

Recreation Vehicle Industry Association

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Recreation Vehicle

Study Guide for Registered Technician



Study Guide for the Registered RV Service Technician Test

Compiled by the Recreation Vehicle Industry Association

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Study Guide for the *Registered RV Service Technician Test*

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Overview

The purpose of this Study Guide is to help the Recreation Vehicle (RV) Service Technician prepare to take and pass the *RVIA/RVDA Registered RV Service Technician Test*.

Note: The Registered RV Service Technician is a Recreational Vehicle Industry registration. It does not constitute licensing or permission to perform any function or task controlled by state or local regulations. Technicians are required to meet all state and local requirements before performing any regulated tasks.

What is an RV Service Technician?

Recreation vehicles have come a long way since the early days of the RV Industry, especially in the technical sense. So much so, it takes training, dedication and the command of specialized skills to become a successful RV service technician.



Today's service technician must acquire and apply intelligent troubleshooting skills covering the vast amount of technical equipment found within a wide range of recreation vehicle types. In addition, a qualified RV service technician must be proficient with a variety of hand and powered tools and have the ability to read, understand, implement and install numerous accessories and add-on components common to the RVing lifestyle. Performing proper and complete preventive maintenance procedures is

yet another must-have skill the qualified service tech will master.

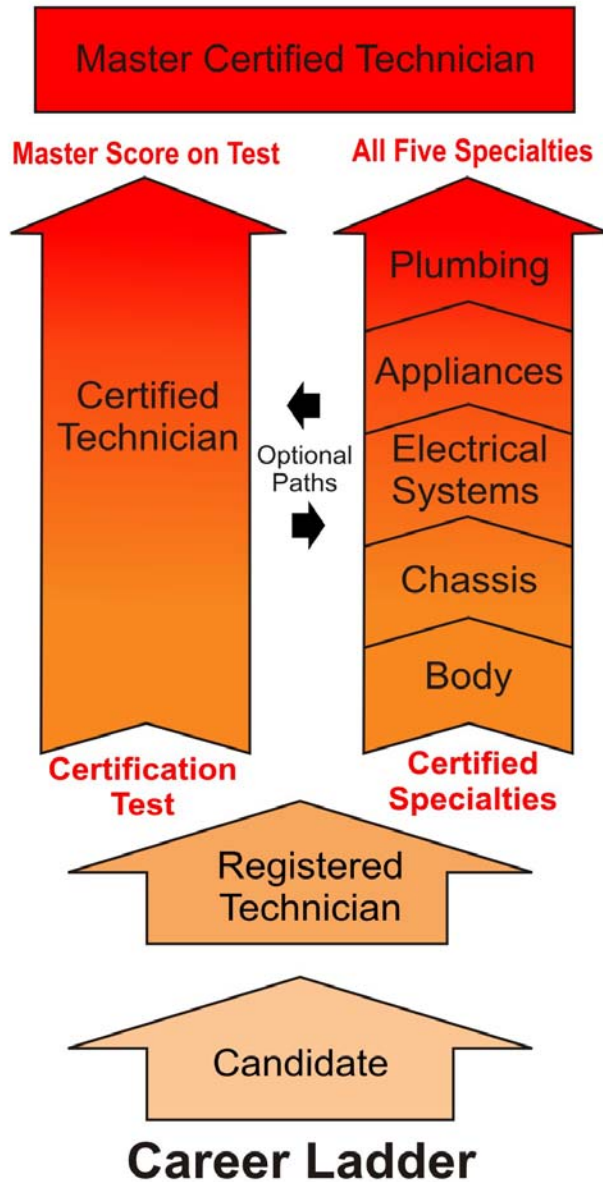
The reward is that, once the above is accomplished, a valued RV service technician will seldom (if ever), be without a job. To this day, there remains a remarkable shortage of qualified RV service technicians in the industry to staff not only traditional RV dealerships, but also those of stand-alone service shops and repair centers that are constantly seeking qualified individuals. There are many service technicians that open their own mobile RV repair business.

The bottom line is that all good RV service technicians will always have work, even during the toughest of economic times. It's been proven; serious RVers will never entirely give up their lifestyle. They may take shorter, less frequent excursions, but even when fuel costs approach record highs, they will still be using that RV! And that's the very reason it is an attractive option to become a professional RV service technician.

RVST Career Ladder

The Service Technician Career Ladder was developed and launched through the combined efforts of the RV Dealer Association (RVDA), the RV Industry Association (RVIA) and the Certification Governing Board.

RV Service Technician



Before the Career Ladder was established there was only one way to become a Certified RV Technician and that was to take and pass a comprehensive certification test. With the launch of the Career Ladder there are now two paths to certification. There is the traditional path through the existing RV Service Technician Certification Test and an alternate path through achieving Specialty Certifications.

The certification process begins with the Candidate level which provides a basic orientation to the RV Service Technician career. Next comes the Registered Technician level where the core knowledge of propane, basic electrical, and other skills are mastered. The technician can then move on to one of two paths. He can choose to take the comprehensive test which covers all subjects required for certification or master certification or he can choose to move through the individual specialties.

- Appliances
- Body
- Chassis
- Electrical Systems
- Plumbing

Once a technician holds all five Specialties, or passes the full certification test at the master level, and meets the time-in-service requirement he becomes a Master Certified RV Technician.

Which Path is Right for You?

When you become involved in lifelong training and decide to seek accreditation as a Certified RV Service Technician, some decisions still need to be made. Do I want to follow the right side of the career ladder and get specialty certifications, or should I go to the left side and take the comprehensive certification path? Am I interested in obtaining Master Certification? These questions and more will need to be pondered in choosing the correct path in fulfilling your career goals.

If your quest is to become Master Certified, which can be obtained by using either path, the decision will be one based your personal abilities as well as the time and resources you can devote to the process. On the comprehensive path, the score on the test will need to be high enough to be granted Master status. On the specialty path, the technician must earn all five specialties to become Master. To acquire Master status by either path, the technician must have at least 5 years of experience as a technician. If the technician has less than the required 5 years, he will hold a Certified status until the time-in-service requirement has been completed.

Following the comprehensive path, the technician will need to study the entire body of knowledge and take a 3-hour 200 question test. Those receiving a score above 76.5% will become Certified. Those receiving a score of 90% or above will become Master Certified pending time in service. Certification status is granted for 5 years. To maintain Certified Technician status, 40 hours of continuing education credit is required with 80% of the credit hours being earned in the last 3 years of the certification period. There is a \$100 fee for this recertification. The fee for the generalist test is \$325.

If your interests and job functions are in specific areas of the technician career, getting specialties may be the way to go. Each specialty test carries a fee of \$165. All 5 specialties must be achieved and held current for Master Certification status. Recertification for each specialty costs \$50 with 8 hours of continuing education credits in the specific area. Once all 5 specialties are earned, Master status is awarded, pending time in service.

Not every technician's goal will be to achieve Master status. The RV industry needs specialists in every category and those technicians that have a talent and an affinity for a specific specialty should develop those skills and become the best they can be in their chosen field. Under these circumstances, the specialty status will be more meaningful to the technician than attempting to achieve a Master status, which includes expertise in areas outside of their interests. One note is that a technician who begins on the specialty path can switch to the comprehensive path at any time and vice versa, because the body of knowledge is the same. If your goal is Master, the knowledge requirements for the specialty path are in smaller "bites" for ease of learning.

Only the individual technician can decide for himself which is the best path to take. In addition to ultimate career goals, the technician must consider which testing method better fits his abilities, either a larger one time comprehensive test or taking smaller tests that focus on a specific subject category. Either way, diligent study is required and the best chance for success is to participate in the Florida Distance Learning Program or the RVIA On-Line Test Prep Course, both of which are offered through the RV Learning Center, www.rvlearningcenter.com. Be sure to review the study guides as well and incorporate the practice test questions into your study plan.

What You Must Know to Pass the Registered Technician Test

The curriculum for the RV Service Technician begins with the DACUM Chart Job and Task Analysis. This document outlines all the Duties, Tasks and Steps a service technician is expected to know. The DACUM is also known as the RV Service Technician Standard and is further broken down to align with the levels of the RVST Career Path.

This study guide is focused on the Registered Technician level of the Career Path. The Registered Technician is the second level, following the Candidate and preceding the Specialty or Certified levels.

The Core Standards Chart lists all of the Duties, Tasks and Steps associated with the Registered Technician level.

Each section begins with the Duties, which will list the main topics covered. The Duties are followed by the activities a technician should be able to perform in each area. This list was developed by working technicians, educators and subject matter experts from across the country and will provide a valuable check list of what to study for the test.

It should be noted that the number of questions in each area may not equal the number of tasks listed. Some of the tasks are complex and broad in scope and may be covered by several questions. Other tasks are simple and narrow in scope and one question may cover several tasks. The main objective in listing the tasks is to describe accurately what is done on the job, not to make each task correspond to a particular test question.

The Core Standards Chart begins on page 5.

Sample questions will follow. Although these same questions will not appear on actual tests, they are in the same format and cover the same topics as the actual test questions.

To be successful on the test you must know the Ohm's/Watt's laws formulas and how to manipulate the equations. This Study Guide provides some tips on how to use and remember Ohm's Law so you will never miss a single Ohm's/Watt's law question or ever forget the formulas, beginning on page 11.

Propane Timed-Pressure Drop and Lock-up Tests and the Electrical Hot-Skin test are also must know subjects. Study the sign-off sheets and memorize the procedures. You will be tested on this, see page 15.

Finally, there are a number of facts which you must remember if you are going to ace the test. These facts, which are generally represented by specific values, have to be learned. Unfortunately, a technician cannot 'work out' the answer by calculation or deductive reasoning. You must know the correct facts. For instance, a propane regulator "locks-up" at what pressure? A list of required RV Technician facts begins on page 16. Learn them, there is no other way.

Resource list

The following resources are available to help you prepare for the Registered Technician Test. The RVIA Textbooks and publications are available through the RVIA Store at www.rvia.org.

Many technicians have found the basic electrical portion of the test to be difficult. *Electricity DeMystified* by Stan Gibilisco is easy to read and presented in a non-technical format. A number of the questions on the test cover electrical theory and this book will help anyone better understand the basic concepts. The *RVIA Electrical Systems* textbook focuses more on the RV Electrical Systems and does not go into great detail regarding basic electrical theory. For that reason, we recommend that you study the concepts presented in the Gibilisco book to prepare for the test. This book is not available through the RVIA Store but can be purchased at retail outlets,

including Amazon.com and others. There are many other good books and on-line resources that cover basic electricity which are not listed here.

Introduction to RV Service – RVIA Textbook

Pre-Delivery Inspection – RVIA Textbook

Electrical Systems – RVIA Textbook

Propane Systems – RVIA Textbook

Preventive Maintenance – RVIA Textbook

Electricity DeMystified – Stan Gibilisco

Electrical and Propane Sign-off Sheets

Taking the test

Get plenty of rest the night before so you will be alert and efficient. Arrive early enough to find the building and testing room. Be sure to bring your test center admission ticket and current photo I.D. The proctor will instruct you in filling out the answer booklet if taking the written test or how to log on to the computer if you are taking the on-line test.

Once testing has begun, keep track of time Do not spend too long on any single question. Be sure to read each question carefully so you understand exactly what is being asked. Do not mark answers in the test booklet if taking the written test; they must be marked on the answer sheet. Your test will not be scored if your answers are not on the answer sheet.

If a question is difficult, mark the answer that you think is correct and put a check by it in the test booklet. (Computer-based tests allow you to do this on screen.) Then go on to the next question. If you finish before time is up, you may go back to the question that you have checked.

It is to your advantage to answer every question. Do not leave any answers blank. Your score will be based only on the number of correct answers you give.

