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STUDENT OUTLINE

**SIMPLIFIED TEST EQUIPMENT/INTERNAL COMBUSTION ENGINES
REPROGRAMMABLE (STE/ICE-R) OPERATING PROCEDURES**

LEARNING OBJECTIVES:

1. Terminal Learning Objective: Given a representative diesel engine, appropriate technical manuals, required tools and a Simplified Test Equipment/Internal Combustion Engine Reprogrammable (STE/ICE-R) test set, perform diagnostic tests with STE/ICE-R, per information contained in the references. (6.3.12)

2. Enabling Learning Objectives: Given a representative diesel engine, appropriate technical manuals, required tools, and a STE/ICE-R test set, per information contained in the references:

(a) perform a STE/ICE-R setup and internal checks,
(6.3.12a)

(b) perform a confidence test, (6.3.12b)

(c) perform a battery voltage test, (6.3.12c)

(d) perform an engine rpm test, (6.3.12d)

(e) perform a starter current first peak test,
(6.3.12e)

(f) perform a fuel supply pressure test, (6.3.12f)

(g) perform a DC current 0 to 1500 amps alternator test, (6.3.12g)

(h) perform a DC voltage 0 to 45 volt test, (6.3.12h)

(i) perform a 0 to 1000 psi engine oil pressure test, (6.3.12i)

(j) perform a starter current average test, (6.3.12j)

(k) perform a starter current test, (6.3.12k)

(l) perform a starter negative cable voltage drop test and, (6.3.12l)

(m) perform a starter solenoid voltage test. (6.3.12m)

OUTLINE

1. INTRODUCTION TO STE/ICE-R

a. Description and Operation

(1) STE/ICE-R is a testing system that allows the mechanic to perform tests and measurements on internal combustion engines.

(2) STE/ICE-R measures standard voltage, current, resistance, pressure, temperature, and speed.

(3) Special tests, such as compression balance tests and starter system evaluations, are also performed by STE/ICE-R.

(4) Standard equipment functions including vacuum gage, compression gage, low-current tester, and multimeter are features of the STE/ICE-R set.

(5) STE/ICE-R is portable and operates on either 12 or 24 volt vehicle batteries or an equivalent power source.

(6) STE/ICE-R properly used can be very effective to test the general serviceability of vehicles and perform special fault isolation tests which were previously accomplished by the use of several items of special test equipment.

b. STE/ICE-R Components

(1) This is a vehicle test meter, referred to as a VTM. The VTM is used to test electrical and mechanical components.

(2) This is a transducer kit. Located inside the kit are transducers, fittings and connectors used during testing with STE/ICE-R. Transducers are devices which convert physical quantities to electrical energy. The transducer kit is referred to as TK.

(3) Diagnostic Connector Assembly, referred to as DCA, receives both its power and test data through DCA cable W1 and provides access through the engine wiring harness to test points and sensors connected to the vehicle mounted DCA.

(4) This is a test probe cable referred to as cable W2. Cable W2 is used for measuring voltage, resistance, and continuity.

(5) Ignition adapter cable is referred to as cable W3. It is used to measure dwell angle, voltage, engine RPM, and power tests on spark ignition engines.

(6) Transducer cables referred to as W4 cables are used as extensions to connect the VTM to a pressure transducer in the TK mode.

(7) Power cable referred to as cable W5 is used to power the VTM when cable W1 is not being used or when the vehicle does not have DCA capabilities.

(8) This is a test probe kit that allows the STE/ICE-R operator to make different types of measurements with greater ease.

(9) The technical manual describes the operation and organization maintenance for the STE/ICE-R system.

(10) STE/ICE-R and accessories are housed in this portable protective transit case. A pressure relief valve located on the front of the case allows the operator to release any pressure or vacuum resulting from changes in the climate during transit.

c. Vehicle Test Meter

(1) The vehicle test meter is referred to as VTM and provides a method for the mechanic to test vehicle electrical and mechanical components.

