voltmeter above or below "0," depending on how the probes are attached. This reading indicates there is an electrical short. Locate and correct the short, then repeat the hot skin test procedure.

Many technicians think that fiberglass and other nonmetal composite materials have eliminated the need for a hot skin test. This is not true! As long as the chassis, steps, or any other part of the RV is made of metal or some other conducting material, the hot skin test needs to be conducted.

Hot skin problems in RVs are typically high-resistance shorts. High-resistance shorts do not cause breakers to trip or fuses to blow. These types of shorts may result from the insulation on wires rubbing thin, where they can cause problems but do not create a dead short. Another example would be where the white (neutral) wire is cross-connected with the ground. In this case, where there is also reverse polarity, the power would bypass the circuit breakers and not be impacted by the overcurrent protection. Of all the tests that are conducted, this is one that should be conducted on every RV that is having the electrical system serviced.

Figure 2-11 Hot Skin Test (Outdoors)



NOTE: There must be no reading on the meter!

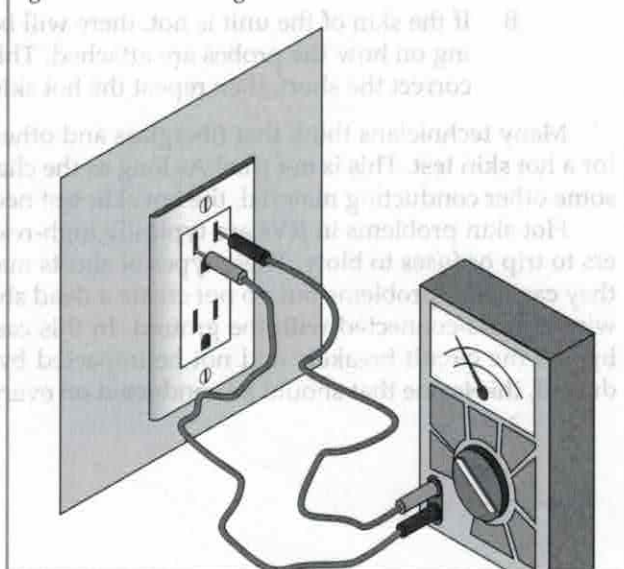
2-3.2.2.3 AC Voltage Test

Check all interior and exterior 120 VAC receptacles with a line voltage tester or a multimeter. The multimeter should be set on the AC voltage scale. If the reading is not acceptable, locate and correct the problem, then repeat test procedure.

The steps for measuring voltage for an analog or digital meter are as follows:

1. Place the meter in a safe position.
2. Set VOM to AC voltage scale.
3. Switch to the highest voltage range.
4. Ensure that the meter capacity is greater than the expected voltage.
5. Connect the leads to the meter as follows:

Figure 2-12 AC Voltage Test



6. Connect the black lead to the circuit ground.
7. Connect the red lead to the live side of the circuit.
8. Switch down to the best range.
9. Read the indicated value.

Check all interior and exterior 120 VAC receptacles with a line voltage tester or a multimeter. The multimeter should be set on the AC voltage scale. Place the test probes into the two slotted openings of a receptacle. The acceptable reading will be at or near 120 VAC, or equal to the voltage output of the source. If the reading is not acceptable, locate and correct the problem, then repeat the test procedure. At least two receptacles on the RV should be tested.

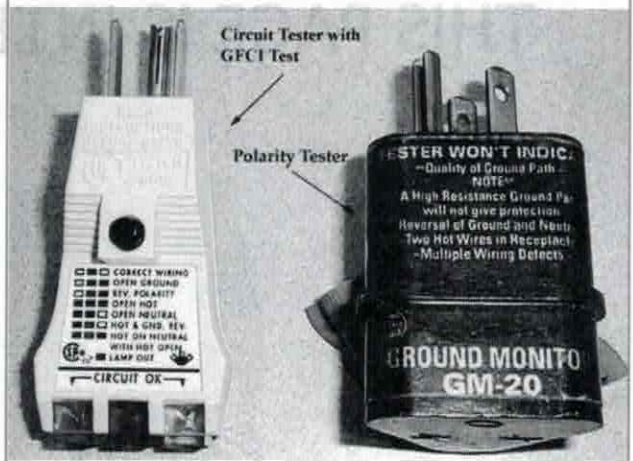
2-3.2.2.4 Polarity Test

A polarity test is also to be performed on every receptacle inside and outside the RV. The polarity test is performed using a ground monitor or circuit tester that plugs into a receptacle. See Figure 2-13. The lights on the ground monitor “light” to show if the polarity at the receptacle is correct. Lights will also indicate if the polarity is incorrect.

2-3.2.2.5 GFCI Test

Use a circuit tester with a button for testing GFCI receptacles. Test all GFCI receptacles by inserting the circuit tester and pushing the button. The GFCI receptacle or circuit breaker should trip. Remember, not all receptacles protected by GFCI will necessarily be GFCI-type receptacles, since receptacles downstream of a GFCI receptacle are also protected. GFCI circuit breakers may also be present. All exterior, kitchen, and bath receptacles must be GFCI protected.

Figure 2-13 Circuit Tester and Polarity Tester



2-3.2.2.6 Inverters

1. Remove shore power and shut off generator.
2. Measure battery voltage. It should be fully charged. If it is not, charge battery.
3. Turn the inverter on.
4. Measure DC voltage input at the inverter. Nominal voltage should be 12 VDC.
5. Measure AC voltage output at the inverter using a true RMS (root mean square) meter. A regular meter could give an incorrect voltage reading because of the square sine wave. Nominal voltage should be 120 VAC.

NOTE: A load must be put on some inverters to read AC output.

6. Accurately diagnose and repair problems if any exist.

NOTE: There is no chapter review for this chapter.

6. Connect the black lead to the circuit ground.
7. Connect the red lead to the test side of the circuit.
8. Switch down to the first range.
9. Read the indicated value.

Check all inputs and outputs for 120 VAC receptacles with a line voltage tester. A multimeter. The meter should be set on the AC voltage scale. Place the test probes into the two slots of the receptacle. The acceptable reading will be at or near 120 VAC or equal to the voltage output of the system. If the reading is not as expected, locate and correct the problem. Then repeat the test procedure. At least two receptacles on the RV should be tested.

2-3-2.3.4 Polarity Test

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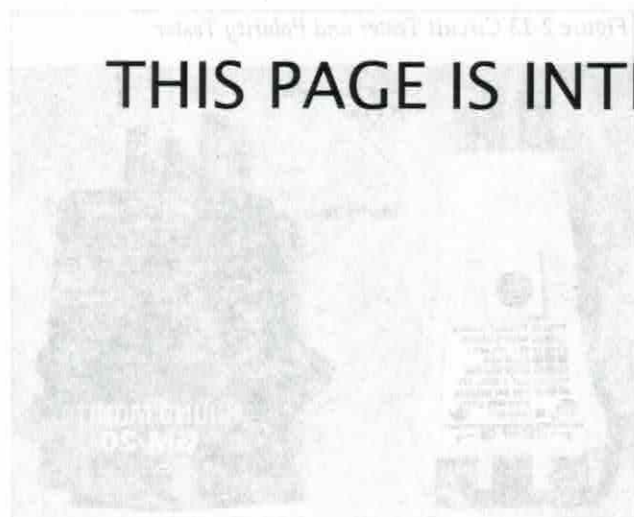


Figure 2-13 Circuit Tester and Polarity Tester

Test the polarity of the RV's AC system using a ground monitor or circuit tester that plugs into a receptacle. See Figure 2-13. The lights on the ground monitor light to show if the polarity at the receptacle is correct. Lights will also indicate if the polarity is incorrect.

2-3-2.3.5 GFCI Test

Use a circuit tester with a button for testing GFCI receptacles. Test all GFCI receptacles by inserting the circuit tester and pushing the button. The GFCI receptacle is correctly wired if the button does not trip. Receptacles not all receptacles protected by GFCI will necessarily be GFCI-type receptacles, which receptacles downstream of a GFCI receptacle are also protected. GFCI circuit breakers may also be present. All extension, lighting and other receptacles must be GFCI protected.

2-3-2.3.6 Inverters

1. Remove shore power and shut off generator.
2. Measure battery voltage. It should be fully charged. If it is not, charge battery.
3. Turn the inverter on.
4. Measure DC voltage input at the inverter. Nominal voltage should be 12 VDC.
5. Measure AC voltage output at the inverter using a true RMS (root mean square) meter. A regular meter could give an incorrect reading because of the square sine wave. Nominal voltage should be 120 VAC.

NOTE: A load must be put on some inverters to read AC output.

6. Visually inspect and repair problems if any exist.

NOTE: There is no chapter review for this chapter.

Chapter

2-4 Generators

- Verify generator operation and output.
- Test system performance (including transfer switch, GFCI).
- Record and report defects.

2-4.1 Pre-start Checks

1. Record the make, model, and serial number of the generator on the PDI form, repair order form, or other appropriate record-keeping form as well as the generator warranty form.
2. Inspect generator compartment.
 - A. The generator compartment door must be clear and provide adequate ventilation per manufacturer's specifications.
 - B. Inspect air intake/discharge.
 - C. Remove foreign material from the compartment. Insulating material must be securely installed.
 - D. Inspect the generator mounting bolts and slide mechanism, if equipped.
3. Inspect all filters.
 - A. Inspect the air filter.
 - B. Inspect the fuel filter.
 - C. Inspect the oil filter.
4. Inspect the generator oil level. Oil level must be at or near FULL. If necessary, add oil according to manufacturer's instruction. DO NOT OVERFILL. Overfilling can cause oil to foam and send a false signal to the oil pressure switch.
5. Inspect the generator exhaust system.
 - A. From under the unit, inspect the generator tailpipe, muffler, and hanger brackets for proper alignment and fit.
 - B. Inspect the tailpipe for obstruction and ensure that the termination of the exhaust pipe is beyond the vehicle's sidewall and skirt so fumes cannot collect under the vehicle.
6. Inspect the fuel line.
 - A. Feel the gasoline fuel line with fingers to determine that it is clear of obstructions.
 - B. Ensure that all fuel connections are tight.
7. Tighten the heavy-duty battery cables, if necessary. Ensure that the first termination of the 120 VAC generator circuits are properly connected and routed.
8. Record results of the checks and any actions taken on the PDI form, the repair order form, or other appropriate record-keeping form.

2-4.1.1 Run Test—No Load

1. Disconnect the shoreline.
2. Ensure that all circuit breakers and all 120 VAC appliances are OFF.

2-4 Generators

3. Ensure that there is adequate fuel in the fuel tank (above 1/4 full for motorized units) to perform the test.
4. Push the start switch at the generator. Push the start switch for a maximum of 10 second intervals, until the generator starts.
5. After the generator starts, allow it to run for 5 minutes or longer.
6. After running a minimum of 5 minutes, check the output for proper voltage and correct frequency (hertz) using a frequency meter.
7. Record the run time and the voltage and hertz readings on the PDI form, the repair order form, or other appropriate record-keeping form.
8. Shut the generator down by pushing the stop switch.

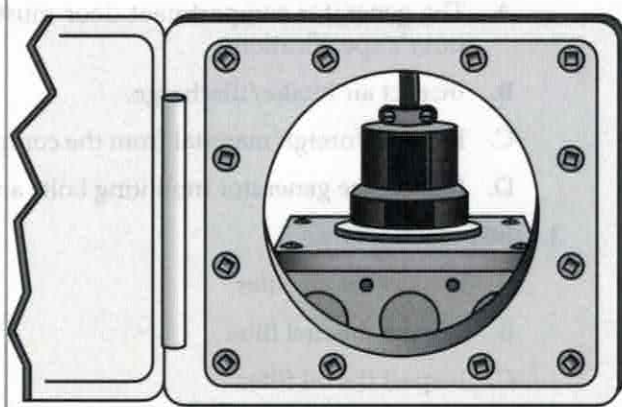
2-4.1.2 Run Test—with Load

This test is performed with the generator connected to the vehicle circuitry.

1. Ensure that all 120 VAC branch circuit breakers at the service panel are on.
2. If the RV has a manual generator transfer switch, turn the switch to the generator setting. If the RV has a generator receptacle, plug the power cord into it. If the RV has an automatic transfer switch, there is typically a minimum 30 second delay before activation.
3. Turn the main circuit breaker off at the service panel.
4. Start the generator by pushing the start switch. WAIT AT LEAST 5 MIN.
5. After 5 minutes, add the load by turning on the main circuit breaker at the service panel. (Load should be at least 50 percent of the generator's rated output.)
6. Set the multimeter on the VAC scale.
7. Measure the voltage at receptacles. Record the run time and the voltage and hertz readings on the PDI form, the repair order form, or other appropriate record-keeping form.
8. Stop the generator and restart from the generator panel inside the RV.
9. Verify the operation of the hour meter, then shut down the system with the switch at the panel.
10. Record the results of the test and any actions taken on the PDI form, the repair order form, or other appropriate record-keeping form.

NOTE: There is no chapter review for this chapter.

Figure 2-14 Generator Receptacle



Chapter

2-5 Plumbing Systems

- Inspect the freshwater supply and drain system.
- Test the water pump operation.
- Inspect the termination valves and cap.
- Perform flow test.
- Inspect and flush the systems.
- Test the water pump operation.
- Flood test holding tanks and drainage system.
- Inspect the tank mounting.
- Record and report defects.

2-5.1 Distribution and Drainage Systems

This chapter contains information on how to inspect both the freshwater system and the wastewater systems.

2-5.1.1 Inspecting the Freshwater System

The freshwater system checks should consist of the following:

1. Inspect the gravity/city water fill connections.
2. Ensure that the freshwater system functions properly on both pump and city water hookup.
3. Test all plumbing and plumbing fixtures for proper operation.
 - A. Test all toilets.
 - B. Test all faucets and drains.
 - C. Test interior and exterior showers.
4. Conduct a water system leak test.
5. Clean/inspect water filter as necessary.
6. Inspect ice maker lines and connections as necessary.
7. Inspect accumulator tank.
8. Inspect washing machine lines and connections as necessary.
9. Inspect all low-point drains.
10. Sanitize the freshwater system.
11. Winterize the water system if necessary.

2-5.2 Inspecting/Testing the Wastewater System

The wastewater system tests should consist of the following:

2-5.2.1 Perform a Flood Test on the Entire System

Use the following procedure to test the drainage system for leaks:

1. Ensure that the RV is in a level position.
2. Fill the entire drainage system, including wastewater holding tanks, until water is visible in the bottom of the lowest fixture on each system. (Usually this is the tub/shower for a gray-water holding system and/or the toilet for the black-water holding system.)
3. Visually check all piping and tanks for leaks.
4. Repair any leaks discovered.
5. Document the results of the test and any actions taken.