RV Registered Technician Core Standards Chart

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

		g	Transport cylinders properly
	2		Demonstrate general knowledge of propane
		a	Demonstrate knowledge of propane theory
			--efficiency of propane based on ambient temperature and rate of vaporization
			--area of wetted surface
			--expansion rate of propane
			--limits of combustibility to ensure proper air mixture
			--container refrigeration
		b	Identify properties of propane
			--boiling point
			--specific gravity of vapor
			--weight per gallon
			--btu's per gallon
			--chemical make-up (odor)
		c	Understand Boyle's Law and Pascal's Laws
			--general definition
		d	Define common terms and identify components
			--cylinder, tank, container
			--butane
			--propane
			--inches of water column (w.c.)
			--psig
			--water capacity (w.c.)
			--other terms in glossary
		e	Demonstrate knowledge of RV codes related to propane
			--NFPA 1192
			--CSA Z240
	3		Inspect/maintain/replace propane containers and fittings
		a	Visually inspect container surface
			--measure dents
			--inspect for damage (e.g., secondary heat damage, drop damage, broken welds, etc.)
			--inspect for surface rust
		b	Review the container data plate
			--date of manufacture/cylinder recertification
			--water capacity
			--dip tube length (cylinder)
			--tare weight (cylinder)
			--manufacturer
			--DOT and/or ASME specifications (e.g., container construction specifications)
			--surface area
			--serial number and registration number (Canadian)
		c	Inspect/install mountings and brackets
		d	Inspect/replace container relief valve
		e	Inspect/replace excess flow valve(s)
		f	Inspect/replace container service valves
		g	Inspect/replace 80% outage valve

		h	Inspect/replace fill valve/insure dip tube correct length
		i	Inspect/replace sight gauge and its float mechanism
		j	Inspect/replace OPD
		k	Inspect/adjust/replace regulator
			--size regulators
			--locate vent position
			--adjust regulator
			--replace regulator
			--ensure required protection
		l	Inspect high pressure system
			--POL and CGA791
			--differentiate between green, black and blue mating connector knobs
			--backflow check valves on automatic changeover
			--quick disconnect (high pressure side)
			--excess flow valve
			--high pressure hose, piping, tubing and routing and support
			--solenoid shut off valves
			--pressure reduced to 30psi within 60" of container outlet
			--differentiate between schedule 40 and schedule 80 pipe including proper use
		m	Purge containers per NPG standards
		n	Fill containers per NPG standards
		o	Transfer propane from one container to another container
		p	Burn off propane in a container
		q	Comply with safety procedures
	5		Perform propane system tests
		a	Perform container and fitting leak tests
			--use appropriate leak detector solution
			--operate electronic gas leak detector
		b	Perform system tests
			--timed pressure drop test
			--leak test ACME pigtail connection (backflow device) (cylinders only)
			--lock up test
			--system operating/demand pressure test
			--regulator adjustment test
		d	Perform propane detector system test
		e	Calibrate manometer (gauge and U-tube)
		f	Complete proper documentation of test results
	6		Troubleshoot propane system faults
		f	Diagnose and Repair container filling problems
		g	Diagnose and Repair container refrigeration situation

B.		DC ELECTRICAL SYSTEMS	
	7		Demonstrate knowledge of basic DC electricity and safety
		a	Apply Ohm's law
		b	Apply Watt's law (derivative of Ohm's Law)
		c	Differentiate between AC and DC current
			--perform visual inspection
			--types of circuits (series and parallel)

			--type of wire used (stranded vs. solid)
			--connector devices
			--meter testing
		d	Define common terms
			--open
			--short
			--voltage drop
			--resistance
			--grounded
			--polarity
			--continuity
			--amperage
			--voltage
		e	Comply with safety procedures
			--common shock hazards
			--battery safety and explosion hazards
			--voltage source
		f	Identify overcurrent protection devices
			--fuses (glass, blade, fusible link and T-fuse ("slow blow"))
			--breakers (type 1, 2 (manual reset), and 3)
		g	Interpret electrical drawings
			--pictorial drawings
			--wiring diagram
			--schematic diagram
		h	Identify common symbols on wiring diagrams

C.			AC ELECTRICAL SYSTEM
	11		Demonstrate knowledge of basic AC theory and safety
		a	Apply Ohm's law
		b	Apply Watt's law (derivative of Ohm's Law)
		c	Differentiate between AC and DC circuits
			--perform visual inspection
			--types of circuits (series and parallel)
			--type of wire used (stranded vs. solid)
			--connector devices
			--meter testing
		d	Define common terms
			--open
			--short
			--resistance
			--grounded
			--continuity
			--polarity
			--amperage
			--voltage
			--isolated neutral
		e	Comply with safety procedures
			--common shock hazards

			--battery safety and explosion hazards
			--voltage source
		f	Identify overcurrent protection devices
			--fuses
			--breakers (including HACR)
		g	Identify GFCI (ground fault circuit interrupter)
			--receptacles
			--circuit breakers
		h	Interpret electrical drawings
			--pictorial drawings
			--wiring diagram
			--schematic diagram
		i	Identify common symbols on wiring diagrams

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

L.			TECHNICAL SKILLS
	70		Install accessories (interior and exterior)
		b	Identify impact of adding accessories on chassis weight and distribution
		e	Comply with regulations regarding adding accessories
			--maximum widths, heights, lengths, weights (Federal weight label compliance)
	71		Perform preventative maintenance
		a	Check propane systems
		b	Service and adjust appliances
		c	Test GFCI
		d	Winterize coach and de-winterize
		e	Check safety items
		f	Check and lubricate doors
		g	Check exterior lights
		h	Check window roof molding seals
		i	Change oil and filter on power plants
		j	Check wiper blades
		k	Visually inspect fluid levels
		l	Service batteries
		m	Inspect belts and hoses
		n	Change chassis oil and filter and lube chassis
		o	Change transmission oil, filter and gasket
		p	Visually inspect chassis
		q	Check lug nuts and tire pressure
		r	Flush and refill cooling system
		s	Test-drive
		t	Drain and flush water and waste systems

		u	Clean and repack wheel bearings
		v	Inspect suspension and brake system
	72		Perform pre-delivery inspection
		a	Check propane systems
			--pressure drop test
			--regulator lock up test
			--system operating pressure test
		b	Pretest all appliances and accessories
		c	Test and inspect AC electrical system
			--hot skin test
			--polarity test
			--voltage test
		d	Test and inspect DC electrical system
		e	Check safety items
		f	Check and lubricate doors
		g	Check exterior lights
		h	Check window roof molding seals
		i	Check interior lights
		j	Check wiper blades
		k	Visually inspect fluid levels
		l	Service batteries
		m	Inspect belts and hoses
		n	Visually inspect chassis
		o	Check lug nuts and tire pressure
		p	Test water supply and drainage systems
		q	Test-drive
	73		Demonstrate effective customer relations skills
		a	Act courteously
		b	Listen carefully
		c	Use effective communication techniques
		d	Empathize with customer
		e	Ask direct questions
		f	Build trust and rapport
		g	Explain plan of action
		h	Provide RV orientation and instructions
		i	Use protective coverings
		j	Provide helpful hints
		k	Ensure follow-up
		l	Test drive with customer
		m	Return replaced parts to customer
	74		Perform recordkeeping tasks
		a	Record consumer complaint/concern
		b	Record registration and warranty forms
		c	Complete personnel records (time sheets, etc.)
		d	Record and sign for work performed and declined on appropriate form
			--timed pressure drop test results (document--date, start and stop time, pressure maintained, etc.)
		e	Record all parts and inventory used
		f	Record time in and time out for service

		g	Record serial number, production number, hours of operation and model of all appliances addressed
		h	Record mileage (motorized units) and serial number of coach
	75		Identify types of RVs
		a	Motor homes--class A, B, and C and Super C's
		b	Towables
			--travel trailers
			--hybrids
			--5th wheels
			--folding camping trailer
		c	Truck camper
		d	Toy hauler

Using and Remembering Ohm's Law Formulas

Although many technicians find the Ohm's Law test questions difficult, in reality they are some of the easiest to answer correctly. By understanding a couple of key concepts and employing simple memory aids you will always be able to calculate the correct answers, on the test and for years to come.

Technicians have told us it is not necessary to memorize the formulas because they are not often used and when they are needed they can just look them up on a chart. While that is true, it is better to be able to use them at a moment's notice without having to look up or rely on reference materials. Once you have command of the formulas, you will be surprised how often they are helpful to you.

The First Problem – What do all of those letters mean?

Ohm's law formulas use letters to represent different variables in the equations. Don't panic if you have never learned, or forgotten, how to solve algebraic equations. The equations that a Service Technician will need to solve are very simple and require only addition, subtraction, multiplication and division, and usually only one unknown. You are allowed to use a non-programmable calculator during the test so there is no worry about math skills. In fact, it is recommended that a simple calculator be a standard tool that is kept in every tech's tool box. The cheapest, most basic calculator will do the job.

Before you learn how to manipulate the equations, what do all of those letters mean? When you read about Ohm's Law you will find what seems to be an endless and confusing array of letters and formulas. Different textbooks use different letters to represent exactly the same thing. Don't let that become a problem for you. What you need to understand is that there are only FOUR components that you need to know. Only four.

Ohm's law defines the relationships between (P) power, (E) voltage, (I) current, and (R) resistance. Here we are using the letters P, E, I and R to represent those four components. In different textbooks you will find different letters. It would be nice if everyone used the same letters but that is not going to change so learn to deal with the differences because it is not that difficult.

Power is the amount of current times the voltage level, measured in wattage or watts. The common symbols for Power are P or W.

Voltage is the electromotive force, or EMF, that is required to make current flow. Voltage applied across a load, or resistance, is required to make electrons flow. The common symbols for voltage are V or E.

Resistance is the opposition to the flow of electrons. If the resistance of a load is increased and a constant voltage applied is maintained, the current flow will decrease. Similarly, if the resistance is lowered, the current flow will become greater. The common symbols for resistance are R or Ω .

Current is the directional flow of electrons along a conductor. The common symbols for current are I or A

The point to all of this is that there are eight letters to represent four components and which one is equal to which this is the most difficult thing to remember. Let's take them one at a time.

P or W. Think of a light bulb. How powerful is it? 60 watts? 100 watts? Power is expressed in watts. When you see the letter P in a formula it can only represent one of four components. Only one starts with P and that is the word Power. Power is expressed in watts, so P represents exactly the same thing as W in an Ohm's Law equation.

V or E. It is easy enough to remember V means voltage, but how does that equal E? You have to think about what you learned from reading the basic electrical books. When a charge builds up, with positive polarity in one place and negative polarity in another, a powerful electromotive force (EMF) exists. This force is known as voltage and you might hear it referred to as "electrical pressure". Think of the word electro-motive and 'motive' or the force (pressure) that moves electrons being the key. Electro-motive force equals voltage. $E=V$.

R or Ω . This one is easy. R=resistance. Resistance is expressed in ohms and the symbol for ohms is a horseshoe shaped object, Ω . Normally O is never used to express a variable in an Ohm's Law equation. The letter or symbol representing resistance will be R or Ω .

A or I. Amperage or Inductive Force is another one that is difficult to connect. Current flow is measured in Amperage. It is easy to remember A=amps, but more difficult to equate I to the same thing. Think of inducing (to bring about) the flow of current. Inducing flow is similar to Inductive Force, both start with the letter I. Amperage and Inductive force both represent current flow. $A=I$.

Cutting to the chase, most often Ohm's Law will use the letters P, I, E, and R. But not always, so you must know the equivalents.

Manipulating the Formulas

This has nothing to do with Ohm's Law, it is purely mathematics. Service Technicians will only have to deal with two different Ohm's Law equations. But these two equations can be manipulated into six different formulas. Combine that with the different letters representing the variables and it is easy to see why the subject is confusing.

It is not within our scope to teach technicians fractions and basic algebra. However, we can show you how to manipulate the one type of equation that you will encounter. Let's use the letters a, b, and c so we don't confuse this part with Ohm's Law. The type of simple equation that you will encounter is $a=bc$. If you manipulate the equation to solve the problem for b or c you will have

$b=a/c$ and $c=a/b$. This is one equation that when solved for a, b, and c, appear to be three different equations, when it is really the same equation that has been manipulated.

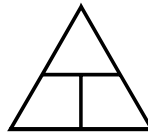
First we have to understand the nomenclature:

$a=bc$ - means a equals b times c (or a equals b multiplied by c).

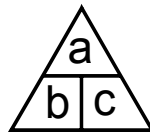
$b=a/c$ - means b equals a over c (or b equals a divided by c).

As you can see we are simply multiplying or dividing depending on where the letters are positioned. The idea here is that the position of the letters determine whether the numbers are multiplied or divided. Without learning any math, there is a very simple method for this type of equation. It is often referred to as the magic triangle.

You begin by imagining a triangle that looks like this



Then add the letters starting at the top:



Determine which letter to solve the problem for, then note the position of the other two letters to know whether to multiply or divide. To solve for letter a, look at the remaining letters, b and c. Note they are side by side, separated by a vertical line. When the letters are side by side they are multiplied together. $a = b \text{ times } c$ (or $a = bc$).

To solve for letter b, notice that the remaining letters are stacked above one another separated by a horizontal line, therefore $b = a \text{ divided by } c$ (or $b = a/c$). In the same way $c = a \text{ divided by } b$ (or $c = a/b$). You have just taken one equation and manipulated it to solve for three different variables, $a=bc$, $b=a/c$ and $c=a/b$.

Manipulating the Ohm's Law equations works in exactly the same way.

Ohm's Law Equations

It was mentioned above that Service Techs will only have to know two different Ohm's Law equations. Ohm's Law states, one ohm is the resistance value through which one volt will maintain a current of one ampere. Putting the commonly used letters into the magic triangle we will see:

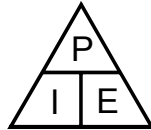


Using the definition above we can put in the values and see if this works. The definition states, one ohm is the resistance value through which one volt will maintain a current of... From this part of the definition the value of r and e known and equal to one. It is always the case if we know two values we can solve for the third, in this example amps (or I). Notice that solving for I leaves E

over R. The equation would be $I = E/R$ or $I = 1/1$ and one divided by one equals one. The definition above states one amp, so yes indeed, the formula did work.

The example is simple because all values are one. But it works the same no matter what values are used. If the problem specifies 6 ohms and 12 volts we can put in those values to get $I = 12/6$ or $I = 2$ amps. The two values we know may be 5 amps at 120 volts which gives us the equation $R = 120/5$ or the Resistance = 24 ohms.