(2) Diagnostic connector assembly referred to as DCA is permanently mounted in the vehicle and provides accessibility to most frequently needed test points. Use of the VTM through the DCA is referred to as DCA mode.

(3) VTM interfaces with the vehicle through the DCA connector or with a transducer(s) from the transducer kit, referred to as TK. Use of the VTM through the TK is referred to as TK mode.

(4) DCA and TK can be used at the same time. This may be necessary when the diagnostic connector assembly has a missing transducer. If a transducer is missing, a no sensor indication E002 is displayed when a measurement is made. If this happens, the TK mode can be used to make the measurement. Use of VTM through DCA and TK is referred to as the combined mode.

(5) Additional tests can be performed that involve manually probing and or connecting transducers to the appropriate test points.

(6) VTM operates on 12-24 volts routed through a diagnostic connector in the DCA mode and cable connected to batteries in the TK mode.

d. Operator's Controls and Indicators

(1) The first control I want you to become familiar with is the power switch that controls the voltage to the VTM.

(a) When the power switch is pushed in, the VTM power is on. To shut the VTM off, pull out the power switch.

(b) A word of caution; never connect the VTM to a power source if the power switch is on (pushed in), the batteries may explode and cause personal injury or equipment damage. This is the reason I elected to identify the power switch first.

(c) The power switch contains a circuit breaker that will cause the switch to pop out to the OFF position automatically if something occurs that would cause a power overload to the VTM.

(d) If the switch pops out, check your hookup carefully, then wait approximately one minute before attempting to reset the power switch to the ON position.

(2) The two test select switches are used to select the test to be performed by STE/ICE-R.

(a) There are ten positions on each select switch, numbered 0 through 9.

(b) The number dialed into these switches is read by the VTM when you press the test button. Changing the number on the test select switches has no affect until the test button is pressed.

(c) Depressing and then releasing the test button causes the test measurement to begin which also displays the measurement value on the readout display. Depressing and holding the test button down initiates an offset test. We will discuss offset testing later.

(d) Numerical values such as 24 for 24 volts and 800 for 800 rpm will be displayed. Only numbers are displayed, there is no indication of what you are measuring such as psi, rpm, or volts; since the operator dialed in the test, he knows what is being measured.

(e) Readings can also be displayed as status and errors, informing the operator to take corrective action.

d. VTM Connectors

(1) DCA connector, J1 (Jack No. 1) connects the VTM to either a vehicle diagnostic connector using DCA cable W1 or to the vehicle batteries using power cable W5 in the TK mode.

(2) When using TK mode, special cables and transducers must be installed at vehicle test points.

(3) Transducer cable connectors J2 and J3 (Jack No. 2 and Jack No. 3) are used to connect cable W4 to

transducers installed at test points. Two W4 cables can be connected together with an adapter to make one long cable when necessary.

(4) Test probe cable connector J4 connects test leads to the VTM when performing manual voltage and resistance tests.

e. Flip Cards

(1) Flip cards are attached to front of the VTM and provide a quick but limited reference for the operator. These flip cards list test numbers, messages and some test procedures.

(2) Flip cards are also used to identify operators' input errors and VTM malfunctions.

(3) The message listed on the flip card provides the operator with information required to correct input error and exceptions.

f. Transducer Kit

(1) The transducer kit contains a collection of transducers, adapters and fittings which permit STE/ICE-R to be used as a general purpose measurement system. Components of the kit allow STE/ICE-R to be used when you need to measure voltage, current, resistance, pressure, or engine speed and appropriate sensors are not built into the vehicle.

(2) When you use components of this kit to obtain measurements, you are in the TK mode of operation opposed to the DCA mode where you are using the built-in sensors of the vehicle to make measurements.

(3) Most TK fittings are not marked; however, the technical manual for STE/ICE-R provides a listing that identifies each individual fitting.

g. Cable Assemblies

(1) Diagnostic connector assembly cable (W1) connects the VTM to the diagnostic connector when performing tests in the DCA mode.

(2) Test probe cable (W2) connects the VTM to the test probe cable for measuring voltage and resistance manually.