2-5.2.2 Perform a Retarded Flow Test on All Fixtures

1. Ensure that the RV is in a level position.
2. Plug all fixture drains and fill all fixtures 1/2 full with water.
3. Open the drains of each fixture. Observe the water in each fixture to ensure that the drainage flow is even and not retarded (slow flowing).
4. Inspect all piping and P-traps for indications of leakage resulting from the drainage process.
5. Repair any leaks discovered.
6. Document results of the test and any actions taken.
7. Test termination valves for proper functioning.
8. Inspect black and gray holding tanks.

2-5.3 Testing the Water Distribution System

2-5.3.1 Pressure System Tests

STEP 1:

Isolate the water heater from the pressurized water distribution system by using the water heater bypass valve, if provided. If these valves are not present, create a temporary bypass by disconnecting the hot and cold water lines at the back of the water heater and connecting them together.

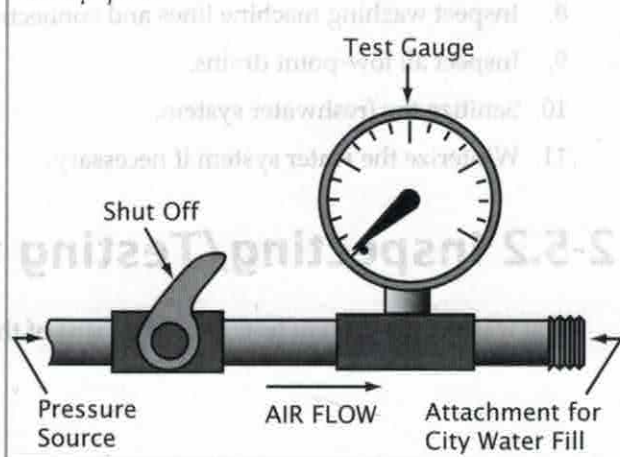
STEP 2:

Pressurize the system with air only to 80 psi (551 kPa), or as directed by the piping materials manufacturer, if CPVC piping is used. The test pressure should be applied at the city water connection.

STEP: 3

After the system is pressurized, disconnect the pressure source and monitor the test gauge for a minimum test period of 10 min. A successful test will show no pressure drop or leak. If pressure drop is noted, repair the piping, then retest until no pressure drop is noted.

Figure 2-15 Water Distribution Piping Systems Pressurized Test Equipment



STEP 4:

Remove the temporary bypass and reconnect the water heater lines to their original configuration

NOTE: When testing with air only, use extreme caution. Air pressure can be dangerous if water lines, fittings, or devices rupture when under test.

2-5.3.2 Pressurized System Air or Water Pressure Test

1. Ensure that the entire water distribution system is fully assembled and complete, including the water heater. Winterization and bypass valves must be aligned properly, if so equipped.
2. Fill the entire piping system with water, including the water heater storage tank and the pressurized potable water storage tank, if equipped.
3. Pressurize the piping system with a minimum of 80 to 100 psi of air or water pressure.

NOTE: If testing through the city water fill, ensure that the check valve (backflow preventer) at the city water fill is fully open throughout the duration of the test (NFPA 1192 paragraph 7.7.1).

4. Disconnect the pressure source and monitor the gauge for a minimum test period of 10 min. The test gauge used is recommended to have minimum 2-psi increments or a needle measuring at least 1-1/2 in. from its pivot point to its end. A successful test will show no pressure drop or leak.
5. If a pressure drop is noted, repair the piping or tank, then retest until no pressure drop is noted.

NOTE: NFPA 1192 paragraph 7.7.2.1.1 calls for 80 to 100 psi.

6. Document the results of the test and any actions taken.

2-5.3.3 Demand System Test

1. Ensure that the RV is in a level position.
2. Pressurize the demand system with water to the maximum discharge pressure (cutoff pressure) listed on the water pump.

NOTE: It is permissible to use air to test the demand system on RVs without a city water connection. When testing with air only, use extreme caution. Air pressure, even as low as 30 psi, can be a dangerous pressure if water lines, fittings, or devices rupture under pressure during the test.

3. Monitor the pressure for at least 10 minutes. A successful test will show no pressure drop or leak. If a pressure drop occurs, find and repair the leak and repeat steps 2 and 3 until no pressure drop is observed.
4. Document the results of the test and any actions taken.

2-5.4 Sanitizing the Freshwater System

The potable or freshwater system contains the water used in the house portion of the vehicle. It is composed of one or more plastic tanks, the water pump, water lines, and faucets. The key to properly maintaining the freshwater system is properly sanitizing the system before use, and to add only good clean water to the system. NFPA 1192 paragraph 7.3.7.5 requires potable water tanks to be sanitized, flushed, and drained before use.

The sanitation process is relatively easy to perform. To ensure complete disinfection of the freshwater system, it is recommended that the following procedure be followed on a new system, one that has not been used

2-5 Plumbing Systems

for a period of time, or one that may have become contaminated. This procedure is also recommended before long periods of storage such as over a winter.

Instructions for disinfection of freshwater systems on recreation vehicles (as approved by the U.S. Public Health Service):

1. Prepare a chlorine solution using 1 U.S. gal (3.8 L) of water and 1/4 cup (60 mL) of household bleach (sodium hypochlorite solution). With the tank empty, pour the chlorine solution into the tank. Use 1 U.S. gal (3.8 L) solution for each 15 U.S. gal (57 L) of tank capacity. This procedure will result in a residual chlorine concentration of 50 parts per million (ppm) in the water system. If a 100-ppm concentration is required, use 1/2 cup (120 mL) of household bleach with 1 U.S. gal (3.8 L) of water to prepare the chlorine solution. Use 1 U.S. gal (3.8 L) for each 15 U.S. gal (60 L) of tank capacity.
2. Complete filling the tank with potable water. Open each faucet and run the water until a distinct odor of chlorine can be detected in the water discharged. Do not forget the hot water taps. Make sure the hot water bypass is aligned to permit the hot water tank to be included.
3. Allow the system to stand for at least 4 hours when disinfecting with 50 ppm residual chlorine. If a shorter time period is desired, then a 100 ppm chlorine concentration should be permitted to stand in the system for at least 1 hour.
4. Drain and flush with potable water.

NOTE: Chlorine is poisonous. Recap bottle and clean utensils after use.

NOTE: There is no chapter review for this chapter.

2-5.3.3 Demand System Test

1. Insure that the RV is in a level position.

2. Priming the demand system with water to the maximum discharge pressure (check pressure) level on the water pump.

NOTE: It is permissible to use air to vent the demand system on RVs without a city water connection. When testing with air only, use extreme caution. Air pressure, even as low as 30 psi, can be a dangerous pressure if water lines, fittings, or devices rupture under pressure during the test.

3. Monitor the pressure for at least 10 minutes. A successful test will show no pressure drop or leak. If a pressure drop occurs, find and repair the leak and repeat steps 2 and 3 until no pressure drop is observed.

4. Document the results of the test and any air in the tank.

2-5.4 Sanitizing the Freshwater System

The potable or freshwater system contains the water used in the house portion of the vehicle. It is composed of one or more plastic tanks, the water pump, water lines, and faucets. The job is properly sanitizing the freshwater system is properly sanitizing the system before use and to add only good clean water to the system. NFPA 1100 paragraph 7.5.2 requires potable water tanks to be sanitized, flushed, and drained before use.

The sanitation process is relatively easy to perform. To insure complete distribution of the sanitizing agent, it is recommended that the following procedure be followed on every system, one that has not been used

Chapter

2-6 Appliances

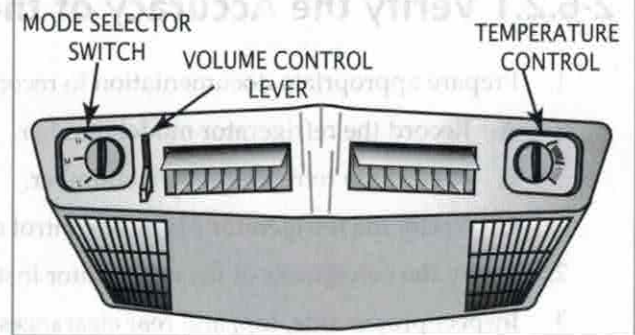
- Verify appliance operation and performance.
- Record and report defects.

2-6.1 Air Conditioners

2-6.1.1 Inspect the Roof Air Conditioner

1. Inspect the condensers on the roof of the unit for obstructions. Look for bent fins, comb out if necessary.
2. Turn the mode selector switch to COOLING. Set the volume control lever to AIR-HI. Turn the temperature control switch to COLD. It should begin cooling within a few minutes if ambient temperature is in excess of 60°F (16°C). Test the operation of all fan speeds.
3. Operate all vents. They must not slip when placed in the open or closed position.
4. Test the optional heat mode. Set the mode selector switch on HEAT. Turn the temperature control to WARM. It should begin to warm within 5 min.
5. Measure for proper ΔT . Record the return and supply temperature.
6. When testing is completed, turn the mode selector switch OFF.
7. Accurately diagnose and repair problems if any exist.
8. Record the roof air conditioner manufacturer, model number, and serial number and all actions taken on the PDI form, repair order form, or other appropriate record-keeping form and the appropriate warranty form.

Figure 2-16 Roof Air Conditioner



2-6.1.2 Inspect the Ducted Air Conditioner

1. Locate the thermostat.
2. Turn the mode selector switch to COOLING. Set the volume control lever to AIR-HI. Turn the temperature control switch to COLD. It should begin cooling within a few minutes if ambient temperature is in excess of 60°F (16°C). Check the operation of all fan speeds.
3. Operate all vents. They must not slip when placed in the open or closed position.
4. Verify airflow through ducts at all vent outlets.
5. Inspect for proper separation of intake and discharge air.
6. Measure for proper ΔT .
7. When testing is completed, turn the mode selector switch OFF.
8. Accurately diagnose and repair problems if any exist.

2-6 Appliances

- Record the ducted air conditioner manufacturer, model number, and serial number and all actions taken on the PDI form, repair order form, or other appropriate record-keeping form and the appropriate warranty form.

2-6.2 Refrigerators

Refer to the appropriate service and installation manuals for the proper procedures.

2-6.2.1 Verify the Accuracy of the Refrigerator Installation

- Prepare appropriate documentation to record inspection results.
 - Record the refrigerator model number.
 - Record the refrigerator serial number.
 - Verify the refrigerator's type of control system.
- Verify the correctness of the refrigerator installation.
- Inspect proper side, top, and rear clearances. Refer to the manual.
- Inspect proper venting per service or installation manual (i.e., bottom, upper, side, or roof vent).
- Verify that the refrigerator compartment is properly sealed from interior of coach (see service or installation manual).
- Verify that the wiring complies to NEC code.
- Verify proper propane connection to refrigerator and conduct a leak test.
- Accurately diagnose and repair installation problems, if any exist, in accordance with the installation instructions.

2-6.2.2 Evaluate Refrigerator Performance

2-6.2.2.1 Measure Propane Pressure at Refrigerator

- Test all propane tubing from the refrigerator gas valve to the refrigerator burner for leaks with leak detector fluid or an electronic leak detector. Repair any leaks.
- Turn the propane off at the container.
- Install a manometer at the provided pressure test port.
- Turn propane back on at the container.
- Measure for proper propane pressure (see service manual).
- Accurately diagnose and repair problems, if any exist, in accordance with the service manual.

2-6.2.2.2 Measure Incoming 12 VDC at Refrigerator

- Measure incoming DC voltage at refrigerator DC terminal block (10.5 to 14.5 VDC, per manufacturer's specification).
- Diagnose and repair problems, if any exist, in accordance with the service manual.

2-6.2.2.3 Measure 120 VAC at Refrigerator (As Appropriate)

1. Measure incoming AC voltage (108 to 132 VAC, per manufacturer's specification) at the receptacle.
2. Measure AC voltage at control board or selector switch.
3. Verify accuracy of the readings.
4. Diagnose and repair problems, if any exist, in accordance with the service manual.

2-6.2.2.4 Perform Run Test (12–24 Hr)

1. Operate the refrigerator on all energy sources.
2. After the refrigerator starts to cool, it may be switched to propane mode.
3. Put a thermometer in 1 gal of water and run the refrigerator at mid-setting for 12 to 24 hours (thermometer should read 40 to 43°F [4 to 6°C] or less).
4. Diagnose and repair problems, if any exist, in accordance with the service manual.

NOTE: It is recommended to use the electrical energy source of the appliance first to prove operation of the heat elements.

5. Document inspection results and any actions taken.

2-6.3 Furnaces

Refer to the appropriate service and installation manuals for the proper procedures.

2-6.3.1 Verify the Accuracy of a Furnace's Installation

1. Prepare document to record results of the checks.
2. Record the furnace model number.
3. Record the furnace serial number.
4. Record the type of furnace system.
5. Verify proper ducting.
6. Verify proper return air.
7. Verify proper propane connections and conduct a leak test.
8. Document leak test results.
9. Verify proper exhaust vent system.
10. Look for any obstruction.
11. Verify proper seals at door, vents, and other locations.
12. Diagnose and repair installation problems, if any exist, in accordance with the installation manual.

2-6.3.2 Evaluate Furnace Performance

2-6.3.2.1 Measure Line Voltage at the Furnace

1. Measure incoming voltage at the wire connections on side of furnace. Nominal voltage should be 10.5 to 13.5 VDC under unloaded condition.
2. Turn furnace on.
3. Verify ignition.
4. Measure voltage at the wire connections on side of furnace. Nominal voltage should be 10.5 to 13.5 VDC under loaded condition.
5. Diagnose and repair problems, if any exist, in accordance with the service manual.

2-6.3.2.2 Measure Propane Pressure at Furnace

1. Close service valve on propane container.
2. Install manometer at pressure test port.
3. Open service valve on propane container.
4. Measure for proper gas pressure (see service manual).
5. Document measurement results.
6. Diagnose and repair problems, if any exist, in accordance with the service manual.

2-6.3.2.3 Evaluate Proper Airflow

1. Open all discharge registers and any closeable registers (see installation and or service manual for requirements).
2. Verify air discharge by feel or using an air speed indicator.
3. Verify that the discharge is warm.
4. Diagnose and repair problems, if any exist, in accordance with the service manual.
5. Verify that no CO (carbon monoxide) is present (CO test).