The other Ohm's Law equation that Service Technicians work with is often called the Power Formula or Watt's Law ($P=IE$):



This formula can be manipulated in the exactly the same way. Let say you have a 1500 watt 120 volt AC water heater element and want to know how many amps it will draw. $I = P/E$. Plugging in the numbers, $I = 1500/120$ or $I = 12.5$ amps.

Never Miss an Ohm's Law Problem

You have learned how to recognize the letters and manipulate the formulas, but how do you remember them? You may have realized that the triangles only work when the letters are put into the correct order. The very first thing you should do when sitting for the Registered Technician Test, or encountering any Ohm's Law problem, is to draw the horizontal and vertical lines (you can imagine the triangle or circle, no need to draw it) on a piece of scratch paper.

Put the letters in place as you repeat this to yourself, "Ohm's Law is as easy as PIE. It is so easy, Even I can Remember it." Say it again, several times. Ohm's Law is as easy as PIE, Even I can Remember. Ohm's Law is as easy as PIE, Even I can Remember. Write down the letters P, I, E and E, I, R in position relative to the lines you have drawn.



One More Example Using Both Formulas

A refrigerator is not functioning properly in electrical mode (no cooling). A faulty 120 VAC heating element is suspected. Measuring the resistance of the heating element using a multimeter shows that it has 20 ohms of resistance. To determine if this is the correct resistance without having access to a service manual, locate the data plate on the refrigerator. The data plate indicates that the refrigerator heating element draws 325 watts on 120 VAC.

Now, the resistance of a properly working heating element must be determined to make a comparison. To do that, the resistance will have to be calculated knowing that it consumes 325 watts of power.

Ohm's law can be used to find the resistance in a circuit if the other two factors, Electromotive Force (Voltage) and Inductive Flow (Amperage) are known. In this example, the voltage and the wattage are known. But the resistance formula requires that the inductive flow (current) be expressed in amperes.

The first step will be to convert watts to amps using the power formulas from Ohm's Law. The power is 325 watts and the voltage is 120 VAC. Which is the power formula? The one that has the letter P in it, P for power. Manipulating that formula to solve for amps gives $I = P/E$. The answer is 2.7 amps, which was calculated by dividing 325 (Watts) by 120 (Volts).

Now that the amperage is known, Ohm's law is used again to determine the resistance. Manipulate the formula to solve for resistance. $R = E/I$. The answer is 44.4 ohms, which was calculated by dividing 120 (Volts) by 2.7 (Amps).

The tolerance for heating element resistance is $\pm 10\%$ of the specified resistance (You will learn this later from the RV Refrigerator textbook). Therefore, the acceptable resistance range is 40 to 49 ohms (44 ohms $\pm 10\%$). The measured resistance of the heating element is 20 ohms. Since 20 ohms falls outside of the acceptable range, the heating element should be replaced.

Ohm's law questions do not get any more difficult than this. If you can follow the logic above and remember that Ohm's Law is as easy as PIE, and Even I can Remember, you will not miss a single Ohm's Law question. Ever.

Sign-off Sheet Required Knowledge

There are five sign-off sheets associated with the Registered Technician career level which are made up of 13 separate tests. You must know how to do each test and in what order the steps are performed. The five sign-off sheets are included in Appendix I at the end of this study guide. The entire group of 14 sign-off sheets can be downloaded from the RV Learning Center's web site, www.rvlearningcenter.com.

Print the sign-off sheets and perform the tests. Practice the tests until you are sure that you have thoroughly learned each one.

- 1. Propane Time Pressure Drop Test**
- 2. Propane System Tests**
 - a. Operating Pressure
 - b. Regulator Adjustment
 - c. Regulator Lockup
 - d. Leak
- 3. AC Electrical Systems Tests**
 - a. Hot Skin
 - b. Polarity
 - c. GFCI
- 4. AC Electrical Tests**
 - a. Voltage
 - b. Amperage
- 5. DC Electrical Tests**
 - a. Voltage
 - b. Amperage
 - c. Continuity

Key Facts to Remember

There will be some questions on the test that require memorization of certain facts or figures. Listed below are some of the facts that a Registered Technician will need to know for the test.

The textbooks and instructional materials outlined in this study guide will explain each of these items in context. If you don't know what an entry means or how it is used, look it up in the reference materials and be sure you understand each one before attempting the test.

1½% – amount propane expands for every 10 degrees it is warmed

1.5 times – weight of propane as compared to air

2.15% to 9.6% – ratio of propane/air mix for combustion (limits of combustibility)

3 minutes – time for pressure drop and regulator lockup tests

4.2 lbs. – weight of one gallon of propane

5mA – amount of current to trip a GFCI

8" W.C. – system pressure during Time Pressure Drop Test

8 times their weight – the amount of force required to hold propane containers

10 psi – 1st stage regulator pressure

11" W.C. – propane system operating pressure

14" W.C. – maximum propane system pressure; regulator lock-up pressure

25 feet – distance from ignition source when handling propane

-44°F – boiling temperature of propane

50% – propane demand during System Operating Pressure Test

80% – fill capacity of propane containers

21,548 – BTUs in a pound of propane

ASME – American Society of Mechanical Engineers

DOT – Department of Transportation

GCWR – Gross Combined Weight Rating

GVWR – Gross Vehicle Weight Rating

Sample Questions

001. What percentage of propane tank capacity is reserved to prevent overpressure from expansion?

- A. 10%.
- B. 20%.
- C. 50%.
- D. 80 %.

002. What test must be performed each time a system is opened?

- E. System Leak.
- F. Propane Delivery.
- G. Time Pressure Drop.
- H. Regulator Lockup.

003. When purging a 20# propane cylinder what is the minimum distance to an ignition source?

- A. 5 feet.
- B. 15 feet.
- C. 25 feet.
- D. 35 feet.

004. A service shut-off valve should be only be closed with

- A. an adjustable wrench.
- B. a socket wrench.
- C. hands.
- D. a short lever.

005. A Type I (CGA 791) valve should

- A. never be fitted with a dust cap.
- B. never be closed with a POL plastic plug.
- C. be used when filling an ASME tank.
- D. be used on quick disconnect containers.

006. Gloves must be worn when

- A. filling a propane cylinder.
- B. performing a regulator lockup test.
- C. closing a service valve.
- D. replacing an empty cylinder.

007. An opened outage valve is used

- A. to indicate excess pressure.
- B. for container purging.
- C. to determine when container is empty.
- D. to indicate the maximum liquid level.

008. Backup wrenches are used

- A. to help break free rusted fasteners.
- B. to prevent damage to propane connections.
- C. keep bolts from turning during installation.
- D. when primary tools are in use.

009. When filling a propane container, 25 feet is the

- A. minimum distance to the nearest building.
- B. maximum distance to a fire extinguisher.
- C. minimum distance to an ignition source.
- D. required length of the fill hose.

010. When transporting a DOT propane cylinder you should

- A. install a dust cap.
- B. never place in car trunk.
- C. lay cylinder on side and block from rolling.
- D. open service valve to assure tank is empty.

011. -44° Fahrenheit is

- A. the temperature propane liquid freezes.
- B. absolute zero.
- C. maximum vapor temperature.
- D. the boiling point of propane.

012. What is the weight of five liquid gallons of propane?

- A. 21 pounds
- B. 42 pounds
- C. 442 ounces
- D. 24 pounds

013. A pound of liquid propane at 60°F

- A. weighs 14 ounces.
- B. contains 21,548 British Thermal Units.
- C. expands to 36.38 cu. ft. of vapor.
- D. is under 196 psi pressure in a closed container.

014. What is the maximum percentage of propane vapor in the atmosphere that will ignite?

- A. 2.15%.
- B. 9.6%.
- C. 11.0%.
- D. 100%.

015. The chemical that gives propane its odor is

- A. butane.
- B. ethylene.
- C. magnesium sulfate.
- D. ethel mercaptan.

016. Temperature of a propane container affects the

- A. flow of vapor from the container.
- B. number of BTU's available.
- C. range of combustibility.
- D. boiling point.

017. 14 inches water column is the

- A. minimum propane system pressure.
- B. maximum depth of liquid within container.
- C. first-stage regulator pressure.
- D. maximum lock-up regulator pressure.

018. What reduces propane container pressure to 10 PSI?

- A. First stage of a regulator.
- B. Second stage of a regulator.
- C. Maximum flow valve.
- D. Pressure relief valve.

019. For each 10 degrees propane liquid is warmed, its volume

- A. decreases 10%.
- B. decreases 1.5%.
- C. increases 1.5%.
- D. increases 10%.

020. Approximate number of BTUs in a 20# propane cylinder?

- A. 150,000.
- B. 275,000.
- C. 345,000.
- D. 960,000.

021. Propane gas is

- A. twice as light as air.
- B. .5 times heavier than air.
- C. equal in weight to air.
- D. 1.5 times heavier than air.

022. When the pressure in a container is near zero as a result of cooling from use, it

- A. has outrun the rate of vaporization.
- B. is undersized for the application.
- C. has reached pressure inversion.
- D. is in thermal imbalance.

023. Propane gas released into the atmosphere is _____ .

- A. unacceptable
- B. greenish in color
- C. condensed into a liquid
- D. Invisible

024. Pressure inside of a propane container varies with

- A. temperature.
- B. size of container.
- C. liquid level in container.
- D. pressure relief valve setting.

025. The Department of Transportation (DOT)

- A. certifies propane tanks.
- B. regulates propane cylinders.
- C. controls interstate transport of containers.
- D. oversees propane retailers.

026. The American Society of Mechanical Engineers (ASME)

- A. oversees the recertification of cylinders.

- B. controls manufacturing of containers.
- C. regulates propane tanks.
- D. certifies propane cylinders.

027. Before filling a propane cylinder you must check the

- A. capacity in gallons.
- B. date of manufacture.
- C. tare weight.
- D. paint condition.

028. The data plate on an ASME tank does not specify

- A. gallons of water capacity.
- B. tare weight.
- C. maximum allowable working pressure.
- D. overall diameter.

029. Propane containers must be mounted to the RV so they will not become dislodged when force equal to ____ times the filled container weight is applied in any direction.

- A. 2
- B. 4
- C. 6
- D. 8

030. Another name for a J-tube

- A. vapor withdraw tube.
- B. dip tube.
- C. suction tube.
- D. filler tube.

031. What information is not found on the protective collar of a DOT cylinder?

- A. Initials of the inspector.
- B. Name of manufacturer.
- C. Dip tube length in inches.
- D. Propane capacity in pounds.

032. What component is not connected directly to the service valve on a DOT cylinder?

- A. Dip tube.
- B. Outage port.
- C. Relief valve.
- D. Excess flow check valve.

033. Component that prevents the accumulation of excess moisture on the regulator diaphragm is called the

- A. outage port.
- B. relief mechanism.
- C. vent.
- D. bonnet.

034. What gauge number indicates the largest diameter copper wire?

- A. 0
- B. 00
- C. 14
- D. 12

035. How many amps will a 12-volt circuit draw with 5 ohms resistance?

- A. .6
- B. 2.4
- C. 24
- D. 60

036. What is the resistance in a 12VDC, 6A circuit?

- A. 0.5 ohms.
- B. 2 ohms.
- C. 7.2 ohms.
- D. 72 ohms.

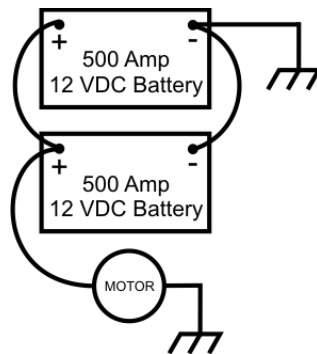
037. How many amps will a 120v, 100w light bulb will draw?

- A. .83
- B. 1.2
- C. 8.3
- D. 12.0

038. What is the resistance of a 120 volt, 1200 watt electric heater?

- A. 1.2 amps.
- B. 12 ohms.
- C. 10 amps.
- D. 100 ohms.

039. What type of circuit is pictured below?



- A. Short.
- B. Series.
- C. Parallel.
- D. Series parallel.

040. A short circuit is a complete circuit that has

- A. a conductor that is less than 6' in total length.
- B. less than five amps.
- C. a grounded wire.

D. no resistance.

041. A circuit must be de-energized to measure

- A. resistance.
- B. voltage.
- C. amperage.
- D. wattage.

042. A fusible link is designed to protect a DC circuit from

- A. incorrect directional current flow.
- B. too much voltage.
- C. too much amperage.
- D. All of the above.

043. A complete circuit consists of

- A. source, conductor, and load.
- B. battery, switch, and light.
- C. conductor, switch, and power using device.
- D. power supply, wire and conductor.

044. An RV 120V supply panel must have

- A. GFCI breakers.
- B. the neutral bus grounded to the panelboard.
- C. main and secondary breakers.
- D. an isolated neutral.

045. Resistance x _____ = Voltage

- A. Current
- B. Ohms
- C. Impedance
- D. Wattage

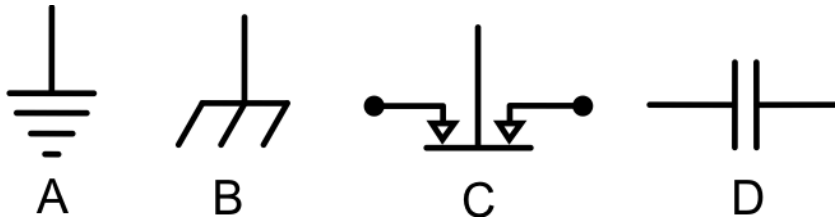
046. In a simple circuit consisting of a battery, load, and conductor, if the voltage decreases slightly, the amperage

- A. decreases slightly.
- B. increases slightly.
- C. does not change.
- D. fluctuates.

