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Standard for Recreation Vehicle Service Technicians 2011 Edition

Recreation Vehicle Industry Association • 1896 Preston White Drive, P.O. Box 2999 • Reston, VA 20195-0999

The Information Appearing on this Page is NOT Part of the Standard

Standard for

Recreation Vehicle

Service Technicians

Origin and Development of the RVST Standard

Since 1996 RVIA and the Certification Governing Board have been using the RV Service TechnicianDACUM Chart Job and Task Analysis as a basis for the certification exams and cirriculmn for RV Service Technician Training. The DACUM is prepared by the National Occupational Competency Testing Institute (NOCTI) is America's foremost provider of high-quality written and performance occupational competency evaluation products and services.

Portions of the DACUM have been reformatted into a more user friendly format to create the RVST Standard. The full DACUM is still used and available.

Statement on Development Procedures

The first edition of this standard is a direct excerpt of the DACUM and which has a thorough review process outlined in that publication.

All questions or requests for information on obtaining formal interpretations, proposing amendments and appeals on matter relating to the contents of this document should be directed to the Vice President, Standards and Education, RVIA, PO Box 2999, Reston, VA 20195-2999.

DACUM Panel

2011 Edition

ALSOP, SAM	RV TRAINING CENTER
BLACK, CHRIS	NORCOLD
BUNZER, GARY	INDEPENDENT
CANNON, WALTER	RVSEF
CAROLUS, GARETT	KEYSTONE RV
CARR, JIM	FLA GATEWAY COLLEGE
COHOE, AL	OKANAGON
FRIBLEY, TOM	FRIBLEY TECH SVCS
HOPKINS, BRUCE	RVIA
LEE, SHARONNE	RVIA
MOTLEY, GARY	MOTLEY RV REPAIR
MUFFOLETTO, MIKE	WINNEBAGO
NOETH, PAUL	RVIA
POULIOT, MARY	NORCOLD
RIEXINGER, JOE	CEQUENT
RODDY, STEVE	LAZY DAYS
SANDERS, JOHN	ONAN
SCHUTZ, DAVE	DOMETIC
SLAVIK, BILL	GENERAC
VANDERMEL, BUD	LIPPERT
VANDERMEL, PAMELA	LIPPERT
WADE, DICK	AIRXCEL
WEIN, TOM	GENERAC
WEST, MARC	JAYCO
WILLIAMS, MIKE	ATWOOD
WOJTKUNSKI, MATT	GENERAC
YERMAN, TONY	RVDA

A PROPANE SYSTEMS

A.i Tools and Equipment
Common hand tools
Safety goggles/glasses
Gloves
Hard soled shoes
Electronic leak detector
Torque wrench
VOM
Scale
Purge hose assembly
Vapor system
Vent stack
Burn off device
Double ended hose to accept container fittings
Second container
Manometer
--digital
--analog
--U-tube
Leak detector solution
Timing device
Test apparatus to connect to system

A.ii Safety
Personal protective equipment (PPE)
Propane safety procedures
Safety and filling procedures

A.1 Comply with propane safety procedures

A.1.a Avoid propane contact with skin to prevent tissue damage
A.1.b Avoid overfilling containers to prevent liquid from getting into propane piping, liquid expansion, regulator damage and propane vapor release
A.1.c Use proper tools
A.1.d Maintain safe distance from ignition sources to avoid explosion and fire
A.1.e Wear proper protective clothing
A.1.e.1 goggles
A.1.e.2 specialized gloves
A.1.e.3 hard soled shoes
A.1.f Properly store propane cylinders to avoid vapor build up
A.1.f.1 open ventilated space
A.1.f.2 proper orientation
A.1.f.3 with valves closed and safety/dust caps installed
A.1.g Transport cylinders properly

A.2 Demonstrate general knowledge of propane

A.2.a Demonstrate knowledge of propane theory
A.2.a.1 efficiency of propane based on ambient temperature and rate of vaporization
A.2.a.2 area of wetted surface
A.2.a.3 expansion rate of propane
A.2.a.4 limits of combustibility to ensure proper air mixture
A.2.a.5 container refrigeration
A.2.b Identify properties of propane
A.2.b.1 boiling point
A.2.b.2 specific gravity of vapor
A.2.b.3 weight per gallon
A.2.b.4 btu(s) per gallon
A.2.b.5 chemical make-up (odor)
A.2.c Understand Boyle's Law and Pascal's Law
A.2.c.1 general definition
A.2.d Define common terms and identify components
A.2.d.1 cylinder, tank, container
A.2.d.2 butane
A.2.d.3 propane
A.2.d.4 inches of water column (w.c.)
A.2.d.5 psig
A.2.d.6 water capacity (w.c.)
A.2.d.7 other terms in glossary
A.2.e Demonstrate knowledge of RV codes related to propane
A.2.e.1 NFPA 1192
A.2.e.2 CSA Z240

A.3 Inspect/maintain/replace propane containers and fittings

A.3.a Visually inspect container surface
A.3.a.1 measure dents

A.3.a.2 inspect for damage (e.g., secondary heat damage, drop damage, broken welds, etc.)
A.3.a.3 inspect for surface rust
A.3.b Review the container data plate
A.3.b.1 date of manufacture/cylinder recertification
A.3.b.2 water capacity
A.3.b.3 dip tube length (cylinder)
A.3.b.4 tare weight (cylinder)
A.3.b.5 manufacturer
A.3.b.6 DOT and/or ASME specifications (e.g., container construction specifications)
A.3.b.7 surface area
A.3.b.8 serial number and registration number (Canadian)
A.3.c Inspect/install mountings and brackets
A.3.d Inspect/replace container relief valve
A.3.e Inspect/replace excess flow valve(s)
A.3.f Inspect/replace container service valves
A.3.g Inspect/replace 80% outage valve
A.3.h Inspect/replace fill valve/insure dip tube correct length
A.3.i Inspect/replace sight gauge and its float mechanism
A.3.j Inspect/replace OPD
A.3.k Inspect/adjust/replace regulator
A.3.k.1 size regulators
A.3.k.2 locate vent position
A.3.k.3 adjust regulator
A.3.k.4 replace regulator
A.3.k.5 ensure required protection
A.3.l Inspect high pressure system
A.3.l.1 POL and CGA791
A.3.l.2 differentiate between green, black and blue mating connector knobs
A.3.l.3 backflow check valves on automatic changeover
A.3.l.4 quick disconnect (high pressure side)
A.3.l.5 excess flow valve
A.3.l.6 high pressure hose, piping, tubing and routing and support
A.3.l.7 solenoid shut off valves
A.3.l.8 pressure reduced to 30psi within 60" of container outlet
A.3.l.9 differentiate between schedule 40 and schedule 80 pipe including proper use
A.3.m Purge containers per NPG standards
A.3.n Fill containers per NPG standards
A.3.o Transfer propane from one container to another container
A.3.p Burn off propane in a container
A.3.q Comply with safety procedures

A.4 Inspect/maintain/replace/add propane piping system

A.4.a Inspect low pressure system
A.4.a.1 flare
A.4.a.2 pipe fitting
A.4.a.3 compression
A.4.a.4 sealant per RV standards
A.4.a.5 tubing, hose, pipe and routing and supports
A.4.a.6 quick disconnect/manual shut off valve
A.4.a.7 solenoid shut off valves
A.4.b Add piping system
A.4.b.1 use flaring tools
A.4.b.2 use pipe cutting and threading equipment
A.4.b.3 select and use proper tube, hose and pipe (types of copper tube, hose or black pipe)
A.4.b.4 use proper fittings and sealants
A.4.c Proper use of plugs and caps
A.4.c.1 removed appliance or opened propane line

A.5 Perform propane system tests

A.5.a Perform container and fitting leak tests
A.5.a.1 use appropriate leak detector solution
A.5.a.2 operate electronic gas leak detector
A.5.b Perform system tests
A.5.b.1 timed pressure drop test
A.5.b.2 leak test ACME pigtail connection (backflow device) (cylinders only)
A.5.b.3 lock up test
A.5.b.4 system operating/demand pressure test
A.5.b.5 regulator adjustment test
A.5.c Perform appliance tests

