UNITED STATES MARINE CORPS
Logistics Operations School
Marine Corps Combat Service Support Schools
Training Command
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LVSM 7206

STUDENT OUTLINE

PERFORM DIAGNOSTIC TESTS WITH STE/ICE-R

LEARNING OBJECTIVES

1. Terminal Learning Objective: Given an LVS requiring diagnostic testing, TM 2320-20/12A, TM 9-4910-571-12&P, and a STE/ICE-R unit, perform trouble diagnosis on LVS with STE/ICE-R, per the reference. (3521.13.17)

2. Enabling Learning Objectives:

a. Given an LVS requiring diagnostic testing, TM 2320-20/12A, TM 9-4910-571-12&P, and a STE/ICE-R unit, perform the Go-chain tests, per the references. (3521.12.17a)

b. Given TM 2320-20/12, TM 9-4910-571-12&P, and partial statements, pertaining to diagnostic testing of the LVS with STE/ICE-R, complete the partial statements to describe the procedures used to perform the NO-GO tests on the LVS with a STE/ICE-R unit, per the references. (3521.13.17b)

OUTLINE

1. COMPONENTS AND FUNCTIONS OF THE STE/ICE-R

a. The STE/ICE-R is the newest version of the STE/ICE, which some of you may have been trained on when you went through the AOMC. The "R" stands for reprogrammable, but not by the operator. The STE/ICE-R consists of the vehicle test meter (VTM) which contains the controls, the cable connections, the flip cards, and the readout display; the transducer kit that contains various transducers, adapters, and fittings; a technical manual (TM); six electrical cables; and a transportation case.

b. The STE/ICE-R is used to test the engine, fuel, and electrical systems of the MK48 and all other prime movers in the fleet of tactical wheeled vehicles employed in the Marine Corps. The results of these tests

indicate the serviceability of the vehicle components by comparing actual vehicle conditions with acceptable standards.

c. Types of Readouts. The VTM displays five types of readouts.

(1) Status readout. This readout displays the status of the test equipment. There are four status readouts.

(a) Readout .8.8.8.8 is displayed each time the VTM is turned on. It simply means there is power to the VTM and that all the display elements are working.

(b) When - - - - readout is displayed, it means one of two things. Immediately after the power is turned on, it means the VTM is ready for testing. During a compression unbalance test, it means testing is in progress.

(c) Readout .9.9.9.9 indicates that the VTM is reading a test value beyond the range of its measurement capability. Either the wrong test has been selected for what is being tested or there is a problem in the vehicle.

(d) PASS/FAIL. This is the result of a test on a component. It either passes or fails the test.

(2) Prompting message. This readout tells the mechanic to do something. After the proper action is taken, the test will continue.

(a) UEH signals the mechanic to enter the vehicle identification (VID) number. The VID numbers are found under TEST DATA on the flip cards, which are on the VTM.

(b) CYL is the signal to dial in the number of cylinders the vehicle you are testing has.

(c) GO means crank the engine in compression balance or first peak test.

(d) CIP tells you to apply full throttle in a CI power test.

(e) OFF is the signal to quit cranking the engine.

(f) CAL signals the mechanic to release the test button during an offset test.

(g) A readout of 66 is the signal to dial in 99 during the confidence test.

(3) Numerical readout. This readout indicates the numerical value of the unit of measure, such as volts, ohms, psi, that you are trying to determine. Only the numeric value is displayed, the readout will not indicate whether the reading is in volts, ohms, psi, degrees or whatever you are trying to read. Actually there is no need for that capability because the operator dials in the test number and he knows what is being measured. Incidentally, the value displayed will be a positive number unless a minus sign is displayed.

(4) Error readout. There are 12 error readouts and they all start with "E." They warn you that something is wrong and the problem must be corrected before the test continues. The flip card identifies what each error message means.

(5) Confidence error readout. There are 44 different confidence error readouts and they all start with "C." They are used during repair of the VTM.

c. Operating Modes. The STE/ICE-R can be operated in three modes.

(1) DCA mode. In the DCA mode, the VTM is connected to the MK48 at the DCA connector permanently mounted in the cab.

(2) TK mode. When in the TK mode, the VTM is connected to the vehicle by use of the transducers, adapters, and cables.

(3) Combined mode. This mode is when the DCA and TK mode are used at the same time.

2. PREPARE THE STE/ICE-R FOR TESTING

a. Connect the VTM to the Vehicle Diagnostic Connector Assembly (DCA)

(1) Pull up on the power switch to make sure the VTM is in the OFF position.

(2) Connect one end of the DCA cable to the J1 connector on the VTM and the other end of the cable to the vehicle diagnostic connector located on the passenger side of the cab. DO NOT connect the cable to the diagnostic connector first as electrical arching may occur and damage the cable or the VTM. Also, remember that you never connect or disconnect the cable while the vehicle is running or while the engine start switch is in the ON position.