047. ATC, mini and maxi refer to what type of fuse?

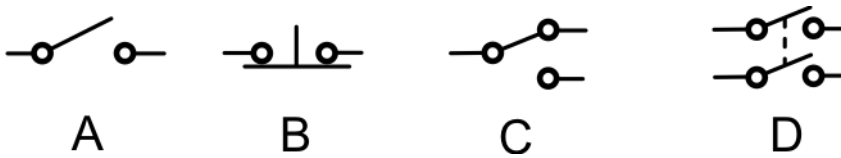
- A. Cylinder.
- B. Slow-blow.
- C. Blade.
- D. Auto-reset.

048. Which symbol represents a chassis ground?



- A. A
- B. B
- C. C
- D. D

049. Which symbol represents a DPST?



- A. A
- B. B
- C. C
- D. D

050. When components having resistance are connected in parallel, the composite resistance can be calculated by

- A. adding the resistance of all components.
- B. averaging the resistance of all components.
- C. multiplying the resistance of all components.
- D. using a complex formula.

051. In a battery bank where the positive terminals are connected to the negative terminals, the batteries are in

- A. series.
- B. series/parallel.
- C. parallel.
- D. parallel/series.

052. When multiple batteries are connected in parallel the available current equals the

- A. lowest amp hour rating.
- B. sum of all amp hour ratings.
- C. average of all amp hour ratings.
- D. highest amp hour rating.

053. What is the voltage of two 6-volt batteries connected in series?

- A. 0
- B. 6
- C. 9
- D. 12

054. The symbol below when found on a wiring diagram represents



- A. a resistor.
- B. a diode.
- C. a relay.
- D. an alternator.

055. The symbol below when found on a wiring diagram represents



- A. connected wires.
- B. SPST switch.
- C. a diode.
- D. a transistor.

056. To measure current drawn by a motor using a clamp-on ammeter, place the sensor clamp around the

- A. ground wire.
- B. black wire.
- C. white and black wire.
- D. black, white and green wires.

057. An open switch will _____ electricity.

- A. increase
- B. conduct
- C. not conduct
- D. decrease

058. This symbol identifies a _____ on a wiring diagram.

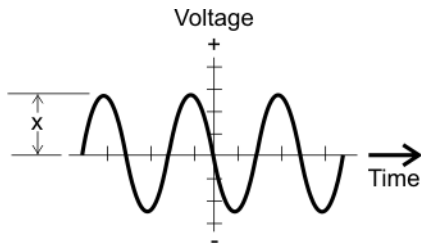


- A. open switch
- B. closed switch
- C. momentary contact
- D. wire connection

059. A continuity test is performed with an

- A. ammeter.
- B. Ohmmeter.
- C. wire lead.
- D. circuit tester.

060. How many AC cycles are represented by the drawing below?



- A. 1
- B. 3
- C. 6
- D. 12

061. What type of breaker is used in the air conditioner circuit?

- A. Slow-blow.
- B. GFCI.
- C. HACR.
- D. Auto reset.

062. What type of over-current protection is not used in the 120V circuits?

- A. Slow-blow fuse.
- B. GFCI.
- C. HACR.
- D. Circuit breaker.

063. What is an obvious difference in 120V AC vs 12V DC RV wiring?

- A. Color of insulation.
- B. Size of wire.
- C. Stranded wire versus solid.
- D. Ampacity.

064. A polarity tester is used to

- A. determine correct battery hookup.
- B. test the 12 volt DC system.
- C. determine magnet poles.
- D. test the 120 volt AC system.

065. What is the proper multimeter dial setting when testing AC voltage?

- A. Ω
- B. DCV
- C. ACV
- D. Hz

066. To test DC voltage, connect the test lead colored black to

- A. a ground.
- B. the white wire.
- C. to the + battery terminal.
- D. a fused test wire.

067. The volt meter indicates 12 volts and the ammeter indicates 500mA. What is the resistance?

- A. .024 ohms.

- B. .24 ohms.
- C. 2.4 ohms.
- D. 24 ohms.

068. Current flow is measure in

- A. ohms.
- B. volts.
- C. amperes.
- D. RMS.

069. What is 5 mA?

- A. 500 amps.
- B. The amount of current required to recharge a 12 volt battery.
- C. Leakage level needed to trip a GFCI.
- D. Amount of amperage that may cause death.

070. A component designed to protect RV users from electrical shock in a wet location is called a

- A. ground fault circuit interrupter.
- B. double insulated circuit breaker.
- C. non-contact switch.
- D. fused power strip.

071. How is voltage determined?

- A. Ohms divided by watts.
- B. Amps times ohms.
- C. Watts times amps.
- D. Watts divided by amps.

072. The mathematical equation $E=I/R$ is named after

- A. German physicist Georg Ohm.
- B. English chemist and physicist Michael Faraday.
- C. German physicist Gustav Robert Kirchhoff.
- D. Scottish engineer James Watt.

073. The narrow blade of a three prong 120v plug is connected to

- A. live (hot) conductor.
- B. neutral wire.
- C. ground connection.
- D. insulating wire.

074. How do you determine how often a fire extinguisher needs to be checked?

- A. Look at the inspection tag located on the extinguisher.
- B. Consult RVIA textbook.
- C. Review local codes.
- D. Read the manufacturer's instructions.

075. Testing procedures for propane alarms can be found

- A. inside the alarm housing.
- B. in the RV owner's manual.
- C. in the manufactures instructions.

D. in the RVIA textbook.

076. The working life of a propane alarm is

- A. 1 year.
- B. 5 years.
- C. 10 years.
- D. specified by the manufacturer.

077. A CO alarm is tested

- A. monthly.
- B. annually.
- C. after every activation.
- D. per manufactures instructions.

078. After sealing a unit's exterior, emergency exit windows should

- A. be thoroughly cleaned.
- B. tested for proper operation.
- C. locked.
- D. checked for proper labeling.

079. Frequently check smoke alarms for

- A. cleanliness.
- B. insect nesting.
- C. fresh batteries.
- D. sufficient sound volume.

080. What doe GVWR mean?

- A. General Vehicle Weather Rating.
- B. Gross Vehicle Weight Reserve.
- C. Government Vehicle Written Report.
- D. Gross Vehicle Weight Rating.

081. The maximum permissible weight of the tow and towed vehicles is the

- A. GCWR.
- B. GVWR.
- C. MPWR.
- D. GAWR.

082. The Cargo Carrying Capacity (CCC) label has been replaced by the

- A. Federal Safety Label (data plate)
- B. RVIA Certification Label
- C. Occupant and Cargo Carrying Capacity (OCCC) Label
- D. Gross Combination Weight Rating (GCRW) Label

083. To assure RV tires are properly inflated

- A. use a dial pressure gauge.
- B. weigh each wheel position.
- C. inflate tires immediately after use.
- D. inflate to maximum pressure as indicated on the sidewall.

084. Tire age can be determined by

- A. reading the 'DOT' code on the tire sidewall.
- B. consulting owners manual.
- C. measuring the amount of remaining tread.
- D. the manufacturer's serial number.

085. Voids, gaps and cracks are defects that may be found when

- A. inspecting exterior moldings, seals and roofs.
- B. sealing water heater access panels.
- C. tires reach replacement age.
- D. inspecting filter elements.

086. At what interval are ASME tanks required to be recertified?

- A. Every five years.
- B. Every ten years.
- C. There is no requirement to recertify.
- D. Whenever the service valve or other appurtenance is replaced.

087. RVIA sanctions what propane tests?

- A. Combustibility.
- B. Container pressure.
- C. Regulator lockup.
- D. Vaporization rate.

088. Correct installation of a propane regulator requires

- A. setting the diaphragm position.
- B. positioning vent downward within 45° of the vertical plane.
- C. using lubricant on the threads.
- D. testing the OPD for proper operation.

089. What percentage of propane flow is required when performing a propane Regulator Lock-up Test?

- A. 0%
- B. 25%
- C. 50%
- D. 75%

090. Foreign material in a propane regulator may cause

- A. increasing system pressure after lock-up.
- B. liquid propane to be introduced into the piping system.
- C. oily residue at or near the vent.
- D. leaking past the diaphragm.

091. Which type of propane connection requires sealant?

- A. Flared.
- B. Pipe threaded.
- C. ACME threaded.
- D. POL fitting.

092. A propane timed pressure-drop test may be invalid if
- A. run for longer than 3 minutes.
 - B. initial system pressure is reduced to 8" water column.
 - C. a U-tube monometer is used.
 - D. piping temperature increases during test.
093. Corrosion may be created in the propane piping system by
- A. leak detector solutions containing ammonia.
 - B. the incorrect sealant.
 - C. condensation forming on the regulator diaphragm.
 - D. .
094. Three minutes is the
- A. recommend amount of time to complete a hot skin test.
 - B. minimum duration for a propane Time Pressure Drop Test.
 - C. required rest period between sequential CO alarm tests.
 - D. time that a five-pound Class ABC fire extinguisher must operate continuously.
095. 11 inches water column is the
- A. vapor pressure in a propane bottle at 00 F.
 - B. maximum pressure indicated by a dial-type manometer.
 - C. correct pressure coming from the second stage of a propane regulator.
 - D. propane regulator lock-up pressure.
096. What must be disconnected when performing a Time Pressure Drop Test using a Propane System Test Kit?
- A. Range burner.
 - B. Low pressure line.
 - C. Appliance regulator.
 - D. Automatic changeover.
097. While performing a regulator lock-up test, the propane pressure exceeds 14 inches water column. You must
- A. adjust the lock-up pressure by turning the screw counter-clockwise.
 - B. adjust the lock-up pressure by turning the screw clockwise.
 - C. replace the regulator.
 - D. open the bypass valve on the propane test apparatus.
098. A propane lock-up test requires _____ vapor flow?
- A. 0%
 - B. 25%
 - C. 50%
 - D. 75%
099. On a correctly adjusted propane system, a Operating Pressure Test will show _____ inches water column.
- A. 8
 - B. 10

- C. 11
- D. 14

100. What percentage of the normal BTU demand is required to perform a Propane Operating Pressure Test?

- A. 0%
- B. 25%
- C. 50%
- D. 75%

101. When burn testing an appliance, a properly adjusted flame

- A. is blue with soft inner cone.
- B. is blue with yellow-orange core.
- C. will make roaring sound as it burns.
- D. has bright yellow tips.

102. A hot skin test is performed to

- A. find electrical faults that cause circuit breakers to trip.
- B. prevent annoying shocks from static electricity.
- C. verify the proper amount insulation has been installed.
- D. assure the RV user's safety.

103. When faced with an dissatisfied customer your best option is

- A. to establish yourself as the expert.
- B. tell the customer whatever he wants to hear.
- C. listen to the customer.
- D. refer the customer to your supervisor or manager.

104. Customers should always be

- A. respected.
- B. agreed with.
- C. treated with watchful caution.
- D. made to feel they are always right.

105. When listening to a customer's problem you should

- A. treat them as a friend.
- B. put yourself in their place (empathize).
- C. offer the cheapest solution.
- D. explain why you (or your dealership) did not cause the trouble.

106. Protective coverings should always be

- A. removed before returning the vehicle.
- B. used on the most expensive units.
- C. placed if your cloths or shoes are dirty.
- D. used when performing any service.

107. Test results should always be

- A. recorded on the repair order.
- B. handed directly to the customer.

- C. kept confidential.
- D. used to justify the cost of repairs.

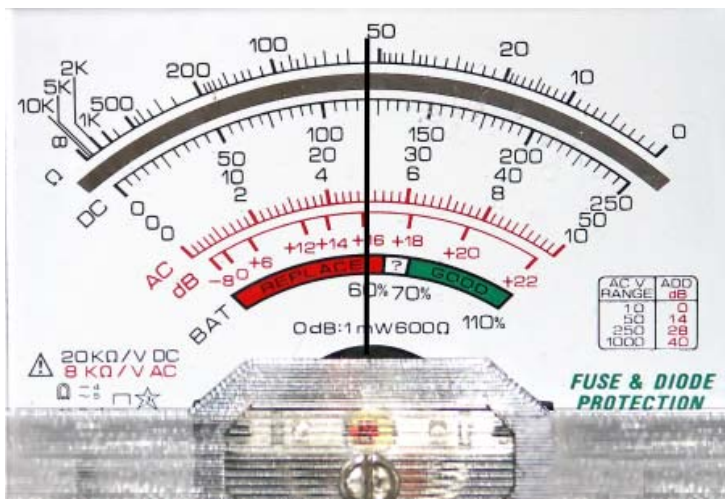
108. The warranty registration form can be used

- A. as a checklist when delivering a new unit.
- B. to educate the owner.
- C. to record serial numbers.
- D. for all of the above.