A.5.c.1 appliance functional tests
A.5.c.2 leak test appliance's internal piping/ tubing
A.5.d Perform propane detector test
A.5.e Calibrate manometer (gauge and U-tube)
A.5.f Complete proper documentation of test results

A.6 Troubleshoot propane system faults
A.6.a Diagnose and Repair erratic propane pressure
A.6.b Locate and remove debris and oil in line (if possible)
A.6.c Diagnose and Repair low propane pressure
A.6.d Diagnose and Repair high propane pressure
A.6.e Diagnose and Repair restricted flow in propane system
A.6.f Diagnose and Repair container filling problems
A.6.g Diagnose and Repair container refrigeration situation

B DC ELECTRICAL SYSTEMS

B.i Tools and Equipment
Textbook
Basic hand tools
VOM
12 volt test light
Test leads
Continuity tester
Logic probe
Hydrometer
Battery load meter
VOM (true RMS)
Inductive amp meter
Battery brush
Battery charger
Basic hand tools
Wire crimpers and strippers
Technical pin tools
Test leads
Micrometer

B.ii Safety
PPE
Basic electrical safety procedures
Basic shop safety

B.7 Demonstrate knowledge of basic DC electricity and safety

B.7.a Apply Ohm's law
B.7.b Apply Watt's law (derivative of Ohm's Law)
B.7.c Differentiate between AC and DC current
B.7.c.1 perform visual inspection
B.7.c.2 types of circuits (series and parallel)
B.7.c.3 type of wire used (stranded vs. solid)
B.7.c.4 connector devices
B.7.c.5 meter testing
B.7.d Define common terms
B.7.d.1 open
B.7.d.2 short
B.7.d.3 voltage drop
B.7.d.4 resistance
B.7.d.5 grounded
B.7.d.6 polarity
B.7.d.7 continuity
B.7.d.8 amperage
B.7.d.9 voltage
B.7.e Comply with safety procedures
B.7.e.1 common shock hazards
B.7.e.2 battery safety and explosion hazards
B.7.e.3 voltage source
B.7.f Identify overcurrent protection devices
B.7.f.1 fuses (glass, blade, fusible link and T-fuse ("slow blow"))
B.7.f.2 breakers (type 1, 2 (manual reset), and 3)
B.7.g Interpret electrical drawings
B.7.g.1 pictorial drawings
B.7.g.2 wiring diagram
B.7.g.3 schematic diagram
B.7.h Identify common symbols on wiring diagrams

B.8 Perform DC voltage system inspection and tests

B.8.a Perform visual inspection of DC system and components
B.8.a.1 insulation (application, material type and temperature rating)
B.8.a.2 support
B.8.a.3 installation
B.8.a.4 ground(s)
B.8.a.5 connections (clean and tight)
B.8.b Verify polarity of the system and individual devices
B.8.c Measure voltage
B.8.c.1 static voltage
B.8.c.2 loaded voltage
B.8.d Measure amperage
B.8.e Measure resistance/continuity
B.8.f Test fuses using continuity test or test light

B.9 Service DC power sources

B.9.a Service/maintain/clean/replace batteries
B.9.a.1 visually inspect batteries
B.9.a.2 verify charge level and load test
B.9.a.3 measure electrolyte level (specific gravity)
B.9.a.4 verify capacity/specifications
B.9.a.5 inspect/maintain terminals
B.9.a.6 clean terminals, clean exterior surface

B.9.a.7	charge battery (wet, gel and AGM types)
B.9.a.8	identify application of deep cycle and starting batteries
B.9.a.9	series and parallel applications
B.9.b	Service/inspect converter
B.9.b.1	types of converters (electronic switch mode, Ferro-resonant, and linear)
B.9.b.2	verify use of appropriate overcurrent protection devices
B.9.b.3	verify charging capacity and compatibility with type of battery
B.9.b.4	verify proper ventilation and air circulation
B.9.b.5	verify connections
B.9.b.6	clean fan, grills, etc.
B.9.b.7	test input voltage (AC)
B.9.b.8	test output "ripple" (AC)
B.9.b.9	test output voltage (DC)
B.9.c	Service/inspect inverters/charger
B.9.c.1	verify charging voltage, amperage and compatibility with type of battery
B.9.c.2	verify use of appropriate overcurrent protection devices
B.9.c.3	verify proper ventilation and air circulation
B.9.c.4	verify connections
B.9.c.5	verify capacity
B.9.c.6	clean fan, grills, etc.
B.9.c.7	test input voltage (DC)
B.9.c.8	test output voltage (AC)
B.9.d	Verify and inspect automotive charging
B.9.d.1	verify output voltage and load/wire capacity
B.9.d.2	inspect belt condition and adjust tension
B.9.d.3	inspect integrity of connections
B.9.e	Inspect solar panels
B.9.e.1	verify output voltage and amperage
B.9.e.2	verify proper installation and mounting
B.9.e.3	verify correct wire sizing
B.9.e.4	adjust voltage, amperage to type of battery

B.10	**Service DC wiring/distribution system**
B.10.a	Inspect/replace fuses (glass, blade, fusible link and T-fuse ("slow blow")) and breakers
B.10.b	Check wiring connections and terminals
B.10.c	Diagnose/repair short/open/ground circuits (high resistance and dead shorts)
B.10.d	Test isolators (diode); replace isolator with proper amperage rating
B.10.e	Test solenoids (coil and contacts); replace solenoid with proper amperage rating and type (continuous duty and momentary)
B.10.f	Test battery disconnect systems
B.10.g	Inspect/test/replace switches and relays
B.10.h	Add electrical device or circuit
B.10.h.1	check load requirement and source availability
B.10.h.2	proper overcurrent protective devices
B.10.h.3	wiring (size vs. ampacity) including length of wire
B.10.h.4	insulation (application, material type and temperature rating)
B.10.h.5	support
B.10.h.6	installation
B.10.h.7	ground(s)
B.10.h.8	connections (clean and tight)

C AC ELECTRICAL SYSTEM

C.i Tools and Equipment
Textbook
Basic hand tools
Amp meter
Polarity tester
Continuity tester
GFCI tester
VOM (true RMS)
Frequency meter (Hertz)
Wire crimpers & strippers

C.ii Safety
PPE
Basic electrical safety procedures
Basic shop safety

C.11 Demonstrate knowledge of basic AC theory and safety

C.11.a Apply Ohm's law
C.11.b Apply Watt's law (derivative of Ohm's Law)
C.11.c Differentiate between AC and DC circuits
C.11.c.1 perform visual inspection
C.11.c.2 types of circuits (series and parallel)
C.11.c.3 type of wire used (stranded vs. solid)
C.11.c.4 connector devices
C.11.c.5 meter testing
C.11.d Define common terms
C.11.d.1 open
C.11.d.2 short
C.11.d.3 resistance
C.11.d.4 grounded
C.11.d.5 continuity
C.11.d.6 polarity
C.11.d.7 amperage
C.11.d.8 voltage
C.11.d.9 isolated neutral
C.11.e Comply with safety procedures
C.11.e.1 common shock hazards
C.11.e.2 battery safety and explosion hazards
C.11.e.3 voltage source
C.11.f Identify overcurrent protection devices
C.11.f.1 fuses
C.11.f.2 breakers (including HACR)
C.11.g Identify GFCI (ground fault circuit interrupter)
C.11.g.1 receptacles
C.11.g.2 circuit breakers
C.11.h Interpret electrical drawings
C.11.h.1 pictorial drawings
C.11.h.2 wiring diagram
C.11.h.3 schematic diagram
C.11.i Identify common symbols on wiring diagrams

C.12 Perform AC voltage system inspection and tests

C.12.a Perform visual inspection of AC system and components
C.12.b Check polarity of the system
C.12.c Measure system voltage
C.12.c.1 static voltage
C.12.c.2 loaded voltage
C.12.d Measure system amperage
C.12.e Measure resistance
C.12.f Perform hot skin/chassis test
C.12.g Perform GFCI systems test
C.12.h Perform continuity test
C.12.i Complete proper documentation on test results
C.12.j Verify proper circuit breakers including HACR breaker