(3) Now push in the VTM power switch to the ON position and verify that the display first indicates .8.8.8.8 for approximately two seconds and then changes to - - - -.

(4) If the VTM does not display correctly after approximately two seconds or if only a partial display is shown, or no display exists, repeat the previous steps. If, after repeating the previous steps and only a partial display is still shown, a defective module exists. Replace the module in accordance with TM 9-4910-571-12&P.

b. Perform the Confidence Test:

(1) Use the TEST SELECT switch to dial 66 into the TEST SELECT then press and release the TEST button and wait for a readout of 0066 on the VTM.

(2) If the VTM does not display and hold "0066", pull out the power switch to the OFF position, push in the switch to the ON position and check the display again. Again, it should indicate ".8.8.8.8" for approximately two seconds then change to four dashes (- - - -).

(3) Redial 66 and press and release the TEST button. If 0066 is not displayed, the VTM is defective and must be repaired or replaced.

(4) If you have the correct reading, dial 99 into the TEST SELECT then press and release the TEST button. The display should read "0099", then go blank, then read ".8.8.8.8" and go blank once more.

(5) At this point, several numbers will begin appearing and disappearing on the display, which indicates the VTM is self-testing. When the self-testing is completed, PASS will display on the VTM, indicating it is serviceable and testing can begin.

(6) If the VTM fails to display PASS, repeat the first four steps. If the VTM fails to display PASS once again, perform the steps listed below.

(a) Pull the VTM power switch to the OFF position and disconnect the DCA cable.

(b) Connect P1 of power cable W5 to the JI connector on the VTM.

(c) Connect the red clip lead of cable W5 to the positive terminal of the vehicle's battery and the black clip lead to the negative terminal of the battery.

(d) Repeat the confidence test. If the VTM passes the confidence test this way, this indicates a bad transducer in the vehicle's DCA. If the VTM fails the test, the problem is internal to the VTM.

c. Entering the Vehicle Identification Number (VID)

(1) With the VTM hooked up with the DCA cable on the W5 cable as we just had it, dial 60 into the TEST SELECT then push and release the TEST button.

(2) The VID number for the MK48 is 18. When UEH appears, dial 18 into the VTM then push and release the TEST button.

(3) The VID number 18 should appear on the display. The VTM is now ready for testing.

d. Offset Tests. The VTM will perform an offset test when the test number is entered and the TEST button is held down until CAL is displayed.

(1) The offset test is a method of zero adjusting the VTM automatically. It determines the effect the transducers and cables have on the measurements and corrects for the offset before displaying the values.

(2) Once the offset value is displayed, it must be checked against limits from the VTC. If the displayed value is outside these limits, the transducer or one of the cables is faulty and must be replaced.

3. STE/ICE-R TESTS

a. The test procedures are arranged in GO and NO-GO chains. In the GO chain, a correct result from a test leads to a GO and on to the next test procedure. If the test failed, the result leads to a corrective action, a higher level of maintenance or to the NO-GO chain. The NO-GO chain contains steps to find the cause of the failure. It's also arranged to isolate the fault and give the corrective actions.

b. To use the test chains, the mechanical condition of the MK48 need not be known. The passing of all tests in sequential order will quickly show that the MK48 has no problem within that chain. The TM clearly states this. However, the only incident that I can think of where you might perform the tests if the vehicle didn't have a problem would be during the performance of a vehicle acceptance check.

c. A more realistic use for the STE/ICE-R would be to isolate a fault that might otherwise be difficult to diagnose. In that case, you would try to go directly to the test for a specific fault. For example, if the vehicle

battery charge was too low to start the vehicle and the battery gage indicated low voltage, the logical test to perform first would be test GO4, CHARGING CIRCUIT AND BATTERY VOLTAGE TEST. To begin with test GO2, FIRST PEAK-STARTER CURRENT TEST or test GO3, ENGINE START-LUBRICATION CHECK, would be of little value and a waste of time.

4. GO CHAIN TESTS

a. VTM Connections and Checkout (GO1). We discussed the VTM connections and check out earlier in the class so we'll move on to the next test.

b. First Peak-Starter Current Test (GO2). The purpose of this test is to determine the overall condition of the entire starting system.

(1) Connect the current probe and do the offset test.

(a) First, attach the P1 end of the test transducer cable W4 to the J2 connector on the VTM.

(b) Now, connect the P2 end of cable W4 to the connector on the current probe TK11.

(c) Next, clamp the current probe TK11 around the positive battery cable, wire 139, connected to the starter. Point the arrow on probe TK11 toward the starter.

(d) Hold down the engine stop switch and crank the engine several cycles.