109. The batteries used in most RV applications are?

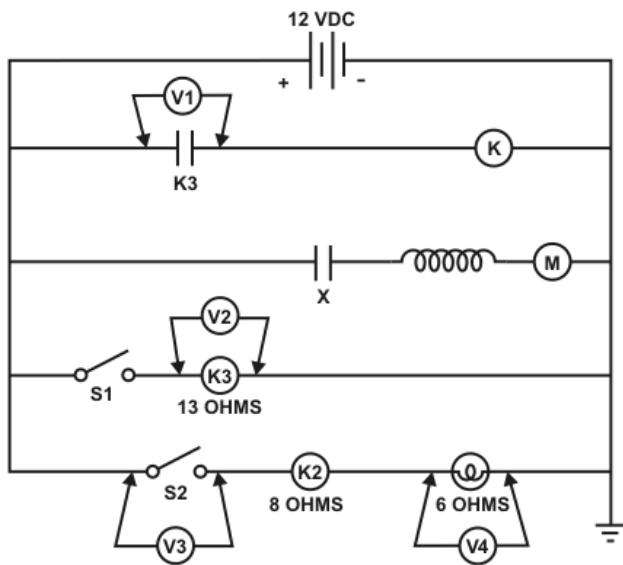
- A. Lead/carbon.
- B. Steel/carbon.
- C. Lead/acid.
- D. Lithium/acid.

110. Using the 50V DC scale, the correct meter reading is ____ V DC.



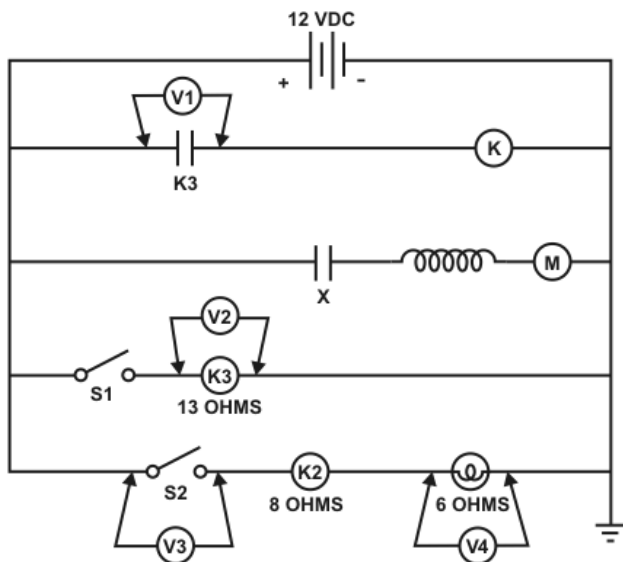
- A. 120
- B. 24
- C. 55
- D. 6

111. The voltage measure at V2 is _____ V DC.



- A. 0
- B. 6
- C. 9
- D. 12

112. With switch S1 closed, voltage measured at V2 would be ____



- A. 0
- B. 6
- C. 9
- D. 12

113. To properly measure current with a VOM in a DC circuit, you must connect the VOM _____.

- A. in parallel with the source
- B. across the component
- C. in series with the source
- D. on the positive side

114. To protect the meter when doing an ohms test, insure that the _____.

- A. meter is properly zeroed
- B. meter is set on the proper scale
- C. the circuit is de-energized
- D. meter has the correct polarity

115. Two 12V batteries connected in series provide _____ V DC.

- A. 6
- B. 12
- C. 24
- D. 48

116. A gassing battery gives off _____.

- A. sulfur oxide.
- B. oxygen.
- C. nitrogen.
- D. hydrogen.

117. A fully charged battery at rest will show an approximate voltage of ____ DC volts.

- A. 14.5
- B. 14.1
- C. 12.8
- D. 12.0

118. Paralleling batteries increases _____.

- A. voltage.
- B. resistance.
- C. capacity.
- D. inductance.

119. A technician makes the following observation: the circuit blows the fuse. What is the problem?

- A. Circuit has an open.
- B. Circuit has a short.
- C. Relay is open.
- D. Switch is open.

120. As the gauge of copper wire increases, its diameter _____.

- A. decreases in size
- B. changes composition
- C. increases in size
- D. varies in length

121. A complete circuit must have _____.

- A. current and source
- B. source and conductor
- C. source, load, and conductor
- D. load and source

122. To determine correct wire size, you must calculate the ____ load.

- A. switch
- B. hardness
- C. amperage
- D. voltage

123. If you remove copper (material or strands) when stripping a wire, you should

- A. continue your work.
- B. cut it off and start over again.
- C. use a crimp connector.
- D. use a butt connector.

124. When replacing fuses on any appliance, you should always use one with

- A. a higher amp and volt rating.
- B. a lower amp rating.
- C. the same amp and volt rating.
- D. the same amp and higher volt rating.

125. Before removing and installing a replacement power converter you would

- A. turn the branch AC circuit breaker on.
- B. always disconnect battery and AC power supply.
- C. always disconnect battery isolator.
- D. always short across battery terminal (+) to ground to discharge convertor filters.

126. 12 volt DC blower motors are ____ protected.

- A. split
- B. thermally
- C. moisture
- D. AC

127. The battery disconnect system in a vehicle is primarily used to

- A. change the batteries.
- B. prevent premature battery discharge.
- C. balance the voltage between batteries.
- D. be a constant source of AC voltage.

128. According to Ohm's law, to find amperage you must

- A. multiply volts by resistance.
- B. divide amperage by resistance.
- C. multiply volts by amperage.
- D. divide volts by resistance.

129. A diode should have continuity in

- A. one direction
- B. two directions

- C. three directions
- D. four directions

130. If a customer complains of receiving shocks from his/her vehicle when plugged in, the first test should be a

- A. polarity check of the shore cord.
- B. polarity check of the battery system.
- C. voltage check.
- D. converter voltage check.

131. When working on a 120V AC electrical circuit, power should be applied only as necessary to

- A. measure current and voltage.
- B. measure resistance of components.
- C. change or replace components parts.
- D. charge the capacitors in a circuit.

132. When reading voltage with a voltmeter, you should always start with the

- A. lowest voltage scale.
- B. lowest ohmmeter scale.
- C. highest voltage scale.
- D. highest ohmmeter scale.

133. Wet location covers are required on all AC receptacles located

- A. outside
- B. in the bathroom
- C. in the kitchen
- D. bedroom

134. The neutral wire connected to the 120V AC shoreline power should be ungrounded

- A. in all 120V AC RV wiring.
- B. only in RV's employing 3 or more branch circuits.
- C. only when 30 amp service is used.
- D. only in "Class A" motor homes.

135. Current supplied by commercial power lines and RV generators is known as

- A. Alternating Current.
- B. Direct Current.
- C. Inducted Current.
- D. Accelerating Current.

136. A material that has a very high resistance and is used for supporting or separating conductors is called

- A. an insulator.
- B. a semi-conductor.
- C. a resistor.
- D. an inductor.

137. A conductor is used to

- A. transfer electricity from one point to another.

- B. resists electrical current.
- C. allow current to leak to ground.
- D. induces electricity to other wires.

138. Black (Hot), White (Neutral) and Ground provide ____ volts.

- A. 12
- B. 120
- C. 240
- D. 480

139. An inverter is used to change _____.

- A. 120V AC to 12V DC
- B. 12V DC to 24V DC
- C. 12V DC to 120V AC
- D. 120V AC to 24V DC

140. The minimum amp breaker that could be used in-line to adequately protect a 120V water heater with a 1400 watt element is ____ amp.

- A. 10
- B. 15
- C. 20
- D. 30

141. When stripping a wire, you should strip only

- A. an area to fit in the connector.
- B. 1/8" larger than the connector.
- C. 1/4" larger than the connector.
- D. 3/8" larger than the connector.

142. When making a 120V AC connection to a screw, the wire should be circled around the screw post connection in a ____ direction.

- A. counter clockwise
- B. left hand
- C. clockwise
- D. opposite

143. As you lower the wattage of a 120V AC heating element, its amperage draw will

- A. increase.
- B. remain the same.
- C. decrease.
- D. decrease 1 amp for every 10 watts.

144. The current flowing through a 120V AC heating element at 1200 watts is


- A. .5 amps
- B. amps
- C. 5.0 amps
- D. 10.0 amps

145. What symbol indicates connected wires

A. 


B. 


C. 


D. 

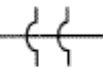
- A. A
- B. B
- C. C
- D. D

146. What symbol indicates a ground connection?

A. 

B. 

C. 

D. 

- A. A
- B. B
- C. C
- D. D

147. A capacitor is a device that

- A. temporarily stores electrical energy.
- B. is used to check electrical pressure.
- C. indicates direction of a magnetic field.
- D. measures electrostatic force between charged particles.

148. Frequency is also known as

- A. columns.
- B. amplitude.
- C. hertz.
- D. capacitance.

149. To properly test that GFCI protection exists for any receptacle down line of a GFCI protection device, you should

- A. turn off the main breaker.
- B. unplug the refrigerator.
- C. use a GFCI fault creation tester.
- D. push the test button on the breaker.

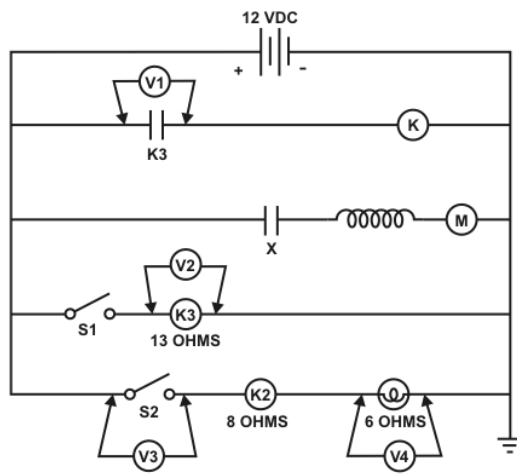
150. What is carbon monoxide?

- A. an inert welding gas.
- B. a gas found in propane.
- C. a toxic gas that has no odor, taste or color.
- D. an additive in ink, paint and rubber.

151. What type of battery is used in an RV's 12v system?

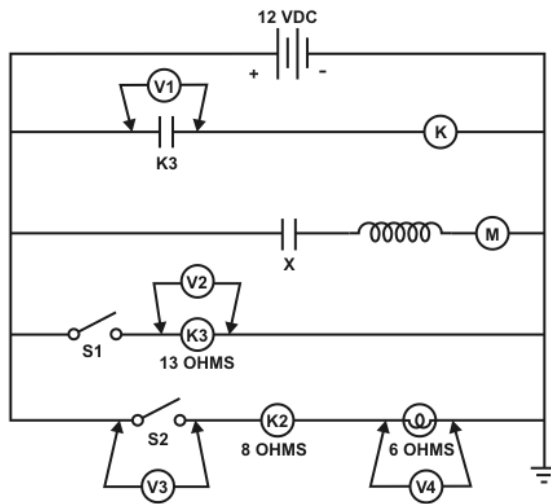
- A. Alkaline.
- B. Lead Acid.
- C. Nickel Cadmium.
- D. Dry Cell.

152. The voltage at V-1 is _____ VDC.



- A. 0
- B. 6
- C. 9
- D. 12

153. With Switch S1- Open, Voltage measured at V- 2 would be _____ VDC.



- A. 0
- B. 6
- C. 9
- D. 12

154. According to Ohm's law, to find amperage you must

- A. multiply volts by resistance.
- B. divide amps by resistance
- C. multiply volts by amps.
- D. divide volts by resistance.

155. Upon removing the control panel you find a white/red wire not connected. To find the proper wire location you?

- A. Look for an unused connection.
- B. Check panel wiring diagram.
- C. Check printed circuit schematic.
- D. Leave it unconnected.

156. To safely remove a battery from a vehicle, the negative lead should be removed

- A. last.
- B. first.
- C. first, only if convenient.
- D. doesn't make a difference.

157. 1000 feet of 14 gauge wire whose temperature is 70 degrees F has a resistance that is _____ 1000 feet of 10 gauge wire at the same temperature.

- A. equal to
- B. larger than
- C. less than
- D. no difference

158. If the needle of a voltmeter gives a reverse reading, you should

- A. change to a higher voltage scale.

- B. change to a lower voltage scale.
- C. reverse the test leads.
- D. voltmeter is defective.

159. If the needle of an analog voltmeter deflects to the right and off the scale, you should

- A. change to a higher voltage scale.
- B. change to a lower voltage scale.
- C. reverse the test leads.
- D. use a test light.

160. When using a DC ammeter to measure current, the meter must be connected in

- A. in series with the circuit.
- B. across the component.
- C. across the circuit.
- D. in parallel with the circuit.

161. When actually measuring the current in a circuit

- A. the power must be turned off for safety reasons.
- B. the power must be turned on.
- C. the power must be filtered with a shunt.
- D. the two leads must be parallel with the load.

162. When using an ohmmeter to measure the resistance of a component in a circuit, one lead of the component should be

- A. disconnected.
- B. grounded to a common ground.
- C. shored to another component lead.
- D. one lead of the meter must be grounded to a common ground.

163. What current is drawn from a 120V source by a 3 KW heating element?

- A. 36.67mA.
- B. 267.30mA.
- C. 3.67A.
- D. 25A.