C.13 Service AC power sources

C.13.a Shore power voltage
C.13.a.1 measure unloaded (static) voltage
C.13.a.2 measure loaded voltage
C.13.a.3 check polarity
C.13.b Generator voltage and frequency
C.13.b.1 measure unloaded (static) voltage
C.13.b.2 measure loaded voltage
C.13.b.3 measure the no load and full load frequency
C.13.c Measure inverter output (loaded)
C.13.d Inspect and verify power cord components
C.13.d.1 cords, adapters, connecting plugs, etc.
C.13.d.2 check adapter polarity
C.13.e Verify separation of AC power sources (generators, shore cord, and inverter)

C.13.e.1 manual plug in
C.13.e.2 transfer switch (automatic or manual) (breaks both hot and neutral)
C.13.e.3 verify transfer switch capacity
C.13.f Verify voltage compatibility (30 amp, 50 amp) of connections

C.14 Service AC wiring/distribution system

C.14.a Inspect/test/replace circuit breakers
C.14.b Inspect/replace distribution panel boards
C.14.c Check wiring connections and terminals
C.14.d Identify short/open/ground circuits
C.14.e Inspect/replace switches, relays and solenoid
C.14.f Verify wire specifications (temperature rating, type, size, etc.)
C.14.g Visually inspect wiring protection
C.14.h Verify ground connection
C.14.i Check/replace receptacles
C.14.j Replace receptacle covers (exterior)
C.14.k Check/replace GFCI (Ground Fault Circuit Interruption Protection)
C.14.k.1 verify proper outlets are GFCI protected
C.14.l Verify neutrals isolated from ground
C.14.m Verify slideout room section ground continuity to main unit
C.14.n Energy management systems
C.14.n.1 reset
C.14.n.2 reconfigure priority scheme
C.14.n.3 replace
C.14.n.4 analyze diagnostic information from unit
C.14.o Add electrical device or circuit
C.14.o.1 check load requirement and source availability
C.14.o.2 proper overcurrent protective devices
C.14.o.3 wiring (size vs. ampacity)
C.14.o.4 insulation (application, material type and temperature rating)
C.14.o.5 support
C.14.o.6 installation
C.14.o.7 ground(s)
C.14.o.8 connections (clean and tight)
C.14.o.9 verify voltage compatibility (120 volt) of connections
C.14.p Add alternative/additional electrical source

D PLUMBING SYSTEMS

D.i Tools and Equipment

Basic hand tools
Pressure gauge (psi)
Air compressor
Water hose
Air pressure regulator
Water pressure regulator
Plastic welder
Drill and router depending on tank material
Common hand tools
Flaring tools
P.B. and PEX tools (crimper, spin, etc.)
Faucet wrench
Pressure gauge
Tube bender
Soldering equipment
Water supply
Water stoppers for shower and sinks
Basic power tools
Pipe reamer
Gloves & mask
Pipe wrenches
Pipe reamer
Pipe wrenches
ABS glue

D.ii Safety

Test pressure vs. materials
PPE
Tank expansion hazard
Cross-contamination hazard
Over pressurization explosion hazard
Correct antifreeze types
Burn hazard
Tub-shower door safety glass

Fresh Water Systems

D.15 Perform fresh water system tests

D.15.a Perform pressure test
D.15.a.1 with air only
D.15.a.2 with water
D.15.b Perform water system operational evaluations for all hot and cold piping
D.15.b.1 city water pressure
D.15.b.2 demand pump
D.15.b.3 air pressurized system (found in older models)
D.15.b.4 manual pump
D.15.c Complete documentation

D.16 Inspect/repair fresh water storage tanks

D.16.a Repair/replace fresh water tanks, gravity fill and vent
D.16.b Repair/replace city water fill, regulator, check valve(s)
D.16.c Inspect/replace low point fresh water storage tank drain system
D.16.d Install/inspect monitor panel probes for leakage
D.16.e Sanitize the fresh water distribution system including fresh water storage tanks
D.16.f Pressure water fill with attached cap; confirm adequate venting
D.16.g Gravity water fill; confirm adequate venting; confirm appropriate sanitizing label

D.17 Inspect/repair fresh water distribution systems

D.17.a Eliminate water leaks in any section of piping, at any fitting or valve in the fresh water system.
D.17.b Repair/replace accumulator
D.17.c Repair/replace water purifiers and filter
D.17.d Repair/replace faucets, diverters
D.17.e Inspect/replace vacuum breakers
D.17.f Inspect/eliminate crossed piping connections between hot and cold lines
D.17.g Winterize fresh water distribution system
D.17.h Verify separation between waste and fresh water systems
D.17.i Repair/replace water manifolds
D.17.j Inspect/replace flexible supply lines for slideout rooms
D.17.j.1 verify no kinks or chafing
D.17.j.2 verify correct sizing

D.18 Inspect/repair/replace fixtures/ devices

D.18.a Repair/replace toilet
D.18.a.1 3 types of toilets (water seal, vacuum flush, and mechanical seal)
D.18.a.2 replace toilet components such as vacuum breakers, solenoid valves, macerators, sprayers, water savers, water valves, seals, etc.
D.18.a.3 verify appropriate line sizes
D.18.b Repair/replace shower/tub
D.18.c Repair/replace sink(s)
D.18.d Install/repair/replace exterior showerhead/faucet assembly
D.18.e Install/repair/replace waste holding tank flushing systems
D.18.f Install/repair/replace winterizing kit (manual and electric)

Waste Water System

D.19 Perform waste water tests

D.19.a Perform flood test
D.19.b Perform flow test

D.20 Inspect/repair/replace waste holding tanks

D.20.a Visually inspect/repair/replace tank and mountings
D.20.b Inspect/repair/replace termination valves/fittings
D.20.b.1 manual
D.20.b.2 electric
D.20.c Install/inspect monitor panel probes for leakage
D.20.c.1 clean monitor panel probes
D.20.d Weld Rotocast tanks
D.20.e Patch ABS tanks
D.20.f Inspect vent stacks
D.20.f.1 inspect for debris and other clogs
D.20.f.2 inspect for proper length

D.21 Inspect/repair/replace drainage piping system

D.21.a Inspect/replace fittings and piping
D.21.b Inspect/replace vents, drains and traps
D.21.c Inspect/replace pipe support system
D.21.d Inspect and verify drain piping slope
D.21.e Install/inspect/replace flexible drain systems
D.21.f Inspect flexible drain connectors for slideout rooms
D.21.f.1 verify slope
D.21.f.2 verify no kinks or chafing
D.21.f.3 verify correct sizing
D.21.g Inspect/repair/replace waterless sanitary valves (Hepvo)
D.21.h Install macerator systems
D.21.i Inspect/replace anti-siphon trap vent devices

E BRAKE, SUSPENSION AND TOWING SYSTEMS

E.i Tools and Equipment

Ammeter
VOM
Common hand tools
Test light
Brake pliers
Brake spring pliers
Brake cleaning fluid
Micrometer
Tape measure
Torque wrench
Jack and jack stands
Wheel chocks
Brake adjusting tool (spoon)
Crimping tool
Wire connections
Trailer and tow vehicle test box
H-gauge
Brake fluid
Brake line bleeder
Pneumatic tools
Wrenches
Drills
Drill bits
Impact wrench
Impact sockets
Welding equipment (arc, mig)
Leak detector solution
Scales
Air impact wrench
Level
Floor jacks
Grease gun
Grease
Tire iron & hammers
Calibrated tire gauge
Sand paper
Valve & valve stems
Valve stem tool
Paint
Tire changing machine
Balance machine
Wheel weights
Soap solution
Tire cage

E.ii Safety

PPE
Electrical safety procedures
Mechanical safety procedures
Pinch points
Safe jack operation
Safe placement of electrical plug
Safe jack operation
Welding mask
Welding gloves
Welding apron
Comply with mfg. recommendations
Floor jack/jack stand procedures
Standard torqueing & tire changing procedures
Safe tire inflation
Rim warnings