(e) If the engine does not crank at this point, NO-GO Test 20 (NG20) No Crank-No Start Test must be performed.

(f) Turn off all the vehicle's electrical power. Dial 72 into the TEST SELECT.

(g) Press and hold the TEST button until CAL appears on the display, then release the TEST button.

(h) Wait for an offset value of -225 to +225 to appear on the display. If the offset value is not correct, perform the offset fault isolation test. Refer to TM 9-4910-571-12&P.

(2) Next, measure the starter current-first peak.

(a) Press and release the TEST button. Wait for the prompting message of GO to appear on the display.

(b) When GO appears, depress and hold the ENGINE STOP switch and crank the engine until OFF or an error message is displayed.

1 If an error message of four dash lines is displayed after cranking, the batteries are discharged or are defective. Perform NO-GO test 81 (NG81).

2 If the 1200-1900 starter amperes are not displayed, perform NO-GO test 80 (NG80), Starter Circuit Test.

3 If the 1200-1900 starter amperes are displayed, perform GO test 3, the Engine Start/Lubrication Check.

c. Engine Start/Lubrication Check (GO3). This test simply determines if the vehicle will start, if all the gages show normal readings and if the resistor module is serviceable.

(1) Check the engine fluid levels.

(a) Check the engine oil level and add oil if necessary.

(b) Check the radiator coolant level and add coolant if necessary.

(c) Check the battery electrolyte level and add distilled water if necessary.

(2) Start the engine.

(a) If the engine will not crank, perform NO-GO test 20 (NG20), No Crank-No Start Test.

(b) If engine cranks but will not start, perform NO-GO test 30 (NG30), Engine Crank-No Start Test.

(3) Check the engine oil pressure gage.

(a) Check that the vehicle's engine oil pressure gage reads a minimum of 5 pounds per square inch at low idle. If the oil pressure gage reads less then specified, perform NO-GO test 05 (NG05), Low Oil Pressure Check.

(b) Check that the vehicle's voltmeter reads 26 to 29 volts. If the voltmeter does not read correctly, perform GO test 4 (GO4), Charging Circuit and Battery Voltage Test.

(4) Check the vehicle's gages. Check that all gages are reading normal. Refer to TM 9-2320-297-10, TM 2320-10/11. If the gages are not reading normal, troubleshoot the gages and/or perform NO-GO test 31 (NG31), Gage Test.

(5) Check the resister module.

(a) Dial 10 into the TEST SELECT and press the TEST button. Watch for the RPM to display on the VTM.

(b) Dial 26 into the TEST SELECT and press the TEST button. Watch for the display of either PASS or FAIL . If the RPM and then a PASS or FAIL message did not display, replace the resistor module.

d. Charging Circuit and Battery Voltage Test (GO4). This test does exactly what the name implies. It's a test for battery voltage and the charging circuit.

(1) Set the engine speed. Turn the vehicle headlights and accessories on and run the engine at 1000 rpm.

(2) Measure the battery voltage.

(a) Dial 67 into the TEST SELECT and press and release the TEST button.

(b) Watch the display to see that voltage is within 26.5 to 29.5 volts. If the battery voltage is within these limits and the vehicle's volt- meter reads normal, turn off the headlights and accessories and stop the engine. Perform GO test 5 (GO5), Engine Warm-up and Coolant Check.

(c) If the battery voltage is low, adjust the voltage regulator to obtain 26.5 to 29.5 volts. If the battery voltage is low, allow the vehicle to run for 5 minutes and then watch for a display of 26.5 to 29.5 volts. If the specified voltage is not obtained, turn the headlights and accessories off and stop the engine. Perform NO-GO test 50 (NG50), Charging Circuit test. If the battery voltage is obtained and the vehicle's voltmeter reads normal, turn off the headlights and accessories and stop the engine. Perform GO test 5 (GO5). If the vehicle's voltmeter does not read normal, troubleshoot the voltmeter and wiring.

e. Engine Warm-up/Coolant Check/Fuel Filter Restriction Test/Oil Pressure Test (GO5). This test indicates the engine normal operating temperature and the engine oil pressure at high speed. It also let's us know if the fuel filter is restricted and requires service.

(1) Check for leaks and coolant temperature.

(a) Check the vehicle for oil, fuel, and coolant leaks.

(b) Warm-up the engine to normal operating temperature, 170 to 195 degrees Fahrenheit.

(c) Check that the vehicle's temperature gage reads within 170 to 195 degrees Fahrenheit. If the engine temperature is too high, perform NO-GO TEST 31 (NG31), Gage Test.

(2) Check the fuel filter restriction sensor.

(a) Dial 26 into the TEST SELECT and press and release the TEST button.

(b) Increase the engine's rpm to 2200.