164. What is the current through a 4.7k ohm, at 13.5 volts?

- A. 3mA.
- B. 2.9mA.
- C. 2.0mA.
- D. 2.4mA.

165. Chemically created electricity is commonly produced from

- A. 110 volt outlets.
- B. generators.
- C. batteries.
- D. gasoline.

166. When measuring the amperage of a circuit, the meter must be connected

- A. in parallel.

- B. with power off.
- C. in series.
- D. in parallel with the power on.

167. The opposition to the flow of electricity is called

- A. inductance.
- B. amperage.
- C. reluctance.
- D. resistance.

168. Ohms Law states that as the resistance in a circuit increases with a fixed voltage source, the current

- A. increases.
- B. decreases.
- C. stays the same.
- D. stops in all cases.

169. Resistance is measured in

- A. ohms.
- B. volts.
- C. amps.
- D. farads.

170. When using Ohm's law, which of the following numbers would have to be converted?

- A. 30mA.
- B. 30 Amps.
- C. 30 Ohms.
- D. 35,000 Ohms.

171. A device, in a circuit, which utilizes power from the source is called a

- A. conductor.
- B. battery.
- C. generator.
- D. load.

172. A control device which opens and closes in a circuit is called a

- A. battery.
- B. switch.
- C. resistor.
- D. load.

173. As resistance increases in a given circuit, the amperage

- A. increases.
- B. decreases.
- C. reverses.
- D. remains constant.

174. The power which is consumed by an AC electric toaster is called

- A. wattage.

- B. ohms.
- C. load.
- D. inductance.

175. The function of an auto transfer switch

- A. connects all power sources together.
- B. only used with battery chargers.
- C. allows only one power source to the vehicle's circuit at a time.
- D. move vehicle electrical control from front dash area to entertainment center.

176. Proper connection of the white wire and the bare copper wire in a 120 VAC distribution panel board is

- A. isolated from each other.
- B. wired together.
- C. must be connected to ground rod.
- D. never used.

177. What is the current through a 4.7 ohm, at 13.5 volts?

- A. 3 amps.
- B. 2.9 amps.
- C. 2.0 amps.
- D. 2.4 amps.

178. At what voltage must a 30W soldering iron operate if it uses .35A?

- A. 245 ohms.
- B. 100 volts.
- C. 10.5 volts.
- D. 85.7 volts.

179. Which of the below meters would NOT be contained in a multimeter?

- A. Voltmeter.
- B. Ohmmeter.
- C. Watt meter.
- D. Milliamp meter.

180. When using a multimeter to measure voltage, one should not

- A. observe polarity of meter probes.
- B. start on the highest voltage scale.
- C. insure meter function switch is set properly.
- D. set on the highest ohm scale.

181. A safety precaution to observe when using an ohmmeter is

- A. isolate the circuit under test from the meter.
- B. de-energize the circuit under test.
- C. observe polarity of test probes.
- D. zero the meter.

182. A water pump runs continuously with the control relay de-energized. Which of the following is the most likely cause?

- A. An open wire to the pump.
- B. A shorted pump.
- C. The switch remains open.
- D. The switch remains closed.

183. Voltage is

- A. electrical pressure that moves electrons.
- B. electrical flow.
- C. opposition to electrical flow.
- D. work being done.

184. Resistance is

- A. electrical pressure that moves electrons.
- B. electrical flow.
- C. opposition to electrical flow.
- D. electrical flow capacitance.

185. Current is

- A. electrical pressure that moves electrons.
- B. electron flow.
- C. opposition to electrical flow.
- D. electrical pressure that measures neutrons.

186. The amperage draw in a 12V series circuit having two 8 ohm resistors would be

- A. 750mV.
- B. 750mA.
- C. 750kV.
- D. 750 amps.

187. When testing a good diode with an ohmmeter and then measuring this part again with the leads reversed, you should have

- A. two low readings.
- B. two high (infinite) readings.
- C. one high (infinite) and one low reading.
- D. this is an incorrect test.

188. The amperage draw in a 12V series circuit with four 3 Ohm resistors would be

- A. 100mA.
- B. 1mA.
- C. 1A.
- D. 0.1A.

189. 50 amp service provides

- A. one 120 volt line at 50 amps.
- B. one 240 volt line at 50 amps.
- C. two lines of 120 volts at 50 amps each.
- D. two lines of 240 volts at 50 amps each.

190. A clearance lamp circuit has a 15 amp fuse installed, What is the maximum draw that should be applied to that circuit?

- A. 15 amps.
- B. 12 amps.
- C. 18 amps.
- D. 10 amps.

191. The type of power produced by the oldest type of RV converter is

- A. 12 volts AC.
- B. 12 volts pure DC.
- C. 12 volts unfiltered DC.
- D. 12 volts square wave.

192. Connecting batteries in parallel

- A. increases voltage.
- B. increases current.
- C. increases amp-hour capacity.
- D. causes immediate failure.

193. Connecting batteries in series

- A. increases voltage.
- B. increases current.
- C. increases amp-hour capacity.
- D. causes immediate failure.

194. The specific gravity of a fully charged lead acid battery is ____ .

- A. 1.285
- B. 1.265
- C. 1.225
- D. 1.155

195. Which type of battery is most often used for the chassis battery?

- A. Lead Acid Gelled.
- B. Deep-Cycle.
- C. Nickel Cadmium.
- D. Automotive.

196. When you connect four 6V, 200-amp DC batteries in series you will get

- A. 6 VDC, 200 amps.
- B. 24 VDC, 200 amps.
- C. 6 VDC, 800 amps.
- D. 24 VDC, 800 amps.

197. When you connect four 6V, 200-amp DC batteries in parallel you will get

- A. 6 VDC, 200 amps.
- B. 24 VDC, 200 amps.
- C. 6 VDC, 800 amps.
- D. 24 VDC, 800 amps.

198. A 10-3 non-metallic sheathed cable consists of

- A. two hots (black and red), one neutral (white), and one ground (bare or green).
- B. two hots (black and blue), one neutral (white), and one ground (green).

- C. two hots (black and white), one neutral (white), and one ground (green).
- D. two hots (black and red), one neutral (white), and one ground (brown).

199. The amount of amperage that can be carried by a 10 gauge wire versus a 16 gauge wire is

- A. lower.
- B. higher.
- C. equal.
- D. not measurable.

200. What minimum gauge wire should be used for a 30 amp circuit?

- A. 8
- B. 10
- C. 12
- D. 14

201. Which is not a type of electrical drawing a technician must be familiar with

- A. pictorial drawings.
- B. ladder diagrams.
- C. schematics.
- D. process flow diagram.

202. When splicing a 120 VAC wire you must

- A. use listed electrical tape.
- B. use a junction box.
- C. both A and B.
- D. you don't splice 120 VAC wire.

203. A hydrometer is used for

- A. test volts & ohms.
- B. measuring specific gravity in electrolytes.
- C. test printed circuit boards.
- D. test diode type battery electrolytes.

204. The function of a multimeter is to

- A. test volts & ohms.
- B. apply variable loads to battery.
- C. test diode type battery isolators.
- D. measure specific gravity in electrolytes.

205. If a GFCI receptacle is properly wired, what condition exists?

- A. Polarity tests are not necessary.
- B. Involved circuit must have circuit breaker protection.
- C. All receptacles downstream will be GFCI protected.
- D. Vehicle grounding for interior lights is not required.

206. What does the electrical term "watts" mean?

- A. Load current.
- B. Voltage drop.
- C. Battery ampacity.
- D. Measurement of electrical power.

207. What procedure must be used when passing all conductors through bulkheads and/or partitions?

- A. Employ clamp & grommets to prevent chaffing.
- B. Wire tie all parallel wires.
- C. Add heat retardant material.
- D. Separate dissimilar wires colors.

208. What should be performed when a bonding strap or bonding screw is present in a distribution panel board intended for use in an RV?

- A. Attach strap or screw to panel.
- B. Discard strap or screw.
- C. Add electrical clamp harness.
- D. Attach strap or screw to ground.

209. When installing a new 120 VAC receptacle when is a GFCI not required?

- A. In a bathroom.
- B. 6 feet from wet location.
- C. On the exterior of RV.
- D. 2 feet from a battery location.

210. What occurs when two adjacent conductors make electrical contact and bypass a portion of a circuit?

- A. A ground.
- B. An open.
- C. A short.
- D. The circuit resistance increases.

211. If the needle of a voltmeter deflects off scale to the left, you should

- A. change to a higher voltage scale.
- B. change to a lower voltage scale.
- C. reverse the test leads.
- D. replace the defective voltmeter.

212. When using a VOM to measure current, always start

- A. at the lowest scale.
- B. with the highest volt scale.
- C. at the highest scale.
- D. with the lowest ohm scale.

213. Basic troubleshooting of the 120 VAC system does not require the use of a

- A. polarity checker.
- B. galvanometer.
- C. multimeter.
- D. GFI tester.

214. Bonding clamps are designed and installed to

- A. safely conduct current likely to be imposed between two metal parts.
- B. act as a fuseable link when installing electrical components.

- C. create a common connection on the load wire of two or more components.
- D. alternate route for load distribution.

215. The diode tester is designed to test diodes found in

- A. fan and limit switches.
- B. relay coils.
- C. battery isolators and converter systems.
- D. audio sound systems.

216. When connecting or disconnecting a propane line at an appliance, you should use

- A. channel locks.
- B. adjustable wrenches.
- C. pliers.
- D. two open-end wrenches.

217. Which of the following two resources are the source of propane gas in the refining process?

- A. Natural gas and kerosene.
- B. Natural gas and crude oil.
- C. Crude oil and kerosene.
- D. Crude oil and oxygen.

218. What is the boiling temperature of propane at sea level?

- A. 15° F (9°C).
- B. -12° F (-24°C).
- C. -22° F (-30°C).
- D. -44° F (-42°C).

219. When the temperature increases, propane will

- A. freeze.
- B. expand.
- C. contract.
- D. not respond.

220. Whenever you transport or store disconnected propane containers you should always

- A. use a plug or cap in the service opening.
- B. remove propane from the container.
- C. lay the containers down for increased stability.
- D. transport the containers in groups of at least five.

221. List the typical safety equipment and clothing that a technician should use and wear while purging a propane container.

- A. Protective eye wear.
- B. Heavy gloves.
- C. Protective footwear.
- D. All of the above.

222. The minimum clearance from any source of ignition when purging is _____ feet:

- A. 10
- B. 15

- C. 20
- D. 25

223. A DOT cylinder utilizes a single valve designed for 3 functions—filling, shut-off, and

- A. regulation.
- B. purging.
- C. relief.
- D. by-pass.

224. A DOT cylinder vent stem (dip tube)

- A. is usually the same length on different size cylinders.
- B. has its length stamped on the valve guard.
- C. is easily removed by unscrewing the liquid level outage valve.
- D. needs to be replaced before recertifying the cylinder.

225. In closing a propane container service valve you should use only

- A. socket wrenches.
- B. two open-end wrenches.
- C. hands.
- D. two adjustable wrenches.

226. Which of the following is NOT a propane container "appurtenance"?

- A. Fill valve.
- B. High pressure pigtail.
- C. Liquid level gauge.
- D. Service valve.

227. Which of the following valves is the primary valve on a DOT cylinder?

- A. Excess-flow valve.
- B. Liquid level outage valve.
- C. Service valve.
- D. Fill valve.

228. A device used to withdraw propane vapor from the tank's service valve is called a

- A. suction hose.
- B. low pressure hose.
- C. decompression tube.
- D. vapor withdrawal tube.

229. The POL valve has

- A. right handed threads.
- B. acme threads.
- C. no threads.
- D. left-handed threads.

230. The main supply on/off valve for the propane system is the

- A. service valve (shutoff valve) assembly.
- B. fill valve.
- C. excess flow valve.
- D. auto stop valve.

231. The internal float device that is connected to the fill valve is called the
- A. excess flow valve
 - B. service valve
 - C. overfilling prevention device
 - D. pressure relief valve
232. The valve designed to open at a specific pressure to prevent container rupture is called the
- A. pressure relief valve.
 - B. excess flow valve.
 - C. auto stop.
 - D. back flow valve.
233. _____ is the minimum time, in minutes, for conducting a timed pressure drop test per NFPA 1192.
- A. 1
 - B. 3
 - C. 5
 - D. 10
234. What is the nominal inches of water column pressure that must be maintained during a timed pressure drop test?
- A. 3
 - B. 7
 - C. 8
 - D. 10
235. A manometer is an instrument used to measure
- A. gas density.
 - B. electrolytes volume.
 - C. gas volume.
 - D. gas pressure.
236. A lock-up test is conducted to determine
- A. the upper operating range of the regulator.
 - B. the lower operating range of the regulator.
 - C. the upper pressure of the container's output.
 - D. the lower pressure of the container's output.
237. The maximum allowable lock-up pressure of any water column propane system is
- A. 16 inches w.c.
 - B. 14 inches w.c.
 - C. 12 inches w.c.
 - D. 11 inches w.c.
238. Which one of the following conditions must exist during a lock-up test?
- A. All appliances operating.
 - B. Only pilot lights lit.
 - C. 50% BTU capacity.