E.22 Inspect/maintain/repair the electrical braking system

E.22.a Verify/measure proper voltage/amperage
E.22.b Inspect wiring, routing and connections
E.22.c Inspect/replace breakaway switch and battery
E.22.d Inspect/replace/machine drums and rotors; inspect/remove/replace armature
E.22.e Inspect/replace shoes and pads
E.22.f Adjust brake shoes
E.22.g Inspect spindles
E.22.h Inspect and repack or replace wheel bearing sets and replace seal
E.22.i Inspect/test/replace magnet
E.22.j Repair/replace spring assemblies, actuator arm
E.22.k Reinstall drum, torque wheel bearings (tighten spindle nut to torque spec)
E.22.l Remove and reinstall dust cover
E.22.m Install wheel
E.22.n Install torque studs and/or lug nuts to mfg. specifications

E.23 Inspect/replace brake controllers

E.23.a Identify types of brake controllers
E.23.a.1 proportional (pendulum)
E.23.a.2 electronic time based
E.23.a.3 cross between hydraulic and proportional (OEM)
E.23.b Inspect/replace brake control, electrical tow connector and connections
E.23.c Inspect/adjust/calibrate brake controllers
E.23.c.1 verify appropriate wiring and grounding
E.23.c.2 adjust gain
E.23.d Inspect/specify/install specific vehicle wiring adapters
E.23.e Perform road test

E.24 Inspect/maintain/repair hydraulic surge brake systems
E.24.a Inspect/repair/replace actuator
E.24.b Inspect/repair/replace master cylinder and supply lines
E.24.c Inspect/replace/machine drums and rotors; inspect/remove/replace armature
E.24.d Inspect/replace shoes and pads
E.24.e Inspect spindles
E.24.f Inspect and repack or replace bearing set and replace seal
E.24.g Inspect/repair/replace wheel cylinders
E.24.h Repair/replace spring assemblies, actuator arm
E.24.i Reinstall drum, torque wheel bearings (tighten spindle nut to torque spec)
E.24.j Remove and reinstall dust cover
E.24.k Install wheel
E.24.l Install torque studs and/or lug nuts to mfg. specifications
E.24.m Add brake fluids and bleed system
E.24.n Adjust brake shoes
E.24.o Flush hydraulic brake system
E.24.p Inspect brake-away switch/device

E.25 Inspect/maintain/repair mechanical towing components
E.25.a Verify ball hitch component weight ratings (i.e., class I, II, III, IV, V)
E.25.b Install/repair/replace receiver hitches
E.25.c Install/repair replace 5th wheel hitches/ frame attachment
E.25.d Determine compatibility of 5th wheel weight and hitch capacity
E.25.e Determine ball/shank size and capacity
E.25.f Determine hitch height/5th wheel pin height
E.25.g Inspect/maintain/repair sway control systems
E.25.h Inspect/maintain/repair weight distribution systems
E.25.i Repair/replace couplers and safety chains/cables per state's standards
E.25.j Verify hitch compatibility with trailer frame and hitch weight
E.25.k Identify hitch types
E.25.k.1 weight bearing
E.25.k.2 weight distribution or equalizing
E.25.k.3 5th wheel
E.25.k.4 goose neck
E.25.k.5 tow bars (A-frame, adjustable, etc.)
E.25.k.6 tow dollies
E.25.l Verify vehicle towing capacity
E.25.m Wire electrical connections
E.25.m.1 left and right turn
E.25.m.2 brake control
E.25.m.3 brake light
E.25.m.4 running lights (tail, clearance, etc.)
E.25.m.5 back up lights
E.25.m.6 charge line
E.25.m.7 specialty connections
E.25.n Wire vehicle (diodes vs. bulb and socket) for 2 and 4 wheel down towing
E.25.o Install add-on brake systems for 4 wheel down towing

E.26 Inspect/maintain/repair air suspension system (RV mfg./dealer add on)
E.26.a Verify unit and axle weights and capacities
E.26.b Verify component ratings and capacities
E.26.c Perform leak testing

E.26.d Inspect/replace air tanks, lines, valves, air bags, air dryer, and fittings
E.26.e Inspect/repair/replace compressor
E.26.f Inspect/replace/adjust height control valve
E.26.g Inspect/repair/replace axle and align
E.26.h Install and adjust air bag kits

E.27 Inspect/maintain/repair mechanical steel suspension systems (RV mfg./dealer add on)
E.27.a Install and adjust helper springs
E.27.b Verify unit weight/spring capacity
E.27.c Measure and level coach
E.27.d Inspect/replace shock absorbers
E.27.e Inspect/replace springs
E.27.f Inspect/replace U-bolts
E.27.g Torque to specs
E.27.h Inspect and align axle(s); confirm alignment
E.27.i Inspect and replace shackles, shackle bolts, equalizer and bushings

E.28 Inspect/maintain/repair mechanical rubber suspension systems (RV mfg./dealer add on)
E.28.a Verify unit weight/spring capacity
E.28.b Measure frame height and level coach
E.28.c Inspect/replace shock absorbers and brackets
E.28.d Inspect/replace rubber springs
E.28.e Inspect/replace U-bolts, rubber bushings, etc. per mfg. specs
E.28.e.1 torque to specs
E.28.e.2 adjust tracking bar
E.28.f Inspect and align axle(s); confirm alignment

E.29 Inspect/maintain/repair trailer suspension systems (steel spring)
E.29.a Verify unit weight/spring capacity
E.29.b Inspect/replace shock absorbers and brackets
E.29.c Inspect/replace springs
E.29.d Inspect/replace shackles, shackle bolts, bushing, rockers/equalizers, and hangers
E.29.d.1 torque to specs
E.29.e Inspect/replace U-bolts and axle beam
E.29.f Inspect and align axle(s); confirm alignment

E.30 Inspect/maintain/repair trailer suspension systems (rubber torsion axle)
E.30.a Verify unit weight vs. axle capacity
E.30.b Inspect and torque mountings
E.30.b.1 torque fasteners to specs
E.30.c Inspect and align axle(s); confirm alignment

E.31 Inspect/maintain/repair tongue, 5th wheel, truck camper and stabilizer jacks
E.31.a Lubricate and adjust components
E.31.a.1 gear box and gears
E.31.a.2 cross over arm and linkage
E.31.b Diagnose and repair electrical and hydraulic jacks, stabilizers and components
E.31.b.1 motors
E.31.b.2 switches
E.31.b.3 wiring
E.31.b.4 hydraulic components
E.31.c Diagnose and repair mechanical type jacks and stabilizers
E.31.d Verify jack weight capacity vs. actual unit weight

E.32 Maintain/change wheels and tires
E.32.a Verify weight and application specification
E.32.b Match rim and tire for compatibility and application
E.32.c Check tire pressure using load inflation pressure chart
E.32.d Check tire age, wear and condition including depth of cracks and manufacturing date
E.32.e Inspect tire wear to diagnose problem
E.32.e.1 inspect axle for camber
E.32.e.2 measure toe-in/out
E.32.e.3 measure tire pressure
E.32.f Balance and rotate tires

E.32.g Inspect/replace wheel/rim, studs and nuts, and hub condition
E.32.g.1 inspect wheel for cracked and distorted lug nut holes
E.32.h Verify and torque lug nuts or lug bolts in proper sequence and to mfg. specifications
E.32.i Inspect tires for date

E.33 Inspect/install/adjust/repair steering stabilizer systems
E.33.a Verify unit weight
E.33.b Verify proper part vs. chassis
E.33.c Confirm proper bolt torque specification
E.33.d Confirm 12VDC when applicable
E.33.e Adjust alignment
E.33.f Road test unit
E.33.g Replace springs
E.33.h Replace steering stabilizer

F APPLIANCES

F.i Tools and Equipment
Basic hand tools
VOM
Electronic leak detector
Vacuum pump
Manifold gauges
Gas welding equipment
Electronic scales
Refrigerant recovery system
Misc. charging fittings
Valve assemblies
Refrigerant
Process tube adapter kit
Thermistor vacuum gauge
Core removal tool
Pinch off tool
Anemometer
Ammeter
Fin comb set
Mirror and flashlight
Manometers (incl. incline)
Leak detector solution
Thermocouple tester
Thermometer
Thermostat wrench
DSI board tester(s)
Millivolt meter
Milliamp meter
Air flow meter
CO detector
Tape measure
PAL tester