(c) Watch for PASS to be displayed on the VTM. If PASS does not appear, service the primary fuel filter and then repeat the TEST. If after repeating the TEST and the VTM does not display PASS, replace the restriction sensor.

(3) Check the engine oil pressure.

(a) Dial 10 into the TEST SELECT and press and release the TEST button.

(b) Increase the engine's speed to 2200 rpm.

(c) Check that the vehicle's oil pressure gage reads 40-70 psi. If the oil pressure gage does not read as specified, perform NO-GO test 5 (NG05), Low Oil Pressure Check.

f. Governor Check/Power TEST (GO6). The purpose of this test is to check the engine speed at no-load, full throttle and to see if the engine has lost any of its power since the last time it was tested.

(1) Check the operation of the engine governor.

(a) Watch the VTM display and gradually increase the engine speed to the maximum governed speed of 2250 rpm, then apply the accelerator to full throttle.

(b) If the engine does not maintain its speed at or below the maximum governed speed, the vehicle must be sent to the next higher echelon of maintenance for repair.

(2) Perform the engine power test.

(a) Dial 12 into the TEST SELECT and press and release the TEST button.

(b) Wait for the prompting message of CIP to appear on the VTM. When CIP does appear, depress the accelerator and hold the accelerator to the floor until a number is displayed on the VTM.

(c) When OFF appears on the VTM, release the accelerator. The VTM will then display the results of the power test. Record the results of the power test and keep the results with the vehicle's records. A change from the normal value for the vehicle indicates failure of the power test.

(d) If a change in the results has occurred since the last power test, perform NO-GO test 90 (NG90), Governor/Power Test Fault Isolation.

g. Idle Speed and Governor Check (GO7). This test will check the engine idle speed.

(1) Dial 10 into the TEST SELECT and press and release the TEST button.

(2) Watch the VTM readout display for about 10 seconds to verify that the idle speed is 600-700 rpm.

(3) If the VTM does not display the correct idle speed, notify the next higher echelon of maintenance.

TRANSITION: There is one more test in the GO chain, the Compression Unbalance Test. However, the Compression Unbalance Test cannot be performed on the MK48 at this time so that concludes our GO chain testing.

INTRODUCTORY TRANSITION: During the first portion of the class we covered the tests that were in the GO chain. Now we want to discuss the NO-GO tests that must be done if those tests in the GO chain could not be completed? As with the GO chain tests, we'll cover these in numerical sequence. The first NO-GO test that we will discuss is NO-GO test number 5, Low Oil Pressure Check.

5. NO-GO CHAIN TESTS ***(MIN)***

a. Low Oil Pressure Check (NG05). Test GO3 and GO5 send you to this test if the oil pressure readings are not within specifications. It will determine if the oil pressure is actually low or if the oil pressure gage or sending unit is faulty and indicating an incorrect reading.

(1) Install the transducer and perform the offset test.

(a) Stop the engine.

(b) Remove the vehicle's oil pressure switch.

(c) Install TK item 16 into the female straight end of TK item 25.

(d) Install TK item 25 in place of the vehicle's oil pressure sending unit with the tee facing up.

(e) Install TK item 20 into the open end of TK item 25.

(f) Install pressure transducer TK item 17 (blue strip) into the open end of TK item 20.

(g) Connect P1 of transducer cable W4 to J2 or J3 of the VTM.

(h) Connect P2 end of the transducer cable to the connector on the pressure transducer TK 17.

(i) Dial 50 into the TEST SELECT. Press and hold the TEST button until the CAL message appears on the VTM display, then release the button.

(j) Wait for the offset value to appear on the display. The offset value should be -150 to +150.

(k) If the offset value is not within -150 to +150, refer to TM 9-4910-571-12&P for the offset isolation.

(2) Check the engine oil pressure.

(a) To check the engine oil pressure, dial 01 into the TEST SELECT and press and release the TEST button.

(b) Watch for PASS to be displayed on the VTM.

(c) When PASS appears, dial 50 into the TEST SELECT and press and release the TEST button. The VTM will now display the engine's rpm and oil pressure alternately.

(d) Start the engine and hold the engine's rpm at 2200. Check that the VTM displays the correct oil pressure of 40 to 70 psi.

(e) Stop the engine immediately if the oil pressure is too low. Check the engine for correct oil type, weight, or a clogged oil filter. Refer to LI 2320-12/9. If the oil pressure is normal, perform NO-GO test 31 (NG31), Gage Test.

b. No Crank-No Start Test (NG20). Tests GO1 and GO2 both direct you to this test if the engine won't crank when attempting to perform the other tests.

(1) Try to crank the engine.

(a) Attempt to start the engine.

(b) Listen to the starter motor for running overspeed.

(c) If the starter motor does not overspeed, perform NO-GO test 80 (NG80), Starter Circuit Test.