D. No LP demand.

239. Upon completion of a regulator adjustment you should always follow-up with a _____ test.

- A. lock up test
- B. time pressure drop test
- C. operating pressure test
- D. atmospheric test

240. The two ingredients that are prohibited in liquid leak detectors are

- A. Ammonia and chlorine.
- B. Chlorine and hydrogen.
- C. Ammonia and hydrogen.
- D. Alcohol and nitrogen.

241. The process of displacing air and contaminants from a propane container using propane vapor or vacuum is

- A. refrigeration.
- B. purging.
- C. priming.
- D. regeneration.

242. After purging a propane container at sea level there will still be _____ pressure inside the container because of atmospheric pressure.

- A. 14.7 psi
- B. 12 psi
- C. 10 psi
- D. 8 psi

243. Contaminants in propane containers can lead to

- A. rust.
- B. false container pressure.
- C. odor fade.
- D. All of the above.

244. It is required that you change the fill valve on a mounted ASME tank. To safely remove propane from the tank you will

- A. open the outage valve and drain the liquid.
- B. remove the fill valve with the cap on.
- C. burn off the propane with a suitable torch.
- D. open the service valve until the vapor is gone.

245. Pinhole leaks in used containers can usually be detected by the presence of

- A. a white mist.
- B. an oily spot.
- C. a rust spot.
- D. an oxidized spot.

246. What is the propane gallon capacity of a properly filled ASME tank at 60°F with a water capacity of 28.6?

- A. 15.0
- B. 20.5
- C. 22.9
- D. 24.8

247. What is the cylinder fill weight for a 30 lb. DOT cylinder with a tare weight of 15 lbs?

- A. 15
- B. 30
- C. 40
- D. 45

248. The correct level that a properly sized and installed dip tube will extend into a propane DOT cylinder is

- A. 20%.
- B. 40%.
- C. 60%.
- D. 80%.

249. Newer overfilling prevention devices for tanks have a piston assembly and _____ that restricts the inlet fill capacity.

- A. orifice
- B. o-ring
- C. valve
- D. baffle

250. An excess flow valve, when activated, _____ the flow of propane.

- A. increases
- B. improves
- C. limits
- D. stops

251. The _____ acts as protection because it will severely restrict the propane flow when a propane line ahead of a regulator(s) is broken or opened.

- A. service valve
- B. back flow valve
- C. excess flow valve
- D. fill valve

252. The device that closes when the liquid or vapor passing through it exceeds the prescribed rate of flow is called the

- A. excess flow valve.
- B. service valve.
- C. pressure relief valve.
- D. backflow check valve.

253. Flare fittings are designed to be used without

- A. pipe dope.
- B. Teflon[®] tape.
- C. thread wrap.
- D. all of the above.

254. The maximum distance, in feet, required between copper tubing supports is _____ feet:

- A. 2
- B. 4
- C. 6
- D. 8

255. The two types of brass flare nuts approved for use in RVs are

- A. forged and molded.
- B. molded and stress-relieved.
- C. welded and forged.
- D. forged and stress-relieved.

256. The number of threads on iron pipe should be _____ for use on propane manifold connectors installed on recreational vehicles.

- A. approximately 10
- B. between 3 and 4
- C. approximately 20
- D. between 35 and 40

257. The first stage of a two-stage regulator is designed to reduce pressure in the first stage to

- A. 6-8 ounces.
- B. 10-12 pounds per square inch.
- C. 14"-16" water column.
- D. 20-22 pounds per square inch.

258. An LP regulator must have rated capacity equal to or greater than

- A. a 2 " diameter if round and 2" x 4" if rectangular.
- B. the BTU input of the largest appliance.
- C. the wetted surface potential of the smallest tank.
- D. the total BTU input of all appliances.

259. Water capacity of an ASME tank is in

- A. quarts.
- B. gallons.
- C. pounds.
- D. ounces.

260. Using the Table below, what is the maximum allowable depth for a dent 2-7/8" in diameter, on a DOT cylinder?

Maximum Allowable Dent Depth for DOT(TC) Cylinders (NLPFA #4003, Table C)

Average Dent Diameter Inches	Maximum Allowable Dent Depth Inches	Average Dent Diameter Inches	Maximum Allowable Dent Depth Inches	Average Dent Diameter Inches	Maximum Allowable Dent Depth Inches
1/2	.05	4 1/2	.45	8 1/2	.85
5/8	.06	4 5/8	.46	8 5/8	.86
3/4	.07	4 3/4	.47	8 3/4	.87
7/8	.09	4 7/8	.49	8 7/8	.89
1	.10	5	.50	9	.90
1 1/8	.11	5 1/8	.51	9 1/8	.91
1 1/4	.12	5 1/4	.52	9 1/4	.92
1 3/8	.14	5 3/8	.54	9 3/8	.94
1 1/2	.15	5 1/2	.55	9 1/2	.95
1 5/8	.16	5 5/8	.56	9 5/8	.96
1 3/4	.17	5 3/4	.57	9 3/4	.97
1 7/8	.19	5 7/8	.59	9 7/8	.99
2	.20	6	.60	10	1.00
2 1/8	.21	6 1/8	.61	10 1/8	1.01
2 1/4	.22	6 1/4	.62	10 1/4	1.02
2 3/8	.24	6 3/8	.64	10 3/8	1.04
2 1/2	.25	6 1/2	.64	10 1/2	1.05
2 5/8	.26	6 5/8	.66	10 5/8	1.06
2 3/4	.27	6 3/4	.67	10 3/4	1.07
2 7/8	.29	6 7/8	.69	10 7/8	1.09
3	.30	7	.70	11	1.10
3 1/8	.31	7 1/8	.71	11 1/8	1.11
3 1/4	.32	7 1/4	.72	11 1/4	1.12
3 3/8	.34	7 3/8	.74	11 3/8	1.14
3 1/2	.35	7 1/2	.75	11 1/2	1.15
3 5/8	.36	7 5/8	.76	11 5/8	1.16
3 3/4	.37	7 3/4	.77	11 3/4	1.17
3 7/8	.39	7 7/8	.79	11 7/8	1.19
4	.40	8	.80	12	1.20
4 1/8	.41	8 1/8	.81	12 1/8	1.21
4 1/4	.42	8 1/4	.82	12 1/4	1.22
4 3/8	.44	8 3/8	.84	12 3/8	1.24

- A. .29"
- B. .30"
- C. .31"
- D. .32"

261. On a new tank, a float-type 80% overfilling prevention device does not appear to be accepting propane, the technician should first
- A. check the outage valve.
 - B. oil the valve plunger.
 - C. check the valve for the correct position.
 - D. manually operate the plunger.
262. In transferring propane from one container to another, the receiving container must be
- A. purged.
 - B. smaller.
 - C. different type.
 - D. a different color.
263. When transferring propane from one container to another, it is recommended that a technician wear all of the following except
- A. protective eye wear.
 - B. heavy gloves.
 - C. protective footwear.
 - D. respirator.
264. Propane needs what percent of vapor in an air gas mixture to ignite?
- A. 10.2 and 15.3.
 - B. 76.1 and 78.3.
 - C. 2.15 and 9.6.
 - D. 0.025 and 0.096.
265. A manometer is an instrument used to measure
- A. utility water pressure.
 - B. tire pressure.
 - C. low pressure systems.
 - D. distance.
266. Any propane cylinder due for re-certification
- A. can be recertified by a master technician.
 - B. can not be filled or used.
 - C. can be used only on pre-1985 RVs.
 - D. must have the service valve replaced.
267. When removing and replacing an ASME tank, mounting bolts should be replaced with _____ bolts.
- A. larger size and stronger
 - B. equal size and strength
 - C. equal size and stronger
 - D. equal size and longer
268. A technician can determine the grade of a bolt by
- A. the shape of the bolt head.
 - B. the color of the bolt.
 - C. the type of nut used.

D. the marking on its head.

269. A high pressure flexible connector or pigtail is limited to a maximum length of _____ feet.

- A. 3
- B. 5
- C. 10
- D. 15

270. If a high or low pressure propane hose needs a new fitting you should

- A. replace the entire hose assembly.
- B. use duct tape.
- C. swag a new fitting on the hose.
- D. replace with barbed fitting with a hose clamp.

271. A solenoid valve on the propane system is a normally closed valve. What does this mean?

- A. The valve is closed manually to allow the gas to flow.
- B. Power to the valve is needed to keep the valve open.
- C. Power to the valve is needed to keep the valve closed.
- D. The valve is closed manually to stop the flow of gas.

272. Blowing unburned propane vapor into the atmosphere through an orifice larger than a _____ drill is against fire safety and/or environmental codes.

- A. #38
- B. #42
- C. #54
- D. #58

273. It is recommended that, when torching off a container, the torch be located at least _____ feet from the unit for fire safety.

- A. 5
- B. 10
- C. 15
- D. 20

274. A torch up to _____ BTU is typically used to burn off the remaining LP gas vapor from a container.

- A. 200,000
- B. 300,000
- C. 400,000
- D. 500,000

275. One gallon of propane contains approximately 91,690 BTU's at 60 degrees F. An appliance rated at 30,000 BTU will have a continuous operation time of approximately

- A. 2 hours.
- B. 3 hours.
- C. 6 hours.
- D. 12 hours.

276. You have two 20 pound cylinders. A pound of propane contains approximately 21, 600 BTU. Approximately how long will a 30,000 BTU appliance operate continuously at 60 degrees F?

- A. 19 hours.
- B. 29 hours.
- C. 39 hours.
- D. 49 hours.

277. Exceeding the vaporization rate of the container is caused by

- A. cold ambient temperature.
- B. high demand on system.
- C. low liquid level.
- D. All of the above.

278. Which of the following are types of maintenance records kept by a dealer or repair facility?

- A. pre-Delivery inspection forms.
- B. warranty registration forms.
- C. maintenance/repair work order forms.
- D. All of the above.

279. When performing welding repairs on a vehicle that is equipped with a 12 VDC battery, you should

- A. disconnect the generator.
- B. disconnect the battery.
- C. unplug the shore cord.
- D. Do all of the above.

280. The most important action a technician can use when dealing with irate customers is

- A. listening to the customer.
- B. explaining the dealers policies.
- C. referring the customer to the service manager.
- D. trying to calm the customer down.

281. What is the purpose of a CO detector?

- A. To detect Carbon and Oxygen levels inside the RV.
- B. To prevent injury by alerting occupants to dangerous levels of carbon monoxide inside the RV.
- C. To meet current RV code requirements.
- D. To prevent CO poisoning by alerting occupants to dangerous levels of carbon dioxide inside the RV.

282. Which item is typically not included on the pre-delivery inspection checklist?

- A. Odometer reading.
- B. Color of the RV.
- C. Customer home telephone.
- D. None of the above.

283. Purging an LP container ensures it does not contain

- A. air.
- B. water.

- C. contaminated LP.
- D. All of the above.

284. To avoid an unnecessary drain on the RV battery during a PDI and to check the condition of the converter, the shore power cord should be connected to a 120-volt AC shop receptacle, however, before proceeding, be sure to

- A. test the converter output circuits.
- B. conduct a hot skin test.
- C. fully charge all batteries.
- D. disconnect the positive and negative conductors at the converter.

285. Which receptacles must be GFCI protected?

- A. Microwave and lavatory.
- B. AES refrigerator and kitchen.
- C. Bathroom and bedroom.
- D. All exterior, kitchen and bath

286. While road testing a motorhome, if you switch fuel tanks you must

- A. drive at least 3 miles after switching.
- B. cover the entire route twice.
- C. top off the main tank when finished.
- D. Never switch tanks during the road test.

287. Who or what fills the center position in the service triangle?

- A. Systems.
- B. People.
- C. Customer.
- D. Service Strategy.

288. What percentage of unhappy customers will the average company never hear from?

- A. 50%.
- B. 65%.
- C. 76%.
- D. 95%.

289. How many customers with problems does the average company have for every complaint received?

- A. 19.
- B. 21.
- C. 26.
- D. 38.

290. What percent of customers will do business with an organization again if a complaint is resolved quickly?

- A. 65%.
- B. 75%.
- C. 85%.
- D. 90%.

291. Which of the following is not one of the three keys to making the repair?

- A. Economics.
- B. Quickness.
- C. Correctness.
- D. Cleanliness.