2-6.3.2.4 Evaluate Return Airflow

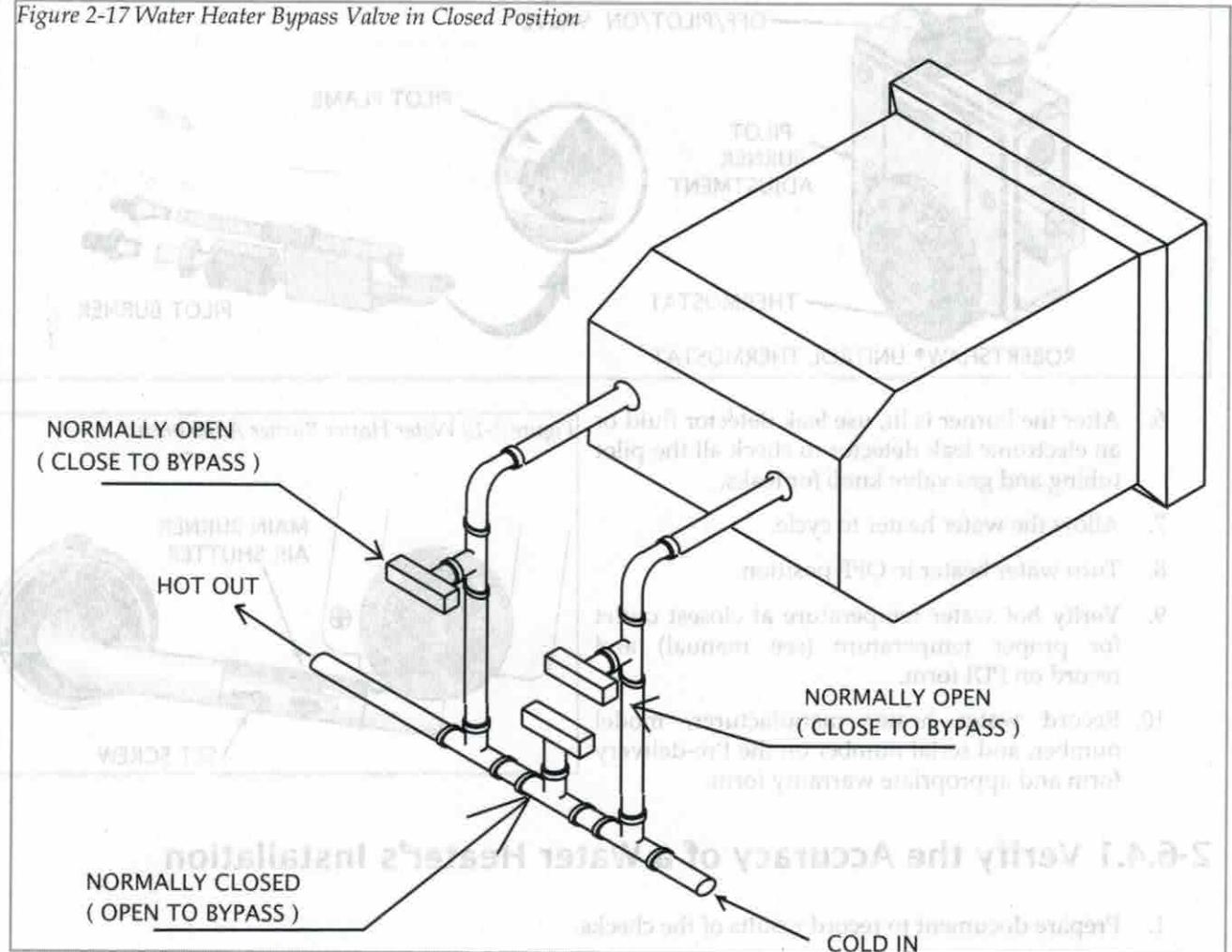
1. Verify proper return air opening size (see installation and or installation manual).
2. Diagnose and repair problems, if any exist, in accordance with the service manual.
3. Document inspection results and any actions taken.

2-6.4 Water Heaters

NOTE: Although the water heater is included under *Propane System and Appliances* for purposes of format, the water heater CANNOT be tested without water in the system. The water heater can be tested ONLY AFTER the water heater tank has been filled. Thus, the water heater burn test must be performed FOLLOWING distribution system tests in the plumbing chapter of this textbook.

1. Before testing the water heater, be certain sufficient water has been purged through the hot water lines (by drawing water from hot water faucets) to fill the water heater tank. Make sure any water heater bypass valves are aligned properly to allow water into the water heater.

Figure 2-17 Water Heater Bypass Valve in Closed Position

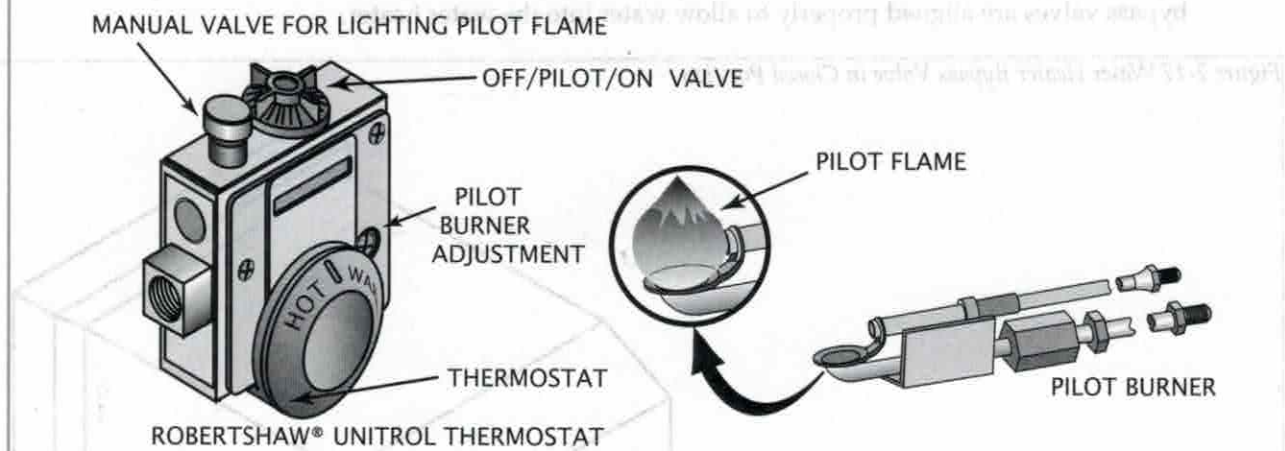


2. Remove foreign material from the compartment. Insulating material must be securely installed.
3. Operate the water heater on all energy sources.

NOTE: It is recommended to use the electrical energy source of the appliance first to prove operation of the heat elements.

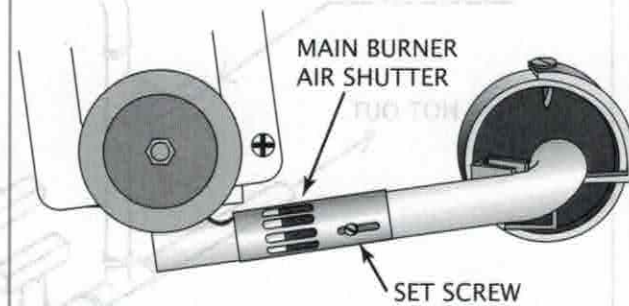
4. Operate the water heater on its propane source.
5. Inspect for proper flame.

Figure 2-18 Water Heater Adjustments



6. After the burner is lit, use leak detector fluid or an electronic leak detector to check all the pilot tubing and gas valve knob for leaks.
7. Allow the water heater to cycle.
8. Turn water heater to OFF position.
9. Verify hot water temperature at closest outlet for proper temperature (see manual) and record on PDI form.
10. Record water heater manufacturer, model number, and serial number on the Pre-delivery form and appropriate warranty form.

Figure 2-19 Water Heater Burner Adjustment



2-6.4.1 Verify the Accuracy of a Water Heater's Installation

1. Prepare document to record results of the checks.
2. Record the water heater model number.
3. Record the water heater serial number.
4. Verify type of control system.
5. Test T&P valve for proper operation and flow.
6. Inspect the seal around the flange.
7. Inspect for proper drain plug or anode rod per manufacturer specifications.
8. Confirm that the vent is clear and properly gapped from door screen (0 to 1/4 in. —see installation manual).
9. Confirm that the gas line is properly sealed from interior of coach.
10. Verify that wiring complies with National Electrical Code (if applicable).
11. Verify that the water heater is properly supported.
12. Diagnose and repair problems, if any exist, in accordance with the installation instructions.

2-6.4.2 Evaluate Water Heater Performance

1. Measure propane pressure at water heater.
2. Close service valve at propane container.
3. Install manometer on the provided pressure test port.
4. Open service valve at propane container.
5. Measure for proper propane pressure (see service manual).
6. If equipped with a 120 VAC element, measure for 120 VAC at the water heater and locate and verify operating switches.
7. Diagnose and repair problems, if any exist, in accordance with the service manual.

2-6.4.3 Conduct Performance Test

2-6.4.3.1 Pilot

1. Visual inspection for parts present and tightness.
2. Start up in low setting.
3. Light pilot light.
4. Set to ON position.
5. Burner should light.
6. Verify proper flame color and size.

2-6.4.3.2 DSI

1. Visual inspection for wires and parts present.
2. Turn water heater on (18 second delay before starting).
3. 7 second ignition try (3 automatic tries).
4. Troubleshoot sequence if no ignition.
5. Document inspection results and any action taken on the PDI form, repair order form, or other appropriate record-keeping form and the appropriate warranty forms.

2-6.5 Range and Oven

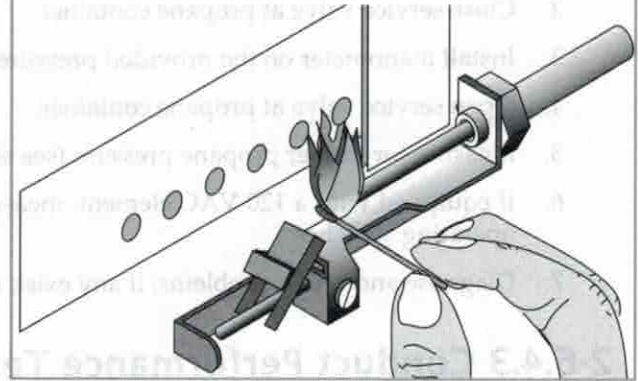
2-6.5.1 Range Top

1. Light all range burners.
2. Inspect for proper burner flame.
3. Shut off the burners.
4. Use leak detector fluid or an electronic leak detector to check all range top burner valves for leaks.

2-6.5.2 Oven

1. Remove all combustible materials from the oven (i.e. paperwork, tape, etc.).
2. Light the oven pilot, then turn to the ON position.
3. Turn up the control knob temperature until the main oven burner ignites.
4. Inspect the pilot burner tubing for leaks around the oven thermostat connection and safety valve/tubing with leak detector fluid or an electronic leak detector.
5. Ensure that the oven cycles properly.
6. Ensure that the oven ignites the main burner at the lowest temperature setting of the oven.
7. Put a thermometer in the oven and measure for calibration of the built-in thermostat. Adjust if so equipped.
8. Turn the oven OFF.
9. Record range/oven manufacturer, model number, and serial number and all actions taken on the PDI form, repair order form, or other appropriate record-keeping form and the warranty form.

Figure 2-20 Lighting Oven Pilot



2-6.6 Microwave

1. Remove all shipping material.
2. Ensure that the microwave is plugged in.
3. Open the door; the light should come on.
4. Set a glass or plastic container of water in the oven. DO NOT use a metal container. Close the oven door, set the timer for two minutes, and turn the microwave ON.
5. After 2 minutes, ensure that the microwave turns OFF. If the water has warmed, the microwave is operating properly.
6. Accurately diagnose and repair problems if any exist.
7. Record the microwave manufacturer, model number, and serial number and all actions taken on the PDI form, repair order form, or other appropriate record-keeping form and the warranty form.

2-6.7 Food Control Center

1. Plug in the blender and other accessory appliances.
2. Test each in turn for proper operation.
3. Accurately diagnose and repair problems if any exist.
4. Record the manufacturer, model number, and serial number and all actions taken for each appliance on the PDI form, repair order form, or other appropriate record-keeping form and the appropriate warranty form.

NOTE: There is no chapter review for this chapter.

Chapter

2-7 Interior

- Inspect interior surface finishes.
- Record and report defects.
- Verify furniture operation and appearance.
- Verify window and door operation.

2-7.1 Introduction

Another item high on the list of customer satisfaction is the appearance of items found in a unit. This detail work is extremely important and will leave a lasting impression.

2-7.1.1 Interior Adjustments and Cleanup

1. Inspect the interior paneling and molding for workmanship. Ensure that seams fit and that all nail and staple holes are filled with putty. Look for nicks and dents on the edges of cabinets, styles, and so on.
2. Inspect windows and screens for proper operation. Test shades and curtains for smooth operation and proper fit, adjust as necessary. Curtains must be clean. Remove shipping clips from jalousie windows and entrance doors.
3. All seats must be securely anchored to the floor. Inspect seat belts for secure installation. Tighten anchorages as necessary to the manufacturer's torque specifications.
4. Open all beds, testing for proper operation (return to the original position when the inspection is completed). Inspect the appearance of cushions and mattresses.
 - A. Gauchos. Facing gauchos must meet evenly when in a bed position.
 - B. Hide-a-bed. The bunk facer board or pad must clear the ceiling. The bed must lock securely in the travel position.
 - C. Convert-a-sofa or sofa.
 - D. Flip seats.
 - E. Front fold-down bed.
5. Set up all tables. They must secure properly and fit in the set-up and storage positions.
6. Countertops should be securely fastened. Inspect for general appearance.
7. Open and shut all drawers and cabinet doors, verifying each for ease of operation. Test drawers for their secure close position. Inspect drawer and cabinet door appearance.
8. Inspect the floor covering (remove plastic covering). Floor covering should be clean.
9. Inspect the ceiling board or fabric. It should be clean.
10. The bathroom door must fit securely and lock properly.
11. Closet hanger rods must fit securely.
12. Inspect the refrigerator, icebox, or cooler. It must be clean. Remove all shipping tape, and so forth.
13. All water lines and wires must be secured to the floor or wall.
14. Clean the interior of the unit:
 - A. Wipe down the walls with cleaners and polishes in accordance with the manufacturer's recommendations.

2-7 Interior

- B. Wipe down and clean the sinks, toilet, and shower/tub. Remove labels and protective coatings.
- C. Vacuum the floor and inside of cabinets and drawers.

2-7.1.1.1 Sample Interior Checklist

ADJUSTMENTS AND CLEANUP

Initials

INTERIOR

Seats OK

Table and Bed Setup OK

Refrigerator/Chest Cooler/Icebox OK

Interior Cleaned: Walls Wiped Down, Fixtures Cleaned, Floor Vacuumed

NOTE: This is no review for this chapter.

Chapter

2-8 Fire, Life, and Safety

- Test operation of CO alarms.
- Test operation of smoke alarms.
- Record and report defects.
- Test operation of propane detectors.
- Inspect fire extinguishers.

2-8.1 Fire Extinguishers

All fire extinguishers must be Underwriters Laboratory (UL) approved. This verifies that they comply with 29.CFR 1910.157(c)(2). Fire extinguishers are assigned an alphanumeric classification based on the type and size of the fire it will extinguish (i.e. 3A:40B:C). The letter represents the type of fire that the fire extinguisher can be used to put out:

- (A) ordinary combustibles (paper, wood, cardboard, plastics)
- (B) flammable liquids (gasoline, kerosene, grease, oil)
- (C) electrical equipment (appliances, wiring, circuit breakers, outlets)
- (D) metals (magnesium, titanium, potassium, sodium)
- (K) combustible cooking fluids (cooking oils and fats)

The number represents the size of the fire it will extinguish.