(2) Next, check the teeth on the flywheel.

(a) Remove the starter motor. Check for missing or damaged teeth on the flywheel.

(b) If all the teeth are good, replace the starter assembly. If teeth are missing or damaged, evacuate the vehicle to the next higher echelon of maintenance.

c. Engine Crank-No Start (NG30)

(1) Check the engine cranking speed.

(a) Dial 10 into the TEST SELECT and press and release the TEST button.

(b) Depress and hold the engine stop switch while cranking the engine.

(c) Crank the engine and watch the readout display on the VTM for minimum cranking speed of 100 rpm.

(d) If the engine cranking speed is not 100 rpm or better, perform NO-GO test 80 (NG80), Starter Circuit Test.

(2) Next, check the fuel supply system.

(a) First, check that there is fuel in the tank.

(b) Next, drain any water from the primary fuel/water separator filter.

(c) Then, check for kinked, flattened, or broken fuel lines from the tank to the filters and the engine.

(d) Also, check the fuel shutdown solenoid and circuitry for proper operation and adjustment.

(e) Dial 27 into the TEST SELECT and press and release the TEST button. Operate the engine stop switch. The VTM should display 26.5 to 27.5 (volts) when the toggle switch is held down and zero when it's released.

(f) If the VTM does not show the specified display, replace the stop switch, repair the wiring, or notify the next higher echelon of maintenance to replace the engine stop solenoid.

(3) Install the transducer.

(a) First, disconnect the fuel line at the secondary fuel filter outlet.

(b) Then, remove the fuel line elbow from the fuel filter.

(c) Now, install the street tee, TK item, 24, into the outlet side of the fuel filter and install the fuel line elbow into the street tee.

(d) Connect the outlet fuel line to the elbow. Install the blue line pressure transducer, TK item 17, in the female outlet of the street tee.

(e) Connect the P1 end of transducer cable W4 to J2 on the VTM.

(f) Connect the P2 end of the transducer cable to the connector on the transducer.

(g) Dial 50 into the TEST SELECT and press and release the TEST button.

(h) Press and hold the TEST button until the CAL message appears on the display of the VTM then release the TEST button.

(i) Wait for the offset value of -150 to +150 to appear. If the offset value fails to appear, refer to TM 9-4910-571-12&P for offset fault isolation.

(4) Measure the fuel pressure during the cranking of the engine.

(a) Press and release the TEST button. Wait for the blinking "O" to appear on the readout of the VTM.

(b) Once the blinking "O" appears, crank the engine and watch the readout display on the VTM.

(c) If the display is greater than 4 psi, the fuel filter is clean.

1 You should check to see if the engine shutdown solenoid is working properly.

2 If the shutdown solenoid is working properly, check for a restricted air intake.

3 Another cause could be that the cold weather starting aid system is inoperable.

4 If after performing these checks the engine still will not start, evacuate the vehicle to the next higher echelon of maintenance.

(d) If the display reading is less than 4 psi, move the pressure transducer to the inlet side of the fuel filter.

(e) Crank the engine and watch the VTM for a readout display of 4 psi or greater.

(f) If the pressure is greater then 4 psi, replace the fuel filter, then attempt to start the engine. If the engine still fails to start, perform Step 2, which is checking the fuel supply system.

(g) If the pressure is not over 4 psi, check the fuel lines for ice blockage due to water accumulation or coagulation of the fuel. If the engine still fails to start, locate and repair the blockage in the fuel line.

***TRANSITION:* NO-GO test 31 is the Gage Test.**

d. Gage Test (NG31)

(1) Installation of the test probe cable.

(a) Connect P1 of the test probe cable W2 to J4 connector on the VTM.

(b) Connect the red and black clip leads together.

(2) Test probe cable offset.

(a) Dial 89 into the TEST SELECT.

(b) Depress and hold the TEST button until the CAL message appears on the VTM display, then release the TEST button.

(c) Wait for an offset value of -6.8 to +6.8 to appear. If an offset value fails to appear, replace the VTM.

(3) Isolating the fault to the sending unit or gage.

(a) Remove the wire from the sending unit. Connect the red clip lead of W2 cable to the wire removed from the sending unit.

(b) Connect the black clip lead to the chassis ground.

(c) Turn the engine start switch to ON then press and release the TEST button.

(d) If the VTM displays 6 to 9 volts, the sending unit needs to be replaced. If the VTM did not display 6 to 9 volts, troubleshoot the gage and or wiring to isolate the fault.

e. Charging Circuit Tests (NG50). These tests are performed to help isolate a malfunction in the charging system.

(1) Check to see if the alternator cooling fan is rotating.

(a) Stop the engine.