292. According to the TARP findings, customers who have their problems resolved tell an average of how many people?

- A. 5
- B. 10
- C. 15
- D. 20

Answer Key

001. B	074. D	147. A	220. A
002. C	075. C	148. C	221. D
003. C	076. D	149. C	222. D
004. C	077. D	150. C	223. C
005. B	078. B	151. B	224. B
006. A	079. C	152. D	225. C
007. D	080. D	153. A	226. B
008. B	081. A	154. D	227. C
009. C	082. C	155. C	228. D
010. A	083. B	156. C	229. D
011. D	084. A	157. B	230. A
012. A	085. A	158. C	231. C
013. B	086. C	159. A	232. A
014. B	087. C	160. A	233. B
015. D	088. B	161. B	234. C
016. A	089. A	162. A	235. D
017. D	090. A	163. D	236. A
018. A	091. B	164. B	237. B
019. C	092. D	165. C	238. D
020. C	093. A	166. C	239. A
021. D	094. B	167. D	240. A
022. A	095. C	168. B	241. B
023. D	096. B	169. A	242. A
024. A	097. C	170. A	243. D
025. B	098. A	171. D	244. C
026. C	099. C	172. B	245. B
027. B	100. C	173. B	246. C
028. B	101. A	174. A	247. D
029. D	102. D	175. C	248. A
030. A	103. C	176. A	249. C
031. D	104. A	177. B	250. C
032. D	105. B	178. D	251. C
033. C	106. D	179. C	252. A
034. B	107. A	180. D	253. D
035. B	108. D	181. B	254. B
036. B	109. C	182. D	255. D
037. A	110. B	183. A	256. A
038. B	111. A	184. C	257. B
039. C	112. D	185. B	258. D
040. D	113. C	186. B	259. B
041. A	114. C	187. C	260. A
042. C	115. C	188. C	261. C
043. A	116. D	189. C	262. A
044. D	117. C	190. A	263. D
045. A	118. C	191. C	264. C
046. A	119. B	192. C	265. C
047. C	120. A	193. A	266. B
048. B	121. C	194. B	267. B
049. D	122. C	195. D	268. D
050. D	123. B	196. B	269. B

051. A	124. C	197. C	270. A
052. B	125. B	198. A	271. B
053. D	126. B	199. B	272. C
054. C	127. B	200. B	273. B
055. A	128. D	201. D	274. D
056. B	129. A	202. B	275. B
057. C	130. A	203. B	276. B
058. B	131. A	204. A	277. D
059. B	132. C	205. C	278. D
060. B	133. A	206. D	279. D
061. C	134. A	207. A	280. A
062. A	135. A	208. B	281. B
063. C	136. A	209. D	282. D
064. D	137. A	210. B	283. D
065. C	138. B	211. C	284. B
066. A	139. C	212. C	285. D
067. D	140. B	213. B	286. A
068. C	141. A	214. A	287. C
069. C	142. C	215. C	288. D
070. A	143. C	216. D	289. C
071. D	144. D	217. B	290. D
072. A	145. B	218. D	291. A
073. A	146. C	219. B	292. A

Time Propane Pressure Drop Test Sign-Off Sheet

Printed Technician Name	ID Number
Address	Telephone Number
City	State
	Zip Code

Time Pressure Drop Test Conducted at the Range

STEP	Initials	Date
Did the Candidate:		
Prepare document (work order, PDI form, etc.) to record time pressure drop test results?		
Ensure the temperature of both air and piping was approximately the same?		
Ensure a uniform temperature was maintained throughout the test procedure?		
Ensure the propane system is turned off at the service valve?		
Turn off the burner valves on the range and gas valves on other appliances?		
Turn off all open pilot lights?		
Turn propane system on at the service valve?		
Listen to the regulator for sounds of escaping propane that would indicate an open line? Silence indicates the regulator has locked up.		
Remove a range burner and attach a manometer to the range burner spud?		
Turn on the burner valve with the manometer and ensure the propane system is pressurized to 10-14" W.C.?		
Turn off propane system at the service valve?		
Slowly open a second range burner and reduce the operating pressure to a nominal 8" W.C. Turn range burner off after achieving a nominal 8" W.C.?		
Monitor the manometer for a minimum of 3 minutes? Locate and repair any leak(s) and retest until a successful test is accomplished? (Go to Leak Test Sign-off Sheet)		
Turn off the range burner with the manometer, disconnect the manometer from the range burner spud, and reconnect the range burner?		
Return propane system to proper operation?		
Document test results on appropriate documentation. Indicate pressure, time, duration of test, date, and sign?		

OR

Time Pressure Drop Test Using a Propane System Test Apparatus

The following procedure is used to connect the Propane System Test Apparatus as described in the RVIA Propane System Textbook. It is provided as guidance but is not part of the Time 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 flex hose to the regulator. Attach the low-pressure hose, previously attached to the regulator, to the test apparatus. Attach the manometer hose to hose barb on the test apparatus, making sure the gas cock is closed. Slowly turn the propane supply back on at the service valve. Conduct a leak test to ensure all connections are leak free.

STEP	Initials	Date
Did the Candidate:		
Prepare documentation (work order, PDI form, etc) to record the Time Pressure Drop Test results?		
Ensure the temperature of both air and piping was approximately the same?		
Ensure a uniform temperature was maintained throughout the test procedure?		
Ensure the propane system is turned off at the service valve?		
Ensure all appliances are turned off?		
Ensure all open pilot lights are turned off?		
Turn propane system on slowly at the service valve to bring pressure to between 7.5 and 8.5 “W.C.”?		
Turn propane off at the service valve?		
Monitor the manometer for a period of three minutes? Locate and repair leak(s) and retest until a successful test (no pressure drop) is accomplished? (See Leak Test sign-off sheet)		
Bleed the propane pressure from the system using the gas cock on the Test Kit?		
Remove the Test Kit from the system and reattach the low-pressure hose or piping?		
Turn propane system on at the service valve?		
Leak test the low-pressure hose or piping connection?		
Document test results on appropriate documentation indicating observed pressure, time, duration of the test, date and sign?		

**System Operating Pressure Test, Leak Test,
Regulator Adjustment & Lock Up Tests
Sign-Off Sheet**

Printed Technician Name	ID Number
Address	Telephone Number
City	State
	Zip Code

STEP	Initials	Date
System Operating Pressure Test		
<i>The following procedures apply using test apparatus as described shown in the RVIA Propane Systems Textbook.</i>		
Did the candidate		
Prepare document (work order, PDI form, etc.) to record test results?		
Ensure the propane system is turned off at the container service valve?		
Turn off all appliances?		
Disconnect the propane low pressure hose from the regulator (use backup wrench)?		
Connect test apparatus to the regulator?		
Connect the Propane low pressure hose to the test apparatus?		
Install manometer to the apparatus?		
Open service valve on the container?		
Open gas cock on test apparatus (simulates 50 % flow)?		
Measure inches of water column WC on manometer 10.5-11.5 WC?		
Adjust regulator if measured WC is incorrect?		
Document test results?		
Propane Regulator Adjustment		
<i>If Propane pressure is greater than 11.5" WC</i>		
Did the candidate		
Prepare documentation?		
Remove dust cap?		
Adjust by turning the adjustment screw counter clockwise until proper pressure is achieved?		
Reinstall dust cap?		
Document results?		
<i>If Propane pressure is less than 10.5" WC</i>		
Did the candidate		
Remove dust cap?		
Adjust by turning the adjustment screw clockwise until proper pressure is achieved?		
Reinstall dust cap?		
Document results?		
Propane Regulator Lockup Test		
Upon completion of the Operating Pressure Test and Regulator Adjustment		
Did the candidate		
Close the cock on apparatus?		

STEP	Initials	Date
Monitor propane pressure on manometer for 3 minutes?		
If pressure exceeds 14" WC replace regulator?		
Turn off Propane at the service valve at the container?		
Remove test apparatus?		
Reconnect low pressure hose to regulator (use backup wrench)?		
Conduct a leak test on any fittings that were disconnected?		
Return system back to proper operation?		
Document results?		
Propane Leak Test		
<i>This test must be performed any time a propane line is opened or a leak is indicated during a timed pressure test. Perform either of the following methods.</i>		
Using an electronic leak detector		
Did the candidate		
Prepare documentation?		
Open service valve to pressurize propane system?		
Turn off all appliances?		
Turn on the electronic leak detector?		
Test the electronic leak detector using a butane lighter?		
Operate the electronic leak detector per the manufactures recommendation?		
Repair or tighten connections using backup wrenches?		
Document results?		
Using a non corrosive leak detector solution		
Did the candidate		
Open service valve to pressurize propane system?		
Turn off all appliances?		
Cover each connection with the solution?		
Monitor for bubbles if leak is present?		
Repair or tighten connections using backup wrenches?		
Document results?		

AC Electrical System Tests Sign-Off Sheet

Printed Technician Name	ID Number
Address	Telephone Number
City	State
	Zip Code

STEP	Initials	Date
Hot Skin Test		
Did the candidate		
Prepare Documentation?		
Make sure shore line is plugged into 120VAC source?		
Set VOM to AC voltage scale?		
Place one probe on a bare metal surface of the RV (i.e., Door frame, Chassis)?		
Place the other probe to an earth ground source (i.e., water pipe)?		
Repeat the test at least twice changing the placement of the probe?		
If there is no voltage reading present the skin is not hot?		
Any voltage reading indicates an electrical short or reverse polarity?		
Accurately diagnose and repair problems if any exist?		
Document Results?		
Polarity Test		
Did the candidate		
Prepare Documentation?		
Perform the test using a ground monitor or circuit tester?		
Accurately diagnose and repair problems if any exist?		
Document Results?		
GFCI Test		
Did the candidate		
Prepare Documentation?		
Push the test button on the GFI outlet or breaker?		
Test any 120VAC receptacles within 5 feet of water and all outside receptacles?		
Use a GFCI Polarity Tester to check outlets that are GFCI protected but have no test button.		
Accurately diagnose and repair problems if any exist?		
Document Results?		

**Measuring AC Voltage, Amperage
Resistance and Continuity
Sign-Off Sheet**

Printed Technician Name	ID Number
Address	Telephone Number
City	State
	Zip Code

STEP	Initials	Date
Measuring AC Voltage		
Did the candidate		
Set VOM to highest AC voltage scale?		
Ensure meter capacity is greater than expected voltage?		
Measure AC voltage at various locations (i.e. AC Receptacles)?		
Connect black lead to circuit neutral?		
Connect red lead to the live side of the circuit?		
Switch VOM down to best range?		
Read the indicated value?		
Measuring Amperage (Current)		
When using an in-line (series) ammeter or VOM		
Did the candidate		
Ensure meter capacity is greater than expected amperage?		
Set VOM to highest AC amps scale?		
Turn off power to the circuit?		
Disconnect the circuit at the point where the current is to be measured?		
Install the VOM leads in series between the source of current and the device being measured?		
Turn on the power to the device being measured?		
Switch the VOM scale to the lowest safe range?		
Read the indicated current?		
Turn off power to the circuit?		
Return the circuit to its original condition		
Accurately diagnose and repair problems if any exist?		
When using a clamp-on meter		
Did the candidate		
Clamp the jaws of the meter around one of the conductors feeding power to a live electrical circuit or device?		
Read the current draw in amperage?		
Isolate the component from the circuit		
Set the ammeter to the proper amp scale		
Read results on the meter		

STEP	Initials	Date
Checking Continuity		
Did the candidate		
Turn off all VAC power?		
Isolate the component to be checked by disconnecting all the wires?		
Set the VOM to the Ohms scale?		
Place one probe on each terminal of the item to be checked?		
Shorted Circuit (i.e., Two wires touching, or a closed switch). Meter reading will show Zero Ohms (sometimes a meter will read .1 to .3 ohms due to resistance in the meter leads).		
Open Circuit (i.e., Wire cut in half, or a switch that won't make continuity). Meter reading will show infinity (i.e., most digital meters will read OL or OFL).		
Grounded Circuit (i.e., Bare wire touching ground). Meter will read the same way as a short (zero) when the circuit is tested from a conductor to ground>		
Read the indicated value?		
Accurately diagnose and repair problems if any exist?		
Compare the reading to component specifications		

**Measuring DC Voltage, Amperage
Resistance and Continuity
Sign-Off Sheet**

Printed Technician Name	Social Security Number
Address	Telephone Number
City	State
	Zip Code

STEP	Initials	Date
Measuring DC Voltage		
Did the candidate		
Set VOM to DC voltage scale?		
Ensure meter capacity is greater than expected voltage?		
Measure DC voltage at various locations (i.e. brake lights, tail lights)?		
Connect black lead to circuit ground?		
Connect red lead to the live side of the circuit?		
Read the indicated value?		
Measuring Amperage (Current)		
If using an in-line (series) ammeter or VOM		
Did the candidate		
Set VOM to DC amps scale?		
Ensure meter capacity is greater than expected amperage?		
Turn off power to the circuit?		
Disconnect the circuit at the point where the current is to be measured?		
Install the VOM leads in series between the source of current and the device being measured?		
Turn on the power to the device being measured?		
Read the indicated value?		
Turn off power to the circuit?		
Return the circuit to its original condition?		
Measuring Resistance (Ohms)		
Did the candidate		
Turn off electrical power?		
Isolate the component from the circuit?		
Set the VOM to the proper Ohms scale?		
Read results on the meter?		

STEP	Initials	Date
Checking Continuity		
Did the candidate		
Turn off all VDC power?		
Isolate the component to be checked by disconnecting all the wires?		
Set the VOM to the Ohms scale?		
Place one probe on each terminal of the item to be checked?		
Shorted Circuit (i.e., Two wires touching, or a closed switch). Meter reading will show Zero Ohms (sometimes a meter will read .1 to .3 ohms due to resistance in the meter leads)		
Open Circuit (i.e., Wire cut in half, or a switch that wont make continuity). Meter reading will show infinity (i.e., most digital meters will read OL or OFL)		
Grounded Circuit (i.e., Bare wire touching ground). Meter will read the same way as a short (zero) when the circuit is tested from a conductor to ground		
Read the indicated value?		
Accurately diagnose and repair problems if any exist?		
Compare the reading to component specifications?		



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