For Type A fires, the number denotes the water equivalent:

- (1) equivalent to 1-1/4 gal of water
- (2) equivalent to 2-1/2 gal of water
- (3) equivalent to 3-3/4 gal of water
- and so on...

For Type B and C fires, the number denotes the amount of square footage it would cover:

- 2 covers 2 ft²
- 5 covers 5 ft²
- 10 covers 10 ft²
- and so on...

Fire extinguishers have more than one letter or number on them because they can also be made to extinguish more than one type of fire. If the extinguisher's label reads 2A:5B, then it would work on Type A fires with a 1-1/2 gal equivalence and for Type B fires with a 5 ft² equivalence.

2-8.1.1 Motorhomes and Toy Haulers

Ensure that any motorhome or RV designed to transport internal combustion vehicles (toy haulers) has a portable fire extinguisher:

1. that is listed.
2. that has a minimum rating of 10B:C.
3. that is mounted within 24 in. of the opening of the primary means of exit.

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4. that is mounted so that the operating instructions face outward.
5. that is NOT mounted in an enclosure with a lockable or solid face door.
6. that is securely attached to its mounting bracket.

Document the results of the inspection on the PDI form, repair order form, or other appropriate record-keeping form.

2-8.1.2 Any Other RV with Fuel-Burning Equipment or 120/240 VAC Electrical System

NOTE: This requirement does not pertain to a motorhome that has a portable fire extinguisher with a minimum 10B:C rating.

Ensure that each RV equipped with a fuel-burning device or 120/240 VAC electrical system has a portable fire extinguisher:

1. that is listed.
2. that has a minimum rating of 5B:C.
3. that is mounted within 24 in. of the opening of the primary means of exit.
4. that is mounted so that the operating instructions face outward.
5. that is NOT mounted in an enclosure with a lockable or solid face door.
6. that is securely attached to its mounting bracket.

Document the results of the inspection on the PDI form, repair order form, or other appropriate record-keeping form.

2-8.2 CO Alarms

Carbon monoxide (CO) alarms must be installed in all RVs manufactured after 09/01/2008. This requirement exists regardless of fuel source (gasoline, propane, diesel, or other/alternative fuel). Include all CO alarms in the PDI inspection process.

Ensure that the CO alarm is:

1. listed for use in an RV.
2. installed in accordance with its listing requirements.

NOTE: Some instructions prohibit installation in areas such as in the direct airflow from a vent or A/C unit or in corners or too close to a wall. When the installation instructions do not specifically state distances from these areas, the general rule is to ensure that the CO alarms are at least 12 in. from vents, air conditioner return air and cold air outlets and 4 in. from corners and walls.

3. is not outdated, especially on used units.
4. tested in accordance with the instructions provided with the alarm.

Document the results of the test on the PDI form, repair order form, or other appropriate record-keeping form and the warranty form for the alarm.

2-8.3 Propane Detectors

All recreation vehicles equipped with a propane appliance and electrical system must be equipped with a propane detector. Ensure that the detector is:

1. listed for use in an RV under the requirements of *UL 1484*.
2. installed in accordance with its listing requirements.
3. is not outdated, especially on used units.
4. tested for proper operation.

Document the results of the test on the PDI form, repair order form, or other appropriate record-keeping form and the warranty form for the detector.

2-8.4 Smoke Alarms

Ensure that any fifth-wheel trailer, travel trailer, truck camper, or motorhome is equipped with a smoke alarm:

1. that is listed for use in an RV under the requirements of *UL 217*.
2. that is battery operated.
3. that is mounted in accordance with its listing requirements.

NOTE: Some instructions prohibit installation in areas such as in the direct airflow from a vent or A/C unit or in corners or too close to a wall. When the installation instructions do not specifically state distances from these areas, the general rule is to ensure that the smoke alarms are at least 12 in. from vents, air conditioner return air and cold air outlets and 4 in. from corners or walls.

4. that has an operational check warning label mounted in a visible location on or within 24 in. (610 mm) of the smoke alarm (see *NFPA 1192 paragraph 6.3.4* for label wording).
5. is not outdated, especially on used units.
6. and is tested for proper operation.

Document the results of the test on the PDI form, repair order form, or other appropriate record-keeping form and on the warranty form.

NOTE: Folding camp trailers are not required to have smoke alarms installed, but some may have them. If installed in these recreation vehicles or if added on, the smoke alarm should still be listed for RV use, and the installation of the smoke alarm should be in accordance with its listing requirements.

2-8.5 Exit Windows, Hatches, Panels

Recreation vehicles are required to have a minimum of two exits located remote from each other. In motorhomes and truck campers, the alternate exit needs to be located on a wall other than the one containing the main vehicle exit, or in the roof. In some cases, the driver's door may be used as the alternate exit.

1. Ensure that alternate exits are clearly marked EXIT in accordance with *NFPA 1192 paragraph 6.2.6.1* and 6.2.6.2.
2. Ensure that alternate exits function properly by hand with no more than 20 lb (89 N) of force required to open it. Testing using a spring scale is acceptable. The minimum force requirement also applies to a sliding door or window.

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3. Ensure that blinds and shades do not hinder the operation of the alternate exit. Blinds and shades must be removable with less than 20 lb (89 N) of force.
4. Ensure that the alternate exit handles or latches are colored red (see NFPA 1192 paragraph 6.2.7 for exception). Latching mechanisms for screen or storm windows over an exit window and a zipper tab used to open a fabric exit do not need to be colored red.
5. Ensure that passageway doors between the primary and alternate exits do not have locks.
6. Ensure that any aftermarket additions do not obstruct the pathway to the alternate exit.
7. Ensure that alternate exits do not require use of a key or tool for operation from the inside.

2-8.6 Seat Belts

Seat belts are required by federal law in all motorhomes. Seat belts are to be provided for all designated seating positions equal to at least the number of sleeping positions provided in the RV. Seat belts are not required in trailers or truck campers.

1. Ensure that each seating position in the motorhome has a seat belt or is clearly marked not to be used while the vehicle is in motion.
2. Ensure that each seat belt is labeled with year of manufacture, model, and name or trademark of manufacturer or distributor.
3. Ensure that each seat belt is securely attached to the vehicle.
4. Ensure that the seat belt buckle connects and disconnects easily.
5. Ensure that each seat belt adjusts properly and smoothly.
6. Document any problems discovered and corrective actions taken on the PDI form, repair order form, or other appropriate record-keeping form.

2-8.7 Liquid Fuel Filler

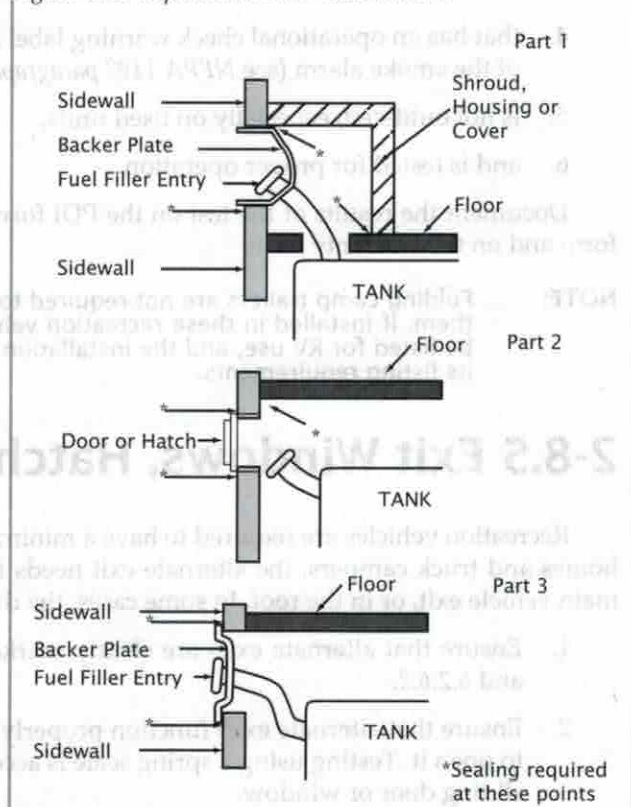
Ensure that all liquid fuel fillers are installed to meet the following provisions:

1. All filler cap ends must be completely above the top of the gas tank.
2. Any fuel fill below the fuel level in the tank must have an anti-expulsion valve.
3. Area around the fill and vent must be sealed so that no vapors can enter the RV.
4. The sidewall within 12 in. around the fuel fill must be fuel resistant and nonabsorbent.

2-8.8 Floor Penetrations

Any motorized RV or any RV with a generator installed must have the floor completely sealed to the

Figure 2-21 Liquid Fuel Filler Installations



exterior so no exhaust can enter the RV. When making any repairs, care should be taken to reseal any penetrations in this area. Any new penetrations made as part of an installation must also be sealed. No open holes through the floor are allowed. Any wiring, piping, or other holes must be completely sealed vapor tight.

2-8.9 Generator Installation

All generators must be "listed for RV use" and installed according to manufacturers installation instructions. When a generator compartment is used it must be 26 ga galvanized sheet metal with lapped joints and sealed vapor tight to the interior of the RV. Fuel lines and exhaust can not pass through the RV interior. All holes and penetrations must be sealed.

2-8.10 Internal Combustion Engine Exhaust

Engine exhaust for both generators and gasoline-powered motorhomes must extend beyond the edge of the RV wall and cannot terminate under the vehicle. The new high-temp diesel exhaust tips are exempt, and it is permitted for part of the exhaust opening to be under the vehicle due to the size of the terminus and need for heat dissipation. Generator exhaust must be located at least 36 in. below any slideout rooms. Exhaust shall not be subject to road damage and should be installed with as much road clearance as possible.

Figure 2-23 Exhaust Terminations

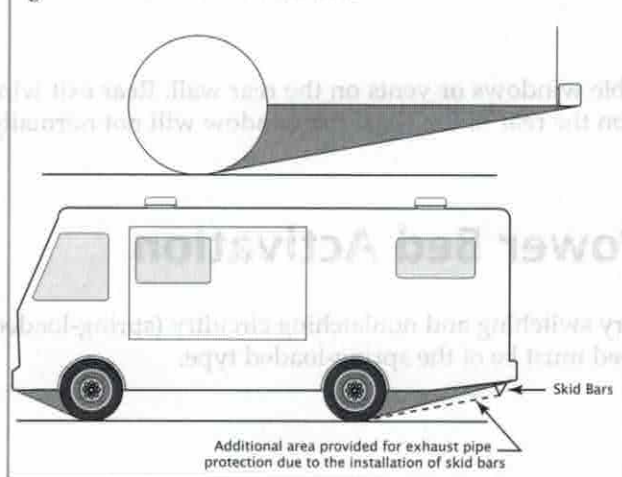


Figure 2-22 Exhaust Terminations

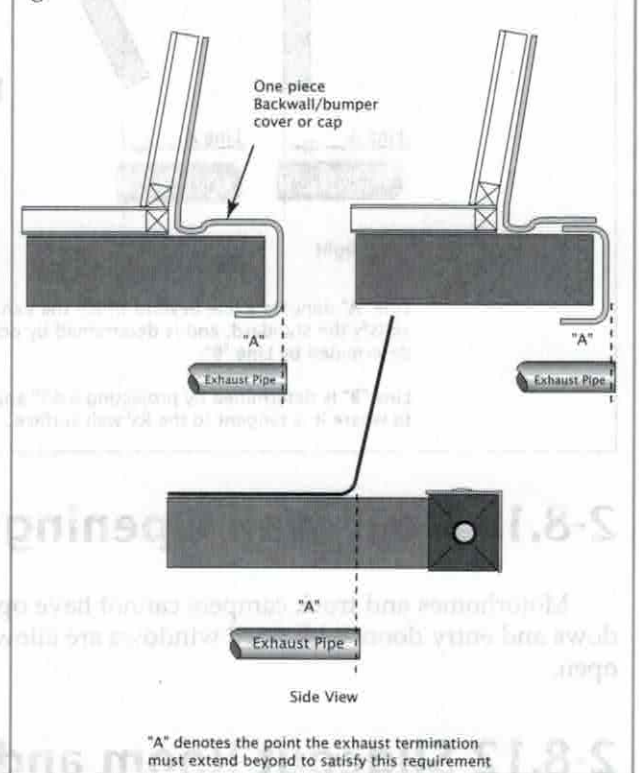
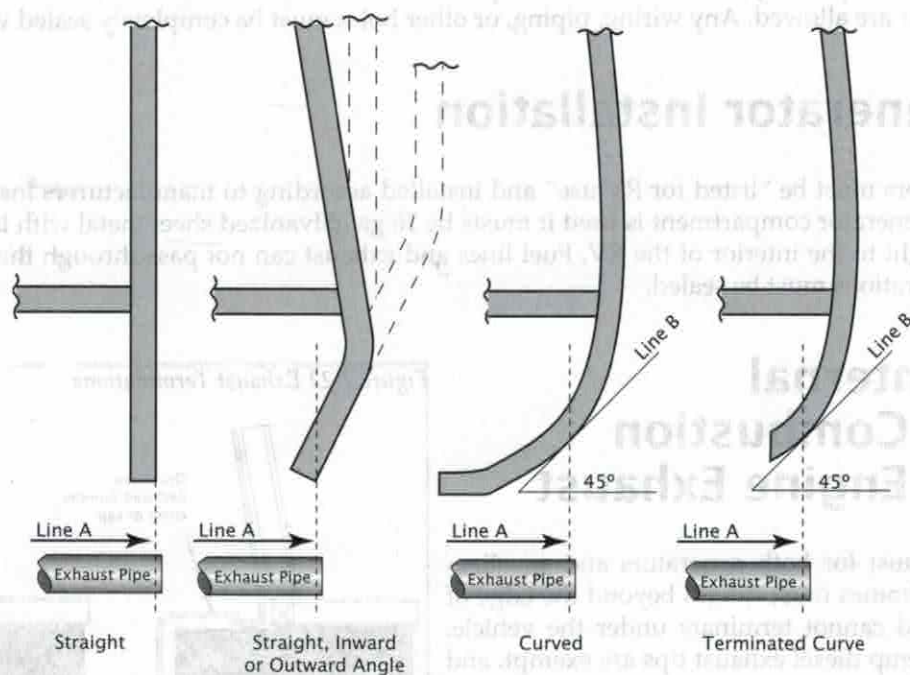


Figure 2-24 Exhaust Terminations



Line "A" denotes a line beyond which the exhaust termination opening must extend to satisfy the standard, and is determined by drawing a vertical line through the tangent point determined by Line "B".

Line "B" is determined by projecting a 45° angle from the horizontal plane created by the ground to where it is tangent to the RV wall surface.