F.ii Safety
PPE
Refrigerant safety procedures
Gas welding safety
Tinted goggles (gas welding)
Propane safety procedures
Burn hazard
Electrical safety procedures
Pinch points

F.34 Repair/replace/install air conditioning/heat pump units

F.34.a Verify air flow
F.34.a.1 Clean coils and air filter
F.34.a.2 Verify ducting system per mfg. specs (size, outlets, duct static pressure, sq. inches, etc.)
F.34.b Assess integrity of electrical system
F.34.b.1 Verify incoming voltage (static and loaded)
F.34.b.2 Verify amp draw
F.34.b.3 Verify connections (tight and proper wiring)
F.34.b.4 Diagnose/replace electrical components (selector switch; thermostat; control board; main board; relay board; PTCR device or kit or start relay; start capacitor; run capacitor(s); motor(s); overload protector; compressor; heat strip assembly; cold control; change over thermostat/ ambient sensor; relay(s); reversing valve; wire harnesses and connectors)
F.34.c Evaluate integrity of refrigerant systems
F.34.c.1 Check for leaks
F.34.c.2 Inspect/remove and replace coils
F.34.c.3 Diagnose/replace compressor
F.34.c.4 Accessing, brazing and leak detection
F.34.c.5 Evacuate, dehydration, charging and recovering per appropriate standards
F.34.c.6 Inspect/replace reversing valves
F.34.c.7 Inspect/replace filter dryer and capillary tubes
F.34.c.8 Perform operational refrigerant test

F.35 Troubleshoot air conditioning problems

F.35.a Visually inspect gas flame, burner tubes, thermocouple tightness, flue vents
F.35.b Verify gas pressure
F.35.c Troubleshoot sequence of operation and repair/replace various components
F.35.c.1 thermocouple

F.35.c.2 control valve
F.35.c.3 burner
F.35.c.4 pilot assembly
F.35.c.5 temperature and pressure relief valve
F.35.c.6 anode rod, if applicable
F.35.c.7 orifices (pilot and main burner)
F.35.c.8 ECO (energy cut off)
F.35.d Drain and flush water heater and inspect for calcium deposits
F.35.d.1 reestablish air pocket in tank
F.35.e Verify by-pass is in proper position (if applicable)
F.35.f Check fittings on tank
F.35.g Inspect/replace water tank
F.35.g.1 reseal flange
F.35.h Inspect/install/replace reigniter kit
F.35.i Verify air tight seal at gas line
F.35.j Perform function test

F.36 Repair/replace/install water heaters (DSI-Direct Spark Ignition, 120 VAC, and Motor-Aid)

F.36.a Visually inspect gas flame, burner tube, flue box, and wires
F.36.b Verify gas pressure and voltage
F.36.c Troubleshoot sequence of operation and repair/replace various components
F.36.c.1 thermostat
F.36.c.2 ECO
F.36.c.3 control valve
F.36.c.4 burner
F.36.c.5 electrode assembly
F.36.c.6 temperature and pressure relief valve
F.36.c.7 anode rod, if applicable
F.36.c.8 DSI module board
F.36.c.9 main burner orifice
F.36.c.10 thermal cutoff
F.36.c.11 on/off switch
F.36.c.12 heating element
F.36.c.13 12VDC activated /120 VAC relay
F.36.c.14 gas control valve
F.36.d Drain and flush water heater and inspect fittings for calcium deposits
F.36.d.1 reestablish air pocket in tank
F.36.e Check fittings on tank
F.36.f Inspect/replace water tank
F.36.g Test/replace fuse on board when applicable
F.36.h Verify air tight seal at gas line
F.36.i Perform function test
F.36.j Perform probe test on 12V/120 VAC section of DSI board
F.36.k Test/replace mixing valve
F.36.l Verify by-pass is in proper position (if applicable)
F.36.m Motor-aid
F.36.n Check automotive coolant connections
F.36.o Check automotive coolant lines

F.37 Repair/replace/install water heaters (Electric)

F.37.a Verify voltage
F.37.b Visually inspect wires and connections
F.37.c Verify proper breaker size
F.37.d Troubleshoot sequence of operation and repair/replace various components
F.37.d.1 thermostat
F.37.d.2 ECO
F.37.d.3 temperature and pressure relief valve
F.37.d.4 anode rod, if applicable
F.37.d.5 on/off switch
F.37.d.6 heating element
F.37.d.7 breaker
F.37.d.8 fuses (12V)
F.37.e Drain and flush water heater and inspect fittings for calcium deposits
F.37.e.1 reestablish air pocket in tank
F.37.f Check fittings on tank
F.37.g Inspect/replace water tank
F.37.h Perform function test

F.38 Repair/replace/install water heaters (Hydronic)

F.38.a Clogged orifice issues
F.38.b Replace orifice
F.38.c Clean burner chamber
F.38.d Clean electric eye
F.38.e Replace ignition valve
F.38.f Repair/replace pumps
F.38.g Check and replace heating element
F.38.h Water flow problems

F.38.i Winterize
F.38.j Test/replace mixing valve
F.38.k Verify/use proper coolant

F.39 Troubleshoot water heater problems
F.39.a Troubleshoot won't light
F.39.b Troubleshoot tepid water
F.39.c Troubleshoot won't stay light
F.39.d Troubleshoot TPR (temperature/pressure relief) valve leaks/no air pocket
F.39.e Troubleshoot won't heat on AC

F.40 Install/repair/replace furnaces (Gravity) (not tested)
F.40.a Verify gas pressure
F.40.b Inspect/clean burner, pilot, exhaust tube and air intake
F.40.c Troubleshoot sequence of operation and repair/replace various components
F.40.c.1 manual shut off valve
F.40.c.2 pilot assembly
F.40.c.3 thermocouple/thermopile
F.40.c.4 valve
F.40.c.5 thermostat
F.40.c.6 burner
F.40.c.7 gaskets
F.40.c.8 orifices (main burner and pilot)
F.40.d Perform function test

F.41 Install/repair/replace furnaces (Pilot)
F.41.a Verify gas pressure
F.41.b Verify voltage and all grounds
F.41.c Inspect/clean burner, pilot, exhaust tube and air intake
F.41.d Troubleshoot sequence of operation and repair/replace various components
F.41.d.1 manual shut off valve
F.41.d.2 circuit breaker
F.41.d.3 on/off switch
F.41.d.4 pilot assembly
F.41.d.5 thermocouple/thermopile
F.41.d.6 gas valve
F.41.d.7 thermostat
F.41.d.8 burner
F.41.d.9 gaskets
F.41.d.10 orifices (main burner and pilot)
F.41.d.11 fan motor
F.41.d.12 fan switch
F.41.d.13 relay (time delay, thermostat relay)
F.41.d.14 limit switch
F.41.d.15 sail switch
F.41.d.16 Piezo igniter and electrode
F.41.d.17 blower wheel
F.41.d.18 combustion wheel (intake air/blower)
F.41.d.19 combustion air hose
F.41.d.20 wire and connections
F.41.e Check integrity of combustion chamber with CO detector
F.41.f Perform function test

F.42 Diagnose/repair/replace furnaces (DSI)
F.42.a Verify gas pressure
F.42.b Verify voltage and all grounds
F.42.c Inspect/clean burner, exhaust tube and air intake
F.42.d Troubleshoot sequence of operation and repair/replace various components
F.42.d.1 manual shut off valve
F.42.d.2 circuit breaker
F.42.d.3 on/off switch
F.42.d.4 gas valve
F.42.d.5 thermostat
F.42.d.6 burner
F.42.d.7 gaskets
F.42.d.8 orifices (main burner)
F.42.d.9 fan motor/polarity
F.42.d.10 fan switch
F.42.d.11 relay (time delay, thermostat relay)
F.42.d.12 limit switch
F.42.d.13 sail switch
F.42.d.14 blower wheel
F.42.d.15 combustion wheel (intake air/blower)
F.42.d.16 combustion air hose
F.42.d.17 electrode assembly
F.42.d.18 DSI module board
F.42.d.19 wire and connections

F.42.e Check integrity of combustion chamber with CO detector
F.42.f Perform function test
F.42.g Verify DSI board shuts fan motor off (new style)