(3) Ignition adapter cable (W3) connects the VTM to the ignition adapter (distributor) when performing ignition tests such as ignition timing.

(4) Transducer cables (W4) connect the VTM to pressure transducers when performing pressure/vacuum tests and checking current flow with current probe.

(5) Power cable (W5) connects the VTM to the power source when operating in the TK mode.

(6) When cables are properly connected, the large key on the cable connector mates with a keyway on the transducer connector or VTM connector.

h. TM 9-4910-571-12&P

(1) TM 9-4910-571-12&P is the operator's and organizational maintenance manual for STE/ICE-R and contains:

(a) operating instructions for setting up and testing STE/ICE-R,

(b) descriptions of how STE/ICE-R is used for general tests such as voltage, pressure, and vacuum and special tests which use specific vehicle information together with test data, and

(c) maintenance and fault isolation procedures to help you keep STE/ICE-R working properly.

(2) TM 9-4910-571-12&P has three chapters. Each chapter is divided into sections:

(a) Chapter 1 has three sections and contains general information, i.e., types of publications, lists of equipment, description and data, and principles of operation.

(b) Chapter 2 has four sections and contains STE/ICE-R controls and indicators, preventive maintenance, operating under usual conditions, and unusual conditions.

(c) Chapter 3 has three sections and contains a list of repair parts, fault isolations, and maintenance procedures.

(3) Appendices are located in the back of the manual and contain the Maintenance Allocation Chart (MAC), stock numbers for repair parts, and test cards.

(4) The index is also located in back of the TM and lists topics in alphabetical order that references the paragraph number where information on the topic can be found.

(5) The glossary is located in back of the manual and contains a listing of terms used in the TM with their explanation.

(6) Vehicle test cards are also located in rear of the technical manual. They provide the STE/ICE-R operator instructions for processing errors, exceptions, and testing battery systems.

2. PERFORM AN INITIAL STE/ICE-R SET UP

a. Power up the VTM DCA mode

(1) Before you provide power to the VTM make sure the power switch is in the OFF position. Remember the power switch is the push ON pull OFF type.

(2) To connect the VTM to the diagnostic connector, align the white mark on connector PL of cable WT with the large slot in the keyway of J1 and twist the backing ring until you hear it click.

(3) Next, attach connector P2 of cable W1 to the diagnostic connector and push the power switch to the ON position.

(4) Look at the display. If everything is functioning properly, 8.8.8.8 should be visible on the display for approximately two seconds and then the display should change to - - - -.

b. Confidence Test. The confidence test, as the name implies, assures the STE/ICE-R operator that the computer and measurement circuits are operating properly. The

confidence test must be performed each time power is applied to the VTM.

(1) To perform a confidence test, set the test select switches to 66 then press and release the test button. Wait a few seconds for the display to show 0066. This series of numbers informs the mechanic that STE/ICE-R is functioning properly.

(2) When 0066 is displayed, set the test select switches to 99, then press and release the test button. A series of readouts will be displayed, and then, 0099 should appear on the display assembly. This series of numbers assures the mechanic that 11 programs within the VTM are operational.

(3) At this time, the VTM will display a series of numbers indicating that it is self testing. When testing is completed, it will display "PASS" and then pre-programmed date 9870 will appear. The VTM is now ready for testing. (See page 2-16, TM 9-4910-571-12&P)

c. Data Entry Tests. STE/ICE-R is pre-programmed to measure components of various types of equipment. Entering a test number allows the VTM to recognize a vehicle identification number, referred to as a VID number.

(1) The VID number is programmed with information such as; number of engine cylinders, prompting message data and error information.

(2) Let's enter vehicle identification test No. 60 into the VTM and see what happens.

(a) First, we set the test select switches to 60, then press and release the test button.

(b) Wait for prompting message UEH to appear on the display, then set the test select switches to the VID for the vehicle being tested. Since the training aid happens to be a DDA 6.2 liter diesel engine that is used in the M998 Series vehicles, let's enter the VID for a M998.