2-8.11 Rear Wall Openings

Motorhomes and truck campers cannot have operable windows or vents on the rear wall. Rear exit windows and entry doors with fixed windows are allowed on the rear of the RV if the window will not normally open.

2-8.12 Slideout Room and Power Bed Activation

Slideout rooms are only permitted to have momentary switching and nonlatching circuitry (spring-loaded switch). Any switch used for a slideout room or power bed must be of the spring-loaded type.

2-8.13 Glass and Mirrors

If interior glass is added or changed, it is important to be aware that all interior glass and mirrors that exceed 431 in² need to comply with ANSI Z97.1 or equivalent. Examples of compliant materials would include safety glass, tempered glass, or glass that is provided with a safety backing. Safety backing is a specific type of film that is applied by the mirror manufacturer, typically with a label to indicate compliance. Mirrors that are backed by mere taping by the installer of the mirror do not meet the requirements.

2-8.14 Markings and Labels

Every RV constructed in accordance with *NFPA 1192* has warning labels mounted throughout the RV. These labels and their required locations can be found in *NFPA 1192*. These labels include, as appropriate, the following:

1. Privacy curtains in vicinity of appliances
2. Storage of combustible materials
3. Use of appliances for comfort heating
4. Eighty percent propane fill limitation
5. Instructions "If You Smell Gas"
6. Types of fuel approved for use with propane piping system
7. Refueling precautions
8. Smoke alarm testing
9. Sleeping location precautions
10. Storage of fuel burning equipment inside an RV
11. Labeling of potable water tanks

Ensure that required labels are conspicuously mounted at or near the appropriate locations.

Document any problems discovered and corrective actions taken on the PDI form, repair order form, or other appropriate record-keeping form.

NOTE: Some of these labels may be required to be placed in more than one location. Check *NFPA 1192* as necessary.

NOTE: There is no chapter review for this chapter.

2-8.14 Markings and Labels

Every RV constructed in accordance with NFPA 1192 has warning labels mounted throughout the RV. These labels and their required locations can be found in NFPA 1192. These labels include, as appropriate, the following:

1. Propane contains in vicinity of appliances
2. Storage of camp-stable materials
3. Use of appliances for cooking heating
4. High-pressure propane fill prohibition
5. Instructions: "If You Smell Gas"

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For use that required labels are conspicuously mounted at or near the appropriate location. Location and position (displayed and corrective action taken on the RV) form, repair order form or other appropriate record-keeping form.

NOTE: Some of these labels may be required to be placed in more than one location. Check NFPA 1192 for details.

NOTE: There is no chart review for this chapter.

Chapter

2-9 Exterior

- Measure tire pressure.
- Conduct under-vehicle visual inspection.
- Inspect fluid levels.
- Inspect exterior body finish and graphics.
- Verify lug nut torque.
- Test exterior DOT lighting.
- Clean and detail unit.
- Record and report defects.

2-9.1 Entrance and Compartment Doors

1. Identify keys to fit every lock—should have two complete sets.
2. Test operation of all entrance door locks.
3. Lubricate as necessary.
4. Ensure that all striker plates allow for tight fit and seals of doors.
5. Ensure that all doorstops work.
6. Close and latch all screen doors and check for fit.
7. Ensure that door screens are not damaged.
8. Test operation of all compartment doors.
9. Lubricate as necessary.
10. Ensure that all compartment door holders hold doors open adequately.
11. Inspect all entrance doors, drip caps, and so forth for intact butyl and/or caulking.
12. Inspect compartment doors for intact butyl and/or caulking.
13. Test operation of all door switches.
14. Test operation of exterior compartment lights.
15. Verify operation of entrance door steps.
16. Lubricate as needed.
17. Paint if required.
18. Ensure that entrance door steps are securely mounted.
19. Verify operation and secure mounting of entry assist handles.

2-9.2 Roof, Vents, Skylights, and Roof-Mounted Accessories

1. Verify if roof is walk-on style (plywood underneath roof surface).
2. If not a walk-on style roof, then use a piece of 3/8 in. plywood, 3 × 5 ft minimum, for support while on roof structure.
3. Inspect condition of caulking on all roof vents, skylights, escape hatches, plumbing vents, antennas, and all other mounted accessories.
4. Look for cracks and lifting in existing caulking.

5. Look for cracks in the actual mounting bases of all components.
6. Clean and reseal as necessary.
7. Inspect condition of caulking on all seams and roof termination moldings.
8. Look for cracks and lifting in existing caulking.
9. Clean and reseal as necessary.
10. Inspect condition of all vent lids, skylights, escape hatch lids, and so on.
11. Inspect roof rack and ladder mounts to be secure.
12. Inspect condition of caulking at all attachment points.
13. Take close look for cracks that open and close while climbing and shifting weight on ladder, and so forth.
14. Inspect storage pods for secure mountings.
15. Inspect TV antenna, radio antenna, and satellite dish.
16. Inspect for secure mounting.
17. Inspect cables to ensure good condition (i.e., cracks).
18. Inspect cable connections to be tight and securely attached.
19. Test TV antenna for operation from inside coach.
20. Test satellite operation (mechanical or electric).
21. Test TV for operation of antenna and/or satellite.
22. Verify that TV antenna booster increases signal (if so equipped).

2-9.3 Exterior Walls, Windows, Accessories, Etc.

1. Inspect condition of all moldings.
2. Look for gaps in butyl and caulking along both edges of all moldings.
3. Inspect condition of all window seals.
4. Look for gaps in butyl or caulking.
5. Verify operation of rock guards.
6. Inspect condition of seal for rock guard and secure mounts.
7. Inspect overall exterior appearance.
8. Look for loose trim and so forth.
9. Look for cracks or holes in fiberglass and aluminum.
10. Pay special attention to any corners above doors, and large openings for cracks, and so on.
11. Test operation of all awnings.
12. Inspect for secure mounting.
13. Open and close, ensuring proper operation.
14. Inspect the condition of fabric, looking for damage.
15. Look for awning wheels to protect fabric on doors, and so on.

2-9.3.1 Decals, Approved Standards, Etc.

1. Ensure that standards certification decals are on units (RVIA certification in U.S.A. and CSA certification in Canada).
2. Check for decals installed straight and square. Install dealer decals if required.
3. Install dealer spare tire cover if required.

NOTE: There is no chapter review for this chapter.

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2-9.3.1 Decals, Approved Standards, Etc.

1. Ensure that standards certification decals are on units (VIA certification in U.S.A. and CSA certification in Canada).

2. Check for decals installed upright and square (install dealer design if required).

3. Install dealer square the cover if required.

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Chapter

2-10 Expandable Rooms/Slideouts

- The components, alignment and operational performance of expandable rooms should be investigated and verified before delivering a new or used RV with an expandable room.

2-10.1 Identify Expandable Rooms

1. Identify the number of expandable rooms.
2. Identify operation systems—note that some coaches may have two or more different types of operating systems on different expandable rooms; i.e., the living room area may be hydraulically operated, but the bedroom area may be electrically operated.
3. Verify operation of all expandable rooms from a closed position to fully open and closed again.
4. Lubricate as needed.
5. Note some manufacturers do not recommend any lubrication, but others recommend a dry lubricant—verify proper lubrication with owner's manual.
6. Inspect expandable rooms for alignment.
7. Verify alignments in closed positions front to rear.
8. Verify alignments in closed positions top to bottom.
9. Verify alignments in open positions front to rear.
10. Verify alignments in open positions top to bottom.
11. Inspect seals and or sweepers in open and closed positions.
12. Test 120 VAC connections for expandable rooms.
13. Test all receptacles, lights, fans, and so forth in the expandable rooms.
14. Inspect all 12 VDC connections for expandable rooms.
15. Verify condition of any propane piping, tubing, and hoses.
16. Look for possible damage from rubbing or catching as expandable room moves.
17. Verify that propane lines are properly secured.
18. Verify that propane lines are routed in a manner that will prevent damage or kinks.
19. Verify condition of any freshwater piping or tubing.
20. Look for possible damage from rubbing or catching as expandable room moves.
21. Verify that freshwater lines are routed in a manner that will prevent damage or kinks.
22. Verify condition of any wastewater piping.
23. Inspect wastewater lines to ensure that they are properly secured.
24. Inspect wastewater lines so they are routed in a manner that will prevent damage or kinks.
25. Inspect condition of all moldings.
26. Look for gaps in butyl and caulking along both edges of all moldings.
27. Inspect condition of all window seals.

2-10 Expandable Rooms/Slideouts

28. Look for gaps in butyl or caulking.
29. Inspect overall exterior appearance.
30. Look for loose trim and so forth.
31. Inspect roof condition.
32. Inspect overall interior appearance.
33. Ensure that all carpet and flooring is in good condition and fastened.
34. Ensure that all furniture is capable of being located so as not to interfere with slideout operation.
35. Test operation of travel locks, safety bars, and so on.
36. Verify that the fit and hold of the expandable room are tight when in the transit position.

NOTE: There is no chapter review for this chapter.

Chapter

2-11 Motorized

- Test operation of backup monitor and mirrors.
- Inspect belts and hoses.
- Record and report defects.
- Verify operation of switches, indicators, and gauges.
- Road test the unit.

2-11.1 Introduction

RV service technicians seldom work on chassis frames and running gear, but they are still required to conduct a PDI on these components.

The information regarding general inspection includes all items that are common to motorized and non-motorized chassis.

2-11.2 General Inspection

1. Tires must be properly inflated; maximum tire pressure is indicated on the side of the tire. Inspect tires for bulges, cuts, and other damage. Tires must be rated for the gross axle weight rating (GAWR) of the vehicle. Be sure to verify the spare tire's pressure, condition, rating, and mounting.
2. Locate the tire-changing tools and jack (if so equipped). Remove the wheel covers and tighten the wheel lugs to specifications indicated in the manufacturer's chassis manual. Record lug torque on the Pre-delivery Checklist. Replace wheel covers, verifying that they match. Install tire-changing tools and jack.
3. Install all loose OEM parts.
4. Test all windows, entrances, screens, emergency exits, and access doors for installation, operation, and fit. Emergency exits need to be capable of operating with no more than 20 lb of force. All doors must be securely closed before the road test.
5. Test doorstep and roof vents for installation, operation, and fit. The doorstep must be in its travel position, and all roof vents must be closed before the road test.
6. Test the operation of the following exterior lights, if applicable:
 - A. Headlights—test dimmer switch operation, check high and low beams on both headlight lamps, and verify proper aim of the beams.
 - B. Clearance lights
 - C. Brake lights
 - D. Backup lights
 - E. Right and left turn signals
 - F. Tail lights
 - G. Emergency four-way flashers
 - H. License plate lamp

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- I. Porch light and/or assist handle light
 - J. Fog lights and alignments
 - K. Docking lights
7. Visually check the chassis and report defects. Under the terms of the warranty, chassis repairs should be referred to the appropriate chassis manufacturer.

2-11.2.1 Sample General Chassis Inspection Checklist

Initials

Tire pressures checked (including spare)

Wheel lugs tightened to required torque of _____

Tire-changing tools, jack and fire extinguisher installed _____

2-11.3 Tires, Exterior Lighting, Fluid Levels, Belts, Dash Panel, Gauges, Road Test

2-11.3.1 Introduction

The PDI procedures for motorized chassis inspections are basically the same checks that should be made by an RV service technician during preventive maintenance activities. Most of the inspection procedures are visual. However, with experience, the technician will learn how different sounds and the vehicle's overall handling will point to possible problems. The pre-delivery inspection will include:

1. Visually verifying all fluid levels
2. Inspecting belts
3. Verifying the operation of dash switches, indicators, and gauges
4. Testing backup monitor
5. Road testing the unit
6. Recording and reporting defects on a motorized unit

2-11.3.2 Test Horns

Test that all horns operate as designed. Correct if necessary.

2-11.3.3 Inspect Windshield Wipers/Washers

1. Verify that the windshield wiper control operates the windshield wipers at all designated speeds.
2. Verify that the windshield washer sprays through all designated ports or windshield wiper ports.
3. Inspect all hoses and fittings for cracks and so forth. Repair as necessary.
4. Fill windshield wiper fluid bottle with correct fluid.

2-11.3.4 Inspect Parking Brake

1. Start the engine, put the vehicle in a forward gear, and test to ensure that there is no forward creep. Adjust the parking brake if necessary.

NOTE: Remain in the driver's seat whenever the engine is running.

2. Vehicles with air brakes will need to build air pressure before this check is performed. Be in a clear zone with no potential obstructions when performing this test.

2-11.3.5 Test Seat Adjustments

1. Be certain the seat moves up/down and forward/back, and the seat back adjusts as designed (either electrically or manually). Repair as necessary.
2. Test seat heater if so equipped.
3. Inspect armrest for proper operation.

2-11.3.6 Operate Dash A/C-Heater-Defrost

1. Verify that the fan speeds are synchronized with the fan selector switch.
2. Verify that the mode selector switch properly switches from heat to defrost to A/C vents and that air flows through the proper vents based on the mode selector switch position.
3. Verify that heat and cool functions are working properly.

NOTE: The engine must be running for a few minutes for heat and cool modes to work properly.

4. Verify that the front defrost windshield fans work properly if so equipped.
5. Refer to manual for proper temperature differentials when checking for A/C cooling operations. Adjust for ambient conditions.

2-11.3.7 Test Backup Monitor/Alarm

1. Verify that the backup alarm is audible with gear shift selector in reverse position and the engine running.
2. Verify that the backup monitor has a legible screen and has the correct area behind the motorhome on the screen. Be certain the screen is showing left/right and up/down properly.
3. Verify that the electric camera aiming switch works properly.
4. Verify all monitor settings are working properly.

NOTE: Due to the numerous backup systems on the market, refer to the manual to determine when different systems will function, such as engine running, gear selector in reverse, time delay, and so on.

2-11.3.8 Inspect Rear/Side View Mirrors

1. Verify that all mirrors are tight and will not vibrate out of position.
2. Verify that all electric mirrors move in all directions when the selector switch is energized.

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3. Verify that the mirror heaters operate if so equipped.

2-11.3.9 Inspect Sun Visors

Verify that the sun visors operate as designed and are properly secured.

2-11.3.10 Operate Convenience Lights

2-11.3.10.1 Fog Lights/Docking Lights

1. Test/verify that all lights work with the designated switches and are aimed properly.
2. Verify mounting is secure.

2-11.3.10.2 Spotlights

1. Verify that the spotlights come on and off and that the aiming device, whether electric or manual, is functioning properly.
2. Verify that mounting is secure.

2-11.3.11 Inspect Tire and Wheels

1. Include the spare tire in all inspections, measurements, and inflation procedures.
2. Ensure that all tires have proper tire inflation pressure as per sidewall markings, tire inflation chart, or manufacturer's specifications.
3. Measure tread depth and record. Report any insufficient tread depth.
4. Inspect the date code on all tires and record.