F.43 Inspect and correct ducting and return air
F.43.a Verify amount of ducting, ducting area and static pressure to mfg. specs
F.43.b Check for restrictions, damaged ducts, air flow, loose/improper connections
F.43.c Check adjustable outlets to mfg. specs
F.43.d Verify return air area to mfg. specs
F.43.e Verify alignment/seal at plenum
F.43.f Measure voltage at furnace under load
F.43.g Verify wire size to mfg. specs

F.44 Diagnose/repair/replace furnaces (Hydronic)
F.44.a Troubleshoot orifice issues
F.44.b Replace orifice
F.44.c Clean burner chamber
F.44.d Clean electric eye
F.44.e Replace ignition valve
F.44.f Replace mixing and zone valves
F.44.g Repair/replace pumps

F.45 Troubleshoot furnace problems (all others)
F.45.a Troubleshoot voltage problems
F.45.b Troubleshoot propane pressure problems
F.45.c Troubleshoot ducting problems
F.45.d Troubleshoot air flow problem

F.46 Install/repair/replace absorption refrigerators (Manual selection)
F.46.a Verify proper installation and venting per mfg. specs
F.46.b Verify AC and DC power sources per mfg. specs
F.46.c Verify propane pressure
F.46.d Verify leveling of refrigerator per mfg. specs
F.46.e Diagnose/replace electric components:
F.46.e.1 selector switch
F.46.e.2 electronic igniter
F.46.e.3 Piezo igniter
F.46.e.4 electrode
F.46.e.5 high voltage cable
F.46.e.6 relay
F.46.e.7 heating element (AC/DC)
F.46.e.8 thermostat
F.46.e.9 interior light and switch
F.46.e.10 fuses
F.46.f Diagnose/replace gas components:
F.46.f.1 shut off valve
F.46.f.2 filter, if appropriate
F.46.f.3 thermostat
F.46.f.4 bypass screw
F.46.f.5 safety valve assembly
F.46.f.6 thermocouple
F.46.f.7 burner assembly
F.46.f.8 flue baffle
F.46.f.9 flue cap
F.46.f.10 orifice
F.46.g Diagnose/replace cooling unit
F.46.h Verify seals for air tightness
F.46.h.1 inspect and verify proper cabinet combustion seal per mfg. specs and codes (e.g., NFPA 1192 and CSA Z240)
F.46.h.2 door gaskets
F.46.h.3 cooling unit
F.46.h.4 drip hose
F.46.i Perform function test

F.47 Install/repair/replace absorption refrigerators (Automatic selection)
F.47.a Verify proper installation and venting per mfg. specs
F.47.b Verify AC and DC power sources per mfg. specs
F.47.c Verify propane pressure
F.47.d Verify leveling of refrigerator per mfg. specs
F.47.e Diagnose/replace electric components:
F.47.e.1 upper circuit board
F.47.e.2 lower circuit board
F.47.e.3 electronic igniter
F.47.e.4 electrode and sensor

F.47.e.5 high voltage cable
F.47.e.6 relay
F.47.e.7 heating element (AC/DC)
F.47.e.8 thermostat or thermistor
F.47.e.9 interior light and switch
F.47.e.10 fuses
F.47.e.11 climate control heater/high humidity heaters
F.47.e.12 valve assembly
F.47.e.13 wire harnesses and connectors
F.47.e.14 low ambient switch
F.47.e.15 power ventilator fan
F.47.f Diagnose/replace gas components:
F.47.f.1 shut off valve
F.47.f.2 filter
F.47.f.3 thermostat
F.47.f.4 solenoid valve assembly (includes safety valve)
F.47.f.5 thermocouple or sensor probe
F.47.f.6 burner assembly
F.47.f.7 flue baffle
F.47.f.8 flue cap
F.47.f.9 orifice
F.47.g Diagnose/replace cooling unit
F.47.h Verify seals for air tightness
F.47.h.1 inspect and verify proper cabinet combustion seal per mfg. specs and codes (e.g., NFPA 1192 and CSA Z240)
F.47.h.2 door gaskets
F.47.h.3 cooling unit
F.47.h.4 drip hose
F.47.i Repair/replace internal ice maker components
F.47.i.1 evaporator coil
F.47.i.2 compressor
F.47.i.3 ice mold assembly
F.47.i.4 water valve
F.47.i.5 timing motor
F.47.i.6 ice mold (micro) switches
F.47.i.7 shut off arm
F.47.i.8 mold thermostat
F.47.i.9 ice ejector
F.47.i.10 mold heater
F.47.i.11 water lines and connections
F.47.i.12 condenser coil
F.47.i.13 condenser fan motor
F.47.i.14 wire harnesses and connectors
F.47.i.15 on/off switch
F.47.j Perform function test

F.48 Troubleshoot refrigerator problems
F.48.a Check installation and venting
F.48.b Check power supply
F.48.c Verify propane pressure
F.48.d Refrigerator freezes or overcooling
F.48.e Poor cooling performance

F.49 Install/repair/replace ranges and cooktops
F.49.a Verify gas pressure
F.49.b Verify grate clips installed
F.49.c Check lines and fittings for proper clearances from heat sources
F.49.d Repair/replace components
F.49.d.1 oven thermostat
F.49.d.2 burners/burner tubes
F.49.d.3 oven safety valve
F.49.d.4 regulator
F.49.d.5 Piezo igniter and electrode
F.49.d.6 ignition system (DSI)
F.49.d.7 pilot assembly
F.49.d.8 gaskets/window/door glass
F.49.d.9 burner valves and manifolds
F.49.d.10 thermocouple (new models)
F.49.e Verify range burners not affected by operation of forced air furnace or other appliances (e.g., microwave)
F.49.f Perform function test
F.49.g verify accuracy of oven thermostat
F.49.h Verify proper installation (per code and mfg. specifications)
F.49.h.1 clearances to adjacent surfaces and flammables
F.49.h.2 do not run a hose as supply line inside burner box

F.50 Demonstrate general knowledge of appliance repair
F.i Tools and Equipment
F.ii Calculations
F.iii Communications
F.iv Technology

F.v *Safety*

F.50.a Demonstrate knowledge of module board operation

F.50.b Demonstrate knowledge of gas pressure

F.50.c Demonstrate knowledge of sequence of operation

F.50.d Demonstrate knowledge of voltage problems on some appliances

F.50.e Perform burner adjustments

G GENERATORS

G.i Tools and Equipment
Torque wrench
Feeler gauge
Pressure gauge
Spark plug gap gauge
Std. Torx screw driver set
Common hand tools
Manometer
Electronic propane leak detector
Rotor/stator tester
Circuit board tester
VOM (true RMS)
Frequency meter
Load test panel
Frequency meter
Load test panel

G.ii Safety
PPE
Accuracy of readings & interpretation
No smoking
Exhaust ventilation
General shop safety
Keep fuel lines and electrical wires apart
Shock hazard
Burn hazard
Component protection

G.51 Maintain external engine components

G.51.a Verify battery voltage
G.51.b Verify fuel source and pressures
G.51.c Inspect/repair components
G.51.c.1 fuel pump
G.51.c.2 gasoline, propane, diesel delivery systems
G.51.c.3 starter motor
G.51.c.4 spark plugs
G.51.c.5 glow plugs
G.51.c.6 fuel and air filters
G.51.c.7 ignition components
G.51.c.8 oil and filter change
G.51.c.9 water pump and belt
G.51.c.10 battery charging system and belt
G.51.c.11 thermostat
G.51.c.12 exhaust system (interior CO test)
G.51.c.13 intake and exhaust valve clearances
G.51.c.14 breather system
G.51.c.15 governor springs, linkage and brackets
G.51.c.16 vibration isolators
G.51.d Verify engine operation

G.52 Inspect/maintain/repair generator section and control system

G.52.a Verify output voltage and frequency (no load and full load) without using the coach
G.52.b Repair/replace components
G.52.b.1 stator testing for opens, grounds, and shorts
G.52.b.2 rotor testing for opens, grounds, and shorts
G.52.b.3 brush block assembly/brushes
G.52.b.4 voltage regulator and control (interpret diagnostic codes)
G.52.b.5 start solenoid
G.52.b.6 circuit breaker
G.52.b.7 control fuses
G.52.b.8 wire and wire harnesses and connectors
G.52.b.9 control relays
G.52.b.10 generator drive system
G.52.c Install new generator