(c) Set the test select switch to 21, then press and release the test button. 0021 should appear on the display.

d. Test Numbers

(1) A test number is a two-digit pre-assigned number used to identify a specific test procedure.

(2) TM 9-2320-280-20 provides a list of tests and references to perform test procedures. Test procedures provide descriptions, applications, error messages, controls functions, and pre-test procedures. For example, test number 50, identifies an oil pressure test and reference procedures are located on page VII-8.

e. Control Test. The control test is used to change or control the way a vehicle test is displayed or the way it is run.

(1) There are six control tests that can be performed with STE/ICE-R but only five can be performed on vehicles with compression ignition engines.

(2) Control tests 01,02,03,04, and 06 specify the action to be taken by the next test only.

(3) Any test dialed in after the test that is being controlled will cancel the effect of the next test.

(4) When using STE/ICE-R, the control function will be accepted by a status message of "CON" vice "PASS."

f. Interleave (Test 01). The interleave test alternately measures engine speed and a second parameter such as fuel pressure or alternator voltage.

(1) To start interleave, dial 01 into test select switches and press and release the test button.

(2) Prompting message "CON" will signal the operator to dial in the second test number and again press and release the test button. Now re-enter the original test number and observe the display for results.

g. Minimum Value (Test 02). The minimum value test displays the minimum value measured during a test.

(1) To perform a minimum value test, dial 02 into the test select switches, press and release the test button.

(2) A prompting message "CON" will signal the operator to dial in the desired test number, again, press and release the test button.

(3) The minimum value is displayed and updated whenever a lower minimum value is displayed.

(4) Entering 02 and the test number again will reset the process and a new minimum value will be displayed.

h. Maximum Value (Test 03). The maximum value test displays the maximum value measured during a test.

(1) To start a maximum value display, dial 03 into the test select switches, press and release the test button.

(2) Prompting message "CON" will signal the operator to dial in the desired test number, again, press and release the test button.

(3) Maximum value is displayed and updated whenever a higher maximum value is measured.

(4) Entering 03 and the test number again will reset the process and a new maximum value will be displayed.

i. Peak-to-peak Value (Test 04). The peak-to-peak value test displays the difference between the highest and lowest value measured between display changes during a test; e.g., 0-45 volts, 0-1500 amps DC, and battery voltage.

(1) To start a peak-to-peak measurement, dial 04 into the test select switches, press and release the test button.

(2) A prompting message "CON" will signal the operator to dial in the test number, again, press and release the test button then, re-enter the original test number.

j. Display Two Measure Functions (Test 06). Test 06 allows the operator to make two general measurements at the same time. The control function causes the VTM display to alternate between the results of the first and second measurement.

k. Offset Test. The offset test is performed to calibrate the VTM to cables, test leads, transducers and vehicle wiring system.

(1) The offset test will zero the VTM and automatically correct for the offset before displaying measured values.

(2) The displayed offset values should be compared to the offset values list located in the vehicle technical manual. If any values are outside the offset limits the faulty item must be replaced before performing the required test.

(3) All tests requiring offset are identified by a star on the flip cards and by the offset limits on vehicle test cards.

3. USER MAINTENANCE RESPONSIBILITY RELATIVE TO STE/ICE

a. Inspecting and Servicing Equipment

(1) Receipt of new or used equipment.

(a) Upon receiving new, used or reconditioned STE/ICE-R equipment, it is the responsibility of the receiving organization to determine whether the equipment has been prepared for service by unit supply and is in condition to satisfactorily perform its assigned mission.

(b) Inspect all items to see that they are in good condition, correctly stowed or assembled and secure, and not excessively worn.

(2) Inspecting for good condition.

(a) Inspection for good condition is usually a visual inspection to determine if the item is safe or serviceable.

(b) At the organizational level, this is further defined to mean: not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, and not deteriorated.

(c) Inspection of an item to see if it is correctly assembled or stowed is usually a visual

inspection to see if the item is in its normal position in the transit case and if all parts are present.