(b) Have an assistant hold down the engine stop switch and crank the engine. Watch the alternator cooling fan to ensure that the fan is indeed turning.

(c) If the cooling fan is not turning, remove the alternator and check the drive coupling.

(2) Checking the charging system output voltage.

(a) Start the engine and turn on the vehicle's lights.

(b) Run the engine at a fast idle.

(c) Dial 82 into the TEST SELECT and press and release the TEST button.

(d) Watch for a display of 26.5 to 29.5 volts. If the voltage is not as specified, perform NO-GO tests 80 (NG80), Starter Circuit Tests.

(e) If the correct voltage is displayed, check for loose or bad connections or broken cables in the charging system output and ground circuit.

f. Starter Circuit Tests (NG80). The Starter Circuit Tests are performed to check resistance, current, and voltage in the starting circuit.

(1) Installation of the current probe.

(a) Install the current probe around the positive battery cable to the starter motor cable.

(b) Point the arrow on the probe away from the starter motor.

(2) DC current probe offset test.

(a) Turn off all vehicle electrical power.

(b) Dial 74 into the TEST SELECT. Press and hold the TEST button until the CAL message appears.

(c) Release the TEST button and wait for the offset value to appear.

(d) The offset value should be within the limits of -225 to +225. If the offset value is not correct, refer to TM 9-4910-571-12&P for offset fault isolation.

(3) Check the starter circuit resistance.

(a) Hold the engine stop switch down.

(b) Press and release the TEST button. When GO appears, attempt to crank the engine.

(c) Stop cranking the engine when the VTM displays OFF or an error message appears. If an error message appears, this could indicate a short circuit, frozen starter or a tight engine.

(d) At this point, the VTM could display either GO or a starter circuit resistance value.

1 If a GO did not appear at first, perform the starter current test. If GO was displayed, repeat the starter circuit resistance TEST again. If GO is still displayed after the cranking attempt, the starter is not being energized. You must go to Step 5, install the test probe cable.

2 If a value reading is displayed and is greater than 25 milliohms, install the test probe cable to check the starter voltage.

3 If you had a resistance reading of 0 then you must look for a short in the starting circuit.

4 If the resistance reading was 25 milliohms or less, then the problem is due to weak batteries or a tight engine. To check for weak batteries, perform the NO-GO tests 81 (NG81), Battery Tests.

(4) Check the starter current.

(a) Dial 90 into the TEST SELECT and press and release the TEST button. Crank the engine for a few seconds with the engine stop switch held down.

(b) Read the VTM display. Starter current value should not be greater than 500 amps.

(c) If the starter current is above 500 amps, check the wiring to the starter for short circuits. Repair as needed. If there are no shorts, perform NO-GO test 130 (NG130), Engine Tightness Test. If the current is not above 500 amps, perform NO-GO tests 81 (NG81), Battery Tests.

(5) Install the test probe cable. Connect P1 end of the test probe cable W2 to J4 on the VTM. Connect the red and black clip leads together.

(6) Perform the test probe cable offset test.

(a) Dial 89 into the TEST SELECT. Press and hold the TEST button until CAL message appears.

(b) Release the TEST button and wait for the offset value to appear.

(c) The offset value should be within -6.8 to +6.8. If the offset value is not as specified, the VTM is malfunctioning.

(7) Check the starter voltage.

(a) Dial 68 into the TEST SELECT and press and release the TEST button.

(b) Crank the engine and observe the voltage reading.

(c) If the display is less than 18 volts, perform the starter solenoid voltage test.

(8) If the display is greater than 18 volts, perform the starter negative cable drop test.

(a) Dial 69 into the TEST SELECT and press and release the TEST button.

(b) Crank the engine and observe the voltage display reading.

(c) The VTM should display cable voltage drop of 0.5 volts or less.

(d) If the VTM display is greater than 0.5 voltage drop, inspect and clean all ground cables from the starter motor and batteries and check for cracks, breaks, and loose connections. Replace as needed. If the voltage drop is less than 0.5 volts, replace the starter motor.

(9) Check the starter solenoid voltage.

(a) Dial 70 into the TEST SELECT and press and release the TEST button.

(b) Crank the engine and observe the voltage display reading.

(c) If the starter solenoid voltage is above 18 volts, you must ask yourself if the starter circuit resistance was high during the starter resistance circuit test. If the resistance was, check the positive battery cables and connections to the starter solenoid. Replace or repair as needed. If the wiring is OK, replace the solenoid. If the GO message occurred during the starter circuit resistance test, check the switches and wiring to the solenoid. If the wiring and switches are good, replace the solenoid and starter.

(d) If the starter solenoid voltage reading was less than 18 volts, check the battery voltage while cranking the engine.

(10) Check the battery voltage while cranking the engine.

(a) Dial 67 into the TEST SELECT and press and release the TEST button.