G.53 Inspect/test/maintain remote start and auto generator start panels (AGS)

G.53.a Check for battery voltage
G.53.b Check demand signal from air conditioner
G.53.c Confirm presence of the safety lockout; input connection

G.54 Troubleshoot generator faults

G.54.a Troubleshoot - will not start
G.54.b Troubleshoot - will not crank
G.54.c Troubleshoot - starts but will not run
G.54.d Diagnose AC voltage output (including high and low)
G.54.e Troubleshoot surging
G.54.f Troubleshoot frequency output (high and low)

G.54.g Troubleshoot intermittent operation or unintentional shut down

G.54.h Troubleshoot using resistive load (not coach load)

H HYDRAULIC SYSTEMS

H.i Tools and Equipment
VOM
Basic hand tools
12 volt test light
Pressure gauge-hydraulic (min. 4K psi)
Swaging/crimp tools
Jack stands and jack
Tape measure
Welder arc/wire
Continuity tester
Ammeter
Wheel chocks

H.ii Safety
PPE
Basic mechanical safety procedures
General shop safety
Safe jack operation
High pressure fluids
Pinch points
Hydraulic fluid hazards

H.55 Inspect/maintain/repair hydraulic systems

H.55.a Verify source voltage to pump
H.55.a.1 load
H.55.a.2 no load
H.55.a.3 proper ground connection
H.55.b Verify fluid level in reservoir
H.55.c Check integrity of hoses and routing and fittings
H.55.d Diagnose/repair/replace components:
H.55.d.1 pump
H.55.d.2 solenoid valve assembly
H.55.d.3 switches and controls
H.55.d.4 hoses and fittings
H.55.d.5 actuators
H.55.d.6 manifold
H.55.d.7 printed circuit boards
H.55.d.8 hydraulic cylinders
H.55.d.9 wiring and wire harnesses and connectors
H.55.d.10 level sensor/jack sensor
H.55.d.11 equalizing (proportioning) valve
H.55.e Perform preventive maintenance on cylinders
H.55.e.1 clean
H.55.e.2 lubricate
H.55.e.3 paint
H.55.f Check for contamination of hydraulic fluids
H.55.f.1 use appropriate fluid

I EXTERIOR/COACH BODY

I.i Tools and Equipment
Caulking gun
Sanders
Grinders
Spray guns
Die grinder
MIG/TIG welder
Arc welder
Circular saws
Chop saws
Staple gun
Screw gun
Jig saw
Tin snips
Pop riveter
VOM
Wire stripper
Wire crimper
Common hand tools
Respirator

I.ii Safety
PPE
Power tool procedures
MSDS
Welding helmet
Gloves
Respirator
Face plate
OSHA regulations
EPA regulations
NIOSH regulations

I.56 Inspect/maintain/repair roofs, sidewalls, and underbelly

I.56.a Inspect/repair/replace sealant
I.56.b Maintain/repair/replace/various types of roofing
I.56.b.1 EPDM rubber
I.56.b.2 fiberglass
I.56.b.3 TPO vinyl
I.56.b.4 metal
I.56.c Repair/replace plastic molded components
I.56.d Repair underbelly material
I.56.e Repair/replace aluminum siding
I.56.f Repair/replace fabric exteriors
I.56.g Identify laminated structural faults
I.56.h Identify non-laminated structural faults

I.57 Inspect/maintain/repair exterior openings, trims and seals

I.57.a Inspect/repair/replace roof jacks/stacks/vents
I.57.b Inspect/repair/replace trim moldings
I.57.c Inspect/repair/replace windows (frames and glass)
I.57.d Inspect/repair/replace entrance/compartment doors and hatches
I.57.e Repair/replace skylights
I.57.f Inspect/repair/replace appliance vents
I.57.g Inspect/repair/replace exterior lamps
I.57.h Inspect/repair/replace emergency exits
I.57.i Inspect/repair/replace wheel wells, skirts, bumpers, and fenders
I.57.j Inspect/repair/replace side mirrors
I.57.k Inspect/repair/replace sealants on exterior accessory components
I.57.k.1 spoilers, antennas, ladders, racks, etc.)
I.57.l Inspect/repair/replace slide room seals/wipes

I.58 Perform basic fiberglass/plastic/metal body repairs

I.58.a prepare surface
I.58.b spray equipment operation
I.58.c paint mixing, matching and applying
I.58.d solving paint application problems
I.58.e finish defects, causes and cures
I.58.f safety precautions
I.58.g graphic installation and repair

J INTERIOR COMPONENTS

J.i Tools and Equipment

Caulking gun
Sanders
Circular saws
Miter saws
Staple gun
Screw gun
Jig saw
Router
Planer
Drill
Table saw
Wire stripper
Wire crimper
Common hand tools
Safety glasses
Sewing machine
Torque wrench
Hog ring pliers
Carpet stretcher
Tile cutter
Linoleum knife
Trowel
Carpet knife
Linoleum roller
Carpet seamer
Screening tool
Saber saw
Die grinder
Hack saw
VOM

J.ii Safety

PPE
Power tool safety
MSDS
Respirators
Gloves
Face plates

J.59 Inspect/maintain/repair/modify cabinetry

J.59.a Install cabinetry
J.59.b Repair and refinish cabinet surfaces
J.59.c Replace cabinet parts and hardware
J.59.d Fabricate components
J.59.e Install/replace/resurface countertops
J.59.f Inspect/repair/replace built-in furniture (dinettes, gaucho, bed, bunks, etc.)

J.60 Clean/repair/replace softgoods (upholstery and curtains)

J.60.a Clean/repair/replace window coverings (curtains, blinds and valances)
J.60.b Upholster/repair/replace furniture
J.60.c Clean/repair/re-cover soft padded assemblies
J.60.d Clean/repair/replace seat bases and seat hardware (Note: Torque specifications)
J.60.e Replace seat belts

J.61 Repair/replace/modify/clean interior floor and coverings

J.61.a Perform structural floor repairs
J.61.b Remove/repair/install carpets
J.61.c Remove/repair/install vinyl
J.61.d Remove/repair/lay tile and ceramics
J.61.e Remove/repair/install laminate/wood flooring
J.61.f Repair/replace engine cover

J.62 Repair/replace/install interior surfaces

J.62.a Install/repair/replace tub and shower enclosures
J.62.b Replace/refinish paneling
J.62.c Install/repair/replace wall coverings
J.62.d Install/repair/replace soft ceiling coverings
J.62.e Repair/replace interior trim moldings
J.62.f Repair/replace/install mirrors and wall hangings
J.62.g Repair/replace miscellaneous hardware
J.62.h Repair/replace screens, window garnishes
J.62.i Repair/replace privacy/divider doors
J.62.j Troubleshoot and repair squeaks and rattles
J.62.k Adjust drawers and slides

J.63 Inspect/install/maintain safety equipment

J.63.a Install/maintain/replace smoke detectors/CO alarm/ propane detector
J.63.b Install/inspect fire extinguishers
J.63.c Check operation of emergency exits
J.63.d Interior glass and mirrors must comply with ANSI Z97.1
J.63.e Exterior glass must comply with ANSI Z26

K SLIDEOUT ROOM SYSTEMS

K.i Tools and Equipment
VOM
Basic hand tools
12 volt test light
Pressure gauge-hydraulic (min. 4K psi)
Swaging/crimp tools
Tape measure
Ammeter
Expandable room lift
Hydraulic fluid
Common hand tools
Cable crimp tools
Cable cutters
Lubricants
Level
Square
Cleaners
Teaching pendant for full wall slide power gear

K.ii Safety
PPE
Basic mechanical safety
Basic shop safety
Safe jack operation
Pinch points
Hydraulic pressure
Hydraulic fluids hazard
Safe use of jacks