(d) Excessively worn means beyond serviceable limits or likely to fail if not replaced before the next inspection.

(e) For example, mating parts or connectors are usually evidenced by too much play (lash or loose fitting), also markings, data and identification plates, and printed matter which are not legible could be considered excessively worn.

b. Preventive Maintenance Checks and Services

(1) Operator's responsibilities.

(a) Operators shall make the preventive maintenance checks and services outlined in TM 9-4910-571-12 & P.

(b) Before operation, keep in mind all cautions and warnings.

(c) The operator must perform before and after operation checks and services to help maintain the equipment in serviceable condition.

(d) If the equipment fails to operate, troubleshoot the equipment, report any deficiencies, checking for presence of oil or fuel spills and clean as necessary.

(2) Checks and services.

(a) VTM (Vehicle Test Meter).

1 Perform confidence test.

2 Check for damage to connectors, pins, switches, instruction cards (if available) and the handle.

(b) Transit case.

1 Check for damaged case, cover, handles, fasteners and relief valve.

2 Check for damage to foam insert.

(c) Tray. Ensure all items are stowed in their designated compartments as shown in TM 9-4910-571-12&P.

(d) Current probe.

1 Check for damage to connector, pins and housing.

2 Check opening and closing of jaws.

(e) Transducers.

1 Check for damage to connectors and that they are securely mounted.

2 Check for correct amount of transducers per TM 9-4910-571-12&P.

(f) Cable assemblies.

1 Check for damaged pins or threads of cable connectors.

2 Check for wear, fraying or abrasions of cable insulation and spring clip insulators.

(g) Adapters and fittings.

1 Check for correct items per TM 9-4910-571-12&P.

2 Inspect threads for physical damage and foreign matter embedded inside.

c. Cleaning

(1) Prior to their installation, any accumulation of oil, grease, or dirt must be cleaned from areas to which components of the transducer kit are to be attached.

(2) Use dry cleaning solvent to clean or wash grease or oil from threads on transducer kit parts.

(3) A solution of one part grease cleaning compound to four parts of dry cleaning solvent can be used for

dissolving grease or oil from engine blocks, chassis and other vehicle parts where transducer kit parts are to be mounted.

(4) After the parts are cleaned, rinse and dry them thoroughly. Apply a light grade of oil to all threads and polished surfaces to prevent rusting.

d. Transducer Kit and Cable Assemblies

(1) Organizational maintenance is limited to inspection of the transducers in the transducer kit, inspection and replacement of the case and tray as well as the adapters, tees, elbows, etc. in the transducer kit.

(2) Perform the tasks outlined in TM 9-4910-571-12&P applicable to the transducer kit and cable assemblies.

(3) Replace any items as required and as authorized by the maintenance allocation chart.

e. Vehicle Test Meter

(1) Maintenance of the VTM is limited to inspection, test, and replacement of display modules and information card set (flip cards).

(a) Inspection. Perform tasks outlined in TM 9-4910-571-12&P for inspection of the VTM.

(b) Test. Refer to test G01 in the Go-Chain (spark ignition or compression ignition engine) for test/checkout of the VTM.

(2) Display module replacement.

(a) Removal.

1 Pull power switch to the OFF position.

2 Remove four screws and washers securing the display cover assembly to the meter panel.

3 Carefully remove the display cover assembly.

4 Remove the bad display module D1, D2, D3, or D4 from the socket.

(b) Installation.

1 Position the display module and be sure that the decimal point is in the lower left hand corner.

2 Install the module in the socket.

3 Install the display cover assembly over the display modules.

4 Secure with four screws and washers.

(3) Information card set replacement.

(a) Removal.

1 Remove two screws and washers.

2 Separate the card holder base from VTM panel.

3 Remove two nuts from card holder pins and information card set from the card holder base.

(b) Installation.

1 Install the information card set with three card holder pins and nuts to the card holder base.

2 Install the card holder base, with the information card set attached so the card may be read, with two screws and washers to VTM panel.

REFERENCES :

TM 9-2320-280-20-1
TM 9-4910-571-12&P