NOTE: Verify the age of the tire by referring to the DOT number. The last digit on the right is the last digit of the year in which it was manufactured. DOT markings related to the year of production may have an additional symbol for the decade of the 1990s. It would be shown as a triangle following the last number. More recent tires have four digits in this last grouping of numbers. The first two will indicate the week of the year that the tire was produced, and the last two will indicate the last two digits of the year of production. For example, "4405" in the last grouping would indicate that the tire was made in the 44th week of the year 2005.

5. Inspect all lug nuts and torque to specifications as needed using a star sequence.
6. Verify that the spare tire is properly secured.

2-11.3.12 Inspect/Adjust Headlights

1. Verify all headlights work properly in both dim and bright positions.
2. Verify that all headlights are properly aimed. Correct if necessary.

2-11.3.13 Inspect Fluid Levels

Verify that all fluid levels are proper.

2-11.3.13.1 Brake Fluid

It may be advisable to flush the hydraulic brake fluid. Refer to the manual for proper procedure.

2-11.3.13.2 Oil

1. Verify correct oil levels.
2. Oil and oil filter should be changed at regular intervals. Check the manual for suggested intervals.

2-11.3.13.3 Coolant

Test fluid for proper degree range protection and record. Make certain any added coolant is compatible with existing coolant.

2-11.3.13.4 Power Steering

Verify that the power steering fluid level is correct. Power steering fluid should be warm to be properly checked.

2-11.3.13.5 Transmission

Measure the fluid level while warm. Add the proper fluid as necessary. On used motorhomes, it may be advisable to service the transmission.

2-11.3.13.6 Drive Belts

Inspect drive belts for visible cracking. Replace as needed. Replace all belts over three years of age.

2-11.3.14 Inspect/Clean/Measure Chassis Battery

1. Inspect chassis battery for proper electrolyte level and fill with distilled water only.
2. Top of the battery should be clean before removing cell caps. This will prevent foreign material from getting into battery.
3. Clean the battery terminals. If removal of terminals is necessary, make provisions to not lose any memory settings by temporarily hooking 12 VDC to the cables.
4. Inspect terminal connections for tightness. Tighten if necessary.
5. The battery should be secured and the battery compartment properly vented. Refer to code specifications for proper venting.
6. Using a temperature-compensated hydrometer, verify that all cells are within 0.50 specific gravity reading of each other. Refer to the literature for more specific information.
7. Verify that the alternator is charging the battery by measuring battery voltage at rest and again after starting the engine. Verify that the voltage of the battery rises.
8. Inspect dual battery isolator. Be sure all contacts and terminals are clean and tight. Clean and tighten if necessary.

If a diode-type isolator is employed, alternator output is measured on the center terminal while the engine is running. If a solenoid-type isolator is employed, alternator output is measured at either of

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the two large terminals. For specific troubleshooting information regarding dual battery isolators, refer to the *RV Electrical Systems* textbook.

2-11.3.15 Inspect Exhaust Components

1. Visually inspect exhaust system for any holes.
2. Start engine and listen for any exhaust leaks.
3. Be sure exhaust termination extends past exterior walls of the motorhome.

2-11.3.16 Test Leveling Systems

1. Operate the leveling system and verify that all levelers extend and retract as designed.
2. Inspect the hydraulic fluid level in the reservoir. Clean top of reservoir before removing cap to prevent foreign material from entering the hydraulic system. Hydraulic fluid should always be checked when levelers and/or rooms are retracted.
3. Inspect all electrical connections for tightness and cleanliness.
4. Verify that the level sensor, if so equipped, is synchronized with the floor of the coach.
5. Check that all indicator lamps illuminate and extinguish at the correct time based on the position of the levelers.

2-11.3.17 Inspect Air Suspension

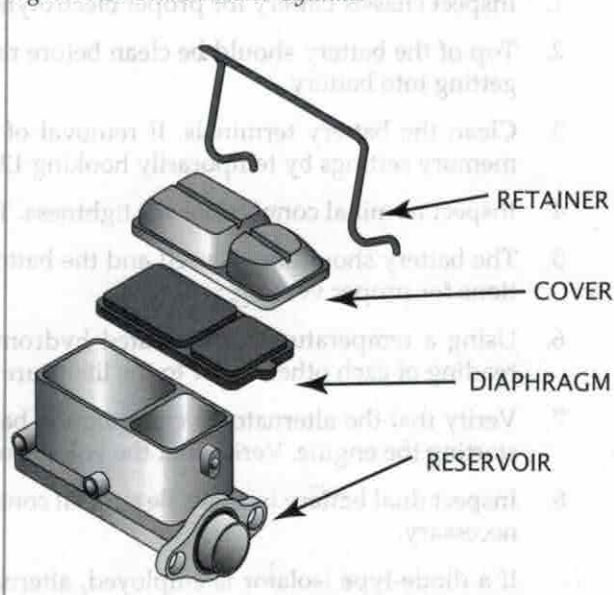
1. Verify that the air pressure gauge goes to the proper pressure before releasing.
2. Ensure that all air shocks and air bags will hold the air pressure and that air pressure chucks are secured and working properly.

2-11.3.18 Motorized Pre-delivery Inspection and Road Test

2-11.3.18.1 Preceding Road Test

1. Inspect the following fluid levels (add proper fluid, indicated in manufacturer's chassis manual, as needed):
 - A. Engine oil.
 - B. Power steering pump reservoir fluid.
 - C. Brake master cylinder fluid. Check both compartments.
 - D. Antifreeze. Use a radiator hydrometer to test the quality of antifreeze in coolant. Record the antifreeze charge level on the Pre-delivery Checklist.

Figure 2-25 Brake Master Cylinder



2. Inspect the chassis battery fluid. Measure the battery charge level with a battery hydrometer. The hydrometer should indicate between 1.225 and 1.265 specific gravity. Return solution to the battery and replace the cap. Record the charge level on the Pre-delivery Checklist. Inspect the battery and starter cable connection. Be certain they are tightened and the battery securely mounted, and be sure the top and sides of the battery are clean.
3. Inspect the automatic transmission fluid level. Refer to the manufacturer's chassis manual for instructions on checking the automatic transmission fluid level.

Figure 2-27 Automatic Transmission

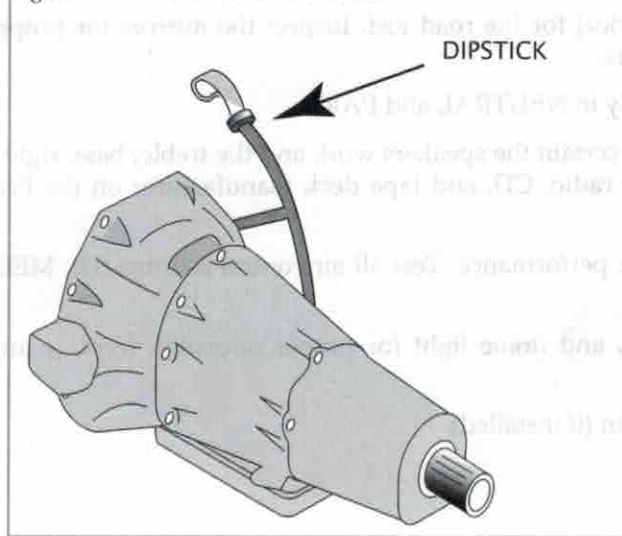
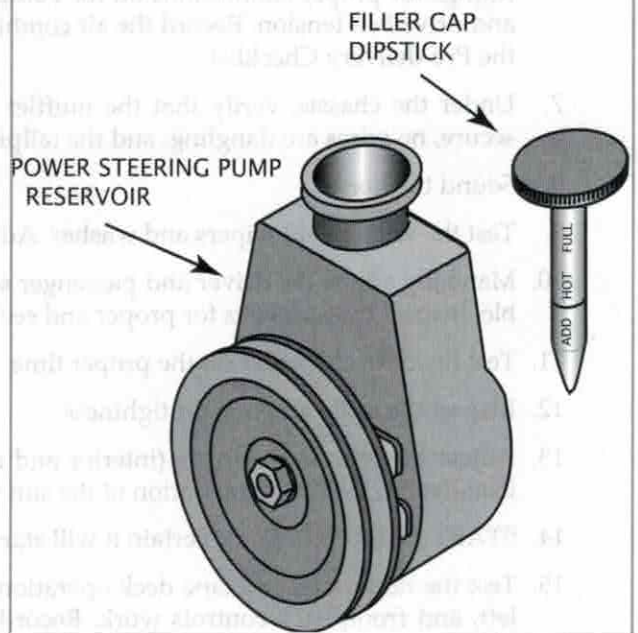
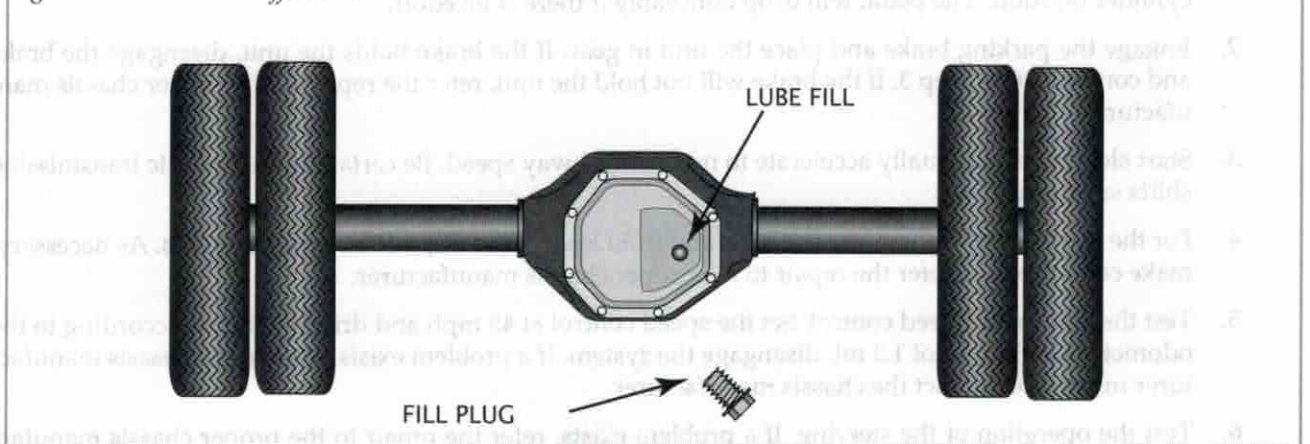


Figure 2-26 Power Steering Pump Reservoir



4. Inspect the differential lubricant level. With the engine OFF, remove the fill plug from the differential and verify the lubricant level. The lubricant level should be no more than 1/2 in. below opening. Replace the fill plug.

Figure 2-28 Rear Axle Differential



5. Inspect the windshield washer fluid level. Fill if necessary.

6. Inspect the fan/drive belt tension and alignment. Inspect the air conditioning components. Inspect the fittings for proper connections on the compressor, condenser, and filter dryer. Verify the clutch wire and drive belt tension. Record the air conditioner manufacturer, model number, and serial number on the Pre-delivery Checklist.
7. Under the chassis, verify that the muffler is securely connected, the heat shields are in place and secure, no wires are dangling, and the tailpipe extends past the edge of the coach.
8. Sound the horn.
9. Test the windshield wipers and washer. Adjust as necessary.
10. Manually adjust the driver and passenger seats. Be certain both seats slide and swivel where applicable. Inspect the seat belts for proper and secure installation.
11. Test the dash clock and set the proper time.
12. Inspect the radio antenna for tightness.
13. Adjust the rearview mirrors (interior and exterior) for the road test. Inspect the mirrors for proper installation. Verify the operation of the sun visors.
14. **START THE ENGINE.** Be certain it will start only in NEUTRAL and PARK.
15. Test the radio, CD, and tape deck operation. Be certain the speakers work and the treble/bass, right/left, and front/back controls work. Record the radio, CD, and tape deck manufacturer on the Pre-delivery Checklist.
16. Switch the dash air conditioner to ON to check performance. Test all air control settings (HI, MED, and LO). Check for in/out ΔT .
17. Test the dash lights, glove compartment light, and dome light for proper operation (replace any burned-out bulbs).
18. Check the proper operation of the leveling system (if installed).
19. Ensure that slideouts are in locked position.

2-11.3.18.2 During Road Test

1. Test the foot brake. Depress the brake pedal and place the unit in gear. If the brake holds the unit, disengage the brake and continue with Step 2. If the brake will not hold the unit, recheck the brake master cylinder fluid level. Hold steady pressure on the brake pedal for 10 to 15 seconds to check the master cylinder bleedoff. The pedal will drop noticeably if there is bleedoff.
2. Engage the parking brake and place the unit in gear. If the brake holds the unit, disengage the brake and continue with Step 3. If the brake will not hold the unit, refer the repair to the proper chassis manufacturer.
3. Start slowly and gradually accelerate to normal highway speed. Be certain the automatic transmission shifts smoothly.
4. For the duration of the test, check for air and fluid leaks, squeaks, rattles, and vibrations. As necessary, make corrections or refer the repair to the proper chassis manufacturer.
5. Test the automatic speed control. Set the speed control at 45 mph and drive for 1.5 mi according to the odometer. At the end of 1.5 mi, disengage the system. If a problem exists, refer to the chassis manufacturer manual or contact the chassis manufacturer.
6. Test the operation of the steering. If a problem exists, refer the repair to the proper chassis manufacturer. Check for straightness of the steering wheel when it is in the straight position.
7. Verify that all dash gauges and indicator lights operate properly.

2-11.3 Tires, Exterior Lighting, Fluid Levels, Belts, Dash Panel, Gauges, Road Test

8. Test the cigarette lighter/12 VDC auxiliary outlets for proper operation.
9. Switch from main to auxiliary fuel tank, if equipped. Drive at least three miles after switching to ensure proper switching of fuel supply as well as gauge switching. The fuel indicator should change to a new reading.
10. Retest the radio and dash air conditioner operation.
11. The side view mirrors must remain securely in place throughout the test.
12. Operate the heater and defroster. When the control is on defroster mode, most of the air should flow from the defroster vents; on heat mode, the main airflow should be through the heater outlets.

2-11.3.18.3 Following Road Test

1. Make corrections as needed following the road test.
2. Look for fluid leaks on the engine, transmission, and differential. Recheck all fluid levels.
3. After cooling, verify the radiator coolant level (add proper solution as needed). Refer to the manufacturer's chassis manual for instructions on checking coolant level.
4. Visually inspect tires for damage.
5. Inspect wheel lugs again, and tighten to specifications if necessary.
6. Inspect chassis tailpipe connections. All connections must be secure and tight. The tailpipe should extend beyond the side of the coach.

2-11.3.18.4 Chassis Repairs

Under the terms of the warranty, all chassis repairs should be referred to the appropriate chassis manufacturer.