K.64 Inspect/maintain/repair slideout room hydraulic assembly

K.64.a Verify source voltage to pump
K.64.a.1 load
K.64.a.2 no load
K.64.a.3 proper ground connection
K.64.b Verify fluid level in reservoir
K.64.c Check integrity of hoses and routing and fittings
K.64.d Diagnose/repair/replace components:
K.64.d.1 pump
K.64.d.2 solenoid valve assembly
K.64.d.3 switches and controls
K.64.d.4 hoses and fittings
K.64.d.5 actuators
K.64.d.6 manifold
K.64.d.7 printed circuit boards
K.64.d.8 ram assembly
K.64.d.9 proportioning valve
K.64.e Clean and lubricate seals

K.65 Repair/adjust slideout room electrical and manual drive mechanisms

K.65.a Repair/adjust electric mechanisms
K.65.a.1 cable driven (including cable and pulley systems)
K.65.a.2 gear driven
K.65.a.3 chain driven
K.65.a.4 screw driven
K.65.a.5 single motor
K.65.a.6 multi motor
K.65.a.7 rack and pinion
K.65.b Repair/adjust manual mechanisms
K.65.b.1 manual crank systems
K.65.b.2 hand extension (push out)
K.65.b.3 tip outs

K.66 Install/replace/repair/adjust slideout room accessory components

K.66.a Replace and refasten seals
K.66.a.1 interior
K.66.a.2 exterior
K.66.a.3 sweep
K.66.b Repair/adjust locking and interlocking mechanisms
K.66.b.1 lock out engine mechanisms
K.66.b.2 travel locks
K.66.b.3 drivers seat interlock
K.66.b.4 storage compartment interlocks
K.66.c Install/repair/adjust slideout room awnings
K.66.d Inspect/repair/replace utility connections between slideout room and coach
K.66.d.1 drain lines
K.66.d.2 fresh water lines
K.66.d.3 propane lines
K.66.d.4 AC and DC lines
K.66.d.5 communication lines (telephone)
K.66.d.6 coaxial cable, speaker wiring, and other entertainment systems

K.66.e Adjust slideout room
K.66.e.1 height
K.66.e.2 front/rear clearances
K.66.e.3 alignment (front/rear skew) and travel limits

L TECHNICAL SKILLS

L.i Tools and Equipment
Basic hand tools
Mask and gloves
Arc welder
Oxyacetylene welder
Mig/tig welder
Steel brush
Common hand tools
Bubble level
Angle master
Manometer
L.P. tap connector
Electronic leak detector
VOM
Circuit tester
GFCI fault creation tester
Hydrometer
Battery charger
Lug wrench
Tire pressure gauge
Pen and paper
Watch or clock
Work order form
PDI form

L.ii Safety
PPE
Basic welding safety
Burn hazard
Eye hazard
Disconnect battery when welding
Propane safety
Electrical safety procedures

L.67 Perform basic welding tasks

L.67.a Welding safety
L.67.b Perform basic arc welding operations
L.67.c Perform basic oxyacetylene welding operations including cutting
L.67.d Perform basic mig/tig welding operations

L.68 Install accessories (interior and exterior)

L.68.a Identify proper fittings and fasteners
L.68.b Identify impact of adding accessories on chassis weight and distribution
L.68.c Identify structural internal walls for support
L.68.d Identify clearances and slideout room openings
L.68.e Comply with regulations regarding adding accessories
L.68.e.1 maximum widths, heights, lengths, weights (Federal weight label compliance)
L.68.f Examples of interior after market applications (not tested)
L.68.f.1 install/repair power door locks and windows
L.68.f.2 install/repair CB radio/antenna
L.68.f.3 install/repair rear vision system
L.68.f.4 install/repair television/AV distribution system
L.68.f.5 install/repair entertainment systems
L.68.f.6 install/repair telephone and cable TV lines
L.68.f.7 install/repair small kitchen appliances
L.68.f.8 install/replace microwave/convection ovens
L.68.f.9 install/replace cellular telephone systems
L.68.f.10 install/repair security alarm systems
L.68.f.11 install/repair garbage disposal
L.68.f.12 install/repair ceiling fans
L.68.f.13 install/repair central vacuum systems
L.68.f.14 install/repair rear automotive heater
L.68.f.15 install/repair ice maker (compressor style)
L.68.f.16 install/repair window tint
L.68.f.17 install/repair navigation systems including GPS systems
L.68.f.18 install additional receptacles and switches and electrical circuits (AC and DC)
L.68.f.19 install/repair washer and dryers
L.68.g Examples of exterior after market applications (not tested)
L.68.g.1 install/repair satellite dishes
L.68.g.2 install/repair electric steps
L.68.g.3 install/repair air horns

L.68.g.4 install/repair mud flaps and skirts
L.68.g.5 install/repair awnings and stone shields
L.68.g.6 install/repair spotlights
L.68.g.7 install/repair storage pods
L.68.g.8 install/repair solar panels
L.68.g.9 install/repair automatic anti-freeze system
L.68.g.10 install/repair skid wheels
L.68.h Install/repair multi-plexing systems

L.69 Perform preventative maintenance
L.69.a Check propane systems
L.69.b Service and adjust appliances
L.69.c Test GFCI
L.69.d Winterize coach and de-winterize
L.69.e Check safety items
L.69.f Check and lubricate doors
L.69.g Check exterior lights
L.69.h Check window roof molding seals
L.69.i Change oil and filter on power plants
L.69.j Check wiper blades
L.69.k Visually inspect fluid levels
L.69.l Service batteries
L.69.m Inspect belts and hoses
L.69.n Change chassis oil and filter and lube chassis
L.69.o Change transmission oil, filter and gasket
L.69.p Visually inspect chassis
L.69.q Check lug nuts and tire pressure
L.69.r Flush and refill cooling system
L.69.s Test-drive
L.69.t Drain and flush water and waste systems
L.69.u Clean and repack wheel bearings
L.69.v Inspect suspension and brake system

L.70 Perform pre-delivery inspection
L.70.a Check propane systems
L.70.a.1 pressure drop test
L.70.a.2 regulator lock up test
L.70.a.3 system operating pressure test
L.70.b Pretest all appliances and accessories
L.70.c Test and inspect AC electrical system
L.70.c.1 hot skin test
L.70.c.2 polarity test
L.70.c.3 voltage test
L.70.d Test and inspect DC electrical system
L.70.e Check safety items
L.70.f Check and lubricate doors
L.70.g Check exterior lights
L.70.h Check window roof molding seals
L.70.i Check interior lights
L.70.j Check wiper blades
L.70.k Visually inspect fluid levels
L.70.l Service batteries
L.70.m Inspect belts and hoses
L.70.n Visually inspect chassis
L.70.o Check lug nuts and tire pressure
L.70.p Test water supply and drainage systems
L.70.q Test-drive

L.71 Demonstrate effective customer relations skills
L.71.a Act courteously
L.71.b Listen carefully
L.71.c Use effective communication techniques
L.71.d Empathize with customer
L.71.e Ask direct questions
L.71.f Build trust and rapport
L.71.g Explain plan of action
L.71.h Provide RV orientation and instructions
L.71.i Use protective coverings
L.71.j Provide helpful hints
L.71.k Ensure follow-up
L.71.l Test drive with customer
L.71.m Return replaced parts to customer

L.72 Perform recordkeeping tasks
L.72.a Record consumer complaint/concern
L.72.b Record registration and warranty forms
L.72.c Complete personnel records (time sheets, etc.)
L.72.d Record and sign for work performed and declined on appropriate form
L.72.d.1 timed pressure drop test results (document date, start and stop time, pressure maintained, etc.)
L.72.e Record all parts and inventory used
L.72.f Record time in and time out for service

L.72.g Record serial number, production number, hours of operation and model of all appliances addressed
L.72.h Record mileage (motorized units) and serial number of coach

L.73 Identify types of RVs
L.73.a Motor homes
L.73.a.1 class A, B, and C and Super C's
L.73.b Towables
L.73.b.1 travel trailers
L.73.b.2 hybrids
L.73.b.3 5th wheels
L.73.b.4 folding camping trailer
L.73.c Truck camper
L.73.d Toy hauler

FORM FOR PROPOSALS ON THE RVST STANDARD

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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.)

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