(b) Crank the engine and observe the voltage display reading.

(c) If the display reading is less than 18 volts, perform NO-GO test 81 (NG81), Battery Tests. If the reading is above 18 volts, check the switches and wiring to the starter solenoid. Repair as needed.

g. Battery Tests (NG81). The battery tests are performed to determine if the battery is serviceable and in a charged condition.

(1) Install the test probe cable W2 and perform the battery offset test.

(a) Each battery should be tested individually. During this test, the fuel supply must be shut off to keep the engine from starting. This is done by keeping the engine stop switch depressed during the cranking of the engine.

(b) Connect test probe cable W2 onto the VTM.

(c) Connect the red and black clip leads of W2 together.

(d) Dial 89 into the TEST SELECT.

(e) Press and hold the TEST button until the CAL message appears, then release the TEST button.

(f) Wait for the offset value of -6.8 to +6.8 to appear on the VTM. If the offset value is not within limits, the VTM is malfunctioning and should be replaced.

(g) Connect the red clip lead of cable W2 to the positive post of the battery being tested. Connect the black clip lead of cable W2 to the negative post of the battery being tested. Always refer to the vehicle test card for the note and hookup drawing for the correct procedures.

(2) Condition current probe and do the offset test.

(a) Connect P1 end of the transducer cable W4 to J3 of the VTM.

(b) Connect P2 end of the transducer cable W4 to the current probe.

(c) Clamp the current probe around the battery cable which connects the series pair of batteries containing the battery to be tested. Point the arrow on the current probe toward the negative post connected to the battery cable.

(d) Attempt to crank the engine for several cycles.

(e) Turn off all vehicle electrical power.

(f) Dial 90 into the TEST SELECT.

(g) Press and hold the TEST button until CAL message appears on the VTM. Then release the TEST button.

(h) Wait for the offset value of -225 to +225 to appear on the display. If the offset value is not within limits, refer to TM 9-4910-571-12&P for the offset fault isolation.

(3) Measure the battery resistance change.

(a) Dial 79 into the TEST SELECT and press and release the TEST button.

(b) Wait for GO message to appear on the VTM. Turn the engine start switch to START then wait for the display to change.

(c) The display may show a message beside a number.

1 If the display shows GO, there is a bad connection in the starter circuit. Check the battery cables and connections to the starter and retest. If the display still shows GO, then you may have a defective battery in the series pair being tested. Test the other batteries in the series pair.

2 If the display shows .9.9.9.9, there may be a bad connection on the battery being tested. Clean and tighten the connections on the battery and retest.

3 If the display shows E013, four dashes or .9.9.9.9, the battery being tested may be in a discharged state. Check the battery electrolyte level, charge the battery, then retest the battery. If the display shows E013, four dashes, or .9.9.9.9 after the battery has been charged, replace the battery.

(d) If the display shows a number but is more than 2.5 milliohms/second then you must check the following:

1 Check the battery electrolyte level.

2 Clean the battery terminals.

3 Refer to TM 9-6140-200-14 to check the battery specific gravity.

4 Charge the battery, if needed. Repeat the test on this battery.

5 If the battery has been charged and the battery resistance change is still greater than 2.5 milliohms/second, replace the battery.

(4) Measure the battery resistance.

(a) Dial 77 into the TEST SELECT and press and release the TEST button.

(b) If GO appears on the display, turn the ENGINE switch to START until OFF appears on the VTM display.

(c) If an error message appears, refer to the vehicle test card and repeat the test.

(d) The VTM should display the battery resistance of 13 milliohms or less.

(e) If the resistance is within limits, the battery is good. Perform the test on the next battery.

(f) If the resistance is not within limits, check the following:

1 Check the battery electrolyte level.

2 Clean the battery terminals.

3 Refer to TM 9-6140-200-14 to check the battery specific gravity.

4 Charge the battery, if needed. Repeat the resistance test on this battery.

5 If the battery has been charged and the battery resistance change is still greater than 2.5 milliohms/second, replace the battery.

h. Governor/Power Test Fault Isolation (NG90). Remember that you are going to compare the results of this test with the results of the last Governor/Power Test Fault Isolation which should be recorded in the vehicle record jacket.

(1) Remove the air cleaner and repeat the power test.

(a) Ensure that the air inlet is clear of debris, dirt, and dust before performing the test.

(b) Remove the air cleaner from the air intake housing.

(c) Repeat the power test, Step 2 from GO6, Governor Check/Power test.

(d) If the engine passes the power test with the air cleaner removed, install new air filters.

(e) If the engine does not pass the test, reinstall the air cleaner.

(2) Install the transducer and perform the offset test. The offset test is Step 3 of NO-GO test 30 (NG30), Engine Cranks - Will Not Start.