Sample Motorized Chassis Inspection Checklist**Initials****Fluid Levels Checked:**

Power steering pump _____

Brake master cylinder _____

Chassis battery fluid _____

Charge level of chassis battery was acceptable (specific gravity) _____

Automatic transmission _____

Differential lubricant _____

Coolant in radiator _____

Air conditioning operation OK _____

Radio/tape deck/cd player operation OK _____

Muffler secured and past sidewall _____

Lug nut torque _____ # _____

During Road Test:

Foot brake OK _____

Parking brake OK _____

Auxiliary fuel tank gauge functions _____

Dash gauges and components functions _____

Following Road Test:

Fluid levels rechecked _____

Radiator coolant level OK _____

Protection level of antifreeze was? _____ ° _____

Tailpipe connection OK _____

NOTE: There is no chapter review for this chapter.

Chapter

2-12 Towable Unique Items

- Road test the unit.
- Tune/adjust electric brake system on tow vehicle.
- Inspect and operate landing gear, stabilizers, and tongue jacks.
- Record and report defects.

2-12.1 Folding Camping Trailers

2-12.1.1 Lift Mechanism

1. Determine the proper method for raising the roof, and raise the roof approximately halfway. Measure that all four corners are raised the same amount. If out of tolerance, refer to the manufacturer's manual for adjustment and tolerance information.
2. Ensure that any safety devices for the lift system are available and fit properly if applicable.

2-12.1.2 Bed Slide Mechanism

1. Pull the beds all the way out and ensure the bed supports are correct and install properly.
2. Lubricate as per manufacturer specifications.

2-12.1.3 Canvas/Vinyl

1. Completely set up the trailer and attach all the bed end and sidewall material/vinyl as per the manufacturer specifications.
2. Inspect all the zippers on the bed ends, sidewalls, window flaps, exit panels, and so on.
3. Install and operate the door completely. Ensure that the canvas attachments are proper.
4. Verify that all latches and attaching devices function properly, and repair as necessary.

2-12.1.4 Ceiling Power Safety Switch

1. Ensure that the ceiling power safety switch has proper operation, and repair if necessary.
2. Lower the unit completely and check for proper operation.
3. Ensure that the canvas/door fits into place properly.

2-12.1.5 Inspect Roof Travel Latches

Ensure that all the latches for the roof mesh properly and pull down as far as needed.

2-12.1.6 Inspect Roof and Body Seals

Adjust or repair as necessary.

2-12.2 Truck Campers

2-12.2.1 Inspect Jack Mechanism

1. Verify that the jack mechanism extends and retracts fully.
2. Verify that the jack capacity is proper for the camper.
3. Verify that the jack brackets are properly attached to the camper body.
4. Verify that the remote control operates.

2-12.2.2 Inspect/Test Truck Camper Plug

1. Verify that the 12 VDC umbilical cord between the pickup and camper is proper and working.
2. Verify that the charging line is charging.
3. Verify that the clearance lights are all working.
4. Verify that the brake lights are working (center high-mounted stop light working properly).
5. Verify that the turn signals are working properly.
6. Verify that the ground is proper by checking for no resistance between ground port on plug and battery ground port on pickup.

2-12.2.3 Inspect Tie-Down Hardware

1. Test for proper attachment of tie-down mechanisms to body of camper and repair as necessary.
2. Test for proper attachment of tie-down mechanisms to pickup body and repair as necessary.
 - A. Proper bolt size
 - B. Proper bolt grade

2-12.2.4 Verify Weight Capacities of Truck

1. Verify proper suspension capacity.
 - A. Frame of pickup truck
 - B. Springs
2. Verify proper wheel capacity.
3. Verify proper tire capacity.
 - A. Tire pressure
 - B. Tire size
4. Verify proper bearing capacity.
5. Verify adequate braking capacity.
6. Verify GVWR of pickup is adequate.

2-12.3 Towables

2-12.3.1 Inspect Hitch Pin or Coupler

1. Verify that it is straight, with hitch pin or coupler square with the frame.
2. Verify that the coupler closes and locks completely into position.
3. Verify that the coupler opens fully and easily when properly activated.
4. Verify that the hitch pin is welded or bolted properly. Make certain all bolts are in place and of the proper size and grade.

2-12.3.2 Inspect Safety Chains

Verify that they are properly attached and of proper size based on weight capacity.

2-12.3.3 Inspect Stabilizing Jacks

1. Verify that the tongue jack fully extends and retracts. If electric, verify that the light works and the manual handle is available.
2. Verify proper attachment to the frame.
3. Verify adequate capacity.
4. Verify proper tongue wheel or stand if applicable.
5. Verify proper operation of the landing gear on fifth wheel.
6. Verify that the jack fully extends and retracts and the slave and master legs are synchronized.
7. Verify that the hydraulic system is filled to proper capacity, with no leaks, if applicable.

2-12.3.4 Lubricate Bearings

Remove the bearing dust cover and verify that the bearings are properly lubricated. For further information, see the bearing section of the proper manual.

2-12.3.5 Test/Adjust Brakes

1. Remove all brake hubs and measure the amount of brake shoe remaining. Record on the sheet and replace if necessary.
2. Adjust brakes on all wheels as necessary.
3. Test all brakes for lockup when energized. This entails jacking up the coach with all four wheels off the ground and applying 12 VDC to the brakes while spinning each wheel. Each wheel should lock up. Any that do not must be repaired as necessary.
4. While spinning a wheel, pull the breakaway cable. The spinning wheel should stop if the breakaway is working properly. This is true for electric and hydraulic brakes.

NOTE: Battery on trailer must be fully charged for breakaway switch to operate properly.

2-12 Towable Unique Items

5. Check all hydraulic fittings for leaks and that the hydraulic cylinder is full of the proper hydraulic brake fluid. Repair as necessary and see service manual for correct brake fluid information.
6. Safety warning: Before jacking any vehicle up, be familiar with all jack safety information and understand the application of all safety guidelines. Be aware that brakes can contain asbestos dust, which can cause health problems. Know and use proper precaution when working on brakes.

2-12.3.6 Inspect Tires

1. Measure and record the tire tread depth on each tire and report any tread depths below those accepted by the dealership. Check the date code as to when the tire was made. Record the date and be aware that most tire experts recommend a five- to eight-year life for any tire, regardless of appearance.
2. Measure for proper tire pressure and correct as necessary, including the spare.
3. Inspect all lug nuts for proper torque as per the manual and correct as necessary. Pay attention to the manual torque specification and sequence. Record the final torque specification.
4. Inspect the springs, shackle bolts, bushings, shocks, and U-bolts for tightness.
5. Be sure the shackle bushings are in good shape. Remove a shackle bolt and inspect the bushing for wear. If there is undue wear, check all bushings and replace as necessary. Refer to the proper manual for torque specifications and so on when replacing bushings and shackle bolts.
6. Inspect the skid plate if so equipped. Repair as necessary.
7. Inspect the whole underside of the coach. Look for loose, hanging, or worn components. Repair as necessary.

NOTE: There is no chapter review for this chapter.

Chapter

2-13 Customer Walk-Through and Road Test

- Review the information on a Customer Acceptance Sheet.
- Install (OEM's) loose items.
- Test operation of all locks and keys.
- Record and report defects.

2-13.1 Owner Delivery—Walk-Through Sheet

2-13.1.1 Inspect the Exterior of the Unit with the Owner

1. Examine the general paint appearance and trim condition.
2. Explain the care and cleaning of the exterior.
3. If delivering a folding camping trailer, set up the unit with the owner, demonstrating and explaining each step of the procedure.
4. If delivering a truck camper, load the unit on the owner's vehicle, demonstrating and explaining each step of the procedure. Caution the owner that the jacks are for loading and unloading the truck camper only.

2-13.1.1.1 Identify All Exterior Items and Demonstrate/Explain Their Functions

NOTE: Always reinforce demonstrations and explanations by showing the customer where the written procedures/instructions are in the owner's manual or other documentation provided with the unit.

1. Lock and unlock the entrance doors.
2. Demonstrate the operation of the door steps.
3. Locate and lock access and compartment doors.
4. Identify the location of the city water fill:
 - A. Explain the differences between city pressure and pump pressures.
 - B. Explain the operation and function of a pressure regulator valve.
 - C. Remind the owner that a rubber-lined hose and perhaps a "Y" adapter are needed.
 - D. Demonstrate the use of the city water fill.
5. Identify the location of the freshwater (potable) holding tank fill:
 - A. Demonstrate the use of the freshwater holding tank fill water fill.
 - B. Point out the location of the freshwater holding tank.
 - C. Explain how to drain the water system.
 - D. Explain the function of the tank overflow device, if applicable.
 - E. Explain how to sanitize the potable water system.

NOTE: A minimum of 8 to 10 gal must be added to the system to make it possible to demonstrate water heater and water pump operation.

2-13 Customer Walk-Through and Road Test

6. Point out the location and operation of the wastewater holding tanks—black water (body or solid waste) and gray water (liquid waste):
 - A. Demonstrate the proper procedures for emptying the wastewater holding tanks with a sewage hose (where applicable).
 - B. Explain the drain piping if the unit does not have a gray-water holding tank. Remind the owner of the need for a hose and adapter.
7. Explain the winterization of the water systems.
8. Identify the generator:
 - A. Explain the function of the generator and demonstrate its proper operation.
 - B. Demonstrate the proper starting procedures for the generator (generator circuit breaker must be OFF).
 - C. Explain care and maintenance; demonstrate slideout tray if so equipped.
 - D. Shut off the generator.
 - E. Explain and demonstrate the use of a receptacle/plug system or automatic transfer switch system to select 120 VAC power from either a shore power line or the generator.
 - F. Explain the carbon monoxide (CO) alarm and demonstrate how to test it. Mention that CO alarms typically last five to seven years before needing to be replaced.
9. Demonstrate the operation of all levelers and jacks.
10. Explain the use of towing equipment. Demonstrate all electrical and physical connections. Refer to *"Road Test the Motorized Unit with the Owner"* on page 2-81.

2-13.1.2 Explain Propane System and Water Heater Operation

1. Describe the properties of propane and carefully explain propane safety procedures.
2. Locate any propane containers and demonstrate how the system operates:
 - A. Demonstrate how propane smells to a customer (scratch-and-sniff cards are available).
 - B. Demonstrate the use of the service valve.
 - C. Demonstrate the correct procedures for shutting the propane system down (e.g., for placing the unit in storage or driving through a propane restricted area such as a tunnel, bridge, or turnpike).
 - D. Explain the function of the propane regulator and how to avoid freeze-ups.
 - E. Explain filling of the propane containers.
 - F. Open the service valve so that propane appliances may be run.
 - G. Explain the operation of the propane leak detector. Demonstrate how to test it. Be sure to refer the customer to the detector's owner's manual for detailed explanations.
3. Identify the water heater (water must be in the system):
 - A. Explain the operation of the water heater.
 - B. Demonstrate lighting the pilot where applicable. Turn pilot off and have owner light the pilot.
 - C. Explain how to flush the water heater tank.
 - D. Demonstrate setting the water temperature where applicable.
 - E. Explain the function of the energy cutoff (ECO), or "high limit control."

- F. Allow the water heater to heat water.
- G. Explain the operation of a temperature and pressure relief valve. Explain “weeping” of this valve.
- H. Demonstrate the water heater bypass system.
- I. Explain 120 VAC operation of the water heater if applicable.

2-13.1.3 Inspect the Interior of the Unit with the Owner

1. Examine the condition of the floor. Explain floor covering care.
2. Examine the condition of the ceiling.
3. Locate and demonstrate the use of all emergency exits:
 - A. Door exit
 - B. Window exit
 - C. Roof exit
4. Identify and demonstrate the operation of all roof vents.
5. Explain smoke alarm, CO alarm, and propane detector operation and testing, if applicable.
6. Show the location of the fire extinguishers.

2-13.1.4 Explain the Unit’s Electrical System to the Owner

1. Differentiate the 12 VDC and 120 VAC systems, explaining the operation and function of each.
2. Identify circuit breaker box and identify components wired into each circuit.
 - A. Explain and identify the ground fault circuit interrupter (GFCI).
3. Identify the converter and explain its function:
 - A. Demonstrate circuit breaker reset.
 - B. Demonstrate fuse changing and sizing.
 - C. Emphasize the importance of carrying extra fuses.
4. Identify the RV battery and explain its function:
 - A. Describe the maintenance of the battery. Emphasize the need to check battery fluids often and, if they are low, to fill with distilled water only.
 - B. Explain the charging of the battery.
5. Identify all lights and their switches. Identify all interior receptacles and explain their use (12 VDC and 120 VAC).
6. Identify the TV wall plate and describe its operation. Identify TV antenna control and demonstrate its operation. Identify and explain TV booster.
7. Identify all fans and their switches.

2-13.1.5 Identify and Demonstrate the Operation of All Appliances

2-13.1.5.1 Refrigerator—Two-Way Compressor

1. Demonstrate 12 VDC and 120 VAC operation.
2. Demonstrate travel lock and storage position.
3. Explain care and maintenance, including storage.
4. Explain the importance of airflow.
5. Explain the importance of proper stowage in a refrigerator and the need to prevent overloading.

2-13.1.5.2 Chest Absorption Refrigerator

1. Emphasize that the unit must be level for the absorption refrigerator to operate properly; explain use of level.
2. Demonstrate 12 VDC operation.
3. Point out the thermostat.
4. Explain to the owner that the refrigerator is portable and that it may be connected to a 12 VDC receptacle, such as in a home.
5. Explain care and maintenance of the unit, including storage.
6. Explain the importance of airflow.
7. Explain the importance of proper stowage in a refrigerator and the need to prevent overloading.

2-13.1.5.3 Refrigerator—Three-Way

1. Emphasize that the unit must be level for the absorption refrigerator to properly operate; explain use of level.
2. Demonstrate 12 VDC and 120 VAC operation.
3. Demonstrate propane operation.
4. Demonstrate travel lock and storage position.
5. Explain care and maintenance of the unit, including storage.
6. Explain the importance of airflow. Show how to check and clear flue of obstructions.
7. Explain the importance of proper stowage in a refrigerator and the need to prevent overloading.

2-13.1.5.4 Range and Range/Oven

1. Demonstrate lighting the oven pilot and range-top pilot, if so equipped, and emphasize that both must be lit. Extinguish all pilots and have owner light them.
2. Demonstrate the range hood fan, light, and damper operation; explain filter cleaning.
3. Explain care and maintenance of the component.
4. Shut off the range or range/oven.
5. Explain the need for proper ventilation and the dangers of using the range or oven for comfort heating.

2-13.1.5.5 Additional Appliances

Identify each of the following appliances, demonstrating the operation and explaining the maintenance of each:

Roof Air Conditioner

1. Identify the thermostat for the roof air conditioner.
2. Demonstrate the use of the thermostat controls.
3. Identify the circuit breaker for the rooftop air conditioner.
4. Explain the importance of airflow.
5. Talk about proper maintenance.

Rear Air Conditioner

1. Identify the thermostat for the rear air conditioner.
2. Demonstrate the use of the thermostat controls.
3. Identify the circuit breaker for the rear air conditioner.
4. Explain the importance of airflow.
5. Talk about proper maintenance.

Microwave Oven

1. Demonstrate operation of the microwave.
2. Identify the circuit into which the microwave is wired.

Food Control Center

1. Demonstrate operation of the food control center.
2. Identify the circuit into which the food control center is wired.

If any of these appliances is on a selector switch, explain the proper operation and the reason for such an installation.

2-13.1.5.6 Monitoring Panel

1. Identify the monitor panel.
2. Explain and demonstrate its operation.

2-13.1.5.7 Furnace

1. Identify the furnace compartment. Emphasize the need to keep all combustible material out of the furnace compartment. Explain the importance of proper airflow.
2. Demonstrate lighting the furnace. Have owner light the furnace.
3. Explain that the blower draws power from the RV battery.
4. Explain and demonstrate pilot adjustment (where applicable). Have owner adjust the pilot.

2-13 Customer Walk-Through and Road Test

5. Identify the heater thermostat and demonstrate its operation.
6. Explain the care and maintenance of furnace.
7. Shut furnace off.

2-13.1.5.8 Water Pump

1. Explain the type of water distribution system the unit has and demonstrate its operation.
 - A. City water pressure system
 - B. Hand pump system
 - C. Air pressure system
 - D. Demand pump pressure system
2. Explain and demonstrate the operation of the water pump.
3. Identify the water pump switch.

2-13.1.6 Demonstrate All of the Furniture and Windows

1. Set up all beds and return to seat position. Demonstrate bed lock position. Explain the storage of mattresses, facer board, and so on.
2. Set up all tables and return to stored position.
3. Demonstrate all seat adjustments.
4. Identify all seats with seat belts.
5. Identify all alternate exits and demonstrate their operation.
6. Operate all windows.
7. Demonstrate operation of all curtains and privacy drapes. Demonstrate blind rewinder.
8. Explain the care and cleaning of all cushions, mattresses, curtains, and tables/countertops. Recommend testing cleaners at a hidden spot prior to using.

2-13.1.7 Explain the Operation of the Interior Plumbing

1. Open all water faucets. Demonstrate all faucets, showing hot and cold operation.
2. Explain care of the kitchen sink.
3. Explain the operation and care of all bathroom components:
 - A. Toilet
 - B. Lavatory
 - C. Shower/tub

2-13.1.8 Prepare the Unit for a Road Test

1. Turn off all lights and appliances.
2. Shut off the propane.

3. Close all vents.
4. Lock all doors.
5. Place door step in its travel position.
6. Demonstrate the operation of all slideouts.
7. Test and install slide room locks.

2-13.1.9 Road Test the Motorized Unit with the Owner

2-13.1.9.1 Preceding Road Test

1. Emphasize the importance of proper tire inflation and periodic tightening of the wheel lugs. Explain the necessity of regularly checking all the fluid levels and battery cleanliness.
2. Explain the proper loading of the unit and the necessity of weighing the unit, fully loaded, prior to every trip. Explain specific vehicle carrying capacity. Explain the relationship of tire ratings, axle ratings, gross vehicle weight, and so on. (See the *RV Brakes, Suspension and Towing* textbook.)
3. Determine the experience of the owner in driving RV-size vehicles.
 - A. Inspect the operation of all exterior lights.
 - B. Adjust the rearview and side view mirrors.
 - C. Demonstrate seat adjustments.
 - D. Explain/demonstrate the operation of all dash components:
 - Speed control
 - Radio
 - Tape deck
 - Air conditioner
 - Auxiliary fuel tank switch
 - Stabilizing jacks
 - Heater/defroster
 - Speciality add-on equipment (i.e., backup camera, GPS systems, and so on)
 - E. Explain physical characteristics of unit that will impact driving.
 - Vehicle height
 - Vehicle width
 - Vehicle turning radius
 - Type of brakes and suspension
4. Explain effects of a towed vehicle on the driving characteristics of the unit, especially on backing up.
5. Explain the effects of weight distribution on vehicle handling, tire wear, suspension problems, and so on.

2-13 Customer Walk-Through and Road Test

2-13.1.9.2 During Road Test

Have the owner do the following:

1. Operate the automatic speed control.
2. Demonstrate backing up the unit with and without the backup camera, and with a towed vehicle if possible.
3. Test the braking capability of the unit.
4. Experience the turning radius.
5. Experience the acceleration capability of the unit.

2-13.1.10 Road Test the Non-motorized Unit with the Owner

2-13.1.10.1 Preceding Road Test

1. Inspect all components of the towing system and ensure that they all are compatible with the weight requirements of the trailer. Explain these actions to the owner. (See the *RV Brakes, Suspension, and Towing* textbook.)
2. Clearly demonstrate the coupling/uncoupling procedure. Allow the owner to couple the unit to the owner's own tow vehicle.
3. Verify that the owner's tow vehicle is capable of towing the trailer safely.
4. Emphasize the necessity of achieving the proper ground clearance height.
5. Explain how the breakaway device is attached between the tow vehicle and the trailer, its importance, and the need to have the breakaway battery tested and fully charged before every trip.
6. Demonstrate connecting the pigtail. Have the owner make the connection.
7. Emphasize the importance of proper tire inflation and periodic tightening of the wheel lugs with a torque wrench.
8. Explain the proper loading of the unit and the necessity of weighing the unit, fully loaded, before every trip. Explain the relationship of tire ratings, axle ratings, gross vehicle weight, and so forth. (See the *RV Brakes, Suspension, and Towing* textbook.)
9. Demonstrate the operation of the brake controller, explaining its function and the procedure for adjusting the device.
10. Inspect the operation of all exterior lights.
11. Adjust the rearview and side-view mirrors of the tow vehicle.

2-13.1.10.2 During the Road Test

1. Have the owner operate and adjust the brake controller.
2. Have the owner demonstrate backing-up procedures.
3. Watch the trailer for sway or other control problems.
4. Have the owner experience the turning radius of the tow vehicle and trailer.
5. Have the owner experience the acceleration capability of the tow vehicle and trailer.

2-13.1.11 Explain All Warranties to the Owner

1. The dealer must read and explain the warranty to the owner. It is important that the owner fully understand what is and what is not covered by the warranty. Take sufficient time to clarify which services and adjustments come under the terms of the warranty and the owner's responsibilities for proper care and maintenance.
2. Clearly explain the terms of the chassis warranty to the owner, emphasizing the maintenance responsibilities. The dealership is required to submit chassis warranty registration forms promptly, and in accordance with their provisions, at the time of owner delivery.
3. Explain all component warranties, including those not covered by the warranty (i.e., generator) and any warranties that may be extended independently.

2-13.1.12 Seals, Labels, and Data Plates

Identify and explain all seals, labels, and data plates found on the RV. They should include the following as appropriate:

1. RVIA weight label
2. Chassis data plate
3. RVIA safety seal
4. Manufacturer data plate
5. Privacy curtains in vicinity of appliances
6. Storage of combustible materials
7. Use of appliances for comfort heating
8. Eighty percent propane fill limitation
9. Instructions "If You Smell Gas"
10. Types of fuel approved for use with propane piping system
11. Refueling precautions and safety
12. Smoke alarm testing
13. Sleeping location precautions
14. Storage of fuel-burning equipment inside an RV
15. Labeling of potable water tanks

NOTE: There is no chapter review for this chapter.

2-13.1.1 Explain All Warranties to the Owner

1. The dealer must read and explain the warranty to the owner. It is important that the owner fully understand what is and what is not covered by the warranty. Take sufficient time to clearly explain the terms and conditions of the warranty and the owner's responsibility for proper care and maintenance.
2. Clearly explain the terms of the dealer's warranty to the owner, emphasizing the dealer's responsibility. The dealer is required to submit claims to the manufacturer's warranty department, and in accordance with their provisions at the time of owner delivery.
3. Explain all component warranties, including those not covered by the warranty (e.g., generator) and any warranties that may be extended independently.

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Identify and explain all labels, labels, and data plates found on the RV. They should include the following as appropriate:

1. RVIA weight label
2. Chassis data plate
3. RVIA safety seal
4. Identification data plate
5. Propane storage or location of appliances
6. Storage of combustible materials
7. Use of appliances for winter heating
8. Eighty percent propane fill limitation
9. Instructions "If You Smell Gas"
10. Types of fuel approved for use with propane piping system
11. Reducing propane and safety
12. Smoke alarm testing
13. Sleeping location restrictions
14. Storage of fuel-burning equipment inside an RV
15. Labeling of potable water tanks

NOTE: There is no chapter review for this chapter.

2 Glossary of Pre-delivery Terms

Black-Water Holding Tank	The name commonly applied to the body waste holding tank receiving waste from the toilet on an RV.
Converter	A device consisting of a transformer and solid state diodes for converting 120 VAC to 12 VDC to operate RV components.
Electrolyte	In a lead-acid battery, the electrolyte is sulfuric acid diluted with water. It is a conductor and a supplier of water and sulfate for the electrochemical reaction necessary in a battery.
GAWR (Gross Axle Weight Rating)	The maximum safe load-carrying capacity of a single axle system as measured at the tire/ground interfaces. It is calculated by determining the capacities of the following: (1) axle rating, (2) suspension rating, (3) tires, (4) wheels. The load on each axle should not exceed the GAWR specified on the safety certification label, nor should the total on both axles exceed GVWR (gross vehicle weight rating).
Gray-Water Holding Tank	The name commonly applied to the liquid waste holding tank receiving waste from the shower and sinks on an RV.
GFCI (Ground Fault Circuit Interrupter)	An extremely sensitive circuit breaker connected to exterior, bath, and kitchen outlets. The GFCI helps to protect against severe electrical shock if a ground fault develops. If such a condition occurs, the GFCI will break (open) the circuit by turning off the power to the protected outlet.
Hot Skin	A term used to describe the existence of electrical current on metal portions of the RV (chassis, steps, etc.) caused by an electrical fault and improper or no grounding.
Hydrometer	A float-type instrument used to determine the state of charge of a battery by measuring the specific gravity of the electrolyte (the concentration of sulfuric acid in the electrolyte).
Inverter	A device consisting of transformers and solid state devices to convert 12 VDC to 60 Hz, 120 VAC.
Jalousie Window	A window that has panes set at an angle that, when open, admits air but excludes rain.
Lock-up Test	A pressure test conducted on the propane regulator to ensure that the correct amount of pressure is required to press against the regulator diaphragm, overcome the spring, and completely seat the lever seat assembly in the regulator so that no gas flows through the regulator when the appliances are turned off. The pressure should not be more than 14 in. WC.
Manometer	An instrument used to measure air and gas pressure or vacuum. Its unit of measurement may be inches of water column (WC). It may be either a tube or dial type of instrument.
OEM (Original Equipment Manufacturer)	The term applied to the manufacturers of the end product (the RV itself) within the RV Industry.
Operating Pressure Test	A test on the propane system to determine how much pressure the system regulator is providing to the system when appliances are functioning.
Polarity	The property of a physical system that has two points with different (usually opposite) characteristics, such as one that has opposite charges or electric potentials.
Shoreline	The term applied to the source of electrical power provided to an RV from a source independent of the RV, such as the electrical outlet provided by a campground.
Termination Valve	A manual valve located at the end of the wastewater drainage system that allows the opening and closing of the drainage system for purging of the holding tanks.

2 Glossary of Pre-delivery Terms

Thermostat	An instrument that measures changes in temperature and directly or indirectly controls sources of heating and cooling to maintain a desired temperature.
Timed Pressure Drop Test	A test conducted on the propane system using a manometer to determine whether a leak exists within the system by measuring the drop in propane pressure over a predetermined period of time.
Waste Holding Tank	A liquid-tight tank for the temporary retention of body or liquid waste (see <i>gray-water holding tank</i> and <i>black-water holding tank</i>).
Gray-Water Holding Tank	The tank commonly applied to the liquid waste holding tank receiving waste from the shower and toilet on an RV.
GFI (Ground Fault) Circuit Interrupter	An electrically sensitive circuit breaker connected to exterior, patio, and kitchen outlets. The GFI helps to protect against severe electrical shock. If a ground fault develops, it such a condition occurs, the GFI will break (open) the circuit by interrupting the power to the protected outlet.
Hot Skin	A term used to describe the sensation of electrical current on metal parts of the RV (e.g., steps, etc.) caused by an electrical fault and improper or no grounding.
Hydrometer	A float-type instrument used to determine the state of charge of a battery by measuring the specific gravity of the electrolyte (the concentration of sulfuric acid in the electrolyte).
Inverter	A device consisting of transformers and solid state devices to convert 12 VDC to 60 Hz 120 VAC.
Insulated Window	A window that has frames set at an angle and when open, admits air but excludes rain.
Load-Up Test	A pressure test conducted on the propane system to ensure that the correct amount of pressure is required to press against the regulator diaphragm, overcome the spring and empty tanks when the level has been reduced to the regulator set point and the pressure regulator when the supply valve is turned off. The pressure should not be more than 10 psi.
Manometer	An instrument used to measure air and gas pressure or vacuum. The unit of measurement may be inches of water column (WC). It may be used as a tool to test an instrument.
QEM (Quality Equipment Manufacturer)	The term applied to the manufacturers of the end product (the RV itself) within the RV industry.
Operating Pressure Test	A test on the propane system to determine how much pressure the system regulator is providing to the system when applied to the tank filling.
Polarity	The property of a physical system that has two points with different (usually opposing) characteristics, such as one that has opposite charges or electric potential.
Shoreline	The term applied to the source of electrical power provided by an RV from a shore-side source of the RV, such as the electrical outlet provided by a campground.
Termination Valve	A manual valve located at the end of the wastewater drainage system that allows the operator to shut off the drainage system for purging of the holding tank.

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FORMAL PROPOSAL TO AMEND THE RVIA TEXTBOOK

Date: _____ Textbook Title: _____

Chapter No.: _____ Section No.: _____ Page No.: _____

Individual's Name: _____

Organization representing (if applicable): _____

Address: _____

Telephone No.: _____

Comment Recommendation (check one)

☐

New Material

☐

Revised Material

☐

Deleted Material

Proposal (include proposed new or revised wording, or identification of wording to be deleted):
(Note: Proposed text should be in legislative format: i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (deleted wording). Use reverse side of this or a blank sheet if necessary. Please provide sketches of required illustrations.

Statement of Problem and Substantiation for Proposal:

(Note: State the problem that will be resolved by your recommendation; give the specific reason for your proposal)

RETURN TO: RVIA Education Department • P.O. Box 2999 •
Reston, VA 20195-0999

**PLEASE USE SEPARATE FORM FOR EACH PROPOSAL
(DUPLICATE THIS FORM AS NECESSARY)**