(3) Check the engine high idle fuel pressure.

(a) Dial 01 into the TEST SELECT and press and release the TEST button.

(b) When PASS appears on the VTM display, dial 50 into the TEST SELECT and press and release the TEST button.

(c) Accelerate the engine to 2250 rpm, (± 50).

(d) The displayed fuel pressure should be greater than 50 psi. If the pressure is greater than 50 psi, the manual directs us to perform test GO8, Compression Unbalance Test. However, the compression unbalance test cannot be performed on this vehicle at this time. If pressure is not as specified, check the following:

1 Check for crimped or broken fuel lines.

2 Drain the fuel filters and check the filters for water or dirt. Replace the filters if needed.

3 Check the vehicle throttle linkage for full travel and proper adjustment.

4 If the reading is still low, evacuate the vehicle to the next higher echelon of maintenance.

(4) Check peak rail pressure.

(a) Dial 03 into the TEST SELECT and press and release the TEST button.

(b) When PASS appears, dial 50 into the TEST SELECT and press and release the TEST button.

(c) Abruptly, accelerate engine at full throttle from idle to 2250 rpm, (± 50).

(d) The displayed fuel pressure should be greater than 50 psi. If the pressure is not greater than 50 psi, check the fuel system.

(5) Check the fuel system.

(a) Check the fuel system for crimped or broken fuel lines.

(b) Drain any water from the primary fuel filter.

(c) Check the vehicle throttle linkage for full travel and proper adjustment. Repair the linkage if needed. If the reading is still low, evacuate the vehicle to the next higher echelon of maintenance.

i. Engine Tightness test (NG130). The purpose of this test is to see if the engine will rotate freely.

(1) Shut off the fuel supply so that the engine will not start. This is done by depressing the engine stop switch.

(2) Rotate the engine at the accessory drive pulley and check for tightness. To rotate the engine, place a socket and breaker bar on the pulley retaining bolt and turn the bolt in a clockwise direction. This will prevent the bolt from loosening as the engine is rotated.

(3) If the engine does not rotate freely, evacuate the vehicle to the next higher echelon of maintenance.

(4) If the engine does rotate freely, replace the starter motor.

j. Testing the Filter Assembly with STE/ICE-R. After inspecting the filter housing, a pressure test should be performed to determine if the hydraulic oil and filter need replacing. As the hydraulic oil picks up contaminants, the filter slowly becomes plugged. This creates a pressure increase inside the filter housing. For this filter, a pressure reading above 12 psi indicates a need to change the hydraulic oil filter and a pressure reading of 12 psi or less indicates clean hydraulic oil and that the filter is not plugged. STE/ICE-R is used to measure the pressure inside the filter housing. To test the filter with STE/ICE-R, the following procedures are used.

(1) The procedures for conducting this test are contained on page 22-18 and 22-19 of TM 9 2320-297-20, Volume II. We are going to deviate slightly from those procedures by using a 0-10000 psi pressure transducer which requires that test number 0051 vice 0050 be entered into the VTM. This transducer is used to test the MK18 and is identified by its stainless steel color without a color strip.

(2) Perform VTM general checkout procedures as prescribed in the technical manual.

(3) Remove the plug from the housing and install the 0-10,000 psi pressure transducer to the filter housing.

(4) Connect P1 of transducer cable W4 to either J2 or J3 on the VTM.

(5) Now, connect P2 of transducer cable W4 to the 0-10,000 psi pressure transducer.

(6) At that time, test Number 51 will be dialed into the test select and an offset test performed by holding the test button down until CAL appears on the display.

(7) Once CAL has appeared, release the test button and wait for a limit value. Limits should be between -150 and +150.

(8) Again, press and release the test button. A "0" reading on the display should appear. You are now ready to measure pressure.

(9) Start the engine to cycle the hydraulic oil and allow the hydraulic oil temperature to reach 130-140 degrees Fahrenheit (54-60 degrees Celsius).

(10) Once the hydraulic oil is at the proper temperature, increase the engine speed to maximum and record the reading.

(a) If the pressure is 12 psi or less, the oil filter is clean and operating correctly.

(b) If the pressure reading is more than 20 psi, the hydraulic oil is heavily contaminated and the oil and filter should be replaced. It may be necessary to replace the filter more than once.

(c) If the pressure reading is between 13 and 20eplace the oil filter.

1 Now, increase the engine speed to maximum and record the reading.

2 If the oil pressure is still more than 12 psi, replace the oil filter and repeat the test until a reading of 12 psi or less is obtained.

3 As I said before, it may be necessary to replace the oil filter more than once to remove all the contaminants from the system.

(11) Now, disconnect the pressure transducer from the filter housing and install the plug.

REFERENCES:

TM 2320-20/12
TM 9-4910-571